

SIMPLE ISOQUINOLINE ALKALOIDS

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As implied by their name, the simple isoquinolines are structurally the simplest of the isoquinoline alkaloids. They are usually bicyclic, although tricyclic species such as peyoglutam (**96**) and mescalotam (**97**) are also included among them. The nitrogen function in ring B is often tertiary and *N*-methylated, but it may also be secondary, *N*-formylated, *N*-acetylated, *N*-ethylated, or oxidized to the imine stage. Completely aromatic isoquinoline alkaloids such as backebergine (**29**) are also known. Quaternary simple isoquinolines, e.g., lophotine (**88**) and 2-methyl-6,7-dimethoxyisoquinolinium salt (**32**), have also been isolated. Of more than passing interest is pilocereine (**54**), the only trimeric isoquinoline alkaloid fully characterized.

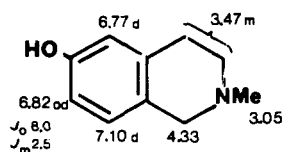
Simple isoquinolines display great variety in their substitution pattern, depending, of course, upon their biogenetic origin. Thus, logimammatine (**2**) possesses only one methoxyl substituent on ring A, while weberine (**98**) has four methoxyls on that ring.

Most simple isoquinolines have been obtained from the Cactaceae, but they also occur among the Alangiaceae, Annonaceae, Berberidaceae, Chenopodiaceae, Euphorbiaceae, Fumariaceae, Leguminosae, Menispermaceae, Monimiaceae, Musaceae, Nymphaeaceae, Papaveraceae, Ranunculaceae, Rhamnaceae, and Sterculiaceae.

Several reviews on the simple isoquinoline alkaloids have appeared (1-4). A comprehensive tabular summary of all the cactus alkaloids through 1980 has also been published (5). *Lemaireocereus weberi* is identical with *Pachycereus weberi* and with *Stenocereus weberi* (6). Similarly, *Lophophora williamsii* is synonymous with *Anhalonium lewinii* (7), and *Pachycereus marginatus* corresponds to *Marginatocereus marginatus* (8).

The alkaloids have been arranged in an ascending order of substitution, and a few purely synthetic but relevant compounds have also been included. Nmr chemical shifts are in ppm on the δ scale, and coupling constants are in Hz. Values with identical superscripts are interchangeable. If more than one reference is cited, it is the first reference only which is actually quoted in this review. Uv wave-lengths are in nm, and log ϵ values are given between parentheses. Only values for λ max are quoted. Ir values are in cm^{-1} . Melting points are in degrees centigrade and are uncorrected.

1. LONGIMAMMOSINE



$\text{C}_{10}\text{H}_{13}\text{NO}$ 163.0994

MP: 180-182° (EtOH) (9, 10)

(HCl) 234-235° (9)

236° (EtOH/Et₂O) (11)

UV: (HCl) (EtOH) 221 (3.82), 228 (3.79), 286 (3.23) (9)

IR: (HCl) (KBr) 3220, 2920, 2680, 2600, 1430, 1200 (9)

¹H NMR: (HCl) 100 MHz (D₂O) (9)

(DMSO-*d*₆) (12)

MS: (HCl) 163 (M⁺, 52) 162 (100), 120 (78), 91 (18), 44 (28) (9)

Sources:

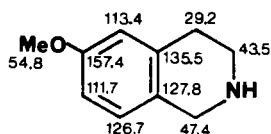
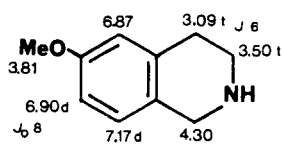
Cactaceae: *Dolichothele longimamma* (9)

Synthetic (11, 12)

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2. LONGIMAMMATINE

C₁₀H₁₃NO 163.0994MP: (HCl) 244-245.5° (EtOH/Et₂O) (9)

238-239° (12)

236° (EtOH/Et₂O) (11), 233-234° (13)

UV: (HCl) (EtOH) 220sh (3.81), 226 (3.85), 277 (3.23), 285 (3.20) (9)

IR: (HCl) (KBr) 2920, 2830, 2780, 1240, 1215, 1160 (9)

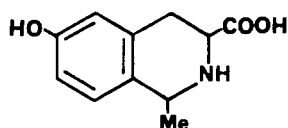
¹H NMR: (HCl) 100 MHz (D₂O) (9); DMSO-*d*₆ (12)¹³C NMR: (14); (HCl) (14)MS: (HCl) 163 (M⁺, 53), 162 (100), 134 (77), 118 (21), 91 (48), 44 (27) (9)

Sources:

Cactaceae: *Dolichotbele longimamma* (9)*Dolichotbele uberiformis* (5)

Synthetic (9, 11, 12)

3. 1-METHYL-3-CARBOXY-6-HYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE

C₁₁H₁₃NO₃ 207.0892

MP: 269-272° (15)

UV: (H₂O) 275 (15)

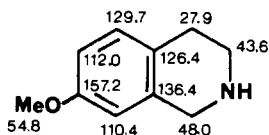
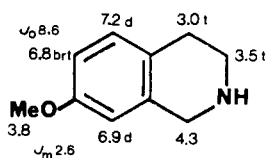
IR: (KBr) (1620) (15)

MS: 206, 192, 162, 160, 148, 147, 146 (15)

Source:

Euphorbiaceae: *Euphorbia myrsinites* (15)

4. WEBERIDINE

C₁₀H₁₃NO 163.0994MP: (Picrate) 207-208° (Et₂O/Me₂CO) (16)

215-216° (EtOH) (17)

(HCl) 228° (C₆H₆/CHCl₃) (6)

228-229° (18)

233-234° (EtOH) (17, 12)

UV: (HCl) (H₂O) 214 (3.8), 280 (3.4), 288 (3.4) (6, 16)

IR: (HCl) (KBr) 2910, 2830, 2780, 1590, 1240, 1160, 900 (6)

¹H NMR: (HCl) 80 MHz (D₂O) (6)100 MHz (DMSO-*d*₆) (12)¹³C NMR (14); (HCl) (14)

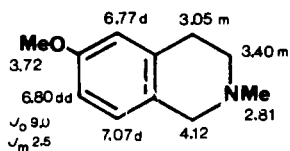
MS: (HCl) 163 (60), 162 (33), 135 (17), 134 (100), 119 (8), 104 (8), 91 (17) (6)

Sources:

Cactaceae: *Pachycereus weberi* (6)

Synthetic (12, 16, 17, 18)

5. 2-METHYL-6-METHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE

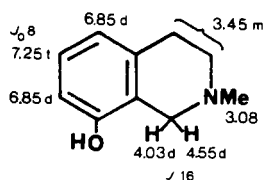
C₁₁H₁₅NO 177.1150

MP: (HCl) 165-168° (12)

170° (EtOH/Et₂O) (11)¹H NMR: (HCl) 100 MHz (DMSO-*d*₆) (12)

Sources: Synthetic (11, 12)

6. LONGIMAMMIDINE

 $C_{10}H_{13}NO$ 163.0994

MP: 171-174° (EtOH) (9)

173-174.5° (20)

175.5-176° (subl.) (12)

(HCl) 243-244° (EtOH) (12, 20)

247-248.5° (MeOH) (9)

UV: (iPrOH) 274 (3.26), 280 (3.26) (12)

(0.1N KOH) 241 (3.94), 388 (3.53) (12)

(HCl) (iPrOH) 218 (3.80), 275 (3.32), 280sh (3.31) (12)

(0.1N KOH) 242 (3.94), 288 (3.52) (12)

(EtOH) 217 (3.81), 279 (3.32) (9)

IR: (HCl) (KBr) 3100, 1590, 1460, 1270, 990 (9)

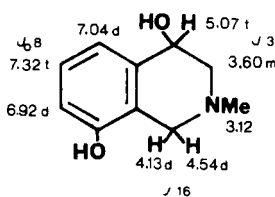
 1H NMR: (HCl) 100 MHz (D₂O) (9); (DMSO-*d*₆) (12)MS: (HCl) 163 (M⁺, 68), 162 (100), 120 (58), 91 (28), 44 (41) (9)

Sources:

Cactaceae: *Dolichothele longimamma* (9)

Synthetic (9, 12)

7. (-)-LONGIMAMMAMINE

 $C_{10}H_{13}NO_2$ 179.0943MP: (HCl) 224-228° (EtOH/Et₂O) (9)235-236.5° (H₂O) (9)[α]²⁵_D: (HCl) -60° (9)

UV: (HCl) (EtOH) 216 (3.61), 279 (3.23) (9)

IR: (HCl) (KBr) 3220, 3170, 3070, 2960, 1460, 1270 (9)

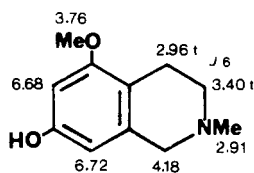
 1H NMR: (HCl) 100 MHz (D₂O) (9)MS: (HCl) 179 (M⁺, 16), 136 (21), 135 (18), 107 (10), 77 (11), 44 (100) (9)

Sources:

Cactaceae: *Dolichothele longimamma* (9)*Dolichothele uberiformis* (19)

Synthetic (9)

8. UBERINE

 $C_{11}H_{15}NO_2$ 193.1099

MP: (HCl) 263-267° (dec.) (19)

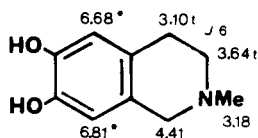
IR: (HCl) (KBr) 3400, 3150, 2920, 740, 690 (19)

 1H NMR: 100 MHz (D₂O) (19)MS: (HCl) 193 (M⁺, 42), 192 (64), 150 (100), 135 (39), 107 (53) (19)

Source:

Cactaceae: *Dolichothele uberiformis* (5, 19)

9. 2-METHYL-6,7-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE

 $C_{10}H_{13}NO_2$ 179.0943

MP: (HCl) 276° (EtOH/EtOAc/aqueous HCl) (11)

220-221° (21)

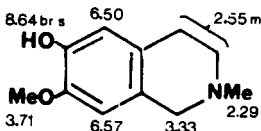
(Methiodide) 238-242° (21)

IR: (Methiodide) (KBr) 3470, 3400, 3300 (21)

 1H NMR: (Methiodide) (D₂O) (21)

Source: Synthetic (11, 21)

10. ISOCORYPALLINE

 $C_{11}H_{15}NO_2$ 193.1099MP: 164-165° (C₆H₆) (22, 23, 24, 25)

(HCl) 285-290° (EtOH) (22)

270-280° (24); 260-263° (EtOH) (17)

285° (23)

(Picrate) 168° (H₂O) (23)

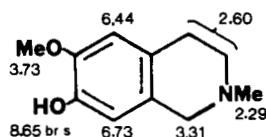
(Methiodide) 285° (iPrOH/EtOH) (23)

UV: (EtOH) 227 (3.55), 286 (3.44) (26, 25)
 (EtOH/NaOH) 247 (3.69), 301 (3.55) (26)
¹H NMR: 90 MHz (DMSO-*d*₆) (23)
 100 MHz (acetone-*d*₆) (24)
 MS: 194 (6), 193 (43), 192 (69), 177 (20), 164 (5),
 151 (13), 150 (100), 148 (6), 135 (21), 107 (16)
 (23, 25)

Sources:

Berberidaceae: *Berberis oblonga* (25)
 Fumariaceae: *Corydalis stricta* (27)
 Synthetic (17, 22, 23)

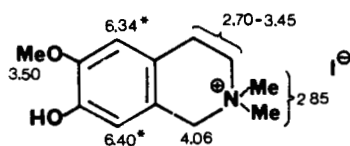
11. CORYPALLINE



$C_{11}H_{15}NO_2$ 193.1099
 MP: 168° (MeOH/Et₂O) (29, 30)
 167-168° (CHCl₃) (31, 32)
 164-166° (C₆H₆) (33, 26)
 171-173° (C₆H₆) (22, 23)
 (HCl) 185° (iPrOH/EtOH) (23)
 203-204° (EtOH) (28)
 (Picrate) 174-177° (22)
 178° (MeOH) (29); (H₂O) (23)
 (Methiodide) 243° (iPrOH/EtOH) (23)
 UV: (MeOH) 202 (4.43), 225 (3.68), 285 (3.56)
 (31, 26)
 (MeOH+NaOH) 245 (3.97), 293 (3.92) (31,
 26)
¹H NMR: 90 MHz (DMSO-*d*₆) (23); (CDCl₃+
 DMSO-*d*₆) (26, 33)
 MS: 194 (6), 193 (48), 192 (60), 177 (19), 151 (13),
 150 (100), 148 (6), 135 (21), 107 (14) (23, 33)

Sources:

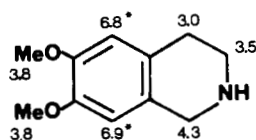
Cactaceae: *Islaya minor* (5)
 Fumariaceae: *Corydalis aurea* (29)
Corydalis ophiocarpa (34)
Corydalis pallida (29, 30)
Corydalis stricta (27)
 Monimiaceae: *Doryphora sassafras* (31)
 Papaveraceae: *Papaver bracteatum* (23)
 Ranunculaceae: *Thalictrum dasycarpum* (32)
Thalictrum rugosum (35)
 Synthetic (22, 23, 26, 28, 29, 33)

12. N-METHYLCORYPALLINE (IODIDE) $C_{12}H_{18}NO_2I$ 335.0378

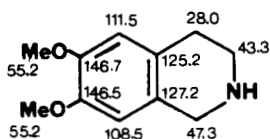
MP: 238-239° (27)
 UV: (EtOH) 287 (4.14) (27)
 IR: (KBr) 3370, 1620, 1610, 1530 (27)
¹H NMR: 100 MHz (CF₃COOH) (27)
 MS: 207, 206, 177, 164, 150, 142, 127 (27)
 Source:

Fumariaceae: *Corydalis stricta* (27)

13. HELIAMINE



$C_{11}H_{15}NO_2$ 193.1099
 MP: 84-85° (17)
 (Picrate) 223-225° (EtOH) (17)
 (Methiodide) 253-254° (EtOH) (17)
 (HCl) 248° (EtOH/Et₂O) (36, 6)
 243° (37)
 254-256° (EtOH)₂ (38, 39)
 253° (EtOH/H₂O) (11, 17)
 UV: (HCl) (H₂O) 203 (4.5), 220 (3.8), 284 (3.6),
 288sh (3.6) (6)



IR: (HCl) (KBr) 2900, 2750, 1610, 1510, 1245, 1210, 1100, 1000, 840, 790 (6)

¹H NMR: (HCl) 80 MHz (D₂O) (6)
CDCl₃ (39)

¹³C NMR: (14, 40)

MS: (HCl) 193 (90), 192 (57), 178 (9), 165 (17), 164 (100), 149 (14), 121 (16) (6)

Sources:

Cactaceae: *Backebergia militaris* (41)

Carnegiea gigantea (37)

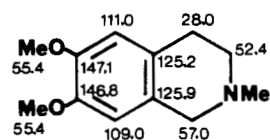
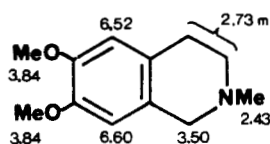
Pachycereus pecten-aboriginum (42)

Pachycereus pringlei (5, 36)

Pachycereus weberi (5, 6)

Synthetic (6, 11, 38, 39)

14. N-METHYLHELIAMINE (O-METHYLCORYPALLINE)



C₁₂H₁₇NO₂ 207.1255

MP: 69-70° (MeOH) (43)

75-77° (Et₂O) (11, 39)

81-82° (petroleum ether) (25)

Hemihydrate 82° (Et₂O) (29, 44)

(HCl) 210° (6)

215° (6, 11, 44)

221-222° (39)

(Picrate) 159-160° (EtOH) (44)

160° (C₆H₆/MeOH) (29)

UV: (HCl) (H₂O) 210 (4.4), 217 (3.6), 282 (3.4), 288 (3.3) (6)

¹H NMR: 90 MHz (CDCl₃) (23)

60 MHz (CDCl₃) (43)

(HCl) 80 MHz (D₂O) (6)

100 MHz (CDCl₃) (45)

¹³C NMR: (14, 40)

MS: (HCl) 207 (63), 206 (57), 164 (100), 149 (14), 120 (17) (6, 23, 46)

Sources:

Cactaceae: *Backebergia militaris* (41, 46)

Pachycereus weberi (5, 6)

Pilosocereus guerreronis (47)

Nymphaeaceae: *Nelumbo nucifera* (48, 49)

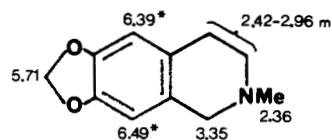
Papaveraceae: *Papaver bracteatum* (23)

Ranunculaceae: *Thalictrum dioicum* (43)

Thalictrum polygamum (50)

Synthetic (6, 39, 45, 48, 51)

15. HYDROHYDRASTININE



C₁₁H₁₃NO₂ 191.0943

MP: 66° (52, 53)

61-61° (light petroleum ether) (10, 22)

(HCl) 263-269° (EtOH) (22)

274° (H₂O) (53)

276-278° (EtOH) (22)

(Picrate) 175-176° (52)

(Oxalate) 182-183° (39)

(HBr) 293° (10)

IR: (CCl₄) 2793 (54)

(Nujol) 1259, 1238, 1138, 1121, 1040, 930 (54)

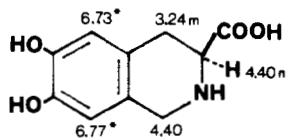
(CHCl₃) 1477, 1379, 1368, 1258, 1235, 1136, 1035, 942 (54)

(HCl) (Nujol) 1361, 1244, 1129, 1031, 937 (54)

¹H NMR: (CDCl₃) (39)

(HCl) (D₂O) (22)

16. (-)-3-CARBOXY-6,7-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



MS: 191 (M^+), 190, 175, 162, 148, 89, 77, 63, 42, 36 (55)

Sources:

Fumariaceae: *Corydalis cava* (52)

Corydalis tuberosa (1)

Synthetic (22, 39)

$C_{10}H_{11}NO_4$ 209.0685

MP: 286-288° (20% HOAc) (56)

293-294° (dec.) (H_2O) (57)

$[\alpha]_D$: -126.9° (c 1, 1N HCl) (57)

$[\alpha]^{25}_D$: -114.9° (c ca 1.65, 20% HCl) (56)

-110.5° (c 1.67, 20% HCl) (56)

UV: (20% HCl) 210, 282 (56, 58)

IR: (KBr) 3400, 3330-2220, 1610 (56)

1H NMR: 60 MHz (2 N CF_3COOD in D_2O) (56)

(2 N NaOD in D_2O) (56)

100 MHz ($CD_3OD + DCl$) (57)

Sources:

Leguminosae: *Mucuna mutisiana* (56, 59)

Mucuna urens (56)

Mucuna deeringiana (56)

Mucuna andreana (56)

Mucuna boltoni (56)

Mucuna pruriens (56)

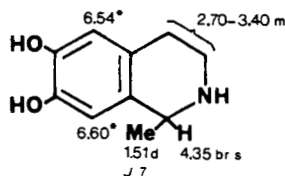
Mucuna sloanei (56)

Stizolobium bassjoo (59)

Synthetic (-) (56, 57, 58)

Synthetic (\pm) (60)

17. SALSOLINOL



$C_{10}H_{13}NO_2$ 179.0943

MP: (-) isomer (HBr) 174-175° (EtOH/Et₂O) (61)

(+) isomer (HBr) 174-175° (61)

(Picrate) 92° (62)

$[\alpha]_D$: (-) isomer (HBr) -30.9° (MeOH) (61)

(+) isomer (HBr) +30.0° (MeOH) (61)

UV: (EtOH) 225 sh (3.81), 288 (3.59) (61)

1H NMR: (HBr) 60 MHz (DMSO- d_6) (61)

ORD: (-) isomer (HBr) (c 0.27, MeOH) $[\phi]_{700} -63^\circ$,

$[\phi]_{589} -65^\circ$, $[\phi]_{298} 0^\circ$ (pk), $[\phi]_{270} -1570^\circ$ (tr),

$[\phi]_{262} -1450^\circ$ (pk), $[\phi]_{242} -3370^\circ$ (tr),

$[\phi]_{228} -1930^\circ$ (pk) (61)

CD: (-) isomer (HBr) (c .001 M, MeOH) $[\theta]_{310} 0$,

$[\theta]_{285} +1160$, $[\theta]_{241} -960$, $[\theta]_{215} +3770$ (61)

Sources:

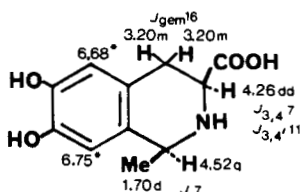
Annonaceae: *Annona reticulata* (63)

Musaceae: *Musa paradisiaca* (64)

Sterculiaceae: *Theobroma cacao* (65)

Synthetic (+) and (-) (61)

18. (-)-1-METHYL-3-CARBOXY-6,7-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



$C_{11}H_{13}NO_4$ 223.0841

MP: 280-281° (dec.) (H_2O) (57)

$[\alpha]^{26}_D$: -143.4° (c 0.5, 6N HCl) (66)

-142.8° (c 0.7, 6N HCl) (66)

$[\alpha]_D$: +151.5° (c 1, 1N HCl) (57)

UV: (H_2O) 286 (66)

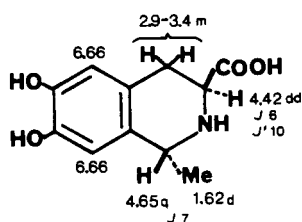
(6N HCl) 282 (66)

$^1\text{H NMR}$: 100 MHz ($\text{D}_2\text{O} + 1$ drop CF_3COOH) (66)
 ($\text{CD}_3\text{OD} + \text{DCl}$) (57, 67)
 MS: 223 (M^+), 162 (66)
 ORD: (c 0.221, 0.1N HCl) $[\phi]_{650} - 277^\circ$, $[\phi]_{589} - 342^\circ$, $[\phi]_{246} - 10,080^\circ(\text{tr})$, $[\phi]_{229} - 2770^\circ(\text{pk})$, $[\phi]_{208} - 20,160^\circ(\text{tr})$ (57)
 CD: (c 0.01M, 1N HCl) $[\theta]_{310} 0$, $[\theta]_{290} - 353$, $[\theta]_{273} - 100$, $[\theta]_{237} - 8570$, $[\theta]_{220} - 810$, $[\theta]_{216} - 5640$ (57, 67)

Sources:

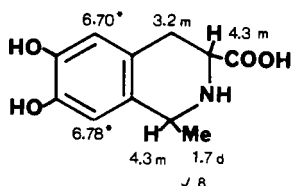
Leguminosae: *Mucuna deeringiana* (66)
 Synthetic (57, 66)

19. (-)-1-METHYL-3-CARBOXY-6,7-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



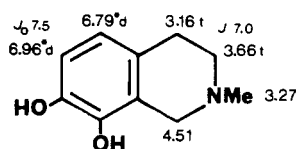
$\text{C}_{11}\text{H}_{13}\text{NO}_4$ 223.0841
 MP: 212° (dec.) (H_2O) (57)
 $[\alpha]_D$: -74.34° (c 2, 1N HCl) (57)
 $^1\text{H NMR}$: 100 MHz ($\text{CD}_3\text{OD} + \text{DCl}$) (57, 67)
 ORD: (c 0.223, 0.1N HCl) $[\phi]_{650} + 137^\circ$, $[\phi]_{589} - 170^\circ$, $[\phi]_{292} - 3750^\circ(\text{tr})$, $[\phi]_{266} - 500^\circ(\text{pk})$, $[\phi]_{235} - 7500^\circ(\text{tr})$, $[\phi]_{220} - 500^\circ(\text{pk})$, $[\phi]_{210} - 1750^\circ$ (57)
 CD: (c 0.1 M, 0.1N HCl) $[\theta]_{302} 0$, $[\theta]_{282} - 3000$, $[\theta]_{250} - 300$, $[\theta]_{230} - 10,000$, $[\theta]_{217} - 8000$, $[\theta]_{204} - 22,000$, $[\theta]_{200} - 13,000$ (57, 67)
 Source: Synthetic (57)

20. 1-METHYL-3-CARBOXY-6,7-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



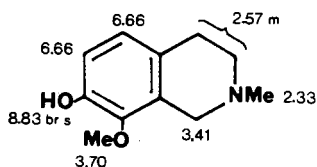
$\text{C}_{11}\text{H}_{13}\text{NO}_4$ 223.0841
 MP: $240-264^\circ$ (dec.) (10% HOAc) (59)
 $^1\text{H NMR}$: ($\text{D}_2\text{O} + \text{DCl}/\text{DSS}$) (59)
 $^{13}\text{C NMR}$: 173.4(s), 146.4(s), 145.9(s), 127.2(s), 125.1(s), 118.5(d), 115.4(d), 58.2(d), 56.0(d), 31.4(t), 21.1(q) (59)
 MS: 223 (M^+), 208, 162, 123, 107 (59)
 Sources:
 Leguminosae: *Stizolobium hassjoo* (59)

21. 2-METHYL-7,8-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



$\text{C}_{10}\text{H}_{13}\text{NO}_2$ 179.0943
 MP: (HBr) $216-219^\circ$ (21)
 (Methiodide) 238° (dec.) (21)
 IR: (Methiodide) (Nujol) 3460, 3270 (21)
 $^1\text{H NMR}$: (Methiodide) (D_2O) (21)
 Source: Synthetic (21)

22. 2-METHYL-7-HYDROXY-8-METHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE

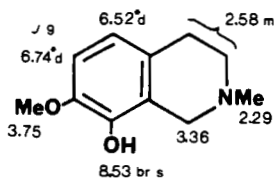


$\text{C}_{11}\text{H}_{15}\text{NO}_2$ 193.1099
 MP: 160° (iPrOH) (23)
 $163-164^\circ$ (ErOH) (10)
 (HCl) 265° (iPrOH/ErOH) (23)
 (Picrrate) 188° (H_2O) (23)
 (Methiodide) 207° (ErOH) (23)
 $^1\text{H NMR}$: 90 MHz ($\text{DMSO}-d_6$) (23)
 MS: 194 (12), 193 (79), 192 (88), 178 (13), 177 (37), 176 (12), 162 (8), 151 (12), 150 (100), 149 (52),

148 (10), 136 (12), 135 (85), 132 (17), 121 (17),
120 (15), 107 (23), 104 (8) (23)

Source: Synthetic (10, 23)

23. 2-METHYL-7-METHOXY-8-HYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



$C_{11}H_{15}NO_2$ 193.1099

MP: 102° (hexane) (23, 68)
(HCl) 217-219° (EtOH/Et₂O) (68, 23)
(Picrate) 180° (H₂O) (23)
(Methiodide) 223° (iPrOH/Et₂O) (23)

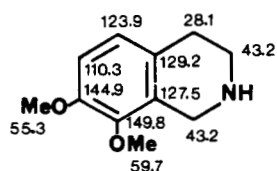
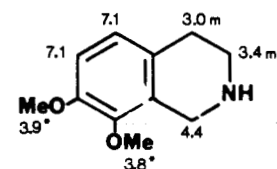
UV: (iPrOH) 233 (3.75), 283 (3.44) (68)
(0.1N KOH) 247 (3.85), 292 (3.60) (68)

¹H NMR: 90 MHz (DMSO-*d*₆) (23, 68)

MS: 194 (7), 193 (53), 192 (57), 177 (18), 176 (7),
151 (11), 150 (100), 136 (5), 135 (30), 121 (7),
120 (6), 107 (14) (23)

Source: Synthetic (23, 68)

24. LEMAIREOCEREINE



$C_{11}H_{15}NO_2$ 193.1099

MP: (HCl) 180° (6)
185° (6)
190° (EtOH/Et₂O) (69)

UV: (HCl) (H₂O) 223sh (3.9), 278 (3.4), 286 (3.4),
293sh (3.3) (6)

IR: (HCl) (KBr) 3035, 2720, 2600, 1580, 1495,
1280, 1250, 1095, 1000, 895, 800 (6)

¹H NMR: 80 MHz (D₂O) (6)

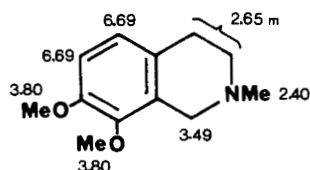
¹³C NMR: (14, 40); (HCl) (14)

MS: 193 (100), 192 (46), 164 (82), 178 (14), 149
(45), 121 (11) (6)

Sources:

Cactaceae: *Backebergia militaris* (5, 69)
Pachycereus pringlei (5, 36)
Pachycereus weberi (6)
Synthetic (6)

25. 2-METHYL-7,8-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE



$C_{12}H_{17}NO_2$ 207.1255

MP: (HCl) 173-174° (Et₂O) (68)

UV: 280 (3.26) (68)

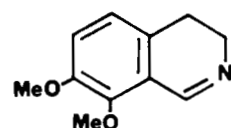
¹H NMR: 90 MHz (CCl₄) (23)

100 MHz (CDCl₃) (68)

MS: 207 (M⁺, 73), 206 (87), 192 (20), 164 (93), 149
(100) (47, 23)

Source: Synthetic (23)

26. DEHYDROLEMAIREOCEREINE



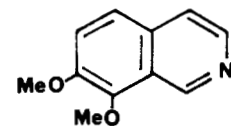
$C_{11}H_{13}NO_2$ 191.0943

MS: (H⁺) 176 (100), 160 (29), 146 (28), 131 (33),
117 (17), 103 (12), 96 (65), 91 (8), 77 (12), 63
(7) (46)

Source:

Cactaceae: *Backebergia militaris* (46)
Synthetic (46)

27. ISOBACKEBERGINE



$C_{11}H_{11}NO_2$ 189.0787

BP: 107-109°/(0.15 mm) (70)

MP: (Methiodide) 178° (70)

(Picrate) 204° (EtOH) (70)

(Methobromide) 175-178° (70)

MS: (H⁺) 174 (100), 158 (29), 145 (44), 129 (38),

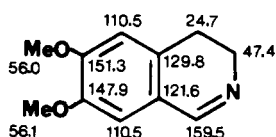
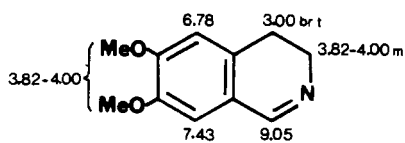
116 (22), 103 (19), 95 (45), 89 (10), 75 (10), 63 (9), 51 (6) (46)

Source:

Cactaceae: *Backebergia militaris* (46)

Synthetic (46, 70)

28. DEHYDROHELIAMINE



$C_{11}H_{13}NO_2$ 191.0943

MP: (HCl) 194-196° (EtOH/Et₂O) (71)

¹H NMR: 80 MHz (CDCl₃) (71)

(HCl) 80 MHz (D₂O) (71)

¹³C NMR: (40)

MS: 191 (100), 190 (15), 176 (70), 164 (5), 146 (10), 136 (30), 117 (12), 104 (15), 91 (10), 77 (20) (71)

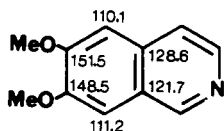
Sources:

Cactaceae: *Backebergia militaris* (46)

Carnegiea gigantea (71)

Synthetic (71, 72)

29. BACKEBERGINE



$C_{11}H_{11}NO_2$ 189.0787

MP: (HCl) 219° (46)

MS: 189 (M⁺, 100), 174 (15), 146 (35) (46)

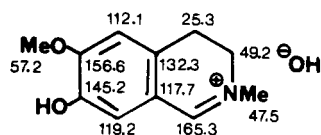
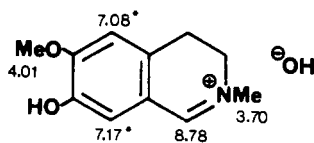
¹³C NMR: (40)

Sources:

Cactaceae: *Backebergia militaris* (46)

Synthetic (46, 73)

30. PYCNARRHINE



$C_{11}H_{15}NO_3$ 209.1048

MP: 185-187° (74)

(Chloride) 184-186° (EtOH) (34)

(Iodide) 216-218° (28)

UV: (ammoniacal MeOH) 265, 325 (74)

(after acidifying with 4N HCl) 254, 310, 355 (74)

(Chloride) (EtOH) 251 (4.24), 312 (4.00), 370 (3.86) (34)

IR: 1655 (75)

¹H NMR: 100 MHz (CD₃OD) (74)

60 MHz (D₂O) (75)

(Chloride) (CF₃COOH) (34)

¹³C NMR: (74)

MS: 194 (7), 193 (60), 192 (66), 191 (6), 190 (12), 177 (16), 151 (12), 150 (100), 135 (8) (74)

Sources:

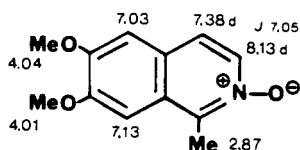
Fumariaceae: *Corydalis ophiocarpa* (34)

Corydalis stricta (27)

Menispermaceae: *Pycnarrhena longifolia* (74)

Synthetic (74, 75)

31. NIGELLIMINE N-OXIDE



$C_{12}H_{13}NO_3$ 219.0892

UV: (MeOH) 236, 267sh, 278sh, 289sh, 310, 324 (75a)

IR: (CHCl₃) 2900, 2845, 1725, 1600, 1318, 1155, 902 (75a)

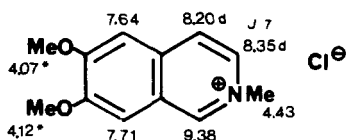
¹H NMR: 300 MHz (CDCl₃) (75a)

MS: 203 (M⁺-O, 100), 188 (2.16), 172 (2.08), 160 (27.62), 145 (7.79), 131 (5.56), 117 (10.73), 97 (5.17), 85 (5.63), 69 (8.26) (75a)

Sources:

Ranunculaceae: *Nigella sativa* (75a)

32. 2-METHYL-6,7-DIMETHOXYISO-
QUINOLINIUM CHLORIDE



$C_{12}H_{14}NO_2Cl$ 239.0709

MP: 185.5-186.5° (EtOH/hexane) (76)

UV: (MeOH) 253 (4.91), 310 (3.95) (76)

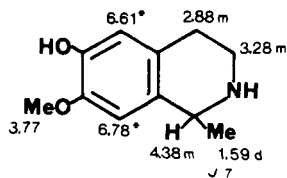
1H NMR: 90 MHz (CD₃OD) (76)

MS: 204 (M⁺, 10), 205 (M⁺+1, 7), 189 (100), 188 (62) (76)

Source:

Ranunculaceae: *Thalictrum revolutum* (76)

33. (+)-SALSOLINE



$C_{11}H_{15}NO_2$ 193.1099

MP: 215-216° (77)

(HCl) 174-175° (78)

171-172° (77)

[α]_D: +31.0° (78)

(H₂O) +40.1° (77)

UV: (HCl) (iPrOH) 204 (4.60), 227 (3.77), 284 (3.55), 286 (3.55) (78)

1H NMR: (HCl) 100 MHz (DMSO-*d*₆) (78)

ORD: (HCl) (c 0.23, MeOH) [φ]₇₀₀ +52°, [φ]₅₈₉ +75°, [φ]₄₀₀ +142°, [φ]₃₆₈ +148°, [φ]₃₅₀ +140°, [φ]₃₁₄ 0°, [φ]₂₉₃ -1100°(tr), [φ]₂₈₃ 0°, [φ]₂₆₆ +1300°(pk), [φ]₂₄₇ 0°, [φ]₂₄₀ -1100°(tr), [φ]₂₃₅ 0°, [φ]₂₀₅ +30,000°(pk), [φ]₁₉₇ 0° (78)

CD: (HCl) (c 0.01 M, MeOH) [θ]₃₀₃ 0, [θ]₂₈₈ -1620, [θ]₂₈₆ -1500, [θ]₂₈₂ -1740, [θ]₂₅₂ -220, [θ]₂₃₁ -5800, [θ]₂₂₀ -4400, [θ]₂₁₄ -7000, [θ]₂₀₆ 0, [θ]₂₀₁ +19,000 (78)

Sources:

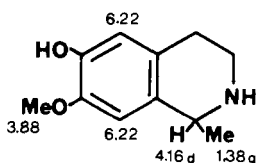
Chenopodiaceae; *Salsola richteri* (77, 79)

Salsola arbuscula (1, 80)

Synthetic (78)

34. SALSOLINE

(Undetermined rotation)



$C_{11}H_{15}NO_2$ 193.1099

MP: 218-222° (MeOH/Me₂CO) (81)

212-215° (82, 77)

218-221° (EtOH) (83)

(HCl) 200° (84, 77)

141-144° (82)

(Picrate) 192-194° (77)

UV: (MeOH) 210 (4.14), 225 (3.81), 286 (3.56), 290 (3.51) (82, 81)

IR: (KBr) 3450, 3318, 1627, 1532, 1030 (81)

1H NMR: (acetone-*d*₆) (81); (CDCl₃) (82)

MS: 193 (M⁺, 3), 192 (12), 178 (100), 164 (5), 163 (17), 149 (11), 134 (7), 122 (6), 43 (25) (81, 85)

Sources:

Alangiaceae: *Alangium lamarckii* (86)

Cactaceae: *Echinocereus merkerii* (5, 85)

Pachycereus pecten-aboriginum (5, 42)

Chenopodiaceae: *Corispermum leptopyrum* (87)

Salsola arbuscula (1, 88)

Salsola kali (88, 89, 90)

Salsola richteri (77, 79, 83, 88, 91)

Salsola ruthenica (88, 89)

Salsola soda (88, 89)

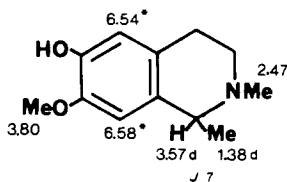
Leguminosae: *Calycotome spinosa* (92)

Desmodium tiliaefolium (81)

Genista purgans (92)

Synthetic (82, 84)

35. (±)-1,2-DIMETHYL-6-HYDROXY-7-METHOXY-1,2,3,4-Tetrahydroisoquinoline



$C_{12}H_{17}NO_2$ 207.1255

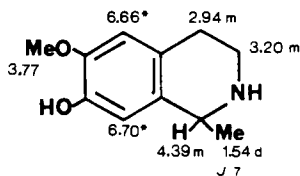
MP: 144.5-147° (C_6H_6) (24)

IR: ($CHCl_3$) 3550 (24)

1H NMR: 100 MHz ($CDCl_3$) (24)

Source: Synthetic (24)

36. ISOSALSOLINE



$C_{11}H_{15}NO_2$ 193.1099

MP: (+) isomer (HCl) 241-242° (78)

$[\alpha]_D$: (HCl) +24.7° (78)

UV: (+) isomer (HCl) (iPrOH) 204 (4.62), 227 sh (3.89), 286 (3.56) (78)

1H NMR: (+) isomer (HCl) 100 MHz ($DMSO-d_6$) (78)

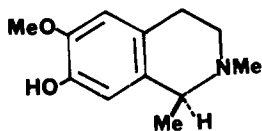
ORD: (+) isomer (HCl) (c 0.23, MeOH) $[\phi]_{700} +39^\circ$, $[\phi]_{589} +54^\circ$, $[\phi]_{400} +101^\circ$, $[\phi]_{375} +105^\circ$, $[\phi]_{350} +98^\circ$, $[\phi]_{317} 0^\circ$, $[\phi]_{292} -950^\circ$ (tr), $[\phi]_{282} 0^\circ$, $[\phi]_{265} +1300$ (pk), $[\phi]_{238} 0^\circ$, $[\phi]_{227} +2250$ (pk), $[\phi]_{207} 0^\circ$ (78)

CD: (+) isomer (HCl) (c 0.01M, MeOH) $[\theta]_{304} 0$, $[\theta]_{285} -1600$, $[\theta]_{252} -120$, $[\theta]_{207} -20,000$, $[\theta]_{202} 0$ (78)

Sources:

Cactaceae: *Pachycereus pecten-aboriginum*, specific rotation and stereochemistry unspecified (5, 42)
Synthetic (+) and (-) (78)

37. (+)-N-Methylisosalsoline (1-Methylcorypalline)



$C_{12}H_{17}NO_2$ 207.1255

MP: 156-158° (93)

(HCl) 200-202° (78)

$[\alpha]_D$: +33.5° (c 0.23, $CHCl_3$) (93)

1.0° (c 0.23, EtOH) (93)

(HCl) +1.6° (c 1%, MeOH) (78)

$[\alpha]_{365}$: (HCl) +40.0° (c 1%, MeOH) (78)

ORD: (78); see also (94)

CD: (78); see also (94)

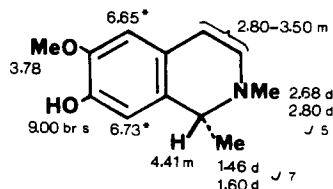
Sources:

Chenopodiaceae: *Haloxylon articulatum* (95)

Fumariaceae: *Corydalis ambigua* (93)

Synthetic (78, 94)

37a. (-)-N-Methylisosalsoline (1-Methylcorypalline)



$C_{12}H_{17}NO_2$ 207.1255

MP: (HCl) 200-202° (78)

$[\alpha]_D$: (HCl) -1.4° (c 1%, MeOH) (78)

$[\alpha]_{365}$: (HCl) -42.6° (c 1%, MeOH) (78)

UV: (HCl) (iPrOH) 203 (4.70), 226 (3.88), 285 (3.59) (78)

1H NMR: (HCl) 100 MHz ($DMSO-d_6$) (78)

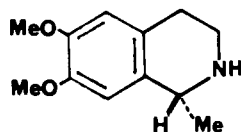
ORD: (HCl) (c 0.24, MeOH) $[\phi]_{700} 0^\circ$, $[\phi]_{589} -6.5^\circ$, $[\phi]_{294} -1750^\circ$ (tr), $[\phi]_{281} 0^\circ$, $[\phi]_{272} +1000^\circ$ (pk), $[\phi]_{265} +900^\circ$ (sh), $[\phi]_{251} 0^\circ$, $[\phi]_{235} -4000^\circ$ (tr), $[\phi]_{231} 0^\circ$, $[\phi]_{225} 4500^\circ$ (pk), $[\phi]_{210} 0^\circ$ (78); see also (94)

CD: (HCl) (c 0.01 M, MeOH) $[\theta]_{308} 0$, $[\theta]_{292} -1720$, $[\theta]_{284} -2000$, $[\theta]_{251} -240$, $[\theta]_{232} -7000$,

$[\theta]_{218}^D 0$, $[\theta]_{207}^D -20,000$, $[\theta]_{200}^D 0$ (78); see also (94)

Source: Synthetic (78, 94)

38. (+)-SALSOLIDINE



$C_{12}H_{17}NO_2$ 207.1255

MP: 47-48° (61)

(HCl) 234-235° (96)

$[\alpha]_D^{25}$: +59.0° (c 2, EtOH) (61)

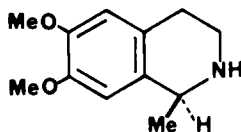
$[\alpha]^{22D}$: (HCl) +22.22° (c 1.53%, H₂O) (96)

Source:

Leguminosae: *Genista purgans* (96)

Synthetic (97, 98)

39. (-)-SALSOLIDINE



$C_{12}H_{17}NO_2$ 207.1255

MP: 41-45° (after vacuum distillation) (99)

44-48° (61)

60-61° (H₂O) (99, 77)

72-73° (after drying in vacuo) (77, 99)

(HCl) 210-215° (after drying in vacuo) (77)

233-235° (after drying in vacuo) (77)

233-235° (H₂O) (99)

227-228° (after washing with Me₂CO) (77)

(Picrate) 194-195° (H₂O) (77)

(Picrolonate) 220-221° (EtOH) (77)

$[\alpha]_D^{25}$: -59.1° (c 4, EtOH) (61, 77, 100)

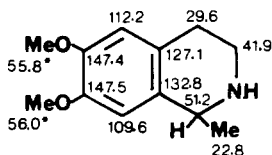
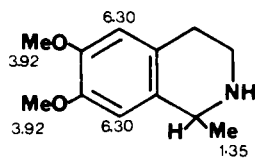
Sources:

Chenopodiaceae: *Salsola arbuscula* (100)

Salsola richteri (77, 79, 99)

Synthetic (98, 100)

40. (±)-SALSOLIDINE



$C_{12}H_{17}NO_2$ 207.1255

BP: 193° (25 mm) (101)

125° (0.2 mm) (102)

MP: 52-53° (102)

(HCl) 194-197° (103)

194° (EtOH) (102)

192-194° (CHCl₂) (104)

189-191° (84)

194-195° (Me₂CO) (96)

(Picrate) 202-204° (dec.) (103)

201° (EtOH) (102, 96)

203-205° (dec.) (104)

(Picrolonate) 252-253° (EtOH) (96)

238-239° (EtOH) (102)

UV: (EtOH) 212 (4.08), 232 (3.99), 285 (3.84) (81)

IR: (105)

¹H NMR: (CDCl₃) (81)

¹³C NMR: (101, 106)

MS: 207 (M⁺, <2%), 206 (14), 192 (100), 163 (7),

162 (3), 154 (6), 153 (17), 151 (5), 149 (8), 133

(4), 43 (21) (81)

Sources:

Cactaceae: *Carnegiea gigantea* (5, 37, 71, 104, 107)

Pachycereus pecten-aboriginum (5, 103)

Chenopodiaceae: *Bienertia cycloptera* (108)

Corispermum leptopyrum (87)

Salsola arbuscula (1, 88)

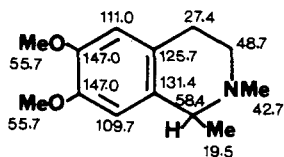
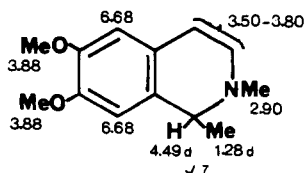
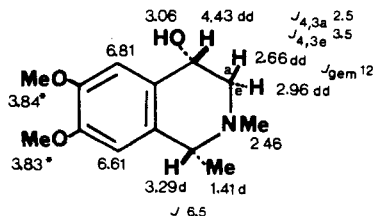
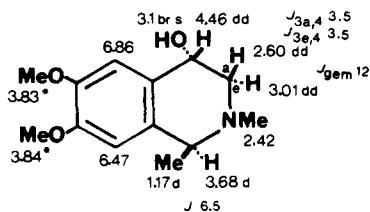
Salsola kali (88, 89, 90)

Salsola richteri (88, 91)

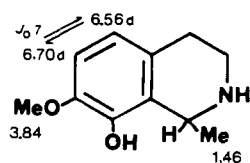
Salsola rubenica (89)

Salsola soda (89)

41. (±)-CARNEGINE

42. (±)-*cis*-1,2-DIMETHYL-4-HYDROXY-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE43. (±)-*trans*-1,2-DIMETHYL-4-HYDROXY-6,7-DIMETHOXY-1,2,3,4-TETRAHYDROISOQUINOLINE

44. (±)-ARIZONINE

Leguminosae: *Alhagi pseudalhagi* (109, 110)*Calycotome spinosa* (92)*Desmodium cephalotes* (111)*Desmodium tiliacifolium* (81)*Genista purgans* (96)

Synthetic (84, 101, 102, 112)

C₁₃H₁₉NO₂ 221.1411

BP: 170° (1 mm) (2)

MP: (HCl) 210° (EtOH) (37, 113, 104, 84, 114)

(HBr) 228° (115)

(Picrate) 211-213° (113, 114)

213-215° (104)

(Methiodide) 209-211° (113)

210-211° (114)

¹H NMR: 60 MHz (CDCl₃) (113)¹³C NMR: (4)

MS: 221 (3), 207 (12), 206 (100), 190 (10), 178 (4),

162 (5), 148 (4), 103 (6), 91 (6), 77 (6), 58 (17)

(113)

Sources:

Cactaceae: *Carnegiea gigantea* (71, 104, 107, 113, 115, 5, 37)*Pachycereus pecten-aboriginum* (1, 116, 117, 118)Chenopodiaceae: *Haloxylon articulatum* (95)

Synthetic (84, 114, 118a)

C₁₃H₁₉NO₃ 237.1360MP: 119-122° (Et₂O) (119)

UV: (MeOH) 227-228sh (3.99), 282-283 (3.55),

298sh (3.51) (119)

IR: (CHCl₃) 3520, 2800, 2780, 2760, 1615, 1520, 1260 (119)¹H NMR: 100 MHz (CDCl₃) (119)MS: 237 (M⁺), 222 (100), 204, 194, 179, 165, 151, 91, 77 (119)

Sources: Synthetic (119)

C₁₃H₁₉NO₃ 237.1360MP: 136.5-139° (Et₂O) (119)

UV: (MeOH) 229-230 (3.95), 282 (3.53), 287-288sh (3.48) (119)

IR: (CHCl₃) 3590, 2800, 2780, 2760, 1615, 1518, 1260 (119)¹H NMR: 100 MHz (CDCl₃) (119)MS: 237 (M⁺), 222 (100), 204, 194, 179, 165, 151, 91, 77 (119)

Source: Synthetic (119)

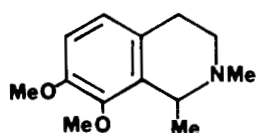
C₁₁H₁₅NO₂ 193.1099MP: (Salicylate) 207-209° (MeOH/Et₂O) (104)208-210° (MeOH/Et₂O) (104)¹H NMR: 100 MHz (CDCl₃) (104)MS: 193 (M⁺, 2), 192 (6), 178 (100), 163 (30) (104)

Sources:

Cactaceae: *Carnegiea gigantea* (104)*Pachycereus pecten-aboriginum* (42)

Synthetic (104)

45. TEPENINE

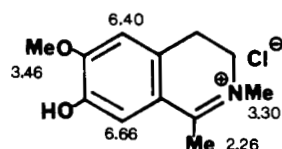
C₁₃H₁₉NO₂ 221.1411

Sources:

Cactaceae: *Pachycereus tebauntepecanus* (120)

Synthetic (120a)

46. 1,2-DIMETHYL-6-METHOXY-7-HYDROXY-3,4-DIHYDROISO-QUINOLINIUM CHLORIDE

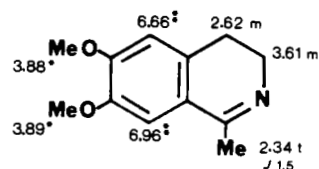
C₁₂H₁₆NO₂Cl 241.0869

IR: 1650 (75)

¹H NMR: 60 MHz (D₂O) (75)

Source: Synthetic (75)

47. DEHYDROSALSOLIDINE

C₁₂H₁₅NO₂ 205.1099

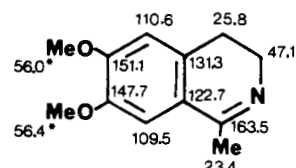
MP: (HCl) 195-197° (37)

201-202° (121)

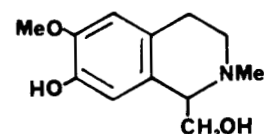
IR: (KBr) 2920, 2820, 1615, 1590, 1560, 1500, 1440, 1400, 1315, 1225, 1190, 1135, 1040, 990, 850, 800 (37)

¹H NMR: 80 MHz (CDCl₃) (37)¹³C NMR: (101)

Source:

Cactaceae: *Carnegiea gigantea* (37)

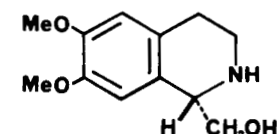
48. HEDYCARINE

C₁₂H₁₇NO₃ 223.1204

Source:

Monimiaceae: *Hedycarya baudouinii* (122)

49. (+)-CALYCOTOMINE

C₁₂H₁₇NO₃ 223.1204

MP: 149-150° (MeOH) (123)

138-140° (EtOH/Et₂O) (124, 125)

(HCl) 192-193° (124, 125)

204-205° (123)

(Picrate) 162-163° (124)

163-166° (125)

(Perchlorate) 176-177° (125)

(Mercurichloride) 118-119° (125)

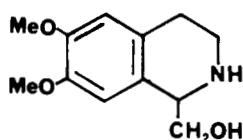
(Tartrate) 178-179° (MeOH/Et₂O) (123)[α]_D²⁷: +20° (H₂O) (124, 123)

+25° (1N HCl) (100)

[α]₆₅₀: +20° (c 0.5, H₂O) (123)[α]₅₈₉: +24° (c 0.5, H₂O) (123)[α]₄₅₀: +29° (c 0.5, H₂O) (123)[α]₃₆₇: 0° (c 0.5, H₂O) (123)

$[\alpha]_{313}^D$: -209° (c 0.17, H_2O) (123)
 (Tartrate) $+35^\circ$ (123)
 IR: (KBr) 333, 2857, 1608, 1511 (123)
 Sources:

Leguminosae: *Acacia concinna* (124)
Calycotome spinosa (92, 125)
Cytisus proliferus (126)
Genista purgans (92)
 Synthetic (+) and (-) (123, 118a)

50. (\pm)-CALYCOTOMINE

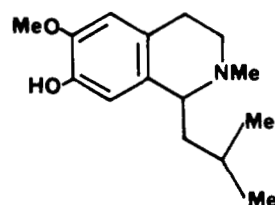
$C_{12}H_{17}NO_3$ 223.1204

MP: 134° (EtOAc/petroleum ether) (127, 128, 129)
 (HCl) $194-195^\circ$ (MeOH/Et₂O) (128, 129)
 $196-198^\circ$ (MeOH/C₆H₆) (130)
 (Picrate) $201-202^\circ$ (EtOH) (130)

Sources:

Leguminosae: *Calycotome spinosa* (125)
 Synthetic (127, 128, 129, 130, 118a)

51. LOPHOCERINE



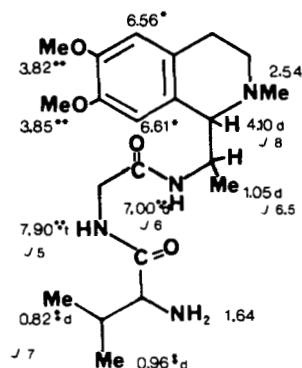
$C_{15}H_{23}NO_2$ 249.1723

MP: (Picrate) $192-193^\circ$ (C₆H₆) (131, 132)
 $186-187^\circ$ (84)
 $194-195^\circ$ (EtOH) (133)
 (Methiodide) $198-200^\circ$ (Me₂CO/MeOH) (133)
 (Styphnate) $171-172^\circ$ (EtOH) (132)
 (Oxalate) $213-214^\circ$ (dec.) (EtOH) (133)

Sources:

Cactaceae: *Lophocereus schottii*, specific rotation and stereochemistry unspecified (5, 134)
 Synthetic (84, 133, 132)

52. (-)-AMPHIBINE-I



$C_{21}H_{34}N_4O_4$ 406.2572

MP: (Dihydrochloride) 175° (135)
 (N-acetyl) $188-190^\circ$ (135)

$[\alpha]_{20}^D$: -50° (c 0.6, C₆H₆) (135)
 -98° (c 0.5, CHCl₃) (136)
 (Dihydrochloride) -3.4° (c 0.24, MeOH) (135)
 (N-acetyl) -20° (c 0.1, EtOH) (135)
 (N,N-dimethyl) -28° (c 0.15, MeOH) (135)

UV: (MeOH) 282 (3.49) (135)

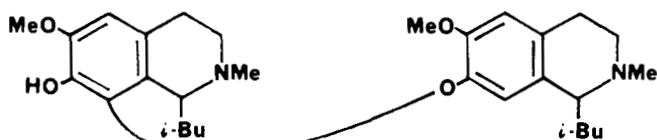
IR: (CHCl₃) 3340, 2820, 2780, 1655, 1240 (135)

¹H NMR: 90 MHz (CDCl₃) (135)

MS: 406 (M⁺), 391, 374, 363, 334, 307, 292, 277,
 234, 206 (100), 191, 190, 175, 162, 149, 145,
 132, 91, 72 (135)

Source:

Rhamnaceae: *Ziziphus amphibia* (135)
 Synthetic (136)

53. (\pm)-ISOPILOCEREINE

$C_{30}H_{44}N_2O_3$ 480.3341

MP: (Dipicrate) $234-238^\circ$ (137)
 235° (133)

$235-237^\circ$ (Me₂CO) (138)
 (Methyl ether) $88-90^\circ$ (139)

UV: (133)

IR: (133)

Sources: Derived from pilocereine
 Synthetic (137)

54. (±)-PILOCERINE

C₄₅H₆₅N₃O₆ 743.4857

MP: 176.5-177° (EtOAc/EtOH) (140)
 173.5-174.5° (C₆H₆/petroleum ether) (141)
 175-176° (Me₂CO/hexane) (134, 142)
 174-175° (EtOAc) (143)
 (Methyl ether) 153-155° (hexane) (138, 140)
 133-135° (EtOAc) (138)
 (Ethyl ether) 90-95°/152-153° (hexane) (138)
 (Acetate) 186-186.5° (Et₂O/Me₂CO) (140)
 (Dihydrochloride dihydrate) 228-232°
 (dec.) (MeOH/EtOAc) (140)
 (Diperchlorate) 214-217° (dec.)
 (MeOH/EtOAc) (140)
 (Dimethiodide) 233-244° (dec.)
 (MeOH/EtOAc) (140)

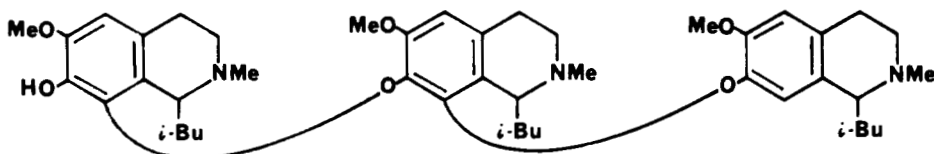
UV: (140, 133)

IR: (140, 133)

MS: (Methyl ether) 757 (139)

Sources:

Cactaceae: *Pachycereus marginatus* (5, 141)
Lophocereus schottii (134, 140, 142, 143)
Lophocereus australis (141)
Lophocereus gatesii (141)



55. NORTEHAUNINE

C₁₂H₁₇NO₃ 223.1204

MP: 71-72° (17)
 (HCl) 260° (6)
 268° (6)
 268-269° (17)
 273-275° (144)
 (Picrate) 175-177° (17)

UV: (H₂O) 203 (4.4), 223sh (3.7), 281 (3.2), 292sh (3.0) (6)

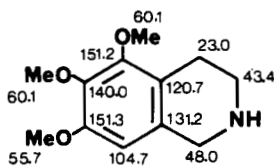
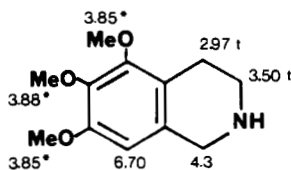
IR: (KBr) 2920, 2770, 1585, 1480, 1115, 1100, 1040, 865, 770 (6)

¹H NMR: 80 MHz (D₂O) (6)¹³C NMR: (14)

MS: 223 (80), 222 (48), 194 (65), 192 (100), 179 (39), 156 (58) (6)

Sources:

Cactaceae: *Pachycereus weberi* (6)
 Synthetic (6, 17)



56. TEHAUNINE

C₁₃H₁₉NO₃ 237.1360

MP: (HCl) 210° (CHCl₃) (36)
 219-221° (6)

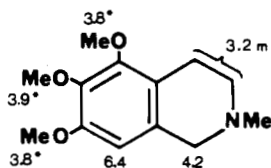
UV: (HCl) (H₂O) 203 (4.35), 211sh (3.68), 280 (2.92), 289sh (2.61) (6)

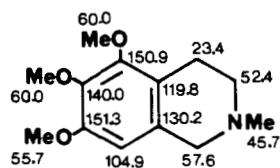
IR: (HCl) (KBr) 2910, 2480, 1880, 1595, 1480, 1450, 1175, 1100, 940, 890, 850, 690 (6)

¹H NMR: (HCl) 80 MHz (CDCl₃) (6)¹³C NMR: (14)

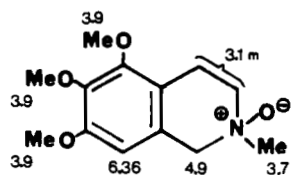
(HCl) (14)

MS: (HCl) 237 (97), 236 (75), 222 (13), 205 (55), 194 (100), 179 (55) (6)

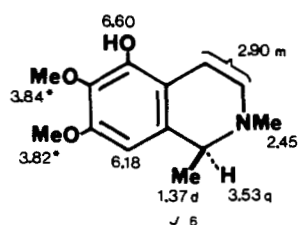




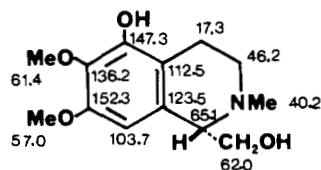
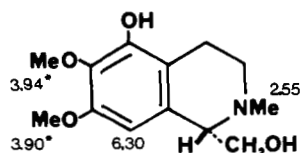
57. TEHAUNINE N-OXIDE



58. (+)-GIGANTINE



59. (-)-DEGLUCOPTEROCEREINE



Sources:

Cactaceae: *Pachycereus pringlei* (36)
Pachycereus tebauntepecanus (120)
Pachycereus weberi (6)
 Synthetic (120a, 145)

$C_{13}H_{19}NO_4$ 253.1309

MP: (HCl) 185° (EtOH/Et₂O) (146)

186-187° (CHCl₃/MeOH) (146)

¹H NMR: (HCl) 80 MHz (CDCl₃) (146)

MS: (HCl) 237 (66), 236 (78), 206 (38), 194 (100),
 179 (76) (146)

Sources:

Cactaceae: *Pachycereus pringlei* (146)
 Synthetic (146)

$C_{13}H_{19}NO_3$ 237.1360

MP: 151-152° (Et₂O) (113, 147)

121-123° (Et₂O) (113)

(±) (HCl) 218-220° (Et₂O) (104)

221.5-222.5° (EtOH) (113)

223° (EtOH) (37)

[α]²⁵_D: +27° (c 1.99, CHCl₃) (113)

+27.1° (c 0.02 g/ml, CHCl₃) (147)

IR: (CHCl₃) 3530 (113, 147)

¹H NMR: 60 MHz (CDCl₃) (113, 147)

MS: 237 (4), 222 (100), 206 (22), 194 (25), 179 (25),
 161 (10), 111 (5), 91 (12), 77 (15), 58 (60) (113,
 147)

Sources:

Cactaceae: *Carnegiea gigantea* (5, 37, 104, 107,
 113)
 Synthetic (+) (113); (±) (148, 149)

$C_{13}H_{19}NO_4$ 253.1309

MP: (HCl) 247-248° (EtOH) (150)

(Picrate) 195-196° (150)

[α]²⁶_D: (HCl) -1.04° (2.20%, H₂O) (150, 150a)

UV: (HCl) (H₂O) 214-215sh (3.15), 268 (2.16) (150)

IR: (HCl) (KBr) 3290, 2620, 1600, 1490, 1110,
 960, 810, 750 (150)

¹H NMR: (HCl) 360 MHz (CDCl₃) (150)

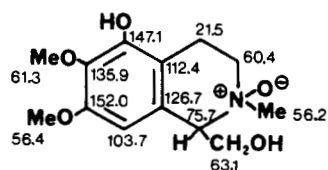
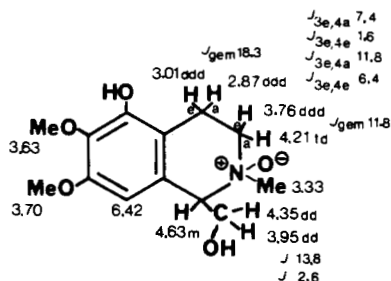
¹³C NMR: (HCl) (146, 150)

MS: 222.113 (M⁺-CH₂OH) (150)

Source:

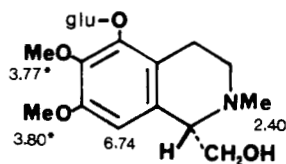
Cactaceae: *Pterocereus gaumeri* (150)

**60. DEGLUCOPTEROCEREINE
N-OXIDE**



The absolute configuration of this alkaloid is unknown but the oxygen atom of the *N*-oxide is *syn* to the C-1 hydroxymethyl group.

61. (-)-PTEROCEREINE



$C_{19}H_{29}NO_9$ 415.1834

MP: 198-199° (150)

$[\alpha]^{26}_D$: +4.51° (1.35%, H₂O) (150, 150a)

UV: (H₂O) 213-215sh (3.29), 268 (2.60) (150)

IR: (KBr) 3400, 3210, 2850, 1660, 1590, 1490, 1150, 850, 750 (150)

¹H NMR: 60 MHz (DMSO-*d*₆) (150)

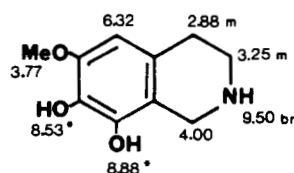
¹³C NMR: (DMSO-*d*₆) 151.2(s), 147.1(s), 139.6(s), 122.1(s), 107.6(d, 157.5), 103.8(d, 163.0), 77.1(d, 140.4), 76.5(d, 140.0), 74.1(d, 144.4), 70.1(d, 142.8), 65.1(d, 133.1), 64.4(t, 140.4), 61.2(t, 141.0), 60.5(q, 145.3), 55.8(q, 144.7), 47.5(t, ca. 145), 42.9(q, ca 144), 20.6(t, 129.4) (150)

MS: 384.164 (M⁺-CH₂OH) (150)

Source:

Cactaceae: *Pterocereus gaumeri* (150)

62. 6-METHOXY-7,8-DIHYDROXY-1,2,3,4-TETRAHYDROISOQUINOLINE



$C_{10}H_{13}NO_3$ 195.0892

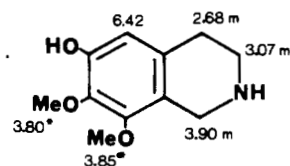
MP: (HCl) 275-277° (151)

UV: (HCl) (EtOH) 206 (4.58), 227sh (3.84), 271 (2.96), 280sh (2.86) (151)

¹H NMR: (HCl) (DMSO-*d*₆) (151)

Source: Synthetic (151)

63. ISOANHALAMINE



$C_{11}H_{15}NO_3$ 209.1048

MP: 172-174° (CH₂Cl₂-Et₂O) (152)

(HBr) 213-215° (153)

214-215.5° (EtOH/Et₂O) (152)

(HCl) 214-216° (154)

(Salicylate) 155-157° (CH₂Cl₂/Et₂O) (152)

UV: (iPrOH) 230sh (3.90), 273sh (3.20), 282 (3.26) (152)

(0.1N HCl) 223sh (3.92), 273sh (3.11), 279 (3.15) (152)

(0.1N KOH) 240sh (3.89), 295 (3.56) (152)

IR: (KBr) 3280, 1605 (152)

¹H NMR: 60 MHz (CDCl₃) (152)

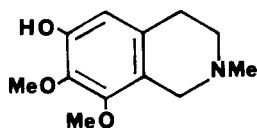
MS: 209 (M⁺, 55), 208 (100), 180 (68) (153)

Sources:

Cactaceae: *Lophophora williamsii* (5, 153)

Synthetic (152, 153)

64. ISOANHALIDINE



C₁₂H₁₇NO₃ 223.1204

MP: (HCl) 215-218° (153)

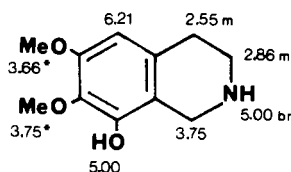
MS: 223 (M⁺, 50), 222 (100), 180 (70) (153)

Sources:

Cactaceae: *Lophophora williamsii* (5, 153)

Synthetic (153)

65. ANHALAMINE



C₁₁H₁₅NO₃ 209.1048

MP: 186-188° (in vacuum) (155.1)

(HCl) 277-278° (HOAc) (155)

257-258° (156, 153)

(Picrate) 249-249.5° (Vacuum) (155)

UV: (iPrOH) 227sh (3.98), 272 (2.90), 280sh (2.84) (155)

(0.1N HCl) 225sh (3.92), 270 (2.88), 280sh (2.70) (155)

(0.1N KOH) 240sh (3.90), 285 (3.38) (155)

IR: (KBr) 3280, 1640, 1585 (155)

¹H NMR: 60 MHz (DMSO-*d*₆) (155)

MS: 209 (M⁺, 55), 208 (100), 180 (68) (153)

Sources:

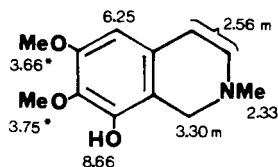
Cactaceae: *Gymnocalycium gibbosum* (5)

Lophophora diffusa (5, 157)

Lophophora williamsii (1, 5, 157, 158)

Synthetic (153, 155)

66. ANHALIDINE



C₁₂H₁₇NO₃ 223.1204

MP: 131-133° (155)

(HCl) 243° (155)

244-245° (159)

UV: (iPrOH) 227sh (4.06), 272 (2.98), 280sh (2.84) (155)

(0.1N HCl) 225sh (4.03), 270 (2.95), 277sh (2.84) (155)

(0.1N KOH) 240sh (3.97), 285 (3.47) (155) (HCl) (155)

IR: (KBr) 3530, 1630, 1600 (155, 158)

¹H NMR: 60 MHz (DMSO-*d*₆) (155) (CDCl₃) (158)

Sources:

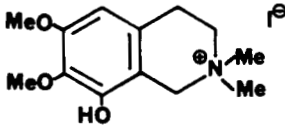
Cactaceae: *Lophophora williamsii* (1, 5)

Pelecyphora aselliformis (118, 159, 160)

Stenonia coryne (5, 118)

Synthetic (155, 161)

67. ANHALOTINE (IODIDE)
(ANHALIDINE METHIODIDE)



$C_{13}H_{20}NO_3I$ 365,0483

MP: 219-220° (EtOH/EtOAc) (7)

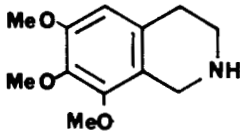
UV: (MeOH) 272 (2.95), 282sh (2.94) (7)
(dilute HCl) 272 (2.96), 282sh (2.86) (7)
(dilute KOH) 291 (3.48) (7)

IR: (KBr) 2940, 1616, 1595, 1510, 1458, 1295,
1125, 1046, 918, 828 (7)

Source:

Cactaceae: *Lophobora williamsii* (5, 7)

68. ANHALININE



$C_{12}H_{17}NO_3$ 223.1204

MP: 61-63° (162)

(HCl) 248-250° (EtOH) (156)

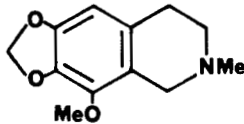
(Picrate) 184-185° (2)

(Methiodide) 211.5-212.5° (2)

Sources:

Cactaceae: *Lophobora williamsii* (5, 157, 162)
Synthetic (156)

69. HYDROCOTARNINE



$C_{12}H_{15}NO_3$ 221.1048

MP: 55° (EtOH) (53)

55.5-56.5° (light petroleum ether) (10)

(HBr) 229° (EtOH) (53)

236-237° (10)

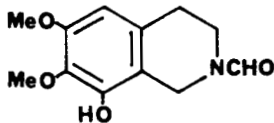
UV: 287(3.23) (163, 164)

MS: 221 (M^+ , 70), 220 (100), 205 (19), 178 (100),
163 (19), 148 (10), 77 (9), 42 (19) (55)

Sources:

Papaveraceae: *Papaver somniferum* (165)
Synthetic (10, 53)

70. N-FORMYLANHALAMINE

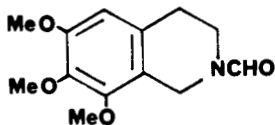


$C_{12}H_{15}NO_4$ 237.0997

Source:

Cactaceae: *Lophobora williamsii* (5, 166)

71. N-FORMYLANHALININE

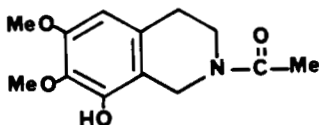


$C_{13}H_{17}NO_4$ 251.1153

Source:

Cactaceae: *Lophobora williamsii* (5, 166)

72. N-ACETYLANHALAMINE

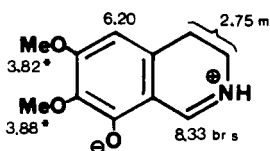


$C_{13}H_{17}NO$ 251.1153

Source:

Cactaceae: *Lophobora williamsii* (5, 166)

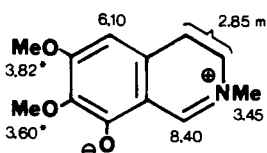
73. 6,7-DIMETHOXY-8-HYDROXY-3,4-DIHYDROISOQUINOLINIUM INNER SALT



$C_{11}H_{13}NO_3$ 207.0892
 MP: 159-165° (158)
 UV: (EtOH) 336, 422 (158)
 (0.1N NaOH/EtOH) 290, 346 (158)
 (1% HCl/EtOH) 335.5 (158)
 (CHCl₃) 280 (158)
 (dioxane) 276 (158)
 IR: (CHCl₃) 1695, 1500, 1467, 1377 (158)
¹H NMR: (DMSO-*d*₆) (158)
 MS: 207 (M⁺) (158)
 Source:

Cactaceae: *Lophophora williamsii* (158)

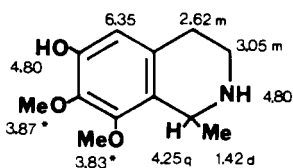
74. 2-METHYL-6,7-DIMETHOXY-8-HYDROXY-3,4-DIHYDROISOQUINOLINIUM INNER SALT



$C_{12}H_{15}NO_3$ 221.1048
 MP: 95-104° (158)
 UV: (EtOH) 341 (4.26), 425 (3.90) (158)
 (0.1N NaOH/EtOH) 340, 420 (158)
 (1% HCl/EtOH) 337 (158)
 (CHCl₃) 345.5, 450 (158)
 (dioxane) 340, 448 (158)
 IR: (Nujol) 1645-1595 br, 1520 (158)
¹H NMR: (DMSO-*d*₆) (158)
 MS: 221 (M⁺) (158)
 Source:

Cactaceae: *Lophophora williamsii* (158)

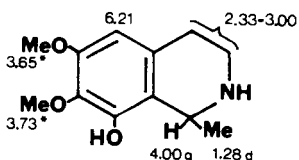
75. ISOANHALONIDINE



$C_{12}H_{17}NO_3$ 223.1204
 MP: 112-114° (Et₂O/pentane) (152)
 (HBr) 209-211° (153)
 210.5-212° (EtOH/Et₂O) (152)
 (HCl) 210-211° (154)
 159-160°/218-223° (CH₂Cl₂/Et₂O) (152)
 UV: (HBr) (iPrOH) 230sh (3.95), 275sh (3.11), 282 (3.15) (152)
 (HBr) (0.1N HCl) 225sh (3.95), 274sh (3.11), 280 (3.15) (152)
 (HBr) (0.1N KOH) 237sh (3.95), 295 (3.54) (152)
 IR: (CHCl₃) 3530, 1620, 1590 (152)
¹H NMR: 60 MHz (CDCl₃) (152)
 MS: 223 (M⁺), 208 (100) (153)
 Sources:

Cactaceae: *Lophophora williamsii* (5, 153)
 Synthetic (152, 153)

76. ANALONIDINE



$C_{12}H_{17}NO_3$ 223.1204
 MP: 160-161° (167)
 161-161.5° (Me₂CO) (141)
 160° (MeOH/Et₂O) (168)
 159.5-160° (subl.) (155)
 (HCl) 250° (169)
 248.5-250° (EtOH/Et₂O) (155)
 (Picrate) 200.5-201.5° (EtOH) (141)
 205-208° (169)
 (Salicylate) 223-225° (168, 153)
 223.5-224.5° (CH₂Cl₂/Et₂O) (152)
 UV: (iPrOH) 270 (2.87), 278sh (2.81) (155)

(0.1N HCl) 270 (2.79), 278sh (2.72) (155)

(0.1N KOH) 245sh (3.84), 286 (3.38) (155)

IR: (KBr) 3520, 1620, 1595, 1295, 1120 (155, 158)

$^1\text{H NMR}$: 60 MHz (DMSO- d_6) (155)

MS: 223 (M^+ , 100), 208 (100) (153)

Sources:

Cactaceae: *Lophobora diffusa*, specific rotation and stereochemistry unspecified (5, 157)

Lophobora williamsii, specific rotation and stereochemistry unspecified (1, 5, 157)

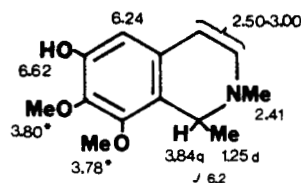
Pachycereus weberi, specific rotation and stereochemistry unspecified (5, 141)

Stetsonia coryne, specific rotation and stereochemistry unspecified (5, 118)

Trichocereus pachanoi, specific rotation and stereochemistry unspecified (1, 170)

Synthetic (152, 153, 155, 168)

77. ISOPELLOTINE



$\text{C}_{13}\text{H}_{19}\text{NO}_3$ 237.1360

MP: 131.5-132.5° ($\text{C}_6\text{H}_6/\text{Et}_2\text{O}$) (113)

(HCl) 212-222° (153)

$^1\text{H NMR}$: 60 MHz (CDCl_3) (113)

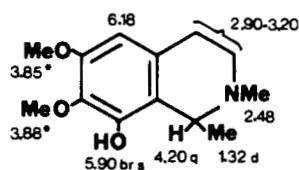
MS: 237 (M^+), 222 (100) (153)

Sources:

Cactaceae: *Lophobora williamsii* (5, 153)

Synthetic (113, 153)

78. (\pm)-PELLOTINE



$\text{C}_{13}\text{H}_{19}\text{NO}_3$ 237.1360

MP: 109-111° (155)

111-112° (1, 113)

110-111.5° (petroleum ether) (7)

116° ($\text{MeOH}/\text{Et}_2\text{O}$) (168.2)

(HCl) 240° (6)

243-244° (EtOH) (7, 159)

(Picrate) 167-169° (1, 7)

(HI) 125-130° (2)

(Methiodide) 199° (171)

UV: (HCl) (EtOH) 230sh (3.99), 271 (2.96), 281sh (2.85) (7, 155)

(5% HCl/ EtOH) 271 (2.98), 281sh (2.90) (7)

(5% KOH/ EtOH) 281 (3.22), 286 sh (3.21) (7)

IR: (CHCl_3) (155)

(HCl) (KBr) 2940, 2640, 1615, 1588, 1508, 1432, 1365, 1295, 1260, 1186, 1125, 1035, 1018 (7, 158)

$^1\text{H NMR}$: 60 MHz (CDCl_3) (7)

(DMSO- d_6) (155, 158)

Sources:

Cactaceae: *Islaya minor* (5)

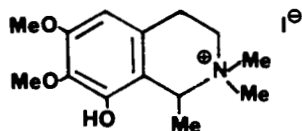
Lophobora diffusa (5, 157, 172)

Lophobora williamsii (1, 5, 7, 157, 158)

Pachycereus weberi (6)

Pelecyphora aselliformis (5, 159, 160)

Synthetic (\pm) (113, 153, 155, 168)

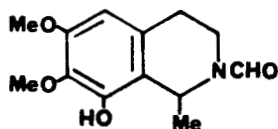
79. PEYOTINE (IODIDE)
(PELLOTINE METHIODIDE)

$C_{14}H_{22}NO_3I$ 379.0639
 MP: 185-186° (H₂O) (7)
 200-201° (EtOH/EtOAc) (7)
 UV: (MeOH) 271 (2.92), 282sh (2.80) (7)
 (dilute HCl) 271 (2.94), 282sh (2.80) (7)
 (dilute KOH) 292 (3.52) (7)
 IR: (KBr) 3430, 3050, 2935, 1618, 1595, 1512,
 1428 1376, 1294, 1248, 1190, 1130, 1070, 987
 (7)

Source:

Cactaceae: *Lophophora williamsii* (7)

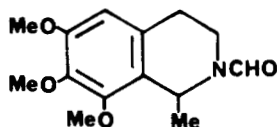
80. N-FORMYLANHALONIDINE

 $C_{13}H_{17}NO_4$ 252.1153

Source:

Cactaceae: *Lophophora williamsii* (5, 166)

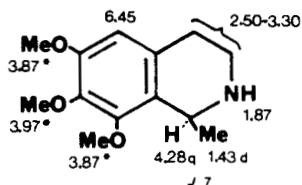
81. N-FORMYL-O-METHYLANHALONIDINE

 $C_{14}H_{19}NO_4$ 265.1309

Source:

Cactaceae: *Lophophora williamsii* (5, 166)

82. (+)-O-METHYLANHALONIDINE

 $C_{13}H_{19}NO_3$ 237.1360

BP: 140°/(0.05 mm) (173)

150°/(0.07 mm) (174)

MP: (Tartrate) 190-191° (174)

(HBr) 202-204° (H₂O) (174)[α]²⁵_D: +11.5° (c 1, MeOH) (174)

+19.7° (c 11, MeOH) (174)

[α]¹⁶_D: +20.7° (c 11, MeOH) (173)[α]²⁵_D: +20.6° (c 1, CHCl₃) (174)

+19.3° (c 1, 1N HCl) (174)

(Tartrate) +27.0° (c 1, MeOH) (174)

(HBr) +16.4° (c 1, MeOH) (174)

UV: (EtOH) 207 (4.61), 228sh (3.97), 273 (3.09),

280 (3.11) (174)

¹H NMR: 60 or 100 MHz (CDCl₃) (174)ORD: (c 0.22, MeOH) [φ]₇₀₀ +14°, [φ]₅₈₉ +23°,[φ]₂₈₈ +512°(pk), [φ]₂₈₃ +380°(tr), [φ]₂₃₈+4130°(pk), [φ]₂₃₀ +2200°(tr) (174)CD: (c 0.01M, MeOH) [θ]₂₉₅ 0, [θ]₂₇₉ +165, [θ]₂₅₄+11, [θ]₂₃₃ +2970, [θ]₂₂₃ +1210, [θ]₂₀₈

+29730 (174)

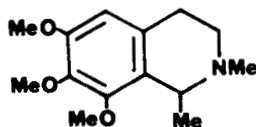
X-RAY: (174)

Sources:

Cactaceae: *Lophophora williamsii* (5, 173)

Synthetic (174)

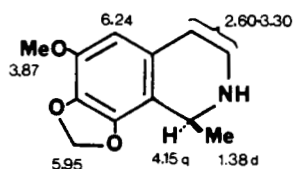
83. O-METHYLPELLOTINE

 $C_{14}H_{21}NO_3$ 251.1516MS: 251 (M⁺, 0.5), 236 (100), 220 (23), 206 (30),
(172, 175)

Sources:

Cactaceae: *Lophophora diffusa* (5, 172)*Lophophora williamsii* (5)

84. (-)-ANHALONINE

C₁₂H₁₅NO₃ 221.1048MP: 83-84° (Et₂O/petroleum ether) (174)

84-85° (petroleum ether) (7)

(HCl) 258-259° (174)

260-261° (EtOH) (7)

(HBr) 270-271° (H₂O) (174)

(Picrate) 164-166° (7)

(Tartrate) 200-201° (174)

[α]_D²⁶₅₈₉ -62° (7)[α]_D²⁵: -56° (c 2.7, CHCl₃) (176)[α]_D²⁶₄₃₆: -111° (7)[α]_D²⁶₃₅₀: -187° (c 0.78, CHCl₃) (7)[α]_D²⁵: -54° (c 1, CHCl₃) (174)-30° (HBr) (c 1, H₂O) (174)

-40° (HCl) (c 1, 50% EtOH) (174)

-33° (Tartrate) (c 1, H₂O) (174)

UV: (EtOH) 277 (2.96), 285sh (2.92) (7)

IR: (HCl) (Nujol) 2940, 1640, 1440, 1380, 1300,

1204, 1138, 1088, 1028 (7)

¹H NMR: 60 MHz (CDCl₃) (7)

MS: 221 (10), 220 (7.2), 206 (100), 192 (3.7), 191

(6), 176 (1), 161 (1.5), 147 (1.1), 133 (1.9), 118

(1.1), 104 (2.1), 103.5 (1.3), 91 (1.6), 77 (1.8),

65 (1.5), 63 (1.2), 51 (1.6), 39 (1) (174)

ORD: (c 0.22, MeOH) [φ]₇₀₀ -94°, [φ]₅₈₉ -137°,[φ]₂₈₈ -1130°(tr), [φ]₂₅₂ -754°(pk), [φ]₂₃₀

-6790°(tr) (174)

CD: (c 0.01M, MeOH) [θ]₂₉₀ 0, [θ]₂₈₀ -463, [θ]₂₅₆0, [θ]₂₄₂ +2110, [θ]₂₃₄ 0, [θ]₂₂₄ -6640 (174)

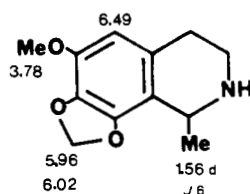
X-RAY: (174)

Sources:

Cactaceae: *Gymnocalycium leeanum* (5)*Lophophora williamsii* (1, 5, 7, 157)*Trichocereus terscheckii* (5)

Synthetic (174)

84a. (±)-ANHALONINE

C₁₂H₁₅NO₃ 221.1048

MP: (HCl) 262-264° (MeOH) (174)

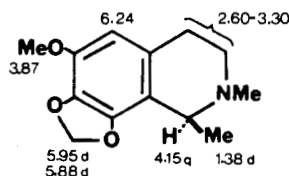
UV: (EtOH) 214 (4.68), 250sh (3.43) 277 (2.99),

286sh (2.94) (174)

¹H NMR: 60 or 100 MHz (DMSO-*d*₆) (174)

Source: Synthetic (174)

85. (-)-LOPHOPHORINE

C₁₃H₁₇NO₃ 235.1204

BP: 140-145°(0.05 mm) (1)

MP: (HCl) 233-235.5° (EtOH) (7, 177)

236-237° (EtOH) (174)

(Picrate) 162-164° (7)

162-163° (1)

(Methiodide) 223° (171)

[α]_D²⁶₅₈₉: -62° (7)[α]_D²⁶₄₃₆: -111° (7)[α]_D²⁶₃₅₀: -187° (c 0.78, CHCl₃) (7)[α]_D²⁵: -46.8° (c 5, CHCl₃) (174, 171)(HCl) -15.6° (c 1, H₂O) (174)-16.3° (c 4, H₂O) (176)

UV: (EtOH) 276 (2.95), 284sh (2.91) (7)

IR: (HCl) (CHCl₃) 2940, 2370(broad), 1640, 1500, 1430, 1365, 1138, 1040, 948 (7)

¹H NMR: 60 MHz (CDCl₃) (7)

MS: (HCl) 235 (2.5), 234 (3.0), 220 (100), 205 (5.0), 192 (3.8), 175 (1.4), 162 (0.7), 161 (0.6), 160 (0.4), 159 (0.5), 147 (2.0), 131 (0.8), 118 (1.3), 110 (2.6), 109.5 (2.0), 91 (1.6), 77 (1.6), 151 (1.3), 42 (2.0), 36 (2.4) (174)

ORD: (*c* 0.2, MeOH) [ϕ]₇₀₀ -72°, [ϕ]₅₈₉ -100°, [ϕ]₂₈₇ -814°(tr), [ϕ]₂₅₃ +175°(pk), [ϕ]₂₃₀ -10, 180°(tr) (174)

CD: (*c* 0.009M, MeOH) [θ]₂₉₄ 0, [θ]₂₇₉ -605, [θ]₂₆₂ 0, [θ]₂₄₅ +2930, [θ]₂₃₅ 0, [θ]₂₂₃ -9310, [θ]₂₁₆ 0 (174)

Sources:

Cactaceae: *Gymnocalycium gibbosum* (5)

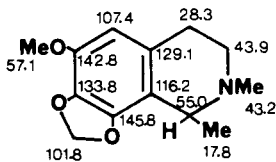
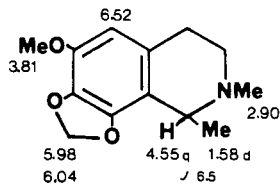
Gymnocalycium leeanum (5)

Lophophora diffusa (5, 157, 172)

Lophophora williamsii (1, 5, 7, 157, 158, 177)

Synthetic (174)

85a. (±) LOPHOPHORINE



C₁₃H₁₇NO₃ 235.1204

MP: (HBr) 221-222° (EtOH) (174)

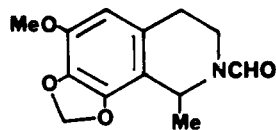
UV: (HBr) (EtOH) 211 (4.63), 250sh (3.47), 278 (3.03), 286sh (2.98) (174)

¹H NMR: (HBr) 60 or 100 MHz (DMSO-*d*₆) (174)

¹³C NMR: (14)

Source: Synthetic (174)

86. N-FORMYLANHALONINE

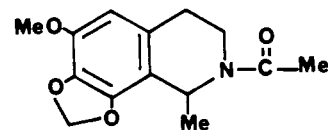


C₁₃H₁₅NO₄ 249.0997

Source:

Cactaceae: *Lophophora williamsii* (5, 166)

87. (+)-N-ACETYLANHALONINE



C₁₄H₁₇NO₄ 263.1153

MP: 151.5-153° (177)

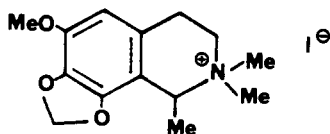
[α]₂₅²⁵₅₈₉: +206° (177)

Sources:

Cactaceae: *Lophophora williamsii* (5, 166, 177)

Synthetic (177)

88. LOPHOTINE (IODIDE)



C₁₄H₂₀NO₃I 377.0483

MP: 240-242° (EtOH/EtOAc) (7)

UV: (MeOH) 276 (3.04), 285sh (2.95) (7)

(dilute HCl) 276 (3.06), 286.5sh (2.97) (7)

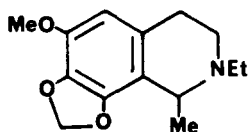
(dilute KOH) 276 (3.15), 286.5sh (3.09) (7)

IR: (KBr) 3430br, 2936, 1640, 1510, 1430, 1325, 1145, 1039, 1000br, 818 (7)

Source:

Cactaceae: *Lophophora williamsii* (5, 7)

89. (-)-PEYOPHORINE

 $C_{14}H_{19}NO_3$ 249.1360

MP: (Ethiodide) 203-204° (177)

(Picrate) 155-156° (177)

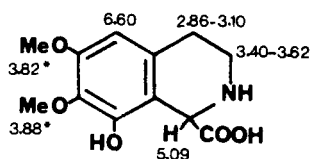
[α]₂₅²⁸⁹: (Ethiodide) -232° (c 0.52, H₂O) (?) (177)MS: 234 (M⁺-CH₃, 100) (177)

Source:

Cactaceae: *Lophophora williamsii* (5, 166, 177)

Synthetic (177)

90. PEYOXYLIC ACID

 $C_{12}H_{15}NO_5$ 253.0946MP: 237-238° (dec.) (MeOH/Me₂CO) (178)

IR: (KBr) 1625, 1600, 1575 (178)

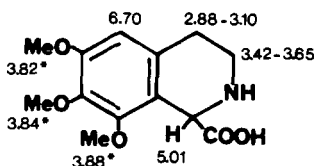
¹H NMR: 100 MHz (D₂O) (178)

Sources:

Cactaceae: *Lophophora williamsii* (5, 178)

Synthetic (178)

91. O-METHYLPEYOXYLIC ACID

 $C_{13}H_{17}NO_5$ 267.1102

MP: 238-240° (dec.) (179)

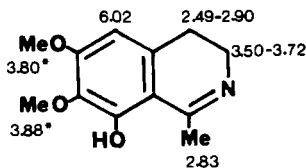
¹H NMR: (D₂O) (179)

Sources:

Cactaceae: *Lophophora williamsii* (179)

Synthetic (±) (179)

92. 1-METHYL-6,7-DIMETHOXY-8-HYDROXY-3,4-DIHYDROISOQUINOLINE

 $C_{12}H_{15}NO_3$ 221.1048MP: 173-175° (C₆H₆/CHCl₃) (178)

UV: (EtOH) 324, 408 (158)

(0.1N NaOH/EtOH) 280sh, 320, 404 (158)

(1% HCl/EtOH) 321.5 (158)

(CHCl₃) 270 (158)

(dioxane) 268 (158)

¹H NMR: 100 MHz (CDCl₃) (178)

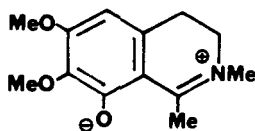
MS: 221 (100), 206 (60) (178)

Sources:

Cactaceae: *Lophophora williamsii* (158)

Synthetic (178)

93. 1,2-DIMETHYL-6,7-DIMETHOXY-8-HYDROXY-3,4-DIHYDROISOQUINOLINIUM INNER SALT

 $C_{13}H_{17}NO_3$ 235.1204

UV: (EtOH) 344, 428 (158)

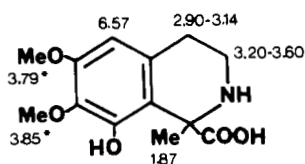
(0.1N NaOH/EtOH) 290, 338, 419 (158)

(dioxane) 341, 450 (158)

Source:

Cactaceae: *Lophophora williamsii* (158)

94. PEYORUVIC ACID

C₁₃H₁₇NO₅ 267.1102

MP: 233-234° (dec.) (MeOH) (178)

IR: (KBr) 1640, 1600, 1565 (178)

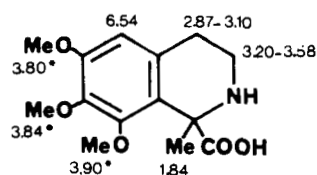
¹H NMR: 100 MHz (D₂O) (178)

Sources:

Cactaceae: *Lophophora williamsii* (5, 178)

Synthetic (178)

95. O-METHYLPEYORUVIC ACID

C₁₄H₁₉NO₅ 281.1258

MP: 245-246° (dec.) (179)

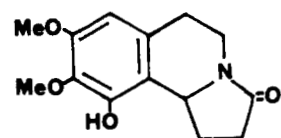
¹H NMR: (D₂O) (179)

Sources:

Cactaceae; *Lophophora williamsii* (179)

Synthetic (±) (179)

96. PEYOGLUTAM

C₁₄H₁₇NO₄ 263.1153

MP: 217-219° (166)

IR: 3300, 1675 (166)

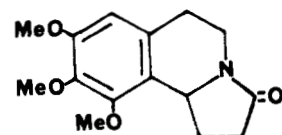
MS: 263 (166)

Sources:

Cactaceae: *Lophophora williamsii* (5, 166)

Synthetic (166)

97. MESCALOTAM

C₁₅H₁₉NO₄ 277.1309

IR: 1675 (166)

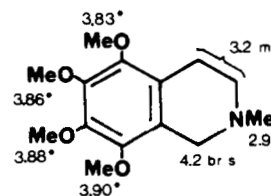
MS: 277 (166)

Sources:

Cactaceae: *Lophophora williamsii* (5, 166)

Synthetic (166)

98. WEBERINE

C₁₄H₂₁NO₄ 267.1465

MP: (HCl) 164-165° (EtOAc) (6, 180)

UV: (HCl) (H₂O) 205 (4), 223sh (3.5), 282 (2.9), 292sh (2.8) (6)

IR: (HCl) (KBr) 2830, 2540, 1415, 1360, 990, 900 (6, 180)

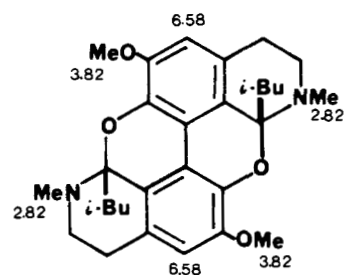
¹H NMR: (HCl) 80 MHz (CDCl₃) (6)

MS: 267 (90), 266 (96), 236 (100), 224 (96), 209 (93), 183 (17) (6)

Sources:

Cactaceae: *Pachycereus weberi* (5, 6)*Pachycereus pringlei* (5, 36)

99. (±)-LOPHOCINE

C₃₀H₄₀N₂O₄ 492.2978MP: 194-196° (Me₂CO) (142)

UV: (MeOH) 230 (4.55), 275 (3.83), 287 (3.88), 338 (3.88) (142)

IR: (CHCl₃) 1580, 1465, 1280 (142)¹H NMR: 100 MHz (CDCl₃) (142)

X-RAY: (142)

Source:

Cactaceae: *Lophocereus schottii*, probably an artifact (142)Me of *i*-Bu at 0.44 and 0.88

Botanical Sources of Simple Isoquinoline Alkaloids

- Alangiaceae
Alangium lamarckii
 Salsoline (34)
- Annonaceae
Annona reticulata
 Salsolinol (17)
- Berberidaceae
Berberis oblonga
 Isocorypalline (10)
- Cactaceae
Backebergia militaris
 Backebergine (29)
 Dehydroheliamine (28)
 Dehydrolemaireocereine (26)
 Heliamine (13)
 Isobackebergine (27)
 Lemaireocereine (24)
N-Methylheliamine (14)
- Carnegiea gigantea*
 (±)-Arizonine (44)
 (±)-Carnegine (41)
 Dehydroheliamine (28)
 Dehydrosalsolidine (47)
 (+)-Gigantine (58)
 Heliamine (13)
 (±)-Salsolidine (40)
- Dolichothele longimamma*
 (-)-Longimammamine (7)
 Longimammamine (2)
 Longimammidine (6)
 Longimammosine (1)
- Dolichothele uberiformis*
 (-)-Longimammamine (7)
 Longimammamine (7)
 Uberine (8)
- Echinocereus merkerii*
 Salsoline (34)
- Gymnocalycium gibbosum*
 Anhalamine (65)
 (-)-Lophophorine (85)
- Gymnocalycium leeanum*
 (-)-Anhalonine (84)
 (-)-Lophophorine (85)
- Islaya minor*
 Corypalline (11)
 (±)-Pellotine (78)
- Lophocereus australis*
 (±)-Pilocereine (54)
- Lophophora diffusa*
 Anhalamine (65)
 Anhalonidine (76)
 (-)-Lophophorine (85)
O-Methylpellotine (83)
 (±)-Pellotine (78)
- Lophocereus gatesii*
 (±)-Pilocereine (54)
- Lophocereus schottii*
 Lophocerine (51)
 (±)-Lophocine (99)
 (±)-Pilocereine (54)
- Lophophora williamsii*
 Anhalamine (65)
 Anhalidine (66)
 Anhalinine (68)
 Anhalonidine (76)
 (-)-Anhalonine (84)
 Anhalotine (Iodide) (67)
 Isoanhalamine (63)
 Isoanhalidine (64)
 Isoanhalonidine (75)
 Isopellotine (77)
 (-)-Lophophorine (85)
 Lophotine (Iodide) (88)
 Mescalotam (97)
 (+)-*O*-Methylanhalonidine (82)
O-Methylpellotine (83)
O-Methylpeyoxylic Acid (91)
O-Methylpeyorovic Acid (95)
N-Acetylanhalamine (72)
 (+)-*N*-Acetylanhalonine (87)
N-Formylanhalamine (70)
N-Formylanhalinine (71)
N-Formylanhalonidine (80)
N-Formylanhalonine (86)
N-Formyl-*O*-methylanhalonidine (81)
 (±)-Pellotine (78)
 (-)-Peyphorine (89)
 Peyoglutam (96)
 Peyoxylic Acid (90)
 Peyorovic Acid (94)
 Peyotine (Iodide) (79)
 6,7-Dimethoxy-8-hydroxy-3,4-dihydro-
 isoquinolinium inner salt (73)
 2-Methyl-6,7-dimethoxy-8-hydroxy-3,4-
 dihydroisoquinolinium inner salt (74)
 1-Methyl-6,7-dimethoxy-8-hydroxy-3,4-
 dihydroisoquinoline (92)
 1,2-Dimethyl-6,7-dimethoxy-8-
 hydroxy-3,4-dihydroisoquinolinium
 inner salt (93)
- Pachycereus marginatus*
 (±)-Pilocereine (54)
- Pachycereus pecten-aboriginum*
 (±)-Arizonine (44)
 (±)-Carnegine (41)
 Heliamine (13)
 Isosalsoline (36)
 (±)-Salsolidine (40)
 Salsoline (34)
- Pachycereus pringlei*
 Heliamine (13)
 Lemaireocereine (24)
 Tehaunine (56)
 Tehaunine-*N*-Oxide (57)
 Weberine (98)
- Pachycereus tehauntepecanus*
 Tehaunine (56)
 Tepenine (45)
- Pachycereus weberi*
 Anhalonidine (76)

- Heliamine (13)
 Lemaireocereine (24)
 N-Methylheliamine (14)
 Nortehaunine (55)
 (±)-Pellostine (78)
 Tehaunine (56)
 Weberidine (4)
 Weberine (98)
Pelecyphora aselliformis
 Anhalidine (66)
 (±)-Pellostine (78)
Pilosocereus guerreronis
 N-Methylheliamine (14)
Pterocereus gaumeri
 (-)-Deglucopterocereine (59)
 Deglucopterocereine N-oxide (60)
 (-)-Pterocereine (61)
Stetsonia coryne
 Anhalidine (66)
 Anhalonidine (76)
Trichocereus pachanoi
 Anhalonidine (76)
Trichocereus terscheckii
 (-)-Anhalonine (84)
- Chenopodiaceae
- Bienertia cycloptera*
 (±)-Salsolidine (40)
Corispermum leptopyrum
 (±)-Salsolidine (40)
 Salsoline (34)
Salsola arbuscula
 (±)-Salsolidine (40)
 (-)-Salsolidine (39)
 Salsoline (34)
 (+)-Salsoline (33)
Salsola kali
 (±)-Salsolidine (40)
 Salsoline (34)
Salsola richteri
 (±)-Salsolidine (40)
 (-)-Salsolidine (39)
 Salsoline (34)
 (+)-Salsoline (33)
Salsola rubenica
 (±)-Salsolidine (40)
 Salsoline (34)
Salsola soda
 (±)-Salsolidine (40)
 Salsoline (34)
Haloxylon articulatum
 (±)-Carnegine (41)
 (+)-N-Methylisalsoline (37)
- Euphorbiaceae
- Euphorbia myrsinites*
 1-Methyl-3-carboxy-6-hydroxy-1,2,3,4-tetrahydroisoquinoline (3)
- Fumariaceae
- Corydalis ambigua*
 (+)-N-Methylisalsoline (37)
Corydalis aurea
 Corypalline (11)
Corydalis cava
- Hydrohydrastinine (15)
Corydalis ophiocarpa
 Corypalline (11)
 Pycnarrhine (30)
Corydalis pallida
 Corypalline (11)
Corydalis stricta
 Corypalline (11)
 Isocorypalline (10)
 N-Methylcorypalline (Iodide) (12)
 Pycnarrhine (30)
Corydalis tuberosa
 Hydrohydrastinine (15)
- Leguminosae
- Acacia concinna*
 (+)-Calycotomine (49)
Albargi pseudalbagi
 (±)-Salsolidine (40)
Calycotome spinosa
 (±)-Calycotomine (50)
 (+)-Calycotomine (49)
 (±)-Salsolidine (40)
 Salsoline (34)
Cytisus proliferus
 (+)-Calycotomine (49)
Desmodium cephalotes
 (±)-Salsolidine (40)
Desmodium tiliacifolium
 (±)-Salsolidine (40)
 Salsoline (34)
Genista purgans
 (+)-Calycotomine (49)
 (+)-Salsolidine (38)
 (±)-Salsolidine (40)
 Salsoline (34)
Mucuna andreana
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Mucuna deeringiana
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
 (-)-1-Methyl-3-carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (18)
Mucuna boltoni
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Mucuna mutisiana
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Mucuna pruriens
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Mucuna sloanei
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Mucuna urens
 (-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)
Stizolobium hassjoo
 1-Methyl-3-carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (20)

(-)-3-Carboxy-6,7-dihydroxy-1,2,3,4-tetrahydroisoquinoline (16)

Menispermaceae

Pycnarrhena longifolia
Pycnarrhine (30)

Monimiaceae

Doryphora sassafras
Corypalline (11)

Hedycarya baudouinii
Hedycarine (48)

Musaceae

Musa paradisiaca
Salsolinol (17)

Nymphaeaceae

Nelumbo nucifera
N-Methylheliamine (14)

Papaveraceae

Papaver bracteatum
Corypalline (11)
N-Methylheliamine (14)
Papaver somniferum

Hydrocotarnine (69)

Ranunculaceae

Nigella sariva
Nigellimine N-oxide (31)

Thalictrum dasycarpum
Corypalline (11)

Thalictrum dioicum
N-Methylheliamine (14)

Thalictrum polygamum
N-Methylheliamine (14)

Thalictrum revolutum
2-Methyl-6,7-dimethoxyisoquinolinium
chloride (32)

Thalictrum rugosum
Corypalline (11)

Rhamnaceae

Ziziphus amphibia
(-)-Amphibine-I (52)

Sterculiaceae

Theobroma cacao
Salsolinol (17)

ACKNOWLEDGMENTS

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