Pharmacologyonline 1: 195-208 (2009) Newsletter *Padmaa M Paarakh*

Phytoconstituents from the genus *Petunia* – a review

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Summary

A review of the phytoconstituents of the genus *Petunia* (Solanaceae) so far reported, has been presented considering that the genus comprises of a number of varieties of ornamental garden plants with wide distribution, the flowers of which possess variously stripped and colored corollas. Keeping in view of the potential of the genus, an attempt is made to present a review of phytoconstituents of the geuns *Petunia* which still remains as a source of lead molecules.

Key words: *Petunia*; phytoconstituents; Solanaceae; review

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Introduction

Genus *Petunia* comprises of a number of varieties of ornamental garden plants, out of which only two species viz., *Petunia nyctaginiflora* Juss and *P. violacea* Lindl occur in India, the latter being originally native of Argentina [1]. *P.nyctaginiflora* has white flowers whereas *P.violacea* has flowers with violet colored petals. The genus has been investigated phytochemically and was reported to possess ergostane type steroids and was able to report some of its novel types viz., petuniasterones, petunioside and petuniolides. However, *P.nyctaginiflora* was found to be devoid of such compounds. Due to abundance of bioactive constituents in this genus and research work published on *Petunia* species, it was felt worthwhile to present a phytochemical review of all compound isolated so far from the genus Petunia.
A list of chemical constituents reported in literature from the genus *Petunia* till date is given below in the Table no. 1.

Table no.1: List of chemical constituents isolated from genus *Petunia*

Name of the compound	Source (plant part)	Structure	Reference numbers
Petuniasterone A	*P.hybrida* (l&s)	1	2
16-Keto-petuniasterone A- 7-acetate	*P.parodii* (l)	2	3
Petuniasterone D	*P.hybrida* (l&s)	3	2
16-Keto-petuniasterone D- 7-acetate	*P.pardoii* (l)	4	3
7-deacetyl petuniasterone L	*P.parodii* (l)	5	3
12-α- acetoxy petuniasterone D-7- acetate	*P.hybrida* (l&s)	6	4
17- β-hydroxy petuniasterone A	*P.hybrida* (l&s)	7	4
17- β-hydroxy petuniasterone A-7-acetate	*P.hybrida* (l&s)	8	5
30 hydroxy petuniasterone A	*P.hybrida* (l&s)	9	5
Petuniasterone E	*P.hybrida* (l&s)	10	5
Petuniasterone I	*P.parodii* (l)	11	6
Petuniasterone J	*P.parodii* (l)	12	6
Petuniasterone L	*P.parodii* (l)	13	6
Petuniasterone K	*P.parodii* (l)	14	6
12-ε-Acetoxy-11β-hydroxy petuniasterone D-7-acetate	*P.integrifolia* (l)	15	6
12-ε-Acetoxy-11β-hydroxy petuniasterone M-7-acetate	*P.integrifolia* (l)	16	6
Petuniasterone M	*P.integrifolia* (l)	17	6
12-α- acetoxy petuniasterone M-7	*P.integrifolia* (l)	18	6
30-Acetoxy petuniasterone A-7- acetate	P.hybrida (l)	19	6

Petuniasterone O	*P.parodii* (l)	20	7
Petuniasterone R	*P.parodii* (l)	21	8
Petuniasterone S	*P.inflata* (l)	22	9
Petunianine C	*P.inflata* (l)	23	9
Petuniasterone B	*P.hybrida* (l&s)	24	2
Petuniasterone C	*P.hybrida* (l&s)	25	2
Petuniasterone C-7-acetate	*P.hybrida* (l&s)	26	5,6
Petuniasterone B-22-nicotinate	*P.inflata* (l)	27	9
Petuniasterone B-7,22-dinicotinate	*P.inflata* (l)	28	9
Petuniasterone C-7,22-diacetate	*P.inflata* (l)	29	9
Petuniasterone C-22-nicotinate	*P.inflata* (l)	30	9
Petuniasterone C-7-acetate,22-nicotinate	*P.inflata* (l)	31	9
Petuniasterone C-7,22-dinicotinate	*P.inflata* (l)	32	9
Petunisterone F	*P.hybrida* (l&s)	33	5
Petuniasterone G1	*P.hybrida* (l&s)	34	5
Petuniasterone G2[24 epimeric petuniasterone G1]	*P.hybrida* (l&s)	34*	5
Petuniasterone H1	*P.hybrida* (l&s)	35	5
Petuniasterone H2[24 epimeric petuniasterone H1]	*P.hybrida* (l&s)	35*	5
Petuniasterons N	*P.hybrida* (l)	36	10
	P.parodii (l)		10
	P.integrifolia (l)		10
Petuniasterone P1	*P.parodii* (l)	37	3
Petuniasterone P2	*P.parodii* (l)	38	3
Petuniasterone P3	*P.parodii* (l)	39	3
Petuniasterone P4	*P.parodii* (l)	40	3
Petuniasterone Q	*P.parodii* (l)	41	3
Petuniolide A	*P.integrifolia* (l)	42	11
Petuniolide B	*P.integrifolia* (l)	43	11
Petuniolide C	*P.parodii* (l)	44	11
Petuniolide D	*P.integrifolia* (l)	45	11
Petuniolide E	*P.parodii* (l)	46	3
Petuniolide F	*P.parodii* (l)	47	3
Petuniolide G	*P.parodii* (l)	48	3
Petunioside A	*P.hybrida* (ap)	49	12
Petunioside B	*P.hybrida* (ap & s)	50	12,13
24 Epipetunioside B	*P.hybrida* (ap)	50*	12
Petunioside	*P.hybrida* (ap)	51	12

24 Epipetunioside C	*P.hybrida* (ap)	51*	12
Petunioside D	*P.hybrida* (ap & s)	52	12,13
Petunioside F	*P.hybrida* (s)	53	13
Petunioside I	*P.hybrida* (s)	54	14
Petunioside L	*P.hybrida* (s)	55	14
Petunioside N	*P.hybrida* (s)	56	14
Oleanic acid	*P.patagonica* (ap)	57	15
Cyclolanosterol	*P.nyctaginiflora* (ep)	58	16
Physalindicanol A	*P.nyctaginiflora* (ep)	59	16
Physalindicanol B	*P.nyctaginiflora* (ep)	60	16
β- sitosterol	*P.nyctaginiflora* (ep)	61	16
Ent-19-hydroxy 17- acetoxy beyer-15-ene	*P.patagonica* (ap)	62	15
Ent-beyer-15-en-17-oic acid	*P.patagonica* (ap)	63	15
Ent-16-β-hydroxy 17- acetoxy kaurene	*P.patagonica* (ap)	64	17
Ent-16-β,17 dihydroxy kaurene	*P.patagonica* (ap)	65	17
Luteolin 7,3',4'-trimethyl ether	*P.patagonica* (ap)	66	15
Luteoline 7,3' dimethyl ether	*P.patagonica* (ap)	67	15
Taxifolin	*P.hybrida* (ap)	68	18
Quercetin 3-O-(2'-O-β-D-glucopyranosyl)-β-D-galactopyranoside	*P.hybrida* (ap)	69	18
Kaempferol-3-O-(2'-O-β-D-glucopyranosyl)-β-D-galactopyranoside	*P.hybrida* (ap)	70	18
2,3,4-tri(5 methylhexanoyl)-α-D-glucopyranosyl-β-D-fructofuranoside	*P.nyctaginiflora* (ep)	-	19
2,3,4-tri(6 methylheptanoyl)-α-D-glucopyranosyl-β-D-fructofuranoside	*P.nyctaginiflora* (ep)	-	19
Malvidin 3-O-(6-)-(4-O-(4-O-(6-O-feruloyl-β-D-glucopyranosyl)-E-p-coumaroyl)-α-rhamnosyl)- β-D-glucopyranoside)-5-β-D-glucopyranoside	*P.hybrida* (f)	-	20
Malvidin 3-O-(6-)-(4-O-(4-O-(6-O-E-p-coumaroyl-β-D-glucopyranosyl)-E-p-coumaroyl)-α-rhamnosyl)- β-D-glucopyranoside)-5-β-D-	*P.hybrida* (f)	-	20

glucopyranoside			
Malvidin	*P.hybrida* (f)	-	20
3-caffeoylglucosyl-p-coumaroylrutinoside-5-glucoside of malvidin	*P.hybrida* (f)	-	20
Petunidin	*P.hybrida* (f)	-	20
3-caffeoylglucosyl-p-coumaroylrutinoside-5-glucoside of petunidin	*P.hybrida* (f)	-	20
Delphinidin-3-O-[6-O-(4-O-(4-O-(6-O-(trans-caffeoyl)-β-D-glucopyranosyl)-trans-p-coumaroyl)-α-L-rhamnopyranosyl)-β-D-glucopranoside]-5-O-[β-D-glucopyranoside]	*P.reitzii* (f)	-	21
Delphinidin-3-O-[6-O-(4-O-(4-O-β-D-glucopyranosyl)-trans-p-coumaroyl)-α-L-rhamnopyranosyl)-β-D-glucopranoside]-5-O-[β-D-glucopyranoside]	P.reitzii (f)	-	21
Malvidin 3-O-[6-O-(4-O-E-caffeoyl-α-rhamnopyranosyl)-β-glucopyranoside]-5-O-β-glucopyranoside	*P.hybrida* (p)	-	22
Malvidin 3-O-[6-O-(4-O-Z-p-coumaroyl-α-rhamnopyranosyl)-β-glucopyranoside]-5-O-β-glucopyranoside	*P.hybrida* (p)	-	22
Cyanidin-3-glucoside	*P.exserta* (f)	-	23
Cyanidin-3-rutinoside	*P.exserta* (f)	-	23
Pelargonidin-3-glucoside	*P.exserta* (f)	-	23
Pelargonidin-3-rutinoside	*P.exserta* (f)	-	23
Malvidin 3-O-(6-)-(4-O-(4-O-(6-O-(trans-caffeoyl)-β-D-glucopyranosyl)-trans-p-coumaroyl)-α-L-rhamnopyranosyl)- β-D-glucopyranoside	*P.integrifolia* (f)	71	24
Malvidin 3-caffeoyl rutinoside	*P.integrifolia* (f)	-	24
Malvidin 3-p-coumaroyl rutinoside	*P.integrifolia* (f)	-	24

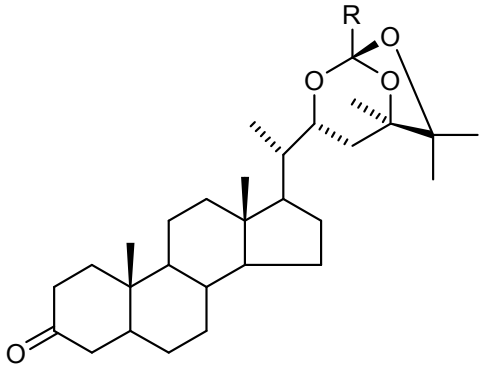
ap- aerial part; l-leaves; s-seed; ep-epigeal part; f-flower; p-petal.

Conclusion

The genus *Petunia* has been carefully studied for its phytoconstituents. Only 8 species have been phytochemically examined. The genus was reported to possess ergostane type steroids and of its novel types viz., petuniasterones, petunioside and petuniolides which could be used as marker for the genus. Hence exploration of this genus for phytoconstituents is by no means exhaustive and there still remains more scope for the study of bioactive molecules.

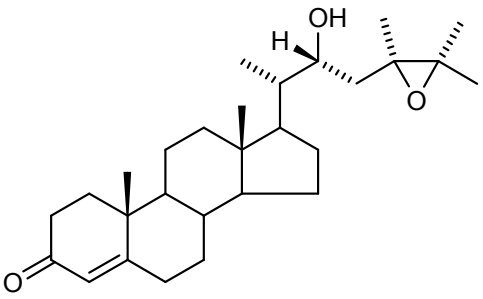
Acknowledgement

The author wish to thank Chairman and Executive Director, Children's Education Society for their support.

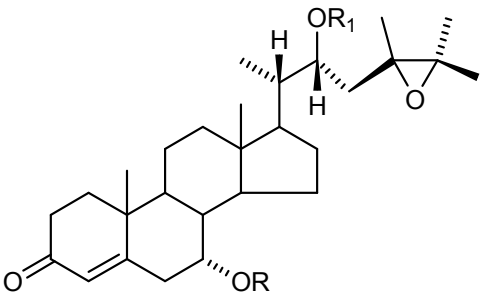


1: $\Delta^{1,4}$; 7α=OH;R=CH_2COSCH_3
2: $\Delta^{1,4}$; 7α=OAc;R=CH_2COSCH_3
3: $\Delta^{1,4}$; 7α=OH;R=CH_3
4: $\Delta^{1,4}$; 7α=OAc;R=CH_3
5: $\Delta^{1,4}$; 7α=OH;16β,17β=epoxy;R=CH_2COSCH_3
6: $\Delta^{1,4}$; 7α=12 α=OAc;R=CH_3
7: $\Delta^{1,4}$; 7α=17β=OH;R=$COSCH_3$
8: $\Delta^{1,4}$; 7α=OAc; 17β=OH;R=$COSCH_3$
9: $\Delta^{1,4}$; 7α=OH;R=$CHOHCOSCH_3$
10: Δ^{4}; 1α=OAc;7α=OH;R=CH_2COSCH_3
11: Δ^{1}; 7α=OAc;4β,5β=epoxy;17=OH;R=CH_2COSCH_3
12: Δ^{1}; 7α=12α=OAc;4β,5β=epoxy; R=CH_3
13: $\Delta^{1,4}$; 7α=OAc;16β,17β=epoxy;R=CH_2COSCH_3
14: $\Delta^{1,4}$; 7α=OAc;16β,17β=epoxy;R=CH_3
15: $\Delta^{1,4}$; 7α=12ε=OAc;11β=OH;R=CH_3
16: $\Delta^{1,4}$; 7α=12ε=OAc;11β=OH;R=C $_2H_5$
17: $\Delta^{1,4}$; 7α=OH;R=C_2H_5
18: $\Delta^{1,4}$; 7α=OH;12α=OAc;R=C_2H_5
19: $\Delta^{1,4}$; 7α=OAc;R=$CHOHCOSCH_3$
20: Δ^{1} =Oxo;2α=OAc;5α=OH;6α,7α=epoxy;R=CH_3

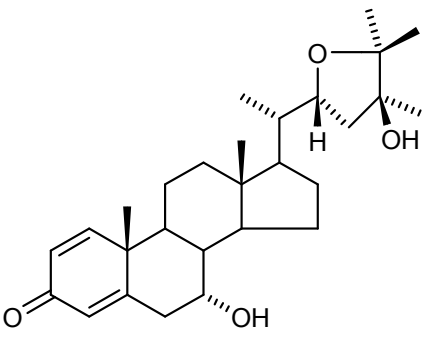
21: $\Delta^{1,4}$; 7α=OAc;16α,17α=epoxy;R=CH_2COSCH_3
22: Δ^4;1α=OAc;7α=OH;R=CH_3
23: Δ^4;1α=OAc;7α=OH;R=3-pyridyl



24: 1α=OAc;7α=OH
25: Δ^1; 7α=OH
26: Δ^1; 7α=OAc



27:R_1=nicotinoyl;R_2=H; 1α=OAc
28: R_1=R_2=nicotinoyl; 1α=OAc
29: $\Delta^{1,2}$;R_1=R_2=OAc
30: $\Delta^{1,2}$; R_1=nicotinoyl; R_2=H
31: $\Delta^{1,2}$; R_1=nicotinoyl;R_2=Ac
32: $\Delta^{1,2}$; R_1=R_2=nicotinoyl



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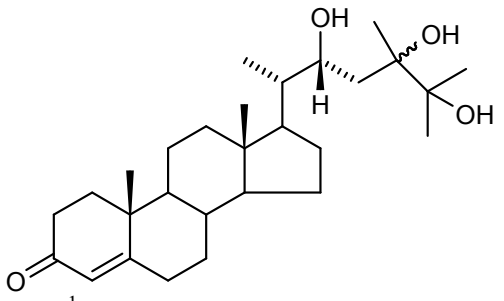
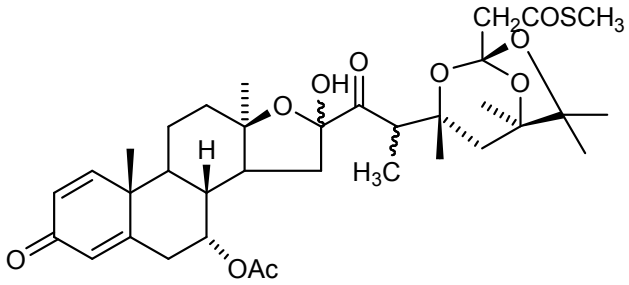


34: Δ^1; 7α=OH
35: 1α=OAc;7α=OH



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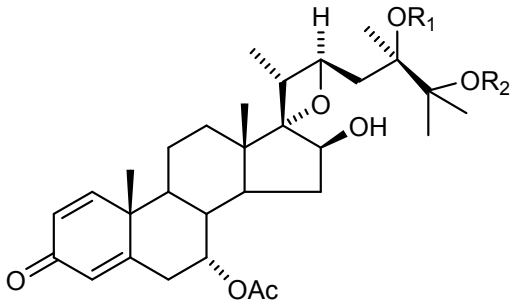
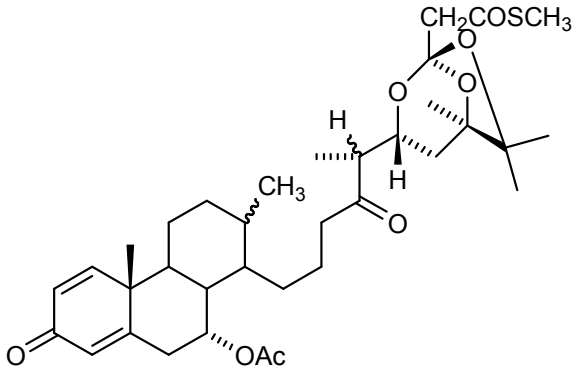


37: R_1=Ac;R_2=H
38: R_1=H;R_2=Ac
39: R_1=$COCH_2COSCH_3$;R_2=H
40: R_1=H;R_2=$COCH_2COSCH_3$



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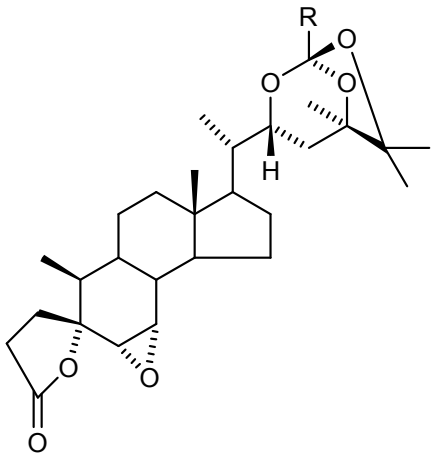
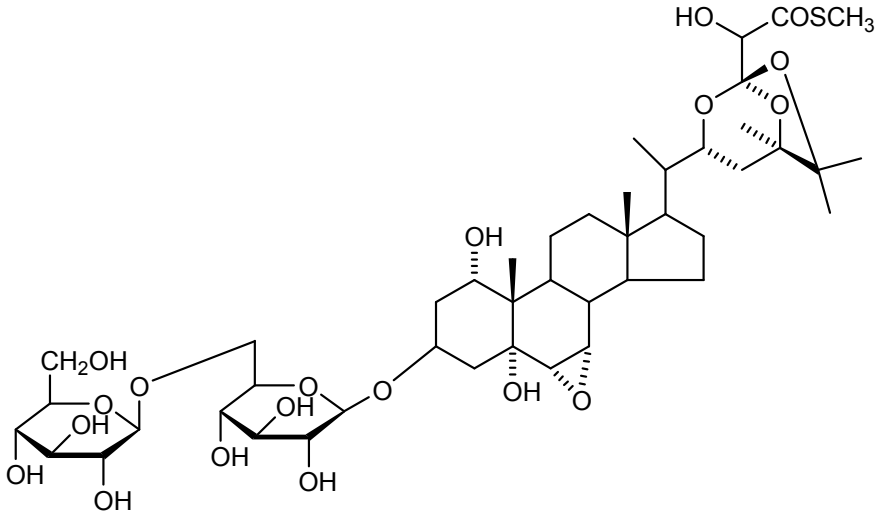


42: $\Delta^{9(11)}$; 12α=OAc;6α,7α=epoxy;R=CH_3
43: $\Delta^{9(11)}$; 12α=OAc;6α,7α=epoxy;R=C_2H_5
44: $\Delta^{9(11)}$; 12=Oxo;6α,7α=epoxy;R=CH_3
45: $\Delta^{9(11)}$; 12α=Oxo;6α,7α=epoxy;R=C2H_5
46: $\Delta^{9(11)}$; 6α,7α=epoxy;R=CH_3
47: Δ^{11}; 9β=OH;6α,7α=epoxy;R=CH_3
48: 9β,19β=cyclopropyl;11β=OH;12=Oxo;R=CH_3



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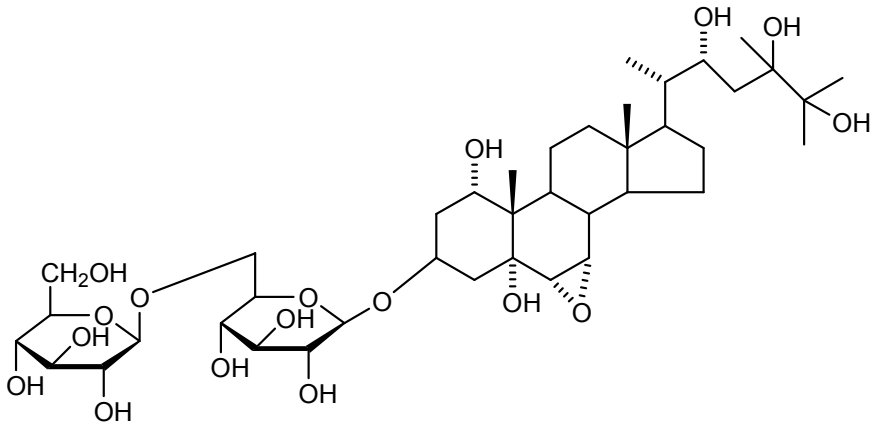
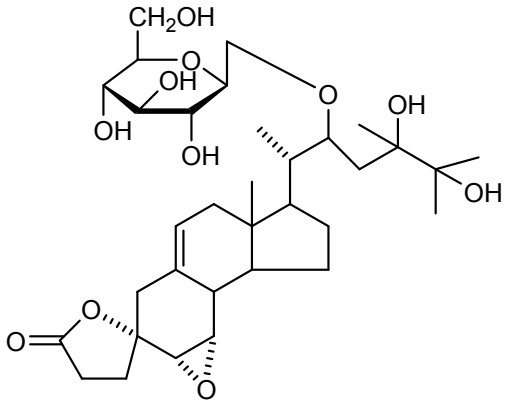
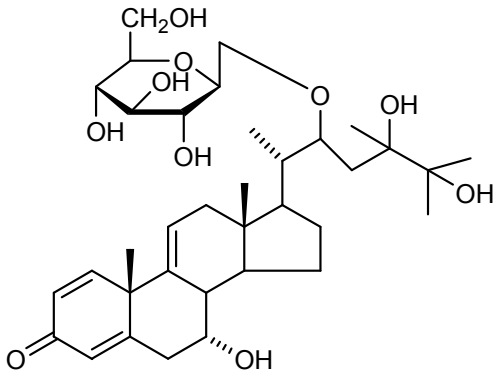

OH
OH
OH
OH
CH2OH
O
O
O
O
OH
OH
OH
OH
OH
O

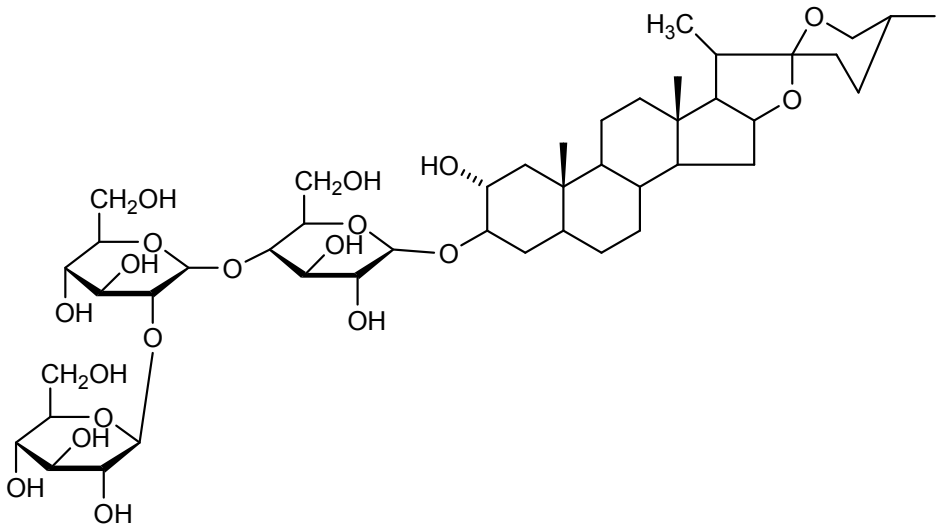
50


CH2OH
O
OH
OH
OH
O
OH
OH
O
O
O

51


CH2OH
O
OH
OH
OH
O
OH
OH
O
OH

52



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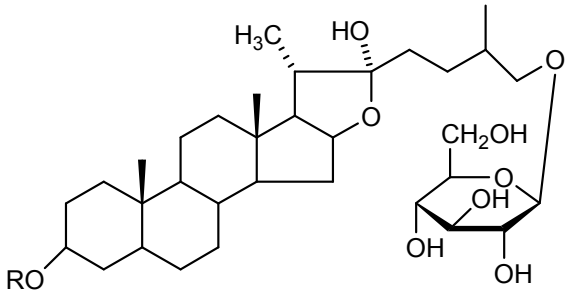
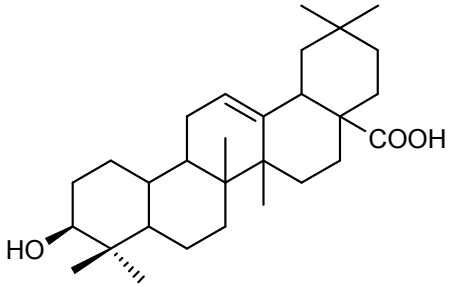


54: R=β-D-galactopyranoside
55: R=β-D-glucopyranosyl (1→4) β-D-galactopyranoside
56: R=β-D-glucopyranosyl (1→2) B-D- glucopyranosyl (1→4)-β-D-galactopyranoside



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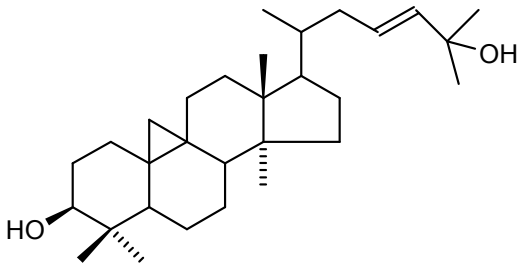

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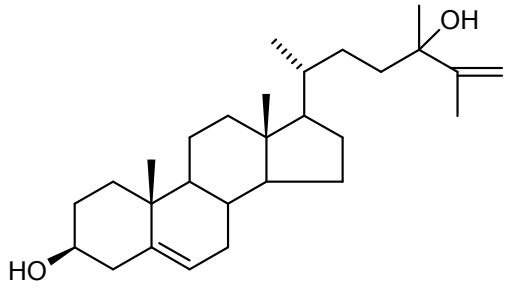

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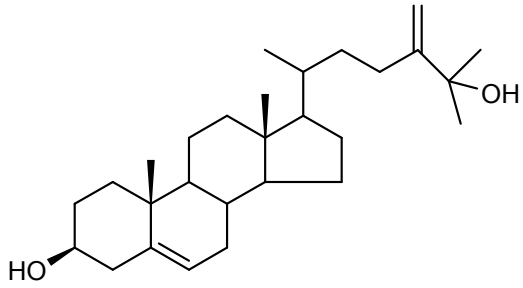

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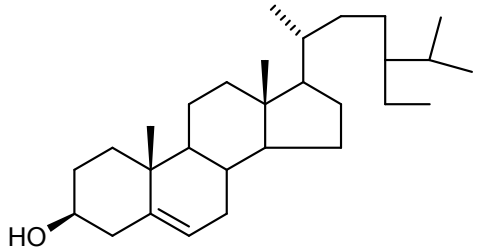

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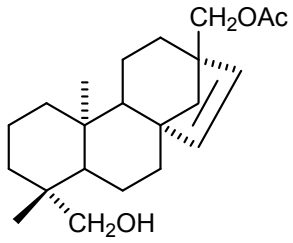

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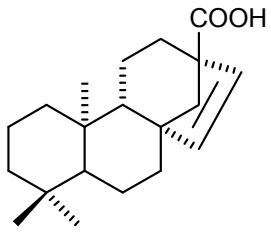

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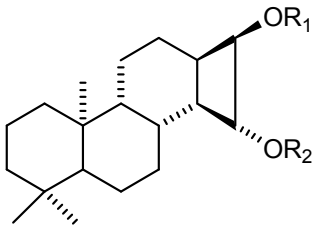
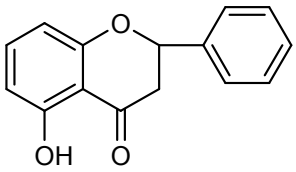
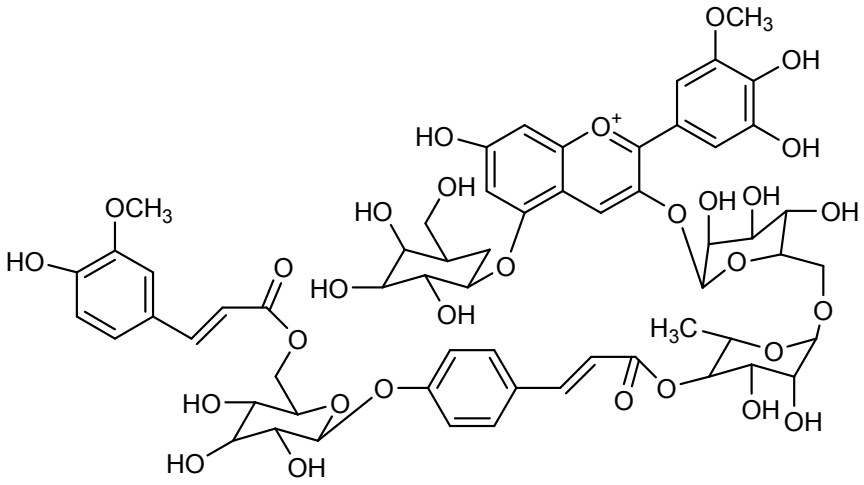


64: R_1=H;R_2=Ac
65: R_1=R_2=OH



66: Δ^2;7=3'=4'=OCH_3
67: Δ^2;7=3'=OCH_3;4'=OH
68: 7=3'=4'=OH
69: Δ^2;3=O-(glu-glu);7=3'=4'=OH
70: Δ^2;7=4'=OH;3=O-(glu-glu)



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