BISBENZYLISOQUINOLINE ALKALOIDS—A REVIEW

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Abstract.—The review presents a glossary of the bisbenzylisoquinoline alkaloids. The following information is tabulated: structural formulas of all the bisbenzylisoquinoline alkaloids (BBI) with their molecular formulas; molecular weights; mp and $[\alpha]_D$ values; uv, ord, nmr, mass data; degradation methods applied to determine their structures; and sources. A list of the plants with the particular part studied and the BBI alkaloid(s) isolated from each source is furnished. In addition, this article summarizes the distribution of different types of BBI alkaloids in different genera, methods of isolation, and degradative techniques applied for structure elucidation.

Since the days of the earliest commercial drug preparations, viz., *Radix pareira bravae, Bebeerium purum* and *Curare* (the arrow poison of South American Indians), natural products chemists and pharmacognosists have been interested in the bisbenzylisoquinoline (BBI) alkaloids because of their diverse formulations and varied pharmacological effects. Several reviews on the BBIs are already available (1–8a). The article by Shamma (7) covers different chemical aspects of this field and has intensified the long-felt need for a glossary of these alkaloids containing all information necessary for a natural product chemist searching for new BBI alkaloids. The present report aims to fulfill this demand.

BBI alkaloids are built up of two benzylisoquinoline (BI) units linked by ether bridges. In addition to this ether linkage, methylenoxy bridging or direct carbon carbon bonding is also found between the two BI units. A variety of structural patterns arise in the BBI molecules due to differences in (1.) the number of aromatic oxygen substituents present; (2.) the number of ether linkages; (3.) the nature of ether bridges, viz., diphenyl ether or benzylphenyl ether; and (4.) the sites on the two BI units at which the ether or the carbon carbon bond originates. Based on these differences, the BBI alkaloids are classified into the groups and subgroups as shown in table 1.

Individual members in each group differ simply in (1.) the nature of the oxygenated substituents (OH, OMe, OCH_2O); (2.) the nature of substitution of the two nitrogen atoms (NH, NMe, N^-Me_2, NO); (3.) the degree of unsaturation of the hetero rings; and (4.) the stereochemistry of the two asymmetric centers.

Botanical source.—Distribution of the different groups of BBI alkaloids in different genera and the botanical sources of these alkaloids are depicted in tables 2 and 3 respectively.

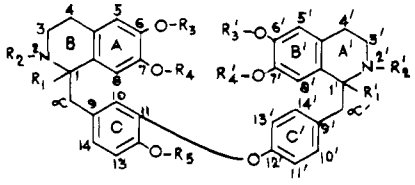
Ecological factors affect the nature and amount of BBI alkaloids in plants. *Cissampelos pareira* Linn. from Kashmir yielded hayatine (No. 137, table 4) and hayatinine (No. 138, table 4) (both **XXI** type); whereas a plant from Pilibhit yielded hayatine and curine (No. 133, table 4) (same type), but no hayatinine (10); the plants from Madras and Madagascar contained, in addition to hayatine and curine, isochondodendrine (No. 122, table 4) (**X** type), which was not found in the extracts from Pilibhit and Kashmir (11).

TABLE 1. *Structural classification of the bisbenzylisoquinoline alkaloids.*

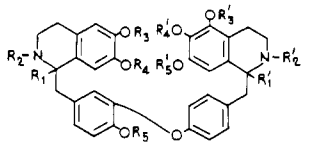
The numbering system is shown in expression **I**. The rings C and C' are always numbered so as to assign the smallest numbers to the substituents on these rings. The Shamma-Moniot nomenclature for the BBI's has been followed (9).[1] However, for purposes of simplification, the different types have also been designated by simple Roman numerals as indicated below.

A. ONE DIPHENYL ETHER LINKAGE.

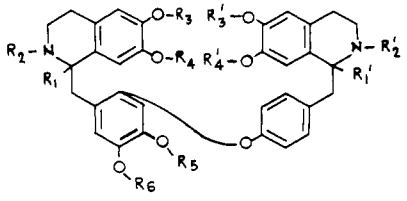
a. Tail to tail



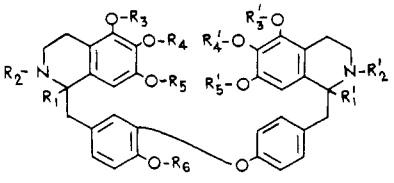
6,7,11*,12–6,7,12* **I**



6,7,11*,12–5,6,7,12* **Ia**

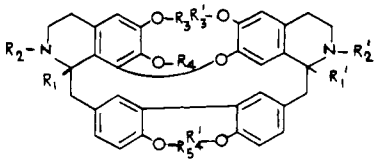


6,7,10*,12,13–6,7,12* **II**



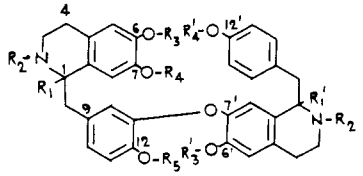
5,6,7,11*,12–5,6,7,12* **III**

b. Head to head



6,7,8*,12–6,7*,12(11–11) **IV**

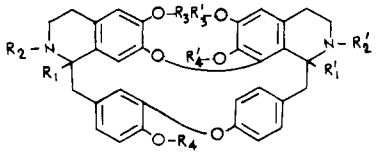
c. Head to tail



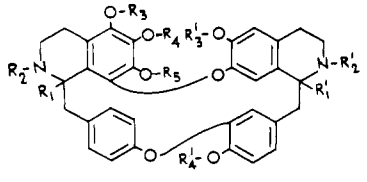
6,7,11*,12–6,7*,12 **V**

B. TWO DIPHENYL ETHER LINKAGES.

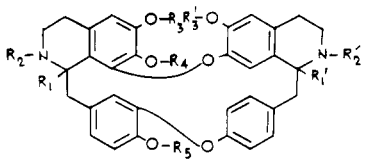
a. Head to head and tail to tail



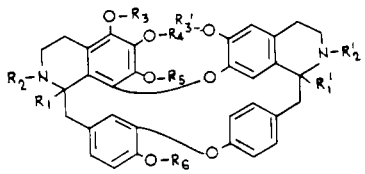
6,7*,11†,12–6,7,8*,12† **VI**



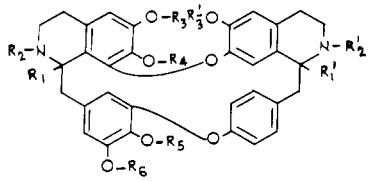
5,6,7,8*,12†–6,7*,11†,12 **VII**



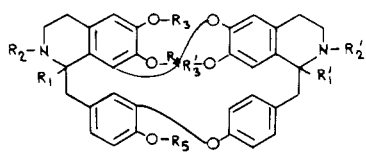
6,7,8*,11†,12-6,7*,12† **VIII**



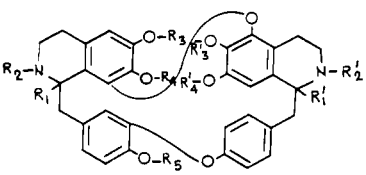
5,6,7,8*,11†,12-6,7*,12† **IX**



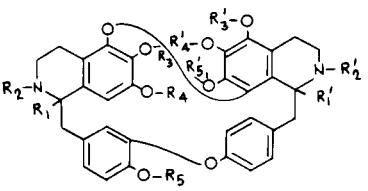
6,7,8*,11†,12,13-6,7*,12† **X**



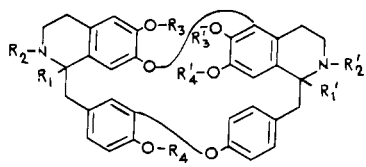
6,7,8*,11†,12-6*,7,12† **XI**



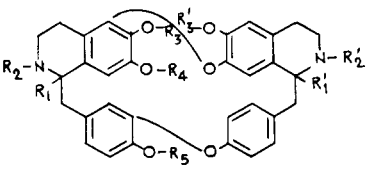
6,7,8*,11†,12-5*,6,7,12† **XII**



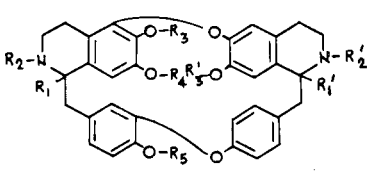
5*,6,7,11†,12-5,6,7,8*,12† **XIII**



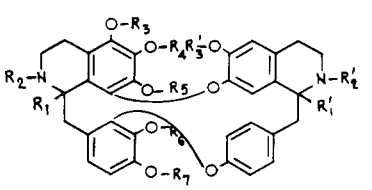
6,7*,11†,12-5*,6,7,12† **XIV**



5*,6,7,11†,12-6,7*,12† **XV**

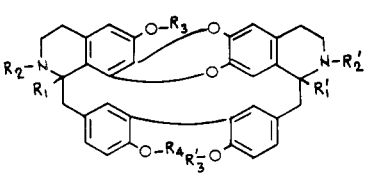


5*,6,7,11†,12-6*,7,12† **XVI**

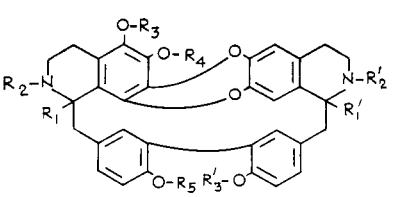


5,6,7,8*,10†,11,12-6,7*,12† **XVII**

b. Only head to head

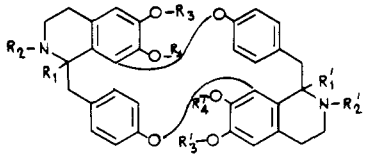


6,7*,8†,12-6*,7†,12(11-11) **XVIII**

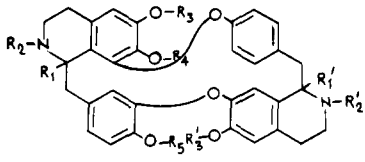


5,6,7*,8†,12-6*,7†,12(11-11) **XIX**

c. Head to tail

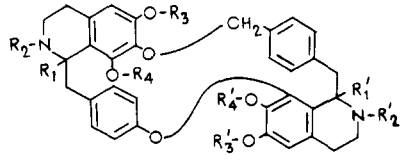


6,7,8*,12†–6,7,8†,12* **XX**



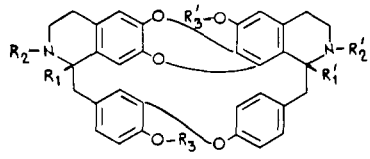
6,7,8*,11†,12–6,7†,12* **XXI**

C. ONE DIPHENYL ETHER AND ONE BENZYL PHENYL ETHER LINKAGES.

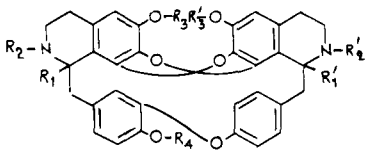


6,7,8*,12*–6,7,8*[7–12] **XXII**

D. THREE DIPHENYL ETHER LINKAGES.

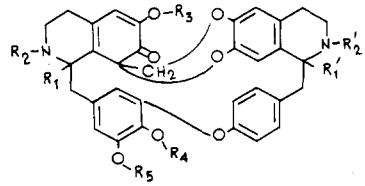


6*,7†,11‡,12–6,7*,8†,12‡ **XXIII**

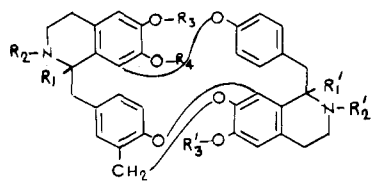


6,7*,8†,11‡,12–6,7†,8*,12‡ **XXIV**

E. TWO DIPHENYL ETHER AND ONE PHENYL-BENZYL ETHER LINKAGES.



6,7,8*,11†,12,13–6,7*,12†[8–6] **XXV**



6,7,8*,12†–6,7,8†,12*[11–7] **XXVI**

[1]The two sets of numbers denoting the oxygenated sites are separated by a hyphen. The more highly oxygenated benzylisoquinoline half constitutes the left hand side of the dimer, and is listed first. In the case of head to tail coupling, the more highly oxygenated benzylisoquinoline is placed on top, and is listed first. An asterisk (*) or other symbol († or ‡) on the upper right of a number indicates the terminal of a diaryl ether. Numbers between parentheses, appearing directly after the listing of oxygenated sites, describe the positions of a biphenyl linkage.

From samples of *Daphnandra micrantha* Benth., collected from New South Wales, Bick (12) separated micranthine (No. 159, table 4) (**XXIII** type) as the minor constituent, the major alkaloids being daphnandrine and daphnoline (Nos. 37 and 38, respectively, table 4) (both **VI** type). In specimens from Southern Queensland, Bick isolated mainly micranthine with little or none of the other

two alkaloids. In samples collected from the Whian State Forest, Australia, *O*-methyl- and *N,O*-dimethylmicranthine (Nos. 158, 156, respectively, table 4) accompanied micranthine, but no trace of daphnandrine or daphnoline (13) could be found.

Indian Mahonia plants have been found in many instances to contain both oxyacanthine (No. 48) (**VI** type) and berbamine (No. 57) (**VIII** type); whereas the Japanese Mahonias yield isotetrandrine (No. 62) and berbamine, both of type **VIII** (14). Only one Japanese Mahonia, *M. fortunei* (Hort.) Fedde, was found to contain oxyacanthine (15).

Stephania rotunda Lour. from the Caucasus gave cycleanine (No. 121) (16) but the plants from India did not. Leaves of *Magnolia fuscata* Andr. collected from Russia gave both magnoline (No. 12) (**I** type) and magnolamine (No. 15) (**II** type), while those from Japan gave magnolamine only (17).

Moreover, the alkaloids vary in nature and in relative proportion in different parts of the plant. Leaves of *Menispermum canadense* Linn. contain no alkaloid; whereas, other parts of the plant—stem, root, and rhizome—contain alkaloids of type **I** (18). Similarly, in the case of *Mahonia fortunei* Fedde, the trunk is found to contain berbamine (No. 57) and oxyacanthine (No. 48) (15) although its leaves do not contain any BBI alkaloid (19).

ISOLATION OF ALKALOIDS.—The isolation of BBI alkaloids is, itself, a challenge for the natural products chemist. A survey of general methods of isolation is therefore presented.

The plant material, leaf, stem, bark, root or rhizome, is rarely defatted (138). It is generally extracted by percolation at room temperature with methanol or ethanol [isopropyl alcohol has also been used (79)] or 1–5% acidic alcohol. The acid is normally acetic acid; Barton (128) used 2% methanolic tartaric acid solution. Hot alcohol extraction was done by Boissier (11). Use of other solvents for this extraction was also reported, e.g., petroleum ether (76, 58), benzene (138) and dichloroethane (17). Impregnation of the plant with ammonium hydroxide prior to extraction is also known (11, 17, 164); the bark of *Daphnandra micrantha* was extracted with methanol-chloroform-ammonia (15:5:1) (13). Kupchan (58) used 1.5% triethylamine in methanol, and Cava (21) used aqueous ammonia-ether for the extraction of *Cissampelos pareira* and *Abuta grisebachii*, respectively.

Removal of solvent in vacuum results in a gummy mass which is treated with 1 to 5% aqueous solution of acetic, citric, tartaric, hydrochloric or sulfuric acid. Only Cava (54) used phosphoric acid solution, and von Bruchhausen used boiling 1% hydrochloric acid (117). However, reports of the extraction of alkaloids directly from the plant by aqueous acid solution are also known (12, 25, 49, 107).

To remove the non-alkaloidal matters from the aqueous acid extracts, King (25) and Tomita (14, 15) precipitated them with lead acetate; the excess lead was then removed as lead sulfide. Now the general method is to remove them by treatment with light petroleum ether or ether. Kupchan (79) has also used heptane and toluene. In several cases (10), the pH of the solution is adjusted to 5 with the addition of sodium bicarbonate to precipitate non basic material. Cava (54) extracted the alkaloids from the alcoholic extracts using ammoniacal ethyl acetate. After the removal of the solvent, the gummy mass was treated with 2% aqueous sulfuric acid to separate the basic substances.

The aqueous acid extracts are then basified with alkali solution to pH 8–9. The total alkaloid fraction precipitates.

The number of alkaloids in the crude alkaloidal mixture is assessed by paper or thin-layer chromatography. Attempts to resolve the BBI alkaloids by paper

TABLE 2. *Distribution of the different groups of bisbenzylisoquinoline alkaloids in different genera.*

Family	Genus	No. of species studied	No. of BBI alkaloids obtained											
			I	Ia	II	III	IV	V	VI	VII	VIII	IX	X	XI
Aristolochiaceae	Aristolochia	1												
Anonaceae	Cremastosperma	1					1							
	Guatteria	1												
	Isolona	1												
	Phaeanthus	1									1			
	Uvaria	1												
Berberidaceae	Berberis	21	3						3		3			2
	Mahonia	13							1		2			
Buxaceae	Buxus	1												
Hernandiaceae	Gyrocarpus	1									2			
Lauraceae	Lindera	1	1											
	Nectandra	1					5		2		1			
Magnoliaceae	Magnolia	2	1		1				1					
Menispermaceae	Abuta	4	2						4		4			
	Anisocyclea	1							2					
	Anomospermum	1												
	Chondodendron	5												
	Cissampelos	4												
	Cocculus	6							3		2			
	Cyclea	5							2		13			
	Epinetrum	3												
	Limacia	2	1						1		1			
	Menispermum	2	5											
	Pachygone	1												
	Paracyclea	1												
	Pleogyne	1												
	Pycnarrhena	3							1		6			
	Sciadotenia	1												
	Stephania	8							6		6			
	Tiliacora	4					3				3			
	Triclisia	3							2		5			
Monimiaceae	Atherosperma	1									3			
	Daphnandra	8							5		1		6	
	Dryadodaphne	1												
	Laurelia	1									1			
	Nemuaron	1												
Nymphaceae	Nelumbo	1						3						
Ranunculaceae	Thalictrum	17	2	3		4			6	6	4	7		4
	Xanthorhiza	1							1		1			
Rhamnaceae	Colubrina	2	1						1		1			
Umbelliferae	Heracleum	1												

chromatography were first made by Tomita and Watanabe (177) using paper pretreated with buffer of pH 3.5 and the solvent system *n*-butanol-acetic acid-water (67:10:23 v/v). Chan (106) impregnated Whatman paper Nos. 1 and 4 with 0.2M potassium hydrogen orthophosphate prior to descending paper chromatography and identified eight spots in the crude alkaloid mixture of *Ocotea rodiaei* by using the solvents (1.) *n*-butanol-glacial acetic acid-water (63:10:27) and (2.) benzene-glacial acetic acid-water (6:7:3). Kidd (178) used the upper layer of the solvent mixture: amyl alcohol (110 ml), pyridine (110 ml), and water suficient for saturation (approximately 90 ml). For the detection of the non-phenolic alkaloids, Dragendorff's reagent was used. With phenolic alkaloids, the red spots obtained

TABLE 2. *Distribution of the different groups of bisbenzylisoquinoline alkaloids in different genera.*

	No. of BBI alkaloids obtained														
XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV	XXVI	Undetermined
									1						
								1	2						
								1	1						
									1						
		1													1
									1						
															2
			2					1	1						
											2				
									1						
								3	8						1
								2	5	7				1	
											4	3			2
								3	3					2	
								3							
											1				
								2	1					1	
								1	1						
															2
								2							
								2			1			1	
						6	1								3
											3				
											5		2		
		2													
				1											
4	2	3			2										
								2							

with this reagent were too transient; Folin-Denis reagent followed by alcoholic ammonia was found to be more satisfactory. Bick (179) was able to separate a few type **VI** alkaloids on Whatman paper No. 1 using a solvent mixture of butanol-acetic acid-water of varying proportions. The spots were detected by spraying the dried paper first with the potassium salt of tetrabromophenolphthalein ethyl ester (0.1%) and then with an aqueous solution (0.05%) of oxalic acid.

Thin layer chromatography is more widely used to assay the alkaloidal mixture. Döpke (180) employed silica gel plates prepared with 0.1 N sodium hydroxide to separate the compounds of greater basicity, phaeanthine, isotetrandrine, pycnamine, berbamine and oxyacanthine. Boissier (173) used this method for

TABLE 3. *Botanical sources of bisbenzylisoquinoline alkaloids.*
(Serial No., according to Table 4, of the alkaloid is placed by the side of its name).

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
Abuta candicans Rich ex DC.	Stem	(+)-Curine 132 (20)	XXI
(*Chondodendron candicans* Sandwith)	"	(+)-Isochondodendrine 122 (20)	XX
A. grisebachii Triana and Planchon	Stem	Grisabine 10 (21)	I
	"	Magnoline 12 (21)	I
		7-*O*-Demethylpeinamine 60a (21a)	XIII
		Macolidine 44a (21a)	VI
		Macoline 44b (21a)	VI
		N-Methyl,7-*O*-demethylpeinamine 66b (21a)	VIII
		Peinamine 71a (21a)	VIII
A. panurensis Eichl.	Stem	Norpanurensine 109 (22)	XV
	"	Panurensine 110 (22)	XV
A. splendida Krukoff and Moldenke	Stem	Aromoline 31 (23)	VI
		Homoaromoline 42 (23)	VI
		Krukovine 63 (23)	VIII
Anisocyclea gradidieri H. Bn.	Stem	12'-*O*-Demethyltrilobine 155 (24)	XXIII
	"	(−)-Epistephanine 41 (24)	VI
	"	Stebisimine 51 (24)	VI
	"	Trilobine 163 (24)	XXIII
Anomospermum grandifolium Eichl.	Stem	(+)-Tubocurarine 142 (25)	XXI
Aristolochia indica Linn.	Root	(−)-Curine 133 (26)	XXI
Atherosperma moschatum Labill.	Leaf	Atherospermoline 56 (27)	VIII
	Bark	Berbamine 57 (28)	VIII
	"	Isotetrandrine 62 (28)	VIII
A. repandulum F. Muell.	See *Daphnandra repandulum* F. Muell.		
Berberis amurensis Rupr.	Stem	Berbamine 57 (29)	VIII
	"	Berbamunine 1 (29)	I
B. aquifolium Pursch.	Root	Berbamine 57 (30)	VIII
	"	Oxyacanthine 48 (30)	VI
B. aristata DC.	See *Berberis floribunda* Wall. ex Don.		
B. asiatica Roxb. ex DC.	Root, bark, stem	Berbamine 57 (31)	VIII
B. floribunda Wall. ex Don.	Root	Berbamine 57 (32)	VIII
B. (aristata)	"	Oxyacanthine 48 (32)	VI
B. fortunei Lindl.	See *Mahonia fortunei* Hort.		
B. heteropoda Schrenk	See *Berberis vulgaris* Linn.		
B. himalaica Ahrendt	Stem-bark	Himanthine 73 (33)	Undetermined
B. integerrima	Leaf	Berbamunine 1 (34)	I
	"	Oxyacanthine 48 (34)	VI
B. japonica R. Br.	See *Mahonia japonica* Thunb.		
Berberis julianae Schneid.	Root	Berbamine 57 (34a)	VIII
	"	Oxyacanthine 48 (34a)	VI
B. kawakamii Hayata	Root	Berbamine 57 (35)	VIII
	"	Isotetrandrine 62 (35)	VIII
B. lambertii R. N. Parker	Root	Berbamine 57 (36)	VIII
	"	Oxyacanthine 48 (36)	VI
B. laurina (Thunb.) Billb.	Root-bark	Belarine 93 (37)	XI
	"	Espinidine 8 (38)	I
	"	Espinine 9 (38)	I
	Trunk-bark and root	Lauberine 106 (39)	XIV
	"	*O*-Methyl isothalicberine 94 (37, 39)	XI
	"	Obaberine 46 (39)	VI
B. lycium Royle		Berbamine 57 (39a)	VIII
B. mingetsensis Hayata	Root	Berbamine 57 (40)	VIII
	"	Isotetrandrine 62 (40)	VIII
B. morrisonensis Hayata	Root and stem	Berbamine 57 (41)	VIII
	"	Isotetrandrine 62 (41)	VIII
B. oblonga		Berbamunine 1 (42)	I
		2'-*N*-Methyl berbamine 66a (42a)	VIII
		Oblongamine 47 (42)	VI
		Oxyacanthine 48 (42)	VI

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
B. petiolaris Nall	Root	Berbamine 57 (42b)	VIII
B. swaseyi Buckey (*Mahonia swaseyi* Fedde)	Root	Berbamine 57 (43)	VIII
B. thunbergii DC.	Whole plant	Berbamine 57 (44)	VIII
	"	Isotetrandrine 62 (44)	VIII
	"	Oxyacanthine 48 (44)	VI
B. tinctoria Leschen. (*B. aristata*)	Root	Berbamine 57 (33)	VIII
B. tschonoskyana Regel	Stem	Obaberine 46 (45)	VI
	"	Obamegine 71 (45)	VIII
	"	Oxyacanthine 48 (45)	VI
B. *vulgaris* Linn. (*B. heteropoda* Schrenk)	Root	Berbamine 57 (46)	VIII
	"	Oxyacanthine 48 (47)	VI
B. zebiliana		Berbamine 57 (47a)	VIII
Buxus sempervirens Linn. (*B. wallichiana* Baill.)	Leaf	(±)-Curine 132 (48)	XXI
Chondodendron candicans Sandwith	See *Abuta candicans* Sandwith		
C. limaciifolium (Diels) Moldenke	Wood	Isochondodendrine 122 (49)	XX
	"	(+)-Norcycleanine 124 (49, 50) (base B)	XX
C. microphylum (Eichl.) Moldenke (*Sychnosepalum microphyllum* Eichl.)	Root	(+)-Curine 132 (20)	XXI
	"	Isochondodendrine 122 (20)	XX
C. platiphyllum Miers	Leaf	Chondrofoline 131 (20)	XXI
	Stem, root and leaf	(−)-Curine 133 (20)	XXI
	Root and leaf	Isochondodendrine 122 (20)	XX
C. tomentosum Ruiz and Pavon	Stem and bark	Chondocurarine 129 (51)	XXI
	"	Chondrocurine 130 (50, 52)	XXI
	"	(−)-Curine 133 (50, 52, 53)	XXI
	"	Cycleanine 121 (50, 52)	XX
	"	Isochondodendrine 122 (50, 52)	XX
	"	(±)-Tubocurarine 142 (52)	XXI
	Stem	(±)-Norcycleanine 124 (50)	XX
	"	(−)-Tubocurarine 143 (53)	XXI
	Stem and leaf	Tomentocurine 186 (50)	Undetermined
C. toxicoferum (Wedd.) Kruk. et Mold.	Stem	(−)-Curine 133 (54)	XXI
	"	Isochondodendrine 122 (54)	XX
	"	Toxicoferine 141 (54)	XXI
Cissampelos insularis Makino	Root	Cycleanine 121 (55)	XX
[*Paracyclea insularis* (Makino) Kudo and Yamamoto]	"	Insularine 170 (55)	XXVI
C. mucronata A. Rich.	Root	Isochondodendrine 122 (56)	XX
C. ovalifolia DC.		Dihydrowarifteine 146 (57)	XXII
		Dimethyldihydrowarifteine 147 (57)	XXII
		Dimethylwarifteine 148 (57)	XXII
		Methyldihydrowarifteine 149 (57)	XXII
		Methylwarifteine 150 (57)	XXII
		Warifteine 151 (57)	XXII
C. pareira Linn.	Whole plant	Cissampareine 145 (58)	XXII
	Root	Insularine 170 (59)	XXVI
	"	Isochondodendrine 122 (11, 59)	XX
	"	4"-*O*-Methylcurine 139 (60)	XXI
	Root and leaf	(−)-Curine 133 (10, 11, 60, 61)	XXI
	"	Cycleanine 121 (59, 61)	XX
	"	Hayatidine 136 (61)	XXI
	"	Hayatine 137 (10, 11, 61)	XXI
	"	Hayatinine 138 (10, 61)	XXI
Cocculus hirsutus (Linn.) Diels	Stem and root	Isotrilobine 157 (62)	XXIII
	"	Trilobine 163 (62)	XXIII
C. japonicus DC.	See *Stephania japonica* (Thunb.) Miers		
C. laurifolius DC.	Bark and trunk	Isotrilobine 157 (63)	XXIII
	"	Trilobine 163 (63)	XXIII

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
C. leaeba DC	Root	Oxyacanthine 48 (64)	VI
	Leaf	Menisarine 165 (65)	XXIV
C. pendulus (Forsk) Diels	Stem and leaf	Cocsoline 152 (66)	XXIII
	"	Cocsuline 153 (66)	XXIII
	"	Cocsulinine 164 (66)	XXIV
	"	Pendine 178 (66)	Undetermined
	"	Penduline 72 (66)	VIII
	"	Pendulinine 179 (66)	Undetermined
C. sarmentosus Diels	Root	Isotrilobine 157 (67)	XXIII
	"	Menisarine 165 (67)	XXIV
	"	Tetrandrine 76 (67)	VIII
	"	Trilobine 163 (67)	XXIII
C. trilobus DC	All parts of the plant	Coclobine 35 (68)	VI
	"	Isotrilobine 157 (69)	XXIII
	"	Normenisarine 166 (69)	XXIV
	"	Daphnoline 38 (69)	VI
	"	Trilobine 163 (69)	XXIII
Colubrina asiatica Brongn.	Bark	*O*-Methyldauricine 12a (69a)	I
C. faralaotra	Leaf, stem-bark, root-bark	Cycleapeltine 36 (69b)	VI
	"	Limacine 64 (69b)	VIII
Cremastosperma polyphlebum (Diels) Fries	Bark	Phlebicine 25 (70)	IV
Cyclea barbata (Wall.) Miers	Rhizome	Homoaromoline 42 (71)	VI
	"	Isotetrandrine 62 (71)	VIII
		Berbamine 57 (71a)	VIII
		Chondrocurine 130 (72)	XXI
		(±)-Fangchinoline 58 (73)	VIII
		(+)-Isochondodendrine 122 (74)	XX
		Limacine 64 (71a)	VIII
		Monomethyl tetrandrinium 67 (75)	VIII
		(+)-Tetrandrine 76 (74)	VIII
		(±)-Tetrandrine 77 (71a)	VIII
		Tetrandrine mono-*N*-2'-oxide 78 (72)	VIII
		Thalrugosine 79 (73)	VIII
C. burmanni Hook. et Thoms.	Root	Tetrandrine 76 (76)	VIII
C. insularis (Makino) Diels	Rhizome	Cycleanine 121 (77)	XX
	"	Insulanoline 169 (77)	XXVI
	"	Insularine 170 (77)	XXVI
	"	Isochondodendrine 122 (78)	XX
	"	(+)-Norcycleanine 124 (77)	XX
C. madagascariensis Baill.	Root	Chondrocurine 130 (11)	XXI
	"	(−)-Curine 133 (11)	XXI
	"	Isochondodendrine 122 (11)	XX
C. peltata Diels	Root	Cycleacurine 134 (79)	XXI
	"	Cycleadrine 58 (79)	VIII
	"	Cycleahomine 59 (79)	VIII
	"	Cycleanorine 60 (79)	VIII
	"	Cycleapeltine 36 (79)	VI
	"	Fangchinoline 61 (79, 80)	VIII
	"	Isochondodendrine 122 (80)	XX
	"	(+)-Tetrandrine 76 (79, 80)	VIII
	"	(±)-Tetrandrine 77 (80)	VIII
Daphnandra aromatica F. M. Bailey	Bark	Aromoline 31 (81)	VI
	"	Daphnoline 38 (81)	VI
D. dielsii Perkins	Bark	*O*-Methylrepandine 45 (32)	VI
	"	Repandinine 90 (82)	X
	"	(−)-Tenuipine 92 (82)	X
	"	Repanduline 168 (82)	XXV
		Pseudorepanduline 167 (83)	XXV

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
D. micrantha Benth.	Bark	Daphnandrine 37 (82)	VI
	"	*N,O*-Dimethylmicranthine 156 (13)	XXIII
	"	*O*-Methylmicranthine 158 (13)	XXIII
	"	Micranthine 159 (13, 82)	XXIII
	"	Daphnoline 38 (82)	VI
D. repandula F. Muell.	Bark	*O*-Methylrepandine 45 (82)	VI
(*Atherosperma rapandulum* F. Muell.)	"	Repandine 49 (84)	VI
	"	Repandinine 90 (82)	X
	"	Repanduline 168 (82, 84)	XXV
D. species	Bark	Isotenuipine 87 (85)	X
D. species Dt-7	Bark	Fangchinoline 61 (13)	VIII
	"	*N,O*-Dimethylmicranthine 156 (13)	XXIII
	"	*O*-Methylmicranthine 158 (13)	XXIII
	"	(+)-Nortenuipine 88 (13)	X
	"	Telobine 160 (13)	XXIII
D. species unnamed	Terminal twig and leaf	1,2-Dehydromicranthine 154 (83)	XXIII
	"	*N,O*-Dimethylmicranthine 156 (83)	XXIII
	"	*O*-Methylmicranthine 158 (83)	XXIII
	"	Micranthine 159 (33)	XXIII
	"	Pseudorepanduline 167 (83)	XXV
	"	(+)-Tenuipine 91 (83)	X
D. tenuipes Perkins	Leaf	(−)-Nortenuipine 89 (82, 86)	X
	Bark	Aromoline 31 (82)	VI
	"	(+)-Nortenuipine 88 (86)	X
	"	Repandinine 90 (86)	X
	"	Repanduline 168 (82)	XXV
	"	(−)-Tenuipine 92 (82)	X
	"	(+)-Tenuipine 91 (86)	X
Dryadodaphne novoguineensis (Perkins) A. C. Smith	Bark	Dryadine 104 (87)	XIV
	"	Dryadodaphnine 105 (87)	XIV
Epinetrum cordifolium Mangenot and Miège	Root	Cycleanine 121 (88)	XX
	"	Isochondodendrine 122 (88)	XX
	"	Norcycleanine 124 (88)	XX
E. mangenotti Guill. and Debray	Root and leaf	Cycleanine 121 (88)	XX
	"	Isochondodendrine 122 (88)	XX
	"	Norcycleanine 124 (88)	XX
E. villosum (Excell) Troupin	Leaf, root	Cycleanine 121 (88a)	XX
	Stem	Isochondodendrine 122 (88a)	XX
	"	Norcycleanine 124 (88a)	XX
Guatteria megalophylla Diels	Stem bark	*O,O*-Dimethylcurine 135 (89)	XXI
	"	Isochondodendrine 122 (89)	XX
	"	12'-*O*-Methylcurine 140 (89)	XXI
Gyrocarpus americanus Jacq. (*G. jacquini* Roxb.)	Bark and leaf	Phaeanthine 74 (90)	VIII
	"	Pycnamine 75 (90)	VIII
Heracleum wallichi	Root	Cycleanine 121 (90a)	XX
	"	Isochondodendrine 122 (90a)	XX
Isolona pilosa Diels	Trunk bark	Curine 133 (90b)	XXI
	"	Isochondodendrine 122 (90b)	XX
Laurelia sempervirens Tul.	Leaf	Isotetrandrine 62 (91)	VIII
Limacia cuspidata Hook. f. and Thoms.	Whole plant	Cuspidaline 2 (92)	I
	"	Limacine 64 (92)	VIII
	"	Limacusine 44 (92)	VI
L. oblonga Miers	Whole plant	Cuspidaline 2 (93)	I
	"	Limacine 64 (93)	VIII
	"	Limacusine 44 (93)	VI
Lindera oldhamii Hemsl.	Leaf	Lindoldhamine 11 (94)	I
Magnolia compressa Maxim.	Bark	Oxyacanthine 48 (95)	VI
M. fuscata Andr.	Leaf	Magnolamine 15 (17)	II
(*Michelia fuscata* Blume)	"	Magnoline 12 (17)	I

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
Mahonia acanthifolia Don	Root	Oxyacanthine 48 (96)	VI
M. aquifolium Nutt		Berbamine 57 (97)	VIII
M. borealis Takeda	Root	Oxyacanthine 48 (98)	VI
M. fortunei (Hort.) Fedde	Trunk	Berbamine 57 (15)	VIII
(*Berberis fortunei* Lindl.)	"	Oxyacanthine 48 (15)	VI
M. griffithii Takeda	Bark	Berbamine 57 (99)	VIII
	"	Oxyacanthine 48 (99)	VI
M. japonica DC.	Trunk and root	Berbamine 57 (15)	VIII
	Trunk, root and leaf	Isotetrandrine 62 (15, 19)	VIII
M. leschenaultii Takeda	Root	Oxyacanthine 48 (100)	VI
M. lomariifolia Takeda	Root	Berbamine 57 (101)	VIII
	"	Isotetrandrine 62 (101)	VIII
M. manipurensis Takeda	Root	Oxyacanthine 48 (100)	VI
M. morrisonensis Takeda	Root	Berbamine 57 (101)	VIII
	"	Isotetrandrine 62 (101)	VIII
M. philippinensis Takeda	Trunk and root	Berbamine 57 (102)	VIII
	"	Isotetrandrine 62 (102)	VIII
M. sikkimensis Takeda	Stem bark	Oxyacanthine 48 (100)	VI
M. simonsii Takeda	Root	Oxyacanthine 48 (98)	VI
M. swaseyi Fedde	See *Berberis*	*swaseyi* Buckley	
Menispermum canadense Linn.	Leaf	No alkaloid (18)	
	Stem, root and rhizome	Dauricine 3 (18, 103)	I
	Rhizome	Daurinoline 6 (103)	I
	"	*N*-Desmethyldauricine 7 (103)	I
M. dauricum DC.	Rhizome	Dauricine 3 (104, 105)	I
	"	Dauricinoline 4 (105)	I
	"	Dauricoline 5 (104)	I
	"	Daurinoline 6 (104)	I
Michelia fuscata Blume	See *Magnolia*	*fuscata* Andr.	
Nectandra rodiei R. Schomb.	Bark and Seed	Ocotine 23 (106)	IV
(*Ocotea rodiei*)	"	Rodiasine 26 (106, 107)	IV
	"	Sepeerine 50 (107)	VI
	Bark	Demerarine 39 (107)	VI
	"	Dirosine 19 (107)	IV
	"	Norrodiasine 22 (107)	IV
	"	Ocodemerine 176 (107)	Undetermined
	"	Otocamine 177 (107)	"
	Seed	2-Nor-(+)-tetrandrine 70 (106)	VIII
	"	Ocotosine 24 (106)	IV
	Root	(+)-Curine 132 (48)	XXI
Nelumbo nucifera Gaertn	Embryo	Isoliensinine 28 (108)	V
	"	Liensinine 29 (109, 110)	V
	"	Neferine 30 (110)	V
Nemuaron vieillardi Baill.	Bark and Leaf	Neumarine 111 (111)	XVI
Ocotea rodiei	See *Nectandra*	*rodiei* R. Schomb.	
Pachygone pubescens Benth.	Root and top	Isotrilobine 157 (111a)	XXIII
Paracyclea insularis (Makino) Kudo and Yamamoto	See *Cissampelos*	*insularis* Makino	
P. ochiaiana (Yamamoto) Kudo and Yamamoto	Stem, root and rhizome	(−)-Curine 133 (112)	XXI
	"	Cycleanine 121 (112)	XX
	"	Insularine 170 (112)	XXVI
	"	Isochondodendrine 122 (112)	XX
Phaeanthus ebraceteolatus (Presl) Merrill	Bark	Phaeantharine 73 (113)	VIII
	"	Phaeanthine 74 (114)	VIII
Pleogyne cunninghamii Miers	Root	(−)-Curine 133 (115)	XXI
(*P. australis* Benth.)	"	Isochondodendrine 122 (115)	XX

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
Pycnarrhena australiana F. Muell.	Whole plant including root	Berbamine 57 (116)	VIII
	"	Isotetrandrine 62 (116)	VIII
	"	2-*N*-Norberbamine 68 (116)	VIII
	"	2-*N*-Norobamegine 69 (116)	VIII
P. manillensis F. Muell.	Root	Berbamine 57 (117)	VIII
	"	Isotetrandrine 62 (117)	VIII
	"	Phaeanthine 74 (117)	VIII
	"	Pycnamine 75 (117)	VIII
	"	Pycnarrhenamine 181 (117)	Undetermined
	"	Pycnarrhenine 182 (117)	"
P. ozantha Diels	Bark	*N*,*N*'-Bisnoraromoline 32 (118)	VI
	"	2-*N*-Norobamegine 69 (118)	VIII
Sciadotenia toxifera Krukoff and A. C. Smith	Stem	Sciadenine 127 (119)	XX
		Sciadoline 128 (120)	XX
Stephania capitata Spreng.		Cycleanine 121 (121)	XX
		(+)-Epistephanine 40 (122)	VI
S. cepharantha Hayata	Root tuber	Berbamine 57 (123)	VIII
	"	Cepharanoline 33 (123)	VI
	"	Cepharanthine 34 (55, 123)	VI
	"	Cycleanine 121 (55, 123)	XX
	"	Isotetrandrine 62 (55, 123)	VIII
S. dinklagei Diels	Root and stem	Dinklageine 172 (124)	Undetermined
S. discolor Spreng.	See *S. hernandifolia* Walp.		
S. glabra (Roxb.) Miers	See *S. rotunda* Lour.		
S. hernandifolia (Willd.) Walp. (*S. discolor* Spreng.)	Root	Fangchinoline 61 (125)	VIII
	"	Isochondodendrine 122 (125)	XX
	"	Isotrilobine 157 (126)	XXIII
	"	(−)-Tetrandrine 76 (125)	VIII
	"	(±)-Tetrandrine 77 (125)	VIII
		Oxoepistephanine 47a (126a)	VI
S. japonica (Thunb.) Miers	Root, stem and leaf	Epistephanine 40 (127, 128)	VI
	Root and terrestrial portion	Hypoepistephanine 43 (127)	VI
	"	Obamegine 71 (129)	VIII
	"	Insularine 170 (130)	XXVI
	Stem and leaf	Stebisimine 51 (128)	VI
S. rotunda Lour. [*S. glabra* (Roxb.) Miers]	Tuber and above ground parts	Cycleanine 121 (16)	XX
S. sasakii Hayata	Root	Berbamine 57 (131)	VIII
	"	Cepharanthine 34 (131)	VI
S. tetrandra S. Moore	Tuber	Fangchinoline 61 (132)	VIII
	"	Menisidine 65 (133)	VIII
	"	Menisine 66 (133)	VIII
	"	Tetrandrine 76 (132)	VIII
Sychnosepalum microphyllum Eichl.	See *Chondodendron microphyllum* Eichl.		
Thalictrum dasycarpum Fisch. and Lall.	Root	Thalidasine 100 (134)	XII
T. fendleri C. L. Anders.	Whole plant	Hernandezine 81 (135)	IX
	"	Thalidezine 83 (135)	IX
T. foetidum Linn.	Aerial parts	Berbamine 57 (136)	VIII
	"	Isotetrandrine 62 (136)	VIII
	"	Thalfoetidine 99 (136)	XII
	Root	Thalfine 102 (137)	XIII
	"	Thalfinine 103 (137)	XIII
T. glaucum Desf.	See *T. rugosum* Ait.		
T. hernandezii Tausch	Root	Hernandezine 81 (138)	XI
T. isopyroides C. A. Mey.	Root	*O*-Methylthalisopine 55 (139)	VII
	"	Thalisopidine 53 (139)	VII
	"	Thalisopine 54 (139)	VII

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
T. longistylum DC.	Root	*N*-Desmethylthalistyline 16 (140)	III
	"	Methothalistyline 17 (140)	III
	"	Thalibrine 14 (140)	I
	"	Thalistyline 18 (140)	III
T. lucidum	Root	Aromoline 31 (141)	VI
	"	Homoaromoline 42 (141)	VI
	"	*O*-Methylthalicberine 95 (141)	XI
	"	Obaberine 46 (141)	VI
	"	Obamegine 71 (141)	VIII
	"	Oxyacanthine 48 (141)	VI
	"	Thalicberine 97 (141)	XI
	"	Thalidasine 100 (141)	XII
	"	Thalrugosine 79 (141)	VIII
T. minus Linn.	Above ground parts	*O*-Methylthalmethine 96 (142)	XI
	"	Thalmethine 98 (142)	XI
	Root and whole plant	*O*-Methylthalicberine 95 (142, 143, 144)	XI
	Root	Obaberine 46 (144a)	VI
		Thalfine 102 (144a)	XIII
		Thalfinine 103 (144a)	XIII
		Thalicberine 97 (142)	XI
		Thalidasine 100 (144a)	XII
	"	Thalidezine 83 (143)	IX
		Thalirabine 17a (144a)	III
		Thaliracebine 14a (144a)	Ia
		Thalrugosaminine 55 (144a)	VII
	Whole plant	Thalmine 108 (144)	XIV
T. pedunculatum Edgew.		Berbamine 57 (145)	VIII
T. podocarpum Humb.	Root	*N*-Desmethylthalidezine 80 (146)	IX
	"	*N*-Desmethylthalistyline 16 (146)	III
	"	Hernandezine 81 (146)	IX
	"	Isothalidezine 82 (146)	IX
	"	Methothalistyline 17 (146)	III
	"	Thalidezine 83 (146)	IX
	"	Thalistyline 18 (146)	III
T. polygamum Muh...l.		Thalrugosine 79 (147)	VIII
T. revolutum DC.	Root	*O*-Methylthalicberine 95 (148)	XI
	"	*O*-Methylthalmethine 96 (148)	XI
	"	Thalidasine 100 (148)	XII
	"	Thalrugosaminine 55 (148)	VII
T. rochebrunianum Franch & Sav.	Root	Hernandezine 81 (149)	IX
	"	Northalibrine 13 (150)	I
	"	Thalibrine 14 (150)	I
	"	Thalibrunimine 112 (151)	XVII
	"	Thalibrunine 113 (149)	XVII
	"	Thalsimine 86 (151)	IX
T. rugosum Ait. (*T. glaucum* Desf.)	Root	Obamegine 71 (152)	VIII
	"	Thalidasine 100 (152)	XII
	"	Thalidezine 83 (143)	IX
	"	Thaligosidine 100a (152a)	XII
	"	Thaligosine 52a (152a)	VII
	"	Thaligosinine 52b (152a)	VII
	"	Thalirugidine 17a (152a)	III
	"	Thalirugine 14a (152a)	Ia
	"	Thaliruginine 14b (152a)	Ia
	"	Thalrugosamine 52 (153)	VI
	"	Thalrugosaminine 55 (154)	VII
	"	Thalrugosidine 101 (152)	XII
	"	Thalrugosine 79 (152)	VIII
	Aerial part	Thalsimine 86 (143)	IX

TABLE 3. *Continued.*

Name of the plant	Plant part studied	Alkaloid	Structural type of the alkaloid
T. simplex Linn.	Aerial part	Hernandezine 81 (155)	IX
	"	Thalidezine 83 (155)	IX
	"	Thalisamine 84 (155)	IX
	"	Thalsimidine 85 (156)	IX
	Aerial part and seed	Thalsimine 86 (155, 156, 157)	IX
T. sultanabadense	Aerial part	Hernandezine 81 (157a)	IX
	"	Thabadensine 106a (157a)	XIV
T. thunbergii DC.	Root	Aromoline 31 (158, 159)	VI
	"	Homoaromoline 42 (158, 159)	VI
	Stem and leaf	*O*-Methylthalicberine 95 (160)	XI
	"	Thalicberine 97 (160)	XI
	"	Thalictine 107 (161)	XIV
Tiliacora dinklagei Engl.	Root	Dinklacorine 114 (162)	XVIII
	"	Funiferine 20 (163)	IV
	"	Nortiliacorinine A 116 (163)	XVIII
	"	Tiliacorinine 119 (163)	XVIII
	"	Tiliageine 27 (163)	IV
T. funifera Engl. ex Diels (*T. warneckei* Engl. ex Diels)	Root	Funiferine 20 (164)	IV
	"	Funiferine *N*-oxide 21 (165)	IV
	"	Nortiliacorine A 115 (166)	XVIII
	"	Nortiliacorinine A 116 (166)	XVIII
	"	Tiliacorine 118 (166)	XVIII
	Leaf	Isotetrandrine 62 (166a)	VIII
	"	Thalrugosine 79 (166a)	VIII
	"	Tiliafunimine 79a (166a)	VIII
T. racemosa Colebr.	Leaf	Tiliacoridine 183 (167)	Undetermined
[*T. acuminata* (Lam.) Miers]	"	Tiliamosine 120 (168)	XIX
	Root and leaf	Nortiliacorinine A 116 (168, 169)	XVIII
	Root	Nortiliacorinine B 117 (169)	XVIII
	"	Tiliacorine 118 (169)	XVIII
	"	Tiliacorinine 119 (169)	XVIII
	"	Tiliarine 185 (170)	Undetermined
T. triandra (Roxb.) Diels	Root	Tiliandrine 184 (74)	Undetermined
Triclisia gilletii (De Wild.) Staner	Stem and root	Cocsuline 153 (171)	XXIII
	"	Isotetrandrine 62 (171)	VIII
	Leaf	Stebisimine 51 (171)	VI
	Stem and root	Trigilletimine 162 (172)	XXIII
T. patens Oliv.	Root and stem	Cocsuline 153 (171)	XXIII
	"	Pycnamine 75 (171)	VIII
	"	Trigilletimine 162 (172)	XXIII
	Root, stem and leaf	Phaeanthine 74 (171, 173)	VIII
	Leaf	Aromoline 31 (174)	VI
T. subcordata Oliv.	Root	Fangchinoline 61 (171)	VIII
	"	Tetrandrine 76 (174)	VIII
	"	Tricordatine 161 (175)	XXIII
Uvaria ovata A. DC.	Leaf	Chondrofoline 131 (175a)	XXI
Xanthorhiza simplicissima Marsh	Rhizome and root	Obamegine 71 (176)	VIII
	"	Oxyacanthine 48 (176)	VI

the detection of phaeanthine in *Triclisia patens;* Bhatnagar (181) was partly successful in identifying and characterizing a large number of BBI alkaloids. Dragendorff's reagent, or a mixture of an aqueous solution of chloroplatinic acid and aqueous potassium iodide, was found to be unsatisfactory because of rapid fading of the colored spots; a solution of iodine in potassium iodide was prescribed.

After determination of the number of alkaloids, the tertiary alkaloid mixture is

treated to separate the individual components. A number of procedures have been developed.

a) The crude alkaloidal mixture contains in most cases both phenolic and nonphenolic bases, and only the tertiary BBI bases containing two -OH groups show common phenolic properties.[2] Bick *et al.*, after extracting the phenolic bases with 5% sodium hydroxide solution, evaporated the chloroform solution of the tertiary alkaloids to dryness, dissolved the residue in benzene, and then extracted the cryptophenols with Claisen reagent (13).

Cava (54) and Grundon (182) applied a modified technique to separate phenols from other bases. The acid solution of total alkaloids was made strongly alkaline with 10% sodium hydroxide solution. After removal of the non-phenolic and cryptophenolic bases by chloroform extraction, the alkaline solution was brought to pH 8 by the addition of ammonium chloride; the phenols were then extracted with chloroform.

b) Countercurrent distribution of the alkaloids between chloroform and buffers of different pH has also been used to separate the BBI bases of different acid constants (106, 169). Fong, using benzene, (149) extracted the alkaloids of *Thalictrum rochebrunianum* from its acid extract at pHs 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 7.3 and 8.8.

c) The separation of alkaloids by distribution among different solvents is also a common process. Remarkable success has been scored by Kupchan (79) by distributing *Cyclea peltata* alkaloids among glycol, benzene, heptane and methanol.

The different fractions separated as above (a, b or c), are then chromatographed on an alumina column, activated (169) or deactivated (76), or on silicic acid. Florisil (134) and diatomaceous earth (103) have also been used on several occasions. Solvents used as eluents are benzene, ether, chloroform, ethyl acetate, methanolic benzene, methanolic chloroform, etc. There are also reports of the use of dichloromethane, but it has some disadvantages; type **IV** alkaloids showed evidence of some decomposition (107), and Kupchan (79) separated a large number of artifacts formed by reaction of the natural alkaloids with dichloromethane.

Partition chromatography was reported to separate obamegine and oxyacanthine from the alkaloidal mixture of *Xanthorhiza simplicissima* (176).

Preparative thin layer chromatography has also been used (13, 61, 79).

On many occasions the bases were separated as their salts or some other derivatives. Shamma (135) converted the crude alkaloid mixture of *Thalictrum fendleri* to hydrochlorides and separated the individual hydrochlorides by partition chromatography on a cellulose column using methyl ethyl ketone-water as eluent. On the other hand, Bick (13) isolated *O*-methyl micranthine and telobine as their N-acetyl derivatives.

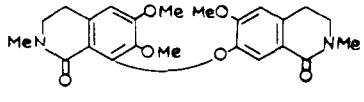
Minimal work has been done on the isolation of quaternary BBI alkaloids. Tubocurarine chloride was isolated by King (25) from *Anomospermum grandifolium*. After the removal of the tertiary bases, the quaternary bases were precipitated from a weakly acidic solution of the alkaloids as reineckates, which were then converted into chlorides, and the solution upon concentration gave crystalline (+)-tubocurarine chloride. Recently, Kupchan (79) used two ion exchange columns, Dowex 1–X8 (OH and Cl forms), with methanol as eluent to separate cycleanorine and cycleahomine chloride.

[2]Compounds containing one -OH group, sometimes called cryptophenols, differ from the former in that they are usually insoluble in sodium hydroxide solution, but soluble in Claisen reagent (25% methanolic potassium hydroxide solution).

STRUCTURAL ELUCIDATION.—For many years little progress was made in the elucidation of the structures of the BBI alkaloids, principally because in almost every case erroneous 'monomeric' formulas (C_{18}–C_{20}) were assigned on the basis of wrong molecular weight determinations. Although Pyman (183) in 1914 assigned formula C_{34}–C_{36} to the three alkaloids of *Daphnandra micrantha* Benth., he failed to determine their structures. The structure elucidation of the BBI alkaloids was pioneered by Spath and Kolbe (47) who in 1925 suggested a 'dimeric' formula (C_{37}) for oxyacanthine for which a monomeric formula had been previously accepted. In the following decades the formulas of the other BBI alkaloids were similarly revised. However, not until the application of mass spectrometry to this labyrinthine problem could the chemists obtain accurate molecular weights and compositions since these alkaloids have a tendency to retain the solvent of crystallization even after drying at a very low pressure. Improved degradation methods and nuclear magnetic resonance spectroscopy including double resonance and nuclear Overhauser effect studies (168) have proven of great value in solving many of the structural problems such as the location of substituents and the determination of the configurations of the chiral centers.

A brief discussion on the important degradation reactions applied to the BBI alkaloids would help researchers in this field because the spectroscopic data alone are still insufficient to predict the structure of a new BBI molecule.

a) Permanganate oxidation.—The methylene groups (α and α' position in **I**, table 1) which are both benzylic and β to nitrogen atoms are susceptible to facile oxidation by an aqueous solution of potassium permanganate. But identification of the degradation products cannot always lead to a single structure for the parent molecule. For example, the expected degradation products **1** and **2** of isotetrandrine (**VIII**,[3] $R_2=R_3=R_4=R_5=R_2'=R_3'=$Me, $R_1=R_1'=$H) are also possible from obaberine (**VI**, $R_2=R_3=R_4=R_2'=R_3'=R_4'=$Me, $R_1=R_1'=$H) and their stereoisomers.



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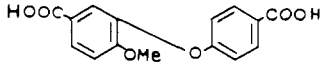
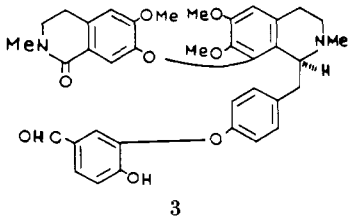


2

Shamma (184) has developed a controlled oxidative method with potassium permanganate in acetone. Cleavage occurs, irrespective of the configurations of the chiral centers, at the benzylic bond of the isoquinoline moiety, which is unsubstituted at C_8' (or C_8) producing a tertiary lactam and an aromatic aldehyde. For instance, oxyacanthine (**VI**, $R_2=R_3=R_2'=R_3'=R_4'=$Me, $R_4=$H, $R_1=R_1'=$H) gives baluchistanamine (**3**), a natural product.

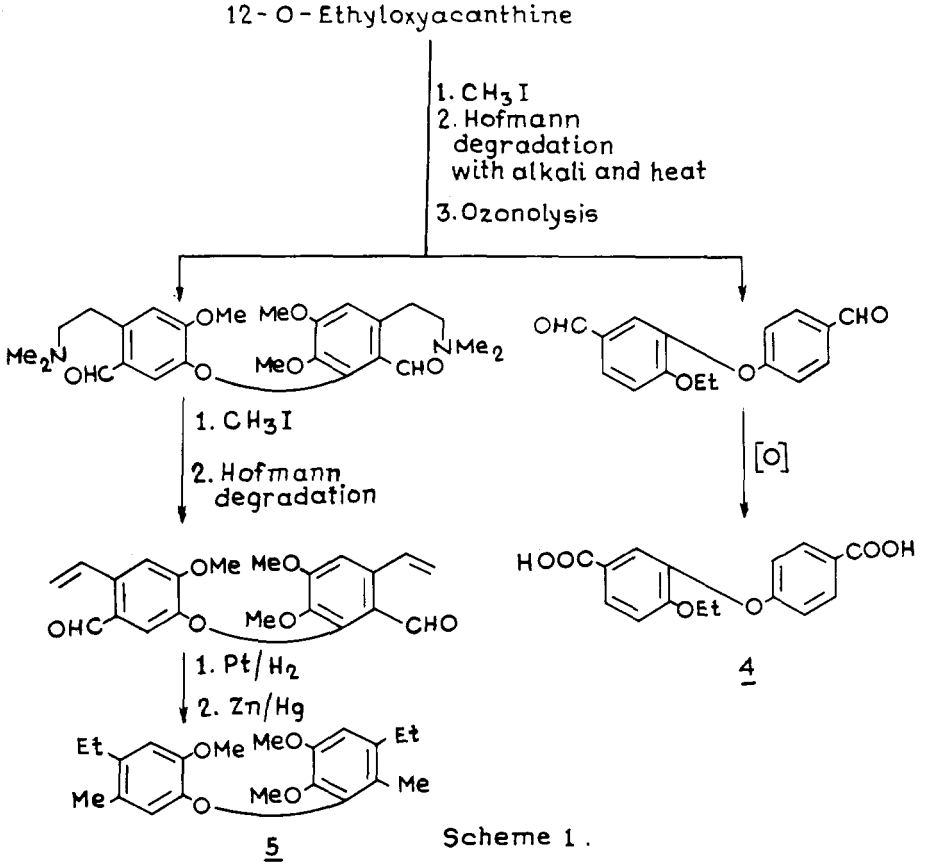


3

[3]The Roman numerals used in this discussion refers to the structural type depicted in Table 1.

The aromatic proton signals in the nmr spectra of BBIs generally overlap and are difficult to assign. On the other hand, the signals of the oxidized products are spread over a large range and are generally easier to identify. Phenolic compounds are oxidized as their *O*-acetates to get better yields. This controlled oxidative method, although of low yield, should assist in the elucidation of the structures of BBI molecules.

b) Hofmann degradation.—The process is illustrated with 12-*O*-ethyl oxyacanthine (**VI**, $R_2=R_3=R_2'=R_3'=R_4'=Me$, $R_4=Et$, $R_1=R_1'=H$[illegible]) in scheme 1.

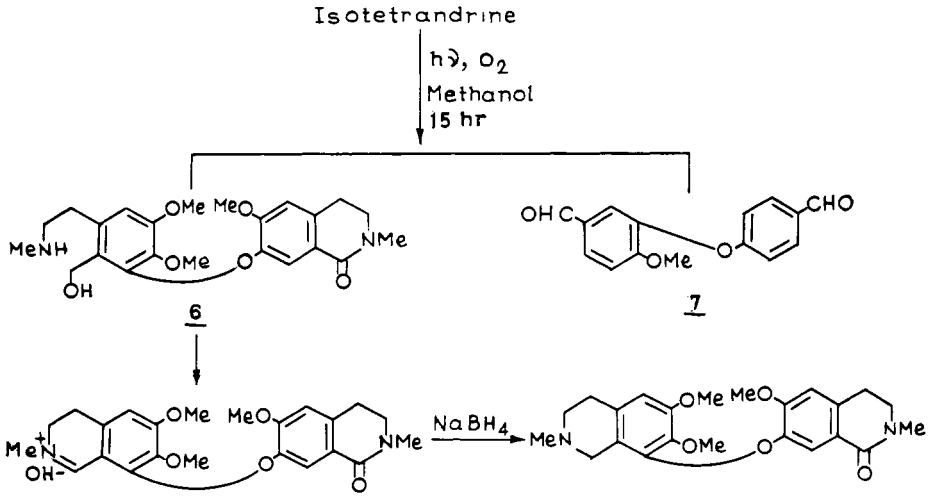


Scheme 1.

Here again, a single structure cannot be predicted. Stereoisomers of the 12-*O*-ethyl derivatives of oxyacanthine and berbamine (**8**, R=H) can give these degradation products, namely **4** and **5**.

In spite of its demerits, the Hofmann degradation is still used for the BBI molecules containing a biphenyl unit (Types **IV**, **XVIII** and **XIX**) where the metal-ammonia degradation (discussed later), the most widely used degradative method of structure elucidation of BBI molecules, is ineffective. The newly developed methods, photolysis (discussed later) and controlled oxidation with potassium permanganate, could supplant the Hofmann degradative method in the near future.

c) Photolysis.—Bick (185) has observed that BBI alkaloids on irradiation with uv light in the presence of oxygen undergo cleavage at the C-1 and C-1' benzylic centers. Isotetrandrine (**VIII**, $R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=R_1'=H$ (II)) gave the amide carbinolamine intermediate **6** and the dialdehyde **7** as the major products. The method is illustrated in scheme 2.



Scheme 2

It has been observed that the lactam is formed on that isoquinoline unit which is unsubstituted at C_8 or C_8'.

The presence of phenolic groups complicates the reaction and diminishes the yield; these are, therefore, methylated or ethylated before irradiation.

d) Metal-ammonia reductive degradation.—Sowa (186) in 1937 cleaved diarylethers reductively with sodium in liquid ammonia.

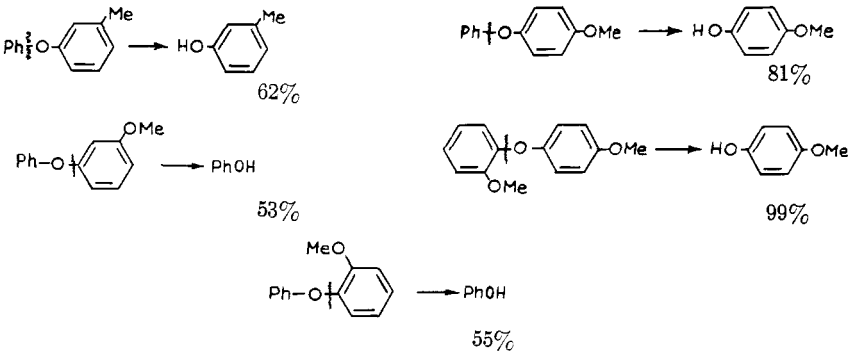
$$\text{Ph-O-Ph} \xrightarrow{\text{Na/liq.NH}_3} \text{PhOH+PhH}$$

Alkyl aryl ether linkages remain mostly unaffected. Substituted diaryl ethers can cleave in two ways.

$$\text{R-C}_6\text{H}_4\text{§O§Ph} \begin{cases} \xrightarrow[\text{at a}]{\text{Cleavage}} \text{RC}_6\text{H}_5+\text{HOPh} \\ \xrightarrow[\text{at b}]{\text{Cleavage}} \text{RC}_6\text{H}_4\text{OH}+\text{HPh} \end{cases}$$

(a b)

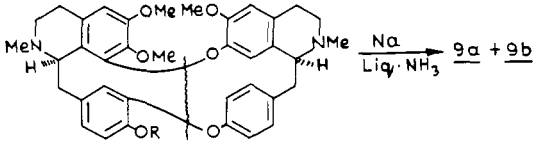
Sowa made a systematic investigation (186, 187, 187a) on different substituted diarylethers to study the effect of substituents on cleavage pattern and observed that the fission of the bond between oxygen and the substituted ring (cleavage at a) is promoted by substituents in the order *o*-MeO > *m*-MeO > *m*-Me > *p*-OMe.



(The yield of the predominant phenol only is indicated).

Scheme 3

In 1951, Tomita first applied this reaction successfully to cleave BBI molecules into two BI molecules. He isolated a phenolic BI **9a** and a non-phenolic BI compound **9b** from the reaction mixture formed by the reaction of *O*-methylberbamine (**8**, R = Me) in toluene with sodium in liquid ammonia (188).



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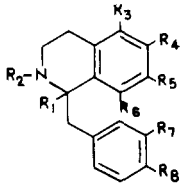
Scheme 4

The reaction has been applied to a large number of BBI molecules, and it has been observed that the direction of cleavage is determined by the substitution pattern in the aryl rings (scheme 3 is generally obeyed); the conformations of the molecules appear to be less important in influencing the cleavage pattern. The case of O-methylberbamine (**8**, R = Me) is illustrated in scheme 4.



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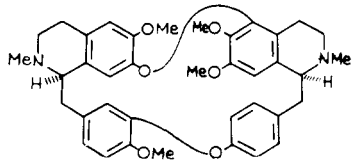
a : R_2=Me,R_4=OMe,R_5=R_8=OH,R_3=R_6=R_7=H,R_1=H▶
b : R_2=Me,R_4=R_5=R_8=OMe,R_3=R_6=R_7=H,R_1=H
c : R_2=Me,R_4=R_5=OMe,R_8=OH,R_3=R_6=R_7=H,R_1=H▶
d : R_2=Me,R_4=R_8=OMe,R_5=OH,R_3=R_6=R_7=H,R_1=H
e : R_2=Me,R_4=R_5=OMe,R_8=OH,R_3=D,R_6=R_7=H,R_1=H▶
f : R_2=Me,R_4=R_8=OMe,R_5=OH,R_3=R_7=D,R_6=H,R_1=H
g : R_2=Me,R_4=R_5=R_8=OMe,R_6=R_7=D,R_3=H,R_1=H
h : R_2=Me,R_5=OMe,R_4=R_8=OH,R_3=R_6=R_7=H,R_1=H▶
i : R_2=Me,R_4=R_5=OMe,R_8=OEt,R_3=R_6=R_7=H,R_1=H
j : R_2=Me,R_4=R_8=OMe,R_3=R_5=R_6=R_7=H,R_1=H▶
k : R_2=Me,R_4=R_8=OMe,R_5=OH,R_3=R_6=R_7=H,R_1=H▶
l : R_2=Me,R_4=R_8=OMe,R_6=OH,R_3=R_5=R_7=H,R_1=H▶
m : R_2=Me,R_4=R_5=OMe,R_8=Me,R_3=R_6=R_7=H,R_1=H
n : R_4=R_6=OMe,R_5=R_8=OH,R_2=R_3=R_7=H,R_1=H
o : R_2=Me,R_5=R_8=OH,R_3=R_4=R_6=R_7=H,R_1=H▶
p : R_2=Me,R_4=R_5=R_8=OMe,R_3=R_6=R_7=H,R_1=H▶
q : R_2=Me,R_4=R_5=OMe,R_3=R_8=OH,R_6=R_7=H,R_1=H▶
r : R_2=Me,R_4=R_5=R_8=OMe,R_6=OH,R_3=R_7=H,R_1=H▶
s : R_2=Me,R_4=R_5=R_8=OMe,R_7=OH,R_3=R_6=H,R_1=H
t : R_2=Me,R_3=OEt,R_4=R_5=R_8=OMe,R_6=R_7=H,R_1=H▶
u : R_2=Me,R_3=OEt,R_5=R_8=OMe,R_4=R_6=R_7=H,R_1=H▶
v : R_2=Me,R_3=R_5=R_8=OMe,R_4=R_6=R_7=H,R_1=H▶
w : R_4=OMe,R_5=R_8=OH,R_2=R_3=R_6=R_7=H,R_1=H
x : R_2=Me,R_4=R_5=OMe,R_8=OH,R_3=R_6=R_7=H,R_1=H

Since the chiral centers are not involved in this reaction, the configurations of the asymmetric centers of BBIs and their degradation products are identical.

Definite conclusions about the sites of attachment of the ether linkages are not always made possible by simple sodium-ammonia cleavage. For example, the degradation products **9c** and **9d** from *O*-methyloxyacanthine (**VI**, $R_2=R_3=R_4=R_2'=R_3'=R_4'=Me$; $R_1=R_1'=H$) suggest the alternate structure **10** also for *O*-methyloxyacanthine.



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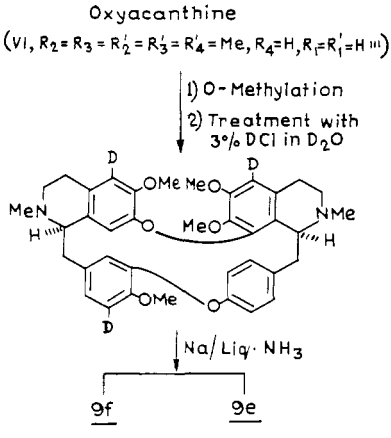
To solve the problem, Inubushi (189) deuterated the BBI molecule under conditions where only the protons ortho to methoxy groups were deuterated before subjecting them to reductive degradation. The method is exemplified in scheme 5. The presence of deuterium at C_5 in **9e** indicates the original ether linkage between C_7 of **9f** and C_8 of **9e**. The deuterium at C_{11} in **9f** shows the terminals of the other diphenyl ether linkage to be at C_{13} in **9f** and at C_{12} in **9e**.



Scheme 5

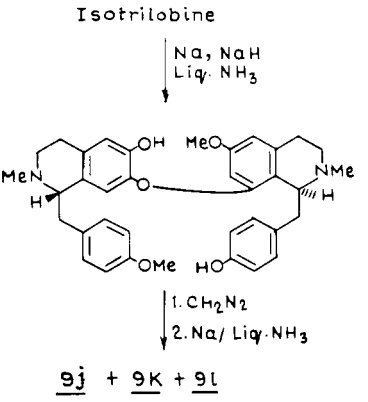
However, extension of this deuteration procedure to another alkaloid nemuarine (XVI, $R_2=R_3=R_4=R_2'=R_3'=Me$, $R_5=H$, $R_1=H$, $R_1'=H$) resulted in the introduction of only one deuterium, at position C_8(111), although both C_8 and C_8', ortho to methoxy groups were expected to be deuterated.

Bick (37) suggested an alternative method; the cleavage was done with sodium in ND_3 instead of ammonia; deuterium marks the terminals of the ether linkage. Bick determined the structure of *O*-methylisothalicberine (**XI**, $R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=R_1'=H$) from the fission products **9g** and **9h**.

The position of the phenolic function can be determined by degrading the *O*-ethyl derivative with sodium-ammonia. Bick (28) found that the non-phenolic cleavage product of *O*-ethylberbamine is **9i**, thus indicating **8** (R=H) as the structure of berbamine. A recent method is to cleave the trideuteriomethyl derivative of the compound (23, 150). Application of this method seems to be

on the increase since several phenolic BBI alkaloids react with diazoethane very slowly making the preparation of their *O*-ethyl derivatives difficult.

When a diphenylenedioxide bridge is present in a BBI molecule, a two-stage reductive fission is required, as illustrated with isotrilobine (**XXIII**, $R_2=R_3=R_2'=R_3'=Me$, $R_1=H$▶, $R_1'=H$▯) in Scheme 6 (190).

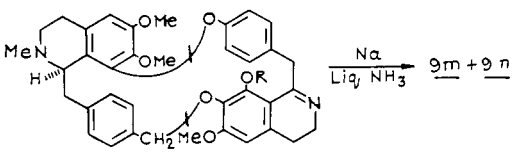


Scheme 6

The phenyl-benzylether linkage cleaves with metal-ammonia in the following way:

$$Ph\text{–}O\text{–}CH_2Ph \longrightarrow Ph\text{–}OH + CH_3Ph$$

For example, *O*-methyl cisampareine (**11**, R=Me) is reduced according to scheme 7 (191).



11 Scheme 7

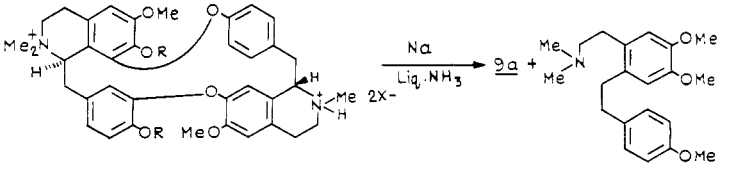
In the above scheme the –C=N-group is reduced during this reductive cleavage. Some other chromophores are also known to react with sodium-liquid ammonia, e.g., >C=O; methylenedioxy groups can be hydrogenolyzed and converted to a single phenolic group. For example, cepharanthine yielded **9o** as one of the two degradation products (192).

Cepharanthine ($R_2=R_3=R_4=R_2'=Me$, $R'_3\text{–}R'_4=CH_2$, $R_1=R_1'=H$▯) $\xrightarrow{Na/liq.NH_3}$ **9d** + **9o**

The hetero ring of the isoquinoline containing a quaternary nitrogen is opened up during metal-ammonia reduction. For instance, a non-phenolic, optically inactive Emde-type degradation product **13** is produced from one quaternary half of *O*,*O*-dimethyl(+)-tubocurarine acetate (**12**, R=Me, X=OAc) (193).

Sodium in liquid ammonia has certain limitations:

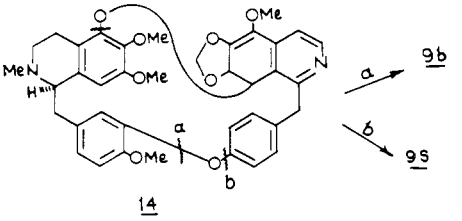
(1.) A complex mixture of more than two BIs can be produced, especially from BBI alkaloids having similar substitution around ether linkages. Kupchan



12 13

(194) separated the four products **9c**, **9p**, **9q** and **9r** from the reductive cleavage of thalidasine (**XII**, $R_2=R_3=R_4=R_5=R_2'=R_3'=R_4'=$Me, $R_1=$H▶, $R_1'=$H◀).

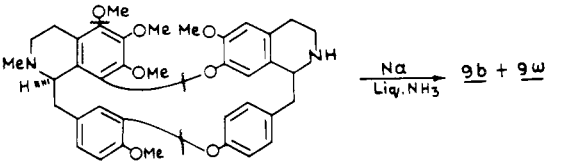
(2.) The cleavage pattern shown in scheme 3 is not strictly obeyed. For example, two BIs **9b** and **9s** were isolated following sodium-ammonia reaction of thalfine (**14**).



14

Scheme 8

(3.) Some methoxyl groups are hydrogenolysed during the reaction. For example, *O*-ethylthalidezine (**IX**, $R_2=R_4=R_5=R_6=R_2'=R_3'=$Me, $R_3=$Et, $R_1=$H▶, $R_1'=$H◀) on sodium-ammonia reduction provided, along with the usual non-phenolic degradation product **9t**, the demethoxy derivative **9u** (135). Similar reduction was also observed in the case of hernandezine (**IX**, $R_2=R_3=R_4=R_5=R_6=R_2'=R_3'=$Me, $R_1=$H▶, $R_1'=$H◀) which by hydrogenolysis of C_6–OMe led to the formation of **9v** (196). During the degradation of dihydrothalsimine (**15**), the C_5–OMe was hydrogenolyzed (157, 196) forming **9b** as one of the products.



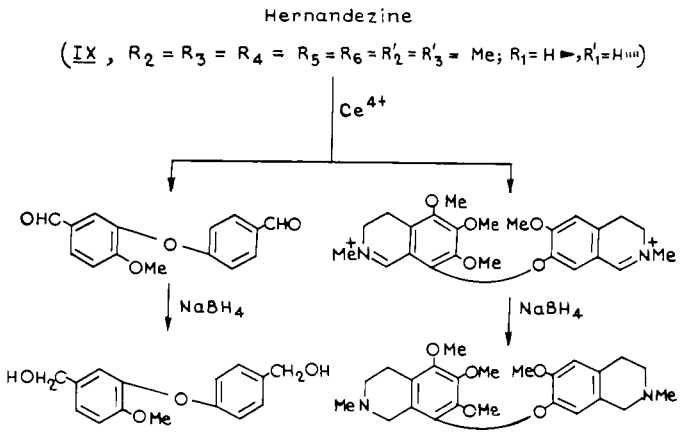
15 Scheme 9

Sodium-ammonia reduction hydrogenolyzes the C_5–OH of thalisopine (**VII**, $R_2=R_4=R_5=R_2'=R_3'=R_4'=$Me, $R_2=$H, $R_1=$H▶, $R_1'=$H◀) so that **9x** is produced as one of the degradation products (197).

$$\text{Thalisopine} \xrightarrow{\text{Na/liq.NH}_3} \mathbf{9x}+\mathbf{9k}$$

e) Oxidative degradation with ceric ammonium nitrate.—

Bick *et al.* (197a) observed that the BBI alkaloids are cleaved quantitatively by ceric ammonium nitrate; the products after reduction were as a diamine and a diol. The process is illustrated in scheme 10 with hernandezine as an example.



Scheme 10

The reaction was applied to a number of BBI alkaloids with success. When applied to berbamine, thalicberine, and tenuipine, this reaction gave good yields of the nitrogen-containing fragments only.

A complete list of the BBI alkaloids follows (table 4). This includes structures showing configurations at the chiral centers, molecular formulas, and calculated molecular weights, melting points and specific rotations, as well as uv, nmr, and mass spectral data, and cd and ord information. The degradative methods used and the botanic sources are also given in table 4. The intent is to provide the researcher who has isolated a BBI alkaloid with a quick means of deciding whether his alkaloid is old or new and, in the latter case, of formulating a structure by correlating its spectral data with those of the known compounds listed here.

The alkaloids are grouped in this table according to table 1. They are arranged in alphabetic order, and the structures are described according to the skeletal structures of table 1.

Unless stated otherwise, uv spectra were obtained in methanol or ethanol, nmr in deuteriochloroform, ord and cd in methanol.

The symbol [α] used in this table actually means [α]D. Melting points are expressed in °C, optical rotations in degrees, chemical shifts in the nmr spectral data in δ units, wavelengths in nm. Uv spectra are described as λ max (log ϵ), cd as [ϕ] x 10^{-2} (wavelengths at which the peaks and troughs appeared), mass as *m/e* (relative abundance). Ord curves are expressed as [ϕ] x 10^{-2} (wavelengths at which the peaks and troughs appeared); only in few cases are they described by the amplitude 'a' of the first Cotton effect and the [ϕ] x 10^{-2} value of the first extremum of the second Cotton effect. This diversity in describing the ord was unavoidable.

The reference number placed after the name of an alkaloid refers to the publication related to the establishment of the final structure of the alkaloid. The reference to both the melting point and optical rotation is the same and is placed after the optical rotation value.

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TABLE 4. *Bisbenzylisoquinoline alkaloids.*

	Type I	
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=R_4'=H, R_1=R_1'=H$	Config. 1-R,1'-S	1. BERBAMUNINE (198) $C_{36}H_{40}O_6N_2$:596.288638 MP 190–191; $[\alpha]^9+87$. (199) DEGRADATION: Metal-ammonia. (198) SOURCES: *Berberis amurensis, B. integerrima, B. oblonga.*
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=R_4'=H, R_5=H$, $R_1=H$▶	1-R,1'-R	2. CUSPIDALINE (92) $C_{37}H_{42}O_6N_2$:610.304288 MP oil; $[\alpha]$ −48 ($CHCl_3$). (92) UV 286. (92) NMR 2.43, 2.48 (2 x NMe); 3.81 (3 x OMe); 5.25 (2 x OH). (92) DEGRADATION: Metal-ammonia. (200) SOURCES: *Limacia cuspidata, L. oblonga.*
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me, R_5=H, R_1=H$, $R_1'=H$▶ (6,6'-Di-*O*-methyldauricoline)	1-R,1'-R	3. DAURICINE (201) $C_{38}H_{44}O_6N_2$:624.319938 MP 115; $[\alpha]$ −139 (MeOH). (18) MP 100–103; $[\alpha]^{21}$ −113 (MeOH). (104) UV 283 (4.0). (103) CD −702 (225), −148 (285). (140) NMR 2.44, 2.48 (2 x NMe); 3.78, 3.80, 3.82 (3 x OMe). (202) MASS 624 (M^+, 0.1), 206 (100). (203) DEGRADATION: Metal-ammonia. (201) SOURCES: *Menispermum canadense, M. dauricum.*
$R_2=R_4=R_2'=R_3'=R_4'=Me, R_3=R_5=H, R_1=H$, $R_1'=H$▶ (6'-*O*-Methyldauricoline)	1-R,1'-R	4. DAURICINOLINE (105) $C_{37}H_{42}O_6N_2$:610.304288 MP amorphous powder; $[\alpha]^{21}$ −94.6 (MeOH). (105) NMR 2.48, 2.52 (2 x NMe); 3.59, 3.64, 3.84 (3 x OMe); 5.44 (2 x OH); 6.06–7.14 (11 x arom. H). (105) DEGRADATION: Metal-ammonia. (105) SOURCE: *Menispermum dauricum.*
$R_2=R_4=R_2'=R_4'=Me, R_3=R_5=R_3'=H, R_1=H$, $R_1'=H$▶	1-R,1'-R	5. DAURICOLINE (104) $C_{36}H_{40}O_6N_2$:596.288638 MP amorphous powder; $[\alpha]^{20}$ −105 (MeOH). (104) NMR 2.49, 2.52 (2 x NMe); 3.59, 3.62 (2 x OMe); 5.53 (3 x OH); 6.03–7.15 (11 x arom. H). (104) DEGRADATION: Metal-ammonia. (104) SOURCE: *Menispermum dauricum.*
$R_2=R_3=R_4=R_2'=R_4'=Me, R_5=R_3'=H, R_1=H$, $R_1=H$▶ (6-*O*-Methyldauricoline)	1-R,1'-R	6. DAURINOLINE (204) $C_{37}H_{42}O_6N_2$:610.304288 MP 95–98; $[\alpha]^{27}$ −114 (MeOH). (103)

TABLE 4. *Continued.*

		UV 284 (3.95). (103) NMR 2.48, 2.51 (2 x NMe); 3.55, 3.60, 3.80 (3 x OMe); 5.95, 6.02 (2 x arom. H); 6.50–7.20 (9 x arom. H). (103) MASS 610 (M^-, 0.1), 206, 192. (203) DEGRADATION: Metal-ammonia. (204) SOURCES: *Menispermum canadense, M. dauricum.*
$R_2=R_3=R_4=R_3'=R_4'=Me, R_5=R_2'=H, R_1=H, R_1'=H$ ▶	1-R,1'-R	7. N'-DESMETHYLDAURICINE (103) $C_{37}H_{42}O_6N_2$:610.304288 MP oil (unstable); $[\alpha]^{27}$ −98 (MeOH). (103) UV 283 (4.0). (103) NMR 2.47 (1 x NMe); 3.60, 3.82 (2 x OMe), 3.84 (2 x OMe); 5.65 (2 x H, lost in D_2O); 6.50–7.30 (10 to 11 x arom. H). (103) MASS No molecular ion peak, 419, 206, 192. (103) DEGRADATION: Metal-ammonia. (103) SOURCE: *Menispermum canadense.*
$R_2=R_3=R_5=R_2'=R_4'=Me, R_4=R_3'=H, R_1=R_1'=H$ (12-*O*-Methylespinine)	1-R,1'-S	8. ESPINIDINE (38) $C_{37}H_{42}O_6N_2$:610.304288 MP amorphous powder; $[\alpha]$ +31 ($CHCl_3$). (38) NMR 2.44, 2.55 (2 x NMe); 3.57, 3.79 (2 x OMe). (38) MASS 610 (M^-, <0.3), 192 (100), 177 (26), 163 (metastable). (38) DEGRADATION: Metal-ammonia. (38) SOURCE: *Berberis laurina.*
$R_2=R_3=R_2'=R_4'=Me, R_4=R_5=R_3'=H, R_1=R_1'=H$	1-R,1'-S	9. ESPININE (38) $C_{36}H_{40}O_6N_2$:596.288638 MP 123–125; $[\alpha]$ +25 ($CHCl_3$). (38) NMR 2.41, 2.49 (2x NMe); 3.57, 3.77 (2 x OMe); 6.02, 6.25 (2 x high field arom. H). (38) MASS 596 (M^+, <1), 192 (100), 177 (26), 163 (metastable). (38) DEGRADATION: Metal-ammonia. (38) SOURCE: *Berberis laurina.*
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=R_4'=H, R_1=R_1'=H$ ▶ (Epimer of cuspidaline)	1-S,1'-R	10. GRISABINE (21) $C_{37}H_{42}O_6N_2$:610.304288 MP 145–146; $[\alpha]$ −60.2 ($CHCl_3$). (21) UV 224 (4.25), 237 (4.26), 287 (4.17). (21) NMR 2.43, 2.48 (2 x NMe); 3.83 (3 x OMe). (21) MASS 610 (M^+, 4), 418 (4), 192 (100), 175 (15). (21) DEGRADATION: Metal-ammonia. (21) SOURCE: *Abuta grisebachii.*
$R_2=R_4=R_5=R_2'=R_4'=H, R_3=R_3'=Me, R_1=H, R_1'=H$ ▶	1-R,1'-R	11. LINDOLDHAMINE (94)

TABLE 4. *Continued.*

		$C_{24}H_{36}O_6N_2$:568.257338 MP 183–186; $[\alpha]^{33}$ +35 (EtOH). (94) UV 205 (4.65), 220 sh (4.39), 280 (3.91). (94) NMR CF_3COOH; 3.98 (2 x OMe); 6.79–7.54 (11 x arom. H). (94) MASS 568 (M^-), 178 (100). (94) DEGRADATION: Metal-ammonia. (94) SOURCE: *Lindera oldhamii.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=R_4'=H, R_1=R_1'=H$▶ (Enantiomer of berbamunine)	1-S,1'-R	12. MAGNOLINE (grisabutine) (205, 21) $C_{36}H_{40}O_6N_2$:596.288638 MP 178–179; $[\alpha]$ −9.6 (pyridine). MP 192–193 (17); $[\alpha]$ −50 ($CHCl_3$). (21) UV 224 (4.24), 239 (4.25), 287 (4.01), 320 sh (3.25). (21) NMR Me_2SO -d_6; 2.32 (2 x NMe); 3.71 (2 x OMe). (21) MASS 596 (M^+, 15), 404 (13), 192 (100), 176 (6). (21) DEGRADATION: Metal-ammonia. SOURCES: *Abuta grisebachii, Magnolia fuscata.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=R_4'=Me$, $R_1=H$▮, $R_1'=H$▶	1-R,1'-R	12a. O-METHYLDAURICINE (69a) $C_{39}H_{46}O_6N_2$:638.335588 MP amorphous powder; $[\alpha]^{20}$: −78.8 (ethanol). (69a) UV 283 (4.04). (69a) NMR 2.39, 2.42 (2 x NMe); 3.48, 3.52 (2 x OMe), 3.70 (3 x OMe); 2.3–3.5 (14 x aliph. H); 5.8–7.0 (11 x arom. H). (69a) MASS 637 (0.08, M^-–H), 623 (0.08), 431 (0.09), 416 (0.15), 206 (100). (69a) SOURCE: *Colubrina asiatica.*
$R_2=R_3=R_4=R_5=R_3'=Me, R_2'=R_4'=H$, $R_1=H$▶, $R_1'=H$▮	1-S,1'-S	13. NORTHALIBRINE (150) $C_{37}H_{42}O_6N_2$:610.304288 MP amorphous powder; $[\alpha]$ +47 ($CHCl_3$). (150) UV 284 (3.70). (150) NMR 2.46 (1 x NMe); 3.60, 3.71 (2 x OMe), 3.73 (2 x OMe). (150) MASS 610 (M^-), 206 (100), 178 (23). (150) DEGRADATION: Metal-ammonia. (150) SOURCE: *Thalictrum rochebrunianum.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me, R_4'=H$, $R_1=H$▶, $R_1'=H$▮ (2'-*N*-Methylnorthalibrine)	1-S,1'-S	14. THALIBRINE (150) $C_{38}H_{44}O_6N_2$:624.319938 MP amorphous powder; $[\alpha]$ +110 ($CHCl_3$). (150) UV 284 (3.90). (150) NMR 2.45 (2 x NMe); 3.60 (1 x OMe), 3.75 (2 x OMe), 3.77 (1 x OMe). (150) MASS: 624 (M^+), 206 (100), 192 (23). (150)

TABLE 4. *Continued.*

		SOURCES: *Thalictrum longistylum*, *T. rochebrunianum*.
	Type **Ia**	
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_4'-R_5'=CH_2$, R_1H▶, $R_1'=H$	1-S,1'-S	14a. THALIRACEBINE (144a) $C_{39}H_{43}O_7N_2$:652.314853 MP 83-84; $[\alpha]^{26}$ +121° (MeOH). (144a) UV 278 (3.90). (144a) CD +1030 (238), +111 (289), −5.1 (310). (144a) NMR 2.48 (2 x NMe); 3.62 (2 x OMe), 3.76, 3.78 (2 x OMe); 5.87 (1 x OCH_2O); 5.77 (H-8), 6.15 (H-8'), 6.52 (H-5), 6.6-7.2 (7 x arom. H). (144a) MASS 652 (M^+, 0.05), 220 (95), 206 (100). 144a) DEGRADATION: Metal-ammonia. (144a) Permanganate in acetone. (144a) SOURCE: *Thalictrum minus*.
$R_2=R_3=R_5=R_2'=R_4'=R_5'=Me$, $R_4=R_3'=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	14b. THALIRUGINE (152a) $C_{38}H_{44}O_7N_2$:640.314853 MP amorphous solid; $[\alpha]^{20}$ +92 (MeOH). (152a) UV 280 (3.81). (152a) CD +780 (226), −31 (248), +64 (282). (152a) NMR 2.43, 2.49 (2 x NMe); 3.58, 3.83 (2 x OMe), 3.78 (2 x OMe); 5.50 (1 x OH); 5.73 (H-8'), 6.38 (H-8), 6.47 (H-5), 6.6-7.2 (7 x arom. H). 152a) MASS 640 (M^+, 0.01), 222 (100), 207 (35), 192 (83). (152a) DEGRADATION: Metal-ammonia. (152a) Permanganate-acetone (152a) SOURCE: *Thalictrum rugosum*.
$R_2=R_3=R_4=R_5=R_2'=R_4'=R_5'=Me$, $R_3'=H$, $R_1=H$▶, $R_1'=H$ (7-*O*-Methylthalirugine)	1-S,1'-S	14c. THALIRUGININE (152a) $C_{39}H_{46}O_7N_2$:654.330503 MP amorphous solid; $[\alpha]^{20}$ +104 (MeOH). (152a) UV 281 (3.90). (152a) CD +930 (230), −21 (252), +145 (287). (152a) NMR 2.48, 2.50 (2 x NMe); 3.57, 3.61, 3.78, 3.80, 3.83 (5 x OMe); 5.4 (1 x OH); 5.71 (H-8), 6.11 (H-8'), 6.53 (H-5'), 6.6-7.2 (7 x arom. H). (152a) MASS 654 (M^+, 0.8), 222 (68), 206 (100), 192 (26). (152a) DEGRADATION: Metal-ammonia. (152a) SOURCE: *Thalictrum rugosum*.
	Type **II**	
$R_2=R_3=R_5=R_2'=R_3'=Me$, $R_4=R_6=R_4'=H$, $R_1=H$▶, $R'_1=H$	1-S,1'-S	15. MAGNOLAMINE (206)

TABLE 4. *Continued.*

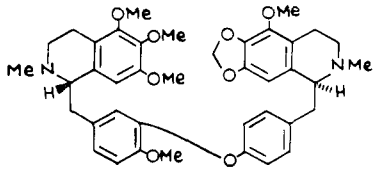
		$C_{37}H_{42}O_7N_2$:626.299203 MP 117–118; $[\alpha]^{22}$ +180 (EtOH). (206) UV 284 (4.11). (207) NMR 2.34, 2.43 (2 x NMe); 3.74, 3.76, 3.78 (3 x OMe); 6.02, 6.21 (H-8 and H-8'), 6.46–6.98 (8 x arom. H). (206) MASS 612 (0.1), 192 (100). (203) DEGRADATION: Metal-ammonia. (208) Permanganate. (206) SOURCE: *Magnolia fuscata*.
	Type **III**	
	1-S,1'-S	16. N-DESMETHYLTHALISTYLINE (140) $C_{40}H_{46}O_8N_2$:682.325418 MP amorphous powder; $[\alpha]^{25}$ +151 (MeOH). (140) UV 282 (3.81). (140) CD +878 (226), +68.2 (284). (140) NMR 2.47, 2.50 (2 x NMe); 3.60, 3.63, 3.77 (3 x OMe), 3.82 (2 x OMe); 5.90 (OCH_2O); 5.75, 5.96 (2 x arom. H), 6.51–7.10 (7 x arom. H). (140) MASS 682 (M^+, 0.6), 236 (94), 221 (17), 220 (100), 206 (14), 205 (6), 204 (7), 192 (4). (140) SOURCES: *Thalictrum longistylum*, *T. podocarpum*.
2'-*N*-Methylthalistyline.....		17. METHOTHALISTYLINE $C_{82}H_{52}O_9N_2^{++}2\ X^-$:712.372368 MP 265–267 (iodide); $[\alpha]^{21}$ +125 (MeOH) (iodide). (140) UV 276 (3.89), 283 (3.87). (140) CD +1340 (226), +135 (280). (140) NMR CF_3COOH; 3.27, 3.53 [2 x $N^+(CH_3)_2$]; 3.63, 3.73, 3.98, 4.03, 4.06 (5 x OCH_3); 5.75, 5.88 (2 x arom. H); 6.08 (1 x OCH_2O); 6.73–7.22 (7 x arom. H). (140) SOURCES: *Thalictrum longistylum*, *T. podocarpum*.
5-*O*-Demethylthalistyline.....		17a. THALIRABINE (144a) $C_{40}H_{47}O_8N_2^+\ X^-$:683.333243 MP 131–132; $[\alpha]^{26}$: +142. (144a) UV 207 (4.99), 276 (3.82), 283 (3.80). (144a) CD +969 (220, +62.6 (279). (144a) NMR 2.55 (1 x NMe); 3.45, 3.78 (2 x N^+-Me); 3.65 (1 x OMe); 3.78 (3 x OMe); 5.93 (1 x OCH_2O); 5.58 (H-8), 5.82 (H-8'), 6.2–7.4 (7 x arom. H). (144a) MASS 222 (57), 220 (100). (144a) MASS WITH CHEMICAL IONIZATION 683 (M^+, 26). (144a) DEGRADATION: *Metal ammonia*. (144a) SOURCE: *Thalictrum minus*.
$R_2=R_4=R_5=R_6=R_2'=R_4'=R_5'=Me$, $R_3=R_3'=H, R_1=H\blacktriangleright, R_1'=H$.....	1-S,1'-S	17b. THALIRUGIDINE (152a)

TABLE 4. *Continued.*

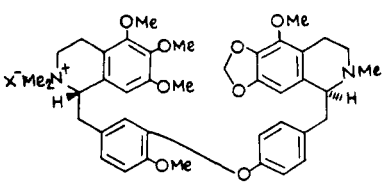
		$C_{39}H_{46}O_8N_2$:670.325418 MP amorphous powder; $[\alpha]^{20}$; +112 (MeOH). (152a) UV 278 (3.82). (152a) CD +985 (230), +72 (280). (152a) NMR 2.48, 2.51 (2 x NMe); 3.61, 3.63, 3.85 (3 x OMe), 3.81 (2 x OMe); 5.76, 5.79 (H-8, H-8'), 6.6–7.2 (7 x arom. H), 5.1 (2 x OH). (152a) MASS 670 (M^+, 1.4), 222 (100), 221 (3), 220 (3), 207 (3), 206 (8), 192 (8), 178 (2). (152a) DEGRADATION: Metal-ammonia. (152a) Permanganate-acetone. (152a) SOURCE: *Thalictrum rugosum.*
	1-S,1'-S	18. THALISTYLINE (140) $C_{41}H_{49}O_8N_2^+ X^-$:697.348893 MP 150–153 (chloride); $[\alpha]^{25}$ +146 (MeOH). (140) UV 276 (3.86), 283 (3.84). (140) CD +1050 (25), +125 (284). (140) NMR 2.48 (1 x NMe); 3.45 (2x N^+Me); 3.63, 3.77, 3.85 (3x OMe), 3.80 (2 x OMe); 5.89 (1 x OCH_2O); 5.70 (H-8), 5.77 (H-8'), 6.39–7.44 (7 x arom. H). (140) MASS 697 (M^+ 0.8), 236 (100), 220 (88). (140) DEGRADATION: Metal-ammonia. (140) SOURCES: *Thalictrum longistylum, T. podocarpum.*
	Type IV	
Isomer of norrodiasine		19. DIROSINE (107) $C_{37}H_{42}O_6N_2$:610.304288 MP 203 (hydrochloride); $[\alpha]$ +97 (H_2O) (hydrochloride). (107) SOURCE: *Nectandra rodiei.*
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me, R_5=H$, $R_1=R_1'=H$, stereochemistry undetermined		20. FUNIFERINE (164) $C_{38}H_{42}O_6N_2$:622.304288 MP 232–234, 168–169; $[\alpha]^{32}$ +184.3 ($CHCl_3$). (164) UV 233 sh (4.64), 286 (4.15), 292 sh (4.12). (164) CD +1214 (241), +308 (274). (164) NMR 2.36, 2.64 (2 x NMe); 3.39, 3.48, 3.79, 3.87 (4 x OMe); 6.33–7.25 (9 x arom. H). (164) MASS 622 (M^+, 100), 515 (1), 431 (1), 396 (19), 395 (69), 381 (21), 198 (77), 175 (27), 174 (21). (164) SOURCES: *Tiliacora funifera, T. dinklagei.*
Funiferine-2-*N*-oxide		21. FUNIFERINE *N*-OXIDE (165) $C_{38}H_{42}O_7N_2$:638.299203 MP 207–209; $[\alpha]^{25}$ +44 (MeOH). (165) UV 261 (4.75), 288 (3.95). (165)

TABLE 4. *Continued.*

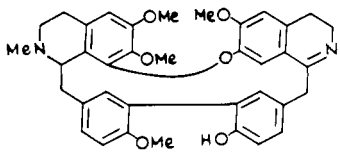
$R_3=R_4=R_5=R_3'=Me, R_4'=H, R_2=Me$ & $R_2'=H$ or vice versa, $R_1=R_1'=H$, stereochemistry undetermined.....	NMR 2.62, 3.16 (2 x NMe); 3.27, 3.51, 3.81, 3.91 (4 x OMe); 6.30–7.55 (9 x arom. H). (165) MASS 638 (M^+, 32), 622 (100), 621 (75), 607 (18), 515 (1), 431 (1), 430 (1), 396 (25), 395 (83), 381 (30), 364 (3), 349 (2), 198 (72), 175 (24), 174 (32). (165) DEGRADATION: Permanganate in acetone. (165) SOURCE: *Tiliacora funifera*.
$R_2=R_3=R_4=R_5=R_3'=Me, R_2'=R_4'=H$, $R_1=R_1'=H$, stereochemistry undetermined.....	22. NORRODIASINE (107) $C_{37}H_{40}O_6N_2$:608.288638 MP 282 (hydrochloride); [α] +74 (H_2O). (107) SOURCE: *Nectandra rodiei*.
	23. OCOTINE (106) $C_{37}H_{40}O_6N_2$:608.288638 MP 165; $[\alpha]^{24}$ +40 ±2 ($CHCl_3$). (106) UV 224 (4.60), 284 (4.04). (106) ORD +127, [φ] x 10^{-2} = +1700. (106) NMR 2.31 (1 x NMe); 3.39, 3.55, 3.80, 3.88 (4 x OMe); 6.40–7.65 (arom. H). (106) MASS 608 (M^-, 60), 609 (19), 607 (60), 485 (1), 448 (1), 430 (2.8), 416 (1), 402 (1), 382 (42), 381 (72), 367 (47), 198 (36), 191 (100), 168 (32), 160 (18). (106) SOURCE: *Nectandra rodiei*.
	24. OCOTOSINE (106) $C_{37}H_{38}O_6N_2$:606.272988 MP 186–188; $[\alpha]^{24}$ +291 ±2 ($CHCl_3$). (106) UV 233 (4.55), 282 (4.01), 298 sh (3.00). (106) ORD +543, [φ] x 10^{-2} >1700. (106) NMR 2.28 (1 x NMe); 3.39, 3.50, 3.80, 3.87 (4 x OMe); 6.41–7.72 (arom. H). (106) MASS 606 (M^+, 14), 59 (43), 58 (100). (106) SOURCE: *Nectandra rodiei*.
$R_2=R_3=R_4=R_5=R_2'=Me, R_3'=R_4'=H$, $R_1=R_1'=H$, stereochemistry undetermined.....	25. PHLEBICINE (70) $C_{37}H_{40}O_6N_2$:608.288638 MP 195; [α] +182.5 ($CHCl_3$). (70) UV 292 (3.93). (70) ORD −1690 (231), +495 (252), −206 (272), +352 (297). (70) CD −660 (225), +695 (246), −110 (260), +257 (285). (70) NMR 2.27, 2.57 (2 x NMe); 3.38, 3.70, 3.80 (3 x OMe); 6.20, 6.28, 6.50, 6.69, 6.73, 6.78 (6 x arom. H), 7.08–7.25 (2 x arom. H), 7.28 (1 x arom. H). (70)

TABLE 4. *Continued.*

		MASS 608 (M^+), 607, 487, 431, 430, 382, 381, 367, 206, 191 (100). (70) DEGRADATION: Photolysis. (70) SOURCE: *Cremastosperma polyphlebum.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me, R_4'=H$, $R_1=R_2'=H$, sterochemistry undetermined (6'-*O*-Methylphlebicine)		26. RODIASINE (70, 106) $C_{38}H_{42}O_6N_2$:622.304288 MP 203–204; $[\alpha]^{24}$ +157 ±2 ($CHCl_3$). (106) UV 233 (4.41), 285 (4.07), 292 sh (4.01). (106) ORD +488, $[\phi] \times 10^{-2} = -2040$. (106) NMR 2.34, 2.64 (2 x NMe); 3.39, 3.50, 3.80, 3.87 (4 x OMe); 6.35–7.25 (arom. H). (106) MASS 622 (M^+, 52), 621 (40), 501 (1), 462 (1), 446 (1), 430 (2), 416 (1), 414 (1), 396 (39), 395 (100), 381 (34), 198 (100), 175 (38), 174 (32). (106) DEGRADATION: Hofmann. (106) SOURCE: *Nectandra rodiei.*
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=R_5=H$, $R_1=R_1'=H$, stereochemistry undetermined		27. TILIAGEINE (209) $C_{37}H_{40}O_6N_2$:608.288638 MP 270; $[\alpha]^{2}$: +132.6 (pyridine). (209) UV 212 (4.83), 231 sh (4.60), 288 (4.03), 295 sh (3.96). (209) NMR 2.34, 2.60 (2 x NMe); 3.41, 3.76, 3.81 (3 x OMe); 6.25–7.18 (arom. H). (209) MASS 608 (M^+, 100), 501 (1), 417 (2), 382 (24), 381 (95), 367 (20), 350 (5), 335 (5), 191 (82), 175 (10), 174 (16). (209) SOURCE: *Tiliacora dinklagei.*
	Type **V**	
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=R_5=H$, $R_1=R_1'=H$	1-R,1'-R	28. ISOLIENSININE (108) $C_{37}H_{42}O_6N_2$:610.304288 MP oil; $[\alpha]^{22}$ +49.3 (Me_2CO), $[\alpha]^{29}$ −43.3 ($CHCl_3$). (108) UV 286 (4.04). (108) NMR 2.38, 2.49 (2 x NMe); 3.70 (1 x OMe), 3.76 (2 x OMe); 5.88 (2 x OH). (108) DEGRADATION: Metal-ammonia. (108) SOURCE: *Nelumbo nucifera.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=R_4'=H$, $R_1=R_1'=H$	1-R,1'-R	29. LIENSININE (210) $C_{37}H_{42}O_6N_2$:610.304288 MP 95–99; $[\alpha]^{31}$ +15.85 (Me_2CO). (109) DEGRADATION: Metal-ammonia. (210) SOURCE: *Nelumbo nucifera.*
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me, R_5=H$, $R_1=R_1'=H$ (12'-*O*-Methylliensinine)	1-R,1'-R	30. NEFERINE (211) $C_{38}H_{44}O_6N_2$:624.319938

TABLE 4. *Continued.*

		MP oil; $[\alpha]$ −37.8 ($CHCl_3$). (110) NMR 2.43, 2.47 (2 x NMe); 3.52, 3.68, 3.71, 3.77 (4 x OMe); 6.01–6.98 (11 x arom. H). (110) DEGRADATION: Metal-ammonia. (211) SOURCE: *Nelumbo nucifera.*
	Type **VI**	
$R_2=R_3=R_2'=R_3'=Me, R_4=R_4'=H, R_1=R_1'=H$ (2-*N*-Methyldaphnoline)	1-R,1'-S	31. AROMOLINE (thalicrine) (23, 212) $C_{38}H_{38}O_6N_2$:594.272988 MP 175; $[\alpha]^{17}$ +327 ($CHCl_3$). (81) MP 198–202, $[\alpha]^{22}$ +249.5 (pyridine). (174) UV 208 (4.94), 228 sh (4.69), 285 (3.95). (174) CD +2200 (224), +210 (293). (141) NMR 2.53, 2.56 (2 x NMe); 3.56, 3.78 (2 x OMe); 6.32–7.45 (10 x arom. H). (174) MASS 594 (M^+, 100), 593 (53), 382 (46), 381 (85), 368 (8), 367 (40), 364 (8), 297 (3), 192 (17), 191.5 (18), 191 (75), 174 (17), 168 (14). (174). SOURCES: *Abuta splendida, Daphnandra aromatica, D. tenuipes, Thalictrum lucidum, T. thunbergii, Triclisia patens.*
$R_2=R_4=R_2'=R_4'=H, R_3=R_3'=Me, R_1=R_1'=H$ (2'-*N*-Demethyldaphnoline)	1-R,1'-S	32. *N,N'*-BISNORAROMOLINE (118) $C_{34}H_{34}O_6N_2$:566.241688 MP 206; $[\alpha]$ +177 (1*N* HCl). (118) UV 285 (3.88). (118) NMR $CDCl_3$–CD_3OD; 2.2–4.6 (14H; benzylic II and N-CH_3); 3.61, 3.79 (2 x OMe); 6.1–7.6 (10 x arom. H). (118) MASS 566 (M^+). (118) SOURCE: *Pycnarrhena ozantha.*
$R_2=R_3=R_2'=Me, R_4=H, R_3'-R_4'=-CH_2-, R_1=R_1'=H$	1-R,1'-S	33. CEPHARANOLINE (123) $C_{36}H_{36}O_6N_2$:592.257338 MP 270: $[\alpha]^{35}$ +319 ($CHCl_3$). (123) UV 282 (3.90). (123) NMR 2.56, 2.62 (2 x NMe); 3.65 (1 x OMe); 5.55, 5.57 (1 x OCH_2O), 6.33–7.49 (10 x arom. H). (123) MASS 592 (M^+), 485, 401, 380, 379, 365, 348, 333, 192, 190, 175, 174. (123) SOURCE: *Stephania cepharantha.*
$R_2=R_3=R_4=R_2'=Me, R_3'-R_4'=-CH_2-, R_1=R_1'=H$ (12-*O*-Methylcepharanoline)	1-R,1'-S	34. CEPHARANTHINE (192, 213) $C_{37}H_{38}O_6N_2$:606.272988 MP 145–155: $[\alpha]^{20}$ +277 ($CHCl_3$). (214) ORD +718 (248), +133.2 (283), −312.3 (294). (215) NMR 2.58, 2.65 (2 x NMe); 3.70, 3.90 (2 x OMe). (216)

TABLE 4. *Continued.*

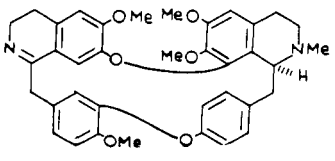
		MASS 606 (M^-), 605, 499, 405, 404, 380, 379, 365, 348, 333, 192, 190 (++), 174. (203) DEGRADATION: Metal-ammonia. (192) SOURCES: *Stephania cepharantha, S. sasakii.*
	1'-S	35. COCLOBINE (68) $C_{37}H_{38}O_6N_2$:606.272988 MP amorphous; $[\alpha]^{20}$ +123 ($CHCl_3$). (68) UV 230 (5.0), 274 (4.15), 300 sh (3.84). (68) NMR 2.53 (1 x NMe); 3.20, 3.51, 3.80, 3.91 (4 x OMe); 6.41-7.60 (10 x arom. H). (68) MASS 606 (M^-, 100), 605 (90), 591 (15), 575 (10), 559 (7), 499 (30), 303 (M^{--}, 30). (68) DEGRADATION: Metal-ammonia. (68) SOURCE: *Cocculus trilobus.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_4'=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	36. CYCLEAPELTINE (faralaotrine) (79) $C_{37}H_{40}O_6N_2$:608.288638 MP 232-234; $[\alpha]^{25}$ −106 ($CHCl_3$). (79) UV 282 (3.72). (79) NMR 2.47, 2.53 (2 x NMe); 3.29, 3.73, 3.93 (3 x OMe). (79) MASS 608 (M^-, 52), 381 (67), 367 (33), 191.5 (22), 191 (100). (79) SOURCES: *Colubrina faralaotra, Cyclea peltata.*
$R_3=R_4=R_2'=R_3'=Me, R_2=R_4'=H$, $R_1=R_1'=H$ (12-*O*-Methyldaphnoline)	1-R,1'-S	37. DAPHNANDRINE (212) $C_{36}H_{38}O_6N_2$:594.272988 MP 270; $[\alpha]^{16}$ +480 ($CHCl_3$). (82) UV 285 (3.91). (179) ORD +1158 (233), +65 (280), +463.5 (297). (215) NMR 2.50 (1 x NMe); 3.60, 3.75, 3.88 (3 x OMe). (216) MASS 594 (M^+), 593, 487, 417, 416, 368, 367, 353, 336, 321, 307, 192, 184 (++), 178, 161 (++), 160. (203) DEGRADATION: Metal-ammonia. (212) SOURCE: *Daphnandra micrantha.*
$R_2=R_4=R_4'=H, R_3=R_2'=R_3'=Me$, $R_1=R_1'=H$	1-R,1'-S	38. DAPHNOLINE (trilobamine) (212) $C_{35}H_{36}O_6N_2$:580.257338 MP 195; $[\alpha]^{15}$ +356.6 (HOAc). (217) UV 285 (3.92). (179) ORD +961 (234), +99.7 (280), +331 (295). (215) NMR HCOOH; 3.65, 3.83 (2 x OMe). (216) MASS 580 (M^+), 579, 473, 403, 402, 368, 367, 353, 336, 321, 307, 192, 184 (++), 178, 161 (++), 160. (203)

TABLE 4. *Continued.*

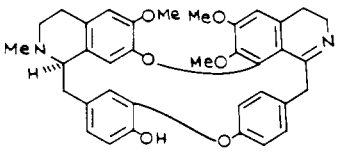
		DEGRADATION: Metal-ammonia. (212) SOURCES: *Cocculus trilobus, Daphnandra aromatica, D. micrantha.*
$R_3=R_2'=R_3'=R_4'=Me, R_2=R_4=H,$ $R_1=H\blacktriangleright, R_1'=H$ (Epimer of sepeerine)	1-S,1'-S	39. DEMERARINE (218) $C_{36}H_{38}O_6N_2$:594.272988 MP 222–223; $[\alpha]^{25}$ −162 (Methanolic chloroform). (218) MASS 594 (M^+), 382, 381, 191.5, 191 (100), 168, 160. (218) SOURCE: *Nectandra rodiei.*
12-*O*-Methylhypoepistephanine		40. (+)-EPISTEPHANINE (128) $C_{37}H_{38}O_6N_2$:606.272988 MP 200–204; $[\alpha]^{25}$ +226 ($CHCl_3$). (128) UV 232.5 (4.53), 282 (4.16). (128) NMR 2.53 (1 x NMe); 3.36, 3.86 (2 x OMe), 3.88 (2 x OMe). (128) MASS 606 (M^+, 100), 605 (95), 591, 575, 561, 559, 545, 485, 483, 381, 379, 303 (++), 190, 174, 145. (128) DEGRADATION: Metal-ammonia. (219) SOURCES: *Stephania capitata, S. japonica.*
Enantiomer of (+)-epistephanine		41. (−)-EPISTEPHANINE (24) $C_{37}H_{38}O_6N_2$:606.272988 MP 198–206; $[\alpha]^{20}$ −216 ($CHCl_3$). (24) UV 284 (4.23). (220) SOURCE: *Anisocyclea gradidieri.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_4'=H,$ $R_1=R_1'=H$ (Epimer of cycleapeltine)	1-R,1'-S	42. HOMOAROMOLINE (homothalicrine) (71) $C_{37}H_{40}O_6N_2$:608.288638 MP 235–236; $[\alpha]^{21}$ +425.3 ($CHCl_3$). (158) UV 284 (3.93). (158) SOURCES: *Abuta splendida, Cyclea barbata, Thalictrum thunbergii.*
	1-R	43. HYPOEPISTEPHANINE (pseudoepistephanine) (221) $C_{36}H_{36}O_6N_2$:592.257338 MP 256–257; $[\alpha]^{15.5}$ +183.8 ($CHCl_3$). (127) SOURCE: *Stephania japonica.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_4'=H,$ $R_1=H\blacktriangleright, R_1'=H\blacktriangleright$ (Enantiomer of cycleapeltine)	1-R,1'-R	44. LIMACUSINE (92) $C_{37}H_{40}O_6N_2$:608.288638 MP 235–237; $[\alpha]$ +110 ($CHCl_3$). (92) UV 283. (92) NMR 2.47, 2.52 (2 x NMe); 3.33, 3.75, 3.95 (3 x OMe). (92) MASS 608 (M^+), 382, 381, 367, 191 (++, 100), 175, 174, 168, 141. (92) SOURCES: *Limacia cuspidata, L. oblonga.*

TABLE 4. *Continued.*

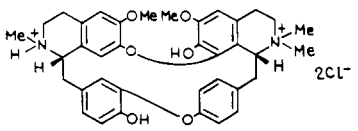
$R_2=R_3=R_2'=R_3'=Me, R_4=R_4'=H,$ $R_1=R_1'=H$▶ (Enantiomer of aromoline)	1-S,1'-R	44a. MACOLIDINE (21a) $C_{36}H_{38}O_6N_2$:594.272988 MP 179–181; $[\alpha]^{20}$ −320 ($CHCl_3$). (21a) UV 284 (3.93). (21a) ORD −390 (247), +100 (284), −100 (298). (21a) NMR 2.50, 2.53 (2 x NMe); 3.55, 3.77 (2 x OMe). (21a). MASS 594 (M^+, 52), 487 (4), 403 (4), 402 (6), 382 (36), 381 (84), 367 (48), 192 (48), 191.5 (24), 191 (100), 174 (48), 168 (28). (21a) SOURCE: *Abuta grisebachii.*
	1-S,1'-R	44b. MACOLINE (21a) $C_{37}H_{42}O_6N_2^{++}2X^-$:610.304288 MP 255–259 (chloride); $[\alpha]^{20}$ −60.6 (chloride) (MeOH). (21a) UV 282 (3.92). (21a) ORD −420 (248), −80 (264), −170 (278), +110 (296). (21a) MASS same as macolidine. (21a) DEGRADATION: Metal-ammonia. (21a) SOURCE: *Abuta grisebachii.*
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me,$ $R_1=H$▶$, R_1'=H$ (Epimer of obaberine)	1-S,1'-S	45. *O*-METHYLREPANDINE (222) $C_{38}H_{42}O_6N_2$:622.304288 MP 211; $[\alpha]^{13}$ −73 ($CHCl_3$), $[\alpha]^{20}$ −108 (0.1 NHCl). (82) UV 206 (5.11), 233 sh (4.65), 282 (3.81). (215) ORD −105 (226), +711 (234), −113 (247), −28.9 (260), −166 (276), −71.6 (289). (215) NMR 2.55 (2 x NMe); 3.05, 3.40, 3.75, 3.95 (4 x OMe). (39) MASS 622 (M^+), 621, 515, 431, 430, 396, 395, 381, 364, 349, 335, 311 (++), 198 (++), 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (222) SOURCES: *Daphnandra dielsii, D. repandula.*
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me,$ $R_1=R_1'=H$	1-R,1'-S	46. OBABERINE (O-methyloxyacanthine) (223) $C_{38}H_{42}O_6N_2$:622.304288 MP 139–140; $[\alpha]^9$ +302. (223) ORD +79.1 (227), +634 (246), +81.1 (289), +135.5 (294). (215) NMR 2.56, 2.65 (2 x NMe); 3.19, 3.62, 3.77, 3.88 (4 x OMe). (39) MASS 622 (M^+), 621, 515, 431, 430, 396, 395, 381, 364, 349, 335, 311 (++), 198 (++), 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (224) SOURCES: *Berberis laurina, B. tschonoskyana, Thalictrum lucidum.*

TABLE 4. *Continued.*

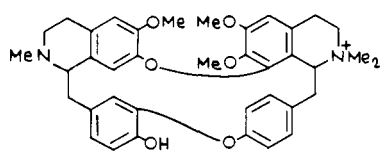
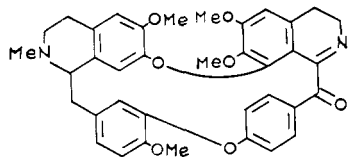
		47. OBLONGAMINE (42) $C_{38}H_{48}O_6N_2$-X^-:623.312113 MP 198-200. (42) UV 284 (3.97). (42) MASS 622, 607, 577, 564, 550, 501, 411, 396, 395, 381, 220, 206, 198, 175, 174, 58 (100). (42) SOURCE: *Berberis oblonga.*
		47a. OXOEPISTEPHANINE (126a) $C_{37}H_{36}O_7N_2$:620.252253 MP 224-226; $[\alpha]^{27}$ +272 ($CHCl_3$). (126a) SOURCE: *Stephania hernandifolia.*
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=H,$ $R_1=R_1'=H$	1-R,1'-S	48. OXYACANTHINE (224) $C_{37}H_{40}O_6N_2$:608.288638 MP 212-214; $[\alpha]^{29}$ +285.6 ($CHCl_3$). (176) UV 206 (4.94), 238 sh (5.45), 282 (3.92). (215) ORD +25.6 (233), +794 (242), +129 (287), +187.5 (295). (215) NMR 2.55, 2.60 (2 x NMe); 3.15, 3.60, 3.75 (3 x OMe). (176) MASS 608 (M^-), 607, 501, 417, 416, 396, 395, 381, 364, 349, 335, 304 (++), 198 (++, 100), 192, 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (224) SOURCES: *Berberis aquifolium, B. floribunda, B. integerrima, B. julianae, B. lambertii, B. oblonga, B. thunbergii, B. tschonoskyana, B. vulgaris, Cocculus laeaba, Magnolia compressa, Mahonia acanthifolia, M. borealis, M. fortunei, M. griffithi, M. leschenaultii, M. manipurensis, M. sikkimensis, M. simonsii, Thalictrum lucidum, Xanthorhiza simplicissima.*
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=H,$ $R_1=H$▶$, R_1'=H$ (Epimer of oxyacanthine)	1-S,1'-S	49. REPANDINE (222, 225) $C_{37}H_{40}O_6N_2$:608.288638 MP 254; $[\alpha]^{21}$ −104.3 ($CHCl_3$). (222) UV 284 (3.83). (179) ORD −1360 (217), +580 (236), −46.4 (258), −239 (279), −136 (292). (215) NMR 2.50 (2 x NMe); 3.02, 3.38, 3.73 (3 x OMe). (39) MASS 608 (M^-), 607, 501, 417, 416, 396, 395, 381, 364, 349, 335, 304 (++), 198 (++), 192, 175 (++), 174. (203) SOURCE: *Daphnandra repandula.*
$R_3=R_2'=R_3'=R_4'=Me, R_2=R_4=H,$ $R_1=R_1'=H$ (7'-*O*-Methyldaphnoline)	1-R,1'-S	50. SEPEERINE (ocoteamine) (218) $C_{38}H_{38}O_6N_2$:594.272988 MP 222; $[\alpha]^{25}$ +392 ($CHCl_3$). (218) UV 284 (3.79). (182)

TABLE 4. *Continued.*

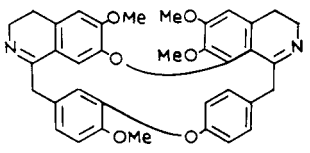
		MASS 594 (M^+), 593, 487, 417, 416, 382, 381, 367, 350, 335, 321, 297 (++), 191 (++), 178, 168 (++), 160. (203) DEGRADATION: Metal-ammonia. (218) SOURCE: *Nectandra rodiei.* 51. STEBISIMINE (128) $C_{36}H_{34}O_6N_2$:590.241688 MP 233–235. (128) UV 238 (4.71), 279 (4.38). (128) NMR 3.25, 3.88, 3.90, 3.96 (4 x OMe); 5.91 (1 x arom. H), 6.2–7.2 (8 x arom. H). (128) MASS 590 (M^-, 100), 575, 559, 370, 295 (++, 13), 221, 206 (17), 192, 175 and a low abundant peak at M^+ +14. (128, 203) DEGRADATION: Metal-ammonia. (128) SOURCES: *Anisocyclea gradidieri, Stephania japonica, Triclisia gilletii.*
$R=R_3=R_4=R_2'=R_3'=Me, R_4'=H, R_1=R_1'=H$▶ (Enantiomer of homoaromoline)	1-S,1'-R	52. THALRUGOSAMINE (153) $C_{37}H_{40}O_6N_2$:608.288638 MP 122–125; $[\alpha]^{30}$ +280 (MeOH). (153) UV 282 (3.91). (153) CD +140 (220), +165 (225), +6.1 (274), 7.0 (280), 9.12 (293). (153) NMR 2.51, 2.55 (2 x NMe); 3.60, 3.78, 3.88 (3 x OMe); 6.3–7.5 (10 x arom. H). (153) MASS 608 (M^+, 51), 382 (23), 381 (74), 367 (29), 206 (93), 205 (28), 192 (80), 191 (100), 190 (39), 176 (23), 175 (28), 174 (39), 168 (28), 149 (90). (153) DEGRADATION: Metal-ammonia. (153) SOURCE: *Thalictrum rugosum.*
	Type **VII**	
$R_2=R_4=R_5=R_2'=R_3'=R_4'=Me, R_3=H, R_1=H$▶, $R_1'=H$‖ (5-*O*-Demethyl thalrugosaminine)	1-S,1'-S	52a. THALIGOSINE (152a) $C_{37}H_{42}O_7N_2$:638.299203 MP 143–145; $[\alpha]$ −109 (MeOH). (152a) UV 282 (3.86). (152a) CD +167 (225), −79.8 (240), −12 (272), +32 (287). (152a) NMR 2.52, 2.56 (2 x NMe); 3.08, 3.39, 3.78, 3.95 (4 x OMe); 6.38 (H-8), 6.46 (H-5), 6.6–7.4 (7 x arom. H); 4.7 (1 x OH). (152a) MASS 638 (M^+, 89), 637 (27), 623 (4), 412 (25), 411 (92), 222 (14), 206 (++, 100), 192 (30). (152a) DEGRADATION: Metal-ammonia. (152a) SOURCE: *Thalictrum rugosum.*

TABLE 4. *Continued.*

$R_2=R_3=R_4=R_5=R'_2=R_3'=Me, R_4'=H,$ $R_1=H\blacktriangleright, R_1'=H$ (12'-*O*-Demethyl thalrugosaminine)	1-S,1'-S	52b. THALIGOSININE (152a) $C_{38}H_{42}O_7N_2$:638.299203 MP 233-234.5; $[\alpha]^{21}$ −58.5 (MeOH). (152a) UV 282 (3.90). (152a) CD +1000 (230), −480 (242), −130 (275). (152a) NMR 2.51, 2.56 (2 x NMe); 3.04, 3.40, 3.80, 3.84 (4 x OMe); 6.36 (H-8), 6.47 (H-5), 6.5-7.5 (7 x arom. H); ~5.0 (1 x OH). (152a) MASS 638 (M^+, 100), 426 (15), 425 (37), 411 (34), 236 (2), 213 (++, 97), 192 (31), 191 (6), 190 (9). (152a) SOURCE: *Thalictrum rugosum.*
$R_2=R_4=R_5=R_2'=R_3'=Me, R_3=R_4'=H,$ $R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	53. THALISOPIDINE (226, 9) $C_{37}H_{40}O_7N_2$:624.283553 MP 215-216; $[\alpha]^{19}$ −9 (EtOH). (139) UV 285 (4.04). (139) NMR 2.44, 2.49 (2 x NMe); 2.96, 3.30, 3.70 (3 x OMe); 6.4-7.2 (9 x arom. H). (139) SOURCE: *Thalictrum isopyroides.*
$R_2=R_4=R_5=R_2'=R_3'=R_4'=Me, R_3=H,$ $R_1=H\blacktriangleright, R_1'=H$ (12'-*O*-Methylthalisopidine)	1-S,1'-S	54. THALISOPINE (139, 9) $C_{38}H_{42}O_7N_2$:638.299203 MP 151-153; $[\alpha]^{20}$ −104.9 (Me_2CO), −71.02 ($CHCl_3$). (227) UV 284 (3.65). (227) ORD −250 (243), −100 (265), −225 (280). (228) NMR 2.43, 2.48 (2 x NMe); 3.00, 3.29, 3.70, 3.86 (4 x OMe); 5.10 (1 x OH); 6.31, 6.38, 6.57, 6.77, 6.85, 7.06 (9 x arom. H). (139) MASS 638 (M^+, 11), 412 (89), 221 (18), 206 (++, 100), 183 (17), 174 (18), 173 (29), 172 (89), 90 89 (20). (139) DEGRADATION: Metal-ammonia. (197) SOURCE: *Thalictrum isopyroides.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=R_4'=Me,$ $R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	55. THALRUGOSAMININE[4] (*O*-methylthalisopine) (148) $C_{39}H_{44}O_7N_2$:652.314853 MP 103-105; $[\alpha]^{25}$ −90.4 (MeOH). (148) UV 205 (4.89), 227 sh (4.51), 282 (3.94). (148) CD +842 (228), −534 (242), −85.4 (272), +22.5 (288), −5.9 (294). (154) NMR 2.52, 2.57 (2 x NMe); 3.08, 3.41, 3.80, 3.83, 3.97 (5 x OMe); 6.10-7.20 (9 x arom. H). (154) MASS 652 (M^+, 49), 651 (33), 426 (19), 425 (59), 411 (22), 409 (19),

[4]The name *O*-methylthalisopine predates the name thalrugosaminine. Still the later name is retained because *O*-methylthalisopine was not isolated, but was detected by TLC of the mother liquor of the plant extract remaining after separation of thalisopidine and thalisopine (139).

TABLE 4. *Continued.*

		214 (27), 213 (100), 212 (16), 206 (11), 205 (31), 198 (21), 192 (7), 191 (6), 190 (16), 189 (6), 176 (14), 174 (38). (154) DEGRADATION: Metal-ammonia. (148) Permanganate in acetone. (148) SOURCES: *Thalictrum isopyroides, T. revolutum, T. rugosum.*
	Type VIII	
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H, R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	56. ATHEROSPERMOLINE (229) $C_{36}H_{38}O_6N_2$:594.272988 MP 183-188; $[\alpha]^{18}$ +202 ($CHCl_3$). (27) UV 284 (3.97). (27) ORD +1520 (233), +60 (264), +314 (290). (27) NMR 2.62 (2 x NMe); 3.30, 3.76 (2 x OMe). (27) MASS 594 (M^-, 85), 593 (59), 471 (0.8), 463 (8), 402 (6.5), 367 (45), 365 (8.5) and 382, 381, 350, 335, 321, 192, 191 (++), 174, 168 (++). (203, 229) SOURCE: *Atherosperma moschatum.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=H, R_1=R_1'=H$	1-R,1'-S	57. BERBAMINE (berbenine) (28) $C_{37}H_{40}O_6N_2$:608.288638 MP 156; $[\alpha]^{32}$ +109.7. (31) UV 284 (3.79). (230) ORD +301 (240), +130 (250), −78.6 (261), −130 (271), +59.9 (294). (215) NMR 2.25, 2.53 (2 x NMe); 3.08, 3.54, 3.70 (3 x OMe); 5.95 (C8'-H). (230) MASS 608 (M^+, 79), 607 (50), 485 (2), 417 (7), 395 (68), 381 (34), 198 (++, 100). (230) DEGRADATION: Metal-ammona. (28) SOURCES: *Atherosperma moschatum, Berberis amurensis, B. aquifolium, B. asiatica, B. floribunda, B. julianae, B. kawakamii, B. lambertii, B. lycium, B. mingetsensis, B. morrisonensis, B. petiolaris, B. swaseyi, B. thunbergii, B. tinctoria, B. vulgaris, B. zebiliana, Cyclia barbata, Mahonia aquifolium, M. fortunei, M. griffithi, M. japonica, M. lomariifolia, M. morrisonensis, M. philippinensis, Pycnarrhena australiana, P. manillensis, Stephania cepharantha, S. sasakii, Thalictrum foetidum, T. pedunculatum.*
$R_2=R_3=R_3=R_2'=R_3'=Me, R_1=H, R_1=R_1'=H$ [(±)-Fangchinoline]		58. CYCLEADRINE (79) $C_{37}H_{40}O_6N_2$:608.288638 MP 160-162; $[\alpha]^{25}$ 0 ($CHCl_3$). (79) UV 282 (3.81). (79)

TABLE 4. *Continued.*

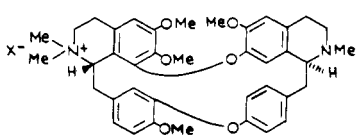
		NMR 2.25, 2.43 (2 x NMe); 3.73 (1 x OMe), 3.88 (2 x OMe). (79) MASS 608 (M^+, 64), 417 (11), 381 (80), 367 (32), 191.5 (++, 25), 191 (++, 100). (79) SOURCES: *Cyclea barbata, C. peltata.*
	1-S,1'-S	59. CYCLEAHOMINE (79) $C_{39}H_{45}O_6N^+_2X^-$:637.327763 MP 190–194 (chloride); $[\alpha]^{25}$ +103 ($CHCl_3$) (chloride). (79) UV 284 (4.08). (79) NMR 2.37 (1 x NMe); 3.30 (1 x OME & 1 x N^+Me), 3.54 (1 x N^-Me); 3.38, 3.72, 3.94 (3 x OMe); 4.5 (ArCH–N^+); 6.0–7.4 (10 x arom. H). (79) SOURCE: *Cyclea peltata.*
$R_2=R_3=R_4=R_5=R_3'=Me, R_2'=H,$ $R_1=H\blacktriangleright, R_1'H$	1-S,1'-S	60. CYCLEANORINE (79) $C_{37}H_{40}O_6N_2$:608.288638 MP 170–172; $[\alpha]^{25}$ +308 ($CHCl_3$). (79) UV 282 (4.01). (79) NMR 2.33 (1 x NMe); 3.22, 3.33, 3.70, 3.88 (4 x OMe); 6.9–7.4 (10 x arom. H). (79) MASS 608 (M^+, 55), 431 (18), 381 (80), 191 (100). (79) SOURCE: *Cyclea peltata.*
$R_2=R_4=R_5=H, R_2'=R_3'=R_3=Me,$ $R_1=R_1'=H\blacktriangleright$ (Enantiomer of 2-N-Norobamegine)	1-S,1'-R	60a. 7-*O*-DEMETHYLPEINAMINE (21a) $C_{35}H_{36}O_6N_2$:580.257338 MP 205–206; $[\alpha]^{20}$ −86 (MeOH). (21a) UV 284 (3.95). (21a) ORD −650 (242), +110 (253), +100 (276), −60 (296). (21a) MASS 580 (M^+, 64), 389 (5), 388 (2), 368 (31), 367 (100), 353 (40), 192 (21), 174 (19). (21a) SOURCE: *Abuta grisebachii.*
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=H,$ $R_1=H\blacktriangleright, R_1'=H$ (12-*O*-Methylatherospermoline)	1-S,1'-S	61. FANGCHINOLINE (231) $C_{37}H_{40}O_6N_2$:608.288638 MP 237; $[\alpha]^{18}$ +250 ($CHCl_3$). (13) UV 236 sh (4.51), 282 (4.01). (171) NMR 2.33, 2.59 (2 x NMe); 3.55, 3.77, 3.93 (3 x OMe); 6.06–7.23 (10 x arom. H). (171) MASS 608 (M^-), 607, 471, 417, 416, 382, 381, 367, 350, 335, 321, 192, 191 (++), 174, 168 (++). (203) DEGRADATION: Metal-ammonia. (231) SOURCES: *Cyclea peltata, Daphnandra species* Dt–7, *Stephania hernandifolia, S. tetrandra, Triclisia subcordata.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me,$ $R_1=R_1'=H$	1-R,1'-S	62. ISOTETRANDRINE (*O*-methylberbamine). (232) $C_{38}H_{42}O_6N_2$:622.304288

TABLE 4. *Continued.*

		MP 180–182; $[\alpha]^6$ +151 ($CHCl_3$). (44) UV 206 (4.97), 238 sh (4.38), 282 (3.85). (215) ORD +122.6 (235), −69.4 (251), −40.9 (258), −131 (274), +151 (290). (215) NMR 2.28, 2.60 (2 x NMe); 3.18, 3.63, 3.78, 3.95 (4 x OMe). (39) MASS 622 (M^-), 621, 485, 431, 430, 396, 395, 381, 364, 349, 198 (++), 190, 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (232) SOURCES: *Atherosperma moschatum, Berberis kawakamii, B. mingetsensis, B. morrisonensis, B. thunbergii, Cyclea barbata, Laurelia sempervirens, Mahonia japonica, M. lomariifolia, M. morrisonensis, M. philippinensis, Pycnarrhena australiana, P. manillensis, Stephania cepharantha, Thalictrum foetidum, Tiliacora funifera, Triclisia gilletii.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H$, $R_1=H$[||], $R_1'=H$▶ (Enantiomer of atherospermoline)	1-R,1'-R	63. KRUKOVINE (23) $C_{36}H_{38}O_6N_2$:594.272988 MP 182–183; $[\alpha]$ −180 ($CHCl_3$). (23) UV 285 (3.82). (23) NMR $CDCl_3$–Me_2SO; 2.28, 2.58 (2 x NMe); 3.30, 3.73 (2 x OMe); 5.97 (1 x H); 6.28–6.75 (arom. H), 7.11 (2 x H); 7.32 (2 x H). (23) MASS 594 (M^+, 69), 593 (44), 487 (<1), 403 (14), 381 (100), 192 (75), 191 (95), 190 (24), 174 (32), 168 (25). (23) DEGRADATION: Metal-ammonia. (23) SOURCE: *Abuta splendida.*
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=H$, $R_1=H, R_1'=H$▶ (Enantiomer of fangchinoline)	1-R,1'-R	64. LIMACINE (92) $C_{37}H_{40}O_6N_2$:608.288638 MP 154–156; $[\alpha]$ −212 ($CHCl_3$). (92) UV 284. (92) NMR 2.33, 2.60 (2 x NMe), 3.33, 3.75, 3.92 (3 x OMe). (92) SOURCES: *Cyclea barbata, Limacia cuspidata, L. oblonga.*
Isomorph of fangchinoline		65. MENISIDINE (125) $C_{37}H_{40}O_6N_2$:608.288638 MP 176; $[\alpha]^{20}$ +260. (133) SOURCE: *Stephania tetrandra.*
Isomorph of (+)-tetrandrine		66. MENISINE (125) $C_{38}H_{42}O_6N_2$:622.304288 MP 152; $[\alpha]^{20}$ +290. (133) SOURCE: *Stephania tetrandra.*

TABLE 4. *Continued.*

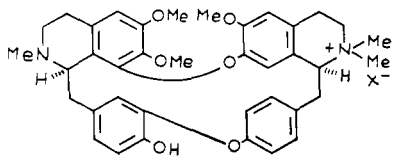
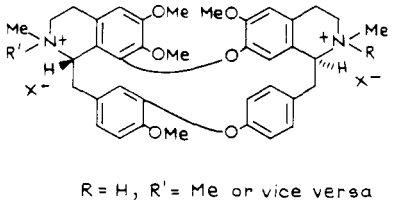
	1-R,1'-S	66a. 2-*N*'-METHYLBERBAMINE (42a) $C_{38}H_{42}O_6N_2$:623.312113 Data not available to the reviewer SOURCE: *Berberis oblonga*.
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H,$ $R_1=R_1'=H$ ▶	1-S,1'-R	66b. *N*-METHYL-7-*O*-DEMETHYL PEINAMINE (21a) $C_{36}N_{38}O_6N_2$:594.272988 MP 187–190; $[\alpha]^{20}$ −259 ($CHCl_3$). (21a) UV 284 (3.90). (21a) ORD −660 (236), +50 (254), +110 (278), −55 (294). (21a) NMR 2.28, 2.50 (2 x NMe); 3.75, 3.85 (2 x OMe), 6.06, 6.20 (2 x arom. H). (21a) MASS 594 (M^+, 41), 471 (1), 403 (8), 402 (6), 382 (29), 381 (100), 367 (45), 192 (91), 191 (100), 174 (59), 168 (25). (21a) SOURCE: *Abuta grisebachii*.
 R = H, R' = Me or vice versa	1-S,1'-S	67. MONOMETHYLTETRANDRINIUM (75) $C_{39}H_{48}O_6N_2^{++}2X^-$:638.335588 MP 208; $[\alpha]^{20}$ +51.5 (MeOH). (75) NMR 2.50, 2.78 (2 x NMe); 3.18, 3.41, 3.74, 3.90 (4 x OMe); 5.9–7.3 (arom. H). (75) MASS 622, 621, 620, 607, 591, 485, 483, 431, 430, 416, 396, 395, 393, 381, 379, 364, 350, 349, 335, 311, 206, 205, 204, 198.5, 198, 192, 191, 190, 175.5, 175, 174, 160, 146, 145. (75) SOURCE: *Cyclea barbata*.
$R_2'=R_3=R_4=R_3'=Me, R_2=R_5=H,$ $R_1=R_1'=H$	1-R,1'-S	68. 2-*N*-NORBERBAMINE (116) $C_{36}H_{38}O_6N_2$:594.272988 MP 166–168; $[\alpha]$ +117 ($CHCl_3$). (116) UV 282 (3.83). (116) NMR 2.62 (1 x NMe); 3.12, 3.62, 3.78 (3 x OMe). (116) MASS 594 (M^+, 35), 382 (100), 192 (30), 191 (85), 174 (35). (116) SOURCES: *Pycnarrhena australiana*, *P. manillensis*.
$R_3=R_2'=R_3'=Me, R_2=R_4=R_5=H,$ $R_1=R_1'=H$	1-R,1'-S	69. 2-*N*-NOROBAMEGINE (118) $C_{35}H_{36}O_6N_2$:580.257338 MP 188–190; $[\alpha]$ −290 ($CHCl_3$). (116) $[\alpha]^{25}$ −146 (0.1N HCl). (118) UV 283 (3.84). (118) NMR $CDCl_3$–CD_3OD: 2.52 (1 x NMe); 3.73, 3.85 (2 x OMe); 2.3–4.2 (14 x H: benzylic CH and N-Me); 6.0–7.5 (10 x arom. H). (116, 118)

TABLE 4. *Continued.*

		MASS 580 (M^+, 25), 368 (25), 367 (80), 353 (15), 192 (45), 191 (40), 184 (100), 174 (40), 161 (30). (116) SOURCES: *Pycnarrhena australiana, P. ozantha.*
$R_3=R_4=R_5=R_2'=R_3'=Me, R_2=H, R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	70. 2-NORTETRANDRINE (106) $C_{37}H_{40}O_6N_2$:608.288638 MP 222–226; $[\alpha]^{24}$ +335±2 ($CHCl_3$). (106) UV 227 (4.53), 282 (3.88). (106) ORD a: +139, $[\phi]$ x 10^{-2}: +1410. (106) NMR 2.62 (1 x NMe); 3.22, 3.39, 3.76, 3.94 (4 x OMe). (106) MASS 608 (M^-, 54), 607 (47), 501 (1), 471 (1), 382 (44), 381 (100), 367 (14), 191 (++, 89), 168 (26), 174 (21). (106) DEGRADATION: Metal-ammonia. (106) SOURCE: *Nectandra rodiei.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H, R_1=R_1'=H$ (Epimer of atherospermoline)	1-R,1'-S	71. OBAMEGINE (stepholine) (129) $C_{36}H_{38}O_6N_2$:594.272988 MP 171–173; $[\alpha]^{19}$ +273 ($CHCl_3$). (129) $[\alpha]^{29}$ +99 ($CHCl_3$). (176) UV 280 (3.19). (176) NMR 2.25, 2.40 (2 x NMe); 3.60, 3.70 (2 x OMe). (176) MASS 594 (M^+), 593, 471, 403, 402, 382, 381, 367, 350, 335, 321, 297, 191 (++), 175, 168 (++). (203) DEGRADATION: Metal-ammonia. (129) SOURCES: *Berberis tschonoskyana, Stephania japonica, Thalictrum lucidum, T. rugosum, Xanthorhiza simplicissima.*
$R_3=R_4=R_2'=R_3'=Me, R_2=R_5=H, R_1=R_1'=H\blacktriangleright$	1-S,1'R	71a. PEINAMINE (21b) $C_{36}H_{38}O_6N_2$:594.272988 MP 170–171; $[\alpha]^{20}$ −109 ($CHCl_3$). (21b) UV 282 (3.90). (21b) ORD −30 (296), +250 (275), +160 (263), +440 (250), −690 (237). (21b) NMR 2.55 (1 x NMe); 3.06, 3.55, 3.68 (3 x OMe); 6.0, 6.22 (2 x arom. H). (21b) MASS 594 (M^-, 22), 471 (1), 403 (1), 402 (1), 382 (26), 381 (100), 367 (20), 192 (18), 191.5 (4), 191 (28), 174 (30), 168 (15). (21b) SOURCE: *Abuta grisebachii.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=H, R_1=H\blacktriangleright, R_1'=H$ (Enantiomer of pycnamine)	1-S,1'-S	72. PENDULINE (233) $C_{37}H_{40}O_6N_2$:608.288638 MP 192–194; $[\alpha]$ +265 ($CHCl_3$). (66) UV 284 (3.84). (233) NMR 2.32, 2.62 (2 x NMe); 3.21 (2 x OMe), 3.75 (1 x OMe); 2.88,

TABLE 4. *Continued.*

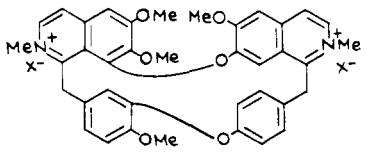
		3.42, 3.90 (8 ring methylene, 2 ring methine and 4 benzylic protons respectively); 6.05, 6.79 (2 x arom. H), 6.20–7.40 (10 x arom. H). (66) MASS 608 (M^+), 607, 416, 396, 395, 381, 364, 349, 198 (++), 198.5 (++), 175.5 (++), 175, 174. (66) SOURCE: *Cocculus pendulus.*
		73. PHAEANTHARINE (113) $C_{38}H_{36}O_6N_2^{--}2X^-$:616.257338 MP 124–130 (picrate), 180–184 (perchlorate). (113) UV (113) DEGRADATION: Metal-ammonia. (113) SOURCE: *Phaeanthus ebracteolatus.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=H$ ▯, $R_1'=H$▶ (Enantiomer of tetrandrine)	1-R,1'-R	74. PHAEANTHINE (178) $C_{38}H_{42}O_6N_2$:622.304288 MP 220–222; $[\alpha]^{24}$ −270 ($CHCl_3$). (171) UV 206 (3.98), 236 sh (4.44), 282 (3.91). (215) ORD −810 (228), −1350 (236), −87 (268), −257 (290). (215) NMR 2.30, 2.60 (2 x NMe); 3.20, 3.32, 3.72, 3.87 (4 x OMe); 3.08 (ring methylene). (216) MASS 622 (M^-), 621, 485, 431, 430, 396, 395, 381, 364, 349, 198 (++), 192, 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (178) SOURCES: *Gyrocarpus americanus, Phaeanthus ebracteolatus, Pycnarrhena manillensis, Triclisia patens.*
$R_2=R_3=R_4=R_2'=R_3'=Me$, $R_5=H$, $R_1=H$ ▯, $R_1'=H$▶ (Epimer of berbamine)	1-R,1'-R	75. PYCNAMINE (234, 235) $C_{37}H_{40}O_6N_2$:608.288638 MP 186–187; $[\alpha]^{25}$ −283 ($CHCl_3$). (117) UV 229 sh (4.59), 282 (3.99), 292 (3.88). (171) ORD −406.5 (227), −609 (235), −83.1 (267), −190 (290). (215) NMR 2.32, 2.60 (2 x NMe); 3.18, 3.22, 3.71 (3 x OMe); 6.01–7.24 (10 x arom. H). (171) MASS 608 (M^-), 607, 485, 417, 416, 396, 395, 381, 364, 349, 335, 304 (++), 198 (++), 192, 175 (++), 174. (203) DEGRADATION: Metal-ammonia. (234) SOURCES: *Gyrocarpus americanus, Pycnarrhena manillensis, Triclisia patens.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	76. (−)-TETRANDRINE (232) $C_{38}H_{42}O_6N_2$:622.304288 MP 218; $[\alpha]^{21}$ +241.4 ($CHCl_3$). (174)

TABLE 4. *Continued.*

		UV 214 (4.78), 283 (3.91). (174) 230 (4.40), 282 (3.89). (106) ORD +1490 (235), +138 (272), +249 (289). (215) NMR 2.29, 2.58 (2 x NMe); 3.15, 3.31, 3.69, 3.87 (4 x OMe); 5.91– 7.35 (10 x arom. H). (174) MASS 622 (M^+, 56), 621 (41), 515 (1), 501 (1), 485 (2), 448 (1), 430 (6), 396 (19), 395 (65), 381 (33), 198 (++, 100), 175 (++, 39). (106) DEGRADATION: Metal-ammonia. (232) SOURCES: *Cocculus sarmentosus, Cyclea barbata, C. burmanni, C. peltata, Stephania hernandifolia, S. tetrandra, Triclisia subcordata.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=R_1'=H$		77. (±)-TETRANDRINE (125) $C_{38}H_{42}O_6N_2$:622.304288 MP 257–258; [α] 0. (125) SOURCES: *Cyclea barbata, C. peltata, Stephania hernandifolia.*
Tetrandrine-*N*-2'-oxide		78. TETRANDRINE MONO-*N*-2'-OXIDE (72) $C_{38}H_{42}O_7N_2$: 638.299203 MP 185–190; $[\alpha]^{23}$ +198 ($CHCl_3$). (72) NMR 2.31 (1 x NMe); 3.25, 3.35, 3.71, 3.92 (4 x OMe); 3.54 (1 x Me N→O). (72) MASS 638 (M^+, 15), 622 (67), 607 (22), 591 (12), 431 (7.5), 430 (6), 396 (16), 395 (55), 382 (8), 381 (30), 379 (11), 206 (6), 204 (7), 198.5 (22), 198 (100), 197.5 (3), 175.5 (10), 175 (25). (72) SOURCE: *Cyclea barbata.*
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=H$, $R_1=R_1'=H$ (Epimer of fangchinoline)	1-R,1'-S	79. THALRUGOSINE (thaligine, isofangchinoline) (147, 152) $C_{37}H_{40}O_6N_2$:608.288638 MP 153; $[\alpha]^{25}$ +87 (MeOH). (147) UV 282 (3.94). (147) ORD +79.6 (240), +4.9 (270), +10.6 (288), +0.6 (310). (147) NMR 2.34, 2.53 (2 x NMe); around 2.90 (6 x $-CH_2-$); 3.59, 3.62 (2 x $-CH-$); 3.76, 3.92, 3.94 (3 x OMe); 6.10 (C8'–H), 6.25–7.20 (9 x arom. H). (147) MASS 608 (M^-, 70), 471 (2), 417 (9), 382 (27), 381 (19), 367 (38), 191 (100), 174 (28), 168 (21). (147) DEGRADATION: Metal-ammonia. (152) SOURCES: *Cyclea barbata, Thalictrum lucidum, T. polyganum, T. rugosum, Tiliacora funifera.*

TABLE 4. *Continued.*

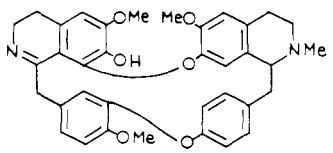
		79a. TILIAFUNIMINE (166a) $C_{36}H_{36}O_6N_2$:592.257338 MP 198–200; $[\alpha]^{22}$ +294.3 ($CHCl_3$). (166a) UV 212 (4.77), 238 sh (4.46), 285 (3.99), 319 sh (3.85). (166a) NMR 2.67 (1 x NMe); 3.46, 3.81, 3.88 (3 x OMe); 6.28–7.39 (10 x arom. H). (166a) MS 592 (M^+, 96), 591 (100), 577 (9), 367 (20), 296.5 (11), 296 (29), 192 (9), 191 (11), 190 (10), 184 (13), 174 (14). (166a) SOURCE: *Tiliacora funifera*.
	Type **IX**	
$R_4=R_5=R_6=R_2'=R_3'=Me, R_2=R_3=H, R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	80. *N*-DESMETHYLTHALIDEZINE (146) $C_{37}H_{44}O_7N_2$:624.283553 MP 173–174; $[\alpha]^{25}$ +280 (MeOH). (146) UV 282 (3.84). (146) CD +957 (216), −354 (250), +312 (290). (146) NMR 2.61 (1 x NMe); 3.28, 3.34, 3.75, 3.92 (4 x OMe); 5.97–7.42 (9 x arom. H). (146) MASS 624 (M^+, 19), 623 (13), 398 (11), 208 (9), 199 (21), 192 (100), 191 (3), 176 (4). (146) SOURCE: *Thalictrum podocarpum*.
$R_2=R_3=R_4=R_5=R_6=R_2'=R_3'=Me, R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	81. HERNANDEZINE (thalicsimine) (196) $C_{38}H_{44}O_7N_2$:652.314853 MP 192–193; $[\alpha]^{20}$ +250 ($CHCl_3$). (138) UV 209 (4.99), 283 (3.90). (138) ORD +1357 (229), +1490 (235), −18.8 (275), +235 (292). (215) CD −703 (245), −166 (273), +199 (290). (236) NMR 2.30, 2.63 (2 x NMe); 3.24, 3.34, 3.79, 3.83, 3.91 (5 x OMe); 6.02–7.50 (arom. H). (138) MASS 652 (M^-), 651, 461, 426, 425, 411, 394, 379, 365, 213 (++, 100), 192, 190 (++), 174. (196, 203) DEGRADATION: Metal-ammonia. (196) SOURCES: *Thalictrum fendleri*, *T. hernandezii*, *T. podocarpum*, *T. rochebrunianum*, *T. simplex*.
$R_2=R_4=R_5=R_6=R_2'=R_3'=Me, R_3=H, R_1=R_1'=H\blacktriangleright$ (Epimer of thalidezine)	1-S,1'-R	82. ISOTHALIDEZINE (146) $C_{35}H_{42}O_7N_2$:638.299203 MP 136–138; $[\alpha]$ −70 (MeOH). (146) UV 282 (3.99). (146) CD −638 (230), +370 (247), −217 (285). (146)

TABLE 4. *Continued.*

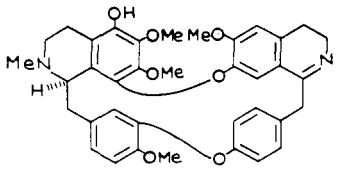
		NMR 2.23, 2.54 (2 x NMe); 3.18, 3.62, 3.75, 3.88 (4 x OMe); 4.85 (phenolic H); 5.99–7.33 (9 x arom. H). (146) MASS 638 (M^+, 47), 637 (18), 412 (23), 411 (80), 397 (38), 222 (11), 206 (86), 192 (100). (146) DEGRADATION: Metal-ammonia. (146) SOURCE: *Thalictrum podocarpum.*
$R_2=R_4=R_5=R_6=R_2'=R_3'=Me, R_3=H, R_1=H\blacktriangleright, R_1'=H$ || (5-*O*-Demethylhernandezine)	1-S,1'-S	83. THALIDEZINE (135) $C_{35}H_{42}O_7N_2$:638.299203 MP 158–159; $[\alpha]$ +235 ($CHCl_3$). (135) UV 283 (4.02). (132) CD +318 (216), −466 (248), +382 (288). (146) NMR 2.33, 2.64 (2 x NMe); 3.27, 3.37, 3.78, 3.92 (4 x OMe); 6.02, 6.12–7.5 (arom. H). (135) MASS 638 (M^+), 411, 192. (135) DEGRADATION: Metal-ammonia. (135, 146) SOURCES: *Thalictrum fendleri, T. minus, T. podocarpum, T. rugosum, T. simplex.*
$R_3=R_4=R_5=R_6=R_2'=R_3'=Me, R_2=H, R_1=H\blacktriangleright, R_1'=H$ || (2-*N*-Demethylhernandezine)	1-S,1'-S	84. THALISAMINE (155) $C_{35}H_{42}O_7N_2$:638.299203 MP 191–194; $[\alpha]^{24}$ −138 ($CHCl_3$). (155) UV 284 (4.60). (155) NMR 2.31 (1 x NMe); 3.44 (2 x OMe), 3.84 (2 x OMe), 3.94 (1 x OMe). (155) MASS 638 (M^+, 36), 219 (100), 206 (48), 191 (25). (155) SOURCE: *Thalictrum simplex.*
	1-S	85. THALSIMIDINE (thalcimidine) (237) $C_{37}H_{38}O_7N_2$:622.267903 MP 195; $[\alpha]^{14}$ +48 ($CHCl_3$). (156) UV 280 (4.12), 312 (3.76). (156) ORD Positive Cotton effect, recorded only down to 290 nm. (228) MASS 622 (M^+, 100), 621 (60), 607 (56), 591 (20), 485 (10), 311 (++, 28), 221 (8), 190 (10), 175 (6). (237) SOURCE: *Thalictrum simplex.*
1:1 Mixture of two conformers of 5-*O*-methylthalsimidine		86. THALSIMINE (thalcimine) (151) $C_{35}H_{40}O_7N_2$:636.283553 MP 149–150; $[\alpha]$ +22.6 ($CHCl_3$). (151) UV 282 (4.23), 312 (3.90). (238) ORD Positive Cotton effect, recorded only down to 290 nm. (228) NMR C_5D_5N; 2.29 (1 x NMe); 3.47, 3.54, 3.89 (3 x OMe), 3.82 (2 x OMe). (151)

TABLE 4. *Continued.*

		MASS 636 (M^+, 100), 635 (64), 621 (51), 605 (17), 499 (11), 318 (++, 24), 235 (12), 205 (13), 190 (11), 175 (5), 174 (7), 90 (15), 89 (6). (237, 239) DEGRADATION: Metal-ammonia. (157) SOURCES: *Thalictrum rochebrunianum, T. rugosum, T. simplex.*
	Type **X**	
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5–R_6=CH_2, R_1=R_1'=H$	1-R,1'-S	87. ISOTENUIPINE (85) $C_{38}H_{40}O_7N_2$:636.283553 MP 239–241; $[\alpha]_D^{13}$ +129 ($CHCl_3$). (85) UV 95% EtOH; 210, 282. (85) NMR 2.30, 2.58 (2 x NMe); 3.16, 3.60, 3.75 (3 x OMe); 5.9 (1 x $-OCH_2O-$). (85) MASS 636 (M^-), 485, 395, 198 (++). (85) SOURCE: *Daphnandra species.*
$R_2=R_3=R_2'=R_3'=Me, R_4=H, -R_5–R_6–CH_2, R_1=H$▶, $R_1'=H$	1-S,1'-S	88. (+)-NORTENUIPINE (86) $C_{37}H_{38}O_7N_2$:622.267903 MP 260; $[\alpha]^{20}$ +236.3 ($CHCl_3$). (86) ORD +915 (236), +131.8 (262), +146.3 (281). (215) MASS 622 (M^-), 621, 471, 431, 430, 382, 381, 367, 350, 335, 321, 192, 191 (++), 174, 168 (++). (203) SOURCES: *Daphnandra species* Dt-7, *D. tenuipes.*
$R_2=R_3=R_2'=R_3'=Me, R_4=H, R_5–R_6=CH_2, R_1=H$, $R_1'=H$▶ (Enantiomer of (+)-nortenuipine)	1-R,1'-R	89. (−)-NORTENUIPINE (86) [at first erroneously named *N*-demethyltenuipine (82)] $C_{37}H_{38}O_7N_2$:622.267903 MP 211; $[\alpha]^{12}$ −218 ($CHCl_3$). (82) NMR 2.32, 2.63 (2 x NMe); 3.33, 3.78 (2 x OMe). (86) SOURCE: *Daphnandra tenuipes.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5–R_6=CH_2, R_1=R_1'=H$ (±)-Tenuipine		90. REPANDININE (86) $C_{38}H_{40}O_7N_2$:636.283553 MP 243; $[\alpha]$ 0. (82) SOURCES: *Daphnandra dielsii, D. repandula, D. tenuipes.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5–R_6=CH_2, R_1=H$▶, $R_1'=H$ (Epimer of isotenuipine)	1-S,1'-S	91. (±)-TENUIPINE (86) $C_{38}H_{40}O_7N_2$:636.283553 MP 140–145, 219; $[\alpha]^{20}$ +223.5 ($CHCl_3$). (86) UV 280 (3.82). (86) ORD −823 (228), +1284 (238), +878 (244). (215) NMR 2.32, 2.63 (2 x NMe); 3.18, 3.33, 3.78 (3 x OMe). (85) MASS 636 (M^-), 635, 485, 445, 444, 396, 395, 381, 364, 349, 335, 318 (++), 198 (++), 192, 175 (++), 174. (203)

TABLE 4. *Continued.*

		DEGRADATION: Metal-ammonia. (86) SOURCES: *Daphnandra species* unnamed, *D. tenuipes*.
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5-R_6=CH_2, R_1=H$ [illegible], $R_1'=H$ ▶ (Enantiomer of (+)-tenuipine)	1-R,1'-R	92. (−)-TENUIPINE (85) $C_{38}H_{40}O_7N_2$:636.283553 MP 140–145; $[\alpha]^{20}$ −258 ($CHCl_3$). (82) ORD −703 (232), −1040 (239), −450 (250). (215) NMR Same as (+)-tenuipine. (85) SOURCES: *Daphnandra dielsii, D. tenuipes*.
	Type **XI**	
$R_2=R_3=R_5=R_2'=R_3'=Me, R_4=H, R_1=R_1'=H$ [illegible]	1-R,1'-S	93. BELARINE (37) $C_{37}H_{40}O_6N_2$:608.288638 MP 158–160; $[\alpha]$ −222 ($CHCl_3$). (37) NMR (37) MASS 608 (M^+), 607, 501, 471, 417, 416, 382, 381, 367, 192, 191 (++), 174, 168 (++). (240) DEGRADATION: Metal-ammonia. (37) SOURCE: *Berberis laurina*.
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me, R_1=R_1'=H$ [illegible] (7-*O*-Methylbelarine)	1-R,1'-S	94. *O*-METHYLISOTHALICBERINE (37) $C_{38}H_{42}O_6N_2$:622.304288 MP 208–209; $[\alpha]$ −195 ($CHCl_3$). (39) NMR 2.38, 2.60 (2 x NMe); 3.51, 3.79, 3.84, 3.91 (4 x OMe). (39) MASS (39) DEGRADATION: Metal-ammonia. (37, 39) SOURCE: *Berberis laurina*.
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me, R_1=H$ ▶, $R_1'=H$ [illegible]	1-S,1'-S	95. *O*-METHYLTHALICBERINE (thalmidine) (241, 242) $C_{38}H_{42}O_6N_2$:622.304288 MP 186–187; $[\alpha]^{19}$ +244.6. (151) UV 278 (3.65). (243) ORD +510 (245), −312 (280), +590 (306). (228) NMR 2.11, 2.83 (2 x NMe); 3.61 (1 x OMe), 3.75 (1 x OMe), 3.87 (2 x OMe); 5.94, 6.15, 6.51 (3 x arom. H), 6.59 (2 x arom. H), 6.83 (2 x arom. H), 7.22 (2 x arom. H). (243) MASS 622 (M^+, 52), 621 (26), 607 (6), 591 (2), 396 (100), 381 (18), 198 (24), 175 (5), 174 (10), 90 (2), 89 (2). (239) DEGRADATION: Metal-ammonia. (241) SOURCES: *Thalictrum lucidum, T. minus, T. revolutum, T. thunbergii*.

TABLE 4. *Continued.*

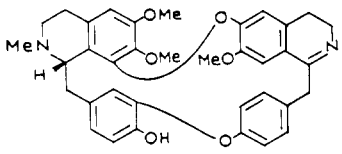
12-*O*-Methylthalmethine.....		96. *O*-METHYLTHALMETHINE (244) $C_{37}H_{38}O_6N_2$:606.272988 MP 245–246; $[\alpha]^{21}$ +237 ($CHCl_3$). (244) UV 280 (4.13), 314 (3.87). (244) NMR 1.94 (1 x NMe); 3.70, 3.84, 3.89, 3.91 (4 x OMe); 4.19 (1 x $-CH_2-$). (232) MASS 606 (M^+), 605 (83), 591 (56), 545, 469, 303 (++), 280 (++). (240) DEGRADATION: Metal-ammonia. (244) SOURCES: *Thalictrum minus, T. revolutum.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=H,$ $R_1=H\blacktriangleright, R_1'=H$.....	1–S,1'–S	97. THALICBERINE (241, 242) $C_{37}H_{40}O_6N_2$:608.288638 MP 161; $[\alpha]^{19}$ +231.2. (160) UV 282 (3.81). (141) CD +2490 (214), −122 (250), +395 (285). (141) NMR 2.10, 2.58 (2 x NMe); 3.66, 3.77, 3.88 (3 x OMe); 6.07–7.20 (10 x arom. H). (141) MASS 608 (M^+), 607, 501, 485, 417, 416, 396, 395, 381, 304 (++), 198 (+−), 192, 175 (+−), 174. (240) DEGRADATION: Metal-ammonia. (241) SOURCES: *Thalictrum lucidum, T. minus, T. thunbergii.*
	1–S	98. THALMETHINE (244) $C_{36}H_{36}O_6N_2$:592.257338 MP 275–277; $[\alpha]^{21}$ +200. (244) MASS 592 (M^+), 591 (93), 577 (6), 545, 469, 295 (++), 273 (++). (240) SOURCE: *Thalictrum minus.*
	Type **XII**	
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me, R_5=H,$ $R_1=H\blacktriangleright, R_1'=H$.....	1–S,1'–S	99. THALFOETIDINE (thalictrimine, thalictrinine). (245) $C_{38}H_{42}O_7N_2$:638.299203 MP 168–170; $[\alpha]^{21}$ −88.6 ($CHCl_3$). (136) UV 275 (3.87), 285 (3.87). (246) ORD −120 (230), +33 (246), +2.5 (260), +30 (278), −33 (295). (228) NMR 2.32, 2.70 (2 x NMe); 3.32, 3.51, 3.77, 3.89 (4 x OMe); 6.33 (2 x arom. H), 6.40 (1 x arom. H), 6.47 (2 x arom. H), 6.75 (2 x arom. H). (246) MASS 638 (M^+, 100), 637 (46), 623 (9), 607 (6), 515 (2), 417 (63), 402 (57), 213 (67), 206 (18), 190 (69), 175 (7), 174 (5), 90 (4), 89 (2). (239) DEGRADATION: Metal-ammonia. (245) SOURCE: *Thalictrum foetidum.*

TABLE 4. *Continued.*

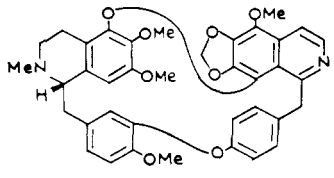
$R_2=R_3=R_4=R_5=R_2'=R_3'=R_4'=Me$, $R_1=H$▶, $R_1'=H$ (12-*O*-Methylthalfoetidine)	1-S,1'-S	100. THALIDASINE (194) $C_{39}H_{44}O_7N_2$:652.314853 MP 105–107; $[\alpha]^{27}$ −70 (MeOH). (194) UV 275 (3.66), 282 (3.66). (194) ORD > −120 (232), +40 (248), +10 (260), +35 (271), −35 (295). (228) NMR 2.25, 2.62 (2 x NMe); 3.27, 3.50, 3.75, 3.87, 3.91 (5 x OMe); 6.30–7.54 (9 x arom. H). (194) MASS 652 (M^-), 651, 637, 621, 515, 426, 425, 411, 397, 394, 331, 330, 213 (100), 204, 190. (194, 240) DEGRADATION: Metal-ammonia. (194) SOURCES: *Thalictrum dasycarpum, T. lucidum, T. revolutum, T. rugosum.*
$R_2=R_3=R_2'=R_3'=R_4'=Me$, $R_4=R_5=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	100a. THALIGOSIDINE (152a) $C_{37}H_{40}O_7N_2$:624.283553 MP 175–177; $[\alpha]^{20}$ −45 (MeOH). (152a) UV 275 (3.72), 283 (3.72). (152a) CD −318 (224), +54.9 (242), +67 (268), −190 (287). (152a) NMR 2.25, 2.66 (2 x NMe); 3.49, 3.75, 3.86 (3 x OMe); 6.2–7.7 (9 x arom. H); 5.6 (2 x OH). (152a) MASS 624 (M^+, 40), 412 (7), 411 (20), 203 (++, 23), 192 (100). (152a) DEGRADATION: Metal-ammonia. (152a) SOURCE: *Thalictrum rugosum.*
$R_2=R_3=R_5=R_2'=R_3'=R_4'=Me$, $R_4=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	101. THALRUGOSIDINE (152) $C_{38}H_{42}O_7N_2$:638.299203 MP 172–174; $[\alpha]^{30}$ −185 (MeOH). (152) UV 275 (3.99), 282 (3.99). (152) ORD −34.3 (226), +98 (241), +171.5 (248), +58.8 (267), −203.35 (286). (152) NMR 2.25, 2.60 (2 x NMe); 3.51, 3.75, 3.85, 3.87 (4 x OMe); 6.3–7.7 (9 x arom. H). (152) DEGRADATION: Metal-ammonia. (153) SOURCE: *Thalictrum rugosum.*
	Type **XIII**	
	1-S	102. THALFINE (thalphine) (195, 9) $C_{38}H_{36}O_8N_2$:648.247168 MP 141–142; $[\alpha]^{15}$ +69 (EtOH). (137) UV 260 (4.58), 348 (3.86). (137) CD +1340 (208), +670 (233), +820 (263), −280 (229), −13.9 (360), +6.9 (388). (144a) NMR 2.20 (1 x NMe); 3.40, 3.50, 3.61, 3.76 (4 x OMe); 6.04 (1 x OCH_2O), 5.93 (C_8–H). (195, 9)

TABLE 4. *Continued.*

		MASS 648 (M^-, 100), 647 (31), 633 (83), 617 (21), 442 (7), 421 (7), 324 (M^{++}, 49), 220 (12), 204 (21). (144a) DEGRADATION: Metal-ammonia. (195) SOURCE: *Thalictrum foetidum*.
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_4'-R_5'=CH_2$, $R_1=H\blacktriangleright$, $R_1'=H\blacktriangleleft$	1-S,1'-S	103. THALFININE (thalphinine) (195, 9) $C_{38}H_{42}O_5N_2$:666.294118 MP 117–118; $[\alpha]^{16}$ +115 (EtOH). (137) UV 282 (3.76). (137) CD +1950 (207), −571 (227), −109 (245), +362 (255), −128 (288). (144a) NMR 2.30, 2.54 (2 x NMe); 3.36, 3.43, 3.66, 3.80 (4 x OMe); 5.80 (1 x $-OCH_2O-$); 5.92 (C_5–H). (195) MASS 666 (M^-, 95), 440 (14), 220 (100), 204 (16). (144a) DEGRADATION: Metal-ammonia. (144a) SOURCE: *Thalictrum foetidum*.
	Type **XIV**	
$R_2=R_4=R_2'=R_5'=R_4'=Me$, $R_3=H$, $R_1=R_1'=H\blacktriangleright$ (12-*O*-Methyldryadodaphnine)	1-S,1'-R	104. DRYADINE (87) $C_{37}H_{46}O_6N_2$:608.288638 MP 249–251; $[\alpha]^{15}$ +486 ($CHCl_3$). (87) UV 285 (3.92). (87) ORD +1140 (241), +156 (280), +475 (296). (87) NMR 2.30, 2.65 (2 x NMe); 3.48 (1 x OMe), 3.93 (2 x OMe); 6.0, 6.28 (C_5 & C_5' H). (247) MASS 608 (M^+), 501, 487, 471, 382, 381, 367, 304 (++), 191 (++, 100), 183 (++, 22), 175 (++, 7.5), 168 (++, 7). (240) DEGRADATION: Metal-ammonia. (87) SOURCE: *Dryadodaphne novoguineensis*.
$R_2=R_2'=R_3'=R_4'=Me$, $R_3=R_4=H$, $R_1=R_1'=H\blacktriangleright$	1-S,1'-R	105. DRYADODAPHNINE (87) $C_{36}H_{38}O_6N_2$:594.272988 MP foam: $[\alpha]^{15}$ +390 (MeOH). (87) UV 285 (3.90). (87) NMR 2.25, 2.66 (2 x NMe); 3.44, 3.90 (2 x OMe); 6.02, 6.25 (C_5 and $C_{5'}$ H). (247) MASS 594 (M^-), 487, 473, 471, 382, 381, 367, 297 (++), 191 (++, 100), 183 (++, 22), 175 (++, 7.5), 168 (++, 7). (240) DEGRADATION: Metal-ammonia. (87) SOURCE: *Dryadodaphne novoguineensis*.

TABLE 4. *Continued.*

$R_2=R_3=R_4=R_2'=R_4'=Me, R_3'=H,$ $R_1=R_1'=H$	1-R,1'-S	106. LAUBERINE (39) $C_{37}H_{40}O_6N_2$:608.288638 MP unstable, 250–255 (hydrobromide); [α] +481 ($CHCl_3$). (39) NMR 2.30, 2.65 (2 x NMe); 3.92 (2 x OMe), 3.95 (1 x OMe); 6.06, 6.12 (C_8 & C_8' H). (247) MASS 608 (M^+), 501, 471, 382, 381, 367, 304 (++), 191 (++, 100), 183 (++, 7), 175 (++, 8), 168 (++, 20). (240) DEGRADATION: Metal-ammonia. (39) SOURCE: *Berberis laurina.*
$R_2=R_3=R_2'=R_4'=Me, R_4-R_3'=H,$ $R_1=H$▶, $R_1'=H$	1-S,1'-S	106a. THABADENSINE (157a) $C_{36}H_{38}O_6N_2$:594.272388 Data not available to the reviewer SOURCE: *Thalictrum sultanabadense.*
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=H,$ $R_1=H$▶, $R_1'=H$	1-S,1'-S	107. THALICTINE (161) $C_{37}H_{40}O_6N_2$:608.288638 MP 226–228 (nitrate); [α] −15.8 ($CHCl_3$). (161) UV 284. (161) NMR 2.19, 2.62 (2 x NMe); 3.62, 3.82, 3.86 (3 x OMe); 5.84, 6.01 ($C_{8'}$ and C_8–H). (161) MASS 608 (M^+), 396, 395, 381, 205, 198, 190, 175. (161) DEGRADATION: Metal-ammonia. (161) SOURCE: *Thalictrum thunbergii.*
$R_2=R_3=R_4=R_2'=R_4'=Me, R_3'=H,$ $R_1=H$▶, $R_1'=H$ (Epimer of lauberine)	1-S,1'-S	108. THALMINE (248) $C_{37}H_{40}O_6N_2$:608.288638 MP 253; [α] 64.5 (144) UV 286 (3.65). (227) ORD +25 (250), −30 (287), +10 (310). (228) NMR 2.22, 2.64 (2 x NMe); 3.93 (3 x OMe); 6.06 (C_8 and $C_{8'}$ H). (247) MASS 608 (M^+), 501, 471, 382, 381, 367, 304 (++), 191 (++, 100), 183 (++, 7), 175 (++, 8), 168 (++, 20). (240) DEGRADATION: Metal-ammonia. (248) SOURCE: *Thalictrum minus.*
	Type **XV**	
$R_2=R_4=R_3=R_3'=Me, R_3=R_2'=H,$ $R_1=H, R_1'=H$▶	1-R,1'-R	109. NORPANURENSINE (22) $C_{36}H_{38}O_6N_2$:594.272988 MP 175; [α] −250 ($CHCl_3$). (22) UV 223 (4.04), 240 (4.30), 288 (4.10). (22) NMR 2.42 (1 x NMe); 3.47, 3.83, 3.94 (3 x OMe); 5.08, 5.28, 6.08, 6.63 (4 x arom. H); 6.50–7.24 (6 x arom. H). (22)

TABLE 4. *Continued.*

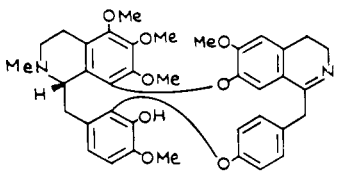
		Mass 594 (M^+, 26), 593 (11), 487 (<1), 473 (1), 457 (2), 367 (100), 206 (11), 205 (15), 192 (8), 191 (10), 190 (23), 184 (92), 176 (14), 168 (5), 161 (26), 160 (7). (22) Source: *Abuta panurensis.*
$R_2=R_4=R_5=R_2'=R_3'=Me, R_3=H,$ $R_1=H$[illegible], $R_1'=H$▶ (2'-*N*-Methylnorpanurensine)	1-R,1'-R	110. Panurensine (22) $C_{37}H_{40}O_6N_2$:608.288638 MP 156–158; $[\alpha]$ −245.6 ($CHCl_3$). (22) UV 225 (4.38), 238 (4.55), 284 (4.22). (22) NMR 2.40, 2.55 (2 x NMe); 3.46, 3.82, 3.92 (3 x OMe); 5.02, 5.24, 5.82, 6.61 (4 x H), 6.42–7.26 (protons). (22) Mass 608 (M^+, 73), 607 (43), 501 (61), 487 (1), 471 (2), 381 (100), 192 (78), 191 (78), 190 (16), 176 (10), 174 (15), 168 (17). (22) Degradation: Metal-ammonia. (22) Source: *Abuta panurensis.*
	Type **XVI**	
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=H,$ $R_1=H$[illegible], $R_1'=H$▶	1-R,1'-R	111. Nemuarine (111) $C_{37}H_{40}O_6N_2$:608.288638 MP 222–223; $[\alpha]^{20}$ −42.7 ($CHCl_3$). (111) UV 211 (4.87), 284 (3.98). (111) NMR 2.57 (2 x NMe); 3.42, 3.80, 3.85 (3 x OMe), 5.77, 6.07, 6.17 (3 x arom. H), 6.8–7.9 (7 x arom. H). (111) Mass 608 (M^+, 100), 607 (80), 593 (5), 577 (16), 396 (36), 395 (87), 381 (83), 204 (33), 198 (79), 190 (54), 177 (38), 175 (41), 173 (39), 159 (17). (111) Degradation: Metal-ammonia. (111) Source: *Nemuaron vieillardii.*
	Type **XVII**	
	1-S	112. Thalibrunimine (151) $C_{35}H_{40}O_5N_2$:652.278468 MP 198–200; $[\alpha]$ +28 ($CHCl_3$). (151) UV 241 (4.48), 283 (4.02), 300 sh (3.91). (151) NMR C_5D_5N; 2.38 (1 x NMe); 3.21, 3.55, 3.79, 3.83, 3.88 (5 x OMe); 4.40 (benzylic methylene); 6.42–7.58 (8 x arom. H). (151) Mass 652 (M^-, 100), 651 (85). (151) Source: *Thalictrum rochebrunianum.*
$R_2=R_3=R_4=R_5=R_7=R_2'=R_3'=Me,$ $R_6=H, R_1=H$▶, $R_1'=H$	1-S,1'-S	113. Thalibrunine (236) $C_{39}H_{44}O_5N_2$:668.309768 MP 172–173; $[\alpha]^{28}$ +160 (MeOH). (149)

TABLE 4. *Continued.*

		UV 205 (5.04), 242 sh, 281–2 (3.93). (149) CD −1690 (245), −472 (274), +7080 (296). (236) NMR 2.45, 2.58 (2 x NMe); 3.16, 3.36, 3.77, 3.82, 3.89 (5 x OMe); 5.90, 6.39 (2 x arom. H). (236) MASS 668 (M^-, 55), 425 (53), 213 (++, 100), 234 (5), 192 (70), and weak peaks at 561, 515, 476. (236) DEGRADATION: Metal-ammonia. (236) SOURCE: *Thalictrum rochebrunianum*.
	Type **XVIII**	
$R_2=R_3=R_2'=R_3'=Me, R_4=H, R_1=R_1'=H$, stereochemistry undetermined..		114. DINKLACORINE (162, 249) $C_{36}H_{36}O_6N_2$:576.262423 MP 238–240; $[\alpha]^{21}$ +42.55 ($CHCl_3$). (162) UV 222 (4.70), 236 sh (4.68), 294 (3.97). (162) CD +156 (230), +672 (250), +396 (290). (162) NMR 2.29, 2.61 (2 x NMe); 3.78, 3.93 (2 x OMe); 6.31–7.88 (9 x arom. H). (162) MASS 576 (M^-, 75), 350 (6), 349 (100), 335 (35), 175 (50). (162) SOURCE: *Tiliacora dinklagei*.
$R_3=R_4=Me, R_4'=H, R_2=Me$ and $R_2'=H$ or vice versa, $R_1=R_1'=H$, stereochemistry undetermined.....		115. NORTILLIACORINE-A (isotiliarine). (166) $C_{35}H_{34}O_6N_2$:562.246773 MP 258–260; $[\alpha]$ +194.5 ($CHCl_3$). (166) UV 215 (4.80), 235 sh (4.69), 293 (4.00). (166) NMR 2.28 (1 x NMe); 3.81, 3.93 (2 x OMe); 0.7–3.3 (6 x $-CH_2-$); 6.26–7.95 (9 x arom. H). (166) MASS 562 (M^-, 69), 366 (35), 335 (100), 321 (24), 168 (42). (166) SOURCE: *Tiliacora funifera*.
$R_2=R_3=R_4=Me, R_2'=R_3'=H, R_1=R_1'=H$, stereochemistry undetermined.. (2'-*N*-Demethyltiliacorinine)		116. NORTILIACORININE-A (pseudotiliarine) (168, 169) $C_{34}H_{34}O_6N_2$:562.246773 MP 262–268; $[\alpha]$ +268.8 (pyridine). (169) MP 252–254; $[\alpha]^{28}$ +325 ($CHCl_3$). (166) UV 212 (4.75), 236 sh (4.67), 292 (3.99). (166) NMR 2.30 (1 x NMe); 2.8–3.07 (6 x $-CH_2-$); 3.80, 3.92 (2 x OMe); 6.26–8.08 (9 x arom. H). (166) MASS 562 (M^+, 100), 336 (36), 335 (89), 321 (22), 186 (40). (166) SOURCES: *Tiliacora dinklagei*, *T. funifera*, *T. racemosa*.

TABLE 4. *Continued.*

$R_2=R_3'=H, R_3=R_4=R_2'=Me, R_1=R_1'=H$, stereochemistry undetermined..		117. NORTILIACORININE-B (169) $C_{55}H_{54}O_8N_2$:562.246773 MP 218–220; $[\alpha]$ +356.2 (pyridine). (169) NMR 2.23 (1 x NMe); 3.75 (2 x OMe); 6.38–8.20 (9 x arom. H). (169) SOURCE: *Tiliacora racemosa*.
$R_2=R_3=R_4=R_2'=Me, R_3'=H, R_1=R_1'=H$	1-R,1'-S	118. TILIACORINE (169, 249, 249a) $C_{36}H_{38}O_5N_2$:576.262423 MP 262–264; $[\alpha]$ +71.2 (pyridine). (169) UV 295 (3.91). (169) CD −216 (230), +754 (250), +461 (291). (162) NMR 2.30, 2.66 (2 x NMe); 2.2–3.5 (6 x $-CH_2-$); 3.83, 3.93 (2 x OMe); 6.3–7.95 (9 x arom. H). (166, 169) MASS 576 (M^-), 350, 349, 335, 288 (++), 175 (++). (203) DEGRADATION: Permanganate in acetone. (249) SOURCES: *Tiliacora funifera*, *T. racemosa*.
$R_2=R_3=R_4=R_2'=Me, R_3'=H, R_1=H$▶, $R_1'=H$ (Epimer of tiliacorine)	1-S,1'-S	119. TILIACORININE (169, 249a) $C_{36}H_{38}O_5N_2$:576.262423 MP 195; $[\alpha]$ +310 (pyridine). (169) UV 290 (3.95). (169) NMR 2.28, 2.62 (2 x NMe); 3.82, 3.95 (2 x OMe). (169) DEGRADATION: Hofmann. (169) SOURCES: *Tiliacora dinklagei*, *T. racemosa*.
	Type **XIX**	
$R_2=R_3=R_4=R_5=Me, R_2'=R_3'=H, R_1=R_1'=H$, stereochemistry undetermined..		120. TILIAMOSINE (168) $C_{36}H_{36}O_6N_2$:592.257338 MP 276–277 (acetate); $[\alpha]^{27}$ +530 ($CHCl_3$). (acetate). (168) SOURCE: *Tiliacora racemosa*.
	Type **XX**	
$R_2=R_3=R_4=R_2'=R_3'=R_4'=Me, R_1=R_1'=H$ (7,7'-*O*,*O*-Dimethylisochondodendrine)	1-R,1'-R	121. CYCLEANINE (methylisochondodendrine) (178) $C_{38}H_{42}O_6N_2$:662.304288 MP 280; $[\alpha]^{22}$ −15.94 ($CHCl_3$). (59) UV 232 sh (4.87), 276 (3.89), 285 sh (3.83). (59) ORD −1080 (237), +121.5 (254), −95 (264), +190 (283). (215) NMR 2.53 (2 x NMe); 3.38 (2 x OMe); 3.78 (2 x OMe); 6.13–7.05 (10 x arom. H). (59) MASS 622 (M^-, 29), 621 (8), 313 (26), 312 (100), 311 (28), 204 (29), 190 (17), 174 (17), 159 (14), 146 (7), 145 (8). (59)

TABLE 4. *Continued.*

		DEGRADATION: Metal-ammonia. (178) SOURCES: *Chondodendron tomentosum, Cissampelos insularis, C. pareira, Cyclea insularis, Epinetrum cordifolium, E. mangenotti, E. villosum, Heracleum wallichi, Paracyclea ochiaiana, Stephania capitata, S. cepharantha, S. rotunda.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_4'=H, R_1=R_1'=H$	1-R,1'-R	122. ISOCHONDODENDRINE (isobebeerine) (250) $C_{36}H_{38}O_6N_2$:594.272988 MP 305; $[\alpha]^{22}$ +120 (0.1 N HCl). (52) MP 330; $[\alpha]^{25}$ +59 (pyridine). (11) UV 211 (4.72), 231 sh (4.58), 278 (3.73), 285 (3.72). (59) ORD −990 (240), −60 (252), −280 (266), +400 (288). (89) NMR 2.27, 2.53 (2 x NMe); 3.87 (2 x OMe), 3.82 (ring $-CH_2-$). (216) MASS 594 (M^+, 60), 593 (14), 487 (4), 312 (4), 299 (14), 298 (100), 297 (20), 191 (9), 190 (7), 162 (6). (59) DEGRADATION: Metal-ammonia. (250) SOURCES: *Abuta candicans, Chondodendron limaciifolium, C. microphylum, C. platiphylum, C. tomentosum, C. toxicoferum, Cissampelos mucronata, C. pareira, Cyclea barbata, C. insularis, C. madagascariensis, C. peltata, Epinetrum cordifolium, E. mangenotti, E. villosum, Guatteria megalophylla, Heracleum wallichi, Isolona pilosa, Paracyclea ochiaiana, Pleogyne cunninghami, Stephania hernandifolia.*
$R_2=R_2'=Me; R_3=R_3'=Me$ and $R_4=R_4'=H$ or vice versa, $R_1=R_1'=H$, stereochemistry undetermined		123. NEOPROTOCURIDINE (251) $C_{36}H_{38}O_6N_2$:594.272988 MP 232; $[\alpha]$ 0. (251) Source: *Curare.*
$R_1=R_3=R_4=R_2'=R_3'=Me, R_4'=H, R_1=R_1'=H$ ▶ [Enantiomer of (−)-norcycleanine]	1-S,1'-S	124. (+)-NORCYCLEANINE (50) $C_{37}H_4[O_5N_2$:608.288638 MP 249–251; $[\alpha]^{11}$ +26.54 ($CHCl_3$). (77) SOURCES: *Chondodendron limaciifolium, Cyclea insularis, Epinetrum villosum.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_4'=H, R_1=R_1'=H$ (7-*O*-Methylisochondodendrine)	1-R,1'-R	125. (−)-NORCYCLEANINE (252) $C_{37}H_{36}O_6N_2$:608.288638 MP 245–246; $[\alpha]^{24}$ −22.50 ($CHCl_3$). (88) UV 229 (4.76), 276 (3.84). (88) NMR 2.35, 2.49 (2 x NMe); 3.41 (1 x OMe), 3.67 (2 x OMe). (216)

TABLE 4. *Continued.*

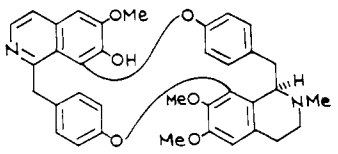
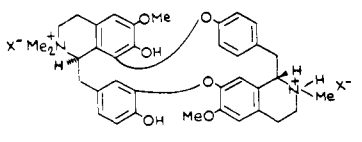
		DEGRADATION: Metal-ammonia. (252) SOURCES: *Chondodendron tomentosum, Cyclea insularis, Epinetrum cordifolium, E. mangenotti.*
$R_2=R_4=R_2'=R_3'=Me, R_3=R_4'=H$, $R_1=R_1'=H$, stereochemistry undetermined		126. PROTOCURIDINE (50) $C_{36}H_{38}O_6N_2$:594.272988 MP 295 (pyridine adduct); $[\alpha]$ +7.6 (H_2O) (hydrochloride). (251) SOURCE: *Curare.*
$R_2=R_3=R_2'=R_3'=R_4'=Me, R_4=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-R	127. SCIADENINE (119) $C_{37}H_{40}O_6N_2$:608.288638 MP 254–256; $[\alpha]^{30}$ −43 (pyridine), $[\alpha]^{25}$ +15 ($CHCl_3$). (119) UV 277 (3.48), 283 (3.47). (119) NMR 2.23, 2.47 (2 x NMe); 3.40, 3.80, 3.82 (3 x OMe); 5.70–6.85 (10 x arom. H). (119) MASS 608 (M^+), 607, 312 (100), 298, 204, 191, 190. (119) DEGRADATION: Metal-ammonia. (119) SOURCE: *Sciadotenia toxifera.*
	1'-R	128. SCIADOLINE (120) $C_{36}H_{34}O_6N_2$:590.241688 MP 225–228; $[\alpha]^{22}$ +46 ($CHCl_3$). (120) UV 275 (3.94), 283 sh (3.88), 326 sh (3.77), 335 (3.78). (120) NMR 2.35 (1 x NMe); 3.55, 3.83, 4.02 (3 x OMe), 5.50–6.85 (9 x arom. H), 7.05, 7.48, 8.40 (3 x arom. H). (120) MASS 590 (M^-), 589 (100), 576, 575, 483, 296, 295.5, 295, 204, 190. (120) DEGRADATION: Metal-ammonia. (120) SOURCE: *Sciadotenia toxifera.*
$R_2=R_2'=Me, R_3=R_4=R_3'=R_4'=H$, $R_1=R_1'=H$▶	1-S,1'-S	128a. TETRA-*O*-DEMETHYL-CYCLEANINE (252a) $C_{34}H_{34}O_6N_2$:566.241688 Data not available to the reviewer
	Type **XXI**	
	1-R,1'-S	129. CHONDOCURARINE (193) $C_{38}H_{44}O_6N_2^{++}$ $2X^-$:624.319938 MP 277–280 (iodide); $[\alpha]^{25}$ +150 (H_2O) (iodide). (51) UV H_2O: 280. (51) SOURCE: *Chondodendron tomentosum.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H$, $R_1'=H$▶, $R_1=H$ (Epimer of curine)	1-R,1'-S	130. CHONDROCURINE [(+)-tubocurine] (193) $C_{36}H_{38}O_6N_2$:594.272988 MP 232–234; $[\alpha]^{24}$ +200 (0.1 *N* HCl). (52)

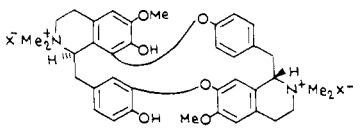
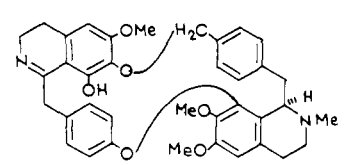
TABLE 4. *Continued.*

		ORD +494 (240), +76 (283), +165 (292). (215) NMR 2.25, 2.45 (2 x NMe); 2.90 (ring $-CH_2-$); 3.82, 3.88 (2 x OMe). (216) MASS 594 (M^+), 593, 579, 298 (100), 297, 296, 266, 251.5 (++), 191, 190, 162. (253) DEGRADATION: Metal-ammonia. (254) SOURCES: *Chondodendron tomentosum, Cyclea madagascariensis.*
$R_2=R_3=R_4=R_2'=R_3'=Me, R_5=H,$ $R_1=R_1'=H$ ▶ [7-*O*-Methyl-(+)-curine]	1-S,1'-S	131. CHONDROFOLINE (255) $C_{37}H_{40}O_6N_2$:608.288638 MP 135; $[\alpha]^{20}$ −280.6 (0.1 *N* HCl). (20) NMR 3.74 (1 x OMe), 3.85 (2 x OMe). (255) MASS 608 (M^+), 607, 593, 487, 312, 298, 297, 258.5 (++), 204, 190, 174, 159, 146, 145. (253) SOURCES: *Chondodendron platiphyllum, Uvaria ovata.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H,$ $R_1=R_1'=H$ ▶	1-S,1'-S	132. (+)-CURINE (berbeerine, chondodendrine) (256) $C_{36}H_{38}O_6N_2$:594.272988 MP 215; $[\alpha]^{20}$ +345.7 (0.1 *N* HCl). (20) MASS 594 (M^+), 593, 298 (100), 297, 283. (257) SOURCES: *Abuta candicans, Buxus sempervirens, Chondodendron microphylum, Nectandra rodiei.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H,$ $R_1=R_1'=H$ (Enantiomer of (+)-curine)	1-R,1'-R	133. (−)-CURINE [(−)-bebeerine] (254) $C_{36}H_{38}O_6N_2$:594.272988 MP 165–167; $[\alpha]^{2}$[−280 (0.1 *N* HCl). (52) MP 221; $[\alpha]^{25}$ −337 (pyridine). (11) UV 206 (4.95), 225 sh (4.61), 282 (3.98). (215) ORD −71 (231), −965 (239), −79 (280), −319 (292). (215) NMR 2.30, 2.47 (2 x NMe); 3.93 (2 x OMe); 2.88 (ring $-CH_2-$). (216) MASS 594 (M^+), 593, 579, 298 (100), 297, 296, 266, 251.5 (++), 191, 190, 162. (253) DEGRADATION: Metal-ammonia. (178, 254) SOURCES: *Aristolochia indica, Chondodendron platiphylum, C. tomentosum, C. toxicoferum, Cissampelos pareira, Cyclea madagascariensis, Isolona pilosa, Paracyclea ochiaiana, Pleogyne cunninghamii.*
$R_2=R_3=R_2'=Me, R_4=R_5=R_3'=H,$ $R_1=R_1'=H$ [6'-*O*-Demethyl(−)-curine]	1-R,1'-R	134. CYCLEACURINE (79) $C_{35}H_{36}O_6N_2$:580.257338 MP 205–208; $[\alpha]^{25}$ −202 (MeOH). (79)

TABLE 4. *Continued.*

		UV 95% EtOH; 284 (3.83). (79) NMR DMSO; 2.18, 2.48 (2 x NMe); 3.75 (1 x OMe). (79) MASS 580 (M^-, 52), 298 (100), 297 (54), 283 (29). (79) DEGRADATION: Metal-ammonia. (79) SOURCE: *Cyclea peltata.*
$R_2=R_3=R_4=R_5=R_2'=R_3'=Me$, $R_1=R_1'=H$	1-R,1'-R	135. *O,O*-DIMETHYLCURINE (89) $C_{37}H_{40}O_6N_2$:608.288638 MP 133–136. (89) MASS 622 (M^-). (89) SOURCE: *Guatteria megalophylla.*
$R_2=R_3=R_5=R_2'=R_3'=Me$, $R_4=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-R	136. HAYATIDINE (258) $C_{37}H_{40}O_6N_2$:608.288638 MP 179–180; [α] −109 (pyridine). (258) UV 80% EtOH; 280 (3.07). (258) NMR Discussion without data. (258) MASS 608 (M^-), 593, 501, 487, 312, 298, 296, 258.5 (+−), 191, 190, 174, 162, 148, 145. (258) DEGRADATION: Metal-ammonia. (258) SOURCE: *Cissampelos pareira.*
$R_2=R_3=R_2'=R_3'=Me$, $R_4=R_5=H$, $R_1=R_1'=H$		137. HAYATINE (259) $C_{36}H_{38}O_6N_2$: 594.272988 MP 298–303; [α] 0. (259) UV 277 (3.73), 283 (3.75). (11) DEGRADATION: Metal-ammonia. (259) SOURCE: *Cissampelos pareira.*
$R_2=R_3=R_5=R_2'=R_3'=Me$, $R_4=H$, $R_1=R_1'=H$		138. HAYATININE (260) $C_{37}H_{40}O_6N_2$:608.288638 MP 231–232; [α] −5. (261) UV 0.1N HCl; 280 (4.16). (261) DEGRADATION: Metal-ammonia. (260) SOURCE: *Cissampelos pareira.*
$R_2=R_3=R_5=R_2'=R_3'=Me$, $R_4=H$, $R_1=R_1'=H$▶ [12-*O*-Methyl-(+)-curine]	1-S,1'-S	139. 4"-*O*-METHYLCURINE (60) $C_{37}H_{40}O_6N_2$:608.288638 MP 164; [α] +273 ($CHCl_3$). (60) NMR 3.72 (1 x OMe), 3.90 (2 x OMe). (60) MASS 608 (M^-), 607, 593, 487, 471, 312, 311, 298, 296, 258.5 (++), 191, 190, 162. (253) DEGRADATION: Metal-ammonia. (60) SOURCE: *Cissampelos pareira.*
$R_2=R_3=R_5=R_2'=R_3'=Me$, $R_4=H$, $R_1=R_1'=H$ [12-*O*-Methyl-(−)-curine]	1-R,1'-R	140. 12'-*O*-METHYLCURINE (89) $C_{37}H_{40}O_6N_2$:608.288638 MP 162–164; $[\alpha]^{20}$ −303 ($CHCl_3$). (89) UV 279 (3.95), 284 (3.95). (89) ORD −1200 (240), +30 (278), −330 (292). (89)

TABLE 4. *Continued.*

		MASS 608 (M^+, 82), 312 (100), 298 (76), 296 (76). (89) SOURCE: *Guatteria megalophylla.*
1:1 molecular complex of (−)-curine and (−)-tubocurine		141. TOXICOFERINE (54)[5] MP 286; $[\alpha]$ −263 (1*N*HCl in EtOH). (54) DEGRADATION: Metal-ammonia. (54) SOURCE: *Chondodendron toxicoferum.*
	1-R,1'-S	142. (+)-TUBOCURARINE (193) $C_{37}H_{41}O_6N_2^{++}$ $2S^-$:609.304210 MP 275 (chloride); $[\alpha]^{20}$ +215 (H_2O) (chloride). (51) UV H_2O; 280. (51) DEGRADATION: Metal-ammonia. (193) SOURCES: *Anomospermum grandifolium, Chondodendron tomentosum.*
Enantiomer of (+)-tubocurarine		143. (−)-TUBOCURARINE (53) $C_{37}H_{41}O_6N_2^{++}$ $2X^-$:609.304210 MP 275 (chloride): $[\alpha]^{20}$ −258 (H_2O) (chloride). (53) SOURCE: *Chondodendron tomentosum.*
$R_2=R_3=R_2'=R_3'=Me, R_4=R_5=H$, $R_1=H$, $R_1'=H$ (Enantiomer of chondrocurine)	1-R,1'-S	144. (−)-TUBOCURINE (54) $C_{36}H_{38}O_6N_2$:594.272988 Pure compound could not be isolated, physical properties could not be determined. SOURCE: *Chondodendron toxicoferum.*
	Type **XXII**	
	1'-R	145. CISSAMPAREINE (191) $C_{37}H_{38}O_6N_2$:606.272988 MP 239–240; $[\alpha]^{26}$ −111 ($CHCl_3$). (58) UV 282 (4.0), 320 sh (3.60). (58) NMR 1.99 (1 x NMe); 3.75, 3.85, 3.92 (3 x OMe); 5.15 (1 x Ar-CH_2-OR). (191) MASS 606 (M^+), 502, 500, 312, 310, 206, 204. (191) DEGRADATION: Metal-ammonia. (191) SOURCE: *Cissampelos pareira.*
1,2-Dihydrowarifteine		146. DIHYDROWARIFTEINE (57) $C_{36}H_{38}O_6N_2$:594.272988 MASS 594 (M^+), 490, 403, 297, 191. (57) SOURCE: *Cissampelos ovalifolia.*
O,O-Dimethyl-1,2-dihydrowarifteine		147. DIMETHYLDIHYDROWARIFTEINE (57)

[5]Toxicoferine is retained in the table since Cava *et al.* (54) though, that in "view of its ease of isolation and its apparent behaviour as a single compound, it will undoubtedly be encountered in future phytochemical investigations".

TABLE 4. *Continued.*

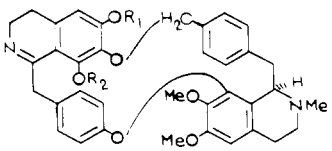
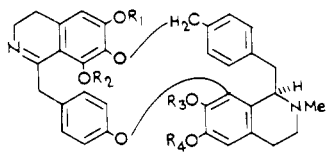
		$C_{35}H_{42}O_6N_2$:622.304288 MASS 622 (M^+), 518, 503, 417, 311, 204. (57) SOURCE: *Cissampelos ovalifolia.*
O-Methylcissampareine		148. DIMETHYLWARIFTEINE (57) $C_{35}H_{40}O_6N_2$:620.288638 MASS 620 (M^+), 517, 516, 501, 473, 457, 429, 311. (57) SOURCE: *Cissampelos ovalifolia.*
		149. METHYLDIHYDROWARIFTEINE (57) $C_{37}H_{40}O_6N_2$:608.28863 8 MASS 608 (M^+), 504, 417, 311, 190. (57) SOURCE: *Cissampelos ovalifolia.*
 R_1 = H, R_2 = Me or vice versa	1'-R	150. METHYLWARIFTEINE (57) $C_{37}H_{38}O_6N_2$:606.272988 MASS 606 (M^+), 502, 486, 459, 430, 312, 311. (57) SOURCE: *Cissampelos ovalifolia.*
 R_1 = H, R_2 = Me or vice versa R_3 = H, R_4 = Me or vice versa	1'-R	151. WARIFTEINE (57) $C_{35}H_{36}O_6N_2$:592.257338 MASS 592 (M^+), 488, 473, 445, 417, 416, 297. (57) SOURCE: *Cissampelos ovalifolia.*
	Type **XXIII**	
$R_2'=R_3'=Me, R_2=R_3=H$, $R_1=H$▶, $R_1'=H$	1-S,1'-S	152. COCSOLINE (262) $C_{34}H_{32}O_5N_2$:548.231123 MP amorphous powder; [α] +204 ($CHCl_3$). (66) UV 225, 277 sh, 291. (66) NMR 2.58 (1 x NMe); 3.87 (1 x OMe); 2.65–3.40 (4 benzylic and 8 ring methylene protons); 3.61–4.0 (10 x arom. H); 4.33 (two deuterium exchangeable protons). (262) MASS 548 (M^+), 336, 335, 321, 168. (66) SOURCE: *Cocculus pendulus.*
$R_2=R_2'=R_3'=Me, R_3=H$, $R_1=H$▶, $R_1'=H$ (2-*N*-Methylcocsoline)	1-S,1'-S	153. COCSULINE (eferine, trigilletine) (66) $C_{33}H_{34}O_5N_2$:562.246773 MP 272–274; [α] +280 ($CHCl_3$). (66) UV 234 (4.72), 275 sh (3.73), 289 (3.77), 307 sh (3.58). (175)

TABLE 4. *Continued.*

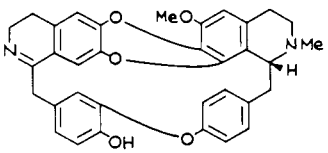
		NMR 2.38, 2.56 (2 x NMe); 2.61–3.60 and 4.11 (8 ring methylene, 4 benzylic and 2 ring methine protons), 3.90 (1 x OMe); 6.18, 6.36 (2 x arom. H), 6.58–7.67 (8 x arom. H). (66) MASS 562 (M^-, 39), 350 (32), 349 (100), 348, 335 (35), 175 (70). (66) DEGRADATION: Metal-ammonia. (66) SOURCES: *Cocculus pendulus, Triclisia gilletii, T. patens.*
	1'-R	154. 1,2-DEHYDROMICRANTHINE (83) $C_{34}H_{30}O_5N_2$:546.215473 MP 188–194; $[\alpha]^{20}$ −150 ($CHCl_3$). (83) UV 335 (3.4). (83) NMR 2.55 (1 x NMe); 3.85 (1 x OMe). (83) SOURCE: *Daphnandra species* unnamed.
$R_2=R_3'=Me, R_3=R_2'=H$, $R_1=H\blacktriangleright, R_1'=H$[‖]	1-S,1'-S	155. 12'-*O*-DEMETHYLTRIOLOBINE (24) $C_{34}H_{32}O_5N_2$:548.231123 MP 256–258; $[\alpha]^{20}$ +332 (pyridine). (24) UV 233 (4.73), 275 (3.80), 289 (3.84), 306 sh (3.64). (24) NMR Pyridine; 2.48 (1 x NMe); 3.80 (1 x OMe). (24) MASS 548 (M^+, 60), 547 (42), 336 (26), 335 (100), 321 (16), 319 (18), 168 (72), 167 (16). (24) SOURCE: *Anisocyclea gradidieri.*
$R_2=R_3=R_2'=R_3'=Me$, $R_1=H$[‖], $R_1'=H\blacktriangleright$ (Enantiomer of isotrilobine)	1-R,1'R	156. *N,O*-DIMETHYLMICRANTHINE (13) $C_{36}H_{37}O_5N_2$:576.262423 MP 210–214; $[\alpha]^{19}$ −230 ($CHCl_3$). (13) UV 286 (3.85). (263) NMR 2.40, 2.59 (2 x NMe); 3.84, 3.96 (2 x OMe); 6.13, 6.30 (2 x highfield arom. H). (13) MASS 576 (M^+). (13) DEGRADATION: Photolysis. (13) SOURCES: *Daphnandra micrantha, D. species* Dt-7, *D. species* unnamed.
$R_2=R_3=R_2'=R_3'=Me$, $R_1=H\blacktriangleright, R_1'=H$ (2-*N*-Methyl-12-*O*-methylcocsoline)	1-S,1'-S	157. ISOTRILOBINE (homotrilobine) (190) $C_{36}H_{36}O_5N_2$:576.262423 MP 213–215; $[\alpha]^{19.5}$ +293.1 ($CHCl_3$). (264) NMR 2.40, 2.60 (2 x NMe); 3.85, 3.97 (2 x OMe); 6.13, 6.30 (2 x high field arom. H). (13) MASS 576 (M^-), 350, 349, 335, 175 (++, 100). (203) DEGRADATION: Metal-ammonia. (190)

TABLE 4. *Continued.*

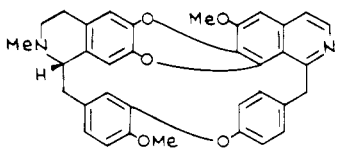
		SOURCES: *Cocculus hirsutus, C. laurifolius, C. sarmentosus, C. trilobus, Pachygone pubescens, Stephania hernandifolia.*
$R_3=R_2'=R_3'=Me, R_2=H,$ $R_1=H, R_1'=H\blacktriangleright$ (12-*O*-Methylmicranthine)	1-R,1'-R	158. *O*-METHYLMICRANTHINE (13) $C_{35}H_{34}O_5N_2$:562.246773 MP 163–165; $[\alpha]_D^{20}$ −208 ($CHCl_3$). (13) UV 286 (3.78). (263) NMR 2.58 (1 x NMe). (13) MASS 562 (M^-). (13) SOURCES: *Daphnandra micrantha, D. species* Dt-7, *D. species* unnamed.
$R_2=R_3=H, R_2'=R_3'=Me,$ $R_1=R_1', R_1'=H\blacktriangleright$ (Enantiomer of cosdoline)	1-R,1'-R	159. MICRANTHINE (13) $C_{34}H_{32}O_5N_2$:548.231123 MP 190–194; $[\alpha]_D^{16}$ −221 ($CHCl_3$). (13) UV 286 (3.76). (263) MASS 548 (M^+), 335, 168 (++). (13) SOURCES: *Daphnandra micrantha, D. species* unnamed.
$R_3=R_2'=R_3'=Me, R_2=H,$ $R_1=R_1'=H$ (Epimer of *O*-methylmicranthine)	1-R,1'-S	160. TELOBINE (13) $C_{35}H_{34}O_5N_2$:562.246773 MP 185–195; $[\alpha]_D^{19}$ +188 ($CHCl_3$). (13) MASS 562.2452 (M^+). (13) DEGRADATION: *Photolysis.* (13) SOURCE: *Daphnandra species* Dt-7.
$R_2=R_2'=Me, R_3=R_3'=H,$ $R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	161. TRICORDATINE (175) $C_{34}H_{32}O_5N_2$:548.231123 MP 280: $[\alpha]_D^{22}$ +247.9 (pyridine). (175) UV 227 (4.60), 275 sh (3.69), 284 (3.71), 304 (3.44). (175) NMR Insolubility in common organic solvents precluded the recording of nmr spectra. (175) MASS 548 (M^-, 27), 336 (31), 335 (100), 321 (32), 168 (49). (175) SOURCE: *Triclisia subcordata.*
	1-S	162. TRIGILLETIMINE (172) $C_{35}H_{30}O_5N_2$:558.215473 MP 284; $[\alpha]_D^{25}$ −285.7 (CH_2Cl_2). (172) UV 210 (4.72), 232 sh (4.67), 273 sh (4.21), 311 sh (3.46), 351 (3.05). (172) NMR 2.40 (1 x NMe); 3.92, 3.99 (2 x OMe); 5.86–7.29 (10 x arom. H), 7.39, 8.34 (2 x arom. H). (172) MASS 558 (M^+, 89), 557 (100), 543 (32), 279 (36), 211 (8), 210.5 (10), 189 (6). (172) SOURCES: *Triclisia gilletii, T. patens.*
$R_2=R_3=R_3'=Me, R_2'=H,$ $R_1=H\blacktriangleright, R_1'=H$	1-S,1'-S	163. TRILOBINE (265) $C_{35}H_{34}O_5N_2$:562.246773

TABLE 4. *Continued.*

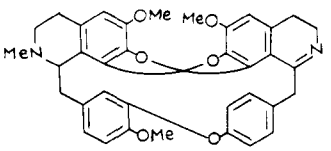
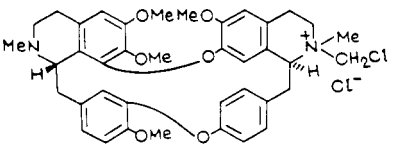
		MP 235; $[\alpha]^{13}$ +304 ($CHCl_3$). (266) UV 287 (3.75). (263) NMR 2.45 (1 x NMe). (13) MASS 562 (M^+), 336, 335, 321, 168 (++, 100). (203) DEGRADATION: Metal-ammonia. (265) SOURCES: *Anisocyclea grandidieri, Cocculus hirsutus, C. laurifolius, C. sarmentosus, C. trilobus.*
	Type **XXIV**	
$R_2=R_3=R_2'=Me, R_4=R_3'=H$, $R_1=H$▶, $R'=H$‖	1-S,1'-S	164. COCSULININE (267) $C_{35}H_{34}O_6N_2$:578.241688 MP 260–263; [α] +312 ($CHCl_3$). (66) UV 235.5, 275 sh, 290.5. (267) NMR TFA; 2.50–3.41 (2 x NMe); 3.68 (1 x OMe); 6.06–7.30 (9 x arom. H). (267) MASS 578 (M^-), 366, 365, 350, 183 (++). (267) DEGRADATION: Metal-ammonia. (267) SOURCE: *Cocculus pendulus.*
		165. MENISARINE (268) $C_{36}H_{34}O_6N_2$:590.241688 MP 203; [α] +149 ($CHCl_3$). (217) SOURCES: *Cocculus leaeba, C. sarmentosus.*
O-Demethylmenisarine (exact location of OH is not determined)		166. NORMENISARINE (269) $C_{35}H_{32}O_6N_2$:576.226038 MP 223; $[\alpha]^{21}$ +190 ($CHCl_3$). (269) SOURCE: *Cocculus trilobus.*
	Type **XXV**	
$R_2=R_3=R_4=R_2'=Me, R_5=H, R_1=R'=H$, stereochemistry undetermined		167. PSEUDOREPANDULINE (83) $C_{37}H_{38}O_6N_2$:606.272988 MP 168–173; $[\alpha]^{18}$ +229 ($CHCl_3$). (83) NMR (83) MASS 606 (M^+), 379, 204. (83) SOURCES: *Daphnandra dielsii, D. species* unnamed.
$R_2=R_3=R_2'=Me, R_4-R_5=CH_2$, $R_1=R_1'=H$, stereochemistry undetermined		168. REPANDULINE (270, 271) $C_{37}H_{36}O_7N_2$:620.252253 MP 215–232; $[\alpha]^{17}$ +473 ($CHCl_3$). (272) UV 285, 350 sh. (272) NMR 2.38, 2.62 (2 x NMe); 3.58 (1 x OMe); 3.88, 4.14 (2 x H of bridging-CH_2O-); 5.94 (1 x $-OCH_2-$). (271) MASS 620 (M^-), 379, 204, 176. (271) DEGRADATION: Metal-ammonia. (270)

TABLE 4. *Continued.*

		SOURCES: *Daphnandra dielsii, D. repandula, D. tenuipes.*
	Type XXVI	
$R_2=R_3=R_2'=R_3'=Me, R_4=H,$ $R_1=R_1'=H$	1-R,1'-R	169. INSULANOLINE (273, 274) $C_{37}H_{38}O_6N_2$:606.272988 MP 195; $[\alpha]^{14}$ +48.6. (77) DEGRADATION: Metal-ammonia. (273) SOURCE: *Cyclea insularis.*
$R_2=R_3=R_4=R_2'=R_3'=Me,$ $R_1=R_1'=H$ (7-*O*-methylinsulanoline)	1-R,1'R	170. INSULARINE (274, 275) $C_{38}H_{40}O_6N_2$:620.288638 MP 157; $[\alpha]^{22}$ +11.36 (EtOH). (59) UV 209 (4.68), 229 sh (4.56), 276 (3.64). (59) NMR 2.48, 254 (2 x NMe); 3.30, 3.75, 3.82 (3 x OMe). (216) MASS 620 (M^+, 90), 619 (38), 605 (6), 313 (20), 312 (100), 311 (28), 310 (74), 309 (26), 204 (14), 190 (12), 174 (19), 159 (8), 146 (8), 145 (9). (253) DEGRADATION: Metal-ammonia. (274) SOURCES: *Cissampelos insularis, C. pareira, Cyclea insularis, Paracyclea ochiaiana, Stephania japonica.*
	ARTIFACT	
	1-S,1'-S	171. NO. 16 (79) $C_{38}H_{44}O_6N_2Cl_2$:636.319938 + wt. of chlorine. MP 213–217; $[\alpha]^{25}$ +156 ($CHCl_3$). (79) UV 283 (3.88). (79) NMR 2.37, 3.30 (2 x NMe); 3.75 (2 x OMe), 3.94 (2 x OMe); 4.6 (1 x $-CH_2Cl$); 5.8–7.7 (10 x arom. H). (59) SOURCE: *Cyclea peltata.*

BBI ALKALOIDS OF UNDETERMINED STRUCTURES

172. DINKLAGEINE
$C_{36}H_{38}O_5N_2$:594.272988
MP 285; $[\alpha]$ −24.4 ($CHCl_3$). (124)
SOURCE: *Stephania dinkelagei.*

173. HIMANTHINE
$C_{37}H_{40}O_6N_2$:608.288638
MP 206–207; $[\alpha]^{33}$ −198.7. (33)
SOURCE: *Berberis himalaica.*

174. (−)-ISOCHONDOCURARINE
$C_{38}H_{44}O_6N_2^{++}$ $2X^-$:624.319938
MP 270 (chloride); $[\alpha]^{20}$ −150 (H_2O) (chloride). (276)
SOURCE: Curare.

175. (+)-NEOCHONDOCURARINE
$C_{38}H_{44}O_6N_2^{++}$ $2X^-$:624.319938
MP 268 (chloride); $[\alpha]^{20}$ +179 (H_2O) (chloride). (276)
SOURCE: Curare.

176. OCODEMERINE
$C_{37}H_{40}O_6N_2$:608.288638
MP 275 (chloride); $[\alpha]$ −170 (H_2O) (chloride). (107)
SOURCE: *Nectandra rodiei.*

177. OTOCAMINE
$C_{37}H_{40}O_6N_2$:608.288638
MP 281 (chloride); $[\alpha]$ +268 (H_2O) (chloride). (107)
SOURCE: *Nectandra rodiei.*

TABLE 4. *Continued.*

178. PENDINE
$C_{35}H_{34}O_6N_2$:578.241688
MP 170–171; [α] +275 ($CHCl_3$). (66)
SOURCE: *Cocculus pendulus.*

179. PENDULININE
$C_{35}H_{34}O_6N_2$:578.241688
MP 272–273; [α] +285 ($CHCl_3$). (66)
SOURCE: *Cocculus pendulus.*

180. PROTOCHONDOCURARINE
$C_{37}H_{41}O_6N_2^+X^-$:609.304210
MP 265 (nitrate); $[\alpha]^{20}$ +175 (H_2O). (276)
SOURCE: Curare.

181. PYCNARRHENAMINE
$C_{35}H_{40}O_9N_2$:632.273383
MP 203. (117)
SOURCE: *Pycnarrhena manillensis.*

182. PYCNARRHENINE
$C_{36}H_{42}O_9N_2$:646.289033
MP 193. (117)
SOURCE: *Pycnarrhena manillensis.*

183. TILIACORIDINE
$C_{39}H_{40}O_8N_2$:664.278468
MP 153–156. (167)
SOURCE: *Tiliacora racemosa.*

184. TILIANDRINE
$C_{34}H_{34}O_5N_2$:550.246773
MP 175; [α] +408 (EtOH). (74)
SOURCE: *Tiliacora triandra.*

185. TILIARINE[6]
$C_{38}H_{34}O_5N_2$:562.246773
MP 203–207; [α] +283.6 (MeOH). (170)
SOURCE: *Tiliacora racemosa.*

186. TOMENTOCURINE
$C_{36}H_{35}O_6N_2$:594.272988
MP 260; $[\alpha]^{18}$ +202 (0.1N HCl). (50)
SOURCE: *Chondrodendron tomentosum.*

[6]Both tiliacorine (No. 118) and tiliarine, isolated from the same source, were considered by Rao and Row (277) to have structures of the same type. But now the structure of tiliacorine has been modified; no work has been done on tiliarine.

TABLE 5. *Names and synonyms of BBI alkaloids.*

(Serial number of the alkaloid (according to Table 4) is placed by the side of its name).

Aromoline 31
Atherospermoline 56

(+)-Bebeerine 132
(−)-Bebeerine 133
Belarine 93
Berbamine 57
Berbamunine 1
Berbenine 57
N,N'-Bisnoraromoline 32

Cepharanoline 33
Cepharanthine 34
Chondocurarine 129
Chondodendrine 132
Chondrocurine 130
Chondrofoline 131
Cissampareine 145
Coclobine 35
Cocsoline 152
Cocsuline 153
Cocsulinine 164
(+)-Curine 132
(−)-Curine 133
Cuspidaline 2
Cycleacurine 134
Cycleadrine 58
Cycleahomine 59
Cycleanine 121
Cycleanorine 60
Cycleapeltine 36

Daphnandrine 37
Daphnoline 38
Dauricine 3
Dauricinoline 4
Dauricoline 5
Daurinoline 6
1,2-Dehydromicranthine 154
Demerarine 39
7-*O*-Demethylpeinamine 60a
N-Demethyltenuipine 89
N-Desmethyldauricine 7
N-Desmethylthalidezine 80
N-Desmethylthalistyline 16
12'-*O*-Desmethyltrilobine 155
Dihydrowarifteine 146
O,O-Dimethylcurine 135
Dimethyldihydrowarifteine 147
N,O-Dimethylmicranthine 156
Dimethylwarifteine 148
Dinklacorine 114
Dinklageine 172
Dirosine 19
Dryadine 104
Dryadodaphnine 105

Eferine 153
(+)-Epistephanine 40
(−)-Epistephanine 41
Espinidine 8
Espinine 9

TABLE 5. *Continued.*

Fangchinoline 61
(±)-Fangchinoline 58
Funiferine 20
Funiferine *N*-oxide 21

Grisabine 10
Grisabutine 12

Hayatidine 136
Hayatine 137
Hayatinine 138
Hernandezine 81
Himanthine 173
Homoaromoline 42
Homothalicrine 42
Homotrilobine 157
Hypoepistephanine 43

Insulanoline 169
Insularine 170
Isobebeerine 122
(−)-Isochondocurarine 174
(+)-Isochondodendrine 122
Isofangchinoline 79
Isoliensinine 28
Isotenuipine 87
Isotetrandrine 62
Isothalidezine 82
Isotiliarine 115
Isotrilobine 157

Krukovine 63

Lauberine 106
Liensinine 29
Limacine 64
Limacusine 44
Lindoldhamine 11

Macolidine 44a
Macoline 44b
Magnolamine 15
Magnoline 12
Menisarine 165
Menisidine 65
Menisine 66
Methothalistyline 17
2'-*N*-Methylberbamine 66a
O-Methylberbamine 62
4''-*O*-Methylcurine 139
12'-*O*-Methylcurine 140
O-Methyldauricine 12a
N-Methyl-7-*O*-demethylpeinamine 66b
Methyldihydrowarifteine 149
O-Methylisochondodendrine 121
O-Methylisothalicberine 94
O-Methylmicranthine 158
O-Methyloxyacanthine 46
O-Methylrepandine 45
O-Methylthalicberine 95
O-Methylthalisopine 55
O-Methylthalmethine 96
Methylwarifteine 150
Micranthine 159
Monomethyltetrandinium 67

Neferine 30
Nemuarine 111
(+)-Neochondocurarine 175
Neoprotocuridine 123
2-*N*-Norberbamine 68
(+)-Norcycleanine 124
(−)-Norcycleanine 125
Normenisarine 166
2-*N*-Norobamegine 69
Norpanurensine 109
Norrodiasine 22
(+)-Nortenuipine 88
(−)-Nortenuipine 89
2-*N*-Nortetrandrine 70
Northalibrine 13
Nortiliacorine-A 115
Nortiliacorinine-A 116
Nortiliacorinine-B 117

Obaberine 46
Obamegine 71
Oblongamine 47
Ocodemerine 176
Ocoteamine 50
Ocotine 23
Ocotosine 24
Otocamine 177
Oxoepistephanine 47a
Oxyacanthine 48

Panurensine 110
Peinamine 71a
Pendine 178
Penduline 72
Pendulinine 179
Phaeantharine 73
Phaeanthine 74
Phlebicine 25
Protochondocurarine 180
Protocuridine 126
Pseudoepistephanine 43
Pseudorepanduline 167
Pseudotiliarine 116
Pycnamine 75
Pycnarrhenamine 181
Pycnarrhenine 182

Repandine 49
Repandinine 90
Repanduline 168
Rodiasine 26

Sciadenine 127
Sciadoline 128
Sepeerine 50
Stebisimine 51
Stepholine 71

Telobine 160
(+)-Tenuipine 91
(−)-Tenuipine 92
(±)-Tenuipine 90
Tetra-*O*-demethylcycleanine 128a
(+)-Tetrandrine 76
(±)-Tetrandrine 77
Tetrandrine mono-*N*-2'-oxide 78

TABLE 5. *Continued.*

Thabadensine 106a
Thalcimidine 85
Thalcimine 86
Thalfine 102
Thalfinine 103
Thalfoetidine 99
Thalibrine 14
Thalibrunimine 112
Thalibrunine 113
Thalicberine 97
Thalicrine 31
Thalicsimine 81
Thalictine 107
Thalictrimine 99
Thalictrinine 99
Thalidasine 100
Thalidezine 83
Thaligine 79
Thaligosidine 100a
Thaligosine 52a
Thaligosinine 52b
Thalirabine 17a
Thaliracebine 14a
Thalirugidine 17b
Thalirugine 14b
Thaliruginine 14c
Thalisamine 84
Thalisopidine 53
Thalisopine 54
Thalistyline 18
Thalmethine 98
Thalmidine 95
Thalmine 108
Thalphine 102
Thalphinine 103
Thalrugosamine 52
Thalrugosaminine 55
Thalrugosidine 101
Thalrugosine 79
Thalsimidine 85
Thalsimine 86
Tiliacoridine 183
Tiliacorine 118
Tiliacorinine 119
Tiliafunimine 79a
Tiliageine 27
Tiliamosine 120
Tiliandrine 184
Tiliarine 185
Tomentocurine 186
Toxicoferine 141
Tricordatine 161
Trigilletimine 162
Trigilletine 153
Trilobamine 38
Trilobine 163
(+)-Tubocurarine 142
(−)-Tubocurarine 143
(+)-Tubocurine 130
(+)-Tubocurine 144

Warifteine 151

TABLE 6. *Calculated molecular weights of BBI alkaloids.*

(Serial number of the alkaloid (according to Table 4) is placed by the side of its name).

546.215473:$C_{34}H_{30}O_5N_2$
1,2-Dehydromicranthine 154

548.231123:$C_{34}H_{32}O_5N_2$
Cocsoline 152
12'-*O*-Desmethyltrilobine 155
Micranthine 159
Tricordatine 161

550.246773:$C_{34}H_{34}O_5N_2$
Tiliandrine 184

558.215473:$C_{35}H_{30}O_5N_2$
Trigilletimine 162

562.246773:$C_{35}H_{34}O_5N_2$
Nortiliacorine-A 115
Nortiliacorinine-A 116
Nortiliacorinine-B 117
Cosuline 153
O-Methylmicranthine 158
Telobine 160
Trilobine 163
Tiliarine 185

566.241688:$C_{34}H_{34}O_6N_2$
N,*N*'-Bisnoraromoline 32
Tetra-*O*-demethylcycleanine 128a

568.257338:$C_{34}H_{36}O_6N_2$
Lindoldhamine 11

576.226038:$C_{35}H_{32}O_6N_2$
Normenisarine 166

576.262423:$C_{36}H_{36}O_5N_2$
Dinklacorine 114
Tiliacorine 118
Tiliacorinine 119
N,*O*-Dimethylmicranthine 156
Isotrilobine 157

578.241688:$C_{35}H_{34}O_6N_2$
Cocsulinine 164
Pendine 178
Pendulinine 179

580.257338:$C_{35}H_{36}O_6N_2$
Daphnoline 38
7-*O*-demethylpeinamine 60a
2-*N*-Norobamegine 69
Cycleacurine 134

590.241688:$C_{36}H_{34}O_6N_2$
Stebisimine 51
Sciadoline 128
Menisarine 165

TABLE 6. *Continued.*

592.257338:$C_{36}H_{36}O_6N_2$
Cepharanoline 33
Hypoepistephanine 43
Tiliafunimine 79a
Thalmethine 98
Tiliamosine 120
Warifteine 151

594.272988:$C_{36}H_{38}O_6N_2$
Aromoline 31
Daphnandrine 37
Demerarine 39
Macolidine 44a
Sepeerine 50
Atherospermoline 56
Krukovine 63
N-Methyl,7-*O*-demethylpeinamine 66b
2-*N*-Norberbamine 68
Obamegine 71
Peinamine 71a
Dryadodaphnine 105
Thalbadensine 106a
Norpanurensine 109
Isochondodendrine 122
Neoprotocuridine 123
Protocuridine 126
Chondrocurine 130
(+)-Curine 132
(−)-Curine 133
Hayatine 137
Toxicoferine 141
(−)-Tubocurine 144
Dihydrowarifteine 146
Dinklageine 172
Tomentocurine 186

596.288638:$C_{36}H_{40}O_6N_2$
Berbamunine 1
Dauricoline 5
Espinine 9
Magnoline 12

606.272988:$C_{37}H_{38}O_6N_2$
Ocotosine 24
Cepharanthine 34
Coclobine 35
(+)-Epistephanine 40
(−)-Epistephanine 41
O-Methylthalmethine 96
Cissampareine 145
Methylwarifteine 150
Pseudorepanduline 167
Insulanoline 169

608.288638:$C_{37}H_{40}O_6N_2$
Nor-rodiasine 22
Ocotine 23
Phlebicine 25
Tiliageine 27
Cycleapeltine 36
Homoaromoline 42
Limacusine 44
Macoline 44b
Oxyacanthine 48
Repandine 49
Thalrugosamine 52
Berbamine 57
Cycleadrine 58
Cycleanorine 60
Fangchinoline 61
(±)-Fangchinoline 58
Limacine 64
Menisidine 65
2-Nortetrandrine 70
Penduline 72
Pycnamine 75
Thalrugosine 79
Belarine 93
Thalicberine 97
Dryadine 104
Lauberine 106
Thalictine 107
Thalmine 108
Panurensine 110
Nemuarine 111
(+)-Norcycleanine 124
(−)-Norcycleanine 125
Sciadenine 127
Chondorfoline 131
Hayatidine 136
Hayatinine 138
4″-*O*-Methylcurine 139
12-*O*-Methylcurine 140
Methyldihydrowarifteine 149
Himanthine 173
Ocodemerine 176
Otocamine 177

609.304210:$C_{37}H_{41}O_6N_2$
(+)-Tubocurarine 142
(−)-Tubocurarine 143
Protochondrocurarine 180

610.304288:$C_{37}H_{42}O_6N_2$
Cuspidaline 2
Dauricinoline 4
Daurinoline 6
N'-Desmethyldauricine 7
Espinidine 8
Grisabine 10
Northalibrine 13
Dirosine 19
Isoliensinine 28
Liensinine 29

616.257339:$C_{35}H_{36}O_8N_2$
Phaeantharine 73

620.252253:$C_{37}H_{36}O_7N_2$
Oxoepistephanine 47a
Repanduline 168

620.288638:$C_{38}H_{40}O_6N_2$
Dimethylwarifteine 148
Insularine 170

622.267903:$C_{37}H_{38}O_7N_2$
Thalsimidine 85
(+)-Nortenuipine 88
(−)-Nortenuipine 89

622.304288:$C_{38}H_{42}O_6N_2$
Funiferine 20

TABLE 6. *Continued.*

Rodiasine 26
O-Methylrepandine 45
Obaberine 46
Isotetrandine 62
Menisine 66
Phaeanthine 74
(+)-Tetrandrine 76
(±)-Tetrandrine 77
O-Methylisothalicberine 94
O-Methylthalicberine 95
Cycleanine 121
O,O-Dimethylcurine 135
Dimethyldihydrowarifteine 147

623.312113:$C_{38}H_{43}O_6N_2$
Oblongamine 47
2-*N*'-Methylberbamine 66a

624.283553:$C_{37}H_{40}O_7N_2$
Thalisopidine 53
N-Desmethylthalidezine 80
Thaligosidine 100a

624.319938:$C_{38}H_{44}O_6N_2$
Dauricine 3
Thalibrine 14
Neferine 30
Chondocurarine 129
(−)-Isochondocurarine 174
(+)-Neochondocurarine 175

626.299203:$C_{37}H_{42}O_7N_2$
Magnolamine 15

632.273383:$C_{35}H_{40}O_9N_2$
Pycnarrhenamine 181

636.283553:$C_{35}H_{40}O_7N_2$
Thalsimine 86
Isotenuipine 87
Repandinine 90
(+)-Tenuipine 91
(−)-Tenuipine 92

636.319938:$C_{39}H_{44}O_6N_2$
(Artefact) No. 16 171

637.327763:$C_{39}H_{45}O_6N_2$
Cycleahomine 59

638.299203:$C_{38}H_{42}O_7N_2$
Funiferine *N*-oxide 21
Thaligosine 52a
Thaligosinine 52b
Thalisopine 54
Isothalidezine 82
Tetrandrine mono-*N*-2'-oxide 78
Thalidezine 83
Thalisamine 84
Thalfoetidine 99
Thalrugosidine 101

638.335588:$C_{39}H_{46}O_6N_2$
O-Methyldauricine 12a
Monomethyltetrandrinium 67

640.314853:$C_{38}H_{44}O_7N_2$
Thalirugine 14b

646.289033:$C_{36}H_{42}O_9N_2$
Pycnarrhenine 182

648.247168:$C_{35}H_{36}O_8N_2$
Thalfine 102

652.278468:$C_{38}H_{40}O_8N_2$
Thalibrunimine 112

652.314853:$C_{39}H_{44}O_7N_2$
Thaliracebine 14a
Thalrugosaminine 53
Hernandezine 81
Thalidasine 100

654.330503:$C_{39}H_{46}O_7N_2$
Thaliruginine 14c

664.278468:$C_{39}H_{40}O_8N_2$
Tiliacoridine 183

666.294118:$C_{39}H_{42}O_8N_2$
Thalfinine 103

668.309768:$C_{39}H_{44}O_8N_2$
Thalibrunine 113

670.325418:$C_{39}H_{46}O_8N_2$
Thalirugidine 17b

682.325418:$C_{40}H_{46}O_8N_2$
N-Desmethylthalistyline 16

683.333243:$C_{40}H_{47}O_8N_2$
Thalirabine 17a

697.348893:$C_{41}H_{49}O_8N_2$
Thalistyline 18

712.372368:$C_{42}H_{52}O_8N_2$
Methothalistyline 17

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