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Natural Compounds

Plant Sources,
Structure, and Properties

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Cycloartane Triterpenoids and
Glycosides

Plant Sources, Structure and Properties

With 862 Figures and 688 Tables

 Springer

Editor

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Preface

Cycloartane triterpenoids, or cycloartane methylsteroids, occupy a special place among natural isoprenoids due to the fact that these compounds are synthesized exclusively by photosynthetic eukaryotes. It should be noted that the genetic relationship between the biosynthesis of these compounds and photosynthesis has not been established.

This class of natural compounds is interesting primarily with respect to phytosteroid biosynthesis. It was found that weakly polar representatives of this class, especially cycloartenol, play the role of a precursor or intermediate in the biogenesis of plant sterols. Cyclization of squalene-2,3-oxide in plants occurs with the formation of an additional 9,19-three-membered ring, which is a signature of phytosterol biosynthesis.

Cycloartane triterpenoids are interesting not only because of the fundamental biogenesis issues. The wide variety of structures makes them attractive as subjects for chemical modification and is also responsible for the broad spectrum of biological activity. These aspects also assured the furious pace of research on this class of compounds. As a result, the number of described compounds is currently approaching 900. Their biological properties are also under active investigation.

It is noteworthy that isolated representatives of this class possess hypolipidemic, hypotensive, diuretic, anti-inflammatory, sedative, analgesic, immunostimulating, and cardiogenic activity. Several compounds exhibit antiviral and antitumor activity. Interferon inducers were found among them.

The chemical structure of cycloartanes is based on the 9b,19-cyclo-5a-lanostane (cycloartane) (**I**) skeleton. The term “cycloartane” evolved from the first representative of this class to be structurally characterized, cycloartenol, which was prepared from the corresponding ketone cycloartenone. Barton gave these names to the compounds because the ketone was isolated from latex of *Artocarpus integrifolia* L. (Moraceae) fruit [1]. Then, Spring et al. isolated cycloartenol from *Strychnos nux-vomica* L. (Loganiaceae) [2]. It soon became clear that cycloartenol and its slightly polar analogs were widely distributed in the plant world.

[Diagram, R. p.]

The 4a-monomethyl- (**II**) and 4,4-demethyl-derivatives (**III**), which are themselves products of partial demethylation, are biogenetically related to cycloartane triterpenoids.

The C atoms in the cycloartane skeleton are numbered according to two different systems. These differ in the order for numbering C-28, C-29, and C-30. The numbering used in this work has an advantage that will become obvious on going to the 4a-monomethyl and 4,4-demethyl analogs.

These compounds occur in nature in the free state, as esters of various organic acids, and as glycosides. Compounds containing sulfuric acid and amide groups were also described. The number of discovered glycosides is approaching 400. Three glycosides are derivatives of 4-monomethyl compounds. Glycosides of the 4,4-demethyl analogs have not been observed.

Actein (**576**) was the first cycloartane glycoside and was isolated in 1962 [3] from *Actaea racemosa* [*Cimicifuga racemosa* (L.) Nutt., Ranunculaceae]. Its structure was elucidated definitively comparatively recently [4].

The development of low-molecular-weight bioregulators spiked in the 1980s. Owing to this, the number of reported compounds was greater than 150 in 1985 and surpassed 300 by the end of that decade. This reference book includes 861 compounds, 472 of which are genins and 389 are glycosides reported in the worldwide literature up to 2005, and also a few studies published in 2005.

Improvement of the methods for isolating and separating secondary plant metabolites did not cause disruptive changes in the pace of development of the chemistry of natural compounds in the reviewed period. Fundamental changes did occur in the methodology for identifying compounds as a result of the widespread implementation of physical research methods, especially one- and two-dimensional modern NMR spectroscopy methods. This led to the obsolescence of labor- and cost-intensive organic chemistry methods in the area of natural products chemistry.

Negative consequences of the resulting situation in the chemistry of natural compounds included a total lack of information on the chemical properties of compounds for which the structures were determined exclusively by instrumental methods. This circumstance hindered the development of not only the chemical savvy of researchers but also their fundamental skills. This was another gap in the modern chemistry of natural compounds.

It can be assumed theoretically that cycloartenol or its slightly polar analogs occur in all plants considering that they are biogenetic precursors of phytosterols, which act as structural elements of cell membranes. Polyhydroxylated, highly oxidized, and glycosylated compounds are much less distributed. The plants from which the 861 compounds included in this book were isolated belong to 50 families, 90 genera, and 200 species. Plants of the genera *Astragalus*, *Thalictrum*, and *Cimicifuga* turned out to be especially rich sources.

The monosaccharides in the glycosides include D-xylose, D-glucose, D-galactose, D-allose, D-apiose, D-fucose, D-quinovose, D-glucuronic acid, L-arabinose, and L-rhamnose.

Both triterpenoid genins and glycosides are found as esters of acetic, tiglic, 2-methylbutanoic, crotonic, malonic, palmitic, benzoic, *p*-hydroxycinnamic (*E*- and *Z*-isomers), ferulic, and isoferulic acids.

Ethers, most often O-methyl types, are also quite common. A specific structural element of cycloartane triterpenoids is the 1,1,2,2,-tetra-substituted ring (9b,19-ring) that is reflected in the name of this class of natural compounds. Therefore, all attempts to designate cycloartanes as tetracyclic triterpenoids are illogical, although the concept "pentacyclic triterpenoids" is firmly entrenched for oleanane and ursane derivatives. The presence in a triterpenoid of a 9b,19-three-membered ring is a compelling argument for assigning a compound to the cycloartane series. This property can be proved using PMR spectra. Resonances of two nonequivalent protons of the cycloartane methylene are observed in the spectral range δ 0.1–0.6 as doublets of an AX system with specific SSCC $^2J = 4$ Hz. The range of chemical

shifts of these protons in isolated instances can be expanded to δ from -0.15 to 1.9 . Adjacent functional groups such as hydroxyls on C-1 and C-11 and D⁶ and D⁷ double bonds play an important role in this.

An absorption band at 3040 cm^{-1} in the IR spectrum can be assigned to stretching vibrations of a cyclopropane methylene only on the basis of PMR spectra or simply by knowing that the compound belongs to this group.

Electron-impact mass spectra (EIMS) exhibit characteristic fragmentation of the three-membered ring of cycloartanes. This decomposition consists essentially of spontaneous cleavage of the 9–10, 5–6, and 9–19 bonds and loss of ring A as a neutral fragment. However, this decomposition depends on the presence of substituents in rings B and C. Such decomposition is clearly observed in spectra of practically all monatomic alcohols and the corresponding ketones. Compounds containing substituents in rings B and C are not fragmented by electron impact along this pathway. Simultaneous occurrence of C-6 and C-11 hydroxyls restores this ionization pathway.

Other types of mass spectrometry such as FDMS, FABMS, and HRESIFTMS that can produce useful information about the molecular weight, elemental composition, and binding sequence of monosaccharide units in the glycoside carbohydrate chain have been broadly applied in addition to EIMS.

The chiroptical methods optical rotary dispersion (ORD) and circular dichroism (CD) enable the location of chromophores such as double bonds and ketones to be determined and certain stereochemistry issues to be resolved. Stereochemistry issues are resolved in isolated instances using x-ray structure analysis.

The question of the novelty of newly discovered compounds and the determination of their structures becomes quite challenging in view of the current state of development of the chemistry of natural compounds and the enormous volume of accumulated information. This requires constant updating, systematizing, and reviewing.

Despite the fact that cycloartane triterpenoids have been the subject of several reviews, all of them taken together do not encompass the existing disparate literature data. Two reviews [5, 6] include a total of 232 compounds and are the most comprehensive, including the worldwide literature up to 1989. Subsequent reviews [7-9] tend to be fragmented and thematic and do not provide comprehensive information on the scale of efforts in this area that appeared after the initial reviews. Therefore, the need arose to organize all worldwide literature up to the present. This reference book "Cycloartane Triterpenoids and Glycosides" is designed to fill this gap in the worldwide literature.

The present tome consists of two sections. The first section reviews the genins (**1–420**) and their 4-monomethyl (**421–461**) and 4,4-demethyl derivatives (**462–472**) in numerical order. The second section includes the glycosides (**473–861**). This section concludes with three glycosides of 4-monomethyl analogs (**859–861**). Each section is structured based on the Hill system order.

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To the Memory of My Father and Mother

M.I. Isaev

Editors Page

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No Name (9,19-Cyclolanostan-20,25-epoxy,24S-acetoxy-6 α ,16 β -diol-3-O[α -L-rhamnopyranosyl(1 \rightarrow 2)-6-O-acetyl- β -D-Glucopyranoside])	405
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Cyclofoetoside A	425
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Thalictoside III	439
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Thalictoside XIII	444
Agroastragaloside IV	444
Aquilegioside C	445
Aquilegioside D	446
Aquilegioside E	447
Trojanoside J	448
Thalifoenoside A	449
Agroastragaloside III	450
No Name (3,16,24,25-Tetrahydroxycycloartan-28-oic acid; (3 β ,16 β ,24 ξ)-form, 3,24-Di-Ac, 28-O-[α -L-rhamnopyranosyl- (1 \rightarrow 2)-[β -D-xylofuranosyl-(1 \rightarrow 6)]- β -D-glucopyranosyl] ester)	450
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Thalictoside F	465
Thalictoside E	466
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No Name (Heinsiagenin A-3-O-[β -D-glucopyranosyl-(1 \rightarrow 2)- β -D-glucopyranosyl-(1 \rightarrow 6)-[α -L-rhamnopyranosyl-(1 \rightarrow 2)]- β -D- glucopyranosyl-(1 \rightarrow 2)- β -D-glucopyranoside])	468
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4-Monomethylcycloartane Glycosides

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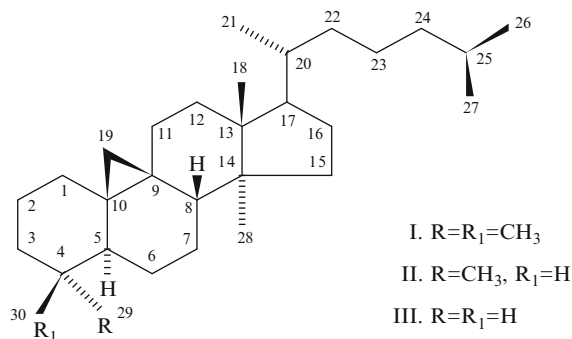
M. I. Isaev S.Yu. Yunusov Institute of the Chemistry of Plant Substances of the Academy of Sciences of the Republic of Uzbekistan, Tashkent, Republic of Uzbekistan

Cycloartane triterpenoids, or cycloartane methylsteroids, take a special place among natural isoprenoids due to the fact that these compounds are synthesized exclusively by photosynthetic eukaryotes. It should be noted that the genetic relationship between the biosynthesis of these compounds and photosynthesis has not been established.

This class of natural compounds is interesting primarily with respect to phytosteroid biosynthesis. It was found that low polar representatives of this class, especially cycloartenol, play the role of a precursor or intermediate in the biogenesis of plant sterols.

Cycloartane triterpenoids are interesting not only because of the fundamental biogenesis issues. The wide variety of structures makes them attractive as subjects for chemical modification. At the same time this compounds possess a broad spectrum of biological activity. It is noteworthy that some representatives of this class have hypolipidemic, hypotensive, diuretic, anti-inflammatory, sedative, analgesic, immunostimulating, and cardiotoxic activity. Moreover, several compounds have antiviral and antitumor activity, and interferon inducers were found among them.

The chemical structure of cycloartanes is based on the $9\beta,19$ -cyclo- 5α -lanostane (cycloartane) (I) skeleton. The concept "cycloartane" comes from the first representative of this class to, which is structurally characterized as cycloartenol, obtained from the corresponding ketone cycloartenone. These names are given by Burton due to the fact that the ketone was isolated from the latex of fruits of *Artocarpus integrifolia* L. (Moraceae). It soon became clear that cycloartenol and its low-polar analogues are widely distributed in the plant world.



The 4α -monomethyl- (II) and 4,4-demethyl-derivatives (III), which are themselves products of partial demethylation, are biogenetically related to cycloartane triterpenoids.

The C atoms in the cycloartane skeleton are numbered according to two different systems. These differ in the order for numbering C-28, C-29, and C-30. The numbering used in this work has an advantage, which become obvious on going to the 4α -monomethyl and 4,4-demethyl analogs.

These compounds occur in nature in the free state, as esters of various organic acids, and as glycosides. There are compounds containing the residues of sulfuric acid and the amide group.

It can be assumed theoretically that cycloartenol or its low polar analogs occur in all plants, since they are biogenetic precursors of phytosterols, which act as structural elements of cell membranes. Polyhydroxylated, highly oxidized, and glycosylated compounds are much less distributed.

The monosaccharides in the glycosides include D-xylose, D-glucose, D-galactose, D-allose, D-apiose, D-fucose, D-quinovose, D-glucuronic acid, L-arabinose, and L-rhamnose.

Both triterpenoid genins and glycosides are found as esters of acetic, tiglic, 2-methylbutanoic, crotonic, malonic, palmitic, benzoic, *p*-hydroxycinnamic (*E*- and *Z*-isomers), ferulic, and isoferulic acids.

Ethers, most often O-methyl types, are also quite common. A specific structural element of cycloartane triterpenoids is the 1,1,2,2,-tetra-substituted ring ($9\beta,19$ -ring) that is reflected in the name of this class of natural compounds. Therefore, all attempts to designate cycloartanes as tetracyclic triterpenoids are illogical, although the concept "pentacyclic triterpenoids" is firmly entrenched for oleanane and ursane derivatives. The presence in a triterpenoid molecule of a $9\beta,19$ -three-membered ring is a compelling argument for assigning a compound to the cycloartane series.

The plants from which the 861 compounds included in this book were isolated belong to 50 families, 90 genera, and 200 species. Plants of the genera *Astragalus*, *Thalictrum*, and *Cimicifuga*

turned out to be especially rich sources of cycloartane triterpenoids and glycosides.

The present volume consists of two sections. The first section reviews the genins (**1-420**) and their 4-monomethyl (**421-461**) and 4,4-demethyl derivatives (**462-472**) in numerical order. The second section includes the glycosides (**473-861**). This section concludes with three glycosides of 4-monomethyl

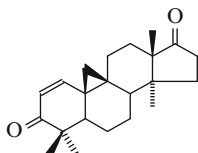
analogs (**859-861**). Each section is structured based on the Hill system order.

This book is intended for a wide range of researchers: chemists, technicians, biologists, students, and managers of pharmaceutical and other companies specializing in screening and producing medicinal preparations and other useful products based on natural compounds.

Cycloartane Triterpenoids

(–) – Buxatenone

$C_{22}H_{30}O_2$, M 326



Taxonomy: Cycloartane Triterpenoids

Buxus papillosa C.K. Schneider (*Buxaceae*) [1].

$[\alpha]_D^{20} -11^\circ$.

CAS Registry Number: 123853-66-7.

IR ν_{max}^{KBr} , cm^{-1} : 1730, 1660, 1610.

MS m/z : M^+ 326.2238, 311, 137 (base peak), 58.

Table 1

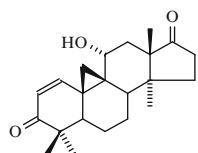
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)		
C-1	152.58	6.73	C-12	26.61	
2	127.28	5.94	13	52.72	–
3	204.69	–	14	30.13	–
4	45.79	–	15	30.82	1.65, 1.78
5	43.69	2.10	16	33.74	2.17, 2.44
6	18.72	–	17	220.12	–
7	24.57	–	18	21.44	1.08
8	40.54	2.17	19	27.03	0.68 d (4.9), 1.37 d (4.9)
9	25.26	–	28	19.21	0.83
10	44.08	–	29	19.21	0.95
11	21.29	–	30	18.38	1.12

References

- Atta-ur-Rahman, H. Nasir, Z. Jqbal, M.I. Choudhary, M. Alam. *Phytochemistry* **28**(10), 2848–2850 (1989)

11 α – Hydroxybuxatenone

$C_{22}H_{30}O_3$, M 342



Taxonomy: Cycloartane Triterpenoids

Buxus papillosa C.K. Schneider (*Buxaceae*) [1].

Amorphous solid, $[\alpha]_D^{24} -18^\circ$ (CHCl₃).

UV λ_{max}^{MeOH} , nm: 202, 241, 260.

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3600, 2950, 1730, 1675, 1610

HREIMS m/z (%): 342.2199 [M]⁺ ($C_{22}H_{30}O_3$) (51),
327.1932 ($C_{21}H_{27}O_3$) (8), 324.2103 ($C_{22}H_{28}O_2$)
(17), 206.1284 ($C_{13}H_{18}O_2$) (24), 205.1242
($C_{13}H_{17}O_2$) (100), 149.0941 ($C_{10}H_{13}O$) (13),
136.0872 ($C_9H_{11}O$) (28)

Table 1

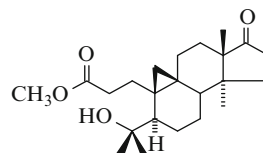
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)		
C-1	151.7	6.92 d (10.2)	C-12	35.8	1.65 m, 2.15 m
2	127.5	5.96 d (10.2)	13	52.4	–
3	204.7	–	14	44.5	–
4	45.9	–	15	30.7	1.81 dd (9.9, 17.5), 1.69 m
5	43.9	2.12 m	16	33.6	2.45 ddd (1.6, 9.9, 19.3), 2.20 m
6	18.5	1.25 dd (5.2, 8.2), 1.70 m	17	219.1	–
7	21.6	1.35 m, 1.70 m	18	19.8	1.26 s
8	39.1	2.37 t (8.2)	19	29.7	1.25 s
9	31.8	–	28	19.7	0.81 s
10	30.5	–	29	21.4	1.11 s
11	67.9	4.06 dd (6.9, 2.4)	30	19.3	0.99 s

References

- Atta-ur-Rahman, H. Nasir, Z. Iqbal. *Phytochemistry* **35**(4), 993–1000 (1994)

Buxapapillosin

$C_{23}H_{36}O_4$, M 376



Taxonomy: Cycloartane Triterpenoids

Buxus papillosa C.K. Schneider (*Buxaceae*) [1].

Amorphous powder, $[\alpha]_D^{24} +20^\circ$ (CHCl₃).

CAS Registry Number: 154486-19-8.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3600, 2950, 1735, 1730.

HREIMS m/z : $(\text{M}-\text{H}_2\text{O})^+$ 358.2511 (11, $\text{C}_{23}\text{H}_{34}\text{O}_3$), 343.2284 (12, $\text{C}_{22}\text{H}_{31}\text{O}_3$), 318.2192 (30, $\text{C}_{20}\text{H}_{30}\text{O}_3$), 316.2026 (10, $\text{C}_{20}\text{H}_{28}\text{O}_3$), 303.1954 (64, $\text{C}_{19}\text{H}_{25}\text{O}_2$), 285.1869 (42, $\text{C}_{19}\text{H}_{25}\text{O}_2$), 190.1365 (40, $\text{C}_{13}\text{H}_{18}\text{O}$), 59.0497 ($\text{C}_3\text{H}_7\text{O}$, 100).

Table 1

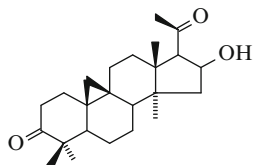
δ_{C} (CDCl_3)	δ_{H} (J/Hz)	δ_{C} (CDCl_3)	δ_{H} (J/Hz)
C-1	30.38 1.35 m, 2.65 dt (5.7, 10.5)	C-12	24.85 1.50 m, 1.72 m
2	31.97 2.20 m, 2.56 dt (5.7, 12.5)	13	51.50 –
3	174.71 –	14	44.18 –
4	75.89 –	15	32.57 1.68 m
5	44.78 1.83 dd (6.1, 11.8)	16	34.20 2.12 m, 2.36 ddd (3, 8.6, 19.4)
6	24.83 0.72 dq (2.5, 12.8), 1.72 m	17	221.24 –
7	24.16 0.95 dq (2.5, 12.6), 1.35 m	18	20.68 1.11 s
8	47.20 1.45 m	19	30.68 0.46 d (4.7), 0.71 d (4.7)
9	22.54 –	28	20.12 0.84 s
10	27.09 –	29	31.65 1.20 s
11	25.69 1.30 m, 2.02 m	30	26.36 1.15 s
		OCH_3	51.52 3.57 s

References

- Atta-ur-Rahman, H. Nasir, S.S Ali, Z. Iqbal. *Nat. Prod. Lett.* **3**(2), 131–138 (1993)

16S-Hydroxy-22-nor-cycloartane-3, 20-dione

$\text{C}_{24}\text{H}_{36}\text{O}_3$, M 372



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 243°C, $[\alpha]_{\text{D}} +38^\circ$ (c 4.8, CHCl_3).

IR $\nu_{\max}^{\text{CHCl}_4}$, cm^{-1} : 3620, 1710.

MS m/z : M^+ 372.266 (63), 354 (28), 339 (100), 311 (34), 297 (21), 270 (20), 234 (68), 201 (68), 173 (51), 93 (98).

Table 1

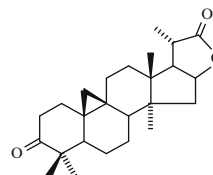
δ_{H} (CDCl_3 , J/Hz)	δ_{H} (CDCl_3 , J/Hz)	δ_{H} (CDCl_3 , J/Hz)			
H-1 α	1.84 ddd (14, 14, 4)	H-7 α	1.12 m	H-18	1.22 s
1 β	1.52 ddd (14, 6, 2.5)	7 β	1.40 m	19 α	0.69 d (4)
2 β	2.17 ddd (14, 14, 6)	8	1.66 dd (13, 4)	19 β	0.80 d (4)
2 α	2.29 ddd (14, 4, 2.5)	15 α	1.43 dd (13.5, 5)	21	2.17 s
5	1.12 m	15 β	2.01 dd (13.5, 8)	28	0.90 s
6 α	1.69 dddd (13, 4, 4)	16	4.59 ddd (8, 7, 5)	29	1.08 s
6 β	0.92 m	17	2.89 d (7)	30	1.02 s

References

- F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

(16S)-23,24,25,26,27-Pentanor-cycloartan-3-one-16,22-olide

$\text{C}_{25}\text{H}_{36}\text{O}_3$, M 384



Taxonomy: Cycloartane Triterpenoids

Lindheimeria texana Gray et Engelm (*Asteraceae*) [1].

Mp 228–231°C (EtOAc). CD curve (MeOH):

$[\theta]_{256} -2700$, $[\theta]_{250} -200$, $[\theta]_{210} -3800$,

IR ν_{\max}^{KBr} , cm^{-1} : 1765, 1705.

HRMS m/z : M^+ 384.2648, 385 (1), 369 (4.2), 299 (1.9), 246 (9.6), 231 (3.8),

Table 1

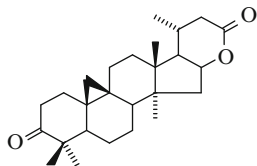
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.30	C-14	49.24 –
2	37.30	15	43.65 2.09 dd (14, 8)
3	215.94 –	16	83.21 5.04 dt (5, 8)
4	50.12 –	17	55.97 2.40 brd (8)
5	47.10	18	19.67 1.14
6	21.09	19	29.96 0.59 d, 0.87 brd
7	26.13	20	36.69 2.66 dq (1, 7.5)
8	48.20	21	18.54 1.36 d (7.5)
9	20.62 –	22	181.11 –
10	26.51 –	28	19.29 0.92
11	25.96	29	22.16 1.07
12	30.71	30	20.74 1.11
13	44.84 –		

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

24-Nor-cycloartan-3-on-16 β , 23-olide

$C_{26}H_{38}O_3$, M 398



Taxonomy: Cycloartane Triterpenoids

Viguiera dentata (Cav) Spreng (*Asteraceae*) [1].

Mp 229–230°C (from EtOAc–MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 1740, 1700, 1460, 1390, 1370, 1250, 1190, 1150, 1120, 1080, 1040.

EIMS m/z (%): M^+ 398 (100), 383 (81), 260 (82), 245 (40).

Table 1

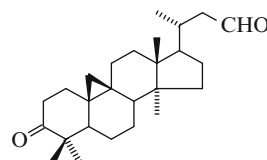
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.31	C-14	46.64 –
	1.86 ddd (14, 14, 4),	15	43.57
	1.56 ddd (14, 6, 2.5)	16	80.58 4.73 ddd (8, 8, 5)
2	37.33	17	54.12 1.97 t (8)
	2.30 ddd (14, 4, 2.5),	18	20.49 1.13 s
	2.71 ddd (14, 14, 6)	19	30.01 0.59 d (4), 0.85 d (4)
3	216.12 –	20	27.00 2.07 dddq (14, 8, 2, 7)
4	50.13 –	21	21.34 1.07 d (7)
5	48.21 1.16	22	38.55 2.12 t (14), 2.39 dd (14, 2)
6	21.12	23	174.43 –
	1.69 ddd (13, 4, 4)	28	19.60 1.04 s
7	25.91	29	22.13 1.09 s
	1.13 m, 1.42 m	30	20.46 0.93 s
8	47.38		
	1.69 dd (13, 4)		
9	20.74 –		
10	26.33 –		
11	26.07 1.23		
12	31.94		
12	44.70		

References

1. F. Gao, T.J. Mabry, F. Bohlmann, J. Jacupovic, *Phytochemistry* **25**(6), 1489–1491 (1986)

24, 25, 26, 27-Tetranor-3-oxo-cycloartan-23-al

$C_{26}H_{40}O_2$, M 384



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (*Bromeliaceae*) [1].

$[\alpha]_D^{20} +14^\circ$ (c 0.27, CHCl₃).

IR ν_{\max}^{KBr} , cm^{-1} : 2923, 2873, 2720, 1718, 1707.

EIMS m/z (%): M^+ 384 (19), 369 (13), 366 (11), 351 (5), 340 (26), 313 (14), 246 (33), 175 (32), 147 (67), 121 (57), 55 (10).

HREIMS m/z : 384.3027 ($C_{26}H_{40}O_2$).

Table 1

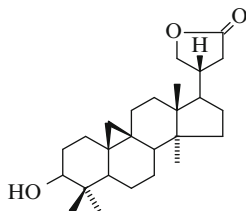
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.4	C-14	48.9
2	37.4	15	35.5
	2.30 m, 2.71 dt (13.8, 6, 6)		
3	216.4	16	28.4
4	50.2	17	52.2
5	48.4	18	18.1
6	21.5	19	29.5
			1.05 s
			0.58 d (4.4), 0.79 d (4.4)
7	25.8	20	31.9
8	47.8	21	19.6
			0.98 d (6.2)
9	21.0	22	51.1
10	26.0	23	203.4
			9.77 brs
11	26.6	28	19.3
			0.91 s
12	32.7	29	22.2
			1.05 s
13	45.5	30	20.8
			1.10 s

References

- G.M. Cabrera, A.M. Seldes, *Phytochemistry* **45**(5), 1019–1021 (1997)

(20R)-3 β -Hydroxy-24,25,26,27-tetranor-5 α -cycloartan-23,21-olide

$C_{26}H_{40}O_3$, M 400



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 219–220°C (from Me₂CO), $[\alpha]_D^{21} +48^\circ$ (c 0.7, CHCl₃).

CAS Registry Number: 146257-61-6.

CD nm ($\Delta\epsilon$): 217 (+0.76),

IR $\nu_{\max}^{CHCl_3}$, cm^{-1} : 3614, 1774.

EIMS m/z (%): M^+ 400 (6), 385 (20), 382 (46), 368 (20), 367 (71), 339 (100), 313 (35), 297 (11), 175 (16), 135 (22), 133 (26), 121 (21), 119 (68), 107 (34), 105 (25).

¹H NMR (CDCl₃, δ): 0.34 and 0.59 (2H-19, d, J = 4.2 Hz), 0.81 (H-6 β , dddd, $J_1 = J_2 = J_3 = 12.5$, $J_4 = 2.5$ Hz), 0.81, 0.91, 0.97, 1.01 (4 \times CH₃, s), 2.19 (H-22_B, m), 2.49–2.63 (H-20, H-22_A, m), 3.28 (H-3, m), 3.89 (H-21_B, dd, $J_1 = J_2 = 9$ Hz), 4.42 (H-21_A, dd, J = 9, $J_2 = 8$ Hz).

Table 1

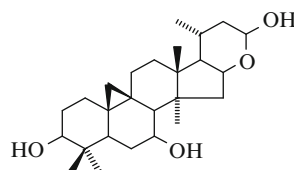
δ_C (CDCl ₃)	δ_C (CDCl ₃)	δ_C (CDCl ₃)			
C-1	31.9	C-10	26.4	C-19	29.9
2	30.3	11	26.1	20	39.2
3	78.7	12	31.5	21	72.5
4	40.5	13	45.5	22	34.7
5	46.9	14	48.4	23	176.7
6	20.9	15	35.6	28	19.2
7	25.9	16	27.4	29	25.4
8	47.7	17	50.8	30	13.9
9	19.8	18	18.9		

References

- H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

Dasyanthogenin

$C_{26}H_{42}O_4$, M 418



Taxonomy: Cycloartane Triterpenoids

Astragalus dasyanthus Pall. (*Leguminosae*) [1].

Mp 210–214°C (from EtOH), $[\alpha]_D^{23} 0^\circ$ (c 1.0, EtOH).

CAS Registry Number: 78556-31-7

IR ν_{\max}^{Nujol} , cm^{-1} : 3400.

EIMS m/z : M^+ 418.3108.

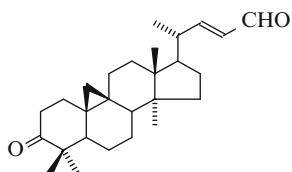
$^1\text{H NMR}$ (CDCl_3): δ 0.3 and 0.7 (2H-19, d, $J = 4$ Hz), 0.8–1.14 ($5 \times \text{CH}_3$), 4.30 (H-16, q, $J = 7$ Hz), 4.75 (H-23, t, $J = 7$ Hz).

References

- R.I. Evstratova, V.I. Sheychenko, D.A. Pakaln. *Khim. Prir. Soedin.* 102–103 (1981)

(22E)-25,26,27-Trisnor-3-oxocycloart-22-en-24-al

$\text{C}_{27}\text{H}_{40}\text{O}_2$, M 396



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (*Bromeliaceae*) [1].

An amorphous solid, $[\alpha]_{\text{D}}^{25} +19^\circ$ (c 0.073, CHCl_3).

CAS Registry Number: 173866-00-7.

UV $\lambda_{\text{max}}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 224 (3.6).

EIMS m/z (%): M^+ 396 (25), 301 (17), 258 (19), 175 (100).

HREIMS m/z : 396.3027 [M] $^+$.

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	33.4	C-14	48.8 –
2	37.4 2.31 m, 2.72 dt (6.2, 13.9)	15	35.6
3	216.5 –	16	28.2
4	50.2 –	17	51.3
5	48.4	18	18.4 1.07 s
6	21.5	19	29.6 0.59 d (4.2), 0.81 d (4.2)
7	25.8	20	40.7
8	47.8	21	18.6 1.10 d (6.5)
9	21.0 –	22	164.3 6.73 dd (15.7, 8.4)
10	26.1 –	23	130.9 6.07 dd (15.7, 7.7)
11	26.7	24	194.4 9.49 d (7.7)

(continued)

Table 1 (continued)

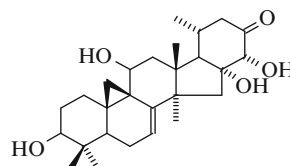
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
12	32.7	28	19.3 0.93 s
13	45.9 –	29	22.2 1.05 s
		30	20.8 1.10 s

References

- G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

Foetidinol

$\text{C}_{27}\text{H}_{40}\text{O}_5$, M 444



Taxonomy: Cycloartane Triterpenoids

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp 255–256°C (from hexane – EtOAc), $[\alpha]_{\text{D}} -93.5^\circ$ (c 0.12, CHCl_3 –MeOH, 1 : 1).

CAS Registry Number: 158204-38-7.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3450, 1718, 1620.

MS m/z : M^+ 444.2909.

CD (c 0.61 mM, MeOH): $[\theta]_{213} -47870$, $[\theta]_{284} -17700$; ORD (c 2.55 mM, MeOH) [M] (nm): -1.19×10^4 (230), $+0.93 \times 10^4$ (264), -1.14×10^4 (303).

Table 1

$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	27.7 1.73 td (12.5, 6.5), 2.76 dt (12.5, 3.5)	C-14	50.9 –
2	31.1 2.06 (2H – 2, m)	16	82.4 –
3	78.0 3.63 dd (10, 5.5)	17	63.6 2.26 d (10)
4	40.5 –	18	21.2 1.29 s

(continued)

Table 1 (continued)

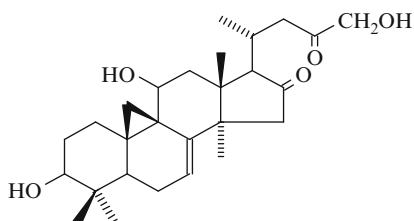
$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
5	43.9	1.38 dd (12.5, 5.5)	19 18.8 1.08 d (4), 2.04 d (4)
6	22.4	1.85 ddd (16, 12.5, 2), 2.01 ddd (16, 7.5, 5.5)	20 25.9 2.19 m 21 20.7 0.93 d (5.5)
7	144.0	5.25 dd (7.5, 2)	22 44.85 2.42 dd (18.5, 4), 2)
8	149.3	–	2.52 dd (18.5, 12)
9	27.5	–	23 211.3 –
10	29.5	–	24 82.0 4.50 s
11	63.6	4.62 ddd (9, 5.5, 3), 6.00 d (5.5, OH)	28 28.2 1.62 s 29 26.4 1.30 s
12	49.0	2.09 dd (13.5, 3.5), 2.87 dd (13.5, 9)	30 13.9 1.21 s
13	46.3	–	

References

1. J.X. Li, S. Kadota, X.F. Pu, T. Namba, *Tetrahedron Lett.* **35**(26), 4575–4576 (1994)

Genin of Cimicifugoside H-3

$\text{C}_{27}\text{H}_{40}\text{O}_5$, M 444



Taxonomy: Cycloartane Triterpenoids
Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].
 An amorphous powder.
 EIMS m/z : M^+ 444, 426 ($\text{M}^+ - \text{H}_2\text{O}$).
 HREIMS m/z : 444.2874.

Table 1

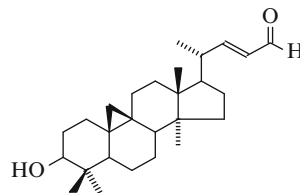
$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	27.7	1.65, 2.68	C-14 46.1 –
2	30.9	2.03, 2.03	15 49.8 2.23 d (18), 2.46 d (18)
3	78.0	3.57 m	16 218.3 –
4	40.5	–	17 61.3 2.33
5	43.5	1.30	18 20.2 1.19 s
6	22.3	1.73, 1.94	19 18.7 0.97 d (4), 1.91 d (4)
7	115.5	5.15 brd (6)	20 27.7 2.56
8	147.2	–	21 20.3 1.01 d (6)
9	27.5	–	22 44.6 2.56, 3.45 dd (11, 7)
10	29.7	–	23 210.8 –
11	63.1	4.50 m	24 69.2 4.42 d (18), 4.53 d (18)
12	47.3	2.14, 2.77	28 27.8 1.16 s
13	44.4	–	29 26.3 1.25 s
			30 13.8 1.15 s

References

1. N. Sakurai, M. Koeda, Y. Aoki, M. Nagai, *Chem. Pharm. Bull.* **43**(9), 1475–1482 (1995)

(22E)-25,26,27-Trinor-3 β -hydroxycycloart-22-en-24-al

$\text{C}_{27}\text{H}_{42}\text{O}_2$, M 398



Taxonomy: Cycloartane Triterpenoids
Ficus microcarpa L. f. (*Moraceae*) [1].
 Mp 110–113°C, $[\alpha]_{\text{D}}^{25} +47.9^\circ$ (c 0.2, CHCl_3),
 IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3458, 3041, 1695, 1635, 1385, 1101, 1049, 738.
 EIMS m/z (%): M^+ 398 (25), 380 (82), 365 (95), 337 (68), 311 (24), 297 (39), 258 (48), 227 (48), 187

(44), 175 (67), 147 (67), 133 (79), 119 (90), 107 (100), 95 (92).

HREIMS m/z: 398.3186 [M]⁺.

Table 1

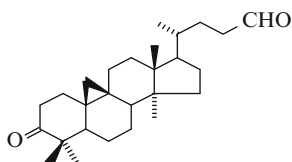
$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	31.9	C-14	48.8 –
2	30.3	15	35.6 1.31
3	78.8	16	28.2
	3.27 dd (10.8, 4.4)		
4	40.5 –	17	51.3 1.74
5	47.0 1.28	18	18.3 1.01 s
6	21.0	19	29.9 0.33 d (4), 0.55 d (4)
7	26.0	20	40.7 2.40 m
8	47.9 1.52	21	18.6 1.07 d (6.4)
9	19.8 –	22	164.7 6.70 dd (15.6, 8.8)
10	26.1 –	23	130.8 6.04 dd (15.6, 7.6)
11	26.3 2.02 m, 1.14	24	194.6 9.46 d (7.6)
12	32.8 1.64	28	19.3 0.89 s
13	45.8 –	29	25.4 0.95 s
		30	14.0 0.79 s

References

1. Y.-M. Chiang, J.-K. Su, Y.-H. Liu, Y.-H. Kuo, Chem. Pharm. Bull. **49**(5), 581–583 (2001)

25,26,27-Trisnor-3-oxo-cycloartan-24-al

$\text{C}_{27}\text{H}_{42}\text{O}_2$, M 398



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1].

$[\alpha]_D^{20} +20^\circ$ (c 0.21, CHCl_3).

CAS Registry Number: 184176-71-4.

EIMS m/z (%): M⁺ 398 (6), 383 (4), 380 (5), 365 (2), 355 (1), 313 (10), 260 (10), 175 (12), 55 (100).

HREIMS m/z: 398.3192 ($\text{C}_{27}\text{H}_{42}\text{O}_2$).

Table 1

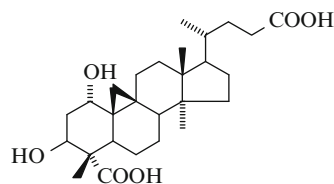
$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	33.4	C-14	48.8 –
2	37.5	15	35.6
	2.30 m, 2.71 dt (13.5, 6.6)		
3	216.4 –	16	28.3
4	50.2 –	17	52.2
5	48.4	18	18.1 1.00 s
6	21.6	19	29.5 0.57 d (4.4), 0.79 d (4.4)
7	25.9	20	35.7
8	47.9	21	18.0 0.89 d (6.5)
9	21.0 –	22	28.1
10	26.0 –	23	41.2
11	26.7	24	203.1 9.77 bt (1.6)
12	32.8	28	19.3 0.91 s
13	45.4 –	29	22.2 1.05 s
		30	20.8 1.10 s

References

1. G.M. Cabrera, A.M. Seldes, Phytochemistry **45**(5), 1019–1021 (1997)

Norquadrangularic Acid A

$\text{C}_{27}\text{H}_{42}\text{O}_6$, M 462



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Colorless amorphous solid, $[\alpha]_D^{25} +200.6^\circ$ (c 0.01, MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3400, 1710, 1550, 1470.

HRFABMS m/z: 485.2883 [M⁺ Na]⁺.

¹H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.54 and 0.82 (2H-19, d, J = 4.5 Hz), 0.95 (CH_3 -21, d, J = 5 Hz), 0.98 (CH_3 -28, s), 1.03 (CH_3 -18, s) 1.74 (CH_3 -30, s), 1.92 (H-7, m), 2.10 (H-22, m), 2.30 (H-2, ddd,

J = 12.5, 11, 2 Hz), 2.50 (H-2, m), 2.52 (H-23, m), 2.62 (H-23, m), 2.74 (H-11, m), 3.43 (H-5, dd J = 11.5, 4.5 Hz), 3.91 (H-1, brs), 5.57 (H-3, dd, J = 12, 4.5 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	72.5	C-8	48.1	C-15	35.8	C-22	32.1
2	37.7	9	20.8	16	25.9	23	32.0
3	70.7	10	30.3	17	52.5	24	176.5
4	55.7	11	26.2	18	18.3	28	19.4
5	38.8	12	33.2	19	29.7	29	180.0
6	23.4	13	45.5	20	36.0	30	9.7
7	28.2	14	49.1	21	18.1		

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C- 1	33.4	C-14	48.8 –
2	37.4	15	35.5
	2.30 m, 2.71 dt (6.3, 14)		
3	216.5	16	28.1
4	50.2	17	52.2
5	48.4	18	18.1 1.00 s
6	21.5	19	29.5 0.57 d (4.2), 0.79 d (4.2)
7	25.8	20	35.8
8	47.9	21	18.3 0.90 d (6.5)
9	21.1	22	32.1
10	26.0	23	29.6
11	26.7	24	63.6 3.63 brt (6.2)
12	32.8	28	19.3 0.91 s
13	45.3	29	22.2 1.05 s
		30	20.8 1.10 s

References

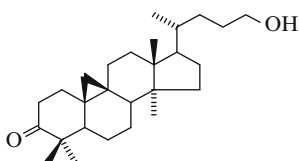
1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, J. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

25,26,27-Trisnor-24-hydroxycycloartan-3-one

C₂₇H₄₄O₂, M 400



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1],

Mp 143–146°C (from Et₂O-hexane), $[\alpha]_D^{25}$ +20° (c 0.11, CHCl₃).

CAS Registry Number: 173866-04-1,

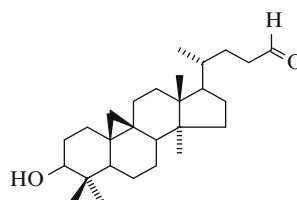
UV $\lambda_{\max}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 220 (2.5).

EIMS m/z (%): M⁺ 400 (25), 385 (14), 382 (14), 313 (67), 262 (38), 175 (46), 154 (100), 107 (84), 95 (62).

HREIMS m/z: 400.3343 [M]⁺, 385.3092 (C₂₆H₄₁O₂), 382.3229 (C₂₇H₄₂O),

Wrightial

C₂₇H₄₄O₂, M 400



Taxonomy: Cycloartane Triterpenoids

Wrightia tinctorica (Roxb.) R. Br. (Apocynaceae) [1].

Mp. 99°C (CHCl₃), $[\alpha]_D^{20}$ +18.33° (c 1.01, MeOH).

CAS Registry Number: 152135-66-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 2920, 2780, 1715, 1440, 1370, 1040.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 280 (log ϵ 1.5).

MS m/z (%): M⁺ 400 (5), 383 (10), 325 (5), 313 (7), 260 (20), 175 (30), 149 (40), 43 (100).

¹H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.32 and 0.52 (2H-19, d, J = 4 Hz), 0.80–1.00

(CH₃ × 4), 3.25 (H-3, m), 9.77 (H-24, t, J = 1 Hz).

(6 × CH₃, s), 3.28 (H-3, m), 6.08 (H-24, d, J = 16 Hz), 6.82 (H-23, m).

Table 1

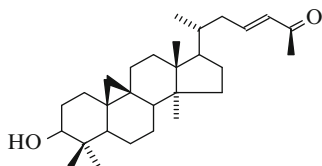
$\delta_C(\text{CDCl}_3)$					
C-1	31.97	C-10	26.12	C-19	29.85
2	30.38	11	25.99	20	35.67
3	78.83	12	35.53	21	28.08
4	40.48	13	45.37	22	28.27
5	47.11	14	48.83	23	29.68
6	21.1	15	32.90	24	203.11
7	28.08	16	26.44	28	19.31
8	47.98	17	52.17	29	25.43
9	19.97	18	18.03	30	13.98

References

1. P. Ramchandra, M. Basheermiya, G.L.D. Krupadanam, G. Srimannarayana, *J. Nat. Prod.* **56**(10), 1811–1812 (1993)

3 β -Hydroxy-26-nor-9, 19-cyclolanost-23-en-25-one

C₂₉H₄₆O₂, M 426



Taxonomy: Cycloartane Triterpenoids

Garcinia mangostana (Guttiferae) [1].

Mp 142–143°C (from CHCl₃–MeOH), $[\alpha]_D^{27} +32.5^\circ$ (c 0.24, MeOH).

CAS Registry Number: 132943-49-8.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm (log ϵ): 226 (14.06).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3450, 1670.

MS m/z (%): M⁺ 426 (23), 411 (31), 408 (31), 393 (97), 365 (51), 339 (26), 297 (14), 286 (89), 271 (17), 255 (31), 203 (57), 202 (40), 189 (29), 187 (34), 175 (66), 173 (37), 161 (46), 159 (28), 147 (63), 135 (51), 121 (65), 119 (49), 111 (45), 109 (54), 107 (60), 105 (54).

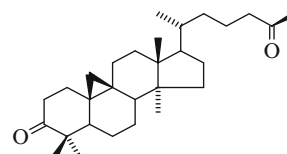
¹H NMR (100 MHz, CDCl₃, δ , 0-TMS): 0.34 and 0.57 (2H-19, d, J = 4 Hz), 0.80, 0.88, 0.96, 2.24

References

1. M. Parveen, N.U.D. Khan, B. Achari, P.K. Dutta, *Phytochemistry* **30**(1), 361–362 (1991)

27-Nor-cycloartane-3,25-dione

C₂₉H₄₆O₂, M 426



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1].

$[\alpha]_D^{20} +23^\circ$ (c 0.15, CHCl₃).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 2966, 2923, 2857, 1718.

EIMS m/z (%): [M⁺] 426 (5), 411 (2), 408 (2), 393 (1), 368 (3), 313 (10), 288 (4), 175 (12), 121 (22), 43 (100).

HREIMS m/z: 426.3492 (C₂₉H₄₆O₂),

Table 1

$\delta_C(\text{CDCl}_3)$	δ_H (J/Hz)	$\delta_C(\text{CDCl}_3)$	δ_H (J/Hz)
C-1	33.4	C-15	35.6
2	37.4 2.30 ddd (13.5, 4, 2.5), 2.71 dt (13.5, 6.5)	16	28.1
		17	52.1
3	216.4 –	18	18.1 0.99 s
4	50.2 –	19	29.6 0.57 d (4), 0.79 d (4)
5	48.5	20	35.7
6	21.5	21	18.2 0.89 d (6.5)
7	25.9	22	35.9
8	47.9	23	21.5 1.4, 1.65 m
9	21.0 –	24	44.3 2.39 m
10	26.0 –	25	210.9 –
11	26.7	26	24.9 2.13 s
12	32.8	28	19.3 0.90 s

(continued)

Table 1 (continued)

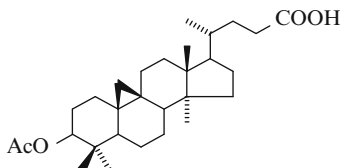
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
13	45.4 –	29	22.2 1.05 s
14	48.8 –	30	20.8 1.10 s

References

- G.M. Cabrera, A.M. Seldes, *Phytochemistry* **45**(5), 1019–1021 (1997)

25-Nor-cycloartanoloic Acid Acetate

$\text{C}_{29}\text{H}_{46}\text{O}_4$, M 458



Taxonomy: Cycloartane Triterpenoids

Artemisia rubripens Nakai (*Asteraceae*) [1]

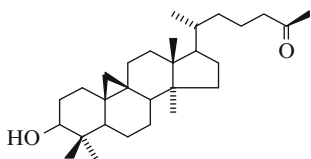
Mp 219–221°C.

References

- A. Lao, Y. Fujimoto, T. Tatsuno, *Yakugaku Zasshi* **103**(6), 696–699 (1983). *C.A.*, 99: 119318u (1983)

27-Nor-3 β -hydroxy-25-oxocycloartane

$\text{C}_{29}\text{H}_{48}\text{O}_2$, M 428



Taxonomy: Cycloartane Triterpenoids

Ficus microcarpa L. f. (*Moraceae*) [1].

Mp 127–129°C, $[\alpha]_{\text{D}}^{25} +38.0^\circ$ (c 0.3, CHCl_3).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3423, 3039, 1716, 1377, 1163, 1099, 1026.

EIMS m/z (%): M^+ 428 (12), 413 (18), 410 (68), 395 (100), 367 (31), 341 (24), 297 (45), 288 (26), 203 (46), 175 (60), 121 (56), 107 (60), 95 (68).

HREIMS m/z : 428.3650 $[\text{M}]^+$.

Table 1

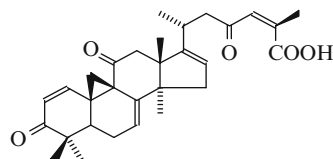
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	32.0	C-16	28.1
2	30.4	17	52.1 1.55
3	78.8 3.26 dd (10.8, 4)	18	18.0 0.93 s
4	40.5 –	19	29.9 0.31 d (4), 0.52 d (4)
5	47.1 1.28	20	35.9 1.20–1.40
6	21.1	21	18.2 0.85 d (5.2)
7	26.0	22	35.7 1.20–1.40
8	48.0 1.48	23	20.7 1.58
9	20.0 –	24	44.3 2.37 m
10	26.1 –	25	209.4 –
11	26.5 1.95, 1.20	26	29.9 2.11 s
12	32.9 1.60	27	– –
13	45.3 –	28	19.3 0.86 s
14	48.8 –	29	25.4 0.94 s
15	35.5 1.30	30	14.0 0.78 s

References

- Y.-M. Chiang, J.-K. Su, Y.-H. Liu, Y.-H. Kuo, *Chem. Pharm. Bull.* **49**(5), 581–583 (2001)

Pistacigerrimone F

$\text{C}_{30}\text{H}_{36}\text{O}_5$, M 476



Taxonomy: Cycloartane Triterpenoids

Pistacia integerrima Stew. ex Brandis (*Anacardiaceae*) [1].

Mp 173–174°C.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm: 242.

IR ν_{\max}^{KBr} , cm^{-1} : 3205, 2910, 1710, 1680, 1628, 1445, 1365, 1245, 1050.

EIMS m/z (%): M^+ 476 (10.4), 462 (1.1), 448 (1.3), 437 (14.6), 432 (0.2), 321 (1.6), 320 (1.6), 306 (1.7), 164 (1.7), 148 (15.4), 134 (25.3), 108 (19.0), 94 (35.6), 71 (49.1), 57 (71.7).

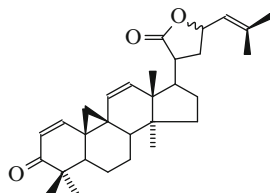
^1H NMR (60 MHz, CDCl_3 , δ , 0-TMS): 0.20 and 0.33 (2H-19, brs), 0.80 (CH_3 -30, s), 0.90 (CH_3 -21, d, $J = 6$ Hz), 0.97 (CH_3 -29, s), 1.00 (CH_3 -28, brs), 1.16 (CH_3 -18, s), 1.56 (CH_3 -27, s), 5.23 (H-1, H-7, H-16, m), 5.97 (H-24, s), 6.20 (H-2, m).

References

1. S.H. Ansari, M. Ali, J.S. Qadry, *Pharmazie* **49**(5), 356–357 (1994)

3-Oxo-cycloarta-1,11,24-trien-23, 21-olide

$\text{C}_{30}\text{H}_{40}\text{O}_3$, M 448



Taxonomy: Cycloartane Triterpenoids

[as a 2:1, 23 (R/S)-epimeric mixture]

Combretum erythrophyllum Burch. (*Combretaceae*) [1].
Mp 191–202°C.

CAS Registry Number: 220665-90-7.

IR ν_{\max}^{KBr} , cm^{-1} : 3105, 2934, 1756, 1659, 1459, 1365, 1166.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (ϵ): 245 (2196), 270 (801), 326 (103).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	158.4	6.57 d (9.5) [6.58 d (9.5)]	C-15 26.8
2	128.7	5.85 d (9.95) [5.86 d (9.95)]	16 32.8 (32.6) 1.38, 1.38 m

(continued)

Table 1 (continued)

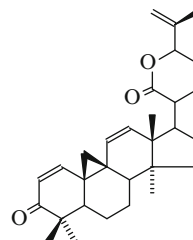
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
3	200.7 –	17	42.4 (42.3) 2.60 dd (7, 10) [2.47 dd]
4	49.0 –	18	20.2 (20.0) 0.92 s
5	45.6 2.20 dd	19	30.2 (30.0)
6	19.8 1.63, 1.63 m	20	41.9 (41.3) 2.76 m
7	24.6	21	178.3 (178.4) –
8	43.9 2.20 dd	22	35.0 (34.7) 2.37 m, 1.83 m
9	37.1 –	23	75.0 (74.8) 5.02 m
10	36.8 –	24	123.1 5.19 d (8.9)
11	129.8 6.52 d (10) [6.56 d (10)]	25	139.6 (139.4) –
	(130.0)	26	18.4 1.72 s
12	132.5 5.97 d (10.3) [6.12 d (10.2)]	27	25.7 1.74 s
	(132.1)	28	19.9 (19.2) 0.92 s
13	31.7 –	29	28.0 1.11 s
	(31.5)	30	21.2 0.98 s
14	48.6 –		
	(48.1)		

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

3-Oxo-cycloarta-1,11,25(26)-trien-24(R),21-olide

$\text{C}_{30}\text{H}_{40}\text{O}_3$, M 448



Taxonomy: Cycloartane Triterpenoids

Combretum erythrophyllum Burch. (*Combretaceae*) [1].

Colorless glassy solid.

IR ν_{\max}^{KBr} , cm^{-1} : 3103, 2940, 1745, 1660.

$[M]^+$ m/z : 448.2989.

Table 1

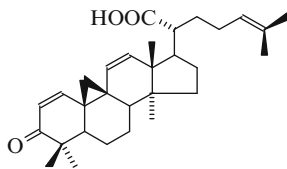
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	
C-1	158.3	6.56 d (9.8)	C-15	26.4	
2	128.7	5.84 d (9.9)	16	32.4	
3	200.7	–	17	41.6	2.54 m
4	49.2	–	18	18.8	1.00 s
5	45.7	2.19 dd	19	30.1	
6	19.9	1.39, 1.39 m	20	40.2	2.56 m
7	24.5	–	21	174.2	–
8	43.7	2.19 dd	22	23.6	2.01 m, 1.45 m
9	37.2	–	23	25.0	1.84 m
10	36.8	–	24	82.0	4.73 t (7.6)
11	129.7	6.49 d (10.3)	25	142.7	–
12	132.9	6.08 d (10.3)	26	112.7	5.03 brs, 4.91 brs
13	31.6	–	27	17.9	1.76 s
14	48.1	–	28	20.2	0.91 s
			29	28.1	1.11 s
			30	21.2	0.98 s

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

Erythrophyllic Acid

$\text{C}_{30}\text{H}_{42}\text{O}_3$, M 450



Taxonomy: Cycloartane Triterpenoids

Combretum erythrophyllum Burch. (*Combretaceae*)

[1].

Mp 200–204°C, $[\alpha]_D + 128.8^\circ$ (c 1.145, CHCl_3).

$[\text{M}]^+$ m/z: 450.3127.

EIMS m/z (%): 450 (100), 435 (42), 432 (16), 417 (9), 407 (6), 389 (6), 381 (5), 350 (5), 335 (7), 308 (47), 293 (50), 267 (58), 243 (22), 212 (26), 197 (23), 174 (42), 162 (43), 136 (45).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3038, 2961, 2864, 2563, 1694, 1670, 1452, 1374, 1204, 1156, 1108.

UV $\lambda_{\text{max}}^{\text{EtOH}}$, nm (ϵ): 252 (2056), 270 (1047), 332 (173).

Table 1

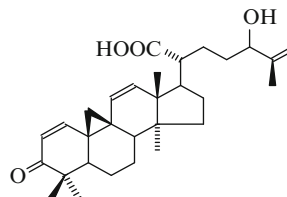
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	
C-1	158.4	6.55 d (9.9)	C-16	32.6	
2	128.6	5.83 d (10)	17	44.8	2.32 m
3	201.1	–	18	18.3	0.97 s
4	49.1	–	19	29.9	1.25 d (4) 1.37 d (4)
5	45.6	2.14 dd (3.3, 11.5)	20	47.7	2.32 m
6	19.9	–	21	181.0	–
7	24.5	–	22	27.5	2.01, 2.01 m
8	43.4	2.20 dd (7, 11.1)	23	25.9	2.01, 2.01 m
9	37.1	–	24	123.6	5.07 t
10	36.8	–	25	132.3	–
11	130.3	6.43 d (10.3)	26	17.7	1.57 s
12	131.9	5.78 d (10.3)	27	25.7	1.66 s
13	31.7	–	28	18.3	0.88 s
14	47.9	–	29	28.1	1.10 s
15	32.4	–	30	21.2	0.97 s

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

24R-Hydroxy-3-oxo-cycloartane-1,11,25 (26)-trien-21-oic Acid

$\text{C}_{30}\text{H}_{42}\text{O}_4$, M 466



Taxonomy: Cycloartane Triterpenoids

Combretum erythrophyllum Burch. (*Combretaceae*)

[1].

Colourless, glassy material.

CAS Registry Number: 220665-92-9.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3424, 3103, 2940, 1660.

Table 1

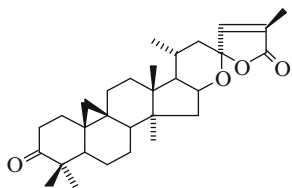
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$		$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C- 1	158.6	6.56 d (9.8)	C-16	32.3	
2	128.6	5.83 d (9.9)	17	44.6	2.54 m
3	200.9	–	18	18.3	0.96 s
4	49.1	–	19	30.2	
5	45.6	2.19 dd	20	47.6	2.56 m
6	19.9		21	180.5	–
7	24.5		22	29.7	
8	43.5	2.19 dd	23	28.4	
9	37.1	–	24	75.9	4.05 m
10	36.8	–	25	147.2	–
11	130.2	6.43 d (10.3)	26	111.7	4.91 brs, 4.81 brs
12	131.9	5.76 d (10)	27	17.2	1.67 s
13	31.7	–	28	19.9	0.86 s
14	47.9	–	29	28.0	1.09 s
15	27.4		30	21.2	0.96 s

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

Pseudolarolide B

$\text{C}_{30}\text{H}_{42}\text{O}_4$, M 466



Taxonomy: Cycloartane Triterpenoids

Pseudolarix kaempferi Gord. (*Pinaceae*) [1].

Mp 229–231°C (from Me_2CO).

CAS Registry Number: 151368-43-3,

CD (c 0.565, EtOH) : $\Delta\epsilon$ (nm) –4.65 (216), 3.75 (245), 0.83 (295),

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3040, 2956, 2936, 2904, 2872, 1769, 1705, 1668, 1453, 1380, 1321, 1309, 1176, 1114, 1030, 972.

UV $\lambda_{\text{max}}^{\text{EtOH}}$, nm (log ϵ): 208.4 (3.76).

EIMS m/z (%): M^+ 466 (23), 451 (15), 423 (3), 422 (4), 381 (3), 380 (3), 356 (3), 338 (8), 328 (44), 323 (6), 313 (21), 311 (8), 218 (15), 207 (19), 203 (11), 201

(11), 189 (13), 173 (14), 161 (15), 159 (17), 155 (17), 147 (24), 137 (100), 135 (29), 133 (34), 121 (42), 119 (61), 107 (39), 105 (44), 95 (32), 93 (43), 91(40), 81 (40), 79 (32), 69 (40), 67 (41), 55 (41), 42 (43).

Table 1

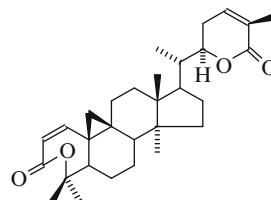
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$		$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C- 1	33.3	1.80 m, 1.51 td (4,14)	C-16	75.5	4.43 q (7.5)
2	37.3	2.28 td (4,14), 2.69 dt (6.5, 14)	17	55.6	1.70 m
3	216.2	–	18	19.5	0.89 s
4	50.1	–	19	30.0	0.58 d (4), 0.83 d (4)
5	48.2	1.68 dd (7,13)	20	25.4	1.75 m
6	21.2	0.90 dt (2,13), 1.54 m	21	20.2	0.99 d (5.5)
7	26.0	1.36 m	22	37.8	1.84 m
8	47.4	1.63 dd (4.5, 13)	23	107.2	–
9	20.8	–	24	146.3	6.83 q (1)
10	26.3	–	25	130.7	–
11	26.3	1.21 m, 2.05ddd (6,10.5,15)	26	172.3	–
12	32.7	1.65 m	27	10.4	1.87 d (1)
13	44.6	–	28	20.4	1.13 s
14	46.2	–	29	22.2	1.03 s
15	43.4	1.42 dd (7.5, 13), 1.96 dd (7.5, 13)	30	20.7	1.08 s

References

1. G. Chen, Z. Li, D. Pan, C. Tang, X. He, G. Xu, K. Chen, K.H. Lee, *J. Nat. Prod.* **56**(7), 1114–1122 (1993)

Schizanolactone B

$\text{C}_{30}\text{H}_{42}\text{O}_4$, M 466



Taxonomy: Cycloartane Triterpenoids

Schizandra sp. (*Schizandraceae*) [1].

Mp 205–207°C.

Table 1

$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$		
C- 1	150.44	6.14 d (12.7)	C-16	35.02	1.34–1.40
2	120.49	5.95 d (12.7)	17	48.11	1.57–1.64
3	167.33	–	18	16.96	0.97 s
4	84.52	–	19	24.05	1.05 d (5), 1.24 d (5)
5	46.38	2.42 dd (13.1, 4.6)	20	39.23	2.04 qd (6.1, 3.5)
6	24.45	0.81 dddd (13.1, 12.9, 11.2, 3.6), 1.87 dddd (12.9, 4.6, 4.6, 4.4)	21	13.18	0.98 d (6.1)
7	28.98*	1.23 dddd (13.2, 11.2, 10.9, 4.6), 1.49 dddd (13.2, 6.0, 4.4, 3.6)	22	80.48	4.47 ddd (13.1, 3.5, 3.5)
8	45.07	1.80 dd (10.9, 6.0)	23	23.60	2.10 dddq (14, 6.5, 3.5, 0.5), 2.38 dddq (14, 13.1, 2.0, 1.5)
9	33.47	–	24	139.24	6.62 ddq (6.5, 1.5, 0.5)
10	28.68	–	25	128.49	–
11	32.14*	2.07 dd? (13.6, 6.8), 1.57–1.64 (6.8, 6.6)	26	166.43	–
12	32.55	1.69 ?? (13.6, 6.6), 1.70 ?? (6.8, 6.8)	27	17.18	1.92 ddd (2.0, 0.5, 0.5)
13	48.71**	–	28	18.99	0.90
14	45.57**	–	29	29.24	1.38
15	26.92	1.57–1.64, 1.78	30	22.08	1.36

*,** May be interchanged

$[\alpha]_D^{20} + 80.2^\circ$ (c 0.94, CHCl_3).

IR ν_{max} , cm^{-1} : 1715, 1675.

MS m/z: M^+ 466.3074.

UV $\lambda_{\text{max}}^{\text{MeOH}}$ nm (log ϵ): 251 (4.15).

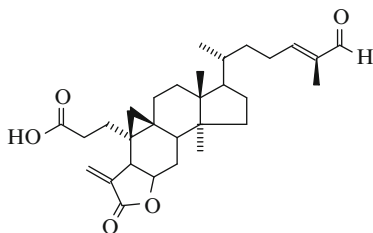
See [Table 1](#)

References

1. J.-S. Liu, M.-F. Huang, W.A. Ayer, J. Bigam, *Tetrahedron Lett.* **24**, 2355–2358 (1983)

Coronalolide

$\text{C}_{30}\text{H}_{42}\text{O}_5$, M 482



Taxonomy: Cycloartane Triterpenoids

Gardenia coronaria (*Rubiaceae*) [1].

Mp 82.5–83° (from hexane – CH_2Cl_2), $[\alpha]_D^{25} + 119.1^\circ$ (c 0.69, CHCl_3).

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm: 241 and 268.

IR $\nu_{\text{max}}^{\text{film}}$, cm^{-1} : 3221, 2946, 2880, 1761, 1707, 1686, 1641, 1458, 1268, 1148, 1028, 988, 757.

EIMS m/z (%): M^+ 482 (25), 464 (15), 384 (22), 357 (100), 245 (13), 219 (18), 147 (37), 121 (41), 107 (49).

HREIMS m/z: 482.3027 [M^+].

Table 1

$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$		
C- 1	30.7	C-16	27.8		
2	31.2	17	51.4		
3	178.1	18	16.0	0.95 s	
4	139.1	19	23.2	0.19 d (5.4), 0.44 d (5.4)	
5	39.0	3.25 bd (8.4)	20	36.0	
6	74.4	4.77 td (8.4, 6.7)	21	18.2	0.94 d (6.5)
7	27.2	22	34.8		
8	38.2	23	26.0		
9	25.1	24	155.4	6.51brt (6.2)	
10	28.1	25	139.1	–	
11	26.5	26	195.5	9.40 s	
12	33.0	27	9.2	1.76 brs	
13	45.7	28	20.1	0.92 s	
14	48.6	29	170.7	–	
15	34.8	30	123.1	6.35 d (2.2), 5.75 d (2)	

Biological activity

This compound showed broad cytotoxic activity when evaluated against a panel of human cancer cell lines.

References

- G.L. Silva, R.R. Gil, B. Cui, H. Chai, T. Santisuk, E. Srisook, V. Reutrakul, P. Tuchinda, S. Sophasan, S. Sujarit, S. Upatham, S.M. Lynn, J.E. Farthing, S.-L. Yang, J.A. Lewis, M.J. O'Neill, N.R. Farnsworth, G.A. Cordell, J.M. Pezzuto, A.D. Kinghorn, *Tetrahedron* **53**(2), 529–538 (1997)

Table 1 (continued)

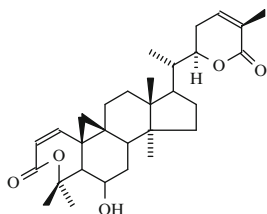
δ_C (CDCl ₃)									
4	84.75	10	28.41	16	37.09	22	80.48	28	19.87
5	49.41	11	35.54	17	48.52	23	23.76	29	28.41
6	65.82	12	35.81	18	17.11	24	140.02	30	24.51

References

- Y. Chen, Z. Lin, H. Zhang, H. Sun, *Phytochemistry* **29**(10), 3358–3359 (1990)

Kadsulactone A

C₃₀H₄₂O₅, M 482



Taxonomy: Cycloartane Triterpenoids

Kadsura heteroclita Roxb. (*Schizandraceae*) [1].

Mp 195–197° (from MeOH), $[\alpha]_D^{23} + 70.65^\circ$ (c 0.552, MeOH).

CD(MeOH): $\Delta\epsilon_{238} -6.69$.

IR ν_{\max}^{KBr} , cm⁻¹: 3460, 1710, 1675, 1120.

EIMS m/z: M⁺ 482, 464, 446, 431, 231, 187, 173, 159, 147, 133, 119, 107, 95, 83, 67, 55, 41 (base peak).

¹HNMR (CDCl₃, δ , 0-TMS): 0.93 (Me-28, s), 0.97 (Me-18, s), 0.98 (Me-21, d, J = 6.5 Hz), 1.60 (H-7 α , m), 1.67 (Me-30, s), 1.86 (Me-29, s), 1.96 (Me-27, s), 2.10 and 2.26 (2H-19, d, J = 5 Hz), 4.44 (H-22, dt, J = 13.1, 3.5 Hz), 4.53 (H-6 α , q, J = 4.5 Hz), 6.15 and 6.20 (H-1 and H-2, d, J = 12 Hz), 6.56 (H-24, dd, J = 6.0, 1.5 Hz).

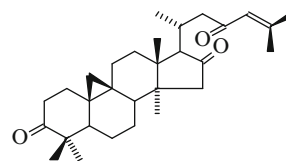
Table 1

δ_C (CDCl ₃)									
C-1	152.28	C-7	33.04	C-13	48.19	C-19	27.09	C-25	128.10
2	119.98	8	39.94	14	45.89	20	39.53	26	166.17
3	167.02	9	32.51	15	28.73	21	13.11	27	18.30

(continued)

5 α -Cycloart-24-ene-3,16,23-trione

C₃₀H₄₄O₃, M 452



Taxonomy: Cycloartane Triterpenoids

Gardenia obtusifolia Roxb. (*Rubiaceae*) [1].

Mp 173–173.8°C (from EtOAc), $[\alpha]_D^{26} -92.7^\circ$ (c 0.85, CHCl₃).

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 236 (4.19).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 1727, 1700, 1682, 1618, 1448, 1385, 1243, 1114, 1037, 974.

EIMS m/z (%): M⁺ 452 (1), 437 (16), 381 (8), 355 (2), 354 (1), 339 (1), 313 (1), 299 (1), 269(1) 233 (1), 203 (1), 185 (2), 177 (2), 161 (2), 147 (3), 135 (5), 125 (15), 98 (24), 91 (15), 83 (100), 69 (21), 55 (62).

Table 1

δ_C (CDCl ₃)		δ_H (J/Hz)		δ_C (CDCl ₃)		δ_H (J/Hz)	
C-1	33.13	1.89, 1.56	C-16	219.26	–		
2	37.30	2.72 ddd (13.9, 13.9, 6.3), 2.32	17	60.87	2.30		
			18	18.95	1.20 s		
3	215.99	–	19	30.04	0.65 d (4.4),		
4	50.15	–			0.86 d (4.4)		
5	48.30	1.75 dd (12.2, 4.3)	20	27.40	2.33		

(continued)

Table 1 (continued)

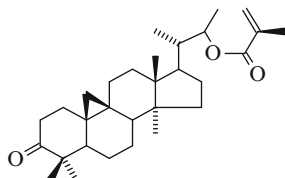
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
6	21.27 1.62, 0.97 q (12.6)	21	20.21 0.99 d (5.7)
7	26.18 1.37, 1.21	22	49.98 3.20 m, 2.34
8	47.28 1.69 dd (12.3, 4.6)	23	200.71 –
9	20.37 –	24	124.40 6.11 m
10	26.45 –	25	154.27 –
11	26.20 2.16, 1.28	26	20.72 2.14 d (1)
12	31.25 1.85	27	27.60 1.88 d (1.3)
13	42.07 –	28	19.70 1.10 s
14	45.29 –	29	22.15 1.06 s
15	50.90 2.07 d (18.5), 2.01 d (18.5)	30	20.64 1.11 s

References

1. P. Tuchinda, W. Pompimon, V. Reutrakul, M. Pohmakotr, C. Yoosook, N. Kongyai, S. Sophasan, K. Sujarit, S.E. Upathum, T. Santisuk, *Tetrahedron* **58**, 8073–8086 (2002)

Kadsulactone

C₃₀H₄₄O₃, M 452



Taxonomy: Cycloartane Triterpenoids

Kadsura longipedunculata (*Schizandraceae*) [1].

Mp 230–232°C (from EtOAc), $[\alpha]_D^{18} +57.7^\circ$ (c 0.09, CHCl₃).

CAS Registry Number: 137348-13-1.

CD (c 0.033, EtOH) $[\theta]$ (nm): –1537 (300), 0 (280), +3797 (258).

HRMS m/z: M⁺ 452.3292 (C₃₀H₄₄O₃).

MS m/z (%): M⁺ 452 (58), [M + 1]⁺ 453 (17), 437 (38), 353 (50), 314 (40), 313 (29), 297 (14), 271 (10), 235 (15), 175 (27), 147 (37), 145 (31), 111 (28).

¹H NMR (CDCl₃, δ): 0.59 and 0.80 (2H-19, d, J = 4.3 Hz), 0.90, 1.04, 1.05, 1.10 (4 × CH₃, s), 0.98 (Me-21, d, J = 6.5 Hz), 1.92 (Me-27, t, J = 1.3 Hz),

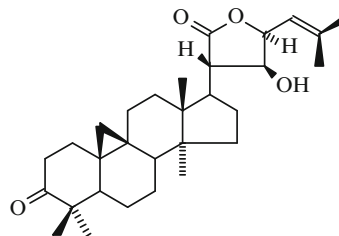
2.04 (H-23, m), 2.38 (H-23, qt, J = 2.4, 14.8 Hz), 2.11(H-20, m), 2.70 (H-2, m), 4.48 (H-22, td, J = 3.5, 13.2 Hz), 6.60 (H-24, d, J = 6.5 Hz).

References

1. R. Ran, H. Xue, L. Li, *Planta Med.* **57**(1), 87–88 (1991)

Argenteanone E

C₃₀H₄₄O₄, M 468



Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D^{20} -10^\circ$ (c 1, CHCl₃).

CAS Registry Number: 186090-64-2.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3410, 1775, 1702.

FABMS m/z: 491 [M + Na]⁺.

HRFABMS m/z: 491.3147 (C₃₀H₄₄NaO₄).

Table 1

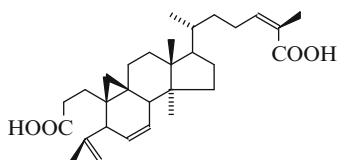
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.4	C-16	28.4
2	37.5 2.30 m, 2.70 m	17	45.5
3	216.9	18	18.4 1.22 s
4	50.3	19	29.6 0.55 d (4), 0.78 (4)
5	48.4	20	52.1 2.65 m
6	21.2	21	177.4 –
7	25.9	22	74.9 4.20 d (3.6)
8	47.8	23	79.0 5.20 dd (8, 3.6)
9	21.0	24	117.1 5.35 dt (8,1)
10	26.1	25	141.5 –
11	26.4	26	26.1 1.82 s
12	30.2	27	19.1 1.75 s
13	45.7	28	19.4 0.90 s
14	48.8	29	22.3 1.02 s
15	35.1	30	20.8 1.08 s

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

Changnanic Acid

C₃₀H₄₄O₄, M 468



Taxonomy: Cycloartane Triterpenoids

Kadsura longipedunculata Finet. et Gagnep
(*Schizandraceae*) [1].

Mp 99–101°C, [α]_D¹⁷ –71.89° (c 1.302, MeOH).

CAS Registry Number: 136040-44-3.

Biological activity

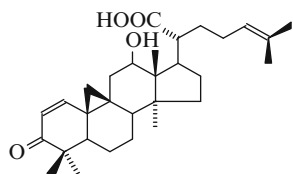
Cytotoxic agent against cells of leukemia P-388
in vitro.

References

1. J.-S. Liu, M.-F. Huang, *Huaxuexuebao (Acta Chim.Sin.)* **49**(5), 502–506 (1991)

12β-Hydroxy-3-oxo-cycloart-1,24-dien-21-oic Acid

C₃₀H₄₄O₄, M 468



Taxonomy: Cycloartane Triterpenoids

Combretum erythrophyllum Burch. (*Combretaceae*) [1].
Amorphous solid.

CAS Registry Number: 220665-95-2.

IR ν_{max}^{KBr}, cm⁻¹: 3450, 2650, 1713, 1657, 1462, 1374, 1291, 1262, 1110.

Table 1

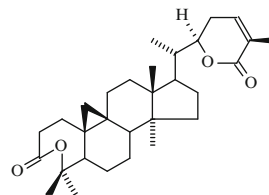
	δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	160.0	6.59 d (9.9)	C-16	32.5
2	127.4	5.81 d (9.9)	17	52.1 1.45 m
3	204.2	–	18	17.8 0.97 s
4	47.9	–	19	29.7 1.26 d (4), 1.15 d (4)
5	45.1	2.30 dd	20	48.2 2.24 m
6	22.7	–	21	179.6 –
7	25.8	–	22	27.2 1.96 m
8	48.8	2.24 m	23	26.0 1.96 m
9	35.7	–	24	123.8 5.07 t
10	35.1	–	25	132.0 –
11	40.1	2.18 dd (14.5, 10.3), 1.86 dd (14.3, 2)	26	17.7 1.55 s
12	72.3	4.08 dd (10, 2)	27	25.7 1.64 s
13	38.1	–	28	18.5 1.18 s
14	44.2	–	29	28.0 1.10 s
15	36.2	–	30	20.6 1.02 s

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

Kadsudilactone

C₃₀H₄₄O₄, M 468



Taxonomy: Cycloartane Triterpenoids

Kadsura coccinea (*Schizandraceae*) [1].

Mp 230–232°C, [α]_D¹⁸ +66.3° (c 0.05; CHCl₃).

CAS Registry Number: 137348-14-2.

MS m/z (%): M⁺468 (15), 453(30), 369(20), 329(14), 314(9), 313(12), 287 (12), 234(15), 175 (13), 111 (33).

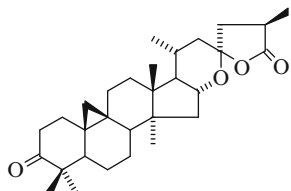
^1H NMR (CDCl_3 , δ): 0.58 and 0.64 (2H-19, d, $J = 5$ Hz), 0.89, 1.00, 1.39, 1.45 ($4 \times \text{CH}_3$, s), 0.96 (CH_3 -21, d, $J = 7$ Hz), 1.91 (CH_3 -27, s), 2.03 (H-23, q, $J = 4$ Hz), 2.38 (H-23, m), 2.05 (H-20, m), 2.70 (H-2, m), 4.45 (H-22, td, $J = 4, 14$ Hz), 6.60 (H-24, d, $J = 7$ Hz).

References

1. R. Ran, H. Xue, L. Li, *Planta Med.* **57**(1), 87–88 (1991)

Pseudolarolide A

$\text{C}_{30}\text{H}_{44}\text{O}_4$, M 468



Taxonomy: Cycloartane Triterpenoids

Pseudolarix kaempferi Gord. (*Pinaceae*) [1].

Mp 257–259°C (from MeOH).

CAS Registry Number: 130396-81-5.

CD (c 0.47, EtOH): $\Delta\epsilon$ (nm) 2.05 (200), 0.88 (295).

UV $\lambda_{\text{max}}^{\text{EtOH}}$, nm (log ϵ): 203.2 (3.27).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3040, 2936, 2880, 1775, 1702, 1457, 1381, 1213, 1080, 979, 896.

EIMS m/z (%): M^+ 468 (100), 453 (56), 425 (29), 424 (50), 395 (8), 383 (10), 382 (10), 356 (11), 338 (11), 330 (64), 315 (14), 311 (18), 303 (16), 295 (11), 271 (16), 250 (21), 201 (21), 187 (16), 173 (20), 159 (24), 147 (23), 139 (86), 135 (34), 121 (28), 119 (28), 107 (28), 105 (28), 95 (26), 93 (28), 91 (26), 81 (19), 79 (20), 67 (28), 55 (29), 42 (29).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	33.3 1.79 dt (8, 14), 1.50 td (6.5, 14)	C-16	77.4 4.09 td (5.5, 10) 17 54.8 1.47 t (10)
2	37.4 2.28 td (6.5, 14), 2.69 dt (8, 14)	18	19.3 1.06 s 19 30.3 0.57 d (4), 0.83 d (4)

(continued)

Table 1 (continued)

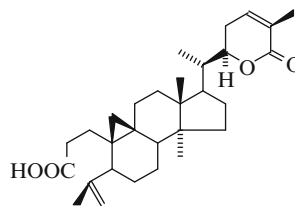
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
3	216.2 –	20	30.0 2.08 m
4	50.2 –	21	19.2 0.88 d (6.5)
5	48.6 1.68 dd (7.5, 12.5)	22	44.2 1.39 dd (12, 14), 1.87 dd (4, 14)
6	21.3 0.90 dt (2, 12.5), 1.54 m	23	107.3 –
7	26.2 1.33 m	24	42.7 2.36 dd (8.5, 13), 1.72 dd (4, 13)
8	47.8 1.53 dd (6, 12.5)	25	34.1 2.92 m
9	20.6 –	26	179.6 –
10	26.6 –	27	14.9 1.23 d (7)
11	26.8 1.14 m, 2.08 m	28	23.1 1.08 s
12	30.9 1.55 m	29	22.1 1.08 s
13	44.1 –	30	20.8 1.03 s
14	47.1 –		
15	40.8 1.23 dd (5.5, 12.5), 1.76 dd (10, 12.5)		

References

1. G. Chen, Z. Li, D. Pan, C. Tang, X. He, G. Xu, K. Chen, K.H. Lee, *J. Nat. Prod.* **56**(7), 1114–1122 (1993)

Shizanolactone E

$\text{C}_{30}\text{H}_{44}\text{O}_4$, M 468



Taxonomy: Cycloartane Triterpenoids

Kadsura longipedunculata Finet. et Gagnep

(*Schizandraceae*) [1, 2].

Mp 120–122°C, $[\alpha]_{\text{D}}^{15} +113^\circ$ (c 0.33, CHCl_3).

Mp 180–182°C.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3333–2666, 3027, 1709, 1452, 1378, 1299, 1224, 1121, 1031, 912, 731, 647.

MS m/z (%): M^+ 468 (35), 453 (85), 425 (10), 369 (40), 314 (30), 287 (20), 233 (30), 121 (60), 107 (70), 85 (100), 55 (95).

^1H NMR (400 MHz, CDCl_3 , δ , 0-TMS): 0.42 and 0.76 (2H-19, d, $J = 4.4$ Hz), 0.92 (CH_3 , s), 0.97

(CH₃-21, d, J = 6.6 Hz), 1.00 (CH₃, s), 1.68 (CH₃, s), 1.92 (CH₃-27, s), 2.07 (H-20, m), 4.48 (H-22, m), 4.73 (H-29, d, J = 2 Hz), 4.81 (H-29, d, J = 2 Hz), 6.63 (H-24, d, J = 6.2 Hz).

Table 1

$\delta_c(\text{CDCl}_3)$									
C-1	28.64	C-7	27.50	C-13	45.48	C-19	29.74	C-25	128.08
2	31.36	8	47.47	14	48.44	20	39.00	26	166.52
3	179.64	9	21.10	15	32.76	21	12.92	27	16.83
4	149.07	10	26.91	16	26.63	22	80.47	28	19.28
5	45.70	11	26.73	17	45.95	23	23.54	29	111.53
6	24.66	12	35.48	18	17.10	24	139.42	30	19.60

Biological activity

Cytotoxic agent against cells of leukemia P-388 in vitro.

References

1. J.-S. Liu, M.-F. Huang, Huaxue Xuebao (Acta Chim. Sin.) **49**(5), 502–506 (1991)
2. Z. You, M. Liao, Y. Zhi, Y. Chen, Yaoxue Xuebao (Acta Pharm. Sin.) **32**(6), 455–457 (1997)

28, s), 0.94, 0.98 (Me-18, Me-29, s), 1.79 (H-22, dd, J = 12.6, 11.6 Hz), 1.90 (Me-26, d, J = 4.4 Hz), 2.15 (H-22, dd, J = 12.6, 6.2 Hz), 2.50 (H-20, m), 3.25 (H-3, dd, J = 7.3, 3.9 Hz), 3.58 (H-21, dd, J = 9.6 Hz), 4.26 (H-21, dd, J = 9.8 Hz), 6.66 (H-24, q, J = 4.4 Hz).

Table 1

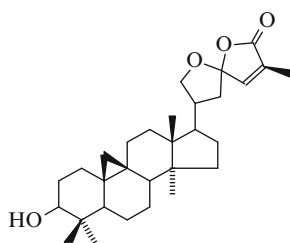
$\delta_c(\text{CDCl}_3)$									
C-1	31.8	C-7	27.6	C-13	45.5	C-19	29.8	C-25	133.2
2	30.2	8	47.7	14	48.2	20	40.7	26	10.4
3	78.6	9	19.8	15	31.2	21	73.9	27	171.1
4	40.4	10	26.3	16	25.8	22	42.4	28	19.1
5	46.9	11	26.1	17	51.0	23	111.9	29	25.3
6	20.8	12	35.6	18	18.8	24	144.6	30	13.8

References

1. P.G. Waterman, J. Mohammad, Phytochemistry **23**(9), 2077–2079 (1984)

Uvariastron

C₃₀H₄₄O₄, M 468



Taxonomy: Cycloartane Triterpenoids

Uvariastrum zenkeri (Annonaceae) [1].

Mp 270°C (from MeOH), $[\alpha]_D^{25} -17.5^\circ$ (c 0.2, CHCl₃).

CAS Registry Number: 93078-68-3.

UV $\nu_{\text{max}}^{\text{MeOH}}$, nm (log ϵ): 241 (4.29).

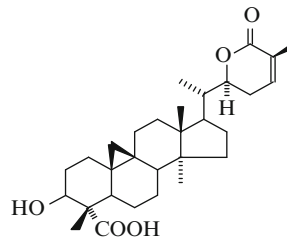
IR $\nu_{\text{max}}^{\text{KCl}}$ cm⁻¹: 3400, 2940, 1750, 1000.

EIMS m/z (%): M⁺ 468 (6), 453 (13), 450 (44), 435 (50), 328 (28), 153 (61), 109 (100).

¹HNMR (360 MHz, CDCl₃, δ , 0-TMS): 0.30 and 0.56 (2H-19, d, J = 4.2 Hz), 0.78 (Me-30, s), 0.86 (Me-

Abrusogenin

C₃₀H₄₄O₅, M 484



Taxonomy: Cycloartane Triterpenoids

Abrusprecatorius L. (Leguminosae) [1, 2].

Mp 278–280°C (from MeOH), $[\alpha]_D^{20} +37^\circ$ (c 0.1, CHCl₃-MeOH, 1:1).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3430, 1707, 1384, 1259, 1147, 1046.

EIMS m/z (%): M⁺ 484 (10), 469 (16), 466 (19), 448 (17), 423 (11), 385 (19), 367 (11), 344 (10), 314 (81), 299 (18), 233 (28), 215 (22), 203 (15), 187 (28), 173 (38), 161 (44), 147 (52), 119 (59), 111 (58), 107 (81), 95 (100), 93 (67), 91 (38), 81 (50), 79 (32), 69 (24), 67 (25), 55 (80).

HRMS m/z: 484.3189 (C₃₀H₄₄O₅), 367.2630 (C₂₅H₃₅O₂), 314.2245 (C₂₁H₃₀O₂), 181.1223

(C₁₁H₁₇O₂), 167.1072 (C₁₀H₁₅O₂), 139.0764
(C₈H₁₁O₂), 111.0445 (C₆H₇O₂), 95.0131 (C₅H₅O₂).

Table 1

	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C- 1	31.58		C-16	25.60
2	29.21		17	47.54
3	75.22	4.09 dd (11.1, 4.3)	18	17.87 0.97 s
4	54.57	–	19	29.92 0.39 d (4), 0.61d (4)
5	44.10		20	40.02
6	23.00		21	12.85 1.00 d (6.7)
7	27.58		22	80.51 4.50 dd (13.2,2.8)
8	47.92		23	27.86 2.58 m
9	19.95	–	24	140.29 6.63 m
10	25.09	–	25	127.96 –
11	26.37		26	167.13 –
12	35.44		27	17.07 1.91brs
13	45.24	–	28	19.37 0.93 s
14	48.87	–	29	180.19
15	32.68		30	9.18 1.13 s

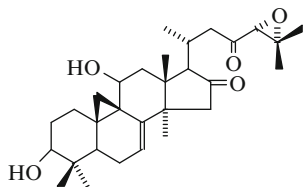
Crystal structure of abrusogenin methyl ester, see [1].

References

1. Y.H. Choi, A.D. Kinghorn, X. Shi, H. Zhang, B.K. Teo. *J. Chem. Soc., Chem. Commun.* 887–888 (1989)
2. Y.H. Choi, R.A. Hussain, J.M. Pezzuto, A.D. Kinghorn, J.F. Morton, *J. Nat. Prod.* **52**(5), 1118–1127 (1989)

Genin of Cimicifugoside H-1 (cimicidanol)

C₃₀H₄₄O₅, M 484



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1, 2].

Cimicifuga foetida L. (*Ranunculaceae*) [2].

Mp 204–206°C (from MeOH), $[\alpha]_D -31.4^\circ$ (c 0.7, MeOH).

ORD (c 0.7, MeOH) $[\alpha]$ (nm): $-31.4^\circ(589)$, $-57.3^\circ(577)$, $-66.8^\circ(545)$, $-148.6^\circ(435)$, $-397.9^\circ(365)$.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3500–3300, 1740, 1705.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm (ϵ): 205 (6214).

EIMS m/z: M⁺ 484, 466, 448.

HREIMS m/z: M⁺ 484.3192.

Table 1

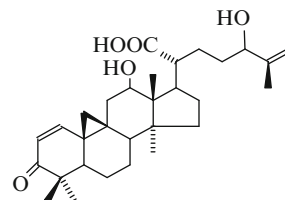
	$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$
C- 1	27.6	1.68, 2.78	C-16	218.4 –
2	30.9	2.04, 2.04	17	61.1 2.40 d (9)
3	78.0	3.62 m	18	20.1 1.24 s
4	40.5	–	19	18.7 1.01 d (4), 1.99 (4)
5	43.5	1.37	20	27.7 2.63
6	22.3	1.78, 2.00	21	20.4 1.06 d (7)
7	115.6	5.18 dd (7, 2)	22	47.3 2.63, 3.68 m
8	147.1	–	23	205.6 –
9	27.6	–	24	65.8 3.75 s
10	29.7	–	25	60.6 –
11	63.1	4.58 m	26	18.3 1.36 s
12	47.3	2.22 dd (14,4), 2.84	27	24.6 1.37 s
13	44.4	–	28	27.7 1.23 s
14	46.1	–	29	26.3 1.30 s
15	49.8	2.31 d (18)	30	13.8 1.20 s

References

1. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)
2. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

12 β ,24R-Dihydroxy-3-oxo-cycloart-1, 25 (26)-dien-21-oic Acid

C₃₀H₄₄O₅, M 484



Taxonomy: Cycloartane Triterpenoids*Combretum erythrophyllum* Burch. (*Combretaceae*) [1].

Amorphous solid

CAS Registry Number: 220665-96-3.

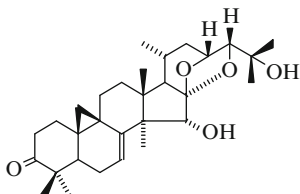
IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3455, 2650, 1711, 1657, 1462, 1420, 1374, 1290, 1261, 1110.**Table 1**

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$		
C-1	160.3	6.62 d (9.9)	C-16	32.4	
2	127.4	5.83 d (9.9)	17	52.1	1.45 m
3	204.5	–	18	17.8	0.97 s
4	47.9	–	19	29.7	
5	45.1	2.26 m	20	48.0	2.26 m
6	22.7	–	21	179.4	–
7	25.8	–	22	29.4	1.96 m
8	48.8	2.26 m	23		1.96 m
9	35.7	–	24	75.8	4.04 m
10	35.1	–	25	146.9	–
11	40.1	2.18 dd (14.5,10.3), 1.82 dd (14.3, 2)	26	111.7	4.91 brs, 4.82 brs
12	72.3	4.04 m	27	17.2	1.68 s
13	38.1	–	28	18.5	1.18 s
14	44.2	–	29	28.0	1.11 s
15	36.0	–	30		1.03 s

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

3-Keto-24-*epi*-7,8-didehydrocimigenol

C₃₀H₄₄O₅, M 484**Taxonomy:** Cycloartane Triterpenoids*Cimicifuga heracleifolia* Komarov (*Ranunculaceae*) [1].Mp 225–226°C (from EtOAc), $[\alpha]_{\text{D}} -12.4^\circ$ (c 0.37, CHCl₃).

CAS Registry Number: 150972-71-7.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3470, 1720.MS m/z: 484 (M⁺) (base peak), 469, 466, 451, 398, 385.HRMS m/z: 484.3187 (M⁺).

X-Ray [1].

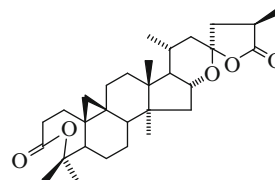
Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$ (C ₅ D ₅ N)	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$ (C ₅ D ₅ N)		
C-1	31.68	1.57 m, 1.83 td (13.5, 4.5)	C-16	111.97	–
2	36.81	2.30 ddd (13.5,4.5,2.0), 2.78 td (13.5,6.5)	17	61.00	1.74 d (6.8)
3	216.34	–	18	21.14	1.19 s
4	48.89	–	19	27.85	0.71 d (4), 1.22 d (4)
5	43.86	1.62 m	20	22.89	1.75 m
6	21.73	1.74 m	21	19.17	0.98 d (5.5)
7	114.26	6.05 dd (7.4, 2.0)	22	29.14	1.98 ddd (13, 6, 2.5), 2.65 m
8	146.79	–	23	73.45	4.62 ddd (9.5, 4.2, 2.5)
9	26.36	–	24	83.30	3.73d (4.2)
10	28.09	–	25	68.70	–
11	25.51	1.38 m, 2.09 m	26	31.37	1.43 s
12	33.48	1.70 m, 1.78 m	27	24.04	1.29 s
13	40.81	–	28	17.91	1.26 s
14	50.25	–	29	22.16	1.07 s
15	77.76	4.05 s	30	20.25	1.11 s

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

Pseudolarolide D

C₃₀H₄₄O₅, M 484

Taxonomy: Cycloartane Triterpenoids*Pseudolarix kaempferi* Gord. (*Pinaceae*) [1].Mp 222–223°C (from Me₂CO).

CAS Registry Number: 151380-77-7

CD (c 0.45, EtOH) Δε (nm): 1.70 (218).

UV λ_{max}^{EtOH}, nm (log ε): 201.2 (2.57).IR ν_{max}^{KBr}, cm⁻¹: 2940, 2885, 1772, 1709, 1457, 1447, 1380, 1290, 1215, 1118, 1080, 982, 894, 875.EIMS m/z (%): M⁺ 484 (34), 469 (53), 466 (4), 451 (10), 440 (23), 426 (5), 411 (17), 354 (17), 339 (9), 331 (12), 250 (12), 139 (100), 121 (29), 119 (29), 109 (20), 107 (31), 105 (25), 95 (29), 93 (29), 69 (45), 56 (35), 42 (31).**Table 1**

δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	29.9 1.79 m, 1.52 m	C-16	77.4 4.09 dt (5.5, 10.5)
2	35.0 2.68 m	17	54.8 1.48 t (10.5)
3	175.4 –	18	19.5 1.05 s
4	87.2 –	19	30.7 0.59 d (4.5),
5	50.0 2.05 dd (5,12.5)		0.7d (4.5)
6	25.7 0.68 q (12.5),	20	30.0 2.07 m
	1.79 m	21	19.3 0.89 d (6.5)
7	25.7 1.10 m, 1.28 m	22	44.3 1.89 dd (4,14),
8	48.4 1.42 m		142 m
9	22.6 –	23	107.2 –
10	28.2 –	24	42.7 2.39 dd (8.5, 13),
11	27.6 1.12 m, 2.10 m		1.72 m
12	31.0 1.69 m	25	34.2 2.91 m

(continued)

Table 1

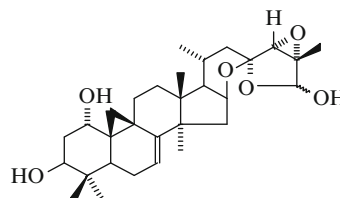
	δ _C (C ₅ D ₅ N)		δ _H (J/Hz)		δ _C (C ₅ D ₅ N)		δ _H (J/Hz)		
	26S	26R	26S	26R	26S	26R	26S	26R	
C-1	72.36	72.36	3.95 s	3.95 s	C-16	73.45	73.50	4.69	4.69
2	38.95	38.98	2.23, 2.40	2.23, 2.40	17	57.23	57.18	1.59	1.59
3	72.73	72.73	4.42	4.42	18	22.99	22.99	1.27 s	1.28 s
4	40.52	40.52	–	–	19	28.28	28.30	0.73 d (4),	0.75 d (4),
5	36.23	36.23	2.23	2.23				1.23 d (4)	1.25 d (4)
6	21.84	21.84	1.76, 2.00	1.76, 2.00	20	26.28	26.40	1.86	1.86
7	113.40	113.51	5.13 dd	5.21 dd	21	20.49	20.45	0.96 d (6.5)	0.94 d (6.5)
			(7.9, 1.9)	(7.9, 1.9)	22	37.46	37.00	1.70, 2.22	1.70, 2.22
8	149.78	149.78	–	–	23	106.17	103.71	–	–
9	21.29	21.29	–	–	24	63.57	62.99	3.87 s	3.73 s
10	33.45	33.45	–	–	25	65.53	63.90	–	–
11	25.19	25.19	1.53, 2.96	1.53, 2.96	26	98.52	98.23	5.72 s	5.74 s
12	33.17	33.17	1.74, 1.78	1.74, 1.78	27	13.06	13.13	1.76 s	1.60 s
13	44.03	44.06	–	–	28	26.81	26.88	1.08 s	1.13 s
14	50.04	50.11	–	–	29	26.23	26.23	1.29 s	1.30 s
15	42.63	42.72	1.78, 1.97	1.92, 2.18	30	12.82	12.82	1.15 s	1.16 s

Table 1 (continued)

δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
13	43.6 –	26	179.7 –
14	47.2 –	27	15.0 1.23 d (7)
15	41.0 1.27 dd (5.5,12),	28	23.2 1.09 s
	1.78 dd (10,12)	29	31.1 1.38 s
		30	23.0 1.44 s

References

1. G. Chen, Z. Li, D. Pan, C. Tang, X. He, G. Xu, K. Chen, K.H. Lee, *J. Nat. Prod.* **56**(7), 1114–1122 (1993)

Genin of Bugbanoside AC₃₀H₄₄O₆, M 500**Taxonomy:** Cycloartane Triterpenoids*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].

Mp 159–160°C (from MeOH), $[\alpha]_D^{23}$ -41.1° (c 0.22, MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 3600–3200.

Positive HRSIMS m/z : 501.3214 (M + H)⁺.

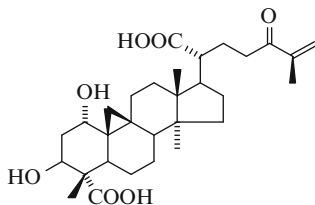
See Table 1

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(6), 1001–1007 (1998)

Quadrangularic Acid H

$\text{C}_{30}\text{H}_{44}\text{O}_7$, M 516



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25}$ $+14.3^\circ$ (c 0.03, MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1710, 1450, 1040.

HRFABMS m/z : 539.2980 [M + Na]⁺.

¹H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.42 and 0.80 (2H-19, d, J = 4.5 Hz), 1.04 (CH₃-28, s), 1.35 (CH₃-18, s), 1.69 (CH₃-30, s), 1.86 (CH₃-27, s), 2.24 (H-2, ddd, J = 12.5, 12, 3 Hz), 2.47 (H-17, H-2, m), 2.65 (H-20, H-11, m), 2.98 (2H-23, m), 3.37 (H-5, dd, J = 12, 4.5 Hz), 3.79 (H-1, brs), 5.52 (H-3, dd, J = 12.5, 4.5 Hz), 5.64 (H-26, brs), 5.97 (H-26, brs).

Table 1

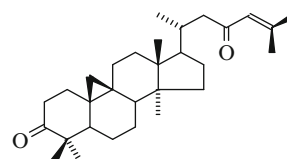
$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$									
C-1	72.3	C-7	27.2	C-13	45.5	C-19	29.6	C-25	144.3
2	38.5	8	47.8	14	48.9	20	48.5	26	124.6
3	70.6	9	20.7	15	35.2	21	178.5	27	17.5
4	55.5	10	30.3	16	25.6	22	27.6	28	19.3
5	37.5	11	25.7	17	49.4	23	35.6	29	180.1
6	23.1	12	30.5	18	18.0	24	201.2	30	9.6

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, J. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

5 α -Cycloart-24-ene-3,23-dione

$\text{C}_{30}\text{H}_{46}\text{O}_2$, M 438



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei (*Annonaceae*) [1].

Gardenia sp: *G. gordonii*, *G. hillii*, *G. strockii* (*Rubiaceae*) [2].

Mp 137–138°C (from CHCl_3 -MeOH, 1:1), $[\alpha]_D^{21}$ $+6^\circ$ (c 0.85, CHCl_3).

CD nm ($\Delta\epsilon$): 260 (+0.09), 298 (−0.61), 330 (−0.2, sh).

UV $\lambda_{\max}^{\text{MeOH}}$, nm (log ϵ): 237 (4.25).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 1699, 1680, 1616.

EIMS m/z (%): M⁺ 438.3498 (12), 340 (41), 325 (10), 313 (7), 175 (9), 147 (41), 125 (97), 121 (37), 98 (44), 83 (100).

Table 1

	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	33.3	1.85 dddd (14, 14, 4.5, 1),	C-14	48.8 –
		1.54 ddd (14, 6.5, 2.5)	15	35.4 1.3, 1.3
2	37.4	2.30 ddd (14, 4.5, 2.5),	16	28.3 1.9, 1.3
		2.71 ddd (14, 14, 6.5)	17	52.4 1.7
3	216.2	–	18	18.1 1.04 s
4	50.1	–	19	29.5 0.58 d, 0.79 brd
5	48.3	1.71 dd (12.5, 4.5)	20	33.3 2.02 m
6	21.4	1.56 dddd (12.5, 4.5, 4.5, 2.5),	21	19.2 ^a 0.89 d
		0.95 dddd (12.5, 12.5, 12.5, 2.5)	22	51.7 2.51 dd, 2.11 dd
7	25.8	1.14 dddd (12.5, 12.5, 12.5, 2.5),	23	201.4 –
		1.38 ddd (12.5, 4.5, 4.5, 2.5)	24	124.3 6.06 qq

(continued)

Table 1 (continued)

$\delta_C(\text{CDCl}_3)$	δ_H (J/Hz)		$\delta_C(\text{CDCl}_3)$	δ_H (J/Hz)
8	47.8	1.60 dd (12.5, 4.5)	25	154.6 –
9	20.9	–	26	20.6 ^b 2.15 d
10	25.9	–	27	27.6 1.89 d
11	26.6	2.1, 1.2	28	19.3 ^a 0.91 s
12	32.6	1.7, 1.7	29	22.1 1.04 s
13	45.4	–	30	20.7 ^b 1.10 s

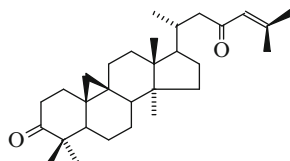
^{a,b}Assignments may be interchangeable

References

- H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)
- N.W. Davies, J.M. Miller, R. Naidu, S. Sotheeswaran, *Phytochemistry* **31**(1), 159–162 (1992)

Cycloart-24-ene-3,23-dione

$\text{C}_{30}\text{H}_{46}\text{O}_2$, M 438



Taxonomy: Cycloartane Triterpenoids

Guarea trichilioides (Meliaceae) [1].

Mp 133–135°C, $[\alpha]_D^{25} +20.5^\circ$ (c 4.2, CHCl_3).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 1700, 1670, 1610.

MS m/z (%): M^+ 438 (2), 423 (2.3), 340 (38), 325 (16), 313 (10), 311 (5), 83 (100), 55 (44), 43 (17).

^1H NMR (CDCl_3 , δ): 0.60 and 0.80 (2H-19, d, $J = 4$ Hz), 0.90, 0.90, 1.10, 1.10, 1.20, 1.70, 2.20 (7 × CH_3), 2.40–2.80 (2H), 6.10 (1H, s).

Table 1

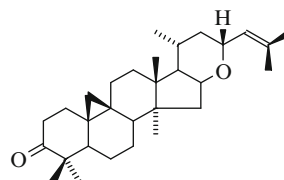
$\delta_C(\text{CDCl}_3)$									
C-1	33.3	C-7	28.2	C-13	45.3	C-19	29.6	C-25	154.3
2	37.3	8	47.7	14	48.8	20	33.3	26	25.9
3	216.2	9	20.9	15	32.6	21	17.9	27	19.3
4	50.0	10	25.9	16	26.6	22	51.6	28	19.2
5	48.3	11	23.9	17	52.4	23	201.3	29	22.0
6	21.4	12	35.4	18	17.9	24	124.3	30	20.6

References

- F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

(16S,23R)-16,23-Epoxycycloart-24-en-3-one

$\text{C}_{30}\text{H}_{46}\text{O}_2$, M 438



Taxonomy: Cycloartane Triterpenoids

Lindheimeria texana Gray et Engelm (Asteraceae) [1].

Mp 160–162.5°C (from hexane).

CAS Registry Number: 99816-23-6.

CD curve (MeOH): $[\theta]_{297} -3000$, $[\theta]_{245} -300$, $[\theta]_{210}$ (last reading) -10000 .

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 1705.

MS m/z (%): M^+ 438, 423 (57.8), 311 (13.6), 300 (27), 285 (20), 109 (100).

Table 1

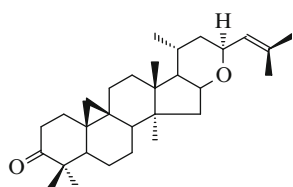
$\delta_C(\text{CDCl}_3)$		δ_H (J/Hz)	$\delta_C(\text{CDCl}_3)$		δ_H (J/Hz)
C-1	33.37	1.86 m	C-16	71.89	4.15 q (7.5)
2	37.40	2.71 dt, 2.30 ddd	17	57.51	1.53 brd (7.5)
3	216.20	–	18	19.64	1.17
4	50.16	–	19	30.02	0.58 d, 0.85 brd
5	47.46	–	20	26.56	–
6	21.33	–	21	20.45	0.95 d
7	26.48	–	22	38.00	–
8	48.40	–	23	70.69	4.51 ddd (10.5, 8.5, 7.5)
9	20.89	–	24	125.61	5.39 brd (8)
10	26.29	–	25	133.70	–
11	26.02	–	26	25.96	1.71 br
12	33.10	–	27	17.95	1.66 br
13	44.65	–	28	20.76	0.89
14	45.82	–	29	22.18	1.05
15	44.43	1.88 dd, 1.62 brdd (14, 7.5)	30	20.76	1.10

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

(16S,23S)-16,23-Epoxy-cycloart-24-en-3-one

C₃₀H₄₆O₂, M 438



Taxonomy: Cycloartane Triterpenoids

Lindheimera texana Gray et Engelm (*Asteraceae*) [1].

CAS Registry Number: 99816-22-5.

MS m/z (%): M⁺ 438, 3516, 423 (8.6), 311 (3.1), 300 (3.2), 285 (1.5).

Table 1

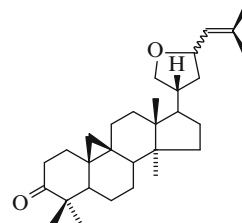
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$		$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	33.42	1.86 m	C-16	76.58	3.99 dt (6, 7.5)
2	37.45	2.7 1 dt (7, 14), 2.30 ddd (14, 4.5, 2)	17	54.55	
3	216.40	–	18	19.87	1.18
4	50.21	–	19	30.17	0.57 d (4.5), 0.85 brd (4.5)
5	47.54	–	20	24.03	
6	21.35	–	21	20.41	0.98 d (7)
7	26.55	–	22	37.76	
8	48.47	–	23	70.09	4.26 ddd (8.5, 7, 4.5)
9	20.99	–	24	127.42	5.30 brd (8.5)
10	26.41	–	25	133.91	–
11	26.09	–	26	25.80	1.71 br
12	32.42	–	27	18.27	1.67 br
13	44.99	–	28	21.53	0.89
14	45.88	–	29	22.20	1.05
15	44.44	1.91 dd (14, 7.5)	30	20.90	1.10

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

(23R)- and (23S)-21,23-Epoxy-5 α -cycloart-24-en-3-one (Mixture of the 23-Epimers in a 9:1 Ratio)

C₃₀H₄₆O₂, M 438



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

CAS Registry Number: 146257-75-2.

CAS Registry Number: 146257-74-1.

CD nm ($\Delta\epsilon$): 293 (–0.65).

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm^{-1} : 1700.

EIMS m/z (%): M⁺ 438.3498 (22), 423 (55), 313 (2), 300 (8), 285 (17), 125 (100), 123 (25), 109 (27), 107 (26), 105 (24), 69 (75).

¹H NMR (CDCl₃, δ): 0.56 and 0.80 (2H-19, d, J = 4.2 Hz), 0.91 (2 × CH₃, s), 1.01 (2 × CH₃, s), 1.05 (2 × CH₃, s), 1.10 (2 × CH₃, s), 1.69 (2 × CH₃, d, J = 1.2 Hz), 1.72 (2 × CH₃, d, J = 1.2 Hz), 2.30 (H-2 α , ddd, J = 14, 4.5, 2.5 Hz), 2.71 (H-2 β ddd, J = 14, 14, 6.5 Hz), 3.21 (H-21_B, dd, J = 9.5, 8.5 Hz), 3.39 (H-21_B, dd, J = 9.5, 8.5 Hz), 3.95 (H-21_A, dd, J = 8.5, 7 Hz), 4.03 (H-21_A, dd, J = 8.5, 7 Hz), 4.54 (H-23, ddd, J = 10, 8.5, 5 Hz), 4.60 (H-23, ddd, J = 8.5, 6.5, 6.5 Hz), 5.19 (H-24, dq, J = 8.5, 1.2, 1.2 Hz), 5.22 (H-24, dq, J = 8.5, 1.2, 1.2 Hz).

Table 1

$\delta_C(\text{CDCl}_3)$									
C-1	33.3	C-7	25.8 ^b	C-13	45.6	C-19	29.4	C-25	132.4
2	37.3	8	47.5	14	48.3	20	40.4	26	18.1
3	216.1	9	21.1 ^a	15	35.8	21	71.3	27	26.3
4	50.2	10	25.7 ^b	16	27.9	22	43.7	28	19.2
5	48.3	11	26.5	17	51.0	23	75.2	29	22.2
6	21.3 ^a	12	31.3	18	18.8	24	126.4	30	20.7

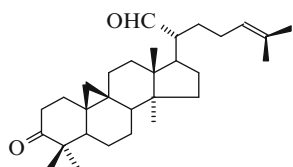
^{a,b}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

3-Oxo-5 α -cycloart-24-en-21-al

C₃₀H₄₆O₂, M 438



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 80–82°C (from Me₂CO), [α]_D²¹ +20° (c 0.72, CHCl₃).

CAS Registry Number: 125292-61-7.

CD (EtOH) nm (Δε): 290 (−0.4), 316 (+0.1).

IR ν_{max}^{CHCl₃}, cm^{−1}: 1717, 1702.

EIMS m/z (%): M⁺ 438.3498 (24), 423 (3), 356 (16), 313 (7), 312 (16), 300(6), 297 (8), 287 (29), 219 (24), 218 (?), 175 (36), 107 (78), 95 (92), 81 (66), 69 (100).

¹H NMR (CDCl₃, δ): 0.55 and 0.79 (2H-19, d, J = 4.2 Hz), 0.92 (CH₃, s), 0.95 (H-6β, qd, J = 12.5, 2.5 Hz), 1.02 (CH₃, s), 1.04 (CH₃, s), 1.09 (CH₃, s), 1.57 (CH₃, brs), 1.68 (CH₃, brs), 2.30 (H-2α, ddd, J = 14, 4.5, 2.5 Hz), 2.71 (H-2β, td, J = 14, 6.5 Hz), 5.05 (H-24, tq, J = 7, 1.2, 1.2 Hz), 9.46 (H-21, d, J = 5.5 Hz).

Table 1

δ _C (CDCl ₃)		δ _H (J/Hz)	
C-1	33.3	C-7	25.8 ^b
2	37.4	8	47.5
3	216.1	9	21.0 ^a
4	50.2	10	25.9 ^b
5	48.3	11	26.5
6	21.3	12	31.4
		13	45.3
		14	48.6
		15	35.2
		16	29.4 ^c
		17	47.5
		18	18.9
		19	29.4
		20	55.4
		21	205.7
		22	26.9 ^c
		23	26.3 ^b
		24	123.6
		25	132.5
		26	17.7
		27	25.6 ^b
		28	19.2
		29	22.2
		30	20.7 ^a

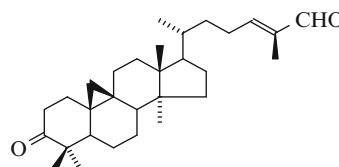
^{a-c} Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

(24E)-3-Oxocycloart-24-en-26-al

C₃₀H₄₆O₂, M 438



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (*Bromeliaceae*) [1].

An amorphous solid, [α]_D²⁵ +25° (c 0.006, CHCl₃).

CAS Registry Number: 105986-49-0.

UV λ_{max}^{CH₃CN}, nm (log ε): 224 (3.9).

EIMS m/z (%): M⁺ 438 (10), 423 (6), 420 (2), 410 (3), 355 (4), 313 (10), 300 (14), 175 (25), 95 (100).

HREIMS m/z: 438.3498 [M]⁺.

Table 1

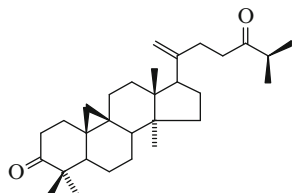
δ _C (CDCl ₃)		δ _H (J/Hz)	
C-1	33.4	C-16	28.2
		17	52.2
2	37.4	18	18.1
3	216.4	19	29.5
4	50.2		0.80 d (4.2)
5	48.4	20	36.0
6	21.5	21	18.1
7	25.8	22	34.8
8	47.9	23	26.1
9	21.1	24	155.6
10	26.0	25	139.2
11	26.7	26	195.4
12	32.8	27	9.2
13	45.5	28	19.3
14	48.8	29	22.2
15	35.5	30	20.7

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

Schizandraflorin

$C_{30}H_{46}O_2$, M 438



Taxonomy: Cycloartane Triterpenoids

Schizandra grandiflora Hook.f and Thom
(*Schizandraceae*) [1].

Mp 107°C (from $CHCl_3$ -MeOH). $[\alpha]_D^{20} +20.1^\circ$ (c 0.0994, $CHCl_3$).

CAS Registry Number: 81719-64-4.

IR ν_{max}^{KBr} , cm^{-1} : 2965, 1715, 1020, 880.

MS m/z (%): M^+ 438 (100), 313 (40.2), 300 (33.4), 229 (6.7), 220 (13.7), 138 (6.1), 135 (43.0), 95 (88.9), 93 (44.5), 71 (18.6).

1H NMR ($CDCl_3$, δ): 0.54 and 0.79 (2H-19, d, J = 4 Hz), 0.91, 0.98, 1.04, 1.09, (4 \times CH_3 , s), 1.02 (CH_3 -26, CH_3 -27, d, J = 6.3 Hz), 1.83 (H-17, 2H-22, m), 2.19 (2H-23, m), 2.35 (2H-2, m), 2.65 (H-25, heptet, J = 6.5 Hz), 4.69 (2H-21, m).

References

1. B. Talapatra, A. Basak, S.K. Talapatra, *Indian J. Chem.* **21B**(1), 76–78 (1982)

Mp 139.5–140.3°C (from CH_2Cl_2 -hexane), $[\alpha]_D^{28} +32.0^\circ$ (c 0.25, $CHCl_3$).

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3029, 2936, 2875, 1724, 1647, 1457, 1379, 1361, 1235, 1161, 997, 921, 839.

EIMS m/z (%): M^+ 438 (4), 410 (4), 340 (4), 327 (15), 111 (14), 69 (77), 55 (100).

HRFAB MS m/z; $[M + H]^+$ 439.3576.

Table 1

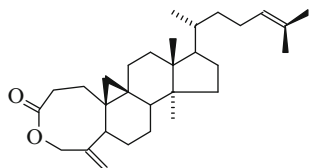
	$\delta_C(CDCl_3)$	$\delta_H(J/Hz)$		$\delta_C(CDCl_3)$	$\delta_H(J/Hz)$
C-1	29.07	2.10, 1.30	C-16	28.05	1.84, 1.24
2	32.00	2.61 m, 2.15	17	52.23	1.55
3	173.66	–	18	18.13	0.91 s
4	147.33	–	19	30.23	0.46 d (4), 0.76 d (4)
5	38.61	2.35 m	20	35.86	1.35
6	29.47	1.75, 0.67	21	18.19	0.83 d (6.3)
7	25.30	1.25, 0.94	22	36.29	1.37
8	47.89	1.52	23	24.92	1.98, 1.77
9	21.00	–	24	125.20	5.04 brt (6.9)
10	27.42	–	25	130.90	–
11	26.74	2.13, 1.21	26	25.71	1.62 brs
12	32.94	1.65, 0.88	27	17.62	1.54 brs
13	45.11	–	28	19.35	0.86 s
14	48.87	–	29	68.23	4.56 d (11.3), 4.30 d (11.3)
15	35.70	1.23, 0.89	30	116.13	5.22 brs, 5.11 brs

References

1. V. Reutrakul, C. Krachangchaeng, P. Tuchinda, M. Pohmakotr, T. Jaipetch, C. Yoosook, J. Kasisit, S. Sophasan, K. Sujarit, T. Santisuk, *Tetrahedron* **60**, 1517–1523 (2004)

Tubiferaoctanolide

$C_{30}H_{46}O_2$, M 438

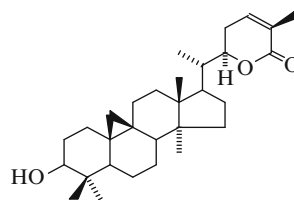


Taxonomy: Cycloartane Triterpenoids

Gardenia tubifera (*Rubiaceae*) [1].

Genin of Juncoside I

$C_{30}H_{46}O_3$, M 454



Taxonomy: Cycloartane Triterpenoids

Juncus effusus (Juncaceae) [1].

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3440, 1698.

UV λ_{max} , nm (ϵ): 233 (15700).

CD: $\Delta\epsilon = -7.0$ (242 nm).

Table 1

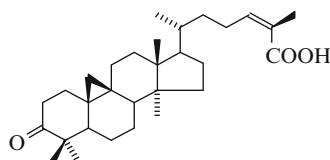
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	32.1 1.96	C-16	12.8 1.31, 1.92
2	30.5 1.22, 1.58	17	52.7 1.74
3	78.9 3.23 dd (4.6, 11.6)	18	18.1 1.04 s
4	40.6 –	19	29.8 0.32 d (4.2), 0.53 d (4.2)
5	47.3 1.30	20	39.2 2.04 m
6	21.2 1.32, 1.61	21	13.2 0.98 d (6.2)
7	26.0 0.80, 1.76	22	80.5 4.47 m
8	47.9 1.63	23	23.6 2.10 m, 2.38 m
9	20.1 –	24	139.2 6.62 dd (1.8, 6.5)
10	26.6 –	25	128.5 –
11	26.3 1.04, 1.69	26	166.4 –
12	33.0 1.69, 1.79	27	17.2 1.92 s
13	45.6 –	28	19.4 0.90 s
14	49.1 –	29	25.1 1.00 s
15	35.6 1.32	30	14.0 0.81 s

References

- M. Della Greca, A. Fiorentino, P. Monaco, L. Previtera, Nat. Prod. Lett. **4**(3), 183–188 (1994)

Ganwuweizic Acid

$\text{C}_{30}\text{H}_{46}\text{O}_3$, M 454



Taxonomy: Cycloartane Triterpenoids
Schizandra sphenanthera Rehd. et Wils
(Magnoliaceae) [1].

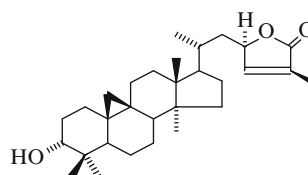
CAS Registry Number: 55511-14-3.

References

- Y. Chen, J. Yue, S. Hua, Gaodeng Xuexiao Huaxue Xuebao **8**, 447–448 (1987). C.A., 107:214811s (1987)

(23R)-3 α -Hydroxy-9,19-cyclo-9 β -lanost-24-en-23,26-olide

$\text{C}_{30}\text{H}_{46}\text{O}_3$, M 454



Taxonomy: Cycloartane Triterpenoids

Abies marocana (Pinaceae) [1].

Mp 179–180°C (from Et_2O), $[\alpha]_{\text{D}} +27.78^\circ$ (c 1.01, CHCl_3).

CAS Registry Number: 140709-02-0.

UV $\lambda_{\text{max}}^{\text{EtOH}}$, nm (log ϵ): 201.7 (3.73).

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm^{-1} : 3486, 3033, 2936, 1749, 1665, 1103, 1054, 995, 971, 958, 933, 889.

MS m/z (%): M^+ 454 (2), 436 (5), 421 (6), 393 (29), 314 (6), 203 (9), 187 (10), 175 (24), 173 (10), 161 (14), 133 (20), 121 (28), 119 (26), 109 (23), 107 (34), 97 (73), 95 (44), 91 (38), 81 (35), 79 (38), 69 (78), 55 (57), 43 (100), 41 (82).

^1H NMR (300 MHz, CDCl_3 , δ , 0-TMS): 0.33 and 0.50 (2H-19, d, $J = 4.2$ Hz), 0.86, 0.86, 0.87, 0.93 (4 \times CH_3 , s), 0.98 (CH_3 -21, d, $J = 8$ Hz), 1.89 (CH_3 -27, t, $J = 1.7$ Hz), 3.45 (H-3, t, $J = 2.8$ Hz), 4.97 (H-23, m), 6.98 (H-24, t, $J = 1.5$ Hz).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$									
C-1	28.64 ^a	C-7	25.68 ^b	C-13	45.49	C-19	29.81	C-25	129.44
2	27.54 ^b	8	47.98	14	49.02	20	33.43	26	174.52
3	77.04	9	19.79	15	35.44	21	18.31	27	10.67
4	39.59	10	26.59	16	28.12 ^a	22	40.72	28	19.30
5	41.10	11	26.28 ^b	17	52.78	23	79.06	29	25.81
6	21.10	12	32.99	18	18.15	24	149.84	30	21.26

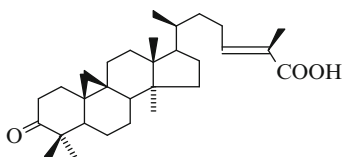
^{a,b}Interchangeable values

References

1. A.F. Barrero, J.F. Sanchez, F.J. Alvares-Manzaneda, M. Munoz, A. Haidour, *Phytochemistry* **31**(2), 615–620 (1992)

Mangiferonic Acid

C₃₀H₄₆O₃, M 454



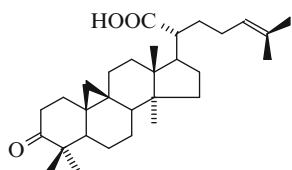
Taxonomy: Cycloartane Triterpenoids
Mangifera indica L. (*Anacardiaceae*) [1].
Schorea acuminata (*Dipterocarpaceae*) [2].
 Mp 187–189°C, [α]_D +23.5° (c 0.8).
 CAS Registry Number: 13878-90-5.

References

1. S. Corsano, E. Mincione, *Ann. Chim (Rome)* **57**(5), 508–521 (1967). *C.A.*, 68:13209d (1968)
2. H.T. Cheung, T.C. Yan, *Aust. J. Chem.* **25**, 2003 (1972)

3-Oxo-cycloart-24-en-21-oic Acid

C₃₀H₄₆O₃, M 454



Taxonomy: Cycloartane Triterpenoids
Lansium domesticum (*Meliaceae*) [1].
 Mp 185–186°C, [α]_D¹² +18.7° (c 1.16, CHCl₃).
 IR ν_{max}, cm⁻¹: 3200, 1710.

¹H NMR (CDCl₃, δ, 0-TMS): 0.50 and 0.79 (2H-19, d, J = 4.3 Hz), 0.90, 1.06, 1.08, 1.08, 1.57, 1.67 (6 × CH₃, s), 5.81 (H-24, t, J = 7.3 Hz).

The correct structure was finally derived by a single crystal x-ray diffraction study.

Table 1

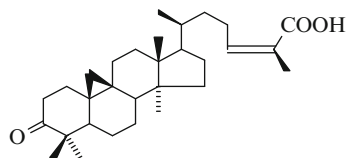
δ _c (CDCl ₃)									
C-1	33.3	C-7	32.6	C-13	48.6	C-19	29.4	C-25	132.9
2	37.4	8	47.5	14	45.2	20	48.2	26	25.7
3	218.5	9	21.0	15	34.9	21	182.6	27	17.7
4	50.2	10	26.1	16	26.0	22	25.7	28	19.3
5	47.7	11	26.6	17	49.1	23	27.2	29	22.2
6	21.3	12	29.9	18	17.8	24	123.6	30	20.8

References

1. M. Nishizawa, M. Emura, H. Yamada, M.S. Chairul, Y. Hayashi, H. Tokuda, *Tetrahedron Lett.* **30**(41), 5615–5618 (1989)

Schizandronic Acid

C₃₀H₄₆O₃, M 454



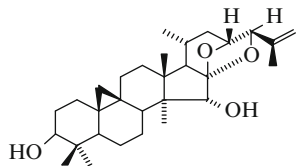
Taxonomy: Cycloartane Triterpenoids
Schizandra nigra Max. (*Schizandraceae*) [1].
 Mp 167–168.5°C, [α]_D²⁷ +15° (c 2.0, CHCl₃).
 CAS Registry Number: 55511-14-3.
 IR ν_{max}^{KBr}, cm⁻¹: 3050, 1710, 1675, 1630.
 ORD: (c 0.205, MeOH, 21°) [φ]₃₅₀ = -66°, = -664°, [φ]₃₁₄ = -1262°, [φ]₂₇₂ = +1993°, [A] = -32.55.

References

1. K. Takahashi, M. Takani, *Chem. Pharm. Bull.* **23**(3), 538–542 (1975)

25-Anhydrocimigenol

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids
Cimicifuga japonica (*Ranunculaceae*) [1]
Mp 194.5°C, [α]_D +61.3°.

References

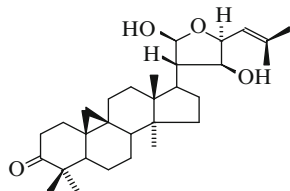
- N. Sakurai, M. Nagai, T. Inoue, *Yakugaku Zasshi* **95**(11), 1354–1360 (1975). *C.A.*, 84;74573v(1976)

Table 1 (continued)

	δ _C (CDCl ₃)	δ _H (J/Hz) (400 MHz)		δ _C (CDCl ₃)	δ _H (J/Hz)
	2	38.0	2.25 ddd (14, 4, 2.5),	17	45.2 1.80 m
			2.70 ddd (14, 7, 7)	18	19.9 1.10 s
	3	216.4	–	19	30.2 0.68 d (4), 0.80 d (4)
	4	50.8	–	20	58.8 2.38 d (11.5)
	5	48.9	1.75 m	21	101.4 5.30 d (7)
	6	22.0	1.55 m, 0.95 m	22	78.0 4.00 dd (6,4)
	7	26.5	1.10 m, 1.40 m	23	80.3 4.75 dd (8,4)
	8	48.4	1.60	24	121.6 5.42 dt (8,1)
	9	21.5	–	25	138.9 –
	10	27.0	–	26	26.7 1.70 s
	11	27.1	2.05 m, 1.20 m	27	19.2 1.80 s
	12	33.0	1.70 m	28	19.9 0.90 s
	13	46.4	–	29	22.8 1.02 s
	14	49.4	–	30	21.4 1.05 s
	15	36.0	1.40 m		

Argenteanone A

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids
Aglaia argentea Bl. (*Meliaceae*) [1].
Mp 144–148°C (from hexane-EtOAc), [α]_D –4.2°
(c 1, CHCl₃)
CAS Registry Number: 175673-63-9.
IR ν_{max}^{CHCl₃}, cm⁻¹: 3410, 1695.
FABMS m/z : 493 [M + Na]⁺ 477 [M + Li]⁺.
EIMS m/z (%): [M-H₂O]⁺ 452 (1.3), 434 (10), 148 (100).

Table 1

	δ _C (CDCl ₃)	δ _H (J/Hz) (400 MHz)		δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	34.0	1.80 m, 1.55 m		C-16	28.2 1.90 m, 1.55 m

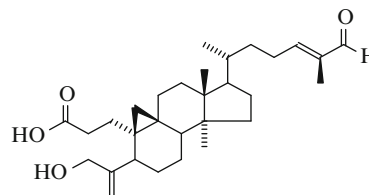
(continued)

References

- O.R. Omobuwajo, M.-T. Martin, G. Perromat, T. Sevenet, K. Awang, M. Pais, *Phytochemistry* **41**(5), 1325–1328 (1996)

Coronalolic Acid

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids
Gardenia coronaria (*Rubiaceae*) [1].
Amorphous gum, [α]_D²⁰ –36.4° (c 0.21, CHCl₃).

IR ν_{\max}^{film} , cm^{-1} : 3431, 2930, 1707, 1688, 1456, 1377, 1177, 1059, 988, 901.

UV ν_{\max}^{MeOH} , nm: 232.

EIMS m/z (%): M^+ 470 (36), 455 (100), 452 (39), 437 (55), 424 (38), 345 (20), 327 (30), 285 (18), 233 (54), 147 (84), 109 (86), 105 (90).

HREIMS m/z: M^+ 470.3405.

Table 1

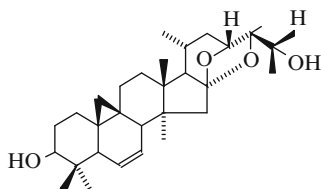
	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J}/\text{Hz})$		$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J}/\text{Hz})$
C-1	28.1		C-16	28.1	
2	30.3		17	52.1	
3	179.3	–	18	18.1	0.98 s
4	152.1	–	19	30.3	0.50 d (4.2), 0.74 d (4.2)
5	41.9		20	36.0	
6	28.7	–	21	18.2	0.93 d (6.5)
7	25.2		22	34.7	
8	47.9		23	26.1	
9	21.8	–	24	155.7	6.51 bt (6.8)
10	27.4	–	25	139.2	–
11	26.9		26	196.0	9.40 s
12	33.0		27	9.2	1.78 brs
13	45.1	–	28	19.4	0.94 s
14	48.9	–	29	64.7	4.12 brs
15	35.6		30	110.6	5.11 s, 5.09 s

References

- G.L. Silva, R.R. Gil, B. Cui, H. Chai, T. Santisuk, E. Srisook, V. Reutrakul, P. Tuchinda, S. Sophasan, S. Sujarit, S. Upatham, S.M. Lynn, J.E. Farthing, S.-L. Yang, J.A. Lewis, M.J. O'Neill, N.R. Farnsworth, G.A. Cordell, J.M. Pezzuto, A.D. Kinghorn, *Tetrahedron* **53**(2), 529–538 (1997)

Cycloorbigenin A

$\text{C}_{30}\text{H}_{46}\text{O}_4$, M 470



Taxonomy: Cycloartane Triterpenoids

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1].

Mp 207–209°C (from CHCl_3 –MeOH, 20:1), $[\alpha]_{\text{D}}^{18}$ –101.3° (c 0.75, MeOH).

CAS Registry Number: 213535-60-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3500-3340, 3035.

MS m/z (%): M^+ 470 (100), 455 (32.5), 452 (32.5), 437 (22.5), 411 (100), 393 (25.0), 253 (25.0).

^1H NMR (200 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): –0.14 and 0.82 (2H-19, d, $J = 4$ Hz), 0.81 (CH_3 -21, d, $J = 6$ Hz), 1.00, 1.06, 1.10, 1.30, 1.39, 1.45 ($6 \times \text{CH}_3$, s), 3.51 (H-3, dd, $J = 11$, 4.5 Hz), 3.63 (H-24, s), 4.72 (H-23, brd, $J = 8.4$ Hz), 5.45 (H-7, ddd, $J = 10$, 5, 3 Hz), 5.75 (H-6, brd, $J = 10$ Hz).

Table 1

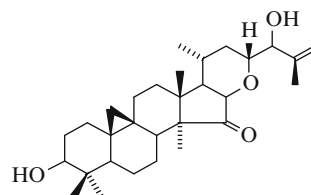
	$\delta_{\text{C}} (\text{C}_5\text{D}_5\text{N})$									
C-1	30.90	C-7	127.52	C-13	44.44	C-19	20.94	C-25	70.98	
2	30.5	8	47.15	14	46.41	20	23.73	26	27.84	
3	77.33	9	18.80	15	46.77	21	20.32	27	24.73	
4	40.85	10	28.75	16	114.6	22	38.16	28	16.08	
5	43.46	11	25.35	17	60.02	23	71.96	29	26.19	
6	128.87	12	33.77	18	17.33	24	90.44	30	15.23	

References

- M.A. Agzamova, M.I. Isaev. *Khim. Prir. Soedin.* 848–850 (1997)

Dehydrodahurinol

$\text{C}_{30}\text{H}_{46}\text{O}_4$, M 470



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1]

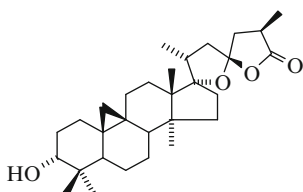
Mp 216–217°C (from EtOAc).

References

1. G. Kusano, Y. Murakami, N. Sakurai, T. Takemoto, *Yakugaku Zasshi* **96**(1), 82–85 (1976). *C.A.*, **84**:135873s (1976)

Desmethylabietospiran

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids

Abies alba (*Pinaceae*) [1].

Mp 212–214°C (from MeCN), $[\alpha]_D^{20} +5.45^\circ$ (c 1.9, CHCl₃).

IR $\nu_{\max}^{\text{CH}_2\text{Cl}_2}$, cm⁻¹: 3617, 1767.

EIMS m/z (%): M⁺ 470 (1), 452 (1), 69 (16), 43 (100).

Table 1

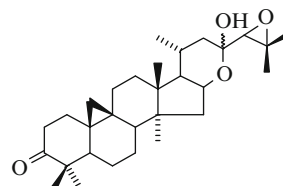
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	25.9		C-16	36.0
2	25.4		17	99.8 –
3	77.0	3.47 brs	18	20.6 0.88 s
4	39.6	–	19	29.7 0.37 d (4.1), 50 d (4.1)
5	41.1		20	43.2 2.21 m
6	21.1		21	18.3 1.02 d (6.8)
7	25.6		22	45.1 1.76 d (13.5),
8	49.0			2.72 dd (6.5, 13.5)
9	20.1	–	23	113.4 –
10	26.6	–	24	36.7 2.04 m, 2.50 dd (8.1, 12.7)
11	27.5		25	35.7 3.02 m
12	27.5		26	179.3 –
13	49.1	–	27	14.9 1.26 d (7)
14	49.7	–	28	20.5 0.95 s
15	28.6		29	25.9 1.06 s
			30	21.2 1.18 s

References

1. J.A. O'Neill, O.P. Gallagher, K.J. Devine, P.W. Jones, A.R. Maguire, *J. Nat. Prod.* **68**(1), 125–128 (2005)

16 β ,23;24S,25-Diepoxy-cycloartan-3-on-23-ol (23-Epimers)

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids

Viguiera dentata (Cav) Spreng (*Asteraceae*) [1].

Mp 164–167°C (from EtOAc).

IR ν_{\max}^{KBr} , cm⁻¹: 3440, 1700.

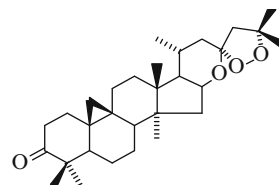
EIMS m/z (%): M⁺ 470 (3), 452 (11), 437 (15), 398 (21), 383 (48), 260 (30), 245 (28), 43 (100).

References

1. F. Gao, T.J. Mabry, F. Bohlmann, J. Jakupovic, *Phytochemistry* **25**(6), 1489–1491 (1986)

(16S,23R)-16,23-Epoxy-23,25-epidioxycycloartan-3-one

C₃₀H₄₆O₄, M 470



Taxonomy: Cycloartane Triterpenoids

Lindheimeria texana Gray et Engelm (*Asteraceae*) [1].

Mp 214–217°C (from hexane-EtOAc).

IR ν_{\max}^{KBr} , cm⁻¹: 1705.

MS m/z (%): M⁺ 470.3394, 455 (2.2), 438 (16.5), 437 (39), 423 (5.5), 332 (11.1), 311 (6.7).

Table 1

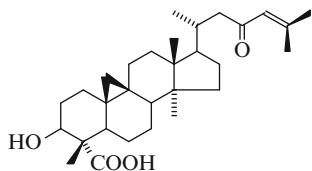
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	33.33		C-16	73.17 3.99 dt (6, 7.5)
2	37.40	2.71 dt, 2.30 ddd	17	55.86
3	216.36	–	18	19.51 1.13
4	50.17	–	19	30.01 0.57 d, 0.85 brd
5	47.44		20	26.44
6	21.27		21	20.44 0.97 d
7	26.40		22	38.62
8	48.30		23	109.38 –
9	20.77	–	24	59.11 2.38 d (12), 2.50 d (12)
10	26.44	–	25	83.74 –
11	25.97		26	26.94 1.37
12	32.88		27	24.44 1.36
13	44.51	–	28	20.77 0.88
14	46.21	–	29	22.16 1.05
15	43.68	1.91 dd	30	20.77 1.10

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

Gardenolic Acid A

$\text{C}_{30}\text{H}_{46}\text{O}_4$, M 470



Taxonomy: Cycloartane Triterpenoids

Gardenia jasminoides Ellis. (*Rubiaceae*) [1].

Mp 212–214°C, $[\alpha]_D^{27} +38.3^\circ$ (c 0.28, MeOH).

CAS Registry Number: 123941-58-2.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3440, 3035, 1707, 1686, 1617.

UV $\lambda_{\text{max}}^{\text{MeOH}}$ nm (log ϵ): 237 (4.02).

$^1\text{H NMR}$ (100 MHz, CDCl_3 , δ , 0-TMS): 0.38 and 0.65 (2H-19, d, $J = 4$ Hz), 0.89 (CH₃-21, d, $J = 7$ Hz), 0.92, 1.02, 1.16, 1.89, 2.16 (5xCH₃, s) 4.12 (H-3, m), 6.06 (H-24, s).

Table 1

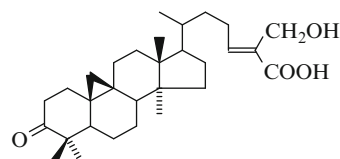
	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{CDCl}_3)$	$\delta_H(\text{J/Hz})$
C-1	31.02		C-7	28.24
2	26.40	8	47.34	14
3	77.32	9	20.16	15
4	52.87	10	24.09	16
5	44.18	11	25.96	17
6	22.62	12	35.32	18
				19
				20
				21
				22
				23
				24
				25
				26
				27
				28
				29
				30
				Ac
				170.19
				21.04

References

1. G.-W. Qin, Z.-Y. Fan, R.-S. Xu, B.-X. Zhang, *Youji Huaxue* **9**(3), 263–265 (1989)

Hydroxymangiferonic Acid

$\text{C}_{30}\text{H}_{46}\text{O}_4$, M 470



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

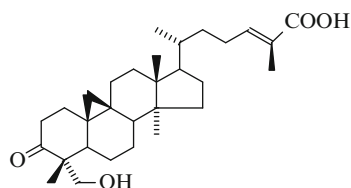
Mp 190–192°C (from Me₂CO), $[\alpha]_D 18.2^\circ$.

References

1. S. Corsano, G. Piantatelli, *Ric. Sci. Rend. Sez.A* **8**(3), 484–487 (1965). *C.A.*, 63:18181c (1965)

29-Hydroxymangiferonic Acid

$\text{C}_{30}\text{H}_{46}\text{O}_4$, M 470



Taxonomy: Cycloartane Triterpenoids*Mangifera indica* L. (*Anacardiaceae*) [1].Mp 182–183°C (from C₆H₆), [α]_D²⁶ +42° (c 1.2, CHCl₃).

CAS Registry Number: 155511-27-6.

IR ν_{max}^{CHCl₃}, cm⁻¹: 3650, 3300–2500, 1715, 1690, 1640.UV λ_{max}^{MeOH}, nm: 218 (ε 13500).MS m/z(%): M⁺ 470 (4), 455 (1), 452 (3), 441 (5), 440 (21), 439 (7), 424 (3), 408 (5), 369 (3), 342 (5), 329 (5), 318 (4), 316 (5), 301 (7), 299 (4), 235 (12), 217 (7), 215 (6), 175 (23), 161 (28), 107 (60), 105 (55), 55 (100).¹H NMR (200 MHz, CDCl₃, δ, 0-TMS): 0.60 and 0.79 (2H-19, d, J = 4 Hz), 0.90, 0.98, 1.07 (3xCH₃, s), 0.91 (CH₃-21, d, J = 5.1 Hz), 1.83 (CH₃-27, s), 2.27 (2H, m) 3.45 and 3.74 (2H-29, d, J = 11.7 Hz), 6.90 (H-24, t, J = 7.2 Hz).**Table 1**

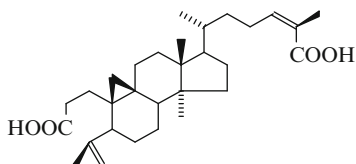
δ _C (CDCl ₃)									
C-1	33.6	C-7	28.1	C-13	45.3	C-19	29.7	C-25	126.6
2	38.2	8	47.8	14	48.7	20	35.9	26	172.9
3	218.7	9	21.0	15	32.7	21	18.1	27	12.0
4	55.0	10	25.9	16	26.7	22	34.8	28	19.3
5	42.7	11	25.6	17	52.2	23	25.4	29	65.2
6	21.1	12	35.5	18	18.1	24	145.7	30	16.0

References1. V. Anjaneyulu, J.S. Babu, J.D. Connolly, *Phytochemistry* **35**(5), 1301–1303 (1994)IR ν_{max}^{KBr}, cm⁻¹: 3050–2870, 2600, 1710, 1690, 1640, 1455, 1413, 1374, 1257, 1218, 1163, 1077, 933, 890.EIMS m/z (%): M⁺ 470 (15), 455 (45), 397 (20), 371 (18), 329 (23), 235 (30), 150 (35), 121 (52), 107 (70), 95 (100), 55 (73).HREIMS m/z: M⁺ 470.3393 (C₃₀H₄₆O₄).**Table 1**

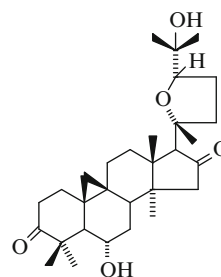
δ _C (CDCl ₃)		δ _H (J/Hz)		δ _C (CDCl ₃)		δ _H (J/Hz)	
C-1	30.29	2.78 m, 2.47 m	C-16	28.72	1.59 m, 1.22 m		
2	32.85	2.32 m, 1.57 m	17	52.79	1.57 m		
3	176.54		18	18.67	0.90 s		
4	150.32	–	19	30.46	0.34 d (4.5), 0.63 d (4.5)		
5	46.30	2.48 m	20	36.73	1.59 m		
6	28.29	0.98 m, 1.51 m	21	18.77	0.95 d (6)		
7	25.59	0.81 m, 1.16 m	22	27.54	1.72 m, 1.42 m		
8	48.16	1.43 m	23	27.42	2.81 m, 2.75 m		
9	21.88	–	24	143.04	6.00 t (7)		
10	27.91	–	25	128.91	–		
11	36.73	1.91 m, 1.62 m	26	170.90			
12	36.22	1.74 m, 1.56 m	27	21.92	2.08 s		
13	45.69	–	28	19.85	0.87 s		
14	49.51	–	29	112.20	4.94 brs, 4.79 brs		
15	33.63	1.88 m	30	20.41	1.67 s		

References

1. M. Kikuchi, A. Yoshikoshi. *Chem. Lett.* 725–728 (1972).
2. H.-D. Sun, S.-X. Qiu, L.-Z. Lin, Z.-W. Lin, T. Pengsuparp, J.M. Pezzuto, H.H.S. Fong, G.A. Cordell, N.R. Farnsworth, *J. Nat. Prod.* **59**(5), 525–527 (1996)

Nigranoic AcidC₃₀H₄₆O₄, M 470**Taxonomy:** Cycloartane Triterpenoids*Schizandra nigra* Max. (*Schizandraceae*) [1].*Schizandra sphaerandra* Stapf. (*Schizandraceae*) [2].Mp 128–130°C (from petroleum ether), [α]_D +61.5° (c 1.15, MeOH).

CAS Registry Number: 39111-07-4.

CycloadsurgeninC₃₀H₄₆O₅, M 486**Taxonomy:** Cycloartane Triterpenoids

Astragalus adsurgens Pall. (*Leguminosae*) [1].
 Mp 249–251°C, $[\alpha]_D^{20}$ –47.06° (c 0.34, CHCl₃).
 CAS Registry Number: 145497-67-2.
 IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3567-3367, 3050, 1740, 1724.
 EIMS m/z (%): M⁺ 486, 472, 454, 143, 125, 107, 85 (100).
¹H NMR (CDCl₃, δ, 0-TMS): 0.44 and 0.65 (2H-19, d, J = 4.49 Hz), 1.07, 1.12, 1.14, 1.15, 1.19, 1.23, 1.37 (7 × CH₃, s), 2.93 (H-17, s), 3.49 (H-6, td), 3.70 (H-24, dd, J = 5.6, 8 Hz).

Table 1

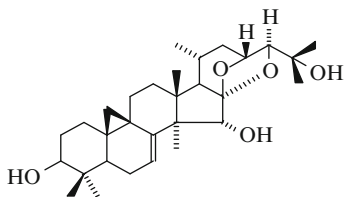
δ_C (CDCl ₃)									
C-1	35.4	C-7	37.6	C-13	44.4	C-19	31.3	C-25	71.1
2	32.4	8	47.0	14	44.1	20	84.4	26	28.0
3	217.0	9	20.0	15	51.5	21	26.9	27	27.8
4	50.1	10	28.6	16	218.4	22	31.6	28	26.2
5	54.2	11	26.4	17	65.2	23	20.5	29	29.6
6	69.1	12	32.5	18	20.4	24	81.9	30	17.9

References

1. S.-Z. Zheng, Z.-P. Sun, X.-W. Shen, Gaodery Huexiao *Huaxue Xuebao* **13**(8), 1090–1091 (1992)

7, 8-Didehydrocimigenol

C₃₀H₄₆O₅, M 486



Taxonomy: Cycloartane Triterpenoids
Cimicifuga heracleifolia Komarov (*Ranunculaceae*) [1].

CAS Registry Number: 150972-72-8.
 IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3425, 1620, 1260.
 MS m/z : 486 [M]⁺ (base peak), 468, 453.
 HRMS m/z: 486.3379 [M]⁺.

Table 1

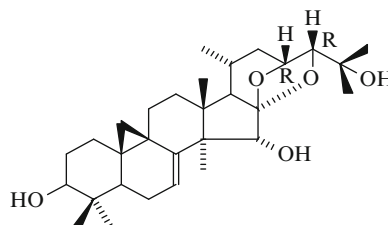
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1 30.16	1.36 m, 1.73 m	C-16 111.79	–
2 29.76	1.67 m, 1.75 m	17 59.03	1.38d (6.7)
3 78.61	3.32 dd (11.2, 3.6)	18 21.20	1.03 s
4 39.72	–	19 28.31	0.54 d (4.3), 1.11
5 41.88	1.24 m	20 23.60	1.67 m
6 21.63	1.63 m, 1.99 ddd (17, 7.5, 5.5)	21 19.47	0.91 d (6.7)
7 114.34	5.64 dd (7.5, 2.1)	22 37.50	0.97 m, 2.33 ddd (13, 10, 3)
8 146.79	–	23 71.35	4.48 dd (10, 1.8)
9 21.02	–	24 88.84	3.46 d (0.5)
10 28.31	–	25 71.81	–
11 25.36	1.19 m, 2.16 ddd (13, 10, 4)	26 26.21	1.20 s
12 33.68	1.69 m, 1.79 m	27 26.15	1.20 s
13 41.15	–	28 17.65	1.09 s
14 50.16	–	29 25.36	1.01 s
15 77.58	4.12 d (7.1)[2.62 d (7.1)OH]	30 12.97	0.86 s

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

24-*epi*-7, 8-Didehydrocimigenol

C₃₀H₄₆O₅, M 486



Taxonomy: Cycloartane Triterpenoids
Cimicifuga heracleifolia Komarov (*Ranunculaceae*) [1].

Mp 222–223°C, $[\alpha]_D$ +6.4° (c 0.47, CHCl₃).

CAS Registry Number: 150972-71-7.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1620.

MS m/z : 486 $[\text{M}]^+$ (base peak), 468, 453.

HRMS: 486.3360 $[\text{M}]^+$.

Table 1

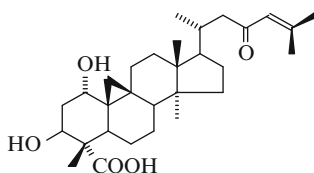
	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)		δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	30.13	1.37 m, 1.72 m	C-16	112.09	–
2	29.73	1.68 ddd (13, 4, 2.2), 1.75 m	17	60.09	1.30 d (6.6)
3	78.76	3.33 dd (11.4, 4)	18	21.41	1.03 s
4	39.66	–	19	28.25	0.55 d (4), 1.09 d (4)
5	41.88	1.25 m	20	22.84	1.60 m
6	21.60	1.63 m, 2.01 ddd (13, 7.5, 2.2)	21	19.17	0.90 d (6.6)
7	114.31	5.62 dd (7.5, 2.2)	22	29.13	1.96 ddd (13, 6.6, 2.2), 2.15 ddd (13, 10, 2.2)
8	146.88	–	23	73.57	4.45 ddd (10, 4.2, 2.2)
9	21.08	–	24	83.25	3.57 d (4.2)
10	28.25	–	25	68.71	–
11	25.30	1.20 m, 2.13 ddd (13, 7, 3.5)	26	31.34	1.33 s
12	33.59	1.70 m, 1.77 ddd (13, 8, 3.5)	27	24.06	1.22 s
13	40.90	–	28	17.86	1.06 s
14	50.41	–	29	25.36	1.01 s
15	77.82	4.04 d (8.4), [2.78 d (8.4) OH]	30	12.94	0.85 s

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

Gardenolic Acid B

$\text{C}_{30}\text{H}_{46}\text{O}_5$, M 486



Taxonomy: Cycloartane Triterpenoids

Gardenia jasminoides Ellis (*Rubiaceae*) [1].

Mp 214–216°C (MeOH), $[\alpha]_{\text{D}}^{17} +51.2^\circ$ (c 0.167, MeOH).

CAS Registry Number: 108864-53-5.

Biological activity

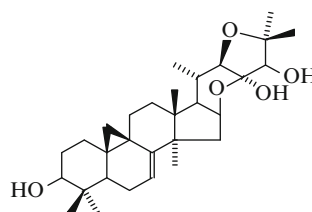
Gardenolic acid B shows significant effect of the discontinuance of pregnancy at an early stage.

References

1. R. Xu, G. Qin, D. Zhu, Z. Fan, F. Jiang, B. Zhang, J. Wang, Y. Wang, *Huaxue Xuebao* **45**(3), 301–304 (1987). *CA*, 107:83740t (1987)

Genin of Cimiaceroside A

$\text{C}_{30}\text{H}_{46}\text{O}_5$, M 486



Taxonomy: Cycloartane Triterpenoids

Cimicifuga acerina C.Tanaka (Miyagi)

(*Ranunculaceae*) [1].

Actaea asiatica Hara (*Ranunculaceae*) [1].

Mp 210–211°C (from MeOH), $[\alpha]_{\text{D}} -48.0^\circ$ (c 0.27, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3600–3300.

EIMS m/z : 486 $[\text{M}]^+$.

HREIMS m/z : 486.3342 $[\text{M}]^+$.

Table 1

	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	30.64	1.30, 1.66	C-16	72.63	5.08 ddd (7.8, 7.8, 7.8)
2	30.73	1.94 (2H)	17	52.88	1.63
3	77.77	3.52	18	22.97	1.24 s
4	40.24	–	19	28.49	0.50 d (4), 1.04 d (4)
5	42.53	1.32	20	34.67	2.30
6	22.18	1.69, 1.93	21	17.49	1.25 d (6.5)
7	113.45	5.15 dd (1.3, 8.1)	22	86.82	3.91 d (10.6)

(continued)

Table 1 (continued)

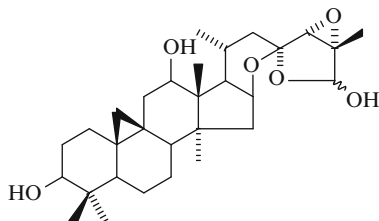
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
8	149.57 –	23	106.11 –
9	21.10 –	24	83.33 4.18 s
10	28.69 –	25	83.61 –
11	25.33 1.12, 2.09	26	27.84 1.77 s
12	33.24 1.70 (2H)	27	24.82 1.68 s
13	44.68 –	28	26.79 1.09 s
14	50.40 –	29	26.19 1.23 s
15	42.02 1.94, 2.14	30	13.65 1.11 s

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, T. Okuyama, G. Kusano, *Heterocycles* **48**(5), 1003–1013 (1998)

Acteol

C₃₀H₄₆O₆, M 502



Taxonomy: Cycloartane Triterpenoids

Actea racemosa (*Cimicifuga racemosa* (L.) Nutt.) (*Ranunculaceae*) [1, 2].

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [3].

Mp 126–133°C, $[\alpha]_D -4^\circ$.

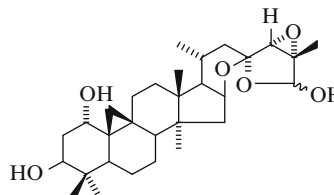
CAS Registry Number: 27208-74-8.

References

1. L. Panizzi, S. Corsano. *Atti Accad. Nazl. Lincei., Rend., Classe Sci. Fis., Mat. Nat.* **32**, 601–605 (1962). *CA*, 58:12814e (1963).
2. G. Piancatelli, S. Corsano, A. Scettri, *Gazz. Chim. hai* **101**, 797–802 (1971)
3. A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(3), 467–472 (1998)

Genin of Bugbanoside B

C₃₀H₄₆O₆, M 502



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 152–153°C (from MeOH), $[\alpha]_D^{23} -2,5^\circ$ (c 0.18, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.

Positive HRSIMS m/z: 502.3285 [M]⁺.

Table 1

26S			26R		
δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)	
C-1	72.56	3.82 s	C-1	72.56	3.83 s
2	39.02	2.19, 2.38	2	39.02	2.19, 2.38
3	73.13	4.37	3	73.13	4.37
4	41.24	–	4	41.24	–
5	40.05	2.38	5	40.05	2.38
6	20.98	0.87, 1.66	6	20.98	0.87, 1.66
7	26.34	1.18, 1.23	7	26.34	1.18, 1.23
8	47.60	1.68	8	47.68	1.68
9	20.65	–	9	20.65	–
10	31.36	–	10	31.36	–
11	25.96	1.46, 2.70	11	25.96	1.46, 2.70
12	33.38	1.62, 1.74	12	33.38	1.62, 1.74
13	44.55	–	13	46.65	–
14	44.70	–	14	44.70	–
15	44.08	1.50 dd (12.5, 7.5), 1.80 dd (12.5, 7.5)	15	44.19	1.67, 1.98 dd (12.5, 7.5)
16	73.26	4.60	16	73.35	4.60
17	56.90	1.60	17	56.88	1.60
18	20.64	1.27 s	18	20.60	1.27 s
19	30.10	0.44 d (4), 0.75 d (4)	19	30.15	0.45 d (4), 0.77 d (4)
20	26.08	1.86	20	26.08	1.86
21	20.43	0.92 d (6.5)	21	20.43	0.91 d (6.5)
22	37.60	1.64, 2.24	22	37.20	1.64, 2.24
23	106.13	–	23	103.67	–
24	63.58	3.88 s	24	63.02	3.74 s
25	65.51	–	25	63.91	–

(continued)

Table 1 (continued)

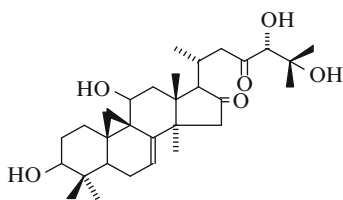
26S			26R		
δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)	
26	98.49	5.17 s	26	98.21	5.63 s
27	13.06	1.75 s	27	13.13	1.60 s
28	19.56	0.93 s	28	19.61	0.98 s
29	26.20	1.29 s	29	26.20	1.30 s
30	14.02	1.12 s	30	14.02	1.13 s

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(6), 1001–1007 (1998)

Genin of Cimicifugoside H-2

C₃₀H₄₆O₆, M 502



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 190–192°C (from MeOH).

CAS Registry Number: 167960-08-9.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3500–3300, 1725, 1700.

Positive ion FABMS m/z: 503 [M + H]⁺.

Positive ion HRFABMS m/z: [M + Na]⁺ 525.3162.

¹H-NMR (C₅D₅N, δ): 1.09 (CH₃-21, d, J = 8 Hz), 1.15, 1.16, 1.23, 1.27, 1.53, 1.65 (6 × CH₃, s), 0.96, 2.00 (2H-19, d, J = 4 Hz), 3.40 (H-22, dd, J = 18, 8 Hz), 3.60 (H-3, m), 3.81 (H-22, dd, J = 18, 3 Hz), 4.48 (H-24, s), 4.54 (H-11, m).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	27.6	C-9	27.4	C-17	61.2	C-25	72.4
2	30.6	10	29.5	18	20.0	26	27.5
3	77.9	11	62.9	19	18.5	27	25.5
4	40.3	12	47.0	20	27.2	28	27.7
5	43.4	13	44.3	21	20.2	29	26.1

(continued)

Table 1 (continued)

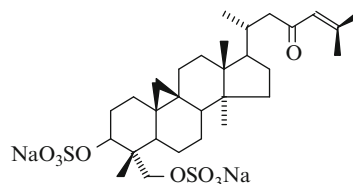
δ_C (C ₅ D ₅ N)							
6	22.1	14	45.9	22	47.4	30	13.6
7	115.3	15	49.6	23	213.6		
8	147.1	16	218.5	24	83.8		

References

1. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)

Cycloart-24-en-3,29-diol-23-one 3,29-disodium sulfate

C₃₀H₄₆O₉S₂Na₂, M 660



Taxonomy: Cycloartane Triterpenoids

Tydemania expeditionis Weber van Bosse

(*Udoteaceae*) [1].

Mp 230–232°C.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm: 240 (ϵ = 8700).

Negative ion HRFABMS m/z: [M-Na]⁻ 637.2.

Table 1

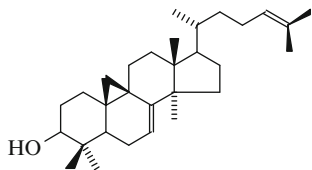
δ_H (J/Hz) (CD ₃ OD)		δ_H (J/Hz) (CD ₃ OD)	
H-1	1.55 m, 1.28 m	H-24	6.18 m (W _{1/2} = 5)
2	2.28 m, 1.77 m	26	1.90 s
3	4.46 m	27	2.15 s
18	1.05 s	28	0.92 s
19	0.40 d (2.5), 0.60 d (2.5)	29	4.04 d (11), 3.79 d (11)
21	0.91 d (7)	30	0.85 s
22	2.53 dd (9.3), 2.29 dd (9.3)		

References

1. M. Govindan, S.A. Abbas, F.J. Schmitz, R.H. Lee, J.S. Papkoff, D.L. Slate, *J. Nat. Prod.* **57**(1), 74–78 (1994)

Cimicifugenol

C₃₀H₄₈O, M 424



Taxonomy: Cycloartane Triterpenoids

The structure was corrected (see Cycloarta-16,24-dien-3 β -ol).

Cimicifuga species (Ranunculaceae) [1].

Mp 112–113°C, [α]_D¹⁵ +21.4° (CHCl₃).

References

1. T. Takemoto, G. Kusano, N. Yamamoto, *Yakugaku Zasshi* **90**(1), 68–72 (1970). *C.A.*, 72: 111644u (1970)

Table 1

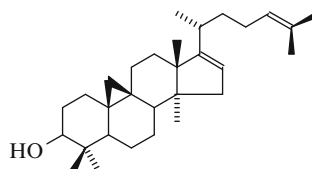
δ_C (CDCl ₃)					
C-1	33.30	C-11	25.75	C- 21	17.98
2	37.36	12	32.66	22	36.20
3	216.52	13	45.19	23	24.81
4	50.11	14	48.60	24	125.08
5	48.30	15	35.45	25	130.79
6	21.39	16	26.60	26	17.54
7	28.03	17	52.16	27	25.63
8	47.78	18	19.18	28	18.11
9	20.96	19	29.45	29	20.66
10	25.83	20	35.75	30	22.096

References

1. D.H.R. Barton. *J. Chem. Soc.* 1444–1451 (1951)
2. N.W. Davies, J.M. Miller, R. Naidu, S. Sotheeswaran, *Phytochemistry* **31**(1), 159–162 (1992)

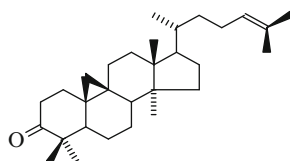
Cycloarta-16,24-dien-3 β -ol

C₃₀H₄₈O, M 424



Cycloartenone

C₃₀H₄₈O, M 424



Taxonomy: Cycloartane Triterpenoids

Artocarpus integrifolia L. (*Moraceae*) [1].

Gardenia sp.: *G. storskii*, *G. gordonii*, *G. hillii*, *G. grieviei* (*Rubiaceae*) [2].

Mp 209°C (from C₆H₆-MeOH), [α]_D +24° (c 3.39, CHCl₃).

CAS Registry Number: 511-63-7.

GC-IR (gas phase) ν_{\max} , cm⁻¹: 1720.

MS m/z (%): M⁺ 424 (18), 409 (24), 340 (17), 313 (20), 311 (22), 286 (24), 271 (20), 205 (18), 147 (20), 111 (187), 95 (57), 69 (100).

Taxonomy: Cycloartane Triterpenoids

It is cimicifugenol whose structure was corrected.

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 112–114°C (from acetone-MeOH), [α]_D²⁵ +20.9° (c 1.09, CHCl₃).

CAS Registry Number: 28282-48-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3320, 3038, 831, 796.

MS m/z (%): M⁺ 424 (8), 409 (8), 391 (3), 342 (4), 327 (3), 315 (5), 313 (7), 297 (5), 284 (3), 269 (5), 255 (3), 217 (5), 203 (14), 187 (19), 69 (78), 41 (100).

HRMS m/z: 424.3726 (M⁺), 313.2510 (C₂₂H₃₃O), 284.2490 (C₂₁H₃₂), 255.7076 (C₁₉H₂₇), 69.0703 (C₅H₉).

Table 1

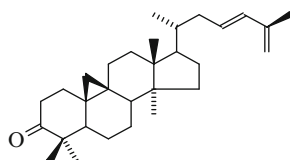
	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	1.57 (α), 1.26 (β)	C-16	119.1	5.20 brs
2	30.4	1.76 (α), 1.56 (β)	17	156.9	–
3	78.8	3.29 dd (10.1, 4.9)	18	22.4	1.06 s
4	40.5	–	19	31.5	0.28 d (4.3), 0.68 d (4.3)
5	47.3	1.30 dd (10.4, 4)	20	31.7	2.02
6	20.9	1.60 (α), 0.84 qd (12.8, 2.3) (β)	21	21.8	1.01 d (6.7)
7	26.6	1.10 (α), 1.37 (β)	22	37.0	1.41, 1.53
8	46.2	1.74 dd (12.8, 4.9)	23	26.3	1.95 (2H)
9	20.1	–	24	125.0	5.11 tq (7.3, 1.5)
10	27.0	–	25	131.1	–
11	26.3	2.04 (α), 1.16 (β)	26	25.7	1.68 s
12	26.0	1.83 (α), 1.44 (β)	27	17.7	1.59 s
13	51.6	–	28	20.6	0.93 s
14	48.3	–	29	25.5	0.98 s
15	42.1	2.05 (α), 1.77 (β)	30	14.0	0.82 s

References

1. A. Toshihiro, H. Ryuichi, K. Kazuo, K. Yumiko, N. Tamotsu. *Chem. Pharm. Bull.* **47**(8), 1157–1160 (1999)

Cycloarta-23,25-dien-3-one

C₃₀H₄₈O, M 424



Taxonomy: Cycloartane Triterpenoids

Guarea macrophylla Vahl. (*Meliaceae*) [1].

White crystals, mp 54–57°C, [α]_D +14° (c 0.50, CHCl₃).

CAS Registry Number: 329240-09-7.

IR ν_{\max}^{KBr} , cm⁻¹: 2937, 1707, 1609, 1461, 1379, 1112, 966, 881,

EIMS m/z (%): 424 (no), 326 (3), 290 (1), 213 (12), 173 (9), 157 (7), 149 (8), 123 (7), 109 (12), 105 (13), 86 (63), 84 (100), 69 (22), 57 (25), 48 (90), 43 (60), 41 (37).

Table 1

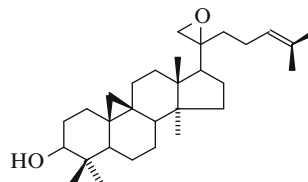
	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.4	1.49, 1.82	C-16	26.7	2.07
2	37.5	2.71 td (13.9, 6.5), 2.30 ddd (14.1, 4.3, 2.6)	17	52.2	1.59
3	216.5	–	18	18.1	1.01
			19	29.6	0.79 d (4), 0.57 d (4.3)
4	50.2	–	20	36.8	1.49
5	48.4	1.70	21	18.5	0.89 d (6.5)
6	21.6	0.94	22	39.7	1.82, 2.27
7	28.2	1.90, 1.32	23	129.5	5.65 ddd (15.3, 8.4, 6.5)
8	47.9	1.59	24	134.1	6.12 d (15.6)
9	21.1	–	25	142.2	–
10	26.0	–	26	18.8	1.85
11	25.9	1.37, 1.15	27	114.0	4.86
12	35.6	1.34	28	19.3	0.91
13	45.4	–	29	22.2	1.05
14	48.8	–	30	20.8	1.10
15	32.7	1.65			

References

1. J.H.G. Lago, C.B. Brochini, N.F. Roque, *Phytochemistry* **55**, 727–731 (2000)

Cyclonivuliaol

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Euphorbia nivulia Buch-Ham (*Euphorbiaceae*) [1].

Mp 101°C (from pet. ether-benzene).

CAS Registry Number: 138994-69-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3300–3600, 3050, 1100.

MS m/z (%): M⁺440 (15), 300 (30), 175 (45), 83 (70), 69 (100).

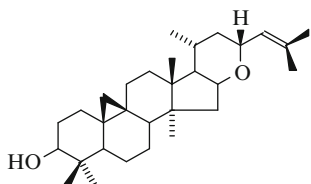
$^1\text{H-NMR}$ (90 MHz, CDCl_3 , δ , 0-TMS): 0.50 and 0.70 (2H-19, d J = 5 Hz), 0.80, 0.92, 0.95, 1.20, 1.60, 1.65 ($6 \times \text{CH}_3$, s), 2.80 (2H-21, q, 2.5 Hz), 3.08 (3-OH, brs), 3.30 (H-3, t, J = 5 Hz), 5.12 (H-24, m).

References

- V. Satyanarayana, G.L. David Krupadanam, G. Srimannarayana, *Indian J. Chem. B* **30**(10), 989–990 (1991)

(16S,23R)-16,23-Epoxychoart-24-en-3 β -ol

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids
Lindheimera texana Gray et Engelm (*Asteraceae*) [1].

CAS Registry Number: 99816-15-6.

Table 1

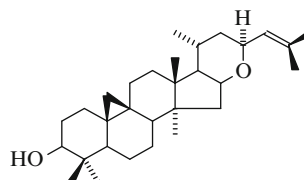
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	31.97	C-16	72.00
2	30.39	17	57.56
3	78.77	18	19.66
4	40.51	19	30.39
5	47.11	20	26.60
6	20.94	21	20.43
7	26.24	22	38.07
8	47.57	23	70.71
9	19.83	24	125.70
10	26.44	25	133.68
11	26.24	26	25.97
12	33.23	27	17.97
13	44.65	28	20.80
14	45.92	29	25.47
15	44.46	30	14.01

References

- W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

(16S,23S)-16,23-Epoxychoart-24-en-3 β -ol

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids
Lindheimera texana Gray et Engelm (*Astraceae*) [1].
CAS Registry Number: 99816-25-8.

$^1\text{H-NMR}$ (270 MHz, CDCl_3 , δ , 0-TMS): 0.32 and 0.62 (2H-19, d), 0.88 (CH_3 -28, s), 0.88 (CH_3 -30, s), 0.94 (CH_3 -21, d), 0.95 (CH_3 -29, s), 1.14 (CH_3 -18, s), 1.65 (CH_3 -27, s), 1.71 (CH_3 -26, s), 1.85 (H-15, dd), 3.28 (H-3, dd, J = 11, 5 Hz), 3.97 (H-16, dt, J = 6, 7.5 Hz), 4.24 (H-23, ddd, J = 8.5, 7, 4.5 Hz), 5.29 (H-24, brd, J = 8.5 Hz).

References

- W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

9,19-Cyclolanostane-3,24-dione

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440

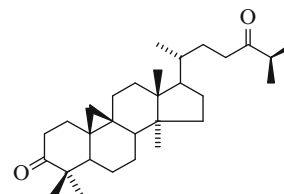


Table 1

δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)	δ_C (CDCl ₃) δ_H (J/Hz) (CDCl ₃)
C-1	33,3	1.85 dddd (13.5, 13.0, 4.0, 1.4), 1.54 ddd (13.5, 4.4, 2.7)
2	37,4	2.72 ddd (13.4, 4.4, 2.7), 2.32 ddd (13.5, 13.4, 6.5)
3	216,4	–
4	50,2	–
5	48,4	1.70 dd (12.5, 4.5)
6	21,5	1.56 m, 0.93 m
7	25,8	1.37 dddd (12.5, 12.5, 3.0, 12.5), 1.12 dddd (12.5, 2.5, 4.9, 4.9)
8	47,9	1.58 dd (12.5, 4.9)
9	21,0	–
10	25,9	–
11	26,7	2.05 m, 1.16 m
12	32,8	1.64 t (7.5) (2 H)
13	48,7	–
14	45,3	–
C-15	35.5	1.32 m (2H)
16	28.0	1.94 m, 1.32 m
17	52.2	1.59 m
18	18.3	1.09 s
19	29.5	0.57 d (4.3), 0.78 d (4.3)
20	35.6	1.39 m
21	20.8	1.09 d (6.5)
22	30.0	1.77 m, 1.24 m
23	37.4	2.14 ddd (16.6, 9.7, 6.0), 2.14 ddd (16.6, 10.0, 5.2)
24	215.4	–
25	40.8	2.61 m
26	18.6	0.86 d (6.5)
27	18.0	0.98 d (6.5)
28	19.3	0.90 s
29	22.1	1.04 s
30	20.7	1.09 s

Taxonomy: Cycloartane Triterpenoids

Gardenia sp.: *G. gordonii*, *G. hillii*, *G. storckii*
(*Rubiaceae*) [1].

Polygonum bistorta (*Polygonaceae*) [2].

Colorless crystals.

CAS Registry Number: 141912-53-0.

EIMS m/z (%): [M]⁺ 440 (84), 425 (61), 407 (21), 379 (19), 354 (78), 342 (30), 313 (100), 302 (59), 271 (20), 203 (66), 175 (84), 135 (87), 127 (77).

HREIMS m/z: 440.3655 [M]⁺.

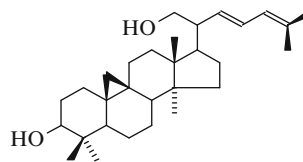
See [Table 1](#)

References

- N.W. Davies, J.M. Miller, R. Naidu, S. Sotheeswaran, *Phytochemistry* **31**(1), 159–162 (1992)
- K.P. Manoharan, T.K.H. Benny, D. Yang, *Phytochemistry* **66**, 2304–2308 (2005)

Desmosinol

C₃₀H₄₈O₂, M 440

**Taxonomy:** Cycloartane Triterpenoids

Desmos cochinchinensis Lour. (*Annonaceae*) [1].

CAS Registry Number: 151606-38-1.

HREIMS m/z (%): M⁺ 440.3627 (13, C₃₀H₄₈O₂),
[M–Me]⁺ 425.3410 (25), [M–H₂O]⁺ 422.3541 (7),
[M–Me–H₂O]⁺ 407.3297 (10), [M–C₄H₇]⁺
385.3058 (6), [M–H₂O–C₄H₇]⁺ 367.2972 (3),
[M–H₂O–C₆H₉]⁺ 341.2835 (2), [M–C₈H₁₃O]⁺
315.2684 (7), [M–C₉H₁₆O]⁺ 300.2438 (13),
[M–C₈H₁₃O–H₂O]⁺ 297.2540 (10), [M–C₉H₁₆O–
Me]⁺ 285.2217 (24), [M–C₉H₁₆O–C₈H₁₃O]⁺

175.1472 (32), [C₇H₁₁]⁺ 95.0864 (100), [C₆H₉]⁺ 81.0712 (76), [C₄H₇]⁺ 55.0549 (92).

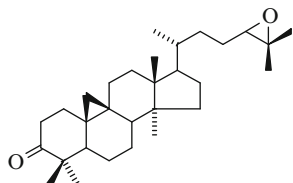
¹HNMR (270 MHz, CDCl₃, δ): 0.33 and 0.56 (2H-19, d, J = 4 Hz), 0.80, 0.90, 0.96, 0.96, 1.56, 1.65 (6 × CH₃, s), 3.28 (H-3, dd, J = 10.6, 4.8 Hz), 3.68 (2H-21, m).

References

1. N.J. Sun, D.K. Ho, J.M. Sneddon, R.E. Stephens, J.M. Cassidy, *Nat. Prod. Lett.* **1**(2), 109–115 (1992)

(24R)-24,25-Epoxycycloartan-3-one

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Borrchia frutescens (L.) DC (*Asteraceae*) [1].

Mp 119–122°C (from hexane-EtOAc).

CAS Registry Number: 155551-21-6.

CD (c 0.0019, MeOH) nm (ε): 212 (−1.8), 225 (−18.2), 236 (−0.5), 298 (−32.6), 401 (−0.1).

IR ν_{max}^{KBr}, cm^{−1}: 1708.

EIMS m/z (%): M⁺ 440 (7), 425 (4), 422 (1), 313 (40), 302 (16), 175 (35), 163 (24), 127 (13), 121 (50), 109 (53), 107 (56), 95 (100), 81 (52), 69 (60), 55 (76), 43 (74).

Table 1

δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	33.4	C-16	26.7
2	37.4	17	52.2
3	216.5	18	18.1
4	50.2	19	29.5

(continued)

Table 1 (continued)

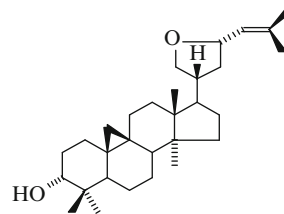
δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
5	48.4	20	35.8
6	21.5	21	18.3
7	28.1	22	32.6
8	47.9	23	25.6
9	21.1	24	64.7
10	26.0	25	58.3
11	25.8	26	18.7
12	35.5	27	24.9
13	45.3	28	19.2
14	48.7	29	22.2
15	32.8	30	20.7

References

1. C.L. Cantrell, T. Lu, F.R. Fronczek, N.H. Fisher, L.B. Adams, S.G. Francblau, *J. Nat. Prod.* **59**(12), 1131–1136 (1996)

(23S)-21,23-Epoxy -5α-cycloart-24-en-3α-ol

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 166–168°C (from MeOH), [α]_D²¹ +5° (c 0.80, CHCl₃).

CAS Registry Number: 146257-58-1.

IR ν_{max}^{CHCl₃}, cm^{−1}: 3629.

EIMS m/z (%): M⁺ 440.3654 (100), 425 (94), 422 (13), 407 (13), 300 (14), 285 (34), 175 (16), 125 (98).

^1H NMR (CDCl_3 , δ): 0.27 and 0.48 (2H-19, d, $J = 4.2$ Hz), 0.73 (H-6 β , dddd, $J_1 = J_2 = J_3 = 12.5$ Hz, $J_4 = 2.5$ Hz), 0.82, 0.84, 0.90, 0.92 ($4 \times \text{CH}_3$, s), 1.63 and 1.67 (CH_3 -26, CH_3 -27, d, $J = 1.2$ Hz), 3.33 (H-21 $_B$, dd, $J_1 = 9.5$, $J_2 = 8$ Hz), 3.42 (H-3, m), 3.89 (H-21 $_A$, dd, $J = 8$, $J_2 = 7.5$ Hz), 4.48 (H-23, ddd, $J = 10$, $J_2 = 8.5$, $J_3 = 5$ Hz), 5.13 (H-24, dq, $J = 8.5$, $J_2 = J_3 = 1.2$ Hz).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	
C-1	27.5	C-11	26.7	C-21	71.4
2	28.5	12	31.2	22	43.7
3	76.6	13	45.4	23	75.2
4	39.5	14	48.4	24	126.3
5	40.9	15	35.7	25	135.7
6	21.2 ^a	16	27.9	26	18.1
7	25.9 ^b	17	50.9	27	26.1 ^b
8	47.9	18	18.7	28	19.2
9	19.8 ^a	19	29.9	29	25.6
10	25.8 ^b	20	40.4	30	20.9 ^a

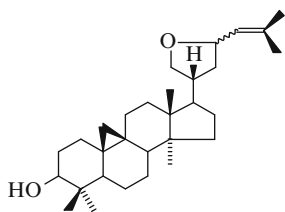
^{a,b}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

(23R)-and (23S)-21,23-Epoxy-5 α -cycloart-24-en-3 β -ol (Mixture of the 23-Epimers in a 4:1 Ratio)

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

CAS Registry Number: 146257-76-3.

CAS Registry Number: 146257-77-4.

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm^{-1} : 3612.

EIMS m/z (%): M + 440. 3655 (35), 425 (68), 422 (17), 407 (26), 379 (20), 353 (7), 300 (36), 285 (92), 182 (20), 175 (14), 161 (22), 147 (23), 135 (21), 133 (20), 125 (100), 123 (31), 121 (23), 119 (24), 109 (35), 107 (43), 105 (29), 69 (70).

^1H NMR (CDCl_3 , δ): 0.31 and 0.57 (2H-19, d, $J = 4.2$ Hz), 0.80 ($2 \times \text{CH}_3$, s), 0.89 ($2 \times \text{CH}_3$, s), 0.96 ($2 \times \text{CH}_3$, s), 0.97 (CH_3 , s), 0.99 (CH_3 , s), 1.69 ($2 \times \text{CH}_3$, d, $J = 1.2$ Hz), 1.72 ($2 \times \text{CH}_3$, d, $J = 1.2$ Hz), 3.28 (H-3, m), 3.20 and 3.39 (H-21 $_B$ and H-21 $_B$, dd, $J = 9.5$, 8.5 Hz), 3.94 and 4.03 (H-21 $_A$ and H-21 $_A$, dd, $J = 8.5$, 7 Hz), 4.53 (H-23, ddd, $J = 10$, 8.5, 5 Hz), 4.59 (H-23, ddd, $J = 8.5$, 6.5, 6.5 Hz), 5.18 and 5.21 (H-24 and H-24, dq, $J = 8.5$, 1.2, 1.2 Hz).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	
C-1	31.9	C-11	26.5	C-21	71.4, 72.0
2	30.4	12	31.3	22	43.7, 42.5
3	78.8	13	45.5	23	75.2, 74.4
4	40.4	14	48.4	24	126.4, 127.0
5	47.0	15	35.8	25	135.5
6	21.0	16	27.9	26	18.1
7	26.0 ^a	17	51.0, 50.8	27	26.3
8	47.8	18	18.7	28	19.3
9	20.1	19	29.9	29	25.4
10	25.8 ^a	20	40.5, 39.2	30	14.0

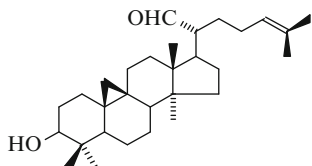
^aAssignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

3 β -Hydroxy-5 α -cycloart-24-en-21-al

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Monoclyanthus vignei Keay (*Annonaceae*) [1].

Mp 81° (from Me₂CO), [α]_D²¹ +47° (c. 0.28, CHCl₃).

CAS Registry Number: 125292-62-8.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3513, 1718.

EIMS m/z (%): M + 440.3651 (6), 422 (19), 407 (22), 379 (14), 358 (20), 340 (?), 300 (9), 288 (12), 218 (45), 175 (59), 107 (91), 95 (88), 81 (100).

¹H NMR (CDCl₃, δ): 0.30 and 0.56 (2H-19, J = 4.2 Hz), 0.80 (H-6 β , qd, J = 12.5, 2.5 Hz), 0.80 (CH₃, s), 0.90 (CH₃, s), 0.96 (CH₃, s), 0.99 (CH₃, s), 1.57 (CH₃, brs), 1.67 (CH₃, brs), 3.28 (H-3, m), 5.05 (H-24, tq, J = 7, 1.2, 1.2 Hz), 9.46 (H-21, d, J = 5.5 Hz).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	
C-1	31.9	C-11	26.5	C-21	205.6
2	30.4	12	31.5	22	26.9
3	78.8	13	45.3	23	25.9
4	40.4	14	48.7	24	123.6
5	47.0	15	35.2	25	132.4
6	21.0	16	29.4	26	17.7
7	25.9	17	47.5	27	25.6 ^a
8	47.5	18	18.8	28	19.2
9	20.0	19	29.8	29	25.5 ^a
10	26.3	20	55.4	30	13.9

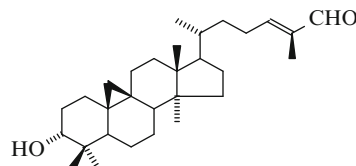
^aAssignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

24(E)-3 α -Hydroxycycloart-24-en-26-al

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Rapanea guyanensis Albl. (*Myrsinaceae*) [1].

Obtained as a gum from CH₂Cl₂-EtOAc, [α]_D +10.6° (c 1.0, CHCl₃).

IR $\nu_{\max}^{\text{liq film}}$, cm⁻¹: 3448, 1687, 1636.

MS m/z (%): M⁺ 440 (2), 315 (3), 125 (8), 84 (8), 81 (45), 55 (97), 53 (13), 43 (100), 41 (62).

¹H NMR (CDCl₃): δ 0.33 and 0.49 (2H-19, d, J = 4.0 Hz), 0.85, 0.88, 0.92, 0.94, 1.73 (5 \times CH₃, s), 0.91 (CH₃-21, d, J = 5.0 Hz), 2.15 and 2.35 (2H-23, m), 3.45 (H-3, brs), 6.47 (H-24, t, J = 6.7 Hz), 9.37 (H-26, s).

Table 1

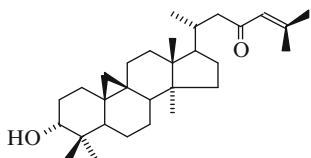
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{C}}(\text{CDCl}_3)$	
C-1	27.5	C-11	26.2	C-21	18.1
2	28.5	12	32.8	22	34.7
3	77.0	13	45.3	23	25.6
4	39.5	14	48.9	24	155.6
5	41.0	15	35.4	25	139.1
6	21.1	16	26.0	26	195.4
7	28.2	17	52.1	27	9.1
8	48.0	18	19.3	28	18.1
9	19.8	19	29.7	29	25.8
10	26.4	20	35.9	30	21.2

References

1. A.H. Januario, M.F. Das, G.F. da Silva, P.C. Vieira, J.B. Fernandes, *Phytochemistry* **31**(4), 1251–1253 (1992)

3 α -Hydroxy-5 α -cycloart-24-en-23-one

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 111–113°C (from Me₂CO), [α]_D²¹ +15° (c 0.4, CHCl₃).

UV $\lambda_{\max}^{\text{MeOH}}$, nm (log ϵ): 232 (3.97).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3623, 1681, 1616.

EIMS m/z (%): M⁺ 440.3655 (6), 425 (5), 422 (3), 407 (2), 342 (26), 327 (14), 324 (8), 315 (?), 309 (7), 300 (5), 175 (18), 125 (52), 98 (12), 83 (100).

¹H NMR (CDCl₃, δ): 0.35 and 0.52 (2H-19, d, J = 4.2 Hz), 0.78 (H-6 β , qd, J = 12.5, 2.5 Hz), 0.88 (CH₃-21, d, J = 6.5 Hz), 0.88 (CH₃, s), 0.91 (CH₃, s), 0.95 (CH₃, s), 1.02 (CH₃, s), 1.88 (CH₃, d, J = 1.2 Hz), 2.10 (H-22_B, dd, J = 15, 10 Hz), 2.15 (CH₃, d, J = 1.2 Hz), 2.51 (H-22_A, dd, J = 15, 2.5 Hz), 3.46 (H-3, brs), 6.06 (H-24, m).

Table 1

δ_{C} (CDCl ₃)					
C-1	27.5 ^a	C-11	26.6	C-21	19.4 ^b
2	28.7	12	32.9	22	51.8
3	76.7	13	45.5	23	201.5
4	39.6	14	49.1	24	124.5
5	41.1	15	35.5	25	154.3
6	21.3	16	28.4	26	20.6
7	25.8	17	52.6	27	27.6 ^a
8	48.0	18	18.0	28	19.3 ^b
9	19.9	19	29.8	29	25.6
10	26.3	20	33.5	30	21.1

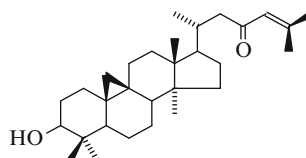
^{a,b}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

3 β -Hydroxy-5 α -cycloart-24-en-23-one

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 130°C (from Me₂CO), [α]_D²¹ +18° (c 0.9, CHCl₃).

UV $\lambda_{\max}^{\text{MeOH}}$, nm (log ϵ): 238 (4.27).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3616, 1681, 1616.

EIMS m/z (%): M⁺ 440.3654(10), 425(5), 422(10), 407(10), 342(6), 327(5), 324(6), 315(10), 309 (7), 300(10), 255(8), 202(18), 175(15), 147(38), 125(60), 98(17), 83(100).

¹H NMR (CDCl₃, δ): 0.34 and 0.56 (2H-19, d, J = 4.2 Hz), 0.79 (H-6 β , qd, J = 12.5, 2.5 Hz), 0.81 (CH₃, s), 0.88 (CH₃-21, d, J = 6.5 Hz), 0.90 (CH₃, s), 0.97 (CH₃, s), 1.02 (CH₃, s), 1.88 (CH₃, d, J = 1.2 Hz), 2.10 (H-22_B, dd, J = 15, 10 Hz), 2.14 (CH₃, d, J = 1.2 Hz), 2.51 (H-22_A, dd, J = 15, 2.5 Hz), 3.27 (H-3, m), 6.06 (H-24, m).

Table 1

δ_{C} (CDCl ₃)					
C-1	32.1	C-11	26.6	C-21	19.5 ^a
2	30.5	12	33.0	22	51.8
3	78.9	13	45.6	23	201.4
4	40.6	14	49.1	24	124.6
5	47.3	15	35.6	25	154.1
6	21.2	16	28.4	26	20.6
7	26.0	17	52.7	27	27.5
8	47.9	18	18.1	28	19.4 ^a
9	20.1	19	29.8	29	25.5
10	26.3	20	33.5	30	14.0

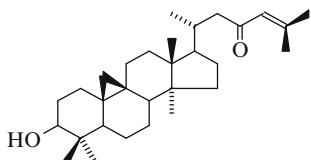
^a Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

3 β -Hydroxycycloart-24-en-23-one

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Guarea trichilioides (Meliaceae) [1].

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 1670, 1620.

MS m/z (%): M⁺ 440 (2), 425 (1), 342 (3.5), 327 (2), 315 (4), 83 (100), 55 (43), 43 (26).

¹H NMR (CDCl₃, δ): 0.30 and 0.50 (2H-19, d, J = 4 Hz), 0.80, 0.90, 1.05, 1.10, 1.90, 2.20 (6 \times CH₃), 3.30 (1H, m).

Table 1

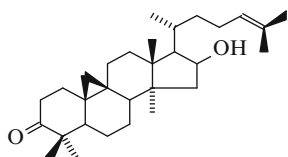
δ_{C} (CDCl ₃)	δ_{C} (CDCl ₃)	δ_{C} (CDCl ₃)			
C-1	31.9	C-11	26.3	C-21	17.9
2	30.2	12	35.4	22	51.6
3	78.7	13	45.3	23	201.6
4	40.3	14	48.8	24	124.3
5	47.0	15	32.7	25	154.3
6	20.9	16	26.5	26	25.9
7	28.2	17	52.2	27	19.2
8	47.8	18	17.9	28	19.2
9	19.8	19	29.7	29	25.3
10	26.0	20	33.3	30	13.9

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

16S-Hydroxycycloartenone

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 169°C, $[\alpha]_{\text{D}} +27^{\circ}$ (c 0.46, CHCl₃).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3580 (OH), 1710.

MS m/z (%): M⁺ 440.365 (6), 425 (20), 407 (7), 379 (2), 340 (8), 325 (10), 313 (13), 311 (9), 203 (23), 109 (60), 69 (100), 55 (76).

Table 1

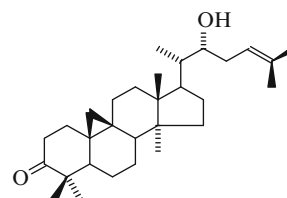
δ_{H} (CDCl ₃ , J/Hz)	δ_{H} (CDCl ₃ , J/Hz)	δ_{H} (CDCl ₃ , J/Hz)			
H-1 α	1.84 ddd (14, 14, 4)	H-8	1.66 dd (13,4)	H-21	0.94 d (7)
1 β	1.52 ddd (14, 6, 2.5)	15 α	1.43 dd (13.5, 5)	23	2.10 m
2 β	2.71 ddd (14, 14, 6)	15 β	2.01 dd (13.5, 8)	23'	2.13 m
2 α	2.29 ddd (14, 4, 2.5)	16	4.41 ddd (8, 7, 5)	24	5.16 t(br)(7)
5	1.12 m	17	1.67 dd (11, 7)	26	1.75 brs
6 α	1.69 dddd (13, 4, 4)	18	1.20 s	27	1.66 brs
6 β	0.92 m	19 α	0.59 d (4)	28	0.90 s
7 α	1.12 m	19 β	0.80 d (4)	29	1.08 s
7 β	1.40 m	20	1.78 m	30	1.02 s

References

1. F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

22R-Hydroxycycloartenone

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Colourless oil, $[\alpha]_{\text{D}} +27^{\circ}$ (c 3.39, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3610, 1710.

MS m/z (%): M⁺ 440.365 (1), 425 (3), 371 (17), 370 (12), 355 (10), 232 (21), 109 (44), 95 (61), 81 (57), 69 (100).

See [Table 1](#)

Table 1

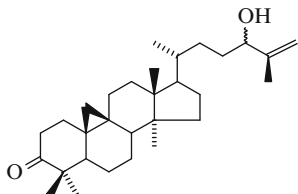
$\delta_{\text{H}}(\text{CDCl}_3, \text{J/Hz})$		$\delta_{\text{H}}(\text{CDCl}_3, \text{J/Hz})$		$\delta_{\text{H}}(\text{CDCl}_3, \text{J/Hz})$	
H-1 α	1.84 ddd (14, 14, 4)	H-8	1.66 dd (13,4)	H-22	3.63 ddd (9, 4.5, 2)
1 β	1.52 ddd (14, 6, 2.5)	15 α	1.43 dd (13.5, 5)	23	2.27 ddd (9, 7, ?) $J_{23} 23 = ?$
2 β	2.71 ddd (14, 14, 6)	15 β	2.01 dd (13.5, 8)	23'	2.13 dd (br) (4.5, 7, ?)
2 α	2.29 ddd (14, 4, 2.5)	17	1.88 dd (11, 7)	24	5.16 t (br) (7)
5	1.12 m	18	1.08 s	26	1.75 brs
6 α	1.69 dddd (13, 4, 4)	19 α	0.59 d (4)	27	1.66 brs
6 β	0.92 m	19 β	0.80 d (4)	28	0.90 s
7 α	1.12 m	20	1.43 m	29	1.08 s
7 β	1.40 m	21	0.87 d (7)	30	1.02 s

References

1. F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

24-Hydroxycycloart-25-en-3-one

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (Bromeliaceae) [1].

Mp 118–121 °C (from Et_2O -hexane), $[\alpha]_{\text{D}}^{25} + 20^\circ$ (c 0.62, CHCl_3).

UV $\lambda_{\text{max}}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 220 (2.3).

EIMS m/z (%): M^+ 440 (5), 422 (14), 407 (6), 379 (6), 355 (7), 313 (29), 302 (14), 175 (40), 95 (87), 55 (100).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	33.4	C-16	28.1
2	37.4	17	52.2
	2.31 m, 2.71 dt	18	18.1
	(6.2, 13.8)	19	29.5
3	216.5	20	35.9
4	50.2		0.99 s
5	48.4		0.57 d (4.2),
			0.79 d (4.2)

(continued)

Table 1 (continued)

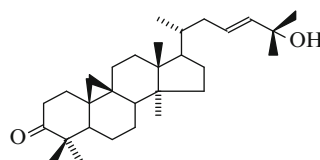
$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{CDCl}_3)$	$\delta_{\text{H}}(\text{J/Hz})$
6	21.5	21	18.3
7	25.8	22	31.9
8	47.9	23	31.5, 31.7
9	21.1	24	76.7, 76.3
10	26.0	25	147.8, 147.5
11	26.7	26	111.3, 110.8
			4.84 brs, 4.93 brs
12	32.8	27	17.6, 17.2
			1.73 brs
13	45.3	28	19.3
			0.90 s
14	48.7	29	22.2
			1.05 s
15	35.5	30	20.7
			1.10 s

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

25-Hydroxycycloart-23-en-3-one

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids

Guarea trichilioides (Meliaceae) [1].

Mp 116–118 °C, $[\alpha]_{\text{D}}^{25} + 15.3^\circ$ (c 1.9, CHCl_3).

CAS Registry Number: 148044-47-7.

IR ν_{\max}^{KBr} , cm^{-1} : 3500, 1700, 1650.

MS m/z (%): M^+ 440 (3), 425 (1), 422 (1.2), 341 (1.5), 313 (2), 109 (33), 81 (37), 55 (51), 43 (100).

^1H NMR (CDCl_3 , δ): 0.60 and 0.80 (2H-19, d, $J = 4$ Hz), 0.90, 1.00, 1.10, 1.20, 1.30, 1.30 ($6 \times \text{CH}_3$), 2.40–2.60 (2H), 5.60 (2H, brs).

Table 1

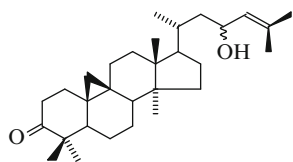
δ_{C} (CDCl_3)									
C-1	33.2	C-7	27.9	C-13	45.3	C-19	29.3	C-25	70.5
2	37.3	8	47.7	14	48.7	20	36.3	26	29.8
3	216.0	9	20.0	15	32.7	21	18.2	27	29.8
4	50.1	10	26.7	16	26.6	22	39.0	28	19.3
5	48.3	11	25.7	17	51.9	23	125.4	29	22.1
6	21.4	12	35.5	18	17.9	24	139.4	30	21.0

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

23-Hydroxycycloart-24-en-3-one (Epimer 1)

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids

Guarea trichilioides (Meliaceae) [1].

Mp 154–156°C, $[\alpha]_{\text{D}}^{25} +27.0^\circ$ (c 1.01, CHCl_3).

IR ν_{\max}^{KBr} , cm^{-1} : 3500, 1700, 1650.

MS m/z (%): M^+ 440 (2), 425 (2), 422 (34), 340 (80), 325 (26), 313 (40), 311 (26), 109 (60), 85 (70), 55 (100), 43 (79).

^1H NMR (CDCl_3 , δ): 0.60 and 0.80 (2H-19, d, $J = 4$ Hz), 0.90, 0.90, 1.10, 1.10, 1.20, 1.70, 1.70 ($7 \times \text{CH}_3$), 2.40–2.80 (2H), 4.30–4.70 (1H), 5.20 (1H).

Table 1

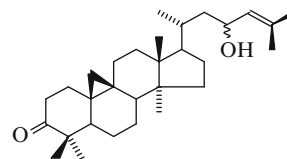
δ_{C} (CDCl_3)									
C-1	33.2	C-7	28.1	C-13	45.3	C-19	29.3	C-25	133.2
2	37.2	8	47.6	14	48.6	20	32.5	26	25.6
3	216.1	9	20.9	15	32.7	21	17.9	27	19.0
4	50.0	10	25.5	16	26.6	22	44.3	28	19.0
5	48.2	11	25.8	17	52.7	23	65.8	29	22.0
6	21.3	12	35.3	18	18.2	24	129.1	30	20.5

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

23 ξ -Hydroxycycloart-24-en-3-one (Epimer 2)

$\text{C}_{30}\text{H}_{48}\text{O}_2$, M 440



Taxonomy: Cycloartane Triterpenoids

Guarea trichilioides (Meliaceae) [1].

Mp 134–136°C, $[\alpha]_{\text{D}}^{25} +52.7^\circ$ (c 1.27, CHCl_3).

IR ν_{\max}^{KBr} , cm^{-1} : 3500, 1700, 1650.

MS m/z (%): M^+ 440 (3), 425 (2), 340 (5), 325 (1.5), 313 (1.7), 311 (1), 109 (53), 85 (100), 55 (57), 43 (48).

^1H NMR (CDCl_3 , δ): 0.60 and 0.80 (2H-19, d, $J = 4$ Hz), 0.80, 1.00, 1.15, 1.20, 1.70, 1.70 ($6 \times \text{CH}_3$), 2.40–2.80 (2H), 4.30–4.70 (1H), 5.20 (1H, brd).

Table 1

δ_{C} (CDCl_3)									
C-1	33.2	C-7	28.1	C-13	45.2	C-19	29.3	C-25	135.1
2	37.2	8	47.6	14	48.6	20	33.3	26	25.8
3	216.1	9	20.9	15	32.7	21	17.8	27	18.9
4	50.0	10	25.6	16	26.5	22	44.3	28	19.0

(continued)

Table 1 (continued)

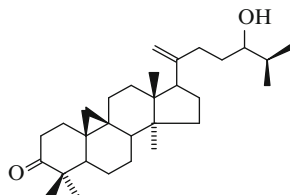
δ_C (CDCl ₃)									
5	48.2	11	25.8	17	52.7	23	67.0	29	22.0
6	21.3	12	35.8	18	18.1	24	128.4	30	20.5

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

Neriifolione

C₃₀H₄₈O₂, M 440



Taxonomy: Cycloartane Triterpenoids

Euphorbia neriifolia (*Euphorbiaceae*) [1].

Mp 92°C (from CHCl₃–MeOH), $[\alpha]_D^{25} -17.5$.

CAS Registry Number: 211686-31-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 3040, 1705, 1380, 1360, 880.

MS m/z (%): M⁺ 440 (15), 425 (12), 422 (9), 367 (8), 353 (8.5), 339 (15), 313 (27.6), 302 (11), 175 (36)

¹HNMR (400 MHz, CDCl₃, δ , 0-TMS): 0.19 and 0.39 (2H-19, d, J = 5 Hz), 0.89–1.10 (6 × Me), 3.25 (H-24, m), 4.65 (2H-21, d, J = 8 Hz).

Table 1

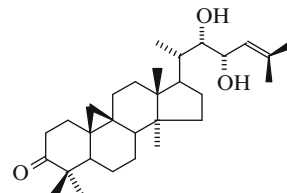
δ_C (CDCl ₃)									
C-1	35.5	C-7	28.30	C-13	45.31	C-19	29.61	C-25	30.51
2	33.53	8	47.51	14	48.60	20	138.25	26	22.50
3	215.10	9	20.02	15	32.71	21	113.21	27	22.71
4	39.4	10	26.00	16	26.52	22	34.50	28	19.42
5	50.63	11	25.91	17	52.10	23	25.10	29	24.71
6	20.91	12	36.24	18	18.70	24	76.30	30	20.52

References

1. M. Ilyas, M. Parveen, K.M.Y. Amin, *Phytochemistry* **48**(3), 561–563 (1998)

Argenteanone C

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous solid, $[\alpha]_D^{20} +11^\circ$ (c 1, CHCl₃).

CAS Registry Number: 186090-62-0.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3410, 1709.

FAB MS m/z: 479 [M + Na]⁺.

HRFABMS m/z: 479.3481 (C₃₀H₄₈NaO₃).

Table 1

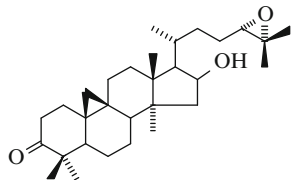
	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.9	1.85 m, 1.55 m	C-16	27.2	1.70 m, 1.35 m
2	36.9	2.30 m, 2.70 ddd (14, 7, 7)	17	40.4	1.85 m
			18	17.0	0.95 s
3	216.8	–	19	28.8	0.58 d (4), 0.78 d (4)
4	49.7	–	20	47.8	1.80 m
5	47.8	1.70 m	21	12.8	0.88 d (6.5)
6	20.9	1.55 m, 0.90 m	22	75.6	3.58 d (9.5)
7	25.3	1.10 m, 1.35 m	23	68.0	4.35 dd (9.5, 7.5)
8	47.1	1.60 m	24	124.3	5.30 brd
9	20.5	–	25	135.9	–
10	25.4	–	26	25.5	1.75 s
11	26.1	2.05 m, 1.15 m	27	18.0	1.75 s
12	32.3	1.50 m	28	18.5	0.78 s
13	45.1	–	29	21.6	0.98 s
14	47.8	–	30	20.0	1.05 s
15	35.2	1.30 m			

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

Desoxyprefruticin B

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Parthenium lozanium Bartlett (*Compositae*) [1].

Colorless oil.

IR $\nu_{\max}^{CHCl_3}$, cm^{-1} : 3540, 1700.

MS m/z (%): M^+ 456.360 (16), 441 (15), 438 (20), 423 (44), 311 (19), 57 (100).

Table 1

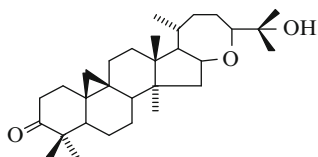
δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
H-1 α	1.85 brddd (13, 13, 4.5)	H-19 β	0.81 brd
1 β	1.55 m	21	0.97 d
2 α	2.30 ddd (14, 4.5, 2)	24	2.82 t (6)
2 β	2.71 ddd (14, 13, 3.5)	26	1.31 s
15	2.04 m	27	1.26 s
16	4.44 ddd (7, 7, 6)	28	1.04 s
18	1.19 s	29	1.10 s
19 α	0.58 d	30	0.89 s

References

1. J. Jakupovic, V.P. Pathak, F. Bohlmann, X.A. Dominguez, *Phytochemistry* **26**(3), 761–764 (1987)

Desoxyisofruticin B

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Parthenium lozanium Bartlett (*Compositae*) [1].

Viguiera superaxillare (*Compositae*) [2].

Colorless oil.

CAS Registry Number: 109291-71-6.

IR $\nu_{\max}^{CHCl_3}$, cm^{-1} : 3540, 1700.

MS m/z (%): M^+ 456.360 (5), 441 (3), 423 (4), 398 (43), 397 (73), 383 (12), 379 (20), 55 (100).

Table 1

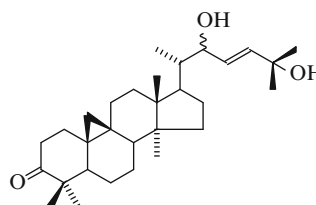
δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
H-1 α	1.84 br ddd (13, 13, 4.5)	H-19 β	0.81 brd
1 β	1.55 m	21	0.94 d
2 α	2.30 ddd(14, 4.5, 2)	24	3.59 dd (12,2)
2 β	2.71 ddd(14, 13, 3.5)	26	1.09 s
15	2.07 m	27	1.09 s
16	4.60 ddd (7, 7, 6)	28	1.04 s
18	1.17 s	29	1.10 s
19 α	0.57 d	30	0.88 s

References

1. J. Jakupovic, V.P. Pathak, F. Bohlmann, X.A. Dominguez, *Phytochemistry* **26**(3), 761–764 (1987)
2. X.A. Dominguez, E. Ellmauerer, H. Sanchez, O.R. Franeo, S.J. Verde, *Rev. Latinoam. Quim.* **19**, 144 (1988). *C.A.*, 110:132171f (1989)

22,25-Dihydroxycycloart-23E-en-3-one

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Guarea macrophylla Vahl (*Meliaceae*) [1].

White amorphous powder, $[\alpha]_D^{+38.8}$ (c 0.15, CHCl₃).

IR ν_{\max}^{KBr} , cm^{-1} : 3394, 2931, 2870, 1706, 1459, 1378, 1237, 1155, 1113, 1086, 977, 917, 841, 757.

EIMS m/z (%): M^+ 456 (no), 413 (2), 299 (7), 257 (14), 239 (19), 135 (53), 98 (71), 93 (25), 87 (33), 83 (62), 74 (61), 69 (55), 59 (60), 43 (56).

Table 1

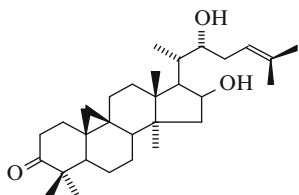
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.4 1.53 m, 1.87 m	C-16	26.7 2.05 m
2	37.4 2.70 dt (13.9, 6.3), 2.32 ddd (13.9, 4.3, 2.3)	17	49.2 1.63 m
3	216.5 –	18	18.2 1.03 s
4	50.2 –	19	29.5 0.58 d (4.3), 0.79 d(4.3)
5	48.4 1.68 m	20	42.4 1.45 m
6	21.5 0.97 m	21	12.0 0.91 d (6.7)
7	27.4 1.93 m, 1.34 m	22	74.4 4.22 dd (6.9, 3.3)
8	47.8 1.58 m	23	125.3 5.70 dd (15.7, 7)
9	21.1 –	24	140.5 5.85 d (15.7)
10	26.0 –	25	70.8 –
11	25.8 1.40 m, 1.18 m	26	30.1 1.34 s
12	35.7 1.36 m	27	29.9 1.34 s
13	45.7 –	28	19.3 0.86 s
14	48.4 –	29	22.2 1.05 s
15	32.8 1.62 m	30	20.8 1.10 s

References

- J.H.G. Lago, N.F. Roque, *Phytochemistry* **60**, 329–332 (2002)

16S,22R-Dihydroxycycloartenone

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 198°C, $[\alpha]_D -5^\circ$ (c 2.8, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3560, 3480, 1710.

MS m/z (%): M⁺ 456.360 (1), 438 (6), 387 (10), 369 (26), 351 (11), 311 (90), 121 (61), 119 (38), 109 (86), 107 (68), 95 (69), 81 (67), 69 (100).

Table 1

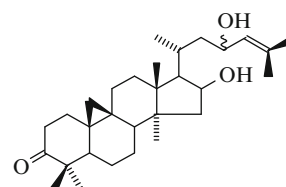
δ_H (CDCl ₃ , J/Hz)	δ_H (CDCl ₃ , J/Hz)
H-1 α	1.84 ddd (14, 14, 4)
1 β	1.52 ddd (14, 6, 2.5)
2 β	2.29 ddd (14, 14, 6)
2 α	2.29 ddd (14, 14, 2.5)
5	1.12 m
6 α	1.69 dddd (13, 4, 4)
6 β	0.92 m
7 α	1.12 m
7 β	1.40 m
8	1.66 dd (13, 4)
15 α	1.43 dd (13.5, 5)
15 β	2.01 dd (13.5, 8)
16	4.41 ddd (8, 7, 5)
17	1.88 dd (11, 7)
H-18	1.20 s
19 α	0.59 d (4)
19 β	0.80 d (4)
20	2.37 ddq (11, 2, 7)
21	0.94 d (7)
22	3.63 ddd (9, 4.5, 2)
23	2.27 ddd (9, 7, ?), J _{23,23'} = ?
23	2.13 dd (br)(4.5, 7, ?)
24	5.16 t (br) (7)
26	1.75 brs
27	1.66 brs
28	0.90 s
29	1.08 s
30	1.02 s

References

- F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

16S,23 ξ -Dihydroxycycloartenone

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 196°C.

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3610, 1710.

MS m/z (%): M⁺ 438.350 [M-H₂O]⁺ (32), 423 (22), 311 (5), 69 (100).

Table 1

δ_H (CDCl ₃ , J/Hz)	δ_H (CDCl ₃ , J/Hz)
H-1 α	1.84 ddd (14, 14, 4)
1 β	1.52 ddd (14, 6, 2.5)
H-17	2.01 dd (11, 7)
18	1.16 s

(continued)

Table 1 (continued)

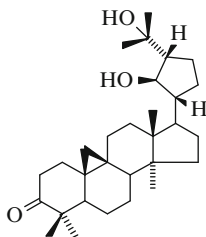
δ_{H} (CDCl ₃ , J/Hz)		δ_{H} (CDCl ₃ , J/Hz)	
2 β	2.71 ddd (14, 14, 6)	19 α	0.59 d (4)
2 α	2.29 ddd (14, 4, 2.5)	19 β	0.80 d (4)
5	1.12 m	20	2.05 m
6 α	1.69 dddd (13, 4, 4)	21	0.98 d (7)
6 β	0.92 m	23	4.38 brt
7 α	1.12 m	24	5.16 brt (7)
7 β	1.40 m	26	1.75 brs
8	1.66 dd (13, 4)	27	1.66 brs
15 α	1.43 dd (13.5, 5)	28	0.90 s
15 β	2.01 dd (13.5, 8)	29	1.08 s
16	4.41 ddd (8, 7, 5)	30	1.02 s

References

1. F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

(21R,24R)-21,25-Dihydroxy-21,24-cyclo-5 α -cycloartan-3-one

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 203–204°C (from MeOH), $[\alpha]_{\text{D}}^{21} +18^\circ$ (c 0.48, CHCl₃).

IR $\nu_{\text{max}}^{\text{CCl}_4}$, cm⁻¹: 3611, 3511 br, 1699.

CD nm ($\Delta\epsilon$): 293 (–0.53).

EIMS m/z (%): M⁺ 456.3603 (3), 438 (47), 423 (16), 420 (29), 405 (9), 380 (9), 341 (15), 318 (11), 313 (27), 312 (28), 300 (12), 297 (18), 219 (29), 201 (23), 175 (25), 174 (20), 173 (21), 161 (21), 159 (28), 147 (38), 145 (31), 135 (26), 133 (39), 131 (23), 121 (41), 120 (21), 119 (45), 109 (47), 108 (27), 107 (62), 105 (45), 43 (100).

¹HNMR (CDCl₃, δ): 0.56 and 0.81 (2H-19, d, J = 4.2 Hz), 0.93, 1.05, 1.07, 1.10, 1.21, 1.24, (6 × CH₃, s), 2.05 (1H, m), 2.30 (H-2 α , ddd, J₁ = 14, J₂ = 4.5, J₃ = 2.5 Hz), 2.71 (H-2 β , ddd, J₁ = J₂ = 14, J₃ = 6.5 Hz), 3.73 (H-21, dd J₁ = 8.5, J₂ = 7 Hz).

Table 1

δ_{C} (CDCl ₃)									
C-1	33.4	C-7	25.8	C-13	45.5	C-19	29.5	C-25	73.6
2	37.5	8	47.6	14	48.4	20	47.6	26	24.3 ^b
3	216.4	9	21.4 ^a	15	35.5	21	79.1	27	30.7 ^b
4	50.2	10	26.3	16	26.8	22	27.5	28	19.4
5	48.4	11	26.5	17	50.8	23	24.5	29	22.2
6	21.3 ^a	12	30.7	18	19.0	24	57.6	30	20.8

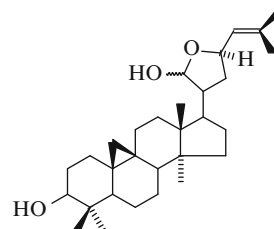
^{a,b}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

(21RS, 23R)-21, 23-Epoxy-5 α -cycloart-24-ene-3 β , 21-diol [Mixture of the 21-Epimers in a 3:2 Ratio (in CDCl₃-CD₃OD, 1:1)]

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

CAS Registry Number: 146257-70-7.

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm⁻¹: 3605, 1602.

CD nm ($\Delta\epsilon$): 293 (–0.53).

EIMS m/z (%): M⁺ 456.3605 (9), 438 (56), 423 (34), 405 (10), 395 (29), 323 (20), 316 (56), 301 (18), 298

Table 1

δ_C (CDCl ₃ -CD ₃ OD, 1:1)									
C-1	31.8 ^a	C-7	26.3	C-13	45.6, 45.9	C-19	30.1	C-25	134.8
2	30.4	8	48.0	14	48.9	20	46.5, 46.0	26	18.0
3	79.0	9	20.6, 20.5	15	35.7, 35.8	21	97.8, 101.7	27	25.7
4	40.9	10	26.8, 26.9	16	27.8, 28.0	22	36.2, 36.7	28	19.6
5	47.6	11	27.0	17	49.9, 49.4	23	73.6, 75.7	29	25.7
6	21.3	12	32.4 ^a	18	19.5, 19.0	24	127.5, 128.3	30	14.2

^aAssignments may be interchangeable

(17), 227 (27), 201 (23), 187 (33), 175 (45), 161 (38), 159 (38), 149 (34), 147 (43), 145 (36), 135 (43), 133 (57), 131 (33), 123 (37), 121 (52), 119 (58), 109 (44), 107 (69), 105 (58), 95 (100), 85 (75), 69 (81).

¹H NMR (CDCl₃ + CD₃OD, 1:1, δ): 0.32, 0.34, 0.58 (2 × 2H-19, d, J = 4.2 Hz), 0.80 (2 × CH₃, s), 0.92 (2 × CH₃, s), 0.95 (2 × CH₃, s), 1.03 (CH₃, s), 1.07 (CH₃, s), 1.69 (2 × CH₃, bis), 1.72 (2 × CH₃, bis), 2.25 (H-20, m), 3.26 (H-3, m), 4.79 (H-23, dt, J = 9, 7.5 Hz), 4.92 (H-23, td, J = 9, 2.5 Hz), 5.22 (H-24, dq, J = 9, 1.2 Hz), 5.25 (H-21, d, J = 2 Hz), 5.29-5.33 (H-21, H-24, m).

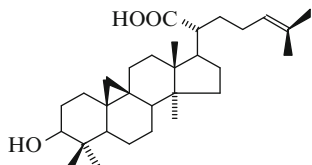
See [Table 1](#)

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

3 β -Hydroxy-5 α -cycloart-24-en-21-oic Acid

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonacaceae*) [1].

Mp 181 °C (from CHCl₃), [α]_D²¹ +23° (c 0.48, CHCl₃).

CAS Registry Number: 125302-31-0

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3610, 1702.

EIMS m/z (%): M⁺ 456.3605 (8), 438 (29), 423 (37), 395 (17), 369 (10), 316 (36), 203 (28), 189 (22), 175 (57), 107 (100), 95 (100), 83 (84), 69 (73).

¹H NMR (CDCl₃, δ): 0.28 and 0.56 (2H-19, d, J = 4.2 Hz), 0.80 (CH₃, s), 0.89 (CH₃, s), 0.96 (CH₃, s), 1.05 (CH₃, s), 1.58 (CH₃, brs), 1.67 (CH₃, brs), 2.16 (1H, m), 2.33 (1H, m), 3.27 (H-3, m), 5.08 (H-24, tq, J = 7, 1.2, 1.2 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	31.9	C-7	25.9 ^a	C-13	45.1	C-19	29.7	C-25	132.2
2	30.3	8	47.6	14	48.6	20	46.9	26	17.6
3	78.8	9	19.9	15	34.9	21	181.4	27	25.7
4	40.4	10	25.9 ^a	16	30.0	22	27.2	28	19.3
5	47.4	11	26.3 ^a	17	49.1	23	26.2 ^a	29	25.4
6	20.9	12	32.6	18	19.2	24	123.6	30	14.0

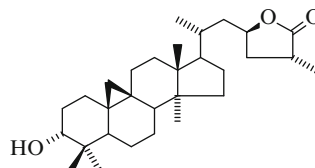
^aAssignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

(23R,25R)-3 α -Hydroxy-9,19-cyclo-9 β -lanostan-23,26-olide

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Abies marocana (*Pinaceae*) [1].

Mp 165–167 °C (from Et₂O), [α]_D +27,2° (c 1.46, CHCl₃).

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm⁻¹: 3548, 3031, 2936, 1750, 1067, 1005, 970, 929.

UV $\lambda_{\text{max}}^{\text{EtOH}}$, nm (log ϵ): 201.7 (3.5).

MS m/z (%): M⁺ 456 (6), 438 (19), 423 (32), 395 (8), 316 (20), 300 (14), 274 (15), 235 (15), 203 (28), 187 (31), 175 (76), 161 (44), 147 (53), 133 (53), 107 (74), 105 (76), 99 (88), 95 (80), 91 (77), 81 (58), 55 (87), 43 (100).

¹NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.32 and 0.49 (2H-19, d, J = 4.4 Hz), 0.86, 0.88, 0.93, 0.96, (4 × CH₃, s), 0.93 (CH₃-21, d, J = 6.3 Hz), 1.27 (CH₃-27, d, J = 7.5 Hz), 2.68 (H-25, sext, J = 7.5 Hz), 3.45 (H-3, t, J = 2.9 Hz), 4.64 (H-23, m).

Table 1

δ_{C} (CDCl ₃)							
C-1	28.60 ^a	C-7	25.64 ^b	C-13	45.38	C-19	29.79
2	27.50 ^b	8	47.95	14	48.97	20	33.06
3	76.96	9	19.74	15	35.42	21	18.12
4	39.54	10	26.46	16	28.16 ^a	22	42.76
5	41.05	11	26.24 ^b	17	52.77	23	76.03
6	21.07	12	32.96	18	18.10	24	36.44
						25	34.17
						26	180.24
						27	15.91
						28	19.27
						29	25.87
						30	21.23

^{a,b}Interchangeable values

CAS Registry Number: 173866-03-0.

UV $\lambda_{\text{max}}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 222 (2.6).

EIMS m/z (%): M⁺ 456 (1), 438 (2), 422 (3), 313 (15), 203 (18), 175 (29), 147 (45), 95 (100).

Table 1

δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	33.4	C-16	28.1
2	37.4	17	52.1
	2.30 m, 2.71dt (6.2, 13.8)		
3	216.5	18	18.1
4	50.2	19	29.6
			0.57 d (4.2), 0.79 d (4.2)
5	48.4	20	36.3
6	21.5	21	18.3
			0.89 d (6.5)
7	25.8	22	39.3
8	47.8	23	130.6
			5.70 ddd (15.8, 8, 5.5)
9	21.1	24	134.5
			5.52 d (15.8)
10	26.0	25	82.3
			-
11	26.7	26	24.4
			1.35 s
12	32.7	27	24.3
			1.35 s
13	45.4	28	19.3
			0.90 s
14	48.8	29	22.2
			1.05 s
15	35.5	30	20.8
			1.10 s
		OOH	7.30 brs

References

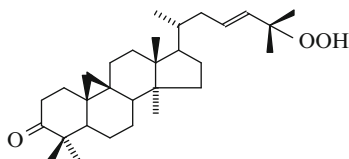
1. A.F. Barrero, J.F. Sanchez, E.J. Alvares-Manzaneola, M. Munoz, A. Haidour, *Phytochemistry* **31**(2), 615–620 (1992)

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

(23E)-25-Hydroperoxycycloart-23-en-3-one

C₃₀H₄₈O₃, M 456



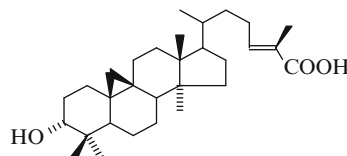
Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (*Bromeliaceae*) [1].

An amorphous solid, [α]_D²⁵ +19° (c 0.13, CHCl₃).

Isomangiferolic Acid

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 168–170°C, [α]_D +29° (c 1).

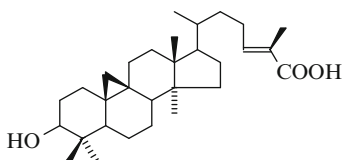
CAS Registry Number: 13878-92-7.

References

1. S. Corsano, E. Mincione, *Ann. Chim. (Rome)* **57**(5), 508–521 (1967). *C.A.*, 68:13209d (1968)

Mangiferolic Acid

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 181–183°C, $[\alpha]_D^{25} +49^\circ$.

CAS Registry Number: 4184-34-3.

UV $\lambda_{max}^{CH_3CN}$ nm (ϵ): 217 (11300).

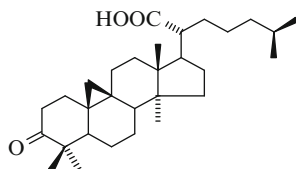
IR ν_{max}^{KBr} , cm^{-1} : 1695, 1650.

References

1. S. Corsano, E. Mincione, *Tetrahedron Lett.* **6**, 2377–2381 (1965)

3-Keto-9,19-cyclolanostan-21-oic Acid

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Notholaena Candida (*Pteridaceae*) [1].

EIMS m/z (%): M^+ 456 (25), 441 (25), 425 (7), 423 (8), 412 (11), 410 (12), 395 (16), 318 (40), 313 (22), 303 (12), 297 (13), 237 (18), 175 (55), 147 (48),

135 (38), 133 (47), 121 (56), 119 (45), 107 (78), 105 (43), 95 (100), 93 (52), 81 (54), 69 (47), 55 (52), 43 (68), 41 (34).

1H NMR ($CDCl_3$, δ): 0.52 and 0.81 (2H-19, d, $J = 4$ Hz), 0.84 (CH_3 , d, $J = 6.5$ Hz), 0.85 (CH_2 d, $J = 6.5$ Hz), 0.90 (CH_3 , s), 1.04 (CH_3 , s), 1.08 (CH_3 , s), 1.09 (CH_3 , s), 2.69 (1H, ddd, 13.7, 13.7, 6.3).

Table 1

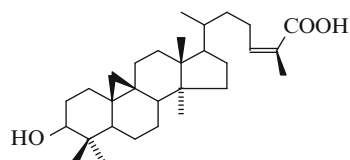
δ_c ($CDCl_3$)									
C-1	33.29	C-7	27.16	C-13	45.16	C-19	29.89	C-25	27.77
2	37.37	8	47.80	14	48.53	20	49.04	26	22.33
3	216.44	9	20.97	15	32.51	21	182.16	27	22.76
4	50.16	10	26.09	16	26.57	22	29.41	28	19.24
5	48.18	11	25.09	17	47.46	23	25.68	29	22.25
6	21.28	12	34.88	18	17.77	24	38.81	30	20.73

References

1. F.J. Arriaga-Giner, A. Rumero, E. Wollenweber, *Z. Naturforsch., C: Biosci.* **47**(7-8), 508–511 (1992)

Schizandrollic Acid

$C_{30}H_{48}O_3$, M 456



Taxonomy: Cycloartane Triterpenoids

Schizandra nigra Max. (*Schizandraeae*) [1, 2].

Mp 164–165°C (from MeOH), $[\alpha]_D^{15} +35^\circ$ (c 1.0, $CHCl_3$).

CAS Registry Number: 55511-17-6.

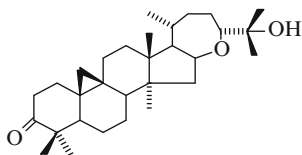
IR ν_{max}^{KBr} , cm^{-1} : 3550, 3050, 1695, 1645, 1020.

References

1. K. Takahashi, M. Takani, *Chem. Pharm. Bull.* **24**(9), 2000–2006 (1976)
2. K. Takahashi, M. Takani, *Chem. Pharm. Bull.* **23**(3), 538–542 (1975)

Argentatine B

C₃₀H₄₈O₃, M 456



Taxonomy: Cycloartane Triterpenoids
Parthenium argentatum Gray (*Compositae*) [1–3].

Table 1

δ_C (CDCl ₃)									
C-1	33.4	C-7	26.0	C-13	45.9	C-19	29.7	C-25	73.2
2	37.4	8	47.4	14	45.9	20	29.0	26	24.0
3	216.3	9	20.9	15	44.9	21	20.9	27	25.6
4	50.2	10	26.1	16	74.9	22	35.5	28	19.5
5	48.4	11	26.3	17	57.5	23	23.4	29	22.2
6	21.4	12	32.7	18	18.5	24	82.6	30	20.8

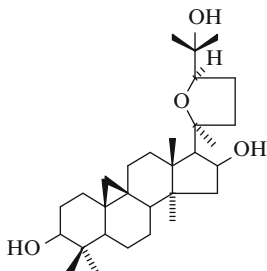
X-ray [4].

References

1. L. Rodrigues-Hahn, A. Romo de Vivar, A. Ortega, M. Aguilar, J. Romo, *Rev. Latinoam. Quim.* **1**(1), 24–38 (1970). *C.A.*, 74:88168 x (1971)
2. A. Romo de Vivar, M. Martinez - Varguez, C. Matsubara, G. Perez - Sanchez, P. Joseph - Nathan, *Phytochemistry* **29**(3), 915–918 (1990)
3. R.A. Komoroski, E.C. Gregg, J.P. Shockcor, J.M. Geckle, *Magn. Res. Chem.* **24**, 534–543 (1986)
4. A. Romo de Vivar, C. Matsubara, *Rev. Latinoam. Quim.* **17**, 7 (1986)

Argentatine A

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids
Parthenium argentatum Gray (*Compositae*) [1, 2].
CAS Registry Number: 31324-30-8.

Table 1

δ_C (CDCl ₃)									
C-1	33.4	C-7	26.0	C-13	46.6	C-19	30.2	C-25	70.9
2	37.4	8	47.8	14	46.7	20	87.2	26	27.4
3	216.1	9	20.9	15	48.7	21	25.6	27	26.2
4	50.3	10	26.4	16	73.4	22	37.6	28	20.4
5	48.7	11	26.7	17	56.1	23	23.9	29	21.1
6	21.5	12	33.4	18	21.1	24	84.7	30	20.9

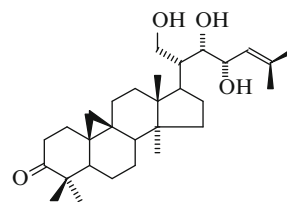
Stereochemistry of C-20 and C-24 have been established by us on the ¹³C NMR data

References

1. L. Rodrigues-Hahn, A. Romo de Vivar, A. Ortega, M. Aguilar, J. Romo, *Rev. Latinoam. Quim.* **1**(1), 24–38 (1970)
2. R.A. Komoroski, E.C. Gregg, J.P. Shockcor, J.M. Geckle, *Magn. Res. Chem.* **24**, 534–543 (1986)

Argenteanone B

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids
Aglaia argentea Bl. (*Meliaceae*) [1].
Amorphous powder, $[\alpha]_D +12.6^\circ$ (c 1, CHCl₃).
CAS Registry Number: 175669-23-5.
IR $\nu_{max}^{CHCl_3}$, cm⁻¹: 3400, 1699.
FABMS, m/z: 495 [M + Na]⁺, 479 [M + Li]⁺.
EIMS, m/z (%): 387 (8), 314 (1), 85 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
	(400 MHz)			
C-1	33.4	1.85 m, 1.60 m	C-16	27.4 1.70 m, 1.45 m

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (J/Hz) (400 MHz)	δ_C (CDCl ₃)	δ_H (J/Hz)
2	37.4 2.30 ddd (13,4,2.5), 2.68 ddd (13, 6.5, 6.5)	17 43.2	2.10 m
3	216.4 –	19 29.3	0.55 d (4), 0.75 d (4)
4	50.2 –	20 47.0	2.00 m
5	47.7 1.70 m	21 59.9	4.00 dd (11, 2.5), 3.65 dd (11, 4)
6	21.5 1.55 m, 0.90 m	22 75.8	3.60 dd (3.5, 3.5)
7	25.8 1.10 m, 1.35 m	23 66.8	4.55 d (9, 3.5)
8	48.3 1.60 m	24 125.0	5.40 brd (9)
9	20.9 –	25 136.3	–
10	25.8 –	26 26.1	1.73 s
11	26.6 2.05 m, 1.15 m	27 18.4	1.73 s
12	32.0 1.60 m, 1.75 m	28 19.4	0.88 s
13	47.0 –	29 21.2	1.07 s
14	48.5 –	30 20.7	1.02 s
15	35.5 1.30 m		

Amorphous powder, $[\alpha]_D^{20} +16^\circ$ (c 0.2, CHCl₃).

FABMS m/z: 495 [M + Na]⁺.

HRFABMS m/z: 495.3487 (C₃₀H₄₈NaO₄).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.1	C-16	27.7
2	30.4	17	44.6
3	77.6 3.30 m (W _{1/2} = 10)	18	19.3 1.12 s
4	40.6 –	19	30.1 0.38 d (4), 0.60 d (4)
5	47.2	20	58.3 2.42 d (12)
6	21.1	21	101.0 5.35 d (7)
7	26.1	22	78.9 4.20 dd (4,4)
8	48.0	23	79.9 4.80 dd (8,4)
9	19.9 –	24	121.1 5.45 brd (8)
10	29.8 –	25	138.4 –
11	26.4	26	26.1 1.82 s
12	32.6	27	19.3 1.75 s
13	45.9 –	28	19.4 0.92 s
14	50.0 –	29	25.5 0.82 s
15	35.6	30	13.2 0.98 s

References

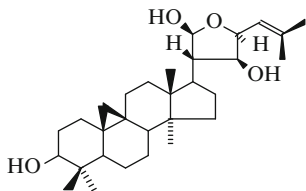
- O.R. Omobuwajo, M.-T. Martin, G. Perromat, T. Sevenet, K. Awang, M. Pais, *Phytochemistry* **41**(5), 1325–1328 (1996)

References

- K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

Argenteanol C

C₃₀H₄₈O₄, M 472

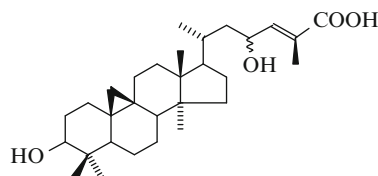


Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

23-Epimeric 3 β ,23-Dihydroxycycloart-24-en-26-oic Acid

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids

Table 1

δ_C (CDCl ₃)									
C-1	31.9	C-7	28.3	C-13	45.2	C-19	29.7	C-25	128.2, 128.2
2	30.3	8	47.8	14	48.8	20	33.4	26	172.5, 170.5
3	78.1	9	19.8	15	35.4	21	19.2	27	12.9, 12.5
4	40.4	10	26.4	16	26.1	22	44.0, 43.1	28	17.9
5	47.1	11	25.9	17	52.9	23	66.6, 65.6	29	25.5
6	21.0	12	32.8	18	19.2	24	144.2, 145.6	30	14.1

Taxonomy: Cycloartane Triterpenoids*Mangifera indica* L. (*Anacardiaceae*) [1].Mp 240–242°C (from CHCl₃–MeOH).

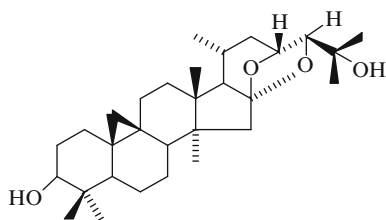
CAS Registry Number: 123563-63-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3590, 3200-2500, 1690, 1635.UV $\lambda_{\max}^{\text{EtOH}}$: 218 nm.

¹NMR (90 MHz, CDCl₃ + 1 drop DMSO-d₆, δ): 0.35, 0.55 (2H-19, d, J = 4 Hz), 0.75, 0.80, 0.90, 0.95 (5 × CH₃, s), 1.85, 1.92 (two br.s, CH₃-27), 3.2 (H-3, m), 4.55 (H-23, m), 6.65, 6.75 (two d, J = 4.5 Hz, H-24). See [Table 1](#)

References

1. V. Anjaneyulu, P. Satyanarayana, K.N. Viswanadham, V.G. Jyothi, K. Nageswara Rao, P. Radhika, *Phytochemistry* **50**(7), 1229–1236 (1999)

Dihydrocycloorbigenin AC₃₀H₄₈O₄, M 472**Taxonomy:** Cycloartane Triterpenoids*Astragalus orbiculatus* Ledeb. (*Leguminosae*) [1].

Mp 237–238°C (from MeOH).

CAS Registry Number: 214146-85-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3449, 3040.

MS m/z (%): M⁺ 472 (7.9), 457 (33.8), 454 (20.0), 439 (36.9), 413 (100), 395 (23.1), 385 (20.0), 367 (10.8), 357 (10.8), 353 (4.6), 332 (10.0), 315 (13.8), 313 (6.2), 299 (9.2), 273 (95.4), 271 (7.7), 261 (18.5), 259 (15.4), 255 (63.1), 251 (13.8).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)		
C-1	32.41	1.24, 1.57	C-16	114.87	–
2	31.31	1.92 dtd (13, 11.4, 4.5), 2.02	17	61.20	1.60 d (11)
3	77.93	3.57 dd (11.4, 4.5)	18	19.33	1.17 s
4	41.15	–	19	30.75	0.33, 0.58 d (4)
5	47.44	1.34 dd (12.5, 4.2)	20	23.95	1.70 tdq (11, 7.6.4)
6	21.30	0.80 qd (12.5, 2.3), 1.60	21	19.83	0.87 d (6.4)
7	26.75	1.15, 1.34	22	38.25	2.28 ddd(13, 9.7), 1.02 ddd (13,11,1.5)
8	47.79	1.54	23	71.83	4.79 ddd (9,1.5,1)
9	19.51	–	24	90.60	3.72 d (1)
10	27.01	–	25	71.01	–
11	26.66	1.15, 2.07	26	27.91	1.53 s
12	33.11	1.58, 1.68	27	24.77	1.46 s
13	44.59	–	28	19.41	1.25 s
14	46.32	–	29	26.22	1.25 s
15	46.62	2.05, 2.10 d (14)	30	14.90	1.13 s

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 477–479 (1998)

A Mixture of 3 β ,22 ξ -Dihydroxycycloart-24E-en-26-oic Acid and 3 β ,23 ξ -Dihydroxycycloart-24E-en-26-oic Acid

C₃₀H₄₈O₄, M 472

See [Figure A Mixture of 3 \$\beta\$,22 \$\xi\$ -Dihydroxycycloart-24E-en-26-oic Acid and 3 \$\beta\$,23 \$\xi\$ -Dihydroxycycloart-24E-en-26-oic Acid](#)

Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 220–223°C.

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 3300–2500, 1690, 1640.

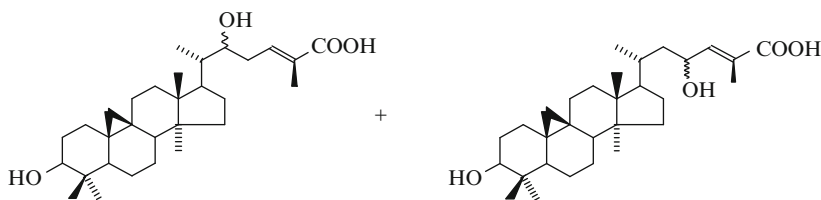
MS m/z (%): M⁺ 472 (3), 457 (3), 454 (10), 441 (6), 440 (6), 436 (2), 421 (6), 411 (5), 408 (2), 385 (5), 357 (3), 355 (6), 354 (5), 340 (6), 332 (10), 315 (5), 314 (5), 297 (8), 257 (5), 232 (10), 227 (11), 215 (10), 209 (17), 205 (5), 204 (8), 203 (27), 202 (11), 189 (20), 175 (48), 149 (28), 135 (56), 123 (39), 121 (71), 95 (100), 55 (80).

¹NMR (200 MHz, CDCl₃ + DMSO-d₆, δ , 0-TMS) : 0.30 and 0.50 (2H-19), 0.78, 0.88, 0.91, 0.94, 0.98, 1.82, 1.85 (methyls), 3.25, 3.45, 3.60 and 3.70 (DMSO-d₆ peaks and geminal protons of hydroxyls), 6.57 (1H, d), 6.90 (1H, t).

Table 1

δ_{C} (CD ₃ OD)	
C-1	33.8
2	31.2
3	79.4
C-7	29.5
8	49.0
9	21.2
C-13	46.4
14	49.8
15	35.2
C-19	29.8
20	44.4,
21	12.8,
	20.0
C-25	131.2
26	173.2
27	12.4

(continued)



A Mixture of 3 β ,22 ξ -Dihydroxycycloart-24E-en-26-oic Acid and 3 β ,23 ξ -Dihydroxycycloart-24E-en-26-oic Acid

Table 1 (continued)

δ_{C} (CD ₃ OD)	
4	42.0
5	47.3
6	22.4
10	27.8
11	27.4
12	34.7
16	27.4
17	51.5,
18	20.0 ^a
22	74.0,
23	28.2,
24	144.8,
	144.0
28	18.4 ^a
29	26.4
30	14.5

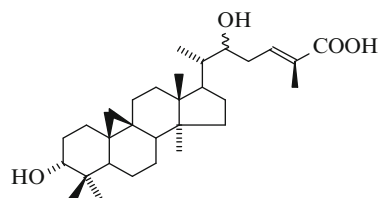
^aAssignments may be interchanged

References

- V. Anjaneyulu, K. Ravi, K. Harischandra Prasad, J.D. Connolly, *Phytochemistry* **28**(5), 1471–1477 (1989)

3 α ,22 ξ -Dihydroxycycloart-24E-en-26-oic Acid

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 218–220°C (from CHCl₃–MeOH), $[\alpha]_{\text{D}}^{30}$ +27.5° (c 0.8, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 3300–2500, 1690, 1640.

UV $\lambda_{\max}^{\text{MeOH}}$, nm (ϵ): 218 (9800).

MS m/z (%): M⁺ 472 (6), 457 (4), 454 (11), 440 (4), 436 (3), 421 (3), 411 (3), 385 (2), 355 (6), 332 (8), 315 (3), 297 (6), 257 (2), 255 (2), 232 (4), 209 (48), 189 (20), 175 (62), 123 (48), 109 (50), 95 (100), 55 (82).

¹H NMR (200 MHz, CDCl₃, δ, 0-TMS) : 0.32 and 0.50 (2H-19, d, J = 4.2 Hz), 0.84, 0.86, 0.92, 0.92, 0.97, 1.82 (6 × CH₃, s), 3.41 (H-3, brs), 3.75 (H-22, m), 6.90 (H-24, t).

Table 1

δ _C (CDCl ₃ + CD ₃ OD)									
C-1	27.3	C-7	29.6	C-13	45.5	C-19	29.9	C-25	129.0
2	28.3	8	47.9	14	48.3	20	42.2	26	170.5
3	76.8	9	19.6	15	35.5	21	12.3	27	11.9
4	39.4	10	26.3	16	26.0	22	72.8	28	17.7 ^a
5	40.9	11	25.6	17	49.1	23	27.1	29	21.1
6	20.9	12	32.7	18	19.2 ^a	24	141.0	30	25.6

^aAssignments may be interchanged

References

1. V. Anjaneyulu, K. Ravi, K. Harischandra Prasad, J.D. Connolly, *Phytochemistry* **28**(5), 1471–1477 (1989)

MS m/z (σ/0): [M-18-18]⁺ 436 (4), 423 (2), 413 (2), 412 (3), 411 (6), 408 (2), 315 (9), 314 (15), 215 (9), 203 (34), 175 (46), 129 (6), 109 (61), 108 (22), 107 (100), 105 (61), 57 (6).

¹H NMR (200 MHz, CDCl₃, δ, 0-TMS) : 0.33 and 0.53 (2H-19, d, J = 4.2 Hz), 0.86, 0.88, 0.96, 0.96, 0.99 (5 × CH₃, s), 3.48 (H-3, brs), 4.36 (2H-27, s), 7.00 (H-24, t).

Table 1

δ _C (CDCl ₃ + DMSO-d ₆)									
C-1	26.8	C-7	27.3	C-13	44.5	C-19	29.0	C-25	127.0
2	28.0	8	48.1	14	47.3	20	35.2	26	173.0
3	75.5	9	18.9	15	34.7	21	17.4 ^a	27	56.0
4	38.8	10	25.5	16	24.9	22	34.6	28	17.4 ^a
5	40.1	11	25.8	17	51.3	23	24.6	29	20.6
6	20.3	12	32.9	18	18.6 ^a	24	145.0	30	25.4

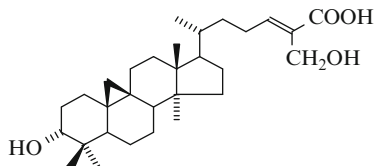
^aAssignments may be interchanged

References

1. V. Anjaneyulu, K. Ravi, K. Harischandra Prasad, J.D. Connolly, *Phytochemistry* **28**(5), 1471–1477 (1989)

3α,27-Dihydroxycycloart-24E-en-26-oic Acid

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (Anacardiaceae) [1].

Mp 205–207°C (from C₆H₆-EtOAc), [α]_D³⁰ +21.5° (c 0.8, CHCl₃).

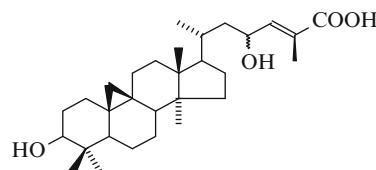
CAS Registry Number: 123563-64-4.

IR ν_{max}^{KBr}, cm⁻¹: 3550, 3300–2600, 1695, 1645.

UV λ_{max}^{MeOH}, nm: 215 (ε 11200).

3β,23(R or S)-Dihydroxycycloart-24-en-26-oic Acid

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (Anacardiaceae) [1].

Mp 279–281°C (from CHCl₃-MeOH), [α]_D³⁰ +49° (c 0.52, MeOH).

CAS Registry Number: 123563-63-3.

IR ν_{max}^{KBr}, cm⁻¹: 3600, 3300–2500, 1695 and 1640.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm: 217.

MS m/z (%): 454 (2), 439 (2), 332 (6), 315 (3), 297 (7), 175 (7).

^1H NMR (90 MHz, CDCl_3 + a drop of DMSO-d_6 , δ): 0.35 and 0.55 (2H-19, d, $J = 4$ Hz), 0.80, 0.85, 0.95 ($5 \times \text{CH}_3$), 1.86 (CH_3 -27, s) 3.20 (H-3, m), 4.4-4.7 (broad, buried under DMSO peak, H-23).

Table 1

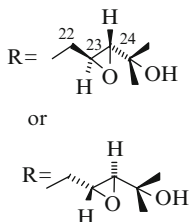
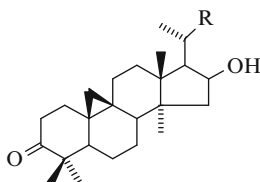
δ_{C} (CDCl_3)									
C-1	31.9	C-7	28.3	C-13	45.2	C-19	29.7	C-25	128.2
2	30.3	8	47.7	14	48.8	20	33.4	26	172.5
3	78.0	9	19.8	15	35.4	21	19.2	27	12.9
4	40.4	10	26.3	16	26.1	22	44.0	28	17.9
5	47.1	11	25.9	17	52.8	23	66.5	29	25.6
6	21.0	12	32.8	18	19.4	24	144.3	30	14.1

References

1. V. Anjaneyulu, P. Satyanarayana, K.N. Viswanadham, V.G. Jyothi, K. Nageswara Rao, P. Radhika, *Phytochemistry* **50**(7), 1229–1236 (1999)

(16S,23S,24R)- or (16S,23R,24S)-23,24-Epoxycycloartan-3-one-16,25-diol

$\text{C}_{30}\text{H}_{48}\text{O}_4$, M 472



Taxonomy: Cycloartane Triterpenoids

Lindheimera texana Gray et Engelm (*Asteraceae*) [1].

Mp 185–186°C (from EtOAc).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3400, 1700.

CD curve (MeOH): $[\theta]_{295} -2200$, $[\theta]_{245} 0$, $[\theta]_{208}$ (last reading) -2500 .

MS m/z (%): 472.3524, 439 (0.5), 413 (0.6), 383 (5.4), 340 (8.2), 311 (5.2).

Table 1

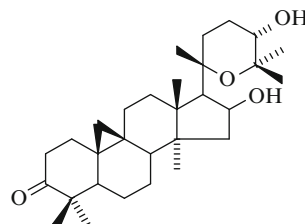
δ_{C} (CDCl_3)		δ_{H} (J/Hz)		δ_{C} (CDCl_3)		δ_{H} (J/Hz)	
C-1	33.33	1.85	br dt	C-16	72.62	4.52	dt (4,5,7)
2	37.39	2.71	dt, 2.30 ddd	17	56.58		
3	216.32	–		18	19.93	1.20	
4	50.18	–		19	29.82	0.59	d, 0.82 brd
5	47.88			20	26.68		
6	21.41			21	18.88	1.02	d
7	26.33			22	41.91		
8	48.43			23	70.01	4.04	brd (11)
9	20.91	–		24	78.13	3.01	br
10	26.11	–		25	74.13	–	
11	25.93			26	27.15	1.31	
12	32.42			27	26.83	1.28	
13	45.33			28	20.18	0.90	
14	46.75			29	22.18	1.05	
15	47.54			30	20.76	1.10	

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

Fruticin B

$\text{C}_{30}\text{H}_{48}\text{O}_4$, M 472



Taxonomy: Cycloartane Triterpenoids

Parthenium fruticosum (*Compositae*) [1].

Mp 235–236°C (from Me_2CO -diisopropyl ether),

$[\alpha]_{\text{D}}^{20} +12.9^\circ$ (c 20, CHCl_3).

CAS Registry Number: 96888-51-6.

IR ν_{max} , cm^{-1} : 3450, 1710.

MS m/z (%): M⁺ 472, 143 (100), 125 (23), 43 (71).
¹NMR (CDCl₃ δ, 0-TMS) : 0.57 (H-19, d), 0.85, 1.05, 1.1, 1.2, 1.3, 1.4, 1.45 (7 × CH₃, s), 3.37 (H-24, m), 4.55 (H-16, m).

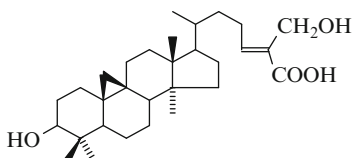
This structure was confirmed by x-ray crystallographic analysis.

References

1. C. Matsubara, A. Romo de Vivar, *Phytochemistry* **24**(3), 613–615 (1985)

27-Hydroxymangiferolic Acid

C₃₀H₄₈O₄, M 472



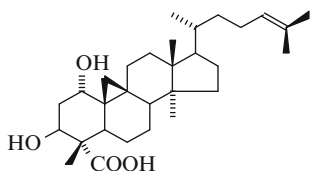
Taxonomy: Cycloartane Triterpenoids
Mangifera indica L (*Anacardiaceae*) [1].
 Mp 201–204°C, [α]_D 39° (c 0.4).
 CAS Registry Number: 17983-82-3.

References

1. S. Corsano, E. Mincione, *Ann. Chim. (Rome)* **57**(5), 508–521 (1967). *C.A.*, 68:13209d (1968)

Mollic Acid

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids

Combretum molle (*Combretaceae*) [1].
 Mp 210–212°C (from EtOAc), [α]_D²¹ +61.9° (c 0.21, C₅H₅N).

CAS Registry Number: 99646-14-7.

IR ν_{max}^{KBr}, cm⁻¹: 3485, 3350, 3045, 2625, 1700, 1660, 1440, 1370, 1270, 1185, 1085, 1045, 1000, 920, 870.

UV λ_{max}^{EtOH}, nm (ε): 210 (3956).

MS m/z (%): M⁺ 472 (30), 457 (6), 454 (24), 439 (11), 436 (40), 429 (6), 421 (6), 409 (8), 392 (30), 388 (9), 377 (10), 361 (6), 359 (10), 341 (8), 325 (9), 281 (29), 259 (36), 231 (10), 207 (100), 205 (23), 199 (28), 191 (11), 189 (9), 187 (15), 185 (15), 183 (10), 175 (11), 157 (45), 139 (40), 121 (32), 119 (40), 109 (46).

Table 1

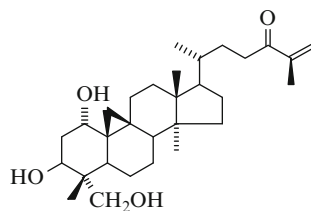
δ _C (C ₅ D ₅ N) [2]									
C-1	72.8	C-7	25.9	C-13	45.8	C-19	29.9	C-25	130.8
2	38.5	8	48.2	14	49.3	20	36.3	26	25.9
3	70.8	9	21.1	15	33.5	21	19.6	27	17.8
4	55.7	10	30.5	16	28.4	22	36.3	28	18.7
5	37.7	11	26.5	17	52.8	23	25.5	29	179.9
6	23.4	12	36.9	18	18.3	24	125.9	30	9.6

References

1. K.H. Pegel, C.B. Rogers, *J. Chem. Soc., Perkin Trans.* **1**(8), 1711–1715 (1985)
2. C.B. Rogers, *Phytochemistry* **28**(1), 279–281 (1989)

Quadrangularol B

C₃₀H₄₈O₄, M 472



Taxonomy: Cycloartane Triterpenoids
Combretum quadrangulare Kurz. (*Combretaceae*) [1].

Colorless amorphous solid, $[\alpha]_D^{25} + 152.9^\circ$ (c 0.04, MeOH).
 IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1680, 1460, 1380, 1050, 1000.
 HRFABMS m/z: 495.3479 $[\text{M} + \text{Na}]^+$.

Table 1

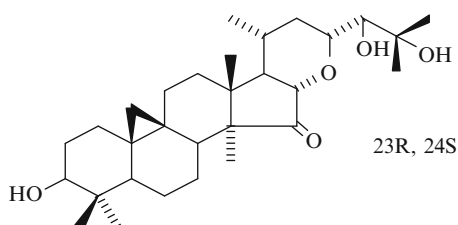
	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	72.7	3.84 brs	C-16	26.1	
2	38.7	2.42 ddd (13, 4.5, 3.5), 2.27 ddd (13.5, 11, 3.5)	17	52.6	2.71 m
			18	18.4	1.08 s
3	69.6	5.08 dd (12, 4.5)	19	30.0	0.52 d (4.5), 0.77 d (4.5)
4	45.0	–	20	36.2	
5	34.5	2.92 dd (12.5, 4.5)	21	18.5	0.92 d (6.5)
6	21.2	–	22	31.4	
7	28.3	–	23	34.9	
8	48.5	–	24	202.2	–
9	20.8	–	25	144.8	–
10	30.5	–	26	124.6	6.02 brs, 5.73 brs
11	26.1	2.71 m	27	17.8	1.92 s
12	33.3	–	28	19.5	0.99 s
13	45.5	–	29	68.0	4.27 d (10.2), 3.89 (10.2)
14	49.1	–	30	10.7	1.22 s
15	36.0	–			

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Aglycone A

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



Taxonomy: Cycloartane Triterpenoids
Actea racemosa (*Ranunculaceae*) [1].

Mp 220–225°C (from CH_2Cl_2), $[\alpha]_D + 46^\circ$ (c 0.8).

IR ν_{\max}^{KBr} , cm^{-1} : 3500, 1750.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 308 (1.60).

ORD (c 0.096): 340 nm, $[\alpha] = +1040^\circ$, 296 nm, $[\alpha] = -480^\circ$.

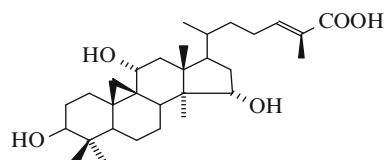
$^1\text{H NMR}$ (CDCl_3 , δ): 0.34 and 0.68 (2H-19, d, J = 4.5 Hz), 0.80, 0.97, 1.07 (CH_3 -21), 1.17, 1.23, 1.23, 1.30 ($7 \times \text{CH}_3$), 3.20 (H-24, d, J = 2.5 Hz), 3.20 (H-3, m), 3.58 (H-16, d, J = 12 Hz), 3.87 (H-23, m).

References

1. G. Piancatelli, *Gazz. Chim. Ital.* **101**, 139–148 (1971)

Ananasic Acid

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Ananas comosus (Stickm.) Merr. (*Bromeliaceae*) [1].

Mp 194–197.5°C (from MeOH), $[\alpha]_D^{25} + 4.23^\circ$ (c 0.47, MeOH).

CAS Registry Number: 60877-02-3.

MS m/z (%): M^+ 488 (2), 470 (21), 434 (8).

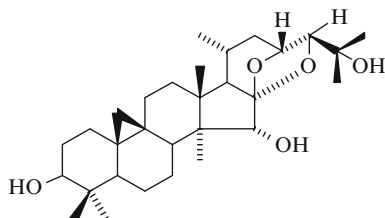
$^1\text{H NMR}$ (100 MHz, δ): 0.87, 0.99, 1.03, 1.19, 1.88, ($5 \times \text{CH}_3$, s), 6.77 (1H, brt, J ~ 6 Hz).

References

1. R.H. Takata, P.J. Scheuer, *Tetrahedron* **32**, 1077–1080 (1976)

Cimigenol

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Actea racemosa (*Ranunculaceae*) [1–3]

Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [4].

Mp 227.5–228.5°C, [α]_D 38° (c 0.86, CHCl₃).

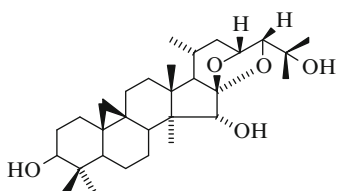
CAS Registry Number: 3779-59-7.

References

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2. S. Corsano, Gazz. Chim. Ital. **95**(1–2), 117–126 (1965)
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Cimigol

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Cimifuga species (*Ranunculaceae*) [1, 2].

Mp 277–278°C (from EtOH), [α]_D + 42.5° (c 0.5, EtOH).

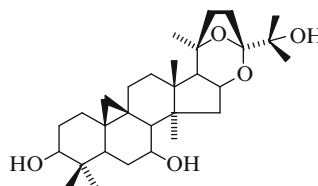
CAS Registry Number: 57943-48-3.

References

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Cycloalpigenin

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Mp 224–226°C (from MeOH), [α]_D²⁴ 0° (c 0.5, MeOH).

CAS Registry Number: 180718-03-0.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3571–3328, 3038.

MS *m/z* (%): M⁺ 488 (6.7), 470 (24.0), 455 (7.7), 452 (8.7), 430 (7.7), 429 (7.7), 426 (8.7), 412 (13.5), 395 (6.7), 384 (11.5), 369 (12.5), 331 (9.6), 313 (9.1), 297 (8.7), 274 (17.3), 272 (12.5), 261 (11.5), 259 (12.0), 256 (16.8), 245 (15.4), 243 (15.4), 227 (12.5), 213 (12.5), 209 (11.5), 201 (12.5), 199 (13.5), 196 (38.5), 191 (12.5), 189 (12.5), 183 (11.5), 172 (23.9), 161 (21.7), 159 (23.9), 143 (100), 107 (56.5).

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS) : 0.29 and 0.79 (2H-19, d, J = 4 Hz), 1.06, 1.08, 1.21, 1.43, 1.49, 1.56, 1.59 (7 × CH₃, s), 2.64 (H-17, d, J = 8 Hz), 3.53 (H-3, dd, J = 10, 4 Hz), 3.74 (H-7, td, J = 9, 3 Hz), 4.56 (H-16, q, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	32.13	C-7	70.07	C-13	45.75 ^a	C-19	30.14	C-25	72.83
2	31.13	8	54.78	14	45.75 ^a	20	84.87	26	25.59
3	77.68	9	19.48	15	45.16	21	30.56	27	25.25
4	40.82	10	27.66	16	74.38	22	31.84	28	19.64
5	46.31	11	26.91	17	61.33	23	33.58	29	26.18
6	32.01	12	33.12	18	22.23	24	110.60	30	14.75

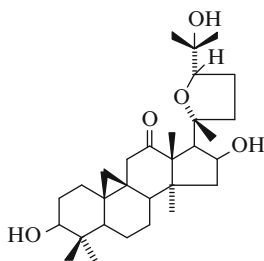
^aSignals are mutually imposed.

References

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Cycloalpigenin A

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Astragalus ephemerotum Gontsch. (*Leguminosae*) [2].

Mp 223–226°C (from MeOH), $[\alpha]_D^{24}$ –43.2° (c 0.37, MeOH).

CAS Registry Number: 172324-47-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3550-3300, 3040, 1705.

CD (c 0.1, EtOH) $\Delta\epsilon$ = –2.64 (286 nm).

MS m/z (%): [M + H]⁺ 489 (4.7), M⁺ 488 (3.5), 473 (15.8), 470 (2.6), 455 (5.3), 445 (2.6), 437 (7.0), 430 (42.1), 419 (3.5), 415 (5.3), 412 (52.6), 397 (9.6), 393 (42.1), 387 (89.4), 379 (6.1), 375 (14.4), 369 (100), 351 (57.9), 343 (7.9), 333 (7.9), 325 (15.8), 311 (8.8), 288 (39.5), 271 (14.0), 269 (14.9), 261 (10.5), 187 (21.1), 143 (28.9).

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
C-1	32.84	1.49	td (12,4), 1.00	C-16	73.01	4.87	q (8)
2	31.00 ^a	1.83, 1.92		17	49.85	3.19	d (8)
3	77.59	3.50	dd (12, 4)	18	14.98	1.58	s
4	40.95	–		19	31.00 ^a	0.36, 0.70	d (4)
5	47.05	1.22		20	87.22	–	
6	20.71	0.77	q (12), 1.54	21	28.74	1.61	s
7	26.54	0.93	q (12), 1.30	22	36.02	2.95	td (12, 6), 1.71
8	47.62	1.73	dd (12, 4)	23	25.92	2.33	m, 1.97
9	19.99	–		24	82.32	3.89	t (8)
10	28.14	–		25	70.67	–	
11	45.91	2.05, 2.75	d (20)	26	27.26	1.29	s
12	211.25	–		27	28.22	1.57	s
13	60.95	–		28	20.78	0.71	s
14	47.54	–		29	26.12	1.20	s
15	46.02	2.10	dd (12,8), 1.86	30	14.79	1.06	s

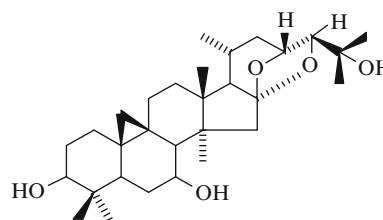
^aSignals are mutually imposed.

References

1. M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **30**(3), 346–351 (1994)
2. I.A. Sukhina, M.I. Isaev, Chem. Nat. Comp. **31**(5), 639–640 (1995)

Cycloorbigenin

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1].

Mp 217–219°C (from MeOH), $[\alpha]_D^{20}$ +28.3° (c 1.19, EtOH).

CAS Registry Number: 106009-91-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3525-3215, 3040.

MS m/z (%): M⁺ 488 (1.6), 473 (5.0), 470 (5.3), 455 (5.3), 452 (1.6), 437 (1.9), 429 (100), 411 (18.5),

400 (2.1), 393 (4.0), 374 (5.8), 332 (7.9), 290 (8.2), 272 (10.3).

$^1\text{H NMR}$ ($\text{C}_5\text{D}_5\text{N}$, δ , 0-HMDS) : 0.23 and 0.65 (2H-19, d, $J = 4$ Hz), 0.76 (CH_3 -21, d, $J = 6$ Hz) 0.99, 1.11, 1.13, 1.26, 1.35, 1.35 ($6 \times \text{CH}_3$, s), 2.46 and 2.70 (2H-15, d, $J = 15$ Hz), 3.38 (H-3, dd, $J = 12$, 5 Hz), 3.58 (H-24, s) 3.70 (H-7, td, $J = 10$, 3) 4.62 (H-23, dd, $J = 9$, 2 Hz).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$) [2]									
C-1	32.34	C-7	70.35	C-13	44.34	C-19	30.00	C-25	71.16
2	31.22	8	55.46	14	46.97	20	23.89	26	27.80
3	77.94	9	19.78	15	48.93	21	20.17	27	24.83
4	40.93	10	27.64	16	115.27	22	38.52	28	19.10
5	46.57	11	26.96	17	60.70	23	71.87	29	26.25
6	32.18	12	33.24	18	19.01	24	90.57	30	14.80

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1. M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(4), 425–429 (1986)
2. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 477–479 (1998)

(0.8), 411 (9.6), 393 (9.6), 375 (1.9), 369 (3.6), 143 (100), 125 (61.5).

Table 1

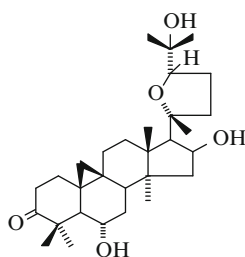
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	
C-1	31.85	1.30, 2.02	C-16	73.41	5.05 qd (8, 2.9), [OH, 5.59 d (2.9)]
2	35.86	2.48 ddd (14, 6.8, 1.2), 2.75 ddd (14, 8.4, 5.7)	17	58.50	2.54 d (8)
3	216.82	–	18	22.14	1.43 s
4	50.56	–	19	31.08	0.37 d (4), 0.69 d (4)
5	53.55	2.23 d (10)	20	87.22	–
6	69.17	3.69 tdd (10, 3.9, 2.9), [OH, 5.68 d (3.9)]	21	28.57	1.34 s
7	38.39	1.61 td (11.6, 10), 1.76 ddd (11.6, 3.6, 2.9)	22	34.93	3.13 td (11.5, 8.8), 1.70 ddd (11.5, 9.8, 2.4)
8	48.19	1.85 dd (11.6, 3.6)	23	26.45	2.07, 2.34 m
9	21.21	–	24	81.73	3.90 dd (9.5, 5.4)
10	28.49	–	25	71.27	(OH) 6.69 s
11	26.07	0.99 ddd (13, 10, 3), 2.05	26	27.18	1.32 s
12	33.20	1.64, 1.64	27	28.22	1.61 s
13	45.00	–	28	20.43	0.97 s
14	46.06	–	29	28.65	1.78 s
15	47.04	1.76, 2.12 dd (12.7, 8)	30	20.45	1.48 s

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 474–476 (1998)

Cyclopycanthogenin

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Astragaluspyncanthus Boriss. (*Leguminosae*) [1].

Mp 233–235°C (from MeOH).

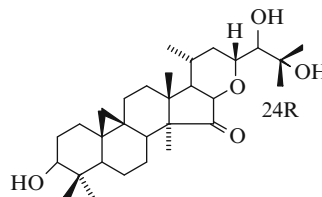
CAS Registry Number: 236747-47-0.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3415, 3040, 1706.

MS m/z (%): M^+ 488 (0.4), 473 (2.0), 470 (3.8), 455 (2.8), 452 (2.1), 437 (2.1), 429 (2.1), 427 (1.9), 419

Dahurinol

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Cimicifuga dahurica (*Ranunculaceae*) [1].

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [2].

Cimicifuga acerina Sieb. et Lucc. (*Ranunculaceae*) [2].

Mp 248–250°C (from EtOAc), $[\alpha]_{\text{D}}^{27}$ 54.5° (CHCl_3).

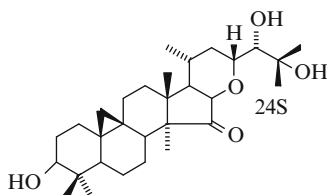
CAS Registry Number: 38908-87-1.

References

1. N. Sakurai, T. Inoue, M. Nagai, *Yakugaku Zasshi* **92**(6), 724–728 (1972). *C.A.*, 77:101932a (1972)
2. G. Kusano, Y. Murakami, N. Sakurai, T. Takemoto, *Yakugaku Zasshi* **96**(1), 82–85 (1976). *C.A.*, 84:135873s (1976)

Isodahurinol

$C_{30}H_{48}O_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Cimicifuga acerina Sieb. et Lucc. (*Ranunculaceae*) [1].

Mp 216–222°C (from EtOAc).

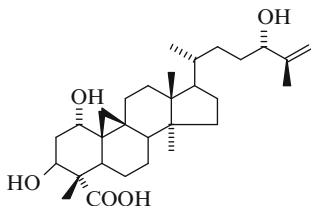
CAS Registry Number: 59331-33-8.

References

1. G. Kusano, Y. Murakami, N. Sakurai, T. Takemoto, *Yakugaku Zasshi* **96**(1), 82–85 (1976). *C.A.*, 84:135873s (1976)

24-Epiquadrangularic Acid M

$C_{30}H_{48}O_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

CAS Registry Number: 254754-50-2.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS) : 0.55 and 0.84 (2 H-19, d, $J = 4.5$ Hz), 0.97 (CH_3 -21, d, $J = 6.5$ Hz), 0.99 (CH_3 -28, s), 1.06 (CH_3 -18, s), 1.74 (CH_3 -30, s), 1.93 (CH_3 -27, s), 2.30 (H-2, ddd, $J = 12.5, 12, 2$ Hz), 2.50 (H-2, ddd, $J = 12.5, 4.5, 4$ Hz), 2.76 (H-11, ddd, $J = 13, 9, 8$ Hz), 3.43 (H-5, dd, $J = 12, 4.5$ Hz), 3.92 (H-1, brs), 4.36 (H-24, t, $J = 6$ Hz), 4.97 (H-26, brs), 5.22 (H-26, brs), 5.57 (H-3, dd, $J = 12, 4.5$ Hz).

Table 1

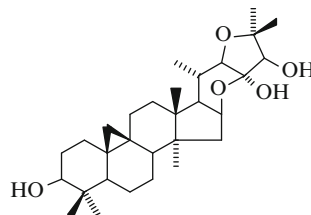
δ_C (C_5D_5N)									
C-1	72.5	C-7	28.4	C-13	45.5	C-19	29.8	C-25	149.6
2	38.8	8	48.2	14	49.1	20	36.4	26	110.4
3	70.7	9	20.8	15	36.3	21	18.7	27	17.7
4	55.7	10	30.3	16	25.9	22	32.7	28	19.5
5	37.7	11	26.2	17	52.6	23	35.9	29	180.1
6	23.4	12	33.3	18	18.4	24	76.1	30	9.8

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1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Genin of Cimiaceroside B

$C_{30}H_{48}O_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].

Mp 271–272°C, $[\alpha]_D +11.4^\circ$ (c 0.25, MeOH).

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3500–3300.

Positive SIMS m/z: 511 [M + Na]⁺, 471 [M-OH]⁺.

Positive HRSIMS m/z: 511.3394 [M + Na]⁺.

Table 1

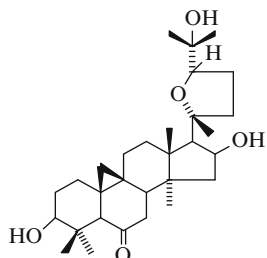
	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
C-1	32.44	1.20, 1.56	C-16	72.46 4.98 ddd (7.8, 7.8, 7.8)
2	31.77	1.88, 1.99	17	52.43 1.57
3	77.99	3.53 dd (4.4, 11.5)	18	20.70 1.24 s
4	41.11	–	19	30.44 0.26 d (4), 0.55 d (4)
5	47.44	1.32 dd (4, 11.9)	20	34.77 2.25
6	21.67	0.78, 1.55	21	17.52 1.23 d (6.5)
7	26.55	1.07, 1.24	22	86.96 3.90 d (10.6)
8	47.67	1.59	23	106.03 –
9	19.73	–	24	83.37 4.17 s
10	26.95	–	25	83.61 –
11	26.21	1.13, 2.00	26	27.78 1.76 s
12	33.53	1.60 (2H)	27	24.80 1.68 s
13	46.92	–	28	19.75 0.89 s
14	45.32	–	29	26.37 1.22 s
15	43.41	1.64, 1.92	30	14.85 1.08 s

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, T. Okuyama, G. Kusano, *Heterocycles* **48**(5), 1003–1013 (1998)

Huangqiyegein I

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Astaragalus membranaceus Bunge (*Leguminosae*) [1].

A white powder, $[\alpha]_D^{+74.4}$ (c 0.59, CHCl₃).

CAS Registry Number: 188666-44-6.

EIMS m/z: [M]⁺ 488, 143.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.21 and 0.75 (2H-19, d, J = 5.3 Hz), 0.99 (CH₃-28, s), 1.28

(CH₃-26, s), 1.32 (CH₃-21, s), 1.34 (CH₃-30, s), 1.34 (CH₃-18, s), 1.52 (CH₃-27, s), 1.64 (CH₃-29, s), 3.46 (H-3, dd, J = 11.3, 4.4 Hz), 3.88 (H-24, dd, J = 9, 5.3 Hz), 4.98 (H-16, ddd, J = 7.9, 7.7, 6.2 Hz).

Table 1

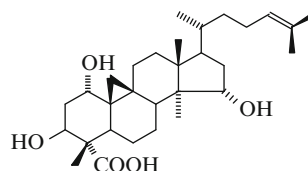
	δ_C (C ₅ D ₅ N)									
C-1	30.8	C-7	41.7	C-13	45.6	C-19	22.9	C-25	71.4	
2	30.3	8	43.5	14	47.3	20	87.2	26	27.1	
3	77.7	9	21.7	15	44.6	21	28.6	27	28.1	
4	41.1	10	31.0	16	73.0	22	35.2	28	19.2	
5	58.1	11	26.7	17	57.9	23	26.5	29	27.3	
6	211.5	12	33.4	18	18.7	24	81.9	30	14.7	

References

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15 α -Hydroxymollic Acid

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Acalypha communis (*Euphorbiaceae*) [1].

Mp 232–234°C, $[\alpha]_D^{25}$ +67.22° (c 0.18, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3440, 3423, 2929, 1701, 1458, 1376, 1262.

HRFABMS m/z: 488.3492 (C₃₀H₄₈O₅)

Table 1

	δ_C (CD ₃ OD)		δ_H (J/Hz)	
C-1	73.7	3.52 brs	C-16	40.4 1.82, 1.68
2	37.7	1.85, 1.78	17	51.8 1.67
3	71.5	4.52 dd (11.9, 4.8)	18	18.9 1.03 s

(continued)

Table 1 (continued)

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
4	55.9 –	19	31.3 0.51 d (4.6), 0.70 d (4.6)
5	38.1 2.56 dd (12.8, 4.6)	20	36.9 1.35
6	24.1 1.30, 0.97 dd (12.8, 1.8)	21	18.7 0.88 d (6.4)
7	26.5 1.63, 1.16	22	37.4 1.42 m, 1.04
8	50.7 1.58 dd (12.4, 4.1)	23	25.8 2.04 m, 1.89 m
9	22.4 –	24	126.1 5.08 t (7.3)
10	30.2 –	25	131.9 –
11	26.4 2.46 ddd (14.7, 11.7, 3), 1.23	26	25.9 1.67 s
12	34.9 1.75, 1.63	27	17.7 1.60 s
13	51.5 –	28	12.0 1.00 s
14	46.9 –	29	181.1 –
15	79.7 3.89 dd (9.6, 5)	30	9.2 1.06 s

Biological activity

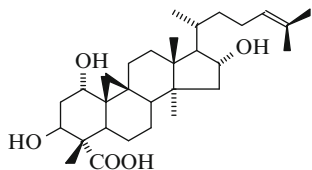
Compound exhibited moderate antimicrobial activity against gram-positive bacteria.

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16 α -Hydroxymollic Acid

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Acalypha communis (*Euphorbiaceae*) [1].

Mp 233–236°C, $[\alpha]_D^{25}$ +43.7° (c 0.55, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3447, 3439, 3423, 2930, 2886, 1706, 1458, 1376, 1261, 1083.

HRFABMS m/z: 488.3543 (C₃₀H₄₈O₅).

Table 1

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
C-1	73.4 3.52 t (2.4)	C-16	78.1 3.95 dd (7.8, 6.4)
2	37.8 1.84, 1.77	17	62.6 1.61 m
3	71.4 4.52 dd (12, 5.4)	18	19.8 1.02 s
4	55.9 –	19	31.4 0.48 d (4.6), 0.69 d (4.6)
5	38.3 2.56 dd (12.6, 4.8)	20	35.6 1.52 m
6	24.0 1.30, 0.97 dd (12.4, 2.8)	21	19.1 0.93 d (6.4)
7	26.7 1.25, 1.25	22	36.7 1.79, 1.16 dd (13.3, 5)
8	50.0 1.46 dd (11.5, 5)	23	26.5 2.13 m, 1.91 m
9	21.5 –	24	126.4 5.12 t (7.3)
10	30.4 –	25	131.8 -
11	26.8 2.47 ddd (14.9, 10.6, 6.4), 1.25	26	25.9 1.66 s
12	33.8 1.76, 1.66 m	27	17.8 1.60 s
13	48.0 –	28	20.6 1.18 s
14	48.4 –	29	180.9 -
15	49.0 1.85, 1.37 d (13.75)	30	9.2 1.05 s

Biological activity

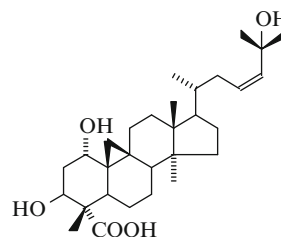
Compound exhibited moderate antimicrobial activity against gram-positive bacteria.

References

1. M.-T. Gutierrez-Lugo, M.P. Syngh, W.M. Maiese, B.N. Timmermann, *J. Nat. Prod.* **65**(6), 872–875 (2002)

Quadrangularic Acid K

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +133.7^\circ$ (c 0.03, MeOH).

CAS Registry Number: 254757-95-4.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1700, 1460, 1380.

HRFABMS m/z : 511.3392 $[\text{M} + \text{Na}]^+$.

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.55 and 0.83 (2 H-19, d, $J = 4.5$ Hz), 0.95 (CH_3 -21, d, $J = 6.5$ Hz), 0.98 (CH_3 -18, s), 1.04 (CH_3 -18, s), 1.55 (CH_3 -26, CH_3 -27, s) 1.73 (CH_3 -30, s), 2.29 (H-2, H-23, m), 2.52 (H-2, ddd, $J = 13, 4.5, 4$ Hz), 2.74 (H-11, ddd, $J = 13, 9, 8$ Hz), 3.41 (H-5, dd, $J = 12, 4.5$ Hz), 3.92 (H-1, brs), 5.57 (H-3, dd, $J = 12, 4.5$ Hz), 5.94 (H-23, H-24, m).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.4	C-7	28.1	C-13	45.4	C-19	29.6	C-25	69.6
2	38.6	8	48.0	14	48.9	20	36.7	26	30.6
3	70.5	9	20.7	15	35.7	21	18.4	27	30.0
4	55.5	10	29.8	16	25.7	22	39.3	28	19.3
5	37.6	11	26.0	17	52.1	23	124.4	29	180.0
6	23.3	12	33.0	18	18.3	24	141.3	30	9.6

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS) : 0.55 and 0.84 (2H-19, d, $J = 4.5$ Hz), 0.97 (CH_3 -21, d, $J = 6.5$ Hz), 0.99 (CH_3 -28, s), 1.06 (CH_3 -18, s), 1.74 (CH_3 -30, s), 1.92 (CH_3 -27, s), 2.30 (H-2, ddd, $J = 12.5, 12, 2$ Hz), 2.50 (H-2, ddd, $J = 12.5, 4.5, 4$ Hz), 2.76 (H-11, ddd, $J = 13, 9, 8$ Hz), 3.43 (H-5, dd, $J = 12, 4.5$ Hz), 3.92 (H-1, brs), 4.36 (H-24, t, $J = 6$ Hz), 4.97 (H-26, brs), 5.27 (H-26, brs), 5.57 (H-3, dd, $J = 12, 4.5$ Hz).

Table 1

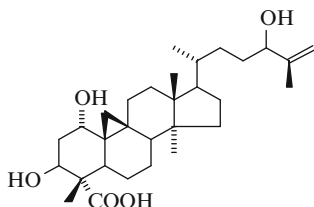
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.5	C-7	28.4	C-13	45.5	C-19	29.8	C-25	149.6
2	38.8	8	48.2	14	49.1	20	36.4	26	110.0
3	70.7	9	20.8	15	36.3	21	18.7	27	18.2
4	55.7	10	30.3	16	25.9	22	32.7	28	19.5
5	37.7	11	26.2	17	52.6	23	35.9	29	180.1
6	23.4	12	33.3	18	18.4	24	75.6	30	9.8

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Quadrangularic Acid M

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



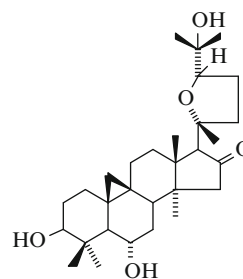
Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

CAS Registry Number: 254757-97-6.

Cycloasalgengin

$\text{C}_{30}\text{H}_{48}\text{O}_5$, M 488



Taxonomy: Cycloartane Triterpenoids

Astragalus zahlbruckneri Hand.-Mazz. (*Leguminosae*) [1].

Synthetic [2].

$[\alpha]_D^{25} +10.0^\circ$ (c 0.5, CHCl_3).

FAB MS m/z : 487 $[\text{M}-\text{H}]^+$.

Table 1

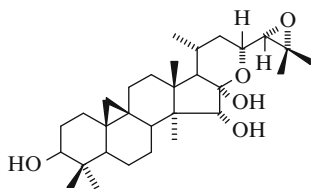
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)	
C-1	31.7	1.58 m, 1.19 m	C-16	218.3 -
2	30.2	1.82 m, 1.58 m	17	65.2 2.92 s
3	78.2	3.33 dd (11.2, 4.5)	18	20.0 1.19 s
4	41.8 -		19	30.9 0.42 d (4.5), 0.55 d (4.5)
5	53.5	1.37 d (8)	20	84.4 -
6	68.6	3.55 ddd (10, 8, 4.5)	21	25.2 1.21 s
7	37.7	1.44 m, 1.38 m	22	31.9 1.80 m, 1.69 m
8	45.9	1.80 m	23	26.3 2.12 m, 1.98 m
9	20.3 -		24	82.0 3.73 dd (8, 5)
10	29.6 -		25	70.8 -
11	25.6	2.05 m, 1.30	26	25.1 1.12 s
12	31.9	1.88 m, 1.62 m	27	28.0 1.27 s
13	44.5 -		28	19.6 1.16 s
14	42.1 -		29	28.0 1.29 s
15	51.0	2.09 s (2H)	30	15.2 0.98 s

References

1. I. Calis, H.A. Gazar, S. Piacente, C. Pizza, *J. Nat. Prod.* **64**(9), 1179–1182 (2001)
2. I. M. Isaev, D.A. Iskenderov, M.I. Isaev, *Chem. Nat. Comp.* **46**(3), 407–411 (2010)

Shengmanol

C₃₀H₄₈O₅, M 488



Taxonomy: Cycloartane Triterpenoids

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 153.5–154.5°C (from EtOH), $[\alpha]_D^{26} +0.5^\circ$ (c 0.9, CHCl₃).

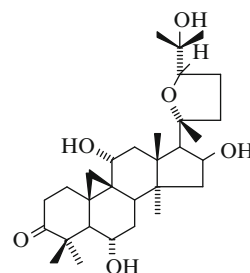
CAS Registry Number: 82872-68-2.

References

1. O. Kimura, N. Sakurai, M. Nagai, T. Inoue, *Yakugaku Zasshi* **102**(6), 538–545 (1982)

Cycloasgenin A

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Astragalus taschkendicus Bunge (*Leguminosae*) [1, 2].

Mp 235–236°C (from MeOH), $[\alpha]_D^{23} +130^\circ$ (c 0.77, MeOH).

CAS Registry Number: 80604-24-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3450–3350, 3060, 1706–1695.

CD (c 0.1, MeOH): $\Delta\epsilon = -0.1$ (320 nm), $\Delta\epsilon = +1.44$ (287 nm).

MS m/z (%): M⁺ 504 (0.82), 486 (8.0), 468 (5.6), 450 (3.7), 442 (3.7), 435 (3.0), 427 (4.9), 409 (8.0), 391 (4.9), 365 (34), 349 (7.4), 347 (3.0), 143 (100), 125 (33.3).

¹HNMR (C₅D₅N, δ): 0.45 and 1.63 (2H-19, d, J = 4 Hz), 0.85, 1.17, 1.21, 1.42, 1.43, 1.46, 1.70 (7 × CH₃, s), 3.71 (H-6, m), 3.74 (H-24, dd, J = 8.8, 5.6 Hz), 4.19 (H-11, dd, J = 9.9, 2.5 Hz), 4.90 (H-16, q, J = 7.3 Hz).

Table 1

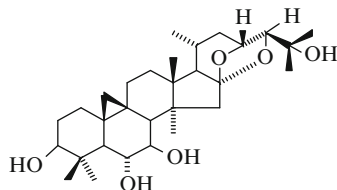
δ_C (C ₅ D ₅ N)									
C-1	30.00	C-7	38.86	C-13	45.65	C-19	29.61	C-25	71.20
2	36.41	8	48.19	14	46.20	20	87.11	26	27.13
3	217.08	9	28.29	15	46.82	21	28.53	27	28.15
4	50.69	10	28.96	16	73.43	22	34.98	28	21.54
5	54.66	11	63.76	17	58.53	23	26.38	29	28.53
6	68.70	12	48.35	18	21.87	24	81.81	30	20.68

References

1. M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, M.R. Yagudaev, N.K. Abubakirov, *Chem. Nat. Comp.* **17**(5), 411–418 (1981)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)

Cycloorbigenin B

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1].

Mp 201–203°C (from C₆H₆–MeOH, 10:1), [α]_D²⁹ +20.7° (c 0.77, MeOH).

CAS Registry Number: 126518-64-7.

IR ν_{max}^{KBr}, cm⁻¹: 3580–3225, 3045.

MS m/z (%): M⁺ 504 (0.63), 489 (2.2), 486 (1.2), 471 (1.1), 468 (1.4), 453 (0.9), 445 (100), 427 (6.0), 416 (2.1), 409 (3.0), 389 (8.6), 347 (6.8), 287 (2.7), 269 (2.7).

¹HNMR (C₅D₅N, δ, 0-HMDS) : 0.28 and 0.64 (2H-19, d, J = 4 Hz), 0.76 (CH₃-21, d, J = 6 Hz), 1.12, 1.26, 1.28, 1.35, 1.35, 1.80, (6 × CH₃, s), 2.46 and 2.70 (2H-15, d, J = 14 Hz), 3.46–3.66 (H-3, H-6, H-7), 3.60 (H-24, s), 4.66 (H-23, brd, J = 9 Hz).

Table 1

δ_c (C₅D₅N) [2]

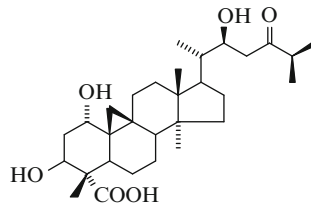
C-1	32.72	C-7	75.00	C-13	44.19	C-19	31.37	C-25	71.01
2	31.68	8	53.58	14	46.75	20	23.61	26	27.95
3	78.05	9	19.53	15	48.84	21	19.97	27	24.64
4	42.46	10	29.03	16	115.15	22	38.34	28	19.28
5	51.67	11	26.61	17	60.59	23	71.73	29	29.15
6	72.88	12	32.97	18	18.72	24	90.52	30	16.00

References

1. M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(6), 688–690 (1989)
2. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 519–522 (1998)

Cyclopassifloic Acid D

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Mp 202–203°C, [α]_D²⁵ +48.3° (c 0.4, MeOH).

CAS Registry Number: 292167-37-4.

IR ν_{max}^{KBr}, cm⁻¹: 3450, 1705, 1090, 1030.

FAB MS m/z: 503 [M-H]⁻.

¹HNMR (400 MHz, C₅D₅N, δ, 0-TMS) : 0.51 and 0.71 (2H-19, d, J = 4 Hz), 0.90 (CH₃-28, s), 0.99 (CH₃-18, s), 1.14, 1.17 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.16 (CH₃-21, d, J = 6 Hz), 1.66 (CH₃-30, s), 2.25 (H-2, ddd, J = 13, 13, 2.5 Hz), 2.48 (H-2, ddd, J = 13, 4, 2.5 Hz), 2.54 (H-23, d, J = 12 Hz), 2.74 (H-11, m), 2.80 (H-25, qq, J = 7 Hz), 2.89 (H-23, dd, J = 12, 5 Hz), 3.33 (H-5, dd, J = 12, 3.5 Hz), 3.87 (H-1, brs), 4.67 (H-22, dd, J = 10, 2 Hz), 5.55 (H-3, dd, J = 13, 4 Hz).

Table 1

δ_c (C₅D₅N)

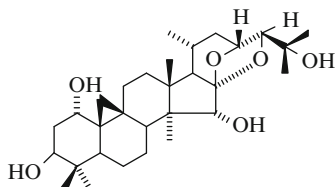
C-1	72.3	C-7	25.9	C-13	45.8	C-19	30.0	C-25	42.9
2	38.2	8	48.1	14	48.6	20	42.8	26	18.1
3	70.6	9	20.8	15	36.0	21	12.5	27	18.0
4	56.3	10	30.1	16	27.4	22	69.7	28	19.5
5	37.6	11	26.0	17	49.6	23	42.0	29	180.1
6	23.4	12	33.1	18	18.3	24	214.6	30	9.6

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, *J. Nat. Prod.* **63**(9), 1229–1234 (2000)

1 α -Hydroxycimigenol

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 145–146°C (from EtOAc), [α]_D²⁰ +50.8° (c 0.78, MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3440-3200.

Positive ion HRFABMS m/z: 527.3367 [M + Na]⁺.

Table 1

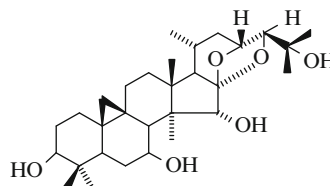
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	72.58 3.84 brs	C-16	111.96 –
2	38.64 2.25, 2.50	17	59.57 1.48 d (11)
3	73.22 4.40 dd (12, 4)	18	19.60 1.21 s
4	41.22 –	19	30.97 0.47 d (4), 0.74 d (4)
5	39.88 2.41	20	24.06 1.70
6	21.21 0.85, 1.70	21	19.60 0.85 d (7)
7	26.39 1.50, 2.25	22	38.16 1.03, 2.25
8	48.89 1.75	23	71.85 4.75 d (9)
9	20.91 –	24	90.19 3.80 s
10	31.18 –	25	71.06 –
11	25.78 1.45, 2.90	26	26.72 1.48 s
12	34.09 1.60, 1.78	27	25.29 1.50 s
13	41.79 –	28	11.75 1.27 s
14	47.32 –	29	26.16 1.31 s
15	80.25 4.32 s	30	14.11 1.15 s

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

7 β -Hydroxycimigenol

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1, 2].

Mp 255–256°C (from EtOAc).

MS m/z (%): M⁺ 504 (15), 489 (25), 486 (95).

Table 1

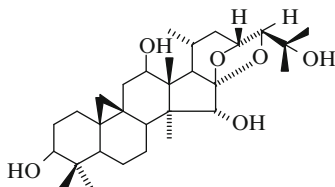
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	30.72 1.20, 1.60	C-16	111.86 –
2	30.31 1.92, 2.35	17	59.82 1.51 d (10.8)
3	77.68 3.57 dd (11.6, 4.5)	18	19.61 1.19 s
4	40.81 –	19	30.79 0.37 d (4), 0.67 d (4)
5	46.08 1.55	20	23.96 1.58
6	32.46 1.20, 2.05	21	19.61 0.88 d (6.5)
7	69.42 3.66 ddd (11.5, 10, 3)	22	38.08 1.10, 2.30
8	56.16 1.82 d (10)	23	71.75 4.73 d (9)
9	18.90 –	24	90.29 3.86 s
10	27.20 –	25	71.22 –
11	26.58 1.10, 2.08	26	25.49 1.56 s
12	33.92 1.50, 1.65	27	26.03 1.52 s
13	42.25 –	28	11.95 1.33 s
14	47.80 –	29	26.03 1.23 s
15	79.12 4.46 s	30	14.72 1.10 s

References

1. G. Kusano, M. Idoji, Y. Sogoh, M. Shibano, A. Kusano, T. Iwashita, *Chem. Pharm. Bull.* **42**(5), 1106–1110 (1994)
2. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **43**(7), 1167–1170 (1995)

12 β -Hydroxycimigenol

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 216–217°C (from EtOAc), $[\alpha]_D^{20} +10.1^\circ$ (c 0.71, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3100.

SIMS m/z: 505 [M + H]⁺.

HREIMS m/z: 504.3447 [M]⁺.

Table 1

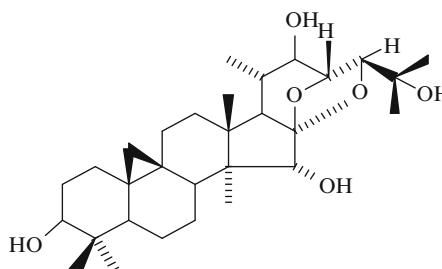
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.54	1.25, 1.57	C-16	112.15	–
2	30.86	1.85, 1.97	17	59.63	1.84 d (9.2)
3	77.77	3.53 dd (11.5, 4)	18	11.96	1.45 s
4	40.84	–	19	30.83	0.46 d (4), 0.67 d (4)
5	47.04	1.30 dd (12, 3.8)	20	23.89	1.85
6	21.01	0.82 q (12), 1.60	21	20.94	1.39 d (6)
7	26.09	1.25, 2.17	22	38.64	1.15, 2.41
8	47.30	1.85	23	71.61	4.77 d (9.2)
9	20.47	–	24	89.88	3.85 s
10	26.47	–	25	70.97	–
11	40.65	1.50, 2.83 dd (16, 7.7)	26	25.37	1.53 s
12	72.66	4.23 dd (7.7, 2.5)	27	26.67	1.50 s
13	47.84	–	28	11.74	1.24 s
14	48.14	–	29	26.00	1.20 s
15	79.68	4.44 s	30	14.68	1.07 s

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **43**(7), 1167–1170 (1995)

22-Hydroxycimigenol

C₃₀H₄₈O₆, M 504



Taxonomy: Cycloartane Triterpenoids

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 274–276°C (from EtOAc), $[\alpha]_D^{19} +45.0^\circ$ (c 0.4, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3620–3130, 1060.

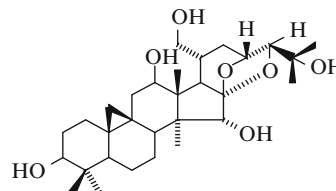
¹H NMR (C₅D₅N, δ): 0.36 and 0.60 (2H-19, d, J = 4.2 Hz), 3.6 (H-3, m), 3.64 (H-24, d, J = 1.2 Hz), 3.68 (H-22, d, J = 12 Hz), 3.99 (H-23, d, J = 1.2 Hz), 4.40 (H-15, s).

References

1. N. Sakurai, O. Kimura, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **29**(4), 955–960 (1981)

12 β ,21-Dihydroxycimigenol

C₃₀H₄₈O₇, M 520



Taxonomy: Cycloartane Triterpenoids

Cimicifuga racemosa Nutt. (*Ranunculaceae*) [1].

Amorphous solid, $[\alpha]_D^{26} +6.0^\circ$ (c 0.1, MeOH).

IR ν_{\max}^{film} , cm^{-1} : 3358, 2935, 2889, 1454, 1384, 1288, 1169, 1071, 1026, 984, 948.
HREIMS m/z : 520.3397 $[\text{M}]^+$.

Table 1

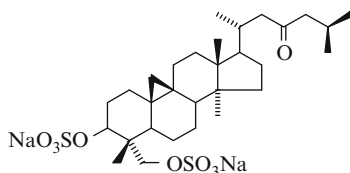
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	
δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{H} (J/Hz)
C-1 32.4	1.52, 1.23	C-16 112.3	–
2 31.0	2.06, 1.80	17 53.8	2.38 d (9)
3 77.8	3.48 dd (11.6, 4.4)	18 11.9	1.49 s
4 40.8	–	19 30.7	0.35 d (4.1), 0.63 d (4.1)
5 46.9	1.24 dd (12.4, 5.5)	20 31.4	2.18
6 20.8	1.52, 0.77 qd (12.5, 2.1)	21 66.0	4.13 dd (10.7, 4.5), 3.98 dd (10.7, 5.8)
7 25.9	2.07, 1.19		
8 47.0	1.85 dd (12, 5)	22 32.8	2.41 ddd (13.6, 8.4, 8.4), 1.50
9 20.8	–	23 71.8	4.78 brd (8.6)
10 27.0	–	24 88.7	3.92 d (0.8)
11 39.4	2.68 dd (15.5, 9.1), 1.46 dd (15.5, 3.7)	25 70.9	–
		26 25.3	1.45 s
12 73.0	4.36 dd (9.1, 3.7)	27 26.7	1.47 s
13 47.8	–	28 12.0	1.21 s
14 48.4	–	29 26.0	1.14 s
15 79.9	4.46 s	30 14.6	1.01 s

References

1. K. Watanabe, Y. Mimaki, H. Sakagami, Y. Sashida, Chem. Pharm. Bull **50**(1), 121–125 (2002)

Cycloartan-3,29-diol-23-one 3,29-disodium sulfate

$\text{C}_{30}\text{H}_{48}\text{O}_9\text{S}_2\text{Na}_2$, M 662



Taxonomy: Cycloartane Triterpenoids
Tydemania expeditionis Weber van Bosse
(*Udoteaceae*) [1].

Mp 198–199°C, $[\alpha]_{\text{D}}^{25} +23.6^\circ$ (c 0.5).

IR ν_{\max} , cm^{-1} : 1705, 1465, 1374, 1221–1247.
Negative HRFABMS m/z : $[\text{M}-\text{Na}]^-$ 639.2637.

Table 1

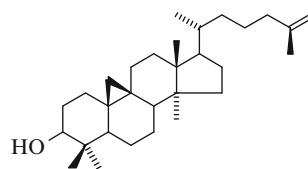
δ_{C} (CD_3OD)		δ_{C} (CD_3OD)	
δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{H} (J/Hz)
C-1 32.6	1.55 m, 1.28 m	C-16 28.2	1.95 m, 1.30 m
2 27.5	2.25 m, 1.77 m	17 53.6	1.64 m
3 80.8	4.46 dd (13, 5)	18 18.6	1.10 s
4 44.6	–	19 30.7	0.40 d (2.5), 0.60 d (2.5)
5 42.1	1.83 dd (7, 2)	20 34.0	1.96 m
6 21.5	1.73 m, 0.80 m	21 19.8	0.91 d (7)
7 29.3	–	22 51.6	2.49 dd (17,2), 2.16 dd (17, 10)
8 49.4	1.52 dd (13, 5)	23 214.1	–
9 21.1	–	24 53.4	2.28 d (7) (2 H)
10 26.6	–	25 25.6	2.05 m
11 26.8	2.05 m, 1.15 m	26 22.9	0.96 d (7)
12 36.6	1.32 m (2H)	27 22.8	0.94 d (7)
13 46.6	–	28 19.9	0.99 s
14 50.2	–	29 69.8	4.05 d (11), 3.78 d (11)
15 34.1	–	30 11.7	0.89 s

References

1. M. Govindan, S.A. Abbas, F.J. Schmitz, R.H. Lee, J.S. Papkoff, D.L. Slate, J. Nat. Prod. **57**(1), 74–78 (1994)

Cycloart-25-en-3 β -ol

$\text{C}_{30}\text{H}_{50}\text{O}$, M 426



Taxonomy: Cycloartane Triterpenoids

Euphorbia nivulia Buck-Ham (*Euphorbiaceae*) [1].

Mp 85°C, $[\alpha]_D^{25} +23^\circ$ (c 0.926, CHCl₃).

CAS Registry Number: 1768-79-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3445, 3045, 1370, 1360, 880.

MS *m/z* (%): M⁺ 426 (63.8), 339 (55.5), 315 (22), 286 (26), 111 (27), 69 (100).

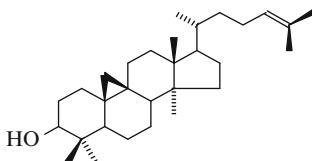
¹H NMR (CDCl₃, δ , 0-TMS): 0.48 and 0.70 (2H-19, d, J = 5 Hz), 0.87–1.65 (6 × CH₃), 4.70 (2H-26).

References

1. K. Laxman Rao, S.K. Ramraj, A.R. Nath, T.V.P.R. Subba Rao, T. Sundararamaiah, *Phytochemistry* **25**(1), 277–278 (1986)

Cycloartenol

C₃₀H₅₀O, M 426



Taxonomy: Cycloartane Triterpenoids

Strychnos nux-vomica L. (*Loganiaceae*) [1].

Euphorbia broteri (*Euphorbiaceae*) [2].

Mp 106–107°C (from MeOH), $[\alpha]_D^{25} +48^\circ$ (c 1, CHCl₃).

CAS Registry Number: 469-38-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3340, 3060, 2960, 2900, 1495, 1470, 1410, 1235, 1130, 1045, 910.

¹H NMR (CDCl₃, δ , 0-TMS) : 0.33 and 0.55 (2H-19, d, J = 3.9 Hz), 0.81, 0.89, 0.96, 0.96, 1.60, 1.68 (6 × CH₃, s), 0.88 (CH₃-21, d, J = 6.2 Hz), 5.10 (H-24, t, J = 7.3 Hz).

Table 1

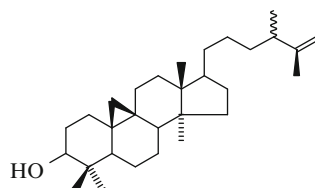
δ_c (CDCl ₃) [3]									
C-1	32.06	C-7	26.07	C-13	45.40	C-19	29.90	C-25	130.84
2	30.48	8	48.00	14	48.91	20	35.94	26	17.64
3	78.90	9	20.12	15	35.65	21	18.31	27	25.70
4	40.56	10	26.25	16	28.18	22	36.44	28	19.36
5	47.22	11	26.60	17	52.38	23	25.02	29	25.49
6	21.17	12	33.02	18	18.05	24	125.35	30	14.04

References

1. H.R. Bentley, J.A. Henry, D.S. Irvine, F.S. Spring, *J. Chem. Soc.* 3673–3678 (1953)
2. J.P. Tereza, J.G. Urones, I.S. Marcos, P. Basabe, M.J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)
3. W. Kamisako, C. Honda, K. Suwa, K. Isoi, *Magn. Res. Chem.* **25**, 683–687 (1987)

Cyclopeltenol

C₃₀H₅₀O, M 426



Taxonomy: Cycloartane Triterpenoids

Macaranga peltata Muell. (*Euphorbiaceae*) [1].

Mp 192°C (from MeOH), $[\alpha]_D^{25} +51^\circ$ (c 1.0, CHCl₃).

CAS Registry Number: 81575-35-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3350.

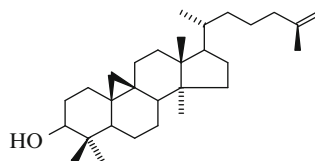
¹H NMR (CDCl₃, δ) : 0.29 and 0.55 (2H-19, d, J = 5 Hz), 0.85–1.1 (5 × CH₃), 1.63 (CH₃-27), 3.2 (H-3, m, W_{1/2} = 12 Hz), 4.6–4.7 (2H-26, m).

References

1. A.S.R. Anjaneyulu, D.S.K. Reddy, *Indian J. Chem.* **20B**, 1033–1036 (1981)

Isocycloartenol (β -Cycloosterol)

C₃₀H₅₀O, M 426



Taxonomy: Cycloartane Triterpenoids

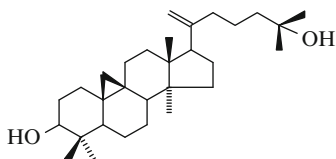
Artocarpus chaplasha Roxb. (*Moraceae*) [1].
 Rice bran oil *Oryza sativa* L. (*Oryzaceae*) [2].
 Mp 92–94°C (from MeOH–CHCl₃, 4:1), $[\alpha]_D^{25}$
 +44.9°.
 CAS Registry Number: 1768-79-2.
 IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3045.

References

1. S.B. Mahato, S.K. Banerjee, R.N. Chakravarti, *Phytochemistry* **10**, 1351–1354 (1971)
2. S. Yoshida, R. Takasaki, H. Sueyoshi, *J. Pharm. Soc. Japan* **76**, 1333–1336 (1956). *C.A.*, 51: 3650e (1957)

Cycloart-20-en-3 β ,25-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Amberboa ramosa Jafri (*Compositae*) [1].

Mp 169–170°C (from hexane–CHCl₃), $[\alpha]_D^{25}$ –18° (c 0.03, CHCl₃).

CAS Registry Number: 146539-98-2.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3580, 3440, 3045, 1380, 1640, 890.

HRMS m/z (%): [M]⁺ 442.3866 (C₃₀H₅₀O₂) (30),
 [M–H₂O]⁺ 424.3728 (C₃₀H₄₈O) (45),
 [M–H₂O–Me]⁺ 409.3481 (C₂₉H₄₅O) (36),
 [M–2H₂O]⁺ 409.3481 (C₂₉H₄₅O) (36), [M–2H₂O]⁺
 406.3666 (C₃₀H₄₆) (12), [M–2H₂O–Me]⁺ 391.3311
 (C₂₉H₄₃) (10), [M–H₂O–C₃H₇]⁺ 381.3129 (C₂₇H₄₁)
 (6), [M–H₂O–C₅H₉]⁺ 355.3062 (C₂₅H₃₉O) (1),
 [M–C₈H₁₅O]⁺ 315.2701 (C₂₂H₃₅O) (17),
 [M–C₉H₁₆O]⁺ 302.2650 (C₂₁H₃₄O) (40),
 [M–C₈H₁₅O–H₂O]⁺ 297.2573 (C₂₂H₃₃) (11),
 [M–C₉H₁₆O–H₂O]⁺ 284.2524 C₂₁H₃₂) (13),
 [M–C₉H₁₆O–C₈H₁₅O]⁺ 175.1483 (C₁₃H₁₉) (55).

¹H NMR (500 MHz, CDCl₃, δ , 0-TMS): 0.30 and 0.50
 (2H-19, d, J = 4.5 Hz), 0.86 (CH₃-29, s), 0.88
 (CH₃-28, s), 0.96 (CH₃-18, s), 0.98 (CH₃-30, s),

1.31 (CH₃-26, s), 1.33 (CH₃-27, s), 2.14 (2H-22,
 m), 3.20 (H-3, dd, J = 9.9, 4.5 Hz), 4.60 and 4.70
 (2H-21, brs).

Table 1

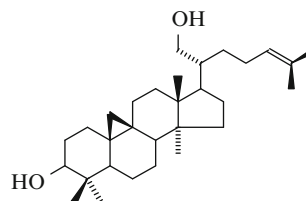
δ_c (CDCl ₃)									
C-1	31.87	C-7	28.12	C-13	45.51	C-19	29.90	C-25	70.97
2	30.26	8	47.92	14	48.47	20	156.49	26	29.39
3	76.82	9	20.32	15	33.03	21	106.69	27	29.46
4	40.36	10	26.17	16	26.50	22	33.04	28	19.30
5	47.11	11	26.02	17	51.97	23	34.29	29	25.31
6	21.09	12	35.66	18	18.23	24	39.19	30	14.89

References

1. N. Akhtar, A. Malik, N. Afza, Y. Badar, *J. Nat. Prod.* **56**(2), 295–299 (1993)

5 α -Cycloart-24-en-3 β ,21-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 130°C (from CHCl₃), $[\alpha]_D^{21}$ +41° (c 0.96, CHCl₃).

CAS Registry Number: 125292-57-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3628.

EIMS m/z (%): M⁺ 442.3812 (7), 424 (17), 409 (?),
 381 (5), 302 (23), 175 (26), 109 (10), 95 (80), 69
 (97).

¹H NMR (CDCl₃, δ): 0.34 and 0.56 (2H-19, d, J =
 4.2 Hz), 0.80 (H-6 β , qd, J = 12.5, 2.5 Hz) 0.81
 (CH₃, s), 0.91 (CH₃, s), 0.97 (CH₃, s), 0.99 (CH₃,
 s), 1.61 (CH₃, brs), 1.69 (CH₃, brs), 3.29 (H-3, m),
 3.62 (H-21_B, dd, J = 11, 5 Hz), 3.73 (H-21_A, dd, J =
 11, 3 Hz), 5.12 (H-24, tq, J = 7, 1.2, 1.2 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	32.1	C-7	26.0	C-13	45.5	C-19	29.8	C-25	131.3
2	30.5	8	47.8	14	49.0	20	42.7	26	17.7
3	78.9	9	20.2	15	35.6	21	63.1	27	25.5 ^b
4	40.6	10	26.5 ^a	16	27.5	22	30.1	28	19.5
5	47.3	11	26.7 ^a	17	46.6	23	25.3 ^b	29	25.5 ^b
6	21.1	12	32.3	18	18.1	24	125.1	30	14.0

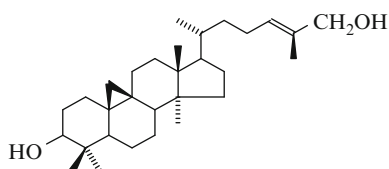
^{a,b}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

Cycloart-24-ene-3 β ,26-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 154–155°C (from C₆H₆), [α]_D³⁰ +51° (c 1, CHCl₃).

CAS Registry Number: 64396-81-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 3042.

MS m/z (%): M⁺ 442 (19), 427 (16), 424 (45), 410 (16), 409 (50), 391 (8), 381 (18), 355 (13), 315 (7), 302 (23), 297 (11), 287 (4), 284 (15), 203 (27), 175 (23), 173 (23), 161 (31), 148 (45), 135 (48), 133 (43), 121 (53), 109 (70), 107 (73), 95 (100).

¹H NMR (CDCl₃, δ , 0-TMS) : 0.32 and 0.53 (2H-19, d, J = 4 Hz), 0.80, 0.95, 0.95, 1.65, (4 × CH₃, s), 3.23 (H-3, m), 3.96 (2H-26, brs), 5.33 (H-24, t, J = 7 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	32.0	C-7	28.2	C-13	45.4	C-19	29.9	C-25	134.4
2	30.4	8	48.0	14	48.8	20	36.0	26	69.0
3	78.8	9	20.0	15	33.0	21	18.3	27	13.7

(continued)

Table 1 (continued)

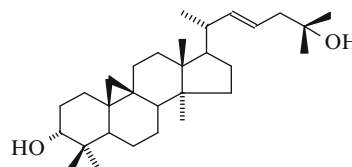
δ_C (CDCl ₃)									
4	40.5	10	26.1	16	26.5	22	36.0	28	19.4
5	47.2	11	26.1	17	52.3	23	25.1	29	25.1
6	21.1	12	35.6	18	18.1	24	127.0	30	14.0

References

1. V. Anjaneyulu, P.K. Harischandra, K. Ravi, J.D. Connolly, *Phytochemistry* **24**(10), 2359–2367 (1985)

Cycloart-22-ene-3 α ,25-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Pentstemon spiralis Decne (*Asclepiadaceae*) [1].

Mp 188°C (from Me₂CO-MeOH, 1: 1), [α]_D +38.5° (c 0.198, CHCl₃)

CAS Registry Number: 135432-70-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3590, 3440, 3045.

HRMS m/z (%): [M]⁺ 442.3870 (C₃₀H₅₀O₂) (31),

[M-H₂O]⁺ 424.3714 (C₃₀H₄₈O) (55),

[M-H₂O-Me]⁺ 409.3500 (C₂₉H₄₅O) (48),

[M-2H₂O]⁺ 406.3615 (C₃₀H₄₆) (18),

[M-2H₂O-Me]⁺ 391.3387 (C₂₉H₄₃) (18),

[M-C₃H₉O]⁺ 381.3168 (C₂₇H₄₁O) (14),

[M-C₃H₉O-H₂O]⁺ 363.3071, (C₂₇H₃₉) (6),

[M-H₂O-C₅H₉]⁺ 355.300 (C₂₅H₄₁O) (14),

[M-C₆H₁₂O]⁺ 342.2957 (C₂₄H₃₈O) (10),

[M-C₈H₁₅O]⁺ 315.2702 (C₂₂H₃₅O) (11),

[M-C₈H₁₇O]⁺ 313.2564 (C₂₂H₃₃O) (10),

[M-C₉H₁₆O]⁺ 302.2650 (C₂₁H₃₄O) (38),

[M-C₈H₁₇O-H₂O]⁺ 295.2425 (C₂₂H₃₁) (12),

[M-C₉H₁₆O-H₂O]⁺ 284.2525 (C₂₁H₃₂) (11),

[M-C₉H₁₆O-H₂O-Me]⁺ 269.2275 (C₂₀H₂₉) (9),

[M-C₉H₁₆O-C₈H₁₇O]⁺ 175.1489 (C₁₃H₁₉) (31).

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS) : 0.30 and 0.50 (2H-19, d, J = 4.5 Hz), 0.84 (CH₃-21, d,

$J = 6.4$ Hz), 0.86 (CH₃-30, s), 0.88 (CH₃-28, s), 0.96 (CH₃-18, s), 0.97 (CH₃-29, s), 1.30 (CH₃-26, s), 1.31 (CH₃-27, s), 3.34 (H-3, t, $J = 2.6$ Hz), 5.59 (H-23, dt, $J = 6.5, 14.8$ Hz), 5.60 (H-22, dd, $J = 7.1, 15.1$ Hz).

Table 1

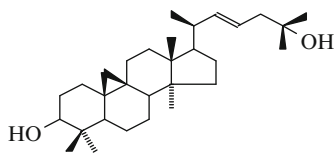
δ_c (CDCl ₃)									
C-1	26.46	C-7	27.41	C-13	45.34	C-19	29.88	C-25	70.77
2	28.09	8	47.98	14	48.86	20	37.41	26	29.88
3	76.88	9	20.01	15	32.81	21	18.29	27	29.99
4	40.51	10	26.13	16	31.98	22	125.67	28	19.30
5	47.13	11	26.01	17	52.04	23	139.44	29	25.45
6	21.12	12	35.60	18	18.08	24	39.06	30	19.00

References

1. N. Rasool, A.Q. Khan, V.U. Ahmad, A. Malik, *J. Nat. Prod.* **54**(3), 889–892 (1991)

Cycloart-23-ene-3 β ,25-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (*Bromeliaceae*) [1, 2].

Mp 200–204°C (from EtOAc), $[\alpha]_D^{27} +38^\circ$ (c 0.85, CHCl₃).

CAS Registry Number: 14599-48-5.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600.

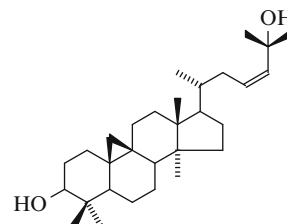
UV $\lambda_{\max}^{\text{EtOH}}$, nm (ϵ): 200 (3300), 210 (330).

References

1. R. McCrindle, C. Djerassi, *Chem. Indust.* 1311–1312 (1961)
2. C. Djerassi, R. McCrindle, *J. Chem. Soc.* 4034–4039 (1962)

Cycloart-23Z-ene-3 β ,25-diol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Juncus effusus (*Juncaceae*) [1].

$[\alpha]_D +45^\circ$ (c 0.12).

CAS Registry Number: 149252-09-5.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3480, 1470, 1380.

MS m/z (%): M⁺ 442 (30), [M-H₂O]⁺ 424 (50), [M-H₂O-Me]⁺ 409 (32), [M-2H₂O]⁺ 406 (15), [M-2H₂O-Me]⁺ 391 (20).

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.34 and 0.56 (2H-19, d, $J = 4.2$ Hz), 0.82, 0.89, 0.98, 0.98, 1.33, 1.33 (6 × CH₃, s), 0.87 (CH-21, d, $J = 6.4$ Hz), 3.29 (H-3, m), 5.59 (H-23 and H-24, m).

Table 1

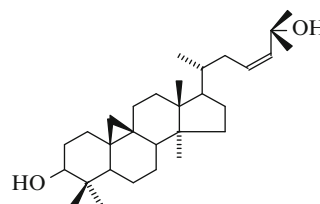
δ_c (CDCl ₃)									
C-1	32.0	C-7	28.1	C-13	45.3	C-19	30.0	C-25	70.8
2	30.4	8	48.0	14	48.8	20	36.4	26	29.9
3	78.8	9	20.0	15	32.8	21	18.3	27	29.9
4	40.5	10	26.0	16	26.4	22	39.0	28	19.3
5	47.1	11	26.1	17	52.0	23	139.3	29	25.4
6	21.1	12	35.6	18	18.1	24	125.6	30	14.0

References

1. M.D. Greca, A. Fiorentino, P. Monaco, L. Previtera, *Phytochemistry* **35**(4), 1017–1022 (1994)

Sterculin A

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Pterospermum lanceaefolium Roxb. (*Sterculiaceae*) [1].
Mp 196–197°C, $[\alpha]_D^{25} +15.2^\circ$ (c 0.023, MeOH).

CAS Registry Number: 149252-09-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3360, 2940, 1590, 1450, 1390, 1050, 980.

EIMS m/z (%): M^+ 442 (34), 424 (67), 409 (71), 391 (23), 327 (18), 313 (21), 302 (30), 269 (14), 255 (21), 215 (16), 203 (43), 187 (31), 175 (32), 161 (31), 147 (46), 135 (48), 121 (61), 109 (100), 95 (80), 81 (69), 69 (66), 55 (72).

Table 1

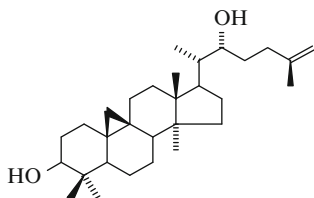
δ_c (CDCl ₃)									
C-1	31.95	C-7	28.06	C-13	45.31	C-19	29.87	C-25	70.73
2	30.38	8	47.94	14	48.82	20	36.38	26	29.87
3	78.83	9	19.99	15	32.79	21	18.27	27	29.97
4	40.47	10	26.10	16	26.44	22	39.03	28	19.28
5	47.09	11	25.99	17	52.00	23	125.60	29	25.43
6	21.09	12	35.57	18	18.06	24	139.35	30	13.98

References

1. Y.-Z. Zhong, J.-Y. Su, L.-M. Zeng, G.-Z. Tu, L.-B. Ma, S.-L. Hong, *Chem. J. Chin. Univ.* **14**(2), 214–216 (1993)

(22R)-Cycloart-25-ene-3 β ,22-diol

C₃₀H₅₀O₂, M 442

**Taxonomy:** Cycloartane Triterpenoids

Amberboa ramosa Jafri (*Compositae*) [1].

Mp 180–181°C (from CHCl₃–MeOH), $[\alpha]_D^{20} +20.6^\circ$ (c 0.87, CHCl₃).

CAS Registry Number: 146539-97-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3600–3450, 3045, 1650, 1380, 890.

HRMS m/z (%): $[M]^+$ 442.3824 (C₃₀H₅₀O₂) (33), $[M-H_2O]^+$ 424.3706 (C₃₀H₄₈O) (46),

$[M-H_2O-Me]^+$ 409.3484 (C₂₉H₄₅O) (38), $[M-2H_2O]^+$ 391.3325 (C₂₉H₄₃) (12), $[M-C_4H_8]^+$ 386.3199 (C₂₆H₄₂O₂) (1), $[M-H_2O-C_3H_7]^+$ 381.3155 (C₂₇H₄₁O) (8), $[M-H_2O-C_5H_9]^+$ 355.3004 (C₂₅H₃₉O) (14), $[M-C_8H_{15}O]^+$ 315.2682 (C₂₂H₃₅O) (13), $[M-C_8H_{17}O]^+$ 313.2654 (C₂₂H₃₃O) (10), $[M-C_9H_{16}O]^+$ 302.2621 (C₂₁H₃₄O) (42), $[M-C_8H_{15}O-H_2O]^+$ 297.2562 (C₂₂H₃₃) (11), $[M-C_9H_{16}O-H_2O]^+$ 284.2528 (C₂₁H₃₂) (15), $[M-C_9H_{16}O-C_8H_{15}O]^+$ 175.1465 (C₁₃H₁₉) (58).

¹H NMR (500 MHz, CDCl₃, δ , 0-TMS): 0.31 and 0.54 (2H-19, d, J = 4.2 Hz), 0.80 (CH₃-29, s), 0.87 (CH₃-21, d, J = 6.4 Hz), 0.88 (CH₃-28, s), 0.95 (CH₃-18, s), 0.96 (CH₃-30, s), 1.43 (H-20, qd, J = 6.4, 1 Hz), 1.60 (CH₃-27, s), 3.20 (H-3, dd, J = 9.8, 4.4 Hz), 4.06 (H-22, ddd, J = 6.6, 6.2, 1 Hz), 4.49 and 4.80 (2H-26, brs).

Table 1

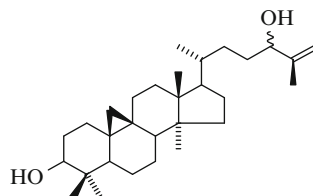
δ_c (CDCl ₃)									
C-1	31.66	C-7	28.12	C-13	45.29	C-19	29.89	C-25	149.70
2	30.45	8	47.99	14	48.80	20	36.01	26	111.30
3	78.89	9	20.41	15	32.02	21	18.37	27	17.27
4	40.48	10	26.15	16	26.55	22	76.78	28	19.36
5	47.19	11	26.04	17	52.26	23	28.12	29	25.48
6	21.14	12	35.61	18	18.03	24	32.98	30	14.02

References

1. N. Akhtar, A. Malik, N. Afza, Y. Badar, *J. Nat. Prod.* **56**(2), 295–299 (1993)

Cycloart-25-ene-3 β ,24 ξ -diol

C₃₀H₅₀O₂, M 442

**Taxonomy:** Cycloartane Triterpenoids

Tillandsia usneoides L. (*Bromeliaceae*) [1].

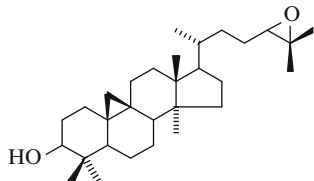
Mp 184–188°C (from EtOAc), $[\alpha]_D^{35} +48^\circ$ (c 1.0, CHCl₃).
CAS Registry Number: 10388-48-4.

References

1. C. Djerassi, R. McCrindle. *J. Chem. Soc.* 4034–4039 (1962)

(24R)-24,25-Epoxy cycloartanol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Borrchia frutescens (L.) DC (*Asteraceae*) [1].

Euphorbia broteri (*Euphorbiaceae*) [2].

Mp 101–103°C.

CAS Registry Number: 155551-21-6.

CD (c 0.0005, MeOH) nm (ε): 201 (−0.06), 222 (+19.1), 224 (−0.01), 307 (−2.9), 396 (−0.03).

IR ν_{\max}^{KBr} , cm^{−1}: 3387.

EIMS m/z (%): [M−H₂O]⁺ 424 (8), 410 (10), 409 (18), 315 (9), 311 (20), 297 (47), 260 (10), 258 (17), 241 (14), 227 (14), 203 (48), 109 (64), 107 (100), 91 (79), 81 (91), 79 (78), 69 (69), 55 (98.6), 43 (99).

FAB MS m/z: [M]⁺ 442.6, [M−H]⁺ 441.7, [M−OH]⁺ 425.5, [M−Me−H₂O]⁺ 409.7.

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	C-16	26.4
2	30.4	17	52.1
3	78.8	18	18.0 0.80 s
4	40.5	19	29.9 0.33 d (4.3), 0.55 d (4.1)
5	48.0	20	35.8
6	21.1	21	18.3 0.88 d (6.2)

(continued)

Table 1 (continued)

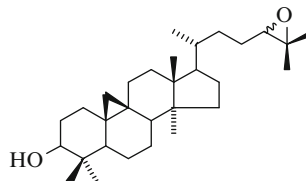
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
7	28.2	22	32.9
8	47.1	23	25.6
9	20.0	24	64.8 2.69 dd (6.1)
10	26.0	25	58.4
11	26.1	26	18.7 1.26 s
12	35.5	27	24.9 1.30 s
13	45.3	28	19.3 0.89 s
14	48.8	29	25.4 0.96 s
15	32.9	30	14.0 0.96 s

References

1. C.L. Cantrell, T. Lu, F.R. Fronczek, N.H. Fischer, L.B. Adams, S.G. Francblau, *J. Nat. Prod.* **59**(12), 1131–1136 (1996)
2. J.P. Teresa, J.G. Urones, I.S. Marcos, P. Basabe, M.J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)

24RS,25-Epoxy cycloartanol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Euphorbia broteri (*Euphorbiaceae*) [1].

$[\alpha]_D^{25} +28.5^\circ$ (c 1, CHCl₃).

CAS Registry Number: 26955-76-0.

IR ν_{\max}^{KBr} , cm^{−1}: 3420, 2920, 2860, 1470, 1450, 1380, 1100, 1030.

MS m/z (%): M⁺ 442 (4), 424 (5), 409 (3.5), 315 (1.5), 297 (1.5), 241 (2), 203 (6), 256 (6), 187 (8), 175 (12), 121 (18), 107 (25), 57 (100), 43 (99).

¹H NMR (CDCl₃, δ , 0-TMS): 0.34 and 0.56 (2H-19, d, J = 4.1 Hz), 0.81, 0.89, 0.97, 0.97, 1.27, 1.31 (6 × CH₃, s), 0.88 (CH₃-21, d, J = 6.1 Hz), 2.70 (H-24, dd, J = 6.6, 5.6 Hz), 3.28 (H-3, m, ΣJ = 14.6 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	32.04	C-7	28.18	C-13	45.41	C-19	29.88	C-25	58.07
2	30.46	8	47.93	14	48.90	20	36.02, 35.88	26	18.69
3	78.90	9	20.08	15	32.92	21	18.30, 18.34	27	24.95
4	40.55	10	26.03	16	26.56	22	33.01	28	19.36
5	47.21	11	26.03	17	52.36, 52.21	23	26.03	29	25.48
6	21.15	12	35.62	18	18.04	24	64.96, 64.70	30	14.02

References

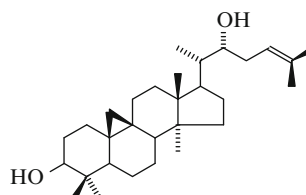
- J.P. Teresa, J.G. Urones, I.S. Marcos, P. Basabe, M.J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)

References

- F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

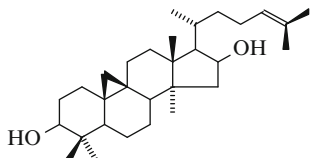
22R-Hydroxycycloartenol

C₃₀H₅₀O₂, M 442



16S-Hydroxycycloartenol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids
Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 92°C, $[\alpha]_D^{+21}$ (c 0.21, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3620.

MS m/z (%): M + 442.381 (44), 427 (100), 424 (60), 409 (25), 232 (24).

Table 1

δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
H-3	3.27 dd (11, 4)	H-21	0.96 d (7)
15 α	1.42 dd (13, 4)	23	2.10 m
15 β	2.01 dd (13, 8)	23'	1.97 m
16	4.41 ddd (8, 8, 4)	24	5.13 brt (7)
17	1.63 dd (11, 8)	26	1.72 brs
18	1.13 s	27	1.63 brs
19 α	0.55 d (4)	28	0.94 s
19 β	0.33 d (4)	29	0.89 s
20	1.76 m	30	0.78 s

Taxonomy: Cycloartane Triterpenoids
Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].

Mp 164°C, $[\alpha]_D^{+41}$ (c 0.48, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3620.

MS m/z (%): M⁺ 442.381 (24), 427 (11), 424 (22), 409 (22), 372 (8), 354 (18), 232 (66), 109 (68), 95 (78), 70 (78), 69 (100).

Table 1

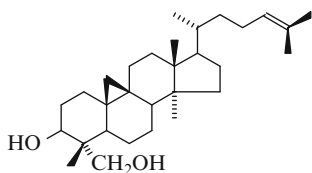
δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
H-3	3.27 dd (11, 4)	H-23'	2.0 m
18	0.94 s	24	5.13 brt (7)
19 α	0.55 d (4)	26	1.72 brs
19 β	0.33 d (4)	27	1.63 brs
21	0.85 d (7)	28	0.94 s
22	3.67 ddd (8, 5, ?)	29	0.89 s
23	2.28 ddd (14, 8, 7)	30	0.78 s

References

- F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

29-Hydroxycycloartenol*

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Garcinia lucida (Clusiaceae) [1].

Mp 182–183°C (from Me₂CO).

CAS Registry Number: 127615-66-1.

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3640, 3620, 2980, 2860.

¹HNMR (200 MHz, CDCl₃, δ): 0.38 and 0.58 (2H-19, d, J = 4 Hz), 1.59 and 1.67 (CH₃-26 and CH₃-27, d, J = 1.5 Hz), 3.70 (H-3, m), 3.50 and 3.75 (2H-29, d, J = 10.5 Hz), 5.09 (H-24, t septets, J = 7, 1.5 Hz).

Table 1

δ_{C} (CDCl ₃)									
C-1	31.7	C-7	28.1	C-13	45.2	C-19	29.8	C-25	138.8
2	30.0	8	47.9	14	48.7	20	35.8	26	25.7
3	76.6	9	19.8	15	32.8	21	18.2	27	18.0
4	43.6	10	25.3	16	26.3	22	36.4	28	19.2
5	42.3	11	24.9	17	52.2	23	25.7	29	70.5
6	20.9	12	35.5	18	17.6	24	125.2	30	10.2

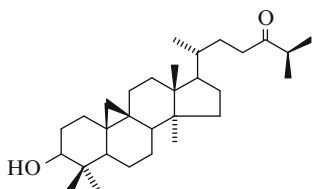
*The name was corrected by us

References

1. A.M. Nyemba, T.N. Mpondo, J.D. Connolly, D.S. Ricroft, *Phytochemistry* **29**(3), 994–997 (1990)

Lagerenol

C₃₀H₅₀O₂, M 442



Taxonomy: Cycloartane Triterpenoids

Lagerstoeimia laucosteri (Lythraceae) [1].

Mp 92°C (from CHCl₃-MeOH), $[\alpha]_{\text{D}}^{30}$ +44.6° (c 0.094, CHCl₃).

CAS Registry Number: 89786-70-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3340, 2930, 1455, 1378, 1362, 1030.

MS m/z (%): M⁺ 442 (30.1), 424 (100), 409 (45.9), 355 (19), 302 (49.6), 222 (11.8), 203 (33), 175 (50.9), 127 (33.6), 122 (16.1), 121 (43.3), 107 (47.8), 95 (61.4), 71 (56.1), 43 (100).

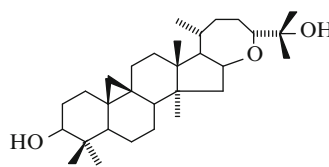
¹H NMR (CDCl₃, δ): 0.35 and 0.59 (2H-19, d, J = 4.5 Hz), 0.82, 0.90, 0.97 (5 × CH₃, s), 1.12 (CH₃-26 and CH₃-27, d, J = 7 Hz), 2.41 (2H-23, t, J = 4.8 Hz), 2.54 (H-25, septet, J = 7 Hz), 3.30 (H-3, dd, J = 10 and 5 Hz).

References

1. B. Talapatra, P.K. Chaudhuri, A.K. Mallik, S.K. Talapatra, *Phytochemistry* **22**(11), 2559–2562 (1983)

Argentatine D

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Parthenium argentatum Gray (Compositae) [1, 2].

Mp 224–227°C, $[\alpha]_{\text{D}} -22.2^\circ$ (c 0.09, CHCl₃).

CAS Registry Number: 129372-83-4.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600, 3510, 2973.

EIMS m/z (%): M⁺ 458 (9), 440 (6), 85 (64.2), 59 (100), 43 (70.7).

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.33 and 0.60 (2H-19, d, J = 5 Hz), 0.81, 0.89, 0.98, 1.09, 1.09, 1.14 (6 × CH₃, s), 0.91 (CH₃-21, d, J = 7 Hz), 3.28 (H-3, dd, J = 10, 6 Hz), 3.59 (H-24, brd, J = 11 Hz), 4.58 (H-16, q, J = 7 Hz).

Table 1

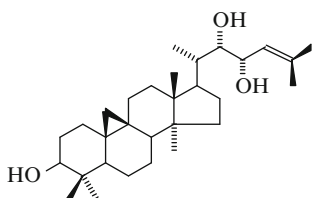
δ_C (CDCl ₃)	
C-1	32.1
2	30.5
3	79.1
4	40.6
5	47.5
6	21.1

References

1. A. Romo de Vivar, M. Martinez-Varquez, C. Matsubara, G. Perez-Sanchez, P. Joseph-Nathan, *Phytochemistry* **29**(3), 915–918 (1990)
2. R.A. Komoroski, E.C. Gregg, J.P. Shockcor, J.M. Geckle, *Magn. Res. Chem.* **24**, 534–543 (1986)

Argenteanol D

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Aglaiia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D^{20} + 24^\circ$ (c 1, CHCl₃).

CAS Registry Number: 186090-67-5.

FABMS m/z : 481 [M + Na]⁺.

HRFAB MS m/z: 481.3671 (C₃₀H₅₀NaO₃).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.3	C-16	28.1
2	30.4	17	41.3
3	79.1	18	17.8
4	40.8	19	30.1
5	47.4	20	48.7
6	21.4	21	13.6
7	26.3	22	76.5
8	48.1	23	68.8

(continued)

Table 1 (continued)

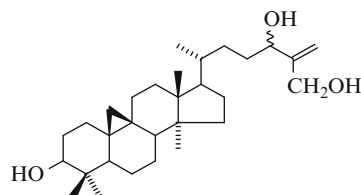
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
9	20.2	24	125.2
10	26.3	25	136.3
11	26.7	26	25.2
12	33.2	27	18.8
13	45.9	28	19.4
14	48.8	29	25.7
15	36.0	30	14.3

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

24RS-Cycloart-25-ene-3 β ,24,27-triol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

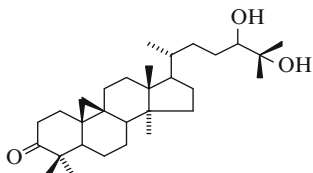
Magnifera indica L. (*Anacardiaceae*) [1].

Mp 190–192°C (from C₆H₆-hexane), $[\alpha]_D^{30} + 18.8^\circ$ (c 1.2, CHCl₃).

¹H NMR (CDCl₃, δ , 0-TMS): 0.30 and 0.55 (2H-19, d, J = 4 Hz), 0.79, 0.87, 0.87, 0.93, 0.93 (5 × CH₃, s), 1.78 (1H, s), 3.25 (H-3, m), 4.25 (3H, m), 5.12 (2H, m).

References

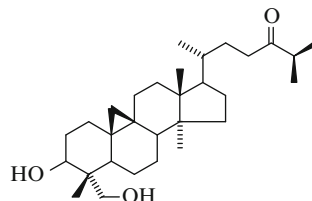
1. V. Anjaneyulu, K. Harischandra Prasad, K. Ravi, J.D. Connolly, *Phytochemistry* **24**(10), 2359–2367 (1985)

(24R)-Cycloartane-24,25-diol-3-oneC₃₀H₅₀O₃, M 458**Taxonomy:** Cycloartane Triterpenoids*Aglaia harmsiana* Perkins (*Meliaceae*) [1].Mp 150–152°C (from EtOH-hexane), $[\alpha]_D^{20} +13.1^\circ$ (c 1.09, CHCl₃).IR ν_{\max}^{KBr} , cm⁻¹: 3470, 2920, 1685, 1460, 1370, 1275, 1120, 1065.HREIMS m/z (%): M⁺ 458.3750 (C₃₀H₅₀O₃) (12), 440 (23), 422 (23), 313 (86), 175 (50), 95 (100).¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.57 and 0.80 (2H-19, d, J = 4 Hz), 0.90 (CH₃-21, d, J = 6.4 Hz), 0.91, 1.00, 1.05, 1.10, 1.17, 1.22 (6 × CH₃, s), 3.30 (H-24, dd, J = 10.1, 2.1 Hz).**Table 1**

δ_C (CDCl ₃)									
C-1	33.6	C-7	28.1	C-13	45.4	C-19	29.6	C-25	73.2
2	37.5	8	47.9	14	48.8	20	36.4	26	23.3
3	216.6	9	21.1	15	32.8	21	18.5	27	26.6
4	50.3	10	26.0	16	26.8	22	33.4	28	19.3
5	48.5	11	25.9	17	52.4	23	28.8	29	22.2
6	21.5	12	35.6	18	18.1	24	79.6	30	20.8

References

1. A. Inada, H. Murayta, Y. Inatomi, T. Nakanishi, D. Darnaedi, *J. Nat. Prod.* **58**(7), 1143–1146 (1995)

Cycloartane-3 β ,29-diol-24-oneC₃₀H₅₀O₃, M 458**Taxonomy:** Cycloartane Triterpenoids*Aglaia harmsiana* Perkins (*Meliaceae*) [1].Mp 137–139°C (from EtOH-hexane), $[\alpha]_D^{20} +46.2^\circ$ (c 0.5, CHCl₃).

CAS Registry Number: 186090-67-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3350, 2900, 1700, 1450, 1370, 1100, 1030.HREIMS m/z: M⁺ 458.3768 (C₃₀H₅₀O₃) (4), 440 (15), 422 (76), 407 (43), 331 (4), 313 (12), 302.2601 (C₂₁H₃₄O) (27), 201 (51), 127.1115 (C₈H₁₅O) (62), 95 (69), 71.0506 (C₄H₇O) (100).¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.38 and 0.59 (2H-19, d, J = 4.2 Hz), 0.86 (CH₃-21, d, J = 6.6 Hz), 0.89, 0.94, 0.96, (3 × CH₃, s), 1.09 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 2.61 (H-25, septet, J = 6.8 Hz), 3.52 and 3.73 (2H-29, d, J = 10.7 Hz), 3.75 (H-3, dd, J = 10.5, 4.5 Hz).**Table 1**

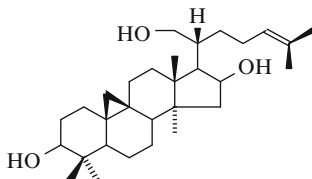
δ_C (CDCl ₃)									
C-1	31.7	C-7	28.1	C-13	45.3	C-19	30.0	C-25	40.9
2	30.2	8	47.9	14	48.8	20	35.8	26	18.3
3	77.0	9	19.9	15	32.9	21	18.4	27	18.1
4	43.7	10	25.7	16	26.4	22	32.9	28	19.3
5	42.5	11	25.4	17	52.3	23	37.6	29	71.1
6	21.0	12	35.6	18	18.0	24	215.5	30	10.1

References

1. A. Inada, H. Murayta, Y. Inatomi, T. Nakanishi, D. Darnaedi, *J. Nat. Prod.* **58**(7), 1143–1146 (1995)

5 α -Cycloart-24-ene-3 β ,16 β ,21-triol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Piptostigma fugax (Annonaceae) [1].

Mp 117–173°C, [α]_D +53° (c 0.35, CHCl₃).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3400.

MS m/z (%): M⁺ 458 (3), 443 (22), 440 (8), 425 (10), 315 (16), 313 (10), 303 (11), 292 (22), 203 (16), 201 (17), 189 (15), 187 (33), 175 (32), 173 (25), 161 (28), 159 (28), 149 (20), 147 (32), 145 (28), 135 (29), 133 (38), 131 (20), 123 (26), 121 (42), 119 (39), 109 (95), 108 (68), 107 (58), 105 (45), 95 (71), 93 (51), 91 (36), 82 (39), 81 (50), 78 (37), 69 (100), 67 (45), 55 (73), 43 (78).

¹H NMR (360 MHz, CDCl₃, δ , 0-TMS): 0.34 and 0.60 (2H-19, d, J = 4.5 Hz), 0.81, 0.89, 0.97, 1.17, 1.63, 1.70, (6 \times CH₃, s), 1.38 (H-15 α , dd, J = 13.5, 5 Hz), 1.84 (H-20, m), 1.98 (H-17, dd, J = 11.5, 7 Hz), 2.04 (H-15 β , dd, J = 13.5, 8 Hz), 3.29 (H-3, dd, J = 11, 4.5 Hz), 3.76 (H-21_A, dd, J = 11.5, 4 Hz), 3.84 (H-21_B, dd, J = 11.5, 3 Hz), 4.40 (H-16, ddd, J = 8, 7, 5 Hz), 5.20 (H-24, brt, J = 6.5 Hz).

Table 1

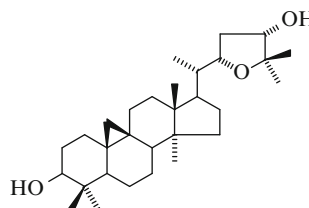
δ_{C} (CDCl ₃)										
C-1	31.8	C-7	26.0	C-13	45.1	C-19	29.8	C-25	132.5	
2	30.3	8	47.9	14	47.0	20	36.5	26	17.7	
3	78.7	9	20.1	15	47.8	21	61.8	27	25.4	
4	40.5	10	26.1	16	72.9	22	30.1	28	19.0	
5	47.0	11	26.3	17	50.9	23	25.2	29	25.7	
6	20.9	12	31.9	18	19.7	24	124.6	30	14.0	

Reference

- H. Achenbach, A. Schwinn, *Phytochemistry* **38**(4), 1037–1048 (1995)

Cyclokirilodiol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Trichosanthes kirilowii Maxim. (Cucurbitaceae) [1].

Mp 220–224°C (from acetone-MeOH).

CAS Registry Number: 188725-44-2.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3419, 3040, 2931, 1451, 1379, 1100, 1049.

MS m/z (%): M⁺ 458 (3), 443 (2), 440 (7), 425 (3), 398 (1), 325 (1), 318 (7), 315 (2), 297 (1), 260 (1), 255 (1), 229 (2), 203 (2), 175 (4), 142 (17), 115 (100), 97 (8), 71 (95).

HREIMS m/z : 458.3775 (M)⁺, 443.3556 (C₂₉H₄₇O₃), 440.3643 (C₃₀H₄₈O₂), 425.3426 (C₂₉H₄₅O₂), 115.0759 (C₆H₁₁O₂), 71.0497 (C₄H₇O).

Table 1

	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	32.0	1.58 (α), 1.25 (β)	C-17	49.1 1.95
2	30.4	1.76 (α), 1.57 (β)	18	17.9 0.96 s
3	78.8	3.29 dd (11, 4.4)	19	29.9 0.34 d (4), 0.55 d (4)
4	40.5	–	20	39.3 1.45
5	47.1	1.30 dd (12.6, 3.7)	21	12.2 0.92 d (7.3)
6	21.1	1.60 (α), 0.79 dq (12.5, 2.6) (β)	22	76.7 4.01 ddd (1.8, 8.1, 8.1)

(continued)

Table 1 (continued)

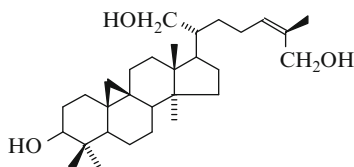
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
7	26.1 1.08(α), 1.33 (β)	23	38.7 1.67 ddd (4.8, 8.1, 13.6),
8	48.1 1.50 dd (12.6, 4.5)		2.25 ddd (7, 8.1, 13.6)
9	20.0 –	24	78.2 3.91 dd (7, 4.8)
10	26.1 –	25	81.7 –
11	26.5 2.02 (α), 1.13 (β)	26	25.0 1.15 s
12	32.8 1.70 (α), 1.61 (β)	27	22.4 1.21 s
13	45.4 –	28	19.6 0.93 s
14	48.7 –	29	25.4 0.97 s
15	35.7 1.31 (2H)	30	14.0 0.81 s
16	27.8 1.98 (α), 1.34 (β)		

References

1. Y. Kimura, T. Akihisa, K. Yasukawa, S. Takase, T. Tamura, Y. Ida, Chem. Pharm. Bull. **45**(2), 415–417 (1997)

Genin of Quadranguloside

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Passiflora quadrangularis L. (*Passifloraceae*) [1].

Mp 170°C (from hexane-EtOAc), $[\alpha]_D^{25} +43^\circ$ (c 1.02, MeOH).

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.31 and 0.54 (2H-19, d, J = 4.4 Hz), 0.78, 0.88, 0.94, 0.96, 1.77 (5 × CH₃, s), 3.25 (H-3, dd, J = 10.6, 4.4 Hz), 3.56 (H-21_B, dd, J = 11, 5.1 Hz), 3.72 (H-21_A, dd, J = 11, 3.3 Hz), 4.08 (H-26_B, d, J = 11.8 Hz), 4.11 (H-26_A, d, J = 11.8 Hz), 5.31 (H-24, t, J = 6.6 Hz).

Table 1

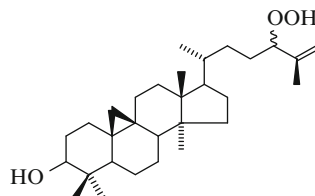
δ_C (CDCl ₃)									
C-1	32.3	C-7	27.7	C-13	45.5	C-19	29.9	C-25	135.8
2	31.2	8	48.1	14	49.0	20	46.7	26	60.8
3	77.9	9	20.0	15	32.3	21	61.9	27	21.8
4	41.0	10	26.3	16	26.7	22	30.9	28	19.7
5	47.4	11	26.6	17	43.1	23	24.9	29	26.1
6	21.4	12	35.8	18	18.6	24	127.6	30	14.8

References

1. F. Orsini, F. Pelizzoni, L. Verotta, Phytochemistry **25**(1), 191–193 (1986)

3 β -Hydroxycycloart-25-ene-24-hydroperoxide

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Euphorbia cyparissias L. (*Euphorbiaceae*) [1].

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3400, 3050, 2960, 2880, 1660, 1465, 1380, 900.

CIMS m/z (%): [M + 1]⁺ 459 (10), M⁺ 458 (20), 441 (100), 425 (69), 424 (30), 407 (25), 355 (16), 315 (13), 297 (11), 205 (12), 203 (24), 175 (18), 109 (22).

¹H NMR (CDCl₃, δ): 0.32 and 0.54 (2H-19, d, J = 4.5 Hz), 1.71 (CH₃-27, s), 3.28 (H-3, dd, J = 11, 5 Hz), 4.26 (H-24, t, J = 6 Hz), 5.01 (2 H-26, brs).

Table 1

δ_C (CDCl ₃)									
C-1	31.92	C-7	28.07	C-13	45.27	C-19	29.87	C-25	158.30
2	30.34	8	47.95	14	48.72	20	36.02	26	114.25
3	78.82	9	19.94	15	32.82	21	18.24	27	18.24

(continued)

Table 1 (continued)

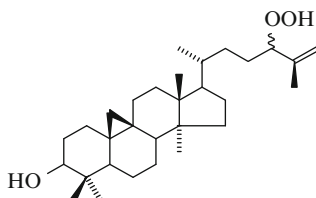
δ_C (CDCl ₃)									
4	40.46	10	26.02	16	26.40	22	29.71	28	19.28
5	47.06	11	25.98	17	52.01	23	27.52	29	25.40
6	22.66	12	35.50	18	18.02	24	obscured	30	13.98

References

1. S. Oeksur, R.R. Gil, H. Chai, J.M. Pezzuto, G.A. Cordell, A. Ulubelen, *Planta Med.* **60**(6), 594–596 (1994)

24-Hydroperoxycycloart-25-en-3 β -ol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Tillandsia recurvata (L.) L. (*Bromeliaceae*) [1].

Mp 112–115°C (from MeOH-H₂O), [α]_D²⁵ +39° (c band (0.1), CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3433, 3276, 2926, 2855, 1466, 1375.

UV $\lambda_{\max}^{\text{CHCl}_3}$, nm (ϵ): 242 (288).

EIMS m/z (%): M⁺ 458 (2), 440 (15), 424 (20), 409 (32), 381 (20), 315 (25), 297 (28), 255 (16), 175 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	C-17	52.1, 52.2
2	30.4	18	18.0
3	78.9	19	29.9
			0.33 d (4.2), 0.56 d (4.2)
4	40.5		
5	47.1	20	35.8, 36.0
6	21.1	21	18.2, 18.3
			0.87 d (6.5)
7	26.0	22	32.0

(continued)

Table 1 (continued)

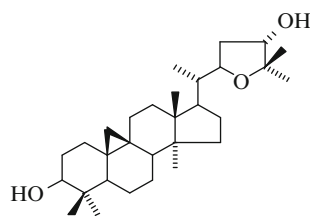
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
8	48.0	23	27.3, 27.6
9	20.0	24	90.2, 90.4
			4.27 t (6.5)
10	26.1	25	143.7, 143.9
11	26.5	26	114.2, 114.5
			5.01 brs
12	32.9	27	16.9, 17.2
			1.74 brs
13	45.3	28	19.3
			0.89 s
14	48.8	29	25.4
			0.97 s
15	35.6	30	14.0
			0.81 s
16	28.1	HOO	7.78 brs

References

1. G.M. Gabrera, A. Seldes, *J. Nat. Prod.* **58**(12), 1920–1924 (1995)

Isocyclokirilodiol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Trichosanthes kirilowii Maxim. (*Cucurbitaceae*) [1].

Mp 210–213°C (from MeOH-acetone).

CAS Registry Number: 188725-45-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3422, 3040, 2925, 1457, 1379, 1099.

MS m/z (%): M⁺ 458 (4), 443 (4), 440 (4), 425 (5), 398 (1), 318 (5), 315 (1), 297 (1), 260 (1), 255 (1), 229 (2), 203 (3), 175 (4), 142 (16), 115 (100), 97 (13), 71 (90).

HREIMS m/z: 458.3749 (M⁺), 443.3570 (C₂₉H₄₇O₃), 440.3687 (C₃₀H₄₈O₂), 425.3395 (C₂₉H₄₅O₃), 115.0751 (C₆H₁₁O₂), 71.0490 (C₄H₇O).

Table 1

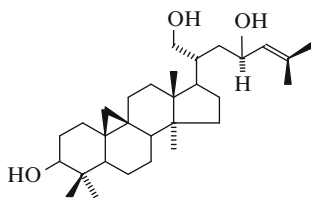
	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	1.58 (α), 1.25 (β)	C-16	27.8	1.98 (α), 1.35 (β)
2	30.4	1.76 (α), 1.57 (β)	17	48.9	1.94
3	78.8	3.29 dd (11, 4.4)	18	17.9	0.95 s
4	40.5	–	19	29.9	0.33 d (4), 0.55 d (4)
5	47.1	1.30 dd (12.6, 4)	20	39.8	1.41
6	21.2	1.60 (α), 0.79 qd (12.1, 2.2)	21	12.2	0.85 d (7)
7	26.1	1.09 (α), 1.33 (β)	23	37.9	1.77 ddd (4.8, 7, 12.8),
8	48.2	1.51 dd (12.5, 4.5)			2.04 ddd (7, 7, 12.8)
9	20.0	–	24	78.4	3.89 dd (4.8, 7)
10	26.1	–	25	81.6	–
11	26.5	2.01 (α), 1.11 (β)	26	27.3	1.19 s
12	32.8	1.70 (α), 1.62 (β)	27	20.9	1.18 s
13	45.4	–	28	19.6	0.93 s
14	48.7	–	29	25.4	0.97 s
15	35.7	1.32 (2H)	30	14.0	0.81 s

References

1. Y. Kimura, T. Akihisa, K. Yasukawa, S. Takase, T. Tamura, Y. Ida, *Chem. Pharm. Bull.* **45**(2), 415–417 (1997)

(23R)-5 α -Cycloart-24-ene-3 β ,21,23-triol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 204–205°C (from MeOH), $[\alpha]_D^{21} +38^\circ$ (c 0.6, CHCl₃).

CAS Registry Number: 146257-57-0.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3611.

EIMS m/z (%): M⁺458.3762 (18), 443 (8), 440 (44), 425 (54), 422 (13), 407 (29), 397 (7), 379 (6), 358

(15), 340 (11), 325 (10), 318 (19), 303 (6), 300 (15), 297 (13), 285 (25), 201 (22), 175 (25), 163 (20), 159 (20), 147 (41), 145 (23), 135 (24), 133 (31), 125 (23), 123 (20), 121 (31), 119 (35), 109 (32), 107 (53), 105 (34), 95 (53), 85 (100), 69 (39).

¹H NMR (CDCl₃, δ): 0.35 and 0.56 (2H-19, d, J = 4.2 Hz), 0.80 (H-6 β , qd, J = 12.5, 2.5 Hz), 0.81 (CH₃, s), 0.93 (CH₃, s), 0.97 (CH₃, s), 1.01 (CH₃, s), 1.70 (CH₃, d, J = 1.2 Hz), 1.72 (CH₃, d, J = 1.2 Hz), 3.29 (H-3, m), 3.63 (H-21_B, dd, J = 11, 5 Hz), 3.79 (H-21_A, dd, J = 11, 3 Hz), 4.60 (H-23, td, J = 9, 2.5 Hz), 5.25 (H-24, dq, J = 9, 1.2, 1.2 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	31.7 ^a	C-7	25.6	C-13	45.1	C-19	29.7 ^b	C-25	132.8
2	29.3 ^b	8	47.6	14	48.7	20	39.7 ^c	26	17.4
3	78.7	9	19.8	15	35.2	21	63.7	27	24.9
4	40.2	10	26.1	16	27.3	22	39.4 ^c	28	19.0
5	47.0	11	26.2	17	46.1	23	65.5	29	24.9
6	20.7	12	32.0 ^a	18	17.7	24	128.3	30	13.5

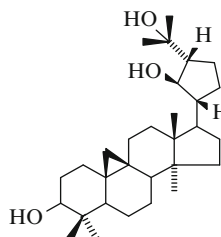
^{a-c}Assignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

(21R,24R)-21,24-Cyclo-5 α -cycloartane-3 β ,21,25-triol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Monocyclanthus vignei Keay (*Annonaceae*) [1].

Mp 177–178°C (from MeOH), $[\alpha]_D^{21} +30^\circ$ (c 0.15, CHCl₃).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3613, 3460 br.

EIMS m/z (%): M⁺ 458.3760 (2), 443 (3), 440 (9), 425 (100), 422 (6), 407 (8), 318 (21), 300 (10), 281 (11), 227 (22), 203 (24), 187 (24), 175 (40), 174 (37), 173 (31), 161 (33), 159 (41), 149 (28), 148 (22), 147 (52), 145 (42), 135 (37), 133 (50), 132 (22), 131 (30), 123 (21), 121 (55), 120 (27), 119 (63), 117 (21), 109 (60), 108 (23), 107 (85), 106 (21), 105 (67), 95 (90), 69 (72), 59 (100), 55 (68), 43 (82).

¹H NMR (CDCl₃, δ): 0.31 and 0.57 (2H-19, d, J = 4.2 Hz), 0.80 (CH₃, s), 0.81 (H-6β, dddd, J = J = J = 12.5 Hz, J₄ = 2.5 Hz), 0.92, 0.97, 1.03, 1.20, 1.23 (5 × CH₃, s), 2.7 (OH, brs), 3.28 (H-3, m), 3.72 (H-21, dd, J = 8.5, 7 Hz).

Table 1

δ _C (CDCl ₃)									
C-1	32.0	C-7	26.0	C-13	45.5	C-19	29.9	C-25	73.4
2	30.5	8	47.7	14	48.6	20	47.7	26	24.5 ^a
3	78.9	9	20.2	15	35.5	21	79.1	27	30.6 ^a
4	40.5	10	26.3	16	26.5	22	27.4	28	19.4
5	47.1	11	26.5	17	50.7	23	24.6	29	25.5
6	21.0	12	31.0	18	19.1	24	57.7	30	14.0

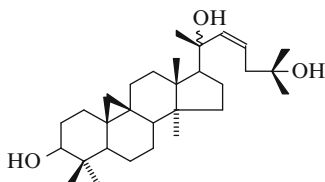
^aAssignments may be interchangeable

References

1. H. Achenbach, D. Frey, *Phytochemistry* **31**(12), 4263–4274 (1992)

Cycloclarkeanol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids
Euphorbia clarkeana Hook. f. (*Euphorbiaceae*) [1].

Mp 190–192°C (from CHCl₃–MeOH), $[\alpha]_D +37.84^\circ$ (c 0.21, CHCl₃).

CAS Registry Number: 144442-83-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3460–3440, 3065, 3040, 1630, 1380, 1015.

MS m/z (%): M⁺ 458 (18), 443 (16), 440 (38), 425 (45), 399 (16), 318 (26), 315 (32), 175 (54).

¹H NMR (400 MHz, CDCl₃, δ, 0-TMS): 0.33 and 0.54 (2H-19, d, J = 4.2 Hz), 0.80 (CH₃-29, s), 0.87 (CH₃-28, s), 0.95 (CH₃-18, CH₃-30, s), 1.33 (CH₃-26, CH₃-27, s), 1.39 (CH₃-21, s), 3.26 (H-3, dd, J = 10.8, 4.6 Hz), 5.40 (H-23, m), 5.68 (H-22, d, J = 7.05 Hz).

Table 1

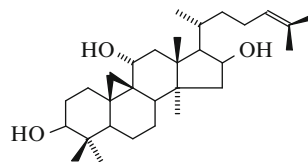
δ _C (CDCl ₃)									
C-1	31.87	C-7	28.10	C-13	45.27	C-19	29.81	C-25	72.28
2	30.26	8	47.89	14	48.82	20	73.01	26	29.39
3	78.84	9	19.93	15	32.68	21	24.26	27	29.44
4	40.39	10	26.17	16	26.42	22	134.47	28	19.22
5	47.03	11	26.01	17	52.10	23	130.68	29	25.36
6	21.02	12	35.59	18	17.98	24	39.68	30	14.01

References

1. S.A.M. Ayatollahi, Z. Ahmed, A. Malik, N. Afza, Y. Badar, *J. Nat. Prod.* **55**(7), 959–962 (1992)

Curculigenin C

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids
Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].
Mp 108–111°C, $[\alpha]_D +78.34^\circ$.
CAS Registry Number: 143599-94-4.
EIMS m/z: M⁺ 458.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.26 and 0.43 (2H-19, d, J = 4 Hz), 1.13, 1.17, 1.26, 1.27, 1.64,

1.66, (6 × CH₃, s) 1.35 (CH₃-21, d, J = 6.8 Hz)
3.54 (H-3, dd, J = 11, 4.6 Hz), 4.21 (H-11, dd, J =
9.5, 5.3 Hz), 4.50 (H-16, m), 5.83 (H-24, m).

Table 1

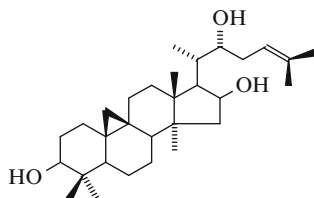
δ_C (C ₅ D ₅ N)									
C-1	32.54	C-7	26.56	C-13	47.30	C-19	30.21	C-25	130.02
2	31.42	8	49.43	14	50.25	20	37.17	26	25.91
3	78.08	9	20.16	15	50.68	21	19.88	27	17.87
4	41.18	10	26.89	16	71.98	22	30.19	28	18.43
5	47.86	11	72.78	17	49.43	23	25.85	29	25.94
6	21.75	12	40.27	18	22.15	24	126.78	30	15.45

References

1. J. Xu, R. Xu, *Phytochemistry* **31**(7), 2455–2458 (1992)

16S,22R-Dihydrocycloartenol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Balsamorhiza sagittata (Push.) Nutt. (*Compositae*) [1].
Mp 219°C.

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3480.

EIMS m/z (%): M⁺ 458.376 (0.4), 440 (1.3), 425 (1.2),
407 (0.8), 389 (4), 371 (10), 353 (8), 313 (30), 295
(11), 69 (100).

Table 1

δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
H-3	3.27 dd (11, 4)	H-21	0.96 d (7)
15 α	1.42 dd (13, 4)	22	3.67 ddd (10, 2, 2)
15 β	2.01 dd (13, 8)	23	2.28 ddd (14, 8, 7)
16	4.41 ddd (13, 8)	23	2.0 m
17	1.88 dd (11, 8)	24'	5.13 brt (7)
18	1.19 s	26	1.72 brs
19 α	0.55 d (4)	27	1.63 brs

(continued)

Table 1 (continued)

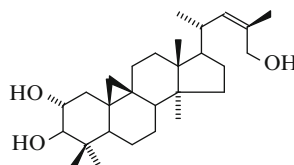
δ_H (CDCl ₃ , J/Hz)		δ_H (CDCl ₃ , J/Hz)	
19 β	0.33 d (4)	28	0.94 s
20	2.35 ddq (11, 2, 7)	29	0.89 s
		30	0.78 s

References

1. F. Bohlmann, L.N. Mispa, J. Jakupovic, R.M. King, H. Robinson, *Phytochemistry* **24**(9), 2029–2036 (1985)

Genipatriol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Genipa spruceana Steyer. (*Rubiaceae*) [1].

White amorphous powder, $[\alpha]_D^{25} +20.0^\circ$ (c 0.05,
MeOH).

IR ν_{\max}^{film} , cm⁻¹: 3303, 2955, 2928, 2863, 1570, 1257,
1087, 1038, 800.

HRESIMS m/z : [M + Na]⁺ 481.3628.

Table 1

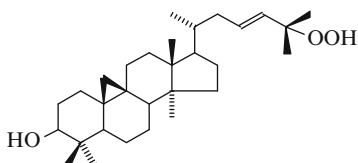
δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)	
C-1	41.5	C-16	28.7
	1.85 m, 1.86 m		1.28 m, 1.90 m
2	71.6	17	52.8
	4.13 dd (9, 16)		1.58 m
3	83.8	18	18.5
	3.49 d (9)		0.97 s
4	41.4	19	30.2
	–		0.38 d (4), 0.58 d (4)
5	47.8	20	36.4
	1.45 dd (4.3, 12.5)		1.44 d (4)
6	21.7	21	18.7
	1.57 m, 0.78 dd (1.9, 12.7)		0.91 d (8.5)
7	1.08 m, 1.31 m	22	37.3
			1.17, 1.54
8	48.2	23	25.1
	1.51 dd (4.8, 12.3)		2.11, 2.27
9	26.0	24	127.7
	–		5.40 t (7.4)
10	19.6	25	149.6
	–		–
11	27.1	26	61.1
	2.00 dd (6, 6.5), 1.17 m		4.51 s (2H)
12	33.4	27	22.1
	1.56 m, (2H)		2.04 s
13	45.8	28	19.8
	–		0.90 s
14	49.4	29	26.9
	–		1.24 s
15	36.0	30	16.3
	1.29 m (2H)		1.13 s

References

1. C.F. Hossain, M.R. Jacob, A.M. Clark, L.A. Walker, D.G. Nagle, *J. Nat. Prod.* **66**(3), 398–400 (2003)

25-Hydroperoxycycloart-23-en-3 β -ol

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Tillandsia recurvata (L.) L. (*Bromeliaceae*) [1].

Mp 127–128°C (hexane-Et₂O), $[\alpha]_D^{25} + 32^\circ$ (c 0.43, CHCl₃).

CAS Registry Number: 173740-54-0.

UV $\lambda_{\max}^{\text{CHCl}_3}$, nm: 244 (330).

IR ν_{\max}^{KBr} , cm⁻¹: 3380, 3266, 2938, 2867, 1462, 1377, 1370.

EIMS m/z (%): [M]⁺ 458 (4), 440 (12), 424 (29), 409 (26), 393 (20), 365 (22), 342 (17), 339 (21), 315(39), 297 (46), 255 (41), 175 (88), 121 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	C-17	52.1
2	30.4	18	18.1 0.97 s
3	78.9 3.28 dd (10.5, 5.1)	19	29.9 0.33 d (4.3), 0.56 d (4.3)
4	40.5		
5	47.1	20	36.3
6	21.1	21	18.4 0.87 d (6.5)
7	26.0	22	39.4
8	47.9	23	130.7 5.70 ddd (15.7, 8.1, 5.9)
9	20.0	24	134.5 5.52 d (15.7)
10	26.1	25	82.3
11	26.5	26	24.4 1.34 s
12	32.8	27	24.3 1.34 s
13	45.4	28	19.3 0.88 s
14	48.8	29	25.4 0.97 s
15	35.6	30	14.0 0.81 s

(continued)

Table 1 (continued)

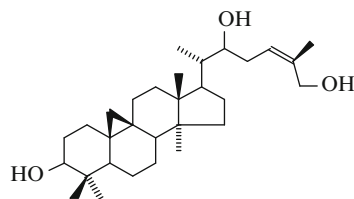
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
16	28.1	HOO	7.32 brs

References

1. G.M. Gabrera, A. Seldes, *J. Nat. Prod.* **58**(12), 1920–1924 (1995)

Thalictogenin a

C₃₀H₅₀O₃, M 458



Taxonomy: Cycloartane Triterpenoids

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

Mp 202–204°C, $[\alpha]_D^{19} + 30.2^\circ$ (c 0.5, C₅H₅N).

CAS Registry Number: 146453-58-9.

EIMS m/z: M⁺ 458.

¹HNMR (C₅D₅N, δ): 0.33 and 0.57 (2H-19, d, J = 3.7 Hz), 0.93, 1.09, 1.13, 1.25, 2.04 (5 × CH₃, s), 1.19 (CH₃-21, d, J = 6.6 Hz), 3.56 (H-3, dd, J = 11.4, 2 Hz), 4.06 (H-22, brs), 4.50 and 4.57 (2 H-26, d, J = 11.9 Hz), 5.71 (H-24, t, J = 7.1 Hz).

Table 1

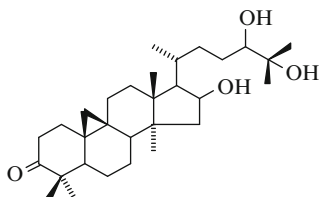
δ_C (C ₅ D ₅ N)									
C-1	32.4	C-7	28.0	C-13	45.4	C-19	30.0	C-25	137.7
2	31.3	8	48.2	14	49.1	20	41.7	26	61.1
3	80.0	9	20.0	15	33.4	21	12.1	27	22.2
4	41.1	10	26.6	16	26.7	22	72.7	28	18.4
5	47.5	11	26.3	17	49.1	23	34.8	29	26.2
6	21.5	12	35.9	18	19.6	24	125.2	30	14.9

References

1. Y. Hitoshi, H. Kazuhiro, S. Kazushi, K. Junci, Y. Shoji, N. Kimiko, M. Kotaro, T. Toshiaki, N. Toshihiro, *Chem. Pharm. Bull.* **40**(9), 2465–2468 (1992)

Argentatine C

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Parthenium argentatum Gray (*Compositae*) [1, 2].

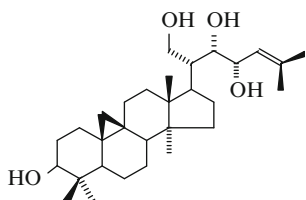
X-Ray [1].

References

1. A. Romo de Vivar, M. Matrinez-Varquez, C. Matsubara, G. Perez-Sanchez, P. Joseph-Nathan, *Phytochemistry* **29**(3), 915–918 (1990)
2. R.A. Komoroski, E.C. Gregg, J.P. Shockcor, J.M. Geckle, *Magn. Res. Chem.* **24**, 534–543 (1986)

Argenteanol

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D -1^\circ$ (c 0.5, CHCl₃).

CAS Registry Number: 175669-24-6.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3410.

FAB-MS m/z : 497 [M + Na]⁺, 481 [M + Li]⁺.

¹HNMR (250 MHz, CDCl₃, δ 0-TMS): 0.33 and 0.56 (2H-19, d, J = 4 Hz), 0.82, 0.90, 0.96, 1.02, 1.80, 1.80 (6 × CH₃, s), 3.29 (H-3, dd, J = 10, 4 Hz), 3.62 (H-22, brs), 3.68 (H-21, dd, J = 11.5, 6 Hz), 4.00 (H-21, dd, J = 11.5, 2.5 Hz), 4.58 (H-

23, dd, J = 9.5, 3.5 Hz), 5.40 (H-24, brd, J = 8.5 Hz).

Table 1

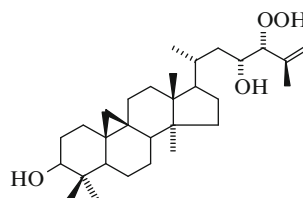
δ_C (CDCl ₃)									
C-1	32.1	C-7	26.1	C-13	46.1	C-19	29.8	C-25	136.3
2	30.5	8	47.9	14	48.7	20	47.2	26	25.6
3	78.9	9	20.0	15	35.7	21	60.9	27	18.5
4	44.9	10	26.2	16	27.6	22	67.0	28	19.5
5	47.2	11	26.5	17	43.4	23	76.0	29	25.6
6	21.5	12	32.3	18	18.0	24	125.2	30	14.1

References

1. O.R. Omobuwajo, M.-T. Martin, G. Perromat, T. Sevenet, K. Awang, M. Pais, *Phytochemistry* **41**(5), 1325–1328 (1996)

Argenteanol E

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D^{20} +29^\circ$ (c 1, CHCl₃).

FABMS m/z: 481 [M + Li]⁺.

HRFABMS m/z: 481.3889 (C₃₀H₅₀LiO₄).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	C-16	28.1
2	30.0	17	52.9
3	78.6	3.26 dd (10, 4)	18 18.0 0.97 s
4	40.4	–	19 29.8 0.31 d (4), 0.54 d (4)
5	47.1	20	32.4
6	21.1	21	17.6 0.82 d (7)
7	25.9	22	39.2
8	47.9	23	67.7 3.77 ddd (11, 8.2, 1.5)

(continued)

Table 1 (continued)

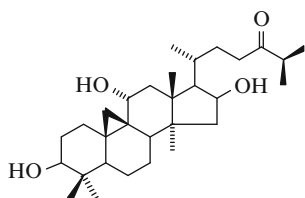
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
9	19.9 –	24	94.5 4.14 d (8.2), [8.40 brs (OOH)]
10	27.4 –	25	144.2 –
11	26.4	26	116.2 5.05 brs, 5.08 brs
12	32.9	27	17.6 1.72 s
13	45.4 –	28	19.2 0.87 s
14	48.7 –	29	25.3 0.79 s
15	35.6	30	13.9 0.94 s

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

Curculigenin A

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 140–143°C, $[\alpha]_D^{25} +18.83^\circ$ (c 0.55, CHCl₃).

CAS Registry Number: 136771-41-0.

HRMS m/z: M⁺ 474.3727.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz) (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz) (C ₅ D ₅ N)
C-1	32.74 1.25 m, 1.37 m	C-16	71.74 4.79 ddd (10.8, 7.6, 6.3)
2	30.85 1.46 m, 2.24 m	17	49.35 2.77 dd (10.8, 7.6)
3	78.03 3.50 m	18	22.11 1.31 s
4	41.14 –	19	30.27 0.37 d (4), 0.49 d (4)
5	47.81 1.27 m	20	30.27 2.23 m
6	21.70 0.75 m, 1.53 m	21	17.12

(continued)

Table 1 (continued)

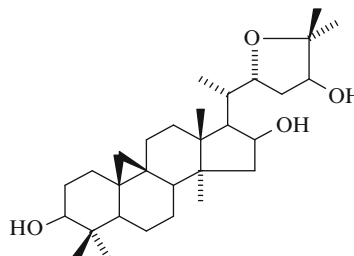
δ_C (C ₅ D ₅ N)	δ_H (J/Hz) (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz) (C ₅ D ₅ N)
7	26.62 1.10 m, 1.30 m	22	31.30 1.95 m (2H)
8	49.50 1.39 m	23	38.15 2.66 (2H)
9	20.13 –	24	215.92 –
10	26.49 –	25	40.79 2.53 septet (7)
11	72.66 4.12 dd (9.5, 5.5)	26	18.43 0.96 d (7)
12	40.22 2.00 m, 2.40 m	27	18.43 0.99 d (7)
13	47.11 –	28	18.43 1.39 s
14	50.13 –	29	26.19 1.08 s
15	50.32 1.60 m, 2.20 m	30	14.89 1.20 s

References

1. J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Depressogenin

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Corchorus depressus L. (*Tiliaceae*) [1].

Mp 195–197°C, $[\alpha]_D^{25} +53.8^\circ$ (c 0.13, CHCl₃).

CAS Registry Number: 215160-92-2.

EIMS m/z: M⁺ 474 (2.53), 456 (6.11), 438 (1.1), 385 (2.28), 334 (2.23), 313 (4.02), 295 (1.68), 245 (3.01), 143 (7.22), 142 (26.32), 115 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.00 1.19, 1.46	C-16	71.85 4.45 ddd (5.8, 8, 8.5)
2	30.38 1.57, 1.74	17	51.28 1.93 dd (7, 12)
3	78.85 3.28dd (4.5, 11.5)	18	18.90 1.18 s

(continued)

Table 1 (continued)

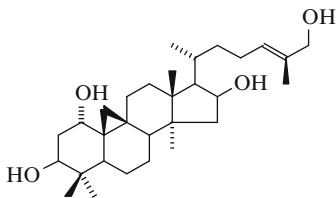
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
4	40.48 –	19	30.38 0.32 d (4), 0.57 d (4)
5	47.18 1.28	20	31.68 2.44 m
6	21.07 0.80, 1.58	21	16.56 0.89 d (7)
7	26.07 1.08, 1.34	22	80.55 3.92 ddd (3.2, 7, 8.9)
8	47.83 1.61	23	35.18 1.79 m, 2.25 m
9	20.68 –	24	77.68 4.03 dd (4.2, 6.8)
10	26.21 –	25	83.00 –
11	26.14 1.10, 1.95	26	24.98 1.16 s
12	33.28 1.25, 1.58	27	22.28 1.26 s
13	46.93 –	28	20.04 0.89 s
14	47.31 –	29	25.42 0.96 s
15	46.24 1.38, 1.80	30	13.97 0.80 s

References

- V.U. Ahmad, A. Ali, Z. Ali, F.T. Baqai, F.N. Zafar, *Phytochemistry* **49**(3), 829–834 (1998)

Genin of Mongholicoside I

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Astragalus mongholicus Bunge (*Leguminosae*) [1].

Table 1

δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)
C-1	73.6 3.56 t (3.1)	C-16	72.7 4.40 m
2	36.8	17	56.5
3	73.8 3.74dd (4.7, 12.1)	18	19.1
4	40.5	19	30.2
5	39.6	20	29.6
6	20.7	21	17.9

(continued)

Table 1 (continued)

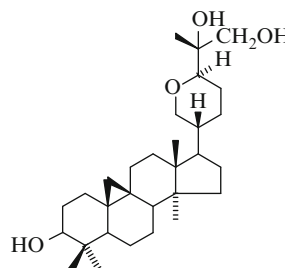
δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)
7	24.7	22	36.3
8	48.0	23	25.9
9	20.7	24	126.4 5.47 t (7.3)
10	30.5	25	135.4
11	25.85	26	13.7
12	32.8	27	68.8 3.99 s
13	45.4	28	20.2
14	46.8	29	25.2
15	48.2	30	13.1

References

- Z.Y. Zhi, L.S. Ha, O. Yoshihito, T. Mitsumasa, O. Toru, *Chem. Pharm. Bull.* **40**(8), 2230–2232 (1992)

No Name (9,19-Cyclolanostan-21,24-epoxy-3 β ,25,26-triol)

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Passiflora quadrangularis L. (*Passifloraceae*) [1]

Mp 138–140°C (from diisopropyl ether), [α]_D²⁵ 17.8° (c 0.08, MeOH).

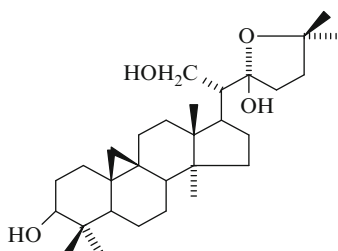
¹H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.28 and 0.56 (2H-19, d, J = 4.5 Hz), 0.80, 0.93, 0.96, 1.05, 1.20 (5 × CH₃, s), 3.26 (H-3, dd, J = 10.5, 4.5 Hz), 3.41 (H-26_B, d, J = 11.6 Hz), 3.5 (2 H-21, m), 3.62 (H-26_A, d, J = 11.6 Hz), 4.06 (H-24, d, J = 12 Hz).

References

1. F. Orsini, F. Pelizzoni, G. Ricca, L. Verotta, *Phytochemistry* **26**(4), 1101–1105 (1987)

No Name (9,19-Cyclolanostan-22,25-epoxy-3 β ,21,22R-triol)

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Passiflora quadrangularis L. (*Passifloraceae*) [1].

Mp 184–185.5°C (from diisopropyl ether-EtOAc, 7:3), $[\alpha]_D^{25} +45^\circ$ (c 0.14, MeOH).

EIMS m/z (%): [M⁺–H₂O] 456 (5), 297 (9), 255 (9), 159 (76).

¹H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.32 and 0.55 (2 H-19, d, J = 4.5 Hz), 0.76, 0.83, 0.92, 0.96, 1.14, 1.22 (6 \times CH₃, s), 3.26 (H-3, dd, J = 10.5, 4.5 Hz), 3.52 (H-21_B, dd, J = 11, 5.5 Hz), 3.78 (H-21_A, dd, J = 11, 3 Hz).

Table 1

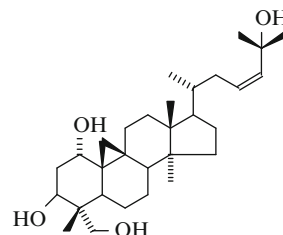
δ_C (C ₅ D ₅ N)									
C-1	32.6	C-7	27.1	C-13	45.5	C-19	29.9	C-25	74.9
2	31.3	8	47.9	14	48.9	20	49.6	26	
3	77.9	9	20.0	15	32.5	21	65.2	27	
4	41.1	10	26.5	16	26.3	22	98.2	28	19.6
5	47.5	11	26.1	17	45.5	23	25.0	29	26.1
6	21.4	12	35.7	18	18.6	24	24.8	30	14.7

References

1. F. Orsini, F. Pelizzoni, G. Ricca, L. Verotta, *Phytochemistry* **26**(4), 1101–1105 (1987)

Quadrangularol A

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Colorless amorphous solid, $[\alpha]_D^{25} +75.2^\circ$ (c 0.14, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2950, 1470, 1380, 1000.

HRFABMS m/z: 497.3557 [M + Na]⁺.

Table 1

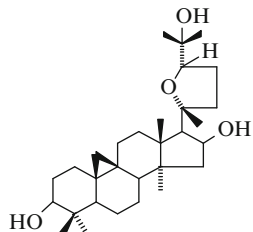
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.7	3.85 brs	C-16	26.1
2	38.6	2.44 ddd (13, 4.5, 3.5), 2.28 ddd (13.5, 11, 3.5)	17	52.4
			18	18.7 1.06 s
3	69.6	5.08 dd (12, 4.5)	19	30.1 0.52 d (4.5), 0.77 d (4.5)
4	45.0	–	20	36.9
5	34.5	2.94 dd (12.5, 4.5)	21	18.6 0.97 d (6.5)
6	21.2		22	39.5
7	28.4		23	124.6 5.94 brs
8	48.5		24	141.6 5.94 brs
9	20.8	–	25	69.7 –
10	30.9	–	26	30.5 1.54 s
11	26.1	2.72 ddd (15, 8, 5)	27	30.5 1.54 s
12	33.2		28	19.5 0.97 s
13	45.5	–	29	68.0 4.28 d (10.2), 3.89 d (10.2)
14	49.1	–	30	10.7 1.22 s
15	36.1			

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Quisquagenin

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Astragalus quisqualis Bunge (*Leguminosae*) [1].

Mp 232.5–234.5°C (from MeOH), $[\alpha]_D^{25} +36.6^\circ$ (c 0.745, CHCl₃).

CAS Registry Number: 112709-68-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3300, 3050.

MS m/z (%): M⁺ 474 (0.9), 456 (2.0), 441 (1.8), 423 (1.7), 415 (2.1), 397 (5.9), 379 (2.5), 255 (3.3), 217 (2.4), 191 (4.6), 187 (5.7), 175 (5.2), 174 (1.7), 173 (7.7), 171 (8.5), 161 (7.0), 159 (6.5), 147 (8.9), 145 (9.2), 144 (11.6), 143 (100).

¹H NMR (CDCl₃, δ , 0-TMS): 0.34 and 0.59 (2H-19, d, J = 4.4 Hz), 0.81, 0.92, 0.97, 1.16, 1.25, 1.28, 1.31 (7 × CH₃, s), 1.59 (H-2, m), 1.98 (H-23, m), 1.98 (H-15, dd, J = 13.6, 8.1 Hz), 2.31 (H-17, d, J = 8.1 Hz), 2.57 (H-22, brq, J = 11.7 Hz), 3.29 (H-3, brdd), 3.77 (H-24, t, J = 7.3 Hz), 4.67 (H-16, td, J = 8.1, 6.4 Hz).

Table 1

δ_C (C₅D₅N)[2]

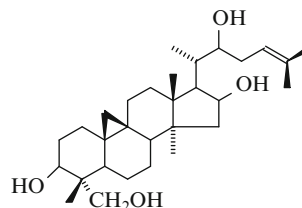
C-1	32.42	C-7	26.60	C-13	45.13	C-19	30.61	C-25	71.24
2	31.33	8	48.20	14	47.08	20	87.28	26	27.18
3	77.99	9	21.33	15	47.08	21	28.57	27	28.22
4	41.13	10	29.98	16	73.48	22	35.00	28	20.33
5	47.56	11	26.47	17	58.55	23	26.47	29	26.20
6	20.33	12	33.53	18	21.92	24	81.79	30	14.60

References

1. L.A. Kholzineva, A.A. Savina, I. Romero Mal' donado, A.N. Shchavlinskii, M.E. Pimenova, *Chem. Nat. Comp.* **23**(4), 439–443 (1987)
2. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **30**(3), 346–351 (1994)

Thalicogenin

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 201–202°C (from EtOAc), $[\alpha]_D^{22} +34.5^\circ$ (c 0.1, C₅H₅N).

CAS Registry Number: 82576-43-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3400–3200, 3045.

MS m/z (%): M⁺ 474 (0.58), 459 (4.6), 456 (1.1), 441 (1.8), 438 (0.8), 369 (23), 329 (100), 311 (47.6), 299 (1.4), 293 (4.6), 173 (14.6), 159 (15.3), 145 (13.8), 109 (17.3), 99 (27.3), 69 (16.9).

¹H NMR (C₅D₅N, δ): 0.44 and 0.62 (2H-19, d, J = 4.5 Hz), 0.96 (CH₃, s), 1.16 (CH₃, s), 1.23 (CH₃-21, d, J = 7.5 Hz), 1.52 (CH₃, s), 1.68 (2 × CH₃, s), 3.78 and 4.22 (2H-29, d, J = 10.5 Hz), 4.30 (H-3, dd, J = 5.2, 11 Hz), 4.35 (H-22, m), 4.85 (H-16, ddd, J = 4.8, 7.9, 8.4 Hz), 5.6 (H-24, m).

Table 1

δ_C (C₅D₅N)

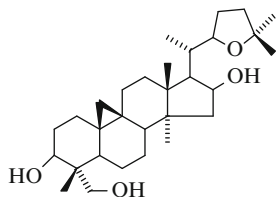
C-1	32.6	C-7	26.9	C-13	46.3	C-19	30.5	C-25	132.4
2	31.0	8	48.6	14	47.6	20	36.2	26	26.0
3	74.8	9	20.3	15	49.0	21	14.8	27	18.2
4	44.9	10	26.0	16	72.1	22	75.8	28	19.7
5	42.3	11	26.5	17	53.3	23	34.0	29	68.5
6	21.4	12	33.7	18	20.7	24	123.9	30	11.4

References

1. A.S. Gromova, V.I. Lutsyki, A.A. Semenov, V.A. Denisenko, V.V. Isakov, *Chem. Nat. Comp.* **20**(2), 191–196 (1984)

Thalicogenin A1

C₃₀H₅₀O₄, M 474



Taxonomy: Cycloartane Triterpenoids

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 332–333°C (from C₆H₆–Me₂CO, 3:1), [α]_D²⁵ +7.1° (c 2.0, CHCl₃–MeOH, 1:1).

CAS Registry Number: 289664-97-7.

IR ν_{max}^{KBr}, cm⁻¹: 3410, 3043, 2940, 2893.

EIMS m/z (%): 474 (4), 441 (8), 329 (7), 173 (10), 159 (11), 126 (12.3), 99 (100), 81 (53).

HREIMS m/z: 474.3709 [M]⁺.

Table 1

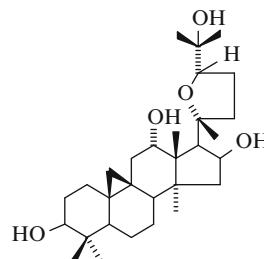
	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	31.98		C-16	71.30	4.61 m (4.8, 7.5)
2	30.56		17	52.43	2.08
3	73.37	4.28 m	18	19.08	1.42 s
4	44.43	–	19	30.01	0.39 d (4), 0.65 d (4)
5	41.20		20	32.69	2.52 m
6	20.83		21	14.57	1.00 d (7)
7	26.11		22	82.19	4.26 m
8	48.15		23	29.96	
9	19.46	–	24	38.19	
10	25.77	–	25	80.12	–
11	26.00		26	28.31	1.28 s
12	33.18		27	27.35	1.19 s
13	45.65	–	28	20.11	0.94 s
14	46.63	–	29	66.90	4.18 d (10.5), 3.76 d (10.5)
15	47.86	2.04, 1.68	30	11.09	1.15 s

References

1. A.S. Gromova, V.I. Lutsky, D. Li, S.G. Wood, N.L. Owen, A.A. Semenov, D.M. Grant, *J. Nat. Prod.* **63**(7), 911–914 (2000)

Cycloalpigigenin B

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Mp 210–211°C (from Me₂CO), [α]_D²⁶ +18.7° (c 0.64, CH₃OH).

CAS Registry Number: 172335-18-1.

IR ν_{max}^{KBr}, cm⁻¹: 3550–3230, 3040.

MS m/z (%): M⁺ 490 (0.9), 472 (4.0), 457 (3.0), 454 (3.8), 439 (5.5), 436 (1.5), 429 (1.6), 421 (2.8), 413 (2.6), 403 (1.1), 396 (6.0), 395 (8.0), 377 (4.1), 353 (3.0), 327 (3.3), 312 (4.0), 143 (100), 125 (22.0).

¹H NMR (200 MHz, C₅D₅N, δ, 0-TMS): 0.35 and 0.47 (2H-19, d, J = 4 Hz), 1.02, 1.14, 1.23, 1.32, 1.47, 1.50, 1.74 (7 × CH₃, s), 3.15 (H-17, d, J = 7 Hz), 3.45 (H-3, dd, J = 10.5, 5.5 Hz), 3.97 (H-24, t, J = 7 Hz), 4.11 (H-12, dd, J = 10, 6 Hz), 4.89 (H-16, q, J = 7 Hz).

¹H NMR (200 MHz, CDCl₃, δ, 0-TMS): 0.41 and 0.52 (2H-19, d, J = 4.4 Hz), 0.79, 0.95, 0.99, 1.14, 1.24, 1.26, 1.44 (7 × CH₃, s), 2.63 (H-17, d, J = 8 Hz), 3.26 (H-3, dd, J = 11, 4.5 Hz), 3.82 (H-24, t, J = 7 Hz), 3.86 (H-12, dd, J = 9, 6 Hz), 4.56 (H-16, td, J = 8, 6 Hz).

Table 1

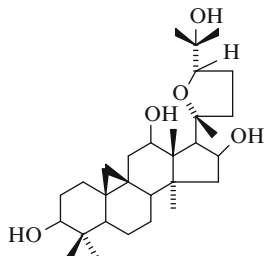
δ _C (C ₅ D ₅ N)									
C-1	32.60	C-7	25.98	C-13	49.90	C-19	30.35	C-25	70.76
2	31.28	8	48.96	14	50.84	20	87.51	26	26.59
3	77.93	9	19.93	15	46.49	21	26.18	27	27.45
4	41.10	10	26.95	16	72.83	22	38.40	28	21.20
5	47.74	11	38.80	17	52.29	23	26.92	29	27.40
6	21.58	12	72.76	18	21.95	24	83.54	30	14.89

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **30**(4), 474–479 (1994)

Cycloalpigenin C

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Mp 242–244°C (from MeOH), $[\alpha]_D^{21} -34.5^\circ$ (c 0.58, CH₃OH).

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3300, 3040.

MS m/z (%): M⁺ 490 (1.3), 475 (1.7), 472 (5.9), 457 (4.2), 454 (3.4), 439 (7.1), 429 (3.8), 421 (3.8), 413(4.6), 396 (10.5), 395 (10.1), 377 (5.5), 353 (3.8), 313 (4.2), 245 (11.8), 143 (100), 125 (18.9).

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.66 (2H-19, d, J = 4 Hz), 0.88, 1.00, 1.15, 1.36, 1.42, 1.73, 1.84 (7 × CH₃, s), 2.49 (H-17, d, J = 7 Hz), 3.44 (H-3, dd, J = 11, 4.5 Hz), 4.09 (H-12 and H-24, m), 4.77 (H-16, q, J = 7 Hz).

¹H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.34 and 0.68 (2H-19, d, J = 4.5 Hz), 0.78, 0.82, 0.95, 1.13, 1.22, 1.35, 1.53 (7 × CH₃, s), 2.14 (H-17, d, J = 8 Hz), 3.25 (H-3, dd, J = 11, 4.5 Hz), 3.77 (H-12, dd, J = 9, 5 Hz), 3.88 (H-24, t, J = 7 Hz), 4.46 (H-16, td, J = 8, 6 Hz).

Table 1

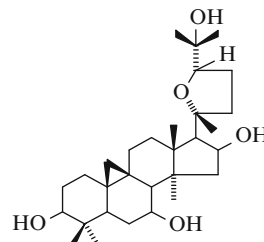
δ_c (C ₅ D ₅ N)									
C-1	32.14	C-7	25.68	C-13	48.68	C-19	29.56	C-25	71.05
2	31.02	8	45.34	14	52.01	20	87.32	26	26.20
3	77.84	9	20.64	15	48.25	21	25.96	27	26.26
4	40.95	10	27.36	16	72.27	22	38.98	28	19.98
5	46.87	11	37.24	17	60.13	23	26.10	29	27.43
6	20.92	12	72.10	18	13.65	24	84.56	30	14.66

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **31**(1), 70–75 (1995)

Cycloalpigenin D

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Mp 209–211°C (from MeOH), $[\alpha]_D^{23} +46.7^\circ$ (c 1.07, CH₃OH).

CAS Registry Number: 142719-37-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3560–3200, 3040.

MS m/z (%): M⁺ 490 (1.8), 475 (2.5), 472 (4.5), 457 (2.5), 454 (3.8), 439 (3.9), 436 (1.6), 431 (3.6), 421 (2.3), 413 (8.9), 395 (11.1), 377 (4.8), 289 (7.5), 271 (6.6), 187 (7.6), 185 (7.6), 173 (12.1), 143 (100), 125 (30.4).

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.19 and 0.68 (2H-19, d, J = 4 Hz), 0.96, 1.00, 1.09, 1.18, 1.23, 1.41, 1.45 (7 × CH₃, s), 2.40 (H-17, d, J = 8 Hz), 2.99 (H-22, q, J = 10 Hz), 3.42 (H-3, dd, J = 12, 4 Hz), 3.70 (H-7, m), 3.78 (H-24, dd, J = 8, 6 Hz), 4.97 (H-16, q, J = 7.3 Hz).

¹H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.29 and 0.78 (2H-19, d, J = 4 Hz), 1.07, 1.11, 1.19, 1.27, 1.33, 1.51, 1.55 (7 × CH₃, s), 2.50 (H-17, d, J = 8 Hz), 2.76 (H-15, dd, J = 14, 8 Hz), 3.10 (H-22, q, J = 10 Hz), 3.51 (H-3, dd, J = 11, 4 Hz), 3.78 (H-7, td, J = 9, 3 Hz), 3.87 (H-24, dd, J = 8, 6 Hz), 5.06 (H-16, q, J = 8 Hz).

Table 1

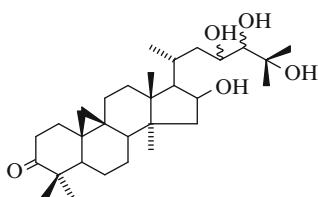
δ_c (C ₅ D ₅ N)[2]									
C-1	32.20	C-7	70.42	C-13	45.55	C-19	29.33	C-25	71.31
2	31.14	8	55.34	14	46.35	20	87.30	26	27.11
3	77.74	9	19.96	15	48.86	21	28.69	27	28.24
4	40.82	10	27.36	16	73.86	22	35.02	28	19.90
5	46.34	11	26.48	17	57.95	23	26.75	29	26.21
6	32.12	12	33.40	18	21.41	24	81.67	30	14.79

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **27**(3), 326–332 (1991)
2. R.P. Mamedova, M.I. Isaev, *Chem. Nat. Comp.* **40**(4), 303–357 (2004)

(23ξ,24ξ)-Cycloartan-3-one-16β,23,24,25-tetrol

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Lindheimera texana Gray et Engelm (*Asteraceae*) [1].

Mp 225–228°C (from CHCl₃–MeOH).

CAS Registry Number: 99816-08-7.

CD curve (MeOH): [θ]₂₉₅–3000, [θ]₂₄₅ 0, [θ]₂₁₀ (last reading)–3000.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3380, 1700.

MS m/z (%): M⁺ 490.3662, 472 (4.6), 457 (1.4), 454 (2.5), 439 (4.3), 400 (6.1), 399 (6.8), 384 (7.4), 383 (26.2), 365 (19.7), 310 (43.4), 311(19.2).

Table 1

δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	33.33 1.84 br dt	C-16	72.68 4.47 dt (4.5, 8)
2	37.39 2.71dt, 2.29 ddd	17	56.53
3	216.26 –	18	19.96 1.20
4	50.20 –	19	29.84 0.59 d, 0.83 brd
5	47.91	20	24.54
6	21.41	21	18.91 1.03 d
7	26.36	22	41.21
8	48.44	23	72.33 3.73 ddd (9, 7.5, 3)
9	20.91 –	24	78.85 3.21 d (7.5)
10	26.14 –	25	73.58 –
11	25.96	26	27.18 1.29
12	32.45	27	26.71 1.27

(continued)

Table 1 (continued)

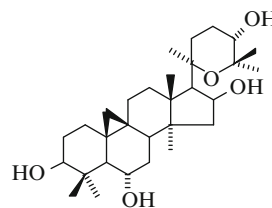
δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
13	45.22 –	28	19.96 0.91
14	46.81 –	29	22.19 1.05
15	47.80 1.39 brdd (14, 4.5), 2.05 dd (14, 8)	30	20.77 1.10

References

1. W. Herz, K. Watanabe, P. Kulanthaivel, J.F. Blount, *Phytochemistry* **24**(11), 2645–2654 (1985)

Cyclocephalogenin

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astaragalus zahlbruckneri Hand.-Mazz.

(*Leguminosae*) [1].

[α]_D²⁵ +23.3° (c 0.5, CHCl₃).

FABMS m/z : 489 [M–H]⁺.

Table 1

δ_{C} (CDCl ₃)	δ_{H} (CDCl ₃ , J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (CDCl ₃ , J/Hz)
C-1	32.1 1.19 m, 1.58 m	C-16	16.73 4.60 ddd (8, 8.2, 5.2)
2	30.3 1.58 m, 1.82 m	17	60.2 1.86 d (8)
3	78.4 3.30 dd (11.2, 4.5)	18	20.9 1.43 s
4	41.5 –	19	31.5 0.38 d (4.5), 0.51 d (4.5)
5	53.8 1.32 d (8)	20	79.3 –
6	69.3 3.53 m	21	27.7 1.53 s
7	38.0 1.32 m, 1.48 m	22	26.0 1.15 m, 2.52 m
8	46.9 1.80 m	23	23.0 1.72 m, 2.16 m
9	20.8 –	24	69.6 3.53 brs
10	29.4 –	25	75.0 –

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (CDCl ₃ , J/Hz)	δ_C (CDCl ₃)	δ_H (CDCl ₃ , J/Hz)
11	25.8 1.15 m, 1.98 m	26	27.6 1.22 s
12	34.0 1.68 m, 1.82 m	27	27.9 1.30 s
13	46.5 –	28	20.2 0.90 s
14	45.9 –	29	28.2 1.26 s
15	47.8 1.38 m, 1.98 m	30	15.3 0.97 s

References

1. I. Calis, H.A. Gazar, S. Piacete, C. Pizza, *J. Nat. Prod.* **64**(9), 1179–1182 (2001)

Table 1

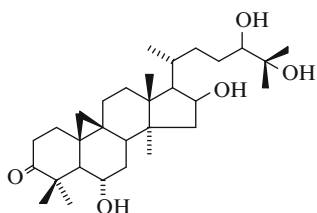
δ_C (C ₅ D ₅ N) [2]									
C-1	31.91	C-7	38.30	C-13	45.64	C-19	30.73	C-25	72.68
2	35.88	8	48.29	14	46.83	20	31.56	26	25.94
3	216.77	9	21.50	15	49.18	21	19.70	27	26.16
4	50.57	10	28.28	16	71.67	22	34.79	28	20.43
5	53.63	11	26.23	17	57.35	23	29.35	29	28.60
6	69.21	12	33.03	18	18.72	24	80.55	30	20.55

References

1. M.I. Isaev, R.U. Umarova, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **21**(2), 203–208 (1985)
2. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 474–476 (1998)

3-Dehydrocycloasgenin C

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus taschkendicus Bunge (*Leguminosae*) [1].

Mp 208–210°C (from EtOAc), $[\alpha]_D^{22} +82.5^\circ$ (c 0.8, CH₃OH).

CAS Registry Number: 97682-74-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3540–3310, 3055, 1705.

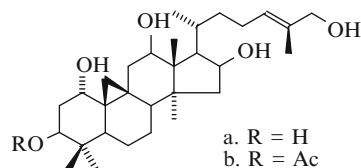
CD (c 0.1, MeOH): $\Delta\epsilon = -0.04$ (322 nm), $\Delta\epsilon = +1.60$ (287 nm).

MS *m/z* (%): M⁺ 490 (5.1), 472 (10.3), 454 (7.7), 439 (12.8), 421 (7.7), 413 (7.7), 395 (12.8), 386 (6.4), 329 (15.4), 327 (35.9), 311 (12.8), 309 (17.9), 234 (30.8), 203 (48.7), 165 (69.2), 161 (66.6), 149 (100).

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.26 and 0.56 (2H-19, d, J = 4 Hz), 0.86 s, 1.01d, 1.28 s, 1.34 s, 1.38 s, 1.38 s, 1.64 s (7 × CH₃), 3.60 (H-6, m), 3.68 (H-24, dd, J = 10, 3 Hz), 4.56 (H-16, m, W_{1/2} = 14 Hz).

Genin of Mongholicoside II

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus mongholicus Bunge (*Leguminosae*) [1].

Table 1

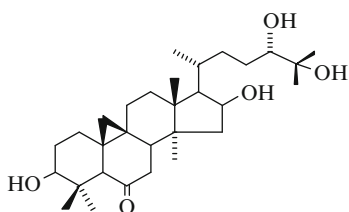
δ_C (C ₅ D ₅ N)(b)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)
C-1	72.5	C-17	57.2
2	33.9	18	12.3
3	76.5	19	29.0
4	39.3	20	29.4
5	39.4	21	18.7
6	20.28	22	36.5
7	25.0*	23	25.2*
8	46.4	24	126.1
9	20.4	25	135.1
10	29.3	26	13.5
11	39.1	27	68.5 3.98 s
12	72.47	28	20.3
13	50.5	29	25.1
14	47.7	30	14.1
15	48.2	Ac	21.0
16	72.3		170.6

* Assignments may be interchangeable

References

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Huangqiyegein II

C₃₀H₅₀O₅, M 490**Taxonomy:** Cycloartane Triterpenoids*Astragalus membranaceus* Bunge (*Leguminosae*) [1].A white powder, $[\alpha]_D^{25} +112.5^\circ$ (c 0.40, CHCl₃).

CAS Registry Number: 188647-82-7.

EIMS m/z : 490 M⁺.

¹HNMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.20 and 0.81 (2H-19, d, J = 5.1 Hz), 0.97 (CH₃, s), 1.08 (CH₃-21, d, J = 6.4 Hz), 1.30, 1.40, 1.48, 1.51, 1.76 (5 × CH₃, s).

Table 1

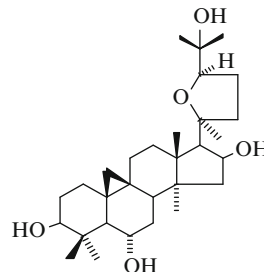
δ _C (C ₅ D ₅ N)									
C-1	30.7	C-7	41.6	C-13	45.8	C-19	21.9	C-25	72.6
2	30.4	8	43.0	14	47.8	20	28.8	26	25.7
3	77.6	9	21.8	15	45.9	21	18.5*	27	26.5
4	41.4	10	30.4	16	71.5	22	32.9	28	19.1
5	57.9	11	26.7	17	56.6	23	28.0	29	27.5
6	211.8	12	33.2	18	15.7*	24	77.2	30	14.9

*Assignment of signals carried out by us

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Cyclogalegigenin

C₃₀H₅₀O₅, M 490**Taxonomy:** Cycloartane Triterpenoids*Astragalus galegiformis* L. (*Leguminosae*) [1, 2].Mp 195–196°C (from MeOH), $[\alpha]_D^{25} +28.7^\circ$ (c 1.15, MeOH).

CAS Registry Number: 84605-18-5.

IR ν_{max}^{KBr}, cm⁻¹: 3460–3380, 3040.

MS m/z (%): M⁺ 490 (1.8), 475 (8.6), 472 (17.2), 457 (15.6), 454 (23.4), 439 (14.1), 431 (4.7), 421 (8.6), 413 (23.4), 395 (37.5), 377 (14.8), 289 (17.2), 271 (56.3), 143 (100), 125 (87.5).

¹H NMR (C₅D₅N, δ): 0.22 and 0.50 (2H-19, d, J = 4.2 Hz), 0.89, 1.17, 1.23, 1.24, 1.40, 1.57, 1.78 (7 × CH₃, s), 3.55 (H-3, dd, J = 11.2, 4.8 Hz), 3.69 (H-6, td, J = 9.6, 3.6 Hz), 3.83 (H-24, t, J = 7.5 Hz), 4.70 (H-16, ddd, ΣJ = 21 Hz).

Table 1

δ _C (C ₅ D ₅ N)[3]									
C-1	32.78	C-7	38.73	C-13	45.50	C-19	30.88	C-25	70.28
2	31.43	8	47.20	14	46.80	20	86.62	26	26.87
3	78.30	9	21.01	15	49.02	21	26.32	27	28.10
4	42.43	10	29.79	16	72.84	22	37.53	28	20.49
5	53.99	11	26.48	17	56.49	23	24.30	29	29.41
6	68.35	12	33.76	18	21.23	24	84.90	30	16.11

X-Ray [4].

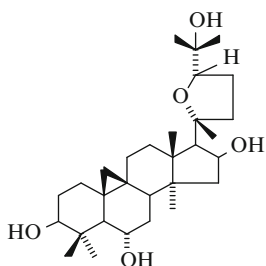
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Cyclosieversigenin (Cycloastragenol, Astramembrangenin)

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Astragalus sieversianus Pall. (*Leguminosae*) [1, 3].
Astragalus taschkendicus Bunge (*Leguminosae*) [2, 3].
Astragalus membranaceus Bunge (*Leguminosae*) [4–6].
Astragalus pamirensis Ovcz. et Rassulova (*Leguminosae*) [3, 7].
Astragalus ptercephalus Bunge (*Leguminosae*) [3, 7].
Astragalus tragacantha Habl. (*Leguminosae*) [3, 8].
Astragalus mongholicus Bunge (*Leguminosae*) [9].
Astragalus uninodus M. Pop. et Nved. (*Leguminosae*) [10].
Astragalus kuhitangi (Nevski) Sirj. (*Leguminosae*) [11].
Astragalus dissectus B. Fedtsch. et N. Ivanova (*Leguminosae*) [12].
Astragalus exilis A. Kor. (*Leguminosae*) [13].
Astragalus aitosensis MB (*Leguminosae*) [14].
 Mp 239–241°C (from MeOH), $[\alpha]_D^{29} +50.6^\circ$ (c 1.59, MeOH).
 CAS Registry Number: 78574-94-4.
 IR ν_{\max}^{KBr} , cm⁻¹: 3450–3300, 3050.
 MS m/z (%): M⁺ 490 (0.6), 472 (6.2), 454 (5.3), 439 (3), 431 (1.3), 413 (5.4), 395 (6), 289 (3.2), 271 (7.3), 143 (100).

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	32.8	1.64 ddd (13, 12, 4.5), 1.25 ddd (13, 4.5, 3)	C-16	73.4	5.02 qd (7.5, 2)
			17	58.4	2.55 d (7.5)
2	31.4	2.055 dtd (12, 4.5, 3), 1.96 tdd (12, 11.5, 4.5)	18	21.6	1.45 s
			19	31.0	0.35 d (4), 0.62 d (4)
3	78.3	3.66 dd (11.5, 4.5)	20	87.2	–
4	42.4	–	21	28.6	1.33 s
5	53.9	1.72 d (9.5)	22	34.9	1.69 ddd (11.5, 9, 2.5), 3.12 td (11.5, 9).
6	68.3	3.80 td (9.5, 4)	23	26.4	2.06 dq (11.5, 9), 2.32 tdd (11.5, 5.5, 2.5)
7	38.8	1.65 td (12, 9.5), 1.83 dt (12, 4)	24	81.7	3.89 dd (9, 5.5)
8	47.2	1.96 dd (12, 4)	25	71.2	–
9	20.9	–	26	27.2	1.30 s
10	29.9	–	27	28.2	1.58 s
11	26.3	1.98 dt (10, 3.5), 1.23 td (10, 4.5)	28	20.2	1.03 s
12	33.4	1.63 m, 1.67 m	29	29.4	1.89 s
13	45.0	–	30	16.1	1.37 s
14	46.2	–			
15	46.7	1.78 dd (12.5, 7.5), 2.13 dd (12.5, 7.5)			

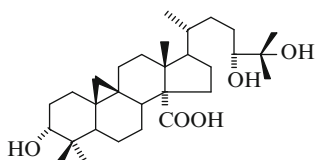
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Protolyofoligenic Acid

C₃₀H₅₀O₅, M 490



Taxonomy: Cycloartane Triterpenoids

Lyonia ovalifolia Drude var *elliptica* Hand.-Mazz. (*Ericaceae*) [1, 2].

Mp 216.5–218°C (from EtOAc), [α]_D²⁵ –10° (c 0.23, MeOH).

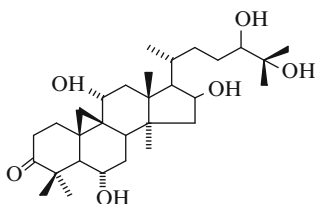
CAS Registry Number: 12708-28-0.

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Cycloasgenin B

C₃₀H₅₀O₆, M 506



Taxonomy: Cycloartane Triterpenoids

Astragalus taschkendicus Bunge (*Leguminosae*) [1, 2].
Mp 232–233°C (from MeOH), [α]_D +98.9° (c 0.89, MeOH).

CAS Registry Number: 95645-57-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 3060, 1697.

CD (c 0.1, MeOH): $\Delta\epsilon = -0.04$ (318 nm), $\Delta\epsilon = +1.03$ (290 nm).

MS m/z (%): M⁺ 506 (4.4), 488 (39.1), 470 (13), 455 (8.7), 452 (10.9), 437 (8.7), 411 (13), 393 (13), 367 (100), 351 (52.2), 343 (13), 331 (17.4), 325 (21.7).

¹H NMR (C₅D₅N, δ): 0.59 and 1.75 (2H-19, d, J = 4.3 Hz), 1.22 (CH₃-21, d, J = 6.6 Hz), 1.00, 1.51, 1.53, 1.55, 1.56, 1.84 (6 × CH₃, s), 3.81 (H-24, dd, J = 10.4, 2.3 Hz), 3.88 (H-6, td, J = 10, 3.2 Hz), 4.38 (H-11, dd, J = 9.3, 3.4 Hz), 4.75 (H-16, q, $\Sigma J = 20.2$ Hz).

Table 1

δ_c (C ₅ D ₅ N) [2]										
C-1	29.66	C-7	38.77	C-13	46.28	C-19	29.29 ^a	C-25	72.64	
2	36.38	8	48.21	14	46.97	20	31.54	26	25.94	
3	216.90	9	28.34	15	48.86	21	19.51	27	26.11	
4	50.70	10	28.72	16	71.65	22	34.72	28	21.56	
5	54.69	11	64.05	17	57.35	23	29.29 ^a	29	28.54	
6	68.72	12	48.02	18	18.63	24	80.52	30	20.62	

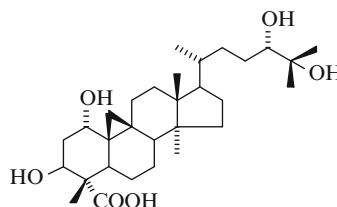
^aSignals are mutually imposed

References

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24-Epiquadrangularic Acid L

C₃₀H₅₀O₆, M 506



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Colorless amorphous solid, $[\alpha]_D^{25} +76.2^\circ$ (c 0.08, MeOH).

CAS Registry Number: 254754-49-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1700, 1470, 1380, 1050.

HRFABMS m/z : 529.3512 $[M + Na]^+$.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.56 and 0.84 (2H-19, d, $J = 4.5$ Hz), 0.98 (CH_3 -28, s), 1.01 (CH_3 -21, d, $J = 6.5$ Hz), 1.05 (CH_3 -18, s), 1.52 (CH_3 -27, s), 1.55 (CH_3 -26, s), 1.74 (CH_3 -30, s), 2.30 (H-2, ddd, $J = 12.5, 12, 2$ Hz), 2.50 (H-2, ddd, $J = 12.5, 4.5, 4$ Hz), 2.75 (H-11, ddd, $J = 13, 9, 8$ Hz), 3.43 (H-5, dd, $J = 12, 4.5$ Hz), 3.71 (H-24, dd, $J = 10, 2$ Hz), 3.92 (H-1, brs), 5.57 (H-3, dd, $J = 12, 4.5$ Hz).

Table 1

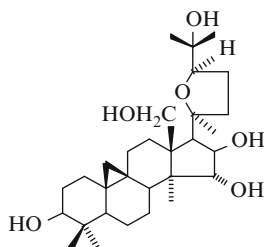
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	75.5	C-7	28.3	C-13	45.5	C-19	29.8	C-25	72.7
2	38.8	8	48.2	14	49.1	20	36.3	26	26.1
3	70.7	9	20.8	15	35.9	21	18.8	27	26.0
4	55.7	10	30.3	16	25.9	22	34.5	28	19.5
5	37.7	11	26.2	17	52.8	23	29.4	29	180.0
6	23.4	12	33.3	18	18.4	24	79.8	30	9.7

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20S,24R-Epoxy-cycloartane-3 β ,15 α ,16 β ,18,25-pentaol

$\text{C}_{30}\text{H}_{50}\text{O}_6$, M 506



Taxonomy: Cycloartane Triterpenoids
Beesia calthaeifolia Maxim. (*Ranunculaceae*) [1].

Amorphous powder.

MS m/z : 506.3600 $[M]^+$, 488, 470, 452, 143 (base peak).

$^1\text{H NMR}$ (100 MHz, CDCl_3 , δ , 0-TMS): 0.81, 0.97, 1.00, 1.12, 1.26, 1.26 (6x CH_3 , s), 2.32 (H-17, d, $J = 9$ Hz), 3.28 (H-3, m), 3.90 (H-24, dd, $J = 8.0, 6.6$ Hz), 4.03 (H-15, brs), 4.16 (H-16, brd, $J = 9$ Hz), 4.24 (2H-18, s).

Table 1

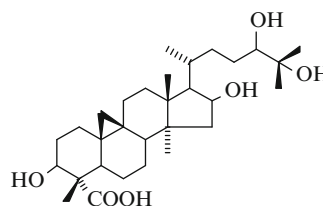
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	32.5	C-7	26.5	C-13	53.0	C-19	31.1	C-25	70.6
2	31.6	8	48.4	14	49.6	20	86.2	26	26.3
3	77.9	9	20.3	15	86.8	21	28.4	27	26.3
4	41.0	10	26.8	16	82.4	22	36.9	28	13.6
5	47.6	11	24.5	17	53.3	23	29.5	29	26.1
6	21.3	12	30.6	18	65.8	24	85.2	30	14.7

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No Name (9,19-Cyclolanostan-3 β ,16 β ,24R,25-tetrol-30-oic acid)

$\text{C}_{30}\text{H}_{50}\text{O}_6$, M 506



Taxonomy: Cycloartane Triterpenoids

Thalictrum uchiyamai Nakai (*Ranunculaceae*) [1].

IR ν_{\max}^{KBr} , cm^{-1} : 3410, 2960, 1470, 1450, 1390.

$^1\text{H NMR}$ (500 MHz, CD_3OD , δ , 0-TMS): 0.24 and 0.55 (2H-19, d, $J = 4.4$ Hz), 0.84 (CH_3 -28, s), 0.86 (CH_3 -21, d, $J = 6.5$ Hz), 1.06 (CH_3 -27, s), 1.08 (CH_3 -26, s), 1.09 (CH_3 -18, s), 1.26 (CH_3 -30, s), 3.19 (H-3, dd, $J = 4.7, 11.8$ Hz), 3.29 (H-24, dd, $J = 2.2, 10.9$ Hz), 4.34 (H-16, dt, $J = 5, 10.3$ Hz).

Table 1

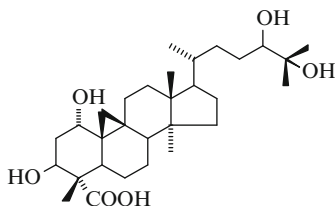
δ_C (CD ₃ OD)									
C-1	33.04	C-7	27.52	C-13	46.44	C-19	30.36	C-25	73.81
2	32.22	8	50.08	14	47.73	20	29.84	26	25.42
3	78.45	9	22.60	15	49.28	21	18.43	27	25.37
4	52.53	10	27.62	16	73.36	22	34.06	28	19.67
5	49.46	11	27.37	17	58.13	23	28.46	29	179.33
6	23.86	12	33.71	18	20.57	24	79.21	30	22.78

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Quadrangularic Acid L

C₃₀H₅₀O₆, M 506



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +100.4^\circ$ (c 0.03, MeOH).

CAS Registry Number: 254757-96-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1700, 1370, 1040.

HRFABMS m/z: 529.3476 [M + Na]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.55 and 0.83 (2H-19, d, J = 4.5 Hz), 0.97 (CH₃-28, s), 1.00 (CH₃-21, d, J = 6.5 Hz), 1.06 (CH₃-18, s), 1.52 (CH₃-27, s), 1.54 (CH₃-26, s), 1.73 (CH₃-30, s), 2.29 (H-2, ddd, J = 12.5, 12, 2 Hz), 2.50 (H-2, ddd, J = 12.5, 4.5, 4 Hz), 2.75 (H-11, ddd, J = 13, 9, 8 Hz), 3.42 (H-5, dd, J = 12, 4.5 Hz), 3.76 (H-24, dd, J = 8, 2.5 Hz), 3.91 (H-1, brs), 5.56 (H-3, dd, J = 12, 4.5 Hz).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	72.6	C-7	28.4	C-13	45.5	C-19	29.8	C-25	72.7
2	38.8	8	48.2	14	49.1	20	36.3	26	26.1

(continued)

Table 1 (continued)

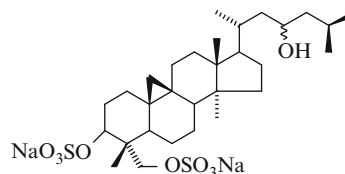
δ_C (C ₅ D ₅ N)									
3	70.7	9	20.8	15	35.9	21	18.6	27	25.9
4	55.7	10	30.3	16	25.8	22	34.1	28	19.5
5	37.7	11	26.2	17	52.9	23	28.9	29	180.0
6	23.4	12	33.3	18	18.4	24	79.0	30	9.7

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, J. Nat. Prod. **63**(1), 57–64 (2000)

Cycloartan-3,23,29-triol 3,29-disodium sulfate

C₃₀H₅₀O₉S₂Na₂ M 664



Taxonomy: Cycloartane Triterpenoids

Tydemania expeditionis Weber van Bosse (*Udoteaceae*) [1].

Mp 203–204°C, $[\alpha]_D +20.5^\circ$ (c 0.2).

IR ν_{\max} , cm⁻¹: 3453, 1464, 1376, 1224–1247.

Negative HRFABMS m/z: 641.2824 [M-Na]⁻.

Table 1

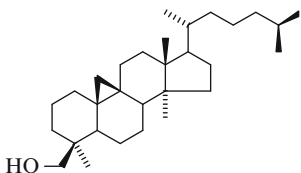
δ_C (CD ₃ OD)	δ_H (J/Hz) (CD ₃ OD)	δ_C (CD ₃ OD)	δ_H (J/Hz) (CD ₃ OD)		
C-1	32.6	1.55 m, 1.28 m	C-16	28.2	1.84 m, 1.30 m
2	27.6	2.26 m, 1.75 m	17	54.5	1.53 m
3	80.8	4.46 dd (13, 5)	18	18.7	1.04 s
4	44.6	–	19	30.8	0.39 d (2.5), 0.58 d (2.5)
5	42.1	1.83 d (7,2)	20	33.7	1.7 m
6	21.5	1.73 m, 0.85 m	21	18.9	0.91 d (7)
7	29.2	1.55 m, 1.24 m	22	49.3	1.36 m, 1.13 m
8	49.6	1.52 dd (13, 5)	23	67.7	3.72 m
9	21.2	–	24	46.0	1.50 m, 0.95 m
10	26.6	–	25	25.8	1.30 m
11	26.8	2.02 m, 1.12 m	26	23.6	0.91 d (7)
12	36.7	1.26 m (2H)	27	22.7	0.91 d (7)
13	46.7	–	28	19.8	0.94 s
14	50.1	–	29	69.8	4.02 d (11), 3.76 d (11)
15	34.3	2.04 m, 1.70 m	30	11.7	0.85 s

References

1. M. Govindan, S.A. Abbas, F.J. Schmitz, R.H. Lee, J.S. Papkoff, D.L. Slate, *J. Nat. Prod.* **57**(1), 74–78 (1994)

Cycloartan-30-ol

C₃₀H₅₂O, M 428



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 180–182°C (from CHCl₃–MeOH), [α]_D +27.38° (c 0.21, CHCl₃).

CAS Registry Number: 157772-01-5.

IR ν_{max}^{CHCl₃}, cm⁻¹: 3420, 3040, 1375.

MS m/z : 428, 413, 410, 395, 315, 288, 175.

¹H NMR (300 MHz, CDCl₃, δ, 0-TMS): 0.33 and 0.56 (2H-19, d, J = 4.28 and 4.21 Hz), 0.86 (CH₃-21, d, J = 6.72 Hz), 0.88 (CH₃-28, s), 0.90 (CH₃-26 and CH₃-27, d, J = 6.98 Hz), 0.91 (CH₃-29, s), 0.94 (CH₃-18, s), 3.62 (2H-30, ABq, J = 12.18 Hz).

Table 1

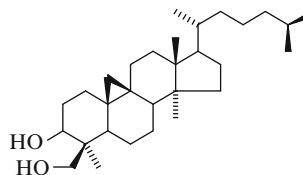
δ _C (CDCl ₃)									
C-1	31.91	C-7	28.10	C-13	45.13	C-19	29.81	C-25	28.21
2	30.34	8	47.84	14	48.79	20	36.01	26	22.51
3	29.84	9	20.10	15	32.71	21	18.30	27	22.71
4	39.80	10	26.21	16	26.52	22	36.42	28	19.33
5	47.09	11	26.02	17	52.21	23	24.01	29	22.03
6	21.01	12	35.62	18	17.91	24	39.42	30	62.98

References

1. M.A. Khan, S.S. Nizami, M.I. Khan, S.W. Azeem, Z. Ahmed, *J. Nat. Prod.* **57**(7), 988–991 (1994)

Cycloartane-3β,30-diol

C₃₀H₅₂O₂, M 444



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 196–198°C (from CHCl₃–MeOH), [α]_D +34.9° (c 0.18, CHCl₃).

CAS Registry Number: 157772-00-4.

IR ν_{max}^{CHCl₃}, cm⁻¹: 3460, 3430, 3040, 1380, 1180, 930.

MS m/z : 444, 429, 426, 411, 331, 288, 175.

¹H NMR (300 MHz, CDCl₃, δ, 0-TMS): 0.33 and 0.56 (2H-19, d, J = 4.26 and 4.18 Hz), 0.87 (CH₃-21, d, J = 6.72 Hz), 0.88 (CH₃-28, s), 0.90 (CH₃-26 and CH₃-27, d, J = 7.18 Hz), 0.92 (CH₃-29, s), 0.95 (CH₃-18, s), 3.27 (H-3, dd, J = 11.21, 4.32 Hz), 3.64 (2H-30, ABq, J = 12.78 Hz).

Table 1

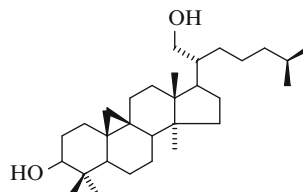
δ _C (CDCl ₃)									
C-1	31.91	C-7	28.08	C-13	45.13	C-19	29.81	C-25	28.21
2	30.33	8	47.84	14	48.79	20	36.01	26	22.51
3	78.60	9	20.10	15	32.71	21	18.30	27	22.71
4	39.61	10	26.20	16	26.51	22	36.42	28	19.32
5	47.08	11	26.01	17	52.21	23	36.42	29	22.01
6	21.00	12	35.62	18	17.91	24	39.41	30	63.14

References

1. M.A. Khan, S.S. Nizami, M.I. Khan, S.W. Azeem, Z. Ahmed, *J. Nat. Prod.* **57**(7), 988–991 (1994)

3β,21-Dihydroxycycloartane

C₃₀H₅₂O₂, M 444



Taxonomy: Cycloartane Triterpenoids*Guarea trichilioides* (Meliaceae) [1].Mp 88–91°C, $[\alpha]_D^{25} +20.2^\circ$ (c 1.06, CHCl₃).

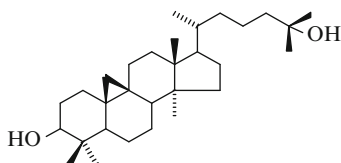
CAS Registry Number: 148044-48-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 2980–2940.MS m/z (%): M⁺ 444 (3), 429 (0.7), 315 (5), 43 (100).¹H NMR (CDCl₃, δ): 0.30 and 0.60 (2H-19, d, J = 4 Hz), 0.75, 0.75, 0.90, 0.94, 0.94 (5 × CH₃), 3.30 (1H, m), 3.64 (2H, brs).**Table 1**

δ_C (CDCl ₃)									
C-1	32.0	C-7	27.5	C-13	45.3	C-19	29.8	C-25	28.0
2	30.4	8	47.9	14	49.0	20	42.5	26	22.5
3	78.6	9	20.0	15	32.0	21	62.7	27	22.5
4	40.5	10	25.9	16	26.5	22	30.8	28	19.4
5	47.1	11	26.2	17	46.3	23	25.0	29	25.7
6	21.1	12	35.5	18	18.2	24	39.5	30	14.0

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

25-HydroxycycloartanolC₃₀H₅₂O₂, M 444**Taxonomy:** Cycloartane Triterpenoids

Rice bran oil

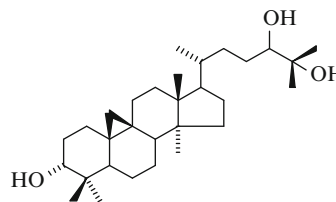
Oryza sativa L. (*Oryzeae*) [1, 2].Mp 181.5°C, $[\alpha]_D 48.7^\circ$.

CAS Registry Number: 26525-84-8.

References

1. T. Endo, S. Naito, Y. Inaba, *Yukagaku* **19**(5), 298–302 (1970). *C.A.*, 73:45627h (1970)

2. T. Endo, Y. Inaba, *Yukagaku* **19**(5), 302–307 (1970). *C.A.*, 73:45628j (1970)

(24R)-Cycloartane-3 α ,24,25-triolC₃₀H₅₂O₃, M 460**Taxonomy:** Cycloartane Triterpenoids*Aglaia harmsiana* Perkins (*Meliaceae*) [1].Mp 201–202°C (from MeOH), $[\alpha]_D^{20} +35.9^\circ$ (c 0.33, MeOH).IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3450, 2940, 1280.HREIMS m/z (%): M⁺ 460.3910 (10), 442 (18), 427 (22), 409 (23), 315 (24), 297 (28), 203 (44), 175 (91), 95 (100).¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.35 and 0.52 (2H-19, d, J = 3.9 Hz), 0.88 (CH₃-30, s), 0.89 (CH₃-21, d, J = 6.6 Hz), 0.90 (CH₃-28, s), 0.95 (CH₃-29, s), 0.97 (CH₃-18, s), 1.17 and 1.22 (CH₃-26 and CH₃-27, s), 3.29 (H-24, dd, J = 9.8, 1.7 Hz), 3.47 (H-3, t, J = 2.5 Hz).**Table 1**

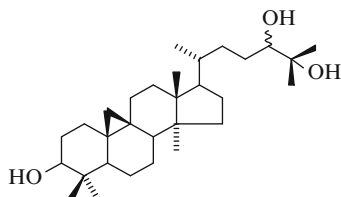
δ_C (CDCl ₃)									
C-1	27.5	C-7	28.1	C-13	45.3	C-19	29.8	C-25	73.2
2	28.8	8	48.1	14	48.9	20	36.4	26	23.3
3	77.1	9	19.9	15	35.5	21	18.5	27	26.6
4	39.6	10	26.5	16	26.3	22	33.6	28	19.3
5	41.1	11	26.3	17	52.3	23	28.6	29	25.9
6	21.1	12	33.6	18	18.0	24	79.7	30	21.3

References

1. A. Inada, S. Ohtsuki, T. Sorano, H. Murata, Y. Inatomi, D. Darnaedi, T. Nakanishi, *Phytochemistry* **46**(2), 379–381 (1997)

24RS-Cycloartane-3 β ,24,25-triol

C₃₀H₅₂O₃, M 460



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 154–156°C (from C₆H₆), [α]_D³⁰ 0° (c 0.8, CHCl₃).

CAS Registry Number: 110044-47-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 3043.

¹H NMR (CDCl₃, δ , 0-TMS): 0.29 and 0.53 (2H-19, d, J = 4.3 Hz), 0.78, 0.87, 0.87, 0.93, 0.93, 1.12, 1.18 (7 \times CH₃), 3.26 (2H, m).

Table 1

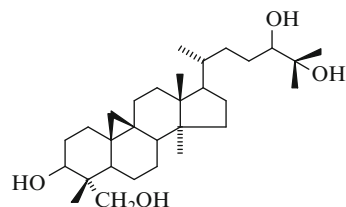
δ_{C} (CDCl ₃)									
C-1	31.9	C-7	28.1	C-13	45.3	C-19	29.9	C-25	73.2
2	30.3	8	48.0	14	48.8	20	36.4, 35.9	26	23.2, 23.1
3	78.8	9	19.9	15	32.9	21	18.4, 18.1	27	26.5
4	40.9	10	26.0	16	26.4	22	33.5, 33.1	28	19.3
5	47.0	11	26.0	17	52.4, 52.3	23	28.7, 28.4	29	25.4
6	21.1	12	35.5	18	18.1	24	79.6, 78.2	30	14.0

References

- V. Anjaneyulu, P.K. Harischandra, K. Ravi, J.D. Connoly, *Phytochemistry* **24**(10), 2359–2367 (1985)

(24R)-Cycloartane-3 β ,24,25,29-tetrol

C₃₀H₅₂O₄, M 476



Taxonomy: Cycloartane Triterpenoids

Aglaia harmsiana Perkins (*Meliaceae*) [1].

Amorphous powder, [α]_D²⁵ +22.8° (c 0.50, MeOH).

CAS Registry Number: 197308-15-9.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3450, 2960, 1260, 1030.

HREIMS m/z (%): M + 476.3863 (2), 458 (9), 443 (10), 440 (8), 425 (10), 331 (8), 320 (17), 175 (51), 95 (93), 59 (100).

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.37 and 0.62 (2H-19, d, J = 4 Hz), 0.89 (CH₃-28, s), 1.02 (CH₃-21, d, J = 6.5 Hz), 1.04 (CH₃-18, s), 1.17 (CH₃-30, s), 1.53, 1.56 (CH₃-26, CH₃-27, s), 3.73 (H-24, dd, J = 10.3, 1.4 Hz), 3.79 and 4.24 (2H-29, d, J = 10.5 Hz), 4.31 (H-3, dd, J = 11.7, 4.4 Hz).

Table 1

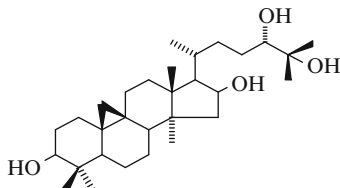
δ_{C} (C ₆ D ₆ N)									
C-1	32.4	C-7	28.5	C-13	45.6	C-19	30.1	C-25	72.8
2	31.0	8	48.3	14	49.1	20	37.0	26	26.1
3	73.9	9	19.9	15	35.9	21	18.9	27	26.0
4	44.8	10	26.1	16	26.7	22	34.5	28	19.6
5	41.6	11	26.2	17	52.9	23	29.4	29	67.5
6	21.3	12	33.3	18	18.5	24	80.0	30	11.5

References

- A. Inada, S. Ohtsuki, T. Sorano, H. Murata, Y. Inatomi, D. Darnaedi, T. Nakanishi, *Phytochemistry* **46**(2), 379–381 (1997)

Cyclofoetigenin A

C₃₀H₅₂O₄, M 476



Taxonomy: Cycloartane Triterpenoids

Thalictrum foetidum L. (*Ranunculaceae*) [1].

Mp 182–184°C (from MeOH), $[\alpha]_D^{21} +68.2^\circ$ (c 1.32, MeOH).

CAS Registry Number: 97763-04-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3520–3310, 3055.

MS m/z (%): M⁺ 476 (30.0), 458 (45.0), 443 (55.0), 440 (30.0), 425 (60.0), 415 (25.0), 407 (25.0), 399 (37.5), 381 (35.0), 371 (17.5), 353 (20.5), 336 (47.5), 313 (67.5), 295 (22.5), 203 (47.5), 173 (65.0), 159 (62.5), 43 (100).

¹H NMR (C₅D₅N, δ , 0-HMDS): 0.20 and 0.45 (2H-19, d, J = 4.4 Hz), 0.83, 0.98, 1.11, 1.33, 1.35, 1.37 (6xCH₃, s), 0.99 (CH₃-21, d), 3.43 (H-3, dd, J = 11.4, 4.8 Hz), 3.83 (H-24, dd, J = 10.9, 2.6 Hz), 4.63 (H-16, ddd, J = 7.9, 7.5, 4.6 Hz).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	32.5	C-7	26.5	C-13	45.8	C-19	30.3	C-25	72.5
2	31.3	8	48.4 ^a	14	47.1	20	28.7	26	26.2
3	78.0	9	20.0	15	48.8	21	19.4	27	26.5
4	41.1	10	26.8	16	72.0	22	33.1 ^b	28	20.3
5	47.6 ^a	11	26.5	17	57.5	23	27.9	29	25.6
6	21.5	12	33.3 ^b	18	18.3	24	77.2	30	14.8

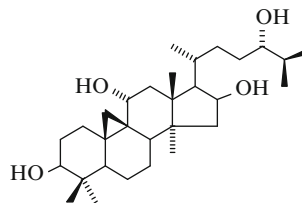
^{a,b}Assignments may be interchangeable

References

1. T.V. Ganenko, M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, V.I. Lutskiy, A.A. Semenov, N.K. Abubakirov, *Chem. Nat. Comp.* **21**(3), 345–350 (1985)

Curculigenin B

C₃₀H₅₂O₄, M 476



Taxonomy: Cycloartane Triterpenoids

Curculigo orchioides Gaerth. (*Hypoxidaceae*) [1].

Mp 119–122°C, $[\alpha]_D +145^\circ$ (c 0.10, CHCl₃).

CAS Registry Number: 143599-93-3.

EIMS m/z: [M]⁺476.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.39 and 0.53 (2H-19, d, J = 4 Hz), 1.06 and 1.08 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.11, 1.22, 1.36, 1.44, (4 × CH₃, s), 1.49 (CH₃-21, d, J = 6.8 Hz), 2.23 (H-20, dq, J = 8, 6.8 Hz), 2.89 (H-17, dd, J = 11, 7.8 Hz), 3.52 (H-3, dd, J = 11.2, 4.8 Hz), 3.64 (H-24, m), 4.19 (H-11, dd, J = 9.5, 5.5 Hz), 4.89 (H-16, m).

Table 1

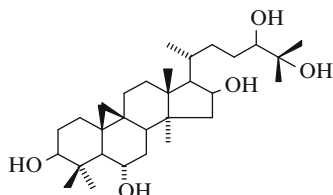
δ_C (C ₅ D ₅ N)									
C-1	32.38	C-7	26.55	C-13	47.29	C-19	30.34	C-25	34.14
2	31.40	8	49.40	14	50.21	20	34.21	26	19.77
3	78.07	9	20.20	15	50.86	21	17.71	27	17.83
4	41.19	10	26.88	16	71.90	22	32.78	28	18.64
5	47.85	11	72.77	17	49.40	23	31.60	29	26.24
6	21.75	12	40.29	18	22.16	24	77.54	30	14.94

References

1. J. Xu, R. Xu, *Phytochemistry* **31**(7), 2455–2458 (1992)

Cycloasgenin C

C₃₀H₅₂O₅, M 492



Taxonomy: Cycloartane Triterpenoids

Astragalus taschkendicus Bunge (*Leguminosae*) [1].

Mp 244–246°C (from Me₂CO), [α]_D²³ +33.7° (c 1.18, MeOH).

CAS Registry Number: 84272-49-1.

IR ν_{max}^{KBr}, cm⁻¹: 3480–3350, 3040.

MS m/z (%): M⁺ 492 (7), 474 (100), 459 (44.2), 456 (72.1), 441 (46.5), 438 (14), 430 (16.3), 423 (40.7), 415 (39.6), 405 (22.1), 397 (48.8), 379 (25.6), 355 (7), 329 (25.6), 311 (34.9).

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.33 and 0.61 (2H-19, d, J = 4 Hz), 1.04, 1.35, 1.41, 1.47, 1.49, 1.87 (6 × CH₃, s), 1.11 (CH₃-21, d, J = 6.5 Hz), 3.66 (H-3, dd, J = 12, 5 Hz), 3.77 (H-24, dd, J = 10, 2 Hz), 3.80 (H-6, td, J = 10, 3 Hz), 4.70 (H-16, td, J = 8, 5 Hz) [2].

Table 1

δ_C(C₅D₅N) [2]

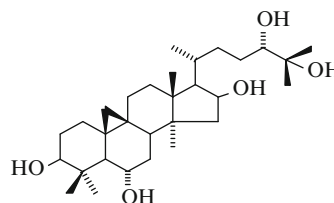
C-1	32.77	C-7	38.59	C-13	45.68	C-19	29.36	C-25	72.68
2	31.41	8	47.22	14	46.91	20	31.59	26	25.90
3	78.32	9	21.26	15	48.75	21	19.08	27	26.13
4	42.40	10	30.38	16	71.72	22	34.82	28	20.28
5	53.95	11	26.35	17	57.24	23	29.56	29	29.37
6	68.27	12	33.17	18	18.79	24	80.53	30	16.13

References

- M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, N.K. Abubakirov, *Chem. Nat. Comp.* **18**(4), 424–430 (1982)
- M.I. Isaev, *Chem. Nat. Comp.* **31**(6), 690–693 (1995)

Cyclocanthogenin

C₃₀H₅₂O₅, M 492



Taxonomy: Cycloartane Triterpenoids

Astragalus tragacantha Habl. (*Leguminosae*) [1].

Mp 194–195°C (from MeOH), [α]_D²³ +57.5° (c 0.87, MeOH).

CAS Registry Number: 114339-78-5.

IR ν_{max}^{KBr}, cm⁻¹: 3560–3280, 3040.

MS m/z (%): M⁺ 492 (4.2), 474 (100), 459 (65.2), 456 (86.9), 441 (84.8), 438 (21.7), 423 (73.9), 415 (47.8), 405 (39.1), 397 (86.9), 379 (43.5), 329 (69.6), 311 (95.7), 293 (30.4).

¹H NMR (250 MHz, C₅D₅N, δ, 0-TMS): 0.32 and 0.60 (2H-19, d, J = 4 Hz), 1.04, 1.36, 1.43, 1.46, 1.48, 1.91 (6 × CH₃, s), 1.11 (CH₃-21, d, J = 6.5 Hz), 3.70 (H-3, dd, J = 11, 4 Hz), 3.82 (H-6, td, J = 9, 3 Hz), 3.95 (H-24, dd, J = 10, 2 Hz), 4.75 (H-16, q, J = 6.3 Hz).

Table 1

δ_C(C₅D₅N) [2]

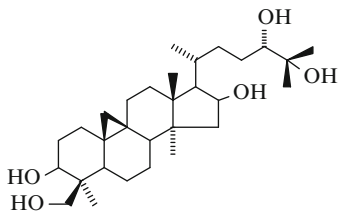
C-1	32.78	C-7	38.45	C-13	45.76	C-19	29.70	C-25	72.49
2	31.34	8	47.17	14	46.85	20	28.78	26	25.43
3	78.34	9	21.35	15	48.41	21	18.97	27	26.46
4	42.33	10	30.37	16	72.02	22	33.07	28	20.18
5	53.96	11	26.43	17	57.39	23	27.99	29	29.17
6	68.29	12	33.33	18	18.24	24	77.22	30	15.98

References

- Y.M. Fadeev, M.I. Isaev, Y.A. Akimov, P.K. Kintia, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **23**(6), 678–684 (1987)
- M.I. Isaev, B.A. Imomnazarov, Y.M. Fadeev, P.K. Kintia, *Chem. Nat. Comp.* **28**(3–4), 315–320 (1992)

Cyclofoetigenin B

C₃₀H₅₂O₅, M 492



Taxonomy: Cycloartane Triterpenoids

Thalictrum foetidum L. (*Ranunculaceae*) [1].

Mp 240–242°C (from Me₂CO), [α]_D²² +72° (c 0.5, MeOH).

CAS Registry Number: 107869-22-7.

IR ν_{max}^{KBr}, cm⁻¹: 3530–3250, 3040.

MS m/z (%): M⁺ 492 (0.8), 474 (55.6), 459 (74.6), 456 (63.5), 441 (49.2), 433 (44.4), 423 (46.0), 415 (31.7), 405 (19.0), 397 (31.7), 379 (19.0), 371 (57.1), 353 (63.5), 329 (30.2), 311 (66.6), 173 (100).

¹H NMR (C₅D₅N, δ, 0-HMDS): 0.35 and 0.48 (2H-19, d, J = 4.4 Hz), 0.94, 1.43, 1.47, 1.50, 1.54 (5 × CH₃, s), 1.11 (CH₃-21, d, J = 6.6 Hz), 3.34 (H-3, dd, ΣJ = 16.2 Hz), 3.83 and 4.71 (2H-30, d, J = 10.8 Hz), 3.95 (H-24, dd, J = 11, 2.8 Hz), 4.74 (H-16, ddd, ΣJ = 20.4 Hz).

Table 1

δ _C (C ₅ D ₅ N)									
C-1	32.4	C-7	26.5 ^a	C-13	45.8	C-19	31.7 ^b	C-25	72.6
2	30.7 ^b	8	48.5	14	47.1	20	28.8	26	26.5
3	80.3	9	21.3	15	48.8	21	19.5	27	25.6
4	43.9	10	26.4	16	72.1	22	33.1	28	20.4
5	48.0	11	26.9 ^a	17	57.5	23	28.1	29	21.7
6	21.9	12	33.4	18	18.2	24	77.3	30	64.6

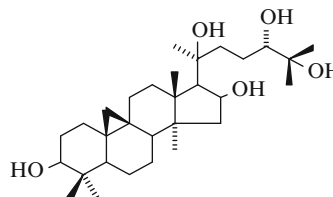
^{a,b}Assignments may be interchangeable

References

1. T.V. Ganenko, M.I. Isaev, A.S. Gromova, N.D. Abdullaev, V.I. Lutskyi, M.F. Larin, A.A. Semenov, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(3), 288–294 (1986)

No Name (9,19-Cyclolanostan-3β,16β,20,24S,25-pentol)

C₃₀H₅₂O₅, M 492



Taxonomy: Cycloartane Triterpenoids

Oxytropis bicolor Bunge (*Leguminosae*) [1].

Mp 262–264°C, [α]_D¹⁵ +33° (c 0.32, MeOH).

CAS Registry Number: 138935-90-7.

EIMS m/z (%): M⁺ 492 (2), 474 (3), 456 (10), 438 (20), 420 (15), 402 (5), 313 (12), 161 (20), 143 (75), 125 (55), 107 (44).

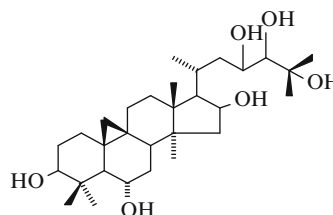
¹H NMR (200 MHz, C₅D₅N, δ, 0-TMS): 0.22 and 0.48 (2H-19, d, J = 4 Hz), 0.90, 1.12, 1.25, 1.52, 1.54, 1.79, 1.92 (7 × CH₃, s), 3.50 (H-3, m), 3.80 (H-24, dd, J = 9, 4 Hz), 4.50 (H-16, m).

References

1. R.Q. Sun, Z.J. Jia, *Phytochemistry* **30**(10), 3480–3482 (1991)

Cycloorbigenin C

C₃₀H₅₂O₆, M 508



Taxonomy: Cycloartane Triterpenoids

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1–3].

Mp 256–258°C (from MeOH).

IR ν_{max}^{KBr}, cm⁻¹: 3540–3200, 3050.

MS m/z (%): M⁺ 508 (1.4), 490 (8.6), 475 (4.4), 472 (8.8), 457 (8.8), 454 (8.8), 439 (11.1), 383 (33.3), 367 (16.7), 349 (16.5), 339 (16.7), 323 (16.7), 311 (27.8), 295 (27.8), 293 (22.2), 271 (33.3), 253 (38.9), 239 (44.4), 213 (66.7), 201 (83.3), 189 (77.8), 171 (100), 163 (88.9), 141 (77.8), 115 (88.9), 99 (83.3).

Table 1

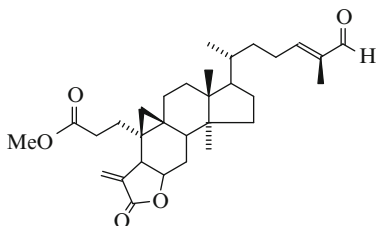
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.85	1.28, 1.65	C-16	72.20	4.72 td (7.2, 5.2)
2	31.49	1.95, 2.05	17	57.51	1.86
3	78.41	3.67 dd (11.5, 4.5)	18	18.94	1.40 s
4	42.51	–	19	30.11	0.33 d (4), 0.61 d (4)
5	54.01	1.75 d (9.2)	20	27.41	2.61 m
6	68.29	3.81 td (9.3, 3.4)	21	20.36	1.21 d (7)
7	38.62	1.75, 2.05	22	42.97	2.15, 2.20
8	47.19	1.97	23	73.17	4.33 t (8.5)
9	21.30	–	24	79.19	3.77 d (8.2)
10	29.64	–	25	74.37	–
11	26.36	1.25, 1.95	26	24.70	1.72 s
12	33.05	1.65, 1.65	27	28.98	1.68 s
13	46.18	–	28	20.25	1.03 s
14	46.90	–	29	29.41	1.89 s
15	47.78	1.80, 2.15	30	16.20	1.37 s

References

1. R.P. Mamedova, M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **38**(4), 354–355 (2002)
2. R.P. Mamedova, M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **39**(5), 470–474 (2003)
3. I.M. Isaev, R.P. Mamedova, M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **43**(1), 115–116 (2007)

Coronalolide Methyl Ester

C₃₁H₄₄O₅, M 496



Taxonomy: Cycloartane Triterpenoids

Gardenia coronaria (Rubiaceae) [1].

Mp 91–92.5°C (from MeOH), $[\alpha]_D^{25} +121.6^\circ$ (c 0.86, CHCl₃).

IR ν_{\max}^{film} , cm⁻¹: 2943, 1768, 1739, 1684, 1641, 1265, 1167.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 213 and 229.

EIMS m/z (%): [M]⁺ 496 (14), 481 (9), 371 (46), 231 (18), 217 (23), 157 (45), 145 (49), 129 (68), 125 (24), 105 (100).

HREIMS m/z: 496.3182 [M]⁺.

X-Ray crystallography performed.

Table 1

	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	30.8	2.25, 1.61	C-16	27.7	1.95, 1.37
2	31.1	2.55, 2.45	17	51.2	1.65
3	173.3	–	18	15.9	0.95 s
4	139.0	–	19	23.1	0.19 d (5.5), 0.43 d (5.5)
5	38.9	3.23 brd (8)	20	35.9	1.48 m
6	74.3	4.74 td (8, 6.5)	21	18.2	0.94 d (6.5)
7	27.1	1.77, 1.55	22	34.7	1.63, 1.24
8	38.2	2.12 t (5.5)	23	25.9	2.43, 2.32
9	25.0	–	24	155.2	6.49 tq (6.5, 1.5)
10	28.1	–	25	139.0	–
11	26.4	1.6–1.7	26	195.2	9.40 s
12	32.9	1.6–1.7	27	9.1	1.76 brs
13	45.7	–	28	20.0	0.92 s
14	48.6	–	29	170.6	–
15	34.7	1.37, 1.37	30	123.0	6.34 d (2.5), 5.75 d (2.3)
			OMe	51.7	3.69 s

Biological activity

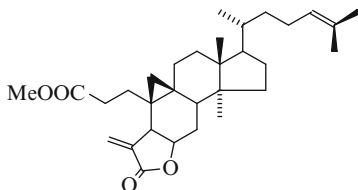
This compound showed broad cytotoxic activity when evaluated against a panel of human cancer cell lines.

References

1. G.L. Silva, R.R. Gil, B. Cui, H. Chai, T. Santisuk, E. Srisook, V. Reutrakul, P. Tuchinda, S. Sophasan, S. Sujarit, S. Upatham, S.M. Lynn, J.E. Farthing, S.-L. Yang, J.A. Lewis, M.J. O'Neill, N.R. Farnsworth, G.A. Cordell, J.M. Pezzuto, A.D. Kinghorn, Tetrahedron **53**(2), 529–538 (1997)

Tubiferolide Methyl Ester

C₃₁H₄₆O₄, M 482



Taxonomy: Cycloartane Triterpenoids

Gardenia tubifera (Rubiaceae) [1].

Mp 125.7–126.3°C (from CH₂Cl₂-hexane), [α]_D³⁰ +142.0° (c 0.26, CHCl₃).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3027, 2952, 2875, 1755, 1734, 1654, 1457, 1438, 1377, 1297, 1270, 1171, 1149, 1017, 982, 945, 823.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 206 (3.96).

EIMS m/z (%): M⁺ 482 (30), 398 (25), 371 (32), 286 (2), 111 (8), 69 (100).

HRFABMS m/z: [M + H]⁺ 483.3474.

Table 1

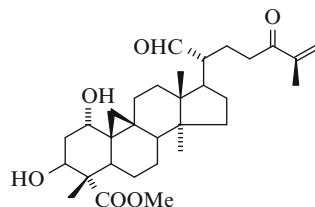
δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	30.95 2.23 m, 1.59	C-16	27.72 1.93, 1.32
2	31.25 2.53 m, 2.44 m	17	51.48 1.62
3	173.42 –	18	15.91 0.93 s
4	139.27 –	19	23.18 0.17 d (5.3), 0.43 d (5.3)
5	39.14 3.24 brd (8.3)	20	35.87 1.47
6	74.46 4.75 td (8.3, 6.5)	21	18.40 0.89 d (6.4)
7	27.26 1.78, 1.53	22	36.33 1.42, 1.06
8	38.37 2.14 brt (5.7)	23	24.88 2.08, 1.86
9	25.18 –	24	125.05 5.10 brt (7)
10	28.26 –	25	131.02 –
11	26.61 1.75, 1.64	26	25.66 1.69 brs
12	33.01 1.70, 1.60	27	17.60 1.61 brs
13	45.70 –	28	20.07 0.91 s
14	48.66 –	29	170.64 –
15	34.84 1.30	30	122.95 6.34 d (2.5), 5.74 (2.1)
		OMe	51.75 3.70 s

References

- V. Reutrakul, C. Krachangchaeng, P. Tuchinda, M. Pohmakotr, T. Jaipetch, C. Yoosook, J. Kasisit, S. Sophasan, K. Sujarit, T. Santisuk, *Tetrahedron* **60**, 1517–1523 (2004)

Methyl Quadrangularate N

C₃₁H₄₆O₆, M 514



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Colorless amorphous solid, [α]_D²⁵ +70.8° (c 0.11, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1710, 1460, 1255, 1250, 1040.

HRFABMS m/z: [M + Na]⁺ 537.3189.

Table 1

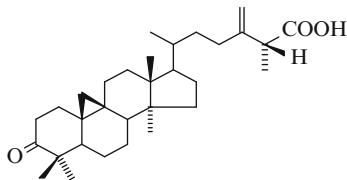
δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	72.1 3.80 brs	C-16	23.4
2	38.7 2.40 ddd (13, 4.5, 3.5), 2.15 ddd (13, 10.5, 3.5)	17	47.4 2.22 m
3	70.4 5.33 dd (10.5, 4.5)	18	19.2 1.06 s
4	56.0 –	19	29.4 0.72 d (4.5), 0.82 d (4.5)
5	37.8 3.20 dd (12, 4.5)	20	55.8 2.37 m
6	23.1	21	205.7 9.59 d (5.6)
7	26.9	22	25.9 2.62 m
8	47.5	23	35.1 2.75 m
9	20.7 –	24	200.1 –
10	30.3 –	25	144.5 –
11	25.6 2.62 m	26	124.8 5.91 brs, 5.60 brs
12	31.7	27	17.8 1.86 s
13	45.5 –	28	19.1 0.98 s
14	48.9 –	29	178.1 –
15	35.4	30	9.5 1.57 s
		OMe	51.5 3.64 s

References

- A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Ammonic Acid

C₃₁H₄₈O₃, M 468



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (*Anacardiaceae*) [1].

Mp 149–150°C, [α]_D 9.4°.

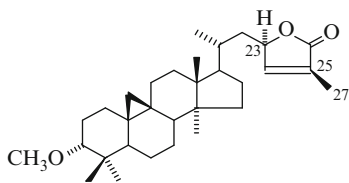
CAS Registry Number: 17984-17-7.

References

1. S. Corsano, E. Mincione, Ric. Sci. **36**(6), 494–497 (1966). C.A., 66:11062x (1967)
2. S. Corsano, E. Mincione, Chem. Commun. 738–739 (1968)

Cyclograndisolid*^{*}

C₃₁H₄₈O₃, M 468



Taxonomy: Cycloartane Triterpenoids

Abies grandis (Dougl.) Lindl (*Pinaceae*) [1, 2].

Mp 191–193°C (from MeOH).

CAS Registry Number: 32764-59-3.

ORD (c 0.0368 in dioxane): [φ]₃₀₀–890°,

[φ]₂₅₀–4,670°, [φ]₂₂₅–26,700°, [φ]₂₂₀–18,000°.

CD (c 0.0368 in dioxane): [θ]₂₇₀ + 120°, [θ]₂₅₀ + 370°,

[θ]₂₃₅ 0°, [θ]₂₂₅–12,600°, [θ]₂₁₅–44,000°.

IR ν_{max}^{KBr}, cm⁻¹: 1745, 1665.

UV λ_{max}^{MeOH}, nm (log ε): 209 (4.33).

MS m/z: M⁺ 468, 453, 436, 421, 314.

¹H NMR (CDCl₃, δ): 0.32 and 0.50 (2H-19, d, J = 4 Hz), 0.86, 0.93, 0.98, 1.02 (5 × CH₃), 1.90

(CH₃-27, t, J = 1.7 Hz), 2.80 (H-3, t, J = 1.8 Hz), 3.28 (CH₃O, s), 4.95 (H-23, m), 6.98 (H-24, t, J = 1.7 Hz).

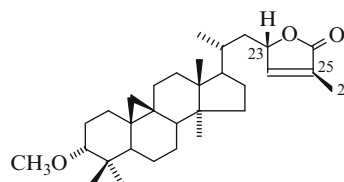
*(23R)-3 α-Methoxy-9,19-cyclo-9β-ianost-24-ene-26,23-olide.

References

1. F.H. Allen, J.P. Cutney, J. Trotter, N.D. Westcott, Tetrahedron Lett. **12**, 283–286 (1971)
2. J.P. Cutney, D.S. Grierson, G.D. Cnowles, N.D. Westcott, I.H. Rogers, Tetrahedron **29**, 13–20 (1973)

Epicyclograndisolid*^{*}

C₃₁H₄₈O₃, M 468



Taxonomy: Cycloartane Triterpenoids

Abies grandis (Dougl.) Lindl (*Pinaceae*) [1, 2].

Mp 194–195°C (from MeOH).

CAS Registry Number: 32764-63-9.

ORD (c 0.0434 in dioxane): [φ]₄₅₀ +53°, [φ]₃₀₀ + 2,370°, [φ]₂₅₀ + 6,420°, [φ]₂₂₅ +22,640°, [φ]₂₂₀ + 10,780°.

CD (c 0.0434 in dioxane): [θ]₂₇₀ + 462°, [θ]₂₆₀ + 1030°, [θ]₂₅₅ + 1424°, [θ]₂₅₀ + 1700°, [θ]₂₄₅ +1850°, [θ]₂₁₅ +39,140°.

IR ν_{max}^{KBr}, cm⁻¹: 1740, 1660.

UV λ_{max}^{MeOH}, nm (log ε): 210 (4.15).

MS m/z: M⁺ 468, 453, 436, 421, 314.

¹H NMR (CDCl₃ δ): 0.32 and 0.50 (2H-19, d, J = 4 Hz), 0.86, 0.93, 0.98, 1.02 (5 × CH₃), 1.88 (CH₃-27, t, J = 1.7 Hz), 2.80 (H-3, t, J = 1.7 Hz), 3.28 (CH₃O, s), 4.90 (H-23, m), 7.02 (H-24, t, J = 1.7 Hz).

*(23S)-3α-methoxy-9,19-cyclo-9β-ianost-24-ene-26,23-olide

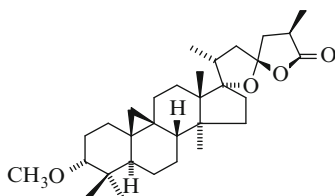
References

1. F.H. Allen, J.P. Cutney, J. Trotter, N.D. Westcott, Tetrahedron Lett. **12**, 283–286 (1971)

2. J.P. Cutney, D.S. Grierson, G.D. Cnowles, N.D. Westcott, I.H. Rogers, *Tetrahedron* **29**, 13–20 (1973)

Abietospiran

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

Abies alba (Pinaceae) [1].

Mp 219–221°C (from EtOAc), $[\alpha]_D^{22} -16.8^\circ$ (c 0.68, CHCl₃).

CAS Registry Number: 71648-15-2.

IR ν_{\max}^{KBr} , cm⁻¹: 1785.

¹HNMR (CDCl₃, δ): 0.34 and 0.47 (2H-19, d, J = 4 Hz), 0.86, 0.92, 1.03, 1.17 (4 × CH₃), 1.01 and 1.24 (2 × CH₃, d, J = 7 Hz), 2.84 (H-3, brs, W_{1/2} = 5 Hz), 3.33 (CH₃O, s).

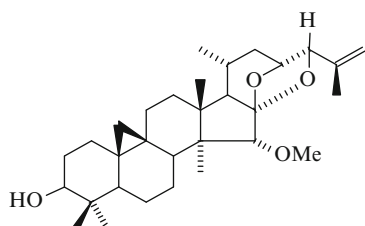
The structure was established by x-ray analysis.

References

1. W. Steglich, M. Claar, L. Zeichlin, H.J. Hecht, *Angew. Chem.* **91**(9), 751 (1979)

Dehydroxy-15-O-methylcimigenol

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

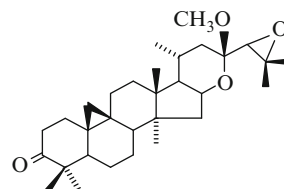
Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].
Mp 222–223°C (from EtOAc), $[\alpha]_D^{25} 38.5^\circ$.

References

1. T. Takemoto, G. Cusano, *Yakugaku Zasshi* **89**(7), 954–958 (1969). *C.A.*, 71:91696m (1969)

16 β ,23R;24S,25-Diepoxy-23-methoxy-cycloartan-3-one

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

Viguiera dentata (Cav) Spreng (*Asteraceae*) [1].

Mp 211–212°C (from EtOAc–MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 1700, 1450, 1380, 1110, 1050, 1000, 910.

MS m/z (%): M⁺ 484 (5), 469 (4), 452 (65), 437 (41), 413 (100).

Table 1

	δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.34	1.86 ddd (14, 14, 4), 1.56 ddd (14, 6, 2.5)	C-16	71.17 4.24 ddd (8, 8, 5)
2	37.39	2.31 ddd (14, 4, 2.5), 2.71 ddd (14, 14, 6)	17	55.94 1.64 t (8)
3	216.35	–	18	20.19 1.04 s
4	49.66	–	19	30.15 0.58 d (4), 0.83 d (4)
5	48.34	1.16	20	25.06 2.08 dddq (14, 8, 2, 7)
6	21.28	1.69 ddd (13, 4, 4)	21	20.47 0.90 d (7)
7	26.03	1.12 m, 1.42 m	22	40.65 1.63 t (14), 1.92 dd (14, 2)
8	47.40	1.62 dd (13, 4)	23	99.80 –
9	20.73	–	24	67.46 2.83 s
10	26.37	–	25	56.90 –

(continued)

Table 1 (continued)

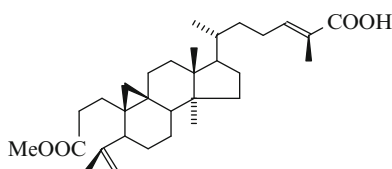
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
11	26.27	1.18	26 18.74 1.43 s
12	32.98		27 25.62 1.33 s
13	44.53	–	28 19.46 1.11 s
14	45.88	–	29 22.13 1.09 s
15	43.03		30 20.74 0.89 s
		OMe	50.15 3.30 s

References

1. F. Gao, T.J. Mabry, F. Bohlmann, J. Jakupovic, *Phytochemistry* **25**(6), 1489–1491 (1986)

Methyl (24E)-26-carboxy-3,4-seco-cycloart-4(29),24-dien-3-oate

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1].

A colorless oil, $[\alpha]_D^{25} +64^\circ$ (c 0.24, CHCl₃).

UV $\lambda_{\max}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 220 (3.6).

EIMS m/z (%): M + 484 (8), 469 (20), 451 (6), 343 (5), 301 (6), 175 (30), 95 (100).

HREIMS m/z: 484.3554 [M⁺].

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	29.1	C-16	28.1
2	31.5	17	52.2
3	174.4	–	18 18.1 0.97 s
4	149.5	–	19 29.9 0.40 d (4), 0.72 d (4)
5	45.9		20 36.0
6	27.8		21 18.1 0.91 d (6.3)
7	25.0		22 34.8
8	47.7		23 26.0
9	21.3	–	24 145.8 6.91 brt (7)

(continued)

Table 1 (continued)

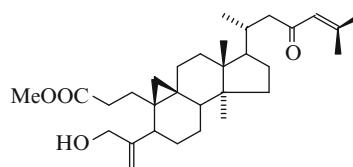
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
10	27.1	–	25 126.6 –
11	27.0		26 172.9
12	33.1		27 12.0 1.84 brs
13	45.2	–	28 19.3 0.93 s
14	49.0	–	29 111.5 4.73 brs, 4.81 brs
15	35.6		30 19.8 1.68 brs
		OMe	51.5 3.64 s

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

Methyl 3,4-seco-cycloart-4(28),24-diene-29-hydroxy-23-oxo-3-oate

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

Gardenia obtusifolia Roxb. (Rubiaceae) [1]

Colorless semisolid, $[\alpha]_D^{31} +58.7^\circ$ (c 0.8, CHCl₃)

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 237 (4.16).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3483, 1729, 1681, 1615, 1438, 1379, 1358, 1282, 1228, 1170, 1041, 904.

EIMS m/z (%): M + 484 (1), 469 (9), 453 (8), 438 (5), 411 (1), 397 (3), 386 (7), 371 (12), 353 (7), 339 (3), 313(2), 299 (3), 287 (4), 271 (2), 260 (4), 247 (5), 231 (5), 219 (5), 187 (10), 173 (12), 159 (12), 147 (38), 125 (34), 121 (38), 105 (28), 98 (13), 91 (32), 83 (100), 67 (20), 55 (55), 41 (28).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	28.90	C-16	28.24 1.87, 1.30
2	31.55	17	52.44 1.63 (15.5, 11, 4.5)
3	174.50	–	18 18.19 1.01

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
4	152.38 –	19	30.20 0.48 d (4.4), 0.73 d (4.4)
5	42.07 2.53	20	33.39 2.04
6	28.85 1.67, 1.03	21	19.28 0.88 d (6.1)
7	25.21 1.30, 1.06	22	51.67 2.51, 2.13
8	47.85 1.56	23	201.59 –
9	21.72 –	24	124.32 6.06 m
10	27.37 –	25	154.67 –
11	26.85 2.12, 1.23	26	20.62 2.14 d (1.3)
12	32.84 1.66	27	27.63 1.89 d (1.1)
13	45.15 –	28	19.31 0.94 s
14	48.96 –	29	110.37 5.11 brdd (2.9, 1.5), 5.08 brs
15	35.58 1.32	30	64.62 4.14 brs
		OMe	51.50 3.64 s

Biological activity

It was found that this compound showed potent inhibitory activity (99.9% inhibition at 200 $\mu\text{g/ml}$) against HIN-1 RT.

References

1. P. Tuchinda, W. Pompimon, V. Reutrakul, M. Pohmakotr, C. Yoosook, N. Kongyai, S. Sophasan, K. Sujarit, S.E. Upathum, T. Santisuk, *Tetrahedron* **58**, 8073–8086 (2002)

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm^{-1} 3400, 1700, 1460, 1370, 1255, 1190.
HREIMS m/z : 484.3580 $[\text{M}]^+$.

Table 1

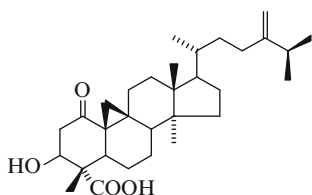
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	208.7 –	C-16	23.5
2	49.0 3.17 d (8)	17	52.2
3	73.6 5.20 t (8)	18	18.4 0.93 s
4	54.7 –	19	28.2 1.02 d (4.5), 1.30 d (4.5)
5	44.7 2.90 dd (12, 4)	20	36.4
6	22.0	21	16.9 0.92 d (6.5)
7	28.0	22	35.3
8	43.8	23	31.6
9	28.1 –	24	156.7 –
10	37.1 –	25	34.0
11	27.8 2.57 ddd (15, 8, 5)	26	21.9 1.07 d (6.5)
12	33.2	27	21.9 1.06 d (6.5)
13	45.4 –	28	18.5 1.01 s
14	49.5 –	29	179.0 –
15	34.6	30	10.6 1.76 s
		31	106.6 4.87 brs, 4.86 brs

References

1. A.H. Banskota, Y. Tezuka, K.O. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Quadrangularic Acid E

C₃₁H₄₈O₄, M 484



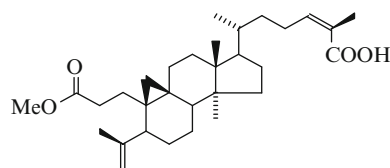
Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].
Colorless amorphous solid, $[\alpha]_{\text{D}}^{25} +18.2^\circ$ (c 0.20, MeOH).

CAS Registry Number: 221455-85-2.

3,4-Seco-(24Z)-cycloart-4(29),24-diene-3,26-dioic Acid 3-Methyl Ester

C₃₁H₄₈O₄, M 484



Taxonomy: Cycloartane Triterpenoids

Illicium dunnianum Tutcher (*Illiciaceae*) [1].

Oil, $[\alpha]_D +43.3^\circ$ (c 2.56, CHCl_3).

IR $\nu_{\text{max}}^{\text{CCl}_4}$, cm^{-1} : 2932, 2874, 1740, 1690, 1639, 1458, 1437, 1375, 1259, 1217, 1167.

HREIMS m/z: M^+ 484.3554, 469 (100), 451 (13), 385 (16), 343 (20), 316 (9), 249 (16).

Table 1

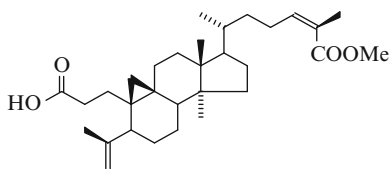
δ_C (CDCl_3)	δ_H (J/Hz)	δ_C (CDCl_3)	δ_H (J/Hz)		
C-1	29.0	2.05, 1.37	C-16	27.8	1.52, 1.08
2	31.5	2.50, 2.25	17	52.2	1.60
3	174.5	–	18	18.1	0.96 s
4	149.5	–	19	30.0	0.40 d (4.4), 0.72 d (4.4)
5	45.9	2.42	20	36.1	1.41
6	28.1	1.92, 1.29	21	18.1	0.89 d (6.4)
7	25.0	1.30, 1.10	22	35.9	1.52, 1.15
8	47.7	1.55	23	27.0	2.55, 2.45
9	21.4	–	24	147.4	6.09 t (7)
10	27.1	–	25	125.7	–
11	27.0	2.08, 1.25	26	172.9	–
12	33.0	1.65, 1.65	27	20.6	1.92 d (0.9)
13	45.2	–	28	19.8	1.68 s
14	49.0	–	29	111.5	4.80 d (1.4), 4.73 d (1.4)
15	35.6	1.29, 1.29	30	19.3	0.93 s
		OMe	51.6	3.65 s	

References

1. L.-K. Sy, R.M.K. Saunders, G.D. Brown, *Phytochemistry* **44**(6), 1099–1108 (1997)

3,4-Seco-(24Z)-cycloart-4(29),24-diene-3,26-dioic Acid, 26-Methyl Ester

$\text{C}_{31}\text{H}_{48}\text{O}_4$, M 484



Taxonomy: Cycloartane Triterpenoids
Illicium verum Hook f. (*Illiciaceae*) [1].

Solid, $[\alpha]_D +17.9^\circ$ (c 1.2, CHCl_3).

CAS Registry Number: 212830-20-1.

IR $\nu_{\text{max}}^{\text{CHCl}_3}$, cm^{-1} : 3400–2400br, 3028, 2947, 2872, 1697, 1638, 1458, 1383.

HREIMS m/z (%): M^+ 484.3552 (20), 469 (50), 454 (100), 439 (35), 436 (25), 355 (65), 316 (55), 313 (80), 301 (20), 261 (20), 249 (25), 235 (55), 217 (20), 201 (25), 175 (60), 161 (55), 133 (45), 107 (60).

Table 1

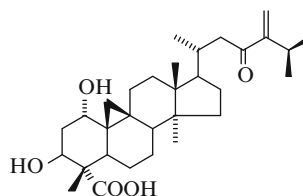
δ_C (CDCl_3)	δ_H (J/Hz)	δ_C (CDCl_3)	δ_H (J/Hz)		
C-1	28.9	2.07, 1.38	C-16	28.1	1.92, 1.29
2	31.1	2.54, 2.29	17	52.2	1.59
3	178.1	–	18	18.1	0.96
4	149.4	–	19	30.0	0.41, 0.73
5	45.9	2.43	20	36.0	1.41
6	27.8	1.51, 1.08	21	18.0	0.89
7	25.0	1.31, 1.10	22	35.9	1.53, 1.13
8	47.7	1.57	23	26.7	2.50, 2.38
9	21.5	–	24	144.0	5.93
10	27.0	–	25	126.5	–
11	27.0	2.10, 1.26	26	168.6	–
12	33.0	1.65, 1.65	27	20.7	1.90
13	45.2	–	28	19.8	0.93
14	49.0	–	29	111.6	4.82, 4.74
15	35.6	1.28, 1.28	30	19.8	1.69
		OMe	51.2	3.74	

References

1. L.-K. Sy, G.D. Brown, *Phytochemistry* **48**(7), 1169–1171 (1998)

Jessic Acid

$\text{C}_{31}\text{H}_{48}\text{O}_5$, M 500



Taxonomy: Cycloartane Triterpenoids

Combretum elaeagnoides (Combretaceae) [1].

Mp 196–202°C (from petrol-EtOAc, 1:1), $[\alpha]_D^{22} +55.5^\circ$ (c 1.0, C₅H₅N).

CAS Registry Number: 91095-52-2.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (ϵ): 219 (6625).

IR ν_{\max}^{KBr} , cm⁻¹: 3460–3400, 2640, 1680.

¹H NMR (60 MHz, C₅D₅N, δ): 0.03 and 0.33 (2H-19, d, J = 4 Hz), 0.55–1.17 (6 × CH₃), 3.37 (H-1, apparent t, W_{1/2} = 7 Hz), 5.0 (H-3, m), 5.20 and 5.53 (2H-31, s).

Table 1

δ_C (C ₅ D ₅ N)					
C-1	72.6	C-13	45.7	C-26	22.1
3	70.7	14	49.3	27	22.1
4	55.7	17	52.8	29	180.0
8	48.1	22	45.7	30	9.7
9	20.8	23	202.4	31	121.1
10	30.3	24	156.1		

Table 1

δ_C (C ₅ D ₅ N)					
C-1	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	C-16	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
2	38.6	2.40 ddd (13, 4.5, 3.5),	17	47.1	2.29 m
		2.18 ddd (13, 12, 3.5)	18	19.2	1.10 s
3	70.5	5.34 dd (12, 4.5)	19	29.9	0.44 d (4.5), 0.73 d (4.5)
4	56.0	–	20	43.5	
5	37.9	3.22 dd (12, 4.5)	21	93.0	5.73 brs
6	23.4		22	24.3	2.29 m
7	25.9		23	32.0	
8	48.4		24	70.9	4.80 brd (11)
9	20.9	–	25	147.7	–
10	30.1	–	26	109.9	5.23 brs, 4.92 brs
11	26.1	2.73 ddd (15.3, 10.2, 6.1)	27	19.3	1.85 s
12	31.5		28	19.1	1.03 s
13	45.5	–	29	178.1	–
14	49.1	–	30	9.5	1.59 s
15	35.9		OMe	51.1	3.64 s

References

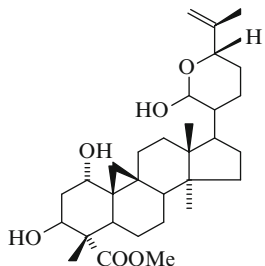
1. R. Osborne, K.H. Pegel, *Phytochemistry* **23**(3), 635–637 (1984)

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Methylquadrangularate O

C₃₁H₄₈O₆, M 516



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangularare Kurz (Combretaceae) [1].

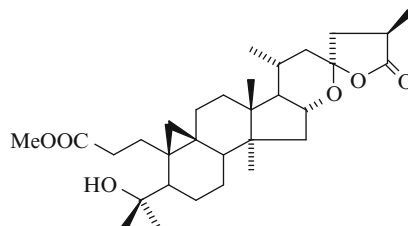
Colorless amorphous solid, $[\alpha]_D^{25} +58.7^\circ$ (c 0.21, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1710, 1450, 1380, 1250, 1090.

HRFABMS m/z: 539.3395 [M + Na]⁺.

Pseudolarolide C

C₃₁H₄₈O₆, M 516



Taxonomy: Cycloartane Triterpenoids

Pseudolarix kaempferi Gord. (Pinaceae) [1].

Mp 205.5–207.5°C (from Me₂CO).

CAS Registry Number: 151368-44-4.

CD (c 0.405, EtOH) Δε (nm): 1.24 (200).

UV λ_{max}^{EtOH}, nm (log ε): 203.8 (2.95).

IR ν_{max}^{KBr}, cm⁻¹: 3496, 3045, 2964, 2950, 2940, 2880, 1757, 1728, 1454, 1378, 1260, 1218, 1180, 1150, 1080, 978, 965, 925, 895, 875.

EIMS m/z (%): [M⁺+1] 517 (0.5), 498 (9), 485 (2), 483 (14), 458 (12), 443 (12), 414 (7), 330 (8), 301 (9), 261 (6), 250 (5), 173 (10), 161 (11), 159 (14), 157 (12), 147 (18), 145 (15), 139 (76), 135 (16), 133 (23), 121 (24), 119 (27), 109 (17), 107 (27), 105 (25), 95 (25), 93 (26), 91 (23), 81 (20), 79 (19), 69 (39), 67 (21), 59 (100), 55 (28), 43 (26).

Table 1

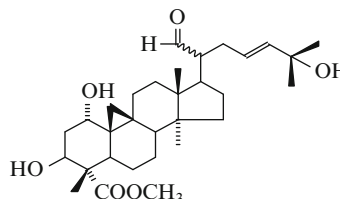
δ _C (C ₅ D ₅ N)		δ _C (C ₅ D ₅ N)	
C-1	δ _H (J/Hz)	C-16	δ _H (J/Hz)
1	33.1	17	4.07 td (5.5, 10)
2	31.2	17	54.8 1.45 t (10)
3	74.8	18	19.4 1.01 s
4	75.8	19	29.6 0.52 d (4.5), 0.70 (4.5)
5	48.2	20	29.8 2.09 m
6	25.6	21	19.6 0.87 d (6.5)
	0.64 qd (14, 5.5), 1.84 dtd (5.5, 14, ?)	22	44.0 1.39 d (13), 1.88 dd (4, 13)
7	26.1	23	107.2 –
8	45.4	24	42.6 2.38 dd (8.5, 13), 1.76 dd (3, 13)
9	21.8	25	34.0 2.91 m
10	27.6	26	179.4 –
11	26.8	27	14.8 1.22 d (7)
12	31.9	28	23.1 1.08 s
13	43.8	29	29.9 1.20 s
14	47.5	30	25.8 1.19 s
15	41.1	OMe	51.3 3.62 s

References

- G. Chen, Z. Li, D. Pan, C. Tang, X. He, G. Xu, K. Chen, K.H. Lee, *J. Nat. Prod.* **56**(7), 1114–1122 (1993)

(20ξ)-1α,3β,25-Trihydroxycycloart-21-al-23-ene-29-oic Acid

C₃₁H₄₈O₆, M 516



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Mp 131–134°C.

IR ν_{max}^{ZnSe}, cm⁻¹: 3442, 2949, 1713, 1457, 1259.

ESIMS m/z: 555.33 [M + K]⁺, 571.30 [M + Na + MeOH]⁺, 587.33 [M + K + MeOH]⁺.

Table 1

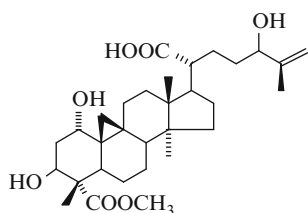
δ _C (CD ₃ OD/ CDCl ₃)		δ _C (CD ₃ OD/ CDCl ₃)	
C-1	δ _H (J/Hz)	C-16	δ _H (J/Hz)
1	75.6 3.62 t (2.8)	17	48.6 2.40 m
2	37.9 1.88 q (2.8), 1.94 m	18	20.0 1.10 s
3	71.7 4.62 dd (11.6, 3.9)	19	31.2 0.55 d (4), 0.77 d (4.1)
4	56.6 –	20	57.1 2.44 m
5	38.8 2.60 dd (12.1, 4.8)	21	208.3 9.55 d (4.6)
6	24.2 1.08 m, 1.20 m	22	33.6 2.43 m
7	26.7 1.28 m, 1.35 m	23	128.0 5.63 m
8	50.0 1.62 m	24	138.4 5.71 m
9	22.3 –	25	82.6 –
10	30.7 –	26	25.3 1.34 s
11	26.7 1.28 m, 1.35 m	27	25.0 1.32 s
12	36.8 1.48 m	28	20.0 1.10 s
13	46.6 –	29	179.4 –
14	48.8 –	30	9.4 1.18 s
15	32.7 1.37 m, 1.65 m	OMe	52.9 3.79 s

References

1. M. Ganzera, E.P. Ellmerer-Muller, H. Stuppner, *Phytochemistry* **49**(3), 835–838 (1998)

24-Epiquadrangularic Acid G

$C_{31}H_{48}O_7$, M 532



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +103.5^\circ$ (c 0.05, MeOH).

CAS Registry Number: 254754-47-7.

R ν_{max}^{KBr} , cm^{-1} : 3450, 1700, 1440, 1250.

HRFABMS m/z: 555.3272 $[M + Na]^+$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.41 and 0.75 (2H-19, d, J = 4.5 Hz), 1.03 (CH₃-28, s), 1.35 (CH₃-18, s), 1.58 (CH₃-30, s), 1.89 (CH₃-27, s), 2.16 (H-2, ddd, J = 13, 12, 3.5 Hz), 2.38 (H-2, dt, J = 13, 4 Hz), 2.52 (H-20, m), 2.65 (H-11, m), 2.72 (H-17, m), 3.21 (H-5, dd, J = 12.5, 4.5 Hz), 3.64 (MeO-29, s), 3.75 (H-1, brs), 4.50 (H-24, t, J = 5 Hz), 4.95 (H-26, brs), 5.31 (H-26, brs), 5.33 (H-3, dd, J = 12, 4 Hz).

Table 1

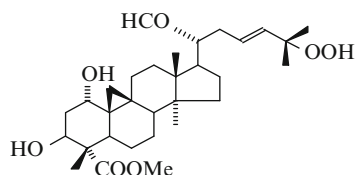
δ_C (C_5D_5N)									
C-1	72.1	C-7	27.5	C-13	45.7	C-19	29.8	C-25	149.6
2	38.5	8	47.9	14	48.9	20	49.6	26	110.0
3	70.4	9	20.8	15	33.9	21	178.5	27	18.1
4	56.0	10	30.3	16	25.7	22	29.2	28	19.4
5	37.8	11	26.0	17	49.0	23	35.4	29	178.1
6	23.2	12	30.6	18	18.3	24	74.8	30	9.5
								OMe	51.4

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Methylquadrangularate B

$C_{31}H_{48}O_7$, M 532



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Mp $190^\circ C$, $[\alpha]_D^{25} +53.4^\circ$ (c 0.79, MeOH).

CAS Registry Number: 221455-83-0.

IR ν_{max}^{KBr} , cm^{-1} : 3500, 1710, 1450, 1380, 1040, 990, 750.

HRFABMS m/z: 555.3315 $[M + Na]^+$.

Table 1

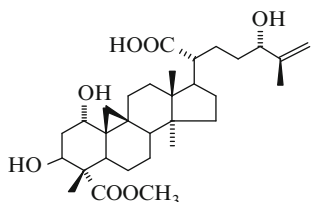
	δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	72.8	3.85 brs	C-16	26.8
2	38.6	2.41 ddd (13, 4.5, 3.5), 2.20 m	17	47.3
3	70.1	5.37 dd (12, 4.5)	18	19.1 1.08 s
4	55.9	–	19	29.3 0.44 d (4.5), 0.74 d (4.5)
5	37.7	3.23 dd (12.5, 4.5)	20	55.8
6	23.0	–	21	205.4 9.63 d (5.5)
7	25.8	–	22	32.6 2.34 dd (9, 6.5)
8	47.4	–	23	126.5 5.78 dt (16, 6.5)
9	20.6	–	24	138.0 6.05 d (16)
10	30.3	–	25	80.9 –
11	25.5	–	26	25.2 1.53 s
12	31.6	–	27	24.9 1.51 s
13	45.5	–	28	19.1 0.98 s
14	48.9	–	29	178.1 –
15	35.3	–	30	9.4 1.60 s
			OMe	51.0 3.66 s

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Quadrangularic Acid G

$C_{31}H_{48}O_7$, M 532



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +73.4^\circ$ (c 0.09, MeOH).

CAS Registry Number: 254757-92-1.

IR ν_{\max}^{KBr} cm^{-1} : 3450, 1700, 1260, 1040.

HRFABMS m/z: 555.3272 $[M + Na]^+$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.41 and 0.75 (2H-19, d, J = 4.5 Hz), 1.03 (CH₃-28, s), 1.35 (CH₃-18, s), 1.58 (CH₃-30, s), 1.63 (H-8, brt, J = 8 Hz), 1.89 (CH₃-27, s), 2.17 (H-2, ddd, J = 13, 12, 3.5 Hz), 2.37 (H-2, dt, J = 13, 4 Hz), 2.52 (H-20, m), 2.66 (H-11, H-17, m), 3.21 (H-5, dd, J = 12.5, 4.5 Hz), 3.64 (OMe-29, s), 3.75 (H-1, brs), 4.46 (H-24, t, J = 5 Hz), 4.93 (H-26, brs), 5.20 (H-26, brs), 5.33 (H-3, dd, J = 12, 4 Hz).

Table 1

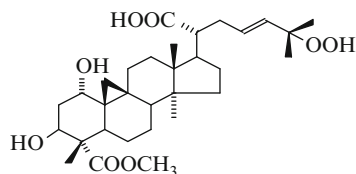
δ_C (C_5D_5N)									
C-1	72.1	C-7	27.5	C-13	45.6	C-19	29.6	C-25	149.4
2	38.5	8	47.8	14	48.9	20	49.6	26	110.6
3	70.4	9	20.8	15	34.0	21	178.6	27	17.5
4	56.0	10	30.2	16	25.7	22	29.5	28	19.4
5	37.8	11	26.0	17	49.2	23	35.4	29	178.1
6	23.1	12	30.6	18	18.1	24	75.6	30	9.4
								OMe	51.4

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Quadrangularic Acid F

$C_{31}H_{48}O_8$, M 548



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +15.7^\circ$ (c 0.03, MeOH).

CAS Registry Number: 254757-91-0.

IR ν_{\max}^{KBr} cm^{-1} : 3400, 1720, 1440, 1250.

HRFABMS m/z: 571.3229 $[M + Na]^+$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.48 and 0.76 (2H-19, d, J = 4.5 Hz), 1.04 (CH₃-28, s), 1.34 (CH₃-18, s), 1.50 (CH₃-27, s), 1.56 (CH₃-26, s), 1.60 (CH₃-30, s), 2.19 (H-2, ddd, J = 13, 12, 3.5 Hz), 2.40 (H-2, ddd, J = 13, 4.5, 4 Hz), 3.23 (H-5, dd, J = 12.5, 4.5 Hz), 3.66 (OMe-29, s), 3.77 (H-1, brs), 5.36 (H-3, dd, J = 12, 4.5 Hz), 6.07 (H-23, dt, J = 16, 6 Hz), 6.18 (H-24, d, J = 16 Hz).

Table 1

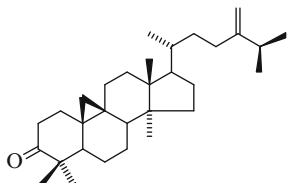
δ_C (C_5D_5N)									
C-1	72.1	C-7	26.0	C-13	45.7	C-19	29.6	C-25	81.1
2	38.6	8	47.8	14	48.9	20	49.5	26	25.3
3	70.4	9	20.8	15	35.4	21	177.8	27	24.9
4	56.0	10	30.3	16	27.3	22	37.8	28	19.4
5	37.9	11	25.7	17	49.2	23	127.5	29	178.1
6	23.2	12	30.6	18	18.1	24	137.5	30	9.4
								OMe	51.4

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

24-Methylene Cycloartanone

C₃₁H₅₀O, M 438



Taxonomy: Cycloartane Triterpenoids

Spondia spinnata (Koen et L.f.) Kurz (*Anacardiaceae*)

[1].

Synthetic [2].

Krameria tomentosa A.St Hill (*Krameriaceae*) [3].

Mp 103–105°C (from EtOH), [α]_D +24° (c 1.2, CHCl₃).

CAS Registry Number: 1449-08-7.

IR ν_{max}^{KBr}, cm⁻¹: 1720, 1635, 884.

MS m/z : M⁺ 438, 423, 300, 313, 175.

Table 1

	δ _C (CDCl ₃)	δ _H (J/Hz)		δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	33.4	1.85, 1.52	C-16	25.8	1.29, 1.90
2	37.4	2.28, 2.70 ddd (2.2, 6.6, 14.1)	17	52.2	1.59
3	217.5	–	18	18.0	1.06 s
4	50.2	–	19	29.5	0.60 d (4.2), 0.80 d (4.2)
5	48.4	1.66	20	36.0	1.38
6	21.5	0.91, 1.51	21	18.3	0.91 d (6.3)
7	28.1	1.10, 1.35	22	35.5	1.10, 1.55
8	47.8	1.56	23	31.2	1.85, 2.10
9	21.0	–	24	157.5	–
10	25.9	–	25	33.7	2.20
11	26.7	1.15, 2.00	26	22.0	1.02 d (5.3)
12	32.7	1.62	27	21.8	1.05 d (5.3)
13	45.3	–	28	20.7	1.12 s
14	48.7	–	29	22.1	0.92 s
15	34.9	1.30	30	19.3	1.07 s
			31	105.9	4.64, 4.69

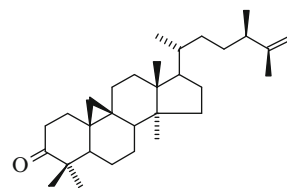
References

1. S. Tandon, R.P. Rastogi, *Planta Med.* **29**(2), 190–192 (1976)

2. G. Ohta, M. Shimizu, *Chem. Pharm. Bull.* **6**, 325–326 (1958). *C.A.*, 53:12340h (1959)
3. J.S. Alves, J.C.M. de Castro, M.O. Freire, E.V. Leitao da-Cunha, J.M. Barbosa-Filho, M. Sobral de Silva, *Magn. Reson. Chem.* **38**, 201–206 (2000)

24R-Cyclolaudenone

C₃₁H₅₀O, M 438



Taxonomy: Cycloartane Triterpenoids

Polypodium formosanum (*Polypodiaceae*) [1].

Mp 105°C, [α]_D²⁴ +14.2° (CHCl₃).

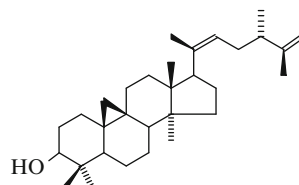
CAS Registry Number: 2315-13-1.

References

1. A. Hiroyuki, A. Yoko, *Chem. Lett.* **6**, 881–884 (1982). *C.A.* 97:145059p (1982)

Cycloeuphornol

C₃₁H₅₀O, M 438



Taxonomy: Cycloartane Triterpenoids

Euphorbia tirucalli L. (*Euphorbiaceae*) [1].

Mp 95–96°C (from MeOH).

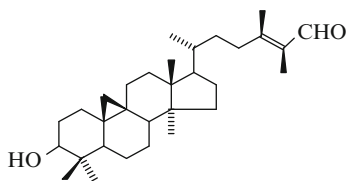
CAS Registry Number: 73583-69-4.

References

1. N. Afza, A. Malik, S. Siddiqui, Pakistan J. Sci. Ind. Res. **22**(4), 173–176 (1979). *C.A.*, 93:26583n (1980)

Cycloarten-3 β -hydroxy-24-methyl-26-al

C₃₁H₅₀O₂, M 454



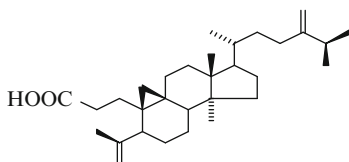
Taxonomy: Cycloartane Triterpenoids
Mangifera indica L. (*Anacardiaceae*) [1].
Mp 166–170°C, $[\alpha]_D^{25}$ 41°.

References

1. S. Corsano, E. Mincione, Ric. Sci. **37**(4), 370–375 (1967).
C.A., 67:116988r (1967)

24-Methylene-3,4-secocycloart-4(28)-en-3-oic Acid

C₃₁H₅₀O₂, M 454



Taxonomy: Cycloartane Triterpenoids
Abies sibirica Ledeb. (*Pinaceae*) [1].
The substance was isolated through a methyl ether.
The data belong to a methyl ether.
Mp 31–32°C (from CH₃CN), $[\alpha]_D^{25}$ +61° (c 2.83, CHCl₃).

CAS Registry Number: 109576-20-7.

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3080, 1740, 1650, 1170, 895.

EIMS, m/z: M⁺ 486.3952.

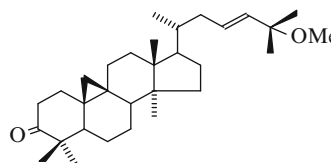
¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.38 and 0.70 (2H-19, d, J = 4 Hz), 0.88 (CH₃-21, d, J = 7 Hz), 0.916 and 0.943 (CH₃-18, CH₃-28, s), 1.005 and 1.01 (CH₃-26, CH₃-27, d, J = 6.8 Hz), 1.66 (CH₃-30, bs), 3.62 (OCH₃, s), 4.68 and 4.70 (2H-31, narrow m), 4.70 and 4.78 (2H-29, narrow m).

References

1. V.A. Raldugin, T.P. Kukina, N.I. Yaroshenko, V.A. Pentegova, Chem. Nat. Comp. **23**(2), 259 (1987)

(23E)-25-Methoxycycloart-23-en-3-one

C₃₁H₅₀O₂, M 454



Taxonomy: Cycloartane Triterpenoids
Tillandsia usneoides L. (*Bromeliaceae*) [1].
An amorphous solid, $[\alpha]_D^{25}$ +14° (c 0.07, CHCl₃).
CAS Registry Number: 173866-02-9.
UV $\lambda_{\max}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 220 (3.1).
EIMS m/z (%): M⁺ 454 (1), 423 (25), 408 (10), 313 (28), 203 (24), 109 (7), 55 (100).

Table 1

	δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	33.4		C-16	28.1
2	37.5	2.30 m, 2.71 dt (6.2, 13.9)	17	52.0
3	216.5		18	18.1 1.00 s
4	50.2		19	29.5 0.57 d (4.2), 0.78 d (4.2)
5	48.4		20	36.3
6	21.5		21	18.4 0.88 d (6.4)
7	25.8		22	39.3

(continued)

Table 1 (continued)

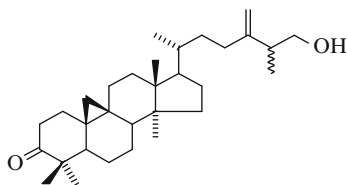
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
8	47.9	23	128.6
			5.54 ddd (15.8, 8, 5.5)
9	21.1	24	136.7
			5.40 d (15.8)
10	26.0	25	74.9
11	26.7	26	26.2
			1.26 s
12	32.7	27	25.9
			1.26 s
13	45.4	28	19.3
			0.89 s
14	48.7	29	22.2
			1.05 s
15	35.6	30	20.8
			1.10 s
		OMe	50.2
			3.15 s

References

- G.M. Gabrera, M. Gallo, A.M. Seldes, J. Nat. Prod. **59**(4), 343–347 (1996)

24-Methylene-26-hydroxycycloartan-3-one

C₃₁H₅₀O₂, M 454



Taxonomy: Cycloartane Triterpenoids

Trichilia clausenii (Meliaceae) [1].

Amorphous solid, mp 138–140°C, $[\alpha]_D^{25} +18.7^\circ$ (c 0.05, CHCl₃).

CAS Registry Number: 178117-39-0.

EIMS m/z (%): [M-CH₂O]⁺ 424 (39), 355 (21), 313 (39), 271 (14), 201 (22), 147 (48), 107 (68), 95 (92), 91 (58), 55 (100).

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.55 and 0.76 (2H-19, d, J = 4.4 Hz), 0.88 (CH₃-21, d, J = 6 Hz), 1.02 (CH₃-27, d, J = 6.8 Hz), 2.29 (H-2 α , ddd, J = 14, 4.4, 2.8 Hz), 2.68 (H-2 β , td, J = 13.6, 6.4 Hz), 2.34 (H-25, septet, J = 6.8 Hz), 3.49 (H-26_A, dd, J = 10.8, 7.2 Hz), 3.51 (H-26_B, dd, J = 10.6, 6.4 Hz), 4.79 and 4.86 (2 H-31, brd).

Table 1

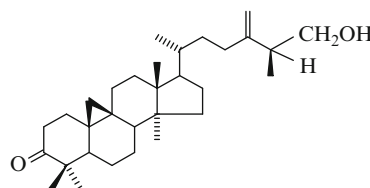
δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)	
C-1	33.4	C-7	28.1	C-13	45.3	C-19	29.5	C-25	42.5
2	37.4	8	47.9	14	48.4	20	36.1	26	65.8
3	216.8	9	21.0	15	32.8	21	18.3	27	16.4
4	50.2	10	25.8	16	26.7	22	31.2	28	19.3
5	48.7	11	25.9	17	52.2	23	34.0	29	22.2
6	21.5	12	35.5	18	18.1	24	152.0	30	20.8
								31	109.5

References

- M.T. Pupo, P.C. Vieira, J.B. Fernandes, M. Fatima das, G.F. da Silva, Phytochemistry **42**(3), 795–798 (1996)

25R-3-Oxo-24-methylenecycloartan-26-ol

C₃₁H₅₀O₂, M 454



Taxonomy: Cycloartane Triterpenoids

Mangifera indica L. (Anacardiaceae) [1].

Mp 145–146°C (from CHCl₃-MeOH), $[\alpha]_D^{30} +175^\circ$ (c 0.6, CHCl₃).

CAS Registry Number: 232266-06-7.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600, 1640, 890.

MS m/z (%): M⁺ 454 (3), 354 (3), 316 (3), 313 (11), 216 (3), 175 (15), 140 (23), 121 (38), 100 (46), 95 (75.8), 69 (65), 55 (100).

¹H NMR (90 MHz, CDCl₃, δ , 0-TMS): 0.57 and 0.75 (2H-19, d, J = 4 Hz), 0.82 (CH₃, s), 0.92 (CH₃, s), 0.97 (Me, d, J = 6 Hz), 1.06 (Me, d, J = 7 Hz), 1.10 (2 × Me, s), 3.51, 3.59 (2H-26, two brs), 4.82, 4.88 (2H-31, two br.s).

Table 1

δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)		δ_C (CDCl ₃)	
C-1	33.4	C-7	28.2	C-13	45.4	C-19	29.5	C-25	36.2
2	37.4	8	47.9	14	48.8	20	36.0	26	66.0
3	216.8	9	21.2	15	35.6	21	18.1	27	16.4
4	50.2	10	25.9	16	26.8	22	35.0	28	18.4

(continued)

Table 1 (continued)

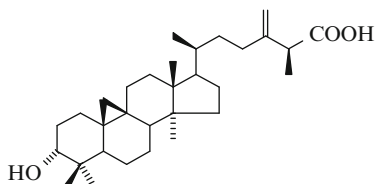
δ_C (CDCl ₃)									
5	48.5	11	26.1	17	52.3	23	31.4	29	25.9
6	21.5	12	32.9	18	19.3	24	152.2	30	20.8
								31	109.5

References

- V. Anjaneyulu, P. Satyanarayana, K.N. Viswanadham, V.G. Jyothi, K. Nageswara Rao, P. Radhika, *Phytochemistry* **50**(7), 1229–1236 (1999)

Ambolic Acid

C₃₁H₅₀O₃, M 470



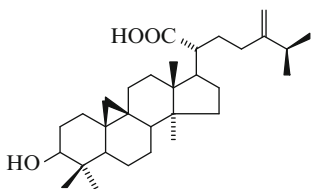
Taxonomy: Cycloartane Triterpenoids
Mangifera indica L. (*Anacardiaceae*) [1].
Mp 167–169°C, $[\alpha]_D^{31}$.
CAS Registry Number: 13878-93-8.

References

- S. Corsano, E. Mincione, *Rci. Sci.* **36**(6), 494–497 (1966). *C.A.*, 66:11062x (1967)

Heynic Acid

C₃₁H₅₀O₃, M 470



Taxonomy: Cycloartane Triterpenoids
Heynea trijuga Roxb. (*Meliaceae*) [1].
Desmos cochinchinensis Lour. (*Annonaceae*) [2].

Mp 235–237°C (from hexane-acetone), $[\alpha]_D^{30} +40^\circ$ (c 1, CHCl₃) [1].

Mp 237–239°C (from ether) [2].

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3400, 1705, 1650, 890, 1030 [1].

MS m/z (%): M⁺ 470, 455, 452, 437 [1].

HREIMS m/z (%): [M]⁺ 470.3762 (4), [M-Me]⁺ 455.3532 (5), [M-H₂O]⁺ 452.3651 (38), [M-H₂O-Me]⁺ 437.3408 (71), [M-H₂O-C₃H₇]⁺ 409.3121 (22), [M-H₂O-C₅H₉]⁺ 383.2942 (13), [M-ring A]⁺ 330.2555 (34), [M-ring A-Me]⁺ 315.2382 (11), [M-ring A-side chain]⁺ 175.1459 (42), [C₄H₇]⁺ 55.0533 (100) [2].

¹H NMR (CDCl₃, δ , 0-TMS): 0.6 (2H-19, d, J = 4 Hz), 0.75, 0.85, 0.92, 0.92, 1.0, 1.0 (6 × CH₃, s), 3.3 (H-3, m), 4.7 (2H-31, d) [1].

¹H NMR (500 MHz, CDCl₃, δ , 0-TMS): 0.27 and 0.56 (2H-19, d, J = 4 Hz), 0.79, 0.89, 0.96, 1.05 (4 × CH₃, s), 1.01 (2 × CH₃, d, J = 6.6 Hz), 2.16 (H-17, m), 2.32 (H-20, m), 3.2 (H-3, m), 4.71 (2H-31, d) [2].

Table 1

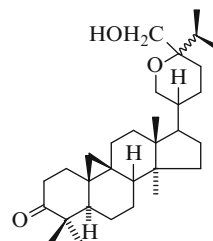
δ_C (CDCl ₃)									
C-1	31.9	C-7	29.7	C-13	45.2	C-19	30.0	C-25	33.8
2	30.3	8	47.6	14	48.6	20	47.6	26	21.8
3	78.8	9	19.9	15	32.0	21	181.5	27	21.7
4	40.4	10	26.3	16	27.2	22	25.8	28	19.3
5	46.9	11	26.2	17	49.0	23	31.0	29	25.4
6	20.9	12	34.9	18	17.7	24	155.2	30	13.9
								31	106.8

References

- K.K. Purushothaman, A. Sarada, M. Venkatanarasimhan, *Indian. J. Chem.* **22B**, 820–821 (1983)
- N.J. Sun, D.K. Ho, J.M. Sneddon, R.E. Stephens, J.M. Cassidy, *Nat. Prod. Lett.* **1**(2), 109–115 (1992)

Lithocarpolone

C₃₁H₅₀O₃, M 470



Taxonomy: Cycloartane Triterpenoids*Lithocarpus polystachya* (Fagaceae) [1].Mp 190–192°C (from Me₂CO), [α]_D +28°.

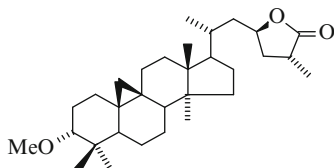
CAS Registry Number: 54300-83-3.

IR ν_{max}^{Nujol}, cm⁻¹: 3450, 1710.MS m/z: M⁺ 470, 455, 427, 452, 439 (100), 409, 313, 312, 311, 301, 289, 271.¹H NMR (CDCl₃, δ): 0.59 and 0.80 (2H-19, d, J = 4 Hz), 0.84 (CH₃, d, J = 7 Hz), 0.89 (CH₃, d, J = 7 Hz), 0.89, 1.03, 1.03, 1.08 (4 × CH₃, s), ~3.3 and 3.83 (2H-21, m), 3.30 and 3.58 (2H-31, d, J = 11 Hz).(CH₃-27, d, J = 7.3 Hz), 2.67 (H-25, sext, J = 7.6 Hz), 2.84 (H-3, pt, J = 2.2 Hz), 3.30 (OMe, s), 4.63 (H-23, m).**Table 1**

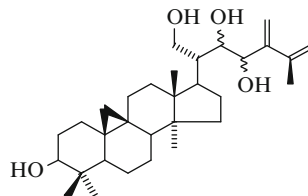
δ _C (CDCl ₃)									
C-1	27.9	C-7	25.6	C-13	45.4	C-19	30.0	C-25	34.2
2	23.4	8	48.2	14	49.0	20	33.1	26	180.3
3	86.8	9	19.6	15	35.5	21	18.2	27	16.0
4	39.8	10	26.5	16	28.2	22	42.8	28	19.3
5	41.8	11	26.3	17	52.8	23	76.1	29	26.0
6	21.0	12	33.0	18	18.1	24	36.5	30	21.5
								OMe	57.3

References

1. R.A. Henry, D.S.K. Phyllis, T.C. Hee, *Phytochemistry* **13**, 2551–2557 (1974)

(23R,25R)-3α-Methoxy-9β,19-cyclolanostan-23,26-olideC₃₁H₅₀O₃, M 470**Taxonomy:** Cycloartane Triterpenoids*Abies pinsapo* (Pinaceae) [1].Mp 170–171°C (from MeOH), [α]_D +35.2° (c 1.06, CHCl₃).IR ν_{max}^{KBr}, cm⁻¹: 2937, 2869, 1764, 1454, 1380, 1359, 1300, 1226, 1205, 1178, 1105, 1062, 1030, 998, 946, 924, 899, 648.EIMS m/z (%): 471 (3), 470 (9) [M]⁺, 455 (10), 439 (15), 438 (44), 423 (32), 395 (23), 203 (31), 187 (26), 175 (63), 147 (46), 133 (44), 121 (57), 119 (58), 107 (70), 105 (71), 99 (79), 55 (92), 43 (100), 41 (91).¹H NMR (300 MHz, CDCl₃, δ, 0-TMS): 0.32 and 0.48 (2H-19, d, J = 4.4 Hz), 0.84, 0.84, 0.90, 0.94 (4 × CH₃, s), 0.92 (CH₃-21, d, J = 7.9 Hz), 1.25**References**

1. A.F. Barrero, J.F. Sanchez, E.J. Alvarez-Manzaneda, D.M. Munoz, A. Haidour, *Phytochemistry* **32**(5), 1261–1265 (1993)

3β,21,22,23-Tetrahydroxycycloart-24(31),25(26)-dieneC₃₁H₅₀O₄, M 486**Taxonomy:** Cycloartane Triterpenoids*Guarea trichilioides* (Meliaceae) [1].Mp 143–145°C, [α]_D²⁵ +18.2° (c 1.2, MeOH).

CAS Registry Number: 148044-49-9.

IR ν_{max}^{KBr}, cm⁻¹: 3500, 1660.¹H NMR (C₅D₅N, δ): 0.30 and 0.50 (2H-19, d, J = 4 Hz), 0.80, 1.20, 1.30, 1.85 (4 × CH₃), 3.60 (1H, m), 3.80 (2H, m), 4.20 (1H, m), 4.50 (1H, brs), 4.80 (2H, s).

Table 1

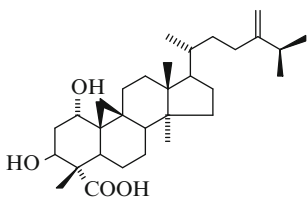
δ_C (C ₅ D ₅ N)									
C-1	32.1	C-7	27.6	C-13	45.5	C-19	29.7	C-25	
2	31.0	8	47.5	14	48.3	20	46.5	26	110.0
3	77.9	9	20.1	15	32.1	21	61.6	27	18.4
4	41.1	10	26.1	16	26.4	22	75.7	28	19.4
5	47.9	11	26.2	17	43.3	23	76.0	29	25.4
6	21.2	12	35.5	18	17.9	24		30	14.6
								31	109.8

References

1. F. Maysa, R.N. Franca, W.F. Wilson, *Phytochemistry* **32**(6), 1519–1522 (1993)

23-Deoxojessic Acid

C₃₁H₅₀O₄, M 486



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_D^{25} +75.4^\circ$ (c 0.24, MeOH).

CAS Registry Number: 215609-93-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3400, 1700, 1470, 1380, 1260.

HREIMS m/z : 486.3663 [M]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.5	C-17	52.5
2	38.8	18	18.3
	2.50 ddd (13.5, 4.5, 3.5), 2.32 m	19	29.7
3	70.7	20	36.5
	5.57 dd (12, 4.5)	21	18.5
4	55.6		0.96 d (6)
	–		4.5
5	37.7		
	3.44 dd (12, 4.5)		

(continued)

Table 1 (continued)

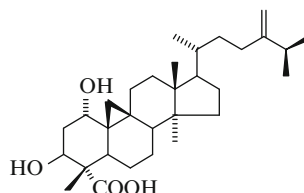
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
6	23.4	22	35.3
7	28.3	23	31.6
			2.20 ddd (14.5, 10, 3.5), 1.98 ddd (14.5, 10, 5)
8	48.1		
9	20.8	24	156.7
	–	25	34.0
10	30.3	26	22.0
	–		1.07 d (7)
11	26.6	27	21.9
	2.76 ddd (14, 10, 7)		1.06 d (7)
12	33.2	28	19.4
	–		1.01 s
13	45.6	29	179.9
	–		
14	49.1	30	9.7
	–		1.74 s
15	35.9	31	106.6
	–		4.87 brs, 4.86 brs
16	25.8		

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

1 α ,3 β -Dihydroxy-24-methylenecycloartan-29-oic Acid

C₃₁H₅₀O₄, M 486



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. Mp 238–240°C.

CAS Registry Number: 215609-93-1.

IR ν_{\max}^{ZnSe} , cm⁻¹: 3489, 2955, 1706, 1463, 1279, 887.

ESIMS m/z: 485 [M–H][–].

Table 1

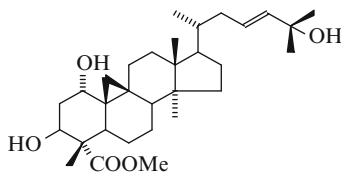
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	72.6	3.94 brs	C-16	28.4	1.32 m, 1.93 m
2	38.8	2.30 m, 2.53 m	17	52.5	1.65 m
3	70.8	5.58 dd (12.1, 3.6)	18	18.3	1.06 s
4	55.7	–	19	29.7	0.57 d (4.1), 0.86 d (4.1)
5	37.7	3.46 m	20	36.4	1.46 m
6	23.4	1.29 m, 1.85 m	21	18.5	0.93 d (6.3)
7	25.6	1.33 m	22	35.3	1.21 m, 1.68 m
8	48.1	1.64 m	23	31.6	2.01 m, 2.33 m
9	20.8	–	24	156.7	–
10	30.3	–	25	34.0	2.27 m
11	26.2	1.56 m, 2.75 m	26	22.0	1.07 d (3)
12	33.3	2.77 m	27	22.1	1.07 d (2.8)
13	45.6	–	28	19.8	1.02 s
14	49.2	–	29	180.6	–
15	35.8	1.25 m, 1.30 m	30	9.8	1.72 s
			31	106.6	4.87 d (2.8)

References

1. M. Ganzera, E.P. Ellmerer-Muller, H. Stuppnez, *Phytochemistry* **49**(3), 835–838 (1998)

Methyl Quadrangularate A

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1]. It is a colorless amorphous solid, $[\alpha]_D^{25} +43.7^\circ$ (c 0.76, MeOH).

CAS Registry Number: 215663-18-6.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3450, 1715, 1460, 1380, 1260, 1090, 1050, 1010.

HREIMS m/z: 516.3442 [M]⁺.

Table 1

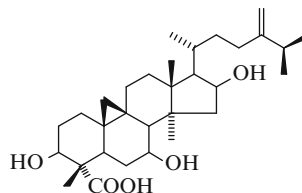
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	72.1	3.82 brs	C-16	26.8	
2	38.6	2.40 ddd (13, 4.5, 3.5), 2.20 m	17	47.5	
3	70.4	5.35 dd (12, 4.5)	18	19.2	1.08 s
4	55.9	–	19	29.4	0.44 d (4.5), 0.74 d (4.5)
5	37.7	3.23 dd (12.5, 4.5)	20	55.9	
6	23.0	–	21	205.5	9.61 d (5.5)
7	25.8	–	22	32.3	2.34 dd (9, 6.5) (2H)
8	47.2	–	23	122.8	5.89 dt (16, 6.5)
9	20.6	–	24	142.4	5.97 d (16)
10	30.3	–	25	69.5	–
11	25.5	–	26	30.5	1.49 s
12	31.6	–	27	30.5	1.49 s
13	45.4	–	28	19.0	0.98 s
14	48.9	–	29	176.1	–
15	35.3	–	30	9.4	1.59 s
			OMe	51.4	3.66 s

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

7 β ,16 β -Dihydroxy-1,23-dideoxyjessic Acid

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids

Acalypha communis (*Euphorbiaceae*) [1].

Mp 299–231°C, $[\alpha]_D^{25} +61.39^\circ$ (c 1.02, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3446, 3430, 3355, 2958, 2942, 2870, 1706, 1458, 1376, 1255, 1098.

FABMS m/z : 503 [M + 1]⁺, 485 [M + 1-H₂O]⁺, 467 [M + 1-2H₂O]⁺, 449 [M + 1-3H₂O]⁺.

Table 1

	$\delta_C(\text{CD}_3\text{OD})$	$\delta_H(\text{J/Hz})$		$\delta_C(\text{CD}_3\text{OD})$	$\delta_H(\text{J/Hz})$
C-1	32.2	1.63, 1.34	C-16	73.1	4.34 dt (7.8, 6)
2	30.3	1.78, 1.62	17	56.8	1.65
3	76.1	4.01 dd (10.8, 4.4)	18	18.5	1.17 s
4	55.3	–	19	28.8	0.35 d (4.2), 0.79 d (4.2)
5	43.8	2.13 dd (12.2, 4.1)	20	31.6	1.87
6	33.7	1.38, 1.14 d (11.4)	21	18.7	0.96 d (6.6)
7	70.7	3.50 ddd (10.9, 8.5, 4.1)	22	36.4	1.86, 1.18
8	55.2	1.75 d (8.4)	23	32.7	2.16, 2.00 td (10.8, 5.4)
9	21.2	–	24	158.1	–
10	26.9	–	25	35.0	2.28 sep (6.6)
11	27.6	1.88, 1.37	26	22.5	1.02 dd (6.6, 1.8)
12	33.8	1.63, 1.60	27	22.4	1.02 dd (6.6, 1.8)
13	47.5	–	28	20.0	0.94 s
14	46.8	–	29	180.6	–
15	50.4	2.17, 1.64	30	9.8	1.09 s
			31	106.6	4.70 brs, 4.69 brs

Biological activity

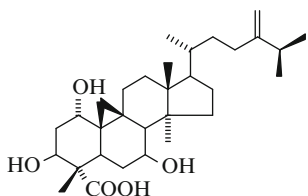
Compound exhibited moderate antimicrobial activity against gram-positive bacteria.

References

1. M.-T. Gutierrez-Lugo, M.P. Syngh, W.M. Maiese, B.N. Timmermann, J. Nat. Prod. **65**(6), 872–875 (2002)

7 β -Hydroxy-23-deoxojessic Acid

$\text{C}_{31}\text{H}_{50}\text{O}_5$, M 502



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Mp 219 °C, $[\alpha]_D^{25} +80.9^\circ$ (c 0.07, MeOH).

CAS Registry Number: 254754-51-3.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3400, 1700, 1470, 1380.

HRFABMS m/z : 525.3593 $[\text{M} + \text{Na}]^+$.

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.55 (H-19, d, $J = 4.5$ Hz), 0.98 (CH_3 -21, d, $J = 5$ Hz), 1.05 (CH_3 -27, d, $J = 7$ Hz), 1.06 (CH_3 -26, d, $J = 7$ Hz), 1.11 (H-19, d, $J = 4.5$ Hz), 1.15 (CH_3 -18, s), 1.31 (CH_3 -28, s), 1.77 (CH_3 -30, s), 2.10 (H-8, d, 8.5 Hz), 2.34 (H-2, ddd, $J = 13, 12, 3.5$ Hz), 2.54 (H-2, ddd, $J = 13, 4.5, 4$ Hz), 2.63 (H-11, ddd, $J = 13, 8, 4$ Hz), 3.71 (H-5, dd, $J = 12.5, 4.5$ Hz), 4.00 (H-1, brs), 4.12 (H-7, ddd, $J = 11, 8.5, 4$ Hz), 4.85 (H-31, brs), 4.86 (H-31, brs), 5.60 (H-3, dd, $J = 12, 4.5$ Hz).

Table 1

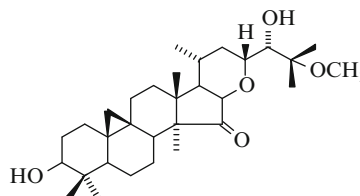
δ_C ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.5	C-7	69.5	C-13	46.0	C-19	27.8	C-25	34.1
2	38.8	8	54.9	14	49.2	20	36.4	26	22.0
3	70.5	9	20.9	15	37.5	21	18.7	27	21.9
4	55.4	10	30.7	16	28.8	22	35.4	28	19.0
5	36.7	11	26.7	17	52.0	23	31.6	29	179.9
6	34.0	12	33.3	18	17.7	24	156.7	30	9.7
								31	106.6

References

1. A.N. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, J. Nat. Prod. **63**(1), 57–64 (2000)

25-O-Methylisodahurinol

$\text{C}_{31}\text{H}_{50}\text{O}_5$, M 502



Taxonomy: Cycloartane Triterpenoids

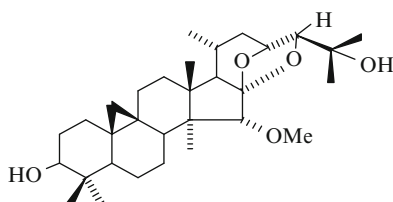
Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].
Mp 237–239°C (from EtOAc).

References

1. G. Kusano, Y. Murakami, N. Sakurai, T. Takemoto, *Yakugaku Zasshi* **96**(1), 82–85 (1976). *C.A.*, 84:135873s (1976)

15-O-Methylcimigenol

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids
Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].

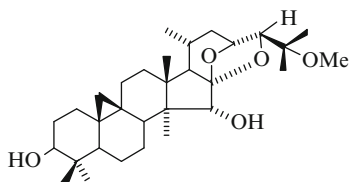
Mp 199.5–200.5°C (from EtOH), $[\alpha]_D^{25}$ 38.9°.
CAS Registry Number: 24399-56-2.

References

1. T. Takemoto, G. Kusano, *Yakugaku Zasshi* **89**(7), 954–958 (1969). *C.A.*, 71:91696m (1969)

25-O-Methylcimigenol

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids
Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1, 2].

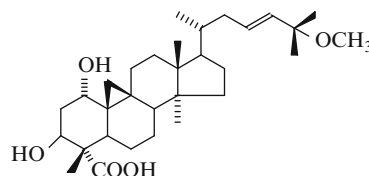
Cimicifuga japonica (*Ranunculaceae*) [1, 2].
Mp 228–230°C.
CAS Registry Number: 0528-90-9.

References

1. T. Takemoto, G. Kusano, *Yakugaku Zasshi* **88**(5), 623–626 (1968). *C.A.*, 69:59440w (1968)
2. N. Sakurai, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **24**(12), 3220–3222 (1976)

Quadrangularic Acid J

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids
Combretum quadrangulare Kurz (*Combretaceae*) [1].
Colorless amorphous solid, $[\alpha]_D^{25}$ +8.4° (c 0.02, MeOH).

CAS Registry Number: 254757-94-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1710, 1450.

HRFABMS m/z: 525.3524 [M + Na]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.55 and 0.84 (2H-19, d, J = 4.5 Hz), 0.96 (CH₃-21, d, J = 6.5 Hz), 0.99 (CH₃-28, s), 1.05 (CH₃-18, s), 1.32 (CH₃-26, CH₃-27, s), 1.72 (CH₃-30, s), 2.28 (H-2, H-22, m), 2.48 (H-2, dt, J = 13, 4 Hz), 2.74 (H-11, ddd, J = 13, 9, 8 Hz), 3.20 (OMe-25, s), 3.40 (H-5, dd, J = 12, 4.5 Hz), 3.90 (H-1, brs), 5.54 (H-3, H-24, m), 5.65 (H-23, ddd, J = 15.5, 8.5, 6 Hz).

Table 1

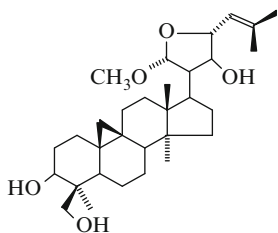
	δ_C (C ₅ D ₅ N)								
C-1	72.5	C-7	28.3	C-13	45.5	C-19	29.7	C-25	74.8
2	38.8	8	48.1	14	49.2	20	36.6	26	26.5
3	70.7	9	20.8	15	35.9	21	18.6	27	26.0
4	55.7	10	30.3	16	25.7	22	39.6	28	19.4
5	37.7	11	26.2	17	52.2	23	128.3	29	180.0
6	23.4	12	33.2	18	18.4	24	137.5	30	9.7
								OMe	50.1

References

1. A.N. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Squarrogenin 1

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids

Thalictrum squarrosum Stephan ex. Willd.
(*Ranunculaceae*) [1].

Mp 169–171°C (from hexane-acetone), $[\alpha]_D^{20}$
–11.06° (c 4.52, C₅H₅N).

CAS Registry Number: 125445-28-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3420-3442.

MS m/z (%): M⁺ 502 (4.17), 484 (100), 469 (50), 466
(20.8), 452 (70.8), 437 (33.3), 434 (50), 419 (16.7),
400 (41.7), 386 (20.8), 368 (66.7), 337 (75.0), 330
(8.3), 312 (54.2), 297 (37.5).

¹H NMR (200 MHz, CDCl₃, δ, 0-TMS): 0.37 and 0.41
(2H-19, d, J = 4 Hz), 0.94, 1.01, 1.22 (3 × CH₃, s),
1.78 (CH₃, d, J = 1.22 Hz), 1.80 (CH₃, d, J =
1.22 Hz), 2.20 (H-20, m), 3.33 (OCH₃, s), 3.40
and 4.41 (2H-30, d, J = 11 Hz), 3.50 (H-3, m),
3.88 (H-22, t, J = 3.97 Hz), 4.65 (H-23, dd, J =
9.16, 3.66 Hz), 4.83 (H-21, d, J = 3.97 Hz), 5.40
(H-24, dq, J = 9.16, 1.22 Hz).

Table 1

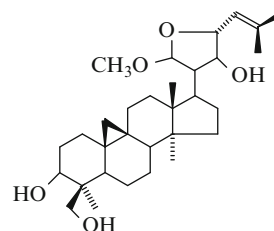
δ_C (C ₅ D ₅ N)										
C-1	32.4	C-7	27.0	C-13	45.3	C-19	31.3	C-25	137.4	
2	31.7	8	47.7	14	48.4	20	52.5	26	21.3	
3	80.1	9	21.7	15	30.6	21	104.9	27	19.8	
4	43.8	10	26.0	16	30.0	22	75.0	28	19.8	
5	48.6	11	26.7	17	40.7	23	80.7	29	18.4	
6	21.8	12	36.1	18	26.3	24	121.4	30	64.5	
								OMe	54.5	

References

1. V.I. Lutskiy, E.A. Khamidullina, A.S. Gromova, A.A. Semenov, *Chem. Nat. Comp.* **25**(4), 436–441 (1989)

Squarrogenin 2

C₃₁H₅₀O₅, M 502



Taxonomy: Cycloartane Triterpenoids

Thalictrum squarrosum Stephan ex. Willd.
(*Ranunculaceae*) [1].

Mp 190–193°C (from hexane-acetone), $[\alpha]_D^{20}$
+106.6° (c 0.3, C₅H₅N).

CAS Registry Number: 125445-29-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3400–3420, 3040.

MS m/z (%): [M⁺–H₂O] 484 (8.6), 469 (10), 466 (2.9),
452 (100), 437 (11.4), 434 (60), 419 (55.7), 400
(12.9), 368 (7.1), 349 (92.9), 341 (24.3), 297 (51.4).

¹H NMR (200 MHz, CDCl₃, δ, 0-TMS): 0.34 and
0.37 (2H-19, d, J = 4 Hz), 0.92, 1.06, 1.22 (3 ×
CH₃, s), 1.78 (CH₃, d, J = 1.53 Hz), 1.80 (CH₃, d,
J = 1.53 Hz), 2.22 (H-20, m), 3.39 (OCH₃, s) 3.47
and 4.40 (2H-30, d, J = 11 Hz), 3.51 (H-3, m), 3.98
(H-22, dd, J = 3.97, 2.14 Hz), 4.66 (H-23, dd, J =
7.93, 1.53 Hz), 4.78 (H-21, d, J = 3.97 Hz), 5.35
(H-24, dq, J = 7.93, 1.53 Hz).

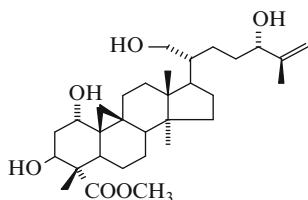
Table 1

δ_C (C ₅ D ₅ N)										
C-1	32.4	C-7	26.9	C-13	45.6	C-19	30.7	C-25	139.4	
2	31.7	8	47.8	14	48.5	20	55.6	26	21.3	
3	80.2	9	21.8	15	30.5	21	108.7	27	19.8	
4	43.8	10	26.0	16	27.8	22	76.7	28	18.9	
5	48.7	11	26.5	17	44.8	23	79.0	29	18.6	
6	21.9	12	35.6	18	26.4	24	119.1	30	64.6	
								OMe	54.8	

References

- V.I. Lutskyi, E.A. Khamidullina, A.S. Gromova, A.A. Semenov, *Chem. Nat. Comp.* **25**(4), 436–441 (1989)

Methyl Quadrangularate I

C₃₁H₅₀O₆, M 518**Taxonomy:** Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].
Colorless amorphous solid, $[\alpha]_D^{25} +137.0^\circ$ (c 0.02, MeOH).

CAS Registry Number: 254754-48-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1710, 1450.HRFABMS m/z: 541.3506 [M + Na]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.50 and 0.76 (2H-19, d, J = 4.5 Hz), 1.01 (CH₃-28, s), 1.12 (CH₃-18, s), 1.61 (CH₃-30, s), 1.94 (CH₃-27, s), 2.21 (H-2, H-17, m), 2.42 (H-2, ddd, J = 13, 4.5, 4 Hz), 2.75 (H-11, ddd, J = 13, 8, 4 Hz), 3.24 (H-5, dd, J = 12, 4.5 Hz), 3.65 (OMe-29, s), 3.84 (H-1, brs), 3.85 (H-21, dd, J = 11, 5 Hz), 4.09 (H-21, dd, J = 11, 3 Hz), 4.42 (H-24, t, J = 5 Hz), 4.95 (H-26, brs), 5.23 (H-26, brs), 5.37 (H-3, dd, J = 12.5, 4.5 Hz).

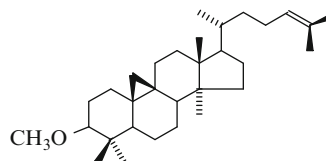
Table 1

δ_C (C ₅ D ₅ N)									
C-1	72.2	C-7	27.7	C-13	45.5	C-19	29.7	C-25	149.5
2	38.6	8	48.3	14	49.1	20	43.6	26	110.2
3	70.4	9	20.9	15	35.9	21	62.0	27	17.9
4	56.0	10	30.1	16	25.8	22	26.4	28	19.7
5	37.9	11	26.2	17	47.0	23	32.4	29	178.1
6	23.4	12	32.5	18	18.7	24	76.2	30	9.5
								OMe	51.5

References

- A.N. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *J. Nat. Prod.* **63**(1), 57–64 (2000)

Cycloartenol Methyl Ether

C₃₁H₅₂O, M 440**Taxonomy:** Cycloartane Triterpenoids

Chionochloa sp.: *C. acicularis* Zotov, *C. pallens* Zotov, *C. rubra* Zotov (*Gramineae*) [1, 2].

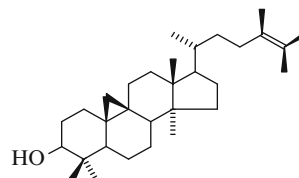
Mp 118–120°C (from EtOAc-MeOH), $[\alpha]_D +66^\circ$ (c 1.8, CHCl₃).

MS m/z: M⁺ 440, 425, 408, 393, 365, 339, 286, 203, 187.
¹H NMR (CDCl₃, δ): 0.33 and 0.59 (2H-19, d, J = 4 Hz), 0.82 (CH₃, s), 0.91–0.98 (4 × CH₃, s), 1.64 (CH₃, s), 1.71 (CH₃, s), 2.68 (1H, q), 3.38 (CH₃O, s), 5.07 (H-24, t).

References

- G.B. Russell, H.E. Conner, A.W. Purdie, *Phytochemistry* **15**, 1933–1935 (1976)
- E. Ritchie, R.G. Senior, W.C. Taylor, *Aust. J. Chem.* **22**, 2371–2387 (1969)

Cyclobranol

C₃₁H₅₂O, M 440**Taxonomy:** Cycloartane Triterpenoids

Rice bran oil

Oryza sativa L. (*Oryzeae*) [1].Mp 156.5–157.5°C, $[\alpha]_D +38.4^\circ$ (CHCl₃).

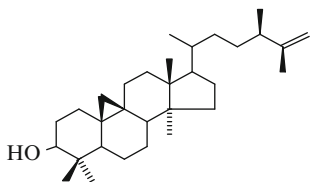
CAS Registry Number: 25692-13-1.

References

- T. Endo, O. Misu, Y. Inaba, *Yakugaku* **18**(5), 255–257 (1969). *C.A.*, 71:4848f (1969)

Cyclolaudenol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids

Opium

Papaver somniferum L. (*Papaveraceae*) [1, 2].

Mp 125°C (from MeOH), [α]_D +46° (1.5).

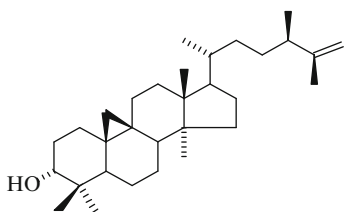
CAS Registry Number: 511-61-5.

References

1. H.R. Bentley, J.A. Henry, D.S. Irvine, D. Mukerji, F.S. Spring, *J. Chem. Soc.* 596–602 (1955).
2. J.A. Henry, D.S. Irvine, F.S. Spring, *J. Chem. Soc.* 1607–1615 (1955).

3-*epi*-Cyclolaudenol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids

Euphorbia coudicifolia (*Euphorbiaceae*) [1].

Mp 140°C (from EtOH), [α]_D −10° (c 0.9324, CHCl₃).

CAS Registry Number: 90686-45-6.

IR ν_{max}^{Nujol}, cm^{−1}: 3430, 3050, 1370, 1360.

MS m/z (%): M⁺ 440 (85), 425 (42), 422 (86), 407 (56), 379 (24), 353 (27), 315 (22), 300 (100), 175 (76).

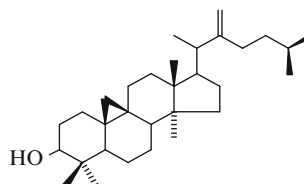
¹H NMR (CDCl₃, δ, 0-TMS): 0.48 and 0.7 (2H-19, d, J = 5 Hz), 0.87–1.65 (7 × CH₃), 4.7 (2H-26, s).

References

1. C. Gowardhau, R.P. Reddy, T. Sundararamaiah, *Phytochemistry* **23**(2), 411–413 (1984)

Cyclopterospermol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids

Pterospermum heyneanum Wall. (*Sterculiaceae*) [1].

Mp 124–125°C (from MeOH), [α]_D +72° (CHCl₃).

CAS Registry Number: 112606-09-4.

MS m/z (%): M⁺ 440 (36), 315 (10), 300 (95), 175 (70).

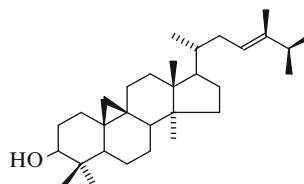
¹H NMR (90 MHz, CDCl₃, δ, 0-TMS): 0.30 and 0.56 (2H-19, d, J = 5 Hz), 0.80, 0.89, 0.96, 1.05 (7 × CH₃), 3.25 (H-3, m), 4.65 (2H-31, d, J = 7 Hz).

References

1. A.S.R. Anjaneyulu, S. Nookaraju, *Phytochemistry* **26**(10), 2805–2810 (1987)

Cyclosadol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids

Zea mays L. (*Gramineae*) [1, 2].

Mp 132–134°C (from MeOH), [α]_D +41° (c 1, CHCl₃).

CAS Registry Number: 25850-61-7.

Table 1

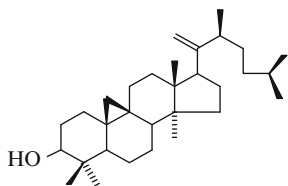
δ_c (CDCl ₃) [2]									
C-1	31.9	C-7	28.2	C-13	45.3	C-19	29.9	C-25	37.1
2	30.3	8	47.9	14	48.7	20	36.9	26	21.6
3	78.8	9	20.0	15	32.8	21	18.3	27	21.6
4	40.4	10	26.0	16	26.4	22	34.3	28	19.3
5	47.0	11	26.0	17	52.4	23	120.8	29	25.4
6	21.1	12	35.6	18	18.0	24	141.3	30	14.0
								31	13.5

References

1. H. Pinhas, Bull. Soc. Chim. France 2037–2039 (1969)
2. T. Itoh, N. Shimizu, T. Tamura, T. Matsumoto, Phytochemistry **20**(6), 1353–1356 (1981)

Cycloswietenol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids
Swietenia mahagoni Linn. (*Meliaceae*) [1, 2].

Mp 143–145°C (from MeOH), $[\alpha]_D^{+55}$ (c 1.0, CHCl₃).

CAS Registry Number: 62875-16-5.

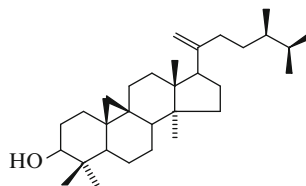
¹H NMR (CDCl₃, δ): 0.13 and 0.40 (2H-19, d, J = 5 Hz), 0.85–1.15 (7 × CH₃), 3.1 (H-3), 4.71 (2H-21, m).

References

1. A.S.R. Anjaneyulu, Y.L.N. Murty, L. Ramachandra Row, Curr. Sci. **46**(5), 141–142 (1977). C.A., 87:2342h (1977)
2. A.S.R. Anjaneyulu, Y.L.N. Murty, L. Ramachandra Row, Indian J. Chem. **16B**, 650–654 (1978)

Cyclotirucanenol

C₃₁H₅₂O, M 440



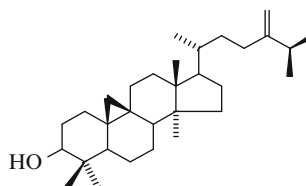
Taxonomy: Cycloartane Triterpenoids
Euphorbia tirucalli L. (*Euphorbiaceae*) [1].
 $[\alpha]_D^{+42.3}$ (CHCl₃).
CAS Registry Number: 121894-65-3.

References

1. A.Q. Khan, Z. Ahmed, N.H. Kasmi, A. Malik, N. Afza, Z. Naturforsch., B: Chem. Sci. **43**(8), 1059–1062 (1988). C.A., 111:74738d (1989)

24-Methylenecycloartanol

C₃₁H₅₂O, M 440



Taxonomy: Cycloartane Triterpenoids
Rice bran oil

Oriza sativa L. (*Orizeae*) [1].

Mp 121–122°C, $[\alpha]_D^{+43}$.

Euphorbia broteri (*Euphorbiaceae*) [2].

Mp 120–121°C (from MeOH), $[\alpha]_D^{+25}$ +41° (c 1, CHCl₃).

CAS Registry Number: 1449-09-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 3040, 2940, 1660, 1480, 1470, 1400, 1235, 1110, 1070, 1040, 900.

¹H NMR (CDCl₃, δ , 0-TMS): 0.33 and 0.56 (2H-19, d, J = 4.2 Hz), 0.81, 0.90, 0.97, 0.97 (4 × CH₃), 0.90

(CH₃-21, d, J = 6.2 Hz), 1.03 (CH₃-26, d, J = 6.8 Hz), 1.03 (CH₃-27, d, J = 6.8 Hz), 3.28 (H-3, m ΣJ = 15.5 Hz), 4.68 and 4.78 (2 H-31, brs).

Table 1

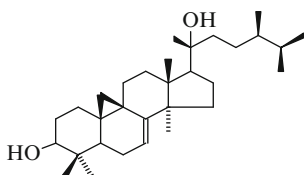
δ _c (CDCl ₃)									
C-1	32.07	C-7	28.20	C-13	45.41	C-19	29.93	C-25	33.89
2	30.45	8	48.02	14	48.89	20	36.18	26	21.94
3	78.83	9	20.08	15	33.02	21	18.39	27	22.06
4	40.54	10	26.23	16	26.58	22	35.15	28	19.40
5	47.21	11	26.07	17	52.37	23	31.41	29	25.52
6	21.19	12	35.65	18	18.06	24	156.79	30	14.06
								31	106.10

References

1. G. Ohta, M. Shimizu, Chem. Pharm. Bull. **6**, 325–326 (1958). C.A., 53:12340h (1959)
2. J.P. Tereza, J.G. Urones, I.S. Marcos, P. Basabe, J.S. Cuadrado, R.F. Moro, Phytochemistry **26**(6), 1767–1776 (1987)

Curculigol

C₃₁H₅₂O₂, M 456



Taxonomy: Cycloartane Triterpenoids

Curculigo orchoides Gaertn. (*Amaryllidaceae*) [1].

Mp 169–170°C (from MeOH), [α]_D +40.8° (CHCl₃).

CAS Registry Number: 127500-55-4.

IR ν_{max}^{KBr}, cm⁻¹: 3350, 2950, 1640, 1470-1455, 1380, 1370, 1340, 1290, 1230, 1170, 1160, 1100, 1050, 1033, 1030, 1015, 1000, 920, 900, 840.

MS m/z (%): M⁺ 456 (8.2), 441 (5), 439 (8.5), 438 (23), 423 (31), 413 (3.2), 396 (15), 379 (2), 371 (2), 357 (2.5), 326 (2), 316 (23), 313 (5), 301 (9), 298 (5), 295 (2), 286 (3), 281 (2), 273 (5), 271 (3.2), 253 (2), 203 (10), 173 (22), 143 (5), 99 (5), 85 (40), 71 (25), 43 (100).

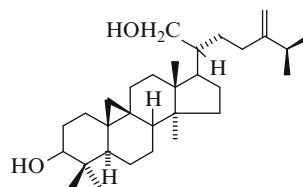
¹HNMR (400 MHz, CDCl₃, δ, 0-TMS): 0.34 and 0.56 (2 H-19, d, J = 5 Hz), 0.76, 0.88, 0.96, 0.96, 1.28 (5 × CH₃, s), 0.80 (CH₃, d, J = 6.5 Hz), 0.81 (CH₃, d, J = 6.5 Hz), 0.85 (CH₃, d, J = 6 Hz), 3.28 (H-3, dd, J = 10, 4 Hz), 4.75 (H-7, m).

References

1. T.N. Misra, R.S. Singh, D.M. Tripathi, S.C. Sharma, Phytochemistry **29**(3), 929–931 (1990)

24-Methylenecycloartan-3β,21-diol

C₃₁H₅₂O₂, M 456



Taxonomy: Cycloartane Triterpenoids

Lithocarpus polystachya (*Fagaceae*) [1].

Desmos cochinchinensis Lour. (*Annonaceae*) [2].

Mp 165–168°C (from Me₂CO–MeOH), [α]_D +42°.

CAS Registry Number: 54300-88-8.

IR ν_{max}^{Nujol}, cm⁻¹: 3350, 1650, 890.

MS m/z (%): M⁺ 456, 441, 438 (100), 425, 423, 420, 413, 407, 405, 395, 369, 351, 316, 315, 314, 313, 301, 297, 285, 273, 255.

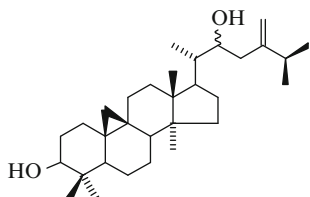
¹HNMR (CDCl₃, δ): 0.31 and 0.56 (2H-19, d, J = 4 Hz), 0.81, 0.91, 0.96, 1.00 (4 × CH₃, s), 1.03 (2 × CH₃, d, J = 4 Hz), 3.7 (2H-21, m), 3.92 (H-3, m, ΣJ = 15.5 Hz), 4.70 and 4.74 (2H-31).

References

1. R.A. Henry, D.S.K. Phyllis, T.C. Hee, Phytochemistry **13**, 2551–2557 (1974)
2. N.J. Sun, D.K. Ho, J.M. Sneddon, R.E. Stephens, J.M. Cassady, Nat. Prod. Lett. **1**(2), 109–115 (1992)

24-Methylenecycloartane-3 β ,22-diol

C₃₁H₅₂O₂, M 456



Taxonomy: Cycloartane Triterpenoids
Guarea macrophylla Vahl. (*Meliaceae*) [1].

White amorphous powder, $[\alpha]_D^{25} +16.5^\circ$ (c 0.63, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3524, 2943, 2867, 1703, 1632, 1457, 1377, 1101, 1041, 895, 755, 554.

EIMS m/z (%): M⁺ 456 (no), 438 (5), 395 (6), 339 (15), 271 (6), 232 (20), 215 (10), 203 (18), 189 (13), 175 (29), 161 (26), 159 (24), 147 (41), 133 (38), 121 (49), 109 (51), 107 (60), 95 (97), 81 (64), 69 (90), 43 (100).

Table 1

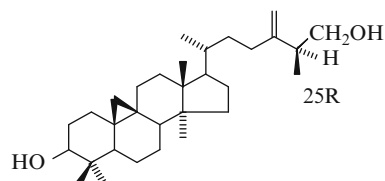
	δ_C (CDCl ₃)	δ_H (J/Hz)		δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.0	1.75 m, 1.25 m	C-16	26.4	1.98 m
2	30.4	1.53 m, 1.73 m	17	49.0	1.64 m
3	78.8	3.28 dd (11.2, 4.3)	18	18.0	1.01 s
4	40.8	–	19	29.9	0.34 d (4.3), 0.56 d (4.3)
5	47.1	1.41 m	20	40.5	1.90 m
6	21.1	1.56 m, 0.82 m	21	12.0	0.90 d (9)
7	27.2	1.97 m, 1.36 m	22	70.4	3.78 dt (9, 3)
8	48.0	1.55 m	23	36.1	2.23 m, 1.33 m
9	20.0	–	24	153.6	–
10	26.1	–	25	33.2	1.63 m
11	26.1	1.41 m, 1.17 m	26	22.3	1.05 d (6.8)
12	35.7	1.93 m	27	21.6	1.08 d (6.8)
13	45.8	–	28	19.5	0.91 s
14	48.4	–	29	25.4	0.97 s
15	32.9	1.56 m	30	14.0	0.80 s
			31	109.7	4.39 s, 4.83 s

References

- J.H.G. Lago, N.F. Roque, *Phytochemistry* **60**, 329–332 (2002)

24-Methylenecycloartane-3,26-diol

C₃₁H₅₂O₂, M 456



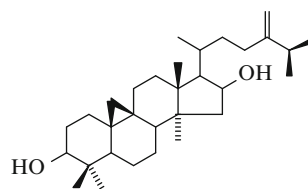
Taxonomy: Cycloartane Triterpenoids
Mangifera indica L. (*Anacardiaceae*) [1, 2].
Mp 154–157°C, $[\alpha]_D^{25} 54^\circ$.

References

- S. Corsano, E. Mincione, *Ric. Sci.* **37**(4), 370–375 (1967). *C.* A., 67:116988r (1967)
- S. Corsano, E. Mincione, *Chem. Commun.* 738–739 (1968)

Cyclomahogenol

C₃₁H₅₂O₂, M 456



Taxonomy: Cycloartane Triterpenoids
Swietenia mahagoni Linn. (*Meliaceae*) [1].
Mp 151–152°C (from C₆H₆), $[\alpha]_D^{25} +42^\circ$ (CHCl₃).
CAS Registry Number: 34257-88-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3600, 3100, 880.

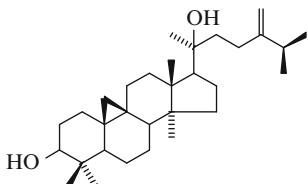
¹HNMR (CDCl₃, δ): 0.32 and 0.60 (2H-19, d, J = 4 Hz), 0.80, 0.88, 1.10, 1.10, 1.10, 1.15 (6 × CH₃), 0.99 (CH₃, d, J = 5 Hz), 3.28 (H-3, m), 4.4 (H-16, m), 4.75 (2H-31, brs).

References

- D.P. Chakraborty, S.P. Basak, B.C. Das, R. Beugelmans, *Phytochemistry* **10**, 1367–1372 (1971)

Sericeol

$C_{31}H_{52}O_2$, M 456



Taxonomy: Cycloartane Triterpenoids

Neolitsea sericea (Lauraceae) [1].

CAS Registry Number: 150527-27-8.

IR ν_{\max}^{KBr} , cm^{-1} : 3350, 3020, 1100, 1150, 886.

MS m/z : 456 $[M]^+$, $C_{31}H_{52}O_2$, 441 $[M-15]^+$, 438 $[M-H_2O]^+$, 423 $[M-Me-H_2O]^+$, 315 $[M-141]^+$, 175 $[M-281]^+$, 69 $[M-387]^+$.

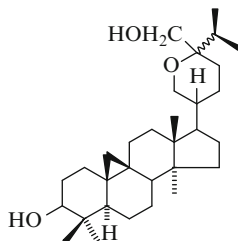
$^1\text{H NMR}$ (400 MHz, CDCl_3 , δ , 0-TMS): 0.33 and 0.55 (2H-19, d, $J = 4.4$ Hz), 0.81, 0.90, 0.96, 0.96 ($4 \times \text{CH}_3$, s), 1.02 (CH_3 -26 or CH_3 -27, d, $J = 7.34$ Hz), 1.03 (CH_3 -26 or CH_3 -27, d, $J = 6.6$ Hz), 1.26 (CH_3 -21, s), 2.25 (H-25, septet), 1.9-2.1 (2H-23, m), 3.28 (H-3, m), 4.67 and 4.71 (2H-31, s).

References

1. M.C. Sharma, T. Ohira, M. Yatagai, *Phytochemistry* **33**(3), 721–722 (1993)

Lithocarpdiol

$C_{31}H_{52}O_3$, M 472



Taxonomy: Cycloartane Triterpenoids

Lithocarpus polystachya (Fagaceae) [1].

Mp 179–180°C (from Me_2CO), $[\alpha]_D^{25} +54^\circ$.

CAS Registry Number: 54300-84-4.

IR $\nu_{\max}^{\text{Nujol}}$, cm^{-1} : 3350.

MS m/z (%): M^+ 472, 457, 454, 441 (100), 429, 423, 411, 393, 332, 315, 314, 313, 297, 289, 273, 255.

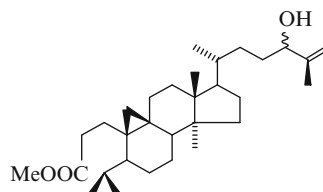
$^1\text{H NMR}$ (CDCl_3 , δ): 0.35 and 0.56 (2H-19, d, $J = 4$ Hz), 0.81, 0.89, 0.96, 1.00 ($4 \times \text{CH}_3$, s), 0.85 and 0.89 ($2 \times \text{CH}_3$, d, $J = 7$ Hz), 3.25 and 3.55 (2H-31, d, $J = 11$ Hz), 3.3 (H-3, m), 3.3 and 3.8 (2H-21, m).

References

1. R.A. Henry, D.S.K. Phyllis, T.C. Hee, *Phytochemistry* **13**, 2551–2557 (1974)

Methyl 24-hydroxy-3,4-seco-cycloart-25-en-3-oate

$C_{31}H_{52}O_3$, M 472



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1].

A colorless oil, $[\alpha]_D^{25} +30^\circ$ (c 0.067, CHCl_3).

CAS Registry Number: 173866-08-5.

EIMS m/z (%): M^+ 472 (3), 457 (5), 454 (7), 439 (14), 345 (8), 302 (12), 175 (33), 95 (100).

HREIMS m/z : 472.3912 $[M]^+$.

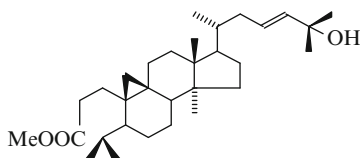
$^1\text{H NMR}$ (CDCl_3 , δ , 0-TMS): 0.34 and 0.59 (2H-19, d, $J = 4.4$ Hz), 0.81 (CH_3 -29, d, $J = 6.8$ Hz), 0.89 (CH_3 -21, d, $J = 6.2$ Hz), 0.91 (CH_3 -28, s), 0.92 (CH_3 -30, d, $J = 6.5$ Hz), 0.95 (CH_3 -18, s), 1.72 (CH_3 -27, brs), 3.66 (OCH_3 , s), 4.02 (H-24, brt, $J = 6$ Hz), 4.83 and 4.92 (2H-26, brs).

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

Methyl (24E)-25-hydroxy-3,4-seco-cycloart-23-en-3-oate

C₃₁H₅₂O₃, M 472



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides (Bromeliaceae) [1].

A colorless oil, $[\alpha]_D^{25} +24^\circ$ (c 0.24, CHCl₃).

CAS Registry Number: 173866-06-3.

UV $\lambda_{\max}^{\text{CH}_3\text{CN}}$, nm (log ϵ): 222 (2.4).

EIMS m/z (%): M⁺ 454 (19), 439 (17), 412 (8), 345 (7), 343 (12), 302 (14), 269 (15), 203 (17), 109 (72), 43 (100).

Table 1

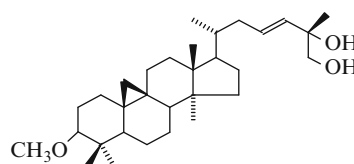
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	28.4	C-16	28.0
2	31.7	17	52.0
3	174.5	18	18.2 0.96 s
4	28.9	19	29.9 0.35 d (4.2), 0.59 d (4.2)
5	41.1	20	36.4
6	20.7	21	18.2 0.86 d (6.5)
7	25.3	22	39.0
8	48.1	23	125.6 5.60 brs
9	21.4	24	139.4 5.60 brs
10	27.5	25	70.7
11	27.0	26	29.9 1.32 brs
12	33.0	27	29.9 1.32 brs
13	45.1	28	19.4 0.91 s
14	49.0	29	22.3 0.81 d (6.7)
15	35.7	30	17.0 0.92 d (6.5)
		OMe	51.5 3.66 s

References

1. G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

No Name (9,19-Cyclolanostan-3 β -methoxy-23-ene-25,26-diol)

C₃₁H₅₂O₃, M 472



Taxonomy: Cycloartane Triterpenoids

Artemisia argyi Levl. et Vant. (Compositae) [1].

Mp 146–147°C, $[\alpha]_D^{20} +87^\circ$ (c 0.84, CHCl₃).

CAS Registry Number: 142950-85-4.

¹HNMR (400 MHz, CDCl₃, δ): 0.33 and 0.55 (2H-19, d, J = 4.1 Hz), 0.80, 0.87, 0.96, 0.97, 1.61 (5 × CH₃, s), 0.87 (CH₃-21, d, J = 6 Hz), 3.15 (CH₃O, s), 3.29 (H-3, dd, J = 11.2, 4.2 Hz), 3.31 (2H-26, s), 5.39 (H-24, d, J = 15.8 Hz), 5.53 (H-23, ddd, J = 15.8, 8.5, 5.6 Hz).

Table 1

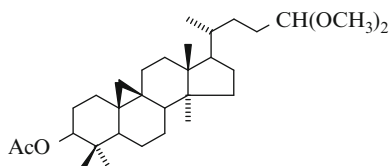
δ_C (CDCl ₃)									
C-1	32.0	C-7	26.0	C-13	45.3	C-19	29.9	C-25	74.9
2	30.4	8	47.9	14	48.8	20	36.3	26	76.3
3	78.8	9	20.0	15	36.6	21	18.4	27	25.8
4	40.4	10	26.2	16	28.1	22	39.3	28	19.3
5	47.1	11	26.5	17	52.0	23	128.7	29	25.4
6	21.1	12	32.8	18	18.1	24	136.6	30	14.0
								OMe	50.2

References

1. T.R. Xiang, J.Z. Jian, *Chin. Chem. Lett.* **3**(2), 117–118 (1992)

25,26,27-Trisnor-3 β -acetoxy-24-dimethoxycycloartane

C₃₁H₅₂O₄, M 454



Taxonomy: Cycloartane Triterpenoids

Euphorbia broteri (*Euphorbiaceae*) [1].

Mp 98–100°C (from MeOH), $[\alpha]_D^{25} +50.3^\circ$ (c 0.68, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3040, 2960, 1740, 1480, 1250, 1145, 1080, 1060, 1040.

MS m/z (%): M⁺ 454 (4.5), 439 (3), 367 (2), 330 (4), 315 (5), 243 (5), 287 (10), 271 (10), 255 (12), 231 (10), 249 (15), 231 (15), 218 (15), 205 (10), 204 (10), 189 (16), 167 (30), 149 (100), 121 (50), 109 (50), 97 (41), 81 (80).

¹HNMR (CDCl₃, δ , 0-TMS): 0.34 and 0.57 (2H-19, d, J = 4.2 Hz), 0.84, 0.89, 0.89, 0.96 (4 \times CH₃, s), 0.88 (CH₃-21, d, J = 5.3 Hz), 2.05 (CH₃COO, s), 4.33 (H-24, t, J = 5.6 Hz), 4.56 (H-3, m, ΣJ = 15.6 Hz).

Table 1

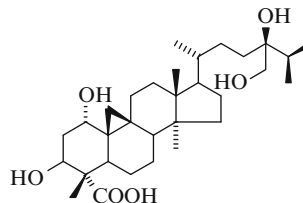
δ_C (CDCl ₃)									
C-1	31.68	C-7	28.14	C-13	45.38	C-19	29.77	C-28	19.33
2	26.87	8	47.84	14	48.90	20	35.89	29	25.47
3	80.75	9	20.23	15	32.94	21	18.32	30	15.18
4	39.52	10	26.10	16	26.58	22	30.92	Ac	21.31
5	47.25	11	25.85	17	52.17	23	29.33		170.90
6	20.96	12	35.57	18	18.00	24	105.17	OMe	52.7
									52.4

References

- J.P. Teresa, J.G. Urones, I.S. Marcos, P. Basabe, J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)

Cyclopassifloic Acid B

C₃₁H₅₂O₆, M 520



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous powder, $[\alpha]_D^{25} +48.7^\circ$ (c 2.2, MeOH).

CAS Registry Number: 292167-35-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1700, 1040.

FABMS m/z: 519 [M-H]⁻.

¹HNMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.53 and 0.84 (2H-19, d, J = 4 Hz), 0.99 (CH₃-28, s), 1.03 (CH₃-18, s), 1.00, 1.22 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.22 (CH₃-21, d, J = 7 Hz), 1.73 (CH₃-30, s), 2.28 (H-2, m), 2.28 (H-25, m), 2.56 (H-2, ddd, J = 13, 4, 2.5 Hz), 2.75 (H-11, m), 3.41 (H-5, dd, J = 12, 4 Hz), 3.92 (H-1, brs), 3.99, 4.05 (2H-31, d, J = 11 Hz), 5.56 (H-3, dd, J = 12, 4 Hz).

Table 1

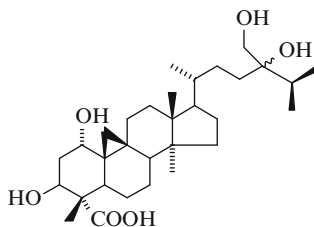
δ_C (C ₅ D ₅ N)									
C-1	72.4	C-7	26.0	C-13	45.6	C-19	30.1	C-25	33.7
2	38.4	8	48.0	14	49.2	20	37.4	26	27.7
3	70.7	9	21.0	15	36.0	21	19.8	27	17.8
4	55.6	10	30.3	16	28.5	22	32.0	28	18.7
5	37.6	11	26.4	17	52.8	23	31.7	29	180.1
6	23.4	12	33.4	18	18.4	24	76.1	30	9.8
								31	66.3

References

- K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, *J. Nat. Prod.* **63**(9), 1229–1234 (2000)

Cyclotricuspidogenin A

C₃₁H₅₂O₆, M 520



Taxonomy: Cycloartane Triterpenoids

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].

$[\alpha]_D^{18} +35.1^\circ$ (c 2.1, C₅D₅N).

CAS Registry Number: 239794-24-2.

HRFABMS m/z: 519.3687 [M-H]⁻.

Table 1

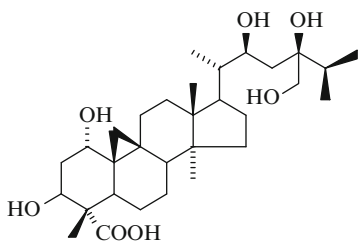
δ_C (C ₅ D ₅ N)									
C-1	72.9	C-7	26.0	C-13	45.4	C-19	29.8	C-25	33.3
2	38.0	8	48.4	14	49.1	20	37.2	26	17.4
3	71.2	9	20.7	15	35.6	21	19.4	27	17.6
4	55.4	10	30.3	16	28.3	22	30.2	28	18.3
5	37.9	11	26.0	17	52.7	23	31.7	29	179.3
6	23.2	12	33.3	18	18.5	24	75.8	30	10.1
								31	65.8

References

1. R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

Cyclopassifloic Acid A

C₃₁H₅₂O₇, M 536



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Mp 229–231°C, $[\alpha]_D^{25} +56.6^\circ$ (c 1.5, MeOH).

CAS Registry Number: 292167-34-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1710, 1050.

FABMS m/z: 535 [M-H]⁻.

¹HNMR (600 MHz, C₅D₅N, δ , 0-TMS): 0.56 and 0.82 (2H-19, d, J = 4 Hz), 0.97 (CH₃-28, s), 1.06 (CH₃-18, s), 1.20, 1.27 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.23 (CH₃-21, d, J = 7 Hz), 1.75 (CH₃-30, s), 2.03 (2H-23, m), 2.31 (H-2, ddd, J = 13, 13, 2.5 Hz), 2.40 (H-25, qq, J = 7 Hz), 2.52 (H-2, ddd, J = 13, 4, 2.5 Hz), 2.77 (H-11, m), 3.44 (H-5, dd, J = 12, 4.5 Hz), 3.92 (H-1, dd, J = 2.5, 2.5 Hz), 4.13 and 4.22 (2H-31, d, J = 10.5 Hz), 4.58 (H-22, m), 5.59 (H-3, dd, J = 13, 4 Hz).

Table 1

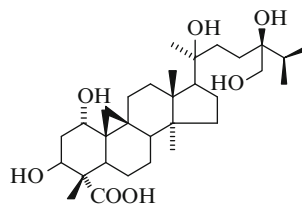
δ_C (C ₅ D ₅ N)									
C-1	72.5	C-7	26.0	C-13	45.9	C-19	29.9	C-25	33.8
2	38.3	8	48.3	14	48.7	20	43.4	26	17.3
3	70.7	9	20.9	15	36.0	21	12.7	27	17.5
4	55.7	10	30.3	16	27.6	22	70.3	28	19.6
5	37.7	11	26.4	17	49.8	23	33.1	29	180.1
6	23.4	12	33.0	18	18.3	24	76.5	30	9.8
								31	66.4

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, *J. Nat. Prod.* **63**(9), 1229–1234 (2000)

Cyclopassifloic Acid C

C₃₁H₅₂O₇, M 536



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous powder, $[\alpha]_D^{25} +23.8^\circ$ (c 2.1, MeOH).

CAS Registry Number: 292167-36-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1710, 1050.

FABMS m/z : 535 $[\text{M}-\text{H}]^-$.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.56 and 0.85 (2H-19, d, $J = 4$ Hz), 1.06 (CH₃-28, s), 1.19, 1.21 (CH₃-26, CH₃-27, d, $J = 7$ Hz), 1.55 (CH₃-18, s), 1.55 (CH₃-21, s), 1.74 (CH₃-30, s), 2.45 (H-2, ddd, $J = 12, 4, 2.5$ Hz), 2.75 (H-11, m), 3.45 (H-5, dd, $J = 11, 3$ Hz), 3.92 (H-1, brs), 5.53 (H-3, dd, $J = 12, 4$ Hz).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.4	C-7	26.0	C-13	46.2	C-19	30.2	C-25	33.6
2	38.3	8	47.9	14	49.3	20	74.7	26	17.4
3	70.6	9	20.9	15	35.4	21	26.1	27	17.6
4	56.4	10	30.2	16	23.0	22	38.1	28	20.3
5	37.5	11	26.4	17	55.1	23	29.2	29	180.0
6	23.3	12	33.5	18	19.8	24	76.0	30	9.7
								31	66.3

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

FABMS m/z : 535 $[\text{M}-\text{H}]^-$.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.55 and 0.84 (2H-19, d, $J = 4$ Hz), 1.01 (CH₃-28, s), 1.10 (CH₃-21, d, $J = 6$ Hz), 1.17 (CH₃-26, CH₃-27, d, $J = 7$ Hz), 1.44 (CH₃-18, s), 1.70 (CH₃-30, s), 2.48 (H-2, ddd, $J = 12, 4, 2.5$ Hz), 2.77 (H-11, m), 3.37 (H-5, dd, $J = 12, 4$ Hz), 3.91 (H-1, brs), 3.98, 4.01 (2H-31, d, $J = 11$ Hz), 4.67 (H-16, dt, $J = 6, 8$ Hz), 5.53 (H-3, dd, $J = 12, 4$ Hz).

Table 1

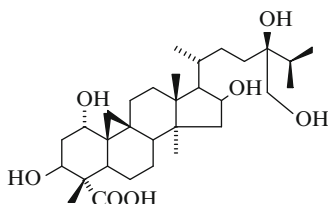
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.6	C-7	26.1	C-13	45.7	C-19	30.2	C-25	33.5
2	38.7	8	48.4	14	47.2	20	33.5	26	17.4
3	70.9	9	20.9	15	49.1	21	19.5	27	17.8
4	55.7	10	30.4	16	71.8	22	32.1	28	20.3
5	37.8	11	26.1	17	57.4	23	30.4	29	180.0
6	23.3	12	33.5	18	19.7	24	76.0	30	9.8
								31	66.2

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclopassifloic Acid F

$\text{C}_{31}\text{H}_{52}\text{O}_7$, M 536



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

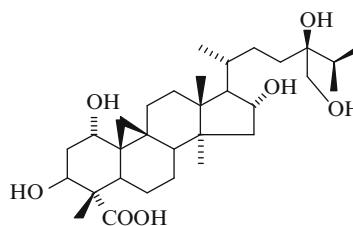
Amorphous powder, $[\alpha]_D^{25} +48.2^\circ$ (c 5.1, MeOH).

CAS Registry Number: 239794-27-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1705, 1040, 1015, 990.

Cyclopassifloic Acid G

$\text{C}_{31}\text{H}_{52}\text{O}_7$, M 536



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous powder, $[\alpha]_D^{25} +39.3^\circ$ (c 3.0, MeOH).

CAS Registry Number: 239794-30-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1700, 1065, 1030.

FABMS m/z: 535 [M-H]⁻.

¹HNMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.58 and 0.84 (2H-19, d, J = 4 Hz), 1.07 (CH₃-21, d, J = 6 Hz), 1.11 (CH₃-18, s), 1.20, 1.22 (CH₃-26, CH₃-27, d, J = 7 Hz) 1.42 (CH₃-28, s), 1.74 (CH₃-30, s), 2.48 (H- 2, ddd, J = 12, 4.5, 2.5 Hz), 2.55 (H-11, m), 3.44 (H-5, dd, J = 12, 4 Hz), 3.93 (H-1, brs), 3.97, 4.05 (2H-31, d, J = 11 Hz), 4.30 (H-16, dd, J = 6.5, 6 Hz), 5.58 (H-3, dd, J = 12, 4.5 Hz).

Table 1

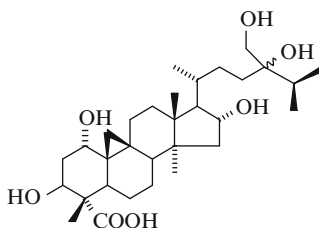
δ _C (C ₅ D ₅ N)									
C-1	72.6	C-7	26.4	C-13	48.0	C-19	29.2	C-25	34.1
2	38.9	8	48.5	14	47.2	20	35.5	26	17.7
3	70.8	9	20.5	15	48.5	21	35.5	27	17.8
4	55.8	10	30.5	16	77.2	22	30.5	28	20.5
5	37.9	11	26.4	17	61.0	23	30.0	29	180.1
6	23.5	12	33.3	18	19.2	24	76.0	30	9.9
								31	66.1

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclotricuspidogenin B

C₃₁H₅₂O₇, M 536



Taxonomy: Cycloartane Triterpenoids

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].

[α]_D²³ +17.0° (c 0.8, MeOH).

CAS Registry Number: 239794-27-5.

HRFABMS m/z: 535.3638 [M-H]⁻.

Table 1

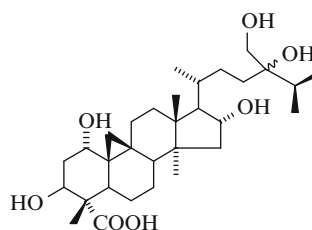
δ _C (C ₅ D ₅ N)									
C-1	72.8	C-7	25.9	C-13	45.5	C-19	30.4	C-25	31.8
2	38.2	8	48.5	14	47.1	20	33.3	26	17.6
3	71.7	9	20.7	15	49.0	21	19.4	27	17.2
4	55.5	10	29.9	16	71.6	22	30.4	28	20.3
5	37.4	11	26.1	17	57.3	23	32.0	30	10.1
6	22.8	12	33.2	18	18.6	24	76.3	31	66.2

References

1. R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

Cyclotricuspidogenin C

C₃₁H₅₂O₇, M 536



Taxonomy: Cycloartane Triterpenoids

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].

[α]_D²³ +28.2° (c 1.0, MeOH).

CAS Registry Number: 239794-30-0.

HRFABMS m/z: 535.3637 [M-H]⁻.

Table 1

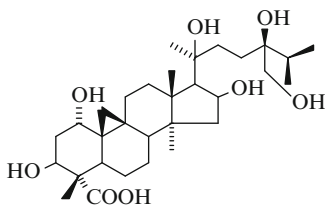
δ _C (C ₅ D ₅ N)									
C-1	72.7	C-7	26.2	C-13	47.8	C-19	30.1	C-25	34.0
2	38.4	8	48.3	14	47.0	20	35.0	26	17.5
3	71.1	9	20.4	15	48.5	21	19.4	27	17.7
4	55.5	10	30.2	16	77.1	22	29.0	28	20.4
5	37.4	11	26.2	17	60.7	23	30.4	29	179.1
6	23.3	12	33.1	18	19.1	24	75.9	30	10.0
								31	65.8

References

1. R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

Cyclopassifloic Acid E

C₃₁H₅₂O₈, M 552



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims (*Passifloraceae*) [1].

Mp 227–228°C, $[\alpha]_D^{25} +41.2^\circ$ (c 0.9, MeOH).

CAS Registry Number: 301540-74-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1710, 1050.

FABMS m/z: 551 [M–H]⁻.

¹HNMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.58 and 0.87 (2H-19, d, J = 4 Hz), 0.98 (CH₃-28, s), 1.18, 1.21 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.55 (CH₃-21, s), 1.74 (CH₃-30, s), 1.92 (CH₃-18, s), 2.19 (H-17, d, J = 8 Hz), 2.83 (2H-22, m), 2.84 (H-11, m), 3.44 (H-5, dd, J = 12, 4 Hz), 3.94 (H-1, brs), 4.01, 4.06 (2H-31, d, J = 11 Hz), 5.06 (H-16, dt, J = 6, 8 Hz), 5.58 (H-3, dd, J = 12, 4 Hz).

Table 1

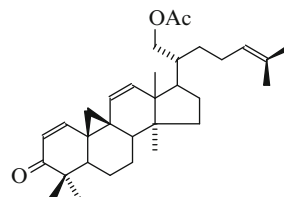
δ_C (C ₅ D ₅ N)									
C-1	72.4	C-7	26.1	C-13	46.7	C-19	29.9	C-25	33.5
2	38.6	8	48.0	14	47.4	20	76.9	26	17.5
3	70.7	9	20.8	15	49.6	21	26.1	27	17.6
4	55.6	10	30.4	16	73.6	22	38.3	28	20.5
5	37.8	11	26.1	17	55.3	23	29.9	29	180.6
6	23.3	12	33.8	18	21.9	24	75.9	30	9.7
								31	66.0

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, *J. Nat. Prod.* **63**(10), 1377–1380 (2000)

21-Acetoxy-3-oxo-cycloart-1,11,24-triene

C₃₂H₄₆O₃, M 478



Taxonomy: Cycloartane Triterpenoids

Combretum erythrophyllum Burch. (*Combretaceae*) [1].

Colourless glass.

CAS Registry Number: 220665-93-0.

IR ν_{\max}^{KBr} , cm⁻¹: 2922, 2844, 1738, 1660, 1461, 1369, 1233.

EIMS m/z: M⁺ 478 (26), 463 (4), 434 (11), 417 (65), 403 (6), 367 (4), 335 (5), 307 (7), 267 (15), 253 (14), 225 (9), 191 (38), 173 (12), 151 (100), 135 (20).

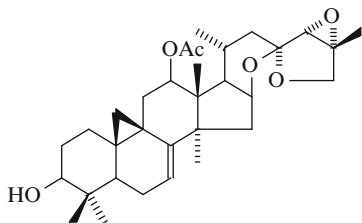
Table 1

	δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	158.6	6.58 d (9.9)	C-17	42.4
2	128.7	5.84 d (9.9)	18	18.4 0.92 s
3	201.0	–	19	30.2
4	49.4	–	20	39.9
5	45.7	–	21	64.5 4.33 dd (11.3, 3.5), 4.00 dd (11.3, 3.4)
6	20.0	–	22	30.4
7	24.6	–	23	24.8
8	43.7	–	24	124.5 5.06 t
9	37.2	–	25	131.5
10	36.8	–	26	131.5 1.58 s
11	130.5	6.52 d (10.3)	27	25.7 1.66 s
12	133.3	5.76 d (10.3)	28	18.5 0.86 s
13	31.6	–	29	28.0 1.11 s
14	47.7	–	30	20.6 0.98 s
15	27.9	–	Ac	2.06 s
16	32.8	–		

References

1. C.B. Rogers, *Phytochemistry* **49**(7), 2069–2076 (1998)

26-Deoxycimicifugenin

C₃₂H₄₆O₆, M 526**Taxonomy:** Cycloartane Triterpenoids*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp >300°C (from MeOH), [α]_D−135.5° (c 0.73, MeOH).

CAS Registry Number: 228251-35-2.

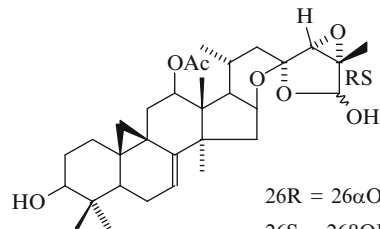
IR ν_{max}^{KBr}, cm^{−1}: 3503, 1732.Positive SIMS m/z: 527 [M + H]⁺.Positive HRSIMS m/z: 527.3352 [M + H]⁺.**Table 1**

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		
C-1	30.58	1.14, 1.56	C-17	56.66	1.82
2	30.62	1.84, 1.84	18	14.86	1.49 s
3	77.58	3.45 dd (4.4, 11.3)	19	29.07	0.54 d (4), 1.04 d (4)
4	40.21	–	20	23.17	2.25
5	42.30	1.16	21	21.44	1.02 d (6.3)
6	22.14	1.58, 1.84	22	37.32	1.50, 1.62
7	114.31	5.14 dd (1.8, 7.5)	23	106.03	–
8	147.73	–	24	62.45	3.68 s
9	21.35	–	25	62.52	–
10	28.67	–	26	68.24	3.63 d (10.2), 4.05 d (10.2)
11	36.79	1.25 d (15.6), 2.95 dd (8.7, 15.6)	27	14.31	1.47 s
12	76.96	5.23 d (8.7)	28	27.00	1.06 s
13	48.19	–	29	26.18	1.18 s
14	50.61	–	30	13.61	1.05 s
15	43.10	2.09, 2.15	Ac	170.85	–
16	74.60	4.34		21.64	2.18 s

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

Cimicifugenin

C₃₂H₄₆O₇, M 542

26R = 26αOH

26S = 26βOH

Taxonomy: Cycloartane Triterpenoids*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1, 2].

Mp 251–253°C (from EtOH) [1].

Mp 165–166°C, [α]_D−113.3° (c 1.01, MeOH) [2].IR ν_{max}^{CHCl₃}, cm^{−1}: 3250–3500, 1731.

¹HNMR (CDCl₃, δ): 0.58 (H-19, d, J = 4 Hz), 0.84 (CH₃, s), 0.99 (2 × CH₃, s), 1.15 (CH₃, s), 1.60 (CH₃-27, s), 2.02 (CH₃COO, s), 2.81 (H-11, q, J = 9, 16 Hz), 3.3 (H-3, m), 3.45 (H-24, s), 4.49 (H-16, m), 5.00 (H-12, t, J = 10 Hz), 5.11 (H-26, s), 5.16 (H-7, bd, J = 6 Hz) [1].

Table 1

δ _C (C ₅ D ₅ N)	26R	δ _H (J/Hz)	26R	
26S	26R	26S	26R	
C-1	30.63	30.63	1.20, 1.60	1.20, 1.60
2	30.55	30.55	1.84, 1.94	1.84, 1.94
3	77.58	77.58	3.47	3.47
4	40.19	40.19	–	–
5	42.28	42.28	1.20	1.20
6	22.13	22.13	1.60, 1.90	1.60, 1.90
7	<u>114.14</u>	<u>114.23</u>	<u>5.10 dd (7.1, 2)</u>	<u>5.19 dd (7.1, 2)</u>
8	147.77	147.77	–	–
9	21.31	21.31	–	–
10	28.68	28.68	–	–
11	36.81	36.81	1.26, 2.96	1.26, 2.96
12	76.89	76.89	5.23	5.23
13	48.09	48.09	–	–
14	<u>50.62</u>	<u>50.69</u>	–	–
15	<u>42.44</u>	<u>42.50</u>	<u>1.88, 1.98</u>	<u>2.06, 2.16</u>
16	73.15	73.15	4.71 q (6.8)	4.71 q (6.8)
17	56.87	56.87	1.78	1.78
18	14.82	14.82	1.44	1.44s
19	29.02	29.02	<u>0.60, 1.13 d (4)</u>	<u>0.61, 1.13 d (4)</u>
20	<u>25.83</u>	<u>25.56</u>	1.88	1.88

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
26S	26R	26S	26R
21	<u>21.02</u>	<u>20.94</u>	<u>0.98 d (6)</u>
22	<u>37.39</u>	<u>37.00</u>	1.70, 2.23
23	<u>105.88</u>	<u>103.46</u>	–
24	<u>63.43</u>	<u>62.88</u>	<u>3.91 s</u>
25	<u>65.60</u>	<u>63.95</u>	–
26	<u>98.47</u>	<u>98.12</u>	5.73 s
27	<u>13.07</u>	<u>13.15</u>	1.78 s
28	<u>26.79</u>	<u>26.84</u>	1.02 s
29	26.14	26.14	1.20 s
30	13.58	13.58	<u>1.06 s</u>
Ac	170.63	170.63	<u>1.07 s</u>
	21.59	21.59	2.19 s

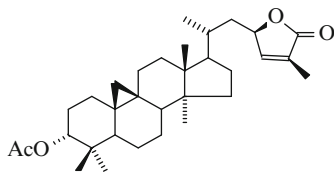
Underlines indicate distinct signals due to the isomers 26S and 26R in solution

References

1. G. Kusano, S. Hojo, Y. Kondo, T. Takemoto, Chem. Pharm. Bull. **25**(12), 3182–3189 (1977)
2. A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, Chem. Pharm. Bull. **46**(3), 467–472 (1998)

(23R)-3 α -Acetoxy-9 β ,19-cyclolanost-24-en-23,26-olide

C₃₂H₄₈O₄, M 496



Taxonomy: Cycloartane Triterpenoids

Abies marocana (Pinaceae) [1].

Mp 180–182°C (from Et₂O), $[\alpha]_D^{25}$ +9.8° (c 0.26, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 2942, 2867, 1755, 1736, 1656, 1446, 1372, 1248, 1196, 1176, 1105, 1061, 1041, 976, 963, 938, 894.

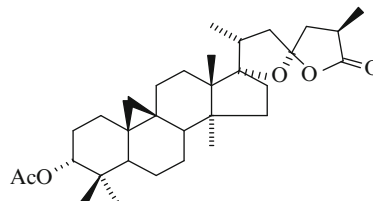
¹HNMR (80 MHz, CDCl₃, δ , 0-TMS): 0.33 and 0.50 (2H-19, d, J = 4.1 Hz), 0.86, 0.86, 0.87, 0.93(4 × CH₃, s), 0.98 (CH₃-21, d, J = 8 Hz), 1.89 (CH₃-27, t, J = 1.7 Hz), 2.06 (OAc, s), 4.69 (H-3, t, J = 2.8 Hz), 4.97 (H-23, m), 6.99 (H-24, t, J = 1.6 Hz).

References

1. A.F. Barrero, J.F. Sanchez, E.J. Alvarez-Manzaneda, M.M. Dorado, A. Haidour, Phytochemistry **35**(5), 1271–1274 (1994)

(23S,25R)-3 α -Acetoxy-17,23-epoxy-9,19-cyclo-9 β -lanostan-23,26-olide

C₃₂H₄₈O₅, M 512



Taxonomy: Cycloartane Triterpenoids

Abies marocana (Pinaceae) [1].

Mp 184–186°C (from Et₂O), $[\alpha]_D^{25}$ -0.04° (c 1.0, CHCl₃).

CAS Registry Number: 155448-85-4.

IR ν_{\max}^{KBr} , cm⁻¹: 2936, 2836, 1776, 1725, 1452, 1371, 1323, 1246, 1180, 1161, 1110, 1079, 1042, 975, 955, 919, 906, 883.

EIMS m/z (%): [M + 1]⁺ 513 (4), 495 (16), 434 (62), 419 (61), 355 (25), 295 (100), 281 (49), 239 (30), 191 (69), 121 (48), 81 (45).

¹HNMR (300 MHz, CDCl₃, δ , 0-TMS): 0.36 and 0.49 (2H-19, d, J = 4.1 Hz), 0.83, 0.91, 1.06, 1.16 (4 × CH₃, s), 1.00 (CH₃-21, d, J = 6.8 Hz), 1.25 (CH₃-27, d, J = 7.2 Hz), 1.75 (H-22_A, d, J = 13.8 Hz), 2.02 (H-24_A, dd, J = 12.6, 10.8 Hz),

2.08 (OAc, s), 2.20 (H-20, dq, $J = 6.8$ Hz), 2.49 (H-24_B, dd, $J = 12.6, 7.5$ Hz), 2.71 (H-22_B, dd, $J = 13.8, 6.8$ Hz), 2.98 (H-25, ddq, $J = 10.8, 7.5, 7.5$ Hz), 4.68 (H-3, t, $J = 2.8$ Hz).

Table 1

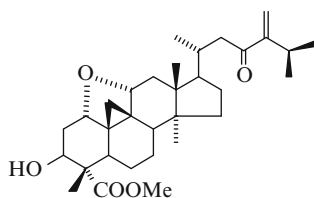
δ_C (CDCl ₃)									
C-1	25.9	C-7	25.7	C-13	49.2	C-19	29.8	C-25	35.7
2	25.4	8	49.2	14	49.2	20	43.2	26	179.5
3	79.1	9	20.2	15	29.8	21	18.4	27	15.0
4	38.8	10	26.5	16	36.1	22	45.1	28	20.6
5	42.3	11	26.2	17	99.8	23	113.6	29	25.5
6	21.1	12	28.2	18	20.7	24	36.7	30	20.9
							Ac		170.9
									21.5

References

1. A.F. Barrero, J.F. Sanchez, E.J. Alvarez-Manzaneda, M.M. Dorado, A. Haidour, *Phytochemistry* **35**(5), 1271–1274 (1994)

Methyl Jessate 1 α ,11 α -Oxide

$C_{32}H_{48}O_5$, M 512



Taxonomy: Cycloartane Triterpenoids

Combretum elaeagnoides (Combretaceae) [1].

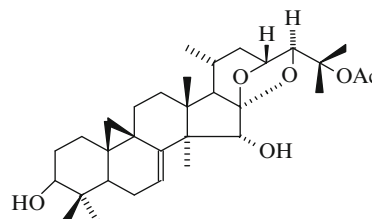
Mp 165–167°C (from petrol ether-EtOAc), $[\alpha]_D^{22} +66.8^\circ$ (c 1, CHCl₃).

References

1. R. Osborne, K.H. Pegel, *S. Afr. J. Chem.* **38**, 83–86 (1985). *C.A.*, 103:211104v (1985)

25-O-Acetyl-7,8-didehydrocimigenol

$C_{32}H_{48}O_6$, M 528



Taxonomy: Cycloartane Triterpenoids

Cimicifuga heracleifolia Komarov (*Ranunculaceae*) [1].

CAS Registry Number: 150972-73-9.

MS m/z : 528 [M]⁺ 510, 468, 435, 409, 95.

HRMS m/z : 528.3445 [M]⁺.

Table 1

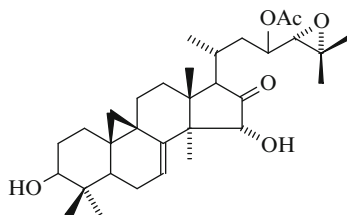
δ_C (CDCl ₃)		δ_H (J/Hz)		δ_C (CDCl ₃)		δ_H (J/Hz)	
C-1	30.37	1.58 m, 1.72 m	C-17	58.82	1.37 m		
2	29.75	1.66 m, 1.75 m	18	21.19	1.03 s		
3	78.67	3.33 dd (11, 4)	19	28.29	0.54 d (4), 1.07 d (4)		
4	39.71	–	20	23.54	1.62 m		
5	41.86	1.24 m	21	19.43	0.90 d (7)		
6	21.61	1.63 m, 1.97 m	22	37.63	1.01 m, 2.32 ddd (13, 6.5, 2.5)		
7	114.20	5.62 dd (7.5, 2.2)	23	71.88	4.39 brd (10)		
8	146.90	–	24	86.26	3.92 s		
9	21.02	–	25	82.51	–		
10	28.29	–	26	23.16	1.48 s		
11	25.33	1.15 m, 2.15 m	27	21.79	1.42 s		
12	33.71	1.67 m, 1.79 m	28	17.65	1.06 s		
13	41.86	–	29	25.38	1.01 s		
14	50.24	–	30	12.94	0.85 s		
15	76.84	4.12 d (8.4) [2.73 d (8.4) OH]	Ac	170.31	–		
16	112.20	–		22.45	1.99 s		

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

23-O-Acetyl-7,8-didehydroshengmanol

C₃₂H₄₈O₆, M 528



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 89–90°C (from MeOH), $[\alpha]_D^{20}$ –75.2° (c 0.29, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600–3300, 1737.

Positive SIMS m/z: 529 [M + H]⁺.

Positive HRSIMS m/z: 529.3514 [M + H]⁺.

Table 1

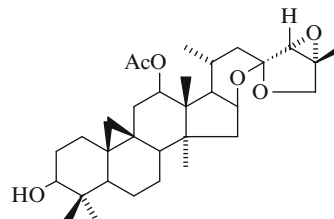
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.57	1.23, 1.69	C-16	220.34 –
2	30.74	1.98, 2.32	17	60.16 2.31 d (7.5)
3	77.73	3.56 dd (5, 10)	18	21.88 1.34 s
4	40.25	–	19	28.92 0.61 d (4), 1.12 d (4)
5	42.45	1.37	20	28.14 2.17
6	21.56	1.73, 1.99	21	19.87 1.25 d (6.5)
7	115.30	6.15 dd (2, 7.5)	22	37.38 1.77, 2.88
8	147.25	–	23	72.04 5.42 td (8.8, 2.5)
9	20.98	–	24	65.26 3.06 d (8.8)
10	28.52	–	25	58.53 –
11	25.31	1.76, 2.25	26	19.40 1.44 s
12	33.59	1.95, 2.01	27	24.76 1.28 s
13	40.90	–	28	18.85 1.42 s
14	49.55	–	29	26.20 1.24 s
15	80.92	4.58 s	30	13.66 1.13 s
			Ac	170.61 –
				22.14 2.04 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

23-*epi*-26-Deoxyacetylacteol

C₃₂H₄₈O₆, M 528



Taxonomy: Cycloartane Triterpenoids

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1, 2].

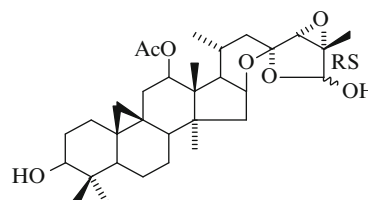
Mp 289–292°C, $[\alpha]_D^{25}$ –87.5° (c 0.46, CHCl₃).

References

1. H. Linde, *Arch. Pharm.* **301**(5), 335–341 (1968)
2. S.-N. Chen, W. Li, D.S. Fabricant, B.D. Santarsiero, A. Mesecar, J.F. Fitzloff, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(4), 601–605 (2002)

Acetylacteol

C₃₂H₄₈O₇, M 544



Taxonomy: Cycloartane Triterpenoids

Actea racemosa (*Ranunculaceae*) [1, 2].

Cimicifuga foetida L. (*Ranunculaceae*) [3].

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [4].

Mp 247–249°C, $[\alpha]_D^{25}$ –80°.

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.37 and 0.68 (2H-19, d, J = 4 Hz), 1.54 (H-15, dd, J = 12, 6 Hz), 1.62 (CH₃-27, s), 1.91 (H-15, dd, J = 12, 7.5 Hz), 2.03 (Ac, s), 3.29 (H-3, dd, J = 11, 4.5 Hz), 3.84

(H-24, s), 4.43 (H-16, td, $J = 7.5, 6$ Hz), 4.86 (H-12, dd, $J = 9, 3.5$ Hz), 5.07 (H-26, s).

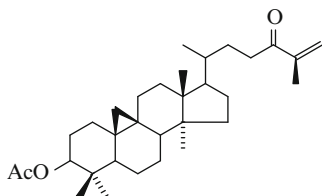
2.64 (H-23, m), 4.57 (H-3, m, $\Sigma J = 16$ Hz), 5.76 and 5.96 (2H-27, brs).

References

1. S. Korsano, H. Linde, G. Piancatelli, L. Panizzi, *Chimia* **21**, 130–131 (1967)
2. G. Piancatelli, S. Corsano, A. Scettri, *Gazz. Chim. Ital.* **101**, 797–802 (1971)
3. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)
4. A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(3), 467–472 (1998)

3 β -Acetoxycycloart-25-en-24-one

$C_{32}H_{50}O_3$, M 482



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (*Bromeliaceae*) [1].

Mp 133–136°C (from MeOH), $[\alpha]_D^{27} +58^\circ$ (c 1.0, $CHCl_3$).

UV λ_{max}^{EtOH} , nm (ϵ): 218 (10,000).

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 1710 (OAc), and 1680 (α, β -unsaturated ketone).

Euphorbia broteri (*Euphorbiaceae*) [2].

Mp 129–130°C (from MeOH), $[\alpha]_D^{25} 55^\circ$ (c 0.81, $CHCl_3$).

UV λ_{max}^{EtOH} , nm (ϵ): 219 (8563).

IR ν_{max}^{KBr} , cm^{-1} : 3080, 2940, 1730, 1640, 1680, 1470, 1375, 1250, 890.

MS m/z (%): $[M]^+$ 482 (3), 467 (5), 422 (5), 407 (13), 125 (18), 121 (25), 109 (22), 107 (25), 95 (44), 83 (49), 69 (98), 43 (100).

1H NMR ($CDCl_3$, δ , 0-TMS): 0.34 and 0.58 (2H-19, d, $J = 4.1$ Hz), 0.85, 0.89, 0.90, 0.96 1.87 ($5 \times CH_3$, s), 0.89 (CH_3 -21, d, $J = 5.6$ Hz), 2.05 (CH_3COO , s),

Table 1

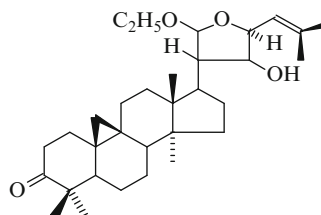
δ_C ($CDCl_3$)		δ_C ($CDCl_3$)		δ_C ($CDCl_3$)		δ_C ($CDCl_3$)	
C-1	31.68	C-9	20.21	C-17	52.30	C-25	144.76
2	26.86	10	26.10	18	18.02	26	17.74
3	80.75	11	25.83	19	29.76	27	124.05
4	39.51	12	35.56	20	35.92	28	19.33
5	47.24	13	45.43	21	18.22	29	25.47
6	20.95	14	48.90	22	34.77	30	15.18
7	28.11	15	32.95	23	31.18	Ac	21.32
8	47.81	16	26.56	24	182.24		170.90

References

1. C. Djerassi, R. McCrindle, *J. Chem. Soc.* 4034–4039 (1962)
2. J.P. Teresa, J.G. Urones, I.S. Marcos, P. Basabe, J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)

Argenteanone D

$C_{32}H_{50}O_4$, M 498



Taxonomy: Cycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D^{20} +12.6^\circ$ (c 1, $CHCl_3$).

CAS Registry Number: 186090-63-1.

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3400, 1709.

FABMS m/z : 521 $[M + Na]^+$.

HRFABMS m/z : 521.3464 ($C_{32}H_{50}NaO_4$).

Table 1

δ_C ($CDCl_3$)	δ_H (J/Hz)	δ_C ($CDCl_3$)	δ_H (J/Hz)
C-1	33.5	C-17	45.0 1.80 m
2	37.5 2.28 m, 2.70 ddd (14, 14, 6.5)	18	19.4 1.08 s

(continued)

Table 1 (continued)

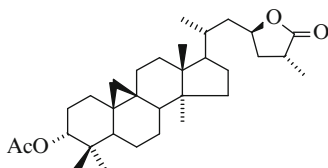
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
3	216.4	19	29.7 0.57 d (4.4), 0.78 d (4.4)
4	50.3	20	57.8
5	48.5	21	105.6 4.97 s
6	21.0	22	77.4 3.87 dd (11, 4.5)
7	26.0	23	79.5 4.75 dd (9, 4.5)
8	48.0	24	121.3 5.40 dt (9, 1)
9	20.9	25	137.5 –
10	26.2	26	26.3 1.70 d (1)
11	27.5	27	18.6 1.78 d (1)
12	32.6	28	19.4 0.90 s
13	45.9	29	22.3 1.02 s
14	48.8	30	20.9 1.05 s
15	35.6	OEt	63.0 3.40 dq (16, 8), 3.78 dq (16, 8)
16	27.5 1.95 m, 1.55 m	15.4	? t (7)

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, *J. Nat. Prod.* **60**(2), 81–85 (1997)

(23S,25R)-3 α -Acetoxy-9 β ,19-cyclolanostan-23,26-olide

C₃₂H₅₀O₄, M 498



Taxonomy: Cycloartane Triterpenoids

Abies marocana (Pinaceae) [1].

Mp 155–157°C (from Et₂O), $[\alpha]_D^{25} +29.3^\circ$ (c 0.96, CHCl₃).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 2932, 2866, 1774, 1730, 1664, 1547, 1459, 1372, 1247, 1202, 1172, 1108, 1057, 1007, 975, 918.

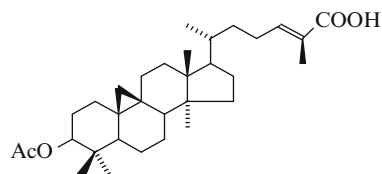
¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.35 and 0.51 (2H-19, d, J = 4.3 Hz), 0.83, 0.91, 0.91, 0.96 (4 × CH₃, s), 0.94 (CH₃-21, d, J = 6.4 Hz), 1.27 (CH₃-27, d, J = 7.3 Hz), 2.06 (OAc, s), 2.69 (H-25, sext, J = 7.5 Hz), 4.65 (H-23, m), 4.68 (H-3, t, J = 2.8 Hz).

References

1. A.F. Barrero, J.F. Sanchez, E.J. Alvarez-Manzaneda, M.M. Dorado, A. Haidour, *Phytochemistry* **35**(5), 1271–1274 (1994)

3 β -O-Acetyl-mangiferolic Acid

C₃₂H₅₀O₄, M 498



Taxonomy: Cycloartane Triterpenoids

Illicium difengpi K.I.B. et K.I.M. (Illiciaceae) [1].

Mp 180–182°C (from EtOAc).

CAS Registry Number: 206197-08-2.

UV $\lambda_{\max}^{\text{EtOH}}$, nm: 217.

IR ν_{\max}^{KBr} , cm⁻¹: 3025, 2865, 2550, 1731, 1675, 1632, 1439, 1367, 1285, 1243, 1035, 1025, 965.

HREIMS m/z: M⁺ 498.3713 (M)⁺, 438.3504 (M-CH₃COOH)⁺.

EIMS m/z (%): M⁺ 498 (13), 438 (76), 423 (45), 395 (18), 369 (20), 316 (48), 256 (12), 203 (37), 175 (49), 57 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	31.62 1.61 m, 1.25 m	C-17	52.20 1.61 m
2	26.81 1.77 m, 1.63 m	18	18.00 0.97 s
3	80.70 4.57 dd (11.8, 4.4)	19	29.75 0.34 d (4.4), 0.58 d (4.4)

(continued)

Table 1 (continued)

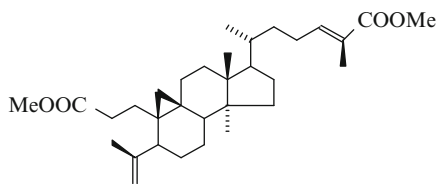
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
4	39.47 –	20	35.98 1.44 m
5	47.18 1.40 dd (12.5, 4.4)	21	18.13 0.91d (6.7)
6	20.91 1.57 m, 0.82 m	22	34.82 1.18 m, 1.58 m
7	25.82 1.09 m, 1.31 m	23	25.94 2.12 m, 2.26 m
8	47.80 1.53 dd (12.1, 4.8)	24	145.82 6.19 td (7.6, 1.2)
9	20.13 –	25	126.64 –
10	26.00 –	26	173.19 –
11	26.50 1.99 m, 1.33 m	27	11.95 1.84 d (1.2)
12	32.88 1.62 m, 1.62 m	28	19.30 0.90 s
13	45.37 –	29	25.43 0.85 s
14	48.84 –	30	15.14 0.89 s
15	35.51 1.30 m, 1.30 m		21.32 2.05 s
		Ac	
16	28.15 1.30 m, 1.90 m		171.01 –

References

1. P. Huang, Z. Xi, X. Zheng, M. Lai, X. Zhong, Yaouxue Xuebao **32**(9), 704–707 (1997)

Dimethyl 3,4-seco-cycloart-4(29),24E-diene-3,26-dioate

C₃₂H₅₀O₄, M 498



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (Bromeliaceae) [1].

Oil, $[\alpha]_D^{+63}$ (c 0.132, CH₂Cl₂).

CAS Registry Number: 206197-08-2.

UV $\lambda_{\max}^{\text{CH}_2\text{Cl}_2}$, nm (ϵ): 234 (5900).

IR ν_{\max}^{KBr} , cm⁻¹: 2928, 1740, 1720, 1647.

EIMS m/z (%): M⁺ 498 (18), 483 (54), 455 (6), 451 (12), 385 (5), 343 (6), 330 (7), 315 (5), 301 (4), 249 (29), 217 (15), 175 (45), 161 (56), 95 (100).

HREIMS m/z: 498.3711 C₃₂H₅₀O₄.

Table 1

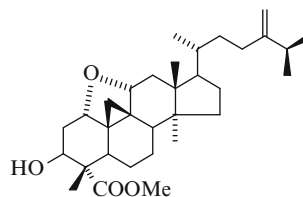
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	29.1 2.05, 1.37	C-17	52.2 1.59
2	31.5 2.46, 2.26	18	18.1 0.97 s
3	174.4 –	19	30.0 0.40 d (4.5), 0.73 d (4.5)
4	149.5 –	20	36.0 1.43
5	45.9 2.43 dd (13, 4)	21	18.2 0.91 d (6.5)
6	27.8 1.51, 1.08	22	35.2 1.55, 1.19
7	25.1 1.31, 1.06	23	25.7 2.0-2.1
8	47.8 1.56	24	143.2 6.76 dt (7.5, 1.5)
9	21.4 –	25	127.2 –
10	27.2 –	26	168.8 –
11	27.1 2.09, 1.26	27	12.4 1.84 brs
12	33.1 1.65	28	19.4 0.94 s
13	45.3 –	29	111.6 4.80 brs, 4.72 brs
14	49.0 –	30	19.8 1.69 brs
15	35.7 1.30	C ₃ -OMe	51.5 3.64 s
16	28.1 1.89, 1.24	C ₂₆ -OMe	51.7 3.73 s

References

1. G.M. Cabrera, M. Gallo, A.M. Seldes, Phytochemistry **39**(3), 665–666 (1995)

Methylquadrangularate D

C₃₂H₅₀O₄, M 498



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Colorless amorphous solid, $[\alpha]_D^{25}$ +57.4° (c 0.39, MeOH).

CAS Registry Number: 221359-73-5.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3400, 1720, 1460, 1380, 1240.

HRFABMS m/z: 499.3814 [M + H]⁺.

Table 1

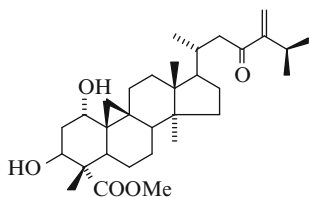
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	80.4	C-17	51.3
2	37.0	18	15.5
	2.60 ddd (12.5, 6, 2.5), 2.40 ddd (12.5, 11, 5)	19	30.6
			0.71 d (4.5), 1.37 d (4.5)
3	71.7	20	36.3
	4.95 dd (5, 2.5)	21	18.7
4	51.6		0.93 d (6.5)
5	37.3	22	35.3
	2.62 dd (11.5, 3)	23	31.6
6	19.0	24	156.6
	–		–
7	22.1	25	34.0
8	38.8	26	22.0
	2.14 dd (10, 5.5)	27	21.9
9	32.9		1.07 d (7)
	–	28	18.8
10	37.5		1.06 d (7)
11	84.4	29	178.5
	3.93 dd (9.5, 6)		–
12	39.6	30	13.6
	2.30 dd (14, 6), 1.86 dd (14, 9.5)		1.55 s
13	47.5	31	106.6
	–		4.87 brs, 4.84 brs
14	49.5	OMe	51.7
	–		3.67 s
15	28.4		
16	34.0		

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Methyl Jessate

$C_{32}H_{50}O_5$, M 514



Taxonomy: Cycloartane Triterpenoids

Combretum elaeagnoides (*Combretaceae*) [1].

Mp 220–223°C (from MeCN), $[\alpha]_D^{20} +60.4^\circ$ (c 1.0, C_5H_5N).

UV λ_{max}^{KBr} , nm (ϵ): 221 (7130).

IR ν_{max}^{KBr} , cm^{-1} : 3550, 3060, 1715, 1675, 1622, 1268.

MS m/z (%): 514.3657 $[M]^+$ (7.8), 496 (16.7), 402 (62.0), 384 (36.7), 366 (12.3), 307 (12.4), 201 (26.4), 175 (59.0).

1H NMR (500 MHz, $CDCl_3$, δ): 0.47 and 0.70 (2H-19, d, $J = 4$ Hz), 0.81–1.08 (6 \times CH_3), 2.88 (H-25, septet, $J = 6.8, 1.25$ Hz), 3.58 (H-1, apparent t, $W_{1/2} = 6$ Hz), 3.68 (OCH₃, s), 4.52 (H-3, dd, $J = 11, 5$ Hz), 5.62 and 5.88 (2 H-31, s).

Table 1

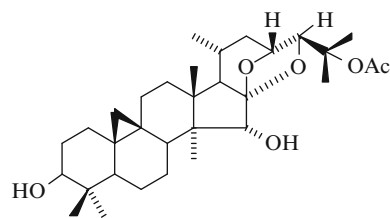
δ_C (C_5D_5N)					
C-1	73.0	C-13	45.3	C-26	21.9
3	70.4	14	48.8	27	21.9
4	54.8	17	52.6	29	177.5
8	47.8	22	45.3	30	8.4
9	20.8	23	202.8	31	120.7
10	29.4	24	156.1	OMe	51.8

References

1. R. Osborne, K.H. Pegel, *Phytochemistry* **23**(3), 635–637 (1984)

25-O-Acetylcimigenol

$C_{32}H_{50}O_6$, M 530



Taxonomy: Cycloartane Triterpenoids

Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].

Cimicifuga heracleifolia Komarov (*Ranunculaceae*) [2].

Mp 193–194°C (from EtOAc), $[\alpha]_D^{15} 39.5^\circ$ (c 1.8, $CHCl_3$).

CAS Registry Number: 24399-54-0.

MS m/z: 530 $[M]^+$ 512, 452, 437, 409, 330 (base peak).

HRMS m/z: 530.3583 $[M]^+$.

Table 1

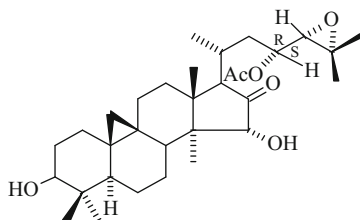
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.13 1.96 m	C-17	58.92 1.38 m
2	30.13 1.22 m, 1.58 m	18	19.12 1.09 s
3	78.79 3.29 dd (11.6, 4.6)	19	30.91 0.37 d (4.3), 0.63 d (4.3)
4	40.52 –	20	23.63 1.62 m
5	47.04 1.30 m	21	19.29 0.88 d (7.2)
6	20.93 1.32 m, 1.61 m	22	37.73 1.00 m, 2.34 ddd (13,7.5,2.5)
7	26.07 0.80 m, 1.76 m	23	71.74 4.38 brd (9.2)
8	48.19 1.63 m	24	86.41 3.88 s
9	19.85 –	25	82.57 –
10	26.55 –	26	23.08 1.47 s
11	26.20 1.04 m, 1.69 m	27	21.75 1.41 s
12	33.71 1.67 m, 1.79 m	28	11.06 0.95 s
13	41.52 –	29	25.44 1.00 s
14	47.02 –	30	14.04 0.81 s
15	79.58 3.19 d (8.4) [2.64 d (8.4) OH]	Ac	170.31 –
16	111.95 –	22.45	1.99 s

References

1. T. Takemoto, G. Kusano, *Yakugaku Zasshi* **89**(7), 954–958 (1969). *C.A.*, 71:91696m (1969)
2. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

Acetyl Shengmanol

C₃₂H₅₀O₆, M 530



Taxonomy: Cycloartane Triterpenoids

Cimicifuga japonica (*Ranunculaceae*) [1].

An amorphous solid, $[\alpha]_D^{17} -16.1^\circ$ (c 0.8, CHCl₃).

CAS Registry Number: 62498-92-4.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600–3400, 1738, 1730, 1235.

CD $[\theta]_{316} -1.11 \times 10^4$ (c 6.37 $\times 10^{-4}$, MeOH).

MS m/z: M⁺ 530, 470.

¹H NMR (CCl₄, δ): 2.07 (CH₃COO, s), 2.65 (H-24, d, J = 8.4 Hz), 3.22 (H-3, m), 3.88 (H-15, brs), 4.90 (H-23, m).

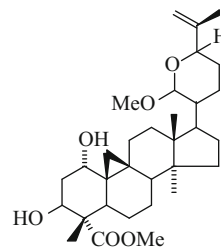
¹H NMR (CDCl₃, δ): 0.43 and 0.66 (2H-19, d, J = 4.2 Hz), 0.81 (CH₃, s), 0.86 (2 \times CH₃, s), 0.98 (CH₃, s), 1.32 (CH₃, s), 1.37 (CH₃, s), 2.09 (CH₃COO, s), 2.80 (H-24, d, J = 8.4 Hz), \sim 3.3 (H-3, m), 3.98 (H-15, s), 4.93 (H-23, td, J = 12.0, 4.0 Hz).

References

1. N. Sakurai, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **27**(1), 158–165 (1979)

Methylquadrangularate C

C₃₂H₅₀O₆, M 530



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Colorless amorphous solid, $[\alpha]_D^{25} +37.2^\circ$ (c 0.33, MeOH).

CAS Registry Number: 221455-84-1.

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3400, 1720, 1450, 1230,

1110, 1030. HRFABMS m/z: 531.3672 [M + H]⁺.

Table 1

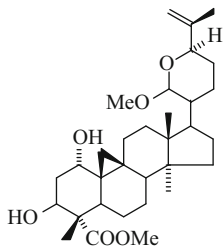
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	72.4	3.85 brs	
2	38.7	2.42 ddd (13, 4.5, 4), 2.22 ddd (13, 12, 3.5)	18 19.1 1.04 s 19 29.9 0.52 d (4.5), 0.76 d (4.5)
3	70.5	5.33 dd (12, 4.5)	20 42.8
4	56.1	–	21 100.1 4.90 brs
5	38.0	3.23 dd (12, 4.5)	22 24.7
6	23.3	–	23 30.8
7	27.2	–	24 71.2 4.22 brd (11)
8	48.2	–	25 146.8
9	20.8	–	26 110.4 5.18 brs, 4.92 brs
10	30.2	–	27 19.0 1.85 s
11	27.2	2.75 m	28 19.1 0.99 s
12	31.6	–	29 178.1 –
13	45.9	–	30 9.5 1.62 s
14	49.1	–	21-OMe 53.9 3.35 s
15	35.9	–	29-OMe 51.6 3.65 s
16	25.8	–	

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Methyl 24-epiquadrangularate C

$C_{32}H_{50}O_6$, M 530



Taxonomy: Cycloartane Triterpenoids
Combretum quadrangulare Kurz (*Combretaceae*) [1].

Table 1

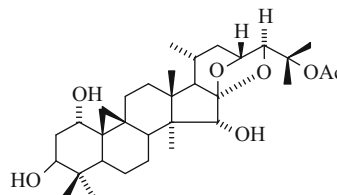
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	72.3	3.81 brs	
2	39.3	2.42 ddd (13, 4.5, 4), 2.22 ddd (13, 12, 3.5)	18 19.1 1.04 s 19 29.8 0.52 d (4.5), 0.76 d (4.5)
3	70.5	5.36 dd (12, 4.5)	20 43.8
4	56.0	–	21 100.5 4.90 brs
5	38.0	3.23 dd (12, 4.5)	22 25.2
6	23.4	–	23 33.2
7	27.4	–	24 71.7 4.26 brd (11)
8	48.2	–	25 147.0 –
9	20.7	–	26 110.4 5.14 brs, 4.94 brs
10	30.2	–	27 18.6 1.85 s
11	26.1	2.75 m	28 19.1 1.02 s
12	31.6	–	29 178.1 –
13	45.2	–	30 9.5 1.62 s
14	49.5	–	21-OMe 54.6 3.43 s
15	35.7	–	29-OMe 51.5 3.65 s
16	25.9	–	

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

25-O-Acetyl-1 α -hydroxycimigenol

$C_{32}H_{50}O_7$, M 546



Taxonomy: Cycloartane Triterpenoids
Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].
Mp 127–128°C (from EtOAc), $[\alpha]_D^{20} +36.7^\circ$ (c 0.35, MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3200, 1739.

HRFABMS m/z : 569.3483 $[\text{M} + \text{Na}]^+$.

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	72.61	C-17	59.46
2	38.80	18	19.67
3	73.23	19	31.02
4	41.29	20	23.99
5	39.94	21	19.56
6	21.27	22	37.96
7	26.44	23	71.71
8	48.91	24	86.28
9	20.94	25	83.28
10	31.27	26	21.51
11	25.84	27	23.41
12	34.11	28	11.77
13	41.83	29	26.23
14	47.32	30	14.16
15	80.25	Ac	170.37
16	112.28		22.37

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

Table 1

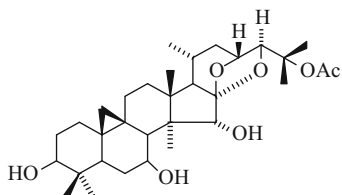
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	30.08	C-17	59.38
2	30.08	18	19.23
3	77.28	19	30.53
4	40.39	20	23.51
5	45.71	21	19.23
6	32.13	22	37.51
7	69.02	23	71.12
8	55.83	24	86.38
9	18.50	25	83.29
10	27.04	26	20.92
11	26.26	27	23.08
12	33.59	28	11.68
13	41.99	29	25.71
14	47.44	30	14.37
15	78.67	Ac	170.21
16	111.92		22.04

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **43**(7), 1167–1170 (1995)

25-O-Acetyl-7 β -hydroxycimigenol

$\text{C}_{32}\text{H}_{50}\text{O}_7$, M 546



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 160–161°C, $[\alpha]_{\text{D}} +22.6^\circ$ (c 0.93, MeOH).

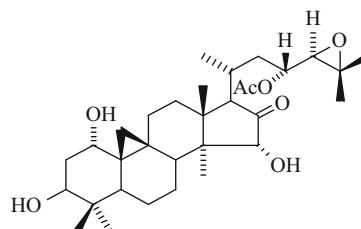
IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3500–3200, 1733.

Positive SIMS m/z : 547 $[\text{M} + \text{H}]^+$, 569 $[\text{M} + \text{Na}]^+$.

Positive HRSIMS m/z : 547.3627.

23-O-Acetyl-1 α -hydroxyshengmanol

$\text{C}_{32}\text{H}_{50}\text{O}_7$, M 546



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 110–112°C (from a mixture of MeOH and isopropyl ether), $[\alpha]_{\text{D}}^{20} -38.9^\circ$ (c 0.18, MeOH).

Positive HREIMS m/z: 546.3556 [M]⁺.

Table 1

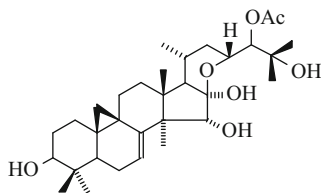
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.24	3.88 dd (3, 3)	C-17	60.06	2.35 d (7)
2	38.77	2.72 dd (14, 12), 2.58 m	18	19.92	1.44 s
3	73.23	4.43 dd (12, 4)	19	30.45	0.52 d (4), 0.80 d (4)
4	41.28	–	20	28.06	2.17
5	39.96	2.48 dd (12, 5)	21	20.38	1.27 d (7)
6	21.16	0.88 q (13), 1.75	22	37.09	1.75, 2.70 t (13)
7	26.63	1.53, 2.17	23	72.57	5.40 td (9, 3)
8	48.39	1.97 dd (7, 4)	24	65.27	3.06 d (9)
9	21.03	–	25	58.73	–
10	31.44	–	26	19.43	1.28 s
11	25.64	1.53, 2.94	27	24.77	1.42 s
12	33.23	1.89, 1.89	28	11.93	1.29 s
13	41.66	–	29	26.17	1.33 s
14	46.31	–	30	14.12	1.18 s
15	82.99	4.42 s	Ac	170.80	–
16	220.01	–		21.09	2.09 s

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

24-*epi*-24-O-Acetyl-7,8-didehydrohengmanol

C₃₂H₅₀O₇, M 546



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 229–230°C (from MeOH), $[\alpha]_D^{20}$ –18.5° (c 0.4, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3600–3250, 1744.

Positive SIMS m/z: 546 [M]⁺, 529 [M-OH]⁺.

Positive HRSIMS m/z: 546.3552 [M]⁺.

Table 1

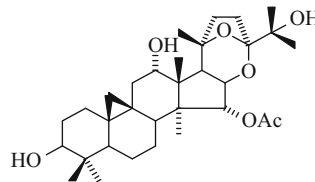
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.66	1.26, 1.37	C-17	60.78	1.83 d (10)
2	30.78	1.94, 2.00	18	22.59	1.29 s
3	77.75	3.54 dd (4, 11.8)	19	28.78	0.58 d (4), 1.15 d (4)
4	40.24	–	20	27.82	1.77
5	42.52	1.32	21	21.64	1.03 d (5.0)
6	22.15	1.70, 1.95	22	32.82	1.87, 2.11
7	113.66	6.03 d (8.8)	23	74.27	4.45 m
8	149.08	–	24	81.39	5.74 d (8.8)
9	21.07	–	25	72.17	–
10	28.65	–	26	27.09	1.50 s
11	25.53	1.32, 2.22	27	27.37	1.46 s
12	33.89	1.67, 1.74	28	18.20	1.45 s
13	41.63	–	29	26.20	1.22 s
14	50.06	–	30	13.68	1.11 s
15	80.13	4.47 s	Ac	170.31	–
16	103.21	–		21.08	2.10 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

Genin of Beesioside IV

C₃₂H₅₀O₇, M 546



Taxonomy: Cycloartane Triterpenoids

Beesia calthaeifolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Souliea vaginata (Maxim.) Franch. (*Ranunculaceae*) [1].

An amorphous powder, $[\alpha]_D^{22}$ +1.6° (c 1.0, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3410, 1730, 1245, 1030.

MS m/z (%): M^+ 546 (15), 528 (20), 486 (15), 141 (20), 123 (100), 59 (85).

Table 1

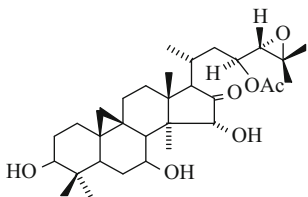
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
C-1	32.74	1.28, 1.58	C-17	44.14	2.77
2	31.13	1.82, 1.95	18	20.52	1.59
3	77.87	3.47	19	30.18	0.40, 0.54
4	41.00	–	20	82.92	–
5	47.48		21	26.06	1.19
6	21.37	0.76, 1.35	22	40.22	1.72, 2.13
7	26.32	1.15, 1.48	23	28.63	2.05, 2.56
8	48.21	1.78	24	110.35	–
9	19.90	–	25	72.13	–
10	26.50	–	26	25.17	1.63
11	39.97	1.88, 2.39	27	24.48	1.74
12	72.19	4.08	28	14.63	1.06
13	49.80	–	29	25.17	1.46
14	50.79	–	30	14.68	1.42
15	86.72	5.68	Ac	169.94	–
16	79.75	4.54		21.37	2.07

References

1. N. Sakurai, T. Goto, M. Nagai, T. Inoue, P. Xiao, *Heterocycles* **30**(2), 897–904 (1990)

7 β -Hydroxy-23-O-acetylshengmanol

$C_{32}H_{50}O_7$, M 546



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 194–196°C, $[\alpha]_D -27^\circ$ (c 0.83, $CHCl_3$).

EIMS m/z : M^+ 546, 528, 486.

HRMS m/z : 546.3546 $[M]^+$.

1H NMR ($CDCl_3$, δ , J/Hz): 0.52 and 0.76 (2H-19, d, $J = 4$ Hz), 1.12 (CH_3 -21, d, $J = 6.7$ Hz), 2.79

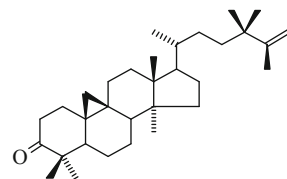
(H-24, d, $J = 8.2$ Hz), 3.32 (H-3, dd, $J = 9.5$, 4.7 Hz), 3.52 (H-7, ddd, $J = 10.2$, 10.2, 2.8 Hz), 4.07 (H-15, s), 4.95 (H-23, ddd, $J = 8.6$, 8.4, 2.5 Hz).

References

1. G. Kusano, M. Idoji, Y. Sogoh, M. Shibano, A. Kusano, T. Iwashita, *Chem. Pharm. Bull.* **42**(5), 1106–1110 (1994)

Cyclobalanone

$C_{32}H_{52}O$, M 452



Taxonomy: Cycloartane Triterpenoids

Quercus glauca Thunb. = *Cyclobalanopsis glauca* Kerst (*Fagaceae*) [1].

Mp 187–190°C (from EtOH), $[\alpha]_D +20^\circ$.

CAS Registry Number: 35043-88-0.

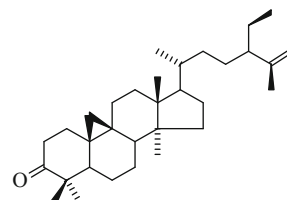
1H NMR ($CDCl_3$, δ): 0.52 and 0.60 (2H-19, d, $J = 4.5$ Hz), 0.90–1.08 ($7 \times CH_3$), 1.68 (CH_3 , s), 4.70 (2H-26, brs).

References

1. Y. Tachi, S. Taga, Y. Kamano, M. Komatsu, *Chem. Pharm. Bull.* **19**(10), 2193–2194 (1971)

24R-Cyclomargenone

$C_{32}H_{52}O$, M 452

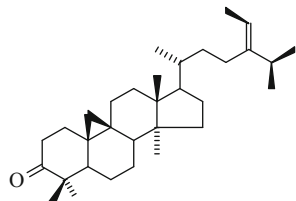


Taxonomy: Cycloartane Triterpenoids*Polypodium formosanum* (*Polypodiaceae*) [1].Mp 122–124°C, $[\alpha]_D^{24} + 13.4^\circ$ (CHCl₃).

CAS Registry Number: 83110-14-9.

References

1. A. Hiroyuki, A. Yoko, *Chem. Lett.* **6**, 881–884 (1982). *C.A.*, 97:145059p (1982)

24(E)–EthylidenecycloartanoneC₃₂H₅₂O, M 452**Taxonomy:** Cycloartane Triterpenoids*Polygonum bistorta* (*Polygonaceae*) [1].

Mp 135.4–137.1°C.

IR ν_{\max}^{KBr} , cm⁻¹: 3046, 2939, 2864, 1712, 1448, 1376.EIMS m/z (%): [M]⁺ 452 (72), 437 (42), 354 (86), 340 (48), 313 (72), 271 (44), 216 (78), 175 (51), 95 (100), 55 (54).HREIMS m/z : 452.4019 [M]⁺.**Table 1**

δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)	δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)
C-1	33.3 1.87 tdd (13.8, 4.4, 1.5), 1.56 ddd (13.5, 6.4, 2.7)	C-16	28.1 1.95 m, 1.33 m 17 52.2 1.63 m
2	37.4 2.72 ddd (13.5, 4.4, 2.7), 2.32 ddd (13.5, 4.5, 6.4)	18	18.0 1.01 s
3	216.4 –	19	29.4 0.59 d (4.3), 0.80 d (4.5)
4	50.2 –	20	36.4 1.41 m
5	48.4 1.73 dd (12.5, 4.5)	21	18.3 0.92 d (6.5)
6	21.5 1.57 m, 0.96 m	22	36.2 1.55 m, 1.12 m
7	25.8 1.39 m, 1.16 m	23	28.2 2.03 m, 1.78 m
		24	145.8 –

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)	δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)
8	47.8 1.61 dd (12.5, 4.9)	25	28.5 2.84 m
9	21.0 –	26	21.0 1.00 d (6.4)
10	25.9 –	27	21.0 1.00 d (6.4)
11	26.7 2.06 m, 1.19 m	28	19.2 0.92 s
12	32.7 1.68 t (7.5), (2H)	29	22.1 1.06 s
13	45.3 –	30	20.7 1.11 s
14	48.7 –	31	116.4 5.13 q (6.5)
15	35.5 1.33 m (2H)	32	12.7 1.60 d (6.0)

References

1. K.P. Manoharan, T.K.H. Benny, D. Yang, *Phytochemistry* **66**, 2304–2308 (2005)

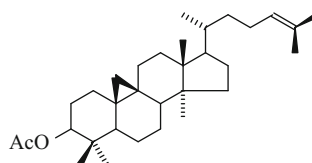
Cycloartenyl AcetateC₃₂H₅₂O₂, M 468**Taxonomy:** Cycloartane Triterpenoids*Artocarpus chaplasha* Roxb. (*Moraceae*) [1].Mp 118–120°C (from EtOH), $[\alpha]_D^{25} + 57^\circ$ (CHCl₃).IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3042, 1740, 1380, 1240, 840.*Euphorbia broteri* (*Euphorbiaceae*) [2].Mp 117–119°C (from Me₂CO), $[\alpha]_D^{25} + 54^\circ$ (c 0.30, CHCl₃).IR ν_{\max}^{KBr} , cm⁻¹: 3040, 2930, 1740, 1470, 1450, 1380, 1250, 1040, 1030, 980.MS m/z (%): M⁺ 468 (4), 453 (5), 408 (8), 393 (8), 365 (3), 339 (5), 297 (2), 286 (5), 271 (3), 175 (13.5), 109 (41), 95 (59), 93 (41), 69 (100), 43 (29).¹H NMR (CDCl₃, δ , 0-TMS): 0.34 and 0.57 (2H-19, d, J = 4.4 Hz), 0.84, 0.88, 0.89, 0.95 (4 × CH₃, s), 0.88 (CH₃-21, d, J = 5.4 Hz), 1.60 (CH₃-26, d, J = 1.1 Hz), 1.68 (CH₃-27, d, J = 1.3 Hz), 2.04 (CH₃COO, s), 4.56 (H-3, ΣJ = 15.1 Hz), 5.09 (H-24, J = 7 Hz).

Table 1

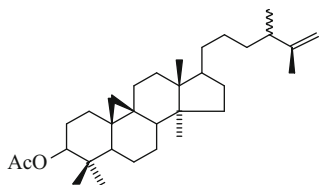
δ_C (CDCl ₃)									
C-1	31.68	C-7	28.18	C-13	45.37	C-19	29.79	C-25	130.86
2	26.87	8	47.84	14	48.87	20	35.95	26	17.66
3	80.74	9	20.23	15	32.94	21	18.31	27	25.73
4	39.52	10	26.07	16	26.60	22	36.43	28	19.33
5	47.25	11	25.86	17	52.34	23	25.03	29	25.48
6	20.98	12	35.60	18	18.00	24	125.34	30	15.17
								Ac	21.31
									170.90

References

1. S.B. Mahato, S.K. Banerjee, R.N. Chakravarti, *Phytochemistry* **10**, 1351–1354 (1971)
2. P. Teresa, J.G. Urones, I.S. Marcos, P. Basabe, J.S. Cuadrado, R.F. Moro, *Phytochemistry* **26**(6), 1767–1776 (1987)

Cyclopeltenyl Acetate

C₃₂H₅₂O₂, M 468



Taxonomy: Cycloartane Triterpenoids

Macaranga peltata Muell. (*Euphorbiaceae*) [1].

Mp 189°C (from MeOH), $[\alpha]_D^{25} +41^\circ$ (c 1.0, CHCl₃).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3040, 1730, 890.

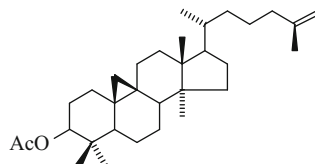
¹HNMR (CDCl₃, δ): 0.29 and 0.55 (2H-19, d, J = 5 Hz), 0.85–1.1 (5 × CH₃), 1.65 (CH₃-27, s), 2.03 (CH₃COO, s), 4.51 (H-3, m, W_{1/2} = 16 Hz), 4.6–4.7 (2H-26, m).

References

1. A.S.R. Anjaneyulu, D.S.K. Reddy, *Indian J. Chem.* **20B**, 1033–1036 (1981)

Isocycloartenyl Acetate

C₃₂H₅₂O₂, M 468



Taxonomy: Cycloartane Triterpenoids

Artocarpus chaplasha Roxb. (*Moraceae*) [1].

Mp 112–113°C (from EtOH), $[\alpha]_D^{25} +53.8^\circ$ (CHCl₃).

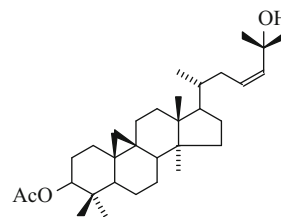
IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3045, 1740, 1638, 1378, 1240, 890.

References

1. S.B. Mahato, S.K. Banerjee, R.N. Chakravarti, *Phytochemistry* **10**, 1351–1354 (1971)

(23Z)-3 β -Acetoxycycloart-23-en-25-ol

C₃₂H₅₂O₃, M 484



Taxonomy: Cycloartane Triterpenoids

Ficus pimula L. (*Moraceae*) [1].

Mp 145–146°C, $[\alpha]_D^{23} +44.1^\circ$ (c 2.3, CHCl₃).

CAS Registry Number: 215380-51-1.

EIMS m/z: 484.3902 [M]⁺, 466.3875 [M–H₂O]⁺, 424 [M–CH₃OOH]⁺, 406 [M–CH₃OOH–H₂O]⁺ (base), 391 [M–CH₃OOH–H₂O–CH₃]⁺.

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	31.60	C-17	52.00
2	26.46	18	18.04 0.97 s

(continued)

Table 1 (continued)

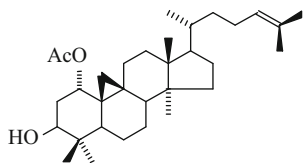
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
3	80.69	4.57 dd (11, 5.5)	19 29.76 0.34 d (4), 0.58 d (4)
4	39.45	–	20 36.42
5	47.16	–	21 18.29 0.86 d (6.5)
6	20.91	–	22 39.05
7	25.81	–	23 125.62 5.60 m
8	47.81	–	24 139.36 5.60 brd (7.5)
9	20.12	–	25 70.76 –
10	25.98	–	26 29.86 1.319 s
11	26.81	–	27 29.99 1.316 s
12	32.75	–	28 19.27 0.89 s
13	45.30	–	29 25.43 0.85 s
14	48.83	–	30 15.14 0.89 s
15	35.54	Ac	21.35 2.05 s
16	28.07	–	171.01 –

References

1. J. Kitajima, K. Kimizuka, Y. Tanaka, *Chem. Pharm. Bull.* **46**(9), 1408–1411 (1998)

1 α -Acetoxy-9,19-cyclolanost-24-en-3 β -ol

C₃₂H₅₂O₃, M 484



Taxonomy: Cycloartane Triterpenoids

Commiphora incisa Choiv. (*Burseraceae*) [1].

Amorphous solid.

CAS Registry Number: 119765-93-4.

MS m/z (%): [M]⁺ 484 (17), 424 (100), 409 (31), 406 (38), 391 (11), 311 (15), 285 (12), 219 (10), 205 (14), 201 (19).

¹H NMR (360 MHz, CDCl₃, δ , 0-TMS): 0.43 and 0.73 (2H-19, d, J = 4.8 Hz), 0.79, 0.90, 0.91, 1.00, 1.59,

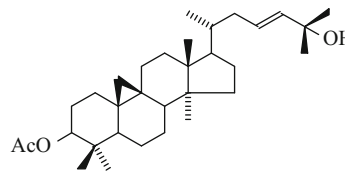
1.67 (6 \times CH₃, s), 0.86 (CH₃-21, d, J = 6.5 Hz), 1.74 (H-2, ddd, J = 14, 12.2, 3.1 Hz), 2.00 (H-2, ddd, J = 14, 4.4, 3.1 Hz), 2.04 (OAc, s), 3.56 (H-3, dd, J = 12.4, 4.4 Hz), 4.62 (H-1, t, J = 3.1 Hz), 5.08 (H-24, brt, J = 7.2 Hz).

References

1. G.J. Provan, P.G. Waterman, *Phytochemistry* **27**(12), 3841–3843 (1988)

3-O-Acetylcycloart-23-en-25-ol

C₃₂H₅₂O₃, M 484



Taxonomy: Cycloartane Triterpenoids

Sapium insigne Trimen (*Euphorbiaceae*) [1].

Tillandsia usneoides L. (*Bromeliaceae*) [2].

Mp 148–150°C (from hexane), [α]_D²² +43° (c 0.75, CHCl₃).

CAS Registry Number: 26531-71-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2950, 2870, 1725, 1395, 1375, 1365, 1250, 1210, 1010, 780.

MS m/z: M⁺ 484, 469, 466, 451, 425, 397, 381, 325, 297, 223, 182.

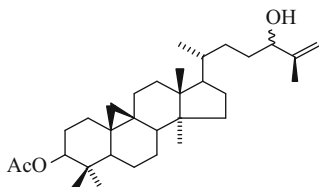
¹H NMR (δ): 0.33 and 0.58 (2H-19, d, J = 3 Hz), 0.79, 0.87, 0.93, 1.00, 1.30, 1.30 (6 \times CH₃, s), 0.95 (CH₃-21, d, J = 6 Hz), 2.02 (OAc, s), 4.50 (H-3, t, J = 4.0 Hz), 5.60 (H-23, H-24,m).

References

1. S.K. Srivastava, V.K. Agnihotri, *J. Nat. Prod.* **48**(3), 496–497 (1985)
2. C. Djerassi, R. McCrindle, *J. Chem. Soc.* 4034–4039 (1962)

(24R_S)-3β-Acetoxy-25-en-24-ol

C₃₂H₅₂O₃, M 484



Taxonomy: Cycloartane Triterpenoids

Ficus pimula L. (*Moraceae*) [1].

Mp 120–124° C.

CAS Registry Number: 215380-49-7.

EIMS m/z: 484.3934 [M]⁺, 466 [M–H₂O]⁺, 424.3708

[M–CH₃COOH]⁺ (base), 406 [M–CH₃

COOH–H₂O]⁺, 391 [M–CH₃ COOH–H₂O–CH₃]⁺.

Table 1

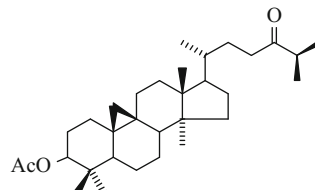
δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	31.63	C-19	29.77
2	26.51	20	35.91
3	80.65	21	18.32
	4.57 dd (11, 5.5)		0.34 d (4), 0.57 d (4)
4	39.42	22	31.92
5	47.17	23	31.63
6	20.19	24	76.75 (24R)
7	25.83		76.31 (24S)
8	47.80	25	147.75 (24R)
9	20.13		147.46 (24S)
10	25.97	26	110.86 (24R)
			4.63, 4.97 brs (24R, 24S)
11	26.80		111.35 (24S)
			4.63, 4.93 brs (24R, 24S)
12	32.84	27	17.64 (24R)
13	45.27		17.20 (24S)
14	48.83	28	19.30
15	35.52	29	25.44
16	28.12	30	15.15
17	52.14	Ac	21.35
18	17.98		171.01
	0.959, 0.962 s		–

References

1. J. Kitajima, K. Kimizuka, Y. Tanaka, *Chem. Pharm. Bull.* **46**(9), 1408–1411 (1998)

Lagerenyl Acetate

C₃₂H₅₂O₃, M 484



Taxonomy: Cycloartane Triterpenoids

Lagerstroemia langosteri (*Lythraceae*) [1].

Mp 122–123° C (from CHCl₃–MeOH), [α]_D³⁰ +57.8°
(c 0.099, CHCl₃).

CAS Registry Number: 1259-95-6.

IR ν_{max}^{KBr}, cm⁻¹: 2945, 1735, 1712, 1450, 1375, 1360,
1235, 1030.

MS m/z (%): M⁺ 484 (19.1), 424 (100), 409 (46.9),
355 (18.4), 302 (45.2), 222 (20.8), 203 (34.9), 175
(48.6), 127 (34.3), 122 (16.2), 121 (34.9), 107
(40.3), 95 (46.9), 71 (44.4), 43 (68.5)

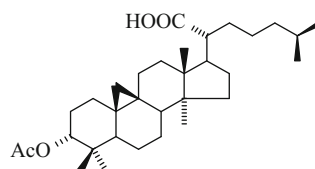
¹H NMR (CDCl₃, δ): 0.30 and 0.55 (2H-19, d, J =
4 Hz), 0.85, 0.90, 0.96 (5 × CH₃), 1.10 (CH₃-26
and CH₃-27, d, J = 7 Hz), 2.05 (CH₃COO, s), 2.38
(2H-23, t, J = 4.8 Hz), 2.50 (H-25, septet, J =
7 Hz), 4.58 (H-3, m, W_{1/2} = 10 Hz).

References

1. B. Talapatra, P.K. Chaudhuri, A.K. Mallik, S.K. Talapatra, *Phytochemistry* **22**(11), 2559–2562 (1983)

3α-Acetoxy-9,19-cyclolanostan-21-oic Acid

C₃₂H₅₂O₄, M 500



Taxonomy: Cycloartane Triterpenoids

Notholaena candida (Pteridaceae) [1].

CAS Registry Number: 145671-15-4.

EMIS m/z (%): M^+ 500 (3), 485 (2), 440 (34), 425 (19), 397 (7), 318 (13), 175 (31), 95 (40), 55 (69), 43 (100), 41 (75).

1H NMR ($CDCl_3$, δ): 0.30 and 0.52 (2H-19, d, $J = 4$ Hz), 0.84 (CH_3 , d, $J = 6.5$ Hz), 0.84 (CH_3 , s), 0.85 (CH_3 , d, $J = 6.5$ Hz), 0.91 (CH_3 , s), 0.93 (CH_3 , s), 1.05 (CH_3 , s), 2.08 (CH_3COO , s), 4.70 (H-3, brs).

Table 1

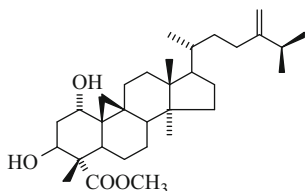
δ_c ($CDCl_3$)									
C-1	29.76	C-7	27.14	C-13	45.07	C-19	29.87	C-25	27.75
2	28.14	8	47.86	14	48.65	20	49.07	26	22.32
3	78.82	9	19.77	15	32.49	21	182.99	27	22.75
4	38.69	10	26.39	16	26.14	22	29.67	28	19.33
5	41.97	11	25.09	17	47.85	23	25.41	29	25.37
6	20.74	12	34.88	18	17.74	24	38.81	30	21.25
							Ac	170.80	
								21.25	

References

1. F.J. Arriaga-Giner, A. Rumero, E. Wollenweber, Z. Naturforsch. **47c**(7-8), 508–511 (1992)

1 α ,3 β -Dihydroxy-24-methylenecycloartan-29-oic Acid Methyl Ester

$C_{32}H_{52}O_4$, M 500



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Mp 190–194°C.

CAS Registry Number: 215609-95-3.

IR ν_{max}^{ZnSe} , cm^{-1} : 3459, 2952, 1703, 1464, 1263, 886.

ESIMS m/z (%): 523 [$M + Na$] $^+$.

Table 1

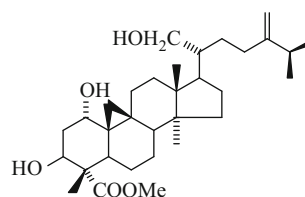
δ_c ($CD_3OD/CDCl_3$)		δ_H (J/Hz)	δ_c ($CD_3OD/CDCl_3$)		δ_H (J/Hz)
C-1	73.0	3.60 s	C-17	53.1	1.70 m
2	37.1	1.84 m, 1.92	18	18.7	1.04 s
3	70.9	4.60 dd (11.7, 3.2)	19	30.4	0.55 d (4.1), 0.76 d (4.1)
4	55.9	–	20	36.8	1.47 m
5	38.1	2.63 dd (11.2, 4.3)	21	19.7	0.97 d (6.2)
6	23.7	1.02 m, 1.18 m	22	35.7	1.63 m
7	26.1	1.28 m, 1.32 m	23	32.0	1.74 m
8	49.4	1.57 m	24	157.4	–
9	21.7	–	25	34.7	2.29 m
10	29.7	–	26	22.2	1.08 d (2.6)
11	26.3	1.28 m, 1.32 m	27	22.3	1.08 d (2.4)
12	36.5	1.36 m	28	18.7	1.04 s
13	46.0	–	29	178.9	–
14	48.8	–	30	8.9	1.17 s
15	33.6	1.78 m	31	106.6	4.72 s, 4.78 s
16	28.8	1.35 m	OMe	52.1	3.76 s

References

1. M. Ganzera, E.P. Ellmerer-Muller, H. Stuppner, Phytochemistry **49**(3), 835–838 (1998)

Methyl Quadrangularate P

$C_{32}H_{52}O_5$, M 516



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (Combretaceae) [1].

Colorless amorphous solid, $[\alpha]_D^{25} +163.5^\circ$ (c 0.03, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3300, 1700, 1450, 1250.

HRFABMS m/z : 539.3731 $[M + Na]^+$.

Table 1

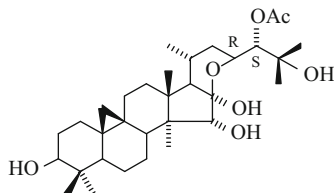
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	72.3 3.85 brs	C-17	46.8 2.24 m
2	38.3 2.41 ddd (13.5, 4.5, 3.5), 2.17 ddd (13.5, 12, 3.5)	18	19.7 1.13 s
		19	30.2 0.51 d (4.5), 0.77 d (4.5)
3	70.5 5.36 dd (12, 4.5)	20	43.6
4	56.1 –	21	61.8 4.06 dd (10.7, 3.1), 3.87 dd (10.7, 4.1)
5	38 3.24 dd (12, 4.5)		
6	23.4	22	29.1
7	27.8	23	31.7
8	48.3	24	157.1 –
9	20.9 –	25	34.1 2.33 m
10	29.8 –	26	22.2 1.07 d (7)
11	26.2 2.75 ddd (15, 8, 5)	27	22.1 1.06 d (7)
12	32.4 –	28	18.8 1.03 s
13	45.6 –	29	178.2 –
14	49.2	30	9.5 1.61 s
15	35.9	31	106.5 4.91 brs, 4.87 brs
16	25.9	29-OMe	51.5 3.65 s

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

24-O-Acetylhydroshengmanol

$C_{32}H_{52}O_7$, M 548



Taxonomy: Cycloartane Triterpenoids

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 200–202° C (from Me_2CO), $[\alpha]_D^{28} +9.0^\circ$ (c 0.7, MeOH).

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 1738 (CH_3COO).

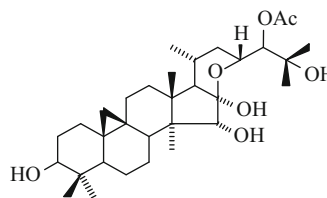
1H NMR ($CDCl_3$, δ): 0.35 and 0.60 (2H-19, d, $J = 4.8$ Hz), 0.80, 0.88, 0.96, 1.12, 1.17, 1.31 (6x CH_3 , s), 2.18 (CH_3COO , s), 3.2 (H-3, m), 3.65 (H-15, d, $J = 9$ Hz, varied to a singlet on addition of D_2O), 4.26 (H-23, m, $M_{1/2} = 20$ Hz), 4.73 (H-24, d, $J = 5$ Hz).

References

1. N. Sakurai, O. Kimura, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **29**(4), 955–960 (1981)

24-*epi*-24-O-Acetylhydroshengmanol

$C_{32}H_{52}O_7$, M 548



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 194–195° C (from MeOH), $[\alpha]_D^{20} +16.2^\circ$ (c 0.5, MeOH).

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3500–3200, 1744.

Positive SIMS m/z : 531 $[M-OH]^+$, 571 $[M + Na]^+$.

Positive HRSIMS m/z : 531.3693 $[M-OH]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	31.34 1.25, 1.64	C-17	60.94 1.82 d (8.2)
2	32.06 1.90, 2.08	18	20.40 1.27 s
3	77.95 3.55 dd (4.3, 11.3)	19	30.96 0.35 d (4), 0.64 d (4)
4	41.12 –	20	27.12 1.81
5	42.42 1.37	21	21.47 0.99 d (6)
6	21.35 0.87 q (12.5), 1.66	22	32.98 1.90, 2.14
7	26.55 1.31, 2.12	23	74.12 4.44 m
8	49.13 1.90	24	81.20 5.74 d (8.5)

(continued)

Table 1 (continued)

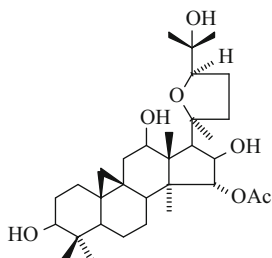
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
9	20.04	–	25 72.26
10	27.38	–	26 27.12 1.50 s
11	26.72	1.15, 1.99	27 27.07 1.46 s
12	34.03	1.59, 1.75	28 11.82 1.24 s
13	42.23	–	29 26.17 1.21 s
14	46.78	–	30 14.86 1.09 s
15	82.17	4.16 s	Ac 170.35
16	102.99	–	21.06 2.10 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

Genin of Beesioside III

C₃₂H₅₂O₇, M 548



Taxonomy: Cycloartane Triterpenoids

Beesia calthaeifolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Souliea vaginata (Maxim.) Franch. (*Ranunculaceae*) [1].

White powder, $[\alpha]_D^{20} +21.7^\circ$ (c 1.3, MeOH).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3640, 3540, 1720, 1240, 1020.

MS m/z M⁺ 548, 143, 125.

¹H NMR (100 MHz, CDCl₃, δ , 0-TMS): 0.46 and 0.54 (2H-19, d, J = 5 Hz), 0.80, 0.97, 1.16, 1.17, 1.29, 1.29, 1.38 (7 × CH₃, s), 2.11 (CH₃COO, s), 2.90 (H-17, d, J = 8.3 Hz), 3.30 (H-3, m), 3.68 (H-12, dd, J = 8.1, 5.7 Hz), 3.80 (H-24, dd, J = 7.6, 5.6 Hz), 4.07 (H-16, dd, J = 8.3, 3.2 Hz), 4.52 (H-15, d, J = 3.2 Hz).

Table 1

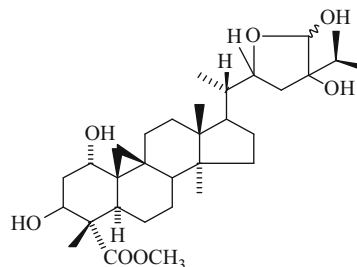
δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)	
C-1	32.6	C-7	26.4	C-13	48.4	C-19	29.5	C-25	69.9
2	31.1	8	48.1	14	51.8	20	85.8	26	26.1
3	77.8	9	19.6	15	91.3	21	27.4	27	26.1
4	40.9	10	26.1	16	77.9	22	36.6	28	14.7
5	47.3	11	35.3	17	48.8	23	28.8	29	26.1
6	20.3	12	73.0	18	21.3	24	83.1	30	14.1
								Ac	171.8
									21.3

References

1. T. Inoue, N. Sakurai, M. Nagai, P. Xiao, *Phytochemistry* **24**(6), 1329–1331 (1985)

Passifloric Acid Methyl Ester

C₃₂H₅₂O₇, M 548



Taxonomy: Cycloartane Triterpenoids

Passiflora edulis Sims. (*Passifloraceae*) [1, 2].

Mp 224°C (from EtOAc), $[\alpha]_D +78.6^\circ$ (C₅H₅N).

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3490, 3405, 3280, 1710.

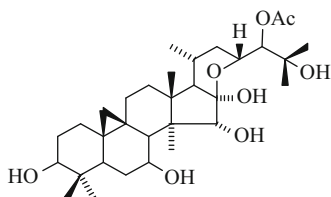
MS m/z (%): M⁺ 548 (11), 530 (27), 512 (25), 414 (21), 404 (18), 375 (20), 374 (22), 357 (29), 339 (25), 297 (19), 279 (20), 263 (18), 262 (21), 245 (29), 199 (38), 185 (41), 175 (40), 173 (38), 159 (51), 147 (73), 145 (71), 133 (59), 121 (80), 119 (69), 107 (100).

References

1. E. Bombardelli, A. Bonati, B. Gabetta, E.M. Martinelli, G. Mustich, B. Danieli, *Phytochemistry* **14**, 2661–2665 (1975)
2. G.D. Andreotti, G. Bocelli, P. Sgarabotto, *J. Chem. Soc. Perkin II* 605–608 (1977)

24-*epi*-7 β -Hydroxy-24-O-acetylhydrohengmanol

C₃₂H₅₂O₈, M 564



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 189–190°C (from MeOH), $[\alpha]_D^{20} +48.0^\circ$ (c 0.35, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3500–3250, 1743.

Positive SIMS m/z: 547 [M–OH]⁺, 587 [M + Na]⁺.

Positive HRSIMS m/z: 547.3628 [M–OH]⁺.

Table 1

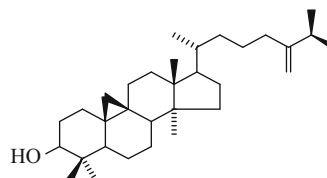
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.88	1.30, 1.60	C-17	61.05	1.81
2	30.88	2.09, 2.00	18	20.35	1.30 s
3	77.40	3.56 dd (11.3, 4.4)	19	31.01	0.41 d (4.2), 0.70 d (4.2)
4	40.65	–	20	26.98	1.88
5	46.22	1.73	21	21.20	0.99 d (5.8)
6	33.68	1.27, 2.02	22	32.74	1.80, 2.00
7	69.93	3.71 ddd (12, 10, 3)	23	73.63	4.46 ddd (11.9, 8.4, 6.4)
8	56.15	1.80	24	81.15	5.79 d (8.4)
9	18.82	–	25	71.97	–
10	26.85	–	26	27.15	1.58 s
11	26.17	1.01, 1.96	27	26.97	1.53 s
12	32.39	1.56, 1.65	28	11.54	1.24 s
13	42.73	–	29	25.91	1.21 s
14	46.94	–	30	14.65	1.10 s
15	81.66	4.20 s	Ac	170.45	–
16	102.92	–		20.99	2.18 s

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

26,26-Dimethylcycloart-25-ene-3 β -ol

C₃₂H₅₄O, M 454



Taxonomy: Cycloartane Triterpenoids

Euphorbia soongarica Boiss. (*Euphorbiaceae*) [1].

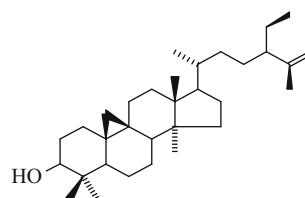
Mp 86–87°C.

References

1. Y. Ding, Z. Jia, T. Chu, *Gaodeng Xuexiao Huaxue Xuebao* **10**(11), 1129–1130 (1989). *C.A.*, 113:3235t (1990)

24R-Cyclomargenol

C₃₂H₅₄O, M 454



Taxonomy: Cycloartane Triterpenoids

Polypodium formosanum (*Polypodiaceae*) [1].

Mp 134–136°C, $[\alpha]_D^{24} +34.3^\circ$ (CHCl₃).

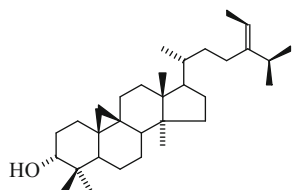
CAS Registry Number: 83150-98-5.

References

1. A. Hiroyuki, A. Yoko, *Chem. Lett.* **6**, 881–884 (1982). *C.A.*, 97:145059p (1982)

24(E)-Ethylidenecycloartan-3 α -ol

C₃₂H₅₄O, M 454



Taxonomy: Cycloartane Triterpenoids
Polygonum bistorta (*Polygonaceae*) [1].

Colorless solid.

CAS Registry Number: 115713-26-3.

EIMS *m/z* (%): [M]⁺ 454 (72), 437 (42), 354 (86), 340 (48), 315 (72), 271 (44), 216 (78), 175 (51), 95 (100), 55 (54).

HREIMS *m/z* : 454.4175 [M]⁺.

Table 1

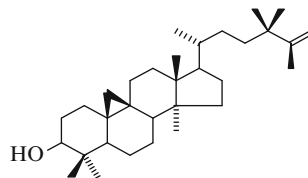
δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)	δ_C (CDCl ₃)	δ_H (J/Hz) (CDCl ₃)		
C-1	27.5	1.56 m, 1.24 m	C-17	52.0	1.56 m
2	28.5	1.75 m, 1.56 m	18	19.3	0.94 s
3	77.0	3.45 brs	19	29.7	0.33, 0.49 d (4.0)
4	39.5	–	20	35.9	1.36 m
5	41.0	1.28 m	21	18.1	0.92 d (5.2)
6	21.1	1.58 m, 0.80 m	22	34.7	1.34 m, 0.92 m
7	28.2	1.87 m, 1.28 m	23	26.8	1.33 m, 1.10 m
8	48.0	1.50 m	24	149.5	–
9	19.8	–	25	29.5	2.80 m
10	26.4	–	26	21.9	0.92 d (6)
11	26.2	1.96 m, 1.10 m	27	21.9	0.81 d (6)
12	32.8	1.60 m	28	19.3	0.85 s
13	45.3	–	29	22.2	0.88 s
14	48.9	–	30	20.8	0.92 s
15	35.4	1.28 m	31	116.4	5.17 q (6.7)
16	25.9	1.33 m, 1.10 m	32	12.8	1.58 d (6.1)

References

1. K.P. Manoharan, T.K.H. Benny, D. Yang, *Phytochemistry* **66**, 2304–2308 (2005)

Cycloneolitsol

C₃₂H₅₄O, M 454



Taxonomy: Cycloartane Triterpenoids
Polypodium juglandifolium H.B. Willd (*Polypodiaceae*) [1].

Synthetic [2].

Mp 120–122°C (from CHCl₃–MeOH), [α]_D +42° (c 0.62, CHCl₃) [1].

Mp 183–185°C, [α]_D +48° [2].

CAS Registry Number: 28840-92-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 885.

MS *m/z* (%): M⁺ 454 (8), 439 (11), 436 (11), 421 (19), 393 (11), 367 (8), 315 (24), 314 (15), 87 (21), 83 (100).

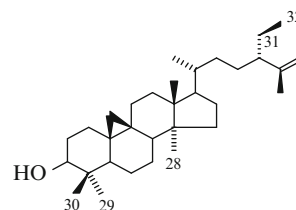
¹H NMR (CDCl₃, δ): 0.31 and 0.54 (2H-19, d, J = 5 Hz), 0.78–1.06 (7 \times CH₃), 1.65 (CH₃, s), 3.20 (H-3, m, W_{1/2} = 13 Hz), 4.70 (2H-26, s).

References

1. R. Sunder, K.N.N. Ayengar, S. Rangaswami, *J. Chem. Soc. Perkin I*, 117–121 (1976)
2. R. Labriola, G. Ourisson, *Tetrahedron* **27**, 1901–1908 (1971)

Polysthicol

C₃₂H₅₄O, M 454



Taxonomy: Cycloartane Triterpenoids

Polysthicum aculeatum (L.) Roth. (*Polypodiaceae*) [1].

Vitreous solid, $[\alpha]_D +42^\circ$ (CHCl_3).

CAS Registry Number: 76236-10-7.

MS m/z : M^+ 454, 439, 436, 421, 393, 367, 315, 314, 297, 203, 175, 95.

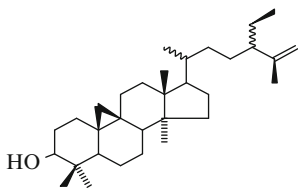
$^1\text{H NMR}$ (270 MHz, CDCl_3 δ): 0.55 and 0.83 (2H-19, d, $J = 4.2$ Hz), 0.80 (CH_3 -32, t, $J = 7.4$ Hz), 0.81 (CH_3 -30, s), 0.85 (CH_3 -21, d, $J = 6.3$ Hz), 0.89 (CH_3 -28, s), 0.96 (CH_3 -18, s), 0.97 (CH_3 -29, s), 1.57 (CH_3 -27, s), 3.29 (H-3, dd, $J = 6.6$ and 13.0 Hz), 4.65 and 4.73 (2H-26, bd, $J = 2.2$ Hz).

References

- G. Laonigro, F. Siervo, R. Lanzetta, M. Adinolfi, L. Mangoni, *Tetrahedron Lett.* **21**, 3109–3110 (1980)

Triphyllol

$\text{C}_{32}\text{H}_{54}\text{O}$, M 454



Taxonomy: Cycloartane Triterpenoids

Adenophora triphylla var. *japonica* (*Campanulaceae*) [1].

Mp 127–133°C (from EtOH), $[\alpha]_D +44.8^\circ$ (c 0.13, CHCl_3).

CAS Registry Number: 79199-90-9.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3430, 3040, 1655, 880.

$^1\text{H NMR}$ (CDCl_3 , δ): 0.32 and 0.56 (2H-19, d, $J = 4$ Hz), 0.80 (CH_3 , s), 0.85 (CH_3 -21, d, $J = 8$ Hz), 0.89 (CH_3 , s), 0.96 (2 \times CH_3 , s), 0.98 (CH_3 , t, $J = 7$ Hz), 1.57 (CH_3 , br), 3.22 (H-3, m), 4.63 and 4.68 (2H-26, br).

Table 1

δ_C (CDCl_3)	
C-1	32.0
C-7	28.1
C-13	45.3
C-19	29.9
C-26	111.1
2	30.4
8	48.0
14	48.8
20	36.1
27	18.5

(continued)

Table 1 (continued)

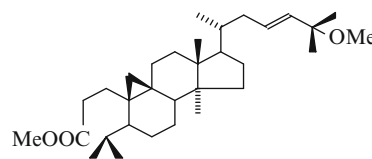
δ_C (CDCl_3)	
3	78.8
9	20.0
15	35.6
21	18.0
28	18.3
4	40.4
10	26.0
16	26.5
22	34.1
29	25.4
5	47.1
11	26.0
17	52.2
23	29.9
30	14.0
6	21.1
12	32.9
18	19.3
24	49.7
31	21.1
25	147.8
32	12.0

References

- C. Konno, T. Saito, Y. Oshima, H. Hikino, C. Kabuto, *Planta Med.* **42**, 268–274 (1981)

Methyl (23E)-25-methoxy-3,4-seco-cycloart-23-en-3-oate

$\text{C}_{32}\text{H}_{54}\text{O}_3$, M 486



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (*Bromeliaceae*) [1].

Colorless oil, $[\alpha]_D^{25} +21^\circ$ (c 0.13, CHCl_3).

CAS Registry Number: 173866-07-4.

EIMS m/z (%): M^+ 454 (13), 439 (17), 373 (6), 345 (9), 343 (19), 301 (11), 284 (13), 269 (14), 207 (11), 203 (33), 175 (31), 55 (100).

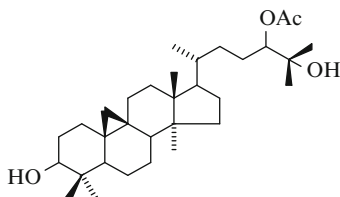
$^1\text{H NMR}$ (CDCl_3 , δ , 0-TMS): 0.35 and 0.59 (2H-19, d, $J = 4.3$ Hz), 0.81 (CH_3 -29, d, $J = 6.9$ Hz), 0.88 (CH_3 -21, d, $J = 6.5$ Hz), 0.91 (CH_3 -28, s), 0.92 (CH_3 -30, d, $J = 6.5$ Hz), 0.96 (CH_3 -18, s), 1.26 (CH_3 -26 and CH_3 -27, brs), 3.15 (25- OCH_3 , s), 3.66 (3- OCH_3 , s), 5.40 (H-24, d, $J = 15.9$ Hz), 5.54 (H-23, ddd, $J = 15.9, 8, 5.5$ Hz).

References

- G.M. Gabrera, M. Gallo, A.M. Seldes, *J. Nat. Prod.* **59**(4), 343–347 (1996)

24R-Acetoxy-3 β ,25-dihydroxycycloartane

C₃₂H₅₄O₄, M 502



Taxonomy: Cycloartane Triterpenoids

Dysoxylum malabaricum Bedd. (*Meliaceae*) [1].

Mp 160°C (from CHCl₃-hexane).

CAS Registry Number: 339155-11-2.

EIMS m/z (%): M⁺ 502 (1), 486 (17), 484 (36), 466 (100), 451 (48), 423 (28), 409 (40), 392 (16), 344 (25), 337 (14), 315 (15), 313 (19), 297 (21), 284 (25), 269 (17), 255 (12), 229 (16), 203 (55), 175 (56), 163 (29).

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.33 and 0.55 (2H-19, brs), 0.81 (CH₃-30, s), 0.88 (CH₃-21, d), 0.88 (CH₃-28, s), 0.96 (CH₃-18, CH₃-29, s), 1.20 (CH₃-26 and CH₃-27, s), 2.02 (CH₃COO, s), 3.27 (H-3, m), 4.75 (H-24, d, J = 6.6 Hz).

Table 1

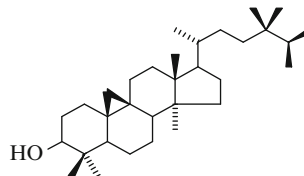
δ_C (CDCl ₃)									
C-1	32.0	C-7	27.9	C-13	45.3	C-19	30.0	C-25	72.5
2	30.4	8	48.0	14	48.8	20	36.3	26	25.0
3	78.8	9	20.0	15	32.9	21	18.4	27	26.8
4	78.8	10	26.0	16	26.4	22	32.7	28	19.3
5	47.1	11	26.0	17	52.1	23	26.4	29	25.4
6	21.1	12	35.5	18	18.0	24	80.9	30	14.0
								Ac	171.3
									21.1

References

1. A. Hisham, M.D. Ajitha Bai, G.J. Kumar, M.S. Nair, Y. Fujimoto, *Phytochemistry* **56**, 331–334 (2001)

24,24-Dimethyl-9,19-cyclolanostan-3 β -ol

C₃₂H₅₆O, M 456



Taxonomy: Cycloartane Triterpenoids

Polypodium juglandifolium H.B. Willd. (*Polypodiaceae*) [1].

Mp 134–136°C (from CHCl₃-MeOH), [α]_D +34.4° (c 0.58, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1370.

MS m/z (%): M⁺ 456 (6), 369 (8), 316 (17), 315 (14), 69 (38), 43 (100).

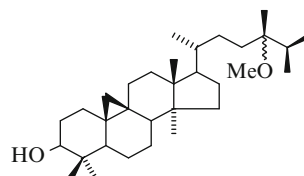
¹H NMR (CDCl₃, δ): 0.35 and 0.60 (2H-19, d, J = 5 Hz), 0.83–1.0 (9 × CH₃), 3.38 (H-3, m).

References

1. R. Sunder, S. Rangaswami, *Indian. J. Chem.* **15B**(6), 541–543 (1977)

24-Methyl-24-methoxycycloartanol

C₃₂H₅₆O₂, M 472



Taxonomy: Cycloartane Triterpenoids

Rice bran oil

Oryzasativa L. (*Oryzeae*) [1, 2].

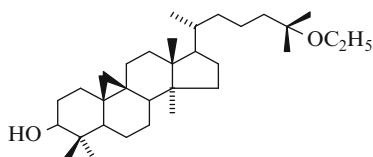
Mp 151°C, [α]_D 42.7°.

References

1. T. Endo, S. Naito, Y. Inaba, *Yukagaku* **19**(5), 298–302 (1970). *C.A.*, 73:45627h (1970)
2. T. Endo, Y. Inaba, *Yukagaku* **19**(5), 302–307 (1970). *C.A.*, 73:45628j (1970)

25-Ethoxycycloartanol

$C_{32}H_{56}O_2$, M 472



Taxonomy: Cycloartane Triterpenoids

Rice bran oil

Oryza sativa L. (*Oryzeae*) [1, 2].

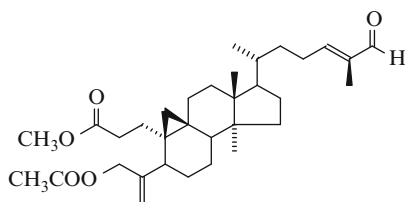
Mp 109°C, $[\alpha]_D$ 47.7°.

References

1. T. Endo, S. Naito, Y. Inaba, *Yukagaku* **19**(5), 298–302 (1970). *C.A.*, 73:45627h (1970)
2. T. Endo, Y. Inaba, *Yukagaku* **19**(5), 302–307 (1970). *C.A.*, 73:45628j (1970)

Methyl Coronalolate Acetate

$C_{33}H_{50}O_5$, M 526



Taxonomy: Cycloartane Triterpenoids

Gardenia coronaria (*Rubiaceae*) [1].

Amorphous gum.

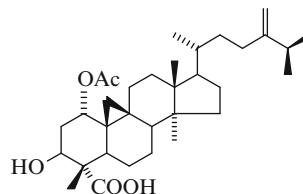
CIMS m/z (%): $[M + 1]^+$ 527 (42), 485 (14), 467 (100).
 1H NMR (500 MHz, $CDCl_3$, δ , 0-TMS): 0.49 and 0.72 (2H-19, d, J = 5 Hz), 0.93 (CH_3 -21, d, J = 6.5 Hz), 0.94 (CH_3 -28, s), 0.97 (CH_3 -18, s), 1.76 (CH_3 -27, s), 2.10 (CH_3 COO, s), 3.65 (OCH_3 , s), 4.57 (2H-29, brs), 5.09 and 5.14 (2H-30, s), 6.49 (H-24, bt, J = 6.5 Hz), 9.40 (H-26, s).

References

1. G.L. Silva, R.R. Gil, B. Cui, H. Chai, T. Santisuk, E. Srisook, V. Reutrakul, P. Tuchinda, S. Sophasan, S. Sujarit, S. Upatham, S.M. Lynn, J.E. Farthing, S.-L. Yang, J.A. Lewis, M.J. O'Neill, N.R. Farnsworth, G.A. Cordell, J.M. Pezzuto, A.D. Kinghorn, *Tetrahedron* **53**(2), 529–538 (1997)

1-O-Acetyl-23-deoxojessic Acid

$C_{33}H_{52}O_5$, M 528



Taxonomy: Cycloartane Triterpenoids

Combretum quadrangulare Kurz (*Combretaceae*) [1].

Colorless amorphous solid, $[\alpha]_D^{25}$ +55.8° (c 0.11, MeOH).

CAS Registry Number: 221359-77-9.

IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 3400, 1700, 1470, 1380, 1250.

HRFABMS m/z: 551.3703 $[M + Na]^+$.

Table 1

	δ_C (C_5D_5N)		δ_C (C_5D_5N)	
	δ_H (J/Hz)		δ_H (J/Hz)	
C-1	76.5	5.02 brs	C-18	17.9 0.97 s
2	35.0	2.55 ddd (13.5, 4.5, 3.5), 2.24 m	19	28.0 0.55 d (4.5), 0.87 d (4.5)
3	70.3	5.16 dd (12, 4.5)	20	36.4
4	55.1	–	21	18.5 0.93 d (6)
5	38.9	3.11 dd (12, 4.5)	22	35.2

(continued)

Table 1 (continued)

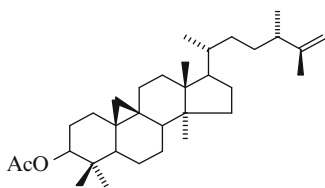
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
6	22.8	23	31.7
7	28.2	24	156.7 –
8	46.3	25	34.0
9	20.8 –	26	22.1 1.07 d (7)
10	30.0 –	27	22.0 1.06 d (7)
11	26.4	28	19.1 1.01 s
12	33.0	29	179.5
13	45.2 –	30	9.6 1.67 s
14	49.2 –	31	106.6 4.87 brs, 4.86 brs
15	35.5	Ac	170.1 –
16	25.1		21.1 2.06 s
17	52.5		

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, Chem. Pharm. Bull. **48**(4), 496–504 (2000)

3 β -Acetoxy-24S-methyl-9 β ,19-cyclolanost-25-ene

$C_{33}H_{54}O_2$, M 482



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (Rutaceae) [1].

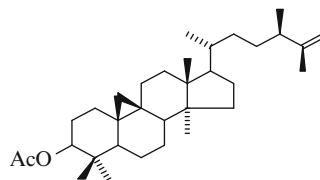
CAS Registry Number: 2315-12-0.

References

1. E.K. Desoky, Indian J. Chem. Sect. B:Org. Chem. Incl. Med. Chem **35B**(10), 1113–1115 (1996). C.A., 125: 217026 x (1996)

24R-Cyclolaudenyl Acetate

$C_{33}H_{54}O_2$, M 482



Taxonomy: Cycloartane Triterpenoids

Polypodium formosanum (Polypodiaceae) [1].

Mp 127–128°C, $[\alpha]_D^{24} +53.5^\circ$ ($CHCl_3$).

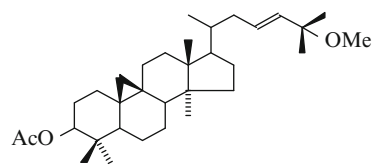
CAS Registry Number: 103425-41-8.

References

1. A. Hiroyuki, A. Yoko, Chem. Lett. **6**, 881–884 (1982). C.A., 97:145059p (1982)

3 β -Acetoxy-25-methoxycycloart-23-ene

$C_{33}H_{54}O_3$, M 498



Taxonomy: Cycloartane Triterpenoids

Tillandsia usneoides L. (Bromeliaceae) [1].

Mp 152–154°C (from Et_2O –MeOH), $[\alpha]_D^{28} +48^\circ$
(c 0.75, $CHCl_3$).

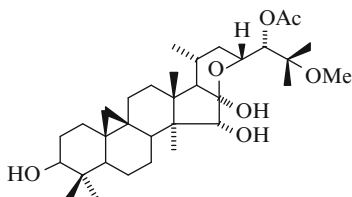
IR $\nu_{max}^{CHCl_3}$, cm^{-1} : 1725.

References

1. C. Djerassi, R. McCrindle, J. Chem. Soc. 4034–4039 (1962)

25-O-Methyl-24-O-acetylhydroshengmanol

C₃₃H₅₄O₇, M 562



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 185–186°C (from MeOH), $[\alpha]_D^{20} +6.8^\circ$ (c 0.41, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3500–3250, 1721.

Positive SIMS m/z: 545 $[\text{M}-\text{OH}]^+$.

Positive HRSIMS m/z: 545.3846 $[\text{M}-\text{OH}]^+$.

Table 1

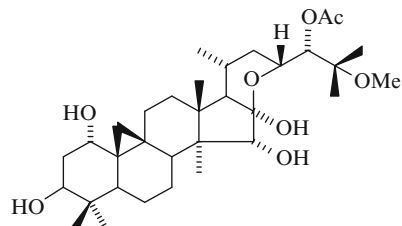
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.29 1.40, 1.55	C-18	20.22 1.30 s
2	30.75 1.98, 2.10	19	30.75 0.34 d (3.9), 0.57 d (3.9)
3	77.60 3.58 dd (11, 4.2)	20	27.30 1.75
4	40.73 –	21	21.03 1.06 d (5.7)
5	47.08 1.25	22	33.80 1.95, 2.00
6	21.20 0.75, 1.40	23	73.97 4.25 ddd (10.7, 8.4, 6.4)
7	26.26 1.15, 2.05	24	79.26 5.72 d (8.4)
8	48.90 1.75	25	75.99 –
9	19.63 –	26	23.00 1.31 s
10	26.59 –	27	21.03 1.28 s
11	26.26 1.05, 2.05	28	11.65 1.25 s
12	32.29 1.55, 1.60	29	25.84 1.21 s
13	41.69 –	30	14.60 1.09 s
14	46.33 –	Ac	171.25 –
15	82.12 4.19 s		20.97 2.15 s
16	102.72 –	OMe	49.19 3.29 s
17	60.11 1.83 d (8.4)		

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

25-O-Methyl-1 α -hydroxy-24-O-acetylhydroshengmanol

C₃₃H₅₄O₈, M 578



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 110–111°C (from MeOH), $[\alpha]_D^{20} +24.0^\circ$ (c 0.99, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm^{-1} : 3550–3300, 1718.

Positive SIMS m/z: 561 $[\text{M}-\text{OH}]^+$, 601 $[\text{M} + \text{Na}]^+$.

Positive HRSIMS m/z: 561.3784 $[\text{M}-\text{OH}]^+$.

Table 1

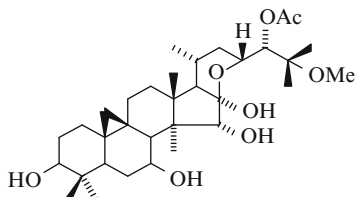
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.41 3.85 brs	C-18	20.35 1.31 s
2	38.58 2.24, 2.43	19	30.75 0.47 d (4.2), 0.72 d (4.2)
3	73.03 4.41 dd (12.0, 8.2)	20	27.40 1.80
4	41.03 –	21	21.20 1.00 d (5.5)
5	39.72 2.45	22	33.92 2.00, 2.10
6	20.99 0.88, 1.67	23	74.07 4.23 ddd (10.8, 8.5, 6.7)
7	25.74 1.35, 1.50	24	79.36 5.69 d (8.5)
8	49.20 1.80	25	76.04 –
9	20.70 –	26	23.07 1.38 s
10	31.05 –	27	21.27 1.30 s
11	26.27 1.65, 2.90	28	11.61 1.22 s
12	33.41 1.40, 1.80	29	25.97 1.28 s
13	41.73 –	30	13.91 1.12 s
14	46.53 –	Ac	171.17 –
15	82.47 4.19 s		21.08 2.14 s
16	102.88 –	OMe	49.20 3.25 s
17	60.29 1.81 d (9.2)		

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

25-O-Methyl-7 β -hydroxy-24-O-acetylhydroshengmanol

C₃₃H₅₄O₈, M 578



Taxonomy: Cycloartane Triterpenoids

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 116–117°C (from MeOH), $[\alpha]_D^{20} +13.5^\circ$ (c 0.31, MeOH).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3500–3250, 1718.

Positive SIMS m/z: 561 [M–OH]⁺, 601 [M + Na]⁺.

Positive HRSIMS m/z: 561.3783 [M–OH]⁺.

Table 1

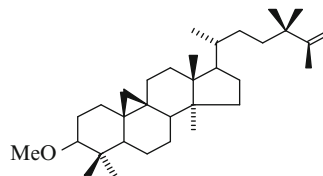
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.52	C-18	20.17
2	30.52	19	29.55
3	77.25	20	27.10
4	40.37	21	20.98
5	45.96	22	33.55
6	32.16	23	73.68
7	69.62	24	79.24
8	55.94	25	75.95
9	18.62	26	22.91
10	26.90	27	20.98
11	26.05	28	11.42
12	33.15	29	25.66
13	42.28	30	14.39
14	46.73	Ac	171.38
15	81.80		20.98
16	102.85	OMe	49.06
17	60.28		1.78

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

Cycloneolitsin

C₃₃H₅₆O, M 468



Taxonomy: Cycloartane Triterpenoids

Neolitsea dealbata R.Br. Merr. (*Lauraceae*) [1].

Neolitsea aciculata (*Lauraceae*) [2].

Mp 169–174°C (from acetone-light petroleum), $[\alpha]_D^{20} +63^\circ$ (c 5.0, CHCl₃).

CAS Registry Number: 25650-33-3.

MS m/z (%): M⁺ 468 (28), 453 (20), 436 (100), 421 (41), 393 (27), 367 (19), 314 (33), 297 (11), 203(17), 175 (25).

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 892.

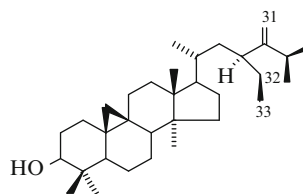
¹H NMR (CDCl₃, δ): 0.31 and 0.56 (2H-19, d, J = 5 Hz), 0.81, 0.90, 0.97, 1.03, 1.70 (8 × CH₃), 2.83–2.60 (H-3), 3.36 (CH₃O, s), 4.71 (2H-26, d, J = 5 Hz).

References

1. E. Ritchie, R.G. Senior, W.C. Taylor, *Aust. J. Chem.* **22**, 2371–2387 (1969)
2. K. Yano, T. Akihisa, T. Tamura, T. Matsumoto, *Phytochemistry* **31**(6), 2093–2098 (1992)

23S-Ethyl-24-methylenecycloartanol

C₃₃H₅₆O, M 468



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (Rutaceae) [1].

Mp 159–161°C (from MeOH), $[\alpha]_D^{25} +36^\circ$ (CHCl₃).

CAS Registry Number: 171901-86-3.

MS m/z (%): M⁺ 468 (21), 453 (16), 450 (7), 435 (3), 407 (2), 381 (3), 328 (10), 315 (11), 297 (10), 203 (26), 187 (30), 175 (67), 163 (47), 151 (23), 137 (22), 123 (43), 109 (62), 81 (56), 69 (77), 55 (100), 43 (35).

IR ν_{\max}^{KBr} cm⁻¹: 3432, 3042, 1385, 1375, 1180, 1140.

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.55 and 0.83 (2H-19, d, J = 5 Hz), 0.80, 0.88, 0.95, 0.97, (4 × CH₃, s), 0.80 (CH₃-33, t, J = 7.35 Hz), 0.85 (CH₃-21, d, J = 6.2 Hz), 1.15 and 1.15 (CH₃-26 and CH₃-27, d, J = 6.2 Hz), 3.42 (H-3, t, J = 5.2 Hz), 4.62 and 4.79 (2H-31, brd, J = 2.3 Hz).

Table 1

δ_C (CDCl ₃)									
C-1	32.2	C-8	47.9	C-15	33.0	C-22	30.5	C-29	25.9
2	30.2	9	20.1	16	26.3	23	49.2	30	14.1
3	77.9	10	25.8	17	52.2	24	49.2	31	106.5
4	40.5	11	25.6	18	18.0	25	33.9	32	27.4
5	48.1	12	35.8	19	29.9	26	20.7	33	13.0
6	20.7	13	45.3	20	35.9	27	21.3		
7	28.0	14	48.7	21	18.3	28	19.3		

References

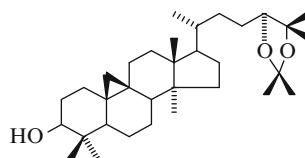
1. E.K. Desoky, *Phytochemistry* **40**(6), 1769–1772 (1995)

Table 1

δ_C (CDCl ₃)									
C-1	31.9	C-8	48.0	C-15	32.9	C-22	33.1	C-29	25.4
2	30.3	9	20.0	16	26.3	23	26.3	30	14.0
3	78.8	10	26.0	17	52.2	24	83.8		
4	40.5	11	26.0	18	18.2	25	80.2	Me	28.6
5	47.1	12	35.5	19	29.9	26	22.9	C=	106.3
6	21.1	13	45.3	20	36.3	27	26.4	Me	26.9
7	28.2	14	48.8	21	18.0	28	19.3		

24R,25-Isopropylidenedioxy-9,19-cyclolanostan-3 β -ol

C₃₃H₅₆O₃, M 500



Taxonomy: Cycloartane Triterpenoids

Notholaena rigida Dav. (*Pteridaceae*) [1].

CAS Registry Number: 57576-30-4.

EIMS m/z (%): M⁺ 500 (10), 485 (31), 482 (26), 467 (7), 442 (9), 439 (6), 427 (8), 424 (7), 409 (21), 360(16), 203 (17), 187 (12), 175 (23), 135 (25), 121 (30), 107 (37), 95 (45), 69 (43), 43 (100).

¹H NMR (CDCl₃, δ): 0.33 and 0.55 (2H-19, d, J = 4.4 Hz), 0.80, 0.88, 0.96, 0.97, 1.10, 1.25, 1.33, 1.41 (8xCH₃, s), 0.90 (CH₃-21, d, J = 6.8 Hz), 3.28 (H-3, dd, J = 8.4, 4.5 Hz), 3.64 (H-24, dd, J = 8.8, 4 Hz).

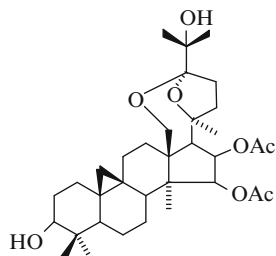
See [Table 1](#)

References

1. F.J. Arriaga-Giner, J. Rullkoetter, T.M. Peakman, E. Wollenweber, *Z. Naturforsch.* **46c**(7-8), 507–512 (1991)

Genin of Beesioside I

C₃₄H₅₂O₈, M 588



Taxonomy: Cycloartane Triterpenoids

Beesia calthaeifolia Maxim. (*Ranunculaceae*) [1].

Mp 188–190 °C (from MeOH).

ORD (c 0.91, CHCl₃–MeOH, 1:1) [α]²⁵ (nm): –0.1° (589), –0.2° (577), –0.4° (546), –1.4° (435), –3.3° (365).

IR ν_{max}^{CCl₄}, cm^{–1}: 3600, 1740, 1235, 1038.

HRMS m/z: 588.3689 [M]⁺.

MS m/z: M⁺ 588, 570, 528, 468.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.51 1.27 m, 1.55 m	C-18	66.38 4.50 d (12.9), 4.62 d (12.9)
2	31.15 1.85, 2.00 m	19	31.62 0.22 d (3.9), 0.55 d (3.9)
3	77.78 3.54 dd (11.7, 4.4)	20	86.79 –
4	41.03 –	21	32.42 1.28 s
5	47.03 1.28 m	22	38.19 1.96 m, 2.98 m
6	20.72 0.67 q (12.2), 1.48 m	23	30.83 2.07 m, 2.78 m
7	26.32 1.27 m, 2.05 m	24	114.22 –
8	47.16 1.55 m	25	72.72 –
9	19.08 –	26	25.65 1.65 s
10	27.90 –	27	25.58 1.54 s
11	26.12 1.27 m, 1.55 m	28	14.71 1.04 s
12	27.98 1.55 m, 2.94 m	29	26.12 1.21 s
13	45.80 –	30	15.41 1.21 s
14	51.50 –	Ac	21.18 2.11 s
15	82.03 5.68 d (9)		21.21 2.12 s

(continued)

Table 1 (continued)

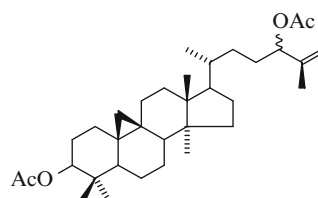
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
16	75.14 5.92 dd (9, 11.5)	170.51	–
17	56.22 2.71 d (11.5)	170.82	–

References

1. N. Sakurai, M. Nagai, T. Goto, T. Inoue, P.-G. Xiao, *Chem. Pharm. Bull.* **41**(2), 272–275 (1993)

24RS-Cycloart-25-ene-3β,24-diol Diacetate

C₃₄H₅₄O₄, M 526



Taxonomy: Cycloartane Triterpenoids

Euphorbia trigona Haw. (*Euphorbiaceae*) [1].

Mp 122 °C (from CHCl₃–MeOH), [α]_D³⁰ +28° (c 0.8, CHCl₃).

MS m/z (%): M⁺ 526 (7), 511 (3), 480 (7), 466 (100), 451 (50), 423 (35), 406 (25), 397 (3), 391 (1), 357 (17), 354 (25), 344 (30), 337 (20), 297 (55), 287 (32), 269 (32), 255 (25), 251 (17), 203 (37), 187 (25), 178 (42), 175 (42).

¹H NMR (100 MHz, CDCl₃, δ, 0-TMS): 0.30 and 0.55 (2H-19, d, J = 4 Hz), 2.00 (2 × CH₃C00, s), 4.50 (H-3, dd, J = 10, 5 Hz), 4.90 and 4.95 (2H-26, brs), 5.10 (H-24, t, J = 6 Hz).

See [Table 1](#)

Table 1

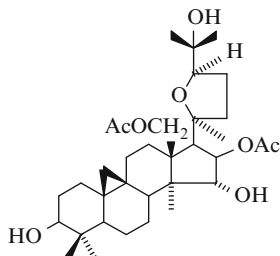
δ_C (CDCl ₃)									
C-1	31.6	C-8	47.8	C-15	32.8	C-22	31.6	C-29	25.4
2	26.8	9	20.1	16	26.5	23	29.2, 29.4	30	15.1
3	80.7	10	26.0	17	52.1	24	78.1, 77.3	Ac	171.0, 170.4
4	39.5	11	25.8	18	18.0	25	143.1, 143.4		21.3, 21.3
5	47.2	12	35.5	19	29.8	26	113.2, 112.5		
6	20.9	13	45.3	20	35.8	27	ca 18		
7	28.0	14	48.8	21	18.2	28	19.3		

References

- V. Anjaneyulu, G. Sambasiva Rao, J.D. Connolly, *Phytochemistry* **24**(7), 1610–1612 (1985)

Genin of Beesioside II

C₃₄H₅₄O₈, M 590



Taxonomy: Cycloartane Triterpenoids

Beesia calthaeifolia Maxim. (*Ranunculaceae*) [1].

Amorphous powder, $[\alpha]_D^{23} +28.7^\circ$ (c 0.7, MeOH).

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3650, 3505, 1738, 1719, 1250, 1230, 1058, 1035.

MS m/z: 590, 572, 554, 530, 470, 143, 125.

¹H NMR (CDCl₃, δ , 0-TMS): 0.34 and 0.62 (2H-19, d, J = 4.4 Hz), 0.79, 0.96, 1.11, 1.11, 1.19, 1.27 (6 × CH₃, s), 2.09, 2.19 (2 × CH₃COO, s), 2.64 (H-17, d, J = 9.5 Hz), 3.3 (H-3, m), 3.71 (H-24, dd, J = 8, 6.6 Hz), 4.15 (H-15, d, J = 4.2 Hz), 4.29, 4.79 (2H-18, d, J = 12.2 Hz), 5.05 (H-16, dd, J = 9.5, 4.2 Hz).

Table 1

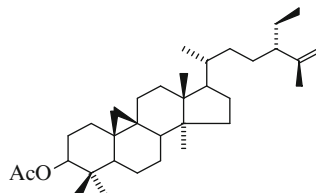
δ_C (CDCl ₃)									
C-1	32.4	C-8	48.4	C-15	83.5	C-22	36.7	C-29	26.5
2	31.0	9	20.0	16	83.3	23	25.9	30	14.7
3	77.7	10	27.0	17	54.2	24	83.5	Ac	170.2
4	40.9	11	25.9	18	67.2	25	70.2		171.3
5	47.3	12	30.1	19	31.0	26	70.2		21.3
6	21.0	13	49.6	20	84.4	27	27.2		21.5
7	25.0	14	49.6	21	27.4	28	13.6		

References

- N. Sakurai, M. Nagai, H. Nagase, K. Kawai, T. Inoue, P. Xiao, *Chem. Pharm. Bull.* **34**(2), 582–589 (1986)

3 β -Acetoxy-24S-ethyl-9 β ,19-cyclolanost-25-ene

C₃₄H₅₆O₂, M 496



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (*Rutaceae*) [1].

CAS Registry Number: 76250-28-7.

References

1. E.K. Desoky, Indian J. Chem. Sect. B:Org. Chem. Incl. Med. Chem. **35B**(10), 1113–1115 (1996). *C.A.*, 125:217026 x (1996)

Mp 177–181°C, $[\alpha]_D +58^\circ$ (CHCl₃).

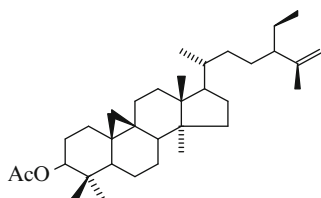
MS m/z (%): M⁺ 496 (5), 481 (8), 436 (27), 421 (27), 393 (16), 367 (12), 357 (7), 314 (15), 69 (17), 43 (100).

IR ν_{\max}^{KBr} , cm⁻¹: 1725, 1250, 885.

¹H NMR (CDCl₃, δ): 0.30 and 0.48 (2H-19, d, J = 5 Hz), 0.82–1.01 (7 × CH₃), 1.65 (CH₃, s), 1.95 (CH₃COO, s), 4.43 (H-3, br), 4.60 (2H-26, s).

24R-Cyclomargenyl Acetate

C₃₄H₅₆O₂, M 496



Taxonomy: Cycloartane Triterpenoids
Polypodium formosanum (Polypodiaceae) [1].
Mp 144–145°C, $[\alpha]_D^{24} +50.5^\circ$.

References

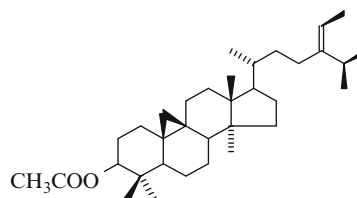
1. A. Hiroyuki, A. Yoko, Chem. Lett. **6**, 881–884 (1982). *C.A.*, 97:145059p (1982)

References

1. R. Sunder, K.N.N. Ayengar, S. Rangaswami, J. Chem. Soc. Perkin I, 117–121 (1976)
2. R. Labriola, G. Ourisson, Tetrahedron **27**, 1901–1908 (1971)

24Z-Ethylidenecycloartanol Acetate

C₃₄H₅₆O₂, M 496



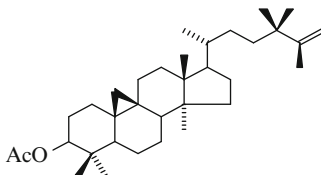
Taxonomy: Cycloartane Triterpenoids
Hippophae rhamnoides L. (Elaeagnaceae) [1].

MS m/z: M⁺ 496.

¹H NMR (CDCl₃, δ , 0-TMS): 0.34 and 0.58 (2H-19, d, J = 5 Hz), 0.84, 0.88, 0.90, 0.97 (4 × CH₃, s), 0.89 (CH₃-21, d, J = 7 Hz), 0.98 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.59 (CH₃-32, d, J = 6.7 Hz), 2.05 (CH₃COO, s), 2.83 (H-25, quintet, J = 7 Hz), 4.57 (H-3, dd, J = 10.6, 5 Hz), 5.13 (H-31, q, J = 6.7 Hz).

Cycloneolitsol Acetate

C₃₄H₅₆O₂, M 496



Taxonomy: Cycloartane Triterpenoids
Polypodium juglandifolium H.B. Willd
(Polypodiaceae) [1].

Synthetic [2].

Mp 112–113°C (from CHCl₃ –MeOH), $[\alpha]_D +48.0^\circ$ (c 0.83, CHCl₃).

Table 1

δ_c (CDCl ₃)									
C-1	31.61	C-8	47.78	C-15	32.87	C-22	36.33	C-29	25.39
2	26.80	9	20.15	16	26.51	23	28.33	30	15.11
3	80.66	10	25.98	17	52.27	24	145.67	31	116.50
4	39.43	11	25.80	18	17.92	25	28.62	32	12.74

(continued)

Table 1 (continued)

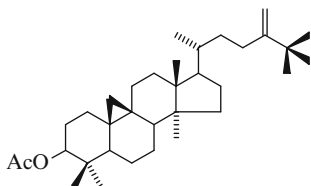
δ_c (CDCl ₃)									
5	47.17	12	35.53	19	29.73	26	21.00	Ac	170.89
6	20.91	13	45.29	20	36.50	27	21.06		21.26
7	28.15	14	48.81	21	18.39	28	19.27		

References

1. E.M. Glazunova, E.Sh. Mukhtarova, K.S. Zakharov, N.D. Gachechiladze, *Chem. Nat. Comp.* **30**(2), 271–272 (1994)

24-Methylene-25-methylcycloartanyl Acetate

C₃₄H₅₆O₂, M 496



Taxonomy: Cycloartane Triterpenoids

Neolitsea sericea Koidz. (*Lauraceae*) [1].

MS *m/z* (%): M⁺ 496.4253 (C₃₄H₅₆O₂, 5), 481.4072 (C₃₃H₅₃O₂, 4), 436.4032 (C₃₂H₅₂, 31), 421.3865 (C₃₁H₄₉, 16), 379.3347 (C₂₆H₄₀O₂, 2), 357.2802 (C₂₄H₃₇O₂, 1), 338.3017 (C₂₅H₃₈, 2), 314.2596 (C₂₃H₃₈, 9), 297.2581 (C₂₂H₃₃, 2), 255.2087 (C₁₉H₂₇, 3), 241.1948 (C₁₈H₂₅, 2), 43.0173 (C₂H₃O, 100).

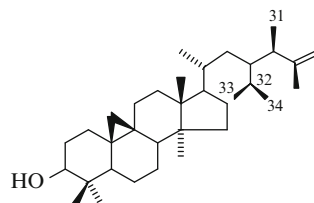
¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.342 and 0.580 (2H-19, d, J = 4.1, 4.7 Hz), 0.848, 0.890, 0.904, 0.971, 1.061, 1.061, 1.061 (7 × CH₃, s), 0.911 (CH₃-21, d, J = 5.8 Hz), 2.052 (OAc, s), 4.569 (H-3, dd, J = 11, 5.8 Hz), 4.667 and 4.836 (2H-31, d, J = 1.1 Hz).

References

1. K. Yano, T. Akihisa, R. Kawaguchi, T. Tamura, T. Matsumoto, *Phytochemistry* **31**(5), 1741–1746 (1992)

23 ξ -Isopropyl-24-methylcycloart-25-en-3 β -ol

C₃₄H₅₈O, M 482



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (*Rutaceae*) [1].

Mp 155–157° C (from MeOH), [α]_D +41° (CHCl₃).

CAS Registry Number: 171901-89-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3432, 3042, 1385, 1375, 1180, 1140, 980.

MS *m/z* (%): M⁺ 482 (20), 467 (18), 464 (9), 449 (3), 421 (2), 395 (3), 342 (14), 315 (16), 297 (14), 203 (30), 187 (30), 175 (73), 163 (48), 151 (11), 137 (26), 123 (41), 109 (60), 95 (93), 81 (59), 69 (78), 55 (100), 43 (63).

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.54 and 0.82 (2H-19, d, J = 5 Hz), 0.80, 0.88, 0.95, 0.97, 1.60 (5 × CH₃, s), 0.86 (CH₃-21, d, J = 6.2 Hz), 0.88 (CH₃-31, d, J = 7.5 Hz), 0.91 and 0.91 (CH₃-33 and CH₃-34, d, J = 6 Hz), 3.45 (H-3, t, J = 5.2 Hz), 4.61 and 4.81 (2H-26, brd, J = 2.2 Hz).

Table 1

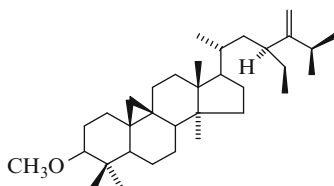
δ_c (CDCl ₃)									
C-1	32.1	C-8	47.8	C-15	33.0	C-22	23.0	C-29	25.8
2	30.5	9	20.2	16	26.3	23	56.4	30	14.0
3	78.0	10	25.8	17	52.2	24	42.3	31	12.3
4	40.5	11	25.7	18	18.0	25	151.7	32	28.0
5	48.2	12	35.8	19	29.9	26	109.4	33	21.1
6	20.7	13	45.3	20	36.1	27	18.3	34	20.4
7	28.0	14	48.7	21	18.3	28	19.4		

References

1. E.K. Desoky, *Phytochemistry* **40**(6), 1769–1772 (1995)

3β-Methoxy-23S-ethyl-24-methylenecycloartan

C₃₄H₅₈O, M 482



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (Rutaceae) [1].

Mp 153–154°C (from acetone-CHCl₃), [α]_D +33° (CHCl₃).

CAS Registry Number: 171901-87-4.

IR ν_{max}^{KBr}, cm⁻¹: 3040, 1385, 1375, 1180, 1140, 1100, 980.

MS m/z (%): M⁺ 482 (15), 467 (11), 450 (18), 435 (10), 407 (5), 381 (4), 328 (9), 315 (7), 297 (11), 203 (25), 187 (35), 175 (70), 163 (45), 151 (25), 137 (22), 123 (40), 109 (65), 101 (8), 81 (59), 69 (75), 55 (100), 43 (41).

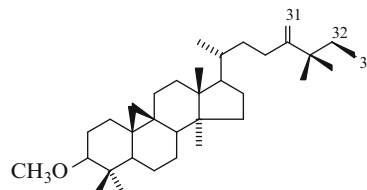
¹H NMR (400 MHz, CDCl₃, δ, 0-TMS): 0.31 and 0.54 (2H-19, d, J = 5 Hz), 0.80 (CH₃-33, t, J = 7.35 Hz), 0.85 (CH₃-21, d, J = 6.2 Hz), 0.84, 0.88, 0.92, 0.96 (4 × CH₃, s), 1.16 and 1.16 (CH₃-26 and CH₃-27, d, J = 6.2 Hz), 2.8 (H-3, m, J = 5 Hz), 3.34 (CH₃O, s), 4.61 and 4.80 (2H-31, brd, J = 2.3 Hz).

References

1. E.K. Desoky, *Phytochemistry* **40**(6), 1769–1772 (1995)

Skimmiwallin

C₃₄H₅₈O, M 482



Taxonomy: Cycloartane Triterpenoids

Skimmia wallichii Hook. f. et Thomas (Rutaceae) [1].

Mp 139–143°C (from MeOH).

CAS Registry Number: 182190-23-4.

IR ν_{max}^{KBr}, cm⁻¹: 1633, 1188, 890.

EIMS m/z (%): M⁺ 482 (17), 467 (22), 450 (100), 435 (37), 407 (33), 381 (22), 328 (17), 297 (15), 295 (1), 216 (39), 203 (48), 201 (30), 175 (48), 173 (30).

Table 1

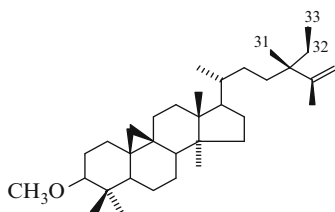
	δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	31.82	1.25, 1.44	C-18	18.00 0.95
2	25.44	1.89, 1.43	19	29.86 0.54 d (4.1), 0.31 d (4.1)
3	88.54	2.70 dd (11, 4.5)	20	36.44 1.39
4	40.48	–	21	18.46 0.88 d (6.3)
5	47.66	1.26	22	36.04 1.14, 1.59
6	20.96	1.54, 0.76	23	27.70 1.79, 2.04
7	25.97	1.05, 1.30	24	156.76 –
8	47.97	1.49	25	39.54 –
9	19.98	–	26	26.96 0.99
10	26.29	–	27	26.96 0.99
11	26.52	1.98, 1.11	28	19.30 0.88
12	32.92	1.61, 1.61	29	25.52 0.93
13	45.30	–	30	14.78 0.77
14	48.83	–	31	107.49 4.75, 4.77
15	35.55	1.27, 1.27	32	33.28 1.36
16	28.16	1.89, 1.28	33	9.01 0.69 t (7.6)
17	52.30	1.60	MeO	57.63 3.35

References

1. I. Kostova, M. Simeonov, T. Iossifova, R. Tappe, N. Pardeshi, H. Budzkievich, *Phytochemistry* **43**(3), 643–648 (1996)

Skimmiwallinin

C₃₄H₅₈O, M 482



Taxonomy: Cycloartane Triterpenoids

Skimmia wallichii Hook. f. et Thomas (*Rutaceae*) [1].

Mp 141–144° C (from MeOH).

CAS Registry Number: 182190-27-8.

IR ν_{\max}^{KBr} , cm⁻¹: 1630, 1189, 886.

EIMS m/z (%): M⁺ 482 (25), 467 (16), 450 (100), 435 (47), 407 (42), 381 (17), 329 (10), 328 (25), 297 (13), 295 (1), 230 (13), 203 (33), 201 (21), 175 (46), 173 (25).

Table 1

δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	31.81 1.25, 1.43	C-18	17.94 0.93
2	25.42 1.90, 1.43	19	29.83 0.53 d (4.2), 0.29 d (4.2)
3	88.54 2.70 dd (11.2, 4.5)	20	36.62 1.30
4	40.48 –	21	18.46 0.84 d (6.5)
5	47.66 1.26	22	36.20 1.24
6	20.94 1.55, 0.76	23	30.34 1.54
7	25.96 1.04, 1.30	24	42.06 –
8	47.94 1.49	25	150.27 –

(continued)

Table 1 (continued)

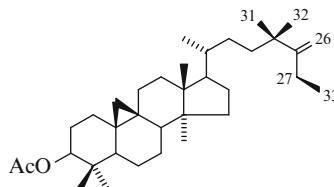
δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
9	19.98 –	26	111.08 4.60, 4.78
10	26.30 –	27	19.30 1.61
11	26.52 1.97, 1.11	28	19.30 0.86
12	32.88 1.59, 1.59	29	25.50 0.93
13	45.25 –	30	14.78 0.77
14	48.81 –	31	22.18 0.93
15	35.55 1.26, 1.26	32	32.26 1.23, 1.44
16	28.16 1.86, 1.25	33	8.38 0.69 t (7.4)
17	52.23 1.57	OMe	57.63 3.34

References

1. I. Kostova, M. Simeonov, T. Iossifova, R. Tappe, N. Pardeshi, H. Budzkievich, *Phytochemistry* **43**(3), 643–648 (1996)

Cyclopodmenyl Acetate

C₃₅H₅₈O₂, M 510



Taxonomy: Cycloartane Triterpenoids

Polypodium vulgare L. (*Polypodiaceae*) [1].

Polypodium fauriei (*Polypodiaceae*) [2].

Polypodium virginianum (*Polypodiaceae*) [2].

Mp 116–118°C, $[\alpha]_{\text{D}}^{23} +52.0^\circ$ (c 0.2, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3080, 1730, 1630, 1245, 1020, 890.

MS m/z (%): M⁺ 510 (4), 495 (45), 450 (100), 435 (47), 381 (18), 328 (33), 297 (26), 255 (6), 229 (10), 215 (10), 203 (41), 175 (50).

$^1\text{H NMR}$ (270 MHz, CDCl_3 , δ , 0-TMS): 0.33 and 0.57 (2H-19, d, $J = 4.1$ Hz), 0.841 (CH_3 -21, d, $J = 6.3$ Hz), 0.845, 0.885, 0.885, 0.943, 1.019, 1.019 ($6 \times \text{CH}_3$, s), 1.047 (CH_3 -33, t, $J = 7.4$ Hz), 1.990 (2H-27, bq, $J = 7.4$ Hz), 4.564 (H-3, dd, $J = 10.4, 5.0$ Hz), 4.762 (H-26, bd, $J = 1.2$ Hz), 4.785 (H-26, dt, $J = 1.2, 1.0$ Hz).

Table 1

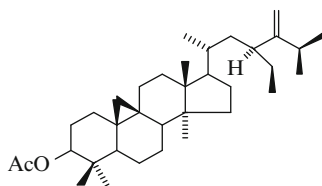
δ_{C} (CDCl_3)									
C-1	31.9	C-8	47.9	C-15	32.9	C-22	30.9	C-29	25.5
2	26.9	9	20.2	16	26.6	23	37.7	30	15.2
3	80.7	10	25.9	17	52.2	24	39.2	31	27.8
4	39.5	11	26.1	18	17.9	25	157.8	32	27.5
5	47.3	12	35.6	19	29.8	26	106.5	33	13.1
6	21.0	13	45.3	20	36.7	27	23.4	Ac	170.9
7	28.1	14	48.9	21	18.5	28	19.3		21.3

References

1. Y. Arai, K. Shiojima, H. Ageta, *Chem. Pharm. Bull.* **37**(2), 560–562 (1989)
2. Y. Arai, M. Yamaide, S. Yamazaki, H. Ageta, *Phytochemistry* **30**(10), 3369–3377 (1991)

23S-Ethyl-24-methylenecycloartan-3 β -yl Acetate

$\text{C}_{35}\text{H}_{58}\text{O}_2$, M 510



Taxonomy: Cycloartane Triterpenoids
Murraya exotica (*Rutaceae*) [1].

Mp 151–152°C (from MeOH), $[\alpha]_{\text{D}} +62^\circ$ (CHCl_3).

CAS Registry Number: 171901-88-5.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3040, 1715, 1385, 1375, 1180, 1140, 980.

MS m/z (%): M^+ 510 (12), 495 (7), 450 (65), 435 (15), 407 (6), 381 (3), 328 (10), 315 (4), 297 (18), 203 (23), 187 (23), 175 (60), 163 (22), 151 (9), 137 (12), 129 (5), 123 (25), 109 (37), 81 (40), 69 (76), 55 (100), 43 (88).

$^1\text{H NMR}$ (400 MHz, CDCl_3 , δ , 0-TMS): 0.32 and 0.55 (2H-19, d, $J = 5$ Hz), 0.80 (CH_3 -33, t, $J = 7.35$ Hz), 0.85 (CH_3 -21, d, $J = 6.2$ Hz), 0.85, 0.88, 0.89, 0.95 ($4 \times \text{CH}_3$, s), 1.15 and 1.15 (CH_3 -26 and CH_3 -27, d, $J = 6.2$ Hz), 4.62 (H-3, dd, $J = 11, 5.3$ Hz), 4.61 and 4.81 (2H-31, brd, $J = 2.3$ Hz).

Table 1

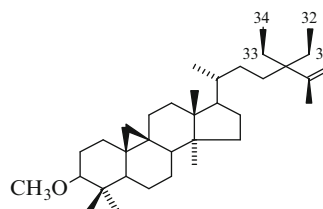
δ_{C} (CDCl_3)									
C-1	30.6	C-8	48.1	C-15	30.0	C-22	30.4	C-29	26.0
2	26.3	9	20.0	16	26.3	23	49.3	30	15.1
3	79.7	10	25.7	17	52.2	24	159.9	31	106.5
4	38.7	11	25.4	18	18.0	25	33.8	32	27.4
5	48.8	12	36.1	19	29.8	26	20.8	33	13.1
6	20.8	13	45.2	20	35.8	27	21.2	Ac	170.8
7	28.0	14	48.9	21	18.4	28	19.4		21.2

References

1. E.K. Desoky, *Phytochemistry* **40**(6), 1769–1772 (1995)

Skimmiwallichin

$\text{C}_{35}\text{H}_{60}\text{O}$, M 496



Taxonomy: Cycloartane Triterpenoids

Skimmia wallichii Hook. f. et Thomas (*Rutaceae*) [1].
Mp 156–159°C (from MeOH).

CAS Registry Number: 65817-00-7.

IR ν_{\max}^{KBr} , cm^{-1} : 1633, 1188, 890.

EIMS m/z (%): M^+ 496 (21), 481 (13), 464 (100), 449 (33), 421 (29), 395 (17), 342 (21), 297 (10), 295 (1), 230 (17), 203 (23), 201 (13), 175 (33), 173 (15).

Table 1

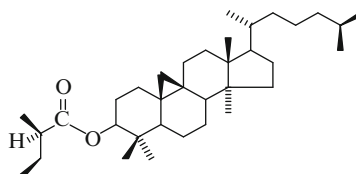
δ_C (CDCl ₃)	δ_H (J/Hz) (250 MHz)		δ_C (CDCl ₃)	δ_H (J/Hz) (250 MHz)	
C-1	31.83	1.26, 1.52	C-18	17.92	0.96 s
2	25.43	1.91, 1.50	19	29.87	0.52 d (4.1), 0.32 d (4.1)
3	88.51	2.70 dd (11.1, 4.4)	20	36.79	1.31
4	40.48	-	21	18.59	0.85 d (6.9)
5	47.68	1.28	22	29.59	0.80, 1.18
6	20.97	1.55, 0.80	23	30.37	1.11, 1.45
7	26.10	1.15, 1.31	24	44.41	-
8	47.98	1.45	25	158.30	-
9	19.97	-	26	112.00	4.66, 4.89
10	26.29	-	27	19.53	1.63
11	26.53	1.98, 1.11	28	19.30	0.87
12	32.87	1.61, 1.61	29	25.53	0.95
13	45.24	-	30	14.79	0.79
14	48.81	-	31	25.99	1.35, 1.35
15	35.57	1.28, 1.28	32	7.87	0.64 t (7.5)
16	28.23	1.91, 1.26	33	25.99	1.35, 1.35
17	52.19	1.57	34	7.87	0.65 t (7.3)
			MeO	57.60	3.36 s

References

- I. Kostova, M. Simeonov, T. Iossifova, R. Tappe, N. Pardeshi, H. Budzkievich, *Phytochemistry* **43**(3), 643–648 (1996)

Cycloartan-3-yl-2-methyl Butanoate

$C_{35}H_{60}O_2$, M 512

**Taxonomy:** Cycloartane Triterpenoids

Espeletia argentea and *E. barclayana* (*Asteraceae*) [1].

Mp 123–124°C (from CHCl₃–MeOH), $[\alpha]_D^{20} +67^\circ$ (CHCl₃).

CAS Registry Number: 207606-42-6.

MS m/z : M^+ 512, $C_{35}H_{60}O_2$, $[M-C_5H_{10}O_2]^+$, 410, $C_{30}H_{50}$.

$^1\text{HNMR}$ (CDCl₃, δ): 0.35 and 0.58 (2H-19, d, J = 4 Hz), 0.97(CH₃-18), 0.87 (CH₃-21, CH₃-26, CH₃-27), 0.91 (CH₃-30), 0.86 (CH₃-29), 0.90 (CH₃-28), 0.92 (CH₃-4'), 1.15 (CH₃-2''), 2.36 (H-2'), 4.57 (H-3).

Table 1

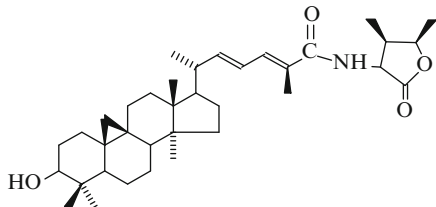
δ_C (C ₅ D ₅ N)									
C-1	31.8	C-8	48.1	C-15	35.8	C-22	39.8	C-29	25.7
2	27.0	9	20.4	16	28.4	23	24.3	30	15.5
3	80.4	10	26.2	17	52.6	24	36.7	1'	176.1
4	39.8	11	26.8	18	18.2	25	36.3	2'	42.0
5	47.4	12	33.1	19	30.0	26	22.8	3'	27.0
6	26.2	13	49.0	20	28.2	27	23.0	4'	11.9
7	21.2	14	45.5	21	18.6	28	19.5	2''	17.0

References

- N. Tellez, R. Torrenegra, J. Pedroyo, A. Gray, *Molecules* **49**(3), 1998. http://www.mdpi.org/molbank/m_0049.htm. C.A., 129:14430j (1998).

Heinsiagenin A

C₃₆H₅₃NO₄, M 565



Taxonomy: Cycloartane Triterpenoids

Heinsia crinata (Rubiaceae) [1].

Mp 166–168°C (from MeOH), $[\alpha]_D^{+138}$ (c 1.0, CHCl₃),
CAS Registry Number: 126594-31-8.

¹H NMR (250 MHz, CDCl₃, δ, 0-TMS): 0.35 (d, J = 4 Hz, 1H), 0.58 (d, J = 4 Hz, 1H), 0.79 (d, J = 7 Hz, CH₃), 0.81 (s, CH₃), 0.91 (s, CH₃), 0.97 (s, CH₃), 1.02 (s, CH₃), 1.04 (d, J = 6.5 Hz, CH₃), 1.39 (d, J = 7 Hz, CH₃), 1.98 (d, J = 1.1 Hz, CH₃), 2.24 (m, 1H), 3.00 (qdd, J = 4.5, 7, 7 Hz, 1H), 3.29 (dd, J = 5, 10 Hz, 1H), 4.70 (qd, J = 4.5, 7 Hz, 1H), 4.78 (dd, J = 5, 7 Hz, 1H), 5.93 (dd, J = 9, 15 Hz, 1H), 6.19 (d, J = 5 Hz, 1H), 6.26 (dd, J = 11, 15 Hz, 1H), 6.90 (br. d, J = 11 Hz, 1H).

¹³C NMR (CDCl₃): 7.2, 12.7, 13.9, 15.4, 18.2, 19.3, 19.5 (7 × CH₃), 19.9 (C), 21 (CH₂), 25.4 (CH₃), 26 (CH₂), 26.1 (C), 26.4, 28.4, 29.9, 30.2, 31.9, 32.8, 35.6 (7 × CH₂), 38.5 (CH), 40.4 (C), 41.1 (CH), 45.5 (C), 47, 47.9 (2 × CH), 48.9 (C), 51.8, 55.7, 77.7, 78.8 (4 × CH), 122.9 (CH), 126.4 (C), 135.7, 149.3 (2 × CH), 169.8 (CONH), 175.4 (COO).

Mussaenda pubescens Ait. f. (Rubiaceae) [2].

Mp 167–169°C (from MeOH), $[\alpha]_D^{+135.6}$ (c 1.2, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3440, 1770, 1660, 1515.

UV $\lambda_{\max}^{\text{MeOH}}$, nm (ε): 264.5 (3557).

EIMS m/z (%): M⁺ 565 (17), 251 (22), 250 (10), 222 (20), 122 (38), 44 (100).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	32.25	C-19	29.52 0.33 d (4), 0.54 d (4)
2	30.45	20	41.28

(continued)

Table 1 (continued)

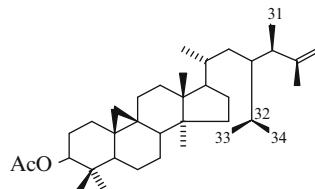
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
3	78.85 3.20 dd (10, 4.2)	21	19.85 1.01 d (6.7)
4	40.40 –	22	147.96 6.91 dd (14.8, 8.7)
5	47.67	23	123.63 6.33 dd (11, 14.8)
6	21.13	24	124.88 6.68 d (11)
7	26.40	25	129.07 –
8	47.95	26	13.47 1.95 s
9	19.98 –	27	176.74 –
10	26.08 –	28	19.48 1.00 s
11	26.63	29	26.03 0.94 s
12	33.05	30	15.30 0.88 s
	45.65 –	1'	175.74 –
14	49.31 –	2'	55.47 4.76 dd (7, 5)
15	35.77	3'	38.63 2.98 ddq (7.2, 7, 4.5)
16	28.75	4'	77.08 4.69 dq (6.5, 4.5)
17	52.00	3'-Me	8.07 0.76 d (7.2)
18	18.42 0.88 s	4'-Me	15.15 1.36 d (6.5)
		NH	9.18 d (5)

References

- B. Bila, A. Kilonda, S. Toppet, F. Compennolle, G. Hoornaert, *Tetrahedron* **45**(18), 5907–5916 (1989)
- J. Xu, R. Xu, Z. Luo, J. Dong, *Huaxue Xuebao* **49**(6), 621–624 (1991)

23ξ-Isopropyl-24-methylcycloart-25-en-3β-yl Acetate

C₃₆H₆₀O₂, M 524



Taxonomy: Cycloartane Triterpenoids

Murraya exotica (Rutaceae) [1].

Mp 148–149°C (from MeOH), $[\alpha]_D^{+52}$ (CHCl₃).

CAS Registry Number: 171901-90-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3040, 1715, 1385, 1375, 1180, 1180, 1140, 980.

MS m/z (%): M^+ 524 (6), 509 (3), 464 (29), 449 (11), 421 (5), 395 (3), 342 (9), 315 (5), 297 (15), 203 (29), 187 (28), 175 (60), 163 (25), 151 (5), 137 (13), 123 (28), 109 (40), 95 (69), 81 (40), 69 (70), 55 (82), 43 (100).

$^1\text{H NMR}$ (400 MHz, CDCl_3 , δ , 0-TMS): 0.32 and 0.57 (2H-19, d, $J = 5$ Hz), 0.85, 0.85, 0.88, 0.95, 1.60 (5 \times CH_3 , s), 0.86 (CH_3 -21, d, $J = 6.2$ Hz), 0.88 (CH_3 -31, d, $J = 7.5$ Hz), 0.91 and 0.91 (CH_3 -33 and CH_3 -34, d, $J = 6$ Hz), 4.61 (H-3, d, $J = 11$, 5.3 Hz), 4.61 and 4.81 (2H-31, brd, $J = 2.2$ Hz).

Table 1

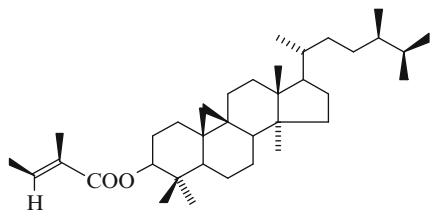
δ_{C} (CDCl_3)									
C-1	30.6	C-8	48.1	C-15	32.9	C-22	23.0	C-29	26.1
2	26.3	9	19.9	16	26.3	23	56.6	30	15.1
3	79.9	10	25.6	17	52.3	24	42.2	31	12.2
4	38.7	11	25.4	18	18.0	25	151.8	32	28.1
5	48.8	12	36.2	19	29.9	26	109.3	33	21.0
6	20.8	13	45.2	20	35.6	27	18.3	34	20.5
7	28.0	14	48.9	21	18.4	28	19.4	Ac	170.8
									21.3

References

1. E.K. Desoky, *Phytochemistry* **40**(6), 1769–1772 (1995)

3-O-Tigloyl-24-methylcycloartanol

$\text{C}_{36}\text{H}_{60}\text{O}_2$, M 524



Taxonomy: Cycloartane Triterpenoids
Almeidea coerulea (Rutaceae) [1].

Amorphous solid.

CAS Registry Number: 208170-81-4.

IR ν_{\max} , cm^{-1} : 2980, 1730, 1460, 1370.

EIMS m/z (%): M^+ 524 (8), 424 (100), 409 (65), 283 (80), 43 (70).

$^1\text{H NMR}$ (80 MHz, CDCl_3 , δ): 0.20 and 0.50 (2H-19, d, $J = 5$ Hz), 1.82 (CH_3 -5', s), 4.65 (H-3, dd, $J = 11$, 4 Hz), 6.8 (H-3', m).

Table 1

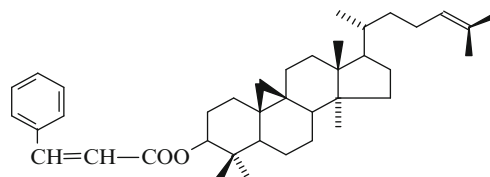
δ_{C} (CDCl_3)									
C-1	31.8	C-8	46.6	C-15	32.7	C-22	33.1	C-29	25.1
2	26.4	9	20.9	16	26.4	23	31.3	30	14.1
3	78.5	10	26.9	17	52.1	24	38.4	31	14.2
4	41.6	11	26.4	18	17.7	25	30.9	1'	167.7
5	46.8	12	35.2	19	29.4	26	19.1	2'	136.1
6	20.9	13	45.2	20	36.9	27	17.4	3'	129.1
7	28.1	14	48.8	21	18.5	28	18.5	4'	19.0
								5'	17.6

References

1. C.S. Santos, A.H. Januario, P.C. Viera, J.B. Fernandes, M. DaSilva, G.F. Fatima, J.R. Pirani, *J. Braz. Chem. Soc.* **9**(1), 39–42 (1998)

Cycloartenyl Cinnamate

$\text{C}_{39}\text{H}_{56}\text{O}_2$, M 556



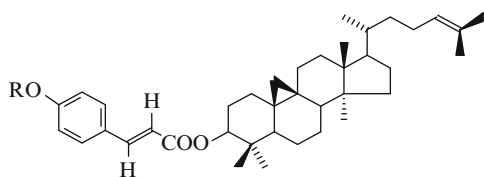
Taxonomy: Cycloartane Triterpenoids
Gymnema alternifolium (Lour.) Merr.
(Asclepiadaceae) [1].

References

1. J.S. Lai, S.P. Wang, K.F. Huang, T.S. Wu, Proc. Natl. Sci. Counc., Repub. China, Part A: Phys. Sci. Eng. **11**(3), 203–208 (1987). *C.A.*, 108:19189p (1988)

Arundinol

$C_{39}H_{56}O_3$, M 572



R = H (arundinol)
R = Ac (acetate of arundinol)

Taxonomy: Cycloartane Triterpenoids

Arundina bambusifolia (Orchidaceae) [1].

Mp 245°C (from petrol-EtOAc, 20:1), $[\alpha]_D^{25} +3.52^\circ$ (MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 3220, 3012, 1680, 1665, 980, 830.

CIMS m/z : 573 [M + 1]⁺.

Acetate of arundinol, $C_{41}H_{58}O_4$, M 614.

Mp 145°C (from petrol-EtOAc).

IR ν_{\max}^{KBr} , cm^{-1} : 3040, 1763, 1698, 1622, 1272, 985, 840.

UV λ_{\max}^{EtOH} , nm (log ϵ): 219 (4.14), 283 (4.39), 288 (4.37).

EIMS m/z (%): 408 (6.3), 393 (2.3), 365 (1.4), 339 (2.4), 297 (1), 203 (5.1), 189 (10), 175 (6), 164 (12), 147 (62), 123 (17), 107 (29.5), 95 (34), 91 (35.6), 69 (100), 55 (47.2), 43 (72.7).

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.36 and 0.60 (2H-19, d, J = 4.2 Hz), 0.88, 0.90, 0.97, 0.97, 1.58, 1.65 (6 × CH₃, s), 0.89 (CH₃-21, d, J = 6.5 Hz), 2.30 (OAc, s), 4.71 (H-3, m, $W_{1/2}$ = 15.6 Hz), 5.10 (H-24, m), 6.40 and 7.64 (H-2' and H-3', d, J = 15.9 Hz), 7.12 and 7.54 (H-2'', H-6'' and H-3'', H-5'', d, J = 8.4 Hz).

Table 1

δ_c (CDCl ₃)									
C-1	31.51	C-9	20.06	C-17	52.15	C-25	130.71	C-3'	142.96
2	26.78	10	25.89	18	17.90 ^a	26	17.49 ^a	1''	132.20
3	80.73	11	25.69	19	29.63	27	25.56	2''	129.0
4	39.57	12	35.42	20	35.76	28	19.16 ^a	3'	121.92
5	47.09	13	45.18	21	18.12 ^a	29	25.36	4'	150.88
6	20.81	14	48.69	22	36.23	30	15.18	5'	121.92
7	28.00	15	32.75	23	24.83	1'	168.92	6'	129.0
8	47.69	16	26.41	24	125.15	2'	119.0	Ac	168.52
									20.95

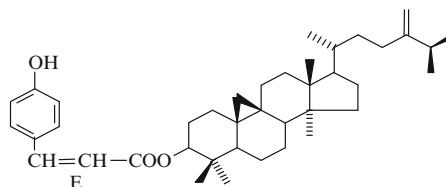
^aValues in the same column are interchangeable

References

1. P.L. Majumder, S. Ghosal, J. Indian Chem. Soc. **68**(2), 88–91 (1991)

24-Methylene-cycloartanyl *p*-hydroxycinnamate

$C_{40}H_{58}O_3$, M 586



Taxonomy: Cycloartane Triterpenoids

Cirrhopetalum elatum (Orchidaceae) [1].

Pholidota rubra (Orchidaceae) [2].

Mp 255°C (from petrol-EtOAc), $[\alpha]_D^{25} +28.3^\circ$ (CHCl₃).

CAS Registry Number: 99132-92-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3190, 1675, 985, 830.

UV λ_{\max}^{EtOH} , nm (log ϵ): 213 (3.99), 228 (4.02), 314 (4.33).

CIMS m/z (%): [M + 1]⁺ 587 (0.4), 439 (2.2), 423 (100), 203 (15), 147 (35), 121 (39).

EIMS m/z (%): [M-C₉H₈O₃]⁺ 422 (15), 407 (17), 297 (12).

¹H NMR (CDCl₃, δ, 0-TMS): 0.37 and 0.67 (2H-19, d, J = 4 Hz), 0.89–1.05 (7 × CH₃, s), 4.67 (H-3, m), 4.67 and 4.72 (2H-31, s), 5.36 (phenolic OH, brs), 6.85 and 7.45 (each 2H, d, J = 8 Hz; four aromatic protons of the *p*-disubstituted benzene moiety), 6.32 and 7.62 (each 1 H, d, J = 16 Hz; *trans*-olefinic protons).

Table 1

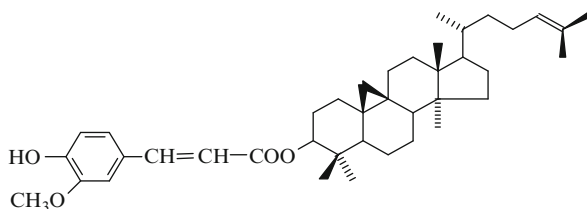
δ _c (CDCl ₃)										
C-1	31.80	C-9	20.31	C-17	52.40	C-25	33.97	C-2'	116.69	
2	27.09	10	26.16	18	19.46	26	22.15	3'	144.00	
3	80.77	11	25.99	19	29.94	27	22.02	1'	127.72	
4	39.86	12	33.03	20	36.28	28	18.13	2'	130.6	
5	48.01	13	45.47	1	18.46	29	25.64	3''	115.98	
6	21.09	14	48.99	22	35.16	30	15.47	4'	157.56	
7	28.30	15	35.69	23	31.48	31	106.10			
8	47.37	16	26.67	24	157.10	1'	167.37			

References

- P.L. Majumder, A. Pal, *Phytochemistry* **24**(9), 2120–2122 (1985)
- P.L. Majumder, A. Pal, S. Lahiri, *Indian J. Chem.* **26B**(4), 297–300 (1987)

Oryzanol A

C₄₀H₅₈O₃, M 586



Taxonomy: Cycloartane Triterpenoids
Rice bran oil

Oryza sativa L. (*Oryzaceae*) [1, 2].

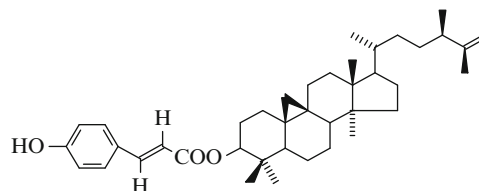
Mp 150.5–151.5°C (from C₆H₆–EtOH), [α]_D 40° (c 0.68).

References

- M. Shimizu, G. Ohta, S. Kitahara, G. Tsunoo, S. Sasahara, *Pharm. Bull.* **5**, 36–39 (1957). *C.A.*, 52:1189e (1958)
- G. Ohta, M. Shimizu, *Pharm. Bull.* **5**, 40–44 (1957). *C.A.*, 52:1189i (1958)

Pholidotanin

C₄₀H₅₈O₃, M 586



Taxonomy: Cycloartane Triterpenoids

Pholidota yunnanensis Rolfe (*Orchidaceae*) [1].

Mp 202–205°C, [α]_D¹⁴ +45.6° (c 0.19, CHCl₃).

IR ν_{max}^{KBr}, cm⁻¹: 3420, 3040, 1695, 1630, 1605, 1580, 1518, 1385, 1165, 980, 888, 850.

UV λ_{max}^{EtOH}, nm (log ε): 210 (4.06), 228 (sh), 312 (4.15).

CIMS m/z (%): [M + 1]⁺ 587 (9.38), M⁺ 586 (3.88), 423 (87.10), 4.07 (8.79), 339 (5.05), 299 (6.41), 285 (10.77), 283 (12.02), 203 (13.83), 147 (76.93), 135 (23.30), 121 (29.79).

¹H NMR (500 MHz, CDCl₃, δ, 0-TMS): 0.15 and 0.41 (2H-19, d), 0.87–1.69 (7xCH₃), 3.93 (H-3), 4.66 and 4.72 (2H-26), 6.29 and 7.61 (1H each, d, J = 16 Hz), 6.92 and 7.42 (2H each, d, J = 8 Hz).

Table 1

δ _c (CDCl ₃)									
C-1	31.92	C-9	20.32	C-17	52.09	C-25	152.41	C-2'	115.84
2	27.17	10	26.26	18	17.75	26	109.27	3'	144.68
3	80.73	11	26.01	19	29.69	27	19.39	1''	127.72

(continued)

Table 1 (continued)

δ_c (CDCl ₃)									
4	40.15	12	35.37	20	36.62	28	19.14	2''	129.89
5	48.37	13	45.33	21	18.49	29	25.56	3''	115.75
6	21.11	14	48.91	22	30.96	30	14.46	4''	156.50
7	28.43	15	32.84	23	37.41	31	27.37	5''	115.75
8	47.27	16	27.02	24	38.73	1'	166.39	6''	129.89

References

1. X. Ma, M. Li, Q. Zhang, *Zhongcaoyao* **26**(2), 59–61 (1995)

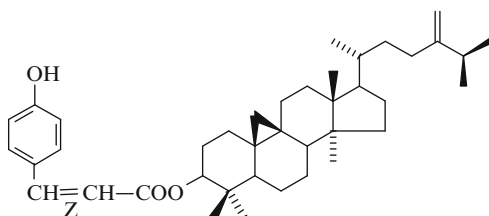
CIMS m/z (%): $[M + 1]^+$ 587 (2.25), 423 (100), 407 (8.99), 339 (5.62), 299 (6.74), 219 (8.99), 203 (14.04), 147 (30.33), 121 (56.18).

EIMS m/z (%): $[M-C_9H_8O_3]^+$ 422 (67.86), 407 (100), 379 (42.86), 353 (24.28), 339 (18.57), 325 (20), 297 (67.86), 295 (29.26), 283 (15), 281 (15), 269 (20), 255 (37.14), 241 (40.71), 147 (31.43), 135 (18.57), 121 (24.29), 107 (33.57), 95 (42.86), 81 (31.43), 69 (45.71), 55 (40).

¹H NMR (CDCl₃, δ , 0-TMS): 0.35 and 0.58 (2H-19, d, $J = 4.1$ Hz), 0.86–1.05 (7 \times CH₃), 4.67 (H-3, m), 4.67 and 4.72 (2H-31, s), 5.21 (phenolic OH, s), 5.85 and 6.84 (each 1H, d, $J = 12.7$ Hz, two olefinic protons), 6.80 and 7.66 (each 2H, d, $J = 8.7$ Hz; four aromatic protons of a *p*-disubstituted benzene moiety).

Pholidotin

C₄₀H₅₈O₃, M 586



Taxonomy: Cycloartane Triterpenoids

Pholidota rubra (Orchidaceae) [1].

Cirrhopetalum elatum (Orchidaceae) [1].

Mp 196°C (from petrol-EtOAc), $[\alpha]_D^{25} +5.54^\circ$ (CHCl₃).

IR ν_{max}^{KBr} , cm⁻¹: 3340, 1690, 845, 750.

UV λ_{max}^{EtOH} , nm (log ϵ): 212 (4.14), 230 (4.04), 312 (4.22).

Table 1

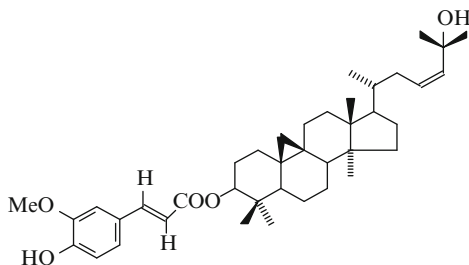
δ_c (CDCl ₃)									
C-1	31.65	C-9	20.16	C-17	52.24	C-25	33.81	C-2'	114.93
2	26.80	10	25.99	18	19.31	26	22.01	3'	143.05
3	80.80	11	25.82	19	29.80	27	21.88	1''	127.60
4	39.52	12	32.86	20	36.12	28	17.78	2'',6''	132.5
5	47.87	13	45.31	21	18.31	29	25.46	3'',5''	117.98
6	20.94	14	48.81	22	34.99	30	15.17	4''	156.93
7	28.15	15	36.12	23	31.30	31	105.93		
8	47.24	16	26.51	24	156.50	1'	166.38		

References

1. P.L. Majumder, A. Pal, S. Lahiri, *Indian J. Soc. Sect. B* **26B**(4), 297–300 (1987)

Cycloart-23Z-ene-3 β ,25-diol-3 β -*trans*-ferulate

C₄₀H₅₈O₅, M 618



Taxonomy: Cycloartane Triterpenoids

Oryza sativa L. (*Oryzae*) [1].

White powder, $[\alpha]_D^{25} +22.4^\circ$ (c 0.25, CHCl₃).

Negative ESIMS m/z: 617 [M-H]⁻, 602 [M-H-Me]⁻.

Positive ESIMS m/z: 425 [M + H-194]⁺, 407 [M + H-194-H₂O]⁺

HRESIMS m/z: 617.4170 [M-H]⁻.

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	31.7	C-21	18.3 0.87 d (6.2)
2	27.0	22	39.1
3	80.5 4.72 dd (4.3, 10.9)	23	139.4 5.61 m
4	39.7 –	24	125.6 5.61 m
5	47.2	25	70.8 –
6	21.0	26	29.8 ^a 1.33 s ^a
7	28.1	27	29.9 ^a 1.32 s ^a
8	47.9	28	19.3 0.90 s
9	20.1 –	29	25.5 0.98 s
10	26.0 –	30	15.4 0.90 s
11	25.9	1'	167.1 –
12	35.6	2'	116.3 6.30 d (16)
13	45.3 –	3'	144.4 7.60 d (16)
14	48.8 –	4'	127.1 –

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
15	32.8	5'	109.3 7.04 d (1.8)
16	26.5	6'	146.8 –
17	52.0	7'	147.9 –
18	18.1 0.98 s	8'	114.7 6.92 d (8.2)
19	30.0 0.37 d (3.9), 0.60 d (3.9)	9'	123.1 7.08 dd (1.8, 8.2)
20	36.4	OMe	56.0 3.93 s
		OH	6.00 s

^aAssignments may be interchangeable

Biological activity

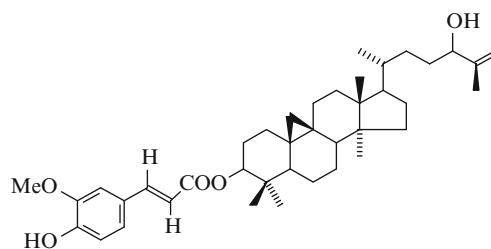
This compound showed moderate cytotoxicity against MCF-7 cells.

References

- H.-F. Luo, Q. Li, S. Yu, T.M. Badger, N. Fang, J. Nat. Prod. **68**(1), 94–97 (2005)

(24R)-Cycloart-25-ene-3 β ,24-diol-3 β -*trans*-ferulate

C₄₀H₅₈O₅, M 618



Taxonomy: Cycloartane Triterpenoids

Oryza sativa L. (*Oryzae*) [1].

White powder, $[\alpha]_D^{25} +24.3^\circ$ (c 0.21, CHCl_3).

Negative ESIMS m/z: 617 $[\text{M}-\text{H}]^-$, 602 $[\text{M}-\text{H}-\text{Me}]^-$.

Positive ESIMS m/z: 425 $[\text{M} + \text{H}-194]^+$, 407 $[\text{M} + \text{H}-194-\text{H}_2\text{O}]^+$.

HRESIMS m/z: 617.4160 $[\text{M}-\text{H}]^-$.

Table 1

δ_C (CDCl_3)	δ_H (J/Hz)	δ_C (CDCl_3)	δ_H (J/Hz)	
C-1	31.6	C-21	18.3	
2	27.0	22	31.9	
3	80.5 4.72 dd (4.7, 11.4)	23	31.6	
4	39.7	24	76.4	4.03 t (6.2)
5	47.2	25	147.8	–
6	21.0	26	111.0	4.84 brs, 4.95 brs
7	28.2	27	17.6	1.74 s
8	47.9	28	19.3	0.91 s
9	20.2	29	25.5	0.98 s
10	26.0	30	15.4	0.90 s
11	25.9	1'	167.1	–
12	35.5	2'	116.3	6.31 d (16)
13	45.3	3'	144.4	7.60 d (16)
14	48.8	4'	127.2	–
15	32.9	5'	109.2	7.05 d (2)
16	26.5	6'	146.8	–
17	52.1	7'	147.8	–
18	18.0	8'	114.7	6.92 d (8.2)
19	29.8	9'	123.1	7.09 dd (2, 8.2) 0.61 d (4.3)
20	35.9	OMe	56.0	3.94 s
		OH		5.88 s

Biological activity

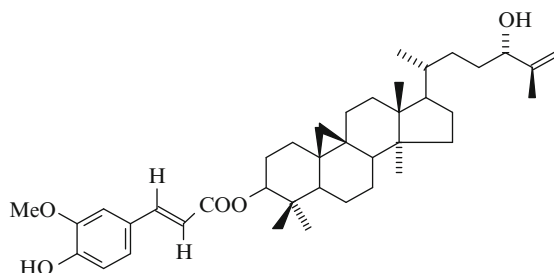
This compound showed moderate cytotoxicity against MCF-7 cells.

References

- H.-F. Luo, Q. Li, S. Yu, T.M. Badger, N. Fang, J. Nat. Prod. **68**(1), 94–97 (2005)

(24S)-Cycloart-25-ene-3 β ,24-diol-3 β -trans-ferulate

$\text{C}_{40}\text{H}_{58}\text{O}_5$, M 618



Taxonomy: Cycloartane Triterpenoids

Oryza sativa L. (*Oryzaceae*) [1].

White powder, $[\alpha]_D^{25} +44.4^\circ$ (c 0.18, CHCl_3).

Negative ESIMS m/z: 617 $[\text{M}-\text{H}]^-$, 602 $[\text{M}-\text{H}-\text{Me}]^-$.

Positive ESIMS m/z: 425 $[\text{M} + \text{H}-194]^+$, 407 $[\text{M} + \text{H}-194-\text{H}_2\text{O}]^+$

HRESIMS m/z: 617.4177 $[\text{M}-\text{H}]^-$.

Table 1

δ_C (CDCl_3)	δ_H (J/Hz)	δ_C (CDCl_3)	δ_H (J/Hz)	
C-1	31.7	C-21	18.4	0.90 d (5.9)
2	27.0	22	31.9	
3	80.5	23	31.5	4.72 dd (4.7, 11.4)
4	39.7	24	76.7	4.04 t (6.4)
5	47.2	25	147.5	–
6	21.0	26	111.5	4.85 brs, 4.94 brs
7	28.1	27	17.2	1.74 s
8	47.9	28	19.3	0.91 s ^a
9	20.2	29	25.5	0.98 s ^a
10	26.0	30	15.4	0.91 s
11	25.9	1'	167.1	–
12	35.5	2'	167.1	6.31 d (16)
13	45.3	3'	144.4	7.61 d (16)
14	48.8	4'	127.1	–
15	32.9	5'	109.3	7.05 d (1.4)
16	26.5	6'	146.8	–
17	52.2	7'	147.8	–
18	18.0	8'	114.7	6.93 d (8.2)
19	29.8	9'	123.1	7.09 dd (1.4, 8.2) 0.38 d (3.9), 0.61 d (3.9)
20	36.0	OMe	56.0	3.95 s
		OH		5.95 s

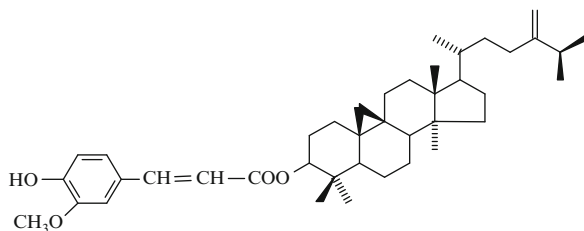
^aAssignments may be interchangeable

References

1. H.-F. Luo, Q. Li, S. Yu, T.M. Badger, N. Fang, *J. Nat. Prod.* **68**(1), 94–97 (2005)

Oryzanol C

C₄₁H₆₀O₄, M 600



Taxonomy: Cycloartane Triterpenoids

Rice bran oil

Oryza sativa L. (*Oryzeae*) [1–3].

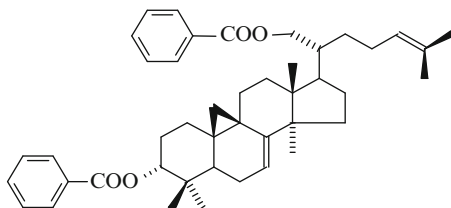
Mp 162–164°C or 193–194°C, [α]_D 36°.

References

1. G. Ohta, M. Shimizu, *Chem. Pharm. Bull.* **6**, 325–326 (1958). *C.A.*, 53:12340h (1959)
2. G. Ohta, *Chem. Pharm. Bull.* **8**, 5–9 (1960). *C.A.*, 55:5570d (1961)
3. G. Ohta, *Chem. Pharm. Bull.* **8**, 9–13 (1960). *C.A.*, 55:5570f (1961)

Mogroester

C₄₄H₅₆O₄, M 648



Taxonomy: Cycloartane Triterpenoids

Momordica grosvenori Swingle (?) [1].

Mp 160–162°C.

CAS Registry Number: 143086-36-6.

IR ν_{\max}^{KBr} , cm⁻¹: 1720, 1600, 1580, 1270, 1110, 710.

UV $\lambda_{\max}^{\text{EtOH}}$, nm: 234.3, 272.3.

EIMS m/z (%): M⁺ 648, 526, 511, 457, 415, 404, 389, 375, 335, 293, 253, 105 (100), 77, 69.

¹H NMR (300 MHz, CDCl₃, δ, 0-TMS): 0.88 (H-19, d, J = 5.6 Hz), 0.93, 0.96, 0.99, 1.07, 1.26, 1.53 (6 × CH₃, s), 4.15 (2H-21, dd, J = 11.2, 2.8 Hz), 4.92 (H-3, t, J = 2.8 Hz), 5.26 (H-7, d), 5.54 (H-24, t, J = 5.6 Hz), 7.28–8.09 (2 × C₆H₅, m).

Table 1

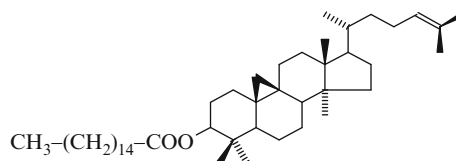
δ _C (CDCl ₃)									
C-1	30.6	C-9	31.4	C-17	44.8	C-25	142.0	C-1'	130.8
2	28.3	10	31.7	18	30.4	26	22.0		130.6
3	70.0	11	30.1	19	29.1	27	27.5	4'	132.8
4	36.2	12	34.1	20	37.1	28	19.4		131.6
5	47.1	13	37.3	21	72.7	29	20.4	2',6'	129.4
6	25.7	14	40.0	22	39.3	30	31.0	3',5'	128.4
7	114.0	15	38.7	23	30.0	CO	166.7		
8	144.5	16	27.4	24	119.3		165.9		

References

1. Y. Wang, J. Chen, *Zhongcaoyao* **23**(2), 61–62 (1992)

Cycloartenyl Palmitate

C₄₆H₈₀O₂, M 664



Taxonomy: Cycloartane Triterpenoids

Strichnos nux-vomica L. (*Loganiaceae*) [1].

Musa sapientum L. (*Musaceae*) [1].

Mp 52–54°C.

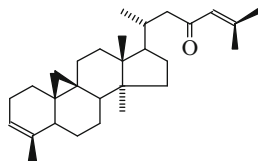
References

1. F.F. Knapp, H.J. Nicholas, *Mol. Cryst. Liquid. Cryst.* **6**(3–4), 319–328 (1970). *C.A.*, 73:10721g (1970)

4-Monomethylcycloartane Triterpenoids

Norcycloartene 1

C₂₉H₄₄O, M 408



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Tydemania expeditionitis Weber van Bosse

(*Chlorophyta-Udoteaceae*) [1].

$[\alpha]_D^{25} +5.6^\circ$ (c 1.0, CHCl₃).

CAS Registry Number: 84323-27-3.

IR $\nu_{\max}^{\text{KBr}}, \text{cm}^{-1}$: 2940, 1675, 1610, 1450, 1380.

UV $\lambda_{\max}^{\text{MeOH}}, \text{nm} (\epsilon)$: 238 (11,400).

HRMS m/z: M⁺ 408.3397.

¹H NMR (360 MHz, CCl₄, δ): -0.05 and 0.50 (2H-19, d, J = 4 Hz), 1.02 (3H, d, J = 7 Hz), 1.07 (6H, s), 1.18 (3H, s), 1.42 (4H, m), 1.47 (4H, m), 1.73 (6H, bs), 2.04 (3H, s), 2.17 (6H, m), 2.28 (3H, s), 2.44 (1H, d, J = 14 Hz), 2.56 (1H, d, J = 14 Hz), 5.44 (1H, bs), 6.09 (1H, bs).

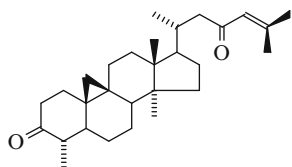
There is X-ray diffraction analysis there.

References

- V.J. Paul, W. Fenical, S. Raffii, J. Clardy, *Tetrahedron Lett.* **23**(34), 3459–3462 (1982)

30-Nor-9,19-cyclolanost-24-ene-3,23-dione

C₂₉H₄₄O₂, M 424



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Gardenia sp: *G. gordonii*, *G. hillii*, *G. storckii*

(*Rubiaceae*) [1].

GCMS m/z: M⁺ 424, 326, 147, 125, 83.

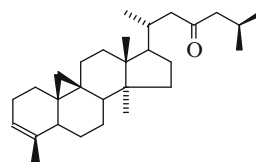
¹³C NMR δ : 201 (C-23), 124 (C-24), 154 (C-25).

References

- N.W. Davies, J.M. Miller, R. Naidu, S. Sotheeswaran, *Phytochemistry* **31**(1), 159–162 (1992)

Norcycloartene 2

C₂₉H₄₆O, M 410



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Tydemania expeditionitis Weber van Bosse

(*Chlorophyta-Udoteaceae*) [1].

$[\alpha]_D^{25} +16.1^\circ$ (c 1.4, CHCl₃).

CAS Registry Number: 84323-28-4.

IR $\nu_{\max}^{\text{CHCl}_3}, \text{cm}^{-1}$: 2960, 1710, 1460, 1375, and 1215.

HRMS m/z: M⁺ 410.3534.

¹H NMR (360 MHz, CCl₄, δ): 0.10 and 0.50 (2H-19, d, J = 4 Hz), 0.83 (CH₃, d, J = 7 Hz), 0.88 (CH₃, s), 0.89 (2 × CH₃, s), 0.91 (CH₃, d, J = 6 Hz), 0.99 (CH₃, s), 1.24 (4H, m), 1.34 (1H, m), 1.5 (4H, m), 1.72 (1H, m), 2.00 (4H, m), 1.09 (1H, m), 2.14 (2H, m), 2.31 (1H, d, J = 14 Hz), 5.27 (1H, s).

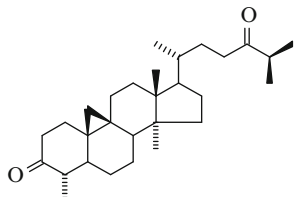
¹³C NMR (50 MHz, CDCl₃, δ): 137.9s, 121.8d, 52.6z, 51.9d, 50.8z, 49.5s, 45.5s, 42.9d, 40.6d, 34.2z, 32.9s, 32.6z, 29.4s, 28.1d, 27.3t, 25.4t, 24.5d, 23.5z, 23.2t, 22.7q, 22.5q, 22.2t, 20.9q, 19.5q, 18.3q 16.4q, 12.6z, 28 C observed.

References

- V.J. Paul, W. Fenical, S. Raffii, J. Clardy, *Tetrahedron Lett.* **23**(34), 3459–3462 (1982)

24-Oxo-30-norcycloartanone

C₂₉H₄₆O₂, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Musa sapientum L. (*Musaceae*) [1].

CAS Registry Number: 207850-22-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3040, 1712.

EIMS m/z(%): M⁺ 426 (23), 411 (7), 340 (12), 325 (2), 302 (5), 299 (27), 287 (2), 257 (3), 243 (3), 221 (6), 136 (21), 43 (100).

HREIMS m/z: M⁺ 426.3471 (C₂₉H₄₆O₂), 411.3264 (C₂₈H₄₃O₂), 340.2760 (C₂₄H₃₆O), 302.2582 (C₂₁H₃₄O), 299.2349 (C₂₁H₃₄O), 257.2003 (C₁₈H₂₅O), 243.1795 (C₁₇H₂₃O).

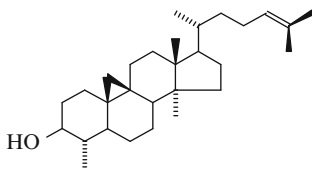
¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.40 and 0.62 (2H-19, d, J = 4 Hz), 0.87 (CH₃-21, d, J = 6.6 Hz), 0.91 (CH₃-28, s), 0.99 (CH₃-29, d, J = 6.2 Hz), 1.00 (CH₃-18, s), 1.10 (CH₃-26, CH₃-27, d, J = 7 Hz), 2.62 (H-25, m).

References

1. T. Akihisa, Y. Kimura, T. Tamura, *Phytochemistry* **47**(6), 1107–1110 (1998)

30-Nor-cycloartenol*

C₂₉H₄₈O, M 412



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Garcinia lucida (*Clusiaceae*) [1].

Mp 116–117°C (from Me₂CO).

CAS Registry Number: 28288-92-8.

IR $\nu_{\max}^{\text{CCl}_4}$, cm⁻¹: 3620, 2900, 2890, 1454, 1360, 1120, 1020.

¹H NMR (90 MHz, CDCl₃, δ , 0-TMS): 0.13 and 0.36 (2H-19, d, J = 4 Hz), 1.60 and 1.70 (CH₃-26, CH₃-27, s), 3.20 (H-3, m), 5.15 (H-24, brt, J = 7 Hz).

Table 1

δ_{C} (CDCl ₃)	
C-1	30.8
C-7	28.0
C-13	45.2
C-19	27.1
C-25	130.7
2	34.7
8	46.8
14	48.8
20	36.3
26	24.8
3	76.3
9	23.4
15	32.8
21	18.2
27	17.7
4	44.4
10	29.5
16	26.9
22	35.8
28	19.0
5	43.3
11	25.1
17	52.2
23	25.7
29	14.4
6	24.7
12	35.3
18	17.7
24	125.2

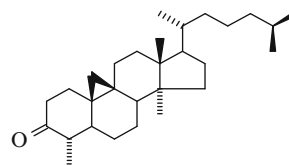
*The name corrected by us.

References

1. A.M. Nyemba, T.N. Mpondo, J.D. Connolly, D.S. Ricroft, *Phytochemistry* **29**(3), 994–997 (1990)

30-Norcycloartanone*

C₂₉H₄₈O, M 412



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Costus speciosus Sm. (*Costaceae*) [1].

Mp 121–123°C (from Me₂CO).

CAS Registry Number: 17320-18-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3020, 2920, 2840, 1700, 1450, 1360, 1210, 1150, 1110, 1090, 1000, 960, 940, 880.

MS m/z (%): M⁺ 412 (70), 397 (20), 299 (60), 257 (8), 123 (30), 83 (100).

¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.40 and 0.62 (2H-19, d, J = 4 Hz), 0.89 (CH₃, s), 1.00 (CH₃, s), 0.98 (CH₃, d, J = 6 Hz), 0.84 (CH₃, d, J = 6 Hz), 0.85 (CH₃, d, J = 6 Hz), 0.86 (CH₃, d, J = 6 Hz), 2.04 (1H, m), 2.24 (1H, m), 2.44 (1H, m).

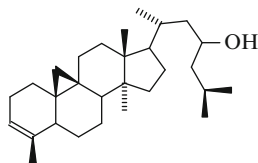
*The name corrected by us.

References

1. M.M. Gupta, S.B. Singh, Y.N. Shukla, *Planta Med.* **54**(3), 268 (1988)

Norcycloartene 3a

C₂₉H₄₈O, M 412



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Tydemanina expeditionitis Weber van Bosse

(*Chlorophyta-Udoteaceae*) [1].

$[\alpha]_D^{25} +12.6^\circ$ (c 1.7, CHCl₃).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3480, 2950, 1450, 1375.

HRMS m/z: M⁺ 412.3720.

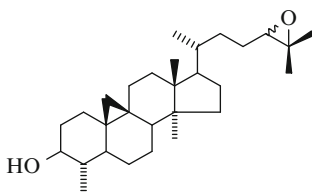
¹H NMR (CCl₄, δ): 0.10 and 0.48 (2H-19, d, J = 4 Hz), 0.88 (CH₃), 0.89 (2 × CH₃, s), 0.90 (CH₃, s), 0.98 (CH₃, s), 1.12 (1H, m), 1.3 (4H, m), 1.56 (4H, bs), 1.70 (1H, m), 2.00 (2H, m), 2.32 (1H, d, J = 14 Hz), 3.67 (1H, m), 5.27 (1H, bs).

References

1. V.J. Paul, W. Fenical, S. Raffii, J. Clardy, *Tetrahedron Lett.* **23**(34), 3459–3462 (1982)

24RS,25-Epoxy-30-norcycloartenol*

C₂₉H₄₈O₂, M 428



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Garcinia lucida (*Clusiaceae*) [1].

Mixture of epimers. Mp 94.5–97°C (from petrol).

IR $\nu_{\max}^{\text{CHCl}_3}$, cm⁻¹: 3630, 2960, 2880, 1370.

¹H NMR (200 MHz, CDCl₃, δ): 0.14 and 0.36 (2H-19, d, J = 4 Hz), 1.25 and 1.29 (CH₃-26, CH₃-27, d, J = 1.5 Hz), 2.70 (H-24, t, J = 6 Hz), 3.20 (H-3, brm).

Table 1

δ_c (CDCl ₃)									
C-1	30.8	C-7	28.1	C-13	45.3	C-19	27.3	C-25	58.4
2	34.8	8	46.8	14	48.9	20	35.9, 35.85	26	18.74
3	76.5	9	23.5	15	32.8	21	18.19	27	24.9
4	44.5	10	29.5	16	26.9	22	32.6	28	19.10
5	43.3	11	25.2	17	52.2	23	25.6, 25.9	29	14.4
6	24.1	12	35.3	18	17.8	24	64.8, 64.9		

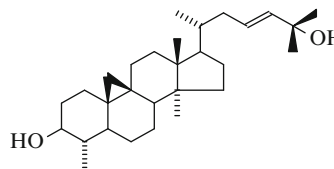
*The name corrected by us.

References

1. A.M. Nyemba, T.N. Mpondo, J.D. Connolly, D.S. Ricroft, *Phytochemistry* **29**(3), 994–997 (1990)

30-Nor-cycloartan-23-ene-3 β ,25-diol*

C₂₉H₄₈O₂, M 428



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Aglaia roxburghiana Miq. var *Beddomei* Gamble (*Meliaceae*) [1].

Mp 155°C (from 5% EtOAc in C₆H₆), $[\alpha]_D^{20} +23^\circ$ (c 0.85, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2950, 1460, 1380, 1340, 1250, 1230, 1115, 1105, 1030, 1020, 970, 960, 860.

MS m/z: M⁺ 428, 410, 377, 329, 310, 301, 283, 206, 204, 188, 109, 94, 81.

¹H NMR (CDCl₃, δ , 0-TMS): 0.14 and 0.38 (2H-19, d, J = 4 Hz), 0.86 (CH₃-21, d, J = 7 Hz), 0.88 (CH₃-28, s), 0.97 (CH₃-18, s), 0.98 (CH₃-29, d,

$J = 7$ Hz), 1.32 (CH₃-26, CH₃-27, s), 3.2 (H-3, m), 5.6 (H-23, H-24, m).

Table 1

δ_C (CDCl ₃)									
C-1	30.82	C-7	28.02	C-13	45.41	C-19	27.11	C-25	70.00
2	34.85	8	46.75	14	48.98	20	36.42	26	30.01
3	76.58	9	23.61	15	32.87	21	18.34	27	29.92
4	44.67	10	29.67	16	27.02	22	39.04	28	19.08
5	43.38	11	25.11	17	52.01	23	125.61	29	14.37
6	24.65	12	35.37	18	17.76	24	139.48		

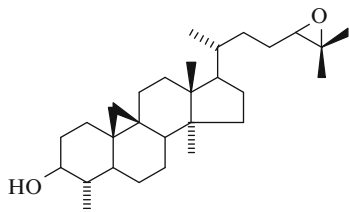
*The name corrected by us.

References

1. S.P. Vishnoi, A. Shoeb, R.S. Kapil, *Planta Med.* **54**(1), 40–41 (1988)

24 ξ ,25-Epoxy-30-nor-cycloartan-3 β -ol*

C₂₉H₄₈O₂, M 428



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Aglaiia roxburghiana Miq. var *Beddomei* Gamble
(*Meliaceae*) [1].

Mp 110°C (from 5% EtOAc in C₆H₆), $[\alpha]_D^{20} +48.6^\circ$
(c 2.5, CHCl₃).

CAS Registry Number: 115040-03-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3550, 2900, 1440, 1380, 1240, 1900,
840, 760.

MS m/z: M⁺ 428, 410, 395, 377, 301, 268, 283, 139.

¹H NMR (CDCl₃, δ , 0-TMS): 0.14 and 0.39 (2H-19, d,
 $J = 4$ Hz), 0.87 (CH₃-28, s), 0.88 (CH₃-21, d,
 $J = 7$ Hz), 0.90 (CH₃-29, d, $J = 7$ Hz), 0.97
(CH₃-18, s), 1.27 (CH₃-26, CH₃-27, s), 2.7 (H-24,
t, $J = 4$ Hz), 3.2 (H-3, m).

Table 1

δ_C (CDCl ₃)									
C-1	30.73	C-7	28.00	C-13	45.38	C-19	26.98	C-25	52.23
2	34.86	8	46.69	14	48.76	20	35.86	26	25.82
3	76.39	9	23.53	15	32.80	21	18.31	27	18.23
4	44.58	10	29.58	16	26.91	22	39.40	28	19.07
5	43.30	11	25.11	17	52.00	23	24.88	29	14.40
6	24.63	12	35.31	18	17.66	24	64.91		

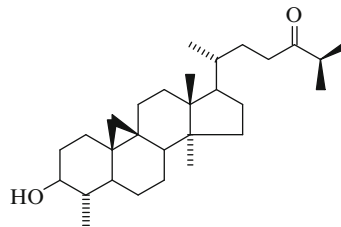
*The name corrected by us.

References

1. S.P. Vishnoi, A. Shoeb, R.S. Kapil, *Planta Med.* **54**(1), 40–41 (1988)

3 β -Hydroxy-30-nor-cycloartan-24-one

C₂₉H₄₈O₂, M 428



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Artemisia caruifolia Buch.-Ham. ex Roxb.

(*Asteraceae*) [1].

Amorphous powder, $[\alpha]_D^{24} +42.6^\circ$ (c 0.19, CHCl₃).

CAS Registry Number: 15371-62-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3440, 2965, 2940, 2920, 2868, 1718,
1470, 1458, 1130, 1103, 1042, 1002.

EIMS m/z (%): M⁺ 428 (60), 413 (100), 410 (80), 395
(90), 302 (30).

HREIMS m/z: 428.3651M⁺.

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	31.1	C-16	28.3
2	35.1	17	52.4

(continued)

Table 1 (continued)

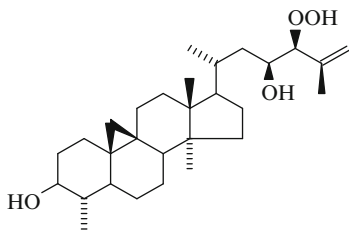
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
3	77.3 3.22 m	18	18.1 0.96 s
4	44.8 1.19	19	27.5 0.14 d (4.5), 0.38 d (4.5)
5	43.6	20	36.0
6	24.9 0.58 m, 1.68 m	21	18.4 0.86 d (6.5)
7	25.5	22	30.4
8	47.1	23	37.8 2.38 m, 2.49 m
9	23.8 –	24	215.5 –
10	29.8 –	25	41.1 2.62 septet (6.5)
11	27.2	26	18.6 1.09 d (6.5)
12	33.1	27	18.7 1.09 d (6.5)
13	45.6 –	28	19.4 0.86 s
14	49.1 –	29	14.7 0.98 d (6)
15	35.6		

References

1. C. Ma, N. Nakamura, B.S. Min, M. Hattori, Chem. Pharm. Bull. **49**(2), 183–187 (2001)

Argenteanol B

C₂₉H₄₈O₄, M 460



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Aglaia argentea Bl. (*Meliaceae*) [1].

Amorphous powder, $[\alpha]_D^{20} +23^\circ$ (c 1, CHCl₃).

CAS Registry Number: 186090-65-3.

FABMS m/z: 467 [M + Li]⁺.

HRFABMS m/z: 467.3753.

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	31.8 1.48 m, 1.23 m	C-16	28.9 1.84 m, 1.25 m
2	35.4 1.88 m, 1.38 m	17	54.1 1.47 m

(continued)

Table 1 (continued)

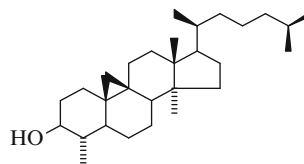
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
3	77.0 3.12 ddd (10)	18	18.4 0.95 s
4	44.7 1.08 m	19	28.0 0.09 d (3.8), 0.33 d (3.8)
5	45.3 1.13 m	20	33.0 1.66 m
6	25.7 1.64 m, 0.52 m	21	18.3 0.82 d (7)
7	26.2 0.98 m, 1.24 m	22	40.6 1.44 m, 0.85 m
8	48.3 1.53 m	23	68.5 3.68 dd (8.4, 10)
9	24.5 –	24	95.4 4.00 d (8.4)
10	30.6 –	25	143.7 –
11	27.9 1.90 m, 1.14 m	26	116.3 4.96 brs, 4.99 brs
12	34.0 1.58 m	27	18.0 1.66 s
13	46.5 –	28	19.6 0.83 s
14	50.0 –	29	14.8 0.91 d (6)
15	36.3 1.23 m		

References

1. K. Mohamad, M.-T. Martin, E. Leroy, C. Tempete, T. Sevenet, K. Awang, M. Pais, J. Nat. Prod. **60**(2), 81–85 (1997)

31-Norcycloartanol

C₂₉H₅₀O, M 414



Taxonomy: 4-Monomethylcycloartane Triterpenoids

Polypodium vulgare L. (*Polypodiaceae*) [1].

Mp 128–132°C, $[\alpha]_D +49^\circ$ (CHCl₃).

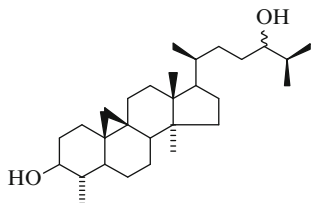
CAS Registry Number: 17320-15-9.

References

1. G. Berti, F. Bottari, A. Marsili, Z. Morelli, M. Polvani, A. Mandelbaum, Tetrahedron Lett. **2**, 125–130 (1967)

4 α ,14-Dimethyl-9,19-cyclocholestan-3 β ,24 ξ -diol

C₂₉H₅₀O₂, M 430



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Pollen grains of *Ambrosia elatior* Linne. (*Asteraceae*) [1].

Mp 144–148°C (from EtOH), $[\alpha]_D^{20} +11.7^\circ$ (c 0.70, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3260, 3040, 2960, 2860, 1456, 1373, 1110, 1095, 1048, 1018, 996.

MS m/z (%): M⁺ 430 (100), 415 (17), 412 (82), 403 (7), 357 (5), 304 (38), 301 (26), 283 (24), 175 (16), 171 (4), 134 (16), 69 (37), 55 (36), 43 (59).

¹H NMR (CDCl₃, δ): 0.13 and 0.40 (2H-19, d, J = 4 Hz), 0.87 (CH₃, d, J = 6 Hz), 0.91 (CH₃, d, J = 6 Hz), 0.94 (CH₃, s), 0.98 (CH₃, s), 1.25 (2 \times CH₃, d, J = 6 Hz), 3.26 (2H, m W_{1/2} = 23 Hz).

Table 1

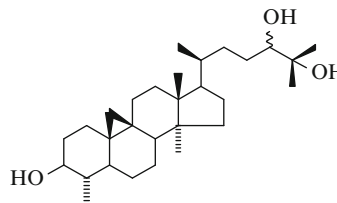
δ_C (CDCl ₃)									
C-1	30.9	C-7	28.1	C-13	45.4	C-19	27.3	C-25	32.9
2	34.9	8	46.9	14	49.0	20	36.4	26	16.7
3	76.6	9	23.5	15	32.5	21	18.5	27	19.1
4	44.6	10	29.6	16	27.0	22	32.9	28	19.1
5	43.4	11	25.2	17	52.2	23	31.1	29	14.4
6	24.7	12	35.4	18	17.8	24	77.5		

References

1. T. Ohmoto, K. Ikeda, T. Chiba, Chem. Pharm. Bull. **30**(8), 2780–2786 (1982)

4 α ,14-Dimethyl-9,19-cyclocholestan-3 β ,24 ξ ,25-triol

C₂₉H₅₀O₃, M 446



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Pollen grains of *Ambrosia elatior* Linne. (*Asteraceae*) [1].

Mp 104°C (from Me₂CO), $[\alpha]_D^{20} +23.4^\circ$ (c 0.20, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2920, 2860, 1460, 1370, 1150, 1100, 1040, 1000.

MS m/z (%): M⁺ 446 (20), 431 (7), 429 (22), 428 (65), 413 (31), 410 (5), 395 (19), 373 (3), 302 (29), 301 (24), 283 (20), 175 (56), 172 (30), 117 (11), 109 (67), 99 (7), 85 (12), 81 (69), 67 (36), 59 (100), 41 (39).

¹H NMR (CDCl₃, δ): 0.13 and 0.39 (2H-19, d, J = 4 Hz), 0.86 (CH₃, d, J = 6 Hz), 0.88 (CH₃, s), 0.94 (CH₃, d, J = 6 Hz), 0.96 (CH₃, s), 1.16 (CH₃, s), 1.21 (CH₃, s), 3.22 (2H, m, W_{1/2} = 17.5 Hz).

δ_C (CDCl₃)

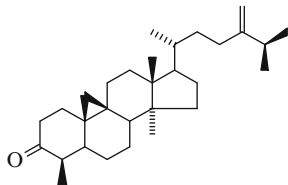
C-1	30.8	C-7	28.1	C-13	45.4	C-19	27.2	C-25	73.1
2	34.9	8	46.9	14	48.9	20	36.4	26	23.3
3	76.5	9	23.5	15	32.9	21	18.5	27	26.5
4	41.6	10	29.4	16	27.0	22	33.6	28	19.1
5	43.4	11	25.1	17	52.3	23	28.8	29	14.4
6	24.7	12	35.4	18	17.9	24	79.6		

References

1. T. Ohmoto, K. Ikeda, T. Chiba, Chem. Pharm. Bull. **30**(8), 2780–2786 (1982)

4-Epicycloeucalenone

C₃₀H₄₈O, M 424



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Musa sapientum L. (*Musaaceae*) [1].

Mp 130–131°C.

CAS Registry Number: 190206-62-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3080, 1720, 1640, 887.

MS m/z (%): M⁺ 424 (11), 409 (4), 381 (5), 340 (5), 327 (5), 326 (5), 325 (3), 300 (7), 299 (13), 297 (3), 257 (3), 245 (3), 243 (2), 231 (3), 229 (3), 219 (5), 55 (100).

HRMS m/z: M⁺ 424.3700 (C₃₀H₄₈O), 381.3138

(C₁₇H₂₃O), 300.2710 (C₂₂H₃₆), 299.2357

(C₂₁H₃₁O), 257.1966 (C₁₈H₂₅O), 243.1798

(C₁₇H₂₃O).

Table 1

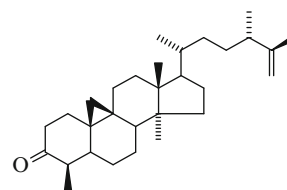
	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)		δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	33.1	1.86 (α), 1.54 (β)	C-16	28.1	1.95 (α), 1.32 (β)
2	37.4	2.28 (α), 2.65 (β)	17	52.3	1.63
3	216.4	–	18	18.1	1.00 s
4	51.7	2.44	19	29.4	0.57 d (4.4), 0.78 d (4)
5	42.6	2.04	20	36.1	1.41
6	25.7	1.37 (α), 1.18 (β)	21	18.3	0.91 d (6.2)
7	25.2	1.13 (α), 1.30 (β)	22	35.0	1.17, 1.57
8	48.2	1.62	23	31.3	1.91, 2.11
9	20.1	–	24	156.9	–
10	24.8	–	25	23.8	2.24 sept. (6.9)
11	26.7	2.06 (α), 1.16 (β)	26	21.9	1.03 d (6.6)
12	32.8	1.66 (2H)	27	22.0	1.03 d (6.6)
13	45.4	–	28	19.3	0.92 s
14	48.8	–	30	12.9	1.14 d (7.3)
15	35.6	1.33 (2H)	31	106.0	4.67 brd (1.1), 4.72 brs

References

1. T. Akihisa, Y. Kimura, W.C.M.C. Kokke, S. Takase, K. Yasukawa, A. Jin-Nai, T. Tamura, *Chem. Pharm. Bull.* **45**(4), 744–746 (1997)

4-Epicyclomusalenone

C₃₀H₄₈O, M 424



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Musa sapientum L. (*Musaceae*) [1].

Mp 125–127°C.

CAS Registry Number: 2315-18-6.

MS m/z (%): M⁺ 424 (23), 409 (7), 381 (2), 354 (2), 341 (3), 328 (4), 326 (5), 300 (14), 299 (28), 297 (4), 285 (3), 273 (3), 257 (3), 245 (4), 243 (3), 231 (3), 219 (6), 55 (100).

HRMS m/z: M⁺ 424.3681 (C₃₀H₄₈O), 409.3469

(C₂₉H₄₅O), 381.3129 (C₂₇H₄₁O), 354.2930

(C₂₅H₃₈O), 341.2813 (C₂₇H₃₇O), 300.2683

(C₂₂H₃₆O), 299.2345 (C₂₁H₃₁O), 257.1972

(C₁₈H₂₅O), 243.1782 (C₁₇H₂₃O)

Table 1

	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)		δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	33.1	1.86 (α), 1.55 (β)	C-16	28.0	1.90 (α), 1.31 (β)
2	37.4	2.26 (α), 2.65 (β)	17	52.2	1.57
3	216.4	–	18	18.0	0.99 s
4	51.7	2.43	19	29.4	0.56 d (4.4), 0.77 d (4)
5	42.6	2.04	20	36.0	1.35
6	25.8	1.36 (α), 1.18 (β)	21	18.3	0.87 d (6.2)
7	25.1	1.11 (α), 1.30 (β)	22	33.9	0.94, 1.33

(continued)

Table 1 (continued)

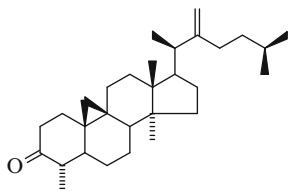
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
8	48.2	23	31.5
9	20.1	24	41.6
10	24.8	25	150.2
11	26.7	26	18.6
12	32.7	27	109.4
13	45.3	28	19.3
14	48.8	30	12.9
15	35.6	31	20.2

References

1. T. Akihisa, Y. Kimura, W.C.M.C. Kokke, S. Takase, K. Yasukawa, A. Jin-Nai, T. Tamura, *Chem. Pharm. Bull.* **45**(4), 744–746 (1997)

30-Norpterospemone

C₃₀H₄₈O, M 424



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Pterospermum heyneanum Wall. (*Sterculiaceae*) [1].

Mp 68–69°C (from MeOH), $[\alpha]_D^{+35}$ (CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 1715.

MS m/z (%): M⁺ 424 (62), 300 (27), 299 (53), 175 (50).

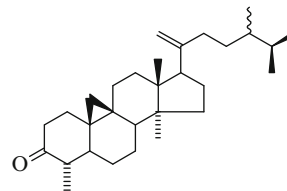
¹H NMR (90 MHz, CDCl₃, δ , 0-TMS): 0.33 and 0.58 (2H-19, d, J = 5 Hz), 0.88, 0.96, 1.02 (6 × CH₃, s), 4.60 (2H-31, d, J = 7 Hz).

References

1. A.S.R. Anjaneyulu, S. Nookaraju, *Phytochemistry* **26**(10), 2805–2810 (1987)

4 α ,14 α ,24 ξ -Trimethyl-9,19-cyclocholestan-20-en-3-one

C₃₀H₄₈O, M 424



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Musa paradisiaca L. (*Musaceae*) [1].

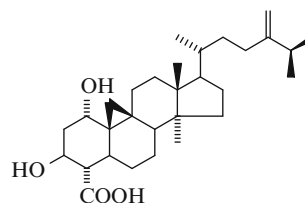
Mp 138–139°C (from Me₂CO), $[\alpha]_D^{30}$ +51.2°

References

1. N. Banerji, A.K. Sen, A.K. Das, *Indian J. Chem.* **21** B(4), 387–388 (1982)

Norquadrangularic Acid B

C₃₀H₄₈O₄, M 472



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Combretum quadrangulare Kurz (*Combretaceae*) [1].
Colorless amorphous solid, $[\alpha]_D^{25}$ +77.7° (c 0.15, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1710, 1460, 1030, 880.

HRFABMS m/z : 495.3401 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	71.8	C-16	28.3
2	42.8	17	52.4

(continued)

Table 1 (continued)

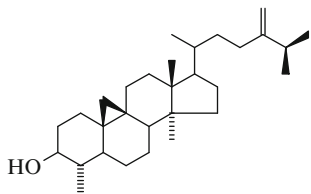
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
3	68.7	5.28 td (11, 4.5)	18	18.0	1.03 s
4	60.2	2.86 t (11)	19	26.5	0.30 d (4.5), 0.67 d (4.5)
5	34.2	3.21 td (11.5, 4.5)	20	36.4	
6	25.7		21	18.6	0.94 d (7)
7	25.0		22	35.3	
8	46.9		23	31.6	2.20 m
9	24.5	–	24	156.7	–
10	33.3	–	25	34.1	2.28 m
11	26.5	2.59 ddd (15, 8, 5)	26	22.1	1.07 d (7)
12	33.1		27	22.0	1.06 d (7)
13	45.6	–	28	19.2	1.00 s
14	49.2	–	29	177.5	
15	35.6		31	106.7	4.87 brs, 4.85 brs

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

Cycloeucalenol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Eucalyptus microcorys (*Myrtaceae*) [1–3].
Mp 138–139°C (from EtOAc), $[\alpha]_D +45^\circ$ (c 2.9).
CAS Registry Number: 469-39-6.

Table 1

δ_C (CDCl ₃) [3]									
C-1	30.7	C-7	28.0	C-13	45.2	C-19	26.9	C-25	33.7
2	34.8	8	46.7	14	48.7	20	36.0	26	21.8
3	76.3	9	23.5	15	32.8	21	18.3 ^a	27	21.8

(continued)

Table 1 (continued)

δ_C (CDCl ₃) [3]									
4	44.5	10	29.5	16	26.9	22	35.0	28	19.1 ^a
5	43.2	11	25.1	17	52.0	23	31.3	29	14.4
6	24.6	12	35.2	18	17.7 ^a	24	156.2	30	–
								31	105.6

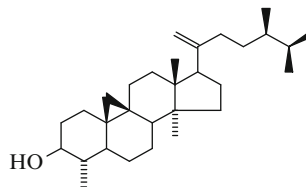
^aAssignments may be interchangeable

References

1. J.S.G. Cox, F.E. King, T.J. King, *J. Chem. Soc.* 1384–1392 (1956)
2. J.S.G. Cox, F.E. King, T.J. King, *J. Chem. Soc.* 514–518 (1959)
3. F. Khuong-Huu, M. Sangare, V.M. Chari, A. Bekaert, M. Devys, M. Barbier, G. Lucacs, *Tetrahedron Lett.*, **16**(22 + 23), 1787–1790 (1975)

Cycloephordenol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Euphorbia tirucalli L. (*Euphorbiaceae*) [1].

Mp 105–106°C (from MeOH), $[\alpha]_D +39^\circ$ (c 0.127, CHCl₃).

CAS Registry Number: 117193-18-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 3045, 1640, 892.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 205.

MS m/z: M⁺ 426, 411, 408, 393, 353, 301, 300, 285, 283, 175.

¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.13 and 0.43 (2H-19, d, J = 4 Hz), 1.03 (CH₃-26 and CH₃-27, d, J = 6.2 Hz), 1.02 (CH₃-29, d, J = 6.6 Hz), 0.97 (CH₃-18, s), 0.93 (CH₃-31, d, J = 6.4 Hz), 0.89 (CH₃-28, s), 3.2 (H-3, td, J = 8.9, 3.9 Hz), 4.6 and 4.7 (2H-21, brs).

Table 1

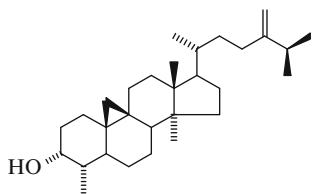
δ_C (CDCl ₃)		δ_H (J/Hz)	
C-1	30.8	C-7	28.12
2	34.8	8	46.8
3	76.2	9	28.71
4	44.5	10	29.62
5	43.4	11	25.11
6	24.69	12	35.32

References

1. A.Q. Khan, T. Rasheed, S.N.H. Kazki, Z. Ahmed, A. Malik, *Phytochemistry* **27**(7), 2279–2281 (1988)

3-Epicycloeucaenol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Mysa sapientum L. (*Musaceae*) [1].

Mp 99–101°C.

IR ν_{\max}^{KBr} , cm⁻¹: 3428, 3079, 3032, 1641, 887.

MS m/z (%): M⁺ 426 (13), 411 (18), 408 (39), 393 (29), 383 (2), 353 (3), 343 (2), 342 (2), 327 (2), 325 (2), 309 (2), 301 (10), 300 (16), 285 (5), 283 (6), 273 (3), 269 (3), 259 (2), 257 (3), 245 (6), 243 (2), 241 (4), 227 (4), 55 (100).

HRMS m/z: M⁺ 426.3882 (C₃₀H₅₀O), 408.3742 (C₃₀H₄₈), 393.3486 (C₂₉H₄₅O), 342.2949 (C₂₄H₃₈O), 301.2697 (C₂₁H₃₃O), 300.2781 (C₂₂H₃₆), 259.2196 (C₁₈H₂₇O), 245.2038 (C₁₇H₂₅O).

Table 1

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)	
C-1	26.8	1.06, 1.84	C-16	28.2
2	33.0	1.67, 1.80	17	52.2
3	72.3	3.83 brs (W _{1/2} = 9 Hz)	18	17.8
4	41.0	1.42	19	26.2

(continued)

Table 1 (continued)

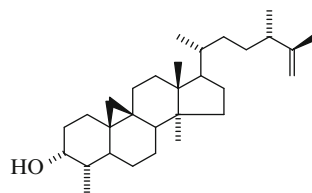
δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)	
5	37.9	1.66	20	36.2
6	24.5	0.55 dq (2.9, 12.5), 1.55	21	18.3
7	24.8	1.10, 1.28	22	35.0
8	46.9	1.60	23	31.3
9	23.2	–	24	157.0
10	30.2	–	25	33.8
11	26.9	1.22, 1.98	26	21.9
12	32.9	1.63 (2H)	27	22.0
13	45.3	–	28	19.1
14	49.0	–	29	15.5
15	35.3	1.30 (2H)	31	105.9

References

1. T. Akihisa, Y. Kimura, T. Tamura, *Phytochemistry* **47**(6), 1107–1110 (1998)

3-Epicyclomusalenol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Musa sapientum L. (*Musaceae*) [1].

Mp 121–122°C.

CAS Registry Number: 207850-20-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3445, 3069, 3033, 1645, 886.

MS m/z (%): M⁺ 426 (25), 411 (37), 408 (5), 393 (4), 356 (2), 328 (2), 301 (15), 300 (22), 285 (7), 283 (8), 259 (3), 245 (6), 233 (4), 227 (3), 215 (6), 201 (10), 55 (100).

HREIMS m/z: M⁺ 426.3864 (C₃₀H₅₀O), 408.3717 (C₃₀H₄₈), 356.3044 (C₂₅H₄₀O), 301.2639 (C₂₁H₃₃O), 300.2758 (C₂₂H₃₆), 259.2194 (C₁₈H₂₇O), 245.2052 (C₁₇H₂₅O).

Table 1

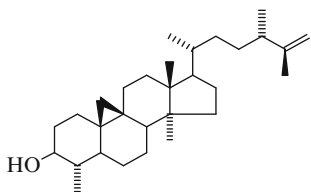
	δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
C-1	26.8	1.06, 1.83	C-16	28.0 1.27, 1.89
2	33.0	1.68, 1.84	17	52.2 1.58
3	72.3	3.83 brs ($W_{1/2} = 9$ Hz)	18	17.7 0.96 s
4	41.0	1.44	19	26.2 0.10 d (3.7), 0.37 d (3.7)
5	37.9	1.66	20	36.1 1.36
6	24.5	0.55dq (2.9, 12.5), 1.56	21	18.4 0.86 d (6.6)
7	24.8	1.10, 1.30	22	33.9 0.96, 1.34
8	46.9	1.61	23	31.5 1.17, 1.41
9	23.2	–	24	41.6 2.09
10	30.2	–	25	150.3 –
11	26.9	1.20, 1.97	26	18.6 1.64 t (1.4)
12	32.9	1.62 (2H)	27	109.7 4.67 t (1.4)
13	45.3	–	28	19.1 0.89 s
14	49.0	–	29	0.94 d (7.1)
15	35.3	1.29 (2H)	30	– –
			31	20.2 1.00 d (6.9)

References

1. T. Akihisa, Y. Kimura, T. Tamura, *Phytochemistry* **47**(6), 1107–1110 (1998)

Norcycloartane 2

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Azolla filiculoides Lamarck (*Azollaceae*) [1].

¹H NMR (270 MHz, CDCl₃, δ , 0-TMS): 0.13 and 0.38 (2H-19, d, J = 4.2 Hz), 0.86 (CH₃-21, d, J = 6.3 Hz), 0.88 (CH₃-28, s), 0.96 (CH₃-18, s), 0.97 (CH₃-29, d, J = 6.5 Hz), 0.99 (CH₃-31, d, J =

7 Hz), 1.64 (CH₃-27, s), 3.12 (H-3, m), 4.66 and 4.67 (2H-26, s).

Table 1

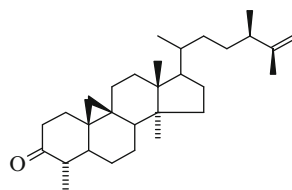
	δ_C (CDCl ₃)									
C-1	32.04	C-7	27.49	C-13	45.54	C-19	28.69	C-25	150.30	
2	33.74	8	49.16	14	48.95	20	36.07	26	109.37	
3	77.09	9	19.38	15	33.06	21	18.36	27	18.69	
4	39.51	10	25.01	16	26.66	22	34.00	28	19.35	
5	43.59	11	26.09	17	52.49	23	31.61	29	14.71	
6	24.41	12	35.73	18	18.05	24	41.69	31	20.16	

References

1. M.D. Greca, P. Monaco, M. Onorato, L. Previtera, *Gazz. Chim. Ital.* **119**, 553–556 (1989)

31-Norcyclolaudenone

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Musa sapientum L. (*Musaceae*) [1].

Synthetic [2].

Mp 130–132°C (from Me₂CO), [α]_D +49.0°

CAS Registry Number: 30452-60-9.

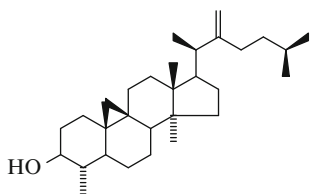
MS m/z: M⁺ 424, 409, 381, 354, 341, 328, 299.

References

1. F.F. Knapp, H.J. Nicholas, *Steroids* **16**(3), 329–351 (1970)
2. G. Berti, F. Bottari, B. Macchia, A. Marsili, G. Ourisson, H. Piotrowska, *Bull. Soc. Chim. Fr.* 2359–2360 (1964)

30-Norcyclopterospermol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Pterospermum heyneanum Wall. (*Sterculiaceae*) [1].

Mp 144–145°C (from MeOH), [α]_D +62° (CHCl₃).

CAS Registry Number: 112606-08-3.

MS m/z (%): M⁺ 426 (9), 301 (9), 300 (15), 175 (21).

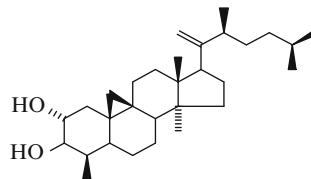
¹H NMR (90 MHz, CDCl₃, δ, 0-TMS): 0.34 and 0.61 (2H-19, d, J = 5 Hz), 0.88, 0.96, 1.03 (6 × CH₃, s), 3.12 (H-3, m), 4.63 (2H-31, d, J = 5 Hz).

References

1. A.S.R. Anjaneyulu, S. Nookaraju, *Phytochemistry* **26**(10), 2805–2810 (1987)

31-Nor-20-methylene-22-methyl-9,19-cycloartane-2α,3β-diol

C₃₀H₅₀O₂, M 442



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Swietenia mahagoni Linn. (*Meliaceae*) [1].

Mp 123°C (from MeOH), [α]_D -19.5°.

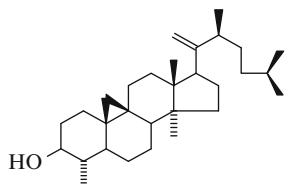
IR ν_{max}^{KBr}, cm⁻¹: 3300, 3040, 890.

References

1. Y.L.N. Murthy, M.A. Jairaj, A.S.S. Srinivas, *Indian J. Chem.* **30 B**(5), 462–465 (1991)

31-Norcycloswietenol

C₃₀H₅₀O, M 426



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Swietenia mahagoni Linn. (*Meliaceae*) [1].

Mp 131–133°C (from CHCl₃-MeOH, 1:1), [α]_D +89.5° (c 1.0, CHCl₃).

CAS Registry Number: 75222-78-5.

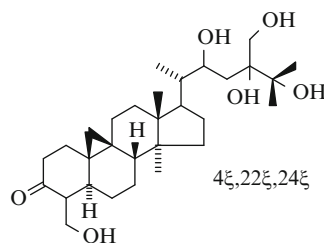
IR ν_{max}^{KBr}, cm⁻¹: 3300 (OH), 3040 (cyclopropane ring) and 890 (=CH₂).

References

1. A.S.R. Anjaneyulu, V. Lakshminarayana, Y.L.N. Murthy, L. Ramachandra Row, *Indian J. Chem.* **17B**, 423–426 (1979)

Cymbidosone

C₃₀H₅₀O₆, M 506



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Cymbidium giganteum (*Orchidaceae*) [1].

Mp 226–229°C (from EtOH), [α]_D²² +28° (C₅H₅N).

CAS Registry Number: 70237-87-5.

IR ν_{max}^{KBr}, cm⁻¹: 3620–3100, 3055, 1695.

MS m/z (%): M⁺ 506 (0.2), 488 (1), 470 (3), 457 (2), 452 (2), 439 (3), 411 (2), 370 (2), 335 (3), 344 (5), 326 (3), 315 (5), 297 (6), 201 (7), 187 (8), 175 (14), 173 (13), 161 (13), 159 (13), 149 (13), 145 (100),

127 (27), 101 (43), 95 (32), 81 (28), 73 (28), 59 (33), 55 (28), 45 (53).

^1H NMR ($\text{CDCl}_3 + \text{D}_2\text{O}$, δ): 0.43 (1H, d, $J = 4$ Hz), 0.63 (1H, d, $J = 4$ Hz), 0.90 (3H, s), 0.92 (3H, d, $J = 6$ Hz), 1.04 (3H, s), 1.23 (3H, s), 1.26 (3H, s), 3.65 and 3.76 (AB pattern, 2H, $J = 12$ Hz), 3.69 and 3.87 (AB part of an ABX system, 2H, $J_{\text{AB}} = 12$ Hz, $J_{\text{AX}} = 3$ Hz $J_{\text{BX}} = 6$ Hz), 4.13 (1H, d, further coupled, $J = 10$ Hz).

Table 1

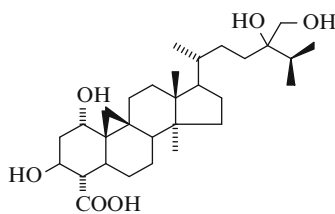
δ_{C} (CDCl_3)									
C-1	32.1	C-7	27.2	C-13	45.9	C-19	26.8	C-25	75.3
2	41.3	8	47.4	14	48.6	20	43.9	26	26.1
3	212.0	9	24.8	15	33.0	21	12.6	27	26.1
4	57.7	10	28.8	16	27.7	22	69.4	28	66.1
5	40.5	11	25.8	17	49.6	23	34.2	29	19.5
6	25.3	12	35.8	18	18.2	24	77.5	30	57.5

References

1. J. Dahmen, K. Leander, *Phytochemistry* **17**, 1975–1978 (1978)

Norquadrangularic Acid C

$\text{C}_{30}\text{H}_{50}\text{O}_6$, M 506



Taxonomy: 4-Monomethylcycloartane Triterpenoids *Combretum quadrangulare* Kurz (*Combretaceae*) [1]. Colorless amorphous solid, $[\alpha]_{\text{D}}^{25} +116.9^\circ$ (c 0.04, MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3400, 1710, 1470, 1380.

HRFABMS m/z : 529.3497 $[\text{M} + \text{Na}]^+$.

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	71.1	C-16	28.3
2	42.8	17	52.5
	(13.5, 4.5, 3.5)		

(continued)

Table 1 (continued)

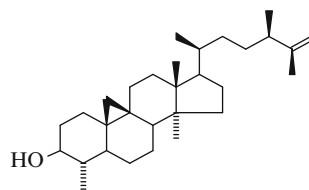
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
3	68.7	18	17.9
4	60.2	19	26.5
	5.27 td (11, 4.5)		1.10 s
	2.85 t (11)		0.29 d (4.5), 0.66 d (4.5)
5	34.1	20	37.2
	3.19 td (11.5, 4.5)		
6	25.7	21	19.2
7	25.0	22	29.9
8	47.0	23	31.9
9	24.5	24	75.7
10	33.3	25	33.1
11	26.5	26	17.7
	2.57 ddd (15, 8, 5)		1.21 d (7)
12	33.2	27	17.7
13	45.5	28	18.7
14	49.2	29	177.5
15	35.6	31	66.1
			4.03 d (10.5), 3.92 d (10.5)

References

1. A.H. Banskota, Y. Tezuka, K.Q. Tran, K. Tanaka, I. Saiki, S. Kadota, *Chem. Pharm. Bull.* **48**(4), 496–504 (2000)

31-Norcyclolaudenol

$\text{C}_{30}\text{H}_{52}\text{O}$, M 428



Taxonomy: 4-Monomethylcycloartane Triterpenoids *Polypodium vulgare* L. (*Polypodiaceae*) [1].

Synthetic [2].

Mp 139–140°C, $[\alpha]_{\text{D}} +44.0^\circ$ [2].

Mp 135–139°C, $[\alpha]_{\text{D}} +40.8^\circ$ [1].

CAS Registry Number: 2464-44-0.

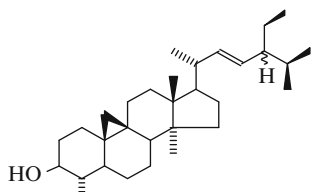
MS m/z : M^+ 426, 411, 408, 393, 353, 300, 283 [2].

References

1. G. Berti, F. Bottari, B. Macchia, A. Marsili, G. Ourisson, H. Piotrowska. *Bull. Soc. Chim. Fr.* 2359–2360 (1964)
2. F.F. Knapp, H.J. Nicholas, *Steroids* **16**(3), 329–351 (1970)

Cyclonervilol

C₃₁H₅₂O, M 440



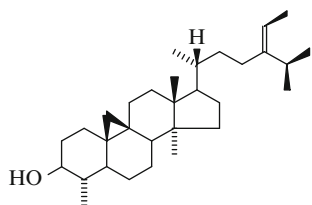
Taxonomy: 4-Monomethylcycloartane Triterpenoids
Nervilia purpurea Schlechter (*Orchidaceae*) [1].
Mp 166–169°C, [α]_D +37.9° (CHCl₃).
CAS Registry Number: 78330-50-4.

References

1. T. Kikuchi, S. Kadota, H. Suchara, T. Namba, *Tetrahedron Lett.* **22**, 465–468 (1981)

Cyclofuntumienol

C₃₁H₅₂O, M 440



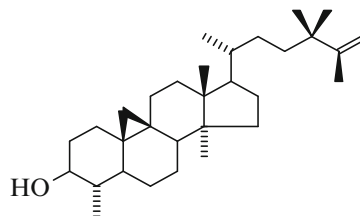
Taxonomy: 4-Monomethylcycloartane Triterpenoids
9,19-Cyclostigmast-24(28)-en-3-ol,4,14-dimethyl-,
(3β, 4α, 5α, 24Z)
Funtimia elastica (*Apocynaceae*) [1].
Mp 143–145°C (from CH₃OH), [α]_D +50° (c 0.44).
CAS Registry Number: 50906-50-8.

References

1. L. Mukam, G. Charles, J. Hentchoya, T. Njimi, G. Ourisson, *Tetrahedron Lett.* **29**, 2779–2782 (1973)

Cyclopholidonol

C₃₁H₅₂O, M 440



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Pholidota chinensis Lindl (*Orchidaceae*) [1].
Mp 174–176°C (from EtOAc), [α]_D¹⁶ +41.1° (c 0.15, CHCl₃).
CAS Registry Number: 103425-39-4.

IR ν_{max}^{KBr}, cm⁻¹: 3400, 3040, 1634, 888, 1378, 1370.

EIMS m/z (%): M⁺ 440 (8), 425 (12), 422 (22), 407 (21), 367 (2), 314 (8), 301 (7), 283 (6), 189 (9), 175(20), 161 (16), 133 (22), 107 (36), 83 (68), 55 (100).

¹H NMR (CDCl₃, δ, 0-TMS): 0.14 and 0.40 (2H-19, d, J = 4 Hz), 0.87 (CH₃-21 d, J = 6 Hz), 0.89, 0.96, 1.02, 1.02, 1.70 (5 × CH₃, s), 1.05 (CH₃-29, d, J = 6 Hz), 3.22 (H-3, m, W_{1/2} ~25 Hz), 4.70 and 4.74 (2H-26, brs).

Table 1

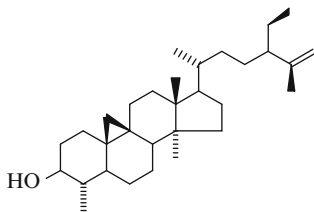
δ _C (CDCl ₃)									
C-1	30.8	C-7	28.1	C-13	45.3	C-19	27.0	C-25	152.3
2	34.8	8	46.8	14	48.9	20	36.6	26	109.3
3	76.6	9	23.6	15	32.8	21	18.5	27	19.4
4	44.6	10	29.7	16	27.2	22	30.8	28	19.2
5	43.4	11	25.1	17	52.1	23	37.4	29	14.4
6	24.7	12	35.4	18	17.7	24	38.7	31	27.2
								32	27.5

References

1. W. Lin, W. Chen, Z. Xue, X. Liang, *Planta Med.* **1**, 4–6 (1986)

Cyclotrichosantol

C₃₁H₅₂O, M 440



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Trichosantes palmata L. (*Cucurbitaceae*) [1].

Mp 143–144°C (from EtOH), [α]_D +42°.

CAS Registry Number: 41507-26-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1640, 1040, 885.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 195 (3.85).

MS m/z (%): M⁺ 440 (55), 425 (74), 422 (100), 407 (75), 367 (17), 314 (45), 301 (32).

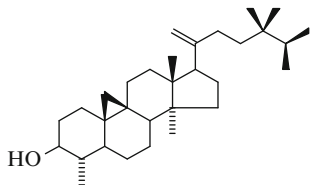
¹H NMR (CDCl₃, δ): 0.1–0.4 (2H-19, d, J = 4 Hz), 0.88 (CH₃, d, J = 6 Hz), 0.92 (CH₃, s), 1.01 (CH₃, s), 3.23 (1H, brs), 4.71 (1H, bs), 4.78 (1H, bs).

References

1. M. Kocor, St J. Pyrek, J. Org. Chem. **38**(21), 3688–3690 (1973)

4 β -Desmethyl-24,24-dimethyl-9,19-cyclolanost-20(21)-en-3 β -ol

C₃₁H₅₂O, M 440



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Polypodium juglandifolium H.B. Willd.

(*Polypodiaceae*) [1].

Mp 142–144°C (from CHCl₃-MeOH), [α]_D +35.7° (c 0.84, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 1370, 1163, 885.

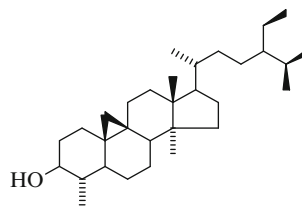
MS m/z (%): M⁺ 440 (17), 367 (11), 314 (19), 301 (M-side chain, 37) and 55 (100).

References

1. R. Sunder, S. Rangaswami, Indian J. Chem. **15** B(6), 541–543 (1977)

Norcycloartane 3

C₃₁H₅₄O, M 442



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Azolla filiculoides Lamarck (*Azollaceae*) [1].

¹H NMR (270 MHz, CDCl₃, δ , 0-TMS): 0.14 and 0.37 (2H-19, d, J = 4.3 Hz), 0.81 (CH₃-26, d, J = 7.7 Hz), 0.83 (CH₃-27, d, J = 7.2 Hz), 0.84 (CH₃-32, t, J = 7.5 Hz), 0.88 (CH₃-28, s), 0.90 (CH₃-11, d, J = 6.4 Hz), 0.95 (CH₃-29, d, J = 6.4 Hz), 0.96 (CH₃-18, s), 3.11 (H-3, m).

Table 1

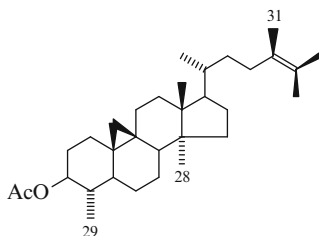
δ_{C} (CDCl ₃)									
C-1	32.04	C-7	27.46	C-13	45.57	C-19	28.70	C-25	29.18
2	33.75	8	49.15	14	48.93	20	36.17	26	19.84
3	77.11	9	19.35	15	33.02	21	18.82	27	19.07
4	39.49	10	25.04	16	26.68	22	33.95	28	19.35
5	43.61	11	26.13	17	52.51	23	26.13	29	14.67
6	24.43	12	35.75	18	18.07	24	45.85	31	23.09
								32	12.32

References

1. M.D. Greca, P. Monaco, M. Onorato, L. Previtera, Gazz. Chim. Ital. **119**, 553–556 (1989)

4 α ,14 α ,24-Trimethyl-9 β ,19-cyclo-5 α -cholest-24-en-3 β -yl Acetate

C₃₂H₅₂O₂, M 468



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Brassica napus L. (*Cruciferae*) [1].

Mp 159–160°C (from Me₂CO-MeOH).

IR ν_{\max} , cm⁻¹: 3040, 1020, 1732, 1240.

MS m/z (%): M⁺ 468 (19), 453 (7), 408 (100), 393 (59), 384 (2), 369 (1), 353 (7), 341 (2), 309 (5), 301(2), 287 (1), 285 (5), 227 (3).

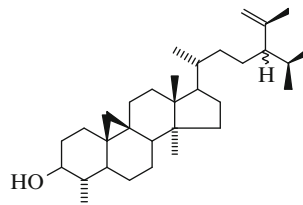
¹H NMR (CDCl₃, δ): 0.17 and 0.42 (2H-19, d, J = 4.4 Hz), 0.86 (CH₃-29, d, J = 7 Hz), 0.89 (CH₃-28, s), 0.91 (CH₃-21, d, J = 7 Hz), 0.97 (CH₃-18, c), 1.63 (CH₃-26, CH₃-27, CH₃-31, s), 4.52 (H-3, m, W_{1/2} = 25 Hz).

References

1. T. Itoh, K. Uchikawa, T. Tamura, T. Matsumoto, Phytochemistry **16**(9), 1448–1450 (1977)

Cyclohomonervilol

C₃₂H₅₄O, M 454



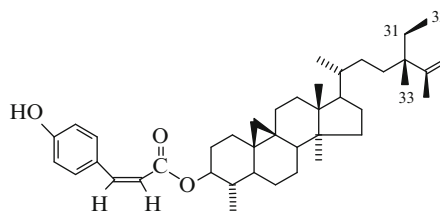
Taxonomy: 4-Monomethylcycloartane Triterpenoids
Nervilia purpurea Schlechter (*Orchidaceae*) [1].
Mp 166–167°C, [α]_D +40.5° (CHCl₃).
CAS Registry Number: 78330-51-5.

References

1. T. Kikuchi, S. Kadota, H. Suehara, T. Namba, Tetrahedron Lett. **22**, 465–468 (1981)

Uniflorin

C₄₁H₆₀O₃, M 600



Taxonomy: 4-Monomethylcycloartane Triterpenoids
Coelogyne uniflora (*Orchidaceae*) [1].
Mp 215°C (from petrol-EtOAc), [α]_D +3.2° (CHCl₃).

CAS Registry Number: 130281-71-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 3050, 1710, 1645, 1620, 905, 860.

UV $\lambda_{\max}^{\text{EtOH}}$, nm (log ϵ): 210 (4.01), 312 (4.22).

MS m/z (%): M^+ 600 (0.8), 437 (13), 436 (38), 422 (13), 421 (17), 407 (5), 283 (15), 190 (10), 189 (22), 188 (18), 187 (15), 177 (10), 175 (27), 174 (12), 173 (23), 164 (25), 163 (27), 161 (35), 159 (25), 151 (12), 148 (28), 147 (100), 145 (23), 135 (33), 134 (20), 133 (33), 131 (20), 123 (30), 121 (48), 120 (40), 119 (58), 109 (55), 108 (43), 107 (60), 105 (48), 97 (37), 95 (65), 93 (50), 91 (50), 83 (42), 81 (57), 79 (37), 71 (30), 69 (58), 67 (35), 57 (33), 55 (72).

$^1\text{H NMR}$ (300 MHz, CDCl_3 , δ , 0-TMS): 0.15 and 0.40 (2H-19, d, $J = 4.02$ Hz), 0.72 (CH_3 -32, t, $J = 7.4$ Hz), 1.05 (2H-31, q, $J = 7.4$ Hz), 0.85, 0.87, 0.89, 0.95, 0.96, 1.63 ($6 \times \text{CH}_3$), 4.57 (H-3, m, $W_{1/2} = 36$ Hz), 4.62 and 4.80 (2H-26, s), 5.83 and

6.85 (two olefinic protons, d, $J = 12.71$ Hz), 6.24 (phenolic OH, s), 6.76 and 7.60 (four aromatic protons, d, $J = 8.6$ Hz).

Table 1

$\delta_{\text{C}}(\text{CDCl}_3)$									
C-1	30.43	C-9	23.63	C-17	52.11	C-25	150.16	C-1'	166.66
2	30.87	10	29.34	18	17.61	26	110.96	2'	115.02
3	78.87	11	24.94	19	26.94	27	19.20	3'	143.19
4	41.50	12	35.28	20	36.57	28	19.04	1''	127.32
5	43.41	13	45.26	21	18.42	29	14.34	2'', 6''	132.15
6	24.58	14	48.81	22	30.18	31	32.11	3'', 5''	117.51
7	28.01	15	32.76	23	36.23	32	8.26	4''	156.83
8	46.75	16	26.94	24	42.00	33	22.16		

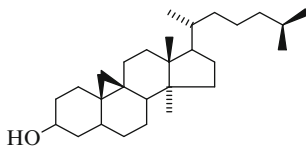
References

1. P.L. Majumder, S. Pal (Nee Roy), *Phytochemistry* **29**(8), 2717–2720 (1990)

4,4-Desmethylcycloartane Triterpenoids

Pollinastanol

C₂₈H₄₈O, M 400



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids

Pollen grains of different plants [1, 2].

Mp 95°C (from MeOH), $[\alpha]_D^{20} +35^\circ$ (CHCl₃).

CAS Registry Number: 1912-66-9.

Pollinastanol acetate [3]

Table 1

δ_C (CDCl ₃)									
C-1	31.4 ^a	C-7	27.8 ^b	C-13	45.3	C-19	25.7 ^c	C-25	28.1
2	30.4 ^a	8	46.1	14	49.0	20	36.2	26	22.9
3	73.7	9	23.5	15	32.9	21	18.5 ^d	27	22.9
4	38.5	10	29.8	16	27.1	22	36.5	28	19.0 ^d
5	37.1	11	24.6 ^c	17	52.3	23	24.2	Ac	170.0
6	28.1 ^b	12	35.2	18	17.5 ^d	24	39.6		21.5

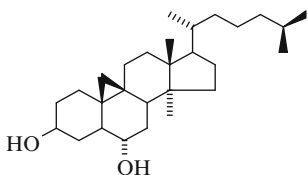
a, b, c, ^dAssignments may be interchangeable

References

1. M.F. Hugel, M. Barbier, E. Lederer. Bull. Soc. Chim. Fr 2012–2013 (1964)
2. A. Ducruix, C. Pascard-Billy, M. Devys, M. Barbier, E. Lederer. Chem. Commun. 929–930 (1973)
3. F. Khuong-Huu, M. Sangare, V.M. Chari, A. Bekaert, M. Devys, M. Barbier, G. Lucacs. Tetrahedron Lett., **16**(22 + 23), 1787–1790 (1975)

Cyclostenol

C₂₈H₄₈O₂, M 416



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids

Stenocereus thurberi (Cactaceae) [1].

Mp 222–223°C (from MeOH), $[\alpha]_D^{24} +42^\circ$ (c 3, CHCl₃).

CAS Registry Number: 84765-67-3.

Cyclostenol diacetate

MS m/z (%): M⁺ 500 (7), 440 (21), 380 (100), 365 (43), 327 (5), 267 (62), 225 (13), 199 (26), 197 (9).

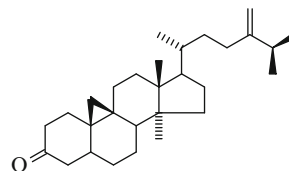
¹H NMR (CDCl₃, δ): 0.20 and 0.45 (2H-19, d), 0.87 (CH₃-26/27, d), 0.88 (CH₃-28, s), 0.90 (CH₃-21, d), 0.95 (CH₃-18, s), 2.03 (2 × OAc, s), 4.36 (H-3, m) and 4.78 (H-6, m).

References

1. H.W. Kircher, H.L. Bird Jr., Phytochemistry **21**(7), 1705–1710 (1982)

24-Methylenepollinastanone

C₂₉H₄₆O, M 410



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids

Musa sapientum L. (Musaceae) [1].

Mp 65–67°C.

CAS Registry Number: 149756-25-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3084, 3040, 1719, 1637, 885.

EIMS m/z (%): M⁺ 410 (20), 395 (7), 367 (10), 327 (9), 326 (9), 313 (7), 311 (4), 301 (2), 300 (2), 285(20), 283 (7), 273 (3), 258 (3), 243 (5), 229 (3), 219 (8), 55 (100).

HREIMS m/z: M⁺ 410.3547 (C₂₉H₄₆O), 395.3323 (C₂₈H₄₃O), 326.2571 (C₂₃H₃₄O), 300.2854 (C₂₂H₃₆), 285.2225 (C₂₀H₂₉O), 243.1788 (C₁₇H₂₃O), 229.1677 (C₁₆H₂₁O).

Table 1

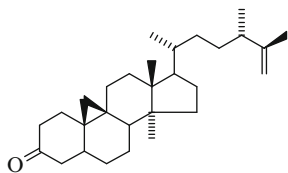
δ_c (CDCl ₃)	δ_H (J/Hz)	δ_c (CDCl ₃)	δ_H (J/Hz)		
C-1	32.1	1.61, 1.90	C-16	28.1	1.33, 1.98
2	41.3	2.39 (2H)	17	52.2	1.64
3	212.9	–	18	17.8	1.00 s
4	48.5	2.16, 2.29	19	25.9	0.35 d (4), 0.61 d (4)
5	39.8	1.95	20	36.1	1.42
6	28.4	0.82 dq (3.2, 12.4), 1.50	21	18.3	0.91 d (7.1)
7	24.9	1.18, 1.37	22	35.0	1.16, 1.58
8	46.9	1.72	23	31.3	1.88, 2.14
9	24.5	–	24	156.9	–
10	29.2	–	25	33.8	2.24 sept. (6.6)
11	27.2	1.31, 2.04	26	21.921.9	1.03 d (7)
12	32.7	1.67 (2H)	27	22.0	1.04 d (7)
13	45.4	–	28	19.1	0.92 s
14	48.9	–	29	–	–
15	35.3	1.34 (2H)	30	–	–
			31	106.0	4.67 d (1.5), 4.72 brs

References

1. T. Akihisa, Y. Kimura, T. Tamura, *Phytochemistry* **47**(6), 1107–1110 (1998)

29-Norcyclomusalenone

C₂₉H₄₆O, M 410



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids
Musa sapientum L. (*Musaceae*) [1].

CAS Registry Number: 207850-21-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3077, 3040, 1718, 1644, 896.

EIMS m/z (%): M⁺ 410 (24), 395 (9), 340 (4), 327 (3), 314 (5), 313 (5), 312 (5), 301 (3), 300 (3), 285 (34), 275 (3), 273 (3), 271 (3), 245 (5), 243 (5), 229 (7), 219 (7), 217 (6), 215 (6), 203 (7), 189 (9), 55 (100).

HREIMS m/z: M⁺ 410.3532 (C₂₉H₄₆O), 395.3342 (C₂₈H₄₃O), 340.2708 (C₂₄H₃₆O), 300.2769

(C₂₂H₃₆), 285.2214 (C₂₀H₂₉O), 243.1799

(C₁₇H₂₃O), 229.1673 (C₁₆H₂₁O).

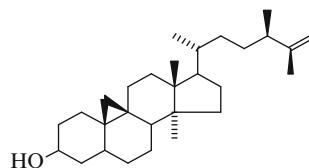
¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.34 and 0.61 (2H-19, d, J = 4 Hz), 0.87 (CH₃-21, d, J = 6.6 Hz), 0.91 (CH₃-28, s), 0.99 (CH₃-18, s), 1.00 (CH₃-31, d, J = 6.9 Hz), 1.64 (CH₃-26, brs), 2.10 (H-24, m), 4.67 (2H-27, brs).

References

1. T. Akihisa, Y. Kimura, T. Tamura, *Phytochemistry* **47**(6), 1107–1110 (1998)

14 α -Methyl-9 β ,19-cyclo-5 α -ergost-25-en-3 β -ol

C₂₉H₄₈O, M 412



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids
Chlorella sorokiniana (*Chlorococcales*) [1].

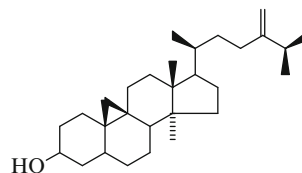
CAS Registry Number: 62305-30-0.

References

1. P.L. Chiu, G.W. Patterson, S.R. Dutky, *Phytochemistry* **15**, 1907–1910 (1976)

24-Methylenepollinastanol

C₂₉H₄₈O, M 412

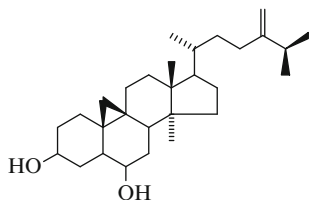


Taxonomy: 4,4-Desmethylcycloartane Triterpenoids*Musa sapientum* L. (*Musaceae*) [1].Mp 115–117°C (from MeOH–H₂O).

CAS Registry Number: 34443-88-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3250 (OH), 3040 (cyclopropane), 1640 and 892 (=CH₂).MS m/z (%): 412 (M⁺, 79), 397 (M⁺–CH₃, 84), 394 (M⁺–H₂O, 100), 379 (M⁺–CH₃–H₂O, 68), 300 (M⁺- ring A, 57), 287 (34), and 269 (M⁺-side chain-H₂O, 28).**References**

1. F.F. Knapp, D.O. Phillips, L.J. Goad, T.W. Goodwin, *Phytochemistry* **11**, 3497–3500 (1972)

Roxburghiadiol AC₂₉H₄₈O₂, M 428**Taxonomy:** 4,4-Desmethylcycloartane Triterpenoids*Aglaiia roxburghiana* Miq. (*Meliaceae*) [1].Mp 173°C (from Et₂O–hexane), [α]_D +51° (c 2, CHCl₃).

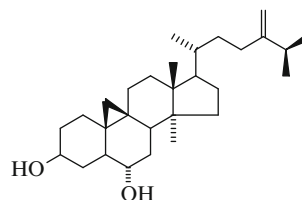
CAS Registry Number: 103629-93-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3325, 3030, 2950, 2925, 2853, 1635, 1470, 1390, 1300, 1100, 1050, 983, 970, 887.EIMS m/z (%): M⁺ 428 (2.8), 413 (2.1), 410 (7.6), 409 (20.7), 395 (6.2), 394 (13.8), 377 (6.2), 327 (6.2), 285 (6.9), 267 (6.9), 225 (6.8), 211 (6.9), 197 (10.3), 191 (17.2), 173 (22.1), 149 (20), 147 (20.7), 143 (20.7), 133 (24.1), 123 (26.2), 121 (26.2), 119 (27.6), 109 (34.5), 107 (31), 105 (35.9), 97 (38), 95 (76), 94 (55.2), 91 (47), 85 (27.6), 83 (48.3), 81 (62.1), 79 (41.4), 77 (27.6), 71 (48.3), 67 (50.3), 57 (100), 55 (96.5).¹H NMR (300 MHz, CDCl₃, δ , 0-TMS): 0.20 and 0.90 (2H-19, d, J = 3.5 Hz), 0.90 (CH₃-21, d, J = 6.6 Hz), 0.94 (CH₃-18, s), 1.04 (CH₃-28, s), 1.02and 1.03 (CH₃-26, CH₃-27, d, J = 6.8 Hz), 3.75 (H-3, m, W_{1/2} = 25 Hz), 3.90 (H-6, m, W_{1/2} = 9 Hz), 4.66 and 4.72 (2H-31, d, J = 1.5 Hz).**Table 1**

	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)	δ_{C} (CDCl ₃)	δ_{H} (J/Hz)
C-1	31.6	1.18, 1.26	C-16	28.0
2	35.5	1.28, 1.28	17	52.3
3	71.6	3.75	18	19.4
4	38.4	1.55, 1.88	19	30.2
5	41.0	1.52	20	36.0
6	69.6	3.90	21	18.3
7	32.2	1.34, 1.50	22	35.0
8	40.2	2.04	23	31.2
9	22.7	–	24	156.8
10	27.6	–	25	33.7
11	26.3	1.34, 1.92	26	21.9
12	35.1	1.38, 1.98	27	21.8
13	45.6	–	28	18.3
14	48.3	–	31	105.9
15	32.8	1.66, 1.66		4.66, 4.72

References

1. K. Balakrishna, A.B. Kundu, A. Patra, *J. Nat. Prod.* **53**(2), 523–526 (1990)

Roxburghiadiol BC₂₉H₄₈O₂, M 428**Taxonomy:** 4,4-Desmethylcycloartane Triterpenoids*Aglaiia roxburghiana* Miq. (*Meliaceae*) [1].Mp 168–170°C (from EtOH), [α]_D +56° (c 2, CHCl₃).

CAS Registry Number: 103629-94-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3250, 3030, 2950, 2900, 2850, 1630, 1470, 1375, 1280, 1115, 1050, 975, 887.EIMS m/z (%): M⁺ 428 (1.2), 413 (1.7), 410 (13.1), 395 (7.6), 377 (2.7), 285 (4), 267 (3.2), 123 (19.4), 121 (26), 119 (21.9), 109 (27.8), 107 (34.5), 105

(32.2), 95 (100), 94 (23.2), 93 (55.2), 91 (37), 83 (23.5), 81 (52.3), 79 (47.1), 77 (17.2), 69 (60.2), 67 (42.7), 57 (14.1), 55 (89).

$^1\text{H NMR}$ (300 MHz, CDCl_3 , δ , 0-TMS): 0.14 and 0.30 (2H-19, d, $J = 4$ Hz), 0.90 (CH_3 -21, d, $J = 6.6$ Hz), 0.93 (CH_3 -18, s), 0.96 (CH_3 -28, s), 1.02 and 1.03 (CH_3 -26, CH_3 -27, d, $J = 6.8$ Hz), 3.10 (H-6, m, $W = 25$ Hz), 3.70 (H-3, m, $W = 25$ Hz), 4.65 and 4.71 (2H-31, d, $J = 2$ Hz).

Table 1

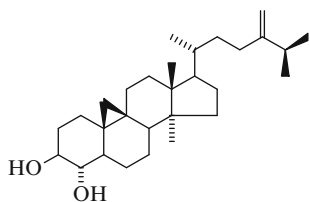
δ_{C} (CDCl_3)	δ_{H} (J/Hz)	δ_{C} (CDCl_3)	δ_{H} (J/Hz)
C-1	30.9	C-16	27.9
2	35.2	17	52.2
3	70.9	18	19.1
4	37.2	19	27.8
5	45.1	20	36.0
6	71.0	21	18.3
7	35.1	22	35.0
8	46.9	23	31.3
9	23.2	24	156.7
10	31.6	25	33.8
11	26.5	26	21.9
12	34.4	27	21.8
13	45.3	28	17.5
14	48.8	31	106.0
15	32.6		1.65, 1.65

References

1. K. Balakrishna, A.B. Kundu, A. Patra, *J. Nat. Prod.* **53**(2), 523–526 (1990)

Surianol

$\text{C}_{29}\text{H}_{48}\text{O}_2$, M 428



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids
Suriana maritima L. (*Surianaceae*) [1].

Mp 173–174.5°C (from Me_2CO), $[\alpha]_{\text{D}}^{25} +39^\circ$

CAS Registry Number: 34146-36-6.

IR $\nu_{\text{max}}^{\text{Nujol}}$, cm^{-1} : 3460, 3390, 3210, 3050, 3025, 1630, 1090, 1070, 1060, 885.

IR $\nu_{\text{max}}^{\text{CCl}_4}$ (0.005 M), cm^{-1} : 3610, 3570, 3060, 3020.

MS m/z (%): 428 $[\text{M}]^+$ (17), 413 $[\text{M}^+-15]$ (10), 410 $[\text{M}^+-18]$ (2), 395 $[\text{M}^+-18-15]$ (4), 385 $[\text{M}^+-43]$ (6), 345 $[\text{M}^+-83]$ (6), 330 $[\text{M}^+-83-15]$ (8), 303 $[\text{M}^+-125]$ (14), 300 (5), 175 $[\text{M}^+-125]$ (18), 121 (43), 109 (46), 107 (57), 95 (84), 93 (49), 81 (62), 69 (78), 67 (43), 55 (100), 44 (57), 43 (43), 41 (70).

$^1\text{H NMR}$ (CDCl_3 , δ): 0.13 and 0.47 (2H-19, d, $J = 4$ Hz), 0.90, 0.96 (3H, s), 1.03 (6H, d, $J = 6.5$ Hz), 2.80 (2H, m, lost after addition of D_2O), 3.09 (1H, t, $J = 9$ Hz), 3.43 (1H, m), 4.66 and 4.71 (2H of $>\text{C} = \text{CH}_2$).

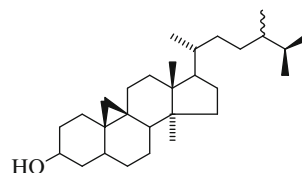
$^1\text{H NMR}$ (C_6D_6 , δ): 0.07 and 0.51 (2H-19, d, $J = 4$ Hz), 0.94 (3H, s), 1.01 (3H, s), 1.08 (6H, d, $J = 6.5$ Hz), 3.25 (1H, t, $J = 9$ Hz), 3.45–4.05 (3H, overlapping multiplets) and 4.86 (2H, bradened s).

References

1. R.E. Mitchell, T.A. Geissman, *Phytochemistry* **10**, 1559–1567 (1971)

24-Methyl pollinastanol

$\text{C}_{29}\text{H}_{50}\text{O}$, M 414



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids
Astasia longa [1].

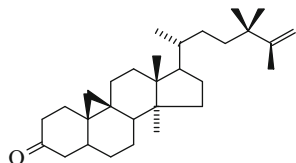
CAS Registry Number: 68736-05-0.

References

1. M. Rohmer, R.D. Brandt, *Eur. J. Biochem.* **36**(2), 446–454 (1973). C.A., 80:45447u (1974)

Cyclootochilone (Cyclopholidone)

C₃₀H₄₈O, M 424



Taxonomy: 4,4-Desmethylcycloartane Triterpenoids
Otochilus porecta and *Otochilus fusca* (*Orchidaceae*)

[1].

Pholidota chinensis Lindl (*Orchidaceae*) [2].

Mp 140°C (from CHCl₃-MeOH), [α]_D +81.4° (CHCl₃)

[1].

Mp 148–150°C (from hexane), [α]_D¹⁶ + 72.8° (CHCl₃)

[2].

CAS Registry Number: 104319-18-8.

IR ν_{max}^{KBr}, cm⁻¹: 1720, 3040, 1634, 888, 1380, 1370.

CD (c 0.044, EtOH): [θ]₃₂₅ +110.4, [θ]₂₉₂ +960.7,
[θ]₂₃₆ 0.

MS m/z (%): M⁺ 424 (19.6), 409 (6.3), 367 (2.8), 340
(7.3), 314 (6), 313 (10.8), 286 (9.1), 285 (33.5), 283

(5.5), 259 (5), 233 (6.2), 229 (6.2), 215 (8), 203
(7.4), 189 (9.2), 175 (25.3), 163 (25.9), 161 (14.6),
149 (28.6), 147 (21.1), 137 (19.1), 135 (28.2), 133
(21), 123 (29.9), 122 (25.6), 121 (40.3), 119 (25),
109 (57.1), 107 (49), 105 (25.2), 95 (73.1), 93
(41.3), 91 (28.4), 84 (30.5), 83 (76.5), 81 (58.3),
69 (60.2), 55 (100), 41 (66.8).

¹H NMR (CDCl₃, δ, 0-TMS): 0.34 and 0.62 (2H-19,
d, J = 4 Hz), 0.87 (CH₃-21, d, J = 6 Hz), 0.91,
1.00, 1.03, 1.03, 1.70 (5 × CH₃, s), 4.69 and 4.74
(2H-26, brs).

Table 1

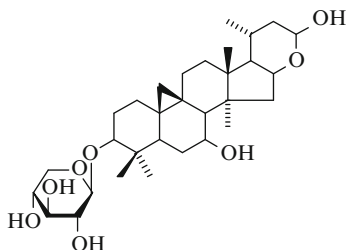
δ _C (CDCl ₃)									
C-1	32.2	C-7	28.1	C-13	45.5	C-19	26.0	C-25	152.2
2	41.3	8	47.0	14	49.0	20	36.7	26	109.2
3	211.5	9	24.6	15	32.9	21	18.7	27	19.6
4	48.6	10	29.4	16	27.4	22	30.9	28	19.3
5	39.9	11	25.0	17	52.2	23	37.5	31	27.4
6	28.5	12	35.4	18	17.9	24	38.8	32	27.7

References

1. P.L. Majumder, J. Chakraborti, *Tetrahedron* **41**(21), 4973–4978 (1985)
2. W. Lin, W. Chen, Z. Xue, X. Liang, *Planta Med.* **52**(1), 4–6 (1986)

Dasyanthoside B

C₃₁H₅₀O₈, M 550



Taxonomy: Cycloartane Glycosides

Astragalus dasyanthus Pall. (*Leguminosae*) [1].

Mp 255–260°C (from EtOH), [α]_D²⁰ –20° (c 1.0, MeOH).

References

1. R.I. Evstratova, A.A. Savina, V.I. Sheychenko, A.N. Shavlinskii, in *Abstracts of reports of All- Union scientific conference "Results and prospects of scientific researches in the field of creation of medicinal products from plant raw material,"* Moscow, 1985, pp. 64–65

HRFABMS m/z: 577.3382.

EIMS m/z: 558 [M⁺ -H₂O], 444 [M⁺ -C₅H₈O₄].

Table 1

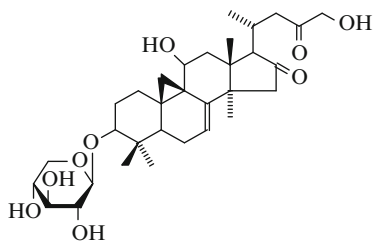
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.4	1.68, 2.78	C-18	20.1 1.20 s
2	29.7	2.05, 2.35	19	18.6 0.95 d (4), 1.94 d (4)
3	88.4	3.58 dd (11, 4)	20	27.7 2.61
4	40.7	–	21	20.3 1.02 d (6)
5	43.8	1.34 dd (13, 6)	22	44.6 2.60, 3.50
6	22.0	1.70, 1.92	23	210.8 –
7	115.4	5.13 brd (6)	24	69.2 4.48 d (18), 4.59 d (18)
8	147.2	–	28	27.7 1.17 s
9	27.5	–	29	25.9 1.40 s
10	29.3	–	30	14.5 1.14 s
11	62.9	4.50 m	β -D-Xylp	
12	47.3	2.17 dd (14, 4), 2.75	1	107.3 4.87 d (7)
13	44.4	–	2	75.4 4.03
14	46.1	–	3	78.4 4.10
15	49.7	2.27 d (18), 2.42 d (18)	4	71.1 4.18
16	218.2	–	5	67.0 3.70 dd (11,11), 4.33 dd (11, 5)
17	61.3	2.35		

References

1. M. Koeda, Y. Aoki, N. Sakurai, K. Kawai, M. Nagai, *Chem. Pharm. Bull.* **42**(10), 2205–2207 (1994)
2. N. Sakurai, M. Koeda, Y. Aoki, M. Nagai, *Chem. Pharm. Bull.* **43**(9), 1475–1482 (1995)

Cimifugoside H-3

C₃₂H₄₈O₉, M 576



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1, 2].

Mp 249–251°C (from MeOH), [α]_D –22.3° (c 0.4, CHCl₃–MeOH, 1: 1).

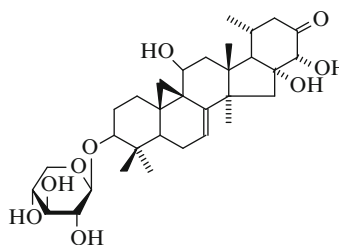
CAS Registry Number: 163046-74-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 1730, 1710, 1040.

Positive FABMS m/z: 577 [M + H]⁺.

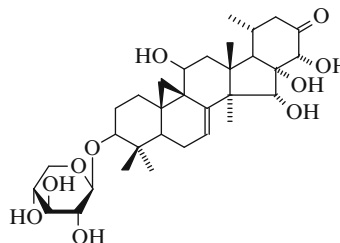
Cimifugoside H-4 (Foetidinol-3-O- β -D-xyloside)

C₃₂H₄₈O₉, M 576



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1, 2].*Cimicifuga foetida* L. (*Ranunculaceae*) [3].Mp 265–267°C (from MeOH), $[\alpha]_D -75^\circ$ (c 1.0, CHCl₃–MeOH, 1:1).

CAS Registry Number: 161097-79-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3350, 1720, 1040.ORD (c 1.0, CHCl₃–MeOH, 1:1) $[\alpha]$ (λ nm): -75.0° (589), -92.4° (546), -197.4° (435), -440.3° (365).Positive ion FABMS m/z: 577 [M + H]⁺.Negative ion FABMS m/z: 575 [M-H]⁻.Positive ion HRFABMS m/z: 599.3208 [M + Na]⁺.EIMS m/z: 558 [M⁺-H₂O], 444 [M⁺-C₅H₈O₄].**Cimifugoside H-6 (15 α -Hydroxyfoetidinal-3-O- β -D-Xyloside)**C₃₂H₄₈O₁₀, M 592**Table 1**

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.5	1.80, 2.75	C-18	21.2 1.24 s
2	29.9	2.00, 2.36	19	18.8 1.01 d (4), 2.02 d (4)
3	88.5	3.56 dd (11, 4)	20	25.9 2.20 m
4	40.7	–	21	20.7 0.92 d (5)
5	44.2	1.40	22	44.9 2.40, 2.48
6	22.1	1.80, 1.90	23	211.2 –
7	113.8	5.19 brd (6)	24	82.3 4.45 s
8	149.4	–	28	28.1 1.56 s
9	27.5	–	29	26.0 1.37 s
10	29.2	–	30	14.6 1.13 s
11	63.6	4.56 m	β -D-Xylp	
12	48.9	2.05, 2.79	1	107.4 4.88 d (7)
13	46.4	–	2	75.5 3.97 m
14	50.9	–	3	78.5 4.09 t (9)
15	48.7	2.19 d (14), 2.50 d (14)	4	71.2 4.16 m
16	82.0	–	5	67.0 3.68 dd (10,10), 4.30 dd (10, 5)
17	63.6	2.20		

References

1. M. Koeda, Y. Aoki, N. Sakurai, K. Kawai, M. Nagai, Chem. Pharm. Bull. **42**(10), 2205–2207 (1994)
2. N. Sakurai, M. Koeda, Y. Aoki, M. Nagai, Chem. Pharm. Bull. **43**(9), 1475–1482 (1995)
3. S. Kadota, J.X. Li, K. Tanaka, T. Namba, Tetrahedron **51**(4), 1143–1166 (1995)

Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].*Cimicifuga foetida* L. (*Ranunculaceae*) [2].Mp 275–276°C (from MeOH), $[\alpha]_D -64.3^\circ$ (c 0.4, CHCl₃–MeOH, 1:1).

CAS Registry Number: 161097-80-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3400, 1725.ORD (c 0.4, CHCl₃–MeOH, 1:1) $[\alpha]$ (λ nm): -64.3° (589), -68.0° (577), -80.9° (546), -181.4° (435), -425.7° (365).Negative FABMS m/z: 591 [M-H]⁻.

Negative HRFABMS m/z: 591.3172.

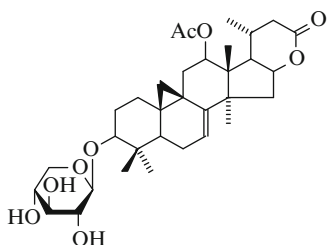
Table 1

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.4	1.73, 2.78	C-18	21.5 1.30 s
2	29.6	2.08, 2.38	19	18.5 1.07 d (4), 2.02 d (4)
3	88.6	3.62 dd (12, 4)	20	25.6 2.13
4	40.6	–	21	20.7 0.92 d (6)
5	43.9	1.43	22	45.0 2.10, 2.43
6	22.0	1.78, 2.08	23	210.9 –
7	114.1	6.25 d (6)	24	82.1 4.54 s
8	148.0	–	28	19.8 1.52 s
9	27.5	–	29	25.9 1.42 s
10	29.0	–	30	14.5 1.16 s
11	63.3	4.62 m	β -D-Xylp	
12	49.4	2.03, 2.79	1	107.1 4.89 d (7)
13	42.4	–	2	75.1 4.03
14	52.6	–	3	78.1 4.15
15	77.0	4.77 s	4	70.9 4.23
16	79.1	–	5	66.8 3.73 dd (11,11), 4.34 dd (11,5)
17	61.5	2.05		

References

1. N. Sakurai, M. Koeda, Y. Aoki, M. Nagai, *Chem. Pharm. Bull.* **43**(9), 1475–1482 (1995)
2. S. Kadota, J.X. Li, K. Tanaka, J. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

Cimilactone B

C₃₃H₄₈O₉, M 588

Taxonomy: Cycloartane Glycosides
Cimicifuga dahurica (Turcz.) Maxim.
(*Ranunculaceae*) [1].

Mp > 300°C (from MeOH), $[\alpha]_D^{20}$ –80.0° (c 0.50, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3200, 1740, 1720, 1295, 1250, 1050.

HRSIMS m/z: 611.3193 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.2 1.11 m, 1.56 m	C-18	14.7 1.26
2	29.5 1.86 m, 2.24 m	19	28.4 0.49 d (4), 1.01
3	87.8 3.43 dd (11, 4)	20	26.8 2.01 m
4	40.4 –	21	21.9 0.96 d (6)
5	42.3 1.17 m	22	38.5 2.27 m, 2.45 m
6	21.3 1.51 m, 1.82 m	23	173.5 –
7	114.5 5.10 d (6)	28	26.7 1.03
8	147.2 –	29	25.6 1.31
9	21.4 –	30	14.2 1.01
10	28.9 –	Ac	170.7 –
11	36.3 1.22 m, 2.90 dd (16, 9)		21.8 2.16
12	76.2 5.18 d (9)	β -D-Xylp	–
13	47.8 –	1	107.5 4.83 d (7.5)

(continued)

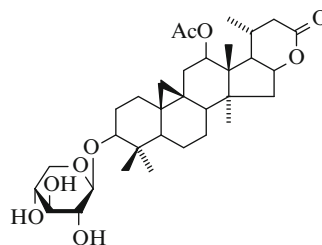
Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	50.8 –	2	75.6 4.03 t (8)
15	42.7 2.15 m, 2.21 m	3	78.6 4.15 t (8.5)
16	80.4 4.89 dd (13.5, 8)	4	71.2 4.22 m
17	54.0 2.10 d (8)	5	67.1 3.72 t (11)

References

1. Y. Liu, D. Chen, J. Si, G. Tu, D. An, *J. Nat. Prod.* **65**(10), 1486–1488 (2002)

Cimilactone A

C₃₃H₅₀O₉, M 590

Taxonomy: Cycloartane Glycosides
Cimicifuga dahurica (Turcz.) Maxim. (*Ranunculaceae*) [1].

Mp 255–256°C (from MeOH), $[\alpha]_D^{20}$ –36.7° (c 0.75, CHCl₃–MeOH, 1:1)

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3200, 1740, 1720, 1290, 1255, 1090, 1045.

Positive HRSIMS m/z: [M + Na]⁺ 613.3345 (C₃₃H₅₀O₉Na).

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.5 1.09 m, 1.51 m	C-18	12.9 1.23
2	29.5 1.87 m, 2.27 m	19	29.2 0.19 d (4), 0.55 d (4)
3	87.7 3.45 dd (11, 4)	20	26.4 1.99 m
4	40.8 –	21	21.6 0.95 d (6)
5	46.5 1.23 m	22	38.2 2.25 m, 2.45 m
6	20.0 0.69 m, 1.46 m	23	173.3 –

(continued)

Table 1 (continued)

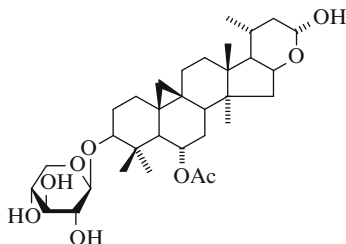
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
7	25.2 0.90 m, 1.23 m	28	19.1 0.83
8	45.5 1.59 dd (11.5, 5)	29	25.3 1.31
9	19.7 –	30	14.9 1.00
10	26.4 –	Ac	170.2 –
11	36.0 1.15 dd (16, 3), 2.69 dd (16, 9)		21.0 2.11
12	76.2 5.05 dd (9, 3)	β -D-Xylp	
13	48.2 –	1	107.2 4.84 d (7.5)
14	47.9 –	2	75.2 4.05 t (8)
15	43.4 1.80 m, 1.96 m	3	78.3 4.15 t (8.5)
16	80.0 4.78 dd (14, 7.5)	4	71.9 4.21 m
17	53.2 2.13 d (7.5)	5	66.8 3.73 t (11)

References

1. Y. Liu, D. Chen, J. Si, G. Tu, D. An, J. Nat. Prod. **65**(10), 1486–1488 (2002)

Tomentoside II

C₃₃H₅₂O₉, M 592



Taxonomy: Cycloartane Glycosides

Astragalus tomentosus Lam. (*Leguminosae*) [1].

Mp 217°C (from MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3375, 1730.

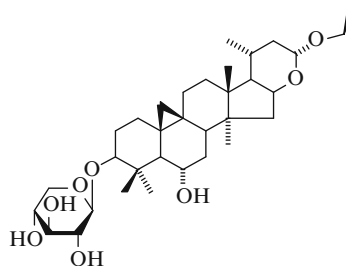
¹H NMR (270 MHz, D₂O, δ , 0-TMS): 0.13 and 0.42 (2H-19, d, J = 4.4 Hz), 0.86 (CH₃-21, d, J = 6.2 Hz), 0.98 (CH₃-30, s), 1.05 (CH₃-18, s), 1.12 (CH₃-29, s), 1.33 (CH₃-28, s), 1.50 (H-20, m), 2.0 (CH₃COO, s), 3.4 (H-3, dd, J = 11, 5 Hz), 3.7 (H-5'a, dd, J = 10, 10 Hz), 3.98 (H-2', dd, J = 8, 8 Hz), 4.15 (H-3', dd, J = 8, 8 Hz), 4.30 (H-4', ddd, J = 10, 8, 5 Hz), 4.68 (H-5'e, dd, J = 10, 5 Hz), 4.75 (H-16, ddd, J = 7.8, 7.6, 6.0 Hz), 4.89 (H-1', d, J = 8 Hz), 5.5 (H-23, dd, J = 7.5, 7.2 Hz).

References

1. R.M. Abdallah, N.M. Ghazy, A.M. Assad, N.A. El-Sebakhy, A. Pirillo, L. Verotta, *Pharmazie* **49**(5), 377–378 (1994)

Deacetyltomentoside I

C₃₃H₅₄O₈, M 578



Taxonomy: Cycloartane Glycosides

Astragalus tomentosus Lam. (*Leguminosae*) [1].

Mp 283°C, $[\alpha]_D^{25}$ –22.7° (c 0.092, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3494, 1442, 1370, 1165.

EIMS m/z (%): M⁺ 533 (5), 428 (78), 381 (100), 311 (23).

HRFABMS m/z: 578.3817 M⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4 1.24 m, 1.62 m	C-18	20.2 1.55 s
2	30.3 2.04 m, 2.42 m	19	29.6 0.22 d (4.8), 0.55 d (4.8)
3	88.6 3.63 dd (5.9, 11.3)	20	25.6 1.88 m
4	42.7 –	21	20.6 0.87 d (6.4)
5	56.7 1.76 dd (8.4, 11.1)	22	33.3 1.52 m
6	67.1 3.72 m	23	99.1 4.92 m
7	38.2 1.82 m	28	19.5 0.98 s
8	53.9 1.76 m	29	28.7 1.97 s
9	21.2 –	30	16.6 1.31 s
10	29.2 –	OEt	62.7 4.46 q (7.1), 3.83 q (7.0)
11	26.2 1.65 m		15.7 1.18 dd (1.6, 7)
12	33.3 1.48 m	β -D-Xylp	
13	44.8 –	1	107.7 4.91 d (7.4)
14	46.1 –	2	75.7 4.07 t (8.4)
15	43.5 1.57 m, 1.94 m	3	78.6 4.16 t (8.4)

(continued)

Table 1 (continued)

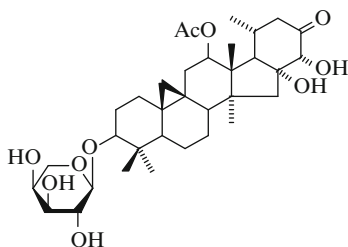
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	70.6	4	71.3
17	46.2	5	67.4

References

- M.M. Radwan, A. Farooq, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, J. Nat. Prod. **67**(3), 487–490 (2004)

16 α ,24 α -Dihydroxy-12 β -acetoxy-25,26,27-trinor-16,24-cyclocycloartan-23-one-3 β -O- α -L-arabinopyranoside

C₃₄H₅₂O₁₀, M 620



Taxonomy: Cycloartane Glycosides

Cimicifuga dahurica (Turcz.) Maxim. (*Ranunculaceae*) [1].

Mp 257–259°C (from MeOH), $[\alpha]_D -102.1^\circ$ (c 0.18, MeOH).

CAS Registry Number: 386748-59-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3350, 1734, 1720, 1632, 1450, 1040, 991.

FABMS m/z: 621 [M + H]⁺, 643 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.1	C-18	13.5
2	30.0	19	30.4
3	88.2	20	25.7
4	41.3	21	21.3
5	47.4	22	45.6

(continued)

Table 1 (continued)

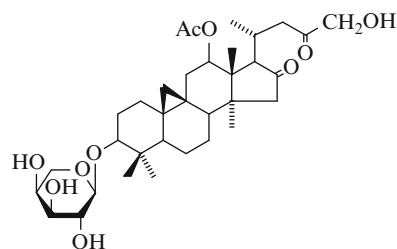
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
6	20.8	23	210.8
7	26.1	24	82.3
8	46.9	28	20.4
9	19.5	29	25.8
10	26.7	30	15.6
11	38.0	Ac	170.4
12	77.4		21.8
13	51.1	α -L-Arap	
14	48.8	1	107.5
15	49.8	2	73.0
16	82.7	3	74.7
17	63.9	4	69.6
		5	66.9

References

- Q.-W. Zhang, W.-C. Ye, W.W.-Z. Hsiao, S.-X. Zhao, C.-T. Che, Chem. Pharm. Bull. **49**(11), 1468–1470 (2001)

24-Hydroxy-12 β -acetoxy-25,26,27-trinor-cycloartan-16,23-dione-3 β -O- α -L-arabinopyranoside

C₃₄H₅₂O₁₀, M 620



Taxonomy: Cycloartane Glycosides

Cimicifuga dahurica (Turcz.) Maxim. (*Ranunculaceae*) [1].

Mp 233–235°C (from MeOH).

CAS Registry Number: 386748-58-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3350, 1734, 1720, 1632, 1450, 1040, 991.

FABMS m/z: 621 [M + H]⁺, 643 [M + Na]⁺.

Table 1

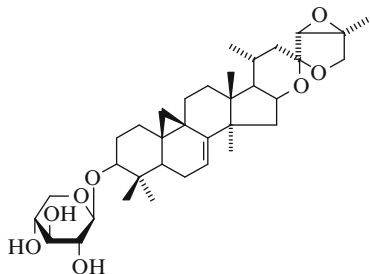
δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		
C-1	32.2	1.10, 1.49	C-18	13.8	1.35 s			
2	30.1	1.88, 2.33	19	30.7	0.27 d (4), 0.58 d (4)			
3	88.2	3.46 dd (11.6, 4.4)	20	26.8	2.80			
4	41.5	–	21	23.3	1.26 d (6.4)			
5	47.2	1.23	22	43.6	2.69, 3.02 dd (17.6, 7.2)			
6	20.7	0.66, 1.47	23	211.0	–			
7	26.3	0.94, 1.13	24	69.6	4.46 d (18.4), 4.53 d (18.4)			
8	45.8	1.59	28	19.5	0.97 s			
9	26.0	–	29	26.0	1.29 s			
10	27.6	–	30	15.8	0.97 s			
11	36.3	1.21, 2.66	Ac	170.6	–			
12	76.4	5.49 dd (9.2, 3.2)		21.6	2.23 s			
13	48.8	–	α -L-Arap					
14	43.8	–	1	107.6	4.79 d (7.2)			
15	50.9	2.08 d (18), 2.29 d (18)	2	73.1	4.44 t (7.2)			
16	217.5	–	3	74.9	4.17 dd (7.2, 2.8)			
17	61.5	2.76	4	69.8	4.32 brs			
			5	67.0	4.30 brd (10.8, 2.4), 3.80 d (10.8)			

References

1. Q.-W. Zhang, W.-C. Ye, W.W.-Z. Hsiao, S.-X. Zhao, C.-T. Che, *Chem. Pharm. Bull.* **49**(11), 1468–1470 (2001)

Cimiracemoside I

C₃₅H₅₂O₈, M 600



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L) Nutt. (*Ranunculaceae*) [1].
Mp > 300°C (began decomposing at 250°C), $[\alpha]_D^{20}$
–13.13° (c 0.267, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3350, 1734, 1720, 1632, 1450,
1040, 991.

HRESIMS m/z: 623.3581 [M + Na]⁺.

Table 1

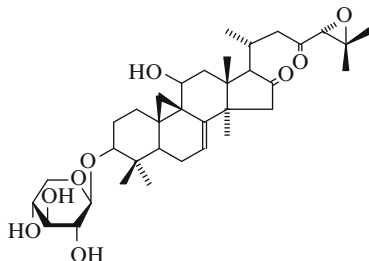
δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		
C-1	30.9	1.70 m, 1.30 m	C-18	22.9	1.26 s			
2	29.6	2.33 m, 1.30 m	19	28.3	0.46 d (3.5), 0.97 d (3.5)			
3	88.1	3.48 brd (7.5)	20	23.7	2.26			
4	40.4	–	21	20.8	1.00 d (6.4)			
5	42.7	1.24	22	37.5	1.58 brd (13.5), 1.40 brt (14.7)			
6	21.8	1.80 m, 1.46 m	23	106.2	–			
7	113.5	5.08 d (7.2)	24	62.6	3.70 s			
8	149.2	–	28	26.9	1.10 s			
9	21.0	–	29	25.8	4.04 d (10.2), 3.61 d (10.2)			
10	23.7	–	30	14.3	1.46 s			
11	25.3	2.09 m, 1.11 m	β -D-Xylp					
12	32.9	1.66 m (2 H)	1	107.6	4.87 d (7.4)			
13	44.1	–	2	75.6	4.05			
14	49.8	–	3	78.7	4.18 t (6.9)			
15	43.0	2.11 brt (8.6), 1.96 dd (6.3, 11.4)	4	71.3	4.24 (9, 6)			
16	74.9	4.31 dd (6.7, 12)	5	67.2	4.38 dd (4.5, 10.5), 3.76 t (10.3)			
17	56.9	1.56 t (13.5)						

References

1. S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Cimicifugoside H-1

C₃₅H₅₂O₉, M 616



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1, 2].
Mp 260–262°C (from MeOH), $[\alpha]_D -43.5^\circ$ (c 0.5, MeOH) [2].

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3300, 1720, 1715, 1040.

UV $\lambda_{\max}^{\text{MeOH}}$, nm (ϵ): 205 (6275).

ORD (c 0.50, MeOH) $[\alpha]$ (λ nm): -43.5° (577), -56.1° (546), -134.2° (435), -357.1° (365).

Positive FAB-MS m/z: 639 $[\text{M} + \text{Na}]^+$.

Positive HRFABMS m/z: 639.3508 $[\text{M} + \text{Na}]^+$.

EIMS m/z: 598 $[\text{M}^+ - \text{H}_2\text{O}]$, 484 $[\text{M}^+ - \text{C}_5\text{H}_8\text{O}_4]$.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.5 1.72, 2.79	C-19	18.6 0.96 d (4), 1.96 d (4)
2	29.8 2.08, 2.40	20	27.7 2.61
3	88.4 3.59 dd (8, 4)	21	20.4 1.04 d (6)
4	40.7 –	22	47.4 2.61, 3.62
5	43.9 1.34	23	205.6 –
6	22.1 1.70, 1.92	24	65.8 3.74 s
7	115.5 5.15 brd (6)	25	60.7 –
8	147.2 –	26	18.4 1.35 s
9	27.6 –	27	24.6 1.36 s
10	29.4 –	28	27.7 1.21 s
11	63.0 4.58 m	29	26.0 1.41 s
12	47.4 2.18 dd (10, 4), 2.78	30	14.5 1.15 s
13	44.4 –	β -D-Xylp	
14	46.2 –	1	107.4 4.88 d (7)
15	49.8 2.37 d (18), 2.50 d (18)	2	75.5 4.02
16	218.4 –	3	78.5 4.15

(continued)

Table 1 (continued)

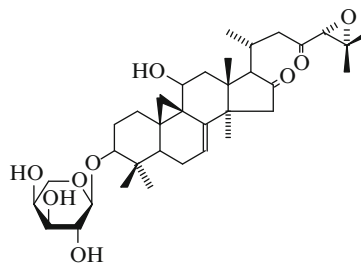
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
17	61.2 2.39	4	71.2 4.22
18	20.1 1.21	5	67.1 3.74 dd (10, 7), 4.34

References

1. M. Koeda, Y. Aoki, N. Sakurai, K. Kawai, M. Nagai, Chem. Pharm. Bull. **42**(10), 2205–2207 (1994)
2. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, Chem. Pharm. Bull. **43**(5), 771–776 (1995)

Cimicidanol-3-O- α -L-arabinoside

C₃₅H₅₂O₉, M 616



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp 214–215°C (from CHCl₃–MeOH), $[\alpha]_D -42.32^\circ$ (c 0.2, CHCl₃–MeOH, 1: 1).

CAS Registry Number: 163046-73-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 2960, 2925, 2850, 1720, 1380, 1040.

Negative ion FABMS m/z: 615 $[\text{M} - \text{H}]^-$.

HRFABMS m/z: 615.3528 $[\text{M} - \text{H}]^-$.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.24 1.62 td (13.5, 5.5), 2.66 dt (13.5, 3.5)	C-19	18.38 0.91 d (4), 1.87 d (4)

(continued)

Table 1 (continued)

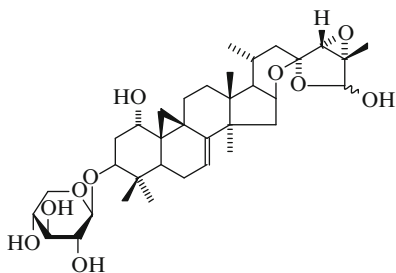
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
2	29.49 1.96 td (13.5, 3.5), 2.27 m	20	27.33 2.51 m
3	88.08 3.48 dd (11.5, 3)	21	20.17 1.00 d (6)
4	40.45 –	22	47.10 2.59 dd (16.5, 9.5),
5	43.58 1.30 m		3.55 dd (16.5, 7)
6	21.84 1.68 brt (12.5), 1.92 m	23	205.32 –
7	115.16 5.12 dd (7.5, 2)	24	65.49 3.66 d (0.5)
8	147.01 –	25	60.48 –
9	27.00 –	26	24.48 1.37 s
10	29.10 –	27	18.20 1.31 s
11	62.70 4.46 dd (9.5, 3.5)	28	27.58 1.17 s
12	47.01 2.76 dd (14.5, 9.5), 2.12 dd (14.5, 3.5)	29	25.73 1.33 s
13	44.15 –	30	14.31 1.07 s
14	45.88 –	α -L-Arap	
15	49.50 2.25 d (18), 2.44 d (18)	1	107.02 4.74 d (7.5)
16	218.23 –	2	75.03 3.87 t (7.5)
17	60.85 2.33 d (9)	3	78.06 4.00 t (8.5)
18	19.90 1.17 s	4	70.78 4.06 m
		5	66.68 3.61 t (11), 4.23 dd (11, 4.5)

References

1. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

Bugbanoside A

C₃₅H₅₂O₁₀, M 632



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp. 205–206°C (from MeOH), $[\alpha]_D^{23}$ –42.7° (c 0.43, MeOH).

Extra CAS Registry Numbers(s): 211106-15-9
211106-16-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.

Positive SIMS m/z: 655 [M + Na]⁺, 615 [M-OH]⁺.

Positive HRSIMS m/z: 615.3545 [M-OH]⁺.

Table 1

	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
	26 S	26R	26 S	26R
C-1	72.15	72.15	3.93 s	3.93 s
2	37.88	37.88	2.25, 2.74	2.25, 2.74
3	83.99	83.99	4.39	4.39
4	40.47	40.74	–	–
5	36.39	36.39	2.28	2.28
6	21.54	21.54	1.69, 1.93	1.69, 1.95
7	113.22	113.22	5.10 dd (7.9, 1.9)	5.18 dd (7.9, 1.9)
8	150.18	150.18	–	–
9	21.95	21.95	–	–
10	32.12	32.12	–	–
11	25.09	25.09	1.44, 2.92	1.44, 2.92
12	33.14	33.14	1.78, 1.78	1.78, 1.78
13	44.01	44.01	–	–
14	50.00	50.08	–	–
15	42.61	42.71	1.79, 1.96	1.96, 2.14
16	73.43	73.43	4.67	4.67
17	57.20	57.15	1.58	1.58
18	22.95	22.95	1.23 s	1.24 s
19	28.16	28.16	0.68 d (4), 1.17 d (4)	0.69 d(4), 1.19 d (4)
20	26.26	26.26	1.84	1.84
21	20.48	20.45	0.95 d (6.3)	0.92 d (6.3)
22	37.43	37.43	1.64, 2.23	1.64, 2.23
23	106.15	103.70	–	–
24	63.56	63.00	3.86 s	3.72 s
25	65.52	63.90	–	–
26	98.62	98.20	5.71 s	5.72 s
27	13.05	13.10	1.75 s	1.60 s
28	26.79	26.85	1.05 s	1.10 s
29	25.87	26.87	1.41 s	1.42 s
30	13.54	13.54	1.11 s	1.12 s
β -D-Xylp				
1	107.53	107.53	4.86 d (7.9)	4.86 d (7.9)
2	75.64	75.64	4.02 dd (7.9, 8.1)	4.02 dd (7.9, 8.1)
3	48.57	78.57	4.08 dd (8.1, 8.8)	4.08 dd (8.1, 8.8)

(continued)

Table 1 (continued)

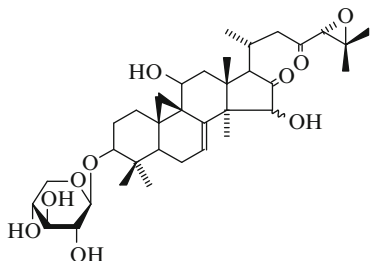
	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
	26S	26R	26S	26R
4	71.20	71.20	4.18 ddd (10, 8, 8.5)	4.18 ddd (10, 8, 8.5)
5	66.99	66.99	3.54 dd (11.1, 5.0)	3.54 dd (11.1, 5.0)
			4.21 dd (11.1, 5)	4.21 dd (11.1, 5.0)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(6), 1001–1007 (1998)

Cimicifugoside H-5

C₃₅H₅₂O₁₀, M 632



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 262–264°C (from MeOH–H₂O, 2:1), $[\alpha]_D -22.9^\circ$ (c 1.9, MeOH).

CAS Registry Number: 168075-12-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3450–3350, 1740, 1725.

Positive FABMS m/z: 655 [M + Na]⁺.

Positive HRFABMS m/z: 655.3467 [M + Na]⁺.

Table 1

	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
	C-1	C-19	C-19	C-19
1	27.5	1.72, 2.80	18.5	1.02 d (4), 1.95 d (4)
2	29.8	2.05, 2.32	20	27.8 2.65
3	88.5	3.58 m	21	20.9 1.05 d (6)
4	40.7	–	22	48.9 2.65, 3.62

(continued)

Table 1 (continued)

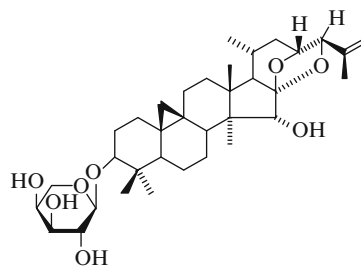
	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
	5	23	23	205.3 –
5	43.9	1.39	24	65.8 3.72 s
6	22.0	1.72, 1.98	25	60.7 –
7	115.9	6.17 brd (6)	26	18.3 1.31 s
8	146.3	–	27	24.6 1.36 s
9	28.0	–	28	21.0 1.37 s
10	29.2	–	29	25.9 1.36 s
11	63.1	4.59 m	30	14.5 1.12 s
12	46.8	2.22, 2.82	β-D-Xylp	
13	40.9	–	1	107.3 4.82 d (7)
14	49.7	–	2	75.4 3.98
15	80.7	4.56 s	3	78.4 4.09
16	220.5	–	4	71.1 4.15
17	58.7	2.20	5	67.0 3.66, 4.33 dd (11, 5)
18	19.5	1.30 s		

References

1. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)

25-Anhydrocimigenol Arabinoside

C₃₅H₅₄O₈, M 602



Taxonomy: Cycloartane Glycosides

Cimicifuga japonica (*Ranunculaceae*) [1].

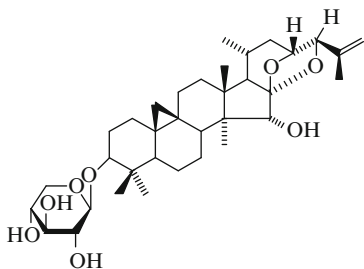
Mp 272–274°C, $[\alpha]_D +29.7^\circ$ (c 1.9, CHCl₃–MeOH).

References

1. N. Sakurai, M. Nagai, T. Inoue, *Yakugaku Zasshi* **95**(11), 1354–1360 (1975). *C.A.*, 84:74573v (1976)

25-Anhydrocimigenol-3-O- β -D-xyloside

C₃₅H₅₄O₈, M 602



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp 245–246°C (from hexane-EtOAc), $[\alpha]_D^{25} +8.42^\circ$
(c 0.14, CHCl₃-MeOH, 1: 1).

CAS Registry Number: 154822-57-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 2960, 2925, 2850, 1720, 1380, 1040.

Positive FABMS m/z: 603 [M + H]⁺.

HRFABMS m/z: 603.3938 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.40 1.25 m, 1.61 m	C-19	30.89 0.30 d (4.0), 0.55 d (4.0)
2	30.07 1.97 m, 2.37 m	20	23.84 1.66 m
3	88.51 3.57 dd (11.5, 4.5)	21	19.44 0.86 d (7.0)
4	41.30 –	22	37.99 1.00 brt (12.5), 2.26
5	47.58 1.37 dd (12.5, 4.5)		ddd (12.5, 9.5, 7.5)
6	21.02 0.74 qd (12.5, 1.5), 1.58 td (7.0, 1.5)	23	78.49 4.30 brd (7.5)
7	26.10 2.09 m, 1.10 qd (7.0, 1.5)	24	86.59 4.17 brs
8	48.59 1.68 m	25	145.82 –
9	19.96 –	26	113.01 4.88 brs, 5.33 brs
10	26.64 –	27	18.17 1.84 s
11	26.39 2.14 m, 1.21 m	28	11.79 1.18 s
12	33.98 1.71 m, 1.55 m	29	25.66 1.33 s
13	41.63 –	30	15.37 1.08 s
14	47.16 –	β -D-Xylp	

(continued)

Table 1 (continued)

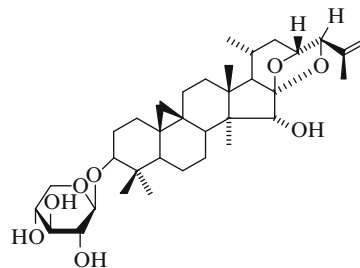
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
15	80.31 4.29 brs	1	107.48 4.86 d (7.5)
16	112.22 –	2	74.91 4.02 t (7.5)
17	59.82 1.46 d (11.0)	3	78.49 4.15 t (8.5)
18	19.44 1.16 s	4	71.14 4.22 ddd (11.0, 8.5, 5.0)
		5	67.01 3.73 t (11.0), 4.34 dd (11.5)

References

1. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

Cimicide E

C₃₅H₅₄O₈, M 602



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp >300°C (from Me₂CO), $[\alpha]_D^{19} +31.4^\circ$ (c 0.058, CHCl₃-MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3700–3000, 1647, 1557, 1458, 1381, 1249, 1165, 1068, 1043, 974.

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.27 and 0.52 (2H-19, d, J = 3.7 Hz), 0.84 (CH₃-21, d, J = 6.4 Hz), 1.06, 1.13, 1.15, 1.32 (4 × CH₃, s), 1.83 (CH₃-27, s), 3.51 (H-3, dd, J = 11.4, 4.4 Hz), 4.16 (H-24, s), 4.28 (H-15 and H-23, d-like, J = 8.4 Hz), 4.86 (H-26 and H-1', d-like, J = 7 Hz), 5.32 (H-26, s), 3.73 (H-5', t, J = 11.3 Hz), 4.03 (H-2', t, J = 8 Hz), 4.16 (H-3', t, J = 8.6 Hz), 4.23 (H-4', m), 4.35 (H-5', dd, J = 11.3, 5.1 Hz).

Table 1

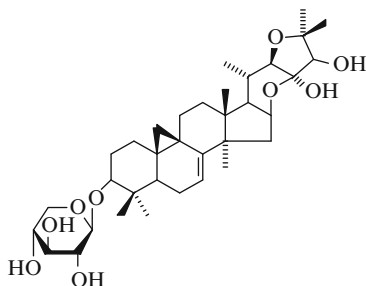
δ_C (C ₅ D ₅ N)									
C-1	32.5	C-8	8.6	C-15	80.4	C-22	38.1	C-29	25.7
2	30.2	9	20.0	16	112.3	23	75.0	30	15.5
3	88.6	10	26.7	17	59.9	24	86.7	β -D-Xylp	
4	41.4	11	26.4	18	19.5	25	145.9	1	107.6
5	47.6	12	34.1	19	30.9	26	113.0	2	75.6
6	21.1	13	41.7	20	23.9	27	18.2	3	78.6
7	26.5	14	47.2	21	19.4	28	11.9	4	71.3
								5	67.1

References

1. C.J. Li, Y.H. Li, S.F. Chen, P.G. Xiao, Yaoxue Xuebao **29**(6), 449–453 (1994)

Cimiaceroside A

C₃₅H₅₄O₉, M 618



Taxonomy: Cycloartane Glycosides

Cimicifuga acerina C. Tanaka (Miyagi)

(*Ranunculaceae*) [1].

Actaea asiatica Hara (*Ranunculaceae*) [1].

Mp 259–260°C (from MeOH–MeCN), $[\alpha]_D$ –39.3°
(c 0.69, MeOH).

CAS Registry Number: 210643-83-7.

IR $\nu_{\text{max}}^{\text{KBr}}$: 3600–3200.

Positive SIMS m/z: 619 [M + H]⁺, 601 [M–OH]⁺.

Positive HRSIMS m/z: 619.3850 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.38	1.31, 1.68	C-19	28.38	0.45 d (4), 0.98 d (4)
2	29.55	1.96, 2.32	20	34.66	2.28

(continued)

Table 1 (continued)

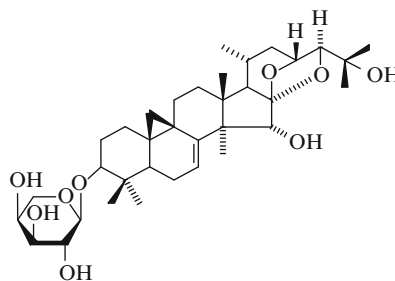
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
3	88.19	3.48 dd (4.3, 11.8)	21	17.50	1.25 d (6.5)
4	40.44	–	22	86.82	3.90 d (10.5)
5	42.77	1.28	23	106.11	–
6	21.90	1.58, 1.89	24	83.33	4.18 s
7	113.29	5.12 dd (2, 8)	25	83.61	–
8	149.63	–	26	27.86	1.76 s
9	21.09	–	27	24.83	1.67 s
10	28.38	–	28	26.76	1.08 s
11	25.26	1.12, 2.09	29	25.81	1.35 s
12	33.23	1.69 (2H)	30	14.34	1.05 s
13	44.67	–	β -D-Xylp		
14	50.39	–	1	107.45	4.85 d (8)
15	42.01	1.92, 2.12	2	75.57	4.03 dd (8, 8)
16	72.62	5.06 ddd (7.8, 7.8, 7.8)	3	78.59	4.15 dd (8, 8.3)
17	52.87	1.60	4	71.27	4.21 ddd (5, 8.3, 11)
18	22.97	1.22 s	5	67.12	3.73 dd (11, 11.1), 4.36 dd (5, 11.1)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, T. Okuyama, G. Kusano, *Heterocycles* **48**(5), 1003–1013 (1998)

7,8-Didehydrocimigenol-3-O- α -L-arabinopyranoside

C₃₅H₅₄O₉, M 618



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 272–273°C (from CHCl₃–MeOH), [α]_D –3.64° (c 0.17, MeOH).

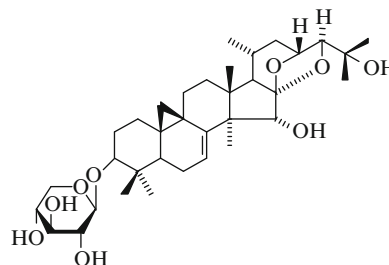
CAS Registry Number: 228251-29-4.

IR ν_{max}^{KBr}, cm⁻¹: 3650–3200.Positive SIMS m/z: 619 [M + H]⁺.Positive HRSIMS m/z: 619.3842 [M + H]⁺.**Table 1**

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		
C-1	30.30	1.36, 1.70	C-19	28.25	0.51 d (4), 1.07 d (4)
2	29.48	1.97, 2.36	20	24.01	1.70
3	88.31	3.47 dd (11, 5, 4.4)	21	19.75	0.91 d (6.6)
4	40.41	–	22	38.08	1.06, 2.31
5	42.70	1.26	23	70.96	4.75 d (9.4)
6	21.32	1.59, 1.88	24	90.26	3.79 s
7	114.29	6.06 dd (1.5, 7.5)	25	72.10	–
8	148.00	–	26	27.08	1.49 s
9	21.78	–	27	25.78	1.47 s
10	28.44	–	28	18.43	1.42 s
11	25.56	1.15, 2.18	29	25.45	1.27 s
12	34.09	1.67 (1.80)	30	14.28	1.03 s
13	41.32	–	α-L-Arap		
14	50.66	–	1	107.31	4.78 d (7.5)
15	78.15	4.52 s	2	72.96	4.43 dd (7.5, 7.5)
16	112.29	–	3	74.96	4.15 dd (3.1, 7.5)
17	59.43	1.52	4	69.48	4.30
18	21.64	1.17 s	5	66.69	3.79 dd (2, 5.11), 4.30 dd (2, 5.13)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

7,8-Didehydrocimigenol-3-O-β-D-xylopyranosideC₃₅H₅₄O₉, M 618**Taxonomy:** Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 291–292°C (from MeOH), [α]_D –14.8° (c 0.88, MeOH).

CAS Registry Number: 150972-77-3.

IR ν_{max}^{KBr}, cm⁻¹: 3650–3200.Positive SIMS m/z: 619 [M + H]⁺.Positive HRSIMS m/z: 619.3837 [M + H]⁺.**Table 1**

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		
C-1	30.39	1.35, 1.71	C-19	28.25	0.51 d (4), 1.05 d (4)
2	29.57	1.97, 2.34	20	24.01	1.71
3	88.29	3.49 dd (4.4, 11.9)	21	19.75	0.91 d (6.3)
4	40.43	–	22	38.08	1.02, 2.28
5	42.72	1.30	23	71.25	4.73 d (9)
6	21.77	1.59, 1.84	24	90.28	3.79 s
7	114.31	6.06 dd (1.5, 7.5)	25	72.11	–
8	148.03	–	26	27.08	1.49 s
9	21.65	–	27	25.78	1.47 s
10	28.45	–	28	18.44	1.41 s
11	25.58	1.17, 2.19	29	25.46	1.30 s
12	34.09	1.67, 1.83	30	14.38	1.05 s
13	41.32	–	β-D-Xylp		
14	50.66	–	1	107.46	4.84 d (7.5)

(continued)

Table 1 (continued)

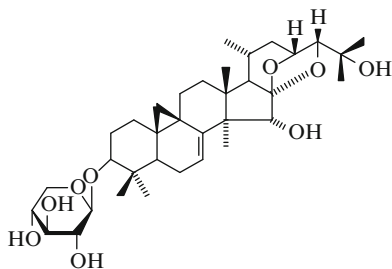
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
15	78.16	4.52 s	2	75.56	4.02 dd (7.5, 8.1)
16	112.30	–	3	78.56	4.14 dd (8.1, 8.1)
17	59.43	1.54	4	71.00	4.21 ddd (5, 8.1, 10)
18	21.34	1.17 s	5	67.10	3.73 dd (10, 11.3), 4.39 dd (5, 11.3)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

24-*epi*-7,8-Didehydrocimigenol-3-xyloside

C₃₅H₅₄O₉, M 618



Taxonomy: Cycloartane Glycosides

Cimicifuga heracleifolia Komarov (*Ranunculaceae*)

[1].

$[\alpha]_D -9.6^\circ$ (c 0.35, CHCl₃–MeOH, 2:3).

CAS Registry Number: 150972-77-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 1630.

Positive FABMS m/z: 619 [M + H]⁺.

Table 1

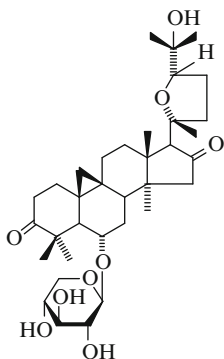
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.31	1.47 m, 1.68 m	C-19	28.31	0.51 d (4), 1.06 d (4)
2	29.46	1.96 m, 2.31 ddd (12.5, 4.3, 3)	20	23.33	1.70 m
3	88.23	3.46 dd (11.6, 4.3)	21	19.62	0.98 d (5.5)
4	40.36	–	22	29.52	1.96 m, 2.61 ddd (13, 9.7, 2)
5	42.70	1.30 m	23	73.78	4.60 ddd (9.7, 4.1, 2)
6	21.69	1.60 m, 1.91 m	24	83.98	3.71 d (4.1)
7	114.22	6.04 dd (7.4, 2)	25	68.56	–
8	148.01	–	26	30.64	1.41 s
9	21.20	–	27	25.76	1.31 s
10	28.18	–	28	18.44	1.27 s
11	25.48	1.12 m, 2.12 ddd (13, 9, 3)	29	25.94	1.28 s
12	33.86	1.67 m, 1.71 m	30	14.19	1.05 s
13	41.06	–	β -D-Xylp		
14	50.74	–	1	107.36	4.79 d (7.3)
15	78.52	4.48 d (7.5) [4.52 d (7.5) OH]	2	75.42	3.96 dd (7.3, 8.5)
16	112.37	–	3	78.43	4.08 t (8.5)
17	60.58	1.73 m	4	71.11	4.17 td (8.5, 5.2)
18	21.57	1.16 s	5	66.98	3.67 t (10.1), 4.31 dd (10.1,5.2)

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

6-O- β -D-Xylopyranosyl Cycloadsurgenin

C₃₅H₅₄O₉, M 618



Taxonomy: Cycloartane Glycosides

Astaragalus adsurgens Pall. (*Leguminosae*) [1].

Mp 238–239°C.

CAS Registry Number: 174414-44-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1740, 1720, 1710.

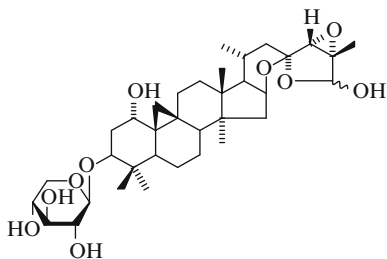
Positive FABMS m/z: 619 [M + H]⁺.

References

1. L.P. Sun, S.Z. Zheng, X.W. Shen, *Chin. Chem. Lett.* **6**(12), 1045–1046 (1995)

Bugbanoside B

C₃₅H₅₄O₁₀, M 634



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1]

Mp. 244–245°C (from MeOH), $[\alpha]_{\text{D}}^{23}$ –21.3° (c 0.20, MeOH).

Extra CAS Registry Numbers(s): 211106-24-0; 211106-25-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.

Positive SIMS m/z: 657 [M + Na]⁺, 617 [M-OH]⁺.

Positive HRSIMS m/z: 617.3683 [M-OH]⁺.

Table 1

	δ_{C} (C ₅ D ₅ N)		δ_{H} (J/Hz)	
	26 S	26 R	26 S	26 R
C-1	72.39	72.39	3.81 s	3.81 s
2	37.90	37.90	2.23, 2.69	2.23, 2.69
3	84.36	84.36	4.33	4.33
4	41.48	41.48	–	–
5	40.14	40.14	2.39	2.39
6	20.69	20.69	0.80, 1.60	0.80, 1.60
7	26.33	26.33	1.18, 1.24	1.18, 1.24
8	<u>47.55</u>	<u>47.60</u>	1.63	1.63
9	20.59	20.59	–	–
10	31.06	31.06	–	–
11	25.90	25.90	1.42, 2.66	1.42, 2.66
12	33.36	33.36	1.58, 1.64	1.58, 1.64
13	<u>46.53</u>	<u>46.70</u>	–	–
14	44.70	44.70	–	–
15	44.06	44.20	<u>1.48, 1.78</u>	<u>1.58, 1.96</u>
16	73.26	73.26	4.59	4.59
17	56.88	56.88	1.58	1.58
18	20.64	20.64	1.25 s	1.25 s
19	29.94	29.94	<u>0.38 d (4), 0.69 d (4)</u>	<u>0.39 d (4), 0.71 d (4)</u>
20	26.18	26.18	1.84	1.84
21	<u>20.48</u>	<u>20.40</u>	<u>0.92 d (6)</u>	<u>0.90 d (6)</u>
22	37.50	37.50	1.63, 2.21	1.63, 2.21
23	<u>106.12</u>	<u>103.60</u>	–	–
24	<u>63.57</u>	<u>63.80</u>	<u>3.87 s</u>	<u>3.73 s</u>
25	<u>65.50</u>	<u>63.90</u>	–	–
26	<u>98.50</u>	<u>98.21</u>	<u>5.70 s</u>	<u>5.71 s</u>
27	<u>13.06</u>	<u>13.10</u>	<u>1.75 s</u>	<u>1.59 s</u>
28	<u>19.54</u>	<u>19.60</u>	<u>0.91 s</u>	<u>0.96 s</u>
29	<u>25.81</u>	<u>25.85</u>	<u>1.39 s</u>	<u>1.41 s</u>
30	14.66	14.66	1.08 s	<u>1.10 s</u>
β -D-Xylp				
1	107.60	107.60	4.87 d (7.8)	4.87 d (7.8)
2	75.63	75.63	4.01 dd (7.8, 8.1)	4.01 dd (7.8, 8.1)
3	78.57	78.57	4.09 dd (8.1, 8.5)	4.09 dd (8.1, 8.5)

(continued)

Table 1 (continued)

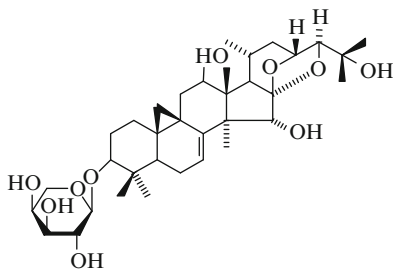
δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
26 S	26 R	26 S	26 R
4	71.22	71.22	4.18 ddd (10, 8.8, 5)
5	67.00	67.00	3.58 dd (11.3, 10)
		4.22 dd (11.3, 5)	4.22 dd (11.3, 5)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyse, G. Kusano, *Chem. Pharm. Bull.* **46**(6), 1001–1007 (1998)

Bugbanoside F

C₃₅H₅₄O₁₀, M 634



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 255–256°C (from MeOH-isopropyl ether), $[\alpha]_D$ –18.5° (c 0.36, MeOH).

CAS Registry Number: 340258-14-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3250.

Positive SIMS m/z: 635 [M + H]⁺, 657 [M + Na]⁺.

Positive HRSIMS m/z: 635.3795 [M + H]⁺.

CD: $\Delta\epsilon_{214}$: –8.34 (c 2.1 × 10⁻⁴ g/ml).

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
C-1	30.42	1.32, 1.63	C-19 28.54
2	29.33	1.85, 2.25	20 23.68
3	88.25	3.44 dd (11.5, 4.0)	21 21.25
			0.76, 1.11 d (4)
			1.82
			1.37 d (5.5)

(continued)

Table 1 (continued)

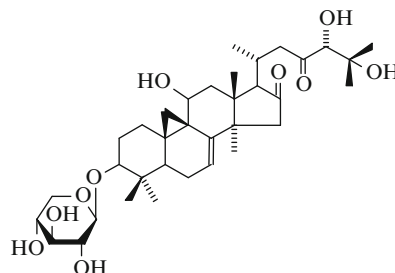
δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		
4	40.29	–	22 38.39	
5	42.51	1.22	23 72.00	
6	21.75	1.58, 1.85	24 90.02	
7	114.16	6.13 dd (2.0, 7.5)	25 71.15	
8	147.41	–	26 25.40	
9	21.82	–	27 26.38	
10	27.90	–	28 18.21	
11	39.89	1.52, 2.91 dd (9.0, 15.5)	29 25.70	
12	72.41	4.34	30 14.18	
13	46.96	–	α -L-Arap	
14	51.04	–	1	107.06
15	77.92	4.72 s	2	72.56
16	112.39	–	3	74.26
17	59.67	1.82	4	69.19
18	13.15	1.47 s	5	66.46
				4.29 dd (2.5, 12.0)
				4.29 dd (2.5, 12.0)

References

1. A. Kusano, M. Shibano, D. Tsukamoto, G. Kusano, *Chem. Pharm. Bull.* **49**(4), 437–441 (2001)

Cimicifugoside H-2 (Cimicidol 3-O- β -D-xyloside)

C₃₅H₅₄O₁₀, M 634



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].*Cimicifuga foetida* L. (*Ranunculaceae*) [2].Mp 227–229°C (from MeOH), $[\alpha]_D -38.8^\circ$ (c 1.1, MeOH).

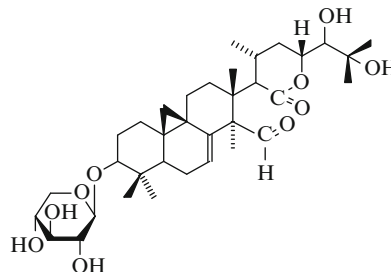
CAS Registry Number: 161097-77-4.

IR ν_{\max}^{KBr} , cm^{-1} : 3400–3300, 1720, 1700, 1650.Positive FAB-MS m/z: 635 $[\text{M} + \text{H}]^+$.Positive HRFAB-MS m/z: 635.3788 $[\text{M} + \text{H}]^+$.**Table 1**

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	27.7 1.69, 2.80	C-19	18.5 0.94 d (4), 1.95 d (4)
2	29.8 2.05, 2.40	20	27.5 2.40
3	88.4 3.59 dd (8, 4)	21	20.4 1.13 d (7)
4	40.7 –	22	47.6 3.44 dd (14, 9), 3.79 dd (14,3)
5	43.8 1.35 dd (9, 4)	23	213.7 –
6	22.0 1.70, 1.93	24	84.0 4.50 s
7	115.3 5.13 brd (6)	25	72.5 –
8	147.3 –	26	27.4 1.55 s
9	27.4 –	27	25.7 1.67 s
10	29.3 –	28	28.0 1.16 s
11	63.0 4.53 m	29	25.9 1.42 s
12	47.2 2.21, 2.78	30	14.5 1.14 s
13	44.5 –	$\beta\text{-D-Xylp}$	
14	46.1 –	1	107.4 4.89 d (7)
15	49.8 2.26 d (18), 2.48 d (18)	2	75.4 4.04
16	218.3 –	3	78.5 4.17
17	61.4 2.43	4	71.2 4.24
18	20.1 1.22 s	5	67.0 3.73 t (10), 4.35 dd (10, 4)

References

- M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)
- S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

No Name ($\text{C}_{35}\text{H}_{54}\text{O}_{10}$) $\text{C}_{35}\text{H}_{54}\text{O}_{10}$, M 634**Taxonomy:** Cycloartane Glycosides*Cimicifuga Rhizome* (*Ranunculaceae*) [1].A white needle, $[\alpha]_D -39.8^\circ$ (MeOH).HRFABMS m/z: 657.3622 $[\text{C}_{35}\text{H}_{54}\text{O}_{10}\text{Na}]^+$.**Table 1**

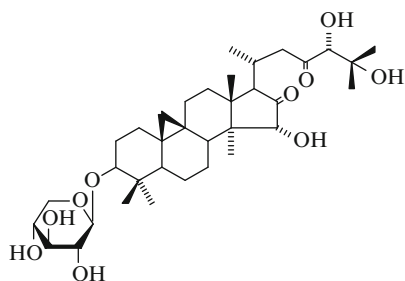
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	31.1 1.27, 1.69	C-19	28.8 0.51 d (3.6), 0.92 d (3.6)
2	29.6 1.97, 2.33	20	28.2 2.18 m
3	88.0 3.49 dd (3.9, 11.2)	21	25.0 1.02 d (6.8)
4	40.5 –	22	36.5 1.93 dd (11.6, 13),
5	40.7 1.29	23	78.3 2.13 dd (6.2, 13)
6	22.6 1.54, 1.93	24	80.0 5.15 brd (11.6)
7	122.2 5.28 brd (6.4)	25	72.5 3.76 brs
8	140.4 –	26	26.1 –
9	19.1 –	27	29.4 1.69 s
10	28.7 –	28	18.9 1.74 s
11	25.0 1.29, 2.09	29	25.6 1.62 s
12	31.3 1.84, 1.84	30	14.0 1.31 s
13	43.2 –	$\beta\text{-D-Xylp}$	
14	59.6 –	1	107.6 4.87 d (7.3)
15	200.4 9.85 s	2	75.6 4.06 dd (7.3, 8.7)
16	173.8 –	3	78.7 4.18 dd (8.7, 8.7)
17	55.6 2.74 d (4.4)	4	71.3 4.26 m
18	22.2 1.56 s	5	67.2 3.77 dd (10.2, 11), 4.40 dd (5.1, 11)

References

1. M. Nishida, H. Yoshimitsu, M. Okawa, T. Ikeda, T. Nohara, *Chem. Pharm. Bull.* **51**(10), 1215–1216 (2003)

15 α -Hydroxycimicidol-3-O- β -D-xylloside

C₃₅H₅₄O₁₁, M 650



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

$[\alpha]_D^{25}$ -45.7° (c 0.38, CHCl₃-MeOH, 1:1)

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2950, 2900, 1720, 1040.

Positive ion FABMS m/z : 651 [M + H]⁺.

HRFABMS m/z : 651.3756 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	27.73 1.68 m, 2.81 m	C-19	18.35 1.02 d (4.5), 1.96 d (4.5)
2	29.70 2.05 m, 2.39 m	20	27.61 2.79 m
3	88.29 3.58 dd (11.5, 3.5)	21	20.93 1.13 d (6.5)
4	40.60 –	22	47.10 3.43 dd (18, 9), 3.86 dd (18, 3)
5	43.79 1.34 m	23	213.49 –
6	21.84 1.73 m, 2.03 m	24	83.89 4.46 s
7	115.71 6.18 dd (7.5, 2)	25	72.39 –
8	146.40 –	26	27.91 1.63 s
9	28.06 –	27	25.45 1.50 s
10	29.10 –	28	19.44 1.28 s
11	62.94 4.60 dd (9, 3.5)	29	25.85 1.38 s

(continued)

Table 1 (continued)

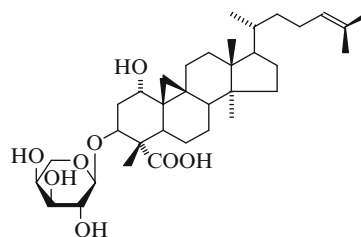
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
12	49.40 2.80 dd (13.5, 9), 2.23 dd (13.5),	30	14.43 1.15 s
13	40.87 –	β-D-Xylp	
14	49.56 –	1	107.33 4.85 d (7.5)
15	80.64 4.56 s	2	75.36 4.00 t (7.5)
16	220.54 –	3	78.40 4.13 t (8.5)
17	58.88 2.25 d (7.5)	4	71.05 4.16 ddd (10, 8.5, 5)
18	20.93 1.40 s	5	66.92 3.71 dd (11, 10), 4.31 dd (11, 5)

References

1. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

Mollic Acid 3-O- α -L-Arabinoside

C₃₅H₅₆O₈, M 604



Taxonomy: Cycloartane Glycosides

Combretum molle (*Combretaceae*) [1].

Combretum edwardsii (*Combretaceae*) [2].

Mp 234–235°C (from MeOH), $[\alpha]_D^{25} + 44.5^\circ$ (c 1.0, C₅H₅N).

IR ν_{\max}^{KBr} , cm⁻¹: 3485–3370, 3045, 2630, 1676, 1445, 1374, 1280, 1245, 1091, 1068, 1011, 990, 920.

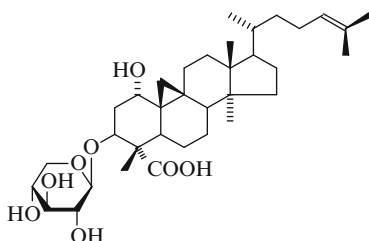
¹H NMR (C₅D₅N, δ): 0.13 and 0.38 (2H-19, d, J = 4 Hz), 0.63–1.35 (6 × CH₃), 3.08–4.10 (arabinose protons, H-1), 4.63 (Arap H-1, d, J = 6.5 Hz), 4.88–5.18 (H-3, H-24).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	72.5	C-8	48.4	C-15	33.5	C-22	36.1	C-29	180.2
2	37.7	9	21.1	16	28.6	23	25.5	30	10.5
3	81.5	10	30.3	17	52.8	24	126.0	α -L-Arap	
4	55.0	11	26.3	18	18.5	25	131.0	1	106.3
5	38.0	12	36.9	19	29.8	26	26.0	2	73.0
6	23.3	13	48.5	20	36.4	27	18.0	3	74.4
7	26.0	14	49.3	21	19.7	28	18.7	4	69.3
								5	66.54

References

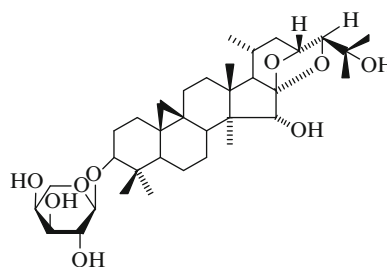
1. C.B. Rogers, I. Thevan, *Phytochemistry* **25**(7), 1759–1761 (1986)
2. C.B. Rogers, *Phytochemistry* **28**(1), 279–281 (1989)

Mollic Acid XylosideC₃₅H₅₆O₈, M 604**Taxonomy:** Cycloartane Glycosides*Combretum molle* (Combretaceae) [1, 2].Mp 235–237°C, $[\alpha]_D^{24} +39.5^\circ$ (c 0.76, C₅H₅N).IR ν_{\max}^{KBr} , cm⁻¹: 3400, 3040, 2625, 1700, 1450, 1375, 1260, 1160, 1110–1020, 990, 920, 890, 820.UV $\lambda_{\max}^{\text{EtOH}}$, nm (ϵ): 210 (2409).**Table 1**

δ_C (C ₅ D ₅ N)									
C-1	72.6	C-8	48.4	C-15	33.5	C-22	36.5	C-29	180.2
2	37.5	9	21.2	16	28.7	23	25.5	30	10.5
3	81.4	10	30.4	17	52.9	24	125.2	β -D-Xylp	
4	54.9	11	26.4	18	18.8	25	131.0	1	106.5
5	38.0	12	37.0	19	30.0	26	26.1	2	75.5
6	23.0	13	45.8	20	36.4	27	18.0	3	78.1
7	25.7	14	49.5	21	19.7	28	18.8	4	71.2
								5	67.1

References

1. K.H. Pegel, C.B. Rogers, *J. Chem. Soc. Perkin Trans.* **1**(8), 1711–1715 (1985)
2. C.B. Rogers, *Phytochemistry* **28**(1), 279–281 (1989)

Cimigenol 3-O- α -L-ArabinopyranosideC₃₅H₅₆O₉, M 620**Taxonomy:** Cycloartane Glycosides*Cimicifuga dahurica* L. (Turcz.) Maxim. (Ranunculaceae) [1].Mp 232–234°C, $[\alpha]_D +16.4^\circ$ (c 0.06, MeOH).

CAS Registry Number: 256925-92-5

IR ν_{\max}^{KBr} , cm⁻¹: 3447, 3031, 2961, 1631, 1453, 1375, 1068, 780.ESIMS m/z: 621 [M + 1]⁺.**Table 1**

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
C-1	32.4	1.22, 1.56		C-19	30.9	0.26 d (3.6), 0.51 d (3.6)	
2	30.0	1.94, 2.37		20	24.1	1.60	
3	88.5	3.47 dd (11.6, 4.2)		21	19.6	0.84 d (6.4)	
4	41.3	–		22	38.1	0.97, 2.25	
5	47.2	1.32		23	71.8	4.72 d (8.9)	
6	21.0	0.72, 1.52		24	90.1	3.75 s	
7	26.4	1.14, 2.21		25	71.0	–	
8	48.6	1.66		26	25.4	1.47 s	
9	20.0	–		27	26.3	1.45 s	
10	27.1	–		28	11.8	1.17 s	
11	26.6	1.04, 2.06		29	25.7	1.25 s	
12	34.0	1.49, 1.69		30	15.4	1.00 s	
13	41.8	–		α -L-Arap			
14	47.5	–		1	107.4	4.77 d (7.2)	
15	80.2	4.29 s		2	72.9	4.42 dd (8.6, 7.2)	

(continued)

Table 1 (continued)

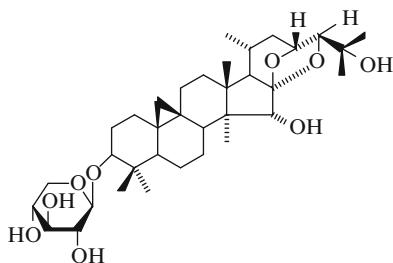
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	111.9 –	3	74.6 4.15 dd (8.6, 3.0)
17	59.5 1.42 d (9.3)	4	69.5 4.30 brs
18	19.5 1.13 s	5	66.7 3.77 brd (11), 4.25 dd (11, 3)

References

1. W. Ye, J. Zhang, C.-T. Che, T. Ye, S. Zhao, *Planta Med.* **65**, 770–772 (1999)

Cimigenol 3-O- β -D-Xylopyranoside

C₃₅H₅₆O₉, M 620



Taxonomy: Cycloartane Glycosides

Actea racemosa L. \equiv *Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1, 2].

Mp 261–264°C, $[\alpha]_D$ 8° (c 1, C₅H₅N).

CAS Registry Number: 27994-11-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3432, 2935, 2870, 1457, 1383, 1071.

ESIMS m/z: 619 [M-H]⁻.

HREIMS m/z: 620.3963 (C₃₅H₅₆O₉).

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4 1.58, 1.26	C-19	30.9 0.29 d (4), 0.51 d (4)
2	30.0 2.33, 1.95	20	24.0 1.66
3	88.6 3.51 dd (11.7, 4.2)	21	19.6 0.87 d (6.5)
4	41.3 –	22	38.1 2.32, 1.07
5	47.5 1.30	23	71.9 4.75 d (9)
6	21.0 1.53, 0.87	24	90.2 3.84 s
7	26.3 2.10, 1.14	25	71.2 –

(continued)

Table 1 (continued)

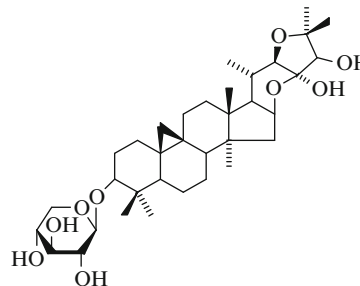
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
8	48.6 1.68	26	26.4 1.55 s
9	19.9 –	27	25.3 1.50 s
10	28.2 –	28	11.1 1.23 s
11	26.3 2.10, 1.08	29	25.7 1.32 s
12	34.0 1.68, 1.56	30	15.4 1.07 s
13	41.8 –	β -D-Xylp	
14	47.2 –	1	107.3 4.87 d (7.6)
15	80.1 4.29 s	2	75.3 4.05 t (7.6)
16	112.0 –	3	78.1 4.23
17	59.5 1.50	4	71.0 4.25
18	19.5 1.16	5	68.2 4.38 dd (4.9, 11.3), 3.51 dd (9.9, 11.3)

References

1. S. Corsano, G. Spano, *Atti Accad. Nazi. Lincei. Rend., Classe Sci., Fis. Mat. Nat.* **32**, 674–678 (1962). *CA.*, 58:11408f (1963)
2. K. Wende, C. Mugge, K. Thurow, T. Schopke, U. Lindequist, *J. Nat. Prod.* **64**(7), 986–989 (2001)

Cimiaceroside B

C₃₅H₅₆O₉, M 620



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Cimicifuga acerina (Oki) (*Ranunculaceae*) [1].

Mp 279–280°C (from MeOH), $[\alpha]_D$ -2.4° (c 0.4, MeOH).

CAS Registry Number: 210643-84-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3200.

Positive SIMS m/z: 643 [M + Na]⁺, 603 [M-OH]⁺.

HRSIMS m/z: 603.3898 [M-OH]⁺.

Table 1

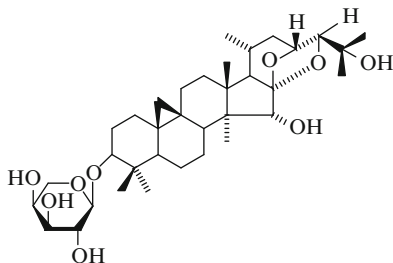
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.16	1.23, 1.60	C-19	30.15	0.21 d (4), 0.51 d (4)
2	30.04	1.93, 2.35	20	34.74	2.25
3	88.42	3.50 dd (4.4, 11.5)	21	17.48	1.22 d (6.5)
4	41.31	–	22	86.91	3.88 d (10.6)
5	47.51	1.33	23	105.99	–
6	20.94	0.73, 1.55	24	83.35	4.16 s
7	26.28	1.04, 1.27	25	83.55	–
8	47.47	1.58	26	27.75	1.75 s
9	19.65	–	27	24.76	1.67 s
10	26.65	–	28	19.64	0.87 s
11	26.35	1.10, 1.94	29	25.76	1.33 s
12	33.47	1.56 (2H)	30	15.41	1.04 s
13	46.88	–	β -D-Xylp		
14	45.27	–	1	107.48	4.86 d (7.5)
15	43.34	1.58, 1.91	2	75.55	4.02 dd (7.5, 8)
16	72.41	4.96 ddd (7.8, 7.8, 7.8)	3	78.59	4.13 dd (8, 8)
17	52.37	1.58	4	71.25	4.20 ddd (5, 8, 10.6)
18	20.59	1.21 s	5	67.08	3.73 dd (10.6, 11.3), 4.35 dd (5, 11.3)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, T. Okuyama, G. Kusano, *Heterocycles* **48**(5), 1003–1013 (1998)

Cimiracemoside C

C₃₅H₅₆O₉, M 620



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (Ranunculaceae) [1].

Mp 258–260°C, [α]_D +39.0° (c 0.11, MeOH).

CAS Registry Number: 256925-92-5

IR $\nu_{\text{max}}^{\text{film}}$, cm⁻¹: 3418.

Negative ESIMS m/z: 619 [M-1]⁻.

Table 1

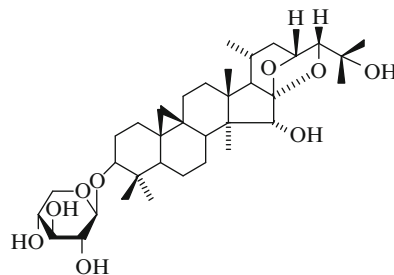
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.7	1.24, 1.56	C-19	31.2	0.29 d (3), 0.52 d (3)
2	30.3	1.96, 2.38	20	24.4	1.66
3	88.9	3.50 dd (11.4, 4)	21	19.8	0.86 d (6)
4	41.6	–	22	38.4	1.03, 2.29
5	47.9	1.32	23	72.1	4.75 d (8.7)
6	21.4	0.72, 1.52	24	90.4	3.78 s
7	26.6	1.08, 2.10	25	71.2	–
8	48.9	1.73	26	25.7	1.49 s
9	20.3	–	27	26.0	1.47 s
10	26.9	–	28	12.1	1.19 s
11	26.7	1.09, 2.07	29	27.5	1.28 s
12	34.4	1.68, 1.54	30	15.7	1.03 s
13	42.1	–	α -L-Arap		
14	47.6	–	1	107.7	4.81 d (7.1)
15	80.5	4.35	2	73.2	4.45
16	112.2	–	3	74.9	4.16 dd (8.8, 2.6)
17	59.8	1.50	4	69.7	4.30
18	19.9	1.15 s	5	67.0	3.80, 4.30

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

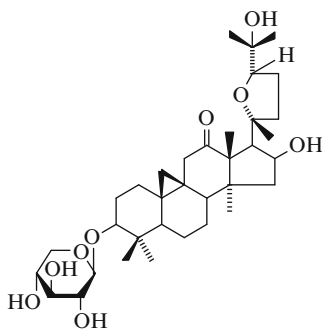
Cimigol Xyloside

C₃₅H₅₆O₉, M 620



Taxonomy: Cycloartane Glycosides*Cimicifuga japonica* (*Ranunculaceae*) [1].Mp 297–299°C (from EtOH), $[\alpha]_D^{19} +23.7^\circ$ (c 0.8, CH₂Cl₂–MeOH, 1:1).**References**

1. N. Sakurai, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **27**(1), 158–165 (1979)

Cycloalpioside AC₃₅H₅₆O₉, M 620**Taxonomy:** Cycloartane Glycosides*Astragalus alopecurus* Pall. (*Leguminosae*) [1].Mp 287–288°C (from MeOH), $[\alpha]_D^{27} -15.1^\circ$ (c 0.53, C₅H₅N).

CAS Registry Number: 172324-48-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3520–3200, 3040, 1720.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.33 and 0.66 (2H-19, d, J = 4 Hz), 0.70, 1.04, 1.29, 1.32, 1.57, 1.57, 1.60 (7 × CH₃, s), 2.04 and 2.74 (2 H-11, d, J = 20 Hz), 2.94 (H-22, m), 3.18 (H-17, d, J = 8.5 Hz), 3.46 (H-3, dd, J = 12, 4.5 Hz), 4.82 (Xylp H-1, d, J = 7 Hz), 4.83 (H-16, m).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.61	C-10	26.43 ^a	C-19	30.86	C-28	20.45
2	30.49	11	45.79	20	87.21	29	27.26 ^b
3	88.03	12	211.22	21	25.70	30	15.38
4	41.20	13	60.93	22	36.00	β-D-Xylp	
5	47.49	14	47.18	23	26.43 ^a	1	107.50

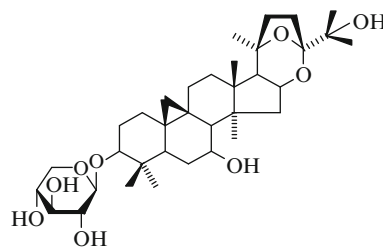
(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)							
6	20.75	15	45.96	24	82.30	2	75.55
7	25.70	16	73.01	25	70.68	3	78.58
8	47.60	17	49.82	26	27.26 ^b	4	71.23
9	20.02	18	14.96	27	27.84	5	67.10

^{a,b}Signals are mutually imposed**References**

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **30**(3), 346–351 (1994)

CycloalpiosideC₃₅H₅₆O₉, M 620**Taxonomy:** Cycloartane Glycosides*Astragalus alopecurus* Pall. (*Leguminosae*) [1].Mp 277–278°C (from MeOH), $[\alpha]_D^{26} -25.1^\circ$ (c 0.71, C₅H₅N).

CAS Registry Number: 180718-07-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 3040.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.27 and 0.78 (2H-19, d, J = 4 Hz), 1.04, 1.05, 1.30, 1.42, 1.49, 1.53, 1.56 (7 × CH₃, s), 2.64 (H-17, d, J = 8 Hz), 3.47 (H-3, dd, J = 11, 4 Hz), 3.70 (Xylp H-5a, t, J = 10 Hz, signal overlapped on the signal of H-7), 3.99 (Xylp H-2, t, J = 8 Hz), 4.09 (Xylp H-3, t, J = 8 Hz), 4.16 (Xylp H-4, m), 4.32 (Xylp H-5e, dd, J = 10, 5 Hz), 4.52 (H-16, q, J = 8 Hz), 4.81 (Xylp H-1, d, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	31.83 ^a	C-10	27.35	C-19	29.93	C-28	19.60
2	29.92	11	26.85	20	84.86	29	25.70
3	88.13	12	33.10	21	30.57	30	15.32
4	41.03	13	45.11	22	31.67	β-D-Xylp	

(continued)

Table 1 (continued)

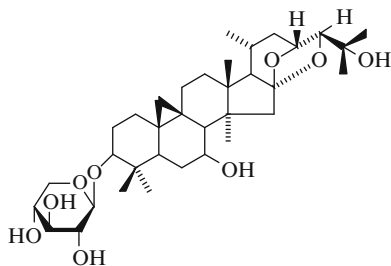
δ_C (C ₅ D ₅ N)							
5	46.40	14	45.59	23	33.54	1	107.56
6	31.83 ^a	15	45.74	24	110.58	2	75.52
7	69.95	16	74.33	25	72.80	3	78.59
8	54.63	17	61.29	26	25.59	4	71.20
9	19.52	18	22.14	27	25.23	5	67.12

^aSignals are mutually imposed

References

1. M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **31**(5), 589–595 (1995)

Cycloorbicoside A

C₃₅H₅₆O₉, M 620**Taxonomy:** Cycloartane Glycosides*Astragalus orbiculatus* Ledeb. (*Leguminosae*) [1].Mp 267–269° C (from EtOH), $[\alpha]_D^{19} + 8.3^\circ$ (c 1.2, MeOH).

CAS Registry Number: 108027-11-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3610–3200, 3040.

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.15 and 0.59 (2H-19, d, J = 4 Hz), 0.73 (CH₃-21, d, J = 6 Hz), 0.93, 1.10, 1.20, 1.24, 1.31, 1.33 (6 × CH₃, s), 3.37 (H-3, dd, J = 11, 4 Hz), 3.56 (H-24, s), 3.64 (H-7, m), 4.22 (Xylp H-5e, m), 4.58 (H-23, brd, J = 9 Hz), 4.71 (Xylp H-1, d, J = 6 Hz).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	32.00	C-8	55.35	C-15	48.85	C-22	38.45	C-29	25.82
2	29.72	9	19.76	16	115.30	23	71.76	30	15.37
3	88.34	10	27.23	17	60.61	24	90.56	β-D-Xylp	

(continued)

Table 1 (continued)

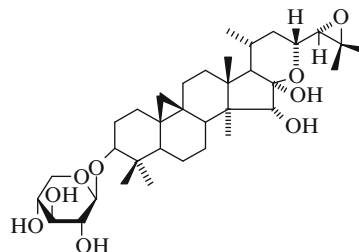
δ_C (C ₅ D ₅ N)										
4	41.10	11	26.80	18	18.99 ^a	25	71.11	1	107.52	
5	46.63	12	33.14	19	30.00	26	27.88	2	75.50	
6	31.84	13	44.25	20	23.82	27	24.74	3	78.59	
7	70.19	14	46.85	21	20.08	28	18.99 ^a	4	71.22	
									5	67.10

^aSignals are mutually imposed

References

1. M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(6), 671–676 (1986)

Shengmanol Xyloside

C₃₅H₅₆O₉, M 620**Taxonomy:** Cycloartane Glycosides*Cimicifuga japonica* (*Ranunculaceae*) [1].Mp 244–245.3° C (from EtOH), $[\alpha]_D^{22} - 10.2^\circ$ (c 0.5, CHCl₃-MeOH, 1:1).

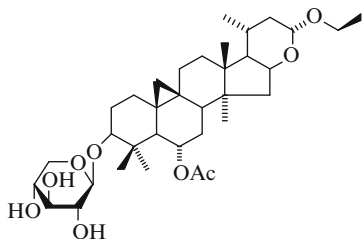
CAS Registry Number: 82868-97-1.

References

1. O. Kimura, N. Sakurai, M. Nagai, T. Inoue, *Yakugaku Zasshi* **102**(6), 538–545 (1982)

Tomentoside I

C₃₅H₅₆O₉, M 620



Taxonomy: Cycloartane Glycosides

Astragalus tomentosus Lam. (*Leguminosae*) [1].

Mp 247–250°C (from MeOH), $[\alpha]_D^{25} -18.7^\circ$ (c 0.47, MeOH).

CAS Registry Number: 132282-75-8.

IR ν_{\max}^{KBr} , cm^{-1} : 3350, 1725.

FABMS (positive) m/z: 643 [M + Na]⁺, 575 [M-45]⁺; (negative) m/z: 619 [M-1]⁻.

EIMS m/z (%): 442 (10), 382 (44), 311 (14), 73 (100).

¹H NMR (270 MHz, C₅D₅N, δ , 0-TMS): 0.17 and 0.49 (2H-19, d, J = 4.4 Hz), 0.86 (CH₃-21, d, J = 6.2 Hz), 0.93 (CH₃-30, s), 1.07 (CH₃-18, s), 1.14 (CH₃-29, s), 1.19 (CH₃-CH₂O, t, J = 7 Hz), 1.38 (CH₃-28, s), 1.53 (H-20, m), 2.03 (CH₃COO, s), 3.45 (1 H, -CH₂O, dq, J = 10, 7 Hz), 3.50 (H-3, dd, J = 11, 5 Hz), 3.80 (Xylp H-5, t, J = 10 Hz), 3.90 (1 H, -CH₂O, dq, J = 10, 7 Hz), 4.05 (Xylp H-2, t, J = 8 Hz), 4.15 (Xylp H-3, t, J = 8 Hz), 4.25 (Xylp H-4, ddd, J = 10, 8, 5 Hz), 4.39 (Xylp H-5, dd, J = 10, 5 Hz), 4.42 (H-16, ddd, J = 7.8, 7.6, 6 Hz), 4.83 (Xylp H-1, d, J = 8 Hz), 4.92 (H-23, dd, J = 7.5, 7.2 Hz), 4.98 (H-6, td, J = 9, 5 Hz).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	31.9	C-8	49.9	C-15	43.3	C-22	33.2	OEt	62.7
2	29.9	9	20.9	16	70.4	23	99.0		15.7
3	87.5	10	28.2	17	44.5	28	19.3	β -D-Xylp	
4	42.2	11	26.0	18	19.8	29	26.8	1	107.0
5	56.5	12	33.0	19	27.8	30	16.4	2	75.5

(continued)

Table 1 (continued)

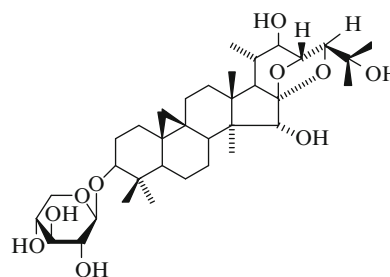
δ_C (C ₅ D ₅ N)									
6	70.2	13	44.8	20	25.6	Ac	21.7	3	78.6
7	38.1	14	46.0	21	20.6		170.3	4	71.2
								5	67.2

References

1. N.A. El-Sebakhy, F.M. Harraz, R.M. Abdallah, A.M. Asaad, F. Orsini, F. Pelizzoni, G. Sello, L. Verotta, *Phytochemistry* **29**(10), 3271–3274 (1990)

22-Hydroxycimigenol Xyloside

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 282–284°C, $[\alpha]_D^{17} +17.7^\circ$ (c 0.6, CHCl₃-MeOH, 1:1).

IR ν_{\max}^{KBr} , cm^{-1} : 3640–3100, 1060.

¹H NMR (C₅D₅N, δ): 0.99, 1.15, 1.16, 1.38 (4 × CH₃, s), 1.25 (2 × CH₃, s), 4.74 (1H, d, J = 6.5 Hz).

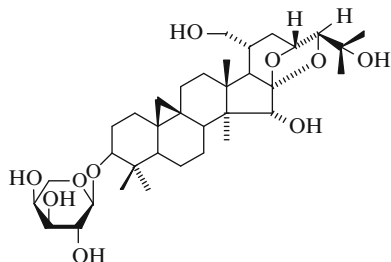
¹³C NMR (C₅D₅N, δ): 34.3 (C-20), 70.9 (C-25), 79.8 (C-15, C-23), 82.2 (C-22), 86.4 (C-24), 88.5 (C-3), 107.4 (anomeric C), 112.6 (C-16).

References

1. N. Sakurai, A. Kimura, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **29**(4), 955–960 (1981)

Cimiracemoside A

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 285–287°C, [α]_D +24.0° (c 0.13, MeOH).

CAS Registry Number: 290821-33-9.

IR ν_{max}^{KBr}, cm⁻¹: 3448.

Negative ESIMS m/z: 635 [M-1]⁻.

Table 1

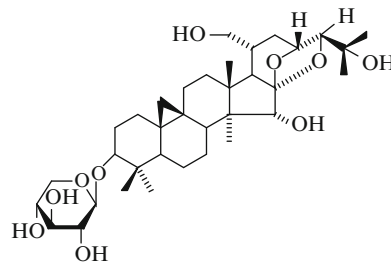
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.7 1.23, 1.60	C-19	31.1 0.27 d (3.6), 0.54 d (3.6)
2	30.4 1.95, 2.35	20	32.7 2.15
3	88.9 3.50 dd (3.9, 11.4)	21	64.3 3.74, 3.97
4	41.7 –	22	33.5 1.75, 2.70
5	47.9 1.35	23	72.5 4.92 d (9)
6	21.4 0.73, 1.53	24	90.3 3.91 s
7	26.7 1.20, 2.10	25	71.3 –
8	49.1 1.75	26	25.7 1.50 s
9	20.4 –	27	27.6 1.50 s
10	27.0 –	28	12.2 1.24 s
11	26.8 1.10, 2.10	29	26.1 1.30 s
12	34.1 1.69, 1.88	30	15.8 1.04 s
13	42.4 –	α-L-Arap	
14	47.7 –	1	107.8 4.82 d (7.5)
15	80.8 4.35	2	73.3 4.45
16	112.7 –	3	75.0 4.13 dd (8.6, 2.5)
17	53.6 2.13	4	69.9 4.33
18	20.4 1.30 s	5	67.1 3.80, 4.31

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Cimiracemoside B

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 288–290°C, [α]_D +8.3° (c 0.24, MeOH).

CAS Registry Number: 290821-38-4.

IR ν_{max}^{film}, cm⁻¹: 3411.

Negative ESIMS m/z: 635 [M-1]⁻.

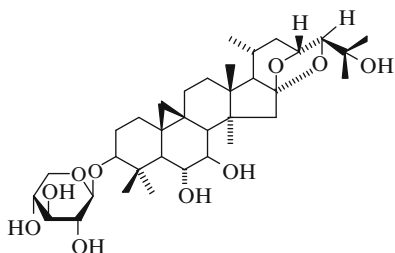
Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.5 1.20, 1.58	C-19	30.9 0.25 d (3.5), 0.50 d (3.9)
2	30.2 1.95, 2.35	20	32.4 2.15
3	88.6 3.49 dd (4.4, 11.7)	21	64.0 3.72, 3.94
4	41.4 –	22	33.2 1.72, 2.70
5	47.6 1.33	23	72.1 4.87 d (9)
6	21.1 0.71, 1.50	24	90.0 3.91 s
7	26.4 1.18, 2.08	25	71.1 –
8	48.8 1.72	26	25.4 1.46 s
9	20.1 –	27	27.1 1.48 s
10	26.7 –	28	12.0 1.20 s
11	26.5 1.13, 2.10	29	25.8 1.28 s
12	33.8 1.69, 1.83	30	15.5 1.04 s
13	42.1 –	β-D-Xylp	
14	47.4 –	1	107.6 4.84 d (7.5)
15	80.5 4.33	2	75.6 4.02
16	112.4 –	3	78.6 4.15 t (8.7)
17	53.3 2.12	4	71.3 4.22
18	19.9 1.24 s	5	67.1 3.72 dd (11.2, 5.1), 4.31 dd (10, 11.2)

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Cycloorbicoside B

C₃₅H₅₆O₁₀, M 636**Taxonomy:** Cycloartane Glycosides*Astragalus orbiculatus* Ledeb. (*Leguminosae*) [1, 2].Mp 242–244°C (from MeOH), $[\alpha]_D^{24} + 20.6^\circ$ (c 0.87, MeOH).

CAS Registry Number: 134985-26-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3190, 3045.

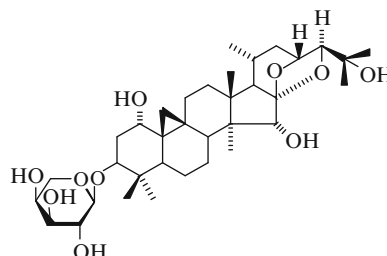
¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.33 and 0.69 (2H-19, d, J = 4 Hz), 0.85 (CH₃-21, d, J = 6 Hz), 1.18, 1.32, 1.36, 1.42, 1.44, 2.00 (6 × CH₃, s), 2.55 and 2.77 (2H-15, d, J = 15 Hz), 3.67 (H-24, s), 4.74 (H-23, d, J = 9 Hz), 4.91 (Xylp H-1, d, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)	
C-1	32.42
2	28.75
3	88.51
4	42.70
5	51.79
6	72.64
7	74.94
8	53.50
9	19.64
C-10	30.30
11	26.53
12	32.94
13	44.18
14	46.72
15	48.74
16	115.12
17	60.57
18	18.64
C-19	31.54
20	23.78
21	19.95
22	38.31
23	71.73
24	90.50
25	71.00
26	27.93
27	24.63
C-28	19.17
29	28.66
30	16.52
β -D-Xylp	
1	107.72
2	75.65
3	78.56
4	71.22
5	67.08

References

- M.A. Agzamova, M.I. Isaev, N.K. Abubakirov, *Chem. Nat. Comp.* **26**(5), 595–596 (1990)
- M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(4), 477–479 (1998)

1 α -Hydroxycimigenol-3-O- α -L-arabinopyranosideC₃₅H₅₆O₁₀, M 636**Taxonomy:** Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 186–187°C (from MeOH-isopropyl ether), $[\alpha]_D + 33.6^\circ$ (c 0.98, MeOH).

CAS Registry Number: 228256-76-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3250.Positive SIMS m/z: 659 [M + Na]⁺, 619 [M-OH]⁺.Positive HRSIMS m/z: 659.3749 [M + Na]⁺.**Table 1**

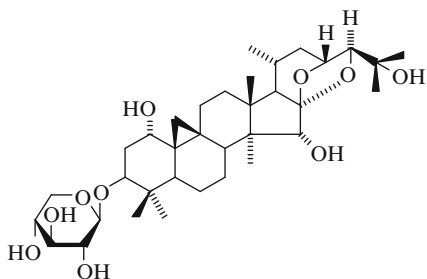
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.50	3.80 brs	C-19	30.85	0.43 d (4), 0.71 d (4)
2	37.77	2.22, 2.70	20	24.16	1.70
3	84.68	4.30 dd (4.3, 11.8)	21	19.66	0.86 d (6.5)
4	41.57	–	22	38.27	1.05, 2.25
5	40.11	2.43 dd (4.3, 12.5)	23	70.98	4.73 d (8.8)
6	21.01	0.86, 1.65	24	90.25	3.75 s
7	26.38	1.38, 2.13	25	71.94	–
8	48.85	1.75	26	27.03	1.45 s
9	21.04	–	27	25.47	1.48 s
10	31.10	–	28	11.74	1.28 s
11	25.86	1.40, 2.85	29	25.86	1.34 s
12	34.21	1.62, 1.78	30	14.70	1.08 s
13	41.96	–	α -L-Arap		
14	47.46	–	1	107.39	4.81 d (6.9)
15	80.30	4.28 s	2	72.81	4.42 dd (6.9, 8.1)
16	112.05	–	3	74.49	4.11 dd (3.1, 8.1)
17	59.66	1.50	4	69.29	4.27
18	19.61	1.20 s	5	66.45	3.66 dd (2.5, 11.8), 4.20 dd (2.5, 11.8)

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

1 α -Hydroxycimigenol-3-O- β -D-xylopyranoside

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 187–188°C, $[\alpha]_D^{20}$ +24.6° (c 0.68, MeOH).

CAS Registry Number: 162897-45-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3580–3200.

FABMS m/z: 637.3 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.42 3.82 brs	C-19	30.90 0.42 d (4), 0.68 d (4)
2	38.16 2.30, 2.72	20	24.05 1.68
3	84.60 4.32 dd (12, 4)	21	19.59 0.84 d (7)
4	41.48 –	22	37.70 1.05, 2.25
5	39.97 2.43	23	71.85 4.74 d (9)
6	20.93 0.85, 2.70	24	90.17 3.79 s
7	26.29 1.50, 2.30	25	71.06 –
8	48.83 1.75	26	26.69 1.47 s
9	20.93 –	27	25.29 1.50 s
10	30.82 –	28	11.71 1.30 s
11	25.73 1.45, 2.87	29	25.73 1.39 s
12	34.06 1.60, 1.75	30	14.67 1.11 s
13	41.78 –	β -D-Xylp	
14	47.29 –	1	107.50 4.84 d (8)
15	80.23 4.30 s	2	75.36 4.02 dd (8, 8)
16	111.95 –	3	78.23 4.12 dd (8, 8)

(continued)

Table 1 (continued)

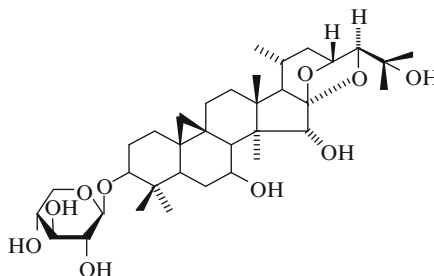
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
17	59.54 1.45 d (11)	4	70.96 4.20 ddd (11, 8, 4)
18	19.59 1.20 s	5	66.82 3.57 dd (10, 9), 4.25 dd (9, 4)

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

7 β -Hydroxycimigenol-3-O- β -D-xylopyranoside

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 310°C (from CH₃CN–MeOH), $[\alpha]_D$ +14.7°

(c 1.17, MeOH).

CAS Registry Number: 168288-00-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3450–3200.

Positive HRSIMS m/z: 637.3947.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.18 1.25, 1.58	C-19	30.64 0.35 d (4.2), 0.66 d (4.2)
2	29.98 1.92, 2.35	20	24.00 1.60
3	88.28 3.52 dd (11.6, 4.3)	21	19.63 0.87 d (6.4)
4	41.03 –	22	38.10 1.10, 2.28
5	46.28 1.60	23	71.70 4.72 d (8.8)
6	32.29 1.20, 2.04	24	90.30 3.81 s

(continued)

Table 1 (continued)

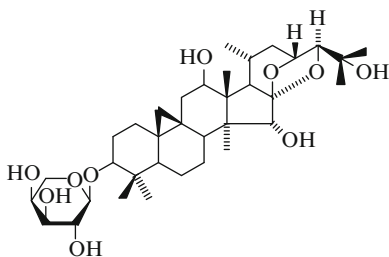
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
7	69.29 3.67 ddd (12, 10, 3)	25	71.18 –
8	56.28 1.80 d (10)	26	25.54 1.52 s
9	18.94 –	27	26.37 1.49 s
10	27.17 –	28	11.94 1.34 s
11	26.57 1.08, 2.08	29	25.65 1.30 s
12	33.96 1.55, 1.65	30	15.29 1.07 s
13	42.37 –	β -D-Xylp	
14	47.76 –	1	107.45 4.84 d (7.5)
15	79.15 4.43 s	2	75.31 4.02 dd (8.5, 7.5)
16	111.72 –	3	78.28 4.17 dd (8.8, 8.5)
17	59.85 1.52 d (10.8)	4	71.01 4.23 ddd (11, 8.8, 5)
18	19.63 1.18 s	5	66.96 3.73 dd (11,11), 4.36 dd (11,5)

References

1. A. Kusano, M. Shibano, G. Kusano, Chem. Pharm. Bull. **43**(7), 1167–1170 (1995)

12 β -Hydroxycimigenol-3-O- α -L-arabinopyranoside

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 267–268°C (from MeOH), $[\alpha]_D^{25} +15.3^\circ$ (c 0.38, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3200.

Positive SIMS m/z: 637 [M + H]⁺, 659 [M + Na]⁺.

Positive HRSIMS m/z: 637.3954 [M + H]⁺.

Table 1

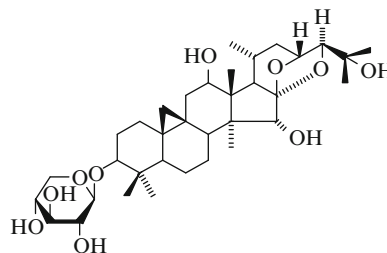
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.06 1.20, 1.55	C-19	30.38 0.42 d (4), 0.58 d (4)
2	29.53 1.80, 2.14	20	23.64 1.86
3	88.18 3.46 dd (11.5, 4.2)	21	20.69 1.37 d (5.8)
4	40.84 –	22	38.39 1.13, 2.39
5	46.92 1.31	23	71.40 4.76 d (8.8)
6	20.47 0.72 q (12.5), 1.60	24	89.65 3.86 s
7	25.71 1.25, 2.28	25	70.81 –
8	46.92 1.79	26	25.10 1.55 s
9	20.25 –	27	26.14 1.51 s
10	26.14 –	28	11.48 1.26 s
11	40.24 1.50, 2.80 dd (15.5, 9)	29	25.34 1.23 s
12	72.39 4.20 bd (9)	30	14.96 0.99 s
13	47.44 –	α -L-Arap	
14	47.86 –	1	106.79 4.81 d (7.2)
15	79.40 4.40 s	2	72.22 4.40 dd (8.5, 7.2)
16	111.90 –	3	73.95 4.20 dd (8.5, 3)
17	59.36 1.82 d (9.3)	4	68.84 4.35 brs
18	11.70 1.43 s	5	66.08 3.80 d (11), 4.30 dd (11, 3)

References

1. A. Kusano, M. Shibano, G. Kusano, Chem. Pharm. Bull. **43**(7), 1167–1170 (1995)

12 β -Hydroxycimigenol-3-O- β -D-xylopyranoside

C₃₅H₅₆O₁₀, M 636



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 286–287°C (from MeOH), $[\alpha]_D +6.4^\circ$ (c 0.44, MeOH).

CAS Registry Number: 152685-90-0.

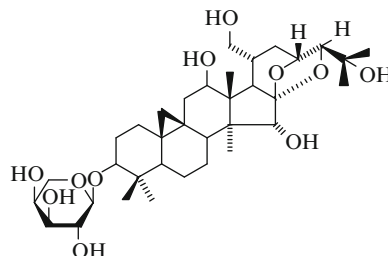
IR ν_{\max}^{KBr} , cm^{-1} : 3550–3250.Positive FABMS m/z: 637 $[\text{M} + \text{H}]^+$, 659 $[\text{M} + \text{Na}]^+$.Positive HRFABMS m/z: 637.3957 $[\text{M} + \text{H}]^+$.**Table 1**

δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)
C-1	32.42 1.20, 1.55	C-19	30.75 0.40 d (4), 0.58 d (4)
2	29.99 1.80, 2.12	20	24.00 1.85
3	88.71 3.45 dd (11.5, 4.2)	21	21.03 1.35 d (5.7)
4	41.23 –	22	38.78 1.12, 2.38
5	47.35 1.31	23	71.89 4.74 d (8.8)
6	20.80 0.72 q (12.5), 1.58	24	90.22 3.84 s
7	26.08 1.25, 2.26	25	71.33 –
8	47.35 1.80	26	25.43 1.52 s
9	20.53 –	27	26.49 1.49 s
10	26.49 –	28	11.81 1.28 s
11	40.63 1.50, 2.78 dd (15.5, 9)	29	25.71 1.21 s
12	72.89 4.20 bd (9)	30	15.32 1.01 s
13	47.85 –	$\beta\text{-D-Xylp}$	
14	48.27 –	1	107.60 4.82 d (7.6)
15	79.93 4.42 s	2	75.41 4.00 dd (8.5, 7.6)
16	112.53 –	3	78.33 4.16 dd (8.5, 8.5)
17	59.81 1.81 d (9.3)	4	71.11 4.24 ddd (10.5, 8.6, 5)
18	12.04 1.41 s	5	67.00 3.71 t (10.5), 4.35 dd (10.5, 5)

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **43**(7), 1167–1170 (1995)

12 β ,21-Dihydroxycimigenol 3-O- α -L-Arabinopyranoside

 $\text{C}_{35}\text{H}_{56}\text{O}_{11}$, M 652**Taxonomy:** Cycloartane Glycosides*Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1].Amorphous solid, $[\alpha]_D^{27} +10.0^\circ$ (c 0.1, MeOH).IR ν_{\max}^{film} , cm^{-1} : 3384, 2946, 2924, 1404, 1365, 1236, 1141, 1077, 1037, 1021, 1006, 977, 947.FABMS m/z: 675 $[\text{M} + \text{Na}]^+$.**Table 1**

δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)
C-1	32.4 1.59 ddd (13.6, 13.3, 3.1), 1.28	C-19	30.5 0.34 d (4.1), 0.65 d (4.1)
2	29.9 2.33, 1.91	20	31.6 2.23
3	88.4 3.49 dd (11.7, 4.3)	21	66.3 4.11 dd (10.6, 4.5), 4.00 dd (10.6, 5.9)
4	41.2 –	22	32.8 2.46 ddd (13.5, 8.5, 8.4), 1.46
5	47.2 1.32 dd (12.4, 4.1)	23	71.9 4.83 brd (8.3)
6	20.9 1.53, 0.78 qd (12.5, 1.8)	24	88.8 3.92 d (0.6)
7	25.9 2.09, 1.22	25	70.9 –
8	47.0 2.08	26	25.3 1.49 s
9	20.7 –	27	27.1 1.49 s
10	26.9 –	28	11.9 1.23 s
11	39.4 2.69 dd (15.5, 9), 1.47 dd (15.5, 3.8)	29	25.7 1.28 s
12	73.2 4.36 dd (9, 3.8)	30	15.3 1.00 s
13	47.9 –		

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	48.6	α -L-Arap	
15	80.0	1	107.4 4.78 d (7)
16	112.4	2	72.9 4.43 dd (8.7, 7)
17	54.1	3	74.6 4.16 dd (8.7, 3.4)
18	12.1	4	69.5 4.32 brs
		5	66.7 4.29 dd (11.8, 1.1), 3.79 dd (11.8, 1.21)

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.83	C-10	26.62	C-19	30.22	C-28	18.49
2	31.39	11	72.50	20	30.41	29	26.22
3	78.15	12	40.29	21	16.89	30	14.92
4	41.21	13	47.24	22	31.39	α -L-Arap	
5	47.90	14	49.97	23	38.73	1	107.18
6	21.75	15	50.15	24	215.72	2	73.01
7	26.82	16	82.61	25	40.95	3	74.53
8	49.32	17	49.46	26	18.60	4	69.34
9	20.33	18	22.14	27	18.60	5	66.69

References

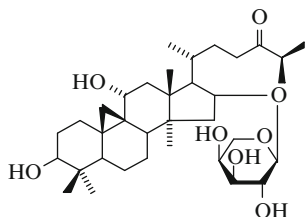
1. K. Watanabe, Y. Mimaki, H. Sakagami, Y. Sashida, Chem. Pharm. Bull. **50**(1), 121–125 (2002)

References

1. J.P. Xu, R.S. Xu, X.Y. Li, Phytochemistry **31**(1), 233–236 (1992)

Curculigosaponin B

C₃₅H₅₈O₈, M 606



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 156–159°C, $[\alpha]_D + 39.93^\circ$ (c 0.21, MeOH).

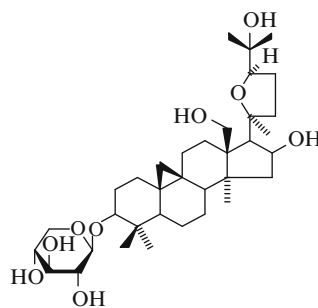
CAS Registry Number: 136771-43-2.

FABMS: 629 [M + Na]⁺, 645 [M + K]⁺, 475 [M + H-132]⁺, 457 [M + H-132-H₂O]⁺, 439 [457-H₂O]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.35 and 0.45 (2H-19, d, J = 4 Hz), 0.97 and 0.99 (CH₃-26 and CH₃-27, d, J = 6.5 Hz), 1.03, 1.28, 1.32, 1.37 (4 × CH₃, s), 2.55 (H-25, septet, J = 6.5 Hz), 4.60 (Ara H-1, d, J = 6.8 Hz).

Beesioside A

C₃₅H₅₈O₉, M 622



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp. 261–263°C (from CHCl₃-MeOH), $[\alpha]_D^{20} + 21.1^\circ$ (c 0.18, CHCl₃-MeOH, 1:1).

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 3330, 2965, 2930, 2860, 1465, 1380, 1375, 1340, 1210, 1160, 1090, 1050, 990, 950.

EIMS m/z (%): [M-18] + 604 (1), 490 (3), 472 (3), 454 (4), 436 (4), 395 (4), 373 (25), 355 (12), 337 (11), 143 (100), 125 (21), 107(18), 73 (25), 57 (10), 43 (19).

Positive ion FABMS m/z (%): 623 [M + H]⁺, 491, 473, 455, 437, 419, 143 (100), 125.

Positive ion HRFABMS m/z : 623.417323 [M + H]⁺.

Table 1

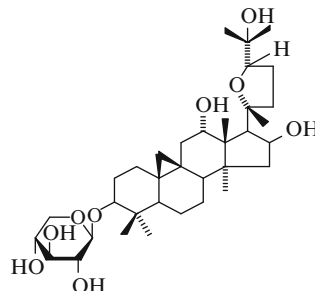
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	32.2 1.18 m, 1.55 m	C-19	30.4 0.20 d (3.6), 0.51 d (3.6)
2	30.1 1.92 m, 2.34 m	20	86.4 –
3	88.5 3.48 dd (11.7, 4.3)	21	26.0 1.36 s
4	41.4 –	22	36.8 1.68 m, 2.49 m
5	47.9 1.30 m	23	24.6 1.98 m, 2.25 m
6	20.9 0.59 q (12.5), 1.47 m	24	85.3 3.97 dd (8.6, 5.2)
7	26.5 1.05 m, 1.28 m	25	70.8 –
8	47.6 1.95 m	26	28.3 1.51 s
9	20.2 –	27	26.5 1.20 s
10	26.8 –	28	22.6 0.95 s
11	26.7 2.03 m, 1.52 m	29	25.8 1.29 s
12	29.2 2.04 m, 1.55 m	30	15.4 0.97 s
13	51.8 –	β -D-Xylp	
14	47.0 –	1	107.5 4.85 d (7.5)
15	49.1 2.07 dd (13, 7.9), 2.13 dd (13, 4.1)	2	75.5 4.01 t (8.4)
16	72.8 4.84 m	3	78.5 4.14 t (8.8)
17	55.7 2.30 d (7.1)	4	71.3 4.21 td (9, 5.2)
18	65.8 4.35 m, 4.51 brd	5	67.1 3.72 t (10.7), 4.35 m

References

- J. Ju, D. Liu, G. Lin, X. Xu, B. Han, J. Yang, G. Tu, L. Ma, J. Nat. Prod. **65**(1), 42–47 (2002)

Cycloalpioside B

C₃₅H₅₈O₉, M 622



Taxonomy: Cycloartane Glycosides

Astragalus alopecurus Pall. (*Leguminosae*) [1].

Astragalus ephemerotum Gontsch. (*Leguminosae*) [2].

Mp 253–254°C (from MeOH), $[\alpha]_{\text{D}}^{23}$ –26.3° (c 0.53, MeOH).

CAS Registry Number: 172343-24-7.

IR ν_{\max}^{KBr} , cm^{-1} : 3600–3400, 3040.

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.34 and 0.47 (2H-19, d, J = 4 Hz), 1.03, 1.25, 1.30, 1.35, 1.51, 1.51, 1.78 (7 × CH₃, s), 3.18 (H-17, d, J = 8 Hz), 3.45 (H-3, dd, J = 11.6, 4 Hz), 4.82 (Xylp H-1, d, J = 7.3 Hz), 4.91 (H-16, q, J = 8 Hz).

Table 1

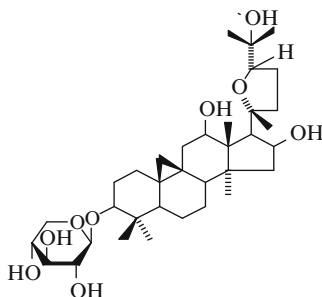
δ_{C} (C ₅ D ₅ N)		δ_{C} (C ₅ D ₅ N)		δ_{C} (C ₅ D ₅ N)		δ_{C} (C ₅ D ₅ N)	
C-1	32.36	C-10	26.81	C-19	30.12 ^a	C-28	21.19
2	30.12 ^a	11	38.76	20	87.53	29	27.47 ^c
3	88.47	12	72.77 ^b	21	25.75	30	15.50
4	41.35	13	49.85	22	38.38	β -D-Xylp	
5	47.65	14	50.76	23	26.29	1	107.55
6	21.30	15	46.44	24	83.48	2	75.54
7	26.03	16	72.77 ^b	25	70.78	3	78.57
8	48.90	17	52.20	26	27.03	4	71.22
9	19.94	18	21.97	27	27.47 ^c	5	67.09

^{a,b,c}Signals are mutually imposed

References

- M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **30**(4), 474–479 (1994)
- I.A. Sukhina, M.I. Isaev, Chem. Nat. Comp. **31**(5), 639–640 (1995)

Cycloalpioside C

C₃₅H₅₈O₉, M 622**Taxonomy:** Cycloartane Glycosides*Astragalus alopecurus* Pall. (*Leguminosae*) [1].Mp 223–225°C (from MeOH), $[\alpha]_D^{26} + 25.7^\circ$ (c 0.71; C₅H₅N).

CAS Registry Number: 176330-31-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3280, 3040.

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.24 and 0.60 (2H-19, d, J = 4 Hz), 0.87, 0.97, 1.27, 1.38, 1.44, 1.73, 1.85 (7 × CH₃, s), 2.50 (H-17, d, J = 8 Hz), 3.41 (H-3, dd, J = 11.5, 4.5 Hz), 3.70 (Xylp H-5a, dd, J = 11, 9 Hz), 3.98 (Xylp H-2, t, J = 7.5 Hz), 4.06 (H-12, dd, J = 9, 4.5 Hz), 4.11 (Xylp H-3 and H-24, t), 4.18 (Xylp H-4, td, J = 9, 5 Hz), 4.32 (Xylp H-5e, dd, J = 11, 5 Hz), 4.79 (H-16, m), 4.80 (Xylp H-1, d, J = 7.5 Hz).

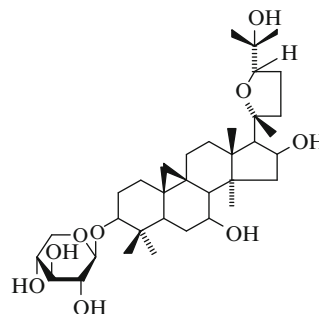
Table 1

δ_C (C ₅ D ₅ N)							
C-1	31.81	C-10	26.96	C-19	29.16	C-28	19.87
2	29.76	11	37.05	20	87.27	29	27.37
3	88.22	12	72.01	21	25.90	30	15.19
4	41.12	13	48.53	22	38.93	β -D-Xylp	
5	46.90	14	51.93	23	26.06	1	107.36
6	20.90	15	48.16	24	84.53	2	75.41
7	25.41	16	72.22	25	71.05	3	78.43
8	45.04	17	60.11	26	25.68	4	71.14
9	20.23	18	13.56	27	26.15	5	66.96

References

1. M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **30**(4), 474–479 (1994)

Cycloalpioside D

C₃₅H₅₈O₉, M 622**Taxonomy:** Cycloartane Glycosides*Astragalus alopecurus* Pall. (*Leguminosae*) [1].

Astragalus ephemerorum Gontsch. (*Leguminosae*) [2].
Mp 300–301°C (from MeOH), $[\alpha]_D^{26} - 18.3^\circ$ (c 0.87, C₅H₅N).

CAS Registry Number: 142713-57-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3250, 3035.

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.13 and 0.63 (2H-19, d, J = 4 Hz), 0.93, 0.99, 1.18, 1.20, 1.20, 1.39, 1.45 (7 × CH₃, s), 4.71 (Xylp H-1, d, J = 7 Hz), 4.95 (H-16, m).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	31.74 ^a	C-10	27.04 ^d	C-19	28.83	C-28	19.94 ^c
2	29.88	11	26.67 ^c	20	87.25	29	25.70
3	88.22	12	33.31	21	28.61	30	15.23
4	40.93	13	45.49	22	34.96	β -D-Xylp	
5	46.31 ^b	14	46.31 ^b	23	26.67 ^c	1	107.49
6	31.74 ^a	15	48.70	24	81.64	2	75.44
7	70.21	16	73.73	25	71.19 ^f	3	78.51
8	55.05	17	57.96	26	27.04 ^d	4	71.19 ^f
9	19.94 ^c	18	21.21	27	28.16	5	67.0

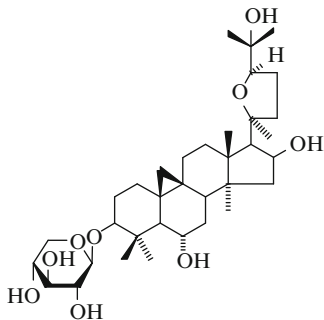
^{a,b,c,d,e,f}Signals are mutually imposed

References

1. M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **27**(3), 326–332 (1991)
2. I.A. Sukhina, M.I. Isaev, Chem. Nat. Comp. **31**(5), 639–640 (1995)

Cyclogaleginoside B

C₃₅H₅₈O₉, M 622



Taxonomy: Cycloartane Glycosides

Astragalus galegiformis L. (*Leguminosae*) [1, 2].

Mp 252–254°C (from CHCl₃–MeOH, 1:1), [α]_D²⁴ +32° (c 1.0, C₅H₅N).

CAS Registry Number: 86541-83-5.

IR ν_{max}^{KBr}, cm⁻¹: 3600–3200, 3040.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.28 and 0.57 (2H-19, d, J = 4 Hz), 0.99, 1.27, 1.31, 1.34, 1.50, 1.65, 1.95 (7 × CH₃,s), 2.23 (H-17, d, J = 8 Hz), 3.62 (H-3, dd, J = 12, 4 Hz), 3.71 (H-5a of D-Xylp, dd, J = 11, 10 Hz), 3.74 (H-6, td, J = 9, 3 Hz), 3.93 (H-24, t, J = 7.5 Hz), 4.04 (H-2 of D-Xylp, dd, J = 8, 7 Hz), 4.12 (H-3 of D-Xylp, t, J = 8 Hz), 4.21 (H-4 of D-Xylp, td, J = 8, 5 Hz), 4.34 (H-5e of D-Xylp, dd, J = 11, 5 Hz), 4.80 (H-16, q, J = 8 Hz), 4.89 (H-1 of D-Xylp, d, J = 7 Hz).

Table 1

δ _C (C ₅ D ₅ N)							
C-1	32.55	C-10	29.30	C-19	30.40	C-28	20.49
2	29.50	11	26.48	20	86.68	29	28.96
3	88.76	12	33.79	21	26.37	30	16.70
4	42.75	13	46.51	22	37.53	β-D-Xylp	
5	54.18	14	46.64	23	24.35	1	107.68
6	68.08	15	48.99	24	84.94	2	75.63
7	38.63	16	72.87	25	70.34	3	78.52

(continued)

Table 1 (continued)

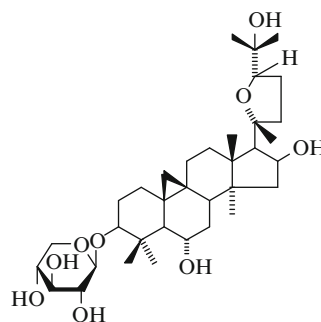
δ _C (C ₅ D ₅ N)							
8	47.08	17	56.60	26	26.92	4	71.26
9	21.12	18	21.19	27	28.15	5	67.08

References

1. M.D. Alania, M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, E. P. Kemertelidze, N.K. Abubakirov, *Chem. Nat. Comp.* **20**(4), 451–454 (1984)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)

Cyclosieversigenin 3-O-β-D-Xylopyranoside (astramembranin II)

C₃₅H₅₈O₉, M 622



Taxonomy: Cycloartane Glycosides

Astragalus pamirensis Ovcz. et Rassulova (*Leguminosae*) [1].

Astragalus membranaceus Bunge (*Leguminosae*) [2].

Astragalus tragacantha Habl. (*Leguminosae*) [3].

Astragalus exilis A. Kor (*Leguminosae*) [4].

Astragalus uninodus M. Pop. et Vved. [5].

Astragalus dissectus B. Fedtsch. et N. Ivanova
(Leguminosae) [6].

Mp 263–264°C (from MeOH), $[\alpha]_D^{24} +41.5^\circ$ (c 0.56, MeOH).

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.27 and 0.56 (2H-19, d, $J = 4$ Hz), 0.99, 1.28, 1.30, 1.31, 1.41, 1.56, 1.96 ($7 \times \text{CH}_3$, s), 2.52 (H-17, d, $J = 8$ Hz), 3.08 (H-22, q, $J = 10$ Hz), 3.61 (H-3, dd, $J = 12, 4$ Hz), 3.71 (Xylp H-5a, dd, $J = 11, 9$ Hz), 3.73 (H-6, td, $J = 9, 3$ Hz), 3.87 (H-24, dd, $J = 9, 5.5$ Hz), 4.03 (Xylp H-2, dd, $J = 9, 7.4$ Hz), 4.12 (Xylp H-3, t, $J = 9$ Hz), 4.21 (Xylp H-4, td, $J = 9, 5.5$ Hz), 4.34 (Xylp H-5e, dd, $J = 11, 5.5$ Hz), 4.89 (Xylp H-1, d, $J = 7.4$ Hz), 5.00 (H-16, q, $J = 8$ Hz). [4].

Table 1

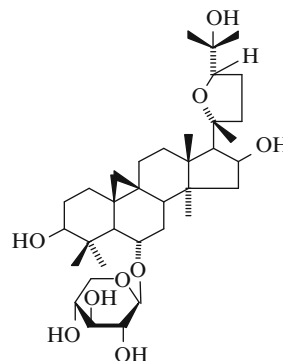
δ_C ($\text{C}_5\text{D}_5\text{N}$) [4]							
C-1	32.50	C-10	29.55	C-19	30.63	C-28	20.20
2	30.35	11	26.25	20	87.25	29	28.55
3	88.72	12	33.43	21	28.94	30	16.68
4	42.72	13	45.07	22	34.95	β -D-Xylp	
5	54.12	14	46.16	23	26.44	1	107.63
6	68.02	15	46.73	24	81.73	2	75.63
7	38.67	16	73.44	25	71.26	3	78.50
8	47.07	17	58.40	26	27.15	4	71.26
9	21.05	18	21.53	27	28.19	5	67.05

References

- M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, Chem. Nat. Comp. **22**(1), 115–116 (1986)
- Z. Cao, J. Yu, L. Gan, Y. Chen, Huaxue Xuebao **43**(6), 581–585 (1985). C.A., 103:175381x (1985)
- Y.M. Fadeev, M.I. Isaev, Y.A. Akimov, P.K. Kintia, M.B. Gorovits, N.K. Abubakirov, Chem. Nat. Comp. **24**(1), 62–65 (1988)
- R.P. Mamedova, M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **38**(6), 579–582 (2002)
- B.A. Imomnazarov, M.I. Isaev, Chem. Nat. Comp. **27**(3), 381 (1991)
- I.A. Sukhina, M.I. Isaev, Chem. Nat. Comp. **31**(5), 639–640 (1995)

Trigonoside I

$\text{C}_{35}\text{H}_{58}\text{O}_9$, M 622



Taxonomy: Cycloartane Glycosides

Astragalus trigonus DC (Leguminosae) [1].

Mp 226°C (from Et_2O), $[\alpha]_D^{25} + 25^\circ$ (c 0.58, MeOH).

CAS Registry Number: 172175-21-2.

FABMS m/z: $[\text{M} + \text{Na}]^+$ 645.

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)
C-1	32.55	C-18	21.05
	1.57 ddd (12, 13.2, 4.5),		1.41 s
	1.26 ddd (13.2, 4.5, 3)	19	28.10
			0.21 d (4.6), 0.63 d (4.6)
2	31.23	20	87.62
	2.02 m, 1.92 m		–
3	78.35	21	28.86
	3.55 dd (11.2, 5)		1.32 s
4	42.59	22	36.16
	–		3.11 ddd (11.2, 9, 12.3), 1.68 ddd (12.3, 9.7, 3)
5	52.38		1.88 d (8.4)
6	78.80	23	26.68
	3.84 ddd (5, 7.1, 8.4)		2.31 dddd (5.6, 12.8, 11.2, 3), 2.04 ddt (12.8, 9.7, 9)
7	34.33		2.14 ddd (5, 12.9, 5.3), 1.94 ddd (7.1, 12.9, 9.4)
		24	81.94
			3.88 dd (9, 5.6)
8	45.17	25	71.58
	2.04 dd (5.3, 9.4)		–
9	21.33	26	28.31
	–		1.53 s
10	29.23	27	27.26
	–		1.30 s

(continued)

Table 1 (continued)

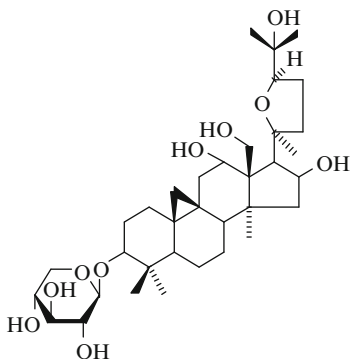
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
11	26.53	1.82 ddd (14.7, 9.3, 5.5), 1.17 ddd (14.7, 8.4, 6.9)	28 20.02 1.08 s
		29 28.99 1.85 s	
12	33.67	1.66 ddd (9.3, 6.9, 13.2), 1.55 ddd (5.5, 8.4, 13.2)	30 16.47 1.35 s
β -D-Xylp			
13	45.40	–	1 105.82 4.88 d (7)
14	46.07	–	2 75.45 3.99 t (7)
15	46.44	2.30 dd (8, 12.9)	3 78.55 4.14 t (7)
		1.84 dd (6.9, 12.9)	4 71.19 4.16 dd (7, 4.8)
16	73.67	5.04 ddd (7.9, 8, 6.9)	5 67.12 4.31 dd (11.1, 4.8), 3.70 dd (11.1, 9.6)
17	58.40	2.55 d (7.9)	

References

- P. Gariboldi, F. Pelizzoni, M. Tato, L. Verrota, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, S.M. Toaima, *Phytochemistry* **40**(6), 1755–1760 (1995)

Beesioside B

C₃₅H₅₈O₁₀, M 638



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp 280–282°C (from CHCl₃–MeOH), $[\alpha]_D^{20}$ +9.1° (c 0.06, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3435, 2960, 2940, 2880, 1460, 1440, 1385, 1350, 1215, 1160, 1110, 1080, 1060, 1045, 1015, 970.

EIMS m/z (%): [M⁺-2H₂O] 602 (1), 584 (0.1), 488 (1), 470 (2), 452 (3), 393 (3), 351 (4), 143 (100), 125 (20), 73 (20), 43 (10).

Positive HRFAB MS m/z: 639.410072 [M + H]⁺.

Table 1

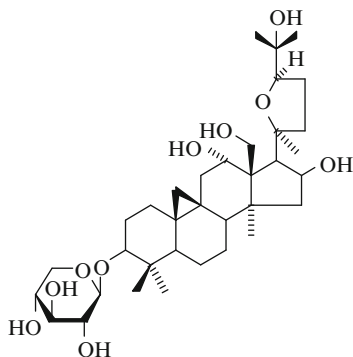
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
C-1	32.4	1.25 m, 1.55 m	C-19 30.9 0.36 d (3.7), 0.53 d (3.7)	
2	30.0	1.86 m, 2.27 m	20 86.1 –	
3	88.5	3.45 dd (11.6, 4.2)	21 27.6 1.68 s	
4	41.3	–	22 34.0 2.13 m, 2.88 m	
5	47.8	1.30 m	23 25.7 1.95 m, 2.30 m	
6	20.9	0.64 q (12.6), 1.50 m	24 82.7 3.95 m	
7	26.3	1.06 q (12.2), 1.35 m	25 70.1 –	
8	46.4	2.04 dd (12.8, 4.5)	26 28.1 1.57 s	
9	21.5	–	27 27.3 1.33 s	
10	27.0	–	28 22.5 0.97 s	
11	39.0	2.69 dd (15.5, 9.3), 1.35 m	29 25.8 1.28 s	
12	73.8	4.24 brd (8.2)	30 15.4 0.94 s	
13	55.6	–	β -D-Xylp	
14	49.0	–	1 107.4 4.81 d (7.4)	
15	50.1	2.12 m, 2.18 dd (14.7, 4.1)	2 75.5 3.95 m	
16	72.8	4.70 m	3 78.5 4.09 t (8.6)	
17	58.6	2.84 d (9.3)	4 71.2 4.15 m	
18	61.5	4.72 d (12.4), 4.70 m	5 67.0 3.69 t (10.4), 4.31 dd (11.3, 5)	

References

- J. Ju, D. Liu, G. Lin, X. Xu, B. Han, J. Yang, G. Tu, L. Ma, *J. Nat. Prod.* **65**(1), 42–47 (2002)

Beesioside C

C₃₅H₅₈O₁₀, M 638



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp 284–286°C (from CHCl₃–MeOH), [α]_D²⁰ +15.9° (c 0.15, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3445, 2960, 2925, 2885, 1460, 1440, 1385, 1345, 1210, 1150, 1110, 1090, 1045, 1010, 975.

Positive ion FABMS m/z: 639 [M + H]⁺, 507, 489, 471, 453, 371, 143 (100), 125.

Positive ion HRFABMS m/z: 639.413928 [M + H]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)		δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)		δ_{H} (J/Hz)
C-1	32.3	1.15 m, 1.55 m	C-19	29.4	0.08 d (3.6), 0.32 d (3.6)
2	30.1	1.83 m, 2.25 m	20	86.5	–
3	88.5	3.44 dd (11.6, 4.3)	21	28.0	1.61 s
4	41.4	–	22	34.7	2.00 m, 2.85 m
5	48.0	1.30 m	23	26.2	2.00 m, 2.20 m
6	21.1	0.55 q (12.5), 1.50 m	24	83.3	3.94 t (7.4)
7	26.4	1.15 m, 1.30 m	25	70.4	–
8	47.4	1.90 m	26	27.7	1.52 s
9	20.3	–	27	27.5	1.31 s
10	26.6	–	28	23.6	1.31 s

(continued)

Table 1 (continued)

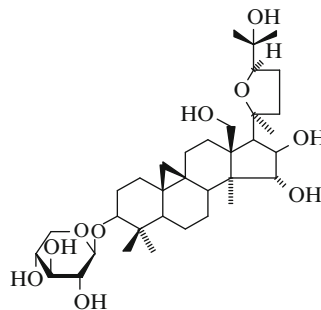
δ_{C} (C ₅ D ₅ N)		δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)		δ_{H} (J/Hz)
11	37.8	2.25 m, 1.62 m	29	25.8	1.30 s
12	69.0	4.17 m	30	15.5	0.94 s
13	55.7	–	β-D-Xylp		
14	47.4	–	1	107.5	4.81 d (7.6)
15	50.7	2.12 dd (12.8, 8.1), 2.20 m	2	75.6	3.97 t (8.2)
16	72.5	4.77 m	3	78.5	4.11 t (8.8)
17	51.1	3.20 d (7.5)	4	71.3	4.20 m
18	63.9	4.17 m, 4.31 m	5	67.1	3.69 t (10.9), 4.31 m

References

- J. Ju, D. Liu, G. Lin, X. Xu, B. Han, J. Yang, G. Tu, L. Ma, J. Nat. Prod. **65**(1), 42–47 (2002)

Beesioside E

C₃₅H₅₈O₁₀, M 638



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp 178–180°C (from CHCl₃–MeOH), [α]_D²⁰ +13.2° (c 0.11, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 2965, 2940, 2885, 1460, 1445, 1385, 1350, 1165, 1110, 1060, 1050, 1045, 1010.

Positive ion FABMS m/z (%): 639 [M + H]⁺, 489, 472, 453, 435, 143 (100), 125.

Positive ion HRFABMS m/z: 661.394448 [M + Na]⁺.

Table 1

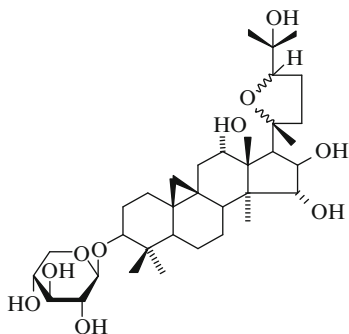
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.4 1.21 m, 1.57 m	C-19	30.5 0.25 d (3.7), 0.53 d (3.7)
2	30.1 1.88 m, 2.31 m	20	86.4 –
3	88.5 3.47 dd (11.5, 4.2)	21	26.4 1.37 s
4	41.3 –	22	37.0 1.67 m, 2.48 m
5	47.8 1.34 m	23	24.7 1.94 m, 2.26 m
6	21.1 0.63 q (12.5), 1.50 m	24	85.4 3.97 t (6.6)
7	26.8 1.28 m, 1.50 m	25	70.6 –
8	48.5 2.08 m	26	26.5 1.20 s
9	20.5 –	27	28.4 1.50 s
10	26.7 –	28	13.6 1.32 s
11	26.6 2.12 m, 1.03 m	29	25.7 1.25 s
12	29.7 2.05 m, 1.72 m	30	15.4 0.96 s
13	53.1 –	β -D-Xylp	
14	49.7 –	1	107.4 4.82 d (7.4)
15	87.0 4.91 d (3.5)	2	75.5 3.98 t (8.2)
16	82.6 4.72 dd (8.4, 3.5)	3	78.4 4.12 t (8.7)
17	53.4 2.53 d (8.4)	4	71.2 4.18 m
18	65.9 4.30 d (13), 4.54 d (13)	5	67.0 3.71 t (10.6), 4.33 m

References

1. J. Ju, D. Liu, G. Lin, X. Xu, B. Han, J. Yang, G. Tu, L. Ma, *J. Nat. Prod.* **65**(1), 42–47 (2002)

Beesioside N

$C_{35}H_{58}O_{10}$, M 638



Taxonomy: Cycloartane Glycosides

Beesia calthaefolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Mp 252–256°C (from $CHCl_3$ –MeOH), $[\alpha]_D^{20} +14.2^\circ$ (c 0.19, $CHCl_3$ –MeOH, 1: 1).

IR ν_{max}^{KBr} , cm^{-1} : 3450, 2965, 2940, 2870, 1450, 1380, 1360, 1160, 1040, 990.

Positive FABMS m/z (%): 661 $[M + Na]^+$, 639 $[M + H]^+$, 621, 603, 585, 489, 471, 453, 435, 143 (100), 125, 71, 43.

Positive ion HRFABMS m/z : 661.39076 $[M + Na]^+$.

Table 1

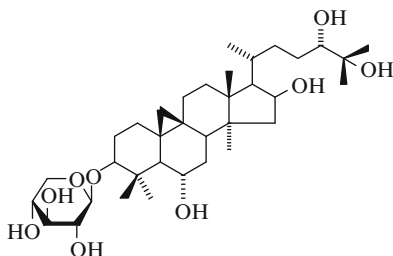
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.6 1.22 m, 1.60 m	C-19	29.7 0.25 d (4), 0.43 d (4)
2	30.2 1.89 m, 2.31 m	20	86.5 –
3	88.6 3.46 dd (11.8, 4)	21	28.6 1.63 s
4	41.4 –	22	35.8 2.93 dt, 1.98 m
5	47.8 1.30 m	23	26.1 2.18 m, 1.92 m
6	21.5 0.73 q (12.5), 1.55 m	24	83.5 3.93 t (7.5)
7	26.1 1.15 m, 1.28 m	25	70.2 –
8	49.5 1.72 m	26	27.7 1.52 s
9	20.2 –	27	27.6 1.38 s
10	27.0 –	28	13.8 1.60 s
11	37.3 2.41 dd (15, 7), 1.73 m	29	25.8 1.28 s
12	73.7 4.23 t (8)	30	15.6 1.01 s
13	48.9 –	β -D-Xylp	
14	51.7 –	1	107.6 4.82 d (7.5)
15	89.3 4.50 d (4)	2	75.6 4.00 t (8)
16	80.9 4.70 dd (10.5, 4)	3	78.6 4.14 t (8.5)
17	48.5 3.39 d (10.5)	4	71.3 4.20 m
18	20.7 1.62 s	5	67.2 3.71 t (10.5), 4.33 dd (11.5, 5)

References

1. J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Cycloanthoside A

C₃₅H₆₀O₉, M 624



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1, 2].

Astragalus cephalotes var. *brevicalyx* (*Leguminosae*) [3].

Mp 154–155°C (from EtOAc), $[\alpha]_D^{24} + 27^\circ$ (c 0.8, MeOH).

CAS Registry Number: 115332-90-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3300, 3050.

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.14 and 0.44 (2H-19, d, J = 4 Hz), 0.90 (CH₃, s), 0.96 (CH₃-21, d, J = 6 Hz), 1.20, 1.26, 1.32, 1.34, 1.84 (5 × CH s), 4.77 (Xylp H-1, d, J = 8 Hz).

Table 1

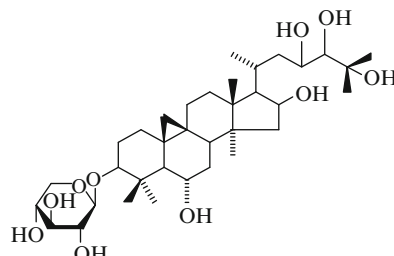
δ_C (C ₅ D ₅ N)							
C-1	32.52	C-10	30.35	C-19	29.53	C-28	20.14
2	28.65	11	26.28	20	28.86	29	29.25
3	88.74	12	33.19	21	18.91	30	16.15
4	42.71	13	45.73	22	33.03	β -D-Xylp	
5	54.11	14	46.81	23	27.91	1	107.59
6	67.93	15	46.99	24	77.19	2	75.61
7	38.42	16	72.01	25	72.54	3	78.49
8	48.36	17	57.35	26	25.71	4	71.26
9	21.36	18	18.28	27	26.47	5	67.04

References

- M.I. Isaev, B.A. Imomnazarov, Y.M. Fadeev, P.K. Kintia, *Chem. Nat. Comp.* **28**(3–4), 315–320 (1992)
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Cycloorbicoside D

C₃₅H₆₀O₁₀, M 640



Taxonomy: Cycloartane Glycosides

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1–3].

Mp 285–287°C (from MeOH).

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.29 and 0.57 (2H-19, d, J = 4 Hz), 1.03 (CH₃-28, s), 1.22 (CH₃-21, d, J = 6.5 Hz), 1.35 (CH₃-30, s), 1.39 (CH₃-18, s), 1.71 (CH₃-27, s), 1.74 (CH₃-26, s), 2.00 (CH₃-29, s), 3.65 (H-3, dd, J = 12, 4 Hz), 3.74 (H-5'a, dd, J = 11, 10 Hz), 3.78 (H-6, m), 3.79 (H-24, d, J = 9 Hz), 4.08 (H-2', dd, J = 9, 8 Hz), 4.18 (H-3', t, J = 9 Hz), 4.26 (H-4', td, J = 10, 5 Hz), 4.34 (H-23, m), 4.38 (H-5'e, dd, J = 11, 5 Hz), 4.72 (H-16, td, J = 7.5, 5 Hz), 4.92 (H-1', d, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.48	C-10	29.37	C-19	30.10	C-28	20.12
2	30.01	11	26.28	20	27.37	29	28.75
3	88.61	12	33.07	21	20.17	30	16.59
4	42.56	13	45.67	22	42.82	β -D-Xylp	
5	54.01	14	46.79	23	72.90	1	107.06
6	67.88	15	47.61	24	79.21	2	75.16
7	38.24	16	72.08	25	74.04	3	77.95
8	46.90	17	57.42	26	24.73	4	71.02
9	21.41	18	18.68	27	28.60	5	66.61

X-Ray [3].

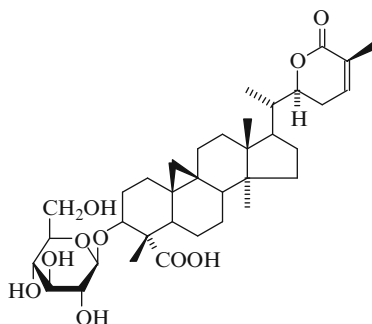
References

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- R.P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **41**(4), 429–431 (2005)

3. R.P. Mamedova, M.A. Agzamova, K.K. Turgunov, A. Todzhiboev, B. Tashkhodzhaev, M.I. Isaev, *Chem. Nat. Comp.* **42**(4), 501–502 (2006)

Abrusoside A

$C_{36}H_{54}O_{10}$, M 646



Taxonomy: Cycloartane Glycosides

Abrus precatorius L. (*Leguminosae*) [1, 2].

Mp 278–280°C (from MeOH), $[\alpha]_D^{20} +11.2^\circ$ (c 0.31, C_5H_5N).

CAS Registry Number: 124962-06-7.

IR ν_{max}^{KBr}, cm^{-1} : 3412, 1713, 1127, 1076, 1045.

Positive ion HRFABMS m/z: 669.3608 ($C_{36}H_{54}O_{10}Na$).

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	31.79	C-19	29.73
			0.28 d (3.5), 0.57 d (3.5)
2	29.29	20	40.04
3	85.31	21	13.11
	4.72 dd (11.7, 4.3)		1.01 d (6.6)
4	54.39	22	80.36
	–		4.53 m
5	44.70	23	27.87
6	23.10	24	140.71
	–		6.58 m
7	27.49	25	127.65
	–		–
8	48.02	26	166.34
	–		–
9	19.78	27	17.28
	–		1.95 s
10	25.51	28	19.46
	–		0.81 s
11	26.44	29	180.19
	–		–
12	35.50	30	11.08
	–		1.61 s
13	45.30	β -D-Glcp	
14	48.98	1	105.50
	–		5.14 d (7.7)
15	32.93	2	75.38
	–		4.00 m

(continued)

Table 1 (continued)

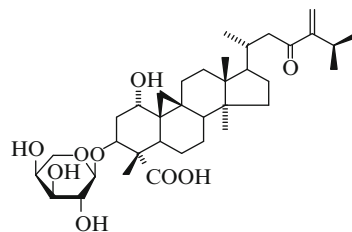
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
16	25.84	3	77.95
	–		4.27 m
17	47.83	4	71.40
	–		4.27 m
18	18.00	5	78.23
	0.95 s		4.00 m
	–	6	62.64
	–		4.53 m, 4.40 dd (11.7, 4.9)

References

1. Y.H. Choi, A.D. Kinghorn, X. Shi, H. Zhang, B.K. Teo, *J. Chem. Soc., Chem. Commun.* **13**, 887–888 (1989)
2. Y.H. Choi, R.A. Hussain, J.M. Pezzuto, A.D. Kinghorn, J.F. Morton, *J. Nat. Prod.* **52**(5), 1118–1127 (1989)

Jessic Acid α -L-Arabinopyranoside

$C_{36}H_{56}H_9$, M 632



Taxonomy: Cycloartane Glycosides

Combretum elaeagnoides (*Combretaceae*) [1].

Mp 225–227°C (from EtOH), $[\alpha]_D^{21} + 52.6^\circ$ (c 1.0, C_5H_5N).

IR ν_{max}^{KBr}, cm^{-1} : 3580–3340, 2650, 1710, 1675, 1620, 1260–1240.

UV λ_{max}^{EtOH}, nm (ϵ): 220 (5952).

1H NMR (60 MHz, C_5D_5N , δ): 0.32 and 0.33 (2H-19, d, $J = 4$ Hz), 0.60–1.21 ($6 \times CH_3$), 3.17–4.00 (various arabinose H), 3.43 (H-1, apparent t, $W_{1/2} = 7$ Hz), 4.50 (anomeric H, d, $J = 7$ Hz), 4.98 (H-3), 5.26 and 5.60 (2H-31, s).

Table 1

δ_C (C_5D_5N)				
C-1	72.6	C-22	46.0	α -L-Arap
3	81.3	23	202.5	C-1
4	54.8	24	156.6	2
				105.7
				72.9

(continued)

Table 1 (continued)

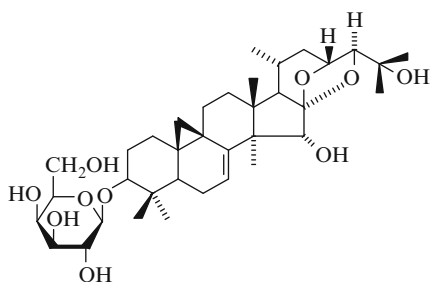
δ_C (C_5D_5N)					
8	48.0	26	22.3	3	74.0
9	21.1	27	22.3	4	68.8
10	30.4	29	179.8	5	65.9
13	46.0	30	10.2		
14	49.4	31	120.7		
17	52.9				

References

1. R. Osborne, K.H. Pegel, *Phytochemistry* **23**(3), 635–637 (1984)

7,8-Didehydrocimigenol-3-O- β -D-galactopyranoside

$C_{36}H_{56}O_{10}$, M 648



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp $>300^\circ C$ (from MeOH), $[\alpha]_D^{20} -9.2^\circ$ (c 0.9, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3600–3200.

Positive SIMS m/z: 649 $[M + H]^+$.

Positive HRSIMS m/z: 649.3944 $[M + H]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
C-1	30.37	1.29, 1.67	C-19 28.24	0.47 d (4), 1.05 d (4)	
2	29.51	1.28, 1.95	20	24.02	1.50
3	88.44	3.51 dd (4.2, 11.3)	21	19.76	0.90 d (6.3)
4	40.37	–	22	38.29	1.10, 2.30

(continued)

Table 1 (continued)

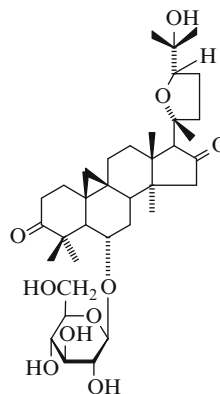
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
5	42.73	1.35	23 72.12	4.75 d (9)	
6	21.78	1.60, 1.82	24	90.28	3.80 s
7	114.32	6.05 dd (7.0, 7.5)	25	70.98	–
8	148.04	–	26	25.47	1.49 s
9	21.28	–	27	27.07	1.46 s
10	28.44	–	28	18.44	1.42 s
11	25.57	1.15, 2.17	29	28.85	1.30 s
12	34.11	1.63, 1.87	30	14.32	1.03 s
13	41.32	–	β -D-Galp		
14	50.68	–	1	107.41	4.86 d (8.8)
15	78.15	4.54 s	2	73.23	4.45 dd (8.8, 8.8)
16	112.32	–	3	75.48	4.15 dd (3.1, 8.8)
17	59.45	1.51 d (11.3)	4	70.32	4.57 d (3.1)
18	21.65	1.16 s	5	76.78	4.07 dd (6.3, 6.3)
			6	62.50	4.43 dd (6.3, 11.3), 4.48 dd (6.3, 11.3)

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

6-O- β -D-Glucopyranosyl Cycloadsurgenin

$C_{36}H_{56}O_{10}$, M 648



Taxonomy: Cycloartane Glycosides*Astragalus adsurgens* Pall. (*Leguminosae*) [1].

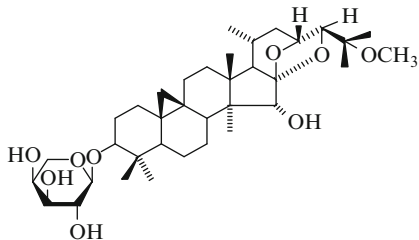
Mp 260–261°C.

CAS Registry Number: 174414-43-8.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 3050, 1740, 1724, 1701.Positive FABMS m/z : M^+ 648, $[M + H]^+$ 649, $[M + H - C_6H_{10}O_5]^+$ 487. ^1H NMR (CDCl_3 , δ): 0.38 and 0.66 (2H-19, d, $J = 4.5$ Hz), 1.07–1.37 ($7 \times \text{CH}_3$, s), 5.23 (Glc p H-1, d, $J = 7.4$ Hz).**References**

1. L.P. Sun, S.Z. Zheng, X.W. Shen, *Chin. Chem. Lett.* **6**(12), 1045–1046 (1995)

25-O-Methylcimigenol-3-O- α -L-arabinopyranoside

 $\text{C}_{36}\text{H}_{58}\text{O}_9$, M 634**Taxonomy:** Cycloartane Glycosides*Cimicifugaracemosa* (L.) Nutt. (*Ranunculaceae*) [1].IR ν_{\max}^{KBr} , cm^{-1} : 3364.HRSIMS m/z : 657.3933 $[M + \text{Na}]^+$.**Table 1**

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		
C-1	36.6	1.20 m, 1.60 m	C-19	31.0	0.28 d (3.0), 0.52 d (3.0)
2	30.2	1.90 m, 2.33 m	20	24.2	1.65 m
3	88.8	3.48 dd (4.2, 11.6)	21	19.8	0.83 d (6.4)
4	41.5	–	22	38.3	0.97 m, 2.08 m
5	47.4	1.32 dd (3.9, 12.3)	23	71.8	4.59 d (9.0)

(continued)

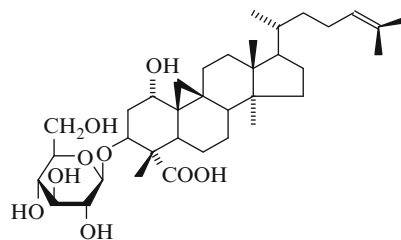
Table 1 (continued)

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		
6	21.3	0.71 m, 1.53 m	24	88.4	3.63 s
7	26.6	1.08 m, 2.08 m	25	76.4	–
8	48.8	1.69	26	19.5	1.24 s
9	20.1	–	27	22.3	1.24 s
10	26.8	–	28	11.9	1.17 s
11	26.6	1.15 m, 2.08 m	29	25.9	1.26 s
12	34.2	1.55 m, 1.68 m	30	15.6	1.01 s
13	42.0	–	α -L-Arap		
14	47.8	–	1	107.5	4.77 d (6.9)
15	88.8	4.21 s	2	73.1	4.41 dd (7.0, 8.5)
16	112.1	–	3	74.8	4.14 dd (3.2, 8.8)
17	59.6	1.44 d (11.0)	4	69.6	4.32 dd (2.7, 3.2)
18	19.7	1.13 s	5	66.8	3.77 dd (2.7, 14.2), 4.30 dd (2.7, 14.2)
			OMe	49.4	3.18 s

References

1. E. Bedir, I.A. Khan, *Pharmazie* **56**, 268–269 (2001)

Mollic Acid 3- β -D-Glucoside

 $\text{C}_{36}\text{H}_{58}\text{O}_9$, M 634**Taxonomy:** Cycloartane Glycosides*Combretum molle* (*Combretaceae*) [1, 2].Mp 248–250°C (from EtOH), $[\alpha]_{\text{D}}^{23} + 38^\circ$ (c 1.278, $\text{C}_5\text{H}_5\text{N}$).

CAS Registry Number: 62687-66-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3595–3280, 3040, 2640, 1705, 1450, 1360, 1265, 1100–1020, 990, 915, 890, 810.UV $\lambda_{\max}^{\text{EtOH}}$, nm (ϵ): 208 (3800).

Table 1

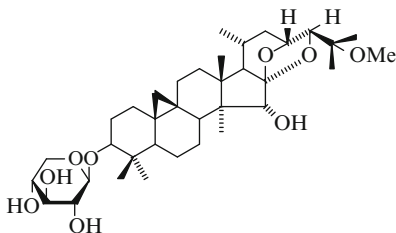
δ_C (C ₅ D ₅ N)							
C-1	72.6	C-10	30.6	C-19	29.8	C-28	19.7
2	37.4	11	25.9	20	36.2	29	180.0
3	81.7	12	37.0	21	18.4	30	10.4
4	54.8	13	45.9	22	36.4	β -D-Glcp	
5	38.0	14	49.5	23	25.6	1	105.6
6	23.2	15	33.6	24	126.1	2	75.8
7	28.5	16	26.6	25	131.0	3	78.3
8	48.2	17	52.9	26	25.9	4	72.0
9	21.3	18	18.8	27	17.9	5	77.9
						6	63.2

References

1. K.H. Pegel, C.B. Rogers, *Tetrahedron Lett.* **47**, 4299–4302 (1976)
2. K.H. Pegel, C.B. Rogers, *J. Chem. Soc., Perkin Trans 1*, 1711–1715 (1985)

25-O-Methylcimigenoside

C₃₆H₅₈O₉, M 634



Taxonomy: Cycloartane Glycosides

Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*) [1].

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 268–270°C.

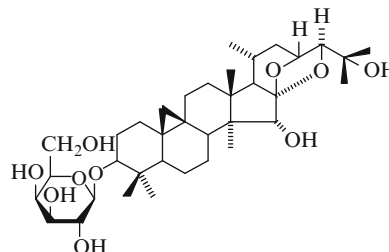
CAS Registry Number: 27994-13-4.

References

1. T. Takemoto, G. Kusano, M. Kawahara, *Yakugaku Zasshi* **90**(1), 64–67 (1970). *C.A.*, 72:111643t (1970)

Cimigenol-3-O- β -D-galactopyranoside

C₃₆H₅₈O₁₀, M 650



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 229–230°C (from MeOH), $[\alpha]_D^{20} +22.9^\circ$ (c 0.6, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.

Positive SIMS m/z: 651 [M + H]⁺.

Positive HRSIMS m/z: 651.4112 [M + H]⁺.

Table 1

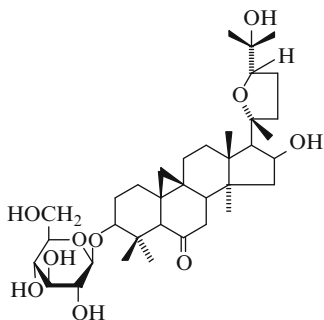
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.43	C-19	30.07
	1.17, 1.54		0.26 d (4), 0.54 d (4)
2	30.86	20	24.11
	1.93, 2.44		1.65
3	90.18	21	19.49
	3.54 dd (4.1, 11.3)		0.87 d (6.3)
4	41.32	22	38.19
	–		1.02, 2.28
5	47.64	23	71.88
	1.31		4.74 d (8.8)
6	21.07	24	88.72
	0.74 q (12.5), 1.54		3.76 s
7	26.42	25	70.96
	1.20, 2.08		–
8	48.61	26	25.81
	1.70		1.48 s
9	19.99	27	26.74
	–		1.46 s
10	27.16	28	11.79
	–		1.20 s
11	26.48	29	25.48
	1.06, 2.08		1.32 s
12	34.13	30	15.44
	1.54, 1.70		1.04 s
13	41.94	β -D-Galp	
14	47.35	1	107.43
	–		4.88 d (8.8)
15	80.20	2	73.26
	4.25 s		4.45 dd (8.8, 8.8)
16	112.01	3	75.51
	–		4.15 dd (3.5, 8.8)
17	59.61	4	70.33
	1.51 d (11.3)		4.58 d (3.5)
18	19.61	5	76.76
	1.16 s		4.08 dd (6.3, 6.3)
		6	62.49
			4.42 dd (6.2, 11.3)
			4.48 dd (6.2, 11.3)

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

Huangqiyein A

$C_{36}H_{58}O_{10}$, M 650



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].
Mp 265–268°C (from MeOH), $[\alpha]_D^{25} + 32.1^\circ$ (c 0.56, MeOH).

CAS Registry Number: 188666-40-2.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1690. FDMS m/z: M^+ 650.

Negative ion HRFABMS m/z: $[M-H]^-$ 649.3962.

$^1\text{H NMR}$ (400 MHz, C_5D_5N , δ , 0-TMS): 0.11 and 0.67 (2H-19, d, $J = 5.1$ Hz), 0.99, 1.31, 1.33, 1.33, 1.38, 1.58, 1.84 ($\tau \times CH_3$, s), 4.99 (Glc p H-1, d, $J = 7.5$ Hz).

Table 1

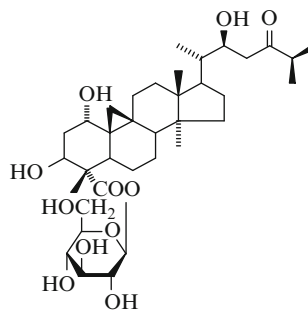
δ_C (C_5D_5N)							
C-1	29.0	C-10	30.2	C-19	22.1	C-28	19.1
2	30.3	11	26.4	20	87.1	29	26.8
3	87.8	12	33.2	21	28.6	30	15.3
4	41.4	13	45.3	22	35.0	β -D-Glcp	
5	57.8	14	47.2	23	26.8	1	106.8
6	211.2	15	44.2	24	81.7	2	75.8
7	41.5	16	72.9	25	71.3	3	78.7
8	42.8	17	57.7	26	27.1	4	71.8
9	21.5	18	18.5	27	28.1	5	78.3
						6	63.1

References

1. Y. Ma, Z. Tian, H. Kuang, C. Yuan, C. Shao, K. Ohtani, R. Kasai, O. Tanaka, Y. Okada, T. Okuyama, *Chem. Pharm. Bull.* **45**(2), 359–361 (1997)

Cyclopassifloside VI

$C_{36}H_{58}O_{11}$, M 666



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous solid, $[\alpha]_D^{25} + 36.2^\circ$ (c 2.6, MeOH).

CAS Registry Number: 292167-43-2.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1735, 1710, 1075, 1040.

FABMS m/z: 665 $[M-H]^-$.

$^1\text{H NMR}$ (400 MHz, C_5D_5N , δ , 0-TMS): 0.53 and 0.74 (2H-19, d, $J = 4$ Hz), 0.87 (CH_3 -28, s), 1.01 (CH_3 -18, s), 1.13, 1.17 (CH_3 -26, CH_3 -27, d, $J = 7$ Hz), 1.14 (CH_3 -21, d, $J = 6$ Hz), 1.67 (CH_3 -30, s), 2.24 (H-2, ddd, $J = 11, 11, 2.5$ Hz), 2.44 (H-2, ddd, $J = 11, 4, 2.5$ Hz), 2.54 (H-23, d, $J = 12$ Hz), 2.75 (H-11, m), 2.82 (H-25, qq, $J = 7$ Hz), 2.85 (H-23, dd, $J = 12, 5$ Hz), 3.35 (H-5, dd, $J = 10, 5$ Hz), 3.87 (H-1, brs), 4.00 (H-5' of Glc, m), 4.15 (H-2' of Glc, dd, $J = 8, 8$ Hz), 4.26 (H-3' of Glc, dd, $J = 8, 8$ Hz), 4.34 (H-4' of Glc, dd, $J = 8, 8$ Hz), 4.38 (2 H-6' of Glc, m), 4.66 (H-22, dd, $J = 11, 2$ Hz), 5.56 (H-3, dd, $J = 11, 4$ Hz), 6.48 (H-F of Glc, d, $J = 8$ Hz).

Table 1

δ_C (C_5D_5N)							
C-1	72.4	C-10	30.2	C-19	30.1	C-28	19.6
2	38.3	11	26.1	20	42.9	29	176.7
3	70.7	12	33.1	21	12.6	30	9.6
4	56.3	13	45.9	22	69.7	31	66.5

(continued)

Table 1 (continued)

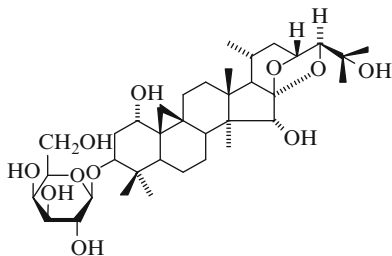
δ_C (C ₅ D ₅ N)						β -D-Glcp		
5	37.6	14	48.6	23	42.0			
6	23.0	15	36.0	24	214.7	1	96.5	
7	25.8	16	27.4	25	42.9	2	74.7	
8	48.2	17	49.7	26	18.1	3	78.4	
9	20.9	18	18.3	27	18.1	4	71.0	
							5	79.6
							6	62.1

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

1 α -Hydroxycimigenol 3-O- β -D-galactopyranoside

C₃₆H₅₈O₁₁, M 666



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 185–186°C (from MeOH-isopropyl ether), $[\alpha]_D^{25}$ +25.7° (c 0.47, MeOH).

CAS Registry Number: 228251-32-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3250.

Positive SIMS m/z: 689 [M + Na]⁺.

Positive HRSIMS m/z: 689.3885 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.32	C-19	30.70
2	37.32	20	23.82
3	84.56	21	19.36

(continued)

Table 1 (continued)

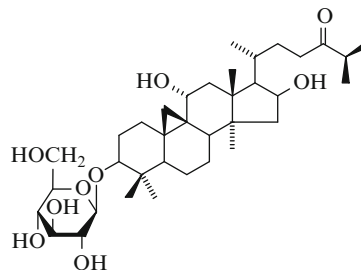
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	41.18	22	37.93
5	39.82	23	71.63
(4.3, 12.5)			
6	20.70	24	89.94
7	26.06	25	70.82
8	48.60	26	25.07
9	20.70	27	26.48
β -D-Galp			
10	30.58	28	11.47
11	25.49	29	25.55
12	33.84	30	14.44
13	41.58		
14	47.07	1	107.20
15	80.00	2	72.74
16	111.72	3	74.96
17	59.32	4	69.89
18	19.33	5	76.26
6			
62.13			
4.38, 4.38			

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, Chem. Pharm. Bull. **47**(4), 511–516 (1999)

Curculigosaponin A

C₃₆H₆₀O₉, M 636



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 148–150°C, $[\alpha]_D^{25}$ +5.13° (c 0.10, MeOH).

CAS Registry Number: 136771-42-1.

FABMS m/z : 659 $[M + Na]^+$, 675 $[M + K]^+$, 457 $[M + H-132-H_2O]^+$, 439 $[457-H_2O]^+$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.34 and 0.41 (2H-19, d, $J = 4$ Hz), 0.96 and 0.98 (CH_3 -26 and CH_3 -27, d, $J = 6.5$ Hz), 1.03, 1.28, 1.31, 1.36 ($4 \times CH_3$, s), 2.52 (H-25, septet, $J = 6.5$ Hz), 4.91 (Glc H-1, d, $J = 7.8$ Hz).

Table 1

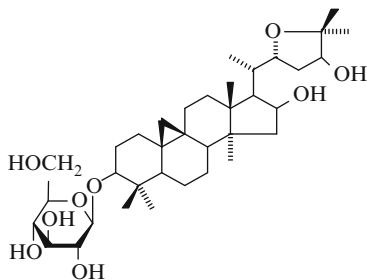
δ_C (C_5D_5N)							
C-1	32.23	C-10	25.98	C-19	29.91	C-28	18.24
2	29.73	11	72.40	20	30.05	29	25.61
3	88.57	12	39.92	21	16.89	30	15.31
4	41.08	13	46.87	22	30.64	β -D-Glcp	
5	47.68	14	49.88	23	37.95	1	106.52
6	21.18	15	50.08	24	215.79	2	75.59
7	26.51	16	71.54	25	40.56	3	78.51
8	49.10	17	49.10	26	18.24	4	71.67
9	19.88	18	21.87	27	18.24	5	77.92
						6	62.86

References

- J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Depressoside A

$C_{36}H_{60}O_9$, M 636



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Mp 208–210°C, $[\alpha]_D^{28} -1.5^\circ$ (c 0.17, MeOH).

CAS Registry Number: 215178-30-6.

IR ν_{max}^{KBr} , cm^{-1} : 3380–3450, 3040.

Positive FABMS m/z : 659 $[M + Na]^+$, 497 $[M + Na-162]^+$, 479 $[M + Na-162-H_2O]^+$.

Negative FABMS m/z : 599 $[M-H-2 H_2O]^+$.

EIMS m/z (%): 456 (7.17), 438 (12.83), 395 (5.6), 313 (3.29), 295 (7.9), 273 (4.74), 255 (3.82), 245 (5.25), 203 (6.98), 143 (10.17), 142 (27.3), 115 (100).

Table 1

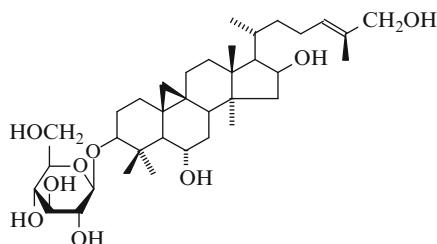
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
C-1	33.10	1.26, 1.54	C-19	31.01	0.37 d (4), 0.57 d (4)
2	30.50	1.70, 2.05	20	33.37	2.26 m
3	91.02	3.25 dd (11, 4.3)	21	15.9	0.93 d (7)
4	42.05	–	22	80.90	4.00 ddd (3.2, 7, 8.9)
5	48.88	1.34	23	36.27	1.79 m, 2.23 m,
6	22.07	0.82, 1.62	24	78.30	4.03 dd (6.8, 4.2)
7	27.20	0.93, 1.30	25	84.0	–
8	49.64	1.64	26	26.0	1.20 s
9	21.08	–	27	23.08	1.19 s
10	27.44	–	28	20.42	0.96 s
11	27.31	1.15, 2.05	29	26.14	1.08 s
12	34.37	1.33, 1.66	30	15.48	0.90 s
13	49.90	–	β -D-Glcp		
14	47.91	–	1	104.16	4.50 d (7.65)
15	47.65	1.38, 1.94	2	81.77	4.05 dd (7.6, 9)
16	73.04	4.50 ddd (8, 8, 5.5)	3	77.73	3.68 t (9)
17	52.94	1.95 dd (11.4, 6.8)	4	71.64	3.42 t (9.66)
18	19.42	1.18 s	5	77.11	3.32 ddd (2.5, 5.5, 8.5)
			6	62.63	3.68 dd (5, 11.9), 3.84 dd (2.5, 11.9)

References

- V.U. Ahmad, A. Ali, Z. Ali, F.T. Baqai, F.N. Zafar, *Phytochemistry* **49**(3), 829–834 (1998)

Kahiricoside II

C₃₆H₆₀O₉, M 636



Taxonomy: Cycloartane Glycosides

Astragalus kahiricus DC (*Leguminosae*) [1].

Mp 118°C, $[\alpha]_D^{25} +12.3^\circ$ (c 0.06, MeOH).

IR ν_{\max} , cm⁻¹: 3580–3240, 2952–2800.

FABMS m/z: 636.4193.

Table 1

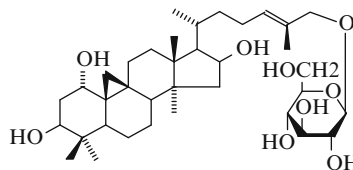
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4 1.08 m, 1.50 m	C-19	29.9 0.22 d (4), 0.55 d (4)
2	30.2 1.90 m, 2.48 m	20	30.8 2.34 m
3	89.1 3.67 dd (4.2, 11.8)	21	18.2 1.08 d (6.8)
4	42.6 –	22	36.8 1.30 m
5	54.1 1.71 d (8.4)	23	25.6 2.26 m, 2.35 m
6	68.1 3.75 m	24	125.9 5.78 t (6.8)
7	38.5 1.69 m, 1.81 m	25	135.3 –
8	46.9 1.96 m	26	14.0 1.83 s
9	21.3 –	27	68.3 4.26 brs
10	29.2 –	28	20.2 1.05 s
11	26.4 1.23 m, 1.90	29	29.0 2.01 s
12	33.3 1.68 m	30	16.7 1.34 s
13	45.8 –	β -D-Glcp	
14	47.0 –	1	107.0 5.01 d (7.6)
15	49.2 1.75 m, 2.15 dd (5.2, 12.8)	2	76.0 4.09 m
16	71.3 4.66 m	3	78.8 4.24 m
17	57.0 1.81 m	4	71.9 4.25 m
18	19.0 1.41 s	5	78.2 4.96 m
		6	63.1 4.42 m, 4.56 m

References

- M.M. Radwan, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.GI. Kingston. *Phytochemistry* **65**, 2909–2913 (2004)

Mongholicoside I

C₃₆H₆₀O₉, M 636



Taxonomy: Cycloartane Glycosides

Astragalus mongholicus Bunge (*Leguminosae*) [1].

Mp 143–145°C, $[\alpha]_D +47.9$.

CAS Registry Number: 145826-21-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3400.

Positive ion FABMS m/z: 659 [M + Na]⁺.

Negative ion FABMS m/z: 635 [M-H]⁻.

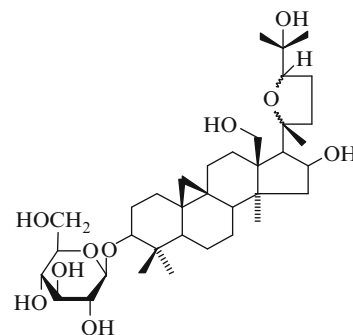
¹H NMR (400 MHz, C₅D₅N, δ , 0 -TMS): 0.48 and 0.75 (2H-19, d, J = 4 Hz), 1.05, 1.07, 1.14, 1.30, 1.47, 1.79 (6 × CH₃), 4.86 (Glcp, H-1, d, J = 7.6 Hz).

References

- Y.Z. Zhu, S.H. Lu, Y. Okada, M. Takata, T. Okuyama, *Chem. Pharm. Bull.* **40**(8), 2230–2232 (1992)

Beesioside G

C₃₆H₆₀O₁₀, M 652



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Amorphous powder, mp 200–204°C (from CHCl₃–MeOH), [α]_D²⁰ +18.3° (c 0.11, CHCl₃–MeOH, 1:1).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3400, 2960, 2920, 1460, 1380, 1090, 1040.

Positive ion FABMS m/z (%): 675 [M + Na]⁺, 653 [M + H]⁺, 495, 473, 455, 437, 419, 143 (100), 125, 93, 71.

Positive ion HRFABMS m/z: 653.42387 [M + H]⁺.

Table 1

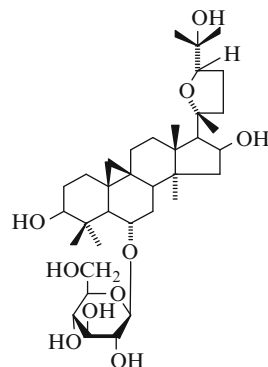
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	32.2 1.07 m, 1.46 m	C-19	30.4 0.18 d (4), 0.51 d (4)
2	29.9 1.84 m, 2.36 m	20	86.4 -
3	88.7 3.50 dd (11.8, 4.5)	21	26.0 1.37 s
4	41.3 -	22	36.8 2.48 m, 1.68 m
5	47.9 1.27 m	23	24.6 2.24 m, 1.98 m
6	20.9 0.61 q (12.5), 1.50 m	24	85.3 3.97 dd (8.5, 5)
7	26.5 1.04 m	25	70.8 -
8	47.5 1.95 m	26	28.2 1.50 s
9	20.1 -	27	26.5 1.21 s
10	26.7 -	28	22.6 0.96 s
11	26.6 2.02 m	29	25.8 1.31 s
12	29.1 2.04 m, 1.59 m	30	15.4 0.98 s
13	51.8 -	β -D-Glcp	
14	46.9 -	1	106.8 4.93 d (7.5)
15	49.1 2.10 m, 2.10 m	2	75.8 4.02 t (8.5)
16	72.7 4.84 m	3	78.2 3.94 m
17	55.7 2.30 d (7)	4	71.9 4.19 m
18	65.7 4.34 dd (13.5), 4.51 dd (13.5)	5	78.8 4.21 m
		6	63.1 4.54 dd (11.8, 2.5), 4.38 m

References

- J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Brachyoside B

C₃₆H₆₀O₁₀, M 652

**Taxonomy:** Cycloartane Glycosides

Astragalus spinosus Vahl. (*Leguminosae*) [1].

Astragalus brachypterus Fischer (*Leguminosae*) [2].

Astragalus dissectus B.Fedtsch. et N.Ivanova (*Leguminosae*) [3].

Astragalus trojanus Stev. (*Leguminosae*) [4].

Mp 259°C (from MeOH) [1], [α]_D²³ + 46.6° (c 0.6, MeOH) [5].

CAS Registry Number: 86764-12-7.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.27 and 0.63 (2H-19, d, J = 4 Hz), 0.93, 1.28, 1.29, 1.39, 1.43, 1.56, 1.94 (7 \times CH₃, s), 2.51 (H-17, d, J = 8 Hz), 3.11 (H-22, q, J = 10 Hz), 3.58 (H-3, dd, J = 12, 5 Hz), 3.70 (H-6, m), 3.87 (H-24, H-5', m), 4.02 (H-2', t, J = 8 Hz), 4.18 (H-3', H-4', m), 4.30 (H-6', dd, J = 12, 6 Hz), 4.46 (H-6'', dd, J = 12, 3 Hz), 4.92 (H-1', d, J = 8 Hz), 4.97 (H-16, q, J = 8 Hz) [3].

See Table 1

References

- R.M. Abdallah, N.M. Ghazy, N.A. El-Sebakhy, A. Pirillo, L. Verotta, *Pharmazie* **48**(6), 452–454 (1993)
- E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)
- I.A. Sukhina, M.A. Agzamova, B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **36**(4), 373–376 (2000)
- E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *Phytochemistry* **51**(8), 1017–1020 (1999)

Table 1

δ_C (C ₅ D ₅ N) [3]		δ_C (CD ₃ OD)		δ_H (CD ₃ OD) [2]					
C-1	32.60	C-21	28.59	C-1	32.8	1.57 m, 1.30 m	C-21	28.1	1.24 s
2	31.31	22	34.98 ^a	2	30.6	1.74 m, 1.65 m	22	35.1	2.64 m, 1.67 m
3	78.10	23	26.29	3	79.0	3.24 dd (11.2, 4.5)	23	26.5	2.06 m (2 H)
4	42.43	24	81.75	4	42.3	–	24	82.4	3.78 dd (8, 5)
5	52.61	25	71.27	5	52.8	1.62 m	25	72.1	–
6	79.85	26	27.11	6	80.0	3.58 td (9.5, 4.5)	26	26.4	1.16 s
7	34.98 ^a	27	28.21	7	34.8	1.94 m, 1.60 m	27	27.1	1.29 s
8	46.30 ^b	28	19.98	8	46.0	1.88 m	28	20.0	1.05 s
9	21.12	29	29.14	9	22.0	–	29	27.7	1.32 s
10	29.64 ^c	30	16.15	10	30.0	–	30	15.6	0.98 s
11	26.48	β -D-Glcp		11	26.0	1.95 m, 1.36 m	β -D-Glcp		
12	33.46	1	105.22	12	32.6	1.71 m, 1.59 m	1	104.5	4.36 d (7.8)
13	45.11	2	75.60	13	46.3	–	2	75.3	3.21 dd
14	46.30 ^b	3	79.23	14	46.7	–	3	78.3	3.36 t
15	46.47	4	71.92	15	46.0	2.07 m, 1.42 m	4	71.4	3.30 m
16	73.42	5	78.31	16	74.2	4.68 td (8.5, 5.2)	5	77.4	3.27 ddd
17	58.33	6	63.15	17	58.6	2.40 d (8)	6	62.6	3.86 dd, 3.68 dd
18	21.34			18	21.1	1.29 s			
19	29.64 ^c			19	29.5	0.31 d, 0.63 d (4.5)			
20	87.27			20	88.1	–			

^{a,b,c}Signals are mutually imposed

5. M.A. Agzamova, M.I. Isaev, I.I. Maltsev, M.B. Gorovits, N. K. Abubakirov, Chem. Nat. Comp. **24**(6), 755–756 (1988)

Mp 240–242°C (from CHCl₃–MeOH–H₂O, 140:14:1),
[α]_D²⁵ +33° (c 1.15, MeOH).

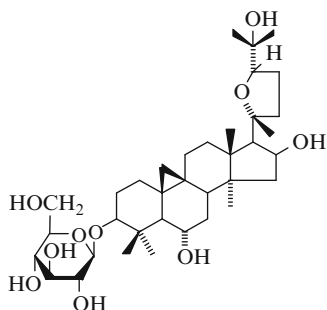
CAS Registry Number: 126640-90-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3580–3205, 3050.

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.08 and 0.42 (2H-19, d, J = 4 Hz), 0.87, 1.18, 1.18, 1.18, 1.28, 1.44, 1.85 (7 × CH₃, s), 4.84 (Glc p H-1, d, J = 8 Hz and H-16).

Cycloaraloside A

C₃₆H₆₀O₁₀, M 652



Taxonomy: Cycloartane Glycosides
Astragalus amarus Pall. (Leguminosae) [1].

Table 1

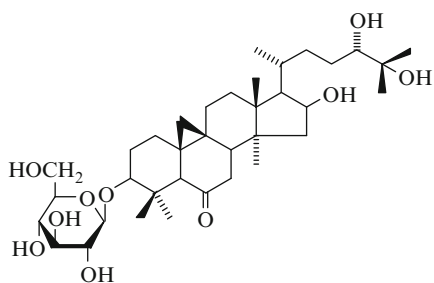
δ_C (C ₅ D ₅ N) [2]							
C-1	32.41	C-10	29.50	C-19	30.55	C-28	20.09
2	30.16	11	26.37 ^a	20	87.17	29	28.91
3	88.96	12	33.31	21	28.41	30	16.66
4	42.58	13	44.97	22	34.88	β -D-Glcp	
5	53.93	14	45.91	23	26.37 ^a	1	106.82
6	67.97	15	46.09	24	81.64	2	75.82
7	38.54	16	73.43	25	71.26	3	78.66
8	47.06	17	58.26	26	27.04	4	71.78
9	20.84	18	21.51	27	28.53	5	78.06
						6	62.87

^aSignals are mutually imposed

References

1. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(6), 684–687 (1989)
2. M.I. Isaev, N.K. Abubakirov, *Chem. Nat. Comp.* **26**(6), 667–670 (1990)

Huangqiyanin B

C₃₆H₆₀O₁₀, M 652**Taxonomy:** Cycloartane Glycosides*Astragalus membranaceus* Bunge (*Leguminosae*) [1].Mp 272–274°C (from MeOH), [α]_D + 54.4° (c 0.60, C₅H₅N).

CAS Registry Number: 188666-43-5.

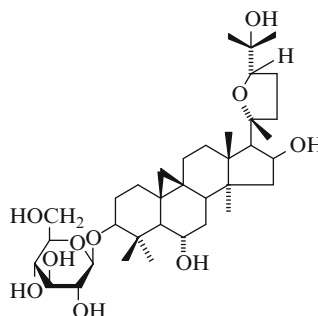
IR ν_{max}^{KBr}, cm⁻¹: 3400, 1690.FDMS m/z: M⁺ 652.Negative ion HRFABMS m/z: [M-H]⁻ 651.4175.¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.10 and 0.70 (2H-19, d, J = 5.1 Hz), 0.98 (CH₃ s), 1.09 (CH₃-21, d, J = 6.6 Hz), 1.29, 1.37, 1.48, 1.51, 1.87 (5 × CH₃, s), 4.95 (Glc p H-1, d, J = 8.1 Hz).**Table 1**

δ _C (C ₅ D ₅ N)							
C-1	29.1	C-10	30.1	C-19	22.7	C-28	19.1
2	30.4	11	26.7	20	28.8	29	27.0
3	87.9	12	33.2	21	18.4	30	15.4
4	41.3	13	45.9	22	32.9	β-D-Glcp	
5	57.9	14	47.8	23	28.0	1	106.9
6	211.4	15	46.0	24	77.3	2	75.8
7	41.6	16	71.4	25	72.5	3	78.7
8	42.7	17	56.6	26	25.7	4	71.8
9	21.8	18	15.7	27	26.4	5	78.3
						6	63.1

References

1. Y. Ma, Z. Tian, H. Kuang, C. Yuan, C. Shao, K. Ohtani, R. Kasai, O. Tanaka, Y. Okada, T. Okuyama, *Chem. Pharm. Bull.* **45**(2), 359–361 (1997)

Astraverrucin I (See Cycloaraloside A)

C₃₆H₆₀O₁₀, M 652**Taxonomy:** Cycloartane Glycosides*Astragalus verrucosus* Moris. (*Leguminosae*) [1].*Astragalus peregrinus* (*Leguminosae*) [2].Mp 225–227°C [2], [α]_D²⁰ + 10.52° (c 0.75, C₅H₅N) [1].

CAS Registry Number: 126640-90-2.

FABMS m/z: 675 [M + Na]⁺, 653 [M + H]⁺ [1].

EIMS m/z (%): 454 (1.60), 395 (1.52), 199 (2.20), 143 (100), 125 (23.56), 107 (6.37) [1].

Table 1

δ _C (C ₅ D ₅ N)		δ _C (C ₅ D ₅ N)		δ _H (C ₅ D ₅ N)	
C-1	32.3	1.53 dd (13.2, 10.7, 4),	C-19	30.5	0.22 and 0.55 d (4.3)
		1.08 dt (10.3, 3.5)	20	87.2	–
2	30.2	2.46 m, 1.92 dt (12.7, 3.7)	21	28.5	1.30 s
3	88.9	3.65 dd (11.7, 4.5)	22	34.9	3.11 ddd (11.3, 9.2, 12.3), 1.70 m
4	42.6	–			
5	54.0	1.70 d (7.7)	23	26.4	2.29 dddd (13, 5.7, 3, 11.3),
6	68.0	3.76 ddd (9.4, 7.5, 3.5)			2.02 ddt (9, 9.4, 13)
7	38.6	1.80 ddd (12.3, 8.4, 4.1),	24	81.6	3.88 dd (9.4, 5.7)
		1.63 m	25	71.2	–

(continued)

Table 1 (continued)

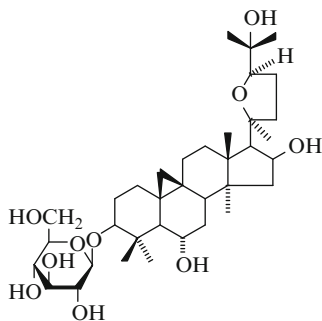
δ_C (C_5D_5N) [2]	δ_H (C_5D_5N)	δ_C (C_5D_5N)	δ_H (C_5D_5N)
8	47.0 1.95 dd (11.3, 4.7)	26	28.2 1.57 s
9	20.9 –	27	27.1 1.25 s
10	29.5 –	28	20.1 1.00 s
11	26.2 1.91 m, 1.16 ddd (14.6, 9.8, 4.3)	29	29.0 2.01 s
12	33.4 1.65 m, 1.60 m	β -D-Glcp	
13	44.9 –	1	107.0 5.00 d (7.7)
14	46.1 –	2	75.9 4.07 dd (9, 7.7)
15	46.6 2.10 dd (12.7, 8.0), 1.75 dd (12.5, 6.2)	3	78.8 4.23 m
		4	73.4 4.24 m
16	73.4 5.01 ddd (8.0, 7.6, 6.0)	5	78.2 3.95 m
17	58.3 2.52 d (7.6)	6	63.0 4.55 dd (11.7, 2.7), 4.41 dd (11.7, 5.2)
18	21.5 1.40 s		

References

1. L. Pistelli, S. Pardossi, G. Flamini, A. Bertoli, A. Manunta, *Phytochemistry* **45**(3), 585–587 (1997)
2. L. Verotta, M. Guerrini, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, M.E. Abou-Sheer, Y.D. Luo, J.M. Pezzuto, *Fitoterapia* **72**(8), 894–905 (2001)

Sieberoside I

$C_{36}H_{60}O_{10}$, M 652



Taxonomy: Cycloartane Glycosides
Astragalus sieberi (Leguminosae) [1].

Mp 177°C (from MeOH), $[\alpha]_D^{25} + 29.9^\circ$ (c 0.62, C_5H_5N).

CAS Registry Number: 88192-85-2.

Negative ion FABMS m/z: $[M-H]^-$ 651, $[M-162-H]^-$ 489.

1H NMR (600 MHz, C_5D_5N , δ , 0-TMS): 0.22 and 0.54 (2H-19), 0.98, 1.28, 1.30, 1.35, 1.51, 1.63, 2.00 (7 \times CH_3), 2.22 (H-17), 2.47 (H-22), 3.65 (H-3), 3.74 (H-6), 3.94 (Glc p H-5, m), 3.95 (H-24), 4.05 (Glc p H-2, dd, J = 9.4, 7.4 Hz), 4.18 (Glc p H-4, m), 4.22 (Glc p H-3, t, J = 9.4 Hz), 4.38 (Glc p H-6', dd, J = 12, 5.6 Hz), 4.52 (Glc p H-6, dd, J = 12, 3.3 Hz), 4.76 (H-16), 4.96 (Glc p H-1, d, J = 7.4 Hz).

Table 1

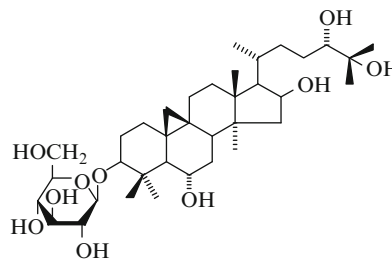
δ_C (C_5D_5N)							
C-1	32.3	C-10	29.3	C-19	30.0	C-28	20.3
2	30.5	11	26.4	20	86.5	29	28.8
3	88.9	12	33.5	21	26.1	30	16.5
4	42.4	13	46.3	22	37.3	β -D-Glcp	
5	53.8	14	46.6	23	24.1	1	106.7
6	67.9	15	48.6	24	85.5	2	75.6
7	38.9	16	72.7	25	70.2	3	78.4
8	46.6	17	56.2	26	27.8	4	71.5
9	20.8	18	21.0	27	26.6	5	77.9
						6	62.7

References

1. L. Verotta, M. Tato, N.A. El-Sebakhy, S.M. Toaima, *Phytochemistry* **48**(8), 1403–1409 (1998)

Alexsandroside I

$C_{36}H_{62}O_{10}$, M 654



Taxonomy: Cycloartane Glycosides

The stereochemistry of C-24 is changed by us on the basis of the spectrum ^{13}C NMR.

Astragalus alexandrinus Boiss. (*Leguminosae*) [1].

Mp 288–290°C (from EtOH–Et₂O), $[\alpha]_{\text{D}} + 43.2^\circ$ (c 1.4, MeOH).

CAS Registry Number: 156165-58-1.

FABMS m/z: $[\text{M} + \text{H}]^+ 655$.

^1H NMR (300 MHz, C₅D₅N, δ , 0-TMS): 0.22 and 0.54 (2H-19, d, J = 4.2 Hz), 1.01 (CH₃, s), 1.12 (CH₃-21, d, J = 5.8 Hz), 1.35, 1.40, 1.45, 1.47, 2.05 (5 × CH₃, s), 3.65 (1H, dd, J = 10.8, 4.8 Hz), 3.75 (1H, m), 3.94 (1H, m), 4.17 (1H, m), 4.23 (2H, m), 4.40 (1H, dd, J = 11.5, 5.2 Hz), 4.55 (1H, dd, J = 11.5, 3 Hz), 4.72 (1H, dt, J = 7.5, 3.7 Hz), 4.98 (Glc p H-1, d, J = 8 Hz).

Table 1

δ_{C} (C ₅ D ₅ N)							
C-1	32.8	C-10	29.6	C-19	30.5	C-28	20.5
2	30.6	11	26.6	20	29.2	29	29.3
3	89.5	12	33.5 ^a	21	18.7	30	17.1
4	43.0	13	46.0	22	33.6 ^a	β -D-Glcp	
5	54.2	14	47.1	23	28.4	1	107.1
6	68.4	15	48.6	24	77.9	2	76.0
7	38.7	16	71.9	25	72.3	3	78.7 ^b
8	47.5	17	57.6	26	26.3	4	72.3
9	21.5	18	19.4	27	26.3	5	78.3 ^b
						6	63.1

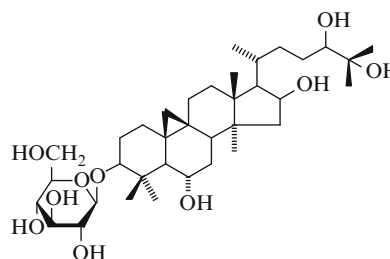
^a, ^bAssignment of signals ambiguously

References

1. F. Orsini, L. Verotta, L. Barboni, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, S.M. Toaima, *Phytochemistry* **35**(3), 745–749 (1994)

Cyclounifolioside C

C₃₆H₆₂O₁₀, M 654

**Taxonomy:** Cycloartane Glycosides

Astragalus unifoliolatus Bunge (*Leguminosae*) [1].

Mp 192–195°C (from MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3580–3205, 3050.

See [Table 1](#)

References

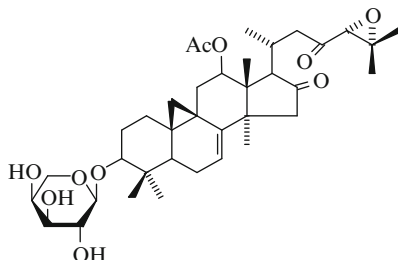
1. K.J. Kucherbaev, K.K. Uteniyazov, V.V. Kachala, Z. Saatov, A.S. Shashkov, *Chem. Nat. Comp.* **38**(5), 447–449 (2002)

Table 1

δ_{C} (C ₅ D ₅ N)		δ_{H} (C ₅ D ₅ N)						
C-1	32.16	1.57, 1.17	C-13	45.45	–	C-25	72.46	–
2	32.91	2.49, 1.87	14	46.64	–	26	25.62	2.01 ?
3	88.81	3.68	15	48.43	2.14, 2.28	27	25.86	1.52
4	42.36	–	16	71.47	4.09 ?	28	19.95	1.04
5	53.83	1.77	17	56.99	1.93	29	28.66	1.49 ?
6	67.70	3.78	18	18.51	1.35	30	16.44	1.40
7	38.16	1.66, 1.59	19	29.14	0.23, 0.56	β -D-Glcp		
8	46.76	1.85	20	31.35	1.98	1	106.66	4.99
9	21.02	–	21	18.69	1.12	2	75.66	4.08
10	29.91	–	22	34.58	2.16, 1.13	3	78.48	4.26
11	26.06	1.83, 1.24	23	29.70	2.16, 1.55	4	71.61	4.23
12	32.91	1.68, 1.47	24	80.29	3.69	5	77.89	3.07
						6	62.79	4.58, 4.40

Bugbanoside E

C₃₇H₅₄O₁₀, M 658



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 125–126°C (from MeOH-isopropyl ether), [α]_D –54.2° (c 0.52, MeOH)

CAS Registry Number: 340258-12-0.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3600–3200, 1735, 1716.

CD: $\Delta\epsilon_{312}$ –2.49 (c 1.18 × 10⁻⁴ g/ml), $\Delta\epsilon_{217}$ –20.28 (c 0.59 × 10⁻⁴ g/ml).

Positive SIMS m/z: 659 [M + H]⁺, 681 [M + Na]⁺.

Positive HRSIMS m/z: 659.3773 [M + H]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	30.09	C-21	23.00
2	1.20, 1.62	22	2.30
3	29.29	26	2.30
4	1.90, 2.30	27	3.46 dd (4.2, 11.6)
5	87.82	28	3.03 dd (8, 18.3)
6	40.35	29	–
7	–	30	205.48
8	42.34	31	65.67
9	1.20	32	3.75 s
10	21.81	33	60.97
11	1.55, 1.86	34	–
12	5.10 dd (1.7, 7.5)	35	24.45
13	114.94	36	1.36 s
14	145.87	37	1.30 s
15	21.37	38	1.21 s
16	–	39	1.30 s
17	28.97	40	1.30 s
18	35.85	41	1.01 s
19	1.30, 2.89 dd (9.3, 16)	42	–
20	75.91	43	170.87
21	5.62 dd (1.5, 9.3)	44	–
22	–	45	–
23	47.65	46	21.11
24	–	47	2.28 s
25	46.42	48	α -L-Arap
26	–	49	–
27	49.51	50	107.24
28	2.35 d (17.6), 2.63 d (17.6)	51	4.79 d (7.0)

(continued)

Table 1 (continued)

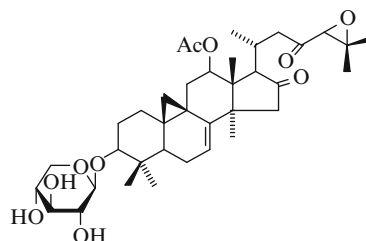
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
16	217.38	2	4.46 dd (7.0, 8.7)
17	62.06	3	4.18 dd (3.5, 8.7)
18	14.69	4	4.33
19	29.20	5	3.81 dd (2.5, 12.5),
20	26.07		4.30 dd (2.5, 12.5)

References

1. A. Kusano, M. Shibano, D. Tsukamoto, G. Kusano, Chem. Pharm. Bull. **49**(4), 437–441 (2001)

Cimicifol

C₃₇H₅₄O₁₀, M 658



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

[α]_D –99.33° (c 0.30, CHCl₃–MeOH, 1:1).

CAS Registry Number: 161206-52-6.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3420, 2950, 1740, 1720.

Positive ion FABMS m/z: 659 [M + H]⁺.

HRFABMS m/z: 659.3896 [M + H]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	30.07	C-21	22.99
2	1.21 m, 1.63 td (12.5, 4)	22	2.22 d (7)
3	29.37	23	2.92 dd (18, 4), 3.0 dd (18, 8)
4	1.94 m, 2.29 m	24	–
5	87.72	25	60.97
6	–	26	–
7	42.34	27	65.67
8	1.20	28	3.75 s
9	21.81	29	60.97
10	1.55, 1.86	30	–
11	5.10 dd (1.7, 7.5)	31	24.45
12	114.94	32	1.36 s
13	145.87	33	1.30 s
14	21.37	34	1.21 s
15	–	35	1.30 s
16	28.97	36	1.30 s
17	35.85	37	1.01 s
18	1.30, 2.89 dd (9.3, 16)	38	–
19	75.91	39	170.87
20	5.62 dd (1.5, 9.3)	40	–
21	–	41	–
22	47.65	42	21.11
23	–	43	2.28 s
24	46.42	44	α -L-Arap
25	–	45	–
26	49.51	46	107.24
27	2.35 d (17.6), 2.63 d (17.6)	47	4.79 d (7.0)

(continued)

Table 1 (continued)

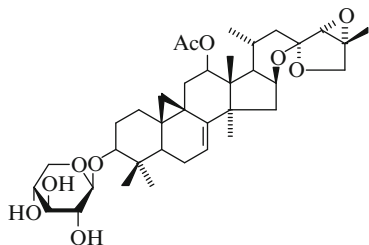
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	40.36	–	24 65.56 3.67 s
5	42.36	1.25 m	25 60.28 –
6	21.81	1.55 m, 1.86 ddd (12.5, 7.5, 5)	26 18.17 1.29 s
7	114.92	5.08 dd (7.5, 2)	27 24.45 1.33 s
8	145.91	–	28 26.42 1.20 s
9	21.11	–	29 25.66 1.33 s
10	28.97	–	30 14.19 1.03 s
11	35.87	2.88 dd (16, 9), 1.30 m	β -D-Xylp
12	75.79	5.60 dd (9, 1.5)	1 107.42 4.82 d (7.5)
13	47.61	–	2 75.51 4.01 t (7.5)
14	46.40	–	3 78.55 4.13 t (8.5)
15	49.47	2.32 d (17.5), 2.60 d (17.5)	4 71.14 4.21 ddd (10, 8.5, 5)
16	216.98	–	5 67.07 3.71 dd (11, 10), 4.34 dd (11, 5)
17	62.03	2.71 d (2.5)	Ac 170.59 –
18	14.68	1.36 s	21.32 2.26 s
19	29.19	0.60 d (4), 1.09 d (4)	
20	26.03	2.81 m	

References

- S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)

26-Deoxycimicifugoside

C₃₇H₅₄O₁₀, M 658



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Actea asiatica Hara (*Ranunculaceae*) [1].

Mp 285–286°C (from MeOH), $[\alpha]_D -121.0^\circ$ (c 0.57, MeOH).

CAS Registry Number: 214146-75-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3250, 1732.

Positive SIMS m/z: 659 [M + H]⁺.

Positive HRSIMS m/z: 659.3796 [M + H]⁺.

Table 1

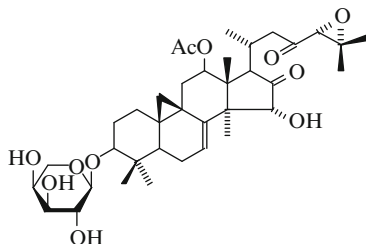
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1 30.29	1.15, 1.60	C-21 21.38	1.02 d (6.6)
2 29.47	1.88, 2.25	22 37.29	1.46, 1.60
3 87.90	3.43 dd (4.2, 11.5)	23 105.95	–
4 40.39	–	24 62.39	3.65 s
5 42.49	1.18	25 62.44	–
6 21.81	1.48, 1.80	26 68.18	3.62 d (10.2), 4.05 d (10.2)
7 114.08	5.11 dd (1.2, 7.5)	27 14.22	1.47 s
8 147.70	–	28 26.88	1.05 s
9 21.28	–	29 25.71	1.30 s
10 28.30	–	30 14.26	0.99 s
11 36.63	1.25 d (16.3), 2.94 dd (8.7, 16.3)	β -D-Xylp	
12 76.80	5.23 d (8.7)	1 107.42	4.83 d (7.6)
13 48.13	–	2 75.58	4.01 dd (7.6, 8.3)
14 50.53	–	3 78.59	4.13 dd (8.3, 8.5)
15 43.06	2.08, 2.13	4 71.24	4.20 ddd (10, 8.5, 5)
16 74.53	4.33	5 67.10	3.71 dd (11, 10), 4.33 dd (11, 5)
17 56.62	1.78	Ac 170.69	–
18 14.79	1.49 s	21.57	2.17 s
19 28.86	0.52 d (4), 1.06 d (4)		
20 23.11	2.25		

References

- A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

Bugbanoside D

C₃₇H₅₄O₁₁, M 674



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 171–172°C (from MeOH-isopropyl ether), [α]_D –58.1° (c, MeOH).

CAS Registry Number: 340258-11-9.

IR ν_{max}^{KBr}, cm⁻¹: 3630–3250, 1738, 1716.

CD: Δε₃₁₂ –3.36 (c 1.48 × 10⁻⁴ g/ml), Δε₂₁₅ –12.70 (c 0.30 × 10⁻⁴ g/ml).

Positive SIMS m/z: 697 [M + Na]⁺.

Positive HRSIMS m/z: 697.3560 [M + Na]⁺.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		
C-1	30.08	1.22, 1.62	C-21	23.00	1.27 d (6.9)
2	29.28	1.92, 2.32	22	46.36	2.92 dd (8.7, 18),
3	87.81	3.47 dd (4.1, 11.4)			3.05 dd (3.2, 18)
4	40.29	–	23	205.27	–
5	42.30	1.24 brd (5.3)	24	65.55	3.72 s
6	21.68	1.64, 1.92	25	60.90	–
7	115.34	6.15 dd (1.5, 7.5)	26	24.37	1.35 s
8	145.11	–	27	18.08	1.30 s
9	21.55	–	28	18.35	1.37 s
10	28.83	–	29	25.65	1.31 s
11	35.94	1.32, 2.96 dd (9.6, 15.8)	30	14.15	1.02 s
12	76.90	5.63 dd (1.6, 9.4)	α-L-Arap		
13	44.11	–	1	107.25	4.80 d (7.4)
14	49.27	–	2	72.72	4.47 dd (7.4, 8.7)
15	80.31	4.78 s	3	74.41	4.18 dd (3.5, 8.7)
16	219.10	–	4	69.36	4.33
17	59.26	2.64 d (3.0)	5	66.71	3.81 dd (2.5, 12.5)

(continued)

Table 1 (continued)

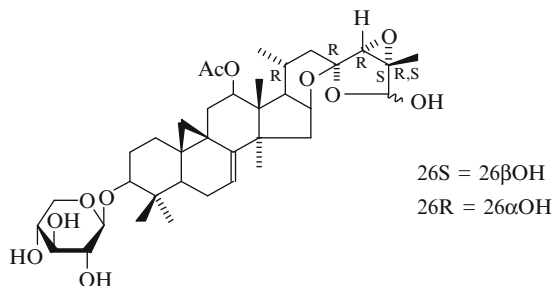
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		
18	14.79	1.55 s	Ac	170.73	–
19	29.12	0.63, 1.17 d (4)		21.31	2.27 s
20	26.66	2.85			

References

1. A. Kusano, M. Shibano, D. Tsukamoto, G. Kusano, *Chem. Pharm. Bull.* **49**(4), 437–441 (2001)

Cimicifugoside

C₃₇H₅₄O₁₁, M 674



26S = 26βOH

26R = 26αOH

Taxonomy: Cycloartane Glycosides

Glycoside is a mixture of epimers on C-26 in the ratio 3:1 = 26β:26α.

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1, 2].

Mp 237–238°C (from EtOH) [1], mp 245–246°C, [α]_D –95.3° (c 0.32, MeOH–CHCl₃ 2:1) [2].

CAS Registry Number: 66176-93-0.

IR ν_{max}^{KBr}, cm⁻¹: 3500, 1720, 1260, 1000 [1]. IR ν_{max}^{KBr}, cm⁻¹: 3700, 3050, 1721 [2].

Positive HRSIMS m/z: 697.3566 [C₃₇H₅₄O₁₁ + Na]⁺ [2].

¹H NMR (C₅D₅N, δ): 0.57 (H-19, d, J = 4 Hz), 1.72 (CH₃-27, s), 2.20 (CH₃COO, s), 3.83 (H-24, s), 4.69 (anomeric H, d, J = 6 Hz), 5.06 (H-12, t, J = 6 Hz), 5.35 (H-7, bs), 5.59 (H-26, s).

Table 1

δ _C (C ₅ D ₅ N)	δ _H (C ₅ D ₅ N) (J/Hz)			
	26S	26R	26S	26R
C-1	30.27	30.27	1.18, 1.60	1.18, 1.60
2	29.48	29.48	1.89, 2.24	1.89, 2.24
3	87.89	87.89	3.44	3.44

(continued)

Table 1 (continued)

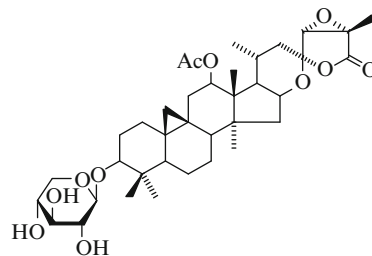
	δ_C (C ₅ D ₅ N)		δ_H (C ₅ D ₅ N) (J/Hz)	
	26S	26R	26S	26R
4	40.40	40.40	–	–
5	42.50	42.50	1.20	1.20
6	21.85	21.85	1.56, 1.82	1.56, 1.82
7	<u>114.00</u>	<u>114.10</u>	<u>5.07 d (8.0)</u>	<u>5.16 d (8.0)</u>
8	147.49	147.79	–	–
9	21.30	21.30	–	–
10	28.35	28.35	–	–
11	36.68	36.68	1.26, 2.95	1.26, 2.95
12	76.81	76.81	5.22 d (8.8)	5.22 d (8.8)
13	<u>48.08</u>	<u>48.10</u>	–	–
14	<u>50.59</u>	<u>50.66</u>	–	–
15	<u>42.40</u>	<u>42.50</u>	<u>1.88, 2.00</u>	<u>2.00, 2.15</u>
16	73.14	73.14	4.70 q (6.8)	4.70 q (6.8)
17	56.85	56.85	1.78	1.78
18	14.80	14.80	1.41 s	1.41 s
19	28.87	28.87	<u>0.57 d (4), 1.09 d (4)</u>	<u>0.59 d (4), 1.10 d (4)</u>
20	<u>25.83</u>	<u>25.55</u>	1.88	1.88
21	<u>21.00</u>	<u>20.99</u>	<u>0.98 d (6)</u>	<u>0.96 d (6)</u>
22	<u>37.36</u>	<u>37.00</u>	1.68, 2.20	1.68, 2.20
23	<u>105.88</u>	<u>103.45</u>	–	–
24	<u>63.42</u>	<u>62.86</u>	<u>3.91 s</u>	<u>3.77 s</u>
25	<u>65.60</u>	<u>63.93</u>	–	–
26	<u>98.47</u>	<u>98.20</u>	<u>5.73 s</u>	<u>5.74 s</u>
27	<u>13.07</u>	<u>13.15</u>	<u>1.78 s</u>	<u>1.64 s</u>
28	<u>26.74</u>	<u>26.78</u>	<u>1.01 s</u>	<u>1.06 s</u>
29	25.73	25.73	<u>1.31 s</u>	<u>1.32 s</u>
30	14.24	14.24	<u>1.02 s</u>	<u>1.03 s</u>
Ac	170.62	170.62	–	–
	21.59	21.59	2.18 s	2.18 s
β -D-Xylp				
1	107.42	107.42	4.83 d (8.1)	4.83 d (8.1)
2	75.59	75.59	4.02 dd (8.8, 8.1)	4.02 dd (8.8, 8.1)
3	78.60	78.60	4.13 t (8.8)	4.13 t (8.8)
4	71.25	71.25	4.21 ddd (11.1, 8.8, 5.1)	4.21 ddd (11.1, 8.8, 5.1)
5	67.10	67.10	3.72 dd (11.8, 11.1)	3.72 dd (11.8, 11.1)
			4.34 dd (11.8, 5.1)	4.34 dd (11.8, 5.1)

References

- G. Kusano, S. Hojo, Y. Kondo, T. Takemoto, Chem. Pharm. Bull. **25**(12), 3182–3189 (1977)
- A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, Chem. Pharm. Bull. **46**(3), 467–472 (1998)

Cimiracemoside P

C₃₇H₅₄O₁₁, M 674



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 151–153°C, $[\alpha]_D^{20}$ –69.77° (c 0.44, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3423, 2956, 2934, 2870, 1787, 1731, 1454, 1362, 1243, 1041, 968, 753.

HRESIMS m/z: 675.3758 [M + H]⁺.

Table 1

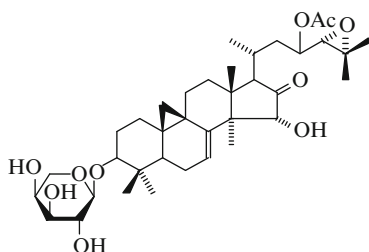
	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
	C-1	C-21	C-21	C-21
1	31.9	1.57, 1.14	20.7	0.93 d (5)
2	29.9	2.32 m, 1.88 m	22	35.6 2.21, 1.67
3	88.1	3.48 brd (7)	23	106.2 –
4	41.2	–	24	62.7 4.41 s
5	45.7	1.27	25	58.6 –
6	20.4	1.43, 0.70	26	172.4 –
7	25.7	1.25, 0.95	27	11.1 1.65 s
8	47.0	1.63 m	28	19.5 0.85 s
9	20.1	–	29	25.7 1.33 s
10	26.8	–	30	15.3 1.02 s
11	36.6	2.75 m, 1.21	β -D-Xylp	
12	76.8	5.11 brd (6.8)	1	107.6 4.87 d (7.1)
13	48.8	–	2	75.4 4.05 m
14	48.0	–	3	78.7 4.20 t (8.6)
15	43.2	1.90, 1.64	4	71.3 4.22 m
16	75.6	4.05 brt (7.7)	5	67.2 4.38 m, 3.76 dd (9.8, 10.1)
17	55.6	1.86	Ac	170.5 –
18	13.5	1.33 s		21.6 2.16 s
19	29.6	0.26 d (3.8), 0.57 d (3.8)		
20	25.3	1.85		

References

1. S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

23-O-Acetyl-7,8-didehydroshengmanol-3-O- α -L-arabinopyranoside

$C_{37}H_{56}O_{10}$, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 239–240°C (from MeOH), $[\alpha]_D^{20}$ –55.5°.

CAS Registry Number: 184419-86-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3600–3300, 1738.

Positive SIMS m/z: 661 $[\text{M} + \text{H}]^+$, 683 $[\text{M} + \text{Na}]^+$.

Positive HR SIMS m/z: 661.3948 $[\text{M} + \text{H}]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
C-1	30.29	1.38, 1.78	C-21	19.87	1.23 d (6.3)
2	29.45	1.95, 2.37	22	37.35	1.78, 2.87
3	88.19	3.50 dd (4, 11.5)	23	72.03	5.41 td (8.8, 2.5)
4	40.42	–	24	65.26	3.05 d (8.8)
5	42.68	1.35	25	58.53	–
6	21.52	1.62, 1.98	26	19.40	1.42 s
7	115.11	6.10 dd (2.5, 8.0)	27	24.75	1.30 s
8	147.26	–	28	18.80	1.43 s
9	19.40	–	29	25.81	1.28 s
10	28.57	–	30	14.30	1.05 s
11	25.23	1.24, 2.15	α -L-Arap		
12	33.57	1.92, 2.00	1	107.34	4.80 d (8.0)
13	40.87	–	2	72.98	4.45 dd (8.0, 8.0)

(continued)

Table 1 (continued)

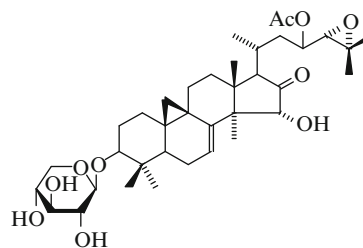
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)		
14	49.52	–	3	74.65	4.17 dd (3.5, 8.0)
15	80.87	4.56 s	4	69.51	4.33 dd (2.5, 3.5)
16	220.32	–	5	66.76	3.82 dd (2.5, 13.5),
17	60.14	2.30			4.32 dd (2.5, 13.5)
18	21.85	1.32 s	Ac	170.32	–
19	28.51	0.55 d (3.8), 1.08 d (3.8)		20.98	2.01
20	27.97	2.17			

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

23-O-Acetyl-7,8-didehydroshengmanol-3-O- β -D-xylopyranoside

$C_{37}H_{56}O_{10}$, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 268–269°C (from a mixture of MeOH, EtOAc and isopropyl ether), $[\alpha]_D$ –49.6° (c 1.27, MeOH).

CAS Registry Number: 245494-52-4.

IR ν_{\max}^{KBr} , cm^{-1} : 3650–3200, 1735.

Positive SIMS m/z: 661 $[\text{M} + \text{H}]^+$.

Positive HRSIMS m/z: 661.3947 $[\text{M} + \text{H}]^+$.

Table 1

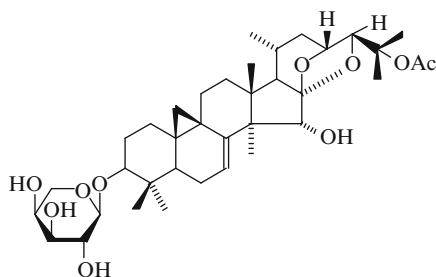
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.30	1.39, 1.70	C-21 19.64 1.24 d (6.6)
2	29.34	2.00, 2.35	22 37.10 1.75, 2.88 ddd (13.5, 10.5, 1.8)
3	88.01	3.60 dd (11.5, 4)	23 71.87 5.42 dd (10.5, 8.5, 2.5)
4	40.23	–	24 65.10 3.07 d (8.5)
5	42.42	1.32	25 58.53 –
6	21.66	1.59, 1.95	26 24.59 1.30 s
7	114.87	6.10 dd (7.5, 1.8)	27 19.22 1.43 s
8	147.04	–	28 18.69 1.45 s
9	21.29	–	29 25.59 1.36 s
10	28.34	–	30 14.15 1.09 s
11	25.02	1.23, 2.22	β -D-Xylp
12	33.30	1.95 (2H)	1 107.25 4.87 d (8.5)
13	40.66	–	2 75.21 4.06 dd (8.8, 7.5)
14	49.24	–	3 78.17 4.20 t (8.8)
15	80.52	4.58 s	4 70.90 4.26 ddd (10, 8.8, 5)
16	220.31	–	5 66.86 3.78 dd (11, 10), 4.39 dd (11, 5)
17	59.91	2.31 d (8)	
18	21.66	1.30 s	Ac 170.32 –
19	27.75	0.56 d (4), 1.07 d (4)	20.88 2.06 s
20	28.28	2.15	

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **47**(8), 1175–1179 (1999)

25-O-Acetyl-7,8-didehydrocimigenol-3-O- α -L-arabinopyranoside

C₃₇H₅₆O₁₀, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 167–168°C (from MeOH), $[\alpha]_D -4.7^\circ$ (c 0.70, MeOH).

CAS Registry Number: 228251-31-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3200, 1738.

Positive SIMS m/z: 661 [M + H]⁺.

Positive HRSIMS m/z: 661.3942 [M + H]⁺.

Table 1

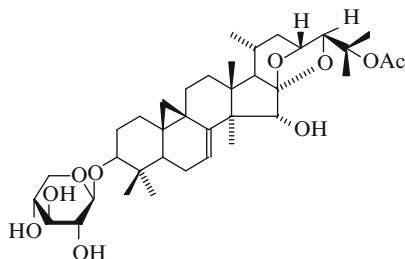
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.46	1.30, 1.76	C-21 19.79 0.90 d (6.5)
2	29.59	1.95, 2.33	22 37.93 1.00, 2.30
3	88.42	3.47 dd (4.4, 11.9)	23 72.05 4.63 d (9.0)
4	40.52	–	24 86.92 4.16 s
5	42.76	1.25	25 83.38 –
6	21.88	1.59, 1.90	26 23.48 1.69 s
7	114.36	6.10 dd (1.3, 7.5)	27 21.42 1.68 s
8	148.10	–	28 18.58 1.44 s
9	21.78	–	29 25.90 1.28 s
10	28.54	–	30 14.40 1.03 s
11	25.64	1.15, 2.18	α -L-Arap
12	34.15	1.63, 1.82	1 107.40 4.80 d (7.5)
13	41.36	–	2 72.88 4.46 dd (7.5, 8.8)
14	50.57	–	3 74.56 4.18 dd (3.1, 8.8)
15	78.15	4.55 s	4 69.48 4.33
16	112.88	–	5 66.78 3.81 dd (2.5, 11.3), 4.32 dd (2.5, 11.3)
17	59.23	1.47 d (10.6)	
18	21.69	1.16 s	Ac 170.47 –
19	28.34	0.55 d (4), 1.05 d (4)	22.44 1.99 s
20	23.98	1.65	

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

25-O-Acetyl-7,8-didehydrocimigenol-3-O- β -D-xylopyranoside

C₃₇H₅₆O₁₀, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 255–256°C (from MeOH), $[\alpha]_D -14.9^\circ$ (c 0.74, MeOH).

CAS Registry Number: 228251-30-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3250, 1738.

Positive SIMS m/z: 661 [M + H]⁺.

Positive HRSIMS m/z: 661.3976 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.38	1.36, 1.71	C-21	19.65	0.89 d (6.5)
2	29.56	1.97, 2.34	22	37.82	1.01, 2.29
3	88.26	3.49 dd (4.4, 11.9)	23	71.95	4.60 d (9.3)
4	40.42	–	24	86.80	4.13 s
5	42.68	1.28	25	83.13	–
6	21.78	1.59, 1.90	26	23.86	1.67 s
7	114.31	6.10 dd (1.3, 7.5)	27	21.60	1.66 s
8	147.96	–	28	18.41	1.42 s
9	21.64	–	29	25.78	1.30 s
10	28.46	–	30	14.32	1.06 s
11	25.57	1.15, 2.18	β -D-Xylp		
12	34.38	1.68, 1.82	1	107.46	4.84 d (7.5)
13	41.27	–	2	75.56	4.02 dd (7.5, 8.1)
14	50.52	–	3	78.57	4.13 dd (8.1, 8.1)
15	78.12	4.53 s	4	71.25	4.21 ddd (5, 8.1, 10)
16	112.75	–	5	67.10	3.72 dd (10, 11),

(continued)

Table 1 (continued)

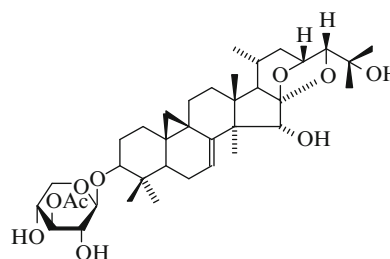
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
17	59.23	1.49 d (10)	4.35 dd (5, 11)
18	21.33	1.15 s	Ac 170.13 –
19	28.25	0.51 d (4), 1.05 d (4)	22.25 1.96 s
20	23.86	1.68	

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

3'-O-Acetyl-24-*epi*-7,8-didehydrocimigenol-3-xyloside

C₃₇H₅₆O₁₀, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga heracleifolia Komarov (*Ranunculaceae*) [1].

$[\alpha]_D -13.2^\circ$ (c 0.53, CHCl₃–MeOH, 2:3).

CAS Registry Number: 150972-76-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 1725, 840.

Positive FABMS m/z: 661 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.31	1.35 ddd (12.5, 4.1, 3), 1.63 m	C-21	19.65	0.98 d (5.8)
2	29.43	1.95 m, 2.29 ddd (12.5, 4.1, 3)	22	29.55	1.95 m, 2.64 ddd (13, 9.7, 2.1)
3	88.54	3.45 dd (11.4, 4.1)	23	73.81	4.60 ddd (9.7, 4.1, 2.1)
4	40.33	–	24	84.01	3.72 d (4.1)
5	42.70	1.28 m	25	68.56	–

(continued)

Table 1 (continued)

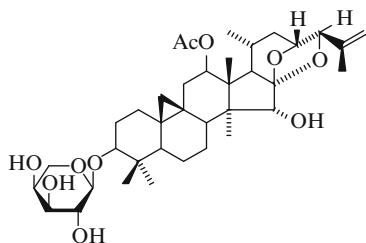
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
6	21.69	1.59 m, 1.88 m	26 30.68 1.42 s
7	114.28	6.05 dd (7.5, 1.5)	27 25.66 1.28 s
8	148.04	–	28 18.50 1.26 s
9	21.23	–	29 25.94 1.28 s
10	28.18	–	30 14.19 1.00 s
11	25.51	1.13 m, 2.12 ddd (13, 3, 2.8)	β -D-Xylp
12	33.89	1.67 m	1 107.05 4.81 d (7.3)
13	41.06	–	2 73.00 4.01 dd (9.2, 7.3)
14	50.77	–	3 79.19 5.68 t (9.2)
15	78.58	4.49 d (7.5) [4.58 d (7.5) OH]	4 69.17 4.20 td (9.2, 5.2)
16	112.40	–	5 66.71 3.96 t (10.7), 4.31 dd (10.7, 5.2)
17	60.61	1.73 m	–
18	21.60	1.18 s	Ac 70.69 –
19	28.30	0.51 d (4), 1.06 d (4)	1.14 1.98 s
20	23.36	1.72 m	–

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

Cimiracemoside J

C₃₇H₅₆O₁₀, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 138–140°C, $[\alpha]_D^{20}$ –14.23° (c 0.26, CHCl₃).

IR ν_{\max} , cm⁻¹: 3468, 2933, 2869, 1731, 1454, 1377, 1240, 1067, 755.

HRESIMS m/z: 683.3763 [M + Na]⁺.

Table 1

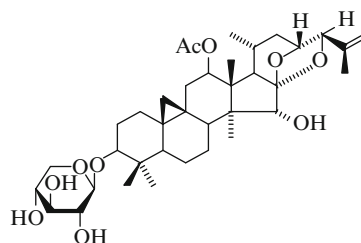
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4	1.58 brd (12.2), 1.11 brd (14.4)	C-21 19.8 0.94 d (6.5)
2	30.1	2.32 m, 1.33 m	22 37.5 2.94 dd (9.6, 15.4), 1.17 brd (15.3)
3	88.3	3.49 dd (3.1, 7.9)	–
4	41.3	–	23 74.7 4.31
5	47.2	1.77 brd (12.4)	24 86.5 4.12 brs
6	20.8	1.56 m, 0.75 m	25 145.8 –
7	26.0	2.22 m, 1.12 m	26 113.2 5.36 brs, 4.89 brs
8	47.2	1.29	27 18.1 1.85 s
9	20.1	–	28 12.0 1.20 s
10	26.8	–	29 25.7 1.28 s
11	38.5	2.29 m, 1.03 m	30 15.4 1.01 s
12	77.3	5.27 brd (7.8)	α -L-Arap
13	48.4	–	1 107.4 4.79 d (6.8)
14	46.1	–	2 73.0 4.44 t (7.8)
15	79.3	4.42 s	3 74.7 4.17
16	112.3	–	4 69.5 4.32
17	59.6	1.65	5 66.7 4.31, 3.79 brd (11.3)
18	12.7	1.37 s	Ac 170.6 –
19	30.9	0.32 d (4), 0.61 d (4)	21.7 2.13 s
20	23.9	1.64	–

References

1. S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Cimiracemoside K

C₃₇H₅₆O₁₀, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

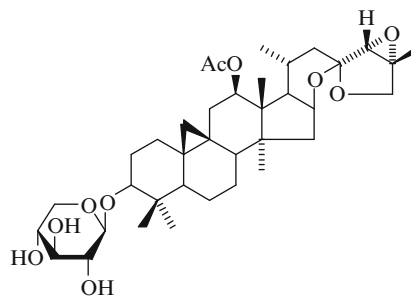
Mp 142–143°C, $[\alpha]_D^{20}$ –59.32° (c 0.147, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3425, 2935, 2869, 1732, 1456, 1376, 1233, 1042, 760.

HRESIMS m/z: 683.3745 [M + Na]⁺.

23-*epi*-26-Deoxyactein (27-Deoxyactein)

C₃₇H₅₆O₁₀, M 660

**Table 1**

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	32.4	1.56 brd (12.4), 1.08 brd (14.4)	C-21	19.8	0.95 d (6.5)
2	30.0	2.30 m, 1.90 m	22	37.5	2.94 dd (9.5, 16.1), 1.16 brd (16.1)
3	88.3	3.49 dd (3.5, 10.8)	23	74.6	4.30 d (8.5)
4	41.3	–	24	86.5	4.18 brs
5	47.2	1.76 brd (12.2)	25	145.8	–
6	20.8	1.53 m, 0.73 m	26	113.2	5.35 brs, 4.89 brs
7	26.0	2.19 m, 1.10 m	27	18.1	1.85 s
8	47.2	1.30	28	12.0	1.20 s
9	20.1	–	29	25.7	1.31 s
10	26.8	–	30	15.4	1.04 s
11	38.5	2.26 m, 1.02 m	β -D-Xylp		
12	77.3	5.28 brd (7.6)	1	107.5	4.84 d (7.4)
13	48.4	–	2	75.6	4.03 dd (8, 15.4)
14	46.1	–	3	78.6	4.15 t (8.4)
15	79.3	4.42 s	4	71.6	4.21 m
16	112.3	–	5	67.1	4.34 dd (4.8, 9.8), 3.72 brd (9.8, 9.1)
17	59.6	1.64	Ac	170.6	–
18	12.7	1.32 s			
19	30.9	0.32 d (3.4), 0.60 d (3.4)			
20	23.9	1.64	21.7	2.12 s	

References

- S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Fansworth. *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1, 2].
Cimicifuga simplex Wormsk. (*Ranunculaceae*) [3].

Mp 252–254°C (from MeOH), $[\alpha]_D$ –44.3° (c 1.4, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3400, 1715, 1250.

ORD (c 1.4, CHCl₃–MeOH, 1:1), $[\alpha](\text{nm})$: –44.3° (589), –48.8° (577), –55.7° (546), –92.6° (435), –142.5° (365).

Positive ion FABMS m/z: 661 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	31.9	1.13, 1.52	C-21	21.3	1.02 d (7)
2	29.8	1.84, 2.23	22	37.6	1.43, 1.56
3	88.1	3.44 dd (11, 4)	23	105.9	–
4	41.2	–	24	62.3	3.61 s
5	47.0	1.25	25	62.5	–
6	20.3	0.64, 1.40	26	13.3	1.41 s
7	25.7	0.91, 1.22	27	68.2	3.62 d (10), 4.05 d (10)
8	45.6	1.61	28	19.6	0.84 s
9	20.2	–	29	25.6	1.29 s
10	26.8	–	30	15.3	0.98 s
11	36.6	1.18 dd (16, 3), 2.71 dd (16, 9)	β -D-Xylp		
12	77.0	5.10 dd (9, 3)	1	107.4	4.82 d (7)
13	48.8	–	2	75.5	4.00
14	47.9	–	3	78.5	4.14
15	44.2	1.77, 1.89	4	71.2	4.21
16	74.5	4.25 m	5	67.0	3.72 t (10), 4.35 dd (10, 5)

(continued)

Table 1 (continued)

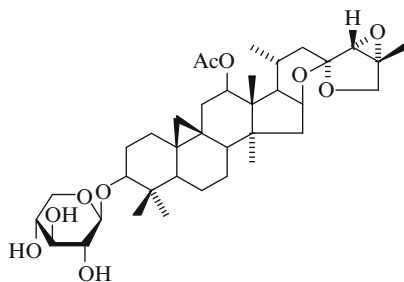
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
17	56.2 1.79	Ac	170.6 –
18	14.3 1.46 s		21.6 2.12 s
19	29.4 0.27 d (4), 0.54 d (4)		
20	23.3 2.21 m		

References

1. S. Berger, P. Junior, L. Kopanski, *Planta Med.* **54**(6), 579–580 (1988)
2. S.N. Chen, W. Li, D.S. Fabricant, B.D. Santarsiero, A. Mesecar, J.F. Fitzloff, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(4), 601–605 (2002)
3. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)

26-Deoxyactein

$C_{37}H_{56}O_{10}$, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 253–254°C, $[\alpha]_D^{20}$ –52.17° (c 0.025, $CHCl_3$).

FABMS m/z (%): 661.4 (6), 451.3 (25), 307.1 (100), 289.1 (58), 219 (15), 154.1 (100), 136.1 (80), 107.9 (60), 78.9 (60).

HRFABMS m/z: 683.3771 ($C_{37}H_{56}O_{10}Na$).

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.0 1.15, 1.52	C-21	21.0 0.96 d (5.7)
2	29.9 1.88, 2.28	22	36.7 1.60, 2.19 brd (12.4)
3	88.1 3.48 dd (4.3, 11.7)	23	105.9 –

(continued)

Table 1 (continued)

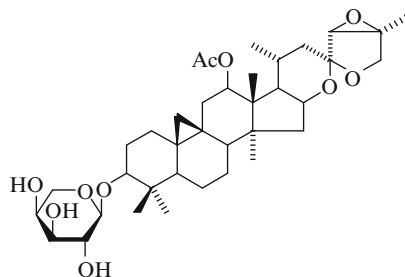
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
4	41.2 –	24	63.3 3.71 s
5	47.0 1.26 brd (12.4)	25	63.3 –
6	20.5 0.69 brd (12.7), 1.44	26	68.8 3.95 d (10), 3.88 d (10)
7	25.7 0.95, 1.30	27	13.8 1.47 s
8	45.8 1.64 dd (4.7, 14.4)	28	19.6 0.86 s
9	20.2 –	29	25.7 1.37 s
10	26.8 –	30	15.4 1.02 s
11	36.7 1.20 dd (3.7, 15.9), 2.74 dd (7.1, 15.9)	β -D-Xylp	
12	77.1 5.11 dd (3.6, 8.8)	1	107.5 4.86 d (7.6)
13	48.8 –	2	75.6 4.05 t (7.8)
14	48.0 –	3	78.7 4.18 t (8.7)
15	43.7 1.68 dd (6.6, 12.6), 1.91 dd (8, 12.6)	4	71.3 4.24 m
16	73.0 4.53 brdd (7.2, 14.2)	5	67.1 3.77 t (10), 4.38 dd (11.2, 5.1)
17	56.5 1.80 (overlapped)	Ac	170.6 –
18	13.5 1.35 s	20.7	2.15 s
19	29.6 0.25 d (4), 0.60 d (4)		
20	26.0 1.79		

References

1. S.N. Chen, W. Li, D.S. Fabricant, B.D. Santarsiero, A. Mesecar, J.F. Fitzloff, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(4), 601–605 (2002)

Cimiracemoside N

$C_{37}H_{56}O_{10}$, M 660



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

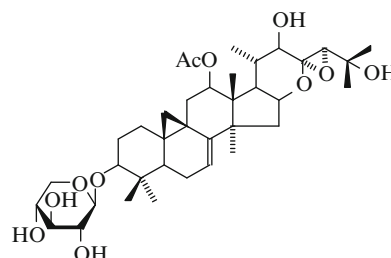
Mp 172–174°C, $[\alpha]_D^{20} -70.36^\circ$ (c 0.367, CHCl₃).

IR ν_{\max}^{KBr} , cm⁻¹: 3454, 2935, 2871, 1729, 1455, 1372, 1244, 1070, 1030, 754.

HRESIMS m/z: 661.3962 [M + H]⁺.

Actaeaepoxide 3-O-β-D-Xylopyranoside

C₃₇H₅₆O₁₁, M 676

**Table 1**

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.9 1.49, 1.12	C-21	21.3 1.02 d (6.3)
2	29.8 2.28 m, 1.83 m	22	37.5 1.58, 1.45
3	88.1 3.44 dd (4.2, 13)	23	105.9 –
4	41.2 –	24	62.5 3.68 s
5	47.0 1.22	25	62.2 –
6	20.3 1.38 m, 0.63 m	26	68.1 4.07 d (10.5), 3.63 d (10.5)
7	25.6 1.29, 0.89	27	14.3 1.48 s
8	45.6 1.60 m	28	19.6 0.85 s
9	20.1 –	29	25.7 1.27 s
10	26.7 –	30	15.3 0.96 s
11	36.6 2.71 dd (8.8, 15.4), 1.16	α -L-Arap	
12	77.1 5.12	1	107.5 4.78 d (6.8)
13	48.8 –	2	72.9 4.45 t (14.5)
14	47.8 –	3	74.5 4.24 d (6.9)
15	44.1 1.88 m, 1.76 m	4	69.6 4.33 brs
16	74.7 4.24 brt (6.9)	5	66.8 4.31 dd (11, 2), 3.80 dd (11, 2)
17	56.2 1.79	Ac	170.7 –
18	13.5 1.42 s		21.7 2.14 s
19	29.5 0.19 d (3.6), 0.54 d (3.6)		
20	23.3 2.23		

References

- S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1]. Amorphous powder, mp 197°C, $[\alpha]_D +26.3^\circ$ (c 0.32, *i*-PrOH-MeOH, 7:5).

CAS Registry Number: 356522-35-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3412, 2935, 2359, 1730, 1649.

ESIMS m/z: 675 [M-H]⁻.

Table 1

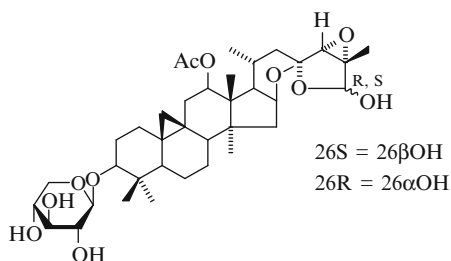
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.2 1.56, 1.15	C-21	17.4 1.31
2	29.4 1.87, 2.23	22	86.6 3.94
3	87.9 3.43 dd (4, 11.5)	23	105.6 –
4	40.3 –	24	82.9 4.29 s
5	42.4 1.18	25	83.7 –
6	21.7 1.54, 1.85	26	27.9 1.77 s
7	113.9 5.12	27	24.9 1.69 s
8	147.5 –	28	26.7 1.07 s
9	21.1 –	29	25.7 1.31 s
10	28.2 –	30	14.2 1.03 s
11	36.6 1.20 dd (8.4, 16), 2.93	β -D-Xylp	
12	76.8 5.23 d (8.4)	1	107.2 4.82 d (7.6)
13	48.7 –	2	75.3 4.04 t (8.3)
14	50.9 –	3	78.2 4.20 dd (8.3, 9)
15	41.8 2.12, 2.06	4	71.0 4.23 dd (5.1, 9)
16	72.2 5.09	5	66.9 4.36 dd (5.1, 11.2),
17	53.2 1.80 dd (8, 1.6)		3.75 dd (10, 11.2)
18	15.0 1.41 s	Ac	171.0 –
19	28.7 0.50 d (4), 0.97 d (4)	?	2.15 s
20	34.1 2.30		

References

1. K. Wende, C. Mugge, K. Thurow, T. Schopke, U. Lindequist, *J. Nat. Prod.* **64**(7), 986–989 (2001)

Actein

$C_{37}H_{56}O_{11}$, M 676



Taxonomy: Cycloartane Glycosides

Actea racemosa ≡ *Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1–6].

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [7].

Mp 232–233 °C (from MeOH), $[\alpha]_D -66.0^\circ$ (c 1.6, $CHCl_3$ -MeOH, 1:1).

CAS Registry Number: 18642-44-9.

IR ν_{max}^{KBr}, cm^{-1} : 3500–3350, 1715.

The glucoside is a mixture of the epimers of C-26 (ratio 3:1 = 26β : 26α)

Table 1 (continued)

	δ_C (C_5D_5N)		δ_H (C_5D_5N) (J/Hz)	
	26S	26 R	26S	26R
12	77.08	77.08	5.11 dd (8.8, 4)	5.11 dd (8.8, 4)
13	48.01	48.01	–	–
14	47.92	47.92	–	–
15	43.59	43.70	1.56, 1.76	1.68, 1.92
16	73.00	73.10	4.62 q (6.8)	4.62 q (6.8)
17	56.43	56.43	1.80	1.80
18	13.48	13.48	1.37 s	1.37 s
19	29.48	29.48	0.25 d (4), 0.61 d (4)	0.26 d (4), 0.62 d (4)
20	26.00	26.00	1.84	1.84
21	21.02	20.95	0.99 d (6.0)	0.97 d (6.0)
22	37.60	37.60	1.66, 2.22	1.66, 2.22
23	105.80	103.41	–	–
24	63.46	62.93	3.91 s	3.76 s
25	65.54	63.90	–	–
26	98.45	98.20	5.72 s	5.72 s
27	13.06	13.15	1.78 s	1.63 s
28	19.50	19.60	0.81 s	0.86 s
29	25.71	25.71	1.30 s	1.31 s
30	15.30	15.30	1.00 s	1.01 s
Ac	170.51	170.51	–	–
	21.62	21.62	2.13 s	2.13 s
β -D-Xylp				
1	107.47	107.47	4.84 d (8.1)	4.84 d (8.1)
2	75.58	75.58	4.01 dd (8.8, 8.1)	4.01 dd (8.8, 8.1)
3	78.60	78.60	4.14 t (8.8)	4.14 t (8.8)
4	71.26	71.26	4.21 ddd (10, 8.8, 5)	4.21 ddd (10, 8.8, 5)
5	67.09	67.09	3.73 dd (11.3, 10)	3.73 dd (11.3, 10)
			4.35 dd (11.3, 5)	4.35 dd (11.3, 5)

Table 1

	δ_C (C_5D_5N)		δ_H (C_5D_5N) (J/Hz)	
	26S	26 R	26S	26R
C-1	31.93	31.93	1.14, 1.54	1.14, 1.54
2	29.88	29.88	1.87, 2.28	1.87, 2.28
3	88.11	88.11	3.46	3.46
4	41.21	41.21	–	–
5	47.03	47.03	1.24	1.24
6	20.40	20.40	0.71, 1.44	0.71, 1.44
7	25.63	25.63	0.92, 1.20	0.92, 1.20
8	45.63	45.70	1.60	1.64
9	20.18	20.18	–	–
10	26.84	26.84	–	–
11	36.69	36.69	1.22, 2.72	1.22, 2.72

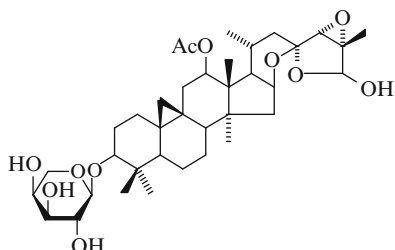
(continued)

References

1. L. Panizzi, S. Corsano, *Atti Accad. Nazl. Lincei., Rend., Classe Sci. Fis., Mat. Nat.* **32**, 601–605 (1962). *C.A.*, 58:12814e (1963)
2. S. Corsano, L. Panizzi, *Atti Accad. Nazl. Lincei., Rend., Classe Sci. Fis., Mat. Nat.* **38**(5), 600–604 (1965). *C.A.*, 64:3666 g (1966)
3. S. Corsano, G. Piancatelli, L. Panizzi, *Gazz. Chim. Ital.* **99** (8–9), 915–932 (1969)
4. S. Corsano, H. Linde, G. Piancatelli, L. Panizzi, *Chimia* **21**, 130–131 (1967)
5. G. Piancatelli, S. Corsano, A. Scettri, *Gazz. Chim. Ital.* **101**, 797–802 (1971)
6. M. Koeda, Y. Aoki, N. Sakurai, M. Nagai, *Chem. Pharm. Bull.* **43**(5), 771–776 (1995)
7. A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(3), 467–472 (1998)

Acetylacteol-3-O- α -L-arabinoside

C₃₇H₅₆O₁₁, M 676



Taxonomy: Cycloartane Glycosides

Cimifuga foetida L. (*Ranunculaceae*) [1].

$[\alpha]_D -66.06^\circ$ (c 0.30, CHCl₃-MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 2960, 2920, 1740.

Positive ion FABMS m/z: 677 [M + H]⁺.

Positive ion HRFABMS m/z: 677.3381 [M + H]⁺.

Table 1

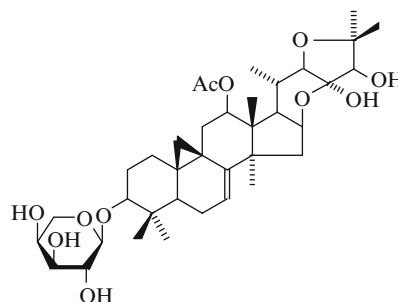
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.15 1.11 m, 1.48 m	C-21	20.52 0.87 d (6)
2	28.97 1.51 m, 1.81 m	22	25.11 0.94 m, 1.32 m
3	86.89 3.08 dd (13, 4.5)	23	104.68 –
4	40.11 –	24	61.94 3.53 s
5	46.30 1.23 dd (11, 4.5)	25	64.49 –
6	19.92 0.82 m, 1.51 m	26	12.42 1.43 s
7	36.65 1.28 brt (13), 1.71 dd (13, 3.5)	27	96.57 4.99 d (5.5), 6.49 d (5.5, OH)
8	45.27 1.58 m	28	19.16 0.84 s
9	19.40 –	29	24.99 0.96 s
10	25.96 –	30	14.76 0.77 s
11	35.83 2.48 m, 0.99 m	α -L-Arap	
12	76.02 4.74 dd (9, 3.5)	1	105.95 4.12 d (7.5)
13	47.76 –	2	73.77 2.95 td (8.5, 5), 4.90 d (5, OH)
14	47.18 –	3	76.69 3.05 m
15	42.93 1.44 m, 1.79 m	4	69.59 3.24 m
16	72.04 4.26 td (8, 7)	5	65.58 3.00 t (11), 3.64 dd (11, 5.5)
17	55.43 1.69 t (8)	Ac	169.89 –
18	13.00 1.13 s		21.38 1.96 s
19	29.15 0.33 d (4.5), 0.60 d (4.5)		
20	24.99 1.59 m		

References

1. S. Kadota, J.X. Li, K. Tanaka, T. Namba, *Tetrahedron* **51**(4), 1143–1166 (1995)
2. A. Kusano, M. Takahira, M. Shibano, Y. In, T. Ishida, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **46**(3), 467–472 (1998)

Cimiracemoside G

C₃₇H₅₆O₁₁, M 676



Taxonomy: Cycloartane Glycosides

Cimifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 198–201°C, $[\alpha]_D -59.1^\circ$ (c 0.11, MeOH).

CAS Registry Number: 289632-43-5.

IR ν_{\max}^{film} , cm⁻¹: 3441, 1733.

Negative ESIMS m/z: 675 [M-1]⁻.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.2 1.15, 1.57	C-21	17.6 1.31 d (6.4)
2	29.5 1.90, 2.28	22	86.7 3.91 d (10.7)
3	87.9 3.42 dd (4.2, 11.6)	23	105.7 –
4	40.4 –	24	83.3 4.22 s
5	42.4 1.20	25	83.7 –
6	21.8 1.57, 1.87	26	28.0 1.76 s
7	113.9 5.12	27	25.0 1.68 s
8	147.7 –	28	26.7 1.05 s
9	21.2 –	29	25.8 1.28 s
10	28.3 –	30	14.2 0.97 s
11	36.7 1.23, 2.92 dd (16.1, 9)	α -L-Arap	
12	76.7 5.23 d (8.6)	1	107.5 4.75 d (7.2)
13	48.8 –	2	73.0 4.44
14	51.0 –	3	74.7 4.14 dd (8.9, 3.3)
15	42.0 2.03, 2.13	4	69.7 4.29 brs

(continued)

Table 1 (continued)

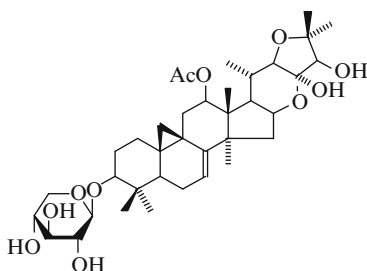
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	72.3	5	66.9
	5.09		3.75 d (10.7),
17	53.3		4.34 dd (10.7, 2.6)
18	15.1	Ac	170.7
	1.39 s		–
19	28.7		21.7
	0.47 d (4.1), 1.00 d (4.1)		2.11 s
20	34.3		2.31

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lekko, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Cimiracemoside F

C₃₇H₅₆O₁₁, M 676



Taxonomy: Cycloartane Glycosides

This glycoside was reported as cimircemoside A [1] *Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [2]. Mp 266–270°C, $[\alpha]_D -56.8^\circ$ (c 0.28, MeOH).

CAS Registry Number: 264875-61-8.

IR ν_{\max}^{film} , cm⁻¹: 3432, 1734.

Negative ESIMS m/z: 675 [M-1]⁻.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.5	C-21	17.9
	1.18, 1.60		1.33 d (6.5)
2	29.8	22	87.0
	1.86, 2.27		3.91 d (10.5)
3	88.2	23	106.0
	3.46 dd (4, 12)		–
4	40.7	24	83.6
	–		4.23 s
5	42.7	25	84.0
	1.20		–
6	22.1	26	28.3
	1.57, 1.87		1.78 s
7	114.2	27	25.2
	5.15		1.70 s
8	148.0	28	27.0
	–		1.08 s

(continued)

Table 1 (continued)

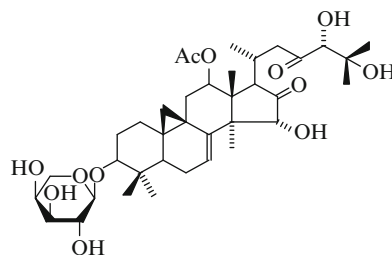
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
9	21.5	29	26.0
	–		1.34 s
10	28.6	30	14.5
	–		1.02 s
11	37.0	β-D-Xylp	
	1.23, 2.95 dd (16, 9)		
12	77.0	1	107.8
	5.26 d (8.6)		4.85 d (7.5)
13	49.1	2	75.9
	–		4.05
14	51.3	3	79.0
	–		4.16 t (8.6)
15	42.3	4	71.6
	2.05, 2.15		4.24
16	72.6	5	67.5
	5.09 dd (7.6, 15.6)		3.73 dd (11.1, 11.2),
17	53.6		4.34 dd (11.1, 5.1)
	1.77		
18	15.4	Ac	170.9
	1.41 s		–
19	29.0		21.9
	0.50 d (4), 1.01 d (4)		2.13 s
20	34.6		2.30

References

1. E. Bedir, I.A. Khan, *Chem. Pharm. Bull.* **48**(3), 425–427 (2000)
2. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Bugbanoside C

C₃₇H₅₆O₁₂, M 692



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 157–158°C (from MeOH-isopropyl ether), $[\alpha]_D -57.5^\circ$ (c 0.98, MeOH).

CAS Registry Number: 340258-10-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200, 1738, 1717.

CD: $\Delta\epsilon_{312} -3.43$ (c 1.27×10^{-4} g/ml), $\Delta\epsilon_{217} -9.25$ (c 0.64×10^{-4} g/ml).

Positive SIMS m/z: 715 [M + Na]⁺.

Positive HRSIMS m/z: 715.3661 [M + Na]⁺.

Table 1

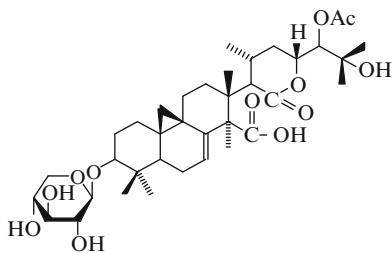
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.06	1.24, 1.64	C-21	23.21	1.37 d (6.8)
2	29.21	1.90, 2.31	22	46.12	3.11 dd (2, 19),
3	87.80	3.46 dd (4.1, 11.7)			3.70 dd (9.5, 19)
4	40.25	–	23	213.65	–
5	42.30	1.23	24	83.68	4.40 s
6	21.64	1.60, 1.92	25	72.27	–
7	115.18	6.09 dd (1.8, 7.8)	26	25.90	1.52 s
8	145.08	–	27	27.63	1.54 s
9	21.57	–	28	18.34	1.32 s
10	28.86	–	29	25.62	1.30 s
11	35.84	1.30, 2.93	30	14.12	1.02 s
12	76.99	5.64 dd (1.6, 9.4)	α -L-Arap		
13	44.01	–	1	107.21	4.77 d (7.0)
14	49.10	–	2	72.64	4.45 dd (7.0, 8.8)
15	80.40	4.67 s	3	74.34	4.17 dd (3.5, 8.8)
16	218.96	–	4	69.29	4.32
17	59.46	2.66 d (2.0)	5	66.66	3.80 dd (2.3, 12.5), 4.31
18	14.88	1.60 s	Ac	170.76	–
19	29.21	0.61, 1.14 d (4.0)		21.32	2.27 s
20	26.52	2.92			

References

1. A. Kusano, M. Shibano, D. Tsukamoto, G. Kusano, Chem. Pharm. Bull. **49**(4), 437–441 (2001)

No Name (C₃₇H₅₆O₁₂)

C₃₇H₅₆O₁₂, M 692



Taxonomy: Cycloartane Glycosides
Cimicifuga Rhizome (Ranunculaceae) [1].
 A white needle, $[\alpha]_D -31.2^\circ$ (MeOH).

Positive ion HRFABMS m/z: 715.3678
 [C₃₇H₅₆O₁₂Na]⁺.

Table 1

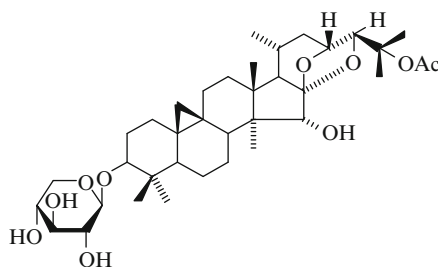
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	31.0	1.36, 1.71	C-21	25.3	1.05 d (6.8)
2	29.7	2.00, 2.38	22	36.1	1.56 dd (11.6, 13.8),
3	88.1	3.53 dd (3.8, 11.3)			2.18 dd (6.7, 13.8)
4	40.5	–	23	75.7	5.33 brd (11.6)
5	41.4	1.36	24	79.7	5.38 brs
6	22.4	1.64, 1.95	25	71.6	–
7	118.0	5.86 brd (6.8)	26	26.6	1.67 s
8	144.3	–	27	28.2	1.61 s
9	20.2	–	28	24.8	1.96 s
10	28.8	–	29	25.7	1.33 s
11	25.0	1.40, 2.10	30	14.1	1.06 s
12	33.2	1.92, 1.92	β -D-Xylp		
13	43.9	–	1	107.5	4.88 d (7.6)
14	57.1	–	2	75.6	4.05 dd (7.6, 8.7)
15	177.8	–	3	78.7	4.18 dd (8.7, 8.7)
16	173.2	–	4	1.3	4.26 m
17	56.7	2.88 d (3)	5	67.2	3.77 dd (10.3, 11.4),
18	23.0	1.98 s			4.40 dd (5, 11.4)
19	28.6	0.57 d (3.7), 1.18 d (3.7)	Ac	170.9	–
20	27.6	2.43 m		21.0	2.10 s

References

1. M. Nishida, H. Yoshimitsu, M. Okawa, T. Ikeda, T. Nohara, Chem. Pharm. Bull. **51**(10), 1215–1216 (2003)

25-O-Acetylcimigenoside

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

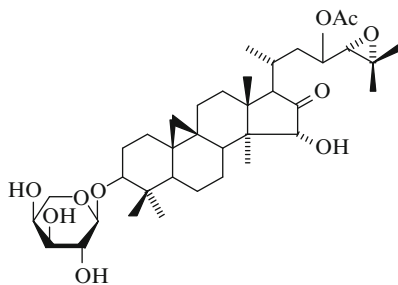
Cimicifuga acerina Sieb. et Zucc. (*Ranunculaceae*)
[1].
Mp 234–235°C.

References

1. T. Takemoto, G. Kusano, M. Kawahara, *Yakugaku Zasshi* **90**(1), 64–67 (1970). C.A., 72: 111643t (1970)

23-O-Acetylshengmanol 3-O- α -L-Arabinopyranoside

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].
Amorphous solid, $[\alpha]_D^{26} -26.0^\circ$ (c 0.1, MeOH).

CAS Registry Number: 402513-88-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3408, 2935, 2889, 1739, 1456, 1381, 1241, 1068, 991, 953.

FABMS m/z: 685 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.2	1.61 ddd (13.7, 13.5, 3.1), 1.25	C-21	20.3	1.26 d (6.6)
2	30.0	2.40, 1.97	22	37.0	2.65, 1.75
3	88.4	3.52 dd (11.7, 4.3)	23	72.1	5.40 ddd (10.7, 8.5, 2.5)
4	41.3	–	24	65.2	3.03 d (8.5)
5	47.5	1.39	25	58.5	–
6	21.0	1.60 dd (13, 1.6), 0.76 qd (13, 1.6)	26	24.7	1.25 s
7	26.7	2.09, 1.28	27	19.3	1.40 s
8	48.2	1.87 dd (12.5, 4.5)	28	12.0	1.21 s

(continued)

Table 1 (continued)

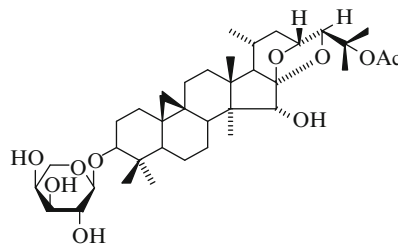
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
9	20.1	–	29	25.7	1.30 s
10	26.8	–	30	15.4	1.05 s
11	26.0	2.13, 1.15	α -L-Arap		
12	33.0	1.79	1	107.4	4.82 d (7)
13	41.5	–	2	72.9	4.47 dd (8.8, 7)
14	46.1	–	3	74.6	4.19 dd (8.8, 3.3)
15	82.9	4.36 s	4	69.5	4.34 brs
16	220.0	–	5	6.7	4.33 dd (12.9, 2.8)
17	60.0	2.34 brd (6.5)			3.82 brd (10.6)
18	19.8	1.37 s	Ac	170.6	–
19	30.5	0.32 d (4), 0.58 d (4)	21.0	2.06 s	
20	28.0	2.13			

References

1. K. Watanabe, Y. Mimaki, H. Sakagami, Y. Sashida, *Chem. Pharm. Bull.* **50**(1), 121–125 (2002)

25-O-Acetylcimigenol 3-O- α -L-Arabinopyranoside

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Cimicifuga dahurica (Turcz.) Maxim. (*Ranunculaceae*) [1].

Mp 221–222°C, $[\alpha]_D +30.1^\circ$ (c 0.20, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3451, 2935, 2868, 1734, 1633, 1453, 1068, 991.

ESIMS m/z: 663 [M + 1]⁺.

Table 1

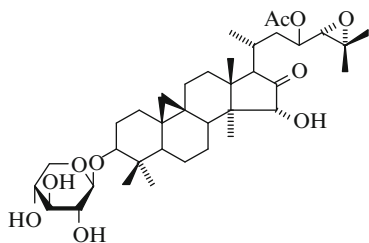
	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4	1.24, 1.58	C-21	19.4 0.89 d (6.2)
2	30.0	1.94, 2.38	22	37.8 0.96, 2.24
3	88.5	3.47 dd (11.6, 4.2)	23	71.6 4.56 d (9.2)
4	41.7	–	24	86.7 4.09 s
5	47.5	1.35	25	83.1 –
6	21.0	0.70, 1.52	26	23.4 1.66 s
7	26.3	1.14, 2.10	27	21.5 1.64 s
8	48.6	1.66	28	11.7 1.16 s
9	19.9	–	29	25.7 1.26 s
10	26.6	–	30	15.3 1.00 s
11	26.4	1.05, 2.06	α -L-Arap	
12	34.0	1.50, 1.68	1	107.4 4.77 d (7)
13	41.3	–	2	72.8 4.42 dd (8.1, 7)
14	47.1	–	3	74.5 4.15 dd (8.1, 3)
15	80.1	4.23 s	4	69.4 4.29 brs
16	112.3	–	5	66.7 3.77 brd (11),
17	59.3	1.40 d (9.2)		4.28 dd (11, 3)
18	19.4	1.12 s	Ac	170.1 –
19	30.8	0.27 d (3.6), 0.51 d (3.6)		22.2 1.94
20	23.9	1.62		

References

- W. Ye, J. Zhang, C.-T. Che, T. Ye, S. Zhao, *Planta Med.* **65**, 770–772 (1999)

Acetyl Shengmanol Xyloside

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Cimicifuga japonica (*Ranunculaceae*) [1].

Mp 280–281°C, $[\alpha]_D^{27}$ –23.7° (c 1.1, CH₂Cl₂-MeOH, 1:1).

CAS Registry Number: 62498-88-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3100, 1735, 1230, 1025.

CD (c 1.62 × 10⁻³, MeOH): $[\theta]_{316}$ –1.86 × 10⁴.

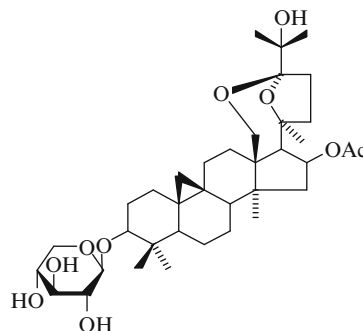
¹H NMR (C₅D₅N, δ): 2.05 (CH₃COO).

References

- N. Sakurai, T. Inoue, M. Nagai, *Chem. Pharm. Bull.* **27**(1), 158–165 (1979)

Beesioside L

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Beesia calthaefolia (*Maxim.*) *Ulber.* (*Ranunculaceae*) [1].

Mp 250–254°C (from EtOAc-MeOH), $[\alpha]_D^{20}$ –2.1° (c 0.09, CHCl₃-MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3500, 2970, 2920, 2840, 1735, 1460, 1380, 1360, 1235, 1160, 1090, 1040.

Positive ion FABMS m/z (%): 685 [M + Na]⁺, 115 (100), 59, 43.

Positive ion HRFABMS m/z: 685.39256 [M + Na]⁺.

Table 1

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.1	1.18 m, 1.55 m	C-21	32.6 1.34 s
2	30.9	1.89 m, 2.35 m	22	37.8 1.96 m, 2.89 m

(continued)

Table 1 (continued)

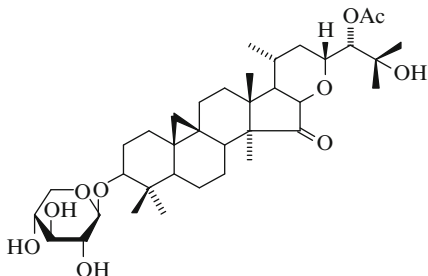
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
3	88.3 3.48 dd (11.5, 3.0)	23	30.0 2.12 m, 2.78 m
4	41.3 –	24	114.1 –
5	47.4 1.25 m	25	72.8 –
6	20.5 0.67 q (12.5)	26	25.7 1.55 s
7	26.5	27	25.7 1.67 s
8	46.9 1.38 m	28	22.2 0.89 s
9	18.9 –	29	25.8 1.31 s
10	27.5 –	30	15.4 1.00 s
11	26.5	β -D-Xylp	
12	28.3 1.48 m, 2.84 m	1	107.6 4.86 d (7)
13	44.3 –	2	75.6 4.04 t (8)
14	52.6 –	3	78.6 4.17 t (9)
15	43.0 1.42 m, 2.02 m	4	71.2 4.21 m
16	73.2 5.64 m	5	67.1 3.73 t (7.5), 4.35 dd (11.3, 4.5)
17	59.3 2.61 d (10.5)		
18	66.7 4.50 d (13), 4.30 d (13)	Ac	21.4 2.09 s
19	31.1 0.13 d (2.5), 0.47 d (2.5)		170.3 –
20	87.2 –		

References

1. J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Cimiracemoside E

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Mp 232–234°C, $[\alpha]_D^{+40.0}$ (c 0.07, MeOH).

IR ν_{\max}^{film} , cm⁻¹: 3426, 1744, 1727.

Negative ESIMS m/z: 661 [M-1]⁻.

Table 1

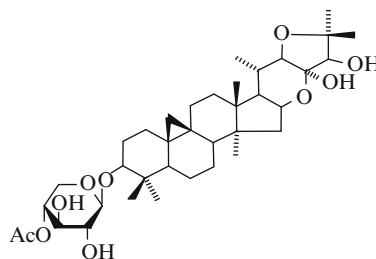
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.5 1.17, 1.56	C-21	21.1 0.90 d (6.4)
2	30.2 1.92, 2.35	22	38.7 1.47, 1.70
3	88.4 3.50 dd (4.3, 11.7)	23	79.0 4.25
4	41.4 –	24	79.9 5.31 d (2.4)
5	47.4 1.30	25	72.1 –
6	20.8 0.59, 1.47	26	26.8 1.61 s
7	25.9 1.00, 1.60	27	28.3 1.61 s
8	43.6 1.28	28	17.6 1.00 s
9	20.1 –	29	25.7 1.30 s
10	27.1 –	30	15.5 1.02 s
11	26.1 1.03, 2.23	β -D-Xylp	
12	31.2 1.48, 1.65	1	107.6 4.85 d (7.5)
13	40.0 –	2	75.6 4.03 dd (8.6, 7.5)
14	55.1 –	3	78.7 4.16 t (8.6)
15	214.1 –	4	71.3 4.22
16	84.3 3.78 d (11.6)	5	67.2 3.73 dd (11.2, 10), 4.35 dd (5.1, 11.2)
17	52.3 1.58		
18	20.3 1.15 s	Ac	171.2 –
19	31.4 0.24 d (4.2), 0.47 d (4.2)		20.0 2.15 s
20	33.2 1.80		

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Soulieoside C

C₃₇H₅₈O₁₀, M 662



Taxonomy: Cycloartane Glycosides

Souliea vaginata (Maxim.) Franch. (*Ranunculaceae*)

[1].

Mp 237–239°C (from MeOH), $[\alpha]_D^{20} -8.6^\circ$ (c 0.07, CHCl₃–CH₃OH, 1: 1).

IR ν_{\max}^{KBr} , cm⁻¹: 3444, 1747.

Positive ion FABMS m/z (%): 663 [M + H]⁺, 645, 471, 453, 185 (100), 175.

Positive ion HRFABMS m/z: 685.3874 [M + Na]⁺.

(22R,23R,24R)-12β-Acetyloxy-16β,23;22,25-diepoxy-23,24-dihydroxy-9,19-cyclolanostan-3β-yl-α-L-arabinopyranoside

C₃₇H₅₈O₁₁, M 678

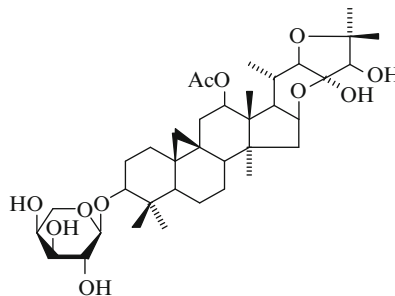


Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	32.1	1.26 m, 1.57 m	C-21	17.5	1.22 d (6.5)
2	30.0	1.90 m, 2.28 m	22	86.9	3.89 d (10.5)
3	88.4	3.46 dd (4.5, 12)	23	106.0	–
4	41.3	–	24	83.3	4.17 s
5	47.5	1.29 m	25	83.6	–
6	20.9	0.70 q (12.5), 1.53 m	26	27.7	1.76 s
7	26.2	1.04 m, 1.29 m	27	24.8	1.68 s
8	47.5	1.58 m	28	19.6	0.84 s
9	20.0	–	29	25.7	1.32 s
10	26.5	–	30	15.3	1.01 s
11	26.3	1.06 m, 1.89 m	β-D-Xylp		
12	33.4	1.54 m	1	107.3	4.86 d (7.5)
13	46.8	–	2	75.7	4.05 t (8)
14	45.2	–	3	75.0	4.26 t (8)
15	43.3	1.61 m, 1.91 m	4	73.2	5.41 ddd (5.5, 8.5, 11)
16	72.4	4.96 brs	5	63.2	3.60 t (10.5), 4.33 dd (5.5, 11)
17	52.3	1.58 m	Ac		
18	20.6	1.20 s	170.6	–	
19	30.1	0.18 d (4), 0.45 d (4)	20.9	1.95 s	
20	34.7	2.28 m			

References

1. L. Zhou, J.S. Yang, J.H. Zou, G.Z. Tu. Chem. Pharm. Bull. 52(5), 622–624 (2004)

Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Amorphous solid, $[\alpha]_D^{26} -20.0^\circ$ (c 0.1, MeOH).

IR ν_{\max}^{film} , cm⁻¹: 3417, 2966, 2936, 1731, 1456, 1381, 1246, 1145, 1060, 986, 950.

FABMS m/z: 701 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	31.9	1.49, 1.10	C-21	17.4	1.32 d (6.3)
2	29.8	2.27, 1.85	22	86.7	3.88 d (10.5)
3	88.1	3.44 dd (11.7, 4.3)	23	105.5	–
4	41.1	–	24	83.3	4.22 s
5	47.0	1.23 dd (12.3, 4.2)	25	83.5	–
6	20.4	1.45, 0.68 qd (12.3, 1.8)	26	24.7	1.68 s
7	25.7	1.26, 0.92	27	27.8	1.75 s
8	45.6	1.56 dd (11.8, 5.3)	28	19.6	0.85 s
9	19.9	–	29	25.7	1.28 s
10	26.7	–	30	15.2	0.96 s
11	36.7	2.71 dd (16, 9), 1.15 dd (16, 3.7)	α-L-Arap		
12	76.9	5.13 dd (9, 3.7)	1	107.3	4.77 d (7.0)
13	49.3	–	2	72.9	4.43 dd (8.8, 7)
14	48.1	–	3	74.6	4.16 dd (8.8, 3.3)
15	43.0	1.90 dd (12.3, 7.9), 1.71	4	69.5	4.31 brs

(continued)

Table 1 (continued)

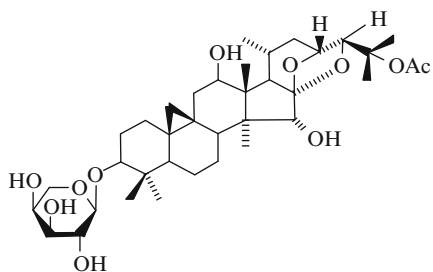
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
16	72.1 5.00 q (7.9)	5 6.7	4.29 dd (11.7, 2.7),
17	52.4 1.81 dd (10.6, 7.9)		3.78 brd (10.9)
18	13.7 1.35 s	Ac 170.5	–
19	29.6 0.19 d (4.1), 0.53 d (4.1)	21.6	2.07 s
20	34.4 2.23		

References

1. K. Watanabe, Y. Mimaki, H. Sakagami, Y. Sashida, Chem. Pharm. Bull. **50**(1), 121–125 (2002)

25-O-Acetyl-12 β -hydroxycimigenol-3-O- α -L-arabinopyranoside

$C_{37}H_{58}O_{11}$, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga racemosa (L.) Nutt. (*Ranunculaceae*) [1].

Amorphous solid, $[\alpha]_D^{26} +26.0^\circ$ (c 0.1, MeOH).
IR ν_{max}^{KBr} , cm^{-1} : 3419, 2936, 2869, 1734, 1456, 1372, 1249, 1141, 1088, 1044, 1024, 988, 947.
FABMS m/z : 701 $[M + Na]^+$.

Table 1

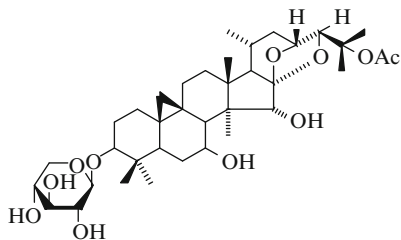
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.5 1.58, 1.24	C-21	21.0 1.39 d (5.8)
2	30.0 2.32, 1.90	22	38.5 2.39, 1.10
3	88.5 3.48 dd (11.7, 4.3)	23	71.6 4.62 brd (9)
4	41.3 –	24	86.7 4.17 brs
5	47.3 1.32	25	83.1 –
6	20.9 1.54, 0.77 qd (12.7, 1.9)	26	21.6 1.69 s
7	26.1 2.14, 1.27	27	23.3 1.71 s
8	47.3 1.82	28	11.8 1.21 s
9	20.7 –	29	25.7 1.27 s
10	26.6 –	30	15.3 1.00 s
11	40.8 2.79 dd (15.6, 9), 1.45 dd (15.6, 2.6)	α -L-Arap	
12	72.7 4.13 dd (9, 2.6)	1	107.4 4.79 d (6.9)
13	47.8 –	2	72.9 4.44 dd (7.7, 6.9)
14	48.2 –	3	74.6 4.17 brd (6.9)
15	79.8 4.44 s	4	69.5 4.32 brs
16	112.8 –	5	66.7 4.29 dd (12.4, 2.3),
17	59.6 1.83		3.79 brs (12.4)
18	12.0 1.42 s	Ac	170.2 –
19	30.7 0.62 d (4.1), 0.38 d (4.1)	22.3	1.98 s
20	23.9 1.83		

References

1. K. Watanabe, Y. Mipaki, H. Sakagami, Y. Sashida, Chem. Pharm. Bull. **50**(1), 121–125 (2002)

25-O-Acetyl-7 β -hydroxycimigenol-3-O- β -D-xylopyranoside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 252–253°C (from CH₃CN–MeOH), [α]_D+14.0° (c 0.41, MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3560–3200, 1720.

Positive HRSIMS m/z: 679.4053 [M + H]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		
C-1	30.50	1.25, 1.58	C-21	19.47	0.88 d (6.5)
2	29.88	1.94, 2.37	22	37.75	1.10, 2.28
3	88.13	3.53 dd (11.6, 4.2)	23	71.36	4.63 d (8.8)
4	40.19	–	24	86.63	4.17 s
5	46.14	1.58	25	83.42	–
6	32.19	1.20, 2.04	26	21.15	1.75 s
7	69.15	3.68 ddd (12, 10, 3)	27	23.34	1.73 s
8	56.18	1.82 d (10)	28	11.88	1.35 s
9	18.85	–	29	25.54	1.30 s
10	27.09	–	30	15.17	1.08 s
11	26.47	1.10, 2.06	β -D-Xylp		
12	33.85	1.55, 1.65	1	107.78	4.86 d (7.5)

(continued)

Table 1 (continued)

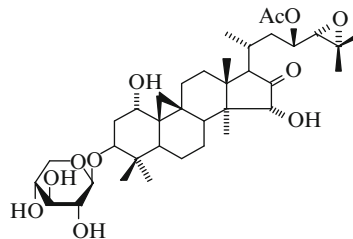
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)			
13	42.23	–	2	75.27	4.05 dd (8, 7.5)	
14	47.71	–	3	78.27	4.19 dd (8.8, 8)	
15	78.93	4.44 s	4	70.96	4.26 ddd (10, 8.8, 5)	
16	112.14	–	5	66.90	3.75 dd (11, 10),	
17	59.60	1.51 d (11)			4.38 dd (11, 5)	
18	19.47	1.19 s	Ac	170.23	–	
19	30.50	0.36 d (4.2), 0.67 (4.2)			22.22	1.98 s
20	23.75	1.60				

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **43**(7), 1167–1170 (1995)

23-O-Acetyl-1 α -hydroxyshengmanol-3-O- β -D-xylopyranoside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 245–247°C (from MeOH), $[\alpha]_D^{23}$ -20° (c 0.5, MeOH).

CAS Registry Number: 162897-43-0.

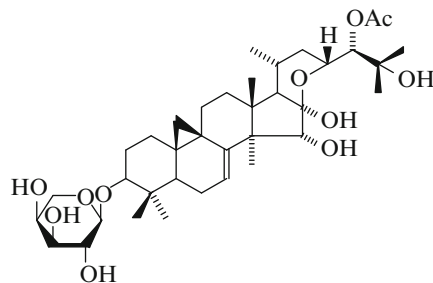
IR ν_{\max}^{KBr} , cm^{-1} : 3500–3250, 1735.ORD (c 0.5, MeOH): $[M]_{290}^{23}$ $+13560.0^\circ$, $[M]_{338}^{23}$ -11119.0° .Positive ion HRFABMS m/z: 679.3562 $[M + H]^+$, 685.3615 $[M + Li]^+$.**Table 1**

	δ_C (C_5D_5N)	δ_H (J/Hz)		δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	72.24	3.83 dd (3, 4)	C-21	20.15	1.22 d (7)
2	37.80	2.26 ddd (14, 12, 3), 2.74 ddd (14, 5, 4)	22	36.88	1.70, 2.68 ddd (13, 11, 2)
3	84.30	4.36 dd (12, 5)	23	71.97	5.38 ddd (9, 9, 3)
4	41.41	–	24	65.02	3.01 d (9)
5	39.87	2.50 dd (13, 5)	25	58.41	–
6	20.07	0.87 qd (13, 2), 1.70	26	19.22	1.24 s
7	26.38	1.49, 2.12	27	24.59	1.37 s
8	48.08	1.93 dd (7, 5)	28	11.79	1.27 s
9	20.86	–	29	25.62	1.39 s
10	30.99	–	30	14.60	1.11 s
11	25.39	1.49, 2.86 ddd (14, 7, 7)	β -D-Xylp		
12	32.97	1.85,	1	107.57	4.86 d (8)
13	41.41	–	2	75.54	4.02 dd (8, 8)
14	46.09	–	3	78.51	4.10 dd (8, 8)
15	82.90	4.37 s	4	71.09	4.20 ddd (11, 8, 5)
16	219.95	–	5	66.91	3.57 dd (11, 10), 4.23 dd (10, 5)
17	59.81	2.30 d (7)			
18	19.69	1.40 s	Ac	170.51	–
19	30.04	0.43 d (4), 0.73 d (4)		20.86	2.06 s
20	27.82	2.12			

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

24-O-Acetyl-7,8-didehydroshengmanol-3-O- α -L-arabinopyranoside

 $C_{37}H_{58}O_{11}$, M 678**Taxonomy:** Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 172–173°C (from MeOH), $[\alpha]_D$ -14.1° (c 0.51, MeOH).

CAS Registry Number: 228251-27-2.

IR ν_{\max}^{KBr} , cm^{-1} : 3700–3200, 1723.Positive SIMS m/z: 701 $[M + Na]^+$.Positive HRSIMS m/z: 701.3876 $[M + Na]^+$.**Table 1**

	δ_C (C_5D_5N)	δ_H (J/Hz)		δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	30.41	1.34, 1.68	C-21	21.79	1.04 d (6.3)
2	29.41	1.98, 2.34	22	34.17	2.09, 2.23
3	88.28	3.48 dd (4.4, 11.3)	23	74.82	4.41
4	40.42	–	24	82.57	5.63 d (7.6)
5	42.79	1.31	25	71.30	–
6	21.86	1.62, 1.93	26	29.03	1.48 s
7	113.42	6.01 dd (1.3, 6.8)	27	25.83	1.47 s
8	149.26	–	28	18.27	1.47 s
9	21.26	–	29	25.48	1.29 s
10	28.45	–	30	14.32	1.09 s
11	25.48	1.17, 2.18	α -L-Arap		
12	33.97	1.66, 1.83	1	107.31	4.79 d (7.5)
13	41.41	–	2	72.98	4.43 dd (7.5, 8.1)
14	50.05	–	3	74.62	4.17 dd (3.1, 8.1)
15	80.75	4.43 s	4	69.50	4.33
16	103.42	–	5	66.70	3.81 dd (2.5, 11.2), 4.31 dd (2.5, 11.2)
17	60.33	1.83 d (8.8)			
18	22.64	1.28 s	Ac	171.33	–

(continued)

Table 1 (continued)

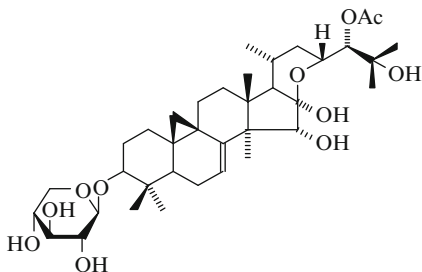
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
19	28.41	0.53 d (4), 1.09 d (4)	21.26 2.00 s
20	27.82	1.80	

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

24-O-Acetyl-7,8-didehydroshengmanol-3-O- β -D-xylopyranoside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 227–228°C (from MeOH), $[\alpha]_D -29.7^\circ$ (c 0.77, MeOH).

CAS Registry Number: 228251-25-0.

IR ν_{\max}^{KBr} : 3760–3250, 1720.

Positive SIMS m/z: 678 [M]⁺, 679 [M + H]⁺, 661 [M - OH]⁺.

Positive HRSIMS m/z: 678.3985 [M]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.41	1.34, 1.70	C-21 21.79 1.03 d (6.3)
2	29.57	1.95, 2.33	22 34.17 2.08, 2.22
3	88.24	3.49 dd (4, 11.3)	23 74.82 4.41

(continued)

Table 1 (continued)

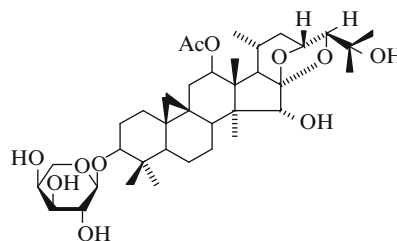
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	40.42	–	24 82.56 5.63 d (7.5)
5	42.79	1.35	25 71.29 –
6	21.85	1.62, 1.92	26 29.02 1.47 s
7	113.43	6.00 dd (1.3, 6.8)	27 25.47 1.47 s
8	149.24	–	28 18.27 1.46 s
9	21.55	–	29 25.81 1.31 s
10	28.46	–	30 14.35 1.04 s
11	25.55	1.16, 2.18	β -D-Xylp
12	33.97	1.68, 1.80	1 107.44 4.85 d (7.5)
13	41.40	–	2 75.57 4.02 dd (7.5, 8.2)
14	50.03	–	3 78.56 4.15 dd (8.2, 8.2)
15	80.74	4.44 s	4 71.26 4.21 ddd (5, 8.2, 10)
16	103.41	–	5 67.10 3.74 dd (10,11), 4.36 dd (5,11)
17	60.32	1.80	
18	22.63	1.29 s	Ac 171.32 –
19	28.41	0.52 d (4), 1.08 d (4)	21.30 2.00 s
20	27.64	1.80	

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

Cimiracemoside D

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides*Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1].Mp 165–168°C, $[\alpha]_D -20.0^\circ$ (c 0.05, MeOH).

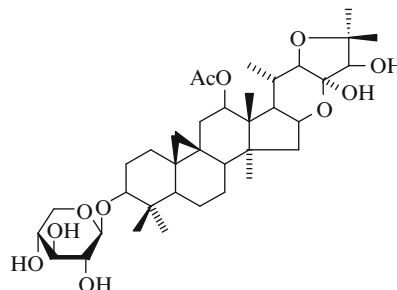
CAS Registry Number: 290821-39-5.

IR ν_{\max}^{film} , cm^{-1} : 3430, 1730.Negative ESIMS m/z : 677 $[\text{M}-1]^-$.**Table 1**

δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)			
C-1	32.4	1.10, 1.50	C-21	21.7	0.92 d (6)	
2	30.0	1.86, 2.30	22	38.6	1.03, 2.09	
3	88.3	3.45 dd (4.2, 11.7)	23	71.5	4.74 d (8.7)	
4	41.3	–	24	90.0	3.78 s	
5	47.2	1.22	25	71.0	–	
6	20.8	0.70, 1.45	26	25.5	1.49 s	
7	26.0	1.08, 2.10	27	27.1	1.47 s	
8	47.3	1.73	28	11.9	1.25 s	
9	20.1	–	29	25.7	1.21 s	
10	26.8	–	30	15.4	0.98 s	
11	37.5	1.14 dd (16, 3), 2.92 dd (16, 9.4)	α -L-Arap	1	107.5	4.77 d (7.1)
12	77.3	5.27 dd (9.4, 3)	2	73.0	4.45	
13	48.5	–	3	74.7	4.16 dd (8.7, 2.6)	
14	46.3	–	4	69.6	4.30 brd	
15	79.2	4.36	5	66.8	3.80, 4.30	
16	112.0	–	Ac	170.6	–	
17	59.3	1.70	20.0	2.10	s	
18	12.7	1.31 s				
19	30.9	0.28 d (4.2), 0.56 d (4.2)				
20	24.1	1.66				

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

Cimiracemoside H $\text{C}_{37}\text{H}_{58}\text{O}_{11}$, M 678**Taxonomy:** Cycloartane Glycosides*Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1].Mp 189–192°C, $[\alpha]_D -30^\circ$ (c 0.06, MeOH).

CAS Registry Number: 290821-41-9

IR ν_{\max}^{film} , cm^{-1} : 3433, 1735.Negative ESIMS m/z : 677 $[\text{M}-1]^-$.**Table 1**

δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)			
C-1	32.2	1.13, 1.52	C-21	17.8	1.38 d (3.3)	
2	30.0	1.85, 2.30	22	86.9	3.92 d (10.8)	
3	88.3	3.49 dd (4.2, 11.7)	23	105.8	–	
4	41.5	–	24	83.6	4.24 s	
5	47.3	1.25	25	83.8	–	
6	20.8	0.73, 1.45	26	28.1	1.79 s	
7	26.0	0.95, 1.23	27	25.2	1.72 s	
8	46.0	1.62	28	20.0	0.87 s	
9	20.3	–	29	25.2	1.35 s	
10	27.0	–	30	15.7	1.02 s	
11	37.1	1.28, 2.75 dd (16.2, 9)	β -D-Xylp	1	107.8	4.88 d (7.5)
12	75.9	5.18 dd (9, 3.6)	2	75.9	4.07	
13	49.6	–	3	78.9	4.19 t (8.7)	
14	48.4	–	4	71.5	4.22	
15	43.3	1.92, 1.77	5	67.4	3.76 t (11.1),	
16	72.3	5.02				

(continued)

Table 1 (continued)

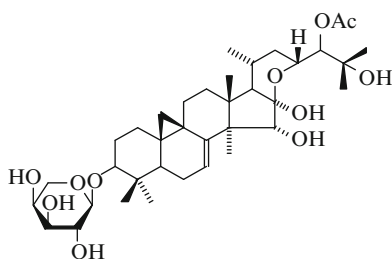
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
17	52.8 1.77		4.39 dd (11.1, 4.8)
18	14.1 1.38 s	Ac	170.6 –
19	30.3 0.21 d (3.9), 0.54 d (3.9)	22.0	2.11 s
20	34.8 2.31		

References

1. Y. Shao, A. Harris, M. Wang, H. Zhang, G.A. Cordell, M. Bowman, E. Lemmo, *J. Nat. Prod.* **63**(7), 905–910 (2000)

24-*epi*-24-O-Acetyl-7,8-didehydroshengmanol-3-O- α -L-arabinopyranoside

$C_{37}H_{58}O_{11}$, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 221–222°C (from MeOH), $[\alpha]_D -9.2^\circ$ (c 0.50, MeOH).

CAS Registry Number: 228251-26-1.

IR ν_{max}^{KBr} , cm^{-1} : 3600–3200, 1720.

Positive SIMS m/z : 703 $[M + Na]^+$, 661 $[M-OH]^+$.

Positive HRSIMS m/z : 701.3846 $[M + Na]^+$.

Table 1

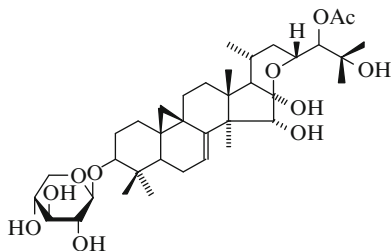
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	30.38 1.33, 1.68	C-21	21.26 1.01 d (6.3)
2	29.48 1.98, 2.35	22	32.79 1.83, 2.08
3	88.22 3.48 dd (4, 11.3)	23	74.26 4.44
4	40.41 –	24	81.36 5.73 d (8.1)
5	42.75 1.35	25	72.98 –
6	21.63 1.63, 1.95	26	27.37 1.49 s
7	113.46 5.99 dd (6.9, 1.5)	27	27.13 1.45 s
8	149.10 –	28	18.13 1.43 s
9	21.86 –	29	25.81 1.29 s
10	28.43 –	30	14.31 1.02 s
11	25.44 1.18, 2.17	α -L-Arap	
12	33.86 1.66, 1.80	1	107.31 4.79 d (7.3)
13	41.60 –	2	72.17 4.43
14	50.04 –	3	74.63 4.16 dd (8.1, 3.1)
15	80.08 4.44 s	4	69.50 4.32
16	103.19 –	5	66.73 3.81 dd (11.2, 2.5), 4.31
17	60.76 1.81	170.37	–
		Ac	
18	22.55 1.25 s	21.07	2.12 s
19	28.43 0.52 d (4), 1.09 d (4)		
20	27.07 1.80		

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

24-*epi*-24-O-Acetyl-7,8-didehydrohengmanol-3-O- β -D-xylopyranoside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 224–225°C (from MeOH), $[\alpha]_D -25.5^\circ$ (c 1.00, MeOH).

CAS Registry Number: 228251-25-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200, 1720.

Positive SIMS m/z: 661 [M-OH]⁺.

Positive HRSIMS m/z: 661.3951 [M-OH]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.40	1.33, 1.73	C-21	21.26	1.03 d (6.3)
2	29.55	1.93, 2.35	22	32.80	1.84, 2.10
3	88.18	3.51 dd (4.4, 11.9)	23	74.26	4.46
4	40.43	–	24	81.37	5.74 d (8.1)
5	42.76	1.33	25	72.18	–
6	21.63	1.65, 1.95	26	27.38	1.50 s
7	113.48	6.01 dd (1.5, 6.9)	27	27.14	1.47 s
8	149.10	–	28	18.14	1.44 s
9	21.86	–	29	25.81	1.34 s
10	28.48	–	30	14.35	1.06 s
11	25.46	1.16, 2.18	β -D-Xylp		
12	33.87	1.68, 1.83	1	107.46	4.87 d (7.5)
13	41.60	–	2	75.56	4.04 dd (7.5, 8.1)

(continued)

Table 1 (continued)

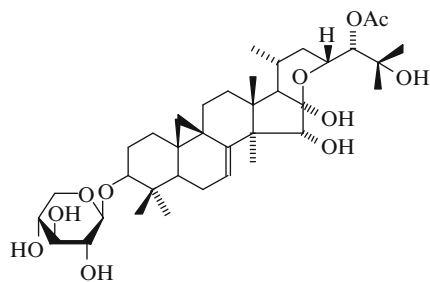
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
14	50.04	–	3	78.59	4.16 dd (8.1, 8.1)
15	80.10	4.45 s	4	71.27	4.23 ddd (5, 8.1, 10)
16	103.19	–	5	67.12	3.76 dd (10, 11),
17	60.76	1.82			4.39 dd (5, 11)
18	22.56	1.27 s	Ac	170.38	–
19	28.44	0.54 d (4), 1.09 d (4)		21.07	2.14 s
20	27.07	1.83			

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

7,8-Didehydro-24-O-acetylhengmanol-3-xyloside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga heracleifolia Komarov (*Ranunculaceae*)

[1].

$[\alpha]_D -27.4^\circ$ (c 0.62, CHCl₃–MeOH, 2:3).

IR ν_{\max}^{KBr} , cm^{-1} : 3346, 1740, 1240.

Positive ion FABMS m/z : 679 $[\text{M} + \text{H}]^+$.

Table 1

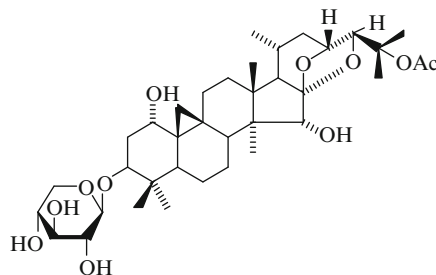
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1 30.34	1.34 m, 1.69 m	C-21 20.63	0.96 d (6.7)
2 29.52	1.95 m, 2.29 ddd (12, 4, 3)	22 33.89	1.55 m, 1.91 m
3 88.20	3.44 dd (11.6, 4)	23 72.72	4.18 t (8.8)
4 40.39	–	24 80.25	4.82 d (2)
5 42.60	1.24 m	25 75.42	–
6 21.75	1.61 m, 1.88 m	26 32.78	1.69 s
7 113.95	6.06 dd (7.5, 1.5)	27 27.12	1.49 s
8 148.28	–	28 18.71	1.34 s
9 21.17	–	29 25.75	1.29 s
10 28.22	–	30 14.28	1.04 s
11 25.42	1.14 m, 2.14 ddd (12.5, 9.4)	β -D-Xylp	
12 34.10	1.66 m, 1.77 m	1 107.39	4.76 d (7.3)
13 40.15	–	2 75.18	3.94 dd (8.6, 7.3)
14 49.98	–	3 78.46	4.06 t (8.6)
15 80.64	4.26 d (7.5) [4.63 d (7.5) OH]	4 71.11	4.15 td (8.6, 5.2)
16 106.57	- [8.47 s (OH)]	5 67.01	3.65 t (10.1), 4.29 dd (10.1, 5.2)
17 61.15	1.49 m	Ac	
18 22.08	1.18 s	170.59	–
19 28.34	0.50 d (4), 1.05 d (4)	20.93	2.02 s
20 25.60	1.74 m		

References

- J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

25-O-Acetyl-1 α -hydroxycimigenol-3-O- β -D-xylopyranoside

$\text{C}_{37}\text{H}_{58}\text{O}_{11}$, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 175–176°C (from a mixture of MeOH and isopropyl ether), $[\alpha]_{\text{D}}^{20} +26.2^\circ$ (c 0.97, MeOH).

CAS Registry Number: 162897-44-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3520–3200, 1736.

FABMS m/z : 679.2 $[\text{M} + \text{H}]^+$, 701.2 $[\text{M} + \text{Na}]^+$.

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1 72.44	3.82 brs	C-21 19.50	0.85 d (7)
2 37.91	2.25, 2.68	22 37.70	1.05, 2.24
3 84.58	4.32 dd (12, 4)	23 71.66	4.61 d (9)
4 41.48	–	24 86.74	4.10 s
5 39.96	2.47 dd (12, 5)	25 83.24	–
6 20.93	0.85	26 21.51	1.66 s
7 26.25	1.45, 2.20	27 23.32	1.68 s
8 48.81	1.73	28 11.69	1.29 s
9 20.93	–	29 25.73	1.38 s
10 30.83	–	30 14.67	1.11 s
11 25.73	1.45, 2.88	β -D-Xylp	
12 34.03	1.60, 1.75	1 107.49	4.84 d (8)
13 41.78	–	2 75.36	4.01 dd (8, 8)
14 47.24	–	3 78.27	4.14 dd (8, 8)
15 80.19	4.29 s	4 70.98	4.20 ddd (11, 8, 4)

(continued)

Table 1 (continued)

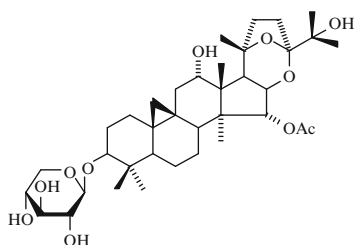
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	112.40 –	5	66.82 3.57 dd (10, 9), 4.25 dd (9, 4)
17	59.38 1.45 d (11)		
18	19.50 1.19 s	Ac	170.39 –
19	30.93 0.43 d (4), 0.70 d (4)		22.34 1.99 s
20	23.92 1.70		

References

1. A. Kusano, K. Shimizu, M. Idoji, M. Shibano, K. Minoura, G. Kusano, *Chem. Pharm. Bull.* **43**(2), 279–283 (1995)

Beesioside IV

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*)

[1].

Souliea vaginata (Maxim.) Franch. (*Ranunculaceae*)

[1].

An amorphous powder, $[\alpha]_D^{20} -11.1^\circ$ (c 1.0, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1720, 1245, 1040.

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.5	C-10	26.2	C-19	29.5	C-28	14.7
2	29.9	11	39.9	20	82.8	29	24.5
3	88.4	12	72.0	21	26.2	30	15.3
4	41.2	13	49.7	22	40.2	β -D-Xylp	
5	47.6	14	50.7	23	28.6	1	107.3
6	21.1	15	86.7	24	110.3	2	75.2

(continued)

Table 1 (continued)

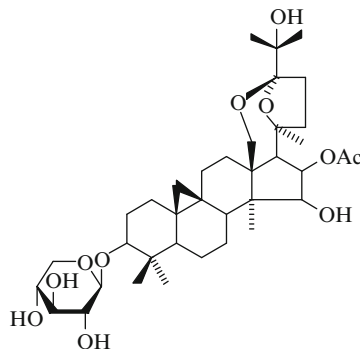
δ_C (C ₅ D ₅ N)							
7	25.7	16	79.7	25	72.0	3	78.3
8	48.1	17	44.1	26	25.2	4	70.9
9	19.8	18	20.5	27	25.1	5	66.9
							Ac
							170.1
							21.4

References

1. N. Sakurai, T. Goto, M. Nagai, T. Inoue, P. Xiao, *Heterocycles* **30**(2), 897–904 (1990)

Beesioside K

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*)

[1].

Mp 278–282°C (from EtOAc–MeOH), $[\alpha]_D^{20} -12.0^\circ$ (c 0.5, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 2970, 2930, 2860, 1710, 1460, 1380, 1365, 1250, 1160, 1100, 1070, 1040, 990, 970.

Positive ion FABMS m/z: 679 [M + H]⁺, 547 [M-132 + H]⁺, 529 [M-150 + H]⁺.

Positive ion HRFAB MS m/z: 679.40223 [M + H]⁺.

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.22 and 0.54 (2H-19, d, J = 3 Hz), 0.72 (H-6, q, J = 12.5 Hz), 1.02, 1.23, 1.29, 1.31, 1.54, 1.65 (6xCHC₃, s), 1.98

(CH₃COO, s), 2.67 (H-17, d, J = 11.2 Hz), 3.50 (H-3, dd, J = 11.5, 3.9 Hz), 4.45 (H-18, d, J = 13 Hz), 4.65 (H-18, d, J = 13 Hz), 4.40 (H-15, d, J = 8.7 Hz), 5.87 (H-16, dd, J = 11.2, 8.7 Hz), 3.71 (Xylp H-5a, t, J = 10.6 Hz), 4.00 (Xylp H-2, t, J = 8.2 Hz), 4.12 (Xylp H-3, t, J = 8.6 Hz), 4.19 (Xylp H-4, m), 4.33 (Xylp H-5e, dd, J = 11.2, 5 Hz), 4.84 (Xylp H-1, d, J = 7.4 Hz).

Table 1

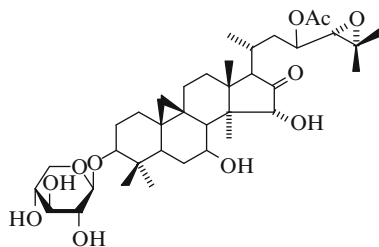
δ_C (C ₅ D ₅ N)							
C-1	32.5	C-10	27.7	C-19	31.9	C-28	14.6
2	30.9	11	26.5	20	87.0	29	25.7
3	88.5	12	28.3	21	32.6	30	15.4
4	41.4	13	46.3	22	38.0	β -D-Xylp	
5	47.5	14	51.4	23	30.1	1	107.5
6	20.8	15	81.6	24	114.1	2	75.6
7	26.6	16	78.5	25	72.8	3	78.5
8	48.6	17	56.9	26	25.7	4	71.3
9	19.7	18	66.9	27	25.7	5	67.1
							Ac
							171.0
							21.4

References

1. J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

7 β -Hydroxy-23-O-acetylshengmanol-3-O- β -D-xylopyranoside

C₃₇H₅₈O₁₁, M 678



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 252–253°C (from EtOH-isopropyl ether),
[α]_D –51.4° (c 0.14, MeOH).

CAS Registry Number: 156759-68-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1730.

Positive ion HRFABMS m/z: 679.3625 [M + 1]⁺.

Table 1

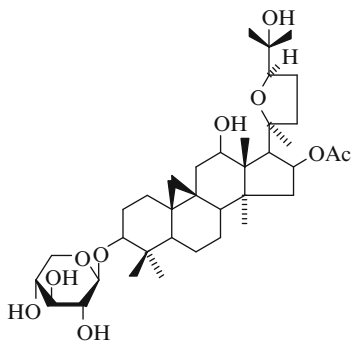
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.09	1.20 m, 1.59 td (13.5, 3)	C-21	20.48	1.28 d (6.5)
2	29.90	1.96 m, 2.38 m	22	36.76	1.79 m, 2.56 ddd (13, 11, 2.5)
3	88.03	3.53 dd (12, 4)	23	72.05	5.38 ddd (8.5, 8.3, 2.5)
4	40.99	–	24	65.02	3.02 d (8.3)
5	46.31	1.65 dd (12.5, 4)	25	58.45	–
6	30.40	1.20 m, 2.08 m	26	25.57	1.38 s
7	69.52	3.75 m	27	24.58	1.23 s
8	55.99	1.92 d (10)	28	11.82	1.22 s
9	19.03	–	29	19.23?	1.35 s
10	27.23	–	30	15.26	1.07 s
11	25.89	1.11 m	β -D-Xylp		
12	32.68	1.78 m	1	107.43	4.87 d (7.7)
13	41.67	–	2	75.47	4.04 dd (8.8, 7.7)
14	46.11	–	3	78.53	4.17 dd (9, 8.8)
15	81.83	4.48 s	4	71.13	4.24 ddd (10, 9, 5)
16	217.45	–	5	67.04	4.37 dd (11.2, 5),
17	60.08	2.39 d (6)			3.75 dd (11.2, 10)
18	19.85	1.40 s	Ac	170.53	–
19	30.40	0.37 d (4), 0.70 d (4)		20.85	2.09 s
20	27.66	2.10 m			

References

1. G. Kusano, M. Idoji, Y. Sogoh, M. Shibano, A. Kusano, T. Iwashita, *Chem. Pharm. Bull.* **42**(5), 1106–1110 (1994)

Beesioside F

$C_{37}H_{60}O_{10}$, M 664



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp 254–256°C (from $CHCl_3$ -MeOH), $[\alpha]_D^{20} +17.9^\circ$ (c 0.09, $CHCl_3$ -MeOH, 1:1).

IR ν_{max}^{KBr} , cm^{-1} : 3450, 2960, 2940, 2885, 1725, 1460, 1385, 1380, 1340, 1245, 1150, 1115, 1060, 1045, 985.

Positive ion FABMS m/z (%): $[M + H]^+$ 665, 605, 587, 507, 455, 437, 419, 371, 143 (100), 125.

Positive ion HRFABMS m/z: 665.430021 $[M + H]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.2 1.25 m, 1.51 m	C-21	28.1 1.34 s
2	30.0 1.88 m, 2.26 m	22	35.0 1.74 m, 2.65 dt
3	88.4 3.46 dd (11.6, 4.3)	23	25.7 1.88 m, 2.26 m
4	41.3 –	24	82.7 3.82 dd (9.2, 6.5)
5	47.5 1.30 m	25	69.7 –
6	20.6 0.74 q (12.5), 1.52 m	26	28.8 1.56 s
7	26.0 0.95 m, 1.20 m	27	27.7 1.33 s
8	46.4 1.52 m	28	20.1 0.86 s
9	20.3 –	29	25.8 1.31 s
10	26.6 –	30	15.4 1.00 s
11	38.1 2.52 dd (15.5, 9), 1.40 m	β -D-Xylp	
12	72.4 4.13 m	1	107.5 4.82 d (7.5)
13	53.0 –	2	75.5 3.99 t (8.6)
14	48.3 –	3	78.5 4.13 m

(continued)

Table 1 (continued)

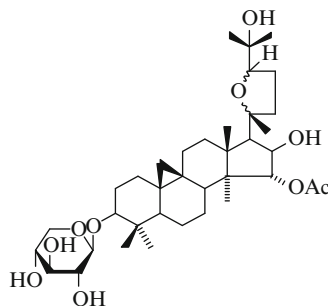
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
15	45.7 2.17 dd (13.1, 8), 1.48 m	4	71.2 4.19 dt (9.7, 5.2)
16	75.3 5.62 q (5.7)	5	67.0 3.71 t (11.3),
17	57.8 2.82 d (8.3)		4.33 dd (11.3, 5.2)
18	13.7 1.49 s	Ac	170.2 –
19	30.4 0.40 d (3.9), 0.56 d (3.9)	21.5	2.10 s
20	85.0 –		

References

- J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Beesioside M

$C_{37}H_{60}O_{10}$, M 664



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Mp 158–164°C (from $CHCl_3$ -MeOH), $[\alpha]_D^{20} -3.3^\circ$ (c 0.06, $CHCl_3$ -MeOH, 1:1).

IR ν_{max}^{KBr} , cm^{-1} : 3500, 2965, 2940, 2870, 1705, 1460, 1380, 1360, 1260, 1090, 1045, 960.

Positive ion FABMS m/z (%): 687 $[M + Na]^+$, 665 $[M + H]^+$, 455, 437, 143 (100), 125, 115, 71, 43.

Positive ion HRFABMS m/z: 665.42761 $[M + H]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.4 1.19 m, 1.53 m	C-21	28.3 1.51 s
2	30.1 1.92 m, 2.34 m	22	34.1 2.49 m, 1.80 m
3	88.5 3.49 dd (11.5, 4.5)	23	24.3 2.23 m, 1.88 m
4	41.3 –	24	84.8 3.90 t (8)
5	47.5 1.31 m	25	70.1 –
6	21.1 0.61 q (12), 1.42 m	26	26.5 1.26 s
7	26.1 1.05 m, 1.34 m	27	26.4 1.32 s
8	48.0 1.77 dd (10.5, 4)	28	13.5 1.08 s
9	19.6 –	29	25.7 1.30 s
10	26.8 –	30	15.4 1.01 s
11	26.1 2.02 m, 1.10 m	β -D-Xylp	
12	37.5 2.44 m, 1.71 m	1	107.7 4.85 d (7.5)
13	48.0 –	2	75.6 4.03 t (8)
14	47.6 –	3	78.6 4.16 t (8.5)
15	90.0 5.62 d (4.5)	4	71.2 4.22 m
16	79.2 4.53 dd (9, 4.5)	5	67.1 3.73 t (11.3), 4.36 dd (11.3, 5)
17	54.3 2.41 d (9)		
18	21.7 1.65 s	Ac	171.2 –
19	30.5 0.25 d (4), 0.48 d (4)	21.5	2.08 s
20	86.1 –		

References

- J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Taxonomy: Cycloartane Glycosides

Astragalus exilis A.Kor. (*Leguminosae*) [1].

1H NMR (500 MHz, C_5D_5N , δ , 0-TMS): 0.16 and 0.42 (2H-19, d, $J = 4.5$ Hz), 0.88, 1.16, 1.21, 1.23, 1.32, 1.48, 1.68 ($7 \times CH_3$, s), 2.05 (CH_3COO , s), 2.43 (H-17, d, $J = 8$ Hz), 2.97 (H-22, q, $J = 10$ Hz), 3.38 (H-3, dd, $J = 12, 4$ Hz), 3.59 (Xylp H-5a, dd, $J = 11, 10$ Hz), 3.63 (H-6, td, $J = 9, 3$ Hz), 3.79 (H-24, dd, $J = 9, 5$ Hz), 4.07 (Xylp H-3, t, $J = 9$ Hz), 4.11 (Xylp H-4, m), 4.22 (Xylp H-5e, dd, $J = 11, 5$ Hz), 4.74 (Xylp H-1, d, $J = 8$ Hz), 4.90 (H-16, m), 5.46 (Xylp H-2, dd, $J = 9, 8$ Hz).

Table 1

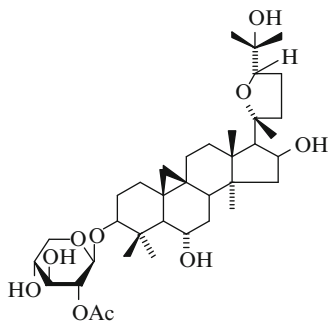
δ_C (C_5D_5N)							
C-1	32.25	C-10	29.43	C-19	30.70	C-28	20.12
2	0.08	11	26.10	20	87.18	29	28.47
3	8.01	12	33.30	21	28.63	30	16.39
4	42.24	13	44.96	22	34.86	β -D-Xylp	
5	53.80	14	46.05	23	26.35	1	104.79
6	68.09	15	46.61	24	81.67	2	76.15
7	38.66	16	73.40	25	71.22	3	75.63
8	47.14	17	58.32	26	27.03	4	71.27
9	20.95	18	21.54	27	28.08	5	67.02
						Ac	21.21
							170.09

References

- R.P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **38**(6), 579–582 (2002)

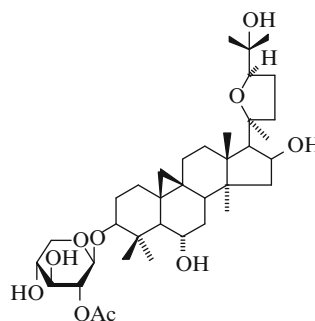
Cycloexoside B

$C_{37}H_{60}O_{10}$, M 664



Cyclogaleginoside A

$C_{37}H_{60}O_{10}$, M 664



Taxonomy: Cycloartane Glycosides*Astragalus galeiformis* L. (*Leguminosae*) [1, 2].*Astragalus falcatus* Lam. (*Leguminosae*) [3].Mp 224–226°C (from CHCl₃–MeOH), [α]_D²⁴ + 40° (c 1.0, C₅H₅N).

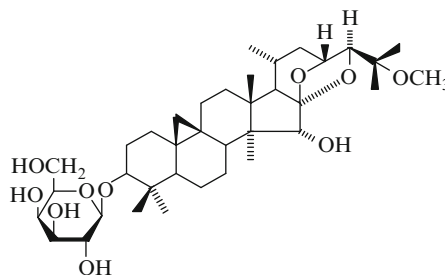
CAS Registry Number: 94443-44-4

IR ν_{\max}^{KBr} , cm⁻¹: 3530–3300, 3050, 1755, 1245.¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.39 (H-19, d, J = 4 Hz), 0.86, 1.11, 1.15, 1.21, 1.37, 1.52, 1.63 (7 × CH₃, s), 1.97 (CH₃COO, s), 4.68 (H-1 of Xylp, d, J = 8 Hz and H-16, m), 5.41 (H-2 of Xylp, t, ΣJ = 15 Hz).**Table 1**

δ_{C} (C ₅ D ₅ N)							
C-1	32.34	C-10	29.41	C-19	30.65	C-28	20.45
2	30.17	11	26.37	20	86.63	29	28.72
3	89.08	12	33.72	21	26.32	30	16.45
4	42.32	13	46.46	22	37.52	β -D-Xylp	
5	53.95	14	46.79	23	24.31	1	104.87
6	68.12	15	48.99	24	84.90	2	76.25
7	38.68	16	72.84	25	70.28	3	75.70
8	47.12	17	56.50	26	26.88	4	71.32
9	21.11	18	21.25 ^a	27	28.09	5	67.11
						Ac	
							169.90
							21.25 ^a

^aSignals are mutually imposed**References**

- M.D. Alaniya, M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, E.P. Kemertelidze, N.K. Abubakirov, *Chem. Nat. Comp.* **20**(4), 451–454 (1984)
- M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
- M.D. Alaniya, *Izv. Akad. NaukGruz. SSR, Ser. Khim.* **14**(1), 73–74 (1988). *C.A.*, 109:187252 t (1988)

25-O-Methylcimigenol-3-O- β -D-galactopyranosideC₃₇H₆₀O₁₀, M 664**Taxonomy:** Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 209–210°C (from MeOH), [α]_D²⁰ +20.4° (c 0.5, MeOH).IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.Positive SIMS m/z: 655 [M + H]⁺.Positive HRSIMS m/z: 665.4293 [M + H]⁺.**Table 1**

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		
C-1	32.03	1.15, 1.52	C-21	19.19	087 d (6.5)
2	29.6	1.90, 2.43	22	37.77	1.00, 2.25
3	88.36	3.53 dd (3.8, 11)	23	71.31	4.60 (11)
4	40.89	–	24	87.76	3.69 s
5	47.18	1.30	25	78.74	–
6	20.66	0.68 q (12.5), 1.53	26	19.19	1.39 s
7	26.01	1.20, 2.08	27	21.60	1.29 s
8	48.25	1.62	28	11.47	1.20 s
9	19.52	–	29	25.40	1.27 s
10	26.30	–	30	15.06	1.03 s
11	26.09	1.05, 2.20	β -D-Calp		
12	33.69	1.50, 1.67	1	10.89	4.88 d (8.5)
13	41.48	–	2	72.58	4.45 dd (8.0 8.5)
14	46.82	–	3	74.85	4.17 dd (3.5, 8.0)

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
15	79.61	4.23 s	4 69.60 4.57 d (3.5)
16	111.61	–	5 76.14 4.0 dd (6, 6)
17	59.03	1.46 d (11)	6 61.75 4.42 dd (6, 11.3),
18	19.19	1.13 s	4.48 dd (6, 11.3)
19	30.56	0.25 d (4.2), 0.50 d (4.2)	OMe 48.95 3.24 s
20	23.66	1.67	

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, Chem. Pharm. Bull. **44**(11), 2078–2085 (1996)

Squarroside A1 and Squarroside A2

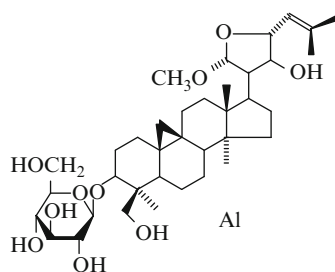
C₃₇H₆₀O₁₀, M 664

See [Figure Squarroside A1 and Squarroside A2](#)

Taxonomy: Cycloartane Glycosides

Thalictrum squarrosum Stephan ex Willd
(*Ranunculaceae*) [1].

CAS Registry Number: 125445-25-2.



CAS Registry Number: 125445-26-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3350, 3040.

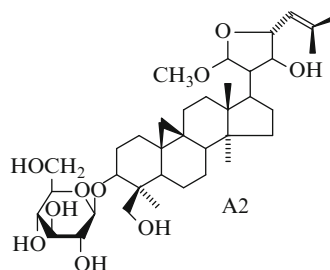
FABMS m/z: 703 [M + K]⁺, 687 [M + Na]⁺, 541 [M + K-162]⁺, 525 [M + Na-162]⁺.

Table 1

δ_C (C ₅ D ₅ N)									
C-1	32.0	C-10	25.7	C-19	29.9	C-28	18.6		
2	30.5	11	25.9	20	55.5, 52.3	29	18.4		
3	89.1	12	35.9	21	108.5, 104.8	30	63.2		
4	44.9	13	45.3, 45.2	22	76.5, 74.8	β -D-Glcp			
5	48.5	14	48.5	23	80.6, 78.8	1	106.0		
6	21.9	15	29.9	24		2	75.4		
7	26.6	16	29.9, 27.6	25		3	78.5		
8	47.7	17	44.3, 40.6	26	21.2	4	71.6		
9	21.2	18	25.7	27	19.7	5	78.2		
						6	62.7		
						OMe			
						54.7, 54.5			

References

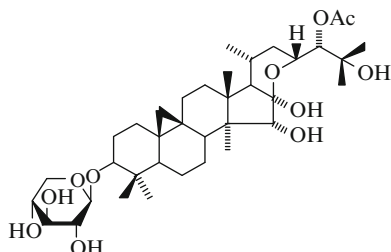
1. E.A. Khamidullina, A.S. Gromova, V.I. Lutsyki, A.L. Vereshagin, A.A. Semenov, M.F. Larin, Chem. Nat. Comp. **25**(4), 441–447 (1989)



Squarroside A1 and Squarroside A2

24-O-Acetylhydroshengmanol Xyloside

C₃₇H₆₀O₁₁, M 680



Taxonomy: Cycloartane Glycosides

Cimicifuga japonica (Ranunculaceae) [1].

Mp 235–237°C (from EtOH), $[\alpha]_D^{22} + 6.6^\circ$ (c 0.7, CHCl₃–MeOH, 1:1).

CAS Registry Number: 78213-32-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200, 1703, 1260, 1040.

CD (c 6.61 × 10⁻⁴, MeOH) $[\theta]^{22}$ (nm): -2.00 × 10³ (314).

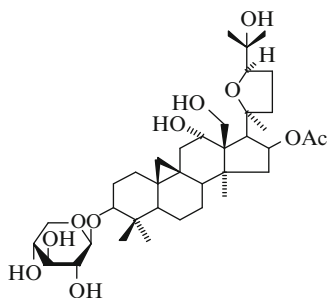
¹H NMR (C₅D₅N, δ): 30.8 (C-19), 71.1 (C-25), 74.5 (C-23), 82.3 (C-15), 88.2 (C-24), 102.9 (C-16), 107.2 (anomeric C), 171.1 (CH₃ COO).

References

1. N. Sakurai, O. Kimura, T. Inoue, M. Nagai, Chem. Pharm. Bull. **29**(4), 955–960 (1981)

Beesioside D

C₃₇H₆₀O₁₁, M 680



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulbr. (Ranunculaceae) [1].

Mp 289–291°C (from CHCl₃–MeOH), $[\alpha]_D^{20} + 23.9^\circ$ (c 0.13, CHCl₃–MeOH, 1:1).

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 2965, 2940, 2880, 1720, 1700, 1460, 1390, 1380, 1350, 1250, 1160, 1110, 1065, 1040, 985.

EIMS m/z (%): 602 (0.2), 470 (1), 452 (2), 353 (2), 143 (100), 125 (22), 73 (12), 43 (10).

Positive ion FABMS m/z (%): 681 [M + H]⁺, 585, 503, 471, 453, 435, 353, 143 (100).

Positive ion HRFABMS m/z: 681.420810 [M + H]⁺.

Table 1

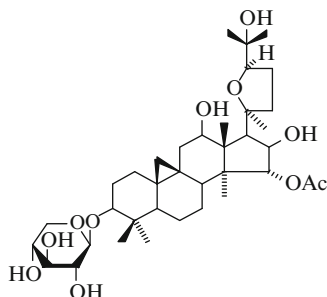
δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	32.2	1.15 m, 1.55 m	C-21	28.7	1.40 s
2	30.0	1.85 m, 2.24 m	22	34.2	1.78 m, 3.09 dt
3	88.4	3.45 dd (11.6, 4.1)	23	26.0	1.97 m, 2.28 m
4	41.3	–	24	83.3	3.93 t (7.8)
5	47.8	1.33 m	25	70.2	–
6	21.1	0.64 q (12.4), 1.51 m	26	28.2	1.50 s
7	26.6	1.08 q (12.1), 1.28 m	27	27.3	1.28 s
8	47.4	1.71 m	28	22.8	1.28 s
9	20.0	–	29	25.8	1.28 s
10	26.2	–	30	15.4	0.95 s
11	36.9	2.25 m, 1.62 dd (15.1, 9.7)	β-D-Xylp		
12	67.9	4.49 t (4)	1	107.4	4.82 d (7.5)
13	55.8	–	2	75.5	3.99 t (8.1)
14	47.4	–	3	78.5	4.13 t (8.7)
15	47.0	2.05 m, 2.25 m	4	71.2	4.20 m
16	75.4	5.78 q	5	67.0	3.70 t (10.6), 4.33 m
17	50.4	3.41 d (8.6)	Ac	170.3	–
18	63.3	4.20 m, 4.33 v	21.6	2.10 s	
19	29.2	0.10 d (3.6), 0.35 d (3.6)			
20	85.4	–			

References

1. J. Ju, D. Liu, G. Lin, X. Xu, B. Han, J. Yang, G. Tu, L. Ma, J. Nat. Prod. **65**(1), 42–47 (2002)

Beesioside III

C₃₇H₆₀O₁₁, M 680



Taxonomy: Cycloartane Glycosides

Beesia calthaeifolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Souliea vaginata (Maxim.) Franch (*Ranunculaceae*) [1].

Colourless needles, had mp of 178–182°C, solidified at 220°C and showed a mp 247–249°C, $[\alpha]_D^{16} +9.2^\circ$ (c 0.8, MeOH).

CAS Registry Number: 98046-82-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1710, 1270, 1040.

Table 1

δ_C (C ₅ D ₅ N)								
C-1	32.3	C-10	25.9	C-19	29.4	C-28	15.3	
2	29.9	11	35.3	20	85.8	29	25.7	
3	88.4	12	73.0	21	28.8	30	14.1	
4	41.2	13	48.3	22	36.5	β -D-Xylp		
5	48.3	14	51.7	23	26.3	1	107.3	
6	21.1	15	91.3	24	83.1	2	75.3	
7	26.1	16	77.9	25	69.9	3	78.3	
8	48.1	17	48.9	26	27.5	4	71.0	
9	19.6	18	20.2	27	27.5	5	66.9	
							Ac	
								21.3
								171.8

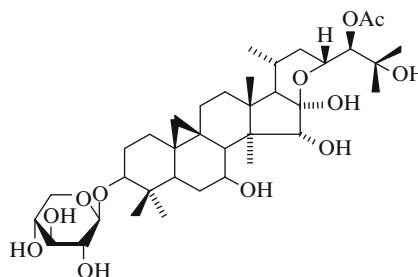
Stereochemistry of C-20 and C-24 was offered by us [2].

References

1. T. Inoue, N. Sakurai, M. Nagai, P. Xiao, *Phytochemistry* **24**(6), 1329–1331 (1985)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)

24-*epi*-7 β -Hydroxy-24-O-acetylhydrohengmanol-3-O- β -D-xylopyranoside

C₃₇H₆₀O₁₂, M 696



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 276–277°C (from MeOH), $[\alpha]_D^{20} +10.3^\circ$ (c 0.6, MeOH).

CAS Registry Number: 173180-26-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3200, 1732.

Positive ion FABMS m/z: 679 [M-OH]⁺, 719 [M-OH]⁺.

Positive ion HRSIMS m/z: 679.4062 [M-OH]⁺.

Table 1

δ_C (C ₅ D ₅ N)					
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	31.37	1.28, 1.60	C-21	21.92	0.98 d (5.5)
2	31.37	2.05, 2.35	22	33.43	1.80, 2.00
3	88.77	3.50 dd (11, 4)	23	74.31	4.43
4	41.59	–	24	81.93	5.76 d (8.3)
5	47.05	1.65	25	72.73	–
6	34.38	1.28, 2.02	26	27.57	1.57 s
7	70.55	3.69 ddd (12, 10, 3)	27	27.57	1.53 s
8	56.79	1.80	28	12.23	1.21 s
9	19.56	–	29	26.15	1.32 s
10	27.57	–	30	15.91	1.05 s
11	26.81	1.08, 1.98	β -D-Xylp		
12	32.88	1.55, 1.65	1	107.98	4.86 d (8.3)
13	43.42	–	2	75.88	4.05 dd (8.3, 8.2)
14	47.61	–	3	78.83	4.20 dd (8.6, 8.2)
15	82.35	4.16 s	4	71.58	4.26 ddd (10.6, 8.6, 4.8)
16	103.61	–	5	67.52	3.77 dd (10.8, 10.6)

(continued)

Table 1 (continued)

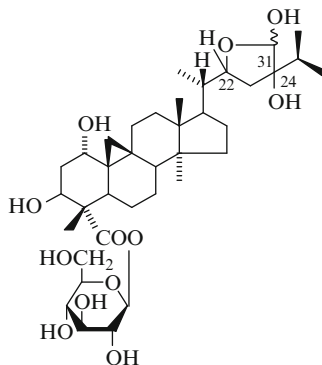
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
17	61.72	1.78	4.38 dd (10.8, 4.8)
18	21.03	1.27 s	Ac 171.37 –
19	30.54	0.36 d (3.9), 0.63 d (3.9)	21.75 2.19 s
20	27.46	1.85	

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

Passiflorine

C₃₇H₆₀O₁₂, M 696



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims. (*Passifloraceae*) [1].

Mp 183°C (from MeOH), $[\alpha]_D^{20} +47.1^\circ$ (C₅H₅N).

CAS Registry Number: 1392-82-1.

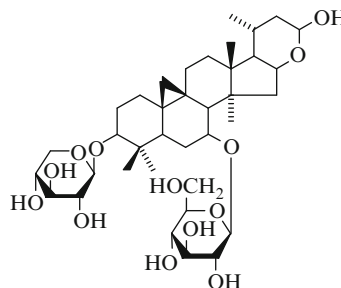
IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3400, 1729.

References

1. E. Bombardelli, A. Bonati, B. Gabetta, E.M. Martinelli, G. Mustich, B. Danieli, *Phytochemistry* **14**, 2661–2665 (1975)

Dasyanthoside A

C₃₇H₆₀O₁₃, M 712



Taxonomy: Cycloartane Glycosides

Astragalus dasyanthus Pall. (*Leguminosae*) [1].

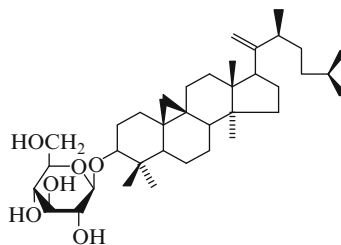
Mp 204–208°C or 265–267°C (from EtOH), $[\alpha]_D^{20} -15^\circ$ (c 0.6, MeOH).

References

1. R.I. Evstratova, A.A. Savina, V.I. Sheychenko, A.N. Shavlinskyi, in *Abstracts of reports of All-Union scientific conference "Results and prospects of scientific researches in the field of creation of medicinal products from plant raw material"*, Moscow, 1985. pp. 64–65

Cycloswietenol-3-O-β-D-glucopyranoside

C₃₇H₆₂O₆, M 602



Taxonomy: Cycloartane Glycosides

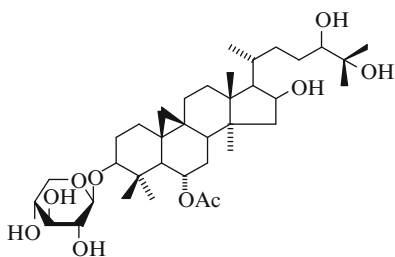
Swietenia mahagoni Linn. (*Meliaceae*) [1].

References

1. V. Lakshminarayana, Y.L.N. Murty, L. Ramachandra Row, Indian J. Chem. **21B**(3), 179–182 (1982)

No Name (9,19-Cyclolanostan-6 α -acetoxy-16 β ,24R,25-triol-3-O- β -D-xylopyranoside)

C₃₇H₆₂O₁₀, M 666



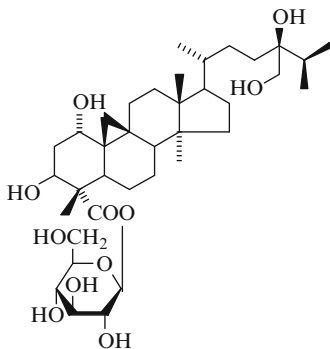
Taxonomy: Cycloartane Glycosides
Astragalus boeticus (*Leguminosae*) [1].
CAS Registry Number: 321602-58-8.

References

1. A.M. Asaad, Alexandria J. Pharm. Sci. **14**, 105 (2000). C.A., 134:128496u (2001)

Cyclopassifloside II

C₃₇H₆₂O₁₁, M 682



Taxonomy: Cycloartane Glycosides
Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous solid, $[\alpha]_D^{25} +46.8^\circ$ (c 6.8, MeOH).

CAS Registry Number: 292167-39-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1730, 1070, 1060.

FABMS m/z: 681 [M-H]⁻.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.53 and 0.75 (2H-19, d, J = 4.5 Hz), 0.88 (CH₃-28, s), 1.00 (CH₃-21, d, J = 6 Hz), 1.20, 1.23 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.69 (CH₃-30, s), 2.75 (H-11, m), 3.35 (H-5, dd, J = 11, 4 Hz), 3.88 (H-1, brs), 4.00, 4.03 (2H-31, d, J = 11 Hz), 4.02 (H-5' of Glc, m), 4.17 (H-2' of Glc, dd, J = 8, 8 Hz), 4.29 (H-3' of Glc, dd, J = 8, 8 Hz), 4.36 (H-4 of Glc, dd, J = 8, 8 Hz), 4.40 (2H-6' of Glc, m), 5.58 (H-3, dd, J = 12, 4 Hz), 6.52 (H-1' of Glc, d, J = 8 Hz).

Table 1

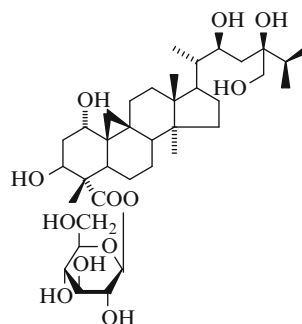
δ_C (C ₅ D ₅ N)							
C-1	72.7	C-10	30.3	C-19	30.3	C-28	18.8
2	38.3	11	26.4	20	37.4	29	176.6
3	70.9	12	33.3	21	19.7	30	9.8
4	56.5	13	45.7	22	32.0	31	66.2
5	37.8	14	49.3	23	31.9	β -D-Glcp	
6	23.2	15	36.1	24	76.0	1	96.6
7	25.8	16	28.6	25	33.8	2	74.8
8	48.4	17	52.9	26	17.7	3	78.5
9	21.2	18	18.6	27	17.8	4	71.4
						5	79.5
						6	62.4

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

Cyclopassifloside I

C₃₇H₆₂O₁₂, M 698



Taxonomy: Cycloartane Glycosides*Passiflora edulis* Sims (*Passifloraceae*) [1].Amorphous solid, $[\alpha]_D^{25} +54.5^\circ$ (c 0.2, MeOH).

CAS Registry Number: 292167-38-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1730, 1070, 1040.FABMS m/z : 697 [M-H]⁻.

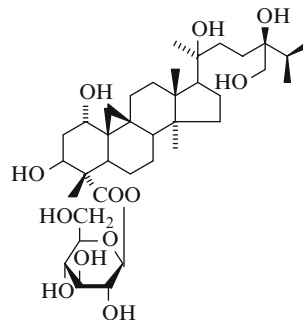
¹H NMR (600 MHz, C₅D₅N, δ , 0-TMS): 0.53 and 0.73 (2H-19, d, J = 4 Hz), 0.87 (CH₃-28, s), 1.03 (CH₃-18, s), 1.21, 1.27 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.22 (CH₃-21, d, J = 6 Hz), 1.68 (CH₃-30, s), 2.03 (2H-23, m), 2.24 (H-2, ddd, J = 12, 12, 2.5 Hz), 2.40 (H-25, qq, J = 7 Hz), 2.43 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.76 (H-11, m), 3.36 (H-5, dd, J = 12, 4.5 Hz), 3.86 (H-1, brs), 4.03 (H-5' of Glc, m), 4.13, 4.20 (2H-31, d, J = 11 Hz), 4.18 (H-2' of Glc, dd, J = 8, 8 Hz), 4.29 (H-3' of Glc, dd, J = 8, 8 Hz), 4.38 (H-4' of Glc, dd, J = 8, 8 Hz), 4.40 (2H-6' of Glc, m), 4.57 (H-22, m), 5.59 (H-3, dd, J = 12, 4 Hz), 6.53 (H-1' of Glc, d, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	72.4	C-10	30.1	C-19	29.9	C-28	19.7
2	38.2	11	26.1	20	43.4	29	176.6
3	70.7	12	33.1	21	12.6	30	9.6
4	56.3	13	45.9	22	70.3	31	66.5
5	37.6	14	48.7	23	33.1	β -D-Glcp	
6	23.1	15	36.1	24	76.5	1	96.5
7	25.7	16	27.6	25	33.9	2	74.7
8	48.3	17	49.4	26	17.2	3	78.4
9	20.9	18	18.3	27	17.5	4	71.0
						5	79.5
						6	62.1

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

Cyclopassifloside IVC₃₇H₆₂O₁₂, M 698**Taxonomy:** Cycloartane Glycosides*Passiflora edulis* Sims (*Passifloraceae*) [1].Amorphous solid, $[\alpha]_D^{25} +33.1^\circ$ (c 6.3, MeOH).

CAS Registry Number: 292167-41-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1730, 1070, 1040.FABMS m/z : 697 [M-H]⁻.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.49 and 0.70 (2H-19, d, J = 4 Hz), 0.92 (CH₃-28, s), 1.16, 1.18 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.48 (CH₃-18, s), 1.53 (CH₃-21, s), 1.64 (CH₃-30, s), 2.45 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.75 (H-11, m), 3.32 (H-5, dd, J = 12, 4.5 Hz), 3.87 (H-1, brs), 3.97, 4.04 (2H-31, d, J = 11.5 Hz), 4.00 (H-5' of Glc, m), 4.15 (H-2' of Glc, dd, J = 8, 8 Hz), 4.25 (H-3' of Glc, dd, J = 8, 8 Hz), 4.38 (H-4' of Glc, dd, J = 8, 8 Hz), 4.40 (2H-6' of Glc, m), 5.53 (H-3, dd, J = 12, 4 Hz), 6.40 (H-1' of Glc, d, J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	72.4	C-10	30.3	C-19	30.3	C-28	20.2
2	38.3	11	26.5	20	74.8	29	176.7
3	70.7	12	33.7	21	26.1	30	9.6
4	56.3	13	46.3	22	38.1	31	66.1
5	37.7	14	49.4	23	29.3	β -D-Glcp	
6	23.0	15	35.6	24	76.0	1	96.5
7	25.8	16	22.9	25	33.7	2	74.8

(continued)

Table 1 (continued)

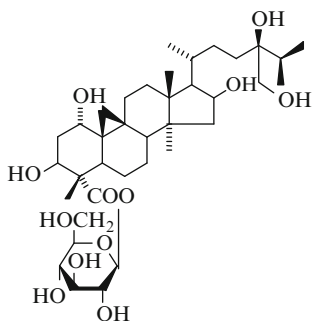
δ_C (C_5D_5N)							
8	47.8	17	55.0	26	17.5	3	78.4
9	20.8	18	19.8	27	17.7	4	71.4
						5	79.5
						6	62.4

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

Cyclopassifloside VIII

$C_{37}H_{62}O_{12}$, M 698



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous solid, $[\alpha]_D^{25} +38.6^\circ$ (c 1.3, MeOH).

CAS Registry Number: 301540-81-8.

IR ν_{max}^{KBr} , cm^{-1} : 3400, 1735, 1065, 1030.

FABMS m/z: 697 $[M-H]^-$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.53 and 0.75 (2H-19, d, J = 4 Hz), 0.91 (CH_3 -28, s), 1.10 (CH_3 -21, d, J = 6 Hz), 1.18 (CH_3 -26, CH_3 -27, d, J = 7 Hz), 1.41 (CH_3 -18, s), 1.67 (CH_3 -30, s), 2.46 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.75 (H-11, m), 3.35 (H-5, dd, J = 12, 4 Hz), 3.88 (H-1, brs), 3.99, 4.02 (2H-31, d, J = 11 Hz), 3.99 (H-5' of Glc, m), 4.15 (H-2' of Glc, t, J = 8 Hz), 4.27 (H-3' of Glc, t, J = 8 Hz), 4.37 (H-4 of Glc, t, J = 8 Hz), 4.40 (2H-6' of

Glc, m), 4.65 (H-16, dt, J = 6, 8 Hz), 5.55 (H-3, dd, J = 12, 4 Hz), 6.50 (H-1' of Glc, d, J = 8 Hz).

Table 1

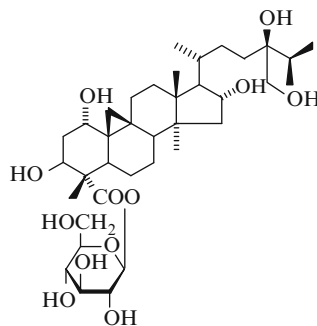
δ_C (C_5D_5N)							
C-1	72.3	C-10	30.2	C-19	30.3	C-28	20.3
2	38.4	11	26.0	20	33.6	29	176.7
3	70.8	12	32.1	21	19.6	30	9.7
4	56.4	13	45.6	22	32.0	31	66.3
5	37.7	14	47.2	23	30.5	β -D-Glcp	
6	23.1	15	49.1	24	76.4	1	96.5
7	25.9	16	71.0	25	33.3	2	74.7
8	48.4	17	57.3	26	17.5	3	78.5
9	20.9	18	18.7	27	17.8	4	71.7
						5	79.6
						6	62.1

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclopassifloside X

$C_{37}H_{62}O_{12}$, M 698



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims (*Passifloraceae*) [1].

Mp 167–169°C, $[\alpha]_D^{25} +36.8^\circ$ (c 2.1, MeOH).

CAS Registry Number: 301540-82-9.

IR ν_{max}^{KBr} , cm^{-1} : 3400, 1740, 1065, 1030.

FABMS m/z: 697 $[M-H]^-$.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.54 and 0.73 (2H-19, d, $J = 4$ Hz), 1.05 (CH_3 -21, d, $J = 6$ Hz), 1.06 (CH_3 -18, s), 1.19, 1.21 (CH_3 -26, CH_3 -27, d, $J = 7$ Hz), 1.27 (CH_3 -28, s), 1.59 (CH_3 -30, s), 2.43 (H-2, ddd, $J = 12, 4, 2.5$ Hz), 2.87 (H-11, m), 3.35 (H-5, dd, $J = 12, 4.5$ Hz), 3.87 (H-1, brs), 3.97, 4.04 (2H-31, d, $J = 11.5$ Hz), 4.01 (H-5' of Glc, m), 4.14 (H-2' of Glc, t, $J = 8$ Hz), 4.26 (H-3' of Glc, t, $J = 8$ Hz), 4.28 (H-16, m), 4.34 (H-4' of Glc, t, $J = 8$ Hz), 4.37 (2H-6' of Glc, m), 5.56 (H-3, dd, $J = 12, 4.5$ Hz), 6.47 (H-1' of Glc, d, $J = 8$ Hz).

Table 1

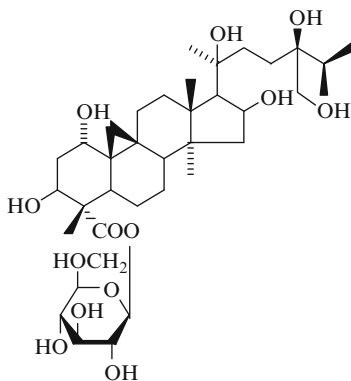
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)							
C-1	72.4	C-10	30.2	C-19	29.2	C-28	20.5
2	38.3	11	26.0	20	35.3	29	176.7
3	70.8	12	33.2	21	19.6	30	9.8
4	56.4	13	47.9	22	30.6	31	66.1
5	37.7	14	47.1	23	30.4	β -D-Glcp	
6	23.2	15	48.5	24	76.1	1	96.5
7	26.0	16	77.2	25	34.1	2	74.7
8	48.5	17	60.9	26	17.7	3	78.5
9	20.5	18	19.2	27	17.8	4	71.1
						5	79.5
						6	62.4

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclopassifloside VII

$\text{C}_{37}\text{H}_{62}\text{O}_{13}$, M 714



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims (*Passifloraceae*) [1].

Mp 163–165°C, $[\alpha]_{\text{D}}^{25} +35.6^\circ$ (c 1.5, MeOH).

CAS Registry Number: 301540-80-7.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3400, 1735, 1065, 1020.

FABMS m/z : 713 $[\text{M}-\text{H}]^-$.

$^1\text{HNMR}$ (600 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.54 and 0.76 (2H-19, d, $J = 4.5$ Hz), 0.87 (CH_3 -28, s), 1.13 (H-6, 2H-7, m), 1.18, 1.20 (CH_3 -26, CH_3 -27, d, $J = 7$ Hz), 1.48 (H-11, m), 1.54 (CH_3 -21, s), 1.68 (CH_3 -30, s), 1.71 (H-8, dd, $J = 11, 5$ Hz), 1.78 (H-15, dd, $J = 13, 8$ Hz), 1.78 (H-12, m), 1.83 (H-6, m), 1.87 (CH_3 -18, s), 1.95 (H-15, dd, $J = 13, 6$ Hz), 1.98 (H-12, m), 2.07 (H-23, dt, $J = 12, 3.5$ Hz), 2.16 (H-17, d, $J = 8$ Hz), 2.25 (H-2, dt, $J = 12, 2.5$ Hz), 2.28 (H-25, qq, $J = 7$ Hz), 2.28 (H-23, m), 2.33 (H-22, dt, $J = 12, 3.5$ Hz), 2.44 (H-2, H-22, m), 2.80 (H-11, m), 3.36 (H-5, dd, $J = 12, 4.5$ Hz), 3.88 (H-1, brs), 4.00, 4.06 (2H-31, d, $J = 11$ Hz), 4.03 (H-5' of Glc, m), 4.17 (H-2' of Glc, dd, $J = 8.5, 8$ Hz), 4.29 (H-3' of Glc, t, $J = 8.5$ Hz), 4.39 (H-4' of Glc, t, $J = 8.5$ Hz), 4.40 (2H-6' of Glc, m), 5.02 (H-16, dt, $J = 6, 8$ Hz), 5.59 (H-3, dd, $J = 12, 4.5$ Hz), 6.53 (H-1' of Glc, d, $J = 8$ Hz).

Table 1

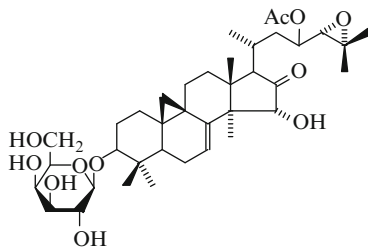
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)							
C-1	72.1	C-10	30.3	C-19	30.5	C-28	20.7
2	38.5	11	25.9	20	76.9	29	176.7
3	70.8	12	33.7	21	26.3	30	9.7
4	56.4	13	46.7	22	38.4	31	66.0
5	37.8	14	47.4	23	30.1	β -D-Glcp	
6	23.0	15	49.4	24	75.7	1	96.5
7	26.0	16	73.5	25	33.6	2	74.8
8	48.0	17	55.2	26	17.6	3	78.5
9	20.5	18	21.3	27	17.7	4	70.9
						5	79.7
						6	62.0

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

23-O-Acetyl-7,8-didehydroshengmanol-3-O- β -D-galactopyranoside

C₃₈H₅₈O₁₁, M 690



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 170–171°C (from MeOH–MeCN), [α]_D –44.1° (c 0.47, MeOH).

CAS Registry Number: 228251-33-0.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3650–3250, 1735.

Positive SIMS m/z: 691 [M + H]⁺.

Positive HRSIMS m/z: 691.4043 [M + H]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		
C-1	30.11	1.28, 1.64	C-21	19.73	1.24 d (6.5)
2	29.33	1.95, 2.44	22	37.17	1.70 ddd (2.5, 10.5, 13.5),
3	88.19	3.53 dd (4, 11.5)			2.87 ddd (2.0, 10.5, 13.5)
4	40.23	–	23	71.92	5.41 ddd (2.5, 8.5, 10.5)
5	42.49	1.28	24	65.15	3.07 d (8.5)
6	21.72	1.60, 1.92	25	58.56	–
7	114.94	6.09 dd (1.5, 7.8)	26	24.66	1.29 s
8	147.11	–	27	19.29	1.43 s
9	21.30	–	28	18.75	1.45 s
10	28.40	–	29	25.72	1.35 s
11	25.08	1.20, 2.20	30	14.19	1.05 s
12	33.37	1.93, 1.93	β -D-Galp		
13	40.73	–	1	107.25	4.89 d (8.0)
14	49.31	–	2	72.89	4.47
15	80.58	4.56 s	3	75.18	4.18 dd (3.5, 9.5)
16	220.33	–	4	69.95	4.60 d (3.5)
17	59.99	2.35	5	76.57	4.12 dd (6.0, 7.0)
18	21.72	1.29 s	6	62.12	4.47, 4.47

(continued)

Table 1 (continued)

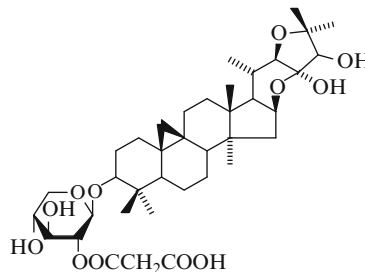
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		
19	27.81	0.52 d (4), 1.04 d (4)	Ac	170.67	–
20	28.34	2.14	20.93	2.05 s	

References

1. A. Kusano, M. Takahira, M. Shibano, T. Miyase, G. Kusano, *Chem. Pharm. Bull.* **47**(4), 511–516 (1999)

2'-O-Malonylcimiaceroside B

C₃₈H₅₈O₁₂, M 706



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

[α]_D –0.72° (c 0.33, MeOH).

CAS Registry Number: 245494-51-3.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3650–3200, 1742.

Positive SIMS m/z: 105 [C₃H₄O₄ + H]⁺, 729 [M + Na]⁺.

Positive HRSIMS m/z: 729.3811 [M + Na]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)		
C-1	32.06	1.20, 1.50	C-21	17.53	1.22 d (6.4)
2	29.84	1.86, 2.22	22	86.90	3.90 d (10.7)
3	88.73	3.39 dd (11.7, 4.3)	23	105.95	–
4	41.05	–	24	83.10	4.20 s
5	47.42	1.28	25	83.65	–
6	20.97	0.68, 1.50	26	27.80	1.76 s
7	26.42	1.00, 1.27	27	24.86	1.67 s
8	47.58	1.50	28	19.53	0.85 s
9	19.78	–	29	25.69	1.18 s
10	26.53	–	30	15.31	1.00 s

(continued)

Table 1 (continued)

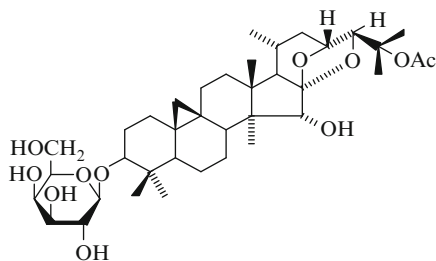
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
11	26.26	1.02, 1.90	β -D-Xylp
12	33.49	1.58, 1.58	1 104.25 4.86 d (7.8)
13	46.87	–	2 76.53 5.59 dd (7.8, 8.5)
14	45.29	–	3 76.21 4.20
15	43.37	1.62, 1.88	4 71.00 4.21
16	72.44	4.97 q (8)	5 67.09 3.70, 4.31 dd (11, 5)
17	52.39	1.60	Malonyl
18	20.72	1.20 s	1 167.56 –
19	30.21	0.16 d (4), 0.42 d (4)	2 42.80 3.89 (2H)
20	34.74	2.26	3 169.76 –

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **47**(8), 1175–1179 (1999)

25-O-Acetylcimigenol-3-O- β -D-galactopyranoside

C₃₈H₆₀O₁₁, M 692



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 213–214°C (from MeOH), $[\alpha]_D^{20} +18.7^\circ$ (c 0.6, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200, 1739.

Positive SIMS m/z: 693 [M + H]⁺.

Positive HRSIMS m/z: 693.4201 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.06	1.15, 1.53	C-21 19.21 0.87 d (6.5)
2	29.68	1.92, 2.45	22 37.59 1.01, 2.30

(continued)

Table 1 (continued)

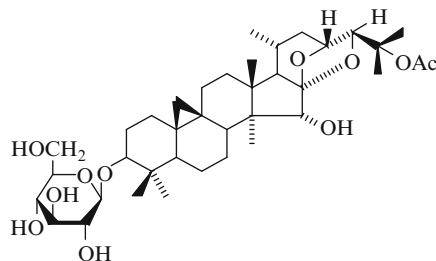
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
3	88.36	3.55 dd (3.8, 11.3)	23 71.38 4.64 d (11)
4	40.92	–	24 86.46 4.13 s
5	47.21	1.30	25 83.01 –
6	20.71	0.70 q (12.5), 1.53	26 21.25 1.70 s
7	26.06	1.20, 2.10	27 23.00 1.67 s
8	48.28	1.70	28 11.52 1.21 s
9	19.21	–	29 25.44 1.30 s
10	26.33	–	30 15.11 1.04 s
11	26.13	1.03, 2.10	β -D-Galp
12	33.69	1.53, 1.70	1 107.21 4.90 d (8.5)
13	41.48	–	2 73.08 4.47 dd (8.5, 8.5)
14	46.85	–	3 75.47 4.19 dd (3.5, 8.5)
15	79.69	4.28 s	4 70.04 4.59 d (3.5)
16	112.10	–	5 76.67 4.10 dd (6, 6)
17	59.07	1.47 d (11)	6 62.25 4.42 dd (6, 11.3),
18	19.21	1.15 s	4.48 dd (6, 11.3)
19	30.68	0.25 d (3.9), 0.50 d (3.9)	Ac 170.20 –
20	23.62	1.65	22.07 2.02 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

25-O-Acetylcimigenol-3-O- β -D-glucopyranoside

C₃₈H₆₀O₁₁, M 692



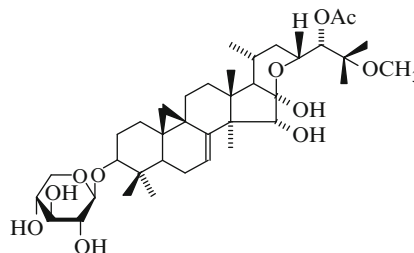
Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 216–217°C (from MeOH), $[\alpha]_D^{20} +20.6^\circ$ (c 0.7, MeOH).IR ν_{\max}^{KBr} , cm^{-1} : 3600–3300, 1737.Positive SIMS m/z: 693 [M + H]⁺.Positive HRSIMS m/z: 693.4199 [M + H]⁺.**Table 1**

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.14	1.15, 1.52	C-21	19.29	0.87 d (6.5)
2	29.69	1.89, 2.43	22	37.69	1.02, 2.29
3	88.61	3.54 dd (3.8, 11.3)	23	71.38	4.61 d (9)
4	41.01	–	24	86.55	4.13 s
5	47.32	1.30	25	83.04	–
6	20.81	0.71 q (12.5), 1.53	26	21.33	1.70 s
7	26.22	1.20, 2.10	27	23.11	1.67 s
8	48.40	1.70	28	11.59	1.21 s
9	19.68	–	29	25.55	1.33 s
10	26.42	–	30	15.25	1.07 s
11	26.12	1.05, 2.08	β -D-Glcp		
12	33.79	1.53, 1.60	1	106.46	4.96 d (8.5)
13	41.59	–	2	75.37	4.05 dd (8.5, 8.5)
14	46.95	–	3	78.22	4.27 dd (8.5, 8.5)
15	79.81	4.26 s	4	71.47	4.21 dd (8.5, 8.5)
16	112.20	–	5	77.85	3.98 m
17	59.17	1.47 d (11)	6	62.57	4.38 dd (5.3, 11.8),
18	19.29	1.15 s			4.56 dd (2.4, 11.8)
19	30.69	0.24 d (4), 0.51 d (4)	Ac	170.18	–
20	23.72	1.65		22.13	2.00 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

24-O-Acetyl-25-O-methyl-7,8-didehydroshengmanol-3-O- β -D-xylopyranoside

C₃₈H₆₀O₁₁, M 692**Taxonomy:** Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 216–217°C (from MeOH), $[\alpha]_D -14.7^\circ$ (c 0.51, MeOH).

CAS Registry Number: 245494-54-6.

IR ν_{\max}^{KBr} , cm^{-1} : 3650–3200, 1700.Positive SIMS m/z: 693 [M + H]⁺, 675 [M-OH]⁺.Positive HRSIMS m/z: 693.4214 [M + H]⁺.**Table 1**

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.33	1.35, 1.70	C-21	21.63	1.05 d (6.3)
2	29.53	1.93, 2.33	22	33.50	1.96, 2.04
3	88.20	3.49 dd (11.5, 4)	23	74.38	4.22
4	40.36	–	24	79.54	5.66 d (8)
5	42.67	1.28	25	76.26	–
6	21.76	1.55, 1.85	26	22.58	1.27 s
7	113.38	6.00 dd (7.5, 1.5)	27	23.27	1.21 s
8	149.22	–	28	18.23	1.46 s
9	21.22	–	29	25.75	1.31 s
10	28.32	–	30	14.30	1.04 s
11	25.49	1.18, 2.20	β -D-Xyp		
12	33.93	1.68, 1.84	1	107.39	4.84 d (7.8)
13	41.35	–	2	75.36	4.03 dd (8, 7.8)
14	49.89	–	3	78.34	4.17 t (8)
15	80.34	4.43 s	4	71.07	4.22 ddd (10, 8, 5)
16	103.23	–	5	67.01	3.75 dd (11, 10),
17	60.20	1.79			4.37 dd (11, 5)
18	21.38	1.26 s	Ac	171.25	–

(continued)

Table 1 (continued)

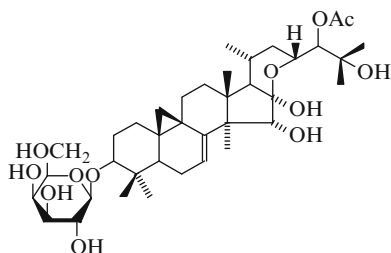
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
19	28.35	0.51 d (4), 1.07 d (4)	21.22	2.02 s
20	27.49	1.78	OMe 49.39	3.24 s

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **47**(8), 1175–1179 (1999)

24-*epi*-24-O-Acetyl-7,8-didehydrohydroshengmanol-3-O- β -D-galactopyranoside

C₃₈H₆₀O₁₂, M 708



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 243–244°C (from MeOH), $[\alpha]_D^{20} -11.4^\circ$ (c 1.1, MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3650–3200, 1718.

Positive SIMS m/z: 691 [M-OH]⁺.

Positive HRSIMS m/z: 691.4037 [M-OH]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	30.37	1.23, 1.75	C-21	21.64	1.01 d (6.3)
2	29.51	1.94, 2.43	22	32.80	1.84, 2.10
3	88.33	3.52 dd (4, 11.8)	23	74.26	4.45 m
4	40.38	–	24	81.37	5.73 d (8.8)

(continued)

Table 1 (continued)

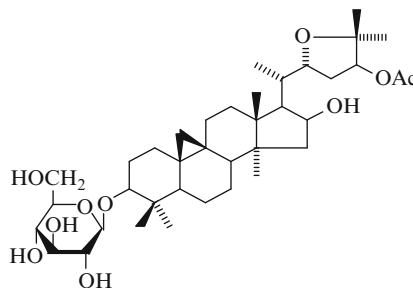
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
5	42.76	1.35	25	72.18	–
6	21.86	1.84, 1.98	26	27.07	1.49 s
7	113.48	5.99 d (8.8)	27	27.37	1.45 s
8	149.46	–	28	18.14	1.44 s
9	21.21	–	29	25.88	1.25 s
10	28.47	–	30	14.33	1.03 s
11	25.44	1.27, 2.17	β -D-Galp		
12	33.87	1.59, 1.64	1	107.41	4.83 d (8.8)
13	41.60	–	2	73.26	4.43 dd (8.8, 8.8)
14	50.05	–	3	75.50	4.16 dd (2.5, 8.8)
15	80.09	4.45 s	4	70.33	4.59 d (2.5)
16	103.20	–	5	76.81	4.09 dd (6.3, 6.3)
17	60.77	1.82 d (10)	6	62.50	4.43 dd (6.3, 11.3),
18	22.55	1.33 s			4.48 dd (6.3, 11.3)
19	28.43	0.49 d (3.8), 1.08 d (3.8)	Ac	170.35	–
20	27.14	1.79		21.10	2.12 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

Depressoside B

C₃₈H₆₂O₁₀, M 678



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Mp 218–220°C, $[\alpha]_D^{28} -1.7^\circ$ (c 0.07, MeOH).

CAS Registry Number: 215178-37-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3350–3450, 1735.

Positive ion FABMS m/z: 701 [M + Na]⁺, 679 [M + H]⁺, 540 [M + H + Na-162]⁺, 517 [M + H-162]⁺, 499 [M + H-H₂O-162]⁺, 479 [M + Na-162-CH₃COOH]⁺.

Negative ion FABMS m/z: 599 [M-H-H₂O-CH₃COOH]⁻, 515 [M-H-162]⁻, 497 [M-H-162-H₂O]⁻.

EIMS m/z (%): 498 (2.57), 454 (1.76), 341 (1.3), 313 (2.96), 295 (1.59), 247 (3.42), 203 (1.26), 157 (10.22), 97 (100).

Table 1

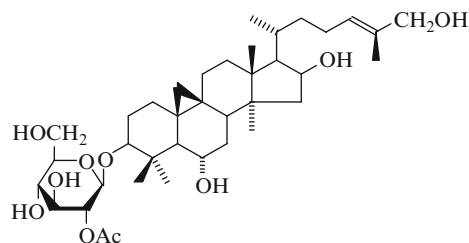
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)		
C-1	33.08	1.28, 1.56	C-21	15.44	0.92 d (7)
2	30.29	1.68, 2.05	22	80.27	4.20 ddd (3.2, 7, 9)
3	90.90	3.24 dd (4.5, 12)	23	34.30	1.85 m, 2.45 m
4	42.02	–	24	81.87	5.02 dd (2.8, 7.05)
5	49.50	1.35	25	83.85	–
6	22.01	0.85, 1.63	26	22.62	1.20 s
7	27.60	1.08, 1.30	27	24.76	1.22 s
8	50.05	1.68	28	20.54	0.94 s
9	21.01	–	29	26.03	1.07 s
10	27.45	–	30	15.13	0.89 s
11	27.79	1.20, 2.05	β -D-Glcp		
12	34.49	1.36, 1.65	1	104.17	4.45 d (7.5)
13	46.95	–	2	81.01	4.05 dd (8, 9.2)
14	47.97	–	3	77.86	3.65 t (9)
15	47.83	1.40, 1.97	4	71.64	3.40 t (9.5)
16	73.12	4.47 ddd (5.5, 8, 8.5)	5	77.29	3.28 ddd (2.5, 5.4, 8.6)
17	52.71	1.94 dd (6.8, 11.5)	6	62.76	3.66 dd (4.5, 12)
18	19.36	1.18 s			3.82 dd (2, 11.5)
19	30.69	0.35 d (4), 0.58 d (4)	Ac	182.19	–
20	33.55	2.28 m		23.88	1.90 s

References

- V.U. Ahmad, A. Ali, Z. Ali, F.T. Bagai, F.N. Zafar, *Phytochemistry* **49**(3), 829–834 (1998)

Kahiricoside III

C₃₈H₆₂O₁₀, M 678



Taxonomy: Cycloartane Glycosides

Astragalus kahiricus DC (*Leguminosae*) [1].

Mp 140°C, $[\alpha]_D^{25} +49^\circ$ (c 0.065, MeOH).

IR ν_{\max} , cm^{-1} : 3396, 2927, 1737.

HRFABMS m/z: 679.4412 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.3	1.15 m, 1.50 m	C-21	18.2	1.08 d (6.8)
2	30.1	2.11 m, 2.36 m	22	36.9	1.33 m, 2.19 m
3	89.4	3.51 dd (4.4, 11.6)	23	25.6	2.25 m
4	42.3	–	24	125.8	5.78 t (6.8)
5	54.0	1.72 d (8.8)	25	135.3	–
6	68.0	3.76 m	26	14.0	1.78 s
7	38.6	1.60 m, 1.80 m	27	68.3	4.26 brs
8	46.9	1.94 m	28	20.2	1.04 s
9	21.3	–	29	28.7	1.82 s
10	29.2	–	30	16.6	1.26 s
11	26.3	1.20 m, 1.91 m	β -D-Glcp		
12	33.3	1.68 m	1	104.0	4.98 d (7.6)
13	45.8	–	2	75.9	5.62 t (8.0)
14	47.1	–	3	76.3	4.20 m
15	49.3	1.65 m, 2.18 m	4	71.9	4.25 m
16	71.3	4.66 m	5	78.4	3.95 m
17	57.0	1.83 m	6	62.7	4.38 m, 4.54 m
18	19.1	1.40 s	Ac	170.1	–
19	30.0	0.19 d (4), 0.50 d (4)		21.3	2.12 s
20	30.8	2.34 m			

Biological activity

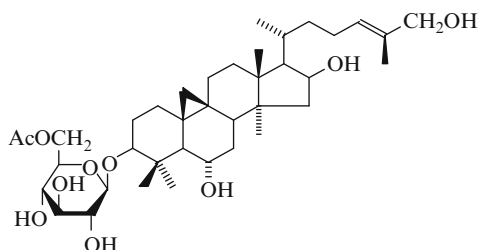
Glycoside exhibited very weak cytotoxicity against the A2780 ovarian cancer cell line.

References

1. M.M. Radwan, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, *Phytochemistry* **65**, 2909–2913 (2004)

Kahiricoside IV

$C_{38}H_{62}O_{10}$, M 678



Taxonomy: Cycloartane Glycosides

Astragalus kahiricus DC (*Leguminosae*) [1].

Mp 165°C, $[\alpha]_D^{25} +175^\circ$ (c 0.02, MeOH).

IR ν_{max} , cm^{-1} : 3396, 2931, 1733.

HRFABMS m/z: 679.4412 $[M + H]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.5 1.28 m	C-21	18.3 1.08 d (6.8)
2	30.2 2.00 m, 2.48 m	22	36.9 1.36 m
3	89.3 3.65 dd (4.4, 11.6)	23	25.6 2.34 m
4	42.6 –	24	125.8 5.79 t (6.8)
5	54.2 1.77 d (8.8)	25	135.3 –
6	67.9 3.76 m	26	14.0 1.82 s
7	38.5 1.70 m, 1.84 m	27	68.3 4.27 brs
8	46.9 1.94 m	28	20.2 1.06 s
9	21.4 –	29	28.9 1.99 s
10	29.3 –	30	16.7 1.31 s
11	26.4 1.24 m, 1.91 m	β -D-Glcp	
12	33.3 1.70 m	1	107.0 4.94 d (7.6)
13	45.8 –	2	75.8 4.09 m
14	47.0 –	3	78.5 4.20 t (8.7)
15	49.2 1.75 m, 2.20 m	4	71.7 4.01 m
16	71.3 4.65 m	5	74.9 4.02 m
17	57.0 1.82 m	6	64.8 4.85 dd (5.8, 11.6), 4.91 m
18	19.0 1.40 s		
19	29.9 0.20 d (4), 0.55 d (4)	Ac	170.8 –
20	30.8 2.16 m	21.4	2.04 s

Biological activity

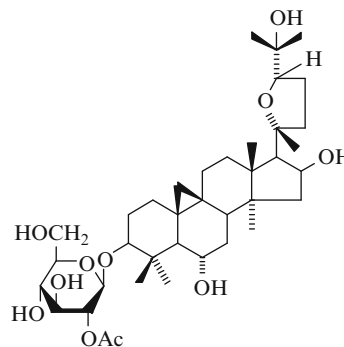
Glycoside exhibited very weak cytotoxicity against the A 2780 ovarian cancer cell line.

References

1. M.M. Radwan, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, *Phytochemistry* **65**, 2909–2913 (2004)

Astraverrucin II

$C_{38}H_{62}O_{11}$, M 694



Taxonomy: Cycloartane Glycosides

Astragalus verrucosus Moris (*Leguminosae*) [1].

$[\alpha]_D^{20} + 2.27^\circ$ (c 1.94, C_5H_5N).

IR ν_{max}^{Nujol} , cm^{-1} : 3425, 1750, 1250, 1040.

FABMS m/z: 717 $[M + Na]^+$, 695 $[M + H]^+$, 472 $[M - Glc - OAc]^+$, 143.

EIMS m/z (%): 454 (1.37), 395 (1.33), 201 (2.04), 187 (4.81), 143 (100), 125 (21.43), 107 (5.94), 85 (7.17).

1H NMR (200 MHz, C_5D_5N , δ , 0-TMS): 0.17 and 0.48 (2H-19, d, $J = 3.9$ Hz), 0.98, 1.25, 1.28, 1.29, 1.39, 1.56, 1.77 ($7 \times CH_3$, s), 1.98 (CH_3COO , s), 2.51 (H-17, d, $J = 7.7$ Hz), 3.49 (H-3, dd, $J = 11.3$, 4.1 Hz), 3.71 (H-6, m), 3.86 (H-24, dd, $J = 8.8$, 5.5 Hz), 4.52 (Glc p H-6, m), 5.00 (Glc p H-1, d, $J = 7.7$ Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.2	C-10	29.4	C-19	30.6	C-28	20.2
2	30.0	11	26.2	20	87.3	29	28.8
3	89.3	12	33.4	21	27.1	30	16.5
4	42.6	13	45.0	22	34.9	β -D-Glcp	
5	54.0	14	46.1	23	26.5	1	104.0
6	67.9	15	46.7	24	81.7	2	75.8
7	38.7	16	73.5	25	71.3	3	76.3
8	47.1	17	58.4	26	28.2	4	71.8
9	21.0	18	21.5	27	28.6	5	78.4
					6		62.6
							Ac
							21.5
							170.1

References

1. L. Pistelli, S. Pardossi, G. Flamini, A. Bertoli, A. Manunta, *Phytochemistry* **45**(3), 585–587 (1997)

EIMS m/z (%): 454 (1.21), 187 (3.52), 159 (3.07), 143 (100), 125 (26.83), 109 (8.69), 107 (7.30), 85 (7.77).

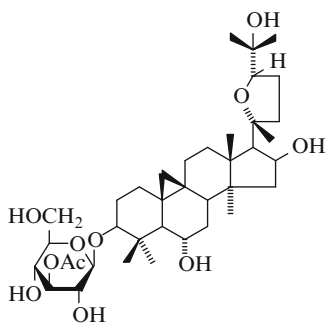
¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.20 and 0.52 (2H-19, d, J = 3.5 Hz), 0.97, 1.28, 1.28, 1.33, 1.40, 1.56, 1.98 (7 \times CH₃, s), 1.98 (CH₃COO, s), 2.51 (H-17, d, J = 7.8 Hz), 3.60 (H-3, m), 3.72 (H-6, m), 3.86 (H-24, dd, J = 8.8, 5.5 Hz), 5.00 (Glc p H-1, d, J = 7.7 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.3	C-10	29.5	C-19	30.5	C-28	20.1
2	30.1	11	26.2	20	87.2	29	28.9
3	89.3	12	33.3	21	27.1	30	16.6
4	42.6	13	45.0	22	34.9	β -D-Glcp	
5	54.0	14	46.1	23	26.4	1	106.7
6	67.9	15	46.6	24	81.6	2	73.4
7	38.6	16	73.7	25	71.3	3	79.7
8	47.0	17	58.3	26	28.2	4	69.4
9	20.9	18	21.5	27	28.6	5	78.1
					6		62.3
							Ac
							21.3
							170.9

Astraverrucin III

C₃₈H₆₂O₁₁, M 694



Taxonomy: Cycloartane Glycosides

Astragalus verrucosus Moris (*Leguminosae*) [1].

$[\alpha]_D^{20} + 1.10^\circ$ (c 0.92, C₅H₅N).

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3400, 1735, 1250, 1040.

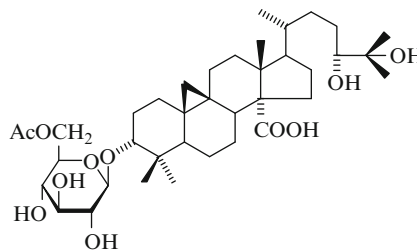
FABMS m/z: 717 [M + Na]⁺, 695 [M + H]⁺, 472 [M - Glc - OAc]⁺, 143.

References

1. L. Pistelli, S. Pardossi, G. Flamini, A. Bertoli, A. Manunta, *Phytochemistry* **45**(3), 585–587 (1997)

Liofolic Acid

C₃₈H₆₂O₁₁, M 694



Taxonomy: Cycloartane Glycosides

Lyonia ovalifolia (Drude) var. *elliptica* (Hand-Mazz) (Ericaceae) [1, 2].

Mp 139–140°C (from EtOAc).

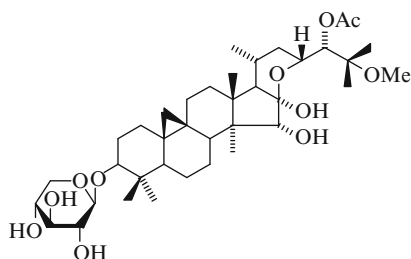
CAS Registry Number: 11076-68-9.

References

1. J. Sakakibara, Y. Hotta, M. Yasue, *Yakugaku Zasshi* **91**(12), 1318–1322 (1971). *C.A.*, 76:59959s (1972)
2. J. Sakakibara, Y. Hotta, M. Yasue, *Yakugaku Zasshi* **95**(9), 1085–1091 (1975). *C.A.*, 84:17579c (1976)

25-O-Methyl-24-O-acetylhydroshengmanol-3-O- β -D-xylopyranoside

$C_{38}H_{62}O_{11}$, M 694

**Taxonomy:** Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 205–206°C (from MeOH), $[\alpha]_D^{20} -1.5^\circ$ (c 0.55, MeOH).

CAS Registry Number: 173180-27-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3550–3300, 1715.

Positive SIMS m/z: 677 [M-OH]⁺, 695 [M + H]⁺.

Positive HRSIMS m/z: 677.4269 [M-OH]⁺.

Table 1

	δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.09	1.38, 1.56	C-21	21.10 1.02 d (5.7)
2	30.56	1.95, 2.36	22	33.81 1.95, 2.00

(continued)

Table 1 (continued)

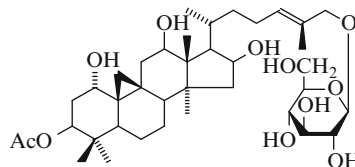
	δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
3	88.26	3.50 dd (11.5, 4.5)	23	74.02 4.21
4	41.03	–	24	79.33 5.70 d (8.6)
5	47.23	1.32	25	76.00 –
6	21.04	0.68, 1.30	26	23.02 1.25 s
7	26.10	1.12, 2.05	27	21.05 1.25 s
8	48.83	1.73	28	11.64 1.23 s
9	19.72	–	29	25.42 1.28 s
10	26.38	–	30	15.19 1.04 s
11	26.25	1.05, 2.03	β -D-Xylp	
12	33.33	1.59, 1.65	1	107.19 4.86 d (7.8)
13	41.70	–	2	75.11 4.05 dd (8.3, 7.8)
14	46.34	–	3	78.06 4.18 dd (8.6, 8.3)
15	82.15	4.15 s	4	70.81 4.30 ddd (10.1, 8.6, 4.8)
16	102.74	–	5	66.92 3.77 dd (10.8, 10.1), 4.38 dd (10.8, 4.8)
17	60.14	1.80 d (8.0)		
18	20.29	1.30 s	Ac	171.18 –
19	29.82	0.28 d (3.8), 0.50 d (3.8)		20.74 2.12 s
20	27.27	1.75	Me	49.18 3.27 s

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

Mongholicoside II

$C_{38}H_{62}O_{11}$, M 694

**Taxonomy:** Cycloartane Glycosides

Astragalus mongholicus Bunge (*Leguminosae*) [1].

Mp 128–130°C, $[\alpha]_D +42.1^\circ$.

CAS Registry Number: 145826-22-8.

IR ν_{\max}^{KBr} , cm^{-1} : 1715.

Positive ion FABMS m/z : 717 $[\text{M} + \text{Na}]^+$.

Negative ion FABMS m/z : 693 $[\text{M}-\text{H}]^-$.

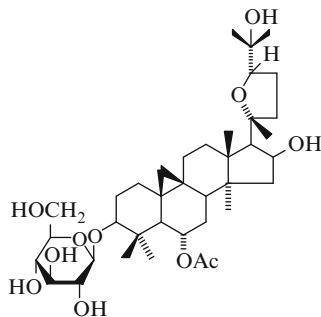
^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.67 and 0.77 (2H-19, d, $J = 4.4$ Hz), 2.05 (CH_3COO , s), 4.86 (Glc p H-1, d, $J = 7.7$ Hz).

References

1. Y.Z. Zhu, S.H. Lu, Y. Okada, M. Takata, T. Okuyama, *Chem. Pharm. Bull.* **40**(8), 2230–2232 (1992)

Huangqiyanin D

$\text{C}_{38}\text{H}_{62}\text{O}_{11}$, M 694



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

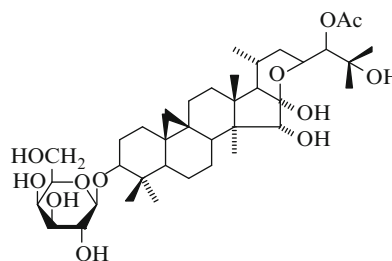
CAS Registry Number: 199734-15-1.

References

1. H. Kuang, N. Zhang, Z. Tian, P. Zhang, Y. Okada, T. Okuyama, *Nat. Med.* **51**(4), 358–360 (1997). *C.A.*, 128:32373 b (1998)

24-*epi*-24-O-Acetylhydroshengmanol-3-O- β -D-galactopyranoside

$\text{C}_{38}\text{H}_{62}\text{O}_{12}$, M 710



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Glycoside was obtained as an inseparable mixture with Δ^7 -derivative.

CAS Registry Number: 184419-89-4.

Positive SIMS m/z : 733 $[\text{M} + \text{Na}]^+$.

Positive HRSIMS m/z : 733.4126 $[\text{M} + \text{Na}]^+$.

Table 1

	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	32.31	1.24, 1.70	C-21	21.47 0.98 d (6.3)
2	30.03	1.92, 2.43	22	32.96 1.85, 2.15
3	88.56	3.54 dd (4.3, 11.3)	23	74.11 4.45 m
4	41.29	–	24	81.18 5.74 d (8.5)
5	47.52	1.31	25	72.77 –
6	21.21	0.82 q (12.5), 1.70	26	26.77 1.46 s
7	26.48	1.22, 2.10	27	27.07 1.45 s
8	48.94	1.92	28	11.77 1.24 s
9	19.99	–	29	25.79 1.22 s
10	27.37	–	30	15.43 1.02 s
11	26.58	1.25, 2.15	β -D-Galp	
12	34.00	1.55, 1.70	1	107.43 4.88 d (8.8)
13	42.20	–	2	73.28 4.45 dd (8.8, 8.8)
14	46.76	–	3	75.52 4.16 dd (3.1, 8.8)
15	82.10	4.14 s	4	70.34 4.59 d (3.1)
16	102.98	–	5	76.78 4.09 dd (6.3, 6.3)
17	60.90	1.85	6	62.50 4.43 dd (6.3, 11.3),

(continued)

Table 1 (continued)

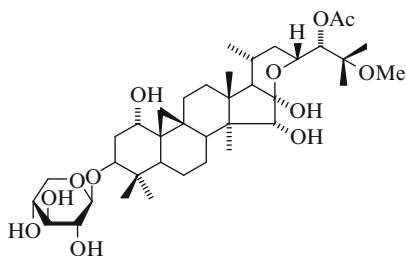
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
18	20.39	1.32 s	4.48 dd (6.3, 11.3)
19	30.69	0.26 d (4.1), 0.56 d (4.1)	Ac 170.34 –
20	27.10	1.80	21.05 2.12 s

References

1. A. Kusano, M. Shibano, G. Kusano, T. Miyase, *Chem. Pharm. Bull.* **44**(11), 2078–2085 (1996)

25-O-Methyl-1 α -hydroxy-24-O-acetylhydroshengmanol-3-O- β -D-xylopyranoside

C₃₈H₆₂O₁₂, M 710



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 149–150°C (from MeOH-EtOAc-isopropyl ether),

$[\alpha]_D^{20} +5.0^\circ$ (c 1.15, MeOH).

CAS Registry Number: 173180-29-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200, 1729.

Positive SIMS m/z: 693 [M-OH]⁺, 733 [M + Na]⁺.

Positive HRSI-MS m/z: 693.4193 [M-OH]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	72.10	3.82 brs	C-21 21.15 0.98 d (5.4)
2	37.41	2.22, 2.70	22 33.80 1.96, 2.10
3	84.25	4.32 dd (8.2, 12)	23 73.96 4.20

(continued)

Table 1 (continued)

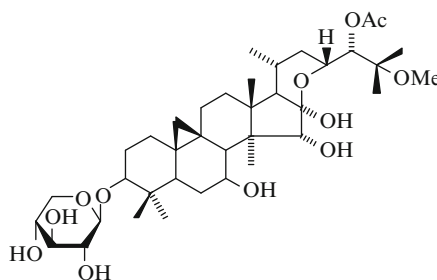
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	41.15 –	24	79.27 5.66 d (8.5)
5	39.69 2.40	25	75.96 –
6	20.62 0.80, 1.65	26	22.99 1.37 s
7	25.58 1.35, 1.52	27	21.15 1.28 s
8	49.15 1.75	28	11.49 1.22 s
9	20.62 –	29	25.44 1.35 s
10	30.54 –	30	14.40 1.07 s
11	26.01 1.60, 2.85	β -D-Xylp	
12	33.29 1.45, 1.75	1	107.19 4.86 d (7.7)
13	41.65 –	2	75.08 4.02 dd (8.5, 7.7)
14	46.38 –	3	77.94 4.12 dd (8.6, 8.3)
15	82.27 4.16 s	4	70.69 4.23 ddd (10.1, 8.6, 5.1)
16	102.70 –	5	66.53 3.59 dd (10.6, 10.1),
17	60.09 1.78 d (8.5)		4.34 dd (10.6, 5.1)
18	20.23 1.29 s	Ac	171.20 –
19	30.62 0.40 d (4), 0.65 d (4)		21.02 2.12 s
20	27.28 1.75	OMe	49.03 3.27 s

References

1. A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **44**(1), 167–172 (1996)

25-O-Methyl-7 β -hydroxy-24-O-acetylhydroshengmanol-3-O- β -D-xylopyranoside

C₃₈H₆₂O₁₂, M 710



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 199–200°C (from CH₃CN-MeOH), $[\alpha]_D^{20} +4.6^\circ$
(c 0.52, MeOH).

CAS Registry Number: 173180-28-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3200, 1725.

Positive SIMS m/z: 693 [M-OH]⁺, 733 [M + Na]⁺.

Positive HRSIMS m/z: 693.42147 [M-OH]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.60	C-21	21.12
2	30.60	22	33.72
3	87.98	23	73.81
4	40.80	24	79.37
5	46.27	25	76.04
6	32.11	26	23.06
7	69.66	27	21.12
8	56.14	28	11.57
9	18.82	29	25.38
10	26.83	30	15.10
11	26.18	β -D-Xylp	
12	33.30	1	102.21?
13	42.42	2	75.08
14	46.90	3	78.05
15	81.96	4	70.78
16	102.98	5	66.76
17	60.43		
18	20.31	Ac	171.38

(continued)

Table 1 (continued)

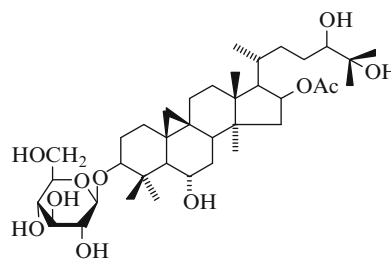
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
19	29.75	21.12	2.11 s
20	27.26	OMe	49.20

References

1. A. Kusano, M. Shibano, G. Kusano, Chem. Pharm. Bull. **44**(1), 167–172 (1996)

Cyclounifolioside D

C₃₈H₆₄O₁₁, M 696



Taxonomy: Cycloartane Glycosides

Astragalus unifoliolatus Bunge (*Leguminosae*) [1].

Mp 171–173°C (from MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3465, 3048, 1718, 1273.

See [Table 1](#)

Table 1

δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)
C-1	32.19	C-16	75.42	β -D-Glcp	
2	29.74	17	55.26	1	106.68
3	88.84	18	18.23	2	75.69
4	42.42	19	29.08	3	78.50
5	53.8	20	31.59	4	71.66
6	67.63	21	18.33	5	77.93
7	32.56	22	33.95	6	62.83
8	45.68	23	30.13	Ac	21.21
9	20.89	24	79.18	170.6	–
10	28.66	25	72.59	–	–
11	25.97	26	25.74	2.01 ?	–
12	33.19	27	25.68	1.54	–
13	46.82	28	19.76	0.95	–
14	45.68	29	27.41	1.51 ?	–
15	46.51	30	16.51	1.37	–

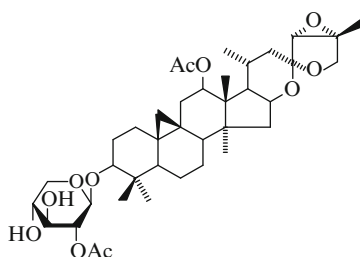
In value of chemical shift C-7, apparently, there was a misprint.

References

1. K.J. Kucherbaev, K.K. Uteniyazov, V.V. Kachala, Z. Saatov, A.S. Shashkov, *Chem. Nat. Comp.* **38**(6), 574–576 (2002)

2'-O-Acetyl-27-deoxyactein

C₃₉H₅₈O₁₁, M 702



Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp 147–149°C, [α]_D –34.1° (c 0.74, MeOH).

IR ν_{max}^{KBr}, cm⁻¹: 3430, 1730.

FABMS m/z: 709 [M + Na]⁺. ?

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.0 1.17 m, 1.56 m	C-21	21.5 1.12 d (6)
2	29.9 1.86 m, 2.24 m	22	37.7 1.57 m, 1.70 m
3	88.5 3.45 dd (11, 4)	23	106.1 –
4	41.0 –	24	62.5 3.77 s
5	47.0	25	62.7 –
6	20.3 0.81 m, 1.44 m	26	13.7 1.50 s
7	25.8 1.00 m, 1.29 m	27	68.3 3.72 d (10.3), 4.15 d (10.3)
8	45.9 1.66 m	28	19.8 0.93 s
9	20.3 –	29	25.6 1.16 s
10	26.8 –	30	15.3 0.99 s
11	36.8 1.28 m, 2.28 dd (16, 9)	Ac	170.9 –
12	77.3 5.13 dd (8.9, 3.4)		21.8 2.22 s
13	48.0 –	β-D-Xylp	
14	49.0 –	1	104.8 4.87 d (7.9)

(continued)

Table 1 (continued)

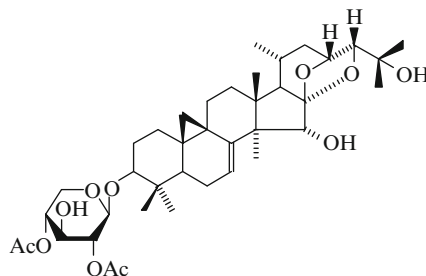
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
15	44.3 1.78 m, 1.94	2	75.8 5.61 m
16	74.7 4.33 m	3	76.4 4.25 m
17	56.4 1.79 m	4	71.5 4.27 m
18	14.5 1.55 s	5	67.3 3.80 m, 4.42 dd (10.2, 5)
19	29.7 0.24 d (4.2), 0.56 d (4.2)	Ac	170.3 –
20	23.5 2.30 m	21.5	2.25 s

References

1. N. Zhu, Y. Jiang, M. Wang, C.-T. Ho, *J. Nat. Prod.* **64**(5), 627–629 (2001)

2',4'-O-Diacetyl-24-epi-7,8-didehydrocimigenol-3-xyloside

C₃₉H₅₈O₁₁, M 702



Taxonomy: Cycloartane Glycosides

Cimicifuga heracleifolia Komarov (*Ranunculaceae*)

[1].

[α]_D –15.5° (c 0.53, CHCl₃).

CAS Registry Number: 150972-75-1.

IR ν_{max}^{KBr}, cm⁻¹: 3550, 1740, 1635.

Positive ion FABMS m/z: 703 [M + H]⁺.

Table 1

δ _C (CDCl ₃)	δ _H (J/Hz)	δ _C (CDCl ₃)	δ _H (J/Hz)
C-1	30.00 1.35 m, 1.69 m	C-21	19.18 0.89 d (6.6)
2	28.52 1.75 m, 1.93 m	22	29.20 1.95 m, 2.13 m
3	89.23 3.20 dd (11.4, 4)	23	73.57 4.44 ddd (10, 4, 2.2)
4	39.92 –	24	83.30 3.57 d (4)

(continued)

Table 1 (continued)

δ_C (CDCl ₃)	δ_H (J/Hz)	δ_C (CDCl ₃)	δ_H (J/Hz)
5	42.18 1.25 m	25	68.70 –
6	21.44 1.65 m, 1.79 m	26	31.42 1.33 s
7	114.16 5.60 dd (7.5, 2.2)	27	24.04 1.22 s
8	149.93 –	28	17.88 1.05 s
9	21.11 –	29	25.33 0.97 s
10	27.99 –	30	13.86 0.85 s
11	25.30 1.20 m, 2.15 m	β -D-Xylp	
12	33.59 1.71 m, 1.77 m	1	102.06 4.60 d (5.9)
13	40.90 –	2	72.51 4.85 dd (7.0, 5.9)
14	50.41 –	3	70.79 3.78 m [2.91 s, OH]
15	77.80 4.03 d (7.9) [2.76 d (7.9)OH]	4	71.37 4.82 td (7, 4)
16	112.09 –	5	60.94 3.39 dd (12, 7), 4.15 dd (12, 4)
17	61.26 1.32 d (6.6)	Ac	170.50 –
18	21.44 1.02 s		170.35 –
19	28.17 0.55 d (4.9), 1.08 d (4.9)		21.00 2.11 s
20	22.84 1.60 m		21.00 2.13 s

References

1. J.X. Li, S. Kadota, M. Hattori, S. Yoshimachi, M. Shiro, N. Oogami, H. Mizuno, T. Namba, *Chem. Pharm. Bull.* **41**(5), 832–841 (1993)

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1735.

FABMS m/z : 725 [M + Na]⁺·?

Table 1

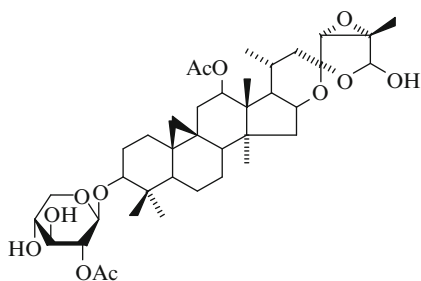
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.0 1.17 m, 1.56 m	C-21	21.6 1.05 d (6.1)
2	30.0 1.86 m, 2.25 m	22	37.8 1.75 m, 2.30 m
3	88.6 3.41 dd (11, 3.8)	23	106.2 –
4	41.1 –	24	63.7 4.04 s
5	47.1	25	65.9 –
6	20.4 0.80 m, 1.34 m	26	13.4 1.88 s
7	25.7 0.98 m, 1.30 m	27	98.7 5.83 s
8	46.1 1.65 m	28	19.8 0.88 s
9	20.7 –	29	26.0 1.20 s
10	26.9 –	30	15.4 1.00 s
11	37.0 1.26 m, 2.70 dd (16.2, 9)	Ac	171.7 –
12	77.4 5.17 dd (8.8, 4)	22.0	2.26 s
13	48.1 –	β -D-Xylp	
14	49.0 –	1	104.8 4.88 d (7.9)
15	43.9 1.67 m, 2.04 m	2	75.9 5.60 m
16	73.7 4.68 m	3	76.4 4.25 m
17	56.7 1.86 m	4	71.6 4.27 m
18	13.8 1.35 s	5	67.3 3.90 dd (10.5, 10.5),
19	29.8 0.29 d (4), 0.62 d (4)		4.42 dd (10.4, 5)
20	26.3 1.90 m	Ac	170.5 –
		21.6	2.28 s

References

1. N. Zhu, Y. Jiang, M. Wang, C.-T. Ho, *J. Nat. Prod.* **64**(5), 627–629 (2001)

2'-O-Acetylactein

C₃₉H₅₈O₁₂, M 718



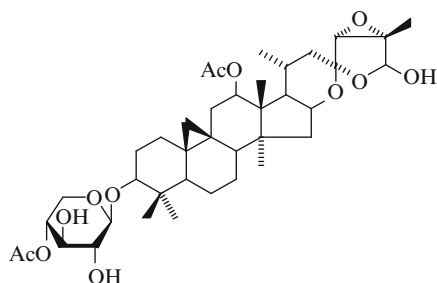
Taxonomy: Cycloartane Glycosides

Cimicifuga foetida L. (*Ranunculaceae*) [1].

Mp 143–146°C, $[\alpha]_D -56.6^\circ$ (c 0.50, MeOH).

Cimiracemoside O

C₃₉H₅₈O₁₂, M 718

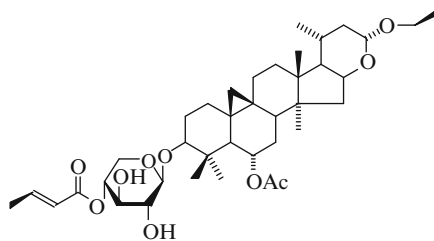


Taxonomy: Cycloartane Glycosides*Cimicifuga racemosa* (L.) Nutt. (*Ranunculaceae*) [1].Mp 143–145°C, $[\alpha]_D^{20}$ –60° (c 0.16, CHCl₃).IR ν_{\max}^{KBr} , cm⁻¹: 3449, 2940, 2869, 1732, 1455, 1371, 1241, 1048, 983, 755.HRESIMS m/z: 701.3889 [M-H₂O + H]⁺.**Table 1**

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	31.9	1.51, 1.12	C-21	21.0	0.98 d (6.5)
2	29.5	2.24, 1.85	22	37.6	2.24, 1.70 dd (6.5, 18)
3	88.2	3.43 dd (4, 11.4)	23	105.8	–
4	41.2	–	24	63.4	3.95 s
5	46.9	1.21	25	65.8	–
6	20.4	1.27 m, 0.67 m	26	98.4	5.76 s
7	25.6	1.25, 0.89	27	13.1	1.79 s
8	45.7	1.62 m	28	19.5	0.80 s
9	20.1	–	29	25.6	1.79 s
10	26.7	–	30	15.3	0.98 s
11	36.7	2.71 m, 1.21	β-D-Xylp		
12	77.0	5.10 brd (6)	1	107.3	4.85 d (7.3)
13	48.7	–	2	75.7	4.04 dd (8.3, 8.5)
14	47.8	–	3	75.0	4.28 dd (9.1, 9.2)
15	43.5	1.75 m, 1.55 m	4	73.1	5.41 ddd (5.4, 9.7, 9.7)
16	73.0	4.62 dd (7.1, 14.3)	5	63.2	4.34 dd (5.5, 11.4), 3.61 dd (10.9, 11.4)
17	56.4	1.78	Ac	170.6	–
18	13.5	1.37 s		170.6	–
19	29.8	0.23 d (4.5), 0.57 d (4.5)		21.6	2.16 s
20	26.0	1.80		20.9	1.99 s

References

1. S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Tomentoside IIIC₃₉H₆₀O₁₀, M 688**Taxonomy:** Cycloartane Glycosides*Astragalus tomentosus* Lam. (*Leguminosae*) [1].Mp 198–200°C, $[\alpha]_D^{25}$ –29.7° (c 0.30, MeOH).IR ν_{\max} , cm⁻¹: 3475, 2917, 2849, 1732, 1707, 1655, 1244.

EIMS m/z (%): 442 (10), 428 (20), 410 (57), 382 (50), 381 (100), 365 (46), 349 (21).

HRFABMS m/z: 687.4199 [M-1]⁺.**Table 1**

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	31.9	1.25 m, 1.62 m	C-22	33.2	1.54 m
2	29.9	1.93 m, 2.32 m	23	99.1	4.93 m
3	87.6	3.50 dd (6, 10.8)	28	19.3	0.94 s
4	42.2	–	29	26.7	1.39 s
5	56.6	1.53 dd (7.6, 10.4)	30	16.4	1.09 s
6	70.3	4.97 m	β-D-Xylp		
7	38.1	1.29 m, 1.78 m	1	107.4	4.87 d (7.6)
8	49.9	1.78 m	2	75.1	4.32 t (8.5)
9	21.0	–	3	75.7	4.06 t (8.5)
10	28.1	–	4	72.9	5.48 dt (5.4, 6.8)
11	25.9	1.75 m	5	63.4	3.68 d (8.6), 4.40 d (5.4)
12	33.0	1.46 m, 1.76 m	Ac	21.7	2.04 s
13	44.8	–		170.2	–
14	46.0	–	OEt	62.7	3.49 q (7), 3.87 q (7.2)

(continued)

Table 1 (continued)

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
15	43.3 1.53 m, 1.81 m	15.7	1.20 t (7.2)
16	70.5 4.41 ddd (5.5, 8.6, 14.8)	OOCCH = CHCH ₃	
17	44.5 1.80 m	17.6	1.58 dd (1.8, 6.8)
18	19.8 1.13 s	145.2	6.97 m
19	27.8 0.19 d (4.8), 0.50 d (4.8)	122.9	5.88 dd (1.6, 15.6)
20	25.6 1.53 m	166.1	–
21	20.6 0.87 d (6.4)		

References

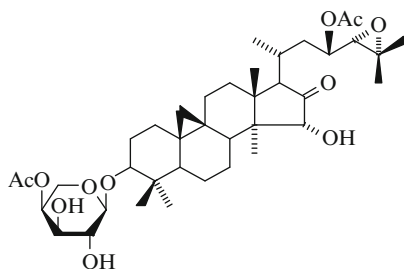
- M.M. Radwan, A. Farooq, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, *J. Nat. Prod.* **67**(3), 487–490 (2004)

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.2 1.62, 1.28	C-21	20.4 1.27 d (6.9)
2	30.1 2.42 m, 1.35 m	22	37.0 2.69 brt (12.2), 1.77 m
3	88.8 3.53 dd (4.3, 11.7)	23	72.1 5.42 brt (8.4)
4	41.4 –	24	65.2 3.05 d (8.4)
5	47.5 1.39	25	58.6 –
6	21.0 1.60 m, 0.76 m	26	24.7 1.26 s
7	26.7 1.30, 1.14	27	19.4 1.40 s
8	48.3 1.88 dd (4.4, 12.4)	28	12.0 1.22 s
9	20.1 –	29	25.7 1.31 s
10	26.8 –	30	15.5 1.06 s
11	26.0 2.10 m, 1.15 m	α -L-Arap	
12	33.1 1.80 m (2H)	1	107.6 4.82 d (7.1)
13	41.6 –	2	73.2 4.48 brt (8.1)
14	46.1 –	3	72.6 4.21 d (7.3)
15	83.0 4.35 s	4	72.1 5.61 brs
16	220.0 –	5	64.4 4.28 d (12.6), 3.85 d (12.6)
17	60.0 2.35 d (6.5)	Ac	170.9 –
18	19.8 1.38 s		170.7 –
19	30.5 0.32 d (3.7), 0.59 d (3.7)		21.0 2.06 s
20	28.0 2.14		21.2 2.12 s

Cimiracemoside L

$C_{39}H_{60}O_{11}$, M 704



Taxonomy: Cycloartane Glycosides

Cimicifugara cemoza (L.) Nutt. (*Ranunculaceae*) [1].

Mp 125–128° C, $[\alpha]_D^{20}$ –41.11° (c 0.45, CHCl₃)

IR ν_{max} , cm⁻¹: 3466, 2937, 2871, 1737, 1455, 1376, 1241, 1089, 757.

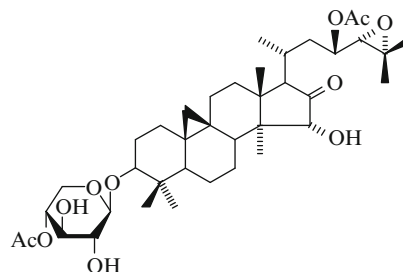
HRESIMS m/z: 705.4205 [M + H]⁺.

References

- S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Cimiracemoside M

$C_{39}H_{60}O_{11}$, M 704

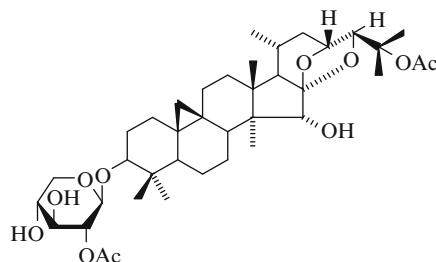


Taxonomy: Cycloartane Glycosides*Cimicifugaracemosa* (L.) Nutt. (*Ranunculaceae*) [1].Mp 107–109°C, $[\alpha]_D^{20} -19^\circ$ (c 0.30, CHCl₃).IR ν_{\max} , cm⁻¹: 3465, 2933, 2866, 1732, 1370, 1235, 1041, 750.HRESIMS m/z: 727.4041 [M + Na]⁺.**Table 1**

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.2	1.60, 1.28	C-21	20.4	1.27 d (6.8)
2	30.0	2.31 m, 1.95 m	22	37.0	2.69 brt (12.8), 1.78 m
3	88.5	3.55 dd (4, 12.8)	23	72.1	5.39 brt (8.4)
4	41.4	–	24	65.2	3.05 d (8.4)
5	47.4	1.39	25	58.6	–
6	21.1	1.59 m, 0.79 m	26	24.7	1.26 s
7	26.4	2.10, 1.18	27	19.4	1.41 s
8	48.3	1.88 dd (4.6, 11.5)	28	12.0	1.22 s
9	20.1	–	29	25.7	1.34 s
10	26.8	–	30	15.4	1.07 s
11	26.7	2.10 m, 1.15 m	β -D-Xylp		
12	33.1	1.82 m (2H)	1	107.4	4.90 d (7.2)
13	41.6	–	2	75.0	4.29 t (8.6)
14	46.1	–	3	75.8	4.08 t (6.7)
15	83.0	4.39 s	4	73.2	5.41
16	220.0	–	5	63.2	4.38, 3.63 t (10.5)
17	60.0	2.39 d (6.5)	Ac	170.5	–
18	19.8	1.38 s		170.5	–
19	30.0	0.33 d (3.6), 0.60 d (3.6)		20.9	1.99 s
20	28.0	2.13		21.0	2.07 s

References

1. S.N. Chen, D.S. Fabricant, Z.-Z. Lu, H.H.S. Fong, N.R. Farnsworth, *J. Nat. Prod.* **65**(10), 1391–1397 (2002)

Soulieoside AC₃₉H₆₀O₁₁, M 704**Taxonomy:** Cycloartane Glycosides*Souliea vaginata* (Maxim.) Franch. (*Ranunculaceae*) [1].Mp 150–152°C (from MeOH), $[\alpha]_D^{20} +22.0^\circ$ (c 0.05, CHCl₃-CH₃OH, 1:1).IR ν_{\max}^{KBr} , cm⁻¹: 3469, 1738.Positive ion FABMS m/z: 705 [M + H]⁺, 513, 469, 453, 435, 175, 157 (100).Positive ion HRFABMS m/z: 727.4004 [M + Na]⁺.**Table 1**

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.2	1.20 m, 1.51 m	C-21	19.5	0.84 d (6.5)
2	30.0	1.87 m, 2.26 m	22	37.9	0.94 m, 2.26 m
3	88.7	3.38 dd (4, 11.5)	23	71.7	4.58 d (9)
4	41.0	–	24	86.7	4.11 s
5	47.4	1.30 m	25	83.1	–
6	21.1	0.70 q (11.5), 1.51 m	26	22.3	1.65 s
7	26.3	1.13 m, 2.04 m	27	23.4	1.67 s
8	48.7	1.64 m	28	11.8	1.13 s
9	20.1	–	29	25.4	1.20 s
10	26.4	–	30	15.2	0.97 s
11	26.5	1.13 m, 2.04 m	β -D-Xyp		
12	34.0	1.53 m, 1.62 m	1	104.7	4.82 d (8)

(continued)

Table 1 (continued)

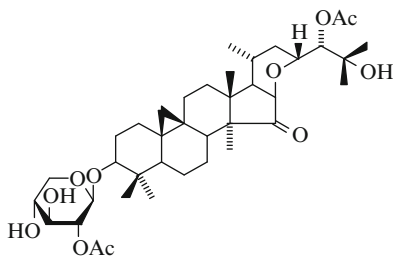
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
13	41.8	–	2 75.6 5.56 t (8)
14	47.2	–	3 76.3 4.16 t (8)
15	80.2	4.27 s	4 71.4 4.20 m
16	112.4	–	5 67.1 3.68 t (10.5),
17	59.4	1.44 d (11)	4.31 dd (4.5, 10.5)
18	19.5	1.08 s	Ac 170.2 –
19	30.8	0.23 d (4), 0.46 d (4)	21.5 1.95 s
20	23.9	1.57 m	

References

1. L. Zhou, J.S. Yang, J.H. Zou, G.Z. Tu. Chem. Pharm. Bull. **52**(5), 622–624 (2004)

Soulieoside B

C₃₉H₆₀O₁₁, M 704



Taxonomy: Cycloartane Glycosides

Souliea vaginata (Maxim.) Franch. (*Ranunculaceae*) [1].

Mp 157–160°C (from MeOH), $[\alpha]_D^{20} +14.0^\circ$ (c 0.05, CHCl₃–CH₃OH, 1:1)

IR ν_{\max}^{KBr} , cm⁻¹: 3479, 1743.

Positive ion FABMS m/z: 705 [M + H]⁺, 687, 513, 175, 157 (100).

Positive ion HRFABMS m/z: 727.4059 [M + Na]⁺.

Table 1

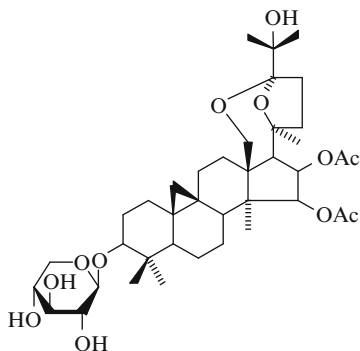
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.3	1.14 m, 1.53 m	C-21 21.0 0.90 d (6)
2	30.0	1.83 m, 2.25 m	22 38.8 1.48 m, 1.73 m
3	88.6	3.36 dd (4.5, 12)	23 79.1 4.24 m
4	41.0	–	24 79.8 5.29 d (2.5)
5	47.3	1.35 m	25 72.1 –
6	20.8	0.60 q (11), 1.47 m	26 26.8 1.59 s
7	25.9	1.04 m, 1.66 m	27 28.4 1.59 s
8	43.6	1.25 m	28 17.6 0.92 s
9	20.1	–	29 25.4 1.15 s
10	27.0	–	30 15.2 1.00 s
11	26.1	1.02 m, 2.23 m	β -D-Xylp
12	31.1	1.48 m, 1.69 m	1 104.7 4.80 d (8)
13	40.0	–	2 75.7 5.53 t (8)
14	55.1	–	3 76.3 4.16 t (8)
15	213.8	–	4 71.4 4.22 m
16	84.3	3.78 d (11.6)	5 67.2 3.68 t (11.5),
17	52.4	1.55 m	4.29 dd (5,11.5)
18	20.3	1.07 s	Ac 171.0 –
19	31.4	0.21 d (3.5), 0.43 d (3.5)	20.0 2.13 s
20	33.3	1.80 m	

References

1. L. Zhou, J.S. Yang, J.H. Zou, G.Z. Tu. Chem. Pharm. Bull. **52**(5), 622–624 (2004)

Beesioside I

C₃₉H₆₀O₁₂, M 720



Taxonomy: Cycloartane Glycosides

Beesia calthaefolia Maxim. (*Ranunculaceae*) [1, 2].

Mp 264–266°C (from CHCl₃–MeOH, 1:1), [α]_D²⁵ –10.7° (c 0.52, MeOH–CHCl₃, 1:1).

IR ν_{max}^{KBr}, cm⁻¹: 3600–3200, 1738, 1238, 1038.

ORD (c 0.52, CHCl₃–MeOH, 1:1) [α]_D²⁵ (nm): –10.7° (589), –11.1° (577), –12.5° (546), –22.0° (435), –35.6° (365).

Positive ion FABMS m/z: 721 [M + H]⁺, 589 [M–132 + H]⁺, 571 [M–150 + H]⁺.

¹H NMR (500 MHz, C₅D₅N, δ, 0-TMS): 0.15 and 0.48 (2H–19, d, J = 3.5 Hz), 0.58 (H–6, q, J = 12.5 Hz), 0.98, 1.17, 1.25, 1.29, 1.51, 1.60 (6 × CH₃, s), 2.08, 2.11 (2 × CH₃COO, s), 2.68 (H–17, d, J = 11.5 Hz), 3.48 (H–3, dd, J = 11.5, 4 Hz), 4.45 and 4.56 (2H–18, d, J = 13 Hz), 5.63 (H–15, d, J = 8.8 Hz), 5.90 (H–16, dd, J = 11.5, 8.8 Hz), 3.70 (Xylp H–5a, t, J = 10.6 Hz), 3.99 (Xylp H–2, t, J = 8.2 Hz), 4.11 (Xylp H–3, t, J = 8.7 Hz), 4.19 (Xylp H–4, m), 4.32 (H–5e, dd, J = 11.2, 5.1 Hz), 4.83 (Xylp H–1, d, J = 7.5 Hz).

Table 1

δ _C (C ₅ D ₅ N)						
C-1	32.35	C-11	25.89	C-21	32.35	β-D-Xylp
2	30.76	12	27.83	22	38.10	1 107.26
3	88.18	13	45.62	23	29.82	2 75.27
4	41.16	14	51.37	24	114.07	3 78.32
5	47.03	15	81.90	25	72.68	4 70.98
6	20.37	16	75.03	26	25.60	5 66.87
7	26.13	17	56.07	27	25.60	Ac

(continued)

Table 1 (continued)

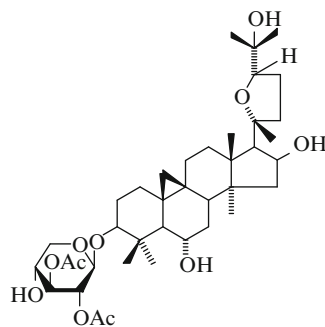
δ _C (C ₅ D ₅ N)						
8	47.03	18	66.23	28	15.20	21.19
9	18.96	19	31.41	29	25.60	21.19
10	27.48	20	86.66	30	15.32	170.50
						170.79

References

1. N. Sakurai, M. Nagai, T. Goto, T. Inoue, P.-G. Xiao. *Chem. Pharm. Bull.* **41**(2), 272–275 (1993)
2. J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Cycloexoside

C₃₉H₆₂O₁₁, M 706



Taxonomy: Cycloartane Glycosides

Astragalus exilis A.Kor. (*Leguminosae*) [1].

Mp 193–196°C (from MeOH), [α]_D²³ –56° (c 0.5, MeOH).

IR ν_{max}^{KBr}, cm⁻¹: 3600–3240, 3050, 1750, 1260–1240.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.17 and 0.42 (2H–19, d, J = 4 Hz), 0.87, 1.08, 1.20, 1.20, 1.29, 1.44, 1.56 (7 × CH₃, s), 1.89 (CH₃COO at C–3 of Xylp, s), 2.03 (CH₃COO at C–2 of Xylp, s), 2.38 (H–17, d, J = 7.7 Hz), 2.90 (H–22, q, J = 10 Hz), 3.34 (H–3, dd, J = 12, 4 Hz), 3.56 (H–6, m), 3.59 (Xylp H–5a, t, J = 10 Hz), 3.77 (H–24, dd, J = 10, 6 Hz), 4.12 (Xylp H–4, m), 4.20 (Xylp H–5e, dd, J = 10, 6 Hz), 4.75 (Xylp H–1, d, J = 7.7 Hz),

4.84 (H-16, q, $J = 7.7$ Hz), 5.26 (Xylp H-2, t, $J = 7.7$ Hz), 549 (Xylp H-3, t, $J = 7.7$ Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.24	C-11	26.18	C-21	28.63	β -D-Xylp	
2	29.98	12	33.36	22	34.91	1	104.10
3	89.30	13	45.02	23	26.40	2	73.15
4	42.21	14	46.11	24	81.71	3	76.61
5	53.81	15	46.71	25	71.23	4	68.81
6	68.05	16	73.41	26	27.11	5	66.67
7	38.71	17	58.37	27	28.14	Ac	20.74
8	47.17	18	21.58	28	20.19		21.04
9	20.81	19	30.76	29	28.52		169.82
10	29.44	20	87.20	30	16.39		170.47

References

1. B.A. Imomnazarov, M.I. Isaev, Chem. Nat. Comp. **28**(3–4), 312–315 (1992)

Table 1

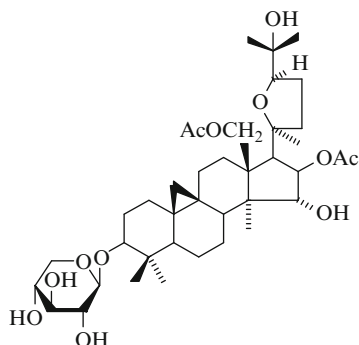
δ_C (C ₅ D ₅ N)							
C-1	32.4	C-11	25.8	C-21	27.7	β -D-Xylp	
2	30.0	12	30.2	22	36.8	1	107.3
3	88.3	13	49.8	23	26.1	2	75.3
4	41.3	14	49.8	24	83.7	3	78.3
5	47.7	15	83.7	25	70.3	4	71.0
6	21.0	16	83.7	26	26.6	5	66.9
7	26.3	17	54.3	27	27.5		Ac
8	48.6	18	67.2	28	13.8		21.5
9	20.2	19	31.2	29	26.6		21.7
10	26.9	20	84.5	30	15.4		170.1
							170.4

References

1. N. Sakurai, M. Nagai, H. Nagase, K. Kawai, T. Inoue, P. Xiao, Chem. Pharm. Bull. **34**(2), 582–589 (1986)

Beesioside II

C₃₉H₆₂O₁₂, M 722



Taxonomy: Cycloartane Glycosides

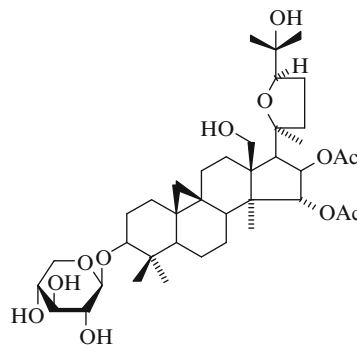
Beesia calthaefolia Maxim. (*Ranunculaceae*) [1].

Amorphous powder, mp 149–151°C, $[\alpha]_D^{15} +9.3^\circ$ (c 0.8, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 1745, 1730, 1260, 1050.

Beesioside J

C₃₉H₆₂O₁₂, M 722



Taxonomy: Cycloartane Glycosides

Beesia calthaefolia (Maxim.) Ulber. (*Ranunculaceae*) [1].

Mp 198–202°C (from EtOAc–MeOH), $[\alpha]_D^{20} +15.1^\circ$ (c 0.16, EtOAc–MeOH, 3:7).

IR ν_{\max}^{KBr} , cm⁻¹: 3530, 3400, 2965, 2935, 1725, 1465, 1370, 1270, 1230, 1090, 1045, 990, 980.

Positive ion FABMS m/z: 723 [M + H]⁺, 705, 681, 663, 591, 573, 453, 435, 417, 308, 143 (100), 125.

Positive ion HRFABMS m/z: 723.43199 [M + H]⁺.

Table 1

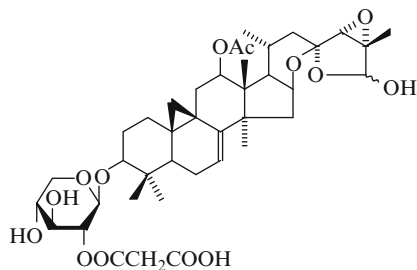
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.2	C-21	27.2 1.36 s
2	30.3	22	36.6
3	88.3 3.42 dd (11.5, 4.1)	23	25.4
4	41.2	24	84.2 3.84 t (7.2)
5	46.8	25	70.0
6	20.5 0.37 q (12)	26	27.6 1.17 s
7	26.6	27	28.0 1.49 s
8	47.4	28	14.3 1.27 s
9	19.8	29	25.7 1.23 s
10	26.2	30	15.3 0.89 s
11	26.0	β -D-Xylp	
12	29.6	1	107.3 4.77 d (7.4)
13	52.7	2	75.3 3.94 t (8)
14	48.6	3	78.4 4.08 t (8.7)
15	84.8 6.33 d (4.7)	4	71.1 4.15 m
16	79.2 5.96 dd (10, 4.7)	5	66.9 3.67 t (10.7), 4.29 dd (11.2, 5)
17	53.5 2.76 d (10)	Ac	171.5 –
18	64.9 4.15 m, 4.39 dd (11.8, 7.8)		170.8 –
19	29.9 0.16 d (3.5), 0.42 d (3.5)		21.7 2.06 s
20	84.3		21.4 2.09 s

References

- J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

2'-O-Malonylcimicifugoside

$C_{40}H_{56}O_{14}$, M 760



Taxonomy: Cycloartane Glycosides

Cimifuga simplex Wormsk. (*Ranunculaceae*) [1].

$[\alpha]_D -55.9^\circ$ (c 0.88, MeOH).

CAS Registry Number: 245513-55-7.

IR ν_{max}^{KBr} , cm^{-1} : 3650–3200, 1737.

Positive SIMS m/z : 105 [$C_3H_4O_4 + H$]⁺, 783 [$M + Na$]⁺.

Positive HRSIMS m/z : 783.3558 [$M + Na$]⁺.

Table 1

δ_C (C_5D_5N) ^a	δ_H (J/Hz) ^a	δ_C (C_5D_5N) ^a	δ_H (J/Hz) ^a
C-1	30.02	1.14, 1.54	C-23 105.86 –
2	29.20	1.82, 2.14	24 63.36 3.94 s
3	87.96	3.35 dd (11.5, 4)	25 65.60 –
4	40.07 –		26 98.29 5.74 s
5	42.25 1.16		27 13.07 1.79 s
6	21.72 1.54, 1.80		28 26.75 1.00 s
7	113.87 5.04 dd (7.5, 1.5)		29 25.56 1.16 s
8	147.65 –		30 14.01 0.99 s
9	21.20 –	β -D-Xylp	
10	28.18 –	1	104.5 4.84 d (8)
11	36.57 1.22, 2.91 dd (16, 8.5)	2	76.76 5.59 dd (8.5, 8)
12	76.44 5.19 d (8.5)	3	76.04 4.19
13	47.99 –	4	70.98 4.20
14	50.52 –	5	66.99 3.68 dd (11, 10)
15	42.34 1.90, 2.00		4.31 dd (11, 5)
16	73.14 4.70	Ac	170.80 –
17	56.79 1.78		21.64 2.21 s
18	14.77 1.38 s	Malonyl	
19	28.66 0.51 d (4), 1.10 d (4)	1	167.34 –
20	25.77 1.86	2	42.34 3.86 (2 H)
21	20.96 0.96 d (6.5)	3	169.58 –
22	37.31 1.68, 2.20		

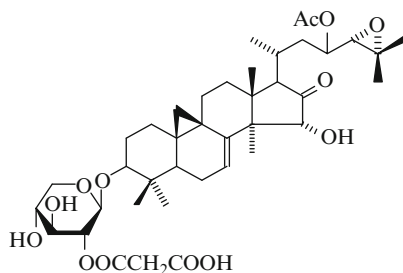
^aSignals due to the major compound (26S) of the 26-isomers

References

- A. Kusano, M. Shibano, G. Kusano, *Chem. Pharm. Bull.* **47**(8), 1175–1179 (1999)

23-O-Acetyl-7,8-didehydroshengmanol-3-O-β-D-(2-O-malonyl)-xylopyranoside

C₄₀H₅₈O₁₃, M 746



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

[α]_D −16.7° (c 0.39, MeOH).

CAS Registry Number: 245494-48-8.

IR ν_{max}^{KBr}, cm^{−1}: 3650–3200, 1735.

Positive SIMS m/z: 105 [C₃H₄O₄ + H]⁺, 747 [M + H]⁺, 769 [M + Na]⁺.

Negative SIMS m/z: 103 [C₃H₄O₄][−], 659 [M-87][−].

Positive HRSIMS m/z: 769.3762 [M + Na]⁺.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	29.95	C-22	37.24
2	29.22	23	71.96
3	88.23	24	65.21
4	40.07	25	58.58
5	42.40	26	24.72
6	21.77	27	19.35
7	114.94	28	18.80
8	147.14	29	25.59
9	21.42	30	14.08
10	28.41	β-D-Xylp	
11	25.13	1	104.08
12	33.45	2	76.43
13	40.77	3	76.09
14	49.38	4	71.00
15	80.70	5	67.02

(continued)

Table 1 (continued)

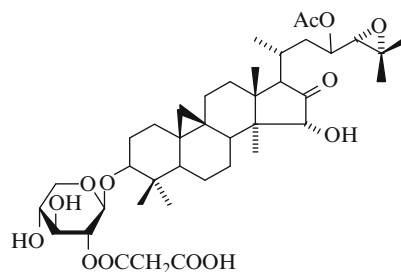
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
16	220.37	–	4.34 dd (11, 5)
17	60.04	2.30 d (8)	Ac 170.68 –
18	21.77	1.29 s	20.99 2.05 s
19	27.77	0.50 d (4), 1.01 d (4)	Malonyl
20	28.41	2.14	1 167.23 –
21	19.79	1.24 d (6.5)	2 42.40 3.89 (2H)
		3	169.53 –

References

1. A. Kusano, M. Shisano, G. Kusano, *Chem. Pharm. Bull.* **47**(8), 1175–1179 (1999)

23-O-Acetylshengmanol-3-O-β-D-(2-O-malonyl)-xylopyranoside

C₄₀H₆₀O₁₃, M 748



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

[α]_D −19.6° (c 1.59, MeOH).

IR ν_{max}^{KBr}, cm^{−1}: 3650–3200, 1738.

Positive SIMS m/z: 105 [C₃H₄O₄ + H]⁺, 749 [M + H]⁺.

Negative SIMS m/z: 103 [C₃H₄O₄][−], 661 [M-87][−].

Positive HRSIMS m/z: 749.4123 [M + H]⁺.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.06	C-22	36.91
2	29.93	23	72.08
3	88.60	24	65.14

(continued)

Table 1 (continued)

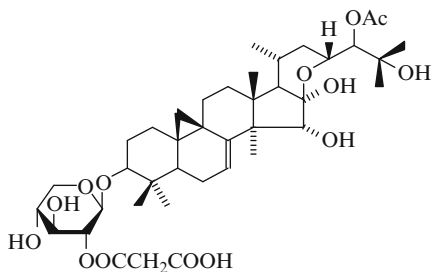
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	40.98	–	25 58.58
5	47.31	1.35	26 24.69
6	20.98	0.75, 1.57	27 19.33
7	26.65	1.25, 2.08	28 11.95
8	48.24	1.83	29 25.54
9	20.07	–	30 15.26
10	26.65	–	β -D-Xylp
11	25.90	1.18, 2.10	1 104.20
12	32.98	1.80 (2H)	2 76.12
13	41.50	–	3 75.37
14	46.02	–	4 70.98
15	82.80	4.36 s	5 67.00
16	220.78	–	4.32 dd (11, 5)
17	59.92	2.34 d (6.5)	Ac 170.67
18	19.80	1.36 s	20.98
19	30.41	0.28 d (4), 0.53 d (4)	Malonyl
20	27.90	2.12	1 168.11
21	20.33	1.26 d (6.5)	2 42.40
			3 169.50

References

1. A. Kusano, M. Shisano, G. Kusano, Chem. Pharm. Bull. **47**(8), 1175–1179 (1999)

24-*epi*-24-O-Acetyl-7,8-didehydroshengmanol-3-O- β -D-(2-O-malonyl)-xylopyranoside

C₄₀H₆₀O₁₄, M 764



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

$[\alpha]_D -8.0^\circ$ (c 0.52, MeOH).

CAS Registry Number: 245494-50-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3650–3200, 1742.

Positive SIMS m/z: 105 [C₃H₄O₄ + H]⁺, 787 [M + Na]⁺.

Positive HRSIMS m/z: 787.3867 [M + Na]⁺.

Table 1

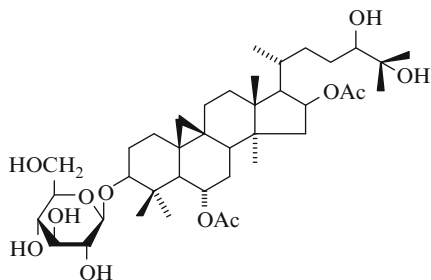
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	30.08	1.34, 1.64	C-22 32.66
2	29.19	1.91, 2.22	23 74.02
3	88.25	3.39 dd (11.5, 4)	24 81.26
4	40.01	–	25 72.00
5	42.41	1.26	26 27.12
6	21.65	1.55, 1.88	27 27.06
7	113.31	5.98 dd (7, 1.5)	28 18.06
8	150.02	–	29 25.53
9	21.10	–	30 14.04
10	28.20	–	β -D-Xylp
11	25.29	1.16, 2.15	1 104.01
12	33.71	1.66, 1.82	2 76.37
13	41.46	–	3 76.06
14	49.84	–	4 70.86
15	79.84	4.44 s	5 66.96
16	102.97	–	Ac 170.47
17	60.56	1.80	21.05
18	22.45	1.24 s	Malonyl
19	28.20	0.46 d (4), 1.02 d (4)	1 167.48
20	26.92	1.78	2 41.46
21	21.52	1.01 d (6.5)	3 169.72

References

1. A. Kusano, M. Shibano, G. Kusano, Chem. Pharm. Bull. **47**(8), 1175–1179 (1999)

Cyclounifolioside A

C₄₀H₆₆O₁₂, M 738



Taxonomy: Cycloartane Glycosides

Astragalus unifoliolatus Bunge (*Leguminosae*) [1].

Mp 208–210°C (from MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3435, 3050, 1734, 1251.

Table 1

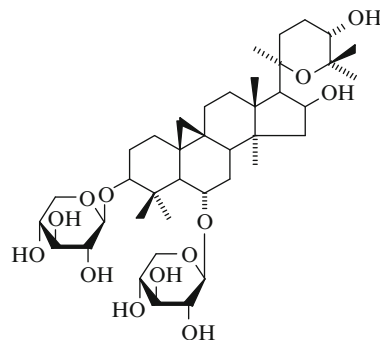
	δ_{C} (C ₅ D ₅ N)	δ_{H} (C ₅ D ₅ N)		δ_{C} (C ₅ D ₅ N)	δ_{H} (C ₅ D ₅ N)
C-1	32.00	1.57, 1.14	C-21	18.50	1.04
2	29.80	2.49, 1.89	22	34.10	2.08, 1.11
3	87.95	3.56	23	30.10	2.13, 1.52
4	42.10	–	24	79.30	3.68
5	50.00	1.76	25	72.10	–
6	70.70	4.98	26	25.90	1.55
7	32.60	1.61, 1.59	27	25.70	1.52
8	45.30	1.83	28	19.80	0.93
9	20.80	–	29	27.00	1.42
10	28.40	–	30	16.60	1.21
11	25.90	1.82, 1.25	β-D-Glcp		
12	33.25	1.62, 1.40	1	106.70	4.94
13	46.90	–	2	75.50	4.06
14	45.95	–	3	78.40	4.29
15	45.60	2.13, 1.25	4	71.70	4.18
16	75.50	5.51	5	78.10	4.02
17	55.30	1.92	6	62.80	4.57, 4.37
18	18.10	1.12	Ac	21.45	2.26
19	28.80	0.23, 0.52		21.8	2.10
20	31.70	1.98		170.70	–
				171.1	

References

1. K.J. Kucherbaev, K.K. Uteniyazov, V.V. Kachala, Z. Saatov, A.S. Shashkov, *Chem. Nat. Comp.* **38**(2), 175–178 (2002)

Cyclodisectoside

C₄₀H₆₆O₁₃, M 754



Taxonomy: Cycloartane Glycosides

Astragalus dissectus B.Fedtsch. et N.Ivanova (*Leguminosae*) [1].

CAS Registry Number: 270903-12-3.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.14 and 0.58 (2H-19, d, J = 4 Hz), 1.09, 1.27, 1.31, 1.44, 1.56, 1.65, 1.93 (7 × CH₃, s), 2.13 (H-17, d, J = 7.5 Hz), 3.11 (H-22, m), 3.46 (H-3, dd, J = 12, 4 Hz), 4.80 (2 × Xylp H-1, d, J = 8 Hz), 4.93 (H-16, m).

Table 1

δ_{C} (C ₅ D ₅ N)						
C-1	32.11	C-11	26.70	C-21	28.84	3-O-β-D-Xylp
2	30.11	12	34.14	22	26.79	1
3	88.42	13	46.03	23	24.11	2
4	42.60	14	46.80	24	68.77	3
5	52.35	15	47.26	25	75.25	4
6	78.55 ^a	16	73.98	26	28.63	5
7	34.24	17	60.76	27	28.16	6-O-β-D-Xylp
8	44.91	18	20.43	28	19.96	1
9	21.19	19	29.59	29	28.16	2
10	28.16	20	79.00	30	16.71	3
						4
						5

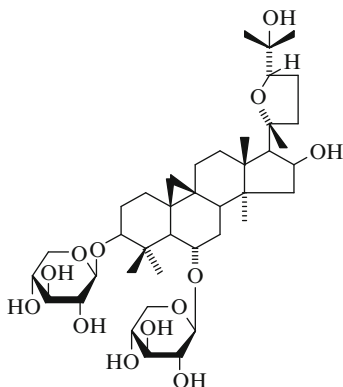
^aSignals are mutually imposed

References

1. I.A. Sukhina, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **35**(4), 442–444 (1999)

Cyclosieversioside E (astrasieversianin X)

C₄₀H₆₆O₁₃, M 754



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1–3].

Astragalus pteroccephalus Bunge (*Leguminosae*) [2, 4].

Astragalus schahrudensis Bunge (*Leguminosae*) [2, 5].

Astragalus basineri Trautv. (*Leguminosae*) [2, 6].

Astragalus dissectus B. Fedtsch. et N. Ivanova
(*Leguminosae*) [7].

Astragalus uninodus M. Pop. et Vved. (*Leguminosae*) [8].

Astragalus exilis A. Kor. (*Leguminosae*) [9].

Astragalus alexandrinus Boiss. (*Leguminosae*) [10].

Astragalus melanophrurius Boiss. (*Leguminosae*)
[11].

Mp 218–220°C (from MeOH), $[\alpha]_D^{20} +29.9^\circ$ (c 0.67,
MeOH).

CAS Registry Number: 83008-44-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3200.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.12 and 0.57
(2H-19, d, J = 4 Hz), 1.05, 1.24, 1.26,
1.26, 1.38, 1.55, 1.89 (7 × CH₃, s), 2.56 (H-17,
d, J = 8 Hz), 3.11 (H-22, m), 3.44 (H-3, dd, J =
12, 4 Hz), 3.86 (H-24, dd, J = 10, 5 Hz), 4.83 and

4.85 (2H-1 of D-Xylp, d, J = 7.5 Hz), 5.03 (H-16, q,
J = 8 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	31.87	C-11	26.33	C-21	28.38	3-O- β - D-Xylp	
2	29.93 ^a	12	33.35	22	34.82	1	107.38
3	88.26	13	45.09	23	26.17	2	75.38
4	42.45	14	45.72	24	81.57	3	78.30 ^b
5	52.03	15	46.07	25	71.21	4	71.09
6	78.30 ^b	16	73.37	26	26.95	5	66.77
7	33.50	17	58.02	27	27.99 ^c	6-O- β - D-Xylp	
8	44.22	18	20.41	28	19.57	1	105.52
9	21.07	19	29.93 ^a	29	28.45	2	75.19
10	27.99 ^c	20	87.20	30	16.54	3	77.80
						4	70.93
						5	66.76

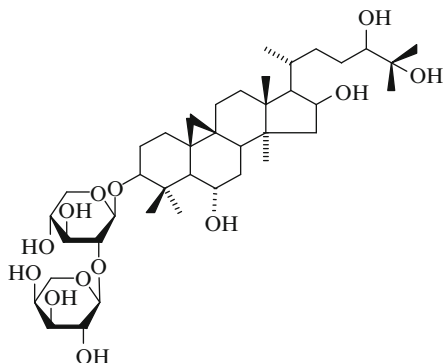
^{a,b,c}Signals are mutually imposed

References

1. A.N. Svechnikova, R.U. Umarova, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **18**(2), 186–189 (1982)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
3. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**, 2389–2393 (1986)
4. M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(1), 115–116 (1986)
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Askendoside C

C₄₀H₆₈O₁₃, M 756



Taxonomy: Cycloartane Glycosides

Astragalus taschkendicus Bunge (*Leguminosae*) [1].

Mp 197–198°C (from MeOH), $[\alpha]_D^{23} +27.3^\circ$ (c 1.1, MeOH).

CAS Registry Number: 86341-54-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3470–3340, 3040.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.27 and 0.54 (2H-19, d, J = 4 Hz), 0.97 (CH₃, s), 1.08 (CH₃-21, d, J = 6 Hz), 1.33, 1.36, 1.41, 1.44, 1.91 (5 × CH₃, s), 4.68 (H-16, m), 4.87 (H-1 of D-Xylp, d, J = 6 Hz), 5.16 (H-1 of L-Arap, d, J = 6 Hz) [2].

Table 1

δ_C (C₅D₅N) [2]

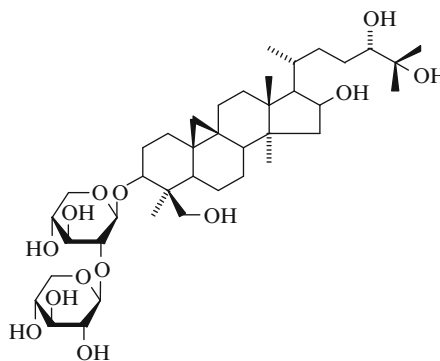
C-1	32.45	C-11	26.25	C-21	18.92	β -D-Xylp	
2	29.13	12	33.11	22	34.78	1	105.53
3	88.44	13	45.61	23	29.33	2	83.47
4	42.67	14	46.78	24	80.42	3	77.48
5	53.98	15	48.55	25	72.68	4	70.25
6	67.91	16	71.67	26	25.81	5	66.48
7	38.33	17	57.20	27	26.01	α -L-Arap	
8	46.92	18	18.71	28	20.14	1	106.52
9	21.25	19	29.95	29	28.54	2	73.51
10	30.29	20	31.51	30	16.18	3	74.16
						4	69.02
						5	66.90

References

1. M.I. Isaev, M.B. Gorovits, T.T. Gorovits, N.D. Abdullaev, N.K. Abubakirov, *Chem. Nat. Comp.* **19**(2), 163–169 (1983)
2. M.I. Isaev, *Chem. Nat. Comp.* **31**(6), 690–693 (1995)

No Name (9,19-Cyclolanostan-16 β ,24S,25,30-tetrol-3-O-[[β -D-Xylopyranosyl-(1 \rightarrow 2)- β -D-xylopyranoside]])

C₄₀H₆₈O₁₃, M 756



Taxonomy: Cycloartane Glycosides

Thalictrum smithii Boivin (*Ranunculaceae*) [1].

Mp 211–213°C.

CAS Registry Number: 245462-73-1.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	31.3	1.16, 1.40	C-22	32.3	1.11, 1.66
2	28.9	1.63, 1.89	23	27.1	1.28, 1.42
3	88.6	3.25	24	76.6	3.16
4	43.9	–	25	71.5	–
5	47.4	1.28	26	25.9	1.03
6	21.3	0.91, 1.55	27	24.8	0.99
7	26.1	0.99, 1.23	28	19.8	0.80
8	47.8	1.43	29	19.7	1.03

(continued)

Table 1 (continued)

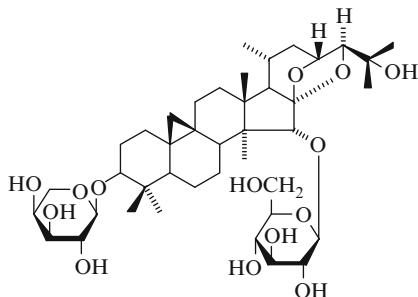
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
9	20.2	30	65.3
10	24.9	β -D-Xylp	
11	25.5	1	103.6
12	32.4	2	79.7
13	44.7	3	75.8
14	46.0	4	69.2
15	48.1	5	65.1
16	70.5	β -D-Xylp	
17	56.2	1	103.8
18	17.6	2	74.1
19	29.2	3	75.8
20	28.3	4	69.2
21	17.6	5	65.6

References

1. S.C. Yu, Q.L. Wu, L.W. Wang, P.G. Xiao, Chin. Chem. Lett. **10**(6), 485–486 (1999)

3-O- α -L-Arabinopyranosylcimigenol-15-O- β -D-glucopyranoside

C₄₁H₆₀O₁₄, M 776



Taxonomy: Cycloartane Glycosides

Cimicifuga dahurica (Turcz.) Maxim.

(*Ranunculaceae*) [1].

Mp 224–225°C (from MeOH), [α]_D +15.9° (c 0.32, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3450, 3034, 1634, 1450, 1065, 987.

FABMS m/z: 777 [M + H]⁺.

Table 1

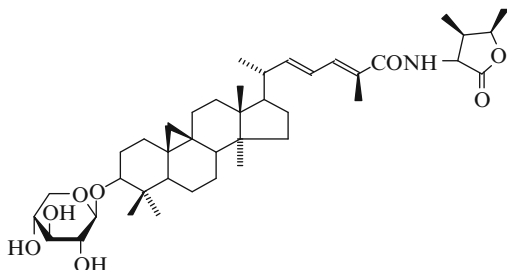
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	33.0	C-22	38.3
2	30.5	23	71.6
3	88.9	24	89.8
4	41.4	25	71.0
5	47.9	26	26.1
6	21.9	27	27.8
7	26.8	28	13.1
8	49.1	29	26.1
9	20.7	30	15.8
10	27.0	α -L-Arap	
11	26.3	1	107.6
12	34.2	2	73.1
13	41.5	3	74.9
14	47.8	4	69.7
15	88.3	5	66.9
16	111.8	β -D-Glcp	
17	59.7	1	105.3
18	20.1	2	75.9
19	31.4	3	78.7
20	24.3	4	72.7
21	20.2	5	78.1
		6	62.3

References

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Mussaendoside B

C₄₁H₆₃NO₈, M 697



Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait.f. (*Rubiaceae*) [1].

Mp 194–197°C, [α]_D +33.4° (c 0.26, MeOH).

UV λ_{max}^{MeOH}, nm (ε): 264.5 (5648).

FABMS m/z: 720 [M + Na]⁺, 698 [M + H]⁺, 566 [M + H-Xylose]⁺.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.08	C-22	147.96 5.50 dd (15, 9)
2	29.81	23	123.50 6.40 dd (15, 11)
3	88.66 3.36 dd (10, 4.3)	24	124.87 7.26 d (11)
4	41.88 –	25	129.20 –
5	47.74	26	13.66 2.18 s
6	21.27	27	170.67
7	26.66	28	19.64 1.42 s
8	47.97	29	25.43 1.14 s
9	20.29 –	30	15.60 0.97 s
10	26.28 –	1'	175.60 –
11	25.85	2'	55.68 5.69 dd (7.4, 5.0)
12	33.18	3'	38.80 2.98 ddq (7.4, 7.2, 4.3)
13	45.91 –	4'	78.50 4.65 dq (6.5, 4.3)
14	49.39 –	3'-Me	8.07 0.84 d (7.2)
15	35.92	4'-Me	15.60 1.14 d (6.5)
16	28.83	NH	9.16 d (5)
17	52.24	β-D-Xylp	
18	18.50 0.88 s	1	107.40
19	30.15 0.24 d (4), 0.48 d (4)	2	75.56

(continued)

Table 1 (continued)

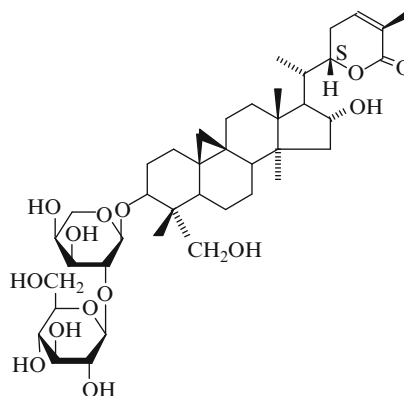
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
20	41.48	3	77.38
21	20.03 0.96 d (6.8)	4	71.35
		5	67.09

References

1. J. Xu, R. Xu, Z. Luo, J. Dong, *Huaxue Xuebao* **49**(6), 621–624 (1991)

Aquilegioside B

C₄₁H₆₄O₁₄, M 780



Taxonomy: Cycloartane Glycosides

Aquilegia flabellata Sieb. et Zucc. var *flabellata* (*Ranunculaceae*) [1].

[α]_D²⁵ +13.2° (c 0.38, MeOH).

CAS Registry Number: 235777-22-7.

Negative ion FABMS m/z: 779 [M-H]⁻.

HRFABMS m/z: 803.42 [M + Na]⁺.

¹H NMR (C₅D₅N, δ): 0.32 and 0.56 (2H-19, d, J = 3.7 Hz), 1.07, 1.12, 1.22 and 1.82 (4 × CH₃, s), 1.12 (CH₃-21, d, J = 6.1 Hz), 3.79 (H-5 Arap, brd, J = 11.0 Hz), 3.84 (H-5 Glcp, m), 4.10 (H-2 Glcp, dd, J = 7.3, 7.9 Hz), 4.18 (H-3 Glcp, dd, J = 7.9, 8.5 Hz), 4.25 (H-4, Glcp, m), 4.26 (H-5, Arap, m), 4.30 (H-3 Arap, m), 4.32 (H-4 Arap, m), 4.39 (H-6

Glc_p, m), 4.48 (H-6 Glc_p, brd, J = 12.2 Hz), 4.61 (H-2 Arap, dd, J = 5.5, 7.3 Hz), 5.21 (H-1 Glc_p, d, J = 7.3 Hz), 5.27 (H-1 Arap, d, J = 5.5 Hz), 5.45 (H-22, dd, J = 4.0, 12.2 Hz), 6.45 (H-24, d, J = 6.1 Hz).

Table 1

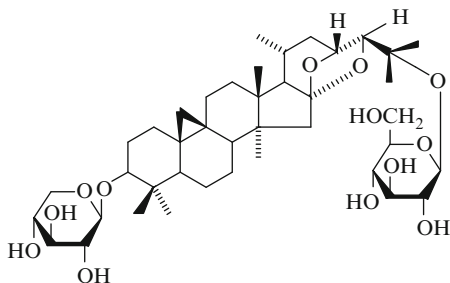
δ_C (C ₅ D ₅ N)							
C-1	32.2	C-11	26.6	C-21	13.3	α -L-Arap	
2	29.3	12	32.9	22	79.6	1	103.6
3	82.1	13	46.8	23	28.3	2	81.4
4	45.5	14	47.7	24	140.4	3	73.6
5	40.9	15	48.7	25	128.0	4	68.1
6	21.0	16	77.2	26	166.4	5	64.8
7	26.3	17	57.2	27	17.2	β -D-Glc _p	
8	48.2	18	19.0	28	20.6	1	106.0
9	19.3	19	30.3	29	64.2	2	76.2
10	26.1	20	39.7	30	11.9	3	78.4
						4	71.4
						5	78.3
						6	62.5

References

1. H. Yoshimitsu, M. Nishida, F. Hashimoto, T. Nohara, *Phytochemistry* **51**(3), 449–452 (1999)

Cycloorbicoside C

C₄₁H₆₆O₁₃, M 766



Taxonomy: Cycloartane Glycosides

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1].

Mp 265–266°C (from MeOH).

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3520–3290, 3050.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.26 and 0.53 (2H-19, d, J = 4 Hz), 0.83 (CH₃-21, d, J = 6.2 Hz), 1.08 (CH₃-30, s), 1.11 (CH₃-18, s), 1.21 (CH₃-28,

s), 1.36 (CH₃-29, s), 1.51 (CH₃-27, s), 1.64 (CH₃-26, s), 3.53 (H-3, dd, J = 11.8, 4 Hz), 3.76 (Xylp H-5a, dd, J = 11.2, 10.1 Hz), 3.79 (H-24, brs), 3.98 (Glc_p H-5, m), 3.99 (Glc_p H-2, dd, J = 9, 7.7 Hz), 4.06 (Xylp H-2, dd, J = 8.7, 7.6 Hz), 4.21 (Xylp H-3, t, J = 8.6 Hz), 4.22–4.29 (Glc_p H-3, H-4 and Xylp H-4, m), 4.34–4.42 (Xylp H-5e and Glc_p H-6, m), 4.54 (Glc_p H-6', dd, J = 11.8, 2.6 Hz), 4.89 (Xylp H-1, d, J = 7.5 Hz), 4.92 (H-23, brd, J = 8 Hz), 5.15 (Glc_p H-1, d, J = 7.7 Hz).

Table 1

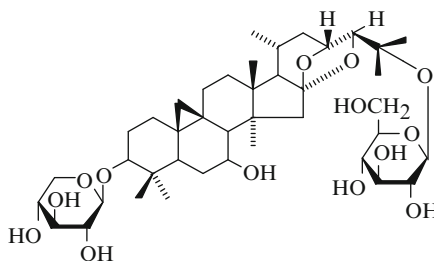
δ_C (C ₅ D ₅ N)							
C-1	32.16	C-11	26.56	C-21	19.79	β -D-Xylp	
2	30.08	12	33.07	22	38.16	1	107.52
3	88.47	13	44.60	23	71.86	2	75.55
4	41.36	14	46.27	24	88.28	3	78.56
5	47.54	15	46.61	25	78.76	4	71.24
6	20.98	16	114.89	26	22.22	5	67.08
7	26.59	17	61.30	27	24.47	β -D-Glc _p	
8	47.57	18	19.21	28	19.33	1	98.81
9	19.60	19	30.46	29	25.76	2	75.23
10	26.77	20	23.91	30	15.43	3	78.83
						4	71.81
						5	78.19
						6	62.92

References

1. R.P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **38**(6), 570–573 (2002)

Cycloorbicoside G

C₄₁H₆₆O₁₄, M 782



Taxonomy: Cycloartane Glycosides

Astragalus orbiculatus Ledeb. (*Leguminosae*) [1].

Mp 247–249°C (from MeOH), $[\alpha]_D^{24}$ 0° (c 0.69, MeOH).

CAS Registry Number: 114317-53-2.

^1H NMR (100 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-HMDS): 0.16 and 0.60 (2H-19, d, $J = 4$ Hz), 0.71 (CH_3 -21, d, $J = 6$ Hz), 0.93, 1.07, 1.19, 1.28, 1.28, 1.44 ($6 \times \text{CH}_3$, s), 2.40 and 2.62 (2H-15, d, $J = 14$ Hz), 3.38 (H-3, m), 3.63 (H-24, s), 4.71 (Xylp H-1, d), 4.73 (H-23, brd), 4.95 (Glc p H-1, d, $J = 8$ Hz).

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)						
C-1	31.89 ^a	C-11	26.75	C-21	19.97	β -D-Xylp
2	29.67	12	33.03	22	38.29	1 107.52
3	88.23 ^b	13	44.19	23	71.71 ^c	2 75.50
4	41.05	14	46.74	24	88.23 ^b	3 78.54
5	46.58	15	48.85	25	78.75 ^e	4 71.17
6	31.89 ^a	16	115.21	26	22.09	5 67.05
7	70.08	17	60.66	27	24.52	β -D-Glcp
8	55.24	18	18.94 ^d	28	18.94 ^d	1 98.74
9	19.65	19	29.94	29	25.72	2 75.18
10	27.18	20	23.82	30	15.31	3 78.75 ^c
						4 71.71 ^c
						5 78.10
						6 62.82

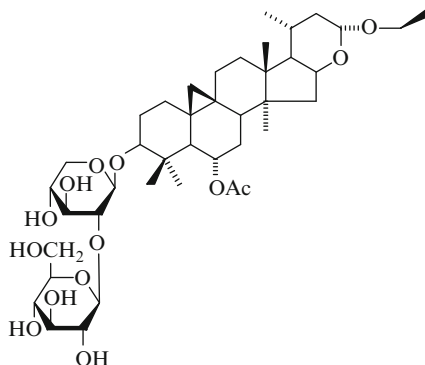
a,b,c,d,e Signals are mutually imposed

References

1. M.A. Agzamova, M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **23**(6), 696–700 (1987)

Tomentoside IV

$\text{C}_{41}\text{H}_{66}\text{O}_{14}$, M 782



Taxonomy: Cycloartane Glycosides

Astragalus tomentosus Lam. (*Leguminosae*) [1].

Mp 178–180°C, $[\alpha]_D^{25}$ –17.5° (c 0.29, MeOH).

IR ν_{max} , cm^{-1} : 3392, 2945, 1733, 1461, 1369, 1243.

EIMS m/z (%): 604 (5.2), 578 (10.4), 382 (20.8), 369 (31.2), 340 (53.7), 314 (59.3), 265 (100).

HRFABMS m/z : 782.4466 $[\text{M}]^+$.

Table 1

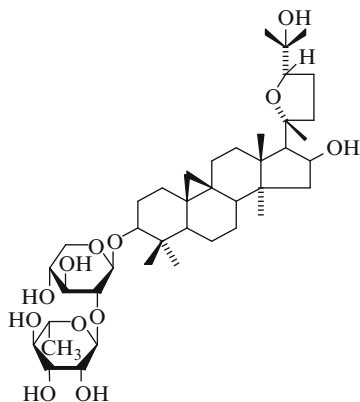
δ_C ($\text{C}_5\text{D}_5\text{N}$)					
δ_C ($\text{C}_5\text{D}_5\text{N}$)	δ_H (J/Hz)	δ_C ($\text{C}_5\text{D}_5\text{N}$)		δ_H (J/Hz)	
C-1	31.8	1.23 m, 1.60 m	C-22	33.2	1.49 m
2	30.0	1.92 m, 2.32 m	23	99.1	4.93 m
3	87.4	3.43 dd (4.4, 11.6)	28	19.3	0.93 s
4	42.3	–	29	26.8	1.34 s
5	56.5	1.52 m	30	16.3	1.26 s
6	70.2	4.93 m	β -D-Xylp		
7	38.1	1.25 m, 1.82 m	1	106.3	4.85 d (6.8)
8	49.8	1.76 m	2	83.6	4.22 t (6.8)
9	21.0	–	3	78.1	4.23 m
10	28.0	–	4	71.0	4.15 dt (5.2, 8.4)
11	26.0	1.74 m	5	66.8	4.30 d (10), 3.70 d (5.2)
12	32.9	1.43 m, 1.78 m	β -D-Glcp		
13	44.2	–	1	105.6	5.34 d (7.6)
14	46.0	–	2	77.1	4.19 dd (7.6, 9.5)
15	43.2	1.48 m, 1.83 m	3	78.4	3.93 t (9.5)
16	70.5	4.40 m	4	71.7	4.32 m
17	44.8	1.91 m	5	78.1	3.94 m
18	19.8	1.08 s	6	70.2?	4.44 dd (12, 3), 3.84 dd (12, 5)
19	27.5	0.16 d (4.4), 0.47 d (4.4)	OEt	62.7	3.48 q (7.2), 3.88 q (6.8)
20	25.6	1.62 m	15.7	–	1.19 t (6.8)
21	20.6	0.85 d (6)	Ac	21.7	2.00 s
				170.3	–

References

1. M.M. Radwan, A. Farooq, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, *J. Nat. Prod.* **67**(3), 487–490 (2004)

Quisvaloside B

C₄₁H₆₈O₁₂, M 752



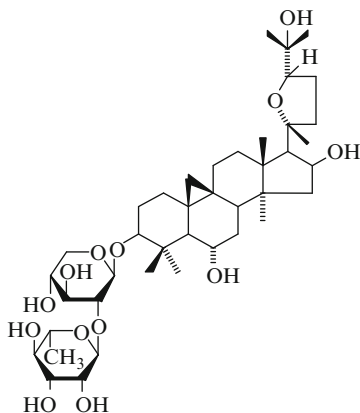
Taxonomy: Cycloartane Glycosides
Astragalus quisqualis Bunge (*Leguminosae*) [1].

References

1. L.A. Kholzineva, A.A. Savina, I.R. Maldonado, in *XIIIth Conference on Isoprenoids: Abstracts of Papers. Pec Pod Shezkou Czechoslovakia*, 1987, pp. 86–87

Astrachryoside A

C₄₁H₆₈O₁₃, M 768



Taxonomy: Cycloartane Glycosides

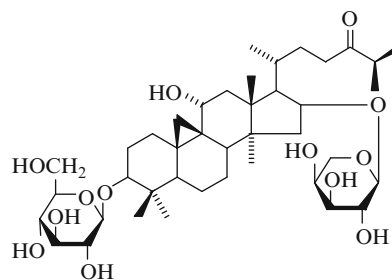
Astragalus chrysopterus Bunge (*Leguminosae*) [1, 2].
CAS Registry Number: 132160-35-1.

References

1. H.K. Wang, K.He, L.Q. Lin, in *16th International Symposium on the Chemistry of Natural Products (IUPAC: Abstracts)*. (Kyoto, 1988), p. 219
2. H.K. Wang, K. He, H.X. Xu, Z.L. Zhang, Y.F. Wang, T. Kikuchi, Y. Tezuka, *Yaoxue Xuebao* **25**(6), 445–450 (1990). *C.A.*, 114:98114k (1991)

Curculigosaponin C

C₄₁H₆₈O₁₃, M 768



Taxonomy: Cycloartane Glycosides
Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].
Mp 180–183°C, [α]_D +25.15° (c 0.21, MeOH).
CAS Registry Number: 136771-44-3.

FABMS m/z: 791 [M + Na]⁺, 807 [M + K]⁺, 629 [M + Na-162]⁺, 611 [629-H₂O]⁺, 457 [M + H-162-132-H₂O]⁺, 439 [457-H₂O]⁺.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.30 and 0.47 (2H-19, d, J = 3.7 Hz), 0.97 and 0.99 (CH₃-26 and CH₃-27, d, J = 6.5 Hz), 1.04, 1.28, 1.32, 1.37 (4 × CH₃, s), 2.68 (H-25, septet, J = 6.5 Hz), 4.59 (Arap H-1, d, J = 6.8 Hz), 4.95 (Glc p H-1, d, J = 7.8 Hz).

Table 1

δ _C (C ₅ D ₅ N)							
C-1	32.16	C-11	72.31	C-21	16.82	β-D-Glcp	
2	29.63	12	40.93	22	31.38	1	106.77
3	88.87	13	47.16	23	38.75	2	75.85
4	40.21	14	50.00	24	215.37	3	78.76

(continued)

Table 1 (continued)

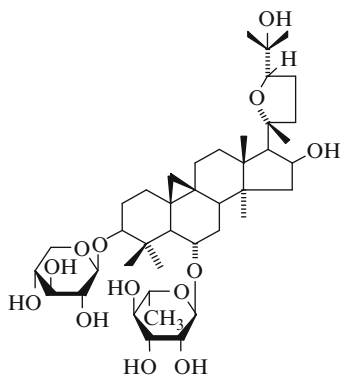
δ_C (C ₅ D ₅ N)							
5	47.96	15	50.06	25	41.38	4	71.95
6	21.48	16	82.57	26	18.45	5	78.14
7	26.81	17	49.41	27	18.45	6	63.14
8	49.26	18	22.15	28	18.61	α -L-Arap	
9	20.14	19	30.01	29	25.70	1	107.26
10	26.29	20	30.27	30	15.58	2	72.93
						3	74.51
						4	69.40
						5	66.76

References

1. J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Cyclocarposide

C₄₁H₆₈O₁₃, M 768



Taxonomy: Cycloartane Glycosides

Astragalus coluteocarpus Boiss. (*Leguminosae*) [1, 2].
Mp 284–285°C (from MeOH), $[\alpha]_D^{24}$ -28° (c 1.0, C₅D₅N).

CAS Registry Number: 135101-62-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3260, 3055.

¹H NMR (100 MHz, C₅D₅N, δ , 0-TMS): 0.10 and 0.30 (2H-19, d, J = 4 Hz), 0.83, 0.98, 1.15, 1.15, 1.25, 1.35, 1.43 (7 × CH₃, s), 1.43 (CH₃ of Rhap), 4.60 (Xylp H-1, d, J = 7 Hz), 4.90 (H-16, m), 5.15 (Rhap H-1, brs).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.20	C-11	26.38	C-21	28.42	β -D-Xylp	
2	30.06	12	33.27	22	34.88	1	107.43
3	87.83	13	45.00	23	25.95	2	75.38
4	42.26	14	46.16 ^a	24	81.67	3	78.44
5	52.03	15	46.67	25	71.22	4	71.14
6	79.16	16	73.33	26	27.05	5	66.96
7	34.55	17	58.23	27	28.11	α -L-Rhap	
8	46.16 ^a	18	21.47	28	20.16	1	103.88
9	20.65	19	30.22	29	28.51	2	72.87
10	28.70	20	87.15	30	17.05	3	72.56
						4	73.71
						5	70.06
						6	18.16

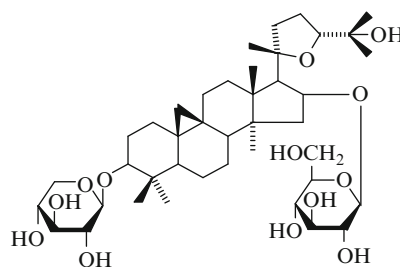
^aSignals are mutually imposed

References

1. B.A. Imomnazarov, M.I. Isaev, S.S. Saboiev, N.K. Abubakirov, *Chem. Nat. Comp.* **26**(5), 555–558 (1990)
2. B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **28**(2), 195–198 (1992)

Prusianoside B

C₄₁H₆₈O₁₃, M 768



Taxonomy: Cycloartane Glycosides

Astragalus prusianus DC (*Leguminosae*) [1].
 $[\alpha]_D^{25}$ $+20.0^\circ$ (c 0.004, MeOH).

CAS Registry Number: 361342-95-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3376, 2933, 2870, 2363, 1726(?), 1459, 1381, 1166, 1071, 1045.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.2 1.27 m, 1.53 m	C-23	26.4 2.04 m, 2.10 m
2	30.2 1.91 m, 2.30 m	24	84.5 4.09 dd (8, 5)
3	88.7 3.47 dd (11.5, 4)	25	71.4 –
4	41.5 –	26	26.3 1.42 s
5	47.7 1.29 ^a	27	27.7 1.48 s
6	21.0 0.59 m, 1.47 m	28	20.7 0.88 s
7	26.2 0.95 m, 1.17 m	29	26.3 1.24 s
8	47.8 1.55 ^a	30	15.6 1.03 s
9	20.0 –	β -D-Xylp	
10	25.9 –	1	107.6 4.85 d (7.3)
11	26.8 1.10 m, 1.92 m	2	75.7 3.99 dd (7.4, 8.5)
12	33.1 1.90 m	3	78.7 4.21 ^a
13	46.9 –	4	71.6 4.21 ^a
14	47.0 –	5	67.2 4.35 ^a , 3.75 t (11)
15	48.0 2.02 ^a , 2.25 ^a	β -D-Glcp	
16	83.7 4.54 ^a	1	106.7 4.78 d (7.6)
17	60.1 2.45 d (7.9)	2	75.7 4.02 dd (7.9, 9)
18	21.7 1.60 s	3	79.0 4.26 t (8.9)
19	30.2 0.19 d (4.5), 0.43 d (4.5)	4	72.0 4.20 ^a
20	87.2 –	5	78.5 3.96 ^a
21	26.3 1.75 s	6	63.1 4.32 ^a , 4.53 ^a
22	39.0 2.13 m, 2.28 m		

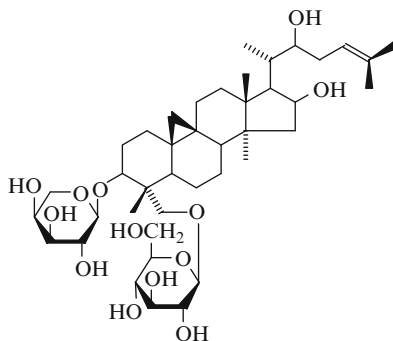
^aSignal pattern was unclear due to overlapping

References

1. E. Bedir, I. Calis, C. Dunbar, R. Sharan, J.K. Buolamwini, I.A. Khan, *Tetrahedron* **57**, 5961–5966 (2001)

Thalicoside A2

$C_{41}H_{68}O_{13}$, M 768



Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 272–274°C, $[\alpha]_D^{25} +10.6^\circ$ (c 0.9, MeOH–CHCl₃, 1:1).

CAS Registry Number: 289664-95-5.

IR ν_{max}^{KBr} , cm⁻¹: 3400, 3045, 2940, 2890, 1125, 1055.

Negative ion FABMS m/z: 767 [M-H]⁻, 635 [M-133]⁻, 605 [M-163]⁻, 473 [M-295]⁻.

HRFABMS m/z: 767.4586 [M-H]⁻.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.06 1.12, 1.26	C-23	33.49 2.46 m, 2.58 m
2	29.51 2.02, 2.39	24	123.86 5.60 brt (6.7)
3	81.11 4.48 dd (4.3, 11.5)	25	132.03 –
4	45.86 –	26	18.07 1.66 brs
5	40.67 2.00	27	25.95 1.68 brs
6	20.65 0.64 dddd (2.1, 12.2, 12.7, 12.9), 1.82	28	20.56 0.89 s
7	26.35 0.98, 1.11	29	71.14 4.11 d (10.2), 4.36 d (10.2)
8	46.57 1.57 dd (4.3, 12.5)	30	11.67 0.94 s
9	19.63 –	α -L-Arap	
10	25.70 –	1	106.43 5.38 d (7.4)
11	26.41 1.04, 1.90	2	73.19 4.45 d (7.4)
12	33.55 1.51, 1.59	3	74.90 4.25
13	44.96 –	4	70.01 4.26
14	47.23 –	5	66.99 4.05 dd (2.5, 11.9), 4.28 dd (4, 11.9)
15	48.83 1.7, 2.04	β -D-Glcp	
16	71.66 4.83 st (4.9, 7.3)	1	105.13 5.28 d (8)
17	52.97 2.36 dd (4.9, 11)	2	75.36 4.14 brt (8)
18	19.69 1.46 s	3	78.67 4.27
19	30.56 0.33 d (3.5), 0.54 d (3.5)	4	71.76 4.26
20	36.02 2.60 m	5	78.39 4.0 ddd (2.5, 5, 9)
21	14.55 1.21 d (7)	6	62.82 4.41 dd (2.5, 11.6), 4.52 dd (5, 11.6)
22	75.23 4.32 dd (5, 11)		

Biological activity

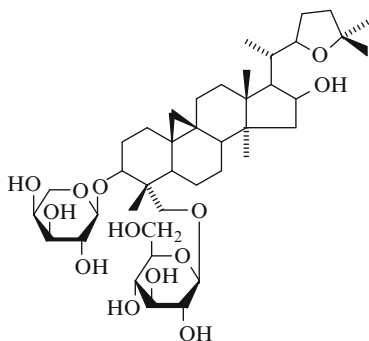
Thalicoside A2 showed inhibitory activity against *Candida albicans* (78.7%) and against *Staphylococcus aureus* (45.7%), both at a concentration of 1 mg.mL⁻¹.

References

1. A.S. Gromova, V.I. Lutsyki, D. Li, S.G. Wood, N.L. Owen, A.A. Semenov, D.M. Grant, *J. Nat. Prod.* **63**(7), 911–914 (2000)

Thalicoside A3

C₄₁H₆₈O₁₃, M 768



Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 253–255°C (from CHCl₃–MeOH–H₂O, 100:12:1),

$[\alpha]_D^{20} +1.1^\circ$ (c 0.57, MeOH–CHCl₃ 1:1).

CAS Registry Number: 289664-96-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3406, 3050, 2945, 2890, 1456, 1382, 1120, 1050.

Negative ion FABMS m/z: 767 [M–H][–], 635 [M–133][–], 605 [M–163][–], 473 [M–295][–].

Positive ion HRFABMS m/z: 791.4565 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1 32.42	a	C-23 27.66	1.88, 1.88
2 29.85	2.02, 2.38	24 38.89	1.63, 1.63
3 81.43	4.47 dd (4.5, 11.6)	25 80.81	–
4 45.30	–	26 29.02	1.30 s
5 41.03	2.08	27 28.02	1.21 s
6 20.98	0.71 dddd (1.7, 11.5, 11.6, 12.3), 1.87	28 20.87	0.88 s
7 26.69	a	29 71.44	4.11 d (9.7), 4.34 d (9.7)
8 48.83	1.61 dd (4.5, 12.5)	30 12.00	0.96 s
9 19.88	–	α -L-Arap	
10 26.01	–	1 106.79	5.35 d (7.4)

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
11 26.69	1.05, 1.87	2 73.56	4.42 d (7.4)
12 33.76	a	3 75.27	4.22
13 46.31	–	4 70.44	4.23
14 47.30	–	5 67.35	4.02 dd (12), 4.29 dd (4,12)
β -D-Glcp			
15 48.56	1.67, 2.08	1 105.65	5.21 d (7.7)
16 71.97	4.65 st (5.1, 7.4)	2 75.74	4.12
17 53.14	2.06	3 79.07	4.24
18 19.80	1.39 s	4 72.15	4.23
19 30.87	0.33 d (4), 0.53 d (4)	5 78.79	4.08 m
20 33.37	2.52 m	6 63.20	4.39 dd (5.2, 11.8)
21 15.22	1.01 d (6.5)		4.52 dd (2.4, 11.8)
22 82.86	4.31 m		

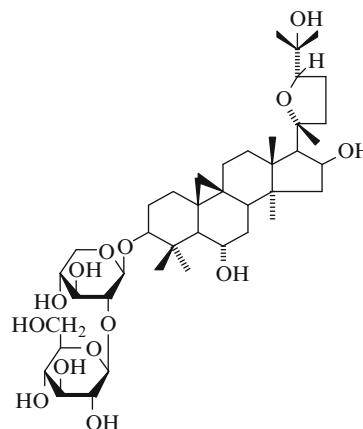
^a Obscured

References

1. A.S. Gromova, V.I. Lutsyki, D. Li, S.G. Wood, N.L. Owen, A.A. Semenov, D.M. Grant, *J. Nat. Prod.* **63**(7), 911–914 (2000)

Astragaloside III

C₄₁H₆₈O₁₄, M 784



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Ranunculaceae*) [1].

Mp 245–247°C (from MeOH), $[\alpha]_D^{18} +21.4^\circ$ (c 0.83, MeOH).

CAS Registry Number: 84687-42-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3370, 1070.

FDMS m/z : 807 $[\text{M} + \text{Na}]^+$.

Table 1

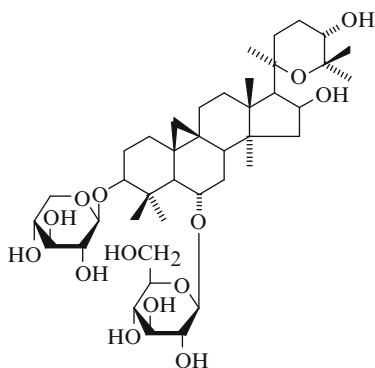
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)					
C-3	88.8	$\beta\text{-D-Xylp}$		$\beta\text{-D-Glcp}$	
5	54.2	1	105.8 ^a	1	105.4 ^a
6	68.2	2	83.1	2	76.7
16	73.7	3	77.5	3	78.1
17	58.7	4	71.5	4	72.2
20	87.4	5	66.4	5	77.9
24	82.2			6	63.2
25	71.2				

References

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Cyclocephaloside I

$\text{C}_{41}\text{H}_{68}\text{O}_{14}$, M 784



Taxonomy: Cycloartane Glycosides

Astragalus microcephalus Willd. (Leguminosae) [1].

$[\alpha]_{\text{D}} + 6.1^{\circ}$ (c 0.42, MeOH).

CAS Registry Number: 205312-83-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3400.

Table 1

δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		
C-1	32.3	1.58 m, 1.20 m	C-22	26.7	3.12 m, 1.22 m
2	30.2	2.35 m, 1.98 m	23	26.3	1.82 m, 2.20 m
3	88.6	3.49 dd (11.4, 4.2)	24	68.7	3.64 brs
4	42.7	–	25	75.2	–

(continued)

Table 1 (continued)

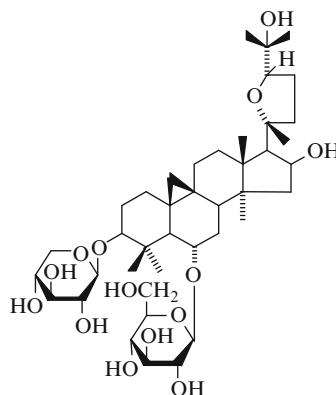
δ_{H} (J/Hz)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		
5	52.7	1.87 d (8.4)	26	28.6	1.42 s
6	79.5	3.76 dt (9.5, 6.7)	27	28.0	1.26 s
7	34.8	2.27 m (2H)	28	20.1	0.88 s
8	46.1	1.95 m	29	28.8	2.01 s
9	21.1	–	30	16.7	1.34 s
10	29.1	–	$\beta\text{-D-Xylp}$		
11	24.1	2.15 m, 1.82 m	1	107.7	4.80 d (7.4)
12	34.2	1.78 m, 1.65 m	2	75.6	4.00
13	45.9	–	3	78.5	4.10 dd (8.4, 8.6)
14	46.8	–	4	71.8	4.20
15	47.4	2.34 m, 1.86 m	5	67.1	4.35, 3.68
16	74.0	4.86 m	$\beta\text{-D-Glcp}$		
17	60.8	2.06 d (7.6)	1	105.1	4.87 d (7.6)
18	20.9	1.64 s	2	75.6	4.00
19	29.5	0.16 d(4), 0.54 d(4)	3	79.2	4.22
20	78.9	–	4	71.3	4.20
21	28.8	1.51 s	5	78.1	3.88
			6		4.44 dd (11.4, 2.3), 4.33

References

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Cyclosieversioside F (astragaloside IV, astrasieversianin XIV, agramembranin I)

$\text{C}_{41}\text{H}_{68}\text{O}_{14}$, M 784



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1–3].

Astragalus membranaceus Bunge (*Leguminosae*) [4].

Astragalus ptercephalus Bunge (*Leguminosae*) [2, 5].

Astragalus schahrudensis Bunge (*Leguminosae*) [2, 6].

Astragalus kuhitangi (Nevski) Boriss. (*Leguminosae*) [2, 7].

Astragalus basineri Trautv. (*Leguminosae*) [2, 8].

Astragalus tragacantha Habl. (*Leguminosae*) [2, 9].

Astragalus mongholicus Bunge (*Leguminosae*) [10, 11].

Astragalus exilis A. Kor. (*Leguminosae*) [12].

Astragalus dissectus B. Fedtsch. et N. Ivanava (*Leguminosae*) [13].

Astragalus pycnanthus Boriss. (*Leguminosae*) [14].

Astragalus uninodus M. Pop. et Vved. (*Leguminosae*) [15].

Astragalus microcephalus Willd. (*Leguminosae*) [16].

Astragalus alexandrinus Boiss. (*Leguminosae*) [17].

Astragalus trojanus Stev. (*Leguminosae*) [18].

Astragalus melanophrurius Boiss. (*Leguminosae*) [19].

Mp 284–286°C (from MeOH), $[\alpha]_D^{20} +38^\circ$ (c 0.5, MeOH).

CAS Registry Number: 84687-43-4.

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3300, 3042.

FDMS m/z (%): 808 (0.3) $[\text{M} + \text{Na} + \text{H}]^+$, 785 (1.5) $[\text{M} + \text{H}]^+$, 784 (1.3) $[\text{M}]^+$.

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.16 and 0.52 (2H-19, d, J = 4 Hz), 0.90, 1.25, 1.25, 1.27, 1.35, 1.51, 1.90 (7 \times CH₃, s), 2.46 (H-17, d, J = 7.7 Hz), 3.02 (H-22, q, J = 11 Hz), 3.43 (H-3, dd, J = 12, 4 Hz), 3.61 (Xylp H-5a, t, J = 11 Hz), 3.70 (H-6, td, J = 9, 4 Hz), 3.75–4.16 (H-24 and 7H of the monosaccharides moiety), 4.21 (Glc p H-6, dd, J = 12, 6 Hz), 4.27 (Xylp H-5e, dd, J = 11, 5 Hz), 4.39 (Glc p H-6', dd, J = 12, 2.5 Hz), 4.74 (Xylp H-1, d, J = 7.4 Hz), 4.79 (Glc p H-1, d, J = 7.7 Hz), 4.90 (H-16, q, J = 7.7 Hz) [20].

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$) [20]						
C-1	32.11	C-11	26.10	C-21	28.05	β -D-Xylp
2	30.09	12	33.30	22	34.82	1 107.47
3	88.45	13	44.98	23	26.36	2 75.44 ^c
4	42.54	14	46.12	24	81.60	3 78.33
5	52.41	15	46.10	25	71.23	4 71.12
6	79.18	16	73.36	26	26.97	5 66.67
7	34.52	17	58.12	27	28.48 ^b	β -D-Glc p

(continued)

Table 1 (continued)

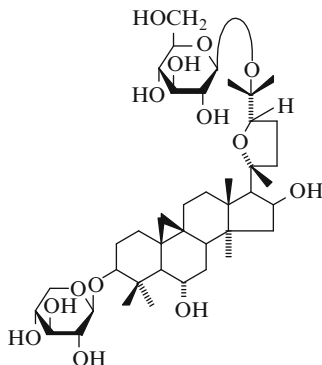
δ_{C} ($\text{C}_5\text{D}_5\text{N}$) [20]						
8	45.62	18	19.76	28	21.02 ^a	1 105.07
9	21.02 ^a	19	28.88	29	28.48 ^b	2 75.44 ^c
10	28.90	20	87.17	30	16.57	3 78.98
						4 71.73
						5 77.95
						6 62.95

^{a,b,c}Signals are mutually imposed**References**

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Isoastragaloside IV

C₄₁H₆₈O₁₄, M 784



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge var *mongholicus* Bunge (*Leguminosae*) [1].

Mp 279–283°C, [α]_D + 17° (c 0.4, H₂O).

CAS Registry Number: 136033-55-1.

FABMS m/z: [M + Na]⁺ 807, [M + H]⁺ 785.

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.55 (2H-19, d, J = 3.8 Hz), 0.93, 1.27, 1.30, 1.33, 1.42, 1.66, 1.99 (7 × CH₃, s), 4.90 (Xylp H-1, d, J = 7 Hz), 4.90 (H-16, m), 5.06 (Glc p H-1, d, J = 7.5 Hz).

Table 1

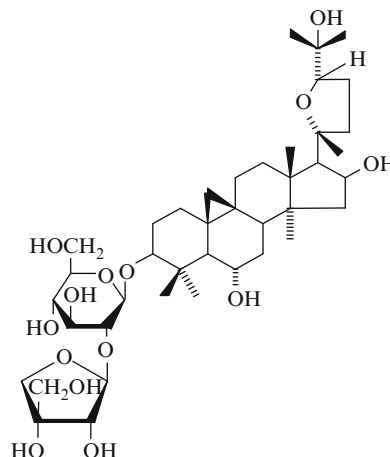
δ_C (C ₅ D ₅ N)						
C-1	32.4	C-11	26.3	C-21	27.9	β -D-Xylp
2	30.3	12	33.3	22	35.0	1 107.4
3	88.7	13	45.1	23	25.9	2 75.3
4	42.6	14	46.0	24	82.1	3 78.1
5	53.7	15	46.8	25	78.2	4 71.0
6	68.1	16	73.4	26	23.0	5 66.8
7	38.4	17	58.0	27	25.7	β -D-Glcp
8	47.1	18	21.6	28	19.9	1 98.6
9	20.8	19	30.8	29	28.8	2 74.7
10	29.9	20	87.3	30	16.6	3 78.8
						4 71.1
						5 77.7
						6 62.4

References

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Cycloaraloside C (astralienin A)

C₄₁H₆₈O₁₄, M 784



Taxonomy: Cycloartane Glycosides

Astragalus amarus Pall. (*Leguminosae*) [1].

Astragalus iliensis (*Leguminosae*) [2].

Astragalus villosissimus Bunge (*Leguminosae*) [3].

Mp 242–244°C (from MeOH), [α]_D³⁰ + 4.9° (c 1.63, MeOH).

CAS Registry Number: 129297-26-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3580–3200, 3055.

¹H NMR (250 MHz, C₅D₅N, δ , 0-TMS): 0.21 and 0.53 (2H-19, d, J = 4 Hz), 1.02, 1.33, 1.34, 1.43, 1.45, 1.60, 2.03 (7 × CH₃, s), 2.55 (H-17, d, J = 7.5 Hz), 3.12 (H-22, q, J = 10 Hz), 3.58 (H-3, dd, J = 11, 4 Hz), 4.45 and 4.81 (apiose 2H-5', d, J = 9 Hz), 5.0 (apiose H-2, d, J = 2 Hz), 5.17 (Glc p H-1, d, J = 4.5 Hz), 6.58 (apiose H-1, d, J = 2 Hz).

Table 1

δ_C (C ₅ D ₅ N)						
C-1	32.42	C-11	26.37 ^a	C-21	28.16	β -D-Glcp
2	30.15	12	33.39	22	34.88	1 105.47
3	88.87	13	45.04	23	26.37 ^a	2 79.40
4	42.58	14	46.09	24	81.72	3 78.66
5	54.01	15	46.61	25	71.26	4 72.01
6	67.97	16	73.43	26	27.12	5 78.21
7	38.54	17	58.34	27	28.53	6 62.89
8	46.98	18	21.51	28	20.17	D-Apio- β -D-f
9	20.84	19	30.47	29	28.76	1 111.15
10	29.43	20	87.25	30	16.58	2 77.83

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)		
3	80.52	
4	75.59	
5	66.11	

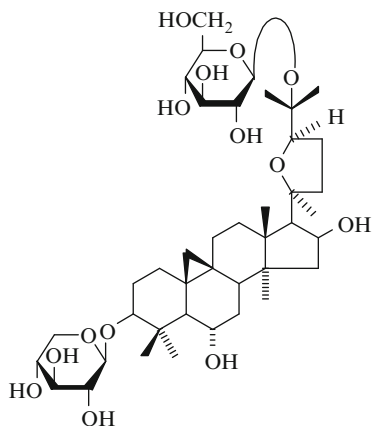
^aSignals are mutually imposed

References

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Cyclogaleginoside E

C₄₁H₆₈O₁₄, M 784



Taxonomy: Cycloartane Glycosides

Astragalus galegiformis L. (*Leguminosae*) [1].

Mp 187–188°C (from MeOH)

IR ν_{\max}^{KBr} , cm⁻¹: 3460–3380, 3045.

MS *m/z* (%): [M + 2Na]⁺ 829.4 (100), [M-H]⁺ 783.6 (10), 727.4 (1.5), 685.4 (4), 669.2 (0.2), 651.4 (0.9), 621.4 (1), 489.4 (0.25), 471 (0.05).

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz, CD ₃ OD)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz, CD ₃ OD)	
C-1	33.30	1.53 td (10.6, 2.5), 1.20 m	C- 24.84 21	1.28 s

(continued)

Table 1 (continued)

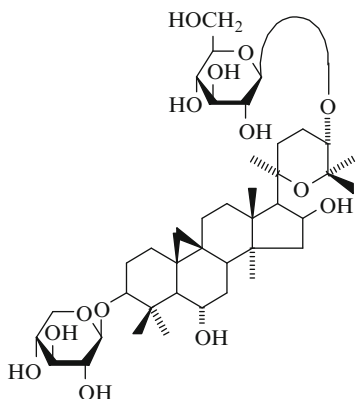
δ_C (C ₅ D ₅ N)	δ_H (J/Hz, CD ₃ OD)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz, CD ₃ OD)		
2	30.58	1.92 m, 1.66 dq (12.5, 8.3)	22	38.00	2.20 m, 1.74 m
3	89.91	3.176 dd (8.5, 1.4)	23	24.27	2.19 m, 1.98 m
4	43.15	–	24	86.38	3.90 dd (8.8, 6.3)
5	54.66	1.36 d (9.8)	25	78.93	–
6	69.60	3.45 ddd (9.8, 5.4)	26	25.01	1.24 s
7	38.85	1.42 m, 1.31 m	27	23.51	1.30 s
8	48.50	1.82 dd (12.2, 4.3)	28	20.90	0.95 s
9	21.91	–	29	28.73	1.29 s
10	30.58	–	30	16.55	1.02 s
11	27.17	2.03 ddd (10, 5, 5), 1.22 m	β-D-Xylp		
12	34.26	1.83 m, 1.72 m	1	107.48	4.26 d (7.5)
13	47.85	–	2	75.50	3.185 dd (8.5, 7.5)
14	47.47	–	3	77.95	3.27 t (8.5)
15	49.23	1.96 dd (13.5, 7.8), 1.48 dd (13.5, 7.8)	4	71.29	3.44 td (8.5, 5.2)
			5	66.70	3.81 dd (11.4, 5.2), 3.16 dd (11.8, 8.5)
16	74.42	4.64 ddd (7.8, 7.1, 4.6)	β-D-Glcp		
17	56.31	2.22 d (7.1)	1	99.04	4.43 d (7.6)
18	21.40	1.41 s	2	75.04	3.17 dd (8.8, 7.6)
19	32.18	0.38 d (4.1), 0.54 d (4.1)	3	77.63	3.35 t (8.8)
20	88.93	–	4	71.80	3.285 t (8.8)
			5	77.63	3.24 dd (8.8, 5.5)
			6	62.84	3.813 d (11.6), 3.63 dd (11.6, 5.5)

References

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No Name (20R,25-Epoxycycloartane-3 β ,6 α ,16 β ,24S-tetrol-3-O- β -D-xylopyranoside, 24-O- β -D-glucopyranoside)

C₄₁H₆₈O₁₄, M 784



Taxonomy: Cycloartane Glycosides

Astragalus caprinus Maire (*Leguminosae*) [1].

White amorphous powder, $[\alpha]_D^{20} -7.0^\circ$ (c 0.1, MeOH).

CAS Registry Number: 342781-42-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2930, 1050.

ESIMS m/z (%): 807 (100) [M + Na]⁺, 645 (25) [M + Na-162]⁺, 675 (30) [M + Na-132]⁺.

HRFABMS m/z: 807.4534 [M]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.5	a	1.30 ^a , 1.45 ^a
2	30.0	a	3.85 ^a
3	88.4	3.47	25 75.0
4	41.2	–	26 28.2 1.20 s
5	54.9	2.00	27 29.0 1.38 s
6	70.4	3.75	28 20.0 1.03 s
7	32.0	a	29 25.9 1.30 s
8	46.5	1.55	30 15.4 0.99 s
9	21.1	–	β -D-Xylp
10	29.0	–	1 107.7 4.82 d (7.5)
11	27.1	a	2 75.7 4.00 ^a
12	34.1	a	3 78.7 4.22 ^a
13	46.5	–	4 72.0 4.13 ^a

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	47.0	–	5 67.5 4.30 ^a , 3.75 ^a
15	49.0	2.25 ^a , 2.70 ^a	β -D-Glcp
16	74.4	4.86 ^a	1 100.9 4.86 d (7.4)
17	60.8	2.08 ^a	2 74.7 4.00 ^a
18	21.2	1.63 s	3 78.7 4.13 ^a
19	30.0	0.20 ^a , 0.55 ^a	4 71.4 4.22 ^a
20	79.6	–	5 78.7 3.95 ^a
21	29.0	1.52 s	6 63.0 4.28 ^a , 4.55 ^a
22	27.0	1.15 ^a , 1.45 ^a	

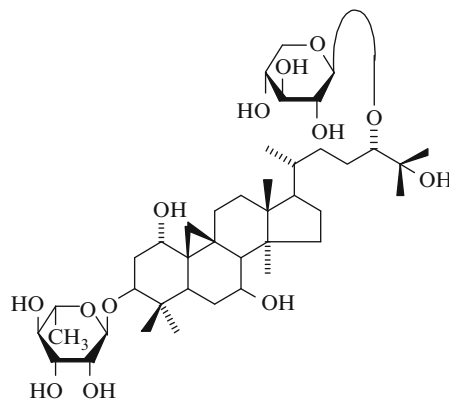
^aSignal pattern was unclear due to overlapping

References

1. N. Semmar, B. Fenet, M.A. Lacaille-Dubois, K. Gluchoff-Fiasson, R. Chemli, M. Jay, J. Nat. Prod. **64**(5), 656–658 (2001)

Macrophyllosaponin B

C₄₁H₇₀O₁₃, M 770



Taxonomy: Cycloartane Glycosides

Astragalus oleifolius DC. (*Leguminosae*) [1].

$[\alpha]_D^{20} + 2.8^\circ$ (c 0.58, MeOH).

CAS Registry Number: 184104-60-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3400.

Table 1

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
C-1	74.7 3.54 dd (3.2, 2.7)	C-21	19.9 0.96 d (6.3)
2	38.0 2.08 ddd (12.7, 4.2, 3.2), 1.88 td (12.7, 2.7)	22	35.4 1.54 m (2H)
		23	30.5 1.65 m, 1.54 m

(continued)

Table 1 (continued)

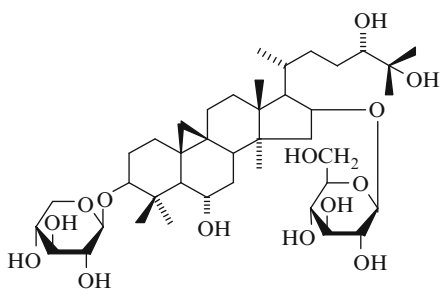
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
3	86.1 3.69 m	24	90.2 3.44 dd (9.2, 1.8)
4	42.5 –	25	74.5 –
5	41.1 2.16 dd (13.1, 4.4)	26	26.2 1.19 s
6	33.1 1.77 m, 1.07 m	27	27.5 1.21 s
7	72.1 3.54 m	28	20.3 1.09 s
8	57.0 1.59 m	29	27.0 1.01 s
9	23.0 –	30	15.5 0.86 s
10	32.1 –	α -L-Rhap	
11	28.0 2.29 m, 1.36 m	1	105.4 4.79 d (1.7)
12	35.0 1.74 m (2H)	2	73.5 3.88 dd (3.4, 1.7)
13	47.9 –	3	73.6 3.68 dd (9.5, 3.4)
14	50.7 –	4	75.1 3.40 t (9.5)
15	39.5 1.59 m (2H)	5	71.0 3.70 dq (9.5, 6.3)
16	30.7 2.04 m, 1.35 m	6	18.9 1.26 d (6.3)
17	54.1 1.63 m	β -D-Xylp	
18	19.3 1.06 s	1	106.4 4.33 d (7.6)
19	30.3 0.48 d (4.6), 0.80 d (4.6)	2	76.2 3.25 dd (9.2, 7.6)
20	38.7 1.44 m	3	78.9 3.35 dd (9.5, 9.2)
		4	72.1 3.53 ddd (10.1, 9.5, 5.4)
		5	68.0 3.90 dd (11.4, 5.4), 3.22 dd (11.4, 10.1)

References

1. I. Calis, M. Zor, I. Saracoglu, A. Isimer, H. Ruegger, J. Nat. Prod. **59**(11), 1019–1023 (1996)

Cyclocanthoside D

C₄₁H₇₀O₁₄, M 786



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].
Astragalus kuhitangi (Nevski) Sirj. (*Leguminosae*) [2].
Astragalus cephalotes var. *brevicalyx* (*Leguminosae*) [3].

Mp 290–292°C (from MeOH), $[\alpha]_D^{21} + 9.3^\circ$ (c 0.86, C₅H₅N).

CAS Registry Number: 115338-09-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3570–3240, 3055.

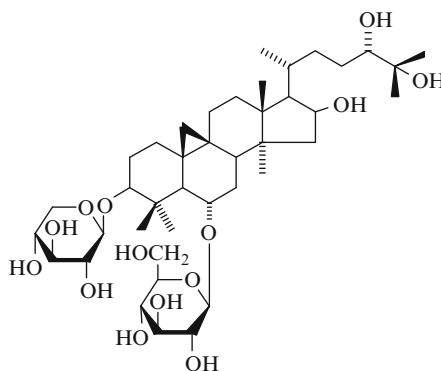
¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.08 and 0.46 (2H-19, d, J = 4 Hz), 0.96 (CH₃-21, d, J = 6 Hz), 0.86, 1.22, 1.26, 1.34, 1.34, 1.84 (6 × CH₃, s), 4.68 and 4.76 (2 anomeric protons, d, J = 7 Hz and 8 Hz respectively).

References

1. Y.M. Fadeev, M.I. Isaev, Y.A. Akimov, P.K. Kintia, M.B. Gorovits, N.K. Abubakirov, Chem. Nat. Comp. **24**(1), 62–65 (1988)
2. M.A. Agzamova, M.I. Isaev, I.I. Maltsev, M.B. Gorovits, N.K. Abubakirov, Chem. Nat. Comp. **24**(6), 755–756 (1988)
3. I. Calis, H. Yusufoglu, O. Zerbe, O. Sticher, Phytochemistry **50**(5), 843–847 (1999)

Cyclocanthoside E

C₄₁H₇₀O₁₄, M 786



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].
Astragalus dissectus B. Fedtsch. et N. Ivanova (*Leguminosae*) [2].

Astragalus microcephalus Willd. (*Leguminosae*) [3].
Astragalus cephalotes var. *brevicalyx* (*Leguminosae*) [4].
Astragalus melanophrurius Boiss. (*Leguminosae*) [5].
 Mp 282–284°C (from EtOH), $[\alpha]_D^{27} + 23.5^\circ$ (c 0.5, C₅H₅N).

CAS Registry Number: 170969-74-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3550–3230, 3060.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.18 and 0.57 (2H-19, d, J = 4 Hz), 1.06 (CH₃-21, d, J = 6.3 Hz), 0.97, 1.32, 1.37, 1.43, 1.45, 1.96 (6 × CH₃, s), 3.49 (H-3, dd, J = 12, 5 Hz), 3.65 (Xylp H-5a, dd, J = 10, 9 Hz), 3.77 (H-6, td, J = 9, 3 Hz), 3.85 (Glc p H-5, ddd, J = 9, 6, 3 Hz), 3.91 (H-24, dd, J = 11, 3 Hz), 3.98 (Glc p H-2, dd, J = 9, 7.6 Hz), 4.00 (Xylp H-2, dd, J = 9, 7.3 Hz), 4.08 (Xylp H-3, t, J = 9 Hz), 4.14 (Glc p H-4, t, J = 9 Hz), 4.15 (Glc p H-3, t, J = 9 Hz), 4.18 (Xylp H-4, td, J = 9, 5 Hz), 4.25 (Glc p H-6, dd, J = 12, 6 Hz), 4.31 (Xylp H-5e, dd, J = 10, 5 Hz), 4.42 (Glc p H-6', dd, J = 12, 3 Hz), 4.68 (H-16, q, J = 7 Hz), 4.79 (Xylp H-1, J = 7.3 Hz), 4.86 (Glc p H-1, d, J = 7.6 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.27	C-11	26.30	C-21	18.48	β -D-Xylp	
2	28.77	12	33.21	22	33.00	1	107.60
3	88.59	13	45.82	23	27.90	2	75.61
4	42.68	14	46.94	24	77.14	3	78.48
5	52.52	15	47.88	25	72.58	4	71.25
6	79.13 ^a	16	72.02	26	25.77	5	67.02
7	34.32	17	57.20	27	26.50	β -D-Glc p	
8	45.61	18	18.37	28	19.84	1	105.18
9	21.45	19	28.21	29	28.65	2	75.56
10	30.20	20	28.57	30	16.71	3	79.13 ^a
						4	71.95
						5	78.06
						6	63.20

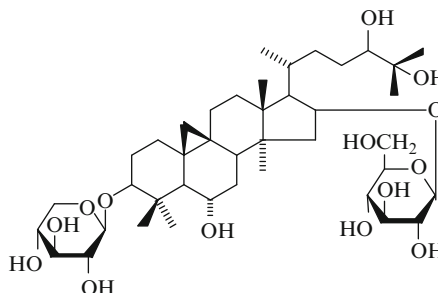
^aSignals are mutually imposed

References

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- I.A. Sukhina, M.I. Isaev, *Chem. Nat. Comp.* **31**(5), 639–640 (1995)
- E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)
- I. Calis, H. Yusufoglu, O. Zerbe, O. Sticher, *Phytochemistry* **50**(5), 843–847 (1999)
- I. Calis, A. Yuruker, D. Tasdemir, A.D. Wright, O. Sticher, Y.-D. Luo, J.M. Pezzuto, *Planta Med.* **63**, 183–186 (1997)

Cyclopycanthoside

C₄₁H₇₀O₁₄, M 786



Taxonomy: Cycloartane Glycosides

Astragalus pycnanthus Boriss. (*Leguminosae*) [1].

Mp 280–282°C (from MeOH), $[\alpha]_D^{19} + 17.5^\circ$ (c 0.6, MeOH).

CAS Registry Number: 221660-33-9.

IR ν_{\max}^{KBr} , cm⁻¹: 3540–3230, 3040.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.50 (2H-19, d, J = 4 Hz), 1.02 (CH₃-21, d, J = 6.8 Hz), 0.98, 1.23, 1.37, 1.46, 1.51, 2.03 (6 × CH₃, s), 3.66 (H-3, dd, J = 11.5, 4.5 Hz), 3.70 (H-6, td, J = 9.2, 3.8 Hz), 3.73 (H-24, dd, J = 10, 1.7 Hz), 3.74 (Xylp H-5a, dd, J = 12, 9 Hz), 3.88 (Glc p H-5, ddd, J = 9, 4.8, 2.7 Hz), 4.00 (Glc p H-2, dd, J = 9, 7.8 Hz), 4.09 (Xylp H-2, dd, J = 9, 7.3 Hz), 4.18 (Xylp H-3, t, J = 9 Hz), 4.22 (Glc p H-4, t, J = 9 Hz), 4.29 (Glc p H-3, t, J = 9 Hz), 4.29 (Xylp H-4, td, J = 9, 5 Hz), 4.36 (Glc p H-6, dd, J = 11.6, 4.8 Hz), 4.38 (Xylp H-5e, dd, J = 12, 5 Hz), 4.41 (H-16, m), 4.45 (Glc p H-6', dd, J = 11.6, 2.7 Hz), 4.88 (Glc p H-1, d, J = 7.8 Hz), 4.93 (Xylp H-1, d, J = 7.3 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.57	C-11	26.25	C-21	19.06	β -D-Xylp	
2	29.26	12	32.79	22	30.33 ^b	1	107.67
3	88.79	13	45.60	23	34.40	2	75.68
4	42.74	14	46.86 ^a	24	79.99	3	78.57
5	54.05	15	47.77	25	72.73	4	71.29
6	67.94	16	83.10	26	25.40	5	67.10
7	38.42	17	57.52	27	26.32	β -D-Glc p	
8	46.86 ^a	18	18.06	28	20.19	1	106.64
9	21.29	19	30.33 ^b	29	28.95	2	75.81
10	30.41	20	31.97	30	16.76	3	78.84

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)		
	4	71.78
	5	78.12
	6	62.89

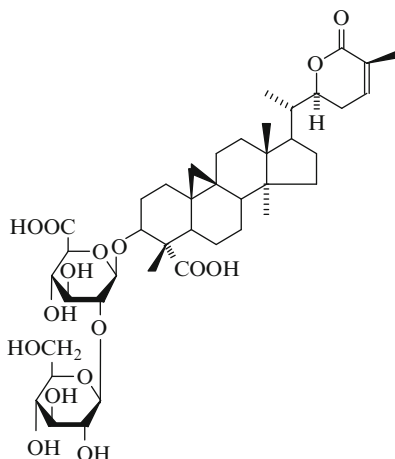
^{a,b}Signals are mutually imposed

References

- M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **34**(2), 155–159 (1998)

Abrusoside D

C₄₂H₆₂O₁₆, M 822



Taxonomy: Cycloartane Glycosides

Abrus precatorius L. (*Leguminosae*) [1].

Mp 237–239°C, $[\alpha]_D + 9.9^\circ$ (c 0.31, C₅H₅N).

CAS Registry Number: 125003-00-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3412, 1710, 1379, 1258, 1115, 1077, 1054.

HRFABMS m/z: 823.4123 [M + H]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.79	C-23	27.89
2	29.23	24	140.58 6.56 m
3	83.71 4.83 dd (11.7, 4)	25	127.68 –
4	54.18 –	26	166.21 –
5	44.86	27	17.29 1.94 brs
6	23.12	28	19.47 0.78 s

(continued)

Table 1 (continued)

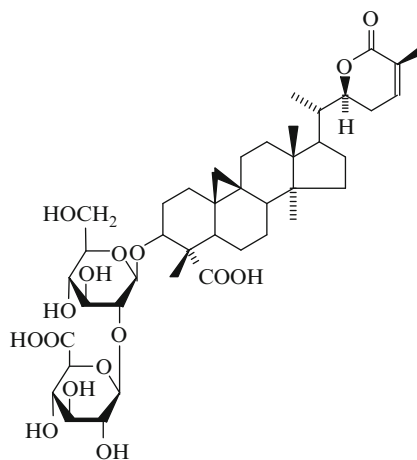
δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
7	27.50	29	179.54 –
8	48.03	30	11.00 1.70 s
9	19.78 –	β-D-GlcA	
10	25.44 –	1	102.59 5.44 d (7.4)
11	26.39	2	83.08
12	35.52	3	77.30
13	45.30 –	4	73.19
14	48.91 –	5	77.70 4.74 d (10)
15	32.39	6	173.69
16	25.86	β-D-Glcp	
17	47.92	1	105.77 5.22 d (7.2)
18	18.04 0.92 s	2	76.52
19	29.71 0.23 d (3.5), 0.50 d (3.5)	3	78.07
20	40.06	4	71.29
21	13.12 1.01 d (6.6)	5	78.07
22	80.29	6	62.56

References

- Y.H. Choi, R.A. Hussain, J.M. Pezzuto, A.D. Kinghorn, J.F. Morton, *J. Nat. Prod.* **52**(5), 1118–1127 (1989)

Abrusoside E

C₄₂H₆₂O₁₆, M 822



Taxonomy: Cycloartane Glycosides

Abrus precatorius L. (*Leguminosae*) [1].

Mp 265°C, $[\alpha]_D + 2^\circ$ (c 0.2, C₅H₅N).

IR ν_{\max} , cm⁻¹: 3402, 1693, 1601, 1535, 1393.

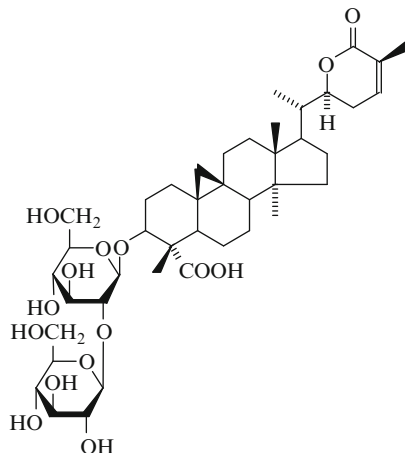
FABMS m/z: 821 (M-H)⁻, 645 (M-176)⁻, 483 (M-176-162)⁻.

References

1. E.J. Kennelly, L. Cai, N.-C. Kim, A.D. Kinghorn, *Phytochemistry* **41**(5), 1381–1383 (1996)

Abrusoside C

C₄₂H₆₄O₁₅, M 808



Taxonomy: Cycloartane Glycosides

Abrus precatorius L. (*Leguminosae*) [1]

Mp 260–262°C, $[\alpha]_D + 31.4^\circ$ (c 0.34, C₅H₅N).

CAS Registry Number: 125002-99-5

IR ν_{\max}^{KBr} , cm⁻¹: 3412, 1709, 1379, 1259, 1077.

HRFABMS m/z: 815.4406 (C₄₂H₆₄O₁₅Li)⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.98	C-23	28.09
2	29.56	24	139.97 6.56 m
3	84.96 4.70 dd (11.7, 4.3)	25	128.10 –
4	54.49 –	26	165.83 –
5	44.92	27	17.00 1.94 brs
6	23.02	28	19.56 0.79 s

(continued)

Table 1 (continued)

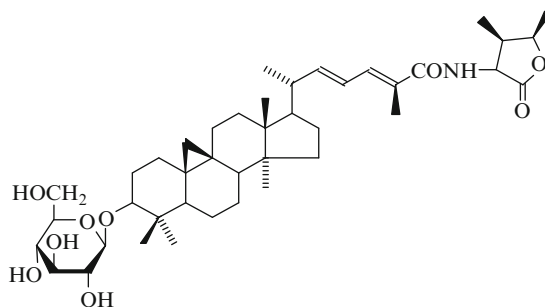
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
7	27.62	29	178.86
8	48.36	30	10.87 1.66 s
9	20.21 –	β-D-Glcp ₁	
10	25.79 –	1	103.63 5.15 d (7.6)
11	26.79	2	83.88
12	35.67	3	77.59
13	45.71 –	4	71.25
14	49.17 –	5	78.03
15	33.27	6	62.62
16	25.87	β-D-Glcp ₂	
17	47.68	1	105.80 5.23 d (7.7)
18	17.90 0.94 s	2	76.60
19	29.63 0.28 d (3.4), 0.56 d (3.4)	3	78.34
20	40.34	4	71.84
21	13.23 1.01 d (6.6)	5	78.03
22	80.45	6	63.16

References

1. Y.H. Choi, R.A. Hussain, J.M. Pezzuto, A.D. Kinghorn, J.F. Morton, *J. Nat. Prod.* **52**(5), 1118–1127 (1989)

Mussaendoside A

C₄₂H₆₅NO₉, M 727



Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait.f. (*Rubiaceae*) [1].

Mp 175–177°C, $[\alpha]_D + 60.23^\circ$ (c 0.44, MeOH).

UV $\lambda_{\max}^{\text{MeOH}}$, nm (ε): 264.5 (18633)

FABMS m/z: 766 (M + K)⁺, 750 (M + Na)⁺.

Table 1

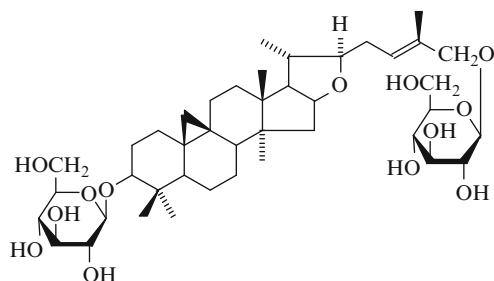
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.16	C-23	123.49 6.49 dd (15, 11)
2	29.65	24	124.77 7.21 d (11)
3	88.76	25	129.10 –
	3.34 dd (10, 4.4)		
4	41.78	26	13.44 2.20 s
5	47.54	27	170.67 –
6	21.11	28	19.48 1.33 s
7	26.46	29	25.48 1.10 s
8	47.86	30	15.48 0.98 s
9	19.87	1'	175.75 –
10	26.16	2'	55.50 5.68 dd (5, 7.5)
11	26.64	3'	38.55 2.95 ddq (7.5, 6.5, 4.6)
12	33.06	4'	78.79 4.66 dq (6.4, 4.3)
13	45.61	3'Me	8.04 0.83 d (7.2)
14	49.23	4'Me	15.48 1.16 d (6.4)
15	35.75	NH	9.10 d (5)
16	28.73	β -D-Glcp	
17	52.04	1	106.84
18	18.40	2	75.56
19	29.09	3	78.34
	0.21 d (4), 0.48 d (4)		
20	41.23	4	71.95
21	19.93	5	77.02
22	147.84	6	63.12
	5.61 dd (16, 9)		

References

1. J. Xu, R. Xu, Z. Luo, J. Dong, *Huaxue Xuebao* **49**(6), 621–624 (1991)

Depressoside C

C₄₂H₆₈O₁₃, M 780



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Amorphous solid, mp 173–175°C (decomp.), $[\alpha]_D^{28}$ –85.97° (c 0.164, MeOH).

CAS Registry Number: 314266-06-3.

IR ν_{\max}^{KBr} , cm⁻¹: 3450–3350, 2160.

Positive ion FABMS m/z: 803 [M + Na]⁺, 641 [M + Na-162]⁺, 623 [M + Na-162-H₂O]⁺, 461 [M + Na-2x162-H₂O]⁺.

Negative ion FABMS m/z: 779 [M-H]⁻, 617 [M-H-162]⁻, 599 [M-H-162-H₂O]⁻, 455 [M-H-2x162]⁻, 437 [M-H-2x162-H₂O]⁻.

EIMS m/z (%): 600 (2.8) [M-162-H₂O]⁺, 456 (5.2) [aglycone]⁺, 438 (16.1) [456-H₂O]⁺, 370 (92.8), 312 (72.9), 294 (36.9), 230 (73.3), 120 (80.0), 106.0 (100).

Table 1

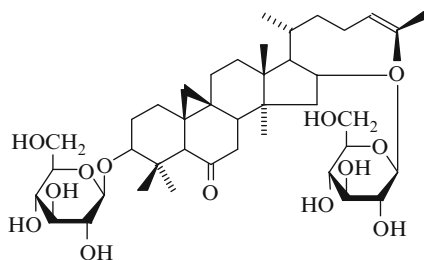
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	33.02	C-23	32.39 2.32 ddd (4.5, 6.0, 12.5),
2	31.8		2.40 ddd (6, 7, 12.5)
3	90.89	24	124.97 5.56 brt (7)
	3.21 dd (4.4, 11.5)		
4	42.00	25	134.64 –
5	48.88	26	75.83 4.05 d (11.6), 4.21 d (11.6)
6	21.70	27	14.31 1.70 s
7	27.46	28	20.17 0.94 s
8	49.10	29	26.04 1.08 s
	1.69 dd (4.4, 12.6)		
9	20.83	30	15.43 0.88 s
10	27.10		3-O- β -D-Glcp
11	27.92	1	104.16 4.48 d (7.6)
12	33.23	2	81.87 4.05 dd (7.6, 9.1)
13	44.98	3	77.84 3.65 t (9.1)
14	52.64	4	71.81 3.28 t (9.1)
15	43.52	5	77.28 3.25 ddd (2.5, 5.5, 9.1)
16	85.04	6	62.85 3.68 dd (5.2, 12), 6.1)
17	63.511		2.14 dd (8.2, 5.6) 3.82 dd (2.5, 12)
18	22.59		1.15 s
		26-O- β -D-Glcp	
19	31.32	1	102.80 4.23 d (7.7)
	0.31 d (4), 0.64 d (4)		
20	39.51	2	75.13 3.20 dd (7.7, 9.2)
21	18.88	3	78.21 3.65 t (9.2)
22	90.80	4	711.30 3.41 t (9.2)
	3.43 ddd (4.5, 7.0, 8.2)		
		5	77.82 3.32 ddd (2.5, 5.4, 9.2)
		6	62.80 3.64 dd (5.4, 11.8), 3.85 dd (2.5, 11.8)

References

1. V.U. Ahmad, A. Ali, Z. Ali, F.N. Zafar, M. Zahid, Chem. Pharm. Bull. **48**(11), 1597–1601 (2000)

6-Oxocycloartan-3 β ,16 β -di-O-glucoside

C₄₂H₆₈O₁₃, M 780



Taxonomy: Cycloartane Glycosides

Astragalus trigonus DC (*Leguminosae*) [1].

Mp 214–215°C (from EtOH), [α]_D +25° (c 0.013, MeOH).

CAS Registry Number: 99481-43-3.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3400, 2980, 1710.

MS m/z (%): 618 (2) [C₃₅H₅₈O₈]⁺, 456 (17) [C₃₀H₄₈O₃]⁺, 438 (20), 423 (7), 327 (30), 257 (30), 203 (11), 167 (20) [C₁₀H₁₅O₂]⁺, 149 (25), 121 (87), 109 (100) [C₈H₁₃]⁺.

¹H NMR (360 MHz, C₅D₅N, δ , 0-TMS): 0.05 and 0.57 (2H-19, d, J = 5 Hz), 0.99 (CH₃-21, d, J = 6.6 Hz), 0.92, 1.08, 1.36, 1.68, 1.72, 1.84 (6 × CH₃, s), 2.12 (2H-7, m), 2.45 (H-5, s), 3.53 (H-3, dd, J = 10, 4 Hz), 3.95 (H-16, m), 3.95–5.00 (14H, 2 glucose units), 5.51 (H-24, t).

Table 1

δ_{C} (C ₅ D ₅ N)							
C-1	31.52	C-11	25.73	C-21	16.81 ⁺	3-O- β -D-Glcp	
2	27.96	12	36.14	22	24.57	1	105.68
3	86.83	13	44.75	23	20.96	2	74.67
4	40.02	14	46.84	24	125.64	3	77.59
5	56.80*	15	44.81	25	128.92	4	70.86
6	210.04	16	80.45	26	24.79***	5	77.09
7	40.38	17	55.30*	27	18.13 ⁺	6	62.07
8	41.84	18	14.74**	28	17.03 ⁺	16-O- β -D-Glcp	

(continued)

Table 1 (continued)

δ_{C} (C ₅ D ₅ N)							
9	20.58	19	29.24	29	25.82***	1	105.54
10	29.16	20	29.51	30	14.19**	2	74.55
						3	77.53
						4	70.86
						5	77.09
						6	61.93

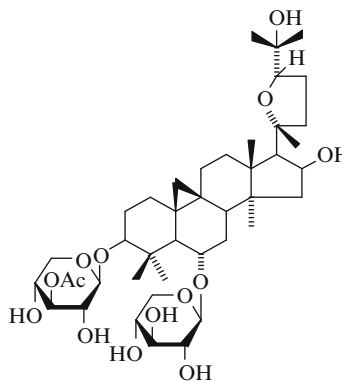
*Assignment of signals ambiguously

References

1. N. El-Sebakhy, P.G. Waterman, Planta Med. **51**(4), 350–352 (1985)

Astrasieversianin V

C₄₂H₆₈O₁₄, M 796



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1].

Mp 233–234°C (from MeOH), [α]_D³¹ +12.6° (c 0.10, MeOH).

IR $\nu_{\text{max}}^{\text{KCl}}$, cm⁻¹: 3350, 1720.

FDMS m/z: 820 (10.3) [M + Na + H]⁺.

¹H NMR (200 MHz, CDCl₃-C₅D₅N, δ , 0-TMS): 0.18 and 0.48 (2H-19, d, J = 4 Hz), 0.99, 1.05, 1.24, 1.35, 1.49, 1.21, 1.21 (7 × CH₃, s), 1.99 (CH₃COO, s).

Table 1

δ_{C} (C ₅ D ₅ N)						
C-3	88.6	3-O- β -D-Xylp	6-O- β -D-Xylp	Ac		
6	78.6	1	107.3	1	105.8	170.8
16	73.4	2	73.2	2	75.4	21.2

(continued)

Table 1 (continued)

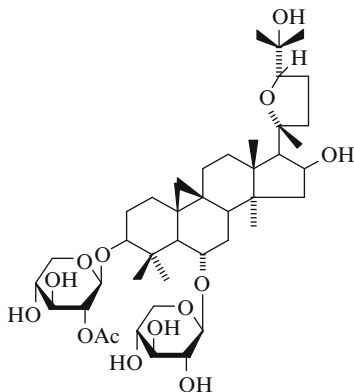
δ_C (C ₅ D ₅ N)					
20	87.2	3	79.4	3	77.7
24	81.6	4	69.3	4	71.0
25	71.3	5	66.7	5	67.0

References

1. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)

Cyclosieversioside C (astrasieversianin VI)

C₄₂H₆₈O₁₄, M 796



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1–3].
Astragalus babatagi M. Pop. (*Leguminosae*) [2, 4].
Astragalus schahrudensis Bunge (*Leguminosae*) [2, 5].
Astragalus basineri Trautv. (*Leguminosae*) [2, 6].
Astragalus exilis A. Kor. (*Leguminosae*) [7].
Astragalus alexandrinus Boiss. (*Leguminosae*) [8].
Astragalus uninodus M. Pop. et Vved. (*Leguminosae*) [9].

Mp 253–255°C (from MeOH), $[\alpha]_D^{20} +30.1^\circ$ (c 0.97, MeOH).

CAS Registry Number: 84883-00-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3360, 1750, 1260.

FDMS m/z: 797 (4) [M + 1]⁺.

¹H NMR (200 MHz, CDCl₃-C₅D₅N, δ , 0-TMS): 0.23 and 0.48 (2H-19, d, J = 4 Hz), 0.93, 0.98, 1.18, 1.18, 1.23, 1.25, 1.36 (7 × CH₃, s), 1.97 (CH₃C=O, s).

Table 1

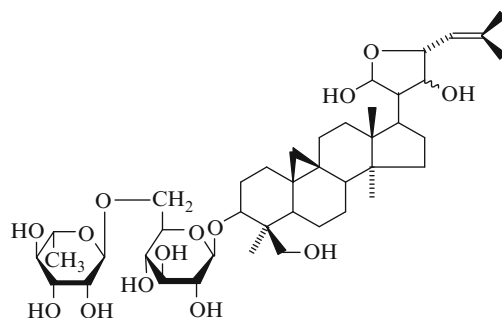
δ_C (C ₅ D ₅ N)					
C-3	88.6	3-O- β -D-Xylp	6-O- β -D-Xylp	Ac	
6	78.5	1	104.7	1	105.7
16	73.4	2	76.1	2	75.4
20	87.3	3	75.5	3	77.8
24	81.6	4	71.0	4	71.3
25	71.3	5	66.7	5	67.0

References

1. A.N. Svechnikova, R.U. Umarova, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **18**(5), 595–598 (1982)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
3. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)
4. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **24**(6), 753–754 (1988)
5. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **24**(1), 123–124 (1988)
6. R.U. Umarova, A.N. Svechnikova, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **20**(2), 174–177 (1984)
7. R.P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **38**(6), 579–582 (2002)
8. F. Orsini, L. Verotta, L. Barboni, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, S.M. Toaima, *Phytochemistry* **35**(3), 745–749 (1994)
9. B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **27**(3), 381 (1991)

Squarroside B3

C₄₂H₆₈O₁₄, M 796



Taxonomy: Cycloartane Glycosides

Thalictrum squarrosum Stephan ex Willd.

(*Ranunculaceae*) [1].

Squarrosides B3 and B4 are a mixture of epimers at C-21.
Mp 187–189°C (from MeOH).

CAS Registry Number: 182353-35-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3350.

FABMS m/z : 835 $[\text{M} + \text{K}]^+$, 819 $[\text{M} + \text{Na}]^+$, 804 $[\text{M} + \text{Na} - \text{CH}_3]^+$, 801 $[\text{M} + \text{Na} - \text{H}_2\text{O}]^+$, 673 $[\text{M} + \text{Na} - 146]^+$, 515 $[\text{M} + 2\text{Na} - \text{H} - 308 - \text{H}_2\text{O}]^+$, 493 $[\text{M} + \text{Na} - 308 - \text{H}_2\text{O}]^+$.

Table 1

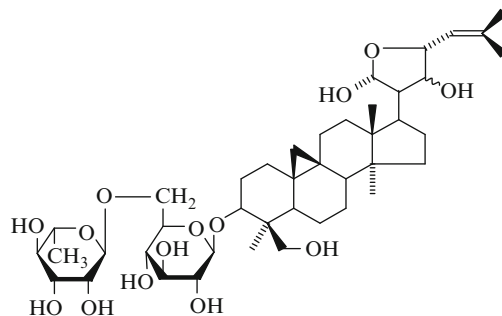
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	32.18	C-23	78.63
2	31.96	24	5.05 dd (2.1, 7.9)
3	89.82	25	5.85 m
4	45.51	26	–
5	48.08	27	1.66 d (1.5) or 1.69 d (1.5)
6	22.13	28	1.64 d (1.5) or 1.65 (1.5)
7	26.74	29	0.93 s or 1.95 s
8	48.84	30	1.47 s or 1.48 s
9	21.62	30	4.41 d (11.2), 3.70 d (11.2)
10	27.22	$\beta\text{-D-Glcp}$	
11	26.90	1	106.15
12	36.11	2	4.84 d (7.6)
13	45.75	3	75.57
14	48.92	4	3.81 m
15	30.39	5	79.50
16	30.18	6	4.0 m
17	45.10	1	72.08
18	25.92	2	4.47 m
19	30.99	3	78.77
20	56.72	4	68.34
21	101.63	$\alpha\text{-L-Rhap}$	
22	77.50	1	102.96
		2	5.35 brs
		3	72.35
		4	4.39 dd (1.8, 3.6)
		5	72.86
		6	4.32 t (3.6)
		1	74.16
		2	4.02 m
		3	69.64
		4	4.21 dq (9.4, 6.5)
		5	18.61
		6	1.54 d (6.5)

References

1. E.A. Khamidullina, A.S. Gromova, V.I. Lutsky, C.V. Zinchenko, A.A. Semenov, *Izv. Akad. Nauk. Ser. Khim.* **6**, 1547–1551 (1996)

Squarroside B4

$\text{C}_{42}\text{H}_{68}\text{O}_{14}$, M 796



Taxonomy: Cycloartane Glycosides

Thalictrum squarrosum Stephan ex Willd.

(*Ranunculaceae*) [1].

Squarrosides B3 and B4 are a mixture of epimers at C-21.
Mp. 187–189°C (from MeOH).

CAS Registry Number: 182510-93-6.

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3350.

FABMS m/z : 835 $[\text{M} + \text{K}]^+$, 819 $[\text{M} + \text{Na}]^+$, 804 $[\text{M} + \text{Na} - \text{CH}_3]^+$, 801 $[\text{M} + \text{Na} - \text{H}_2\text{O}]^+$, 673 $[\text{M} + \text{Na} - 146]^+$, 515 $[\text{M} + 2\text{Na} - \text{H} - 308 - \text{H}_2\text{O}]^+$, 493 $[\text{M} + \text{Na} - 308 - \text{H}_2\text{O}]^+$.

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)
C-1	32.18	C-23	80.53
2	31.96	24	4.76 dd (3.3, 8.5)
3	89.82	25	5.85 m
4	45.51	26	–
5	48.08	27	1.66 d (1.5) or 1.69 d (1.5)
6	22.13	28	1.64 d (1.5) or 1.65 d (1.5)
7	26.74	29	0.93 s or 1.95 s
8	48.84	30	1.47 s or 1.48 s
9	21.62	30	4.41 d (11.2), 3.70 (11.2)
10	27.22	$\beta\text{-D-Glcp}$	
11	26.90	1	106.15
12	36.32	2	4.85 d (7.9)
13	45.75	3	75.57
14	48.92	4	3.81 m
15	30.39	5	79.50
		6	4.0 m
		1	72.08
		2	4.47 m
		3	78.77
		4	68.34

(continued)

Table 1 (continued)

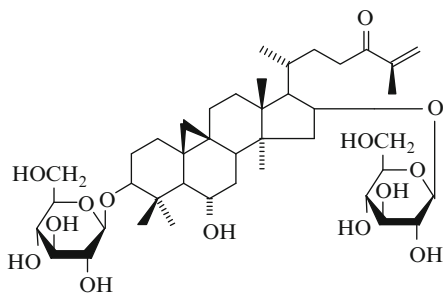
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	30.18	1.55 m	α -L-Rhap
17	41.28	2.82 q (11.2)	1 102.96 5.35 brs
18	25.92	1.07 s or 1.36 s	2 72.35 4.39 dd (1.8, 3.6)
19	30.99	0.21 d (3.9), 0.49 d (3.9)	3 72.86 4.30 t (3.3)
20	52.55	2.08 m	4 74.16 4.02 m
21	98.84	5.60 d (3.9)	5 69.64 4.21 dq (9.4, 6.5)
22	77.04	4.18 t (3.3)	6 18.61 1.53 d (6)

References

1. E.A. Khamidullina, A.S. Gromova, V.I. Lutsky, C.V. Zinchenko, A.A. Semenov, *Izv. Akad. Nauk. Ser. Khim* **6**, 1547–1551 (1996)

3 β ,16 β -Di- β -D-glucopyranosyloxy-6 α -hydroxy-9,19-cyclolanost-25-en-24-one

C₄₂H₆₈O₁₄, M 796



Taxonomy: Cycloartane Glycosides

Astragalus trigonus DC (*Leguminosae*) [1].

Mp 229°C (from Et₂O-MeOH, 2:1), $[\alpha]_D^{25} -74^\circ$ (c 0.61, MeOH).

CAS Registry Number: 182876-04-6.

UV $\lambda_{\max}^{\text{MeOH}}$, nm (ϵ): 218 (17.3×10^3).

FABMS m/z: 819 [M + Na]⁺.

Table 1

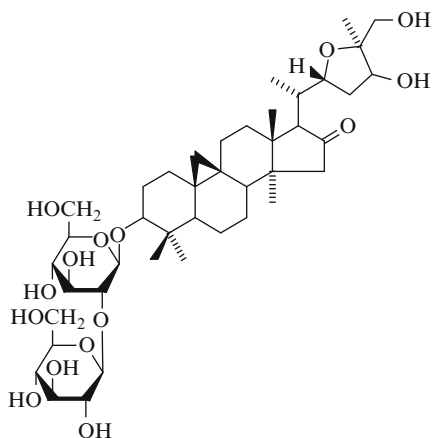
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)			
C-1	32.2	1.50 ddd (14.1, 13.2, 4.5),	C-21	17.5	0.92 d (7.3)	
		1.08 ddd (14.1, 4.2, 3.9)	22	31.8	1.53 m, 2.23 m	
2	29.9	2.44 m, 1.88 m	23	35.5	3.28 dt (11.3, 5.5),	
3	88.9	3.62 dd (11.2, 5.5)			2.81 ddd (11.3, 4, 3.5)	
4	42.7	–	24	203.0	–	
5	53.7	1.68 d (9.2)	25	145.0	–	
6	67.6	3.61 ddd (9.2, 9, 4.1)	26	124.6	6.20 brs, 5.66 brs	
7	38.0	1.69 m, 1.55 dt (12.1, 9.9)	27	17.6	1.87 s	
8	46.6	1.66 m	28	19.9	0.93 s	
9	21.3	–	29	28.6	1.98 s	
10	29.4	–	30	16.4	1.31 s	
11	25.9	1.85 dd (14.3, 6.4),	3-O- β -D-Glcp	1	106.7	4.97 d (7.4)
		1.11 dd (14.3, 8.9)	2	75.6	4.04 dd (9.4, 8)	
12	32.4	1.58 m (2H)	3	78.3	4.20 t (9)	
13	45.8	–	4	71.6	4.18 m	
14	46.6	–	5	77.9	3.93 m	
15	48.1	2.20 dd (14.2, 7.7),	6	62.6	4.53 m, 4.38 m	
		1.94 dd (14.2, 5.1)	16-O- β -D-Glcp	1	106.6	4.63 d (7.4)
16	82.3	4.30 ddd (7.7, 7.1, 5.1)	2	75.3	3.94 dd (7.8, 9.6)	
17	56.8	1.83 dd (11, 7.1)	3	78.2	4.16 t (8.6)	
18	18.7	1.17 s	4	71.6	4.20 m	
19	30.0	0.17 d (4), 0.43 d (4)	5	77.8	3.84 m	
20	29.9	2.27 dddq (11, 8.2, 7.3, 5.1)	6	62.6	4.40 dd (11.8, 3.3), 4.28 dd (12.4, 5.7)	

References

1. F. Pelizzoni, L. Verotta, G. Nicastro, M. Tato, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, S.M. Toaima, *Gazz. Chim. Ital.* **126**(10), 657–661 (1996)

Aquilegioside G

C₄₂H₆₈O₁₅, M 812



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} - 30.8^\circ$ (c 0.30, MeOH).

Positive FABMS m/z: 835 [M + Na]⁺.

Negative FABMS m/z: 811 [M-H]⁻.

HRFABMS m/z: 835.4446 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	31.9	1.07, 1.40	C-23	39.5	2.18 ddd (3.8, 6.7, 12.8),
2	29.9	1.89, 2.39			2.45 ddd (6.7, 6.7, 12.8)
3	88.6	3.46 dd (4.3, 11.6)	24	78.7	4.53
4	41.3	–	25	83.6	–
5	47.4	1.23	26	22.5	1.48 s
6	20.9	0.68, 1.51	27	67.1	4.08 d (11), 4.29 d (11)
7	26.1	1.00, 1.16	28	19.9	0.95 s
8	47.1	1.51	29	25.7	1.35 s
9	19.2	–	30	15.3	1.18 s
10	26.6	–	β-D-Glcp ₁		
11	26.4	1.07, 1.91	1	104.9	4.97 d (7.3)
12	31.5	1.07, 1.72	2	83.4	4.27 dd (7.3, 9.2)
13	42.3	–	3	78.4	4.32 dd (9.2, 9.2)
14	45.5	–	4	71.6	4.18 dd (9.2, 9.2)
15	50.8	2.04 d (18.3), 2.10 d (18.3)	5	78.0	3.92 m

(continued)

Table 1 (continued)

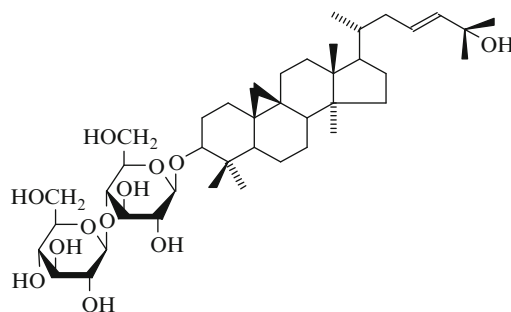
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
16	219.0	–	6	62.8	4.37 dd (4.9, 11.6),
17	58.8	2.86 d (9.2)			4.55 brd (10.8)
18	19.1	1.15 s	β-D-Glcp ₂		
19	30.0	0.21 d (3.7), 0.49 d (3.7)	1	106.0	5.41 d (7.3)
20	36.1	2.24 m	2	77.1	4.15 dd (7.3, 9.2)
21	12.0	1.27 d (6.7)	3	78.2	4.27 dd (9.2, 9.2)
22	76.6	5.10 brt (6.7)	4	71.7	4.34 dd (9.2, 9.2)
			5	78.0	3.95 m
			6	62.8	4.46 dd (4.8, 11.6),
					4.52 brd (10.6)

References

1. M. Hishida, H. Yoshimitsu, M. Okawa, T. Nohara, *Chem. Pharm. Bull.* **51**(8), 956–959 (2003)

Acanthoside K₃

C₄₂H₇₀O₁₂, M 766



Taxonomy: Cycloartane Glycosides

Acanthopanax sesiliflorus (*Araliaceae*) [1].

Mp 179.5–181°C, $[\alpha]_D^{23} + 28^\circ$ (c 0.51, MeOH).

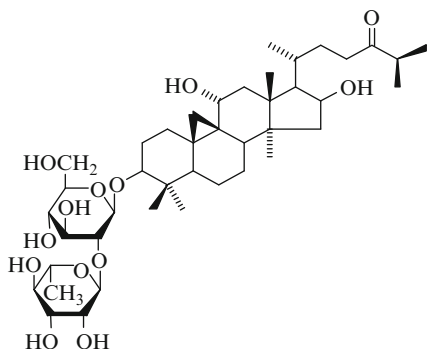
CAS Registry Number: 119259-75-5.

References

1. L. Kong, C. Shao, J. Xu, *Zhongcaoyao* **19**(11), 482–486 (1988)

Curculigosaponin G

C₄₂H₇₀O₁₃, M 782



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 154–157°C, $[\alpha]_D^{25} +4.23^\circ$ (c 0.1, MeOH).

CAS Registry Number: 142998-33-2.

FABMS m/z: 805 [M + Na]⁺, 821 [M + K]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.25 and 0.43 (2H-19, d, J = 4 Hz), 0.95 and 0.98 (2 × CH₃, d, J = 6.8 Hz), 1.20, 1.23, 1.29, 1.33 (4 × CH₃, s), 1.66 (Rha CH₃, d, J = 6 Hz), 2.53 (H-25, septet, J = 6.8 Hz), 4.90 (Glc H-1, d, J = 7.8 Hz), 6.52 (Rha H-1, s).

Table 1

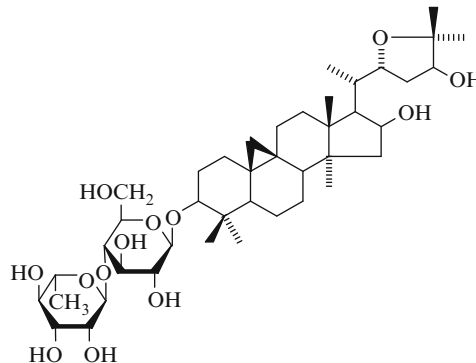
δ_C (C ₅ D ₅ N)						β -D-Glcp	
C-1	32.74	C-11	72.44	C-21	17.16	1	105.09
2	30.10	12	40.09	22	30.95	1	105.09
3	88.52	13	47.14	23	38.15	2	79.67
4	40.85	14	50.20	24	215.71	3	77.78
5	48.20	15	50.32	25	41.32	4	72.30
6	21.45	16	71.84	26	18.50	5	78.18
7	26.77	17	49.40	27	18.50	6	63.10
8	49.23	18	22.05	28	18.58	α -L-Rhap	
9	20.03	19	30.10	29	25.75	1	101.62
10	26.26	20	30.29	30	15.82	2	72.30
						3	72.55
						4	74.20
						5	69.57
						6	18.45

References

1. J. Xu, R. Xu, X. Li, *Planta Med.* **58**(2), 208–210 (1992)

Depressoside E

C₄₂H₇₀O₁₃, M 782



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Amorphous solid, mp 212–214°C, $[\alpha]_D^{25} -19.8^\circ$ (c 0.18, MeOH).

Positive ion FABMS m/z: 805 [M + Na]⁺, 783 [M + H]⁺, 659 [M + Na-146]⁺, 641 [M + Na-146-H₂O]⁺, 497 [M + Na-146-162]⁺, 461 [M + Na-146-162-2H₂O]⁺.

Negative ion FABMS m/z: 781 [M-H]⁻, 635 [M-H-146]⁻, 473 [M-H-146-162]⁻, 455 [M-H-146-H₂O]⁻.

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)		δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	
C-1	33.06	1.19, 1.53		C-23	36.24	1.78 m, 2.21 m	
2	30.35	1.73, 2.10		24	78.35	4.03 dd (4, 6.9)	
3	89.99	3.20 dd (10.9, 4.1)		25	84.21	–	
4	42.05	–		26	26.01	1.32 s	
5	48.87	1.30 dd (11.8, 3)		27	23.15	1.23 s	
6	22.08	0.81, 1.63		28	20.54	0.98 s	
7	27.27	0.98, 1.28		29	26.17	1.09 s	
8	49.50	1.62 dd (3.9, 12.2)		30	15.50	0.88 s	
9	21.05	–		β -D-Glcp			
10	27.42	–		1	104.0	4.58 d (8.5)	
11	27.33	1.13, 2.03		2	73.8	3.08 m	
12	34.38	1.36, 1.65		3	77.00	3.45 m	
13	48.20	–		4	78.64	4.51 m	
14	47.56	–		5	77.40	3.37 m	
15	47.60	1.37, 1.95		6	61.80	3.69 dd (5.2, 10.7),	

(continued)

Table 1 (continued)

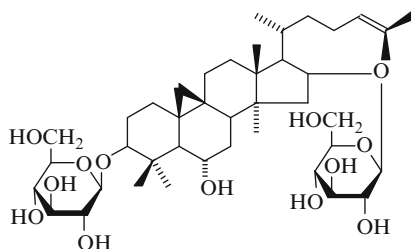
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	73.10	4.51 ddd (5.3, 8, 8.2)	3.85 dd (2.8, 10.7)
17	53.01	1.96 dd (6.8, 11.9)	α -L-Rhap
18	19.42	1.18 s	1 102.3 5.20 d (1.68)
19	31.01	0.35 d (3.9), 0.55 d (3.9)	2 71.80 3.51 m
20	33.38	2.28 m	3 72.20 3.43 m
21	16.02	0.93 d (6.8)	4 73.70 3.11 m
22	81.12	4.02 ddd (3.2, 7.2, 8.3)	5 68.80 3.01 m
		6 18.10	1.25 d (6)

References

1. M. Zahid, A. Ali, O. Ishurd, A. Ahmed, Z. Ali, V.U. Ahmad, Y. Pan, *Helv. Chim. Acta* **85**(2), 689–697 (2002)

3 β ,16 β -Di- β -D-glucopyranosyloxy-6 α -hydroxy-9,19-cyclolanost-24-ene

C₄₂H₇₀O₁₃, M 772



Taxonomy: Cycloartane Glycosides

Astragalus trigonus DC (*Leguminosae*) [1].

Mp 166°C (from Et₂O-MeOH), $[\alpha]_D^{25} - 31^\circ$ (c 1.35, MeOH).

FABMS m/z: 805 [M + Na]⁺.

Table 1

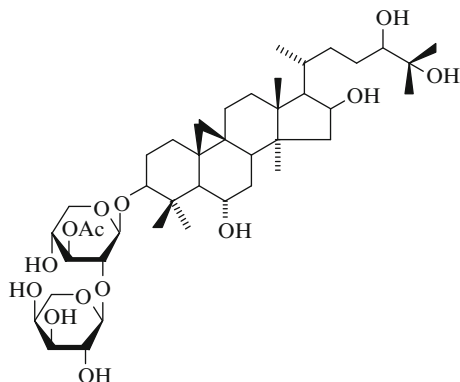
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.56	1.53 ddd (14, 13, 4.6),	C-24 126.86 5.52 dt (7.7, 1.8)
		1.11 ddd (14, 4.6, 4)	25 130.01 –
2	30.37	2.47 m (13.6), 1.94 ddt (13.6, 5.8, 4.6)	26 25.94 1.66 d (1.8)
3	89.17	3.65 dd (11.2, 5.8)	27 17.93 1.70 d (1.8)
4	42.71	–	28 20.40 2.00 s
5	54.10	1.67 d (9.5)	29 29.08 1.33 s
6	67.99	3.63 ddd (9.5, 9, 4.1)	30 16.84 0.97 s
7	38.50	1.69 m (12.1), 1.58 dt (12.1, 9)	3-O- β -D-Glcp
8	46.98	1.70 m	1 106.70 4.92 d (7.7)
9	21.27	–	2 75.52 4.03 dd (9.4, 7.7)
10	29.34	–	3 78.38 4.20 t (9)
11	26.36	1.89 dd (14.3, 6.4), 1.14 dd (14.3, 8.9)	4 71.49 4.17 m
12	32.90	1.61 m (2H)	5 77.79 3.91 ddd (11, 5.5, 2.9)
13	45.76	–	6 62.67 4.50 dd (12.1, 2.9),
14	46.95	–	4.33 dd (12.1, 5.5)
15	48.16	2.24 dd (14.2, 7.7), 1.98 dd (14.2, 5.1)	16-O- β -D-Glcp
16	82.57	4.38 ddd (7.7, 7.3, 5.1)	1 106.53 4.65 d (7.6)
17	57.01	1.87 dd (11, 7.3)	2 75.28 3.99 dd (7.6, 9.6)
18	19.12	1.20 s	3 78.33 4.15 t (8.6)
19	30.29	0.21 d (4.5), 0.45 d (4.5)	4 71.49 4.19 t (8.4)
20	30.44	2.31 dddq (11, 8, 7.2, 5.3)	5 77.74 3.85 ddd (9.9, 5.5, 3.3)
21	17.93	1.01 d (7.2)	6 62.64 4.40 dd (12.1, 3.3),
22	37.06	2.02 m, 1.27 m	4.27 dd (12.1, 5.5)
23	25.78	2.35 m, 2.29 m	

References

1. L. Verotta, F. Orsini, M. Tato, N.A. El-Sebakhu, S.M. Toaima, *Phytochemistry* **49**(3), 845–852 (1998)

Askendoside A

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides

Astragalus taschkendicus Bunge (*Leguminosae*) [1].

Mp 213–214°C (from MeOH), $[\alpha]_D^{25}$ 0° (c 0.8, MeOH).

CAS Registry Number: 89203-17-8.

IR ν_{\max}^{KBr} , cm⁻¹: 3520–3325, 3040, 1735, 1258.

¹H NMR (300 MHz, C₅D₅N, δ , 0-HMDS): 0.16 and 0.45 (2H-19, d, J = 4.4 Hz), 0.89 (CH₃, s), 0.98 (CH₃-21, d, J = 6.6 Hz), 1.27, 1.27, 1.36, 1.38, 1.70 (5 × CH₃, s), 2.03 (Ac, s), 3.34 (H-3, m), 4.59 (H-16, m), 4.88 and 4.89 (2 anomeric protons, d, J = 5.8 and 7 Hz), 5.54 (Xylp H-3, t, J = 7.5 Hz).

Table 1

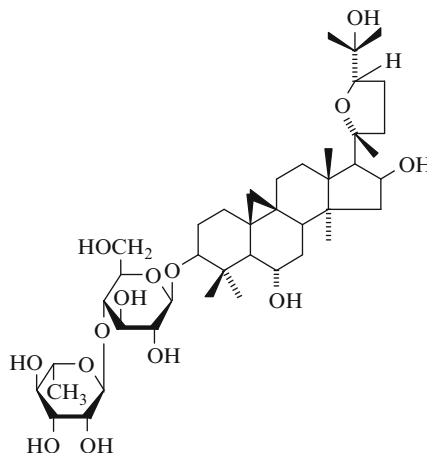
δ_C (C ₅ D ₅ N)									
C-1	32.40	C-11	26.33	C-21	18.99	β -D-Xylp	Ac		
2	29.19	12	33.14	22	34.82 ^a	1	104.37	21.41	
3	89.10	13	45.70	23	30.00 ^a	2	75.76	170.60	
4	42.68	14	46.91	24	80.55	3	77.20		
5	54.01	15	48.70	25	72.65	4	68.54		
6	67.88	16	71.69	26	25.91	5	65.18		
7	38.39	17	57.21	27	26.13	α -L-Arap			
8	46.99	18	18.76	28	20.21	1	105.16		
9	21.32	19	29.37	29	28.66	2	72.47		
10	30.00 ^a	20	31.62	30	16.32	3	74.40		
						4	69.25		
						5	67.06		

References

- M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, N.K. Abubakirov, *Chem. Nat. Comp.* **19**(5), 552–556 (1983)

Astraverrucin IV

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides

Astragalus verrucosus (*Leguminosae*) [1].

Astragalus peregrinus (*Leguminosae*) [2].

$[\alpha]_D^{20}$ +10.5° (c 0.18, MeOH).

CAS Registry Number: 220997-48-8.

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3370, 1732, 1050.

FABMS m/z: 821 [M + Na]⁺, 799 [M + H]⁺.

EIMS m/z (%): 185 (8.39), 143 (82.32), 125 (93.50), 107 (70.73), 95 (55.39), 85 (71.71), 71 (87.12), 59 (100).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.4	δ_H (J/Hz)		C-23	26.2	δ_H (J/Hz)	
2	30.1	1.58, 1.15		24	81.7	2.05, 2.38	
3	89.2	1.92, 2.4		25	71.3	–	
4	42.6	–		26	28.2	1.6	
5	54.0	3.63 dd (11.8, 4.6)		27	28.6	1.3	
6	68.0	–		28	20.2	1.0	
7	38.7	1.75		29	29.0	2.05	
8	47.2	1.6, 1.8		30	16.7	1.35	
9	21.6	1.9		β -D-Glcp			
10	29.5	–		1	106.8	4.9 d (7.6)	
11	26.5	2.05, 2.32		2	76.1	4.05 dd (7.6, 8.2)	
12	34.9	–		3	76.8	4.2 dd (8.2, 9.3)	
13	45.0	1.7, 3.1		4	78.4	4.42 dd (9.3, 8.9)	

(continued)

Table 1 (continued)

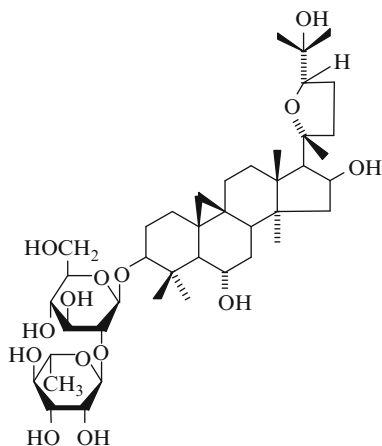
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
14	46.9	5	77.0
15	46.1	6	63.0
16	73.5	α -L-Rhap	
17	58.4	1	102.7
18	20.9	2	72.6
19	30.6	3	72.8
20	87.2	4	74.0
21	27.1	5	70.3
22	33.4	6	19.0

References

1. L. Pistelli, S. Pardossi, A. Bertoli, D. Potenza, *Phytochemistry* **49**(8), 2467–2471 (1998)
2. L. Verotta, M. Guerrini, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, M.E. Abou-Sheer, Y.D. Luo, J.M. Pezzuto, *Fitoterapia* **72**(8), 894–905 (2001)

Cycloaraloside D

$C_{42}H_{70}O_{14}$, M 798



Taxonomy: Cycloartane Glycosides

Astragalus amarus Pall. (*Leguminosae*) [1].

Astragalus peregrinus (*Leguminosae*) [2].

Mp 226–228°C (from MeOH), $[\alpha]_D^{28} - 11.9^\circ$ (c 0.84, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3600–3150.

1H NMR (250 MHz, C_5D_5N , δ , 0-TMS): 0.19 and 0.55 (2H-19, d, $J = 4$ Hz), 1.03, 1.31, 1.33, 1.41, 1.55, 1.60, 2.02 ($7 \times CH_3$, s), 1.77 (Rhap CH_3 , d, $J = 6$ Hz), 2.55 (H-17, d, $J = 7.5$ Hz), 3.12 (H-22, q, $J = 10$ Hz), 3.60 (H-3, dd, $J = 11, 4$ Hz), 3.77 (H-6, td, $J = 8.5, 3.5$ Hz), 5.03 (Glc p H-1, d, $J = 7$ Hz), 6.62 (Rhap H-1, brs).

Table 1

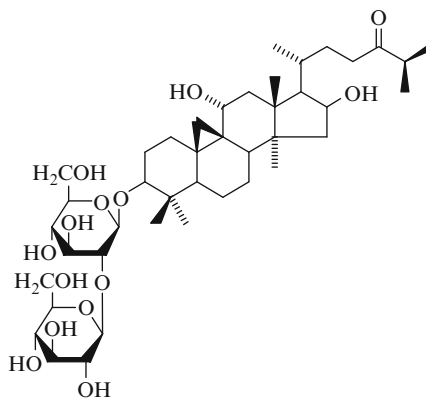
δ_C (C_5D_5N)		δ_C (C_5D_5N)		δ_C (C_5D_5N)	
C-1	32.72	C-11	26.48	C-21	27.99
2	30.25	12	33.66	22	35.21
3	88.55	13	45.38	23	26.34
4	42.61	14	46.35	24	82.03
5	54.31	15	46.87	25	71.19
6	67.99	16	73.40	26	27.08
7	38.36	17	58.56	27	28.40
8	46.96	18	21.35	28	20.23
9	21.06	19	30.51	29	28.69
10	29.63	20	87.20	30	16.71

References

1. M.I. Isaev, *Chem. Nat. Comp.* **27**(4), 457–459 (1991)
2. L. Verotta, M. Guerrini, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, M.E. Abou-Sheer, Y.D. Luo, J.M. Pezzuto, *Fitoterapia* **72**(8), 894–905 (2001)

Curculigosaponin D

$C_{42}H_{70}O_{14}$, M 798



Taxonomy: Cycloartane Glycosides

Curculigo orchioides Gaerth. (*Hypoxidaceae*) [1].

Mp 161–164°C, $[\alpha]_D -10.46^\circ$ (c 0.95, MeOH).

CAS Registry Number: 136771-45-4.

FABMS m/z: 821 [M + Na]⁺, 837 [M + K]⁺, 439 [M + H-162 × 2-H₂O]⁺.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.27 and 0.43 (2H-19, d, J = 4 Hz), 0.97 and 0.99 (CH₃-26 and CH₃-27, d, J = 7.2 Hz), 1.16, 1.30, 1.32, 1.38 (4 × CH₃, s), 1.37 (CH₃-21, d, J = 6.8 Hz), 2.54 (H-25, septet, J = 7.2 Hz), 5.38 (Glc H-1, d, J = 7 Hz), 5.79 (Glc' H-1, d, J = 7 Hz).

Table 1

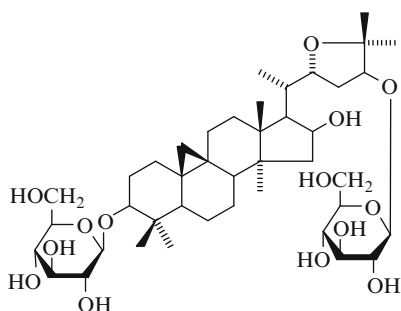
δ _C (C ₅ D ₅ N)									
C-1	32.48	C-11	72.69	C-21	17.11	β-D-Glcp ₁		β-D-Glcp ₂	
2	30.00	12	40.15	22	30.88	1	104.84	1	106.04
3	88.81	13	47.11	23	38.15	2	83.57	2	76.10
4	40.79	14	50.13	24	215.80	3	77.84	3	78.05
5	47.90	15	50.34	25	41.37	4	71.74	4	71.91
6	21.42	16	71.74	26	18.49	5	78.05	5	78.39
7	26.74	17	49.35	27	18.49	6	62.93	6	62.93
8	49.35	18	22.06	28	18.49				
9	20.10	19	29.80	29	25.80				
10	26.20	20	30.27	30	15.43				

References

- J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Depressoside D

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Amorphous solid, mp 213–215°C, $[\alpha]_D^{25} -24.96^\circ$ (c 0.45, MeOH).

CAS Registry Number: 314266-09-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3350–3450.

Positive ion FABMS m/z: 821 [M + Na]⁺, 799 [M + H]⁺, 659 [M + Na-162]⁺, 641 [M + Na-146-H₂O]⁺, 497 [M + Na-2 × 162]⁺, 479 [M + Na-2 × 162-H₂O]⁺.

Negative ion FABMS m/z: 797 [M-H]⁻, 635 [M-H-162]⁻, 599 [M-H-162-2H₂O]⁻, 455 [M-H-2 × 162-H₂O]⁻.

Table 1

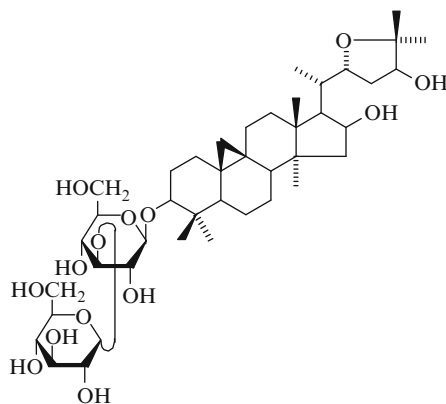
	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)		δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	33.10	1.15, 1.53	C-23	35.31	2.20, 2.30
2	30.25	1.75, 2.05	24	86.85	4.02 dd (3.5, 7)
3	91.01	3.23 dd (4.4, 11.3)	25	84.14	–
4	42.04	–	26	26.03	1.30 s
5	48.88	1.31 dd (3.4, 12.2)	27	23.37	1.22 s
6	22.06	0.82, 1.62	28	20.63	0.95 s
7	27.26	1.02, 1.32	29	26.35	1.07 s
8	49.46	1.60 dd (4.4, 12)	30	15.48	0.89 s
9	21.06	–	3-O-β-D-Glcp ₁		
10	27.42	–	1	104.17	4.48 d (7.6)
11	27.35	1.13, 2.05	2	81.84	4.08 dd (7.6, 9)
12	34.35	1.38, 1.65	3	78.30	3.65 t (9)
13	47.89	–	4	71.66	3.25 t (9)
14	47.02	–	5	77.25	3.30 ddd (2.5, 5.5, 9)
15	47.40	1.36, 1.95	6	63.15	3.68 dd (5.5, 11.6),
16	73.05	4.53 ddd (5.6, 8.0, 8.1)			3.85 dd (2.5, 11.6)
17	52.47	1.97 dd (7, 12)	24-O-β-D-Glcp ₂		
18	19.41	1.17 s	1	105.45	4.32 d (7.7)
19	30.91	0.35 d (4), 0.59 d (4)	2	75.50	3.20 dd (7.7, 9.2)
20	33.51	2.30 m	3	77.87	3.68 t (9.2)
21	16.19	0.92 d (7)	4	71.99	3.40 t (9.2)
22	81.67	4.05 ddd (2.5, 7.5, 7.5)	5	77.76	3.35 ddd (2.5, 5.3, 9.2)
			6	63.71	3.71 dd (5.3, 12),
					3.89 dd (2.5, 12)

References

- V.U. Ahmad, A. Ali, Z. Ali, F.N. Zafar, M. Zahid, *Chem. Pharm. Bull.* **48**(11), 1597–1601 (2000)

Depressoside F

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides

Corchorus depressus L. (*Tiliaceae*) [1].

Amorphous solid, mp 202–204°C, $[\alpha]_D^{25} - 10.9^\circ$ (c 0.24, MeOH).

Positive ion FABMS m/z: 821 [M + Na]⁺, 799 [M + H]⁺, 659 [M + Na-162]⁺, 641 [M + Na-162-H₂O]⁺, 497 [M + Na-2 × 162]⁺, 479 [M + Na-2 × 162-H₂O]⁺.

Negative ion FABMS m/z: 797 [M-H]⁻, 635 [M-H-162]⁻, 599 [M-H-162-2H₂O]⁻, 473 [M-H-2 × 162]⁻, 455 [M-H-2 × 162-H₂O]⁻.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	33.08 1.20, 1.55	C-23	36.27 1.77 m, 2.20 m
2	30.30 1.72, 2.13	24	78.49 4.02 dd (4.1, 7.1)
3	90.01 3.22 dd (4, 10.5)	25	84.18 –
4	42.15 –	26	26.05 1.33 s
5	49.0 1.35 dd (3.4, 11.7)	27	23.32 1.25 s
6	22.12 0.80, 1.64	28	20.62 0.96 s
7	27.55 0.97, 1.29	29	26.29 1.10 s
8	49.79 1.60 dd (3.8, 12)	30	15.45 0.89 s
9	21.10 –	β-D-Glcp	
10	27.32 –	1	103.5 4.58 d (8)
11	27.23 1.15, 2.01	2	73.8 3.06 m
12	34.40 1.30, 1.63	3	83.9 4.02 m
13	48.54 –	4	68.9 3.26 m
14	47.59 –	5	77.4 3.19 m
15	47.91 1.38, 1.92	6	61.8 3.72 m, 3.40 m

(continued)

Table 1 (continued)

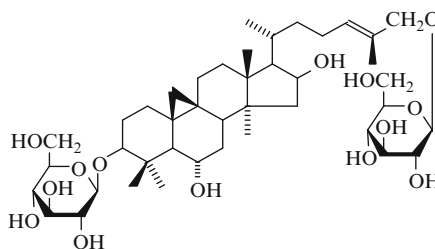
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
16	73.0 4.55 ddd (5.4, 8.1, 8.5)	α-D-Glcp	
17	52.72 1.98 dd (7, 12.1)	1	100.2 4.32 d (3.5)
18	19.22 1.18 s	2	72.3 3.09 m
19	29.89 0.37 d (4.2), 0.58 d (4.2)	3	75.9 3.14 m
20	33.35 2.25 m	4	70.2 3.09 m
21	16.05 0.95 d (6.9)	5	76.5 3.15 m
22	81.12 4.00 ddd (2.9, 7.1, 8)	6	60.8 3.65 m, 3.45 m

References

- M. Zahid, A. Ali, O. Ishurd, A. Ahmed, Z. Ali, V.U. Ahmad, Y. Pan, *Helv. Chim. Acta* **85**(2), 689–697 (2002)

Kahiricoside V

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides

Astragalus kahiricus DC (*Leguminosae*) [1].

Mp 157–158°C, $[\alpha]_D^{25} +86.7^\circ$ (c 0.015, MeOH).

IR ν_{\max} , cm⁻¹: 3386, 2979–2842.

HRFABMS m/z: 821.4708 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.5 1.32 m, 1.54	C-23	25.6 2.13 m, 2.27 m
2	30.2 1.92 m, 2.47 m	24	129.6 5.72 t (6)
3	89.1 3.65 dd (4.4, 11.6)	25	131.8 –
4	42.7 –	26	14.3 1.78 s
5	54.1 1.73 d (9.2)	27	75.3 4.26 brs, 4.48 brs
6	68.0 3.76 m	28	20.3 1.04 s
7	38.5 1.64 m, 1.80 m	29	29.0 2.01 s

(continued)

Table 1 (continued)

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
8	46.9 1.98 m	30	16.8 1.31 s
9	21.3 –	3-O- β -D-Glcp	
10	29.3 –	1	107.0 5.00 d (8)
11	26.4 1.20 m, 1.88 m	2	76.0 4.08 m
12	33.3 1.70 m	3	78.8 4.29 m
13	45.8 –	4	71.9 4.29 m
14	47.1 –	5	78.2 3.95 m
15	49.7 1.76 m, 2.14 m	6	62.9 4.39 m, 4.57 m
16	71.4 4.63 m	27-O- β -D-Glcp	
17	57.0 1.80 m	1	103.5 4.88 d (7.6)
18	19.1 1.39 s	2	75.3 4.07 m
19	30.0 0.22 d (4.4), 0.54 d (4.4)	3	78.7 4.29 m
20	30.8 2.27 m	4	71.8 4.39 m
21	18.3 1.05 d (6.6)	5	78.5 4.95 m
22	36.6 1.26 m, 2.1 m	6	63.0 4.36 m, 4.56 m

Biological activity

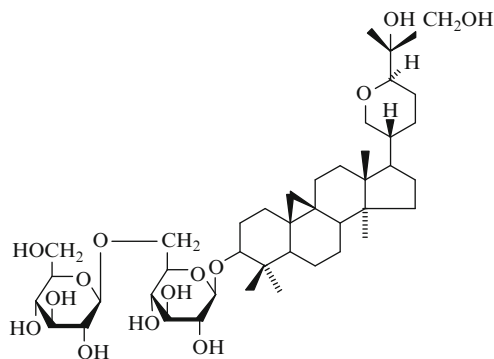
Glycoside exhibited very weak cytotoxicity against the A 2780 ovarian cancer cell line.

References

1. M.M. Radwan, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, D.G.I. Kingston, *Phytochemistry* **65**, 2909–2913 (2004)

No Name (9,19-Cyclolanostan-21,24-epoxy-3 β ,25,26-triol-3-O- β -gentiobioside)

$C_{42}H_{70}O_{14}$, M 798

**Taxonomy: Cycloartane Glycosides**

Passiflora quadrangularis L. (*Passifloraceae*) [1].

Mp 189–191°C (from EtOAc-EtOH, 1:1), $[\alpha]_D^{25} +5^\circ$ (c 0.07, MeOH).

FABMS m/z: 838 [M + Ca]⁺.

Table 1

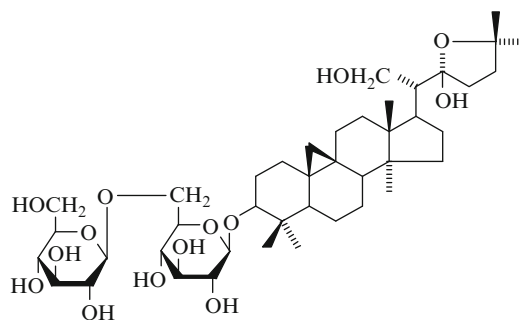
δ_C (C_5D_5N)							
C-1	32.2	C-11	26.3	C-21	68.0	β -D-Glcp ₁	β -D-Glcp ₂
2	29.8	12	35.8	22	1	105.2	1 106.8
3	88.7	13	45.6	23	2	75.2	2 75.6
4	41.4	14	49.3	24	3	78.3	3 78.4
5	47.6	15	32.5	25	4	71.9	4 71.9
6	21.2	16	26.6	26	62.2	5	77.1 5 78.5
7	27.9	17	42.9	27	21.2	6	70.3 6 62.9
8	48.1	18	18.7	28	19.8		
9	20.0	19	30.0	29	27.8		
10	26.4	20		30	15.5		

References

1. F. Orsini, F. Pelizzoni, G. Ricca, L. Verotta, *Phytochemistry* **26**(4), 1101–1105 (1987)

No Name (9,19-Cyclolanostan-22,25-epoxy-3 β ,21,22R-triol-3-O- β -gentiobioside)

$C_{42}H_{70}O_{14}$, M 798

**Taxonomy: Cycloartane Glycosides**

Passiflora quadrangularis L. (*Passifloraceae*) [1].
Mp 167–168°C (from EtOAc–EtOH, 7:3), $[\alpha]_D^{25} +6^\circ$
(c 0.57, MeOH).
FABMS m/z: 838 [M + Ca]⁺, 822 [M + Mg]⁺, 781 [M-17]⁺, 763 [M-18]⁺. ¹H NMR (300 MHz, C₅D₅N, δ , 0-TMS): 0.19 and 0.41 (2H-19, d, J = 4.5 Hz), 0.79, 0.97, 1.08, 1.32, 1.61, 1.64 (6 × CH₃, s).

Table 1

δ_C (C ₅ D ₅ N)									
C-1	32.5	C-11	26.1	C-21	65.2	β -D-Glcp ₁	β -D-Glcp ₂		
2	29.6	12	35.7	22	98.1	1	105.1	1	106.5
3	88.5	13	45.4	23	25.0	2	75.1	2	75.5
4	41.2	14	48.8	24	24.8	3	78.2	3	78.2
5	47.4	15	32.4	25	74.9	4	71.7	4	71.7
6	21.2	16	26.3	26	19.9	5	77.0	5	78.4
7	27.0	17	45.1	27		6	70.2	6	62.7
8	47.9	18	18.7	28	19.5				
9	19.9	19	29.8	29	25.7				
10	26.3	20	49.6	30	15.4				

References

1. F. Orsini, F. Pelizzoni, G. Ricca, L. Verotta, *Phytochemistry* **26**(4), 1101–1105 (1987)

Mp 255–258°C (from MeOH), $[\alpha]_D^{22} +8.94^\circ$ (c 2.0, C₅H₅N).

CAS Registry Number: 93208-45-8.

Table 1

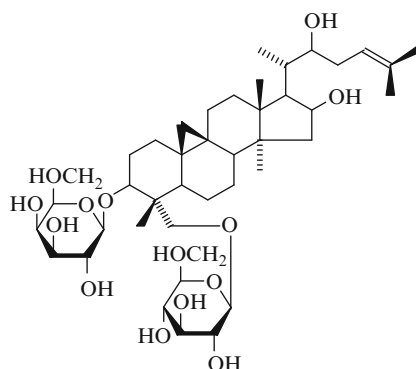
δ_C (C ₅ D ₅ N)									
C-1	32.6	C-11	26.6	C-21	14.9	β -D-Galp	β -D-Glcp		
2	29.7	12	33.8	22	75.6	1	106.2	1	105.2
3	82.1	13	46.3	23	34.0	2	75.9	2	75.9
4	45.3	14	47.7	24	123.8	3	73.8	3	79.0
5	41.2	15	49.1	25	131.9	4	70.8	4	72.5
6	21.1	16	72.1	26	26.2	5	76.5	5	78.2
7	26.8	17	53.3	27	18.4	6	63.5	6	62.9
8	48.8	18	21.0	28	19.9				
9	20.3	19	31.9	29	71.5				
10	26.3	20	36.3	30	12.1				

References

1. A.S. Gromova, V.I. Lutsky, A.A. Semenov, V.A. Denisenko, V.V. Isakov, *Chem. Nat. Comp.* **20**(2), 197–203 (1984)

Thalicoside A

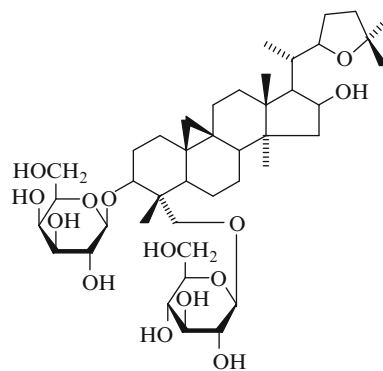
C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides
Thalictrum minus L. (*Ranunculaceae*) [1].

Thalicoside A1

C₄₂H₇₀O₁₄, M 798



Taxonomy: Cycloartane Glycosides
Thalictrum minus L. (*Ranunculaceae*) [1].
Mp 300–301°C (from CHCl₃–MeOH–H₂O, 70:23:1),
 $[\alpha]_D^{25} +3.6^\circ$ (c 0.66, C₅H₅N).
IR ν_{\max}^{KBr} , cm⁻¹: 3411, 3043, 2944, 2888, 1122, 1054.

Negative ion FABMS m/z : 797 $[M-H]^-$, 635 $[M-163]^-$, 474 $[M-325]^-$.
HRFABMS m/z : 797.4686 $[M-H]^-$.

Beesioside H

$C_{42}H_{70}O_{15}$, M 814

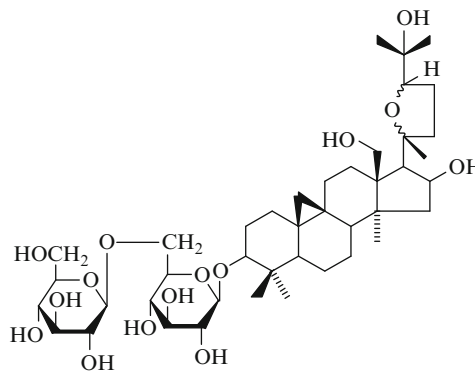


Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.29 0.98, 1.12	C-23	27.66 1.76, 1.79
2	29.80 2.02, 2.44	24	38.87 1.61a, 1.61b
3	81.75 4.46 dd (4.9, 11.1)	25	80.79 –
4	45.25 –	26	28.99 1.26 s
5	40.89 2.00 dd (4.1, 11.1)	27	28.03 1.17 s
6	20.95 0.61 dddd (2.3, 11.1, 12.2, 12.5), 1.78	28	20.84 0.83 s
7	26.63 0.96, 1.11	29	71.57 4.09 d (9.8), 4.42 d (9.8)
8	48.52 1.54 dd (4.4, 12.5)	30	11.59 0.92 s
9	19.78 –	β -D-Glcp	
10	25.93 –	1	105.74 5.34 d (7.8)
11	26.69 1.07 m, 1.80	2	75.82 4.18 d (7.8)
12	33.71 1.34, 1.62	3	78.96 4.27
13	46.27 –	4	72.09 4.24
14	47.28 –	5	78.73 4.03 m
15	48.52 1.63, 2.01	6	62.72 4.41, 4.52
16	71.94 4.64 st (4.6, 7.8)	β -D-Galp	
17	53.09 2.02	1	106.77 5.50 d (7.8)
18	19.72 1.34 s	2	73.61 4.43
19	30.84 0.23 d (3.8), 0.43 d (3.8)	3	75.87 4.27
20	33.36 2.50 m	4	70.81 4.55
21	15.16 0.96 d (6.5)	5	76.67 4.33 m
22	82.80 4.30 dd (2.2, 7.8)	6	63.15 4.43, 4.53

References

- A.S. Gromova, V.I. Lutsky, D. Li, S.G. Wood, N.L. Owen, A.A. Semenov, D.-M. Grant, J. Nat. Prod. **63**(7), 911–914 (2000)

Taxonomy: Cycloartane Glycosides

Beesia calthifolia (Maxim.) Ulbr. (*Ranunculaceae*) [1].

Amorphous powder, mp 190–194°C (from $CHCl_3$ –MeOH), $[\alpha]_D^{20} +23.8^\circ$ (c 0.08, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3440, 2960, 2925, 1460, 1380, 1360, 1160, 1090, 1040.

Positive ion FABMS m/z (%): 853 $[M + K]^+$, 837 $[M + Na]^+$, 815 $[M + H]^+$, 797, 779, 761, 653, 635, 617, 599, 455, 437, 419, 143 (100), 125, 93, 71.

Positive HRFABMS m/z : 815.47992 $[M + H]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1	32.2 1.18 m, 1.62 m	C-23	24.5 2.23 m, 1.96 m
2	30.0 1.88 m, 2.48 m	24	85.2 3.95 m
3	88.6 3.50 dd (11.6, 4.3)	25	70.8 –
4	41.3 –	26	28.2 1.49 s
5	47.8 1.21 m	27	26.4 1.20 s
6	20.9 0.58 q (12.4), 1.43 m	28	22.6 0.89 s
7	26.4 0.98 m	29	25.7 1.25 s
8	47.6 1.90 m	30	15.4 0.96 s
9	20.1 –	β -D-Glcp ₁	
10	26.5 –	1	106.7 4.86 d (7.7)
11	26.7 1.96 m	2	75.6 3.94 m
12	29.1 1.96 m, 1.45 m	3	78.3 4.17 m
13	51.7 –	4	71.7 4.02 m
14	46.9 –	5	77.1 4.06 m

(continued)

Table 1 (continued)

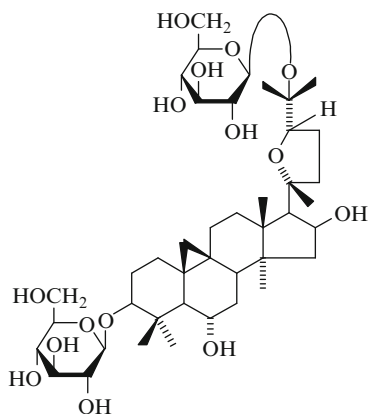
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
15	49.0 2.05 m, 2.05 m	6	70.3 4.77 m, 4.28 m
16	72.7 4.80 m	β -D-Glcp ₂	
17	55.6 2.27 d (7)	1	105.3 5.11 d (7.8)
18	65.7 4.46 m, 4.28 m	2	75.2 4.01 m
19	30.4 0.17 d (3.8), 0.49 d (3.8)	3	78.5 4.13 m
20	86.4 –	4	71.7 4.18 m
21	26.0 1.36 s	5	78.3 3.90 m
22	36.8 2.45 m, 1.65 m	6	62.8 4.45 m, 4.29 m

References

- J. Ju, D. Liu, G. Lin, Y. Zhang, J. Yang, Y. Lu, N. Gong, Q. Zheng, *J. Nat. Prod.* **65**(2), 147–152 (2002)

Cycloaraloside E

$C_{42}H_{70}O_{15}$, M 814



Taxonomy: Cycloartane Glycosides

Astragalus amarus Pall. (*Leguminosae*) [1].

Mp 180–182°C (from $CHCl_3$ –MeOH, 1: 1), $[\alpha]_D^{28} - 5^\circ$ (c 0.5, MeOH).

CAS Registry Number: 134563-28-3.

IR ν_{max}^{KBr} , cm^{-1} : 3600–3240.

¹H NMR (100 MHz, C_5D_5N , δ , 0-HMDS): 0.08 and 0.42 (2H-19, d, J = 4 Hz), 0.80, 1.16, 1.18, 1.18, 1.28, 1.52, 1.84 (7 × CH₃, s), 4.82 (3-O- β -D-Glcp

H-1, d, J = 7 Hz and H-16), 4.90 (25-O- β -D-Glcp H-1, d, J = 8 Hz).

Table 1

δ_C (C_5D_5N)							
C-1	32.40	C-12	33.45	C-23	25.80	3	78.45 ^b
2	30.00	13	45.15	24	82.05	4	71.85
3	88.95	14	46.05 ^a	25	78.45 ^b	5	77.85 ^c
4	42.60	15	46.05 ^a	26	22.80	6	62.83
5	53.85	16	73.80	27	25.50	25-O- β -D-Glcp	
6	68.10	17	58.20	28	19.95	1	98.70
7	38.55	18	21.45	29	28.65	2	75.15
8	46.95	19	30.45	30	16.50	3	78.45 ^b
9	20.70	20	87.15	3-O- β -D-Glcp		4	71.25
10	29.25	21	27.75	1	106.95	5	77.85 ^c
11	26.10	22	34.95	2	75.75	6	62.70

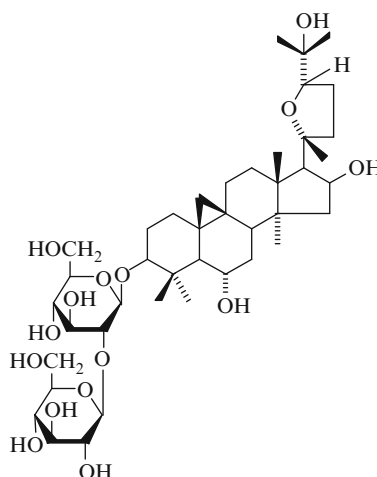
^{a,b,c}: Signals are mutually imposed

References

- M.I. Isaev, N.K. Abubakirov, *Chem. Nat. Comp.* **26**(5), 559–561 (1990)

Cyclounifolioside B

$C_{42}H_{70}O_{15}$, M 814



Taxonomy: Cycloartane Glycosides

Astragalus unifoliolatus Bunge (*Leguminosae*) [1].

Mp 210–215°C.

IR ν_{max}^{KBr} , cm^{-1} : 3487.

Table 1

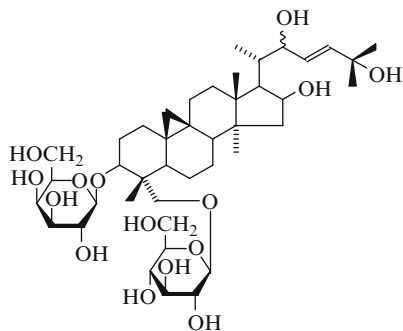
	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_H (C ₅ D ₅ N)		
C-1	32.38	1.51, 1.11	C-16	73.47	5.03	β -D-Glcp ₁		
2	30.62	2.43, 1.94	17	58.40	2.54	1	105.05	4.99
3	88.93	3.58	18	21.44	1.43	2	83.61	4.30
4	42.76	–	19	30.21	0.22, 0.56	3	78.42	4.33
5	53.97	1.66	20	87.28	–	4	71.67	4.18
6	67.80	3.73	21	28.59	1.32	5	77.95	3.88
7	38.51	1.82, 1.64	22	34.96	3.10, 1.68	6	62.89	4.53, 4.37
8	46.81	1.95	23	26.47	2.31, 2.05	β -D-Glcp ₂		
9	21.02	–	24	81.75	3.89	1	106.12	5.42
10	29.42	–	25	71.28	–	2	77.05?	4.13
11	26.28	1.90, 1.21	26	28.21	1.58	3	78.15	4.24
12	33.47	1.68, 1.60	27	27.15	1.30	4	71.88	4.30
13	45.10	–	28	20.16	1.02	5	78.08	3.95
14	46.19	–	29	28.87	1.96	6	62.95	4.50, 4.44
15	46.66	2.13, 1.77	30	16.59	1.44			

References

1. K.J. Kucherbaev, K.K. Uteniyazov, V.V. Kachala, Z. Saatov, A.S. Shashkov, K.U. Uteniyazov, P. Khalmuratov, *Chem. Nat. Comp.* **38**(1), 62–65 (2002)

Thalicoside E

C₄₂H₇₀O₁₅, M 814



Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1]

Mp 249–251°C (from CHCl₃-MeOH, 1:1), $[\alpha]_{546}^{20} +4.7^\circ$ (c 0.85, C₅H₅N).

CAS Registry Number: 172274-38-3.

FABMS m/z: 837 [M + Na]⁺, 777 [M + Na-60]⁺, 615 [M + Na-60-hex]⁺, 597 [M + Na-60-hex-H₂O]⁺, 579 [M + Na-60-hex-2H₂O]⁺, 453 [M + Na-60-2hex]⁺, 435 [M + Na-60-2hex-H₂O]⁺, 417 [M + Na-2hex-2H₂O]⁺.

HRFABMS m/z: 797.4686 [M-H]⁻.

Table 1

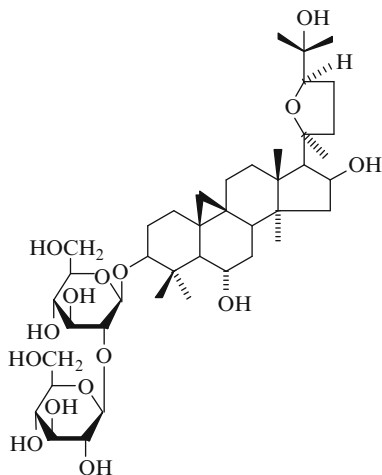
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.17	1.10 m, 1.28 m	C-23	128.45	6.21 dd (4.8, 16)
2	29.46	1.89 m, 2.31 m	24	139.84	6.26 dd (0.9, 16)
3	81.91	4.28 dd (11.5, 3)	25	69.98	–
4	45.09	–	26	30.85	1.44 s
5	40.89	1.95 dd (12.4, 4.5)	27	30.92	1.46 s
6	20.77	0.68 m, 1.82 m	28	19.58	0.83 s
7	26.62	1.02 m, 1.58 m	29	71.21	3.96, 4.21
8	48.41	1.18 m	30	11.78	0.87 s
9	20.03	–	β -D-Galp		
10	26.11	–	1	106.20	5.28 d (7.8)
11	26.31	–	2	73.53	4.24
12	37.76	–	3	75.58	4.04
13	46.18	–	4	70.54	4.34
14	47.46	–	5	76.26	4.0
15	48.52	1.60 dd (13, 8.2), 2.00 dd (13, 4.8)	6	63.25	4.26
16	72.00	4.74 ddd (4.8, 7.2, 8.2)	β -D-Glcp		
17	53.34	2.19 dd (7.2, 11.2)	1	104.98	5.04 d (7.8)
18	20.52	1.36 s	2	75.30	3.92
19	30.44	0.22 d (4.1), 0.49 d (4.1)	3	78.75	4.03
20	36.79	2.59 m (2.3, 7, 11.2)	4	72.29	3.95
21	15.46	1.08 d (7)	5	78.02	3.80
22	76.31	4.70 ddd (0.9, 2.3, 4.8)	6	62.60	4.18, 4.21

References

1. A.S. Gromova, V.I. Lutsky, S.V. Zinchenko, T.V. Ganenko, A.A. Semenov, *Chem. Nat. Comp.* **29**(4), 498–501 (1993)

Sieberoside II

C₄₂H₇₀O₁₅, M 814



Taxonomy: Cycloartane Glycosides
Astragalus sieberi Pall. (*Leguminosae*) [1].
 Mp 250°C (from MeOH).
 CAS Registry Number: 213819-04-6.
 $[\alpha]_D^{25} -82^\circ$ (c 0.5, MeOH).
 FABMS m/z: 837 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.5	1.51, 1.10	C-25 70.4 –
2	30.4	2.42, 1.94	26 28.3 1.50
3	89.1	3.57	27 27.0 1.27
4	42.9	–	28 20.6 1.00
5	54.2	1.67	29 29.0 1.96
6	67.9	3.74	30 16.7 1.42
7	38.6	1.79, 1.62	β -D-Glcp ₁
8	46.9	1.97	1 105.1 4.97 d (8.1)
9	21.2	–	2 83.7 4.24 t (9)
10	29.5	–	3 78.5 4.26 m
11	26.6	1.90, 1.22	4 71.7 4.16 m
12	33.9	1.82, 1.70	5 78.1 3.86 m
13	46.6	–	6 63.0 4.52 dd (10.2, 7)
14	47.0	–	4.35 dd (10.2, 3.3)
15	49.0	2.13, 1.80	β -D-Glcp ₂
16	73.0	4.81	1 106.2 5.38 d (8.1)
17	56.6	2.24	2 77.2 4.12 t (9.1)
18	21.2	1.65	3 78.2 4.22 t (7.9)
19	30.4	0.21, 0.56	4 72.0 4.29 m

(continued)

Table 1 (continued)

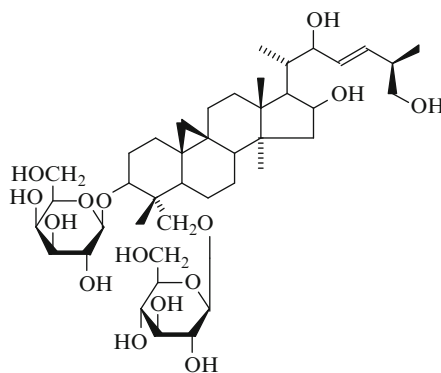
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
20	86.8 –	5 78.3	3.94 m
21	26.5 1.33	6 63.0	4.48 dd (10.5, 7.7)
22	37.7 2.49, 1.68		4.42 dd (10.5, 3)
23	24.5 2.23, 1.90		
24	85.1 3.94		

References

1. L. Verotta, M. Toto, N.A. El-Sebakhy, S.M. Toaima, *Phytochemistry* **48**(8), 1403–1409 (1998)

Thalicoside G₁

C₄₂H₇₀O₁₅, M 814



Taxonomy: Cycloartane Glycosides
Thalictrum minus L. (*Ranunculaceae*) [1].
 Mp 296–298°C (from C₅H₅N), $[\alpha]_{546}^{24} +11.1^\circ$ (c 0.18, C₅H₅N).
 CAS Registry Number: 213539-67-4.
 IR ν_{\max}^{KBr} , cm⁻¹: 3408, 3050, 1069.
 FABMS m/z: 837 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.1	1.15 m, 1.38 m	C-23 33.0 2.55 m, 2.78 m
2	29.4	2.01 m, 2.43 m	24 125.5 5.72 t (7.1)
3	81.7	4.46 m	25 137.5 –
4	45.0	–	26 61.2 4.41 d (12.2), 4.53 d (12.2)
5	40.7	1.92 m	27 22.5 1.98 s
6	20.7	0.78 m, 2.07 m	28 19.5 0.94 s

(continued)

Table 1 (continued)

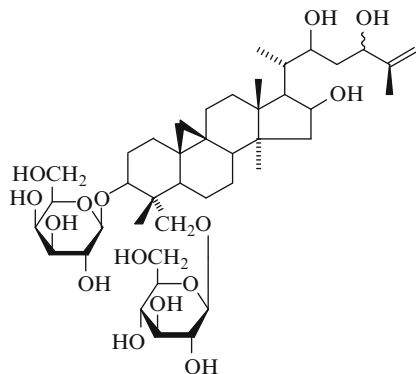
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
7	26.5 1.12 m, 1.70 m	29	71.1 4.15 m, 4.47 m
8	48.4 1.98 m	30	11.7 0.98 s
9	19.8 –	β -D-Galp	
10	25.9 –	1	106.5 5.56 d (7.6)
11	26.3	2	73.3 4.53 m
12	33.6	3	75.5 4.34 m
13	46.0 –	4	70.4 4.62 m
14	47.3 –	5	76.2 4.39 m
15	48.7 1.72 m, 2.11 m	6	63.0 4.42 m, 4.58 m
16	71.7 4.79 m	β -D-Glcp	
17	53.0 2.33 dd (7.4, 10.5)	1	105.0 5.55 d (7.5)
18	20.6 1.46 s	2	75.3 4.34 m
19	30.5 0.34 d (3.9), 0.59 d (3.9)	3	78.6 4.32 m
20	36.0 2.60 m	4	72.1 4.33 m
21	14.7 1.18 d (7)	5	78.0 4.08 m
22	75.1 4.28 m	6	62.5 4.39 m

References

1. N.N. Trofimova, A.S. Gromova, V.I. Lutsky, A.A. Semenov, S.A. Avilov, A.I. Kalinovsky, D. Li, N.L. Owen, *Izv. Akad. Nauk. Ser. Khim.* **7**, 1434–1437 (1998)

Thalicoside G₂

C₄₂H₇₀O₁₅, M 814



Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 292–294°C (from C₅H₅N), $[\alpha]_{546}^{24} +12.3^\circ$ (c 0.41, C₅H₅N).

CAS Registry Number: 213539-68-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3395, 3050, 1070.

FABMS m/z: 837 [M + N]⁺.

Table 1

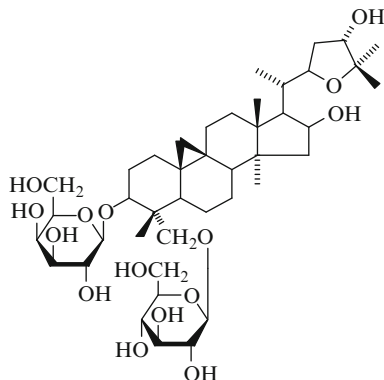
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.4 1.15 m, 1.38 m	C-23	39.6 2.08 m, 2.18 m
2	29.8 2.00 m, 2.43 m	24	72.9 4.81 m
3	81.6 4.46 m	25	–
4	44.9 –	26	110.0 5.00 brs, 5.38 brs
5	40.7 1.91 m	27	18.8 1.93 s
6	20.7 0.70 m, 2.07 m	28	19.8 0.98 s
7	26.5 1.10 m, 1.70 m	29	71.0 4.11 m, 4.45 m
8	48.4 1.95 m	30	11.7 0.94 s
9	19.8 –	β -D-Galp	
10	25.9 –	1	106.1 5.39 d (7.8)
11	26.3	2	73.3 4.49 m
12	33.6	3	75.4 4.28 m
13	46.0 –	4	70.4 4.59 m
14	47.3 –	5	76.1 4.35 m
15	48.4 1.74 m, 2.10 m	6	63.0
16	71.9 4.79 m	β -D-Glcp	
17	53.2 2.28 dd (7.1, 11.1)	1	104.9 5.39 d (7.6)
18	20.6 1.46 s	2	75.2 4.18 m
19	30.5 0.34 d (3.9), 0.59 d (3.9)	3	78.5 4.29 m
20	36.5 2.61 m	4	72.0 4.30 m
21	15.0 1.19 d (6.7)	5	77.9 4.06 m
22	72.5 4.65 brd (9.2)	6	62.4 4.47 m

References

1. N.N. Trofimova, A.S. Gromova, V.I. Lutsky, A.A. Semenov, S.A. Avilov, A.I. Kalinovsky, D. Li, N.L. Owen, *Izv. Akad. Nauk. Ser. Khim* **7**, 1434–1437 (1998)

Thalicoside H₁

C₄₂H₇₀O₁₅, M 814



Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 260–262°C (from C₅H₅N), [α]₅₄₆¹⁷ +10.3° (c 0.34, C₅H₅N)

IR ν_{max}^{KBr}, cm⁻¹: 3408, 3050, 1069.

HRFABMS m/z: 837.4612 [M + Na]⁺.

Table 1

δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
C-1	32.1 1.14 m, 1.36 m	C-23	36.7 1.98 m, 2.36 m
2	29.4 2.02 m, 2.42 m	24	77.6 4.31 m
3	81.7 4.46 m	25	82.8 –
4	44.9 –	26	26.3 1.30 s
5	40.7 2.06 m	27	23.4 1.52 s
6	20.7 0.77 m, 1.90 m	28	19.4 0.97 s
7	26.5 1.10 m, 1.67 m	29	71.1 4.18 m, 4.40 m
8	48.3 1.94 m	30	11.7 0.91 s
9	19.7 –	β-D-Galp	
10	25.9 –	1	106.1 5.29 d (7.5)
11	26.3	2	73.3 4.51 m
12	33.6	3	75.5 4.28 m
13	46.1 –	4	70.4 4.60 m
14	47.0 –	5	76.2 4.38 m
15	47.9 1.71 m, 2.07 m	6	63.0 4.46 m
16	71.7 4.87 m	β-D-Glcp	
17	52.5 2.18 m	1	105.0 5.16 d (7.5)
18	20.5 1.42 s	2	75.3 4.19 m

(continued)

Table 1 (continued)

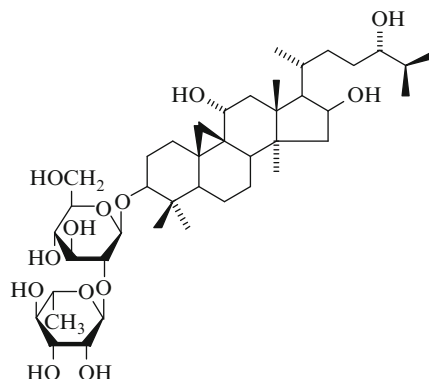
δ _C (C ₅ D ₅ N)	δ _H (J/Hz)	δ _C (C ₅ D ₅ N)	δ _H (J/Hz)
19	30.4 0.32 d (3.8), 0.58 d (3.8)	3	78.6 4.31 m
20	32.7 2.61 m	4	72.0 4.32 m
21	15.4 1.09 d (6.9)	5	78.0 4.05 m
22	79.7 4.26 m	6	62.4 4.43 m

References

1. N.N. Trofimova, A.S. Gromova, V.I. Lutsky, A.A. Semenov, S.A. Avilov, D. Li, N.L. Owen, *Izv. Akad. Nauk. Ser. Khim* **3**, 602–604 (1999)

Curculigosaponin L

C₄₂H₇₂O₁₃, M 784



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 148–151°C, [α]_D –11.09° (c 1.07, MeOH).

CAS Registry Number: 143572-72-9.

FABMS m/z: 807 [M + Na]⁺, 823 [M + K]⁺.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.27 and 0.42 (2H-19, d, J = 4 Hz), 1.05 and 1.07 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.24, 1.27, 1.34, 1.39 (4 × CH₃, s), 1.46 (CH₃-21, d, J = 6.8 Hz), 4.96 (Glc H-1, d, J = 7.2 Hz), 6.63 (Rha H-1, s).

Table 1

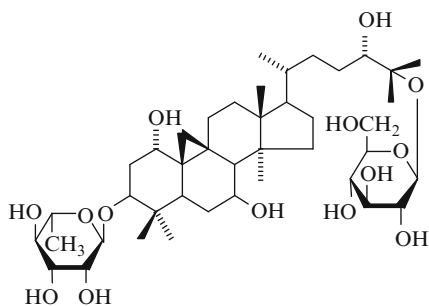
δ_C (C ₅ D ₅ N)									
C-1	32.45	C-11	72.39	C-21	17.48	β -D-Glcp	α -L-Rhap		
2	29.93	12	39.97	22	32.16	1	105.08	1	101.55
3	88.34	13	47.02	23	31.36	2	79.75	2	70.93
4	41.10	14	49.95	24	77.30	3	77.69	3	72.39
5	47.90	15	50.58	25	33.91	4	71.66	4	74.03
6	21.21	16	71.66	26	19.73	5	77.89	5	69.44
7	25.94	17	49.13	27	17.53	6	62.78	6	18.37
8	49.13	18	21.90	28	18.51				
9	19.73	19	29.93	29	25.47				
10	26.58	20	33.91	30	15.44				

References

1. J. Xu, R. Xu, *Phytochemistry* **31**(7), 2455–2458 (1992)

Macrophyllosaponin C

C₄₂H₇₂O₁₄, M 800



Taxonomy: Cycloartane Glycosides

Astragalus oleifolius DC (*Leguminosae*) [1].

$[\alpha]_D^{20} +15^\circ$ (c 0.32, MeOH).

CAS Registry Number: 184104-62-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3400.

FABMS m/z : $[\text{M} + \text{Na}]^+$ 723.

Table 1

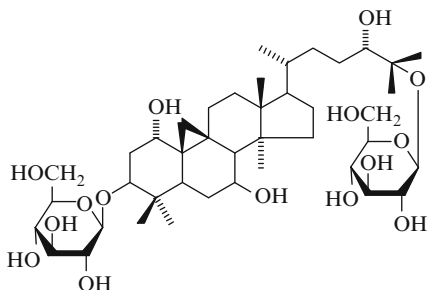
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)		
C-1	74.8	3.56 dd (3.6, 2.7)	C-23	30.0	1.46 m (2H)
2	38.0	2.07 ddd (13.5, 4.2, 3.6), 1.87 td (13.5, 2.7)	24	79.0	3.49 dd (6.1, 6)
3	86.1	3.67 m	25	82.5	–
4	42.5	-	26	24.0	1.26 s
5	41.1	2.16 dd (13.1, 4.4)	27	23.6	1.23 s
6	33.1	1.75 m, 1.05 m	28	20.2	0.85 s
7	72.1	3.58 m	29	27.0	1.08 s
8	57.0	1.59 m	30	15.5	1.00 s
9	23.0	–	β -D-Glcp		
10	32.4	–	1	105.4	4.78 d (1.7)
11	28.0	2.27 m, 1.36 m	2	73.5	3.91 dd (3.3, 1.7)
12	35.0	1.70 m (2H)	3	73.6	3.66 dd (9.5, 3.3)
13	47.9	–	4	75.1	3.39 t (9.5)
14	50.7	–	5	71.0	3.70 dq (9.5, 6.3)
15	39.5	1.60 m (2H)	6	18.8	1.28 d (6.3)
16	30.6	1.98 m, 1.36 m	α -L-Rhap		
17	54.2	1.61 m	1	99.0	4.54 d (7.8)
18	19.3	1.05 s	2	76.4	3.19 dd (9.2, 7.8)
19	30.3	0.45 d (4.6), 0.80 d (4.6)	3	79.3	3.40 dd (9.2, 9)
20	38.3	1.46 m	4	72.7	3.31 t (9)
21	19.9	0.94 d (6.4)	5	78.8	3.29 m
22	35.7	1.57 m, 1.33 m	6	63.8	3.85 dd (12, 2.2), 3.67 m

References

1. I. Calis, M. Zor, I. Saracoglu, A. Isemer, H. Ruegger, *J. Nat. Prod.* **59**(11), 1019–1023 (1996)

Macrophyllsaponin E

C₄₂H₇₂O₁₅, M 816



Taxonomy: Cycloartane Glycosides

Astragalus oleifolius DC (*Leguminosae*) [1].

CAS Registry Number: 289710-65-2.

HRESIFTMS m/z: [M + Na]⁺ 839.4721.

Table 1

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
C-1	73.1 3.54 dd (2.7, 3.6)	C-22	33.7 1.56 m, 1.35 m
2	36.4 1.86 ddd (11.8, 2.7, 1.6), 2.17 m	23	28.0 1.45 m
3	84.1 3.73 dd (12, 4.3)	24	77.0 3.47 dd (5.8, 11.6)
4	40.7 –	25	80.5 –
5	39.3 2.16 t (12, 4.8)	26	22.0 1.27 s
6	31.0 1.05 m, 1.75 m	27	21.6 1.23 s
7	70.2 3.57 ddd (10.5, 8.3, 5)	28	18.2 0.89 s
8	55.1 1.56 m	29	24.8 1.07 s
9	21.0 –	30	13.5 1.09 s
10	30.4 –	3-O- β -D-Glcp	
11	26.0 2.27 m, 1.36 m	1	105.7 4.36 d (7.8)
12	33.0 1.70 m	2	74.3 3.22 ^a
13	45.9 –	3	77.2 ^c 3.37 ^a
14	48.9 –	4	70.8 3.30 ^a
15	37.5 1.58 m	5	76.8 ^b 3.28 ^a
16	28.6 1.36 m, 1.96 m	6	61.8 3.84 dd (10.3, 2), 3.65 ^a
17	52.2 1.58 m	25-O- β -D-Glcp	
18	17.4 1.05 s	1	97.0 4.54 d (7.8)
19	28.4 0.44 d (4.5), 0.79 d (4.5)	2	74.7 2.20 ^a

(continued)

Table 1 (continued)

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
20	36.2 1.45 m	3	77.3 3.37 ^a
21	17.9 0.95 d (6.3)	4	70.6 3.30 ^a
		5	77.0 ^b 3.28 ^a
		6	62.1 3.91 dd (10.1, 2), 3.65 ^a

^aSignal pattern was unclear due to overlapping

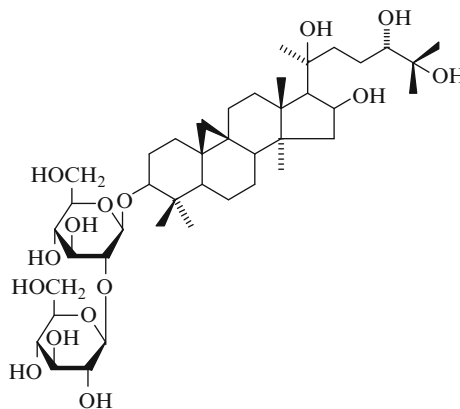
^{b,c}Assignments may be interchangeable

References

1. E. Bedir, I. Calis, I.A. Khan, *Chem. Pharm. Bull.* **48**(7), 1081–1083 (2000)

No Name (Cycloartane-3 β ,16 β ,20S,24S,25-pentol-3-O-[β -D-Glucopyranosyl(1 \rightarrow 2)- β -D-glucopyranoside])

C₄₂H₇₂O₁₅, M 816



Taxonomy: Cycloartane Glycosides

Oxytropis bicolor Bunge (*Leguminosae*) [1].

Mp 273–275°C (from MeOH), [α]_D²⁵ +3.0° (c 1.2, MeOH).

CAS Registry Number: 138935-91-8.

FABMS m/z: 839 [M + Na]⁺.

EIMS m/z (%): 492 [M-Glcx2]⁺ (0.5), 474 (1), 456 (7), 438 (22), 420 (11), 402 (4), 313 (8), 161 (26), 143 (82), 125 (52), 107 (51).

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.23 and 0.52 (2H-19, d, $J = 3.7$ Hz), 0.90, 1.16, 1.33, 1.53, 1.55, 1.83, 1.96 (7 \times CH₃, s), 3.44 (H-3, dd, $J = 11.5$, 4.2 Hz), 3.81 (H-24, dd, $J = 9.2$, 3 Hz), 4.47 (H-16, m), 4.94 (anomeric H, d, $J = 7.5$ Hz), 5.37 (another anomeric H, d, $J = 7.6$ Hz).

Table 1

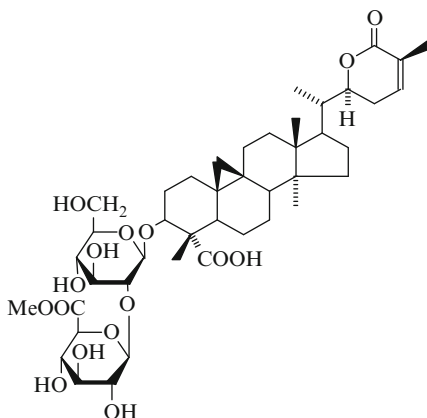
δ_C (C ₅ D ₅ N)									
C-1	32.0	C-11	26.5	C-21	26.1	β -D-Glcp ₁	104.8	β -D-Glcp ₂	105.9
2	29.9	12	33.7	22	42.7	1	83.3	2	76.9
3	88.8	13	47.2	23	27.3	2	77.8	3	77.8
4	41.2	14	46.6	24	79.9	3	71.4	4	71.5
5	47.3	15	49.1	25	72.8	4	78.2	5	78.1
6	21.0	16	73.5	26	25.7	5	62.2	6	62.6
7	26.3	17	55.5	27	25.8	6			
8	47.6	18	21.2	28	20.4				
9	19.7	19	30.2	29	26.2				
10	26.2	20	76.7	30	15.3				

References

1. R.Q. Sun, Z.J. Jia, *Phytochemistry* **30**(10), 3480–3482 (1991)

Abrusoside B

C₄₃H₆₄O₁₆, M 836



Taxonomy: Cycloartane Glycosides

Abrus precatorius L. (*Leguminosae*) [1].

Mp 243–245°C, $[\alpha]_D +5.8^\circ$ (c 0.35, C₅H₅N).

CAS Registry Number: 125002-98-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3407, 1712, 1378, 1245, 1114, 1081, 1059.

HRFABMS m/z : 837.4271 [M + H]⁺.

Table 1

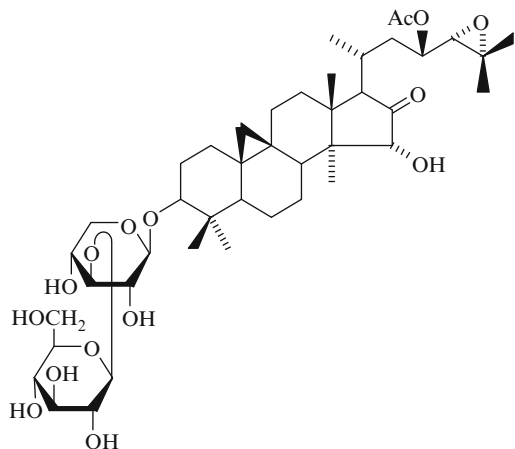
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.88	C-23	27.88
2	29.63	24	140.51 6.56 m
3	82.59 4.87 dd (11.7, 4.4)	25	125.71 –
4	54.16 –	26	166.21 –
5	45.19	27	17.28 1.94 brs
6	23.21	28	19.48 0.81 s
7	27.52	29	179.52
8	48.03	30	10.60 1.71 s
9	19.77 –	β -D-Glcp	
10	25.39 –	1	102.47 5.28 brd (7.1)
11	26.41	2	84.05
12	35.58	3	77.70
13	45.32 –	4	72.87
14	48.93 –	5	78.05
15	32.96	6	62.59
16	25.97	β -D-GlcA	
17	48.03	1	106.35 5.37 d (7.6)
18	18.10 0.96 s	2	76.15
19	29.73 0.30 d (3.5), 0.60 d (3.5)	3	77.43
20	40.07	4	71.32
21	13.11 1.01 d (6.5)	5	78.15
22	80.28	6	170.35
		OMe	51.99 3.86 s

References

1. Y.H. Choi, R.A. Hussain, J.M. Pezzuto, A.D. Kinghorn, J.F. Morton, *J. Nat. Prod.* **52**(5), 1118–1127 (1989)

23-O-Acetylshengmanol-3-O- β -D-glucopyranosyl (1 \rightarrow 3)- β -D-xylopyranoside

$C_{43}H_{68}O_{15}$, M 824



Taxonomy: Cycloartane Glycosides

Cimicifuga simplex Wormsk. (*Ranunculaceae*) [1].

Mp 245–246°C, $[\alpha]_D -38.2^\circ$ (c 1.01, MeOH).

CAS Registry Number: 163860-88-6.

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3420, 1738.

FABMS m/z : 825 $[M + H]^+$, 847 $[M + Na]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)	
C-1	31.70	1.20, 1.55	C- 71.73	
			23	
			(2, 8.3, 9.2)	
2	29.48	1.90, 2.30 ddd	24	
		(4, 4, 13)	64.75	
			3.06 d (8.3)	
3	88.11	3.48 dd (4, 11.5)	25	
			58.35	
			–	
4	40.82	–	26	
			24.24	
			1.29 s	
5	46.92	1.28	27	
			18.87	
			1.44 s	
6	20.47	0.73 q (12), 1.58	28	
			11.52	
			1.21 s	
7	26.17	1.18, 2.05	29	
			25.09	
			1.33 s	
8	47.77	1.78	30	
			14.98	
			1.05 s	
9	19.59	–	β -D-Xylp	
10	26.25	–	1	106.31
				4.83 d (8)
11	25.47	1.15, 2.10	2	74.93
				4.04 dd (8, 9)
12	32.52	1.75, 1.75	3	87.39
				4.21 dd (9, 9)
13	41.06	–	4	69.03
				4.10 ddd (5.5, 9, 9)

(continued)

Table 1 (continued)

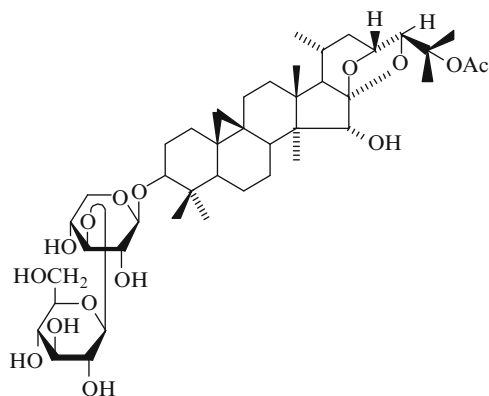
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)	
14	45.58	–	5	
			65.81	
			3.71 dd	
			(9, 11.3),	
15	82.31	4.36 s		
			4.30 dd	
			(5.5, 11.3)	
16	219.64	–	β -D-Glcp	
17	59.46	2.35 d (6.2)	1	104.91
				5.32 d (8)
18	19.34	1.37 s	2	73.81
				4.05 dd (8, 8)
19	30.01	0.33 d (4), 0.56 d (4)	3	78.02
				4.03 dd (8, 8)
20	27.46	2.10	4	71.06
				4.06 dd (8, 8)
21	19.86	1.26 d (6.7)	5	77.49
				4.02 ddd
				(2, 5, 8)
22	36.44	1.78, 2.60 td (12, 2)	6	61.95
				4.20 dd
				(5, 11.3),
				4.53 dd
				(2, 11.3)
			Ac	–
			170.49	
			20.56	2.12 s

References

1. A. Kusano, M. Shibano, S. Kitagawa, G. Kusano, S. Nozoe, S. Fushiya, *Chem. Pharm. Bull.* **42**(9), 1940–1943 (1994)

25-O-Acetylcimigenol-3-O- β -D-glucopyranosyl(1 \rightarrow 3)- β -D-xylopyranoside

$C_{43}H_{68}O_{15}$, M 824



Taxonomy: Cycloartane Glycosides*Cimicifuga simplex* Wormsk. (*Ranunculaceae*) [1].Mp 285–286°C, $[\alpha]_D^{25} +11.6^\circ$ (c 0.30, MeOH).

CAS Registry Number: 163894-56-2.

IR ν_{\max}^{KBr} , cm^{-1} : 3550–3480, 1738.FABMS m/z: 825 $[\text{M} + \text{H}]^+$.**Table 1**

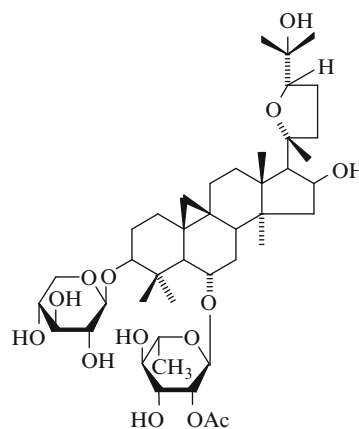
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	δ_{H} (J/Hz)		
C-1	32.08	1.17, 1.51	C-23	71.38	4.63 d (9.2)
2	29.72	1.88, 2.32	24	86.47	4.13 s
3	88.36	3.48 dd (4, 11.5)	25	82.94	–
4	41.00	–	26	21.26	1.67 s
5	47.20	1.25	27	22.70	1.71 s
6	20.74	0.65, 1.50	28	11.50	1.15 s
7	26.12	1.15, 2.05	29	25.29	1.26 s
8	48.31	1.63	30	15.13	1.01 s
9	19.68	–	β -D-Xylp		
10	26.32	–	1	106.56	4.81 d (7.5)
11	26.02	1.15, 2.05	2	74.00	4.03 dd (7.5, 9)
12	33.69	1.50, 1.62	3	87.80	4.19 dd (9, 9)
13	41.50	–	4	71.38	4.08 ddd (5, 9, 9)
14	46.89	–	5	66.03	3.69 dd (9, 11.5), 4.28 dd (5, 11.5)
15	79.84	4.26 s	β -D-Glcp		
16	112.10	–	1	105.21	5.32 d (7.7)
17	59.08	1.41 d (11)	2	75.23	4.05 dd (7.7, 9)
18	19.19	1.10 s	3	77.90	4.22 dd (8.5, 8.5)
19	30.60	0.23 d (4), 0.48 d (4)	4	69.27	4.06 dd (8.5, 8.5)
20	23.62	1.62	5	78.29	4.02 ddd (2, 5, 8.5)
21	19.19	0.81 d (7)	6	62.26	4.19 dd (5, 11.5), 4.54 dd (2, 11.5)
22	37.59	0.95, 2.25	Ac 170.08		–
				22.03	1.95 s

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)								
C-1	32.16	C-11	26.39	C-21	28.42	β -D-Xylp	α -L-Rhap	Ac
2	30.06	12	33.28	22	34.90	1	107.49	21.03
3	87.85	13	45.02	23	25.94	2	75.50	170.76
4	42.27	14	46.19	24	81.71	3	78.46	70.45
5	51.93	15	46.71	25	71.22	4	71.18	73.80
6	79.90	16	73.35	26	27.07	5	66.99	69.97
7	34.33	17	58.29	27	28.13	6	18.16	
8	46.22	18	58.29	28	20.18			
9	20.64	19	30.26	29	28.51			
10	28.77	20	87.18	30	16.98			

References

1. A. Kusano, M. Shibano, S. Kitagawa, G. Kusano, S. Nozoe, S. Fushiya, *Chem. Pharm. Bull.* **42**(9), 1940–1943 (1994)

Cyclocarposide B $\text{C}_{43}\text{H}_{70}\text{O}_{14}$, M 810**Taxonomy:** Cycloartane Glycosides*Astragalus coluteocarpus* Boiss. (*Leguminosae*) [1].Mp 271–273°C (from MeOH), $[\alpha]_D^{24} 0^\circ$ (c 0.5, $\text{C}_5\text{H}_5\text{N}$).IR ν_{\max}^{KBr} , cm^{-1} : 3600–3200, 3045, 1730, 1250.

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.23 and 0.42 (2H-19, d, $J = 4$ Hz), 0.95, 1.13, 1.28, 1.30, 1.39, 1.56, 1.61 ($7 \times \text{CH}_3$, s), 1.62 (Rhap CH_3 , d, $J = 6$ Hz), 2.04 (CH_3COO , s), 2.52 (H-17, d, $J = 8$ Hz), 3.07 (H-22, q, $J = 10$ Hz), 3.43 (H-3, dd, $J = 12, 5$ Hz), 3.50 (H-6, td, $J = 9, 3.5$ Hz), 4.76 (Xylp H-1, d, $J =$

7.5 Hz), 4.98 (H-16, q, $J = 8$ Hz), 5.17 (Rhap H-1, d, $J = 0.9$ Hz), 5.71 (Rhap H-2, dd, $J = 3, 0.9$ Hz).

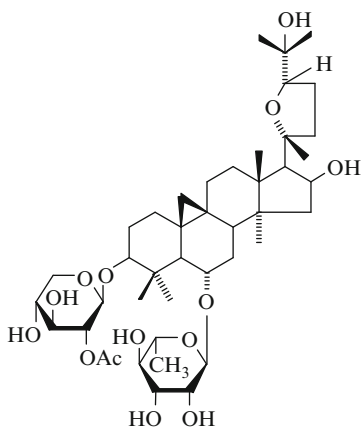
See [Table 1](#)

References

1. B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **28**(2), 195–198 (1992)

Cyclocarposide C

$C_{43}H_{70}O_{14}$, M 810



Taxonomy: Cycloartane Glycosides

Astragalus coluteocarpus Boiss. (*Leguminosae*) [1].

Mp 257–259°C (from MeOH), $[\alpha]_D^{23} -21^\circ$ (c 0.59, C_5H_5N).

IR ν_{max}^{KBr}, cm^{-1} : 3600–3230, 3045, 1740, 1255.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.10 and 0.26 (2H-19, d, $J = 4$ Hz), 0.81, 0.89, 1.14, 1.16, 1.16, 1.22, 1.40 ($7 \times CH_3$, s), 1.42 (Rhap CH_3 , d, $J = 6$ Hz), 1.92 (CH_3COO , s), 2.33 (H-17, d, $J = 7.5$ Hz), 2.84 (H-22, q, $J = 9.7$ Hz), 3.17 (H-3, dd, $J = 11, 5$ Hz), 3.36 (H-6, td, $J = 9, 4$ Hz), 3.56 (Xylp H-5a, t, $J = 10$ Hz), 3.73 (H-24, dd, $J = 10, 6$ Hz), 3.90–4.20 (Xylp H-3, H-4, Rhap H-3, H-4, H-5), 4.28 (Xylp H-5e, dd, $J = 10, 3$ Hz), 4.39 (Rhap H-2, brd, $J = 4$ Hz), 4.58 (Xylp H-1, d, $J = 8$ Hz), 4.82 (H-16, q, $J = 7.5$ Hz), 5.18 (Rhap H-1, brs), 5.21 (Xylp H-2, t, $J = 8$ Hz).

See [Table 1](#)

References

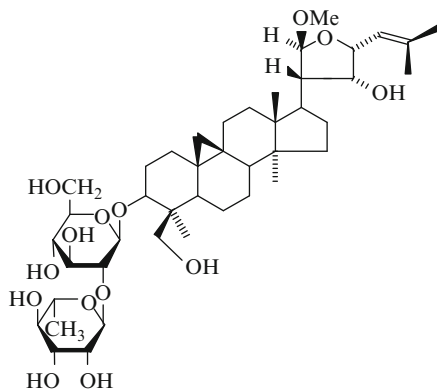
1. B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **28**(6), 603–606 (1992)

Table 1

δ_C (C_5D_5N)										
C-1	32.06	C-11	26.40	C-21	28.02	β -D-Xylp	α -L-Rhap	Ac		
2	29.93	12	33.29	22	34.90	1	104.95	1	104.00	21.17
3	88.05	13	45.03	23	25.92	2	76.21	2	72.98	169.95
4	41.95	14	46.19	24	81.72	3	75.55	3	72.60	
5	51.98	15	46.19	25	71.30	4	71.23	4	73.81	
6	79.25	16	73.36	26	27.07	5	67.10	5	70.12	
7	34.70	17	58.30	27	28.13			6	18.17	
8	46.77	18	21.57	28	20.21					
9	20.73	19	30.38	29	28.52					
10	28.69	20	87.18	30	16.96					

Thalictoside I

C₄₃H₇₀O₁₄, M 810



Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

[α]_D +10.3° (MeOH).

CAS Registry Number: 150968-30-2.

Negative ion FABMS m/z: 809 [M-H]⁻.

¹H NMR (C₅D₅N, δ , 0-TMS): 0.29 and 0.88 (2H-19, d), 1.02, 1.26, 1.56, 1.68, 1.70 (5 × CH₃, s), 3.51 (CH₃O, s), 5.03 (Glc p H-1, d), 5.98 (H-24, d, J = 8.1 Hz), 6.74 (Rhap H-1, s).

Table 1

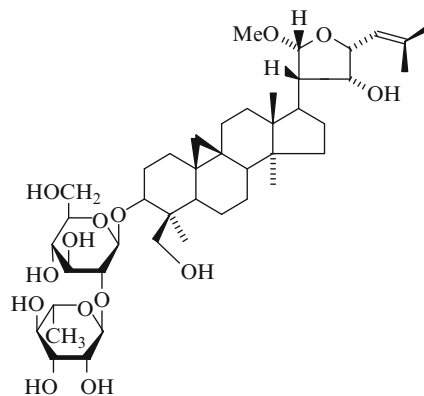
δ_C (C ₅ D ₅ N)									
C-1	30.8	C-11	26.6	C-21	108.7	β -D-Glc p	α -L-Rhap	OMe	
2	29.9	12	35.7	22	76.7	1	105.4	1	100.2 55.5
3	89.3	13	45.5	23	79.0	2	80.3	2	71.9
4	45.3	14	48.8	24	122.7	3	76.3	3	72.1
5	47.6	15	32.2	25	136.1	4	72.4	4	74.5
6	22.6	16	26.7	26	26.0	5	78.2	5	69.1
7	27.7	17	44.7	27	19.7	6	62.8	6	18.5
8	48.2	18	18.6	28	18.6				
9	20.1	19	29.8	29	19.9				
10	26.4	20	54.8	30	60.7				

References

1. H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, Chem. Pharm. Bull. **41**(4), 786–788 (1993)

Thalictoside II

C₄₃H₇₀O₁₄, M 810



Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

[α]_D –32.2° (MeOH).

CAS Registry Number: 150968-29-9.

Negative ion FABMS m/z: 809 [M-H]⁻.

¹H NMR (C₅D₅N, δ , 0-TMS): 0.34 and 0.92 (2H-19, d, J = 3.7 Hz), 0.99, 1.06, 1.57, 1.72, 1.74 (5 × CH₃, s), 1.75 (Rhap CH₃, d, J = 7.3 Hz), 1.77 (H-16 β , m), 2.11 (H-20, m), 2.78 (H-17, m), 3.39 (CH₃O, s), 4.15 (H-22, brs), 4.89 (H-23, dd, J = 8.8, 3.0 Hz), 5.05 (H-21, d), 5.05 (Glc p H-1, d), 5.87 (H-24, d, J = 8.8 Hz), 6.75 (Rhap H-1, s).

Table 1

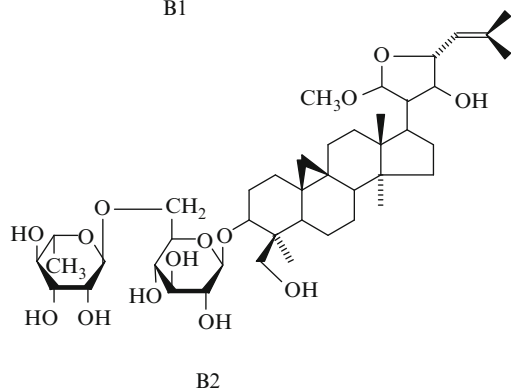
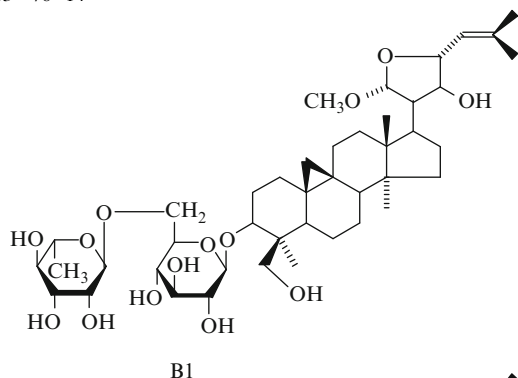
δ_C (C ₅ D ₅ N)									
C-1	31.5	C-11	26.6	C-21	104.9	β -D-Glc p	α -L-Rhap	OMe	
2	29.9	12	35.8	22	75.0	1	105.4	1	100.9 54.6
3	89.3	13	45.3	23	80.6	2	80.3	2	72.0
4	45.3	14	48.8	24	123.7	3	76.3	3	72.1
5	47.4	15	32.2	25	135.9	4	72.4	4	74.4
6	22.5	16	26.9	26	26.0	5	78.2	5	69.1
7	27.0	17	40.7	27	19.6	6	62.8	6	18.4
8	48.2	18	19.5	28	18.6				
9	20.1	19	29.7	29	19.9				
10	26.5	20	52.5	30	60.7				

References

1. H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, Chem. Pharm. Bull. **41**(4), 786–788 (1993)

Squarroside B1 and Squarroside B2

C₄₃H₇₀O₁₄, M 810



Taxonomy: Cycloartane Glycosides

Thalictrum squarrosom Stephan ex Willd
(*Ranunculaceae*) [1].

Mp 200–202°C (from EtOH).

CAS Registry Number: 125445-27-4.

CAS Registry Number: 125474-76-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3440.

FABMS m/z : 833 [M + Na]⁺, 687 [M + Na-146]⁺, 507 [M + Na-308-H₂O]⁺.

See [Table 1](#)

References

1. E.A. Khamidullina, A.S. Gromova, V.I. Lutsky, A.L. Vereshagin, A.A. Semenov, M.F. Larin, Chem. Nat. Comp. **25**(4), 441–447 (1989)

Cyclocephaloside II

C₄₃H₇₀O₁₅, M 826

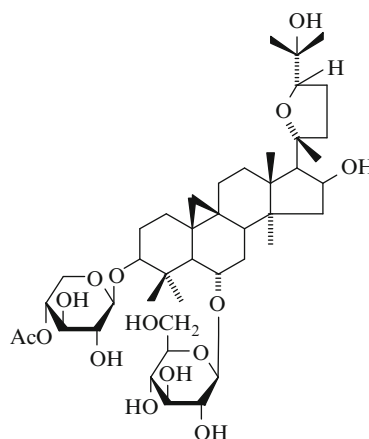


Table 1

δ_c (C₅D₅N)

C-1	33.2	C-12	37.2, 37.1	C-23	81.9, 79.9	β -D-Glcp	α -L-Rhap
2	31.1	13	46.7, 46.6	24		1	106.9
3	90.9	14	49.9	25		2	75.0
4	46.1	15	31.1	26	20.9	3	79.5
5	49.9	16	31.1	27	19.7	4	70.4
6	22.6	17	45.8, 41.9	28	19.5	5	77.8
7	27.9, 27.3	18	27.3	29	19.5	6	68.7
8	49.1	19	32.6, 32.0	30	64.6		
9	22.2	20	55.5, 53.6		OMe 55.9, 56.4		
10	26.9	21	109.6, 106.1				
11	28.8, 27.9	22	76.4, 76.1				

Taxonomy: Cycloartane Glycosides

Astragalus microcephalus Willd. (*Leguminosae*) [1].
 $[\alpha]_D^{23} +12.5^\circ$ (c 0.1, MeOH).

CAS Registry Number: 215776-78-6.

FABMS m/z: 825 $[M-H]^-$, 663 $[M-H-162]^-$, 783 $[M-H-42]^-$, 489 $[M-H-162-42-132]^-$.

Table 1

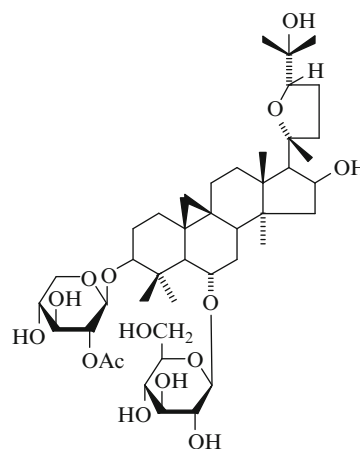
δ_C (CD ₃ OD)		δ_H (J/Hz)	δ_C (CD ₃ OD)		δ_H (J/Hz)
C-1	32.7	1.57 m, 1.28 m	C-23	26.4	2.06 m (2H)
2	30.3	1.96 m, 1.70 m	24	82.5	3.79 dd (8, 5)
3	89.8	3.23 dd (11.2, 4.5)	25	72.9	–
4	42.8	–	26	26.4	1.15 s
5	53.7	1.64 m	27	27.4	1.29 s
6	79.8	3.57 td (10, 4.5)	28	20.0	1.05 s
7	35.0	1.93 m, 1.62 m	29	29.0	1.32 s
8	46.7	1.89 m	30	16.2	1.04 s
9	22.0	–	β -D-Xylp		
10	30.0	–	1	107.0	4.31 d (7.8)
11	26.8	1.95 m, 1.36 m	2	75.1	3.30 dd (7.8, 8.5)
12	33.8	1.71 m, 1.62 m	3	74.7	3.56 t (8.5)
13	46.3	–	4	73.0	4.70 ddd (4.5, 8.5, 10.5)
14	47.0	–	5	63.1	3.95 dd (10.5, 4.5), 3.26 t (10.5)
15	46.0	2.07 m, 1.42 m	β -D-Glcp		
16	74.4	4.69 ddd (8, 8.2, 5.2)	1	104.9	4.36 d (7.5)
17	58.6	2.40 d (8)	2	75.3	3.20 dd (9, 7.5)
18	21.1	1.29 s	3	78.4	3.35 t (9)
19	29.3	0.30 d (4.5), 0.62 d (4.5)	4	71.5	3.30 t (9)
20	88.1	–	5	77.8	3.26 ddd (9, 4.5, 3.5)
21	29.0	1.24 s	6	62.7	3.87 dd (12, 3.5), 3.69 dd (12, 4.5)
22	35.4	2.65 m, 1.67 m	Ac	20.6	2.09 s
				171.9	–

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)

Cyclosieversioside D (astragaloside II, astrasieversianin VII)

C₄₃H₇₀O₁₅, M 826

**Taxonomy:** Cycloartane Glycosides

Astragalus basineri Trautv. (*Leguminosae*) [1, 2].
Astragalus sieversianus Pall. (*Leguminosae*) [1–3].
Astragalus membranaceus Bunge (*Leguminosae*) [4].
Astragalus schahrudensis Bunge (*Leguminosae*) [2, 5].
Astragalus mongholicus Bunge (*Leguminosae*) [6].
Astragalus exilis A. Kor. (*Leguminosae*) [7].
Astragalus microcephalus Willd (*Leguminosae*) [8].
Astragalus trojanus Stev. (*Leguminosae*) [9].
Astragalus melanophrurius Boiss. (*Leguminosae*) [10].

Astragalus spinosis (*Leguminosae*) [11].

Mp 254–257°C (from MeOH), $[\alpha]_D^{29} +31.1^\circ$ (c 0.96, MeOH).

CAS Registry Number: 91739-01-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 1752, 1250.

FDMS m/z: 850 (2.3) $[M + Na + H]^+$, 826 (13.9) $[M]^+$.

¹H NMR (200 MHz, C₅D₅N, δ): 0.20 and 0.56 (2H-19, d, J = 4.4 Hz), 0.95, 1.29, 1.31, 1.31, 1.41, 1.59, 1.82 (7 × CH₃, s), 2.05 (Ac, s).

Table 1

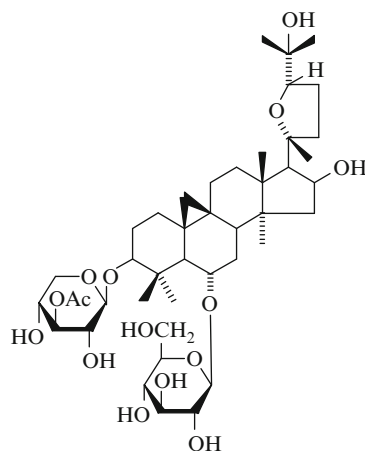
δ_C (C ₅ D ₅ N)						
C-3	89.2	β -D-Xylp		β -D-Clcp		Ac
6	79.4	1	104.8	1	105.0	170.1
16	73.6	2	76.4	2	75.7	21.4
25	71.4	3	75.8	3	79.1	
		4	71.4	4	72.3	
		5	67.1	5	77.8	
				6	63.4	

References

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Isoastragaloside II (astrasieverianin VIII)

C₄₃H₇₀O₁₅, M 826



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Astragalus sieversianus Pall. (*Leguminosae*) [2].

Mp 223–224°C, $[\alpha]_D^{18} +15.0^\circ$ (c 1.1, MeOH).

CAS Registry Number: 86764-11-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1738, 1235, 1040.

FDMS m/z: 826 [M]⁺.

¹H NMR (90 MHz, C₅D₅N, δ): 0.22 and 0.54 (2H-19, brs), 1.97 (Ac, s).

Table 1

δ_C (C ₅ D ₅ N)						
C-3	88.8	β -D-Xylp		β -D-Clcp		Ac
6	79.2	1	106.6	1	104.9	170.7
16	73.4	2	72.8	2	75.5	21.1

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)					
25	71.3	3	78.7	3	78.9
		4	69.1	4	72.3
		5	66.2	5	68.4
				6	63.4

Taxonomy: Cycloartane Glycosides*Astragalus trojanus* Stev. (*Leguminosae*) [1].

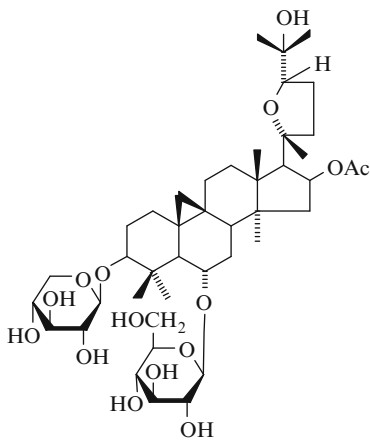
Synthetic [2].

 $[\alpha]_D^{25} + 20.1^\circ$ (c 0.1, MeOH).

CAS Registry Number: 223924-10-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3420, 1735, 1260, 1049.FABMS m/z: 825 [M-H]⁻, 693 [M-H-132]⁻, 663 [M-H-162]⁻.**References**

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Trojanoside AC₄₃H₇₀O₁₅, M 826**Table 1**

δ_C (CD ₃ OD)	δ_H (CD ₃ OD)	δ_C (CD ₃ OD)	δ_H (CD ₃ OD)
C-1 32.6	1.59 m, 1.31 m	C-23 27.1	1.95 m, 1.78 m
2 30.0	1.98 m, 1.70 m	24 83.0	3.77 dd (8, 5)
3 89.9	3.24 dd (11.1, 4.5)	25 72.4	–
4 42.9	–	26 25.8	1.17 s
5 52.8	1.66 d (10)	27 25.8	1.16 s
6 79.2	3.58 td (10, 4.5)	28 20.1	1.10 s
7 33.6	1.88 m, 1.71 m	29 28.1	1.30 s
8 45.4	1.96 m	30 16.3	1.03 s
9 22.4	–	β -D-Glcp	
10 29.5	–	1 107.1	4.31 d (7.8)
11 26.8	1.91 m, 1.47 m	2 75.1	3.22 dd (7.8, 8.5)
12 33.4	1.79 m, 1.72 m	3 77.8	3.32 t (8.5)
13 45.9	–	4 70.9	3.50 ddd (4.5, 8.5, 11)
14 47.4	–	5 66.5	3.21 t (11), 3.85 dd (4.5, 11)
15 45.3	2.33 m, 1.37 m	β -D-Xylp	
16 77.6	5.48 td (8, 5.2)	1 104.7	4.34 d (7.5)
17 58.4	2.58 d (8)	2 75.1	3.21 dd (7.5, 9)
18 20.3	1.35 s	3 78.1	3.33 t (9)
19 28.0	0.28 d (4.5), 0.63 d (4.5)	4 70.4	3.32 t (9)

(continued)

Table 1 (continued)

δ_C (CD ₃ OD)	δ_H (CD ₃ OD)	δ_C (CD ₃ OD)	δ_H (CD ₃ OD)
20	87.0	–	5 77.6 3.25 ddd (3.5, 4.5, 9)
21	27.8	1.35 s	6 62.7 3.67 dd (4.5, 12), 3.87 dd (3.5, 12)
22	37.1	2.40 dd (6, 12), 1.65 m	Ac 20.6 2.06 s
			171.2 –

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.15 and 0.60 (2H-19, d, J = 4 Hz), 0.93, 1.328, 1.334, 1.346, 1.349, 1.38, 1.99 (7 × CH₃, s), 2.05 (CH₃COO, s), 2.58 (H-17, d, J = 7.5 Hz), 3.49 (H-3, dd, J = 12.5, 5 Hz), 3.69 (Xylp H-5a, t, J = 11.3 Hz), 3.80–3.88 (H-6 and Glcp H-5, m), 3.91 (H-24, t, J = 8 Hz), 3.99–4.05 (Glcp H-2, Xylp H-2, H-3, m), 4.11–4.18 (Glcp H-3, H-4, m), 4.21 (Xylp H-4, td, J = 10, 5 Hz), 4.29 (Glcp H-6, dd, J = 12.5, 5 Hz), 4.34 (Xylp H-5e, dd, J = 10, 5 Hz), 4.45 (Glcp H-6', dd, J = 12.5, 2.5 Hz), 4.83 (Xylp H-1, d, J = 7.5 Hz), 4.87 (Glcp H-1, d, J = 7.5 Hz), 5.61 (H-16, td, J = 7.5, 5 Hz) [2].

See Table 2

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, J. Nat. Prod. **62**(4), 563–568 (1999)
2. R.P. Mamedova, M.A. Agzamova, A.I. Isaev, Chem. Nat. Comp. **37**(6), 529–532 (2001)

Table 2

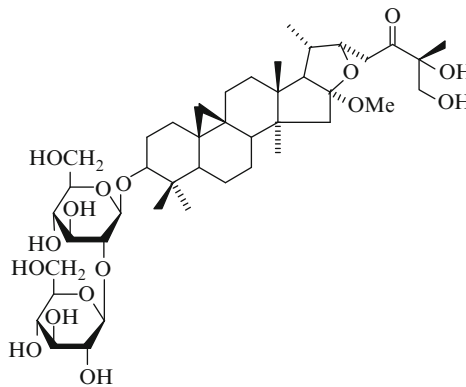
δ_C (C ₅ D ₅ N) [2]								
C-1	32.04	C-11	26.20	C-21	26.61	β -D-Xylp	β -D-Glcp	Ac
2	30.13	12	33.27	22	36.82	1 107.69	1 104.95	20.19
3	88.43	13	46.38	23	26.71	2 75.61*	2 75.57*	170.25
4	42.64	14	46.62	24	82.82	3 78.58 ^a	3 78.58 ^a	
5	52.13	15	45.08	25	70.78	4 71.26	4 71.78	
6	79.18	16	76.09	26	26.74	5 67.09	5 78.21	
7	32.82	17	57.55	27	27.94		6 62.38	
8	44.66	18	19.80	28	21.58			
9	21.13	19	28.71	29	28.34			
10	27.65	20	85.75	30	16.57			

*Assignment of signals ambiguously

^aSignals are mutually imposed

Aquilegioside F

C₄₃H₇₀O₁₆, M 842



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} - 2.5^\circ$ (c 0.35, C₅H₅N).

Positive ion FABMS m/z: 865 [M + Na]⁺.

HRFABMS m/z: 865.4553 [M + Na]⁺.

See Table 1

Biological activity

Aquilegioside F suppressed the proliferation of lymphocytes and 50% of the inhibitory concentrations (IC₅₀, 31 mg/ml or 37 μ M) were calculated from the dose-dependent curve.

References

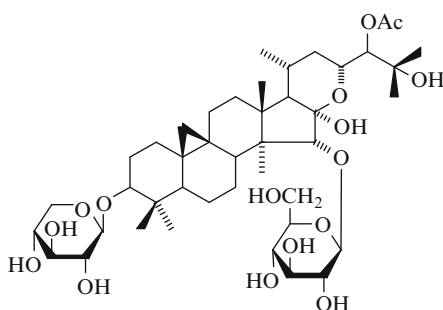
1. M. Nishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(6), 683–687 (2003)

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.0	1.07, 1.40	C-23	42.0	3.51 dd (6.7, 18.3), 3.56 dd (6.7, 18.3)
2	29.9	1.86, 2.38	24	215.0	–
3	88.7	3.46 dd (4.3, 11.6)	25	81.0	–
4	41.3	–	26	69.2	4.04 d (11), 4.49 d (11)
5	47.6	1.23	27	22.8	1.62 s
6	20.8	0.69, 1.51	28	19.5	1.10 s
7	26.2	1.01, 1.23	29	25.8	1.35 s
8	47.4	1.54	30	15.3	1.17 s
9	19.5	–	OMe	50.1	3.36 s
10	26.9	–	β -D-Glcp		
11	26.5	1.08, 1.90	1	105.0	4.97 d (7.3)
12	31.0	1.40, 1.53	2	83.6	4.27 dd (7.3, 9.2)
13	44.3	–	3	8.4	4.37 dd (9.2, 9.2)
14	49.4	–	4	71.6	4.20 dd (9.2, 9.2)
15	45.3	1.65 d (13.4), 1.94 d (13.4)	5	78.0	3.91 m
16	119.6	–	6	62.8	4.34 brd (10.4), 4.55 brd (10.4)
17	69.2	2.45 brs	β -D-Glcp		
18	19.4	1.18 s	1	106.2	5.41 d (7.3)
19	30.4	0.13 d (3.7), 0.52 d (3.7)	2	77.2	4.16 dd (7.3, 9.2)
20	34.6	2.57 m	3	78.3	4.27 dd (9.2, 9.2)
21	18.1	1.19 d (7.3)	4	71.7	4.37 dd (9.2, 9.2)
22	82.2	5.22 ddd (6.7, 6.7, 7.3)	5	78.0	3.95 m
			6	62.8	4.47 brd (10.5), 4.53 brd (10.5)

Cimicide C

C₄₃H₇₀O₁₆, M 842



Taxonomy: Cycloartane Glycosides
Cimicifuga dahurica (Turcz.) Maxim.
 (Ranunculaceae) [1].

Mp 210–213°C, $[\alpha]_D^{25}$ 0° (c 0.54, CH₃OH).

CAS Registry Number: 158059-07-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3680–3080, 1740, 1460, 1380, 1240, 1160, 1100, 1080, 1030, 980.

Negative ion FABMS m/z: 841 [M-1]⁻.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.6	1.36 m, 1.61	C-23	76.1	4.53 d (11.3)
2	30.2	1.95 m, 2.35	24	78.6	5.05 brs
3	88.6	3.49 dd (11.5, 4.1)	25	72.6	–
4	41.4	–	26	28.4	1.53 s
5	47.8	1.35	27	27.0	1.36 s
6	21.5	0.87, 1.61	28	12.7	1.27 s
7	25.7	1.34, 2.04	29	25.7	1.27 s
8	49.2	1.78 m	30	15.4	1.08 s
9	20.3	–	β -D-Xylp		
10	26.8	–	1	107.6	4.84 d (7.2)
11	26.4	1.17, 2.66	2	75.5	4.01 t (7.8)
12	32.8	1.46, 1.63	3	78.4	4.18 m
13	42.1	–	4	71.2	4.20 m
14	47.7	–	5	67.1	3.75 t (10.6), 4.4)
15	95.4	4.22 s			
16	103.0	–	β -D-Glcp		
17	59.7	1.91 d (8.3)	1	105.5	5.01 d (7.5)
18	20.2	1.21 s	2	75.4	3.95 t (8.1)

(continued)

Table 1 (continued)

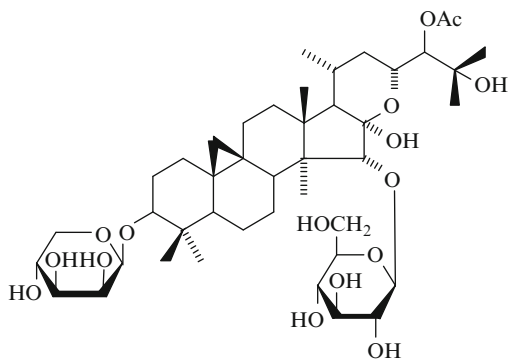
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
19	31.1	0.30 d, 0.60 d	3 78.5 4.16 m
20	27.1	1.78 m	4 70.2 4.40 t (9.3)
21	23.0	0.92 d (5.4)	5 78.3 4.23 m
22	32.3	1.46 brd, 2.08 d (12.7)	6 61.5 4.53 d (11.3), 4.65 d (11.6)
		Ac	171.3 –
			21.1 2.28 s

References

- C.J. Li, D.H. Chen, P.G. Xiao, *Huaxue Xuebao* **52**(7), 722–726 (1994)

Cimiside D

C₄₃H₇₀O₁₆, M 842



Taxonomy: Cycloartane Glycosides
Cimicifuga dahurica (Turcz.) Maxim.
(*Ranunculaceae*) [1].

Mp 204–206°C, $[\alpha]_D^{25}$ +22.8° (c 0.51, CH₃OH).

CAS Registry Number: 158059-08-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3100, 1720, 1325, 1250, 1150, 1070–1020, 940.

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.58 (2H-19, d, J = 3.9 Hz), 0.91 (CH₃-21, d, J = 6.4 Hz), 1.02, 1.20, 1.22, 1.25, 1.35, 1.51 (6 × CH₃, s), 1.89 (H-17, d, J = 8.7 Hz), 2.27 (OAc, s), 3.45 (H-3, dd, J = 11.6, 4.2 Hz), 4.15 (H-15, s),

4.52 (H-23, dd, J = 12.1, 3.3 Hz), 5.03 (H-24, brs), 5.00 (Glc p H-1, d, J = 7.8 Hz), 3.92 (Glc p H-2, t, J = 8.5 Hz), 4.14 (Glc p H-3, m), 4.42 (Glc p H-4, t, J = 8.6 Hz), 4.18 (Glc p H-5, m), 4.61 and 4.50 (Glc p 2H-6, d, J = 10.5 Hz), 4.76 (Lyxp H-1, d, J = 7.5 Hz).

Table 1

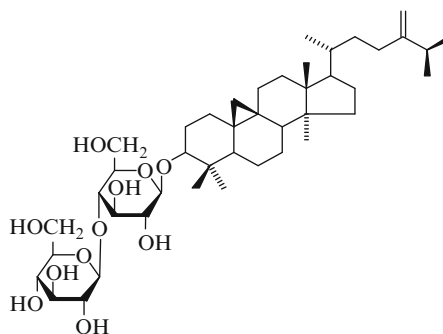
δ_C (C ₅ D ₅ N)								
C-1	32.7	C-11	26.5	C-21	23.1	β -D-Lyxp	β -D-Glcp	Ac
2	30.1	12	32.9	22	32.4	1	107.6	1 105.6 21.2
3	88.7	13	42.2	23	76.2	2	74.6	2 75.4 171.5
4	41.5	14	47.8	24	78.6	3	72.9	3 78.4
5	47.8	15	95.5	25	72.6	4	69.5	4 70.0
6	21.6	16	103.0	26	28.4	5	66.8	5 78.6
7	25.8	17	59.7	27	27.0			6 61.4
8	49.4	18	20.3	28	12.8			
9	20.3	19	31.2	29	25.8			
10	26.8	20	27.2	30	15.5			

References

- C.J. Li, D.H. Chen, P.G. Xiao, *Huaxue Xuebao* **52**(7), 722–726 (1994)

Acanthoside K₂

C₄₃H₇₂O₁₁, M 764



Taxonomy: Cycloartane Glycosides
Acanthopanax sesiliflorus (Rupr. et Maxim.) Seem.
(*Araliaceae*) [1].

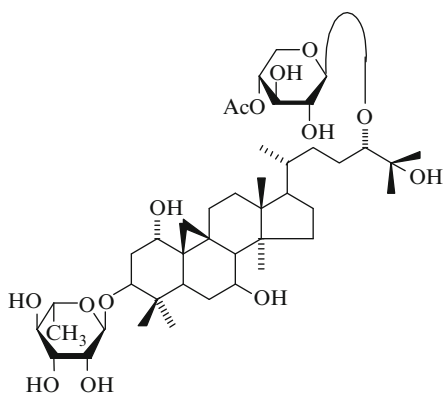
Mp 168–170°C, $[\alpha]_D^{23} +22^\circ$ (c 1.20, MeOH).
CAS Registry Number: 119272-08-1.

References

1. L. Kong, C. Shao, J. Xu, *Zhongcaoyao* **19**, 482–486 (1988)

Macrophyllosaponin A

$C_{43}H_{72}O_{14}$, M 812



Taxonomy: Cycloartane Glycosides

Astragalus oleifolius DC (*Leguminosae*) [1].

$[\alpha]_D^{20} - 5.0^\circ$ (c 0.28, MeOH).

CAS Registry Number: 184104-58-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1735.

FABMS m/z (%): $[M + Na]^+$ 835 (38), 175 (15).

Table 1

δ_C (CD_3OD)	δ_H (J/Hz)	δ_C (CD_3OD)	δ_H (J/Hz)
C-1	74.7 3.56 m	C-23	30.4
2	38.0	24	90.0 3.44 m
3	86.1 3.70 m	25	74.0 –
4	42.5 –	26	26.4 1.19 s
5	41.1	27	27.4 1.21 s
6	33.1 –	28	20.2 1.09 s
7	72.1 3.56 m	29	27.0 1.02 s
8	57.0 –	30	15.5 0.87 s
9	23.0 –	α -L-Rhap	
10	32.4	1	105.3 4.79 d (1.7)
11	28.0	2	73.5 3.88 dd (3.4, 1.7)
12	35.0	3	73.6 3.68 dd (3.4, 9.5)

(continued)

Table 1 (continued)

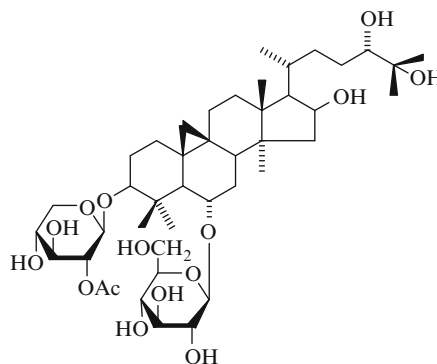
δ_C (CD_3OD)	δ_H (J/Hz)	δ_C (CD_3OD)	δ_H (J/Hz)
13	47.9 –	4	75.1 3.41 t (9.5)
14	50.7 –	5	70.9 3.71 dq (9.5, 6.3)
15	39.5	6	18.8 1.28 d (6.3)
16	30.6	β -D-Xylp	
17	54.0 1.60 m	1	106.2 4.38 d (7.6)
18	19.2 1.07 s	2	75.0 3.32 dd (7.6, 9.2)
19	30.3 0.48 d (4.6), 0.81 d (4.6)	3	76.3 3.60 dd (9.3, 9.2)
20	38.7	4	74.5 4.74 ddd (10.3, 9.3, 5.4)
21	19.9 0.97 d (6.3)	5	64.6 4.00 dd (11.3, 5.4),
22	35.4		3.22 dd (11.3, 10.3)
		Ac	21.8 2.11 s
			173.2 –

References

1. I. Calis, M. Zor, I. Saracoglu, A. Isiker, H. Ruegger, *J. Nat. Prod.* **59**(11), 1019–1023 (1996)

Agroastragaloside II

$C_{43}H_{72}O_{15}$, M 828



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Mp 267–269°C (from MeOH), $[\alpha]_D^{25} + 48^\circ$ (c 0.22, MeOH).

CAS Registry Number: 160896-39-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3420, 2950, 1780, 1380, 1260, 1070, 1045.

FABMS m/z: $[M + Na]^+$ 851.

HRFABMS m/z : $[M + Na]^+$ 851.4774.

EIMS m/z (%): 474 (17), 456 (42), 438 (37), 311 (39), 187 (43), 175 (65), 151 (45), 126 (47), 114 (100), 112 (91).

Table 1

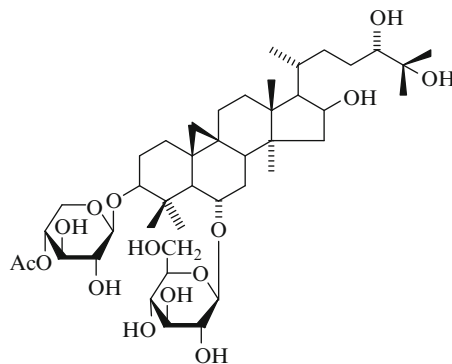
δ_C (C_5D_5N)		δ_H (J/Hz)	δ_C (C_5D_5N)		δ_H (J/Hz)
C-1	32.2	–	C-23	28.0	
2	30.1	–	24	77.2	3.96 dd (11, 2)
3	89.1	3.39 dd (11.1, 4)	25	72.6	–
4	42.4	–	26	25.9	1.49 s
5	52.6	1.91 d (8.5)	27	26.6	1.47 s
6	79.3	3.80 td (8.5, 4)	28	20.0	0.98 s
7	34.6	–	29	28.4	1.83 s
8	45.9	–	30	16.7	1.29 s
9	21.6	–	β -D-Xylp		
10	28.8	–	1	104.9	4.80 d (7.7)
11	26.3	–	2	75.8	
12	33.3	–	3	76.4	
13	45.9	–	4	71.5	
14	47.0	–	5	67.3	
15	48.1	–	β -D-Glcp		
16	72.1	4.72 m	1	105.3	4.96 d (7.4)
17	57.3	1.82 m	2	75.8	
18	18.7	1.40 s	3	79.3	
19	28.5	0.18 d (4), 0.54 d (4)	4	72.0	
20	28.7	–	5	78.3	
21	18.5	1.08 d (6.5)	6	63.3	
22	33.1	2.31 m	Ac	21.4	2.04 s
				170.2	–

References

1. M. Hirotani, Y. Zhou, H. Rui, T. Furuya, *Phytochemistry* **37**(5), 1403–1407 (1994)

Cycloanthoside B

$C_{43}H_{72}O_{15}$, M 828



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].

Mp 235–237°C (from MeOH), $[\alpha]_D^{23} + 12.6^\circ$ (c 0.96, MeOH).

IR ν_{max}^{KBr}, cm^{-1} : 3510–3320, 1730, 1255.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.18 and 0.56 (2H-19, d, $J = 4$ Hz), 1.06 (CH_3 -21, d, $J = 6.4$ Hz), 0.95, 1.31, 1.38, 1.43, 1.45, 1.98 (6 \times CH_3 , s), 1.94 (CH_3COO , s), 3.48 (H-3, dd, $J = 12, 4$ Hz), 3.51 (Xylp H-5a, dd, $J = 10, 9$ Hz), 3.78 (H-6, td, $J = 9, 4$ Hz), 3.85 (Glc p H-5, ddd, $J = 9, 6, 3$ Hz), 3.91 (H-24, dd, $J = 12, 3$ Hz), 3.99 (Glc p H-2, dd, $J = 9, 7.7$ Hz), 4.01 (Xylp H-2, dd, $J = 9, 7.5$ Hz), 4.14 (Glc p H-4, t, $J = 9$ Hz), 4.18 (Glc p H-3, t, $J = 9$ Hz), 4.20 (Xylp H-3, t, $J = 9$ Hz), 4.27 (Glc p H-6, dd, $J = 12, 6$ Hz), 4.29 (Xylp H-5e, dd, $J = 10, 5.6$ Hz), 4.43 (Glc p H-6', dd, $J = 12, 3$ Hz), 4.69 (H-16, q,

Table 1

δ_C (C_5D_5N)									
C-1	32.19	C-11	26.26	C-21	18.32	β -D-Xylp	β -D-Glcp	Ac	
2	28.74	12	33.18	22	32.97	1	107.38	1	105.15
3	88.61	13	45.79	23	27.87	2	75.74	2	75.60
4	42.64	14	46.91	24	77.11	3	74.91	3	79.15 ^a
5	52.48	15	47.88	25	72.52	4	73.23	4	71.98
6	79.15 ^a	16	71.93	26	25.74	5	63.17 ^b	5	78.07
7	34.35	17	57.19	27	26.46			6	63.17 ^b
8	45.65	18	18.48	28	19.82				
9	21.41	19	28.26	29	28.61				
10	30.09	20	28.52	30	16.62				

^{a,b}Signals are mutually imposed

$J = 7$ Hz), 4.80 (Xylp H-1, d, $J = 7.5$ Hz), 4.87 (Glc p H-1, d, $J = 7.7$ Hz).

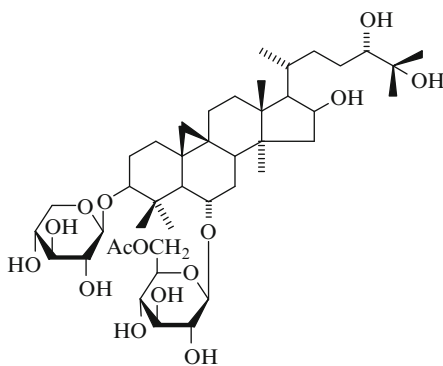
See Table 1

References

- M.I. Isaev, B.A. Imomnazarov, Y.M. Fadeev, P.K. Kintia, *Chem. Nat. Comp.* **28**(3–4), 315–320 (1992)

Cyclocanthoside C

$C_{43}H_{72}O_{15}$, M 828



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].

Mp 240–242°C (from $CHCl_3$ –MeOH, 1:1), $[\alpha]_D^{20} + 30.6^\circ$ (c 1.11, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3570–3350, 1740, 1270.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.16 and 0.60 (2H-19, d, $J = 4$ Hz), 1.08 (CH₃-21, d, $J = 6.4$ Hz), 1.10, 1.28, 1.39, 1.43, 1.45, 1.91 (6 × CH₃, s), 2.08 (CH₃COO, s), 3.47 (H-3, dd, $J = 12, 4$ Hz), 3.65

(Xylp H-5a, dd, $J = 10, 9$ Hz), 3.78 (H-6, m), 3.91 (H-24, dd, $J = 11, 3$ Hz), 3.94 (Glc p H-5, m), 3.98 (Glc p H-2, dd, $J = 9, 7.8$ Hz), 4.01 (Xylp H-2, dd, $J = 9, 7.4$ Hz), 4.11 (Xylp H-3, t, $J = 9$ Hz), 4.15 (Glc p H-4, t, $J = 9$ Hz), 4.18 (Glc p H-3, t, $J = 9$ Hz), 4.19 (Xylp H-4, td, $J = 9, 5$ Hz), 4.32 (Xylp H-5e, dd, $J = 10, 5$ Hz), 4.57 (Glc p H-6, dd, $J = 11, 6$ Hz), 4.74 (H-16, q, $J = 7$ Hz), 4.78 (Xylp H-1, d, $J = 7.4$ Hz), 4.85 (Glc p H-1, d, $J = 7.8$ Hz), 4.97 (Glc p H-6', dd, $J = 11, 2$ Hz).

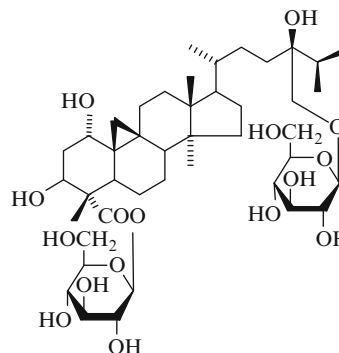
See Table 1

References

- M.I. Isaev, B.A. Imomnazarov, Y.M. Fadeev, P.K. Kintia, *Chem. Nat. Comp.* **28**(3–4), 315–320 (1992)

Cyclopassifloside III

$C_{43}H_{72}O_{16}$, M 844



Taxonomy: Cycloartane Glycosides

Table 1

δ_C (C_5D_5N)										
C-1	32.09	C-11	26.31	C-21	18.32	β -D-Xylp	β -D-Glc p	Ac		
2	28.52	12	33.18	22	33.04	1	107.54	1	105.07	21.03
3	88.44	13	45.83	23	27.14	2	75.55	2	75.49	170.97
4	42.60	14	46.82	24	77.18	3	78.48	3	78.71 ^a	
5	52.19	15	47.53	25	72.55	4	71.24	4	71.51	
6	78.71 ^a	16	72.05	26	25.63	5	67.01	5	74.98	
7	33.59	17	57.16	27	26.49			6	65.06	
8	44.93	18	18.08	28	19.77					
9	21.46	19	27.85	29	28.30					
10	30.12	20	28.70	30	16.69					

^aSignals are mutually imposed

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous solid, $[\alpha]_D^{25} +25.7^\circ$ (c 3.5, MeOH).

CAS Registry Number: 292167-40-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1730, 1070, 995.

FABMS m/z : 843 $[\text{M-H}]^-$.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-MS): 0.53 and 0.75 (2H-19, d, $J = 4.5$ Hz), 0.87 (CH₃-28, s), 0.97 (CH₃-21, d, $J = 6$ Hz), 0.99 (CH₃-18, s), 1.12, 1.14 (CH₃-26, CH₃-27, d, $J = 7$ Hz), 1.68 (CH₃-30, s), 2.23 (H-2, ddd, $J = 12, 12, 3$ Hz), 2.42 (H-2, ddd, $J = 12, 4, 3$ Hz), 2.75 (H-11, m), 3.35 (H-5, dd, $J = 11, 4$ Hz), 3.87 (H-1, brs), 3.96, 4.32 (H₂-31, d, $J = 11$ Hz), 3.98 (H-5'' of Glc, m), 4.07 (H-3'' of Glc, dd, $J = 8, 8$ Hz), 4.07 (H-5' of Glc, m), 4.15 (H-2' of Glc, dd, $J = 8, 8$ Hz), 4.22 (H-2', H-4'' of Glc, m), 4.26 (H-3' of Glc, dd, $J = 8, 8$ Hz), 4.35 (H-4' of Glc, dd, $J = 8, 8$ Hz), 4.38 (2H-6', H-6'' of Glc, m), 4.55 (H-6'' of Glc, dd, $J = 12, 2.5$ Hz), 4.96 (H-1'' of Glc, d, $J = 8$ Hz), 5.57 (H-3, dd, $J = 12, 4$ Hz), 6.49 (H-1' of Glc, d, $J = 8$ Hz).

' – 29-O- β -D-Glcp

'' – 31-O- β -D-Glcp

Table 1

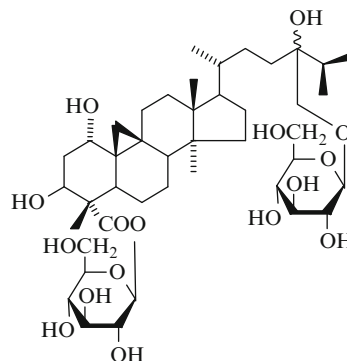
δ_C ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.5	C-11	26.4	C-21	19.6	29-O- β -D-Glcp	31-O- β -D-Glcp		
2	38.3	12	33.5	22	31.9	1	96.6	1	106.0
3	70.8	13	45.7	23	30.4	2	74.8	2	75.4
4	56.5	14	49.2	24	75.8	3	78.5	3	78.5
5	37.7	15	36.1	25	33.5	4	71.3	4	72.0
6	23.1	16	28.5	26	17.6	5	79.5	5	78.5
7	25.8	17	52.9	27	17.7	6	62.4	6	63.0
8	48.3	18	18.5	28	18.8				
9	21.1	19	30.1	29	176.6				
10	30.3	20	37.3	30	9.8				
				31	75.2				

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(9), 1229–1234 (2000)

Cyclotricuspidoside A

$\text{C}_{43}\text{H}_{72}\text{O}_{16}$, M 844



Taxonomy: Cycloartane Glycosides

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].

$[\alpha]_D^{23} +24.5^\circ$ (c 1.0, MeOH).

CAS Registry Number: 239794-21-9.

HRFABMS m/z : $[\text{M} + \text{Na}]^+$ 867.4719.

$^1\text{H NMR}$ ($\text{C}_5\text{D}_5\text{N}$, δ): 0.50 and 0.71 (2H-19, d, $J = 5$ Hz), 0.84 (s, CH₃-18), 0.94 (CH₃-21, d, $J = 6$ Hz), 0.95 (CH₃-28, s), 1.08 (CH₃-26, d, $J = 7$ Hz), 1.10 (CH₃-27, d, $J = 7$ Hz), 1.66 (CH₃-30, s), 3.35 (H-5, dd, $J = 5, 12$ Hz), 4.96 (31-Glcp H-1, d, $J = 8$ Hz), 5.56 (H-3, dd, $J = 5, 12$ Hz), 6.49 (29-Glcp H-1, d, $J = 8$ Hz).

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)									
C-1	72.3	C-11	26.1	C-21	19.4	29-O- β -D-Glcp	31-O- β -D-Glcp		
2	38.3	12	33.2	22	29.9	1	96.4	1	106.0
3	71.7	13	45.4	23	31.9	2	74.7	2	75.4
4	56.3	14	49.0	24	75.5	3	79.6	3	78.6
5	37.6	15	35.8	25	33.2	4	70.7	4	70.7
6	23.1	16	28.4	26	17.3	5	78.4	5	78.6
7	25.6	17	52.7	27	17.5	6	62.0	6	62.7
8	48.2	18	18.7	28	18.4				
9	20.8	19	30.0	29	176.7				
10	30.0	20	37.3	30	9.7				
				31	75.1				

References

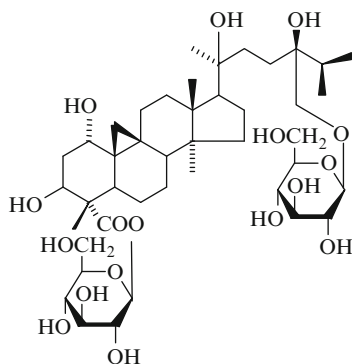
- R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

' – 29-O-β-D-Glcp

'' – 31-O-β-D-Glcp

Cyclopassifloside V

C₄₃H₇₂O₁₇, M 860



Taxonomy: Cycloartane Glycosides

Passiflora edulis Sims (*Passifloraceae*) [1].

Amorphous solid, $[\alpha]_{\text{D}}^{25} +16.5^\circ$ (c 6.8, MeOH).

CAS Registry Number: 292167-42-1.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3450, 1735, 1070, 1035.

FABMS m/z: 859 [M-H]⁻.

¹HNMR (400 MHz, C₅D₅N, δ, 0–TMS): 0.49 and 0.70 (2H-19, d, J = 4 Hz), 0.93 (CH₃-28, s), 1.07, 1.11 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.49 (CH₃-18, s), 1.50 (CH₃-21, s), 1.65 (CH₃-30, s), 2.24 (H-2, ddd, J = 12, 12, 2.5 Hz), 2.44 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.75 (H-11, m), 3.32 (H-5, dd, J = 12, 4.5 Hz), 3.87 (H-1, brs), 3.87, 4.30 (2H-31, d, J = 11 Hz), 3.95 (H-5'' of Glc, m), 4.00 (H-5' of Glc, m), 4.02 (H-3'' of Glc, dd, J = 8, 8 Hz), 4.12 (H-2' of Glc, dd, J = 8, 8 Hz), 4.20 (H-2'', H-4'' of Glc, m), 4.26 (H-3' of Glc, dd, J = 8, 8 Hz), 4.30 (H-4' of Glc, dd, J = 8, 8 Hz), 4.35 (2H-6' and H-6'' of Glc, m), 4.52 (H-6'' of Glc, dd, J = 12, 2.5 Hz), 4.91 (H-1'' of Glc, d, J = 8 Hz), 5.54 (H-3, dd, J = 12, 4 Hz), 6.41 (H-1' of Glc, d, J = 8 Hz).

Table 1

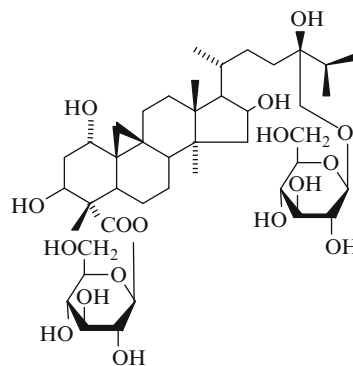
δ _C (C ₅ D ₅ N)									
C-1	72.6	C-11	26.5	C-21	26.1	29-O-β-D-Glcp		31-O-β-D-Glcp	
2	38.3	12	33.4	22	38.5	1	96.5	1	105.8
3	70.8	13	46.4	23	29.5	2	74.8	2	75.4
4	56.5	14	49.5	24	75.6	3	78.5	3	78.5
5	37.8	15	35.8	25	33.6	4	71.3	4	71.9
6	23.1	16	23.1	26	17.4	5	79.4	5	78.5
7	25.8	17	55.2	27	17.6	6	62.4	6	62.9
8	48.0	18	19.9	28	20.4				
9	20.9	19	30.4	29	176.6				
10	30.4	20	74.8	30	9.8				
				31	75.0				

References

- K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, *J. Nat. Prod.* **63**(9), 1229–1234 (2000)

Cyclopassifloside IX

C₄₃H₇₂O₁₇, M 860



Taxonomy: Cycloartane Glycosides*Passiflora edulis* Sims (*Passifloraceae*) [1].Amorphous solid, $[\alpha]_D^{25} +19.0^\circ$ (c 1.3, MeOH).

CAS Registry Number: 239794-22-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1730, 1070, 1030.FABMS m/z : 859 [M-H]⁻.

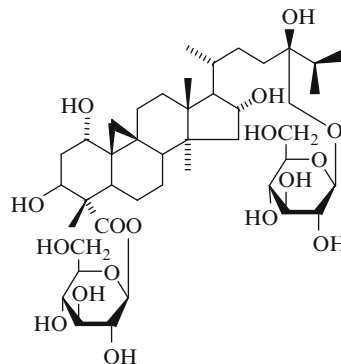
¹H NMR (400 MHz, C₅D₅N, δ , 0-MS): 0.51 and 0.71 (2H-19, d, J = 4 Hz), 0.87 (CH₃-28, s), 1.04, (CH₃-21, d, J = 6 Hz), 1.12 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.35 (CH₃-18, s), 1.66 (CH₃-30, s), 2.48 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.74 (H-11, m), 3.34 (H-5, dd, J = 12, 4 Hz), 3.87 (H-1, brs), 3.98, 4.01 (2H-31, d, J = 11 Hz), 3.99 (H-5'' of Glc, m), 4.04 (H-5' of Glc, t, J = 8 Hz), 4.23 (H-3'' of Glc, t, J = 8 Hz), 4.25 (H-3' of Glc, t, J = 8 Hz), 4.29 (H-4' of Glc, t, J = 8 Hz), 4.33 (H-6' and H-6'' of Glc, t, J = 8 Hz), 4.42 (H-6' of Glc, dd, J = 12.5, 2.5 Hz), 4.53 (H-6'' of Glc, dd, J = 12, 2.5 Hz), 4.67 (H-16, dt, J = 6, 8.5 Hz), 4.91 (H-1'' of Glc, d, J = 8 Hz), 5.54 (H-3, dd, J = 12, 4 Hz), 6.41 (H-1' of Glc, d, J = 8 Hz).

' – 29-O- β -D-Glcp'' – 31-O- β -D-Glcp**Table 1**

δ_c (C ₅ D ₅ N)											
C-1	72.3	C-11	26.0	C-21	19.6	29-O- β - D-Glcp	31-O- β -D- Glcp				
2	38.3	12	31.9	22	32.3	1	96.5	1	105.5		
3	70.9	13	45.8	23	30.7	2	74.8	2	75.5		
4	56.5	14	47.2	24	76.1	3	78.5	3	78.5		
5	37.8	15	49.1	25	33.5	4	71.7	4	71.7		
6	23.1	16	72.1	26	17.4	5	79.5	5	78.5		
7	26.0	17	57.4	27	17.6	6	62.4	6	62.8		
8	48.4	18	18.7	28	20.4						
9	21.1	19	30.4	29	176.6						
10	30.4	20	33.5	30	9.8						
				31	75.1						

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclopassifloside XIC₄₃H₇₂O₁₇, M 860**Taxonomy:** Cycloartane Glycosides*Passiflora edulis* Sims (*Passifloraceae*) [1].Mp 171–173°C, $[\alpha]_D^{25} +13.6^\circ$ (c 2.7, MeOH).

CAS Registry Number: 239794-23-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3450, 1735, 1045, 1030.FABMS m/z : 859 [M-H]⁻.

¹H NMR (400 MHz, C₅D₅N, δ , 0-MS): 0.54 and 0.74 (2H-19, d, J = 4 Hz), 1.03 (CH₃-21, d, J = 6 Hz), 1.03, (CH₃-18, s), 1.09, 1.14 (CH₃-26, CH₃-27, d, J = 7 Hz), 1.31 (CH₃-28, s), 1.68 (CH₃-30, s), 2.43 (H-2, ddd, J = 12, 4, 2.5 Hz), 2.83 (H-11, m), 3.36 (H-5, dd, J = 12, 4.5 Hz), 3.87 (H-1, brs), 3.94, 3.99 (2H-31, d, J = 11 Hz), 3.95 (H-5'' of Glc, m), 4.03 (H-5' of Glc, m), 4.05 (H-2'' of Glc, t, J = 8 Hz), 4.15 (H-2' of Glc, t, J = 8 Hz), 4.20 (H-3'', H-4'' of Glc, t, J = 8 Hz), 4.27 (H-3' of Glc, dd, J = 8, 8 Hz), 4.28 (H-16, m), 4.35 (H-4' of Glc, t, J = 8 Hz), 4.38 (2H-6', H-6'' of Glc, m), 4.55 (H-6'', of Glc, dd, J = 12, 2.5 Hz), 4.92 (H-1'' of Glc, d, J = 8 Hz), 5.58 (H-3, dd, J = 12, 4.5 Hz), 6.50 (H-1' of Glc, d, J = 8 Hz).

' – 29-O- β -D-Glcp'' – 31-O- β -D-Glcp

Table 1

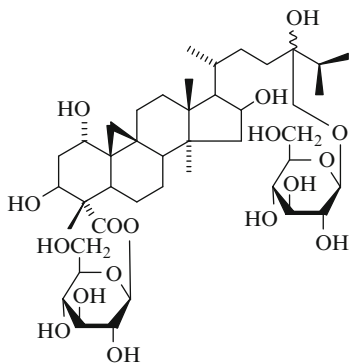
δ_C (C_5D_5N)										
C-1	72.3	C-11	26.3	C-21	19.3	29-O- β - D-Glcp	31-O- β -D- Glcp			
2	38.4	12	33.3	22	32.3	1	96.5	1	105.7	
3	70.8	13	47.9	23	30.6	2	74.7	2	75.5	
4	56.5	14	47.0	24	76.1	3	78.5	3	78.5	
5	37.8	15	48.5	25	34.3	4	71.7	4	71.7	
6	23.2	16	77.1	26	17.5	5	79.6	5	78.5	
7	26.0	17	61.8	27	17.5	6	62.1	6	62.8	
8	48.5	18	18.6	28	20.5					
9	20.5	19	29.6	29	176.8					
10	30.3	20	36.1	30	9.8					
				31	75.2					

References

1. K. Yoshikawa, S. Katsuta, J. Mizumori, S. Arihara, J. Nat. Prod. **63**(10), 1377–1380 (2000)

Cyclotricuspidoide B

$C_{43}H_{72}O_{17}$, M 860



Taxonomy: Cycloartane Glycosides

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].

$[\alpha]_D^{23} +35.9^\circ$ (c 1.0, MeOH).

CAS Registry Number: 301644-33-7.

HRFABMS m/z: $[M + H]^+$ 861.4848.

1H NMR (C_5D_5N , δ): 0.51 and 0.75 (2H-19, d, J = 4 Hz), 0.89 (CH₃-28, s), 1.05 (CH₃-21, d, J = 6 Hz),

1.09 (CH₃-26, d, J = 6 Hz), 1.11 (CH₃-27, d, J = 6 Hz), 1.36 (CH₃-18, s), 1.66 (CH₃-30, s), 2.42 (H-2a, m), 2.72 (H-11a, m), 3.35 (H-5, dd, J = 4, 12 Hz), 3.86 (H-1, m), 4.65 (H-16, m), 4.92 (31-O- β -D-Glcp H-1, d, J = 8 Hz), 5.56 (H-3, dd, J = 5, 12 Hz), 6.48 (29-O- β -D-Glcp H-1, d, J = 8 Hz).

Table 1

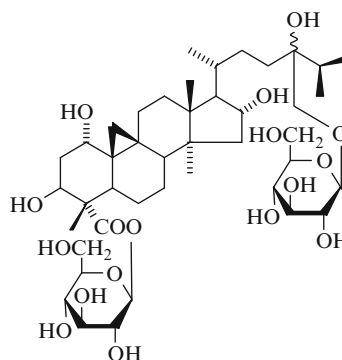
δ_C (C_5D_5N)										
C-1	72.2	C-11	25.7	C-21	19.4	29-O- β - D-Glcp	31-O- β - D-Glcp			
2	38.2	12	33.1	22	30.1	1	96.4	1	105.5	
3	71.6	13	45.5	23	32.0	2	74.6	2	75.2	
4	56.3	14	47.0	24	75.7	3	79.5	3	78.5	
5	37.6	15	48.9	25	31.7	4	70.9	4	70.6	
6	22.9	16	71.5	26	17.3	5	78.4	5	78.5	
7	25.8	17	57.2	27	17.2	6	62.0	6	62.5	
8	48.2	18	18.4	28	20.2					
9	20.8	19	30.5	29	176.6					
10	30.1	20	33.3	30	9.6					
				31	75.0					

References

1. R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

Cyclotricuspidoide C

$C_{43}H_{72}O_{17}$, M 860



Taxonomy: Cycloartane Glycosides

Trichosanthes tricuspidata Lour. (*Cucurbitaceae*) [1].
 $[\alpha]_D^{23} +12.1^\circ$ (c 1.0, MeOH).

CAS Registry Number: 301644-34-8.

HRFABMS m/z: $[M + H]^+$ 861.4847.

1H NMR (C_5D_5N , δ): 0.50 and 0.72 (2H-19, d, J = 4 Hz), 1.01 (CH₃-21, d, J = 6 Hz), 1.02 (CH₃-28, s), 1.06 (CH₃-26, d, J = 7 Hz), 1.10 (CH₃-27, d, J = 7 Hz), 1.28 (CH₃-18, s), 1.63 (CH₃-30, s), 3.30 (H-5, dd, J = 5, 13 Hz), 4.86 (31-Glcp H-1, d, J = 8 Hz), 5.51 (H-3, dd, J = 5, 12 Hz), 6.42 (29-Glcp H-1, d, J = 8 Hz).

1H NMR (200 MHz, $CDCl_3$ - C_5D_5N , δ , 0-TMS): 0.22 and 0.49 (2H-19, d, J = 4 Hz), 0.95, 0.99, 1.19, 1.22, 1.22, 1.25, 1.37 (7 \times CH₃, s), 1.97, 2.00 (2 \times CH₃COO, s).

Table 1

δ_C (C_5D_5N)	3-O- β -D-Glcp	6-O- β -D-Glcp	Ac
C-3	88.8	C-1	104.3
C-1	104.3	C-1	105.6
6	78.6	2	75.3
16	73.4	3	72.5
20	87.3	4	72.2
24	81.6	5	63.0
25	71.3		

References

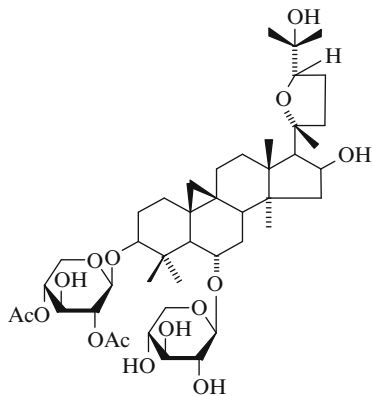
1. R. Kasai, A. Sasaki, T. Hashimoto, T. Kaneko, K. Ohtani, K. Yamasaki, *Phytochemistry* **51**(6), 803–808 (1999)

References

1. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)

Astrasieversianin III

$C_{44}H_{70}O_{15}$, M 838

**Taxonomy:** Cycloartane Glycosides

Aragalus sieversianus Pall. (*Leguminosae*) [1].

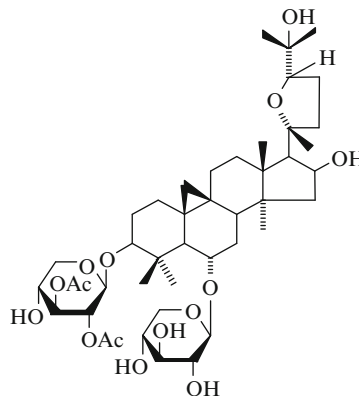
Mp 250–254°C (from MeOH), $[\alpha]_D^{24} +15.7^\circ$ (c 0.49, MeOH).

IR ν_{max}^{Nujol} , cm^{-1} : 3340, 3450, 1740, 1750.

FDMS m/z (%): 838 $[M + H]^+$ (15.3).

Cyclosieversioside A (astrasieversianin II)

$C_{44}H_{70}O_{15}$, M 838

**Taxonomy:** Cycloartane Glycosides

Aragalus sieversianus Pall. (*Leguminosae*) [1–3].

Aragalus basineri Trautv. (*Leguminosae*) [2, 4].

Aragalus schahrudensis Bunge (*Leguminosae*) [2, 5].

Astragalus babatagi M. Pop. (*Leguminosae*) [2, 6].
Astragalus siculus Biv. (*Leguminosae*) [7].
Astragalus uninodus M. Pop. et Vved. (*Leguminosae*) [8].

Astragalus exilis A. Kor. (*Leguminosae*) [9].

Astragalus melanophurarius Boiss. (*Leguminosae*) [10].

Mp 230–232°C (from MeOH), $[\alpha]_D^{20} +23.8^\circ$ (c 0.84, MeOH).

CAS Registry Number: 84882-99-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3430–3370, 1757, 1725, 1265–1235.

FDMS m/z (%): $[M + H]^+$ 839 (10.3), $[M]^+$ 838 (20.5).

$^1\text{H NMR}$ (200 MHz, CDCl_3 , δ): 0.26 and 0.50 (2H-19, d, $J = 4$ Hz), 0.90, 0.96, 1.06, 1.16, 1.24, 1.24, 1.32 ($7 \times \text{CH}_3$, s), 2.04, 2.06 ($2 \times \text{Ac}$, s).

Table 1

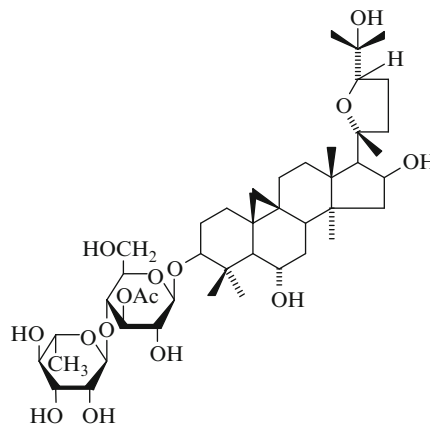
δ_C ($\text{C}_5\text{D}_5\text{N}$)		3-O- β -D-Xyl		6-O- β -D-Xyl		Ac
C-3	88.9	C-1	103.9	C-1	105.7	170.5
6	78.6	2	73.0	2	75.4	169.8
16	73.4	3	76.7	3	77.8	20.8
20	87.3	4	68.7	4	71.0	20.8
24	81.6	5	66.7	5	67.0	
25	71.3					

References

- A.N. Svechnikova, R.U. Umarova, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **18**(5), 595–598 (1982)
- M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
- L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)
- R.U. Umarova, A.N. Svechnikova, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **20**(2), 174–177 (1984)
- M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **24**(1), 123–124 (1988)
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- P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **38**(6), 579–582 (2002)
- I. Calis, A. Yuruker, D. Tasdemir, A.D. Wright, O. Sticher, Y.-D. Luo, J.M. Pezzuto, *Planta Med.* **63**, 183–186 (1997)

Astraverrucin V

$\text{C}_{44}\text{H}_{72}\text{O}_{15}$, M 840



Taxonomy: Cycloartane Glycosides

Astragalus verrucosus Moris (*Leguminosae*) [1].

$[\alpha]_D^{20} + 12.2^\circ$ (c 0.27, MeOH).

CAS Registry Number: 220997-49-9.

IR ν_{\max}^{KBr} , cm^{-1} : 3430, 1732, 1250, 1070.

FABMS m/z : 863 $[M + \text{Na}]^+$, 841 $[M + H]^+$, 676 $[\text{M-Rha}]^+$, 495 $[\text{M} + \text{Na-Glc-Rha-OAc}]^+$, 473 $[\text{M} + \text{H-Glc-Rha-OAc}]^+$, 437, 143, 85.

EIMS m/z (%): 185 (4.27), 157 (6.49), 143 (40.39), 125 (14.38), 105 (17.54), 91 (20.44), 71 (48.34), 59 (100).

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)		δ_H (J/Hz)		δ_C ($\text{C}_5\text{D}_5\text{N}$)		δ_H (J/Hz)		
C-1	32.4	C-16	73.6	4.80 m	β -D-Glcp			
2	30.1	17	58.4	2.52 d (7.6)	1	106.5	4.9	
3	89.5	3.50 m	18	21.0	1.37 s	2	74.1	4.05
4	42.6	–	19	30.8	0.21 d (3.4), 0.54 d (3.5)	3	77.5	5.75
5	54.0	–	20	87.3	–	4	76.0	4.45
6	68.2	3.65 m	21	27.3	1.28 s	5	77.0	3.65
7	38.8	–	22	35.0	–	6	62.0	4.12, 4.35
8	47.3	–	23	26.5	–	α -L-Rhap		
9	21.4	–	24	81.8	3.72 m	1	103.0	5.75
10	29.5	–	25	71.4	–	2	73.0	4.63
11	26.3	–	26	28.3	1.56 s	3	72.5	4.55
12	33.4	–	27	28.7	1.40 s	4	74.0	4.3
13	45.1	–	28	20.2	0.97 s	5	72.5	4.85

(continued)

Table 1 (continued)

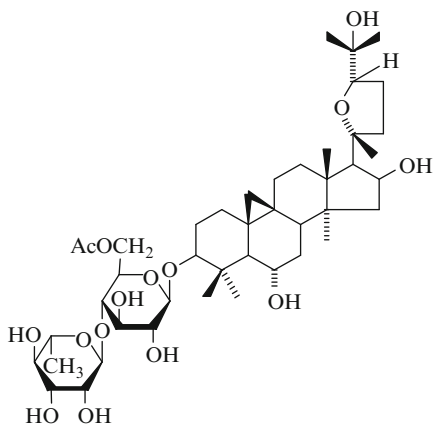
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	46.2	29	29.0	6	19.0
	–	1.96 s			1.66 d (5.7)
15	46.7	30	16.7	Ac	21.7
			1.28 s		2.19
					170.9 –

References

1. L. Pistelli, S. Pardossi, A. Bertoli, D. Potenza, *Phytochemistry* **49**(8), 2467–2471 (1998)

Astraverrucin VI

C₄₄H₇₂O
15, M 840



Taxonomy: Cycloartane Glycosides

Astragalus verrucosus Moris (*Leguminosae*) [1].

$[\alpha]_D^{20} +2.86^\circ$ (c 0.7, MeOH).

CAS Registry Number: 220997-50-2.

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3410, 1730, 1250, 1030.

FABMS m/z: 863 [M + Na]⁺, 841 [M + H]⁺, 550, 495 [M + Na-Glc-Rha-OAc]⁺, 473 [M + H-Glc-Rha-OAc]⁺, 437, 143, 85.

EIMS m/z (%): 149 (25.62), 109 (27.48), 97 (44.32), 85 (51.27), 69 (78.19), 57 (100).

Table 1

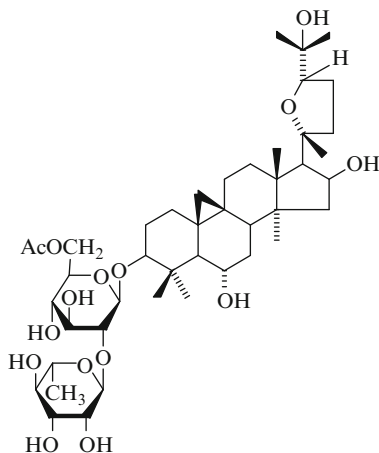
δ_C (C ₅ D ₅ N)	δ_H (J/z)	δ_C (C ₅ D ₅ N)	δ_H (JHz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.7	C-16	73.4	5.00 m	β -D-Glcp
2	30.0	17	58.3	2.51 d (7.7)	1 105.5 4.9
3	89.2	18	21.0	1.38 s	2 74.2 4.25
				(12, 4.2)	
4	42.6	19	30.4	0.21 m, 0.54 m	3 79.7 4.15
5	54.3	20	87.2	–	4 77.6 4.20
6	67.8	21	27.1	1.30 s	5 74.8 3.95
7	38.6	22	33.4	3.05 m	6 64.5 4.78, 4.84
8	46.9	23	26.2	3.80 m	α -L-Rhap
9	21.4	24	81.7	3.80 m	1 101.9 6.5
10	29.5	25	71.3	–	2 72.0 4.8
11	26.5	26	28.2	1.6 s	3 72.5 4.68
12	34.9	27	28.6	1.30 s	4 74.2 4.32
13	45.0	28	20.2	0.99 s	5 69.7 4.88
14	46.1	29	29.0	1.97 s	6 18.8 1.68 d (6.1)
15	46.6	30	16.7	1.56 s	Ac 21.5 2.1 s
					170.8 –

References

1. L. Pistelli, S. Pardossi, A. Bertoli, D. Potenza, *Phytochemistry* **49**(8), 2467–2471 (1998)

Cycloaraloside B

C₄₄H₇₂O₁₅, M 840



Taxonomy: Cycloartane Glycosides

Astragalus amarus Pall. (*Leguminosae*) [1].

Mp 181–183°C (from EtOAc-MeOH, 5:1), $[\alpha]_D^{24}$ 0° (c 0.7, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹ 3550–3310, 1740, 1260.

¹H NMR(400 MHz, C₅D₅N, δ , 0-TMS): 0.25 and 0.58 (2H-19, d, J = 4 Hz), 1.01, 1.28, 1.30, 1.40, 1.49, 1.56, 1.95 (7 × CH₃, s), 1.71 (Rhap CH₃, d, J = 6 Hz), 2.04 (CH₃COO, s), 2.52 (H-17, d, J = 7.8 Hz), 3.08 (H-22, q, J = 8 Hz), 3.54 (H-3, dd J = 11, 4 Hz), 3.76 (H-6, td, J = 9, 4 Hz), 3.87 (H-24, dd, J = 10, 5.5 Hz), 3.92 (Glc p H-3, H-5), 4.28 (Glc p H-2, t, J = 8 Hz), 4.31 (Rhap H-4, t, J = 10 Hz), 4.35 (Glc p H-4, t, J = 6 Hz), 4.69 (Rhap H-3, dd, J = 10, 4 Hz), 4.75 (Glc p H-6, dd, J = 12, 6 Hz), 4.79 (Rhap H-2, dd, J = 4, 1.3 Hz), 4.83 (Glc p H-6', dd, J = 12, 2 Hz), 4.86 (Rhap H-5, dq, J = 10, 6 Hz), 4.92 (Glc p H-1, d, J = 8 Hz), 5.00 (H-16, q, J = 7.8 Hz), 6.55 (Rhap H-1, d, J = 1.3 Hz).

Table 1

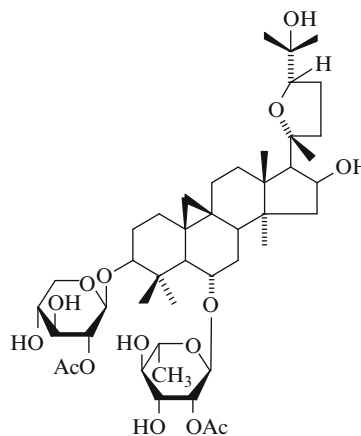
δ_C (C ₅ D ₅ N)									
C-1	32.65	C-11	26.21	C-21	27.09	β -D-Glcp	α -L-Rhap		
2	29.47	12	33.39	22	34.89	1	105.35	1	101.81
3	89.14	13	45.02	23	26.39	2	79.60	2	72.50
4	42.59	14	46.13	24	81.68	3	77.70	3	72.42
5	54.25	15	46.61	25	71.20	4	72.01	4	74.13
6	67.87	16	73.40	26	28.13	5	74.74	5	69.64
7	38.47	17	58.34	27	28.50	6	64.80	6	18.68
8	46.85	18	21.38	28	20.11			Ac	20.76
9	20.86	19	30.40	29	28.65				170.71
10	30.25	20	87.21	30	16.70				

References

1. M.I. Isaev, *Chem. Nat. Comp.* **28**(5), 461–463 (1992)

Cyclocarposide A

C₄₅H₇₂O₁₅, M 852



Taxonomy: Cycloartane Glycosides

Astragalus coluteocarpus Boiss. (*Leguminosae*) [1].
Mp 224–226°C (from MeOH), $[\alpha]_D^{23} -31.7^\circ$ (c 0.57, MeOH).

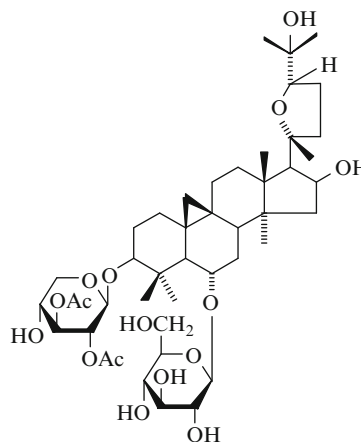
IR, ν_{\max}^{KBr} , cm^{-1} : 3600–3235, 3055, 1730, 1260.

$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.16 and 0.32 (2H-19, d, $J = 4$ Hz), 0.87, 1.01, 1.21, 1.22, 1.29, 1.34, 1.47 ($7 \times \text{CH}_3$, s), 1.51 (Rhap CH_3 , d, $J = 6$ Hz), 1.95, 2.09 ($2 \times \text{CH}_3\text{COO}$, s), 2.41 (H-17, d, $J = 7.6$ Hz), 2.95 (H-22, q, $J = 10$ Hz), 3.28 (H-3, dd, $J = 12, 5$ Hz), 3.45 (H-6, td, $J = 9, 4$ Hz), 3.62 (Xylp H-5a, t, $J = 10$ Hz), 3.81 (H-24, dd, $J = 10, 6$ Hz), 4.05–4.30 (Xylp H-3, H-4, Rhap H-3, H-4, H-5), 4.50 (Xylp H-5e, dd, $J = 10, 5$ Hz), 4.67 (Xylp H-1, d, $J = 8$ Hz), 4.90 (H-16, q, $J = 7.6$ Hz), 5.09 (Rhap H-1, brs), 5.35 (Xylp H-2, t, $J = 8$ Hz), 5.61 (Rhap H-2, brd, $J = 4$ Hz).

See Table 1

Cyclosieversioside B (astragaloside I, astasioversianin IV)

$\text{C}_{45}\text{H}_{72}\text{O}_{16}$, M 868

**References**

1. B.A. Imomnazarov, M.I. Isaev, *Chem. Nat. Comp.* **28**(6), 603–606 (1992)

Taxonomy: Cycloartane Glycosides

Astragalus basineri Trautv. (*Leguminosae*) [1, 2].
Astragalus sieversianus Pall. (*Leguminosae*) [1–3].
Astragalus membranaceus Bunge (*Leguminosae*) [4].

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)										
C-1	32.04	C-11	26.41	C-21	28.05	β -D-Xylp	α -L-Rhap	Ac		
2	29.99	12	33.28	22	34.91	1	105.01	1	100.65	20.99
3	88.25	13	45.03	23	25.90	2	76.24	2	74.34	21.29
4	41.95	14	46.16	24	81.74	3	75.61	3	70.60	170.14
5	51.95	15	46.74	25	71.30	4	71.24	4	73.91	170.75
6	79.75	16	73.36	26	27.09	5	67.12	5	70.09	
7	34.62	17	58.32	27	28.15			6	18.07	
8	46.34	18	21.56	28	20.21					
9	20.66	19	30.34	29	28.63					
10	28.76	20	87.19	30	16.95					

Atragalus schahrudensis Bunge (*Leguminosae*) [2, 5].
Atragalus babatagi M. Pop. (*Leguminosae*) [2, 6].
Atragalus exilis A. Kor. (*Leguminosae*) [7].
Atragalus siculus Biv. (*Leguminosae*) [8].
Atragalus microcephalus Willd. (*Leguminosae*) [9].
Atragalus melanophrurius Boiss. (*Leguminosae*) [10].
 Mp 198–200°C (from MeOH), $[\alpha]_D^{20} +10.7^\circ$ (c 0.88, MeOH).

CAS Registry Number: 91739-00-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3500–3350, 1760, 1750, 1260–1250.

FDMS $m/z(\%)$: $[\text{M} + \text{Na} + 1]^+$ 892 (100), $[\text{M} + \text{H}]^+$ 869 (1.2).

^1H NMR (200 MHz, CDCl_3 - $\text{C}_5\text{D}_5\text{N}$, δ): 0.28 and 0.56 (2H-19, d, $J = 4$ Hz), 0.99, 1.03, 1.24, 1.27, 1.31, 1.35, 1.43 ($7 \times \text{CH}_3$, s), 1.97, 1.99 ($2 \times \text{Ac}$, s).

Table 1

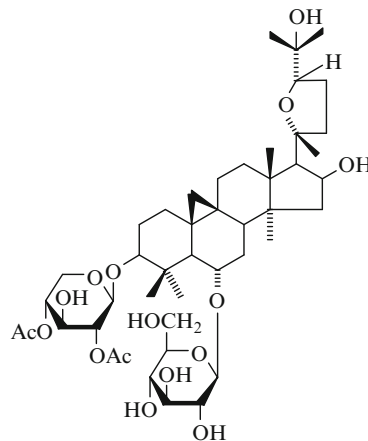
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	β -D-Xylp		β -D-Glcp		Ac
C-3	89.1	1	104.0	1	169.8
6	79.3	2	73.0	2	170.5
16	73.4	3	76.7	3	20.8
20	87.2	4	68.7	4	21.2
24	81.6	5	66.6	5	78.1
25	71.3		6	63.0	

References

- R.U. Umarova, A.N. Svechnikova, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **20**(2), 174–177 (1984)
- M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
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- I. Calis, A. Yuruker, D. Tasdemir, A.D. Wright, O. Sticher, Y.-D. Luo, J.M. Pezzuto, *Planta Med.* **63**, 183–186 (1997)

Isoastragaloside I

$\text{C}_{45}\text{H}_{72}\text{O}_{16}$, M 868



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Mp 218–220°C, $[\alpha]_D^{18} +17.9^\circ$ (c 1.0, MeOH).

CAS Registry Number: 84676-88-0.

IR, ν_{\max}^{KBr} , cm^{-1} : 3400, 1740, 1230, 1050.

FDMS m/z : M^+ 868.

^1H NMR (90 MHz, $\text{C}_5\text{D}_5\text{N}$, δ): 0.22 and 0.54 (2H-19, brs), 1.93, 1.97 ($2 \times \text{Ac}$, s).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	β -D-Xylp	b-D-Glcp	Ac			
C-3	89.3	1	104.0	1	105.0	170.5
6	79.5	2	75.6 ^a	2	75.5 ^a	170.5
16	73.6	3	72.7	3	79.1	20.9
25	71.5	4	73.1	4	72.3	21.4
		5	63.1	5	77.7	
				6	63.5	

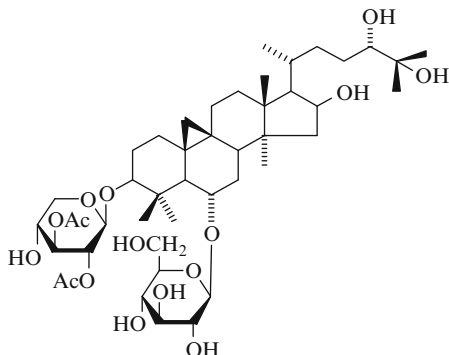
^aAssignment of signals ambiguously

References

1. I. Kitagawa, H.K. Wang, M. Saito, A. Takagi, M. Yoshikawa, *Chem. Pharm. Bull.* **31**(2), 698–708 (1983)

Agroastragaloside I

C₄₅H₇₄O₁₆, M 870



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Mp 237–239°C (from MeOH), $[\alpha]_D^{25} + 17.3^\circ$ (c 0.15, MeOH).

CAS Registry Number: 156769-94-7.

IR, ν_{\max}^{KBr} , cm⁻¹, 3400, 2950, 1730, 1730, 1630, 1370, 1250, 1070, 1030.

FABMS m/z: 893 [M + Na]⁺.

HRFABMS m/z: [M + Na]⁺ 893.4875.

EIMS m/z (%): 474 (5), 456 (21), 438 (26), 311 (22), 187 (23), 147 (30), 126 (63), 112 (100).

See [Table 1](#)

References

1. M. Hirotsani, Y. Zhou, H. Rui, T. Furuya, *Phytochemistry* **36**(3), 665–670 (1994)

Askendoside D

C₄₅H₇₄O₁₇, M 886

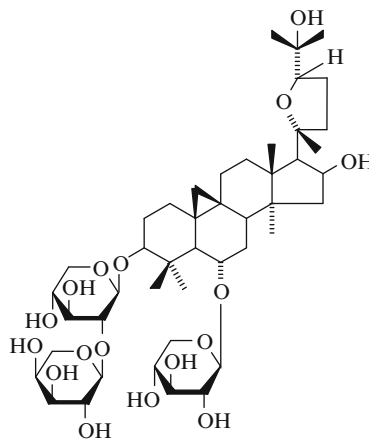


Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.2	C-16	72	β -D-Xylp	
2	29.9	17	57.3	1	104.1
3	89.4	18	18.8	2	73.3
4	42.4	19	28.6	3	77.0
5	52.5	20	28.8	4	68.9
6	79.4	21	18.5	5	66.8
7	34.7	22	33.1	β -D-Glcp	
8	46.0	23	28.0	1	105.3
9	21.6	24	77.3	2	75.8
10	28.8	25	72.7	3	79.3
11	26.4	26	25.9	4	72.0
12	33.3	27	26.6	5	78.3
13	45.9	28	20.0	6	63.3
14	47.0	29	28.4	Ac	20.9
15	48.1	30	16.7		21.0
					170.0
					170.6

Taxonomy: Cycloartane Glycosides*Astragalus tashkendicus* Bunge (*Leguminosae*)

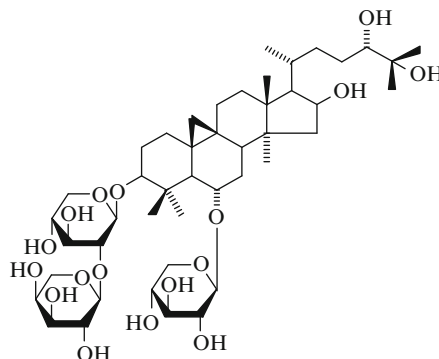
[1, 2].

Astragalus stipulosus Boriss. (*Leguminosae*) [3].*Astragalus trigonus* DC (*Leguminosae*) [4].Mp 235–236°C (from aqueous MeOH), $[\alpha]_D^{20} -9.1^\circ$
(c 1.1, C₅D₅N).

CAS Registry Number: 86408-17-5.

IR ν_{\max}^{KBr} , cm⁻¹: 3512, 3450–3285, 3035.

See Table 1

Oleifolioside AC₄₅H₇₆O₁₇, M 888**References**

- M.I. Isaev, M.B. Gorovits, N.D. Abdullaev, N.K. Abubakirov, *Chem. Nat. Comp.* **19**(2), 170–174 (1983)
- M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
- M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **36**(6), 626–628 (2000)
- P. Gariboldi, F. Pelizzoni, M. Tato, L. Verotta, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, M. Toaima, *Phytochemistry* **40**(6), 1755–1760 (1995)

Taxonomy: Cycloartane Glycosides*Astragalus oleifolius* DC (*Leguminosae*) [1].Amorphous white powder, $[\alpha]_D^{27} +18.9^\circ$ (c 0.1, MeOH).IR ν_{\max}^{KBr} , cm⁻¹: 3427, 2922, 1048.EISMS m/z: [M + Na]⁺ 911.

See Table 1

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.76	1.25, 1.50	C-16	73.37	4.99 q (8)
2	29.93	1.92, 2.22	17	57.97	2.54 d (8)
3	87.59	3.31 dd (11, 5)	18	20.05	1.33 s
4	42.56	–	19	25.43	0.07 d (4),
5	51.64	1.78 d (8)			0.57 d (4)
6	77.18	3.73 m	20	87.26	–
7	32.88	1.65, 2.03	21	28.55	1.26 s
8	43.11	2.03	22	34.85	1.63, 3.05 q (11)
9	21.24	–	23	26.22	2.02, 2.25
10	27.93	–	24	81.58	3.83 dd (9.6)
11	26.41	1.50, 2.03	25	71.23	–
12	33.45	1.50, 1.65	26	27.04	1.26 s
13	45.18	–	27	28.08	1.53 s
14	46.09	–	28	19.48	1.10 s
15	45.54	1.78 dd (12, 8),	29	27.48	1.72 s
		2.29 dd (12, 8)	30	16.26	1.28 s
3-O-β-D-Xylp					
				1	105.21
				2	83.54
				3	77.37
				4	70.91
				5	66.47
					4.73 d (7)
					4.02 dd (9, 7)
					4.08
					4.08
					3.53 dd (12, 9)
					4.23
α-L-Arap					
				1	106.67
				2	73.63
				3	74.18
				4	69.07
				5	67.01
					5.12 d (6.6)
					4.53 dd (8.4, 6.6)
					4.15 dd (9, 3.5)
					4.25
					4.36 dd (12, 3.5),
					3.74 dd (12, 2)
6-O-β-D-Xylp					
				1	105.61
				2	75.31
				3	78.20
				4	71.01
				5	66.77
					4.74 d (7.2)
					3.91 t (8)
					4.05
					4.08
					3.61 dd (12, 9),
					4.25

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)(600 MHz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	3-O- β -D-Xylp				
C-1	31.8	1.60 m, 1.34 m	C-16	72.0	4.77 m	1	105.3	4.79 d (7.1)
2	30.1	2.00 m, 2.30 m	17	56.9	1.88 m	2	83.6	4.10 dd (8.6, 7.1)
3	87.7	3.39 dd (11.6, 4.4)	18	17.5	1.37 s	3	77.5	4.16
4	42.7	–	19	25.0	0.12 d (4.4), 0.63 d (4.4)	4	71.0	4.17
5	51.9	1.87 d (7.2)	20	28.7	2.41	5	66.0	3.59 dd (11.3, 9.5), 4.27 dd (11.3, 5.3)
6	77.2	3.80 m	21	18.4	1.09 d (6.5)	6-O- β -D-Xylp		
7	33.0	2.09 m, 2.13 m	22	32.8	1.51 m	1	105.8	4.85 d (7.2)
8	43.2	2.13 m	23	27.8	1.85 m, 1.99 m	2	75.5	3.99 t (7.9)
9	21.5	–	24	77.1	3.94 brd (10.6)	3	78.4	4.14 t (8.4)
10	27.9	–	25	72.5	–	4	71.1	4.17
11	26.4	1.69 m, 1.54 m	26	26.5	1.46 s	5	66.9	3.69 dd (11.2, 9.6), 4.31 dd (11.2, 5)
12	33.2	1.66 m, 2.13 m	27	25.8	1.49 s	α -L-Arap		
13	45.9	–	28	19.5	1.18 s	1	106.8	5.20 d (6.6)
14	46.8	–	29	27.5	1.80 s	2	73.7	4.61 dd (8.5, 6.6)
15	47.2	2.41 dd (12.8, 8) 1.84 m	30	16.4	1.35 s	3	74.3	4.23 dd (8.5, 3.2)
						4	69.1	4.30 m
						5	67.1	3.81 dd (12, 1.8), 4.43 dd (12, 3.2)

References

- M. Ozipek, A.A. Donmez, I. Calis, R. Brun, P. Ruedi, D. Tasdemir, *Phytochemistry* **66**, 1168–1173 (2005)

Atragalus sieversianus Pall. (*Leguminosae*) [1].
Mp 236–237°C (from MeOH), $[\alpha]_D^{12} +5.3^\circ$ (c 0.30, MeOH).

CAS Registry Number: 101843-92-9.

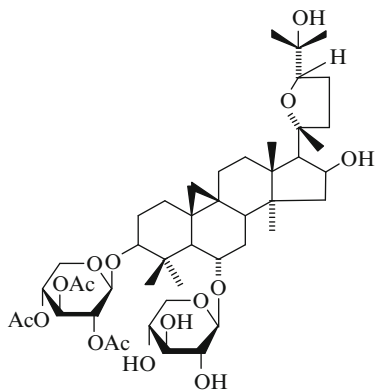
IR $\nu_{\max}^{\text{Nujol}}$, cm^{-1} : 3450, 1750, 1730, 1720.

FD MS m/z (%): 881 [M + H] + (8.4), 880 [M] + (8.1).

^1H NMR (200 MHz, CDCl₃, δ , 0-TMS): 0.28 and 0.50 (2H-19, d, J = 4 Hz), 0.90, 0.95, 1.06, 1.18, 1.23, 1.23, 1.32 (7 × CH₃, s), 2.04, 2.05, 2.08 (3 × CH₃COO, s).

Astrasieversianin I

C₄₆H₇₂O₁₆, M 880



Taxonomy: Cycloartane Glycosides

Table 1

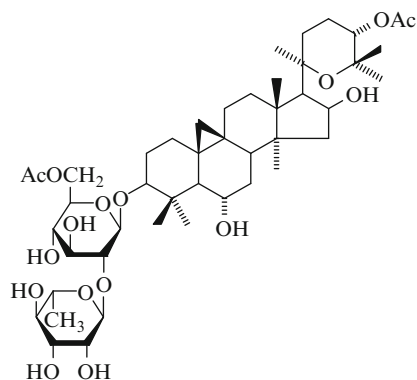
δ_C (C ₅ D ₅ N)	3-O- β -D-Xylp	6-O- β -D-Xylp	Ac			
C-3	89.0	1	103.4	1	105.7	170.2
6	78.7	2	72.2	2	75.4	170.0
16	73.4	3	72.6	3	77.9	169.6
20	87.3	4	69.8	4	71.1	20.6
24	81.6	5	62.5	5	67.0	20.6
25	71.2					20.6

References

- L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)

No Name (9,19-Cyclolanostan-20,25-epoxy,24S-acetoxy-6 α ,16 β -diol-3-O[α -L-rhamnopyranosyl(1 \rightarrow 2)-6-O-acetyl- β -D-Glucopyranoside])

C₄₆H₇₄O₁₆, M 882



Taxonomy: Cycloartane Glycosides

Astragalus peregrinus (*Leguminosae*) [1].

White amorphous powder. $[\alpha]_D^{20} + 5.3^\circ$ (c 0.4, MeOH).

TSPMS m/z (%): 905 [M + Na]⁺, 736 [M-146]⁺, 532 [736-204]⁺, 496 (100) [532-2 × H₂O]⁺, 436 [496-CH₃COOH]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.6 1.67 dd (5.3, 11.8), 1.21 m	C-24	71.6 4.873 dd (6.8, ?)
2	30.1 2.46 m, 1.96 m	25	74.1 –
3	89.1 3.54 dd (11.5, 4.3)	26	27.4 1.21 s
4	42.5 –	27	27.6 1.14 s
5	54.4 1.71 d (9.5)	28	20.6 0.96 s
6	68.1 3.77 brt (8.3)	29	28.7 1.97 s
7	38.5 1.80 m, 1.65 m	30	16.6 1.50 s
8	47.1 1.96 m	β -D-Glcp	
9	21.3 –	1	105.4 4.91 d (7.6)
10	29.4 –	2	77.6 4.28 t (8.6)
11	26.3 2.00 m, 1.21 m	3	79.6 4.18 t (8.1)
12	34.5 1.85 m, 1.71 m	4	71.8 3.92 m

(continued)

Table 1 (continued)

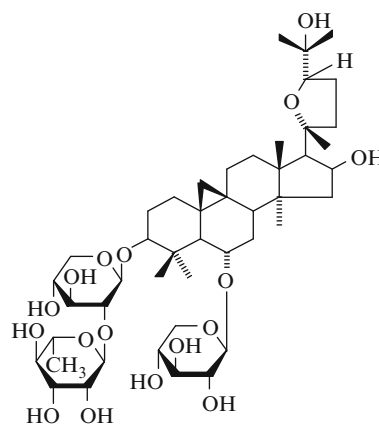
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
13	46.8 –	5	74.6 3.91 m
14	46.3 –	6	64.3 4.86 m, 4.77 dd (11.5, 5.3)
15	48.4 2.106 m, 1.766 m	α -L-Rhap	
16	73.6 4.78 dt (8.1, 6.8)	1	101.8 6.54 brs
17	60.5 1.97 d (8.1)	2	72.36 4.81 d (3)
18	20.6 1.62 s	3	72.40 4.70 dd (9.2, 3)
19	30.6 0.26 d (3.8), 0.58 d (3.8)	4	74.1 4.32 t (9.5)
20	79.8 –	5	69.5 4.87 m
21	27.4 1.56 s	6	18.6 1.71 d (6.4)
22	26.9 2.45 m, 1.15 m	Ac	20.7 2.02 s
23	20.7 2.076 m, 1.736 m		20.8 2.17 s
			169.8 –
			176.0 –

References

1. L. Verotta, M. Guerrini, N.A. El-Sebakhy, A.M. Asaad, S.M. Toaima, M.E. Abou-Sheer, Y.D. Luo, J.M. Pezzuto, *Fitoterapia* **72**(8), 894–905 (2001)

Cyclosieversioside G (astrasieversianin XV)

C₄₆H₇₆O₁₇ M 900



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (Leguminosae) [1–3].

Astragalus exilis A. Kor. (Leguminosae) [4].

Astragalus alexandrinus Boiss. (Leguminosae) [5].

Astragalus chrysopterus Bunge (Leguminosae) [6].

Mp 222–224°C, $[\alpha]_D^{20} -5.42^\circ$ (c 1.34, MeOH).

CAS Registry Number: 86850-51-3.

IR ν_{\max}^{KBr} , cm^{-1} : 3430–3350.

FDMS m/z (%): $[\text{M} + \text{Na} + \text{H}]^+$ 924 (6), $[\text{M} + 1]^+$ 901, $[\text{M}]^+$ 900 (0.6).

^1H NMR (200 MHz, $\text{CDCl}_3 + \text{C}_5\text{D}_5\text{N}$, δ): 0.13 and 0.57 (2H-19, brs), 1.06, 1.22, 1.24, 1.29, 1.44, 1.47, 1.50 (7 \times CH_3 , s), 1.21 (Rhap CH_3 , d, $J = 6$ Hz).

Table 1

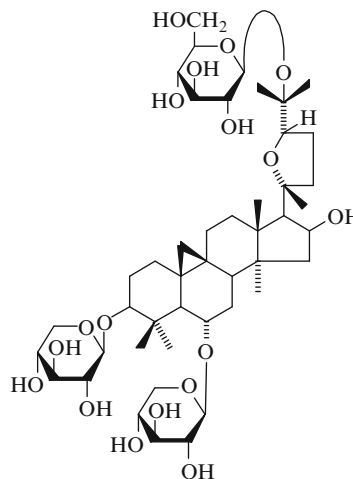
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)	3-O- β -D-Xylp		α -L-Rhap		6-O- β -D-Xylp		
C-3	87.5	1	105.7	1	101.0	1	105.7
6	78.4	2	78.0	2	71.0	2	75.4
16	73.4	3	77.0	3	72.4	3	77.1
20	87.3	4	71.4	4	74.2	4	72.1
24	81.5	5	66.8	5	69.6	5	66.8
25	71.3			6	18.7		

References

1. A.N. Svechnikova, R.U. Umarova, M.B. Gorovits, N.D. Abdullaev, N.K. Abubakirov, *Chem. Nat. Comp.* **19**(3), 296–299 (1983)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
3. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(6), 1437–1441 (1986)
4. R.P. Mamedova, M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **38**(6), 579–582 (2002)
5. F. Orsini, L. Verotta, L. Barboni, N.A. El-Sebakhy, A.M. Asaad, R.M. Abdallah, S.M. Toaima, *Phytochemistry* **35**(3), 745–749 (1994)
6. H.K. Wang, K. He, H.X. Xu, Z.L. Zhang, Y.F. Wang, T. Kikuchi, Y. Tezuka, *Yaoxue Xuebao* **25**(6), 445–450 (1990)

Trojanoside B

$\text{C}_{46}\text{H}_{76}\text{O}_{18}$, M 916



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (Leguminosae) [1].

$[\alpha]_D^{25} +13.2^\circ$ (c 0.1, MeOH).

CAS Registry Number: 223924-11-6.

IR ν_{\max}^{KBr} , cm^{-1} : 3420, 1270, 1040.

FABMS m/z: 915 $[\text{M}-\text{H}]^-$, 783 $[\text{M}-\text{H}-132]^-$, 753 $[\text{M}-\text{H}-162]^-$, 651 $[\text{M}-\text{H}-132 \times 2]^-$, 489 $[\text{M}-\text{H}-132 \times 2-162]^-$.

Table 1

δ_{C} (CD_3OD)	δ_{H} (J/Hz)		δ_{C} (CD_3OD)	δ_{H} (J/Hz)	
C-1	32.6	1.58 m, 1.31 m	C-24	82.8	3.86 dd (8, 5)
2	30.1	1.97 m, 1.70 m	25	79.9	–
3	90.0	3.24 dd (11.1, 4.5)	26	22.7	1.41 s
4	42.6	–	27	25.0	1.26 s
5	52.8	1.66 d (10)	28	19.7	1.05 s

(continued)

Table 1 (continued)

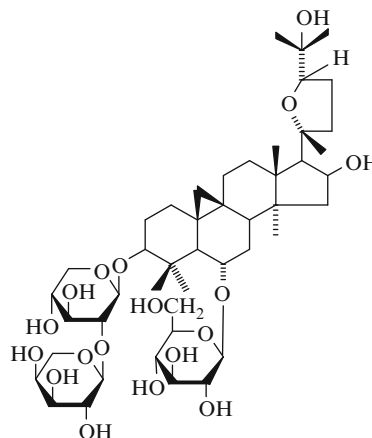
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
6	79.1 3.55 td (10, 4.5)	29	28.1 1.29 s
7	35.0 1.93 m, 1.62 m	30	16.3 1.03 s
8	45.4 1.94 m	3-O- β -D-Xylp	
9	21.9 –	1	105.2 4.32 d (7.5)
10	29.5 –	2	75.0 3.19 dd (7.5, 9)
11	26.7 1.92 m 1.42 m	3	77.6 3.32 t (9)
12	33.6 1.65 m, 1.63 m	4	70.8 3.50 ddd (4.5, 9, 11)
13	46.1 –	5	66.1 3.21 t (11), 3.86 dd (4.5, 11)
14	46.9 –	6-O- β -D-Xylp	
15	45.5 2.03 m, 1.43 m	1	105.2 4.34 d (7.5)
16	74.5 4.71 td (8, 5.2)	2	75.0 3.19 dd (7.5, 9)
17	58.5 2.41 d (8)	3	77.6 3.32 t (9)
18	20.9 1.28 s	4	70.8 3.50 ddd (4.5, 9, 11)
19	28.5 0.28 d (4.5), 0.61 d (4.5)	5	66.1 3.21 t (11), 3.86 dd (4.5, 11)
20	87.0 –	β -D-Glcp	
21	27.5 1.25 s	1	98.4 4.56 d (7.5)
22	35.1 2.59 dd (6,12), 1.67 m	2	75.0 3.18 dd (7.5, 9)
23	26.1 2.17 m, 2.04 m	3	77.9 3.38 t (9)
		4	71.1 3.37 t (9)
		5	77.5 3.27 ddd (2.5, 4.5, 9)
		6	62.5 3.68 dd (4.5, 11), 3.89 dd (2.5, 11)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, J. Nat. Prod. **62**(4), 563–568 (1999)

Trojanoside H

C₄₆H₇₆O₁₈, M 916



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (*Leguminosae*) [1].

$[\alpha]_D^{25} +14.2^\circ$ (c 0.1, MeOH).

FABMS m/z : 915 $[M-H]^-$, 783 $[M-H-132]^-$, 621 $[M-H-162]^-$, 601 $[M-H-132 \times 2]^-$.

Table 1

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
C-1	33.0 1.60 m, 1.29 m	C-24	82.7 3.80 dd (8, 5)
2	30.5 1.95 m, 1.71 m	25	72.4 –
3	89.8 3.23 dd (11.1, 4.5)	26	27.7 1.30 s
4	42.9 –	27	26.6 1.16 s
5	53.3 1.64 d (10)	28	20.3 1.06 s
6	80.0 3.57 d (10, 4.5)	29	28.4 1.32 s
7	35.0 1.94 m, 1.65 m	30	16.4 1.04 s
8	46.5 1.92 m	β -D-Xylp	
9	22.4 –	1	105.6 4.50 d (7.4)
10	29.5 –	2	83.2 3.46 dd (7.4, 9)
11	27.0 1.95 m, 1.39 m	3	76.9 3.55 t (9)
12	34.1 1.71 m, 1.63 m	4	71.0 3.55 ddd (4.5, 9, 11)
13	46.3 –	5	66.0 3.23 t (11), 3.88 dd (4.5, 11)
14	47.0 –	α -L-Arap	
15	46.2 2.08 m, 1.43 m	1	106.7 4.52 d (5.8)

(continued)

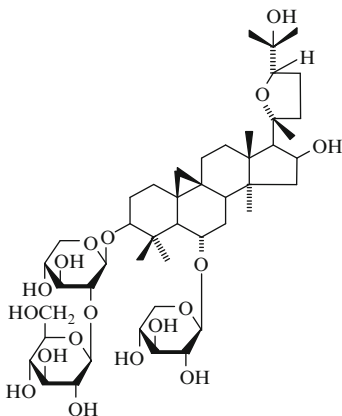
Table 1 (continued)

δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
16	74.7	4.69 td (8, 5.2)	2 73.5 3.68 dd (5.8, 8.2)
17	59.0	2.41 d (8)	3 74.1 3.59 dd (3, 8.2)
18	21.1	1.29 s	4 69.6 3.82 m
19	29.3	0.29 d (4.5), 0.63 d (4.5)	5 67.2 3.54 dd (3, 12), 3.92 dd (2, 12)
20	87.0	–	β -D-Glcp
21	27.8	1.24 s	1 105.8 4.37 d (7.8)
22	35.5	2.65 dd (12, 6), 1.69 m	2 75.7 3.21 dd (7.8, 9)
23	26.7	2.06 m, 2.02 m	3 78.6 3.36 t (9)
			4 71.8 3.31 t (9)
			5 77.8 3.28 ddd (3, 4.5, 9)
			6 62.9 3.68 dd (4.5, 12), 3.88 dd (3, 12)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *Phytochemistry* **51**(8), 1017–1020 (1999)

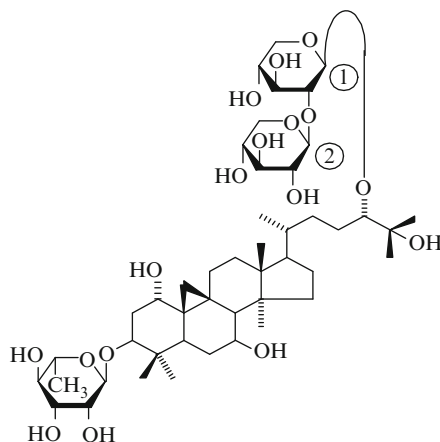
No Name (20S,24R-Epoxy) cycloartane-3 β ,6 α ,16 β ,25-tetrol-3-O-[-D-Glucopyranosyl-(1 \rightarrow 2)- β -D-xylopyranoside], 6-O- β -D-xylopyranoside)

C₄₆H₇₆O₁₈, M 916**Taxonomy:** Cycloartane Glycosides

Astragalus adsurgens Pall. (*Leguminosae*) [1].
Mp 210–212°C, $[\alpha]_D^{20} +9.5^\circ$ (c 1.0, MeOH).

References

1. L. Sun, S. Zheng, X. Shen, *Indian J. Chem. Sect B: Org. Chem. Incl. Med. Chem.* **36B**(9), 840–841 (1997). *C.A.*, 128:178100g (1998)

Macrophyllisosaponin DC₄₆H₇₈O₁₇, M 902**Taxonomy:** Cycloartane Glycosides

Astragalus oleifolius DC (*Leguminosae*) [1].

$[\alpha]_D^{20} -1.0^\circ$ (c 0.32, MeOH).

CAS Registry Number: 184104-63-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3400.

FABMS m/z (%): [M + Na]⁺ 925 (19).

Table 1

δ_C (CD ₃ OD)	δ_H (J/z)	δ_C (CD ₃ OD)	δ_H (J/z)
C-1	74.8 3.56 m	C-24	89.7 3.41 dd (9.3, 1.8)
2	38.0 2.07 ddd (13.5, 4.3, 3.5), 1.87 ddd (13.5, 13.1, 2.8)	25	74.6 –
3	86.1 3.68 m	26	26.3 1.18 s
4	42.5 –	27	27.3 1.17 s
5	41.1 2.16 dd (13.1, 4.4)	28	20.4 1.09 s
6	33.1 1.76 m, 1.05 m	29	27.0 1.00 s
7	72.1 3.54 m	30	15.5 0.86 s
8	57.0 1.60 m	α -L-Rhap	
9	23.0 –	1	105.4 4.78 d (1.7)
		2	73.5 3.87 dd (3.4, 1.7)

(continued)

Table 1 (continued)

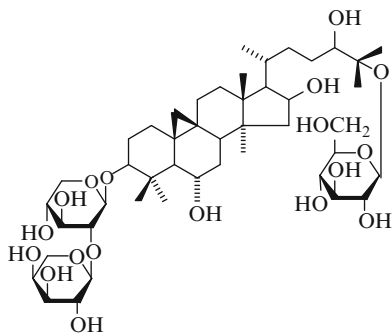
δ_C (CD ₃ OD)	δ_H (J/z)	δ_C (CD ₃ OD)	δ_H (J/z)
10	32.4 –	3	73.6 3.67 dd (9.5, 3.4)
11	28.0 2.27 m, 1.36 m	4	75.1 3.39 t (9.5)
12	35.0 1.73 m (2H)	5	71.0 3.70 dq (9.5, 6.3)
13	47.9 –	6	18.8 1.26 d (6.3)
14	50.7 –	β -D-Xylp ₁	
15	39.5 1.50 m (2H)	1	104.9 4.48 d (7.1)
16	30.7 2.0 m, 1.33 m	2	84.3 3.43 m
17	54.0 1.63 m	3	78.6 3.56 m
18	19.3 1.06 s	4	71.9 3.58 m
19	30.1 0.46 d (4.6), 0.80 d (4.6)	5	67.5 3.90 m, 3.23 m
20	38.9 1.41 m	β -D-Xylp ₂	
21	19.9 0.95 d (6.4)	1	107.5 4.55 d (7.4)
22	35.6 1.54 m (2H)	2	76.8 3.30 dd (9.1, 7.4)
23	30.3 1.68 m, 1.51 m	3	78.7 3.36 dd (9.5, 9.1)
		4	72.2 3.51 ddd (10.2, 9.5, 5.4)
		5	68.2 3.88 m, 3.20 m

References

1. I. Calis, M. Zor, I. Saracoglu, A. Isimer, H. Ruegger, J. Nat. Prod. **59**(11), 1019–1023 (1996)

Askendoside F

C₄₆H₇₈O₁₈, M 918



Taxonomy: Cycloartane Glycosides
Astragalus taschkendicus Bunge (*Leguminosae*) [1].

Amorphous powder. $[\alpha]_D^{24}$ 0° (c 0.7, MeOH).

CAS Registry Number: 178600-69-6.

IR ν_{\max}^{KBr} , cm⁻¹: 3392.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.58 (2H-19, d, J = 4 Hz), 1.07 (CH₃-21, d, J = 6.5 Hz), 1.01, 1.38, 1.42, 1.47, 1.49, 1.95 (6 × CH₃, s), 4.92 (Xylp H-1, d, J = 7 Hz), 5.18 (Glc p H-1, d, J = 8 Hz), 5.21 (Arap H-1, J = 6 Hz).

Table 1

δ_C (C ₅ D ₅ N)						
C-1	32.51	C-13	45.68	C-25	80.90	α -L-Arap
2	29.22 ^a	14	46.84	26	21.54	1 106.61
3	88.52	15	48.62	27	24.22	2 73.63
4	42.75	16	71.80	28	20.17	3 74.28
5	54.12	17	57.32	29	28.63	4 69.11
6	67.94	18	18.77	30	16.24	5 66.98
7	38.40	19	29.93	β -D-Xylp		β -D-Glc p
8	46.94	20	31.53	1	105.59	1 98.69
9	21.34	21	18.93	2	83.55	2 75.34
10	30.35	22	34.94	3	77.58	3 78.73
11	26.31	23	29.22 ^a	4	70.97	4 71.71
12	33.18	24	78.94	5	66.57	5 78.19
				6	62.80	6 62.80

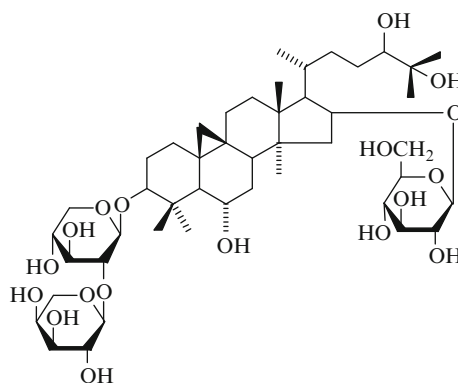
^aSignals are mutually imposed

References

1. M.I. Isaev, Chem. Nat. Comp. **31**(6), 690–693 (1995)

Askendoside G

C₄₆H₇₈O₁₈, M 918



Taxonomy: Cycloartane Glycosides*Astragalus tashkendicus* Bunge (*Leguminosae*) [1].*Astragalus stipulosus* Boriss. (*Leguminosae*) [2].Mp 273–275°C (from MeOH), $[\alpha]_D^{20} +11^\circ$ (c 0.9, C₅H₅N).

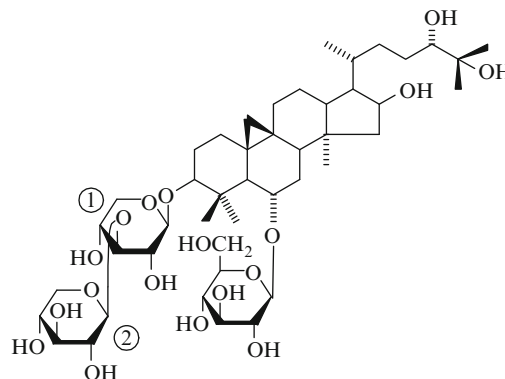
CAS Registry Number: 193288-66-3.

¹H NMR (100 MHz, C₅D₅N, δ, 0-HMDS): 0.15 and 0.38 (2H-19, d, J = 4 Hz), 0.87 (CH₃-21, d, J = 6 Hz), 0.83, 1.08, 1.30, 1.32, 1.36, 1.84 (6 × CH₃, s), 4.69 (Glc_p H-1, d, J = 8 Hz), 4.81 (Xyl_p H-1, d, J = 7 Hz), 5.08 (Arap H-1, d, J = 7 Hz).¹H NMR (500 MHz, C₅D₅N, δ, 0-TMS): 0.27 and 0.50 (2H-19, d, J = 4 Hz), 1.00 (CH₃-21, d, J = 7.5 Hz), 0.95, 1.21, 1.44, 1.45, 1.50, 2.00 (6 × CH₃, s), 4.83 (Glc_p H-1, d, J = 7.5 Hz), 4.93 (Xyl_p H-1, d, J = 7.5 Hz), 5.25 (Arap H-1, d, J = 7.5 Hz).**Table 1**

δ_C (C ₅ D ₅ N)						
C-1	32.64 ^a	C-13	45.57	C-25	72.76	α -L-Arap
2	30.33 ^b	14	46.84	26	25.40	1 106.74 ^d
3	88.59	15	47.73	27	26.30 ^c	2 73.65
4	42.80	16	83.14	28	20.17	3 74.32
5	54.01	17	57.52	29	28.69	4 69.17
6	67.98	18	18.08	30	16.36	5 67.08
7	38.40	19	30.33 ^b	β -D-Xyl _p		β -D-Glc _p
8	46.84	20	31.97	1	105.70	1 106.74 ^d
9	21.29	21	19.05	2	83.66	2 75.82
10	29.21	22	34.44	3	77.76	3 78.81
11	26.30 ^c	23	30.33 ^b	4	71.04	4 71.79
12	32.64 ^a	24	80.00	5	66.71	5 78.13
				6	62.90	

^{a,b,c,d}Signals are mutually imposed**References**

- M.I. Isaev, Chem. Nat. Comp. **32**(5), 706–709 (1996)
- M.A. Agzamova, M.I. Isaev, Chem. Nat. Comp. **36**(6), 626–628 (2000)

Brachyoside AC₄₆H₇₈O₁₈, M 918**Taxonomy:** Cycloartane Glycosides*Astragalus brachypterus* Fischer (*Leguminosae*) [1]. $[\alpha]_D +15.5^\circ$ (c 0.1, MeOH).

CAS Registry Number: 215776-45-7.

FABMS m/z: 917 [M-H]⁻, 775 [M-H-132]⁻, 755 [M-H-162]⁻, 491 [M-H-162-132-132]⁻.**Table 1**

δ_C (CD ₃ OD)				δ_C (CD ₃ OD)			
	δ_C	δ_H (J/Hz)		δ_C	δ_H (J/Hz)		
C-1	33.4	1.30 m, 1.57 m	C-24	81.2	3.27 dd (4.5, 12)		
2	30.9	1.72 m, 1.96 m	25	74.0	–		
3	90.1	3.23 dd (4.5, 11.2)	26	25.7	1.17 s		
4	43.0	–	27	26.4	1.20 s		
5	53.7	1.64 d (9.5)	28	28.7	1.02 s		
6	80.4	3.57 ddd (4.5, 9.5, 9.5)	29	16.8	1.32 s		

(continued)

Table 1 (continued)

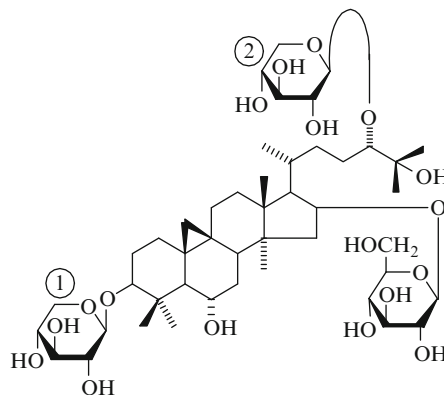
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
7	35.3 1.63 m, 1.92 m	30 20.8	1.04 s
8	46.1 1.89 m	β -D-Xylp ₁	
9	22.0 –	1 106.1	4.50 d (7.8)
10	30.0 –	2 74.5	3.60 dd (7.8, 8.5)
11	27.4 1.38 m 1.89 m	3 83.6	3.47 t (8.5)
12	34.2 1.60 m 1.67 m	4 69.9	3.83 ddd (4, 8.5, 11)
13	46.6 –	5 67.8	3.56 t(11), 3.93 dd (4, 11)
14	47.6 –	β -D-Xyp ₂	
15	48.0 1.43 dd (5.2, 12)	1 106.8	4.51 d (7.8)
	2.13 dd (8.2, 12)	2 74.1	3.69 dd (7.8, 8.5)
16	73.8 4.47 ddd (5.2, 8, 8.2)	3 77.0	3.56 t (8.6)
17	58.3 1.74 m	4 71.3	3.55 ddd (4.5, 8.6, 11)
18	18.8 1.16 s	5 66.5	3.23 t (11), 3.90 dd (4.5, 11)
19	29.3 0.27 d (4.5), 0.61 d (4.5)	β -D-Glcp	
20	32.6 1.85 m	1 105.5	4.37 d (7.5)
21	19.2 1.00 d (6)	2 75.8	3.23 dd (7.5, 9)
22	35.8 1.03 m	3 78.7	3.37 t (9)
23	30.0 1.21 m, 1.82 m	4 72.2	3.31 t (9)
		5 77.8	3.29 ddd (3.5, 4.5, 9)
		6 63.5	3.70 dd (3.5, 12), 3.84 dd (3.5, 12)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, J. Nat. Prod. **61**(12), 1469–1472 (1998)

Cephalotoside A

C₄₆H₇₈O₁₈, M 918



Taxonomy: Cycloartane Glycosides

Astragalus cephalotes var. *brevicalyx* (Leguminosae)

[1].

$[\alpha]_D^{20} + 20.9^\circ$ (c 0.53, MeOH).

CAS Registry Number: 226948-29-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 2927, 1170, 1044.

FABMS m/z: 919 [M + H]⁺, 941 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.62 1.58 ^a , 1.14 ^a	C-24	90.67 4.13
2	30.43 2.42 ^a , 2.06 ^a	25	72.26 –
3	88.82 3.64 ^a	26	25.83 1.51 s
4	42.76 –	27	26.85 1.49 s
5	54.08 1.72 ^a	28	20.34 0.88 s
6	67.98 3.64 ^a	29	28.99 2.00 s
7	38.51 1.69 ^a , 1.58 ^a	30	16.78 1.34 s
8	47.01 1.65 ^a	β -D-Xylp ₁	
9	21.26 –	1	107.68 4.90 d (7.3)
10	29.30 –	2	75.68 4.07 ^a
11	26.26 1.91 ^a , 1.13 ^a	3	78.58 4.26–4.10 ^a
12	32.76 1.58 ^a	4	71.29 4.22 ^a

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
13	45.67	–	5	67.10
				4.34 ^a , 3.72 ^a
14	46.83	–	β -D-Xylp ₂	
15	48.18	2.19 ^a , 1.94 ^a	1	106.97
				5.04 d (7.6)
16	82.75	4.42 ^a	2	75.36
				4.03 ^a
17	57.40	1.90 ^a	3	78.50
				4.26–4.10 ^a
18	19.15	1.20 s	4	71.03
				4.17 ^a
19	30.55	0.25 d (3.6), 0.46 d (3.6)	5	67.25
				4.20 ^a , 3.65 ^a
20	31.32	2.23 ^a	β -D-Glcp	
21	17.83	0.97 d (6.3)	1	106.23
				4.80 d (7.3)
22	34.43	2.20 ^a , 2.03 ^a	2	75.81
				3.97 ^a
23	30.00	1.95 ^a , 1.32 ^a	3	78.62
				4.26–4.10 ^a
			4	71.82
				4.22 ^a
			5	77.95
				3.88 m
			6	62.97
				4.38 ^a , 4.30

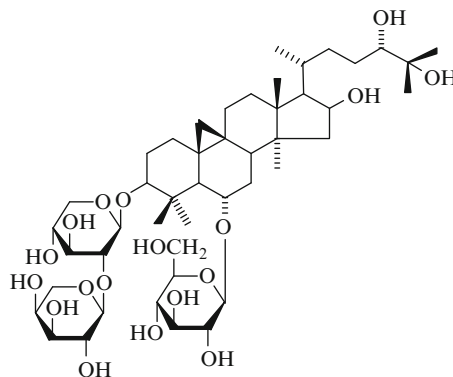
^aSignal patterns are unclear due to overlapping

References

1. I. Calis, H. Yusufoglu, O. Zerbe, O. Sticher, *Phytochemistry* **50**(5), 843–847 (1999)

Oleifolioside B

C₄₆H₇₈O₁₈, M 918



Taxonomy: Cycloartane Glycosides

Aragalus oleifolius DC (*Leguminosae*) [1].

Amorphous white powder, $[\alpha]_D^{27} +21.9^\circ$ (c 0.1, MeOH).

IR ν_{\max}^{KBr} , cm^{-1} : 3423, 2923, 1167, 1078.

EISMS, m/z: $[M + Na]^+$ 941.

See [Table 1](#)

Table 1

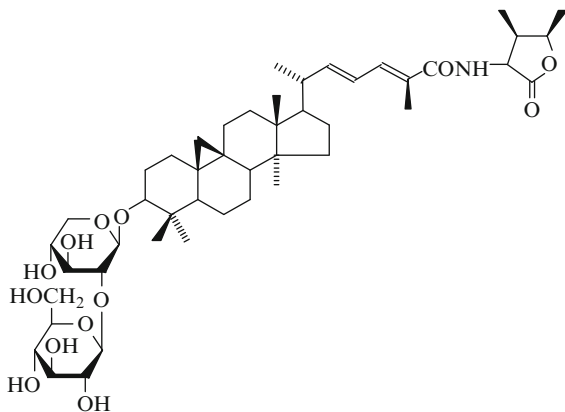
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)(600 MHz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	β -D-Xylp		
C-1	32.1	1.60 m, 1.33 m	C-16	72.0	1	105.4	4.84 d (7)
2	30.2	2.02 m, 2.33 m	17	57.1	2	83.6	4.13 dd (8.8, 7)
3	87.9	3.46 dd (11.3, 4.1)	18	18.1	3	77.5	4.17
4	42.7	–	19	26.9	4	71.0	4.17
5	52.3	1.88 m			5	66.6	3.58 dd (11, 9.5), 4.27 dd (11, 5.2)
6	78.4	3.80 m	20	28.6	α -L-Arap		
7	33.8	2.04 m, 2.22 m	21	18.4	1	106.7	5.21 d (6.6)
8	44.5	2.02 m	22	32.9	2	73.7	4.61 dd (8.3, 6.6)
9	21.5	–	23	27.8	3	74.3	4.22 dd (8.3, 3.1)
10	28.3	–	24	77.1	4	69.2	4.30 m
11	26.3	1.76 m, 1.35 m	25	72.5	5	67.1	3.82 dd (12.1, 1.7), 4.44 dd (12.1, 3.1)
12	33.2	1.64 m	26	26.5	β -D-Glcp		
13	45.8	–	27	25.8	1	105.2	4.93 d (7.6)
14	46.9	–	28	19.7	2	75.7	4.03 t (8.1)
15	47.6	2.43 m, 1.85 m	29	27.9	3	79.0	4.20
			30	16.4	4	72.0	4.17
					5	78.1	3.92 ddd (9, 5.4, 2.5)
					6	63.3	4.31 dd (11.4, 5.4), 4.49 dd (11.4, 2.5)

References

1. M. Ozipek, A.A. Donmez, I. Calis, R. Brun, P. Ruedi, D. Tasdemir, *Phytochemistry* **66**, 1168–1173 (2005)

Mussaendoside C

$C_{47}H_{73}NO_{13}$, M 859



Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

Mp 186–190°C, $[\alpha]_D^{20} +23.02^\circ$ (c 0.63, MeOH).

UV λ_{max}^{MeOH} , nm (ϵ): 264.5 (49135).

FABMS m/z: 898 $[M + K]^+$, 882 $[M + Na]^+$, 566 $[M + H\text{-xylose-glucose}]^+$.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)	β -D-Glcp
C-1	32.32	C-20	41.48	1 105.53
2	29.66	21	19.38	2 83.45
3	88.53	22	147.89	3 77.04
4	41.81	23	123.55	4 71.00
5	47.54	24	124.65	5 66.69
6	21.13	25	129.13	
7	26.43	26	13.44	2.19 s β -D-Glcp
8	47.83	27	170.83	1 106.16
9	19.88	28	19.47	1.32 s 2 75.00
10	26.15	29	25.75	1.15 s 3 78.04
11	26.67	30	15.49	0.99 s 4 71.80
12	33.10	1'	175.80	– 5 78.23

(continued)

Table 1 (continued)

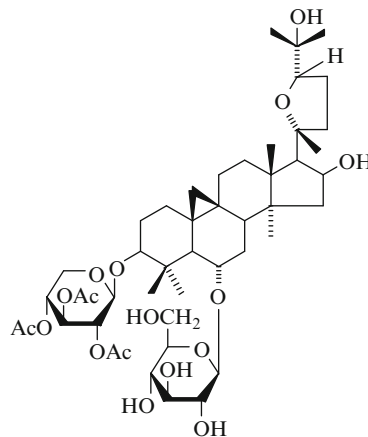
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)	β -D-Glcp
13	45.71	2'	55.60	5.68 dd 6 62.39
14	49.24	3'	38.60	2.90 ddq (7.4, 5)
15	35.46			7.2, 4.3)
16	28.73	4'	78.60	4.66 dq (6.5, 4.3)
17	52.04	3'-Me	8.04	0.84 d (7.2)
18	18.60	4'-Me	15.52	1.16 d (6.5)
19	30.09	NH		9.16 d (5)
				d (4), 0.50 d (4)

References

1. J. Xu, R. Xu, Z. Luo, J. Dong, *HuaxueXuebao* **49**(6), 621–624 (1991)

Acetylastragaloside I

$C_{47}H_{74}O_{17}$, M 910



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Mp 280–281°C, $[\alpha]_D^{18} +1.8^\circ$ (c 1.0, MeOH).

IR ν_{max}^{KBr} , cm^{-1} : 3400, 1750, 1225, 1030.

FDMS m/z: M^+ 910.

1H NMR (90 MHz, C_5D_5N , δ , 0-TMS): 0.24 and 0.57

(2H-19, brs), 1.95, 1.98, 2.00 (3 \times Ac, s).

Table 1

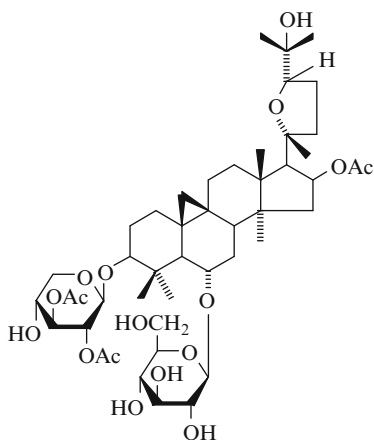
δ_C (C ₅ D ₅ N)	β -D-Xylp		β -D-Glcp		Ac	
C-3	89.5	1	103.4	1	105.0	169.5
6	79.3	2	72.5	2	75.5	170.0
16	73.5	3	72.9	3	79.1	170.1
25	71.3	4	70.0	4	72.3	20.5
		5	62.6	5	77.7	20.7
			6	63.4		21.4

References

- I. Kitagawa, H.K. Wang, M. Saito, A. Takagi, M. Yoshikawa, *Chem. Pharm. Bull.* **31**(2), 698–708 (1983)

Trojanoside I

C₄₇H₇₄O₁₇, M 910



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (*Leguminosae*) [1].
White powder.

IR ν_{\max}^{KBr} , cm⁻¹: 3419, 2936, 1726, 1461, 1379, 1262, 1078, 1041.

HRESIMS m/z: [M + Na]⁺ 933.3207.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.3	C-25	71.3
2	30.2	26	28.5
3	89.6	27	27.2
	3.39 dd (4.5, 11.1)		1.35 s
4	42.7	28	20.3
	–		1.04 s
5	52.6	29	28.5
	–		1.70 s
6	79.1	30	16.9
	3.94 m		1.04 s
7	34.0	β -D-Xylp	
8	45.4	1	104.5
	–		4.80 d (7.7)
9	22.1	2	73.6
	–		5.37 dd (9.4, 7.9)
10	29.1	3	77.3
	–		5.56 dd (9.4, 9.1)
11	26.3	4	69.3
	–		4.25 ^a
12	33.3	5	67.2
	–		3.66 t (10, 7), 4.28 ^a
13	46.8	β -D-Glcp	
14	47.1	1	105.4
	–		4.85 d (7.6)
15	45.7	2	76.1
	–		4.08 dd (9.2, 8.9)
16	76.6	3	79.7
	5.66 ddd (5.2, 7.8, 7.9)		4.23 ^a
17	58.0	4	72.3
	2.62 d (8)		4.21 ^a
18	20.8	5	78.8
	1.42 s		3.94 ^a
19	28.2	6	63.5
	0.23 d (4.4), 0.64 d (4.4)		4.27 ^a , 4.39 dd (11.7, 2.9)
20	86.2	Ac	21.2
	–		2.00 s
21	27.2		21.3
	1.40 s		2.07 s
22	37.3		21.7
	–		2.09 s
23	27.1		170.4
	–		–
24	83.3		170.8
	3.96 ^a		–
	–		171.0
	–		–

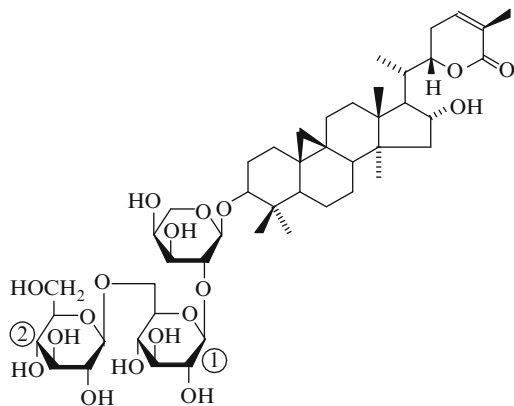
^a Multiplicity of the signals are unclear due to overlapping

References

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Aquilegioside I

C₄₇H₇₄O₁₈, M 926



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} -1.9^\circ$ (c 0.30, MeOH).

Positive ion FABMS m/z: 949 [M + Na]⁺.

Negative ion FABMS m/z: 925 [M-H]⁻.

HRFABMS m/z: 949.4765 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1 32.1		C-27 17.2	1.82 s
2 29.9		28 20.5	1.25 s
3 88.8	3.41 dd (4.3, 11.6)	29 26.0	1.29 s
4 41.4	–	30 15.5	1.14 s
5 47.5		α -L-Arap	
6 21.2		1 104.5	5.03 d (5.5)
7 26.4		2 80.0	4.70 dd (6.1, 6.6)

(continued)

Table 1 (continued)

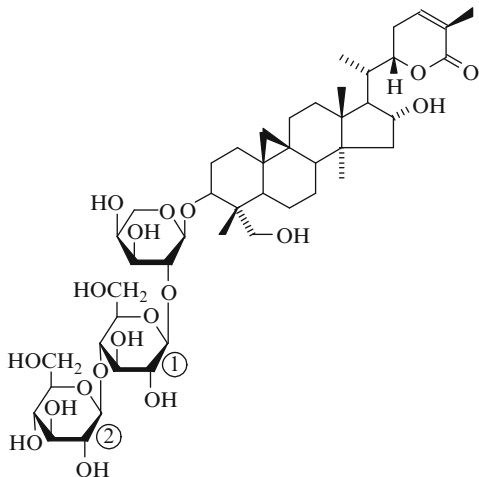
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
8 48.1		3 73.1	4.39
9 19.5	–	4 68.1	4.39
10 26.0	–	5 64.6	3.77 brd (9.8),
11 26.6			4.28
12 33.0		β -D-Glcp ₁	
13 46.8	–	1 105.4	5.18 d (7.9)
14 47.7	–	2 76.0	4.04 dd (7.9, 8.5)
15 48.7		3 78.3	4.15 dd (8.5, 9.2)
16 77.2	4.27	4 71.8	4.22 dd (9.2, 9.2)
17 57.5	2.49 dd (6.1, 10.3)	5 77.0	3.98 m
18 19.0	1.05 s	6 70.0	4.44 dd (4.9, 11.6),
19 30.1	0.27 d (3.7), 0.51 d (3.7)		4.74 dd (3, 11.6)
20 39.7	1.78 m	β -D-Glcp ₂	
21 13.3	1.12 d (6.7)	1 105.5	5.12 d (7.3)
22 79.6	5.46 dd (4, 12.2)	2 75.3	4.05 dd (7.9, 8.5)
23 28.3	2.02, 2.60 m	3 78.3	4.26 dd (8.5, 8.5)
24 140.4	6.46 d (6.1)	4 71.7	4.30 dd (9.2, 9.2)
25 128.0	–	5 78.4	3.97 m
26 166.4	–	6 62.9	4.37, 4.54 dd (3.2, 11.6)

References

1. M. Hishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(8), 956–959 (2003)

Aquilegioside J

C₄₇H₇₄O₁₉, M 942



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_{\text{D}}^{25} +15.2^\circ$ (c 0.30, MeOH).

Negative ion FABMS (m/z): 941 [M-H]⁻.

Table 1

$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
C-1	32.2	C-24	140.4 6.45 d (6.1)
2	29.4	25	128.0 –
3	81.8 4.30	26	166.4 –
4	45.6 –	27	17.2 1.82 s
5	40.9	28	20.5 1.22 s
6	21.0	29	64.1
7	26.3	30	11.9 1.11 s
8	48.2	α -L-Arap	
9	19.4 –	1	103.7 5.18 d (5.5)
10	26.1 –	2	81.9 4.54
11	26.6	3	73.8 4.23 brd (9.1)
12	33.0	4	78.5 4.31
13	46.8 –	5	65.4 3.67 brd (11.6),
14	47.7 –		4.26 brd (11.7)
15	48.7	β -D-Glcp ₁	
16	77.2 4.25	1	105.7 5.16 d (7.9)
17	57.6 2.47 dd (6.2, 11.2)	2	75.9 4.07 dd (7.9, 8.5)
18	19.0 1.07 s	3	76.4 4.20 dd (8.5, 8.5)

(continued)

Table 1 (continued)

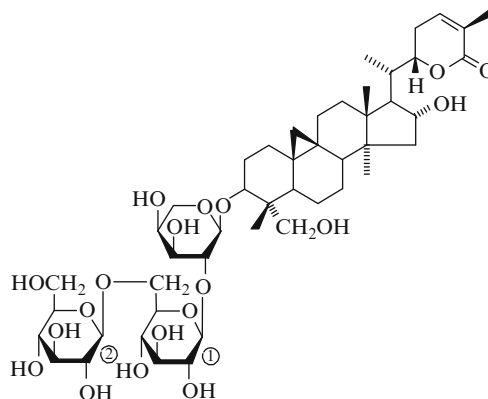
$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
19	30.3 0.32 d (3.7), 0.55 d (3.7)	4	81.3 4.27
20	39.7	5	76.5 3.81 m
21	13.3 1.12 d (6.1)	6	62.1 4.42 brd (12.2),
22	79.6 5.44 dd (4, 12.1)		4.55 brd (11.9)
23	28.3 2.01, 2.60 m	β -D-Glcp ₂	
		1	105.3 5.16 d (7.9)
		2	75.9 4.07 dd (7.9, 8.5)
		3	78.3 4.18 dd (8.5, 8.5)
		4	71.6 4.18 dd (8.5, 8.5)
		5	78.5 4.00 m
		6	62.5 4.29, 4.54 brd (12)

References

1. M. Hishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(8), 956–959 (2003)

Aquilegioside A

C₄₇H₇₄O₁₉, M 942



Taxonomy: Cycloartane Glycosides

Aquilegia flabellata Sieb. et Zucc. var *flabellata*
(*Ranunculaceae*) [1].

$[\alpha]_D^{25} +10.8^\circ$ (c 0.22, MeOH).

CAS Registry Number: 235777-17-0.

CD (c 0.00346M, MeOH) $[\theta]$ (nm): -7620 (255).

Negative ion FABMS (m/z): 941 (M-H)⁻.

HRFABMS (m/z): [M + Na]⁺ 965.47.

¹H NMR (C₅D₅N, δ): 0.33 and 0.55 (2H-19, d, J = 3.7 Hz), 1.06, 1.11, 1.20 and 1.82 (4 × CH₃, s), 1.12 (CH₃-21, d, J = 6.1 Hz), 1.70 (H-20, m), 2.02 (H-23, m), 2.47 (H-17, dd, J = 6.1, 11.0 Hz), 2.59 (H-23, m), 3.68 (Arap H-5, brd, J = 9.8 Hz), 3.79 (H-29, brd, J = 9.8 Hz), 3.95 (Glc_{p1} H-5, m), 3.96 (Glc_{p2} H-5, m), 4.03 (Glc_{p2} H-2, dd, J = 7.9, 8.5 Hz), 4.05 (Glc_{p2} H-2, dd, J = 7.9, 8.5 Hz), 4.13 (Glc_{p1} H-3, t, J = 8.5 Hz), 4.24 (Glc_{p2} H-3, m), 4.25 (Glc_{p2} H-4, m), 4.26 (Arap H-5, m), 4.29 (Arap H-3, m), 4.32 (Arap H-4, m), 4.35 (H-3, m), 4.36 (Glc_{p2} H-6, m), 4.40 (Glc_{p1} H-6, m), 4.51 (Glc_{p2} H-6, brd, J = 11.6 Hz), 4.68 (Arap H-2, dd, J = 5.5, 7.3 Hz), 4.75 (Glc_{p1} H-6, brd, J = 11.0 Hz), 5.08 (Glc_{p2} H-1, d, J = 7.9 Hz), 5.19 (Glc_{p1} H-1, d, J = 7.9 Hz), 5.24 (Arap H-1, d, J = 5.5 Hz), 5.44 (H-22, dd, J = 4.0, 12.2 Hz), 6.45 (H-24, d, J = 6.1 Hz).

Table 1

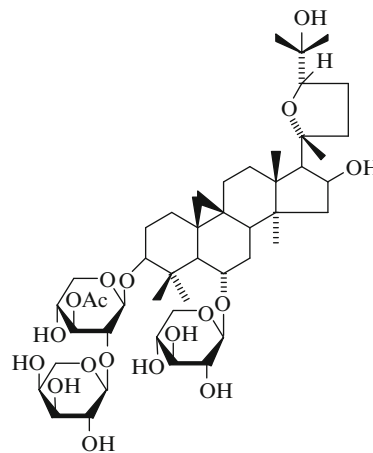
δ_c (C ₅ D ₅ N)											
C-1	32.0	C-11	26.6	C-21	13.3	α -L-Arap	β -D-Glc _{p1}	β -D-Glc _{p2}			
2	29.3	12	32.9	22	79.5	1 103.6	1 105.1	1 105.3			
3	81.6	13	46.8	23	28.3	2 80.1	2 75.9	2 75.3			
4	45.6	14	47.7	24	140.4	3 73.2	3 78.2	3 78.2			
5	40.6	15	48.7	25	128.0	4 68.3	4 71.7	4 71.5			
6	20.9	16	77.2	26	166.4	5 64.9	5 76.9	5 78.4			
7	26.3	17	57.5	27	17.2		6 69.8	6 62.8			
8	48.3	18	19.1	28	20.6						
9	19.2	19	30.4	29	63.6						
10	26.0	20	39.6	30	12.0						

References

- H. Yoshimitsu, M. Nishida, F. Hashimoto, T. Nohara, *Phytochemistry* **51**(3), 449–452 (1999)

Askendoside B

C₄₇H₇₆O₁₈, M 928



Taxonomy: Cycloartane Glycosides

Astragalus taschkendicus Bunge (*Leguminosae*) [1, 2].

Astragalus stipulosus Boriss. (*Leguminosae*) [3].

Astragalus trigonus DC (*Leguminosae*) [4].

Mp 215–218°C (from MeOH), $[\alpha]_D^{25} - 45.5^\circ$ (c 1.1, C₅H₅N).

CAS Registry Number: 88192-84-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3485–3315, 1730, 1260.

See [Table 1](#)

Biological activity

Askendoside B which exhibited highly potent (IC₅₀ = 13.95 mM) tyrosinase inhibition could be a possible lead molecule for the development of new medications of several skin diseases related with the overexpression of the enzyme tyrosinase, like hyperpigmentation [5].

References

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- M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **36**(6), 626–628 (2000)
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- M.T.H. Khan, M.I. Chaudhary, Atta-ur-Rahman, R.P. Mamedova, M.A. Agzamova, M.N. Sultankhodzhaev, M.I. Isaev, *Bioorg. Med. Chem.* **14**(17), 6085–6088 (2006)

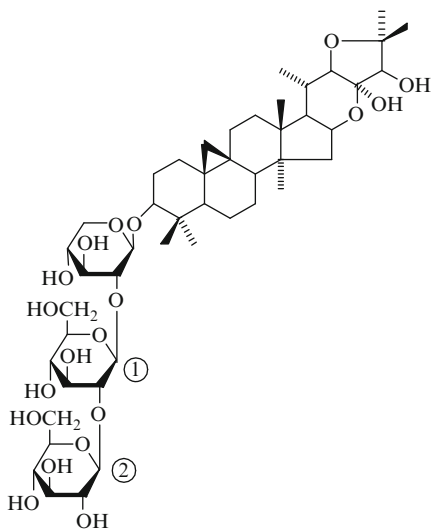
Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	α -L-Arap				
C-1	31.70	1.26, 1.50 m	C-20	87.35	–	1	105.22	5.01 d (7)
2	29.69	1.93, 2.20 m	21	28.63	1.31 s	2	72.48	4.41 dd (9, 7)
3	88.26	3.22 dd (11.6, 4.5)	22	34.92	1.66, 3.15 q (10.6)	3	74.46	4.19 dd (10, 4.5)
4	42.57	–	23	26.31	2.06, 2.33 m	4	69.31	4.29 m
5	51.77	1.79 d (7.6)	24	81.66	3.89 dd (9, 5.3)	5	67.12	4.35 dd (12, 2.9), 3.76 dd (12.3, 2)
6	77.19	3.76 m	25	71.28	–	6-O- β -D-Xylp		
7	32.92	1.66, 2.13 m	26	27.12	1.31 s	1	105.73	4.83 d (7)
8	43.16	2.12 d (7.6)	27	28.18	1.60 s	2	75.47 ^a	4.00 t (7.5)
9	21.29	–	28	19.53	1.17 s	3	78.39	4.16 t (8)
10	27.99	–	29	27.59	1.65 s	4	71.12	4.14 td (7.6, 4.4)
11	26.51	1.50, 2.06 m	30	16.37	1.32 s	5	66.92	3.72 dd (11.5, 8), 4.37 dd (11.7, 4.6)
12	33.52	1.50, 1.66 m	3-O- β -D-Xylp					
13	45.25	–	1	104.05	4.89 d (5.5)			
14	46.16	–	2	75.47 ^a	4.29 dd (7.4, 5.5)	Ac		
15	45.62	1.84 dd (12.5, 7.5), 2.83 dd (12.5, 7.9)	3	77.04	5.66 t (7.4)	21.41	2.17 s	
			4	68.48	4.14 td (7.6, 4.4)	170.61	–	
16	73.43	5.08 q (7.3)	5	65.00	3.71 dd (11.3, 9.5), 4.33 dd (11.3, 5)			
17	58.04	2.61 d (7.8)						
18	20.11	1.39 s						
19	25.40	0.09 d (4.4), 0.61 d (4.4)						

^aSignals are mutually imposed

No Name (16,23;22,25-diepoxy-*cycloartan-23R,24R*-diol-3-O-[-D-Glucopyranosyl-(1→2)- β -D-glucopyranosyl-(1→2)- β -D-xylopyranoside])

C₄₇H₇₆O₁₉, M 944



Taxonomy: Cycloartane Glycosides

Cimicifuga Rhizome (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} - 8.5^\circ$ (c 0.5, MeOH).

Positive ion FABMS m/z: 967 [M + Na]⁺.

Negative ion FABMS m/z: 943 [M-H]⁻, 781 [M-H-hexose]⁻, 619 [M-H-hexose-hexose]⁻, 487 [M-H-hexose-hexose-pentose]⁻.

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.20 and 0.48 (2H-19, d, J = 3.7 Hz), 0.85 (CH₃-28, s), 1.11 (CH₃-30, s), 1.20 (CH₃-18, s), 1.22 (CH₃-21, d, J = 6.7 Hz), 1.26 (CH₃-29, s), 1.70 (CH₃-27, s), 1.76 (CH₃-26, s), 2.26 (H-20, m), 3.38 (H-3, dd, J = 4.3, 11.6 Hz), 3.89 (H-22, d, J = 11 Hz), 4.17 (H-24, s), 4.96 (H-16, q, J = 7.9 Hz); Xyl-1 to Xyl-5, 4.89 (d, J = 7.3 Hz), 4.13 (dd, J = 7.3, 9.2 Hz), 4.42 (dd, J = 9.2, 9.2 Hz), 4.11 (overlapped), 3.74 (dd, J = 10.3, 11 Hz), 4.33 (dd, J = 4.9, 11 Hz); Glc₁-1 to Glc₁-6, 5.42 (d, J = 7.9 Hz), 4.14 (dd, J = 7.9, 9.2 Hz), 4.30 (dd, J = 9.2, 9.2 Hz), 4.22 (dd, J = 9.2, 9.2 Hz), 3.86 (m), 4.38 (dd, J = 4.7, 11.5 Hz), 4.46 (brd, J = 10.4 Hz); Glc₂-1 to Glc₂-6, 5.38 (d, J = 7.3 Hz), 4.10 (dd, J = 7.3, 9.2 Hz), 4.18 (dd, J = 9.2, 9.2 Hz), 4.18 (dd, J = 9.2, 9.2 Hz), 3.96 (m), 4.32 (dd, J = 4.8, 11.6 Hz), 4.56 (brd, J = 11.6 Hz).

Table 1

δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		β -D- Xylp				
	C-11	26.3	C-21	17.5	1	104.8			
C-1	32.0						5	77.8	
2	29.8	12	33.4	22	86.9	2	82.3	6	62.7
3	88.5	13	45.2	23	106.0	3	76.6	β -D- Glc _{p2}	
4	41.3	14	46.8	24	83.3	4	70.1	1	106.4
5	47.4	15	43.3	25	83.6	5	66.0	2	76.3
6	21.0	16	72.3	26	24.8	β -D- Glc _{p1}		3	77.8
7	26.4	17	52.3	27	27.7	1	103.2	4	71.1
8	47.5	18	20.6	28	19.7	2	85.3	5	79.2
9	19.7	19	30.2	29	25.7	3	77.8	6	62.5
10	26.6	20	34.7	30	15.4	4	71.5		

Biological activity

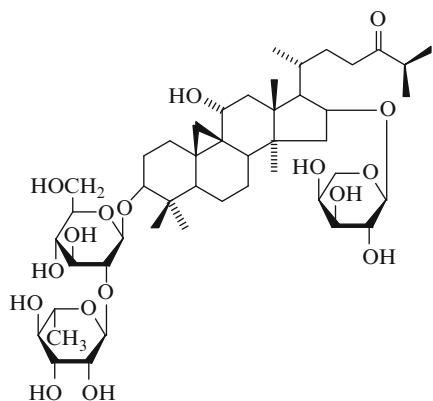
This glycoside showed potent immunosuppressive activity in mouse allogeneic mixed lymphocyte reaction (IC₅₀ 5.56 × 10⁻⁵ M). Immunosuppressive activity of the glycoside was much of the same value, independent of the sugar moiety.

References

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Curculigosaponin H

C₄₇H₇₈O₁₇, M 914



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 180–183°C, [α]_D +11.79° (c 0.94, MeOH).

CAS Registry Number: 142998-34-3.

FABMS m/z: 937 [M + Na]⁺ and 953 [M + K]⁺.

¹H NMR(400 MHz, C₅D₅N, δ, 0-TMS): 0.28 and 0.49 (2H-19, d, J = 4 Hz), 1.06 and 1.08 (2 × CH₃, d, J = 6.8 Hz), 1.18, 1.27, 1.31 (4 × CH₃, s), 1.72 (Rha CH₃, d, J = 6 Hz), 2.69 (H-25, septet, J = 6.8 Hz), 4.55 (Ara H-1, d, J = 7 Hz), 4.95 (Glc H-1, d, J = 7.2 Hz), 6.63 (Rha H-1, s).

Table 1

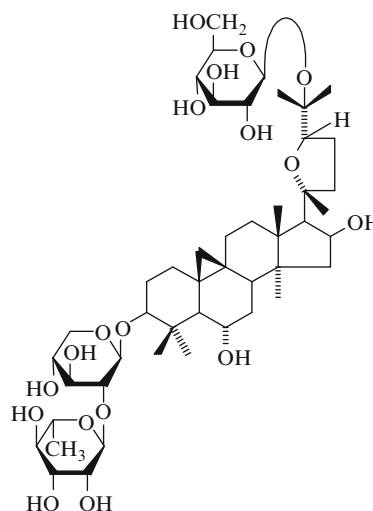
δ_C (C ₅ D ₅ N)							
C-1	32.70	C-13	47.25	C-25	41.41	α -L-Rhap	
2	30.19	14	50.10	26	18.78	1	101.82
3	88.66	15	50.30	27	18.79	2	72.26
4	41.04	16	82.69	28	18.93	3	72.69
5	48.16	17	49.50	29	25.76	4	74.28
6	21.50	18	22.31	30	15.81	5	69.70
7	26.69	19	30.19	β -D-Glcp		6	18.57
8	49.29	20	30.25	1	105.43	α -L-Arap	
9	19.97	21	16.93	2	80.15	1	107.64
10	26.23	22	31.02	3	77.68	2	72.69
11	72.26	23	38.94	4	72.26	3	74.70
12	40.37	24	215.72	5	78.30	4	69.81
				6	62.98	5	67.10

References

1. J. Xu, R. Xu, X. Li, Planta Med. **58**(2), 208–210 (1992)

Asernestioside A

C₄₇H₇₈O₁₈, M 930



Taxonomy: Cycloartane Glycosides*Astragalus ernestii* Comb. (*Leguminosae*) [1–3].

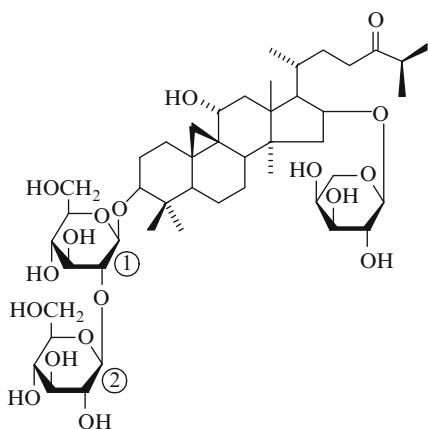
CAS Registry Number: 123914-38-5.

References

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2. H.K. Wang, K. He, L. Ji, Y. Tezuka, T. Kikuchi, I. Kitagawa, *Chem. Pharm. Bull.* **37**(8), 2041–2046 (1989)
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Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.51	C-13	47.16	C-25	41.41	β -D-Glc _{p2}	
2	30.04	14	50.10	26	18.46	1	105.99
3	88.89	15	50.06	27	18.46	2	76.02
4	40.93	16	82.57	28	18.61	3	78.07
5	47.94	17	49.41	29	25.85	4	71.70
6	21.44	18	22.15	30	15.49	5	78.11
7	26.74	19	30.13	β -D-Glc _{p1}		6	62.94
8	49.22	20	30.10	1	104.87	α -L-Arap	
9	20.10	21	16.83	2	83.43	1	107.27
10	26.26	22	31.37	3	77.91	2	72.94
11	72.32	23	38.76	4	71.91	3	74.54
12	40.23	24	215.38	5	78.42	4	69.41
				6	62.94	5	66.78

Curculigosaponin EC₄₇H₇₈O₁₈, M 930**Taxonomy:** Cycloartane Glycosides*Curculigo orchoides* Gaerth. (*Hypoxidaceae*) [1].Mp 174–177°C, $[\alpha]_D^{20} +23.27^\circ$ (c 0.65, MeOH).

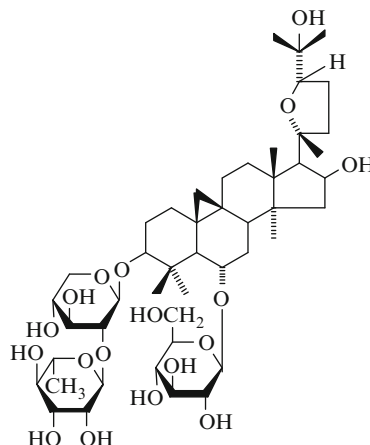
CAS Registry Number: 136800-60-7.

FABMS m/z: 953 [M + Na]⁺, 969 [M + K]⁺, 821 [M + Na-132]⁺, 659 [M + Na-132-162]⁺, 439 [M + H-132-162 × 2]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.28 and 0.48 (2H-19, d, J = 4 Hz), 1.06 and 1.08 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.09, 1.20, 1.29, 1.35 (5 × CH₃, s), 2.68 (H-25, septet, J = 6.8 Hz), 4.92 (Ara H-1, d, J = 7.3 Hz), 5.40 (Glc₁ H-1, d, J = 7 Hz), 5.60 (Glc₂ H-1, d, J = 7 Hz).

References

1. J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Cyclosieversioside H (astrasieversianin XVI)C₄₇H₇₈O₁₈, M 930**Taxonomy:** Cycloartane Glycosides*Astragalus sieversianus* Pall. (*Leguminosae*) [1–3].Mp 262–264°C (from MeOH), $[\alpha]_D^{20} -30.0^\circ$ (c 1.05, MeOH).

CAS Registry Number: 88192-83-0.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 3040.

FDMS m/z: $[M + Na + H]^+$ 954 (16.5), $[M]^+$ 930 (2.3).
 1H NMR (200 MHz, C_5D_5N , δ): -0.007 and 0.49 (2H-19, d, $J = 4$ Hz), 0.92 , 1.16 , 1.17 , 1.25 , 1.33 , 1.46 , 1.76 ($7 \times CH_3$, s), 1.62 (Rhap CH_3 , d, $J = 6$ Hz).

Table 1

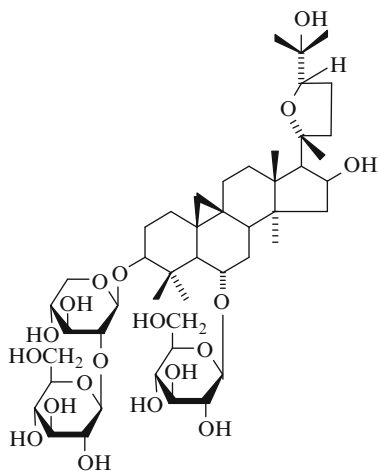
δ_C (C_5D_5N)							
C-3	87.7	β -D-Xylp	α -L-Rhap	β -D-Glcp			
6	78.8	1	105.7	1	101.9	1	105.4
16	73.4	2	79.4	2	72.0	2	75.7
20	87.3	3	78.3	3	72.5	3	78.0
24	81.6	4	71.5	4	74.2	4	72.5
25	71.3	5	66.9	5	69.6	5	78.0
			6	18.8	6	63.2	

References

1. A.N. Svechnikova, R.U. Umarova, N.D. Abdullaev, M.B. Gorovits, T.T. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **19**(4), 432–434 (1983)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **25**(2), 131–147 (1989)
3. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)

Astragaloside VI

$C_{47}H_{78}O_{19}$, M 946



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].
Astragalus melanophrurius Boiss. (*Leguminosae*) [2].

Mp 290–291°C (from MeOH), $[\alpha]_D^{14} +17.3^\circ$ (c 1.0, MeOH).

CAS Registry Number: 84687-45-6.

IR ν_{max}^{KBr} , cm^{-1} : 3400, 1075, 1033.

Table 1

δ_C (C_5D_5N)							
C-3	88.5	β -D-Xylp		2'-O- β -D-Glcp		6-O- β -D-Glcp	
5	52.3	1	105.9 ^a	1	105.2 ^a	1	104.9 ^a
6	79.1	2	83.5	2	76.6	2	75.5
16	73.4	3	77.8	3	78.7	3	78.7
17	58.2	4	70.8	4	71.9	4	71.9
20	87.2	5	66.3	5	77.8	5	77.8
24	82.2			6	63.2 ^b	6	63.0 ^b
25	71.3						

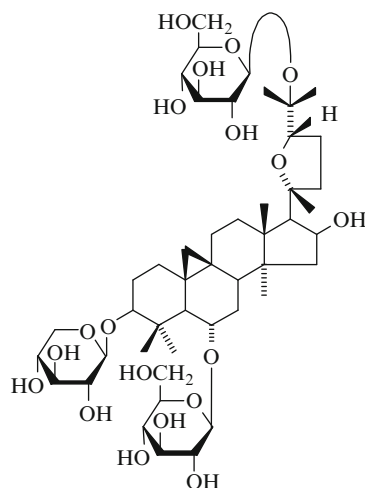
^{a,b}Assignment of signals ambiguously

References

1. I. Kitagawa, H.K. Wang, M. Saito, M. Yoshikawa, *Chem. Pharm. Bull.* **31**(2), 709–715 (1983)
2. I. Calis, A. Yuruker, D. Tasdemir, A.D. Wright, O. Sticher, Y.-D. Luo, J.M. Pezzuto, *Planta Med.* **63**, 183–186 (1997)

Astragaloside VII

$C_{47}H_{78}O_{19}$, M 946



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].
Astragalus kuhitangi (Nevski) Sirj. (*Leguminosae*) [2, 3].
Astragalus trojanus Stev. (*Leguminosae*) [4].

Mp 292–293°C (from MeOH), $[\alpha]_D^{18} +10.3^\circ$ (c 0.6, MeOH).

CAS Registry Number: 84687-46-7.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1070, 1040.

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)							
C-3	88.6	β -D-Xylp	6-O- β -D-Glcp	25-O- β -D-Glcp			
5	52.4	1	107.3	1	104.8	1	98.8
6	79.1	2	75.3 ^a	2	75.5 ^a	2	75.1 ^a
16	73.5	3	77.8	3	78.7	3	78.4
17	58.1	4	71.4 ^b	4	72.0 ^b	4	71.5 ^b
20	87.2	5	66.8	5	77.8	5	77.8
24	82.2		6	62.8	6	62.8	
25	78.6						

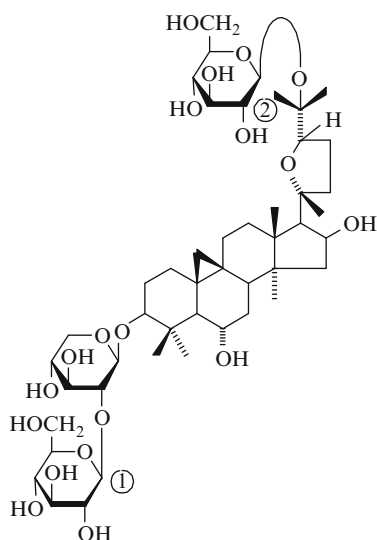
^{a,b}Assignment of signals ambiguously

References

1. I. Kitagawa, H.K. Wang, M. Yoshikawa, Chem. Pharm. Bull. **31**(2), 716–722 (1983)
2. M.A. Agzamova, M.I. Isaev, I.I. Maltsev, M.B. Gorovits, N. K. Abubakirov, Chem. Nat. Comp. **24**(6), 755–756 (1988)
3. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, Chem. Nat. Comp. **25**(2), 131–147 (1989)
4. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, Phytochemistry **51**(8), 1017–1020 (1999)

Astragaloside V

$\text{C}_{47}\text{H}_{78}\text{O}_{19}$, M 946



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].
Mp 202–204°C (from MeOH), $[\alpha]_D^{14} +7.2^\circ$ (c 1.0, MeOH).

CAS Registry Number: 84687-44-5.

IR ν_{\max}^{KBr} , cm^{-1} : 3400, 1075, 1035.

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)							
C-3	88.6	β -D-Xylp	β -D-Glcp ₁	β -D-Glcp ₂			
5	54.0	1	105.7 ^a	1	105.3 ^a	1	98.7
6	67.9	2	83.0	2	76.6	2	75.0
16	73.5	3	77.6	3	78.3	3	78.6
17	58.2	4	71.4	4	71.9	4	71.4
20	87.3	5	66.4	5	77.9	5	77.9
24	82.2		6	62.9 ^b	6	62.8 ^b	
25	78.6						

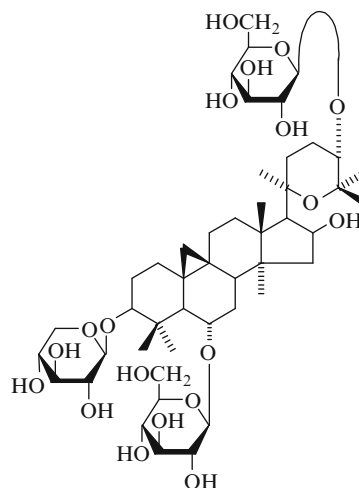
^{a,b}Assignment of signals ambiguously

References

1. I.K. Kitagawa, H.K. Wang, M. Saito, M. Yoshikawa, Chem. Pharm. Bull. **31**(2), 709–715 (1983)

Cyclotrisectoside

$\text{C}_{47}\text{H}_{78}\text{O}_{19}$, M 946



Taxonomy: Cycloartane Glycosides

Astragalus dissectus B. Fedtsch. et Ivanova (*Leguminosae*) [1].

¹H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.05 and 0.51 (2H-19, d, J = 4 Hz), 0.87, 1.20, 1.34, 1.37, 1.47, 1.55, 1.99 (7 \times CH₃, c), 2.09 (H-17, d, J = 8 Hz),

2.98 (H-22, td, $J = 13, 5$ Hz), 3.51 (H-3, dd, $J = 12, 4$ Hz), 4.75 (H-16, m), 4.834, 4.888, 4.894 (3 anomeric H, d, $J = 8$ Hz).

Table 1

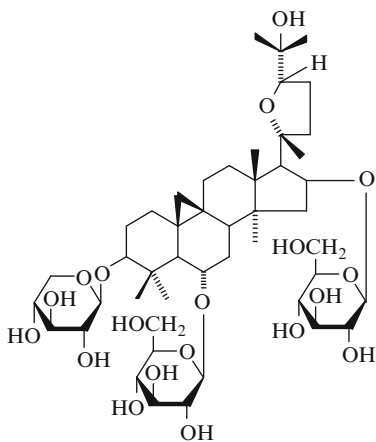
δ_C (C ₅ D ₅ N)							
C-1	32.20	C-13	45.93	C-25	74.62	6-O- β -D-Glcp	
2	29.35	14	46.51	26	28.76	1	105.01
3	88.59	15	46.68	27	27.95	2	75.18
4	42.66	16	74.13	28	19.92	3	78.54
5	52.66	17	60.70	29	28.72	4	71.66
6	79.28	18	21.00	30	16.59	5	78.13
7	34.07	19	28.92	β -D-Xylp		6	63.03
8	45.66	20	78.62	1	107.67	24-O- β -D-Glcp	
9	21.08	21	28.76	2	75.58	1	100.67
10	30.18	22	26.67	3	77.99	2	74.24
11	26.20	23	18.89	4	71.25	3	78.54
12	33.93	24	79.50	5	67.04	4	71.36
						5	79.04
						6	63.11

References

1. I.A. Sukhina, R.P. Mamedova, M.A. Agzamova, M.I. Isaev, in *Proceedings of 6th International Symposium on the Chemistry of Natural Compounds*, Ankara-Turkey, 28–29 June 2005, p. 28

Trojanoside K

C₄₇H₇₈O₁₉, M 946



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (*Leguminosae*) [1].

White powder.

IR ν_{\max}^{KBr} , cm⁻¹: 3389, 2933, 1648, 1455, 1367, 1261, 1075, 1044.

HRESIMS m/z: [M + Na]⁺ 969.4943.

Table 1

δ_C (C ₅ D ₅ N)		δ_H (J/Hz)	δ_C (C ₅ D ₅ N)		δ_H (J/Hz)
C-1	32.4		C-26	27.6	1.46 s
2	30.3		27	26.5	1.37 s
3	88.8	3.49 dd (11.5, 4.2)	28	20.3	0.92 s
4	42.8	–	29	28.9	2.03 s
5	52.7		30	16.8	1.35 s
6	80.1	3.66 m	β -D-Xylp		
7	35.1		1	107.8	4.83 d (7.4)
8	46.1		2	75.8	4.05 ^a
9	20.3	–	3	78.7	4.20 ^a
10	29.4	–	4	71.4	4.17 ^a
11	26.7		5	67.2	3.64 ^a , 4.35 ^a
12	33.2		6-O- β -D-Glcp		
13	46.9	–	1	105.7	4.85 d (7.7)
14	46.9	–	2	75.7	4.03 ^a
15	47.4		3	79.4	4.20 ^a
16	83.7	4.47 dd (7.5, 5.1)	4	72.2	4.15 ^a
17	59.9	2.45 d (7.7)	5	78.1	3.94 ^a
18	21.3	1.58 s	6	63.0	4.35 ^a , 4.57 ^a
19	29.6	0.16 d (3.5), 0.52 d (3.5)	16-O- β -D-Glcp		
20	87.2	–	1	106.6	4.75 d (7.7)
21	26.4	1.72 s	2	75.7	4.00 ^a
22	38.8		3	79.0	4.20 ^a
23	25.9		4	72.0	4.15 ^a
24	84.5	4.04 dd (3.1, 2.7)	5	78.5	3.94 ^a
25	72.0	–	6	63.4	4.35 ^a , 4.57 ^a

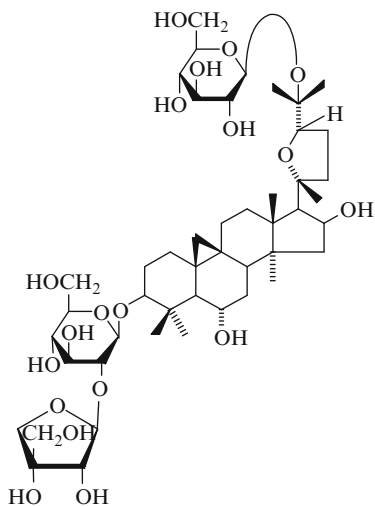
^aMultiplicity of the signals is unclear due to overlapping

References

1. E. Bedir, I.I. Tatli, I. Calis, I.A. Khan, *Chem. Pharm. Bull.* **49**(11), 1482–1486 (2001)

Cycloaraloside F

C₄₇H₇₈O₁₉, M 946



Taxonomy: Cycloartane Glycosides

Astragalusamarus Pall. (*Leguminosae*) [1].

Astragalus villosissimus Bunge (*Leguminosae*) [1].

Amorphous powder.

$[\alpha]_D^{28} -26.1^\circ$ (c 0.84, MeOH).

CAS Registry Number: 142735-27-1.

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3160, 3050.

¹H NMR (100 MHz, C₅D₅N, δ , 0-HMDS): 0.40 (H-19, d, J = 4 Hz), 0.82, 1.16, 1.20, 1.26, 1.26, 1.52, 1.83 (7 × CH₃, s), 4.25 and 4.61 (apiose 2H-5, d, J = 10 Hz), 4.78 (apiose H-2, brs), 4.82 (H-1 of Glcp at C-3, d, J = 8 Hz), 4.90 (H-1 of Glcp at C-25, d, J = 8 Hz), 6.37 (apiose H-1, brs).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.35	C-13	45.13	C-25	78.52	D-Apio- β -D-f	
2	30.19	14	45.97	26	22.97	1	111.13
3	88.84	15	46.01	27	25.60	2	77.91
4	42.58	16	73.47	28	19.96	3	80.56
5	53.90	17	58.06	29	28.75	4	75.58
6	67.81	18	21.43	30	16.56	5	66.11
7	38.45	19	30.34	3-O- β -D-Glcp	25-O- β -D-Glcp		
8	46.69	20	87.14	1	105.46	1	98.76

(continued)

Table 1 (continued)

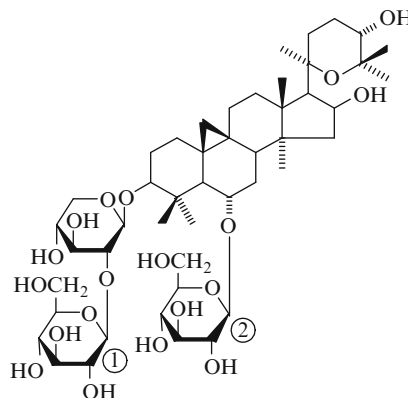
δ_C (C ₅ D ₅ N)							
9	20.73	21	27.80	2	79.39	2	75.09
10	29.37	22	34.95	3	78.71	3	78.44
11	26.14	23	25.90	4	71.95	4	71.28
12	33.41	24	82.03	5	78.28	5	77.86
				6	62.85	6	62.67

References

- M.I. Isaev, B.A. Imomnazarov, *Chem. Nat. Comp.* **27**(3), 323–326 (1991)

Cyclocanthoside F

C₄₇H₇₈O₁₉, M 946



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].

Amorphous powder.

CAS Registry Number: 260995-82-2.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		
C-1	32.26	1.54, 1.23	C-25	75.25	–
2	30.12	2.29 m, 1.97	26	28.63	1.48 s
3	88.52	3.44 dd (11.7, 4.4)	27	28.02	1.32 s

(continued)

Table 1 (continued)

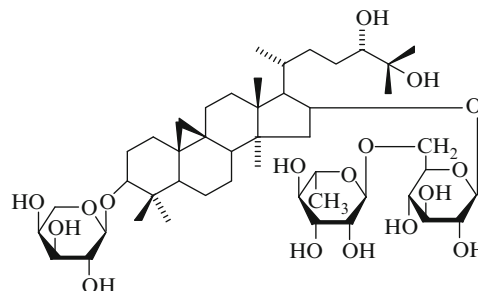
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
4	42.65 –	28	20.07 0.95 s
5	52.54 1.85 d (8.6)	29	28.56 1.94 s
6	79.33 3.78 td (8.6, 3.9)	30	16.58 1.44 s
7	34.56 2.26, 1.84	β -D-Xylp	
8	45.72 2.00	1	105.42 4.85 d (7.3)
9	21.20 –	2	83.87 4.23
10	29.01 –	3	77.72 4.20
11	26.38 1.82, 1.44	4	70.93 4.20
12	34.24 1.84, 1.68	5	66.55 4.29 dd (11.1, 4.6), 3.62 dd (11.1, 9.3)
13	45.99 –	β -D-Glcp ₁	
14	46.86 –	1	106.24 4.88 d (7.7)
15	47.32 2.37 dd (12.8, 8.2), 1.90	2	76.94 4.00 dd (8.9, 7.7)
16	74.00 4.92 m	3	77.98 4.22
17	60.86 2.13 d (7.5)	4	72.00 4.21
18	20.75 1.69 s	5	78.14 3.90 m
19	29.01 0.19 d (4), 0.58 d (4)	6	63.03 4.49 dd (11.5, 2.7), 4.33 dd (11.5, 5.4)
20	78.97 –	β -D-Glcp ₂	
21	28.88 1.56 s	1	105.02 5.35 d (7.7)
22	26.74 3.15 td (13.9, 5), 1.26	2	75.66 4.13 dd (9.3, 7.7)
23	24.11 2.20, 1.92	3	78.97 4.26
24	68.84 3.70 dd (3.5, 2)	4	71.95 4.24
		5	77.98 3.98 m
		6	63.19 4.55 dd (11.7, 3.2), 4.45 dd (11.7, 4.5)

References

- M.A. Agzamova, M.I. Isaev, *Chem. Nat. Comp.* **35**(3), 314–319 (1999)

Cyclofoetoside A

C₄₇H₈₀O₁₇, M 916



Taxonomy: Cycloartane Glycosides

Thalictrum foetidum L. (*Ranunculaceae*) [1].

Mp 265–266°C (from MeOH), $[\alpha]_D^{24} +22^\circ$ (c 1.1, C₅H₅N).

CAS Registry Number: 103654-33-7.

IR ν_{\max}^{KBr} , cm⁻¹: 3500–3300, 3040.

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.14 and 0.37 (2H-19, d, J = 4 Hz), 0.86 (CH₃-21, d, J = 6 Hz), 0.88, 1.22, 1.22, 1.37, 1.37, 1.37 (6 × CH₃, s), 1.49 (Rhap CH₃, d, J = 6 Hz), 3.30–4.50 (H-3, H-16, H-24 and protons of monosaccharides moiety), 4.55 (Glcp H-1, d, J = 8 Hz), 4.67 (Arap H-1, d, J = 8 Hz), 5.30 (Rhap H-1, brs).

Table 1

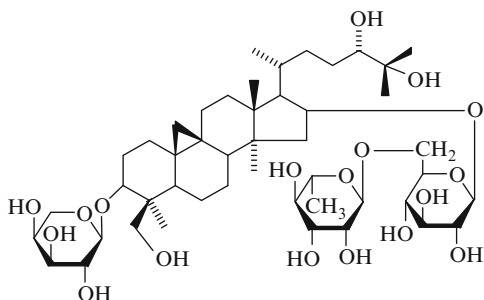
δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)		
C-1	32.3	C-13	45.8	C-25	72.8	α -L-Rhap	
2	29.9	14	47.1	26	26.3	1	102.2
3	88.7	15	48.2	27	25.8	2	72.7
4	41.3	16	82.7	28	20.5	3	72.2
5	47.8	17	57.8	29	25.6	4	74.0
6	21.2	18	17.5	30	15.4	5	69.5
7	26.4	19	30.2	β -D-Glcp		6	18.6
8	48.2	20	29.7	1	106.5	α -L-Arap	
9	20.1	21	19.5	2	75.5	1	106.9
10	26.4	22	33.1	3	78.4	2	72.7
11	26.4	23	28.9	4	71.9	3	74.4
12	33.6	24	78.1	5	76.6	4	69.1
				6	68.4	5	66.2

References

1. T.V. Ganenko, M.I. Isaev, V.I. Lutsyki, A.A. Semenov, N.D. Abdullaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(1), 61–65 (1986)

Cyclofoetoside B

C₄₇H₈₀O₁₈, M 932



Taxonomy: Cycloartane Glycosides

Thalictrum foetidum L. (*Ranunculaceae*) [1].

Mp 194–197°C (from MeOH), $[\alpha]_D^{24} +15.7^\circ$ (c 0.88, C₅H₅N).

CAS Registry Number: 108333-83-1.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3560–3200, 3035.

¹H NMR (C₅D₅N, δ , 0-TMS): 0.24 and 0.45 (2H-19, d, J = 4 Hz), 0.97 (CH₃, s), 1.01 (CH₃-21, d, J = 7.7 Hz), 1.24, 1.52, 1.52, 1.52 (6 × CH₃, s), 1.65 (Rhap CH₃, d, J = 6.1 Hz), 4.70 (Glc p H-1, d, J = 7.8 Hz), 4.95 (Arap H-1, d, J = 6.3 Hz), 5.48 (Rhap H-1, d, J = 1.4 Hz).

Table 1

δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		
C-1	32.2	C-13	45.8	C-25	72.7	α -L-Rhap
2	30.0	14	47.0	26	26.2	1
3	89.6	15	48.1	27	25.7	2
4	45.0	16	82.7	28	20.6	3
5	48.0	17	57.8	29	21.3	4

(continued)

Table 1 (continued)

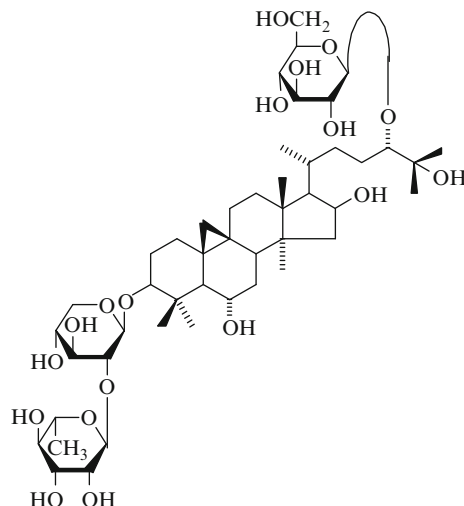
δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		
6	21.9	18	17.5	30	63.5	5
7	26.5	19	30.0	β -D-Glcp		6
8	48.6	20	29.6	1	106.5	α -L-Arap
9	21.3	21	19.7	2	75.6	1
10	26.2	22	33.2	3	78.4	2
11	25.7	23	28.9	4	71.9	3
12	33.6	24	77.1	5	76.7	4
				6	68.4	5

References

1. T.V. Ganenko, M.I. Isaev, A.S. Gromova, N.D. Abdullaev, A.A. Semenov, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **22**(3), 315–319 (1986)

Trojanoside C

C₄₇H₈₀O₁₈, M 932



Taxonomy: Cycloartane Glycosides*Astragalus trojanus* Stev. (*Leguminosae*) [1].[α]_D²⁵ -5.0° (c 0.1, MeOH).

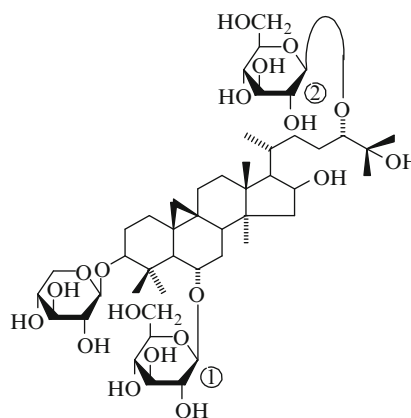
CAS Registry Number: 223924-12-7.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3420, 2933, 1250, 1024.FABMS m/z: 931 [M-H]⁻, 785 [M-H-146]⁻, 769 [M-H-162]⁻, 491 [M-H-132-146-162]⁻**Table 1**

δ_{C} (CD ₃ OD)		δ_{H} (J/Hz)	δ_{C} (CD ₃ OD)		δ_{H} (J/Hz)
C-1	33.1		C-24	89.8	3.53 dd (12, 4.5)
2	30.1	1.97 m, 1.71 m	25	73.9	–
3	89.5	3.23 dd (11.2, 4.5)	26		1.21 s
4	43.0	–	27	26.3	1.19 s
5	54.5	1.39 d (9.5)	28	19.9	0.98 s
6	69.2	3.47 ddd (9.5, 9.5, 4.5)	29	28.2	1.32 s
7	38.5	1.49 m, 1.38 m	30	16.3	1.05 s
8	48.4	1.82 m	β -D-Xylp		
9	21.4	–	1	105.9	4.41 d (7.5)
10	29.9	–	2	78.5	3.45 dd (7.5, 9)
11	26.6	2.03 m, 1.25 m	3	78.5	3.45 t (9)
12	33.7	1.72 m, 1.66 m	4	71.2	3.48 ddd (4.5, 8.5, 11)
13	46.1	–	5	65.9	3.21 t (11), 3.89 dd (4.5, 11)
14	46.8	–	α -L-Rhap		
15	48.8	2.05 dd (12, 8), 1.45 dd (12, 5.2)	1	101.7	5.37 d (1.5)
			2	71.8	3.98 dd (1.5, 2.5)
16	72.3	4.43 ddd (8.2, 8, 5.2)	3	71.7	3.78 dd (2.5, 9)
17	57.8	1.62 m	4	73.6	3.42 t (9)
18		1.19 s	5	69.7	4.01 m
19	31.5	0.41 d (3.5), 0.57 d (3.5)	6	18.0	1.28 d (6.5)
20	30.7	1.88 m			
21	17.7	0.97 d (6)	β -D-Glcp		
22	32.9	1.90 m, 1.36 m	1	104.7	4.44 d (7.5)
23	29.3	1.64 m, 1.62 m	2	75.2	3.27 dd (7.5, 9)
			3	77.7	3.40 t (9)
			4	71.2	3.33 t (9)
			5	77.7	3.33 ddd (3, 4.5, 9)
			6	62.2	3.68 dd (4.5, 12), 3.89 dd (3, 12)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, J. Nat. Prod. **62**(4), 563–568 (1999)

Brachyoside CC₄₇H₈₀O₁₉, M 948**Taxonomy:** Cycloartane Glycosides*Astragalus brachypterus* Fischer (*Leguminosae*) [1].*Astragalus trojanus* Stev. (*Leguminosae*) [2].[α]_D²⁵ +12.5° (c 0.1, MeOH).

CAS Registry Number: 215776-56-0.

FABMS m/z: 947 [M-H]⁻, 785 [M-H-162]⁻, 623 [M-H₂ × 162]⁻, 491 [M-H-2 × 162-132]⁻.**Table 1**

δ_{C} (CD ₃ OD)		δ_{H} (J/Hz)	δ_{C} (CD ₃ OD)		δ_{H} (J/Hz)
C-1	32.7	1.29 m, 1.58 m	C-27	24.0	1.21 s
2	30.1	1.71 m, 1.97 m	28	19.8	1.01 s
3	89.8	3.23 dd (4.5, 11.1)	29	28.1	1.32 s
4	42.7	–	30	16.2	1.05 s
5	52.9	1.65 d (9.5)	β -D-Xylp		

(continued)

Table 1 (continued)

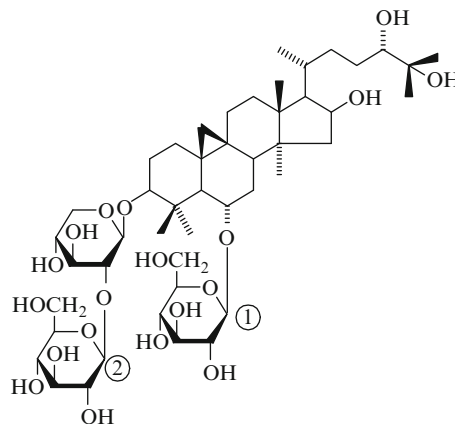
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
6	79.9 3.58 ddd (10, 10, 4.5)	1	107.1 4.32 d (7.6)
7	34.8 1.63 m, 1.93 m	2	75.2 3.23 dd (7.6, 8.5)
8	46.6 1.90 m	3	77.7 3.33 t (8.5)
9	21.9 –	4	71.0 3.50 ddd (4, 8.5, 11)
10	29.8 –	5	66.4 3.21 t (11), 3.86 dd (4.5, 11)
11	26.8 1.37 m, 1.93 m	β -D-Glcp	
12	33.7 1.62 m, 1.67 m	1	104.6 4.37 d (7.8)
13	46.3 –	2	75.2 3.21 dd (7.8, 9)
14	47.1 –	3	78.2 3.38 t (9)
15	48.1 1.44 dd (5.2, 12), 2.13 dd (8, 12)	4	71.3 3.32 t (9)
16	72.5 4.44 ddd (8, 8, 5.2)	5	77.6 3.28 ddd (3, 4.5, 9)
17	57.6 1.75 m	6	62.7 3.69 dd (4.5, 12), 3.89 dd (3, 12)
18	18.0 1.18 s	β -D-Glcp	
19	28.9 0.27 d (4.5), 0.61 d (4.5)	1	104.6 4.45 d (7.8)
20	30.9 1.88 m	2	75.2 3.28 dd (7.8, 9)
21	17.5 0.97 d (6)	3	77.8 3.41 t (9)
22	33.0 1.91 m	4	71.3 3.35 t (9)
23	29.4 1.62 m, 1.65 m	5	78.2 3.36 ddd (3, 4.5, 9)
24	89.7 3.54 dd (4.5, 12)	6	62.2 3.69 dd (4.5, 12), 3.89 dd (3, 12)
25	73.5 –		
26	26.5 1.19 s		

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)
2. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *Phytochemistry* **51**(8), 1017–1020 (1999)

Cycloanthoside G

C₄₇H₈₀O₁₉, M 948



Taxonomy: Cycloartane Glycosides

Astragalus tragacantha Habl. (*Leguminosae*) [1].

Astragalus melanophrurius Boiss. (*Leguminosae*) [2].

Mp 190–195°C (from CHCl₃–MeOH–H₂O, 70:23:4),

$[\alpha]_D^{28}$ 0° (c 1.18, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3600–3230.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.15 and 0.56 (2H-19, d, J = 4 Hz), 1.06 (CH₃-21, d, J = 6.4 Hz), 0.99, 1.37, 1.39, 1.43, 1.46, 1.86 (6 × CH₃, s), 3.40 (H-3, dd, J = 12, 5 Hz), 4.66 (H-16, q, J = 7 Hz), 4.80 (Xylp H-1, d, J = 6.2 Hz), 4.83 (H-1 of Glcp at C-6, d, J = 7.7 Hz), 5.30 (H-1 of Glcp at C-2 of Xylp, d, J = 7.6 Hz).

Table 1

δ_C (C ₅ D ₅ N)							
C-1	32.10	C-11	26.29	C-21	18.34	β -D-Xylp	4 71.95
2	28.56	12	33.19	22	32.98	1	105.36 5 77.97
3	88.39	13	45.82	23	27.70	2	83.86 6 63.20
4	42.63	14	46.89	24	77.12	3	76.93 β -D-Glcp ₂

(continued)

Table 1 (continued)

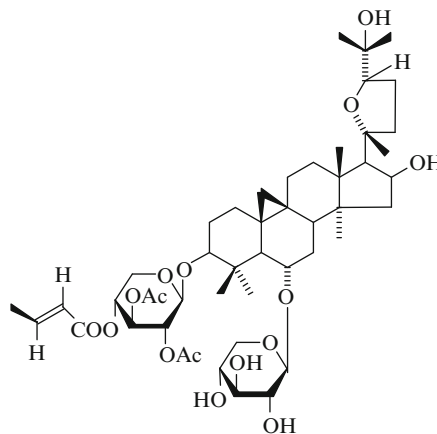
δ_C (C ₅ D ₅ N)									
5	52.28	15	47.69	25	72.55	4	70.90	1	106.25
6	78.87	16	71.98	26	25.75	5	66.58	2	75.66 ^a
7	33.95	17	57.11	27	26.43	β -D-Glc _p		3	78.15
8	45.09	18	18.23	28	19.72	1	105.11	4	71.91
9	21.43	19	27.88	29	28.64	2	75.66 ^a	5	77.79
10	30.06	20	28.28	30	16.56	3	78.85	6	63.02

^aSignals are mutually imposed

References

- M.I. Isaev, B.A. Imomnazarov, Y.M. Fadeev, P.K. Kintia, *Chem. Nat. Comp.* **28**(3–4), 315–320 (1992)
- I. Calis, A. Yuruker, D. Tasdemir, A.D. Wright, O. Sticher, Y.-D. Luo, J.M. Pezzuto, *Planta Med.* **63**, 183–186 (1997)

Kahiricoside I

C₄₈H₇₄O₁₆, M 906**Table 1**

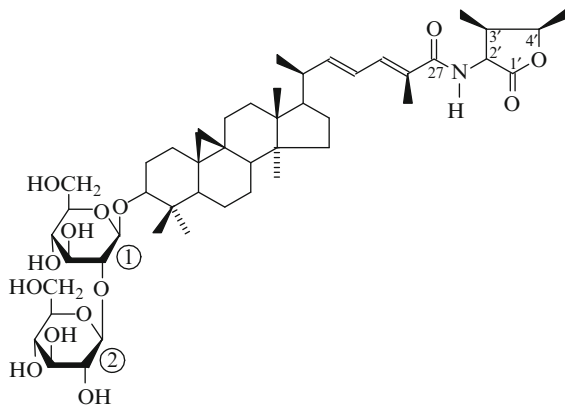
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)			
C-1	31.8	1.50, 1.25	C-23	26.6	2.27, 2.02	2'-O Ac		
2	29.7	2.17, 1.90	24	81.3	3.89 dd (5.4, 8.9)	20.7	2.01 s	
3	89.3	3.34 dd (4.6, 11.7)	25	71.2	–	169.9	–	
4	42.3	–	26	28.3	1.58 s	3'-O Ac		
5	51.7	1.82 d	27	27.2	1.31 s	20.7	2.03 s	
6	78.2	3.76 m	28	19.9	1.06 s	170.5	–	
7	34.0	2.11, 1.90	29	28.1	1.66 s	CH ₃	18.0	1.64 dd (6.9, 1.6)
8	44.8	2.01	30	16.6	1.20 s	CH	146.9	7.02 dq (15.5, 6.9)
9	21.3	–	3-O- β -D-Xylp		–	CH	122.2	5.85 dd (15.5, 1.7)
10	28.6	–	1	103.6	4.87 d (7.6)	COO	165.5	–
11	26.4	1.72, 1.36	2	72.4	5.45 dd (7.4, 9.3)			
12	33.5	1.65, 1.55	3	72.8	5.75 t (9.3)			
13	45.3	–	4	69.9	5.35 ddd (5.4, 9.8, 9)			
14	46.3	–	5	62.7	4.37 dd (5.5, 11.6),			
15	46.1	2.29, 1.82			3.68 m			
16	73.2	5.04 m	6-O- β -D-Xylp					
17	58.3	2.55 d (7.8)	1	105.7	4.84 d (7.3)			
18	20.8	1.19 s	2	75.5	4.00 t (7.8)			
19	27.6	0.18 d, 0.56 d	3	78.7	4.14 t (8.4)			
20	87.4	–	4	71.9	4.17 m			
21	28.7	1.31	5	67.1	4.30 dd (4.7, 11.1),			
22	35.1	3.09, 1.67			3.68 m			

Taxonomy: Cycloartane Glycosides*Astragalus kahiricus* DC (*Leguminosae*) [1].Mp 190–192°C, $[\alpha]_D^{20} +28.3^\circ$ (c 0.9, MeOH).FABMS m/z: $[M + Na]^+$ 929.

See Table 1

References

1. L. Verotta, M. Guerrini, N.A. El-Sebakhy, A.M. Assad, S.M. Toaima, M.M. Radwan, Y.D. Luo, J.M. Pezzuto, *Planta Med.* **68**, 986–994 (2002)

FABMS m/z: 912 $[M + Na]^+$.
 $^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.19 and 0.48 (2H-19, d, $J = 3.7$ Hz), 2.19 (CH₃-26, brs), 2.90 (H-20, m), 3.45 (H-3, dd, $J = 11, 4$ Hz), 4.66 (H-4', m), 4.95 (H-1 Glcp₁ d, $J = 7.5$ Hz), 5.41 (H-1 Glcp₂, d, $J = 7.4$ Hz), 5.63 (H-22, dd, $J = 14.8, 8.7$ Hz), 5.68 (H-2', dd, $J = 7.3, 7.3$ Hz), 6.41 (H-23, dd, $J = 14.8, 11.1$ Hz), 7.27 (H-24, d, $J = 11.1$ Hz), 9.16 (NH, d, $J = 7.5$ Hz).
Mussaendoside D $\text{C}_{48}\text{H}_{75}\text{NO}_{14}$, M 889**Taxonomy:** Cycloartane Glycosides*Mussaenda pubescens* Ait. f. (*Rubiaceae*) [1].Amorphous powder, $[\alpha]_D^{24} +30.2^\circ$ (c 0.54, MeOH).

CAS Registry Number: 178402-86-3.

UV $\lambda_{\text{max}}^{\text{MeOH}}$, nm: 265.**Table 1**

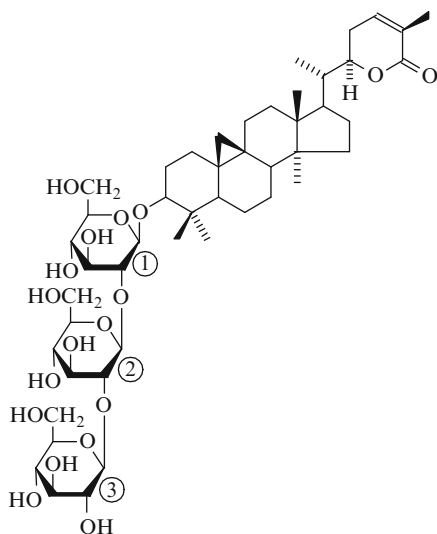
δ_C ($\text{C}_5\text{D}_5\text{N}$)					
C-1	32.0	C-19	29.9	$\beta\text{-D-Glcp}$	
2	29.5	20	41.2	1	104.9
3	88.7	21	19.8	2	83.3
4	41.2	22	147.9	3	77.9
5	47.3	23	123.5	4	71.5
6	21.0	24	134.8	5	78.2
7	26.1	25	129.0	6	62.7
8	47.7	26	13.4	$\beta\text{-D-Glcp}_2$	
9	19.8	27	170.7	1	106.0
10	26.2	28	19.4	2	77.0
11	26.5	29	25.7	3	78.2
12	33.0	30	15.3	4	71.6
13	45.5	1'	175.7	5	77.9
14	49.1	2'	55.4	6	62.7
15	35.6	3'	38.6		
16	28.7	4'	77.0		
17	51.9	3'-Me	8.1		
18	18.3	4'-Me	15.4		

References

1. W. Zhao, P. Wang, R. Xu, G. Qin, S. Jiang, H. Wu, *Phytochemistry* **42**(3), 827–830 (1996)

Juncoside I

C₄₈H₇₆O₁₈, M 940



Taxonomy: Cycloartane Glycosides

Juncus effusus (*Juncaceae*) [1].

$[\alpha]_D^{20} +8^\circ$ (c 0.8, MeOH).

CAS Registry Number: 158511-65-0.

IR ν_{\max}^{KBr} , cm^{-1} : 3440, 1700.

UV λ_{\max} , nm (ϵ): 233 (15700).

FABMS, m/z: $[M + Na]^+$ 963, $[M + Na\text{-hexose}]^+$ 801, $[M-2\text{ hexoses}]^+$ 616, $[M-3\text{ hexoses}]^+$.

¹H NMR (400 MHz, CD₃OD, δ , 0-TMS): 0.37 and 0.58 (2H-19, d, J = 4.2 Hz), 0.90 (CH₃-18, s), 0.90 (CH₃-21, d, J = 6.2 Hz), 0.97 (CH₃-30, s), 1.02 (CH₃-28, s), 1.07 (CH₃-29, s), 1.83 (CH₃-27, s), 3.53 (H-3, m), 4.42 (H-22, m), 4.47 (H-1 Glc_{p1}), 4.59 (H-1 Glc_{p3}), 4.82 (H-1 Glc_{p2}), 6.82 (H-24, dd, J = 6.6, 1.8 Hz).

Table 1

δ_C (C ₅ D ₅ N)				β -D-Glcp ₂			
C-1	33.5	C-13	46.6	C-25	132.8	C-1	103.3
2	31.1	14	obscured	26	165.8	2	85.3
3	91.1	15	36.0	27	14.6	3	77.4
4	41.1	16	27.9	28	18.8	4	71.0

(continued)

Table 1 (continued)

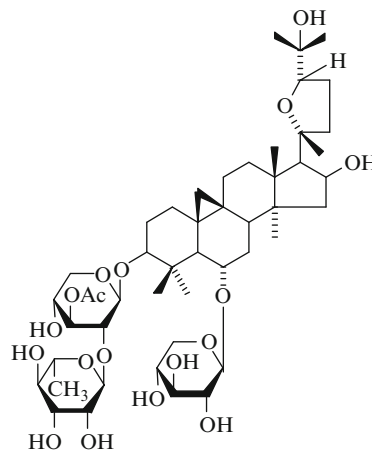
δ_C (C ₅ D ₅ N)				β -D-Glcp ₂			
5	obscured	17	50.4	29	24.2	5	78.0
6	22.4	18	20.2	30	14.0	6	62.8
7	28.9	19	30.6	β -D-Glcp ₁		β -D-Glcp ₃	
8	48.7	20	41.8	1	105.1	1	106.1
9	21.5	21	12.6	2	82.0	2	76.4
10	27.5	22	82.6	3	77.4	3	78.2
11	27.5	23	30.8	4	71.0	4	72.0
12	34.5	24	141.5	5	78.9	5	78.2
				6	63.3	6	62.4

References

- M.D. Della Greca, A. Fiorentino, P. Monaco, L. Previtera, *Nat. Prod. Lett.* **4**(3), 183–188 (1994)

Astrasieversianin IX

C₄₈H₇₈O₁₈, M 942



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1].

Astragalus babatagi M. Pop. (*Leguminosae*) [2].

Astragalus kulabensis Lipsky (*Leguminosae*) [3].

Mp 208–209°C (from MeOH), $[\alpha]_D^{20} -6.5^\circ$ (c 0.17, MeOH).

CAS Registry Number: 101843-87-2.

IR ν_{\max}^{KBr} , cm^{-1} : 3350, 1730.

FDMS, m/z (%): 965 $[\text{M} + \text{Na}]^+$ (6.0), 943 $[\text{M} + \text{H}]^+$ (1.8), 942 $[\text{M}]^+$ (1.9).

$^1\text{H NMR}$ (200 MHz, $\text{CDCl}_3 + \text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.21 and 0.55 (2H-19, d, $J = 4$ Hz), 1.00, 1.07, 1.19, 1.22, 1.27, 1.32, 1.38 ($7 \times \text{CH}_3$, s), 1.20 (Rhap CH_3 , d, $J = 6$ Hz), 1.98 (CH_3COO , s).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)						
C-3	87.8	3-O- β -D-Xylp	α -L-Rhap	6-O- β -D-Xylp		
6	78.2	1	105.1	1	102.2	1 105.6
16	73.3	2	76.4	2	70.9	2 75.3
20	87.2	3	78.2	3	71.9	3 77.1
24	81.5	4	70.4	4	73.6	4 72.2
25	71.2	5	66.4	5	68.9	5 66.7
				6	18.5	Ac 170.7
						21.0

References

1. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(6), 1437–1441 (1986)
2. M.I. Isaev, M.B. Gorovits, N.K. Abubakirov, *Chem. Nat. Comp.* **24**(6), 753–754 (1988)
3. I.A. Sukhina, M.I. Isaev, *Chem. Nat. Comp.* **31**(5), 639–640 (1995)

Astragalus sieversianus Pall. (*Leguminosae*) [1].

Mp 192–193°C (from MeOH), $[\alpha]_{\text{D}}^{12} -9.0^\circ$ (c 0.20, MeOH).

CAS Registry Number: 101843-86-1.

IR $\nu_{\max}^{\text{Nujol}}$, cm^{-1} : 3350, 1720.

FDMS, m/z (%): 966 $[\text{M} + \text{Na} + \text{H}]^+$ (2.8), 943 $[\text{M} + \text{H}]^+$ (3.2).

$^1\text{H NMR}$ (200 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.23 and 0.56 (2H-19, brs), 1.10, 1.24, 1.24, 1.24, 1.31, 1.50, 1.58 ($7 \times \text{CH}_3$, s), 1.56 (Rhap CH_3 , d, $J = 6$ Hz), 1.90 (CH_3COO , s).

Table 1

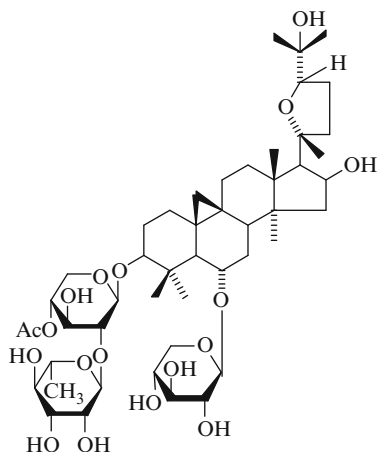
δ_{C} ($\text{C}_5\text{D}_5\text{N}$)							
C-3	87.6	3-O- β -D-Xylp	α -L-Rhap	6-O- β -D-Xylp			
6	78.4	1	105.1	1	101.9	1	105.8
16	73.4	2	77.4	2	71.1	2	75.5
20	87.3	3	73.1	3	72.5	3	77.0
24	81.6	4	74.7	4	74.1	4	72.4
25	71.3	5	62.5	5	69.6	5	66.9
				6	18.7	Ac	170.6
							20.8

References

1. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(6), 1437–1441 (1986)

Astrasieversianin XI

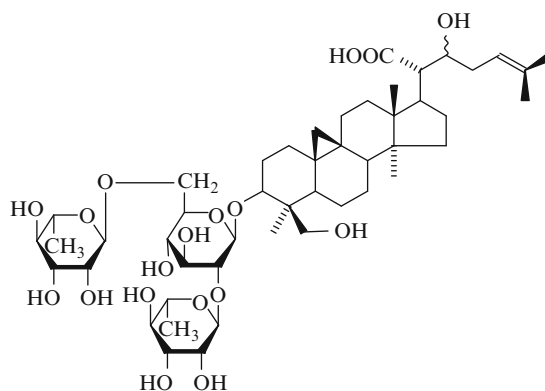
$\text{C}_{48}\text{H}_{78}\text{O}_{18}$, M 942



Taxonomy: Cycloartane Glycosides

Thalictoside V

$\text{C}_{48}\text{H}_{78}\text{O}_{18}$, M 942



Taxonomy: Cycloartane Glycosides

Thalictrum sp (*Ranunculaceae*) [1].

$[\alpha]_D -16.5^\circ$ (c 0.23, MeOH).

CAS Registry Number: 164231-02-1.

Negative ion FABMS m/z: 941 $[M-H]^-$.

1H NMR (C_5D_5N , δ , 0-TMS): 0.21 and 0.80 (2H-19, brs), 0.94, 1.27, 1.52, 1.63, 1.69 ($5 \times CH_3$, s), 1.63 (Rha CH_3 , d, $J = 6.2$ Hz), 1.70 (Rha CH_3 , d, $J = 6.2$ Hz), 2.65 (2H-23, m), 3.59 (H-3, brd, $J = 13$, 6 Hz), 4.03 (H-22, m), 4.96 (Glc H-1, d, $J = 7.7$ Hz), 5.47 (Rha H-1, brs), 5.61 (H-24, brt), 6.68 (Rha H-1, brs).

Table 1

δ_C (C_5D_5N)	δ_C (C_5D_5N)	δ_C (C_5D_5N)	α -L-Rhap
C-1 30.5	C-13 45.2	C-25 132.8	1 100.7
2 30.0	14 48.8	26 25.8	2 71.9
3 89.4	15 32.0	27 18.0	3 72.0
4 45.2	16 26.9	28 18.5	4 74.3
5 47.9	17 45.9	29 19.7	5 69.1
6 22.6	18 19.6	30 60.5	6 18.5
7 26.7	19 29.8	β -D-Glcp	α -L-Rhap
8 48.2	20 52.3	1 105.2	1 102.3
9 19.8	21 *	2 80.0	2 71.9
10 26.2	22 72.2	3 76.1	3 72.2
11 26.2	23 35.2	4 72.6	4 73.8
12 36.2	24 122.2	5 76.4	5 69.6
		6 68.1	6 18.3

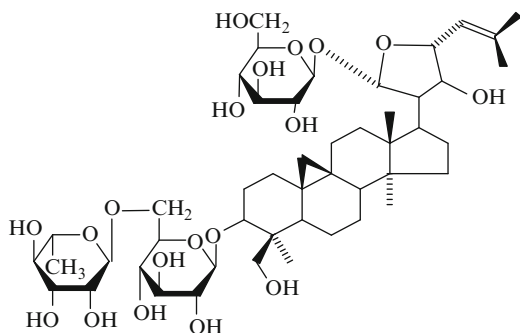
*Unobserved

References

1. H. YoshiKitsu, K. Hayashi, M. Kumabe, T. Nohara, *Phytochemistry* **38**(4), 939–942 (1995)

Squarroside C

$C_{48}H_{78}O_{19}$, M 958



Taxonomy: Cycloartane Glycosides

Thalictrum squarrosum St. ex. Willd. (*Ranunculaceae*) [1].

Mp 211–213°C (from $CHCl_3$ –MeOH– H_2O), $[\alpha]_D^{25} -46.9^\circ$ (c 1.1, MeOH).

CAS Registry Number: 252251-73-3.

IR ν_{max}^{KBr} , cm^{-1} : 3345, 2933, 1448, 1079, 1043.

FABMS m/z: 981 $[M + Na]^+$, 819 $[M + Na-162]^+$, 673 $[M + Na-146]^+$, 511 $[M + Na-2 \times 162-146]^+$.

HRFABMS m/z: 981.5026 ($C_{48}H_{78}O_{19}Na$).

Table 1

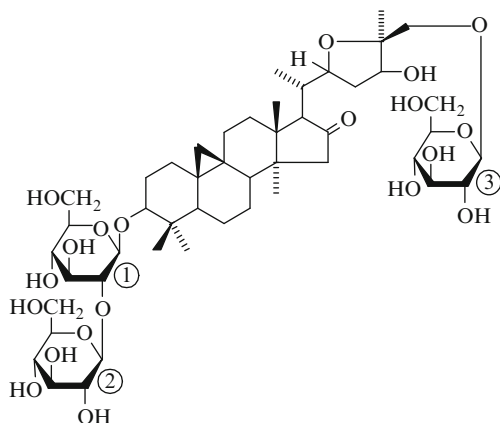
δ_C (C_5D_5N)	δ_H (J/Hz)	δ_C (C_5D_5N)	δ_H (J/Hz)
C-1 32.33	1.09 m, 1.54 m	C-26 18.73	1.77 d (1.2)
2 30.71	2.11 dddd (12, 10, 10, 4), 2.53 m	27 26.37	1.67 d (1.2)
		28 20.16	0.81 s
3 89.84	3.80 dd (12, 4.9)	29 21.66	1.58 s
4 45.44	–	30 63.75	3.86, 4.56 d (10.5)
5 48.14	1.40 m	3-O- β -D-Glcp	
6 22.44	0.96 m, 1.67 m	1 106.58	5.06 d (8)
7 27.19	0.92 m, 1.25 m	2 75.87	4.00
8 48.97	1.40 m	3 79.18	4.22
9 21.59	–	4 72.41	3.99
10 26.09	–	5 77.46	4.13
11 27.76	1.53 m, 2.32 m	6 68.59	4.21, 4.68 d (11.5)
12 36.59	1.40 m (2H)	21-O- β -D-Glcp	
13 45.70	–	1 96.87	5.64 d (8)
14 48.97	–	2 75.29	4.09 dd (9.2, 8)
15 26.73	0.78 m, 1.66 m	3 79.05	4.26
16 31.68	1.64 m, 1.98 brt (11.5)	4 72.41	4.15
17 41.04	2.92 q (11.5)	5 79.18	3.92
18 20.40	1.03 s	6 63.27	4.32 dd (11.2, 5.2), 4.52
19 30.52	0.10 brd (3.9), 0.42 d (3.9)	α -L-Rhap	
20 53.22	2.21 dt (11.5, 4, 4)	1 102.93	5.60 brs
21 99.10	5.96 d (4)	2 72.79	4.64 brs
22 75.69	4.25 m	3 73.25	4.56
23 81.71	5.04 dd (8.9, 4)	4 74.43	4.29
24 123.75	6.22 dq (8.9, 1.2)	5 70.14	4.41
C-25 136.26	–	6 19.14	1.62 d (6.1)

References

1. E.A. Khamidulina, A.S. Gromova, V.I. Lutsky, D. Li, N.L. Owen, *J. Nat. Prod.* **62**(11), 1586–1588 (1999)

Aquilegioside H

$C_{48}H_{78}O_{20}$, M 974



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

Awhite powder, $[\alpha]_D^{25} -32.4^\circ$ (c 0.50, MeOH).

Negative ion FABMS m/z: 973 [M-H]⁻.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.9	C-26	22.5 1.45 s
2	29.9	27	75.0 4.26, 4.39
3	88.7 3.46 dd (4.3, 11.6)	28	19.9 0.96 s
4	41.3 –	29	25.8 1.35 s
5	47.4	30	15.4 1.18 s
6	20.9	β-D-Glcp ₁	
7	26.2	1	104.8 4.96 d (7.9)
8	47.2	2	83.5 4.25
9	19.2 –	3	78.5 4.34 dd (9.2, 9.2)
10	26.7 –	4	71.6 4.18 dd (9.2, 9.2)
11	26.4	5	78.0 3.92 m
12	31.6	6	62.8 4.37, 4.54 brd (10.9)
13	42.3 –	β-D-Glcp ₂	

(continued)

Table 1 (continued)

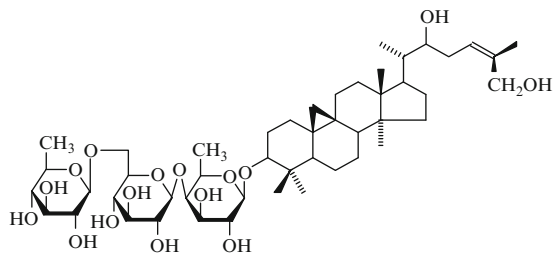
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	45.6 –	1	106.1 5.39 d (7.3)
15	50.9	2	77.1 4.14 dd (7.3, 9.2)
16	219.0	3	78.2 4.25
17	59.0 2.83 d (9.2)	4	71.7 4.32 dd (9.2, 9.2)
18	19.2 1.15 s	5	78.0 3.95 m
19	30.0 0.23 d (3.7), 0.51 d (3.7)	6	62.8 4.47, 4.52 brd (11.6)
20	36.4 2.25 m	β-D-Glcp ₃	
21	12.2 1.28 d (6.1)	1	105.9 4.98 d (7.9)
22	77.5 5.10 brt (6.7)	2	75.1 4.03 dd (7.9, 9.2)
23	38.8 2.08, 2.54 ddd (6.7, 6.7, 12.8)	3	78.7 4.21
C-24	77.9 4.45	4	71.5 4.23
25	84.1 –	5	78.4 3.95 m
		6	62.6 4.37, 4.52 brd (11.6)

References

1. M. Hishida, H. Yoshikitsu, M. Okawa, T. Nohara, *Chem. Pharm. Bull.* **51**(8), 956–959 (2003)

Thalictoside A

$C_{48}H_{80}O_{16}$, M 912



Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

An amorphous powder, $[\alpha]_D^{25} -1.3^\circ$ (c 0.25, C₅H₅N).

CAS Registry Number: 146445-76-3.

Negative ion FABMS m/z: 911 [M-H]⁻.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.27 and 0.52 (2H-19, d, J = 3.7 Hz), 0.91, 1.05, 1.05, 1.34, 2.03

(5 × CH₃, s), 1.18 (CH₃-21, d, J = 6.6 Hz), 1.60 (CH₃ Qui, d, J = 5.5 Hz), 1.74 (CH₃ Fuc, d, J = 6.7 Hz), 3.47 (H-3, dd, J = 11.6, 4.2 Hz), 4.48 and 4.45 (2H-26, d, J = 12.1 Hz), 4.72 (H-1 Fuc, d, J = 7.3 Hz), 5.03 (H-1 Glc, d, J = 7.7 Hz), 5.16 (H-7 Qui, d, J = 7.7 Hz), 5.69 (H-24, dd, J = 7, 7.3 Hz).

Table 1

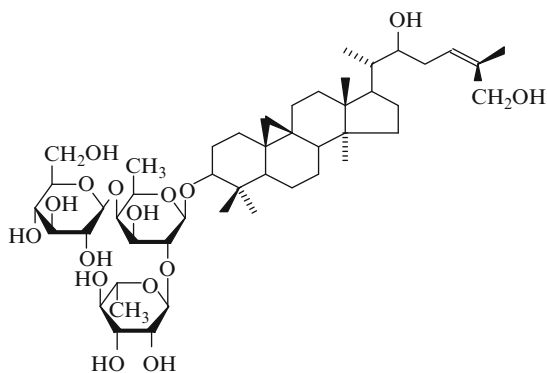
δ _C (C ₅ D ₅ N)		δ _C (C ₅ D ₅ N)		δ _C (C ₅ D ₅ N)		β-D-Glcp	
C-1	32.2	C-13	45.4	C-25	137.7	1	106.6
2	30.0	14	49.1	26	61.1	2	75.8
3	88.6	15	33.4	27	22.3	3	78.9
4	41.3	16	26.7	28	18.4	4	71.4
5	47.7	17	49.1	29	25.8	5	77.4
6	21.2	18	19.6	30	15.4	6	69.9
7	28.0	19	29.7	β-D-Fucp		β-D-Quip	
8	48.0	20	41.7	1	106.9	1	105.3
9	20.1	21	12.1	2	73.5	2	75.4
10	26.3	22	72.7	3	75.7	3	77.9
11	26.2	23	34.9	4	82.9	4	76.9
12	35.9	24	125.2	5	70.4	5	72.9
				6	17.9	6	18.6

References

1. Y. Hitoshi, H. Kazuhiro, S. Kazushi, K. Junci, Y. Shoji, N. Kimiko, M. Kotaro, T. Toshiaki, N. Toshihiro, Chem. Pharm. Bull. **40**(9), 2465–2468 (1992)

Squarroside I

C₄₈H₈₀O₁₆, M 912



Taxonomy: Cycloartane Glycosides

Thalictrum squarrosum Stephan ex Willd
(*Ranunculaceae*) [1].

[α]_D²⁵ −2.7° (c 0.90, MeOH).

CAS Registry Number: 288840-54-0.

Negative ion FABMS (m/z): 911 [M-H][−], 749 [M-H-hexose][−].

Table 1

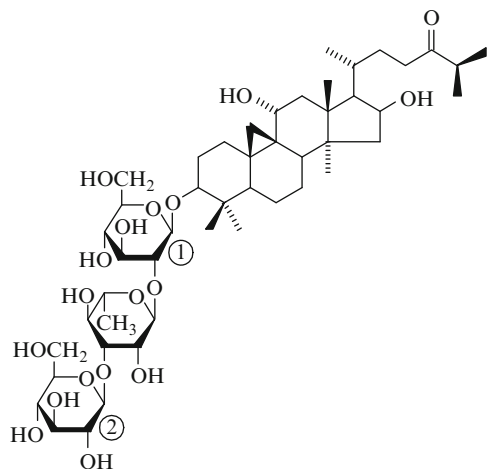
δ _C (C ₅ D ₅ N)		δ _H (J/Hz)		δ _C (C ₅ D ₅ N)		δ _H (J/Hz)	
C-1	32.3			C-27	22.7	2.01 s	
2	30.0			28	19.5	0.91 s	
3	88.4	3.38 dd (11.6, 4.3)		29	25.6	1.29 s	
4	41.2			30	15.5	1.23 s	
5	47.9			β-D-Fucp			
6	21.1			1	105.1	4.70 d (7.9)	
7	26.1			2	76.5	4.46	
8	47.7			3	77.1	4.10 brd (9.2)	
9	19.9			4	84.8	3.98	
10	26.3			5	70.3	3.74 m	
11	26.7			6	17.4	1.60 d (6.1)	
12	33.4			α-L-Rhap			
13	45.4			1	101.9	6.37 brs	
14	49.1			2	72.3	4.78 brd (3.7)	
15	35.8			3	72.4	4.62 dd (9.2, 3.7)	
16	28.0			4	74.1	4.27 dd (9.8, 9.2)	
17	49.0			5	69.5	4.75 m	
18	18.2	1.03 s		6	18.7	1.63 d (6.1)	
19	29.6	0.24 d (3.7), 0.55 d (3.7)		β-D-Glcp			
20	41.7			1	107.0	5.06 d (7.9)	
21	12.1	1.15 d (6.7)		2	75.7	3.98 dd (7.9, 9.2)	
22	72.7	4.01 brs		3	78.7	4.14 dd (9.2, 8.6)	
23	34.8			4	71.5	4.18 dd (8.6, 8.6)	
C-24	125.2	5.66 dd (6.7, 7.3)		5	78.5	4.00 m	
25	137.7			6	62.8	4.33 dd (11.6, 4.9), 4.48	
26	61.1						

References

1. H. Yoshimitsu, M. Nishida, Z.-Z. Qian, Z.-H. Lei, T. Nohara, Chem. Pharm. Bull. **48**(6), 828–831 (2000)

Curculigosaponin I

C₄₈H₈₀O₁₈, M 944



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 187–190°C, [α]_D +4.09° (c 0.51, MeOH).

CAS Registry Number: 142998-35-4.

FABMS m/z: 967 [M + Na]⁺ and 983 [M + K]⁺.

¹H NMR(400 MHz, C₅D₅N, δ, 0-TMS): 0.26 and 0.43 (2H-19, d, J = 4 Hz), 0.97 and 0.99 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.20, 1.25, 1.28, 1.33 (4 × CH₃, s), 1.65 (Rha CH₃, d, J = 6 Hz), 2.59 (H-25, septet, J = 6.8 Hz), 3.81 (Glc₂ H-5, m), 3.88 (Glc₁H-5, m), 4.04 (Glc₂ H-2, m), 4.05 (Glc₁ H-3, m), 4.07 (Glc₂ H-4, m), 4.18 (G₁ H-4, m), 4.20 (Glc₂ H-3, m), 4.23 and 4.30 (Glc₁ 2H-6, m), 4.25 and 4.40 (Glc₂ 2H-6, m), 4.45 (Rha H-4, m), 4.70 (Rha H-5, dq, J = 9.3, 6 Hz), 4.78 (Rha H-3, dd, J = 9, 2.4 Hz), 4.83 (Glc₁ H-1, d, J = 7.2 Hz), 4.92 (Rha H-2, brs), 5.41 (Glc₂ H-1, J = 7.8 Hz), 6.58 (Rha H-1, s).

Table 1

δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	α-L-Rhap
C-1	32.54	C-13	47.06
		C-25	41.33
2	30.09	14	50.05
		26	18.48
3	88.50	15	50.29
		27	18.48
4	40.73	16	71.78
		28	18.64
5	47.94	17	49.31
		29	25.80
6	21.26	18	22.07
		30	15.88

(continued)

Table 1 (continued)

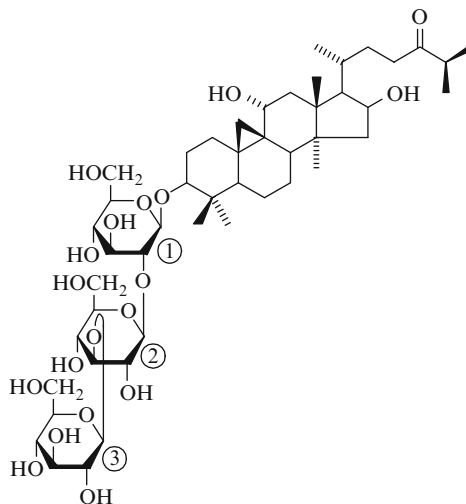
δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	α-L-Rhap
7	26.69	19	30.09
		β-D-Glcp ₁	β-D-Glcp ₂
8	49.17	20	30.25
		1	105.31
9	19.85	21	17.08
		2	79.78
10	26.02	22	30.79
		3	76.79
11	72.48	23	38.14
		4	71.78
12	40.14	24	215.96
		5	78.69
		6	62.81
		6	63.41

References

1. J. Xu, R. Xu, X. Li, *Planta. Med.* **58**(2), 208–210 (1992)

Curculigosaponin F

C₃₈H₈₀O₁₉, M 840



Taxonomy: Cycloartane Glycosides

Cucurliigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 166–168°C, [α]_D –28.60° (c 0.76, MeOH).

CAS Registry Number: 136771-46-5.

FABMS m/z: 983 [M + Na]⁺, 999 [M + K]⁺, 799 [M + H-162]⁺, 457 [799-162 × 2-H₂O]⁺, 439 [457-H₂O]⁺.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.25 and 0.42 (2H-19, d, J = 4 Hz), 0.96 and 0.98 (CH₃-26 and

CH₃-27, d, J = 6.8 Hz), 1.13, 1.26, 1.29, 1.37 (4 × CH₃, s), 2.52 (H-25, septet, J = 6.8 Hz), 4.78 (Glc_{p1}, H-1, d, J = 7.6 Hz), 5.16 (Glc_{p2} H-1, d, J = 7 Hz), 5.28 (Glc_{p3} H-1, d, J = 7 Hz).

Thalicoside C

C₄₈H₈₀O₁₉, M 960

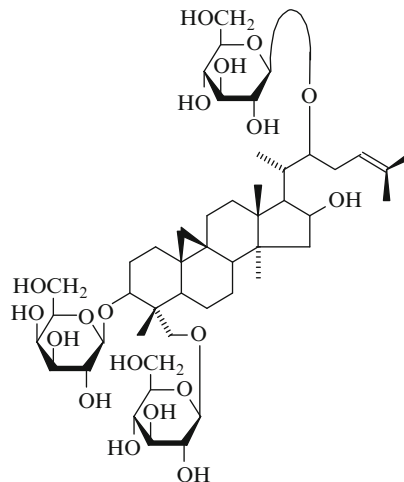


Table 1

δ_C (C ₅ D ₅ N)						
C-1	32.27	C-13	47.06	C-25	41.29	β -D-Glc _{p2}
2	29.91	14	50.06	26	18.36	1 105.21
3	88.81	15	50.29	27	18.36	2 75.63
4	40.73	16	71.64	28	18.42	3 87.98
5	47.82	17	49.26	29	25.74	4 69.84
6	21.35	18	22.06	30	15.40	5 78.42
7	26.70	19	29.91	β -D-Glc _{p1}		6 62.55
8	49.26	20	30.24	1	104.71	β -D-Glc _{p3}
9	20.03	21	17.07	2	82.91	1 105.75
10	26.12	22	30.81	3	77.87	2 75.63
11	72.53	23	38.14	4	71.64	3 78.42
12	40.15	24	215.88	5	78.22	4 71.53
				6	62.38	5 78.62
						6 62.78

References

- J.P. Xu, R.S. Xu, X.Y. Li, *Phytochemistry* **31**(1), 233–236 (1992)

Taxonomy: Cycloartane Glycosides

Thalictrum minus L. (*Ranunculaceae*) [1].

Mp 205–207°C, $[\alpha]_{546}^{25} +50^\circ$ (c 1.0, C₅H₅N).

CAS Registry Number: 146469-97-8.

FABMS m/z: 983 [M + Na]⁺, 965 [M + Na-H₂O]⁺, 821 [M + Na-162]⁺, 803 [M + Na-162-H₂O]⁺,

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	22-O- β -D-Glc _p
C-1	32.07	C-20	34.51	1 106.62 4.90 d (7.8)
2	29.53	21	13.10	2 75.43 3.92
3	81.73	22	85.28	3 78.89 4.05
4	45.08	23	33.36	4 72.02 4.05
5	40.72	24	123.10	5 78.03 3.75
6	20.78	25	131.50	6 63.06 4.28, 4.38
7	26.62	26	25.94	29-O- β -D-Glc _p
8	48.45	27	18.24	1 105.32 5.15 d (7.5)
9	19.77	28	19.67	2 75.58 3.88
10	26.00	29	71.38	3 78.69 4.08
11	26.00	30	11.80	4 72.02 4.01
12	33.50	β -D-Galp		5 78.23 3.86
13	46.03	1	106.37	6 63.17 4.28, 4.38
14	47.34	2	75.58	4.12
15	49.67	3	73.42	4.32
16	71.85	4	70.52	4.45
17	51.85	5	76.30	4.15
18	20.62	6	62.50	4.30, 4.43
19	30.50			0.39 d (4), 0.65 d (4)

641 [M + Na-324-H₂O]⁺, 636 [M-324]⁺, 439 [M + H-486-2 H₂O]⁺, 421 [M + H-486-3 H₂O]⁺.

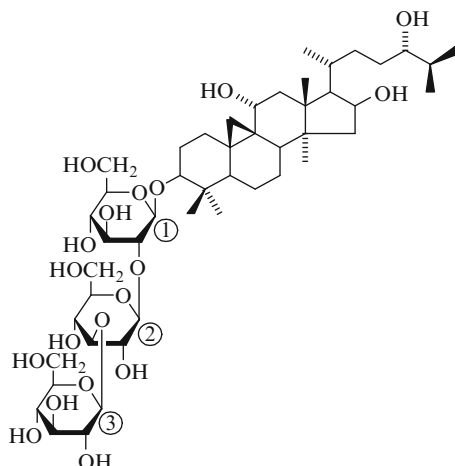
See Table 1

References

1. A.S. Gromova, V.I. Lutsky, S.V. Zinchenko, N.N. Trofimova, A.A. Semenov, N.A. Nakhova, *Chem. Nat. Comp.* **29**(1), 87–91 (1993)

Curculigosaponin K

C₄₈H₈₂O₁₉, M 962



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 185–188°C, [α]_D +8.34° (c 2.15, MeOH).

CAS Registry Number: 143572-71-8. FABMS m/z:

985 [M + Na]⁺, 1001[M + K]⁺.

¹H NMR (400 MHz, C₅D₅N, δ, 0-TMS): 0.28 and 0.44 (2H-19, d, J = 4 Hz), 1.05 and 1.07 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.14, 1.28, 1.31, 1.38 (4 × CH₃, s), 1.46 (CH₃-21, d, J = 6.5 Hz), 4.88 (Glc_{p1} H-1, d, J = 7.2 Hz), 5.26 (Glc_{p2} H-1, d, J = 7.8 Hz), 5.37 (Glc_{p3} H-1, d, J = 7.8 Hz).

Table 1

δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	β-D-Glc _{p2}
C-1	32.30	C-13	47.14
		C-25	34.13
2	29.91	14	50.07
		26	19.71
3	88.80	15	50.75
		27	17.72
		3	87.96

(continued)

Table 1 (continued)

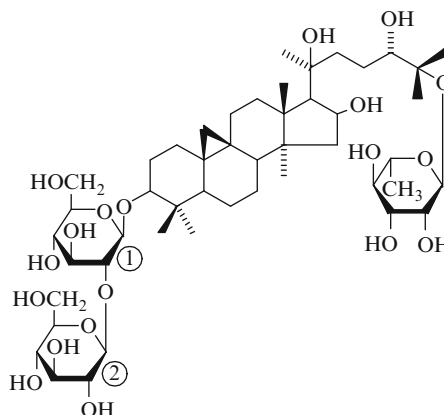
δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	δ _C (C ₅ D ₅ N)	β-D-Glc _{p2}
4	41.29	16	71.53
		28	18.52
5	47.82	17	49.27
		29	25.75
6	21.36	18	22.05
		30	15.40
7	26.12	19	30.07
		β-D-Glc _{p1}	β-D-Glc _{p3}
8	49.27	20	34.29
		1	104.73
9	20.03	21	17.61
		2	82.89
10	26.71	22	32.31
		3	77.91
11	72.59	23	31.50
		4	71.61
12	40.12	24	77.42
		5	78.42
		6	62.74
		6	62.33

References

1. J. Xu, R. Xu, *Phytochemistry* **31**(7), 2455–2458 (1992)

No Name (Cycloartane-3β,16β,20S,24S,25-pentol-3-O-[β-D-glucopyranosyl(1→2)-β-D-glucopyranoside], 25-O-α-L-rhamnopyranoside)

C₄₈H₈₂O₁₉, M 962



Taxonomy: Cycloartane Glycosides

Oxytropis bicolor Bunge (*Leguminosae*) [1].

Mp 212–214°C, [α]_D²⁵ +2.0° (c 0.3, MeOH).

CAS Registry Number: 137553-11-8.

Positive ion FABMS m/z: 969 [M + Li]⁺, 985 [M + Na]⁺.

Table 1

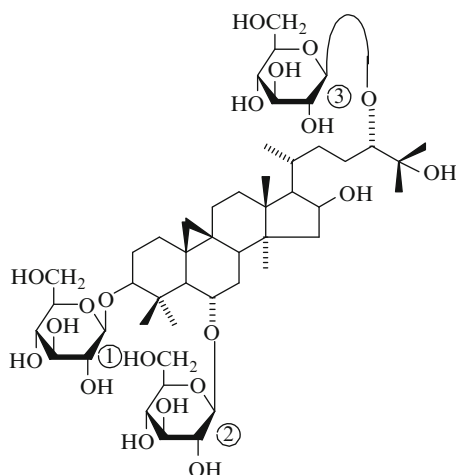
	δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		δ_C (C ₅ D ₅ N)		β -D-Glcp ₂	
C-1	33.1	C-13	46.9	C-25	78.0	1	105.8	
2	32.0	14	46.6	26	23.1	2	76.8	
3	88.7	15	48.7	27	24.1	3	77.7	
4	41.2	16	75.0	28	20.2	4	71.5	
5	47.5	17	56.3	29	25.7	5	78.0	
6	21.0	18	21.4	30	15.2	6	62.6	
7	25.7	19	30.6	β -D-Glcp ₁		α -L-Rhap		
8	48.0	20	76.8	1	104.7	1	98.5	
9	19.7	21	26.1	2	83.2	2	71.0	
10	26.2	22	41.2	3	77.7	3	71.5	
11	26.3	23	26.6	4	71.3	4	73.5	
12	29.9	24	78.5	5	78.1	5	68.0	
				6	62.6	6	18.7	

References

1. R.Q. Sun, Z.J. Jia, D.L. Cheng, *Phytochemistry* **30**(8), 2707–2709 (1991)

Trojanoside D

C₄₈H₈₂O₂₀, M 978



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (*Leguminosae*) [1].

$[\alpha]_D^{25} +22.5^\circ$ (c 0.1, MeOH).

CAS Registry Number: 223924-13-8.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3392, 2935, 1257, 1044.

FABMS m/z : 977 [M-H]⁻, 815 [M-H-162]⁻, 653 [M-H-162 × 2]⁻, 491 [M-H-162 × 3]⁻.

¹H and ¹³C NMR data of the aglycone moiety were superimposable on those reported for brachyoside C (803) [2].

Table 1

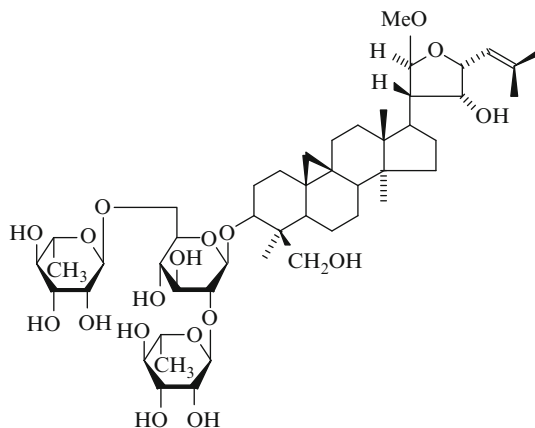
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)		
β -D-Glcp ₁		β -D-Glcp ₂			
C-1	104.8	4.37 d (7.5)	1	105.8	4.37 d (7.5)
2	75.2	3.21 dd (7.5, 9)	2	75.2	3.21 dd (7.5, 9)
3	78.2	3.37 t (9)	3	78.2	3.37 t (9)
4	71.4	3.31 t (9)	4	71.4	3.31 t (9)
5	77.5	3.27 ddd (3.5, 4.5, 9)	5	77.5	3.27 ddd (3.5, 4.5, 9)
6	62.5	3.71 dd (4.5, 12), 3.87 dd (2.5, 12)	6	62.2	3.71 dd (4.5, 12), 3.87 dd (2.5, 12)
β -D-Glcp ₃					
1	104.8	4.44 d (7.5)			
2	75.0	3.28 dd (7.5, 9)			
3	77.9	3.42 t (9)			
4	71.4	3.31 t (9)			
5	77.8	3.34 ddd (2.5, 4.5, 9)			
6	62.5	3.70 dd (4.5, 12), 3.90 dd (2.5, 12)			

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **62**(4), 563–568 (1999)
2. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)

Thalictoside III

C₄₉H₈₀O₁₈, M 956



Taxonomy: Cycloartane Glycosides*Thalictri* Herba (*Ranunculaceae*) [1].A white powder, $[\alpha]_D^{25} +4.5^\circ$ (c 0.51, MeOH).

CAS Registry Number: 155326-54-8.

Negative ion FABMS m/z : 955 $[M-H]^-$.Positive ion HRFABMS m/z : 979.5248 $[M + Na]^+$.

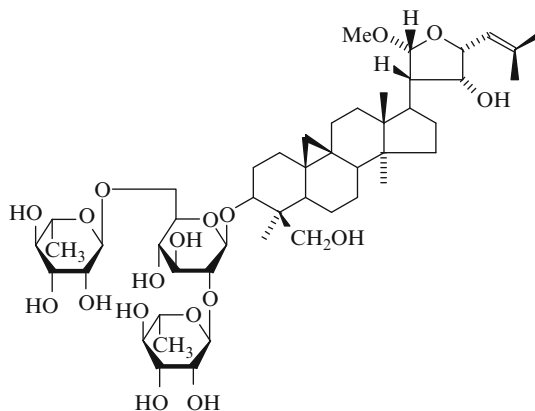
1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.28 and 0.87 (2H-19, d, $J = 3.7$ Hz), 0.99, 1.26, 1.56, 1.67, 1.70 ($5 \times CH_3$, s), 1.66 (CH_3 Rhap, d, $J = 6.2$ Hz), 1.73 (CH_3 Rhap, d, $J = 6.2$ Hz), 2.45 (H-20, m), 2.70 (H-17, m), 3.55 (OCH_3 , s), 3.63 (H-3, brd, $J = 13.6$ Hz), 4.27 (H-22, brs), 4.96 (H-23, dd, $J = 8.4, 4.4$ Hz), 4.99 (H-1 Glcp, d, $J = 7.7$ Hz), 5.15 (H-21, d, $J = 4.8$ Hz), 5.50 (H-1 Rhap, brs), 5.97 (H-24, d, $J = 8.4$ Hz), 6.71 (H-1 Rhap, brs).

Table 1

δ_C (C_5D_5N)						
C-1	30.8	C-13	45.5	C-25	136.1	α -L-Rhap
2	30.3	14	48.8	26	26.0	1 100.9
3	89.7	15	32.3	27	19.8	2 72.2
4	45.4	16	27.0	28	18.8	3 72.3
5	48.2	17	44.8	29	19.9	4 74.4
6	22.9	18	18.7	30	60.7	5 69.2
7	27.7	19	30.1	OMe	55.6	6 18.5
8	48.5	20	54.8	β -D-Glcp		α -L-Rhap
9	20.1	21	108.7	1	105.4	1 102.5
10	26.4	22	76.7	2	80.1	2 72.2
11	26.5	23	79.0	3	76.3	3 72.3
12	35.8	24	122.6	4	72.8	4 74.0
				5	76.6	5 69.8
				6	68.2	6 18.5

References

- H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, Chem. Pharm. Bull. **42**(1), 101–104 (1994)

Thalictoside IV $C_{49}H_{80}O_{18}$, M 956**Taxonomy:** Cycloartane Glycosides*Thalictri* Herba (*Ranunculaceae*) [1].A white powder, $[\alpha]_D^{25} -40.8^\circ$ (c 0.63, MeOH).

CAS Registry Number: 155313-57-8.

Negative ion FABMS m/z : 955 $[M-H]^-$.Positive ion HRFABMS m/z : 979.5250 $[M + Na]^+$.

1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.37 and 0.89 (2H-19, d, $J = 3.7$ Hz), 0.94, 1.06, 1.56, 1.72, 1.74 ($5 \times CH_3$, s), 1.65 (CH_3 Rhap, d, $J = 6.2$ Hz), 1.73 (CH_3 Rhap, d, $J = 6.2$ Hz), 2.11 (H-20, m), 2.75 (H-17, m), 3.42 (OCH_3 , s), 3.62 (H-3, dd, $J = 11.8, 4.4$ Hz), 4.15 (H-22, brs), 4.88 (H-23, dd, $J = 9.2, 3.8$ Hz), 5.00 (H-1 Glcp, d, $J = 7.7$ Hz), 5.05 (H-21, d, $J = 4.4$ Hz), 5.51 (H-1 Rhap, brs), 5.86 (H-24, d, $J = 9.2$ Hz), 6.71 (H-1 Rhap, brs).

Table 1

δ_C (C_5D_5N)	δ_C (C_5D_5N)	δ_C (C_5D_5N)	δ_C (C_5D_5N)	δ_C (C_5D_5N)	α -L-Rhap	
C-1	31.4	C-13	45.4	C-25	135.8	1 101.0
2	30.5	14	48.8	26	26.0	2 72.1
3	89.6	15	32.3	27	19.8	3 72.3
4	45.4	16	26.9	28	18.7	4 74.5
5	48.2	17	40.7	29	19.9	5 69.2
6	22.8	18	19.7	30	60.7	6 18.5

(continued)

Table 1 (continued)

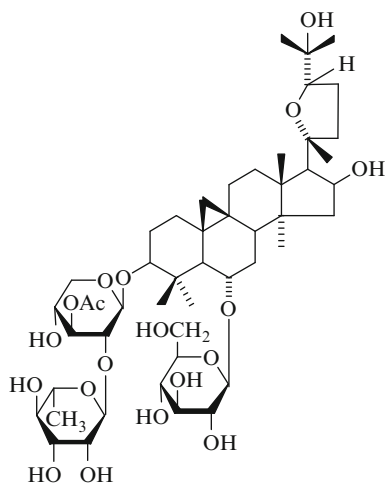
δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	α -L-Rhap
7	27.0	19	30.1	OMe	54.6
8	48.3	20	52.5	β -D-Glcp	1 102.5
9	20.1	21	104.9	1	105.3 2 72.1
10	26.5	22	75.0	2	80.1 3 72.3
11	26.7	23	80.6	3	76.3 4 74.0
12	36.0	24	123.8	4	72.8 5 69.8
				5	76.6 6 18.4
				6	68.2

References

- H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, Chem. Pharm. Bull. **42**(1), 101–104 (1994)

Astrasieversianin XII

C₄₉H₈₀O₁₉, M 972



Taxonomy: Cycloartane Glycosides

Astragalus sieversianus Pall. (*Leguminosae*) [1].

Mp 235–237°C (from MeOH–Me₂CO–CHCl₃), [α]_D¹² –4.0° (c 0.20, MeOH).

IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3350, 1735.

FDMS m/z (%): 995 [M + Na]⁺ (0.6), 972 [M]⁺ (1.6).

¹H NMR (200 MHz, C₅D₅N, δ , 0-TMS): 0.14 and 0.57 (2H-19, d, J = 4 Hz), 0.97, 1.26, 1.26, 1.30, 1.34, 1.52, 1.69 (7 × CH₃, s), 1.58 (Rhap CH₃, d, J = 6 Hz), 2.00 (CH₃COO, s).

Table 1

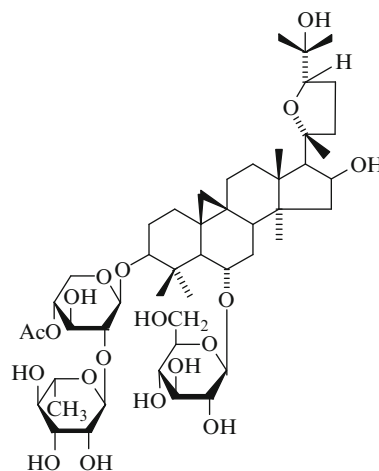
δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)
C-3	88.1	β -D-Xylp	β -D-Glcp	α -L-Rhap	Ac	
6	78.9	1 105.1	1 105.3	1 102.3	170.6	
16	73.3	2 76.0	2 75.7	2 72.0	20.8	
20	87.2	3 78.5	3 78.0	3 72.4		
24	81.6	4 70.5	4 71.9	4 73.8		
25	71.2	5 66.2	5 78.0	5 68.9		
			6 63.1	6 18.7		

References

- L.X. Gan, X.B. Han, Y.Q. Chen, Phytochemistry **25**(10), 2389–2393 (1986)

Astrasieversianin XIII

C₄₉H₈₀O₁₉, M 972

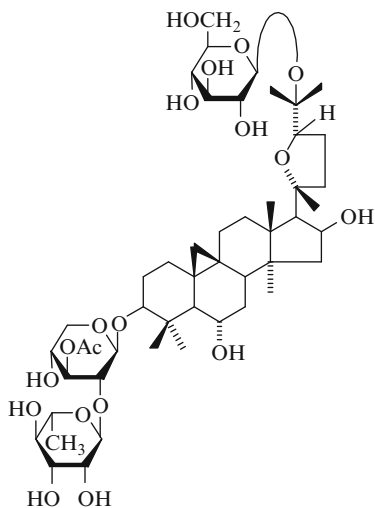


Taxonomy: Cycloartane Glycosides*Astragalus sieversianus* Pall. (*Leguminosae*) [1].Mp 223–225°C (from MeOH–H₂O), $[\alpha]_D^{12}$ –6.3° (c 0.18, MeOH–H₂O).IR $\nu_{\max}^{\text{Nujol}}$, cm⁻¹: 3320, 1735.FDMS m/z (%): 973 [M + H]⁺(3.8), 972 [M]⁺(3.2).¹H NMR (200 MHz, CDCl₃–C₅D₅N, δ , 0-TMS): 0.15 and 0.54 (2H-19, d, J = 4 Hz), 0.94, 1.18, 1.22, 1.29, 1.44, 1.48, 1.59 (7 × Me, s), 1.20 (Rhap CH₃, d, J = 6 Hz), 1.92 (CH₃COO, s).**Table 1**

δ_C (C ₅ D ₅ N)							
C-3	87.9	β -D-Xylp	β -D-Glcp	a-L-Rhap	Ac		
6	78.4	1	105.0	1	105.3	1	101.9
16	73.3	2	77.5	2	75.6	2	71.2
20	87.2	3	74.0	3	78.0	3	72.3
24	81.5	4	73.0	4	71.9	4	74.3
25	71.2	5	63.1	5	78.0	5	69.8
			6	62.2	6	18.7	

References

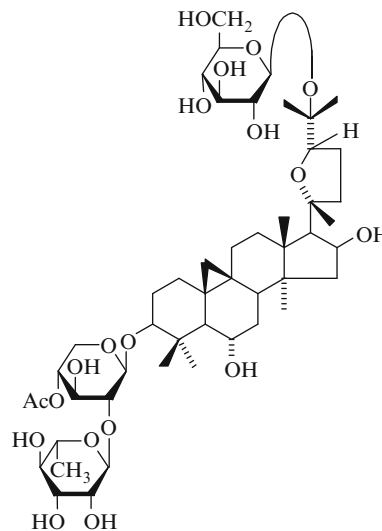
1. L.X. Gan, X.B. Han, Y.Q. Chen, *Phytochemistry* **25**(10), 2389–2393 (1986)

Asernestioside BC₄₉H₈₀O₁₉, M 972**Taxonomy:** Cycloartane Glycosides*Astragalus ernestii* Comb. (*Leguminosae*) [1–3].

CAS Registry Number: 123914-39-6.

References

1. H.K. Wang, K. He, L.Q. Lin, in *16th International Symposium on the Chemistry of Natural Products (IUPAC): Abstracts*, Kyoto, 1988, p. 219
2. H.K. Wang, K. He, L. Ji, Y. Tezuka, T. Kikuchi, I. Kitagawa, *Chem. Pharm. Bull.* **37**(8), 2041–2046 (1989)
3. H. Wang, K. He, L. Ling, H. Li, *HuaxueXuebao* **47**(6), 583–587 (1989). C.A., 111:228965q (1989)

Asernestioside CC₄₉H₈₀O₁₉, M 972**Taxonomy:** Cycloartane Glycosides*Astragalus ernestii* Comb. (*Leguminosae*) [1].Mp 204–207°C (from MeOH), $[\alpha]_D$ –13.22° (c 0.32, MeOH).

CAS Registry Number: 125028-57-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3375, 1732, 1623, 1369, 1241, 1039.
 FABMS m/z : 973 $[\text{M} + \text{H}]^+$.

Thalictoside XII

$\text{C}_{49}\text{H}_{80}\text{O}_{19}$, M 972

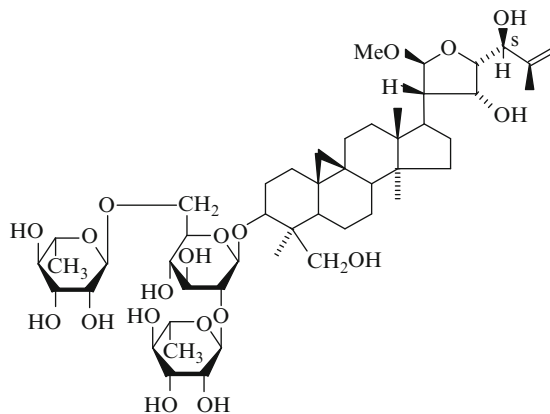


Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		δ_{H} (J/Hz)	δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		δ_{H} (J/Hz)
C-1	32.4	1.55 m, 1.18 m	C-28	20.0	0.94 s
2	30.3	2.23 m, 1.91 m	29	28.6	1.87 s
3	88.4	3.48 dd (11.5, 4.5)	30	16.6	1.41 s
4	42.6	–	$\beta\text{-D-Xylp}$		
5	54.0	1.65 d (9)	1	105.4	4.90 d (6)
6	67.7	3.72 td (9.4)	2	77.6	4.28 dd (8.5, 6)
7	38.4	1.64, 1.76 dt (12, 4)	3	74.6	4.24 t (8.5)
8	46.7	1.89 dd (12, 4)	4	73.3	5.25 td (8.5, 5)
9	20.8	–	5	62.5	3.53 dd (11.5, 8.5),
10	29.9	–			4.31 dd (11.5, 5)
11	26.2	1.88 m, 1.16 m	$\alpha\text{-L-Rhap}$		
12	33.4	1.59 m	1	101.9	6.32 d (1)
13	45.1	–	2	72.3	4.74 dd (3.5, 1)
14	46.0	–	3	72.5	4.61 dd (9.5, 3.5)
15	46.0	1.61 m, 1.99 dd (12.5, 8)	4	74.0	4.28 t (9.5)
16	73.5	4.89 td (8, 6)	5	69.9	4.72 dq (9.5, 6)
17	58.1	2.43 d (8)	6	18.6	1.68 d (6)
18	21.4	1.32 s	$\beta\text{-D-Glcp}$		
19	30.4	0.26 d (4), 0.56 d (4)	1	98.8	5.01 d (8)
20	87.2	–	2	75.1	3.96 t (8)
21	27.8	1.27 s	3	78.4	4.14
22	35.0	1.58 m, 2.79 td (11.5, 8)	4	71.3	4.12
23	25.9	1.93 m, 2.30 m	5	77.9	3.83 ddd (8.5, 5, 2.5)
24	82.0	3.88 dd (8.5, 7)	6	62.7	4.24 dd (11.5, 5),
25	78.5	–			4.37 dd (11.5, 2.5)
26	23.0	1.40 s	Ac	20.8	1.91 s
27	25.6	1.64 s		170.5	–

Taxonomy: Cycloartane Glycosides

Thalictrum sp. plants (*Ranunculaceae*) [1].

A white powder, $[\alpha]_{\text{D}}^{25} -2.4^\circ$ (c 1.00, MeOH).

CAS Registry Number: 193203-10-0.

Negative ion FABMS m/z : 971 $[\text{M}-\text{H}]^-$.

^1H NMR ($\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.27 and 0.84 (2H-19, d, $J = 3.7$ Hz), 0.97, 1.21, 1.55, and 2.11 ($4 \times \text{CH}_3$, s), 1.65 (Rha CH_3 -6, d, $J = 6.2$ Hz), 1.72 (Rha CH_3 -6, d, $J = 5.9$ Hz), 2.40 (H-20, m), 2.69 (H-17, m), 3.50 (OMe, s), 4.36 (H-23, m), 4.72 (H-22, brs), 5.04 (Glc H-1, d, $J = 7.7$ Hz), 5.10 (H-26, brs), 5.11 (H-24, d, $J = 7.7$ Hz), 5.13 (H-21, d, $J = 5.1$ Hz), 5.45 (H-26, brs), 5.49 (Rha H-1, brs), 6.71 (Rha H-1, brs).

Table 1

δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		δ_{C} ($\text{C}_5\text{D}_5\text{N}$)		$\alpha\text{-L-Rhap}$	
C-1	30.7	C-13	45.4	C-25	147.9	1	100.9
2	30.3	14	48.8	26	112.3	2	72.0
3	89.6	15	32.3	27	19.8	3	72.3
4	45.4	16	27.0	28	18.7	4	74.5
5	48.2	17	44.6	29	19.9	5	69.1
6	22.8	18	18.8	30	60.6	6	18.7
7	27.6	19	30.1	OMe	55.5	$\alpha\text{-L-Rhap}$	
8	48.4	20	54.3	$\beta\text{-D-Glcp}$		1	102.5
9	20.1	21	109.2	1	105.4	2	72.1
10	26.5	22	73.3	2	80.2	3	72.3
11	26.4	23	82.8	3	76.2	4	74.0
12	35.8	24	75.0	4	72.8	5	69.8
				5	76.5	6	18.5
				6	68.2		

References

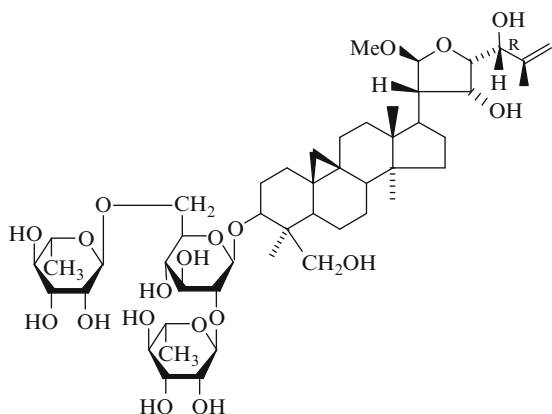
- H.K. Wang, K. He, L. Ji, Y. Tezuka, T. Kikuchi, I. Kitagawa, *Chem. Pharm. Bull.* **37**, 2041–2046 (1989)

References

1. H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, *Nat. Med.* **51**(2), 131–133 (1997)

Thalictoside XIII

C₄₉H₈₀O₁₉, M 972



Taxonomy: Cycloartane Glycosides

Thalictrum sp plants (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} +3.9^\circ$ (c 1.00, MeOH).

CAS Registry Number: 193203-11-1.

Negative ion FABMS m/z : 971 [M-H]⁻.

¹H NMR (C₅D₅N, δ , 0-TMS): 0.24 and 0.83 (2H-19, d, J = 3.7 Hz), 0.98, 1.21, 1.56, and 2.09 (4 × CH₃, s), 1.65 and 1.72 (2 × Rha CH₃-6, d, J = 5.9 Hz), 2.36 (H-20, m), 2.64 (H-17, m), 3.52 (OMe, s), 4.34 (H-23, m), 4.35 (H-22, brs), 5.04 (Glc H-1, d, J = 7.7 Hz), 5.04 (H-24, d, J = 7.7 Hz), 5.05 and 5.43 (2 H-26, brs), 5.16 (H-21, d, J = 4.8 Hz), 5.50 (Rha H-1, brs), 6.71 (Rha H-1, brs).

Table 1

δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	α -L-Rhap
C-1	30.7	C-13	45.4
2	30.3	14	48.8
3	89.7	15	32.3
		C-25	146.7
		26	112.7
		27	19.7
		1	100.9
		2	72.0
		3	72.3

(continued)

Table 1 (continued)

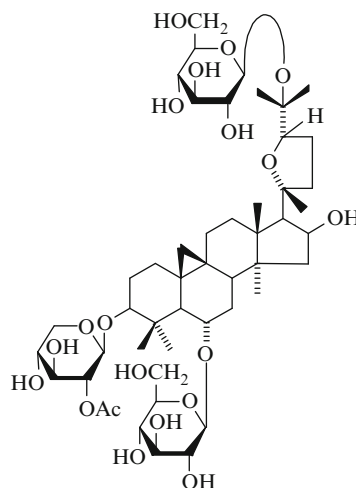
δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	δ_C (C ₅ D ₅ N)	α -L-Rhap
4	45.4	16	27.0	28	19.1
5	48.2	17	44.5	29	19.9
6	22.9	18	18.7	30	60.6
7	27.5	19	30.1	OMe	55.7
8	48.5	20	54.9	β -D-Glcp	1
9	20.1	21	109.0	1	105.4
10	26.5	22	74.8	2	80.2
11	26.4	23	83.1	3	76.2
12	35.8	24	75.9	4	72.8
				5	76.5
				6	68.2

References

1. H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, *Nat. Med.* **51**(2), 131–133 (1997)

Agroastragaloside IV

C₄₉H₈₀O₂₀, M 988



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].
Mp 187–189°C (from MeOH), $[\alpha]_D^{25} +13.9^\circ$ (c 0.75, MeOH).

CAS Registry Number: 164991-87-1.

IR ν_{\max}^{KBr} , cm^{-1} : 3430, 1755.

FABMS m/z: 1011 [M + Na]⁺.

HRFAB MS m/z: 1011.5167 [M + Na]⁺.

EIMS m/z (%): 472 (2), 454 (11), 395 (10), 311 (5), 270 (9), 143 (100), 125 (30).

Table 1

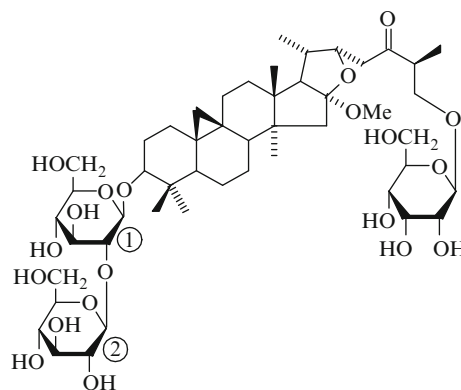
δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	32.2	C-27	25.8
2	30.1	28	19.9
3	89.0	29	28.4
4	42.4	30	16.7
5	52.6	β -D-Xylp	
6	79.4	1	104.9
	3.80 ddd (7.8, 7.8, 3.5)		4.80 d (7.7)
7	34.4	2	75.8
8	45.6	3	76.4
9	21.3	4	72.0
10	29.0	5	67.3
11	26.3	6-O- β -D-Glcp	
12	33.6	1	105.1
			4.92 d (7.5)
13	45.4	2	75.8
14	46.3	3	79.2
15	45.7	4	71.5
16	73.7	5	78.7
17	58.1	6	63.2
18	21.4	25-O- β -D-Glcp	
19	28.8	1	99.0
	0.16 d (4.1), 0.54 d (4.1)		5.07 d (7.7)
20	87.3	2	75.3
21	27.9	3	78.3
22	35.2	4	71.5
	1.60 m, 2.80 dd (19.5, 11.5)		
23	26.2	5	78.2
24	82.2	6	62.9
25	78.7	Ac	
26	23.1	21.2	2.04 s

References

1. Y. Zhou, M. Hirotani, H. Rui, T. Furuya, *Phytochemistry* **38**(6), 1407–1410 (1995)

Aquilegioside C

C₄₉H₈₀O₂₀, M 988



Taxonomy: Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} -28.3^\circ$ (c 1.08, C₅H₅N).

IR ν_{\max}^{KBr} , cm^{-1} : 3464, 1718

Positive ion FABMS m/z: 1011 [M + Na]⁺.

HRFABMS m/z: 1011.5156 [M + Na]⁺.

Table 1

δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)	δ_{C} (C ₅ D ₅ N)	δ_{H} (J/Hz)
C-1	31.9	C-28	19.5
2	29.9	29	25.8
3	88.7	30	15.3
4	41.3	OMe	50.1
5	47.5	β -D-Glcp ₁	
6	20.8	1	104.9
	0.70, 1.51		4.94 d (7.3)
7	26.2	2	83.4
	1.01, 1.22		4.28 dd (7.3, 9.2)
8	47.4	3	78.3
	1.55		4.32 dd (9.2, 9.2)
9	19.5	4	71.6
	–		4.17 dd (9.2, 9.2)
10	26.9	5	78.0
	–		3.90 m
11	26.5	6	62.8
	1.08, 1.91		4.35 dd (4.9, 11.6),
12	31.0		4.53 dd (2.4, 11.6)
	1.39, 1.53		
13	44.3	β -D-Glcp ₂	

(continued)

Table 1 (continued)

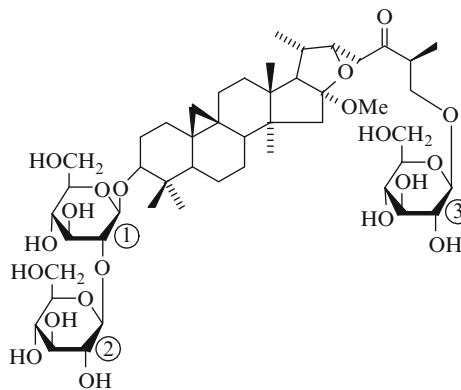
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
14	49.4	–	1 106.0 5.39 d (7.3)
15	45.1	1.63 d (13.4), 1.93 d (13.4)	2 77.1 4.13 dd (7.3, 9.2)
16	119.7	–	3 78.2 4.28 dd (9.2, 9.2)
17	69.0	2.42 brs	4 71.7 4.33 dd (9.2, 9.2)
18	19.4	1.17 s	5 78.0 3.92 m
19	30.3	0.13 d (4.3), 0.52 d (4.3)	6 62.8 4.44 dd (4.3, 11),
20	34.5	2.44 m	4.51 dd (3, 11)
21	18.2	1.13 d (7.3)	β -D-Allop
22	82.2	5.05 ddd (5.5, 7.9, 7.2)	1 102.3 5.31 d (7.9)
23	45.4	2.99 dd (5.5, 17.7), 3.19 dd (7.9, 17.7)	2 72.2 3.39 dd (3.1, 7.9) 3 73.1 4.70 dd (2.5, 3.1)
24	211.6	–	4 69.0 4.20 dd (3.1, 9.8)
25	47.2	3.13	5 76.0 4.44 m
26	71.6	3.78 dd (5.5, 9.8), 4.41 dd (7.3, 9.8)	6 63.0 4.35 dd (4.9, 11.6), 4.50 dd (2.4, 11.6)
27	13.7	1.16 d (6.7)	

Biological activity

Aquilegioside C suppressed the proliferation of lymphocytes and the 50% inhibitory concentrations (IC₅₀) were calculated from the dose-dependent curve (225 mg/ml or 227 μ M).

References

1. M. Nishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(6), 683–687 (2003)

Aquilegioside DC₄₉H₈₀O₂₀, M 988**Taxonomy: Cycloartane Glycosides**

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} -31.7^\circ$ (c 1.07, C₅H₅N).

Positive ion FABMS m/z: 1011 [M + Na]⁺.

HRFABMS m/z: 1011.5149 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	31.9	1.07, 1.41	C-28 19.4 1.10 s
2	29.8	1.84, 2.38	29 25.7 1.34 s
3	88.6	3.45 dd (4.9, 11.6)	30 15.3 1.16 s
4	41.2	–	OMe 50.1 3.36 s
5	47.5	1.22	β -D-Glcp ₁
6	20.7	0.69, 1.50	1 104.8 4.95 d (7.3)
7	26.1	0.99, 1.21	2 83.3 4.26 dd (7.3, 9.2)
8	47.3	1.53	3 78.3 4.33 dd (9.2, 9.2)

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
9	19.4	4	71.6
	–		4.17 dd (9.2, 9.2)
10	26.8	5	77.9
	–		3.90 m
11	26.4	6	62.7
	1.08, 1.90		4.34 brd, (10.4),
12	30.9		4.54 brd (10.3)
13	44.2	β -D-Glcp ₂	
14	49.3	1	105.9
	–		5.39 d (7.3)
15	45.1	2	77.0
	1.63 d (13.4), 1.93 d (13.4)		4.14 dd (7.3, 9.2)
16	119.7	3	78.2
	–		4.26 dd (9.2, 9.2)
17	69.0	4	71.7
	2.41 brs		4.32 dd (9.2, 9.2)
18	19.3	5	77.9
	1.17 s		3.95 m
19	30.3	6	62.7
	0.13 d (4.3), 0.51 d (4.3)		4.37 dd (4.3, 11),
20	34.4		4.51 brd (10.5)
21	18.1	β -D-Glcp ₃	
22	82.1	1	104.7
	5.05 ddd (5.5, 7.2, 7.9)		4.88 d (7.9)
23	45.4	2	74.9
	3.00 dd (5.5, 17.1),		4.00 dd (7.9, 9.2)
	3.21 dd (7.9, 17.1)	3	78.5
			4.21 dd (9.2, 9.2)
24	211.5	4	71.5
	–		4.25 dd (9.2, 9.2)
25	47.1	5	78.5
	3.17		3.95 m
26	71.6	6	62.7
	3.87 dd (5.5, 9.8),		4.37 dd (5.5, 11.5),
	4.43 dd (7.3, 9.8)		4.55 brd (10.4)
27	13.7		1.19 d (6.7)

Biological activity

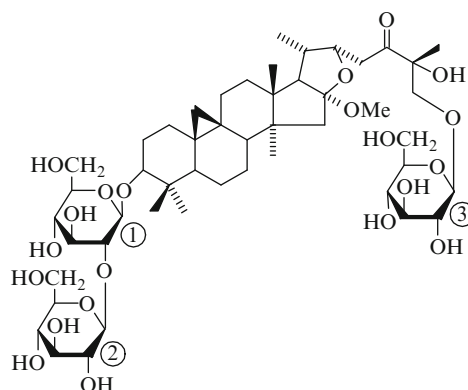
Aquilegioside D suppressed the proliferation of lymphocytes and the 50% inhibitory concentrations (IC₅₀, 154 mg/ml or 155 μ M) were calculated from the dose-dependent curve.

References

1. M. Nishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(6), 683–687 (2003)

Aquilegioside E

C₄₉H₈₀O₂₁, M 1004

**Taxonomy:** Cycloartane Glycosides

Aquilegia vulgaris L. (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} -8.6^\circ$ (c 0.43, C₅H₅N).

Positive ion FABMS m/z: 1027 [M + Na]⁺.

HRFABMS m/z: 1027.5081 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C	δ_H
C-1	32.0	1.07, 1.41	C-28	19.4
2	29.9	1.86, 2.39	29	25.8
3	88.7	3.46 dd (4.3, 11.5)	30	15.4
4	41.3	–	OMe	50.2
5	47.6	1.21	β -D-Glcp ₁	3.36 s

(continued)

Table 1 (continued)

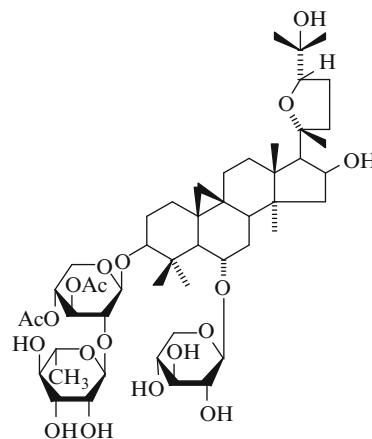
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)				
6	20.8	0.68, 1.50	1	105.0	4.97 d (7.3)
7	26.2	1.02, 1.22	2	83.6	4.27 dd (7.3, 9.2)
8	47.4	1.54	3	78.4	4.37 dd (9.2, 9.2)
9	19.5	–	4	71.6	4.19 dd (9.2, 9.2)
10	26.9	–	5	78.0	3.90 m
11	26.5	1.08, 1.91	6	62.8	4.32 brd (10.6),
12	31.0	1.40, 1.53			4.63 brd (10.8)
13	44.3	–	β -D-Glcp ₂		
14	49.4	–	1	106.2	5.41 d (7.3)
15	45.3	1.65 d (12.8), 1.93 d (12.8)	2	77.2	4.15 dd (7.3, 9.2)
16	119.6	–	3	78.3	4.27 dd (9.2, 9.2)
17	69.1	2.44 brs	4	71.7	4.37 dd (9.2, 9.2)
18	19.4	1.19 s	5	78.0	3.96 m
19	30.4	0.13 d (3.7), 0.50 d (3.7)	6	62.8	4.48 brd (10.4),
20	34.5	2.53 m			4.52 dd (3.1, 11.5)
21	18.2	1.18 d (7.3)	β -D-Glcp ₃		
22	82.2	5.22 ddd (6.7, 6.7, 7.3)	1	105.6	4.93 d (7.9)
23	41.8	3.52 dd (6.7, 18.3),	2	75.0	4.00 dd (7.9, 9.2)
		3.60 dd (6.7, 18.3)	3	78.8	4.22 dd (9.2, 9.2)
24	214.3	–	4	71.6	4.26 dd (9.2, 9.2)
25	79.8	–	5	78.5	3.96 m
26	77.2	4.21 d (11), 4.31 d (11)	6	62.7	4.39 dd (5.5, 11.6)
27	23.1	1.56 s			4.57 brd (11)

Biological activity

Aquileioside E suppressed the proliferation of lymphocytes and the 50% inhibitory concentrations (IC₅₀, 73 mg/ml or 72 μ M) were calculated from the dose-dependent curve.

References

- M. Nishida, H. Yoshimitsu, M. Okawa, T. Nohara, Chem. Pharm. Bull. **51**(6), 683–687 (2003)

Trojanoside JC₅₀H₈₀O₁₉, M 984**Taxonomy:** Cycloartane Glycosides

Astragalus trojanus Stev. (Leguminosae) [1].

White powder.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3408, 2928, 1745, 1371, 1244, 1042.

HRFABMS m/z: [M + Na]⁺ 1007.3524.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.7	C-28	20.5
2	30.4	29	28.7
3	89.2	30	17.3
			3.24 dd (11.6, 4.4)
4	43.2	3-O- β -D-Xylp	
5	52.8	1	104.5
6	78.5	2	75.2
7	34.3	3	72.6
8	44.6	4	70.3
			5.13 dd (6.5, 4.4)
9	22.1	5	61.7
			3.66 ^a , 4.32 dd (12.1, 4.1)
10	29.0	α -L-Rhap	
11	27.2	1	102.9
12	34.1	2	71.5
13	46.1	3	73.3
14	47.0	4	74.6
15	46.6	5	72.9
16	74.3	6	19.5
			5.03 dd (7.1, 7.3)

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
17	59.0		2.56 d(7.7) 1.38 s
18	21.2	6-O- β -D-Xylp	
19	27.3	1	106.6 4.79 d (7.2) 0.15 d (4), 0.60 d (4)
20	88.2	2	76.2 3.95 dd (8.1, 7.7)
21	29.5	3	79.3 4.08 t (8.5)
22	35.8	4	71.9 4.14 ^a
23	27.2	5	67.8 3.64 ^a , 4.28 dd (11.3, 5)
24	82.5	Ac	3.87 dd (5.3, 12.2)
25	72.1		21.2 1.91 s
26	29.0		21.7 2.07 s
27	28.0		171.0 – 171.1 –

^aMultiplicity of the signals is unclear due to overlapping

References

1. E. Bedir, I.I. Tatli, I. Calis, I.A. Khan, Chem. Pharm. Bull. **49**(11), 1482–1486 (2001)

Taxonomy: Cycloartane Glycosides

Thalictrum foeniculaceum (Ranunculaceae) [1].

Mp 254°C (from MeOH), $[\alpha]_D^{25} +12.5^\circ$ (c .99, MeOH).

CAS Registry Number: 142605-09-2.

IR ν_{\max}^{KBr} , cm⁻¹: 3300–3000, 1750.

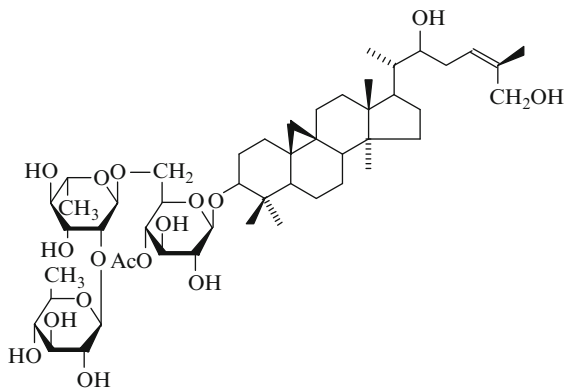
EIMS m/z (%): 636 (0.7), 457 (4), 441 (30), 423 (29), 408 (20), 357 (36), 313 (25), 232 (40), 222 (56), 181 (31), 175 (11.6), 147 (13.5), 43 (100).

FABMS m/z: 977 [M + Na]⁺, 534, 531, 513, 496, 457, 441, 440, 423, 351, 335, 327, 325, 313, 309, 297, 293, 203, 189.

¹H NMR(400 MHz, C₅D₅N, δ , 0-TMS): 0.20 and 0.43 (2H-19, d, J = 4.4 Hz), 0.85 (CH₃, s) 0.95 (CH₃, s), 1.02 (CH₃, s), 1.15 (CH₃-21, d, J = 6.6 Hz), 1.57 (CH₃, d, J = 6 Hz), 1.75 (CH₃, d, J = 6.6 Hz), 2.00 (CH₃-27, s), 2.10 (CH₃COO, s), 2.40 (H-23, m), 2.75 (H-23, m), 3.30 (H-3, dd, J = 10.7, 4.4 Hz), 3.87 (H-26, d, J = 12 Hz), 4.28 (H-26, d, J = 12 Hz), 4.31 (1H, dd, J = 5.9, 2 Hz), 4.79 (anomeric H, d, J = 2 Hz), 5.00 (anomeric H, d, J = 7.7 Hz), 5.07 (anomeric H, d, J = 8 Hz), 5.67 (H-24, t, J = 7.3 Hz).

Thalifoenoside A

C₅₀H₈₂O₁₇, M 954

**Table 1**

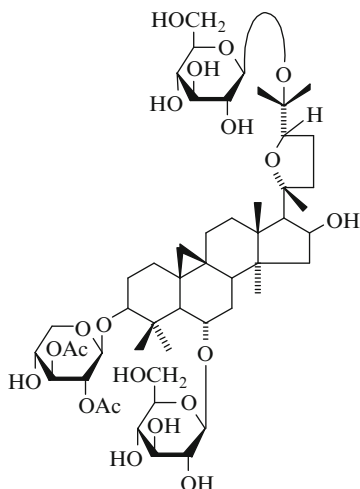
δ_C (C ₅ D ₅ N)						
C-1	32.1	C-14	47.0	C-27	22.1	2 83.1
2	29.6	15	35.9	28	19.6	3 72.8
3	88.7	16	28.0	29	25.4	4 74.5
4	41.0	17	49.0	30	15.1	5 70.5
5	47.6	18	18.2	β -D-Glcp		6 18.4
6	21.3	19	29.6	1	104.9	β -D-Quip
7	26.2	20	41.0	2	75.2	1 106.3
8	47.9	21	12.0	3	75.2	2 76.7
9	20.2	22	72.8	4	73.5	3 78.5
10	26.7	23	34.7	5	77.2	4 71.2
11	26.1	24	125.0	6	69.7	5 77.6
12	33.3	25	137.7	α -L-Rhap		6 17.6
13	45.4	26	61.0	1	103.4	Ac 21.2
						170.0

References

1. Y. Yi, Z. Wu, J. China Pharm. Univ. **22**(5), 270–274 (1991)

Agrostragaloside III

C₅₁H₈₂O₂₁, M 1030



Taxonomy: Cycloartane Glycosides

Astragalus membranaceus Bunge (*Leguminosae*) [1].

Mp 191–193°C (from MeOH). $[\alpha]_D^{25} +5.9^\circ$ (c 2.74, MeOH).

CAS Registry Number: 165074-74-8.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm⁻¹: 3425, 1750, 1250, 1035.

FABMS m/z: 1053 [M + Na]⁺.

HRFAB MS m/z: 1053.5277 [M + Na]⁺.

EIMS m/z (%): 472 (9), 454 (21), 395 (10), 271 (10), 187 (16), 143 (100), 125 (78).

Table 1

$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$
C-1	32.1	C-27	25.9 1.66 s
2	29.9	28	20.0 0.90 s
3	89.4 3.65 dd (11.6, 4.4)	29	28.4 1.76 s
4	42.4 –	30	16.7 1.27 s
5	52.5 1.88 m	$\beta\text{-D-Xylp}$	
6	79.4 3.78 ddd (8.5, 8.5, 4)	1	104.2 4.81 d (7.6)
7	34.4	2	73.3
8	45.7	3	77.0
9	21.0 –	4	71.5
10	28.8 –	5	66.9
11	26.3	6-O- $\beta\text{-D-Glcp}$	
12	33.6	1	105.1 4.91 d (7.2)
13	45.4 –	2	75.7
14	46.3 –	3	79.2
15	45.7	4	72.0
16	73.7 4.88 m	5	78.7

(continued)

Table 1 (continued)

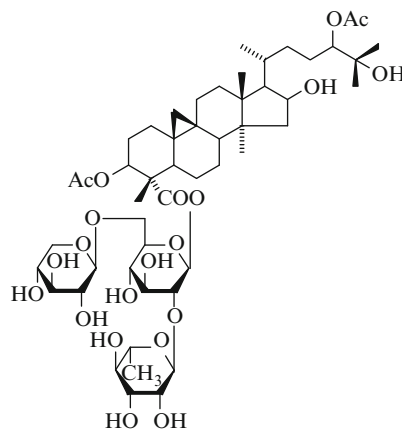
$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$	$\delta_C(\text{C}_5\text{D}_5\text{N})$	$\delta_H(\text{J/Hz})$
17	58.2 2.42 d (7.2)	6	63.2
18	21.4 1.33 s	25-O- $\beta\text{-D-Glcp}$	
19	29.0 0.18 d (4.2), 0.55 d (4.2)	1	99.0 5.06 d (7.3)
20	87.4 –	2	75.3
21	28.0 1.25 s	3	78.3
22	35.2 1.61 m, 2.79 dd (19.8, 11.5)	4	71.5
23	26.2	5	78.1
24	82.2 3.91 m	6	62.9
25	78.8 –	Ac	170.0 –
26	23.1 1.42 s		170.7 –
			21.0 1.97 s
			21.3 2.03 s

References

1. Y. Zhou, M. Hirotani, H. Rui, T. Furuya, *Phytochemistry* **38**(6), 1407–1410 (1995)

No Name (3,16,24,25-Tetrahydrocycloartan-28-oic acid; (3 β ,16 β ,24 ζ)-form, 3,24-Di-Ac, 28-O-[$\alpha\text{-L-rhamnopyranosyl-(1}\rightarrow\text{2)-}[\beta\text{-D-xylofuranosyl-(1}\rightarrow\text{6)]-}\beta\text{-D-glucopyranosyl}]$ ester)

C₅₁H₈₂O₂₁, M 1030



Taxonomy: Cycloartane Glycosides*Thalictrum uchiyamai* Nakai (*Ranunculaceae*) [1].

Mp 220–222°C.

CAS Registry Number: 184169-62-8.

IR ν_{\max}^{KBr} , cm^{-1} : 3410, 2920, 1730, 1450, 1250, 1070, 1020.FABMS m/z : $[\text{M}-\text{H}]^+$ 1029, 589, 547, 529.

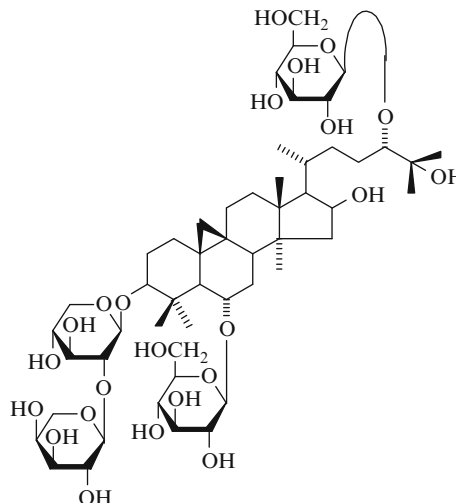
^1H NMR (500 MHz, CD_3OD , δ , 0-TMS): 0.27 and 0.71 (2H-19, d, $J = 4.8$ Hz), 0.87 (CH_3 -28, s), 0.88 (CH_3 -21, d, $J = 6.5$ Hz), 1.12 (CH_3 -18, s), 1.13 (CH_3 -26, CH_3 -27, s), 1.19 (CH_3 -Rhap, d, $J = 6.2$ Hz), 1.26 (CH_3 -30, s), 2.02 (CH_3COO , s), 2.05 (CH_3COO , s), 4.19 (H-1 Xylp, d, $J = 7.3$ Hz), 4.30 (H-16, m), 4.59 (H-3, dd, $J = 5, 11.8$ Hz), 4.76 (H-24, brd), 5.29 (H-1 Rhap, d, $J = 1.6$ Hz), 5.56 (H-1 Glcp, d, $J = 7.6$ Hz).

Table 1

$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$					
C-1	32.34	C-16	72.89	β -D-Glcp	β -D-Xylp
2	28.00	17	57.81	1 94.57	1 105.59
3	81.33	18	20.62	2 77.56	2 74.88
4	51.47	19	30.20	3 79.16	3 77.53
5	49.34	20	31.06	4 70.80	4 70.99
6	23.24	21	18.21	5 77.02	5 66.81
7	27.61	22	34.11	6 69.68	3-OAc
8	49.98	23	27.30	α -L-Rhap	172.66
9	22.08	24	81.37	1 101.52	21.18
10	26.80	25	72.86	2	24-OAc
11	27.49	26	25.89	3 72.11	173.36
12	33.80	27	25.84	4 73.79	21.38
13	46.48	28	20.01	5 70.04	
14	47.73	29	172.90	6 18.42	
15	49.56	30	21.87		

References

1. Y.-H. Choi, N.G. Kik, I.R. Lee, Arch. Pharm. Res. **19**(5), 429–431 (1996)

Trojanoside F $\text{C}_{52}\text{H}_{88}\text{O}_{23}$, M 1080**Taxonomy:** Cycloartane Glycosides*Astragalus trojanus* Stev. (*Leguminosae*) [1]. $[\alpha]_{\text{D}}^{25} + 5.2^\circ$ (c 0.1, MeOH).

CAS Registry Number: 223924-15-0

IR ν_{\max}^{KBr} , cm^{-1} : 3408, 2928, 1745, 1371FABMS m/z : 1079 $[\text{M}-\text{H}]^-$, 947 $[\text{M}-\text{H}-132]^-$, 785 $[\text{M}-\text{H}-132-162]^-$, 491 $[\text{M}-\text{H}-162 \times 2-132 \times 2]^-$.

^1H and ^{13}C NMR data of the aglycone moiety were superimposable on those reported for brachyoside C (803) [2].

Table 1

δ_{C} (CD_3OD)		δ_{H} (J/Hz)	δ_{C} (CD_3OD)		δ_{H} (J/Hz)
β -D-Xylp			24-O- β -D-Glcp		
C-1	105.6	4.50 d (7.7)	1	104.7	4.44 d (7.5)
2	82.8	3.45 dd (7.7, 9)	2	75.2	3.27 dd (7.5, 9)
3	76.6	3.55 t (9)	3	77.6	3.40 t (9)
4	70.6	3.54 ddd (4.5, 9, 11)	4	71.1	3.34 t (9)
5	65.7	3.22 t (11), 3.89 dd (4.5, 11)	5	77.7	3.33 ddd (2.5, 4.5, 11)
6-O- β -D-Glcp			6	62.5	3.70 dd (4.5, 11), 3.89 dd (2.5, 11)
1	104.7	4.36 d (7.5)	α -L-Arap		
2	75.3	3.21 dd (7.5, 9)	1	106.2	4.51 d (5.8)

(continued)

Table 1 (continued)

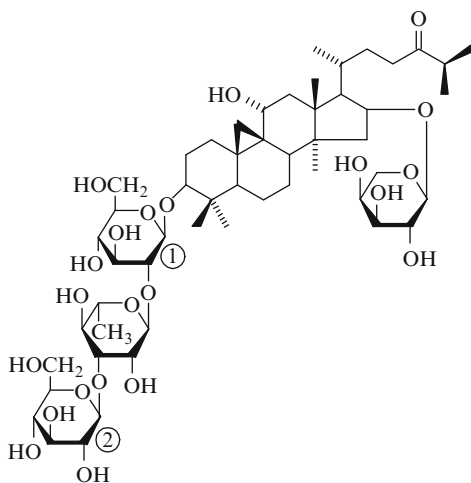
δ_C (CD ₃ OD)	δ_H (J/Hz)	δ_C (CD ₃ OD)	δ_H (J/Hz)
3	78.2	3.36 t (9)	
4	71.4	3.30 t (9)	
5	77.5	3.28 ddd (2.5, 4.5, 11)	
6	62.2	3.68 dd (4.5, 11), 3.89 dd (2.5, 11)	5 66.8 3.54 dd (3.5, 12), 3.93 dd (2.5, 12)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **62**(4), 563–568 (1999)
2. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)

Curculigosaponin J

C₅₃H₈₈O₂₂, M 1076



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 195–197°C, $[\alpha]_D^{+25}$ +6.37° (c 0.97, MeOH).

CAS Registry Number: 142998-36-5.

FABMS m/z: 1099 [M + Na]⁺ and 1115 [M + K]⁺.

¹H NMR (400 MHz, C₅D₅N, δ , 0-TMS): 0.26 and 0.43 (2H-19, d, J = 4 Hz), 1.04 and 1.06 (CH₃-26 and CH₃-27, d, J = 6.8 Hz), 1.19, 1.28, 1.30 and 1.34 (4 × CH₃, s), 1.61 (Rhap CH₃, d, J = 6 Hz), 2.67 (H-25, septet, J = 6.8 Hz), 4.53 (Arap H-1, d, J =

7 Hz), 4.86 (Glc_{p1} H-1, d, J = 7.2 Hz), 5.52 (Glc_{p2} H-1, d, J = 7.8 Hz), 6.68 (Rhap H-1, s).

Table 1

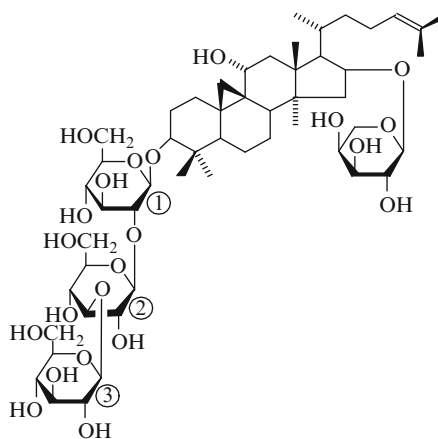
δ_C (C ₅ D ₅ N)							
C-1	32.66	C-15	50.06	C-29	25.85	5	69.71
2	30.09	16	82.54	30	15.82	6	18.57
3	75.94	17	49.38	β -D-Glc _{p1}		β -D-Glc _{p2}	
4	40.89	18	22.05	1	105.31	1	106.58
5	48.07	19	30.09	2	79.79	2	75.79
6	21.36	20	30.31	3	77.32	3	78.48
7	26.67	21	16.79	4	71.68	4	72.39
8	49.17	22	31.29	5	77.95	5	78.40
9	19.95	23	38.60	6	62.69	6	62.93
10	26.18	24	215.44	α -L-Rhap		α -L-Arap	
11	72.39	25	41.38	1	101.34	1	107.06
12	40.08	26	18.57	2	71.68	2	72.90
13	47.12	27	18.57	3	83.27	3	74.44
14	49.89	28	18.39	4	72.90	4	69.24
						5	66.58

References

1. J. Xu, R. Xu, X. Li, *Planta Med.* **58**(2), 208–210 (1992)

Curculigosaponin M

C₅₃H₈₈O₂₂, M 1076



Taxonomy: Cycloartane Glycosides

Curculigo orchoides Gaerth. (*Hypoxidaceae*) [1].

Mp 193–196°C, $[\alpha]_D^{+25}$ +12.07° (c 1.13, MeOH).

CAS Registry Number: 143599-92-2.

FABMS m/z: 1099 [M + Na]⁺, 1115 [M + K]⁺.

^1H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.25 and 0.45 (2H-19, d, $J = 4$ Hz), 1.15, 1.19, 1.26, 1.26, 1.63, 1.66 ($6 \times \text{CH}_3$, s), 1.34 (CH_3 -21, d, $J = 6.8$ Hz), 4.62 (Ara H-1, d, $J = 7.2$ Hz), 4.85, 5.27, 5.39 ($3 \times \text{Glc}$ H-1, d, $J = 7.8$ Hz).

Table 1

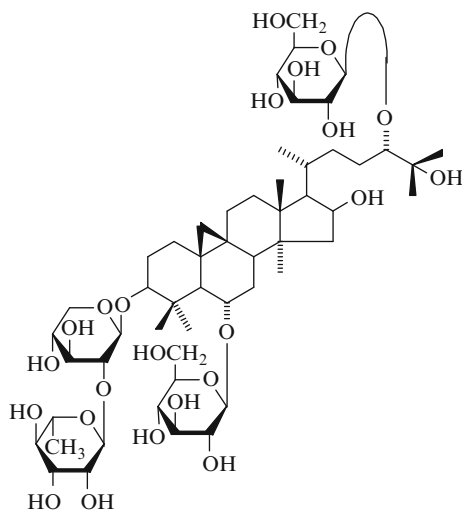
$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$							
C-1	32.33	C-15	50.06	C-29	25.88	5	78.12
2	29.86	16	82.46	30	15.37	6	62.43
3	88.85	17	49.28	$\beta\text{-D-Glcp}_1$		$\beta\text{-D-Glcp}_3$	
4	41.26	18	22.18	1	104.06	1	105.61
5	47.78	19	30.18	2	82.57	2	75.56
6	21.33	20	37.22	3	77.81	3	78.54
7	26.64	21	19.96	4	71.48	4	71.39
8	49.17	22	30.18	5	78.56	5	78.36
9	19.96	23	25.71	6	62.64	6	62.30
10	25.71	24	126.73	$\beta\text{-D-Glcp}_2$		$\alpha\text{-L-Arap}$	
11	72.68	25	129.94	1	104.93	1	107.19
12	40.17	26	25.88	2	75.54	2	72.14
13	47.00	27	17.83	3	87.82	3	74.34
14	49.94	28	18.36	4	69.65	4	69.07
						5	66.39

References

1. J. Xu, R. Xu, *Phytochemistry* **31**(7), 2455–2458 (1992)

Trojanoside E

$\text{C}_{53}\text{H}_{90}\text{O}_{23}$, M 1094



Taxonomy: Cycloartane Glycosides

Astragalus trojanus Stev. (*Leguminosae*) [1].

$[\alpha]_{\text{D}}^{25} + 2.6^\circ$ (c 0.1, MeOH).

CAS Registry Number: 223924-14-9.

IR $\nu_{\text{max}}^{\text{KBr}}$, cm^{-1} : 3392, 2933, 1257, 1044.

FABMS m/z : 1093 $[\text{M-H}]^-$, 947 $[\text{M-H-1146}]^-$, 785

$[\text{M-H-146-162}]^-$, 653 $[\text{M-H-146-162-132}]^-$, 491

$[\text{M-H-162} \times 2\text{-146-132}]^-$.

^1H and ^{13}C NMR data of the aglycone moiety were superimposable on those reported for brachyoside C (803) [2].

Table 1

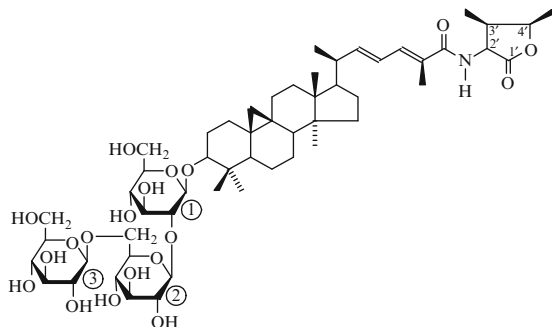
δ_{C} (CD_3OD)		δ_{H} (J/Hz)	δ_{C} (CD_3OD)		δ_{H} (J/Hz)
$\beta\text{-D-Xylp}$			24-O- $\beta\text{-D-Glcp}$		
C-1	105.9	4.41 d (7.7)	1	104.6	4.44 d (7.5)
2	78.7	3.47 dd (7.7, 9)	2	75.2	3.27 dd (7.5, 9)
3	78.1	3.47 t (9)	3	77.7	3.40 t (9)
4	71.1	3.49 ddd (4.5, 9, 11)	4	71.3	3.34 t (9)
5	66.1	3.21 t (11),	5	77.7	3.33 ddd (2.5, 4.5, 11)
		3.89 dd (4.5, 11)	6	62.2	3.68 dd (4.5, 11),
6-O- $\beta\text{-D-Glcp}$					3.89 dd (2.5, 11)
1	104.6	4.35 d (7.8)	$\alpha\text{-L-Rhap}$		
2	75.3	3.22 dd (7.8, 9)	1	101.6	5.43 d (1.5)
3	78.2	3.36 t (9)	2	71.9	3.96 dd (1.5, 2.5)
4	71.3	3.33 t (9)	3	71.7	3.78 dd (2.5, 9)
5	77.5	3.27 ddd (2.5, 4.5, 11)	4	73.5	3.43 t (9)
6	62.2	3.68 dd (4.5, 11),	5	69.5	4.06 m
		3.89 dd (2.5, 11)	6	18.0	1.28 d (6.5)

References

1. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **62**(4), 563–568 (1999)
2. E. Bedir, I. Calis, R. Aquino, S. Piacente, C. Pizza, *J. Nat. Prod.* **61**(12), 1469–1472 (1998)

Mussaendoside E

C₅₄H₈₅NO₁₉, M 1051



Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

Amorphous powder, $[\alpha]_D^{24} -1.4^\circ$ (c 0.03, MeOH).

CAS Registry Number: 178402-87-4.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 265.

FABMS m/z: 1074 [M + Na]⁺.

See [Table 1](#)

References

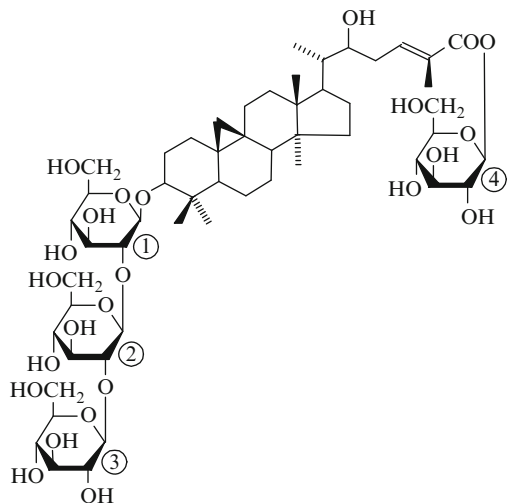
1. W. Zhao, P. Wang, R. Xu, G. Qin, S. Jiang, H. Wu, *Phytochemistry* **42**(3), 827–830 (1996)

Table 1

$\delta_C(\text{C}_5\text{D}_5\text{N})$	δ_H (J/Hz)	$\delta_C(\text{C}_5\text{D}_5\text{N})$	δ_H (J/Hz)	
C-1	31.8	C-19	29.9	$\beta\text{-D-Glcp}_1$
2	29.6	20	41.3	1 104.8 5.13 d (7.8)
3	88.9	21	19.8	1.00 m 2 82.9 4.48 m
4	41.3	22	147.9	5.66 m 3 78.3 4.49 m
5	47.7	23	123.5	6.43 dd (14.9, 10.9) 4 71.7 4.39 m
6	21.1	24	134.8	7.28 d (10.9) 5 78.0 4.07 m
7	26.5	25	129.0	– 6 62.8 4.68 m, 4.53 m
8	47.4	26	13.4	2.20 brs $\beta\text{-D-Glcp}_2$
9	19.8	27	170.7	– 1 105.7 5.55 d (7.6)
10	26.3	28	19.3	0.90 s 2 76.7 4.27 m
11	26.5	29	26.0	1.36 s 3 78.2 4.38 m
12	33.0	30	15.4	1.21 s 4 71.5 4.52 m
13	45.6	1'	175.7	– 5 77.0 4.23 m
14	49.2	2'	55.4	5.66 m 6 70.0 4.96 m, 4.66 m
15	35.7	3'	38.6	2.92 m $\beta\text{-D-Glcp}_3$
16	28.7	4'	77.0	1 105.3 5.32 d (7.8)
17	51.9	3'-Me	8.1	0.87 d (7.4) 2 75.2 4.24 m
18	18.2	4'-Me	15.5	1.18 d (6.6) 3 78.3 4.43 m
		NH		9.25 d (7.6) 4 71.7 4.42 m 4.17 m
				5 78.3 4.17 m, 4.57 m
				6 62.8

Juncoside II

C₅₄H₈₈O₂₄, M 1120



Taxonomy: Cycloartane Glycosides

Juncus effusus (*Juncaceae*) [1].

$[\alpha]_D +11^\circ$.

CAS Registry Number: 159934-05-1.

IR ν_{\max} , cm⁻¹: 3500, 1640.

FABMS m/z: 1143 [M + Na]⁺.

See [Table 1](#)

References

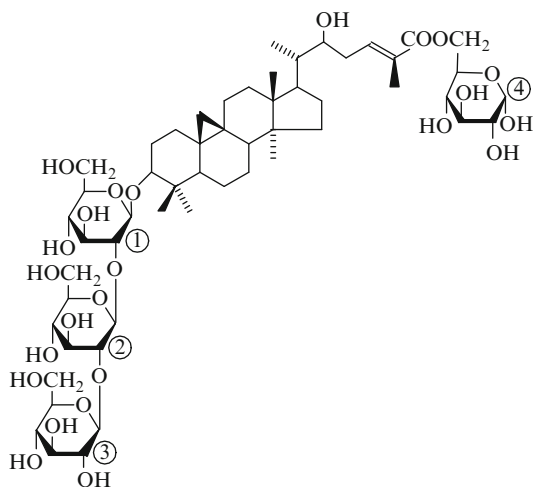
1. M.M. Corsaro, M. Delia Greca, A. Fiorentino, P. Monaco, L. Previtera, *Phytochemistry* **37**(2), 515–519 (1994)

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz) (400 MHz)	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)					
C-1	32.4	1.12	C-20	42.6	1.61	β-D-Glcp ₁		
2	30.1	1.29	21	12.4	1.20 d (6.3)	1	104.8	5.01 d (7.3)
3	89.4	3.46 dd (4, 11.4)	22	72.1	4.16	2	83.2	4.18
4	41.6	–	23	36.4	2.37, 2.72	3	77.7	4.30
5	47.7	1.25	24	143.6	7.41 dd (7.1, 7.3)	4	71.2	4.10
6	21.3	1.52	25	128.7	–	5	79.4	3.97
7	28.3	2.20, 1.45	26	13.2	1.99 s	6	62.7	4.32, 4.58
8	48.2	1.48	27	163.5	–	β-D-Glcp ₂		
9	20.2	–	28	18.5	1.05 s	1	103.6	5.52 d (7.5)
10	26.5	–	29	25.9	1.35 s	2	85.7	4.21
11	26.5	1.10, 1.25	30	15.6	1.20 s	3	77.7	4.42
12	36.0	1.34	β-D-Glcp ₄			4	71.8	4.12
13	45.7	–	1	96.4	6.47 d (7.9)	5	78.3	4.03
14	49.3	–	2	74.3	4.24	6	62.8	4.32, 4.58
15	33.6	1.68	3	78.5	4.36	β-D-Glcp ₃		
16	26.9	1.09	4	71.3	4.09	1	106.4	5.38 d (7.4)
17	49.2	2.36	5	79.6	4.00	2	76.7	4.12
18	19.8	0.92 s	6	62.4	4.32, 4.58	3	78.1	4.35
19	29.9	0.19 d (4.2), 0.42 d (4.2)				4	70.9	4.12
						5	78.3	3.92
						6	63.1	4.32, 4.58

Juncoside III

$C_{54}H_{88}O_{24}$, M 1120



Taxonomy: Cycloartane Glycosides

Juncus effusus (*Juncaceae*) [1].

CAS Registry Number: 159934-06-2.

IR ν_{\max} , cm^{-1} : 1720, 1640.

FABMS m/z : 1143 [M + Na]⁺.

Table 1

δ_C (C_5D_5N)	δ_H (J/Hz) (400 MHz)	
C-1 32.2	1.13	α -D-Glcp ₄
2 30.0	1.29	1 94.2 5.89 d (3.2)
3 89.9	3.47 dd (4, 11.4)	2 72.5 4.21
4 41.4	–	3 74.4 4.25
5 47.6	1.25	4 71.1 4.10
6 21.2	1.52	5 71.9 4.12
7 28.1	2.23, 1.47	6 65.1 4.81 dd (6.2, 11.5),
8 48.0	1.48	5.10 dd (1.6, 11.5)
9 20.0	–	β -D-Glcp ₁
10 26.3	–	1 104.6 5.01 d (7.3)
11 26.5	1.10, 1.25	2 83.8 4.18
12 35.8	1.34	3 77.7 4.30
13 45.5	–	4 71.3 4.10
14 49.1	–	5 79.3 3.97
15 33.4	1.68	6 62.7 4.32, 4.58

(continued)

Table 1 (continued)

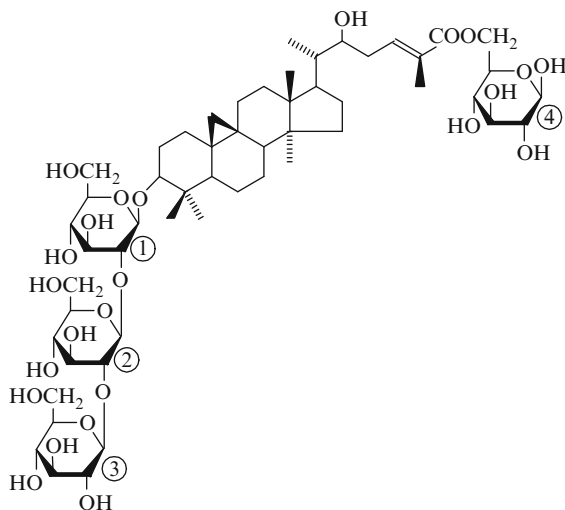
δ_C (C_5D_5N)	δ_H (J/Hz) (400 MHz)	
16 26.7	1.09	β -D-Glcp ₂
17 49.1	2.36	1 103.7 5.52 d (7.5)
18 19.6	0.90 s	2 85.6 4.21
19 29.7	0.20 d (4.2), 0.49 d (4.2)	3 77.7 4.42
20 42.3	1.61	4 71.8 4.12
21 12.1	1.20 d (6.3)	5 78.3 4.03
22 72.0	4.16	6 62.9 4.32, 4.58
23 36.0	2.37, 2.72	β -D-Glcp ₃
24 141.6	7.41 dd (7.1, 7.3)	1 106.3 5.38 d (7.4)
25 128.8	–	2 76.8 4.12
26 13.0	1.97 s	3 78.3 4.35
27 168.4	–	4 70.8 4.12
28 18.3	1.03 s	5 78.3 3.92
29 25.9	1.34 s	6 63.0 4.32, 4.58
30 15.5	1.20 s	

References

- M.M. Corsaro, M. Della Greca, A. Fiorentino, P. Monaco, L. Previtera, *Phytochemistry* **37**(2), 515–519 (1994)

Juncoside IV

$C_{54}H_{88}O_{24}$, M 1120



Taxonomy: Cycloartane Glycosides*Juncus effusus* (*Juncaceae*) [1].

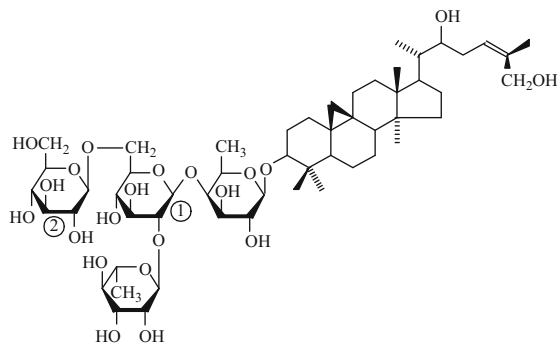
CAS Registry Number: 159934-07-3.

IR ν_{max} , cm^{-1} : 1720, 1640.FABMS m/z : 1143 [M + Na]⁺.**Table 1**

δ_C ($\text{C}_5\text{D}_5\text{N}$)		δ_H (J/Hz) (400 MHz)			
C-1	32.2	1.13		β -D-Glcp ₄	
2	30.0	1.29	1	99.0	5.31 d (7.8)
3	89.9	3.47 dd (4, 11.4)	2	75.4	4.15
4	41.4	–	3	78.6	4.00
5	47.6	1.25	4	70.8	4.12
6	21.2	1.52	5	77.3	4.16
7	28.1	2.23, 1.47	6	65.4	4.90 dd (5.7, 11),
8	48.0	1.48			5.08 dd (1.5, 11
9	20.0	–		β -D-Glcp ₁	
10	26.3	–	1	104.6	5.01 d (7.3)
11	26.5	1.10, 1.25	2	83.8	4.18
12	35.8	1.34	3	77.7	4.30
13	45.5	–	4	71.3	4.10
14	49.1	–	5	79.3	3.97
15	33.4	1.68	6	62.7	4.32, 4.58
16	26.7	1.09		β -D-Glcp ₂	
17	49.1	2.36	1	103.7	5.52 d (7.5)
18	19.6	0.90 s	2	85.6	4.21
19	29.7	0.20 d (4.2), 0.49 d (4.2)	3	77.7	4.42
20	42.3	1.61	4	71.8	4.12
21	12.1	1.20 d (6.3)	5	78.3	4.03
22	72.0	4.16	6	62.9	4.32, 4.58
23	36.0	2.37, 2.72		β -D-Glcp ₃	
24	141.6	7.41 dd (7.1, 7.3)	1	106.3	5.38 d (7.4)
25	128.9	–	2	76.8	4.12
26	13.0	1.97 s	3	78.3	4.35
27	168.4	–	4	70.8	4.12
28	18.3	1.03 s	5	78.3	3.92
29	25.9	1.34 s	6	63.0	4.32, 4.58
30	15.5	1.20 s			

References

1. M.M. Corsaro, M. Della Greca, A. Fiorentino, P. Monaco, L. Previtiera, *Phytochemistry* **37**(2), 515–519 (1994)

Thalictoside C $\text{C}_{54}\text{H}_{90}\text{O}_{21}$, M 1074**Taxonomy:** Cycloartane Glycosides*Thalictrum thunbergii* DC (*Ranunculaceae*) [1].An amorphous powder, $[\alpha]_D^{26}$ -23.5° (c 0.48, $\text{C}_5\text{H}_5\text{N}$).

CAS Registry Number: 146469-97-8.

Negative ion FABMS m/z : 1073 [M-H]⁻, 911 [M-hexose-H]⁻, 765 [M-hexose-deoxyhexose-H]⁻.

¹H NMR (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.22 and 0.47 (2H-19, d, J = 3.4 Hz), 0.90, 0.99, 1.03, 1.30, 2.01 (5 × CH₃, s), 1.15 (CH₃-21, d, J = 6.6 Hz), 1.65 (CH₃ Fuc, d, J = 6.2 Hz), 1.72 (CH₃ Rha, d, J = 5.9 Hz), 3.42 (H-3, dd, J = 4, 11.4 Hz), 4.46 and 4.54 (2H-26, d, J = 12.1 Hz), 4.63 (H-1 Fuc, d, J = 7.7 Hz), 5.06 (H-1 Glc, d, J = 7.7 Hz), 5.45 (H-1 Glc, d, J = 7 Hz), 5.66 (H-24, dd, J = 7, 7.3 Hz), 6.24 (H-1 Rha, brs).

Table 1

δ_C ($\text{C}_5\text{D}_5\text{N}$)					
C-1	32.0	C-16	26.5	β -D-Fucp	α -L-Rhap
2	29.7	17	48.9	1	107.0
3	89.1	18	19.4	2	74.9
4	41.1	19	29.5	3	75.6
5	47.5	20	41.4	4	77.8
6	20.6	21	11.9	5	72.7
7	27.8	22	72.6	6	17.8
8	47.8	23	34.6	β -D-Glcp ₁	β -D-Glcp ₂
9	19.8	24	124.9	1	102.7
10	26.1	25	137.4	2	78.5
11	26.0	26	60.8	3	78.2
12	35.6	27	22.0	4	71.4
13	45.2	28	18.1	5	76.6

(continued)

Table 1 (continued)

$\delta_C(C_5D_5N)$							
14	48.9	29	25.6	6	69.8	6	62.5
15	33.2	30	15.1				

References

1. Y. Hitoshi, H. Kazuhiro, S. Kazushi, K. Junci, Y. Shoji, N. Kimiko, M. Kotaro, T. Toshiaki, N. Toshihiro, *Chem. Pharm. Bull.* **40**(9), 2465–2468 (1992)

Table 1 (continued)

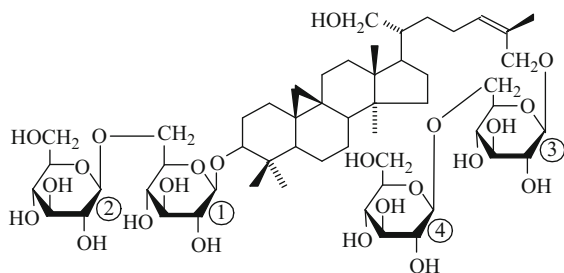
$\delta_C(C_5D_5N)$							
5	47.4	20	46.6	4	71.4	4	71.4
6	21.3	21	61.7	5	76.8	5	76.8
7	27.7	22	30.7	6	69.9	6	69.7
8	47.9	23	25.0	β -D-Glcp ₂	β -D-Glcp ₄		
9	19.9	24	131.5	1	104.9	1	104.9
10	26.2	25	134.4	2	74.8	2	74.8
11	26.2	26	67.5	3	78.1	3	78.1
12	35.7	27	22.0	4	71.4	4	71.4
13	45.4	28	19.7	5	78.1	5	78.1
14	48.9	29	25.6	6	62.6	6	62.6
15	32.2	30	15.3				

References

1. F. Orsini, F. Pelizzoni, L. Verotta, *Phytochemistry* **25**(1), 191–193 (1986)

Quadrangulose

$C_{54}H_{90}O_{23}$, M 1106



Taxonomy: Cycloartane Glycosides

Passiflora quadrangularis L. (*Passifloraceae*) [1].

An amorphous powder, mp 164–165°C, $[\alpha]_D^{25} -11^\circ$ (c 0.89, MeOH).

CAS Registry Number: 100182-36-3.

IR ν_{max}^{Nujol} , cm^{-1} : 3300.

FABMS m/z: 1129 [M + Na]⁺.

¹H NMR(200 MHz, DMSO-d₆, δ , 0-TMS): 0.34 and 0.54 (2H-19, d, J = 4 Hz), 0.84, 0.92, 0.99, 1.02, 1.76 (5 × CH₃, s), 5.34 (H-24, brt, J = 5.5 Hz).

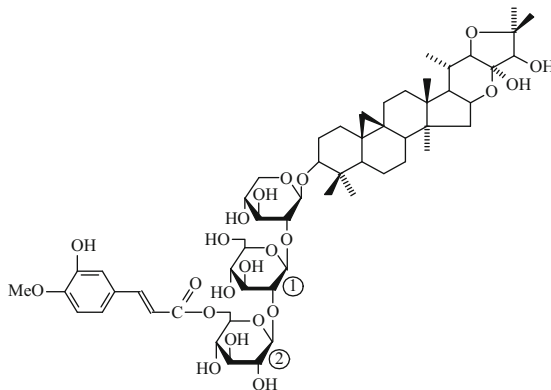
Table 1

$\delta_C(C_5D_5N)$					
C-1	32.2	C-16	26.5	β -D-Glcp ₁	β -D-Glcp ₃
2	29.8	17	42.8	1	103.0
3	88.6	18	18.5	2	74.6
4	41.1	19	29.7	3	78.1

(continued)

No Name ($C_{57}H_{84}O_{22}$)

$C_{57}H_{84}O_{22}$, M 1120



Taxonomy: Cycloartane Glycosides

Cimicifuga Rhizome (*Ranunculaceae*) [1].

A white powder, $[\alpha]_D^{25} -35.4^\circ$ (c 0.3, MeOH).

Positive ion FABMS m/z: 1143 [M + Na]⁺.

Negative ion FABMS m/z: 1119 [M-H]⁻, 943 [M-H-isoferuloyl unit]⁻, 781 [M-H-isoferuloyl unit-hexose]⁻, 619 [M-H-isoferuloyl unit-hexose]⁻.

Table 1

$\delta_C(C_5D_5N)$											
C-1	32.1	C-11	26.2	C-21	17.5	β -D-Xylp	4	71.1	Isoferuloyl		
2	30.0	12	33.5	22	86.9	1	105.1	5	77.8	1	128.6
3	88.4	13	45.3	23	106.0	2	83.0	6	62.9	2	115.8
4	41.3	14	46.8	24	83.4	3	77.7	β -D-Glcp ₂		3	148.5
5	47.4	15	43.4	25	83.6	4	71.7	1	106.3	4	150.9
6	21.1	16	72.4	26	24.8	5	66.5	2	76.1	5	112.1
7	26.4	17	52.4	27	27.8	β -D-Glcp ₁		3	77.9	6	121.4
8	47.7	18	20.7	28	19.7	1	103.3	4	70.4	7	145.6
9	19.7	19	30.4	29	25.7	2	85.5	5	76.4	8	116.5
10	26.6	20	34.8	30	15.4	3	77.4	6	64.4	9	167.6
										10	55.8

hexose]⁻, 487 [M-H-isoferuloyl unit-hexose-hexose-pentose]⁻.

¹H NMR (500 MHz, C₅D₅N, δ , 0-TMS): 0.18 and 0.47 (2H-19, d, J = 3.7 Hz), 0.85 (CH₃-28, s), 1.15 (CH₃-30, s), 1.21 (CH₃-21, d, J = 6.7 Hz), 1.23 (CH₃-18, s), 1.31 (CH₃-29, s), 1.68 (CH₃-27), 1.77 (CH₃-26, s), 2.26 (H-20, m), 3.39 (H-3, dd, J = 4.3, 11.6 Hz), 3.90 (H-22, d, J = 10.4 Hz), 4.18 (H-24, s), 4.97 (H-16, q, J = 7.8 Hz), 3.76 (isoferuloyl CH₃-10, s), 6.80 (isoferuloyl H-8, d, J = 15.9 Hz), 6.95 (isoferuloyl H-5, d, J = 7.9 Hz), 7.18 (isoferuloyl H-6, d, J = 7.9 Hz), 7.51 (isoferuloyl H-2, s) 7.96 (isoferuloyl H-7, d, J = 15.9 Hz); Xyl-1 to Xyl-5, 4.95 (d, J = 7.3 Hz), 4.10 (dd, J = 7.3, 9.2 Hz), 4.38 (dd, J = 9.2, 9.2 Hz), 4.12 (overlapped), 3.79 (dd, J = 10.3, 11 Hz), 4.31 (dd, J = 4.8, 11 Hz); Glc₁-1 to Glc₁-6, 5.51 (d, J = 7.3 Hz), 4.18 (dd, J = 7.3, 9.2 Hz), 4.32 (dd, J = 9.2, 9.2 Hz), 4.21 (dd, J = 9.2, 9.2 Hz), 3.88 (m), 4.38 (dd, J = 4.8, 11.5 Hz), 4.48 (brd, J = 10.3 Hz); Glc₂-1 to Glc₂-6, 5.41 (d, J = 7.9 Hz), 4.17 (dd, J = 7.9, 9.2 Hz), 4.24 (dd, J = 9.2, 9.2 Hz), 4.12 (dd, J = 9.2, 9.2 Hz), 3.96 (overlapped), 4.92 (dd, J = 4.8, 11.6 Hz), 5.19 (brd, J = 11 Hz).

See [Table 1](#)

Biological activity

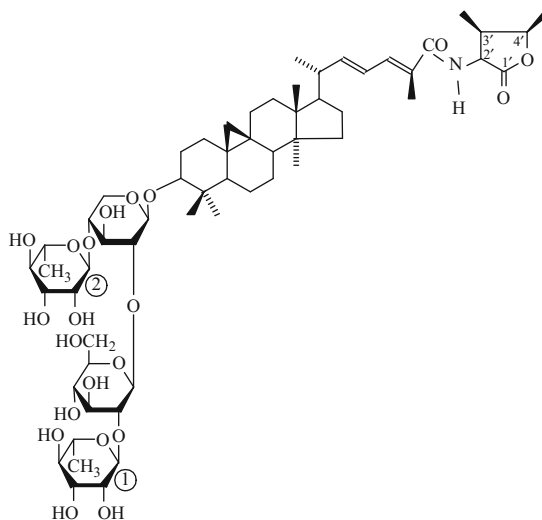
This glycoside showed potent immunosuppressive activity in mouse allogeneic mixed lymphocyte reaction (IC₅₀ 9.96 × 10⁻⁵ M). Immunosuppressive activity of the glycoside was much of the same value, independent of the sugar moiety.

References

1. M. Nishida, H. Yoshimitsu, T. Nohara, Chem. Pharm. Bull. **51**(3), 354-356 (2003)

Mussaendoside M

C₅₉H₉₃NO₂₁, M 1173



Taxonomy: Cycloartane Glycosides*Mussaenda pubescens* Ait. f. (*Rubiaceae*) [1].Mp 178°C, $[\alpha]_D^{20} +20.79^\circ$ (c 4.33, MeOH).

CAS Registry Number: 136864-53-4.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 270.FABMS m/z: $[M + K]^+1190$, $[M + Na]^+1174$, $[M + H]^+1152$.

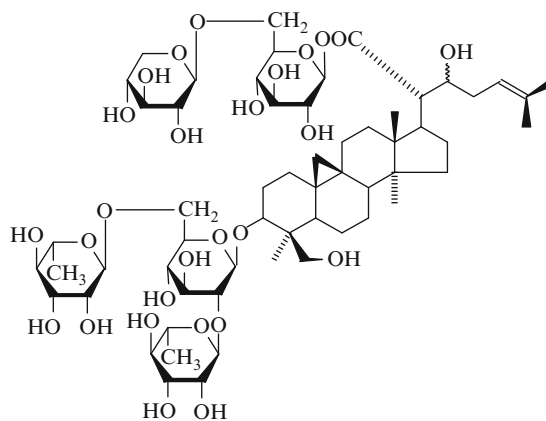
$^1\text{H NMR}$ (400 MHz, $\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.21 and 0.46 (2H-19, d, $J = 4$ Hz), 0.85 (CH-3', d, $J = 7.5$ Hz), 0.87 (CH₃-18, s), 1.03 (CH₃-30, s), 1.04 (CH₃-21, d, $J = 6.5$ Hz), 1.13 (CH₃-29, s), 1.15 (CH₃-4', d, $J = 6.6$ Hz), 1.31 (CH₃-18, s), 1.60 (Rha₁-CH₃, d, $J = 6$ Hz), 1.85 (Rha₂-CH₃, d, $J = 6$ Hz), 2.20 (CH₃-26, s), 3.46 (H-3, m), 4.88 (Xyl H-1, d, $J = 7.2$ Hz), 5.50 (Rha₁ H-1, s), 5.60 (H-22, dd, $J = 15, 9.3$ Hz), 5.69 (H-2', dd, $J = 7.5, 5$ Hz), 5.88 (Glc H-1, d, $J = 7.6$ Hz), 6.41 (H-23, dd, $J = 15, 11$ Hz), 6.45 (Rha₂ H-1, s), 7.27 (H-24, d, $J = 11$ Hz), 9.16 (NH, d, $J = 5$ Hz).

Table 1

$\delta_C(\text{C}_5\text{D}_5\text{N})$						
C-1	32.15	C-16	28.75	1'	175.73	α -L-Rhap ₁
2	29.83	17	52.00	2'	55.47	1 99.73
3	89.23	18	18.42	3'	38.63	2 72.37
4	41.23	19	29.83	4'	78.64	3 72.60
5	47.61	20	41.35	CH ₃ -3'	8.07	4 73.93
6	21.16	21	19.85	CH ₃ -4'	15.51	5 69.72
7	26.40	22	147.91	β -D-Xylp		6 18.59
8	47.95	23	123.68	1	105.42	α -L-Rhap ₂
9	19.98	24	34.82	2	78.64	1 102.17
10	26.05	25	129.12	3	75.49	2 72.37
11	26.63	26	13.49	4	76.85	3 72.72
12	33.05	27	170.74	5	63.30	4 74.27
13	45.65	28	19.48	β -D-Glcp		5 69.99
14	49.21	29	26.03	1	102.17	6 19.07
15	35.77	30	15.30	2	79.27	
				3	77.02	
				4	72.37	
				5	77.68	
				6	63.30	

References

1. J. Xu, R. Xu, Z. Luo, J. Dong, H. Hu, *J. Nat. Prod.* **55**(8), 1124–1128 (1992)

Thalictoside IX $\text{C}_{59}\text{H}_{96}\text{O}_{27}$, M 1236**Taxonomy:** Cycloartane Glycosides*Thalictrum* sp. (*Ranunculaceae*) [1]. $[\alpha]_D -14^\circ$ (c 1.0, MeOH).

CAS Registry Number: 164178-19-2.

Negative ion FABMS m/z: 1235 $[M-H]^-$.

$^1\text{H NMR}$ ($\text{C}_5\text{D}_5\text{N}$, δ , 0-TMS): 0.20 and 0.75 (2H-19, brs), 0.89, 1.17, 1.52, 1.66, 1.71 (5 \times CH₃, s), 1.65 (Rha CH₃, d, $J = 5.9$ Hz), 1.70 (Rha CH₃, d, $J = 6.2$ Hz), 2.75 (2H-23, m), 3.59 (H-3, brd, $J = 8.4$ Hz), 4.92 (Xyl H-1, d, $J = 7.3$ Hz), 4.97 (Glc H-1, d, $J = 7$ Hz), 5.49 (Rha H-1, brs), 5.58 (H-24, brt), 6.25 (Glc H-1, d, $J = 7.7$ Hz), 6.71 (Rha H-1, brs).

Table 1

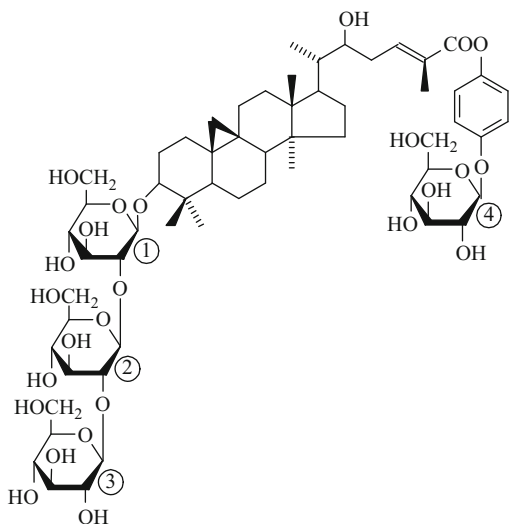
$\delta_C(\text{C}_5\text{D}_5\text{N})$						
C-1	30.7	C-16	27.0	β -D-Glcp	3	72.4
2	30.5	17	45.9	1	105.4	4 74.0
3	89.7	18	19.6	2	80.1	5 69.8
4	45.4	19	30.0	3	76.2	6 18.5
5	48.4	20	53.1	4	72.8	β -D-Glcp
6	22.8	21	173.5	5	76.5	1 96.1
7	26.3	22	72.3	6	68.4	2 73.8
8	48.4	23	35.5	α -L-Rhap	3	78.5
9	19.9	24	122.4	1	100.9	4 71.2
10	26.4	25	133.2	2	72.0	5 77.7
11	26.7	26	26.0	3	72.3	6 69.6
12	35.9	27	18.3	4	74.5	β -D-Xylp
13	45.6	28	18.7	5	69.1	1 105.7
14	48.7	29	19.9	6	18.6	2 74.8
15	32.1	30	60.6	α -L-Rhap	3	78.1
				1	102.6	4 71.0
				2	72.3	5 66.8

References

1. H. Yoshimitsu, K. Hayashi, M. Kumabe, T. Nohara, *Phytochemistry* **38**(4), 939–942 (1995)

Juncoside V

C₆₀H₉₂O₂₅, M 1212



Taxonomy: Cycloartane Glycosides

Juncus effusus (*Juncaceae*) [1].

[α]D -5° .

CAS Registry Number: 159934-08-4.

FABMS m/z: 1235 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)(400 MHz)	
C-1	32.4	1.15 β -D-Glcp ₁ ,
2	30.2	1.32 1 104.9 5.02 d (8.5)
3	89.5	3.49 dd (4, 11.4) 2 83.1 4.20
4	41.6	– 3 77.7 4.41
5	47.7	1.28 4 71.3 4.12
6	21.4	1.55 5 79.3 4.01

(continued)

Table 1 (continued)

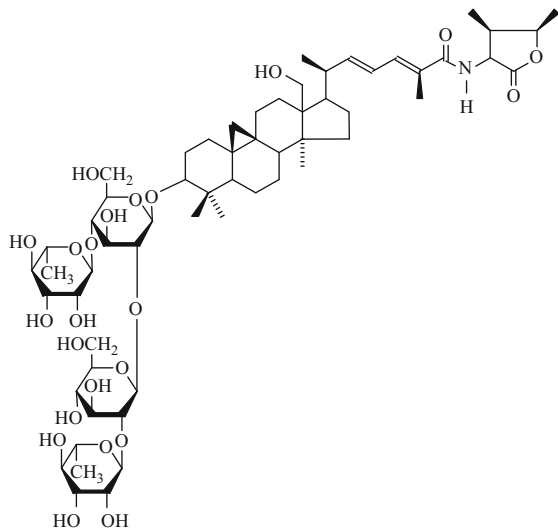
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)(400 MHz)	
7	28.2	1.48, 2.21 6 62.7 4.32, 4.58
8	48.1	1.50 β -D-Glcp ₂
9	20.2	– 1 103.5 5.52 d (7.5)
10	26.5	– 2 85.7 4.18
11	26.5	1.11, 1.28 3 77.7 4.42
12	36.2	1.38 4 71.8 4.12
13	45.7	– 5 78.2 4.03
14	49.2	– 6 62.8 4.32, 4.57
15	33.6	1.70 β -D-Glcp ₃
16	26.9	1.10 1 106.4 5.34 d (7.7)
17	49.3	2.39 2 76.7 4.12
18	19.8	0.92 s 3 78.3 4.35
19	29.8	0.19 d (4.2), 0.50 d (4.2) 4 70.9 4.12
20	42.3	1.62 5 78.3 3.92
21	12.3	1.22 d (6.3) 6 63.1 4.32, 4.57
22	72.3	4.16
23	36.2	2.48, 2.81 Ar
24	142.1	7.41 dd (7, 7.4) 1 154.2 –
25	128.9	– 2, 6 116.9 7.25 d (9)
26	13.2	2.01 s 3, 5 119.0 7.38 d (9)
27	168.5	– 4 152.0 –
28	18.5	1.05 s
29	26.0	1.35 s
30	15.6	1.20 s
		β -D-Glcp ₄
		1 103.7 5.37 d (7.5)
		2 74.9 4.32
		3 78.3 4.54
		4 71.8 4.15
		5 75.5 4.19
		6 65.3 4.72 dd (6.5, 11.7), 5.10 dd (1.5, 11.7)

References

1. M.M. Corsaro, M. Della Greca, A. Fiorentino, P. Monaco, L. Previtera, *Phytochemistry* **37**(2), 515–519 (1994)

Mussaendoside H

C₆₀H₉₅NO₂₃, M 1197



Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

Amorphous powder, $[\alpha]_D^{24} +6.3^\circ$ (c 0.20, C₅N₅H).

CAS Registry Number: 178402-88-5.

FABMS m/z: 1221 [M + Na]⁺, 1237 [M + K]⁺.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 265.

See [Table 1](#)

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
C-1	32.3	β -D-Glcp ₁
2	29.8	1 104.7 4.90 d (7.1)
3	89.7	3.44 dd (11.7, 4) 2 79.9 4.35 m
4	41.3	– 3 77.8 4.52 m
5	47.9	4 79.4 4.23 m
6	21.2	5 76.5 3.67 m
7	26.5	6 61.8 4.09 m, 4.26 m
8	47.9	β -D-Glcp ₂

(continued)

Table 1 (continued)

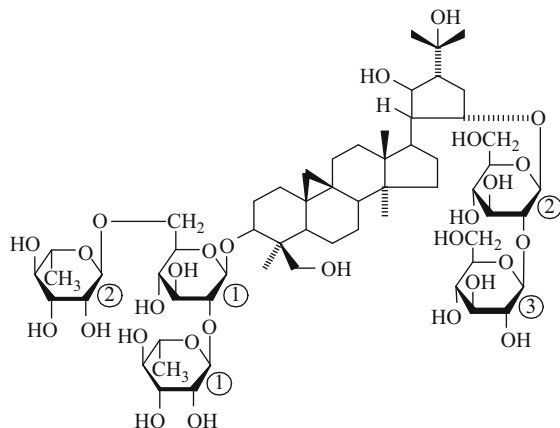
δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
9	20.5	– 1 102.3 5.79 m
10	26.8	– 2 78.6 4.32 m
11	27.0	– 3 77.5 3.85 m
12	30.4	– 4 73.1 4.07 m
13	49.9	– 5 79.4 4.30 m
14	52.4	– 6 63.7 4.32 m, 4.48 m
15	36.6	α -L-Rhap ₁
16	28.9	1 102.7 5.80 s
17	50.7	2 72.6 4.68 m
18	64.7	4.29 m, 4.05 m 3 72.6 4.58 m
19	30.0	0.11 d (3.2), 0.41 d (3.2) 4 74.1 4.32 m
20	41.5	3.02 m 5 70.7 4.91 m
21	21.8	1.18 m 6 18.7 1.66 d (6)
22	149.2	5.75 m α -L-Rhap ₂
23	123.1	6.44 m 1 101.9 6.45 s
24	135.1	7.31 brd (10.9) 2 72.4 4.80 brs
25	128.8	– 3 72.8 4.70 m
26	13.5	2.11 brs 4 74.3 4.35 m
27	170.8	– 5 69.6 5.02 m
28	21.1	– 6 19.1 1.85 d (6.1)
29	26.1	–
30	15.6	–
1'	175.7	–
2'	55.6	5.67 dd (7.5, 7.3)
3'	38.8	2.90 m
4'	77.2	4.70 m
3'-Me	8.1	0.86 d (7.3)
4'-Me	15.4	–
NH	9.12	d (7.7)

References

1. W. Zhao, P. Wang, R. Xu, G. Qin, S. Jiang, H. Wu, *Phytochemistry* **42**(3), 827–830 (1996)

Thalictoside D

C₆₀H₁₀₀O₂₈, M 1268



Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

[α]_D²⁵ 28.9° (c 0.45, MeOH).

CAS Registry Number: 214284-46-5.

Negative ion FABMS m/z: 1267 [M-H]⁻.

Positive ion FABMS m/z: 1291 [M + Na]⁺.

Positive ion HRFABMS m/z: 1291.6300 [M + Na]⁺.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
C-1	32.4	1.25, 1.74 β -D-Glcp ₁
2	30.0	1.87, 2.48
3	90.0	3.68 dd (4.3, 11.6)
4	45.4	–
5	48.7	1.38
6	22.9	1.39, 1.78
7	27.4	0.90, 1.23
8	48.8	1.62
9	19.9	– α -L-Rhap ₁

(continued)

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)	
10	26.5	–
11	26.7	1.08, 2.08
12	30.8	2.08, 2.44
13	45.7	–
14	48.8	–
15	36.1	1.25, 1.41
16	28.1	1.41, 2.39 α -L-Rhap ₂
17	45.7	2.89
18	18.9	1.43 s
19	31.2	0.32 d (3.7), 0.85 d (3.7)
20	57.3	2.27 dt (5.1, 7.2)
21	77.4	4.82 brs
22	86.7	4.22 dd (3.2, 7.2)
23	34.5	2.22 ddd (3.2, 9.2, 13.8), 2.68 brd (14)
24	60.7	2.35 brd (11.6)
25	71.1	–
26	29.2	1.61 s
27	29.8	1.40 s
28	21.2	1.24 s
29	20.1	1.60 s β -D-Glcp ₃
30	60.8	4.33, 4.41
		1 105.4 5.47 d (7.3)
		2 75.5 4.18 dd (7.3, 8.5)
		3 78.7 4.19
		4 71.9 3.96 dd (9.2, 9.2)
		5 77.8 3.95 m
		6 63.9 4.32 dd (5, 11), 4.40 brd (11)

References

1. H. Yoshimitsu, M. Nishida, T. Nohara, *Tetrahedron* **57**, 10247–10252 (2001)

Mussaendoside N

$C_{65}H_{103}NO_{26}$, M 1313

Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

Mp 194°C, $[\alpha]_D + 19.63^\circ$ (c 3.50, MeOH).

CAS Registry Number: 145396-78-7.

UV λ_{max}^{MeOH} , nm: 268.

See [Figure Mussaendoside N](#)

FABMS m/z: $[M + K]^+$ 1352, $[M + Na]^+$ 1336.

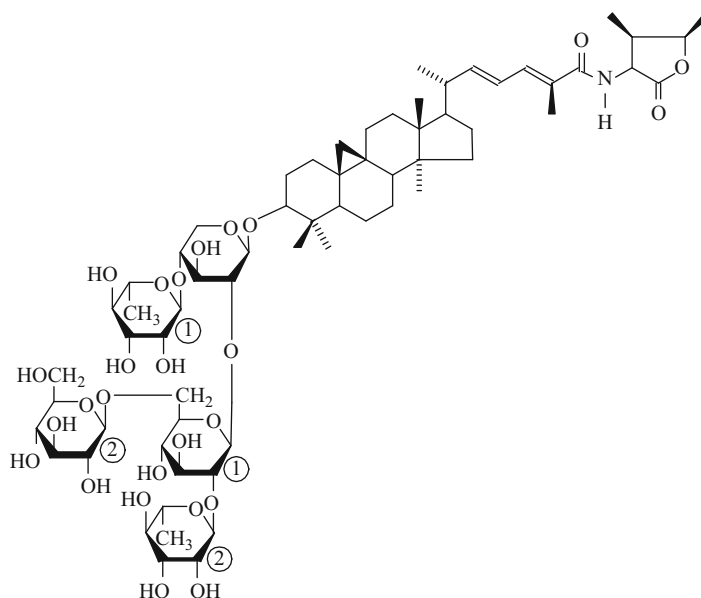
1H NMR (400 MHz, C_5D_5N , δ , 0-TMS): 0.26 and 0.48 (2H-19, d, $J = 4$ Hz), 0.85 (CH₃-3', d, $J = 7.5$ Hz), 87 (CH₃-18, s), 0.96 (CH₃-30, s), 0.98 (CH₃-21, d, $J = 6.5$ Hz), 1.15 (CH₃-4', d, $J = 6.6$ Hz), 1.21 (CH₃-29, s), 1.37 (CH₃-28, s) 1.63 (Rha₁-CH₃, d, $J = 6.2$ Hz), 1.84 (Rha₂-CH₃, d, $J = 6.2$ Hz), 2.20 (CH₃-26, s), 3.44 (H-3, m), 4.88 (Xy1 H-1, d, $J = 7.2$ Hz), 5.23 (G1c₁ H-1, d, $J = 7.6$ Hz), 5.44 (Rha₁ H-1, s), 5.60 (H-22, dd, $J = 15, 9.3$ Hz), 5.69 (H-2', dd, $J = 7.5, 5$ Hz), 5.78 (G1c₂ H-1, d, $J = 7.6$ Hz), 6.40 (Rha₂ H-1, s), 6.42 (H-23, dd, $J = 15, 11$ Hz), 7.26 (H-24, d, $J = 11$ Hz), 9.16 (NH, d, $J = 5$ Hz).

Table 1

$\delta_C(C_5D_5N)$					
C-1	32.20	C-17	51.98	β -D-Xylp	α -L-Rhap ₁
2	29.77	18	18.47	1 105.26	1 99.81
3	89.27	19	29.98	2 78.70	2 72.34
4	41.46	20	41.58	3 76.03	3 72.60
5	47.66	21	19.85	4 76.88	4 73.90
6	21.17	22	147.92	5 63.18	5 69.62
7	26.39	23	123.84	β -D-Glcp ₁	6 18.59
8	48.01	24	134.82	1 02.08	α -L-Rhap ₂
9	19.84	25	129.15	2 79.31	1 102.05
10	26.10	26	13.44	3 77.00	2 72.34
11	26.56	27	170.73	4 72.34	3 72.79
12	33.03	28	19.49	5 77.00	4 74.24
13	45.63	29	26.10	6 70.07	5 70.03
14	49.35	30	15.49		6 18.99
15	35.76	1'	175.71		β -D-G1cp ₂
16	28.74	2'	55.44		1 105.56
		3'	38.61		2 75.43
		4'	78.44		3 78.22
		CH ₃ -3'	8.07		4 71.72
		CH ₃ -4'	15.49		5 78.22
					6 62.86

References

1. J. Xu, R. Xu, Z. Luo, J. Dong, H. Hu, J. Nat. Prod. **55**(8), 1124–1128 (1992)



Mussaendoside N

Thalictoside F

$C_{65}H_{108}O_{32}$, M 1400

See [Figure Thalictoside F](#)

Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

$[\alpha]_D^{25} -29.1^\circ$ (c 0.51, MeOH).

CAS Registry Number: 267008-46-8.

Negative ion FABMS m/z: 1399 $[M-H]^-$.

Positive ion FABMS m/z: 1423 $[M + Na]^+$.

HRFABMS m/z: 1423.6724 $[M + Na]^+$.

Table 1

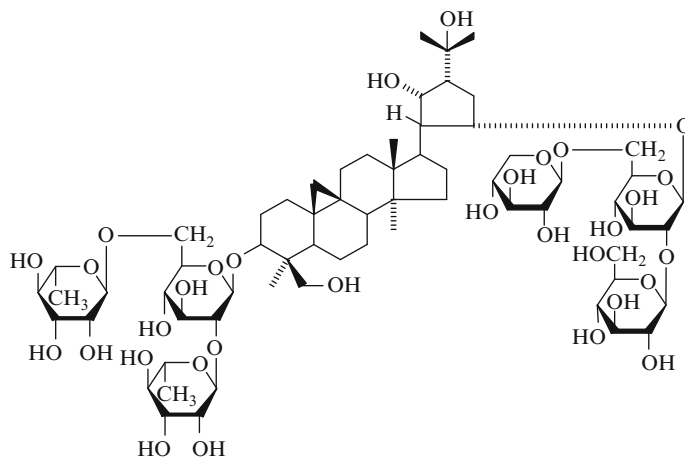
$\delta_C(C_5D_5N)$	δ_H (J/Hz)			
C-1	32.4	1.22, 1.69	α -L-Rhap ₁	
2	29.9	1.88, 2.48	1	101.0 6.69 brs
3	89.8	3.65 dd (4.3, 11.6)	2	72.3 4.77 brs
4	45.3	–	3	72.4 4.76 brd (9.2)
5	48.2	1.37	4	74.5 4.31
6	22.7	1.39, 1.78	5	69.2 4.93 m
7	27.0	0.91, 1.24	6	18.5 1.74 d (6.1)
8	48.5	1.54	α -L-Rhap ₂	
9	19.8	–	1	102.7 5.50 brs
10	26.5	–	2	72.3 4.57 brs
11	26.8	0.99, 1.99	3	72.8 4.50 dd (3.1, 9.2)

(continued)

Table 1 (continued)

$\delta_C(C_5D_5N)$	δ_H (J/Hz)			
12	31.5	1.68, 2.28	4	73.9 4.27 dd (9.2, 9.2)
13	45.5	–	5	69.8 4.33 m
14	48.8	–	6	18.7 1.65 d (6.1)
15	36.2	1.31, 1.42	β -D-Glcp ₂	
16	28.4	1.44, 2.12	1	102.6 4.90 d (7.9)
17	40.1	3.07	2	83.5 3.84 dd (7.9, 8.5)
18	19.2	1.01 s	3	78.6 4.19 dd (8.5, 8.5)
19	30.7	0.32 d (3.6), 0.82 d (3.6)	4	70.8 4.13 dd (8.5, 8.5)
20	52.6	1.75	5	77.4 4.05 m
21	75.6	4.55 brd (4.4)	6	69.5 4.39 dd (4.8, 11.6), 4.80 brd (10.4)
22	87.2	4.35 brs		
23	35.9	1.95 ddd (3.1, 9.3, 13.2), 2.65 dd (9.2, 13.2)	β -D-Glcp ₃	
24	61.1	2.75 dd (9.2, 9.2)	1	106.2 5.30 d (7.3), 4.13 dd (7.3, 8.5)
25	70.6	–	3	78.4 4.18 dd (8.5, 8.5)
26	29.6	1.52 s	4	70.8 4.23
27	27.4	1.30 s	5	78.9 3.73 m
28	20.4	1.07 s	6	62.1 4.33, 4.40
29	20.0	1.58 s	β -D-Xylp	
30	60.8	4.33, 4.40	1	106.0 5.10 d (7.3)
			β -D-Glcp ₁	
			2	75.0 4.07 dd (7.3, 7.9)

(continued)



Thalictoside F

Table 1 (continued)

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
1	105.3	5.00 d (7.9)	3	78.3	4.16 dd (7.9, 8.5)
2	76.4	4.34 dd (7.9, 9.2)	4	71.2	4.25 m
3	80.2	4.28	5	67.2	3.73 dd (9.8, 11.6),
4	72.1	3.94 dd (9.2, 9.2)			4.40 dd (4.9, 11.6)
5	76.6	4.04 m			
6	68.5	4.15 dd (4.8, 11.5), 4.63 brd (10.4)			

References

- H. Yoshimitsu, M. Nishida, T. Nohara, *Tetrahedron* **57**, 10247–10252 (2001)

Thalictoside E

C₆₅H₁₀₈O₃₂, M 1400

See [Figure Thalictoside E](#)

Taxonomy: Cycloartane Glycosides

Thalictrum thunbergii DC (*Ranunculaceae*) [1].

$[\alpha]_D^{25}$ -29.6° (c 0.40, MeOH).

CAS Registry Number: 214284-49-8.

Negative ion FABMS m/z: 1399 [M-H]⁻.

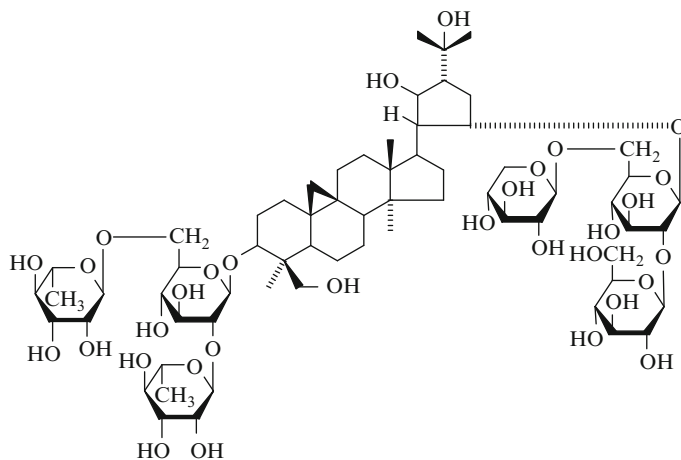
Positive ion FABMS m/z: 1423 [M + Na]⁺.

HRFABMS m/z: 1423.6727 [M + Na]⁺.

Table 1

	δ_C (C ₅ D ₅ N)	δ_H (J/Hz)		δ_C (C ₅ D ₅ N)	δ_H (J/Hz)
C-1	32.5	1.27, 1.74			α -L-Rhap ₁
2	30.0	1.86, 2.49	1	101.0	6.68 brs
3	90.0	3.68 dd (4.9, 11.6)	2	72.3	4.77 brs
4	45.4	–	3	72.4	4.76 dd (3, 9.2)
5	48.7	1.38	4	74.5	4.30 dd (9.2, 9.2)
6	22.9	1.38, 1.78	5	69.2	4.94 m
7	27.4	0.90, 1.23	6	18.5	1.72 d (6.1)
8	48.8	1.61			α -L-Rhap ₂
9	19.9	–	1	102.7	5.48 brs
10	26.5	–	2	72.2	4.55 brs
11	26.7	1.08, 2.06	3	72.9	4.50 dd (3.1, 9.2)
12	30.8	2.06, 2.43	4	73.9	4.28 dd (9.2, 9.2)
13	45.7	–	5	69.8	4.32 m
14	48.8	–	6	18.7	1.64 d (6.1)
15	36.1	1.26, 1.36			β -D-Glcp ₂
16	28.1	1.29, 2.33	1	103.1	4.76 d (7.9)
17	45.7	2.86	2	81.3	3.98 dd (7.9, 9.2)
18	18.9	1.45 s	3	78.6	4.11 dd (9.2, 9.2)
19	31.2	0.32 d (3.6), 0.82 d (3.6)	4	71.2	3.93 dd (9.2, 9.2)
20	57.2	2.22 dt (5.2, 7)	5	77.3	3.89 m
21	77.5	4.78 brs	6	68.9	4.19 dd (4.9, 11.5), 4.79 brd (10.4)
22	86.8	4.21 dd (3, 7)			β -D-Glcp ₃
23	34.7	2.37 ddd (3, 9.3, 13.2), 2.77 brd (13.4)	1	105.4	5.41 d (7.3)
24	60.4	2.34 brd (11.3)	2	75.5	4.14 dd (7.3, 8.5)
25	71.2	–	3	78.2	4.17 dd (8.5, 9.2)
26	29.2	1.60 s	4	71.9	3.93 dd (9.2, 9.2)

(continued)



Thalictoside E

Table 1 (continued)

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)				
27	29.8	1.40 s	5	79.8	3.96 m
28	21.2	1.23 s	6	63.9	4.29, 4.63 brd (10.4)
29	20.1	1.59 s			β -D-Xylp
30	60.9	4.32, 4.40	1	105.9	5.00 d (7.9)
		β -D-Glcp ₁	2	75.0	4.04 dd (7.9, 8.5)
1	105.4	5.00 d (7.9)	3	78.2	4.17 dd (8.5, 8.5)
2	76.4	4.35 dd (7.9, 9.2)	4	71.2	4.26 m
3	80.2	4.28 dd (9.2, 9.2)	5	67.2	3.72 brt (10.4),
4	72.1	3.93 dd (9.2, 9.2)			4.37 dd (4.5, 11)
5	76.6	4.04 m			
6	68.6	4.14 dd (4.3, 11.6),			
		4.64 brd (10.4)			

References

1. H. Yoshimitsu, M. Nishida, T. Nohara, *Tetrahedron* **57**, 10247–10252 (2001)

Mussaenoside G

C₆₆H₁₀₅N O₂₇, M 1343

See [Figure Mussaenoside G](#)

Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

Amorphous powder. $[\alpha]_D^{24} +13.6^\circ$ (c 0.09, MeOH).

CAS Registry Number: 178468-01-4.

IR ν_{\max}^{KBr} , cm⁻¹: 3400, 1765, 1640, 1600.

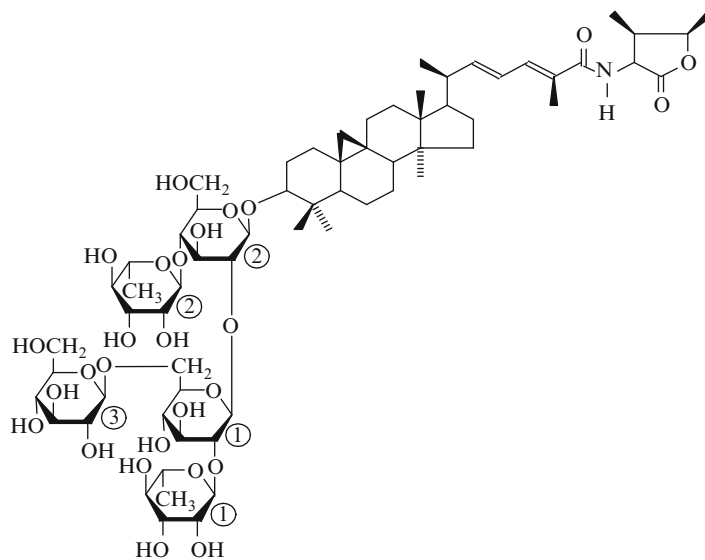
FABMS m/z: 1366 [M + Na]⁺.

UV $\lambda_{\max}^{\text{MeOH}}$, nm: 265.

Table 1

δ_C (C ₅ D ₅ N)	δ_H (J/Hz)				
C-1	32.0			β -D-Glcp ₁	
2	29.7		1	101.9	5.76 m
3	89.9		2	78.1	4.31 m
4	41.2		3	78.1	4.22 m
5	47.5		4	72.5	4.08 m
6	21.1		5	76.7	4.04 m
7	26.2		6	70.5	4.75 m, 4.35 m
8	47.9				β -D-Glcp ₂
9	19.7		1	104.7	4.93 m
10	26.2		2	79.2	4.58 m
11	26.4		3	77.6	4.51 m
12	33.0		4	79.2	4.33 m
13	45.5		5	76.1	3.67 m
14	49.0		6	61.4	4.20 m, 4.08 m
15	35.6				β -D-Glcp ₃
16	28.6		1	105.1	5.27 d (7.5)
17	51.8		2	75.2	4.07 m
18	18.3		3	78.7	4.25 m
19	29.7	0.22 d, 0.46 d	4	71.5	4.38 m
20	41.3		5	78.0	4.08 m
21	19.7		6	62.7	4.59 m, 4.42 m

(continued)



Mussaenoside G

Table 1 (continued)

$\delta_c(\text{C}_5\text{D}_5\text{N})$	δ_H (J/Hz)				
22	147.8	5.68 dd	$\alpha\text{-L-Rhap}_1$		
23	123.5	6.46 dd	1	101.9	6.43 s
24	134.8	7.39 d	2	72.2	4.78 m
25	128.9		3	72.5	4.68 m
26	13.3	2.24 s	4	74.1	4.37 m
27	170.7		5	69.4	5.02 m
28	19.3		6	19.0	1.88 d (4.5)
29	26.0		$\alpha\text{-L-Rhap}_2$		
30	15.4		1	102.6	5.76 s
1'	175.7		2	72.4	4.62 m
2'	55.3		3	72.4	4.55 m
3'	38.5	2.94 m	4	73.8	4.30 m
4'	76.9		5	70.5	4.89 m
3'-Me	8.0		6	18.5	1.73 d (7)
4'-Me	15.4				
NH	9.15				
7 \times CH ₃	0.89 d, 0.91 s,				
	1.01 s, 1.02 d,				
	1.20 d, 1.24 s,				
	1.42 s				

References

1. W. Zhao, R. Xu, G. Qin, T. Vaisar, M.S. Lee, *Phytochemistry* **42**(4), 1131–1134 (1996)

No Name (Heinsiagenin A-3-O-[$\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{2)-}\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{6)-}[\alpha\text{-L-rhamnopyranosyl-(1}\rightarrow\text{2)]-}\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{2)-}\beta\text{-D-glucopyranoside}]$)

$\text{C}_{66}\text{H}_{105}\text{NO}_{28}$, M 1359

Taxonomy: Cycloartane Glycosides

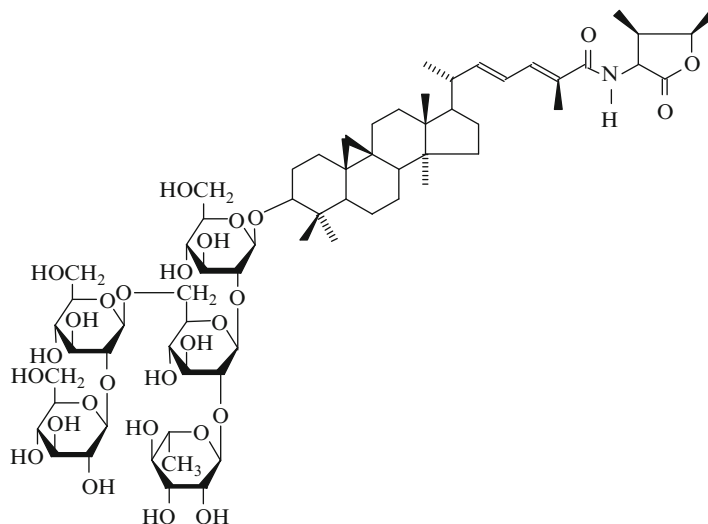
Heinsia crinita (Afz) G. Tayl (*Rubiaceae*) [1].

CAS Registry Number: 158754-07-5.

See [Figure No Name \(Heinsiagenin A-3-O-\[\$\beta\text{-D-glucopyranosyl-\(1}\rightarrow\text{2\)-}\beta\text{-D-glucopyranosyl-\(1}\rightarrow\text{6\)-}\[\alpha\text{-L-rhamnopyranosyl-\(1}\rightarrow\text{2\)\]-}\beta\text{-D-glucopyranosyl-\(1}\rightarrow\text{2\)-}\beta\text{-D-glucopyranoside}\]\$ \)](#)

References

1. Babady-Bila, C. Wynants, S. Toppes, G. Hoornaert, in *19th IUPAC Symposium on the Chemistry of Natural Products*, Karachi, 1994, p. 157



No Name (Heinsiagenin A-3-O-[$\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{2)-}\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{6)-}[\alpha\text{-L-rhamnopyranosyl-(1}\rightarrow\text{2)]-}\beta\text{-D-glucopyranosyl-(1}\rightarrow\text{2)-}\beta\text{-D-glucopyranoside}]$)

Mussaendoside U

$C_{72}H_{115}NO_{32}$, M 1506

See [Figure Mussaendoside U](#)

Taxonomy: Cycloartane Glycosides

Mussaenda pubescens Ait. f. (*Rubiaceae*) [1].

$[\alpha]_D^{25} - 14.0^\circ$ (c 0.27, CH_3OH).

UV λ_{max}^{MeOH} , nm: 265 nm.

Negative ion mode FABMS m/z: 1505 $[M-H]^-$.

Positive ion mode FABMS m/z: 1507 $[M+H]^+$, 1529

$[M+Na]^+$, 1545 $[M+K]^+$.

Table 1

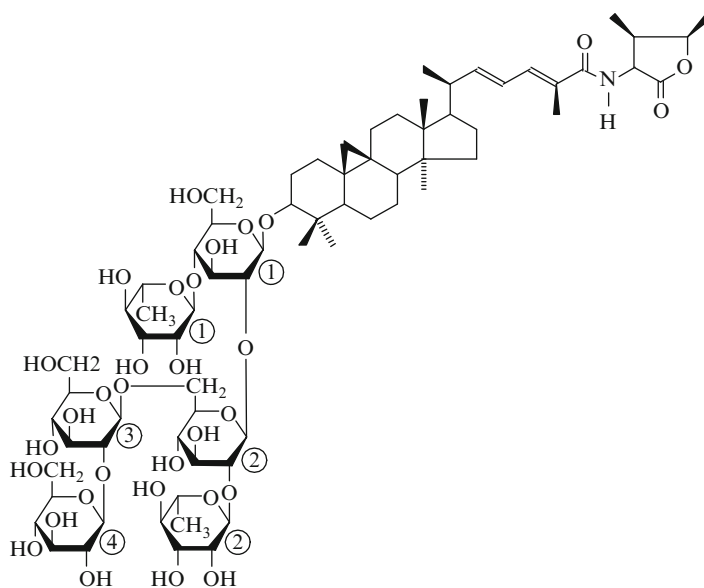
$\delta_C(C_5D_5N)$	δ_H (J/Hz)	
C-1	32.2 1.13, 1.50 m	β -D-Glcp ₂
2	29.8 1.98, 2.32 m	1 102.8 5.76 d 7.4 m
3	90.5 3.45 dd (10.8, 4.8)	2 84.5 4.32 m
4	41.4 –	3 78.3 4.32 m
5	47.8 1.34 m	4 72.3 4.28 m
6	21.2 0.82, 1.62 m	5 76.0 4.18 m
7	26.4 1.07, 1.27 m	6 70.3 4.31, 4.64 m
8	48.1 1.45 m	β -D-Glcp ₃
9	19.8 –	1 102.8 5.37 d 7.7
10	26.3 –	2 84.5 4.14 m
11	26.6 1.05, 1.95 m	3 77.8 4.50 m
12	33.0 1.56, 1.56 m	4 71.2 4.24 m

(continued)

Table 1 (continued)

$\delta_C(C_5D_5N)$	δ_H (J/Hz)	
13	45.6 –	5 77.8 4.08 m
14	49.2 –	6 62.5 4.41, 4.55 m
15	35.8 1.27, 1.27 m	β -D-Glcp ₄
16	28.8 1.23, 1.58 m	1 106.5 5.34 d (6.8)
17	52.0 1.60 m	2 76.5 4.20 m
18	18.5 0.99 s	3 78.1 4.21 m
19	29.9 0.29, 0.55 brs	4 71.1 4.23 m
20	41.3 2.18 m	5 78.8 3.95 m
21	19.9 1.01 d (6.5)	6 62.3 4.35, 4.55 m
22	147.9 5.65 dd (14.8, 8.9)	α -L-Rhap ₁
23	123.8 6.44 dd (14.8, 11.1)	1 102.8 5.80 brs
24	134.8 7.29 d (11.1)	2 72.5 4.63 m
25	129.1 –	3 72.7 4.51 m
26	13.5 2.21 brs	4 73.9 4.28 m
27	170.8 –	5 70.7 4.82 m
28	19.5 0.90 s	6 18.7 1.69 d (6.1)
29	26.2 1.47 s	α -L-Rhap ₂
30	15.6 1.27 s	1 102.1 6.39 brs
1'	175.8 –	2 72.4 4.74 brs
2'	55.4 5.69 dd (7.4, 7.4)	3 72.7 4.63 m
3'	38.6 2.94 m	4 74.2 4.33 m
4'	77.0 4.70 m	5 69.5 5.02 m
3'-CH ₃	8.1 0.88 d (7.2)	6 19.1 1.86 d (6.0)
4'-CH ₃	15.5 1.19 d (6.5)	
NH	9.11 d (7.7)	
	β -D-Glcp ₁	
1	105.1 4.89 d (7.6)	

(continued)



Mussaendoside U

Table 1 (continued)

	$\delta_{\text{C}}(\text{C}_5\text{D}_5\text{N})$	$\delta_{\text{H}}(\text{J/Hz})$
2	78.5	4.60 m
3	78.0	4.49 m
4	79.4	4.38 m
5	76.3	3.64 m
6	61.6	4.07, 4.17 m

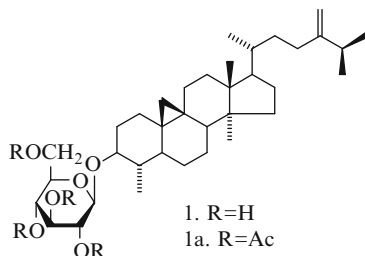
References

1. W. Zhao, J.-L. Wolfender, K. Hostettmann, K. Cheng, R. Xu, G. Qin, *Phytochemistry* **45**(5), 1073–1078 (1997)

4-Monomethylcycloartane Glycosides

3-O- β -D-Glucopyranosylcycloeucalenol

C₃₆H₆₀O₆, M 588



Taxonomy: 4-Monomethylcycloartane Glycosides

Cedrela odorata (Meliaceae) [1].

Amorphous solid, mp 231–234°C, $[\alpha]_D +24.65^\circ$ (c 0.14, MeOH).

IR ν_{\max}^{KBr} , cm⁻¹: 3392, 2920, 1640, 1456, 1375, 1163, 1084, 1024, 886.

1a: ¹H NMR (400 MHz, CDCl₃, δ , 0-TMS): 0.13 and 0.36 (2H-19, d, J = 4 Hz), 0.88 (CH₃, d, J = 6.8 Hz), 0.89 (CH₃, s), 0.90 (CH₃, d, J = 4.8 Hz), 0.96 (CH₃, s), 1.02 (CH₃, d, J = 6.8 Hz), 1.03 (CH₃, d, J = 6.8 Hz), 2.01 (Ac, s), 2.03 (Ac, s), 2.04 (Ac, s), 2.07 (Ac, s), 3.12 (H-3 α , dt, J = 10.5, 4.8 Hz), 3.70 (H-5', m), 4.12 (H-6', dd, 12, 2.4 Hz), 4.25 (H-6', dd, J = 12, 5.2 Hz), 4.58 (H-1', d, J = 8 Hz), 4.66 (H-31, brs), 4.71 (H-31, brs), 5.01 (H-2', dd, J = 9.6, 8 Hz), 5.06 (H-4', t, J = 9.6 Hz), 5.21 (H-3', t, J = 9.6 Hz).

Table 1

$\delta_C(\text{C}_5\text{D}_5\text{N})$ (1a)							
C-1	30.6	C-12	32.9	C-23	31.3	4	68.6
2	34.9	13	45.3	24	156.9	5	71.6
3	88.0	14	48.9	25	33.8	6	62.2
4	42.5	15	32.8	26	21.9	Ac	
5	43.6	16	26.9	27	22.0	169.3	
6	24.7	17	52.2	28	19.1	169.4	
7	28.1	18	17.8	29	14.1	170.4	

(continued)

Table 1 (continued)

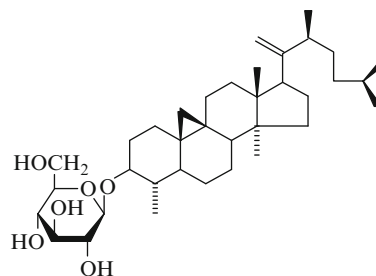
$\delta_C(\text{C}_5\text{D}_5\text{N})$ (1a)							
8	46.9	19	27.3	31	105.9	170.7	
9	23.5	20	36.1	β -D-Glcp		20.6	
10	29.2	21	18.3	1	102.1	20.6	
11	25.1	22	35.3	2	71.5	20.7	
				3	72.9	20.8	

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3 β -D-Glucopyranoside of 31-norcycloswietenol

C₃₆H₆₀O₆, M 588



Taxonomy: 4-Monomethylcycloartane Glycosides

Swietenia mahagoni Linn. (Meliaceae) [1].

Mp 165–169°C (from EtOH), $[\alpha]_D +79.5^\circ$.

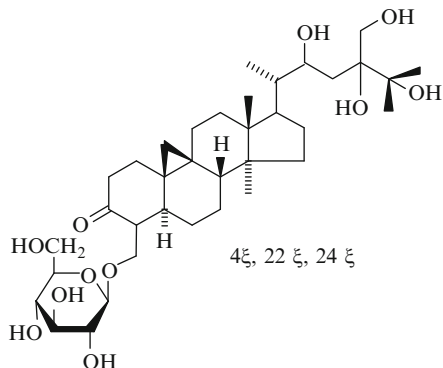
CAS Registry Number: 75222-76-3.

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Cymbidoside

$C_{36}H_{60}O_{11}$, M 668



Taxonomy: 4-Monomethylcycloartane Glycosides

Cymbidium giganteum (Orchidaceae) [1]

Mp 150–152°C (from *iso*-PrOH-H₂O), $[\alpha]_{578}^{22} +24^\circ$
(c 1.5, MeOH).

CAS Registry Number: 70237-86-4.

IR ν_{\max}^{KBr} , cm^{-1} : 3700–3000, 1700.

¹H NMR (C₅D₅N + D₂O, δ): 0.30 (d, 1H, J = 4 Hz),
0.49 (d, 1H, J = 4 Hz), 0.83 (s, 3H), 1.03 (s, 3H),
1.25 (d, 3H, J = 6 Hz), 1.72 (s, 6H), 3.80–4.48
(11H), 4.99 (d, 1H, J = 7.5 Hz).

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- 3,4-*Seco*-(24Z)-cycloart-4(29),24-diene-3,26-dioic acid
3-methyl ester C₃₁H₄₈O₄, 121–122
- 3,4-*Seco*-(24Z)-cycloart-4(29),24-diene-3,26-dioic acid,
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 23-O-Acetyl-7,8-didehydroshengmanol 3-O- β -D-galactopyranoside, 313
- $C_{38}H_{58}O_{12}$
 2'-O-Malonylcimiaceroside B, 313–314
- $C_{38}H_{60}O_{11}$
 25-O-Acetylcimigenol-3-O- β -D-galactopyranoside, 314
 25-O-Acetylcimigenol-3-O- β -D-glucopyranoside, 314–315
 24-O-Acetyl-25-O-methyl-7,8-didehydroshengmanol 3-O- β -D-xylopyranoside, 315–316
- $C_{38}H_{60}O_{12}$
 24-*epi*-24-O-Acetyl-7,8-didehydroshengmanol-3-O- β -D-galactopyranoside, 316
- $C_{38}H_{62}O_{10}$
 Depressoside B, 316–317
 Kahiricoside III, 317
 Kahiricoside IV, 318
- $C_{38}H_{62}O_{11}$
 Astraverrucin II, 318–319
 Astraverrucin III, 319
 Liofolic acid, 319–320
 25-O-Methyl-24-O-acetylshengmanol-3-O- β -D-xylopyranoside, 320
 Mongholicoside II, 320–321
 Huangqiyein D, 321
- $C_{38}H_{62}O_{12}$
 24-*epi*-24-O-Acetylshengmanol-3-O- β -D-galactopyranoside, 321–322
 25-O-Methyl-1 α -hydroxy-24-O-acetylshengmanol-3-O- β -D-xylopyranoside, 322
 25-O-Methyl-7 β -hydroxy-24-O-acetylshengmanol-3-O- β -D-xylopyranoside, 322–323
- $C_{38}H_{64}O_{11}$
 Cyclounifolioside D, 323–324
- $C_{39}H_{58}O_{10}$
 2'-O-Acetyl-27-deoxyactein, 324

- C₃₉H₅₈O₁₁
2',4'-O-Diacetyl-24-*epi*-7,8-didehydrocimigenol-3-xyloside, 324–325
- C₃₉H₅₈O₁₂
2'-O-Acetylactein, 325
Cimiracemoside O, 325–326
- C₃₉H₆₀O₁₀
Tomentoside III, 326–327
- C₃₉H₆₀O₁₁
Cimiracemoside L, 327
Cimiracemoside M, 327–328
Soulieoside A, 328–329
Soulieoside B, 329
- C₃₉H₆₀O₁₂
Beesioside I, 320
- C₃₉H₆₂O₁₁
Cycloexoside, 330–331
- C₃₉H₆₂O₁₂
Beesioside II, 331
Beesioside J, 331–332
- C₄₀H₅₆O₁₄
2'-O-Malonylcimicifugoside, 332
- C₄₀H₅₈O₁₃
23-O-Acetyl-7,8-didehydroshengmanol-3-O-β-D-(2-O-malonyl)-xylopyranoside, 333
- C₄₀H₆₀O₁₃
23-O-Acetylshengmanol 3-O-β-D-(2-O-malonyl)-xylopyranoside, 333–334
- C₄₀H₆₀O₁₄
24-*epi*-24-O-Acetyl-7,8-didehydroshengmanol 3-O-β-D-(2-O-malonyl)-xylopyranoside, 334
- C₄₀H₆₆O₁₂
Cyclounifolioside A, 335
- C₄₀H₆₆O₁₃
Cyclodisectoside, 335
Cyclosieversioside E (astrasieversianin X), 336
- C₄₀H₆₈O₁₃
Askendoside C, 337
No name (666), 337–338
- C₄₁H₆₀O₁₄
3-O-α-L-Arabinopyranosyl cimigenol 15-O-β-D-glucopyranoside, 338
- C₄₁H₆₃NO₈
Mussaendoside B, 339
- C₄₁H₆₄O₁₄
Aquilegioside B, 339–340
- C₄₁H₆₆O₁₃
Cycloorbicoside C, 340
- C₄₁H₆₆O₁₄
Cycloorbicoside G, 340–341
Tomentoside IV, 341
- C₄₁H₆₈O₁₂
Quisvaloside B, 342
- C₄₁H₆₈O₁₃
Astrachryoside A, 342
Curculigosaponin C, 342–343
Cyclocarposide, 343
Prusianoside B, 343–344
Thalicoside A2, 344
Thalicoside A3, 345
- C₄₁H₆₈O₁₄
Astragaloside III, 345–346
Cyclocephaloside I, 346
Cyclosieversioside F (astragaloside IV, astrasieversianin XIV), 346–347
Isoastragaloside IV, 348
Cycloaraloside C (astrailienin A), 348–349
Cyclogaleginoside E, 349
No name (686), 350
- C₄₁H₇₀O₁₃
Macrophyllsaponin B, 350–351
- C₄₁H₇₀O₁₄
Cyclocanthoside D, 351
Cyclocanthoside E, 352–353
Cyclopycanthoside, 352–353
- C₄₂H₆₂O₁₆
Abrusoside D, 353
Abrusoside E, 353–354
- C₄₂H₆₄O₁₅
Abrusoside C, 354
- C₄₂H₆₅NO₉
Mussaendoside A, 354–355
- C₄₂H₆₈O₁₃
Depressoside C, 355
6-Oxocycloartan-3β,16β-di-O-glucoside, 356
- C₄₂H₆₈O₁₄
Astrasieversianin V, 356–357
Cyclosieversioside C (astrasieversianin VI), 357
Squarroside B3, 357–358
Squarroside B4, 358–359
3β,16β-Di-β-D-glucopyranosyloxy-6α-hydroxy-9,19-cyclolanost-25-en-24-one, 359
- C₄₂H₆₈O₁₅
Aquilegioside G, 360–361
- C₄₂H₇₀O₁₂
Acanthoside K₃, 360
- C₄₂H₇₀O₁₃
Curculigosaponin G, 361
Depressoside E, 361–362
3β,16β-Di-β-D-glucopyranosyloxy-6α-hydroxy-9,19-cyclolanost-24-ene, 362
- C₄₂H₇₀O₁₄
Askendoside A, 363
Astraverrucin IV, 363–364
Cycloaraloside D, 364
Curculigosaponin D, 364–365
Depressoside D, 365
Depressoside F, 366
Kahiricoside V, 366–367
No Name, 367–368
No name, 368–369
Thalicoside A, 368
Thalicoside A1, 368–369
- C₄₂H₇₀O₁₅
Beesioside H, 369–370
Cycloaraloside E, 370
Cyclounifolioside B, 370–371
Thalicoside E, 371
Siebersoside II, 372
Thalicoside G1, 372–373

- C₄₂H₇₀O₁₅ (*cont.*)
Thalicoside G2, 373
Thalicoside H1, 374
- C₄₂H₇₂O₁₃
Curculigosaponin L, 374–375
- C₄₂H₇₂O₁₄
Macrophyllsaponin C, 375
- C₄₂H₇₂O₁₅
Macrophyllsaponin E, 376
No name (729), 376–377
- C₄₃H₆₄O₁₆
Abrusoside B, 377
- C₄₃H₆₈O₁₅
23-O-Acetylshengmanol 3-O-β-D-glucopyranosyl(1→3)-
β-D-xylopyranoside, 378
25-O-Acetylshengmanol 3-O-β-D-glucopyranosyl(1→3)-
β-D-xylopyranoside, 378–379
- C₄₃H₇₀O₁₄
Cyclocarposide B, 379–380
Cyclocarposide C, 380
Thalictoside I, 381
Thalictoside II, 381
Squarroside B1, 382
Squarroside B2, 382
- C₄₃H₇₀O₁₅
Cyclocephaloside II, 382–383
Cyclosieversioside D, 383–384
Isoastragaloside II (astrasieversianin VIII),
384–385
Trojanoside A, 385–386
- C₄₃H₇₀O₁₆
Aquilegioside F, 386
Cimiside C, 387–388
Cimiside D, 388
- C₄₃H₇₂O₁₁
Acanthoside K₂, 388–389
- C₄₃H₇₂O₁₄
Macrophyllsaponin A, 389
- C₄₃H₇₂O₁₅
Agroastragaloside II, 389–390
Cyclocanthoside B, 390–391
Cyclocanthoside C, 391
- C₄₃H₇₂O₁₆
Cyclopassifloside III, 391–392
Cyclotricuspidoside A, 392
- C₄₃H₇₂O₁₇
Cyclopassifloside V, 393
Cyclopassifloside IX, 393–394
Cyclopassifloside XI, 394–395
Cyclotricuspidoside B, 395
Cyclotricuspidoside C, 395–396
- C₄₄H₇₀O₁₅
Astrasieversianin III, 396
Cyclosieversioside A (astrasieversianin II),
396–397
- C₄₄H₇₂O₁₅
Astraverrucin V, 397–398
Astraverrucin VI, 398
Cycloaraloside B, 399
- C₄₅H₇₂O₁₅
Cyclocarposide A, 399–400
- C₄₅H₇₂O₁₆
Cyclosieversioside B (astragaloside I, astrasieversianin IV),
400–401
Isoastragaloside I, 401
- C₄₅H₇₄O₁₆
Agroastragaloside I, 402
- C₄₅H₇₄O₁₇
Askendoside D, 402–403
- C₄₅H₇₆O₁₇
Oleifolioside A, 403–404
- C₄₆H₇₂O₁₆
Astrasieversianin I, 404
- C₄₆H₇₄O₁₄
No name (770), 405
- C₄₆H₇₆O₁₇
Cyclosieversioside G (astrasieversianin XV), 405–406
- C₄₆H₇₆O₁₈
Trojanoside B, 406–407
Trojanoside H, 407–408
No name (774), 408
- C₄₆H₇₈O₁₇
Macrophyllsaponin D, 408–409
- C₄₆H₇₈O₁₈
Askendoside F, 409
Askendoside G, 409–410
Brachyoside A, 410–411
Cephalotoside A, 411–412
Oleifolioside B, 412
- C₄₇H₇₃NO₁₃
Mussaendoside C, 413
- C₄₇H₇₄O₁₇
Acetylastragaloside I, 413–414
Trojanoside I, 414
- C₄₇H₇₄O₁₈
Aquilegioside I, 415
- C₄₇H₇₄O₁₉
Aquilegioside J, 416
Aquilegioside A, 416–417
- C₄₇H₇₆O₁₈
Askendoside B, 417
- C₄₇H₇₆O₁₉
No name (788), 418–419
- C₄₇H₇₈O₁₇
Curculigosaponin H, 419
- C₄₇H₇₈O₁₈
Asernestioside A, 419–420
Curculigosaponin E, 420
Cyclosieversioside H (astrasieversianin XVI), 420–421
- C₄₇H₇₈O₁₉
Astragaloside VI, 421
Astragaloside VII, 421–422
Astragaloside V, 422
Cyclotrisectoside, 422–423
Trojanoside K, 423
Cycloaraloside F, 424
Cyclocanthoside F, 424–425
- C₄₇H₈₀O₁₇
Cyclofoetoside A, 425
- C₄₇H₈₀O₁₈
Cyclofoetoside B, 426
Trojanoside C, 426–427

- C₄₇H₈₀O₁₉
Brachyoside C, 427–428
- C₄₇C₈₀C₁₉
Cyclocanthoside G, 428–429
- C₄₈H₇₄O₁₆
Kahiricoside I, 429–430
- C₄₈H₇₅NO₁₄
Mussaendoside D, 430
- C₄₈H₇₆O₁₈
Juncoside I, 431
- C₄₈H₇₈O₁₈
Astrasierversianin IX, 431–432
Astrasierversianin XI, 432
Thalictoside V, 432–433
- C₄₈H₇₈O₁₉
Squarroside C, 433
- C₄₈H₇₈O₂₀
Aquilegioside H, 434
- C₄₈H₈₀O₁₆
Thalictoside A, 434–435
Squarroside I, 435
- C₄₈H₈₀O₁₈
Curculigosaponin I, 436
- C₄₈H₈₀O₁₉
Curculigosaponin F, 436–437
Thalictoside C, 437–438
- C₄₈H₈₂O₁₉
Curculigosaponin K, 438
No name (819), 438–439
- C₄₈H₈₂O₂₀
Trojanoside D, 439
- C₄₉H₈₀O₁₈
Thalictoside III, 439–440
Thalictoside IV, 440–441
- C₄₉H₈₀O₁₉
Astrasierversianin XII, 441
Astrasierversianin XIII, 441–442
Asernestioside B, 442
Asernestioside C, 442–443
Thalictoside XII, 443
Thalictoside XIII, 444
- C₄₉H₈₀O₂₀
Agroastragaloside IV, 444–445
Aquilegioside C, 445–446
Aquilegioside D, 446–447
- C₄₉H₈₀O₂₁
Aquilegioside E, 447
- C₅₀H₈₀O₁₉
Trojanoside J, 448–449
- C₅₀H₈₂O₁₇
Thalifoenoside A, 449
- C₅₁H₈₂O₂₁
Agroastragaloside III, 450–451
No name (836), 450–451
- C₅₂H₈₈O₂₃
Trojanoside F, 451–452
- C₅₃H₈₈O₂₂
Curculigosaponin J, 452
Curculigosaponin M, 452–453
- C₅₃H₉₀O₂₃
Trojanoside E, 453
- C₅₄H₈₅NO₁₉
Mussaendoside E, 454
- C₅₄H₈₈O₂₄
Juncoside II, 455
Juncoside III, 456
Juncoside IV, 456–457
- C₅₄H₉₀O₂₁
Thalictoside C, 457–458
- C₅₄H₉₀O₂₃
Quadranguloside, 458
- C₅₇H₈₄O₂₂
No name (847), 458–459
- C₅₉H₉₃NO₂₁
Mussaendoside M, 459–460
- C₅₉H₉₆O₂₇
Thalictoside IX, 460
- C₆₀H₉₂O₂₅
Juncoside V, 461
- C₆₀H₉₅NO₂₃
Mussaendoside H, 462
- C₆₀H₁₀₀O₂₈
Thalictoside D, 462–463
- C₆₅H₁₀₃NO₂₆
Mussaendoside N, 464
- C₆₅H₁₀₈O₃₂
Thalictoside F, 465–466
Thalictoside E, 466–467
- C₆₆H₁₀₅NO₂₇
Mussaendoside G, 467–468
- C₆₆H₁₀₅NO₂₈
No name (857), 468
- C₇₂H₁₁₅NO₃₂
Mussaendoside U, 468–469
- C₃₆H₆₀O₆
3-O-β-D-Glucopyranosylcycloeucalenol, 473
3β-D-Glucopyranoside of 31-norcycloswitenol, 473
- C₃₆H₆₀O₁₁
Cymbidoside, 474

