The Tetracyclic Erythrina Alkaloids

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THE TETRACYCLIC *ERYTHRINA* ALKALOIDS

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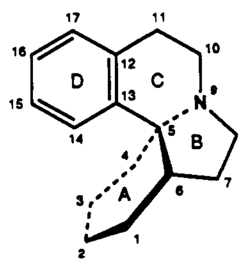
ABSTRACT.—A listing of more than 90 tetracyclic erythrina-type alkaloids, originating mainly from *Erythrina* (Leguminosae) and *Cocculus* (Menispermaceae) plant species, is supplied, together with appropriate spectral data.

Erythrina plant species, botanical family Leguminosae, are the main source for the tetracyclic erythrina-type alkaloids. Interestingly enough, however, *Cocculus* species, family Menispermaceae, also produce closely related alkaloids which differ from the true *Erythrina* alkaloids in their oxygenation pattern in ring A. These *Cocculus* alkaloids have also been included in the present review.

An interesting insight into the possible catabolism of the erythrina-type alkaloids is provided by such lactonic compounds as (+)-cocculolidine [**72**], (+)-erythroidine [**88**], (+)-β-erythroidine [**89**], (+)-8-oxo-α-erythroidine [**90**], and (+)-8-oxo-β-erythroidine [**91**], which are most probably products of in vivo oxidation of the aromatic ring D of the classical skeleton **I** below.



I

The numbering system for the erythrina-type alkaloids is shown in structure **I**.

The nomenclature of the erythrina-type alkaloids is interesting. The prefix eryso- usually denotes the presence of a phenolic function. The prefix erythroi- indicates that ring D is lactonic; while the prefix erythra- points to the classical skeleton as in **I** above. So-called dienoid alkaloids possess one carbon-carbon double bond in ring A and another in ring B, but alkenoids incorporate only one double bond, usually in ring A.

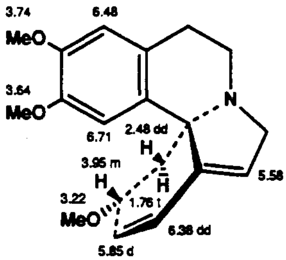
The lactonic alkaloids mentioned above represent the third subdivision of erythrina-type alkaloids. The in vivo oxidation of classical type alkaloids possessing skeleton **I** may also possibly explain the biogenesis of the 16-azoerythrinanes such as (+)-erymelanthine [**92**] and (+)-melanacanthine [**93**], because in such instances oxidation could be followed by ammonia uptake and recyclization to form an aminated ring D. Finally, a few so-called dimeric alkaloids are known (e.g., **94–97**) that incorporate a tryptophan moiety.

Erythrina-type alkaloids are generally dextrorotatory, and their absolute configuration is as denoted in structure **I** above.

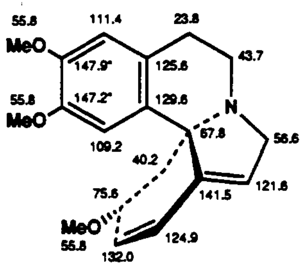
Unless otherwise stated, uv (nm, log e) and cd (Δϵ, nm) spectra were obtained in EtOH or MeOH and nmr spectra in $CDCl_3$. Chemical shifts are on the δ scale, and the coupling constants are in Hz. Ir frequencies are in cm^{-1}, and melting points are in degrees centigrade.

DIENOIDS

1 (+)-ERYSOTRINE

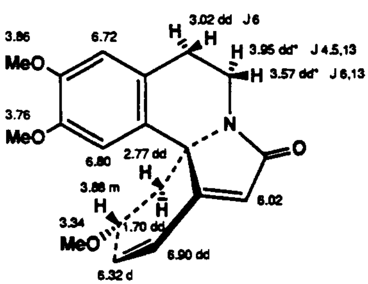


J 1,2 10.0
J 1,3 2.5
J 3,4ax 12.0
J 3,4eq 5.5
J 4gem 12.0

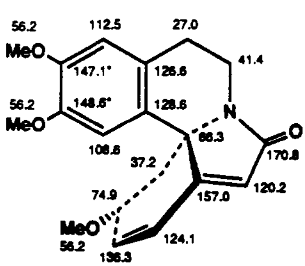


$C_{19}H_{23}O_3N$: 313.1678
MP: 96—98° (Me_2CO/petroleum ether) (1)
$[\alpha]^{25}D$: +165.9° ($CHCl_3$) (1)
UV: 230 (4.3), 280 (3.8) (1)
^{1}H NMR: (360 MHz) (M.E. Amer, S. El-Masry, and M. Shamma, unpublished results)
^{13}C NMR: (25.2 MHz) (3)
MS: $[M]^+$ 313 (84), 298 (81), 282 (100) (1,2)
SOURCES: *Erythrina caffra*, *E. zeyheri*, *E. senegalensis*, *E. livingstoniana*, *E. abyssinica*, *E. suberosa*, *E. arborescens*, *E. variegata*, *E. fucosa*, *E. poeppigiana*, *E. flabelliformis*, *E. coralloides*, *E. goldmanii*, *E. folkersi*, *E. atitlanensis*, *E. macrophylla*, *E. tajumulcensis*, *E. guatemalensis*, *E. steyermarkii*, *E. oliviae* (4,5), *E. mulungu* (3), *E. blakei* (1), *E. crista-galli* (32), *E. cobeleata* (19), *E. lysistemon* (5, M.E. Amer *et al.*, unpublished results)

2 (+)-ERYSOTRAMIDINE

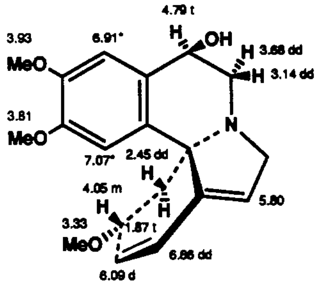


J 1,2 10.0
J 1,3 2.5
J 3,4ax 10.5
J 3,4eq 5.0
J 4gem 11.5

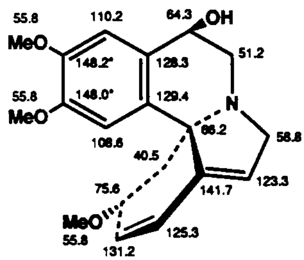


$C_{19}H_{21}O_4N$: 327.1470
Oil (6)
$[\alpha]^{21}D$: +121° (c = 1.0, $CHCl_3$) (6)
UV: 212 (4.02), 236 (4.07), 257 (3.7 sh), 316 (3.15 sh) (6)
IR: 1665 (6)
^{1}H NMR: (100 MHz) (6)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 327, 312, 296, 294 (6)
SOURCES: *Erythrina arborescens* (6)

3 (+)-11β-HYDROXYERYSOTRINE
[(+)-Erythrartine]

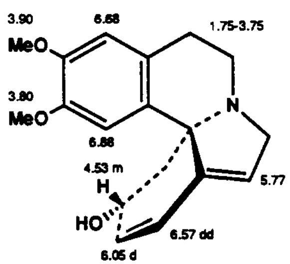


J 1,2	10.0	J 10ax,11eq	4.5
J 1,3	2.5	J 10eq,11eq	4.5
J 3,4ax	10.5	J 10gem	14.0
J 3,4eq	5.0		
J 4gem	10.5		

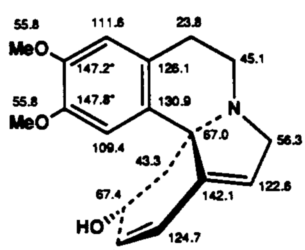


$C_{19}H_{23}O_4N$: 329.1627
MP: 166–168° (10)
[α]D: +135° (*c* = 0.5, $CHCl_3$) (6), +256° (*c* = 1.4, $CHCl_3$) (7)
UV: 229 (4.16), 287 (3.51) (6)
IR: 3600 (6)
^{1}H NMR: (100 MHz) (6,10)
^{13}C NMR: (25.2 MHz) (3)
MS: $[M]^+$ 329, 311, 296, 280, 278 (6)
SOURCES: *Erythrina arborescens* (6), *E. herbacea* (8), *E. poeppigiana* (9), *E. variegata* (10), *E. mulungu* (3)

4 (+)-ERYTHRAVINE

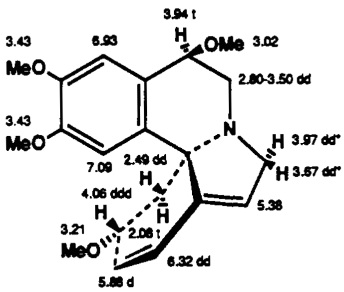


J 1,2	10.0
J 1,3	2.0



$C_{18}H_{21}O_3N$: 299.1521
Oil (11)
UV: 282 (3.49) (11)
^{1}H NMR: (360 MHz) (M.E. Amer *et al.*, unpublished results)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 299 (94), 282 (100), 280 (17), 266 (23) (11)
SOURCES: *Erythrina folkersii* (11), *E. steyermarkii* (4), *E. eggersii*, *E. abyssinica* (45), *E. lysistemon* (M.E. Amer *et al.*, unpublished results)

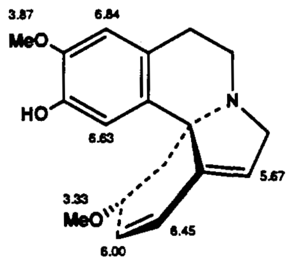
5 (+)-ERYTHRISTEMINE

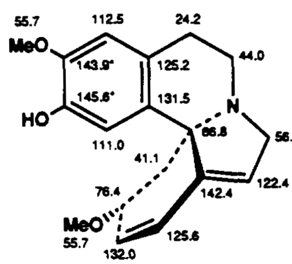


J 1,2	10.0	J 10ax,11eq	4.0
J 1,3	2.0	J 10eq,11eq	4.0
J 3,4ax	10.5	J 10gem	14.0
J 3,4eq	5.5	J 8gem	15.0
J 4gem	10.5	J 7,8α	2.5
		J 7,8β	2.5

$C_{20}H_{25}O_4N$: 343.1783
MP: 127–129° (light petroleum ether) (23)
$[\alpha]^{22}$D: +189° (c = 0.4, $CHCl_3$) (23)
UV: 235 (4.3), 283 (3.5) (23)
IR: 1610 (23)
^{1}H NMR: (C_6D_6) (23,25)
MS: $[M]^+$ 343, 328, 312, 311 (100), 310, 296, 280 (23)
X-RAY: 2-bromo-4,6-dinitrophenolate (24)
SOURCES: *Erythrina lysistemon* (23,24, M.E. Amer *et al.*, unpublished results), *E. abyssinica* (23)

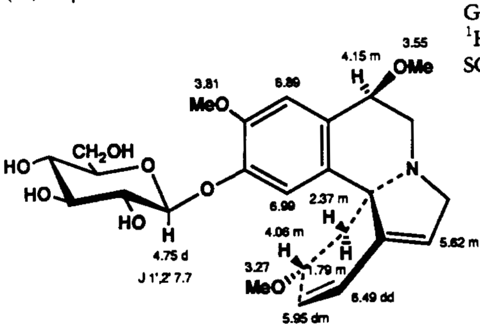
6 (+)-ERYSOVINE





$C_{18}H_{21}O_3N$: 299.1521
MP: 167–169° (Me_2CO/petroleum ether) (15)
$[\alpha]$D: +252° (c = 0.123, EtOH) (20)
UV: 228 (4.3), 283 (3.6) (15)
^{1}H NMR: (60 MHz) (15)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 299 (39), 284 (41), 268 (100) (15)
SOURCES: *Erythrina caffra*, *E. zeyheri*, *E. senegalensis*, *E. livingstoniana*, *E. abyssinica*, *E. suberosa*, *E. arborescens*, *E. variegata*, *E. fusca*, *E. poeppigiana*, *E. flabelliformis*, *E. coralloides*, *E. goldmanii*, *E. folkersii*, *E. atitlanensis*, *E. macrophylla*, *E. tajumulcensis*, *E. guatemalensis*, *E. steyermarkii*, *E. oliviae*, *E. mulungu*, *E. blakei*, *E. crista-galli*, *E. cobeleata*, *E. lysistemon* (4,5,15,16,20,48)

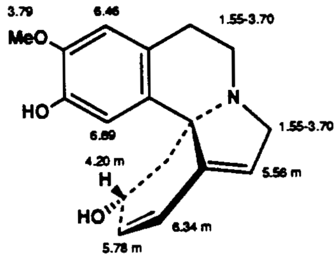
7 (+)-11β-METHOXYGLUCOERYSOVINE

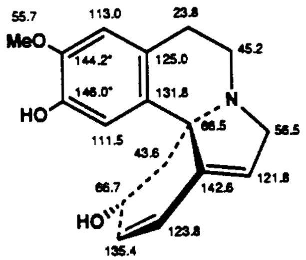


J 1,2	10.2
J 1,3	2.2

$C_{25}H_{33}O_9N$: 491.2154
Gum (69)
^{1}H NMR: (500 MHz) (69)
SOURCES: *Erythrina lysistemon* (69)

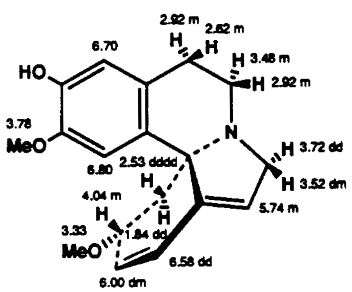
8 (+)-ERYSOLINE



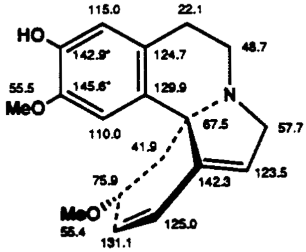


$C_{17}H_{19}O_3N$: 285.1365
UV: 285 (3.47) (11)
^{1}H NMR: (60 MHz) (11)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 285 (100), 268 (89), 266 (21), 254 (22) (11)
SOURCES: *Erythrina folkersii* (11), *E. guatemalensis*, *E. steyermarkii*, *E. berteroana*, *E. subumbrans*, *E. lanata*, *E. acanthocarpa* (4,5), *E. caribaea* (19)

9 (+)-ERYSODINE



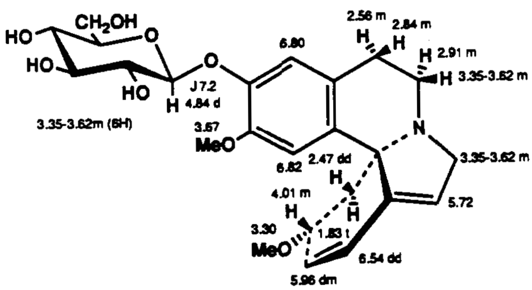
J 1,2	10.1	J 4eq,7	1.1
J 1,3	2.3	J 2,4eq	1.1
J 3,4ax	10.5	J 8gem	14.5
J 3,4eq	5.6	J 7,8α	3.0
J 4gem	11.5		



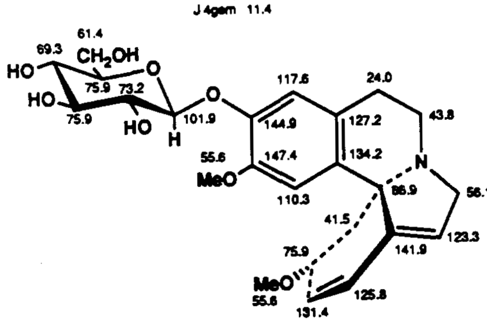
$C_{18}H_{21}O_3N$: 299.1521
MP: 204–206° (17)
$[\alpha]^{27}$D: +248° (EtOH) (17)
UV: 235, 285 (17)
UV: (MeOH) 228 (4.3), 283 (3.7) (15)
IR: (Nujol) 796, 870, 992, 1100, 1160, 1180, 1260, 1295, 1330, 1385, 1468, 1510, 1592, 2873, 2940, 3435 (17)
^{1}H NMR: (360 MHz) (69)
^{13}C NMR: (90.6 MHz, DMSO-d_6) (12)
MS: $[M]^+$ 299, 284, 268, 266, 241, 228, 215 (15)
SOURCES: *Erythrina caffra*, *E. zeyheri*, *E. senegalensis*, *E. livingstoniana*, *E. abyssinica*, *E. suberosa*, *E. arborescens*, *E. variegata*, *E. fucosa*, *E. poeppigiana*, *E. flabelliformis*, *E. coralloides*, *E. goldmanii*, *E. folkersii*, *E. atitlanensis*, *E. macrophylla*, *E. tajumulcensis*, *E. guatemalensis*, *E. steyermarkii*, *E. oliviae*, *E. mulungu*, *E. blakei*, *E. crista-galli*, *E. cobeleata*, *E. lysistemon* (1,4,5,17,20,32,36, 47,48,69, M.E. Amer *et al.*, unpublished results)

10 (+)-GLUCOERYSODINE

$C_{24}H_{31}O_8N$: 461.2049
Gum (M.E. Amer *et al.*, unpublished results)
[α]D: +100.92° (c = 1.56, $CHCl_3$) (M.E. Amer *et al.*, unpublished results)
UV: 225 (4.03), 281 (3.39) (M.E. Amer *et al.*, unpublished results)
^{1}H NMR: (360 MHz) (M.E. Amer *et al.*, unpublished results)
^{13}C NMR: (90.6 MHz) (12, M.E. Amer *et al.*, unpublished results)
MS: $[M]^+$ 461 (26), 430 (4), 299 (100), 284 (55), 268 (60), 241 (14), 214 (9), 130 (8) (M.E. Amer *et al.*, unpublished results)
SOURCES: *Erythrina lysistemon* (M.E. Amer *et al.*, unpublished results)

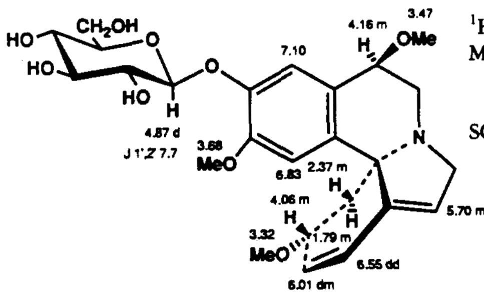


J 1,2 10.0
J 1,3 1.8
J 3,4ax 10.9
J 3,4eq 5.0
J 4gem 11.4



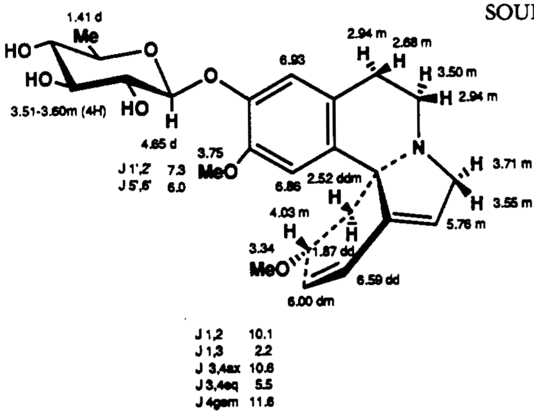
11 (+)-11β-METHOXYGLUCOERYSODINE

$C_{25}H_{33}O_9N$: 491.2154
Gum (69)
[α]D: +73° (c = 0.42, $CHCl_3$) (69)
UV (MeOH): 208 (4.21), 226 (4.02), 287 (3.18) (69)
^{1}H NMR: (500 MHz) (69)
MS: $[M]^+$ 491 (5), 459 (20), 329 (42), 314 (18), 298 (100), 282 (53), 266 (78), 250 (22), 234 (18), 213 (18), 167 (14) (69)
SOURCES: *Erythrina lysistemon* (69)



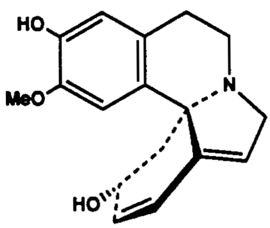
J 1,2 10.2
J 1,3 2.2

12 (+)-RHAMNOERYSODINE



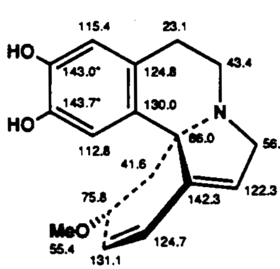
$C_{24}H_{31}O_7N$: 445.2100
Gum (69)
[α]D: +83° (*c* = 0.13, $CHCl_3$) (69)
UV (MeOH): 208 (4.30), 226 (4.22), 258 (3.63), 279 (3.51) (69)
^{1}H NMR: (500 MHz) (69)
MS: [M]$^+$ 445 (5), 299 (59), 284 (37), 268 (100), 254 (11), 241 (15), 228 (9), 215 (14), 130 (6) (69)
SOURCES: *Erythrina lysistemon* (69)

13 (+)-ERYSONINE



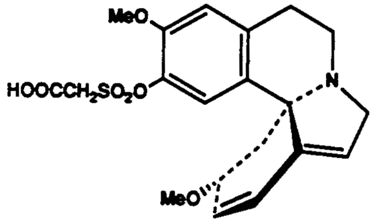
$C_{17}H_{19}O_3N$: 285.1365
MP: 237–238° (EtOH) (18)
$[\alpha]^{25}$D: +285–288° (*c* = 0.5, HCl) (18)
MS: [M]$^+$ 285 (100), 268 (89), 266 (21), 254 (22) (11)
SOURCES: *Erythrina caribaea* (19), *E. guatemalensis, E. steyermarkii, E. berteroana, E. costaricensis, E. folkersii* (19), *E. lithosperma, E. variegata, E. lanata* (4), *E. melanacantha* (36)

14 (+)-ERYSOPINE



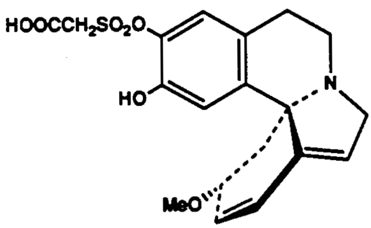
$C_{17}H_{19}O_3N$: 285.1365
MP: 240–241° (EtOH) (20)
[α]D: +263.4° (*c* = 0.291, EtOH/glycerin) (20)
^{13}C NMR: (90.6 MHz, DMSO-d_6) (12)
MS: TMSi derivative [M]$^+$ 429 (62), 414 (24), 398 (100), 340 (12), 73 (45) (21)
SOURCES: Commonly present in *Erythrina* species (4,5,20,36,45,46,48,51)

15 (+)-ERYSOTHIOVINE



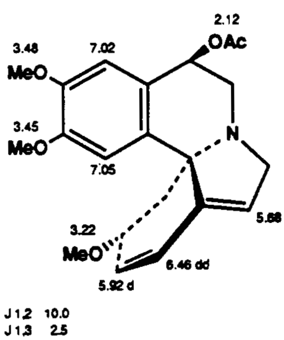
$C_{20}H_{23}O_7NS$: 421.1188
MP: 187–189° (H_2O) (22)
$[\alpha]^{25}$D: +208° (*c* = 0.359, EtOH) (22)
SOURCES: *Erythrina glauca, E. pallida, E. poeppigiana* (22)
Minimal structural proof.

16 (+)-ERYSOTHIOPINE



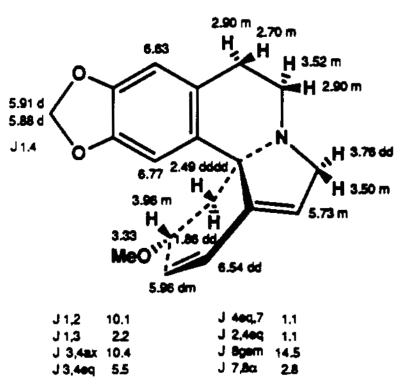
$C_{19}H_{21}O_7NS$: 407.1032
MP: 168–169° (H_2O) (22)
$[\alpha]^{25}$D: +194° (*c* = 0.103, EtOH) (22)
SOURCES: *Erythrina glauca* (22)
Minimal structural proof.

17 (+)-ERYTHRASCINE

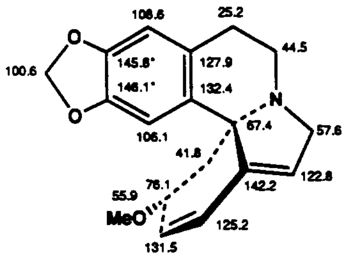


$C_{21}H_{25}O_5N$: 371.1733
MP: 138–140° (EtOH/Me_2CO) (26)
$[\alpha]^{25}$D: +152° (*c* = 0.51, $CHCl_3$) (26)
UV: 210–212 (4.88), 233–235 (4.35), 284–288 (3.34) (26)
IR: (KBr) 1728 (26)
^{1}H NMR: (26)
MS: $[M]^+$ 371 (42), 356 (22), 340 (100), 339 (27), 329 (31), 313 (24), 311 (17) (26)
SOURCES: *Erythrina arborescens* (26)

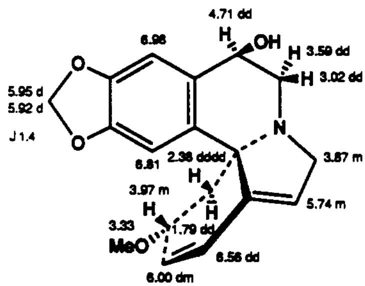
18 (+)-ERYTHRALINE



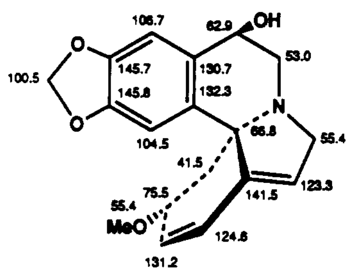
$C_{18}H_{19}O_3N$: 297.1365
MP: 106–107° (EtOH) (13)
$[\alpha]^{27}$D: +211.8° (*c* = 0.944, EtOH) (13)
UV: 232, 290 (14)
^{1}H NMR: (360 MHz) (69)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 297, 282, 266 (100), 264, 239, 225, 212 (14)
X-RAY: (49)
SOURCES: *Erythrina fusca, E. coralloides, E. tajumulcensis, E. macrophylla, E. guatemalensis, E. globocalyx, E. oliviae, E. steyermarkii, E. huehuetenangensis, E. lanceolata, E. barqueroana, E. folkersii, E. velutina, E. stricta, E. lysistemon, E. zeyheri, E. senegalensis, E. excelsa, E. latissima, E. abyssinica, E. tahitensis, E. vespertilio, E. burana, E. perrieri, E. suberosa, E. arborescens, E. variegata* (4,5), *E. glauca* (9,13), *E. cristagalli* (14), *E. milbraedii* (45), *E.X. bidwillii* (47), *E. caffra* (5,69)



19 (+)-ERYTHRININE

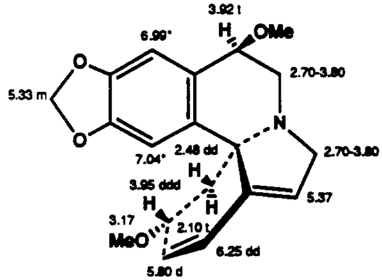


J 1,2	10.1	J 4eq,7	1.1
J 1,3	2.2	J 2,4eq	1.1
J 3,4ax	10.8	J 10ax, 11eq	4.8
J 3,4eq	5.5	J 10eq, 11eq	4.2
J 4gem	11.8		



$C_{18}H_{19}O_4N$: 313.1314
MP: 197–200° (MeOH) (dec) (27)
$[\alpha]^{20}D$: +204° (c = 1.0, $CHCl_3$) (27)
UV: 209 (4.38), 230 (4.26), 289 (3.7) (27)
IR: 3500 (27)
^{1}H NMR: (360 MHz) (69)
^{13}C NMR: (22.6 MHz, DMSO-d_6) (29)
MS: $[M]^+$ 313 (98), 298 (70), 295 (57), 283 (70), 282 (100), 280 (80), 264 (85), 262 (50), 224 (35), 211 (40) (27)
SOURCES: *Erythrina X. bidwilli* (27), *E. indica* (28), *E. glauca* (9), *E. brucei* (29), *E. crista-galli*, *E. lithosperma*, *E. stricta*, *E. vespertilio*, *E. burana*, *E. perrieri*, *E. macrophylla* (5), *E. caffra* (5,69)

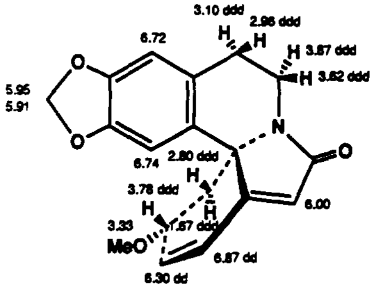
20 (+)-11-METHOXYERYTHRALINE



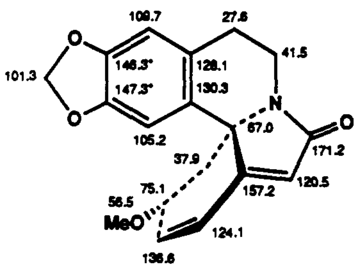
J 1,2	10.0		
J 1,3	2.5		
J 3,4ax	11.0	J 10ax,11eq	4.5
J 3,4eq	5.5	J 10eq,11eq	4.5
J 4gem	11.0		

$C_{19}H_{21}O_4N$: 327.1470
Gum (30)
$[\alpha]^{25}D$: +199° (c = 0.6, $CHCl_3$) (30)
UV: 227 (4.15), 286 (3.5) (30)
IR: (film) 1616 (30)
^{1}H NMR: (100 MHz, C_6D_6) (30)
MS: $[M]^+$ 327, 312, 297, 296, 295, 294, 280 (30)
SOURCES: *Erythrina lysistemon* (30), *E. caffra*, *E. vespertilio* (5)

21 (+)-8-OXOERYTHRALINE

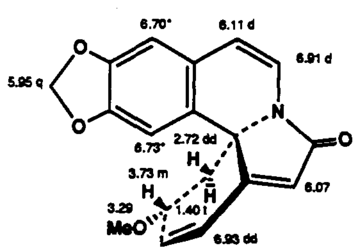


J 1,2	10.0	J 11gem	15.8
J 1,3	2.6	J 10ax,11ax	9.0
J 2,3	2.3	J 10eq,11ax	7.1
J 3,4ax	10.1	J 10ax,11eq	7.1
J 3,4eq	5.3	J 10gem	15.8
J 4gem	11.6		



$C_{18}H_{17}O_4N$: 311.1157
Oil (32)
UV: 254 (31)
IR: ($CHCl_3$) 1665 (32)
^{1}H NMR: (31)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 311 (100), 296 (50), 280 (65), 279 (33), 278 (76), 268 (15), 266 (15), 250 (30) (31)
SOURCES: *Erythrina crista-galli* (31), *E. brucei* (29), *E. chiriquensis* (12), *E. tahitensis*, *E. lysistemon*, *E. abyssinica* (36)
Semi-synthesis (32).

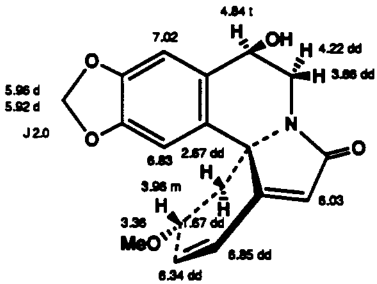
22 (+)-CRYSTAMIDINE
[(+)-10,11-Dehydro-8-oxoerythraline]



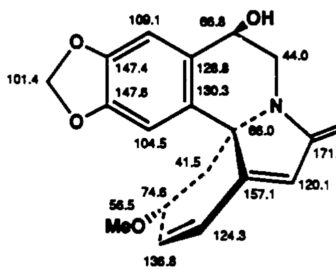
J 1,2	10.0		
J 1,3	2.5		
J 3,4ax	10.0	J 11,10	7.0
J 3,4eq	5.0		
J 4gem	10.0		

$C_{18}H_{15}O_4N$: 309.1001
Oil (32)
$[\alpha]^{23}$D: +840° (c = 0.5, $CHCl_3$) (32)
UV: 235 (4.13), 267 (4.15), 357 (3.31) (32)
IR: 1695 (32)
^{1}H NMR: (32)
MS: $[M]^+$ 309, 294, 278, 276 (100) (32)
SOURCES: *Erythrina crista-galli* (32), *E. brucei* (29)
This compound may be an artifact (38).

23 (+)-8-OXOERYTHRININE

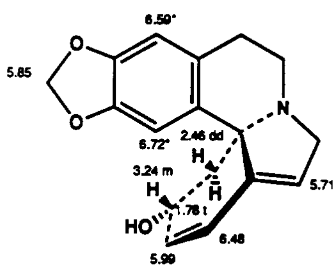


J 1,2 11.4
J 1,3 2.0
J 3,4ax 11.0
J 3,4eq 5.0
J 4gem 11.0
J 11eq,10eq 4.0
J 11eq,10ax 4.0
J 10gem 14.0



$C_{18}H_{17}O_5N$: 327.1107
Oil (29)
[α]D: +100° (*c* = 0.35, $CHCl_3$) (29)
UV: 238 (4.10), 272 (3.83), 357 (3.01) (29)
IR: 870, 930, 1040, 1100, 1250, 1485, 1505, 1680, 2960, 3040, 3460 (29)
^1H NMR: (400 MHz) (29)
^{13}C NMR: (100 MHz) (29)
MS: $[M]^+$ 327 (93), 312 (72), 296 (85), 295 (68), 294 (100), 282 (49), 238 (64) (29)
SOURCES: *Erythrina brucei* (29)

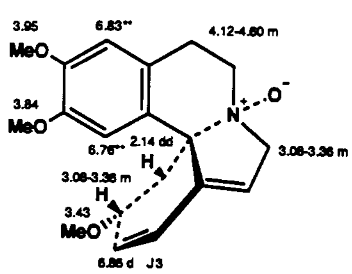
24 (+)-ERYTHROCARINE



J 3,4ax 11.0
J 3,4eq 6.0
J 4gem 11.0

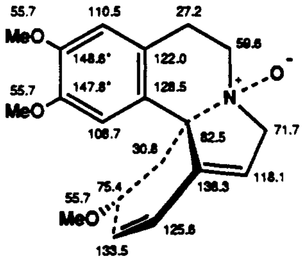
$C_{17}H_{17}O_3N$: 283.1208
Gum (19)
UV: 235 (19)
^1H NMR: (19)
MS: $[M]^+$ 283, 282, 266, 264 (19)
CD: 290 (trough) (19)
SOURCES: *Erythrina caribaea* (19)

25 (+)-ERYSOTRINE *N*-OXIDE

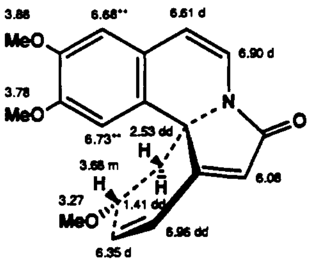


J 3,4eq 5.5
J 4gem 11.0

$C_{19}H_{23}O_4N$: 329.1627
Oil (3)
$[\alpha]^{25}D$: +78.3° (*c* = 1.0, EtOH) (3)
UV: 231 (4.15), 278 (3.46) (3)
IR: (KBr) 1610 (3)
^1H NMR: (360 MHz) (M.E. Amer *et al.*, unpublished results)
^{13}C NMR: (25.2 MHz) (3)
MS: $[M]^+$ 329 (5), 313 (10), 311 (10), 298 (12), 282 (20), 269 (90), 254 (36), 239 (100), 224 (55), 165 (62), 152 (52) (3)
SOURCES: *Erythrina mulungu* (3), *E. lysistemon* (M.E. Amer *et al.*, unpublished results)



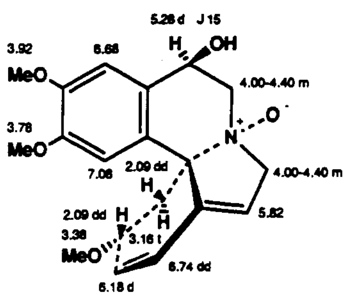
26 (+)-ERYTHARBINE



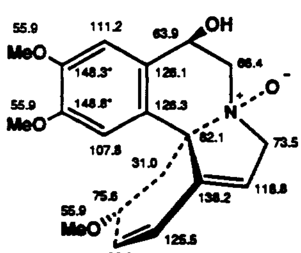
J 1,2	10.0
J 1,3	2.5
J 3,4ax	10.5
J 3,4eq	5.0
J 4gem	10.5
J 10,11	7.0

$C_{19}H_{19}O_4N$: 325.1314
Oil (6)
[α]D: +848° (c = 0.56, $CHCl_3$) (6)
UV: 233 (4.17), 265 (4.16), 350 (3.17 sh) (6)
IR: 1685 (6)
^{1}H NMR: (6)
MS: $[M]^+$ 325, 310, 294, 292 (6)
SOURCES: *Erythrina arborescens* (6)
This compound may be an artifact (38).

27 (+)-ERYTHRARTINE *N*-OXIDE

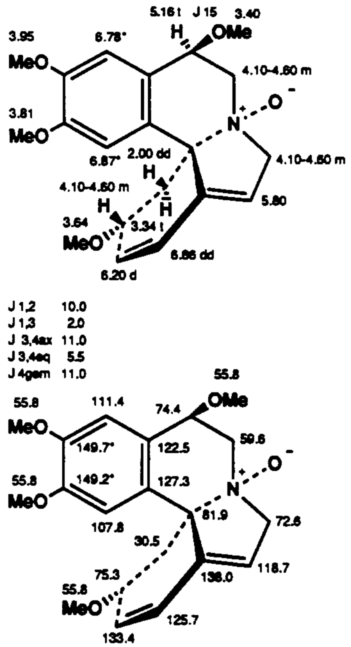


J 1,2	10.0
J 1,3	2.0
J 3,4ax	10.5
J 3,4eq	5.0
J 4gem	10.5



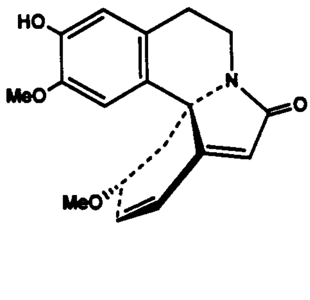
$C_{19}H_{23}O_5N$: 345.1576
$[\alpha]^{25}D$: +88.57° (c = 1.4, EtOH) (3)
UV: 231 (4.15), 278 (3.46) (3)
IR: (KBr) 1610 (3)
^{1}H NMR: (100 MHz) (3)
^{13}C NMR: (25.2 MHz) (3)
MS: $[M]^+$ 345 (4), 329 (26), 326 (29), 298 (70), 239 (100), 224 (45), 165 (47), 152 (39) (3)
SOURCES: *Erythrina mulungu* (3)

28 (+)-*O*-METHYLERYTHRARTINE *N*-OXIDE



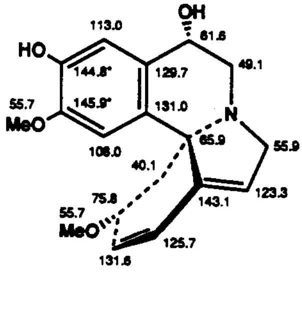
$C_{20}H_{25}O_5N$: 359.1733
^{1}H NMR: (100 MHz) (3)
^{13}C NMR: (25.2 MHz) (3)
SOURCES: Semi-synthesis (3)

29 (+)-8-OXOERYSODINE



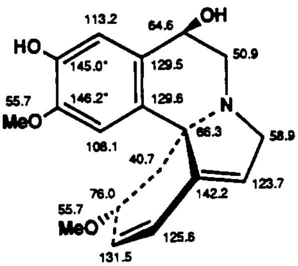
$C_{18}H_{19}O_4N$: 313.1314
SOURCES: *Erythrina tahitensis* (36,37)
Minimal structural proof.

30 (+)-11α-HYDROXYERYSODINE



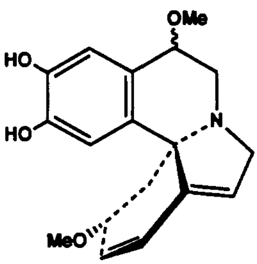
$C_{18}H_{21}O_4N$: 315.1470
^{13}C NMR: (90.6 MHz) (12)
SOURCES: *Erythrina lysistemon* (36,37)

31 (+)-11β-HYDROXYERYSODINE



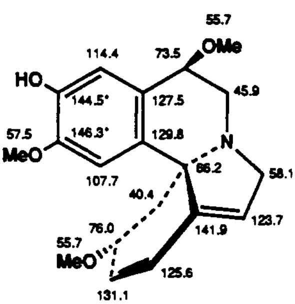
$C_{18}H_{21}O_4N$: 315.1470
^{13}C NMR: (60.6 MHz) (12)
SOURCES: *Erythrina lysistemon* (36,37), *E. senegalensis, E. latissima, E. livingstoniana* (5)

32 (+)-11-METHOXYERYSOPINE



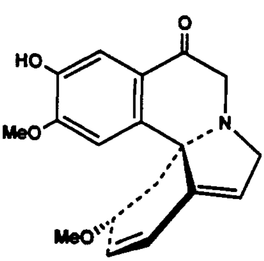
$C_{18}H_{21}O_4N$: 315.1470
SOURCES: *Erythrina caffra* (5)
Minimal structural proof.

33 (+)-11β-METHOXYERYSODINE



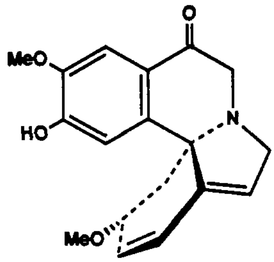
$C_{19}H_{23}O_4N$: 329.1627
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 329, 314, 298, 297, 282, 266 (36,37)
SOURCES: *Erythrina lysistemon* (36,37), *E. caffra* (5)

34 (+)-11-OXOERYSODINE



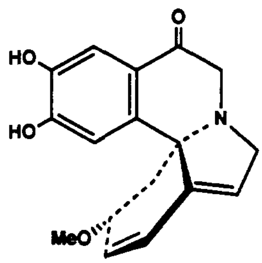
$C_{18}H_{19}O_4N$: 313.1314
SOURCES: *Erythrina arborescens, E. caffra, E. senegalensis, E. excelsa, E. livingstoniana, E. abyssinica, E. tahitensis* (5)
Minimal structural proof.

35 (+)-11-OXOERYSOVINE



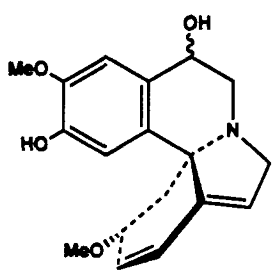
$C_{18}H_{19}O_4N$: 313.1314
SOURCES: *Erythrina arborescens*, *E. livingstoniana*, *E. tahitensis* (5)
Minimal structural proof.

36 (+)-11-OXOERYSOPINE



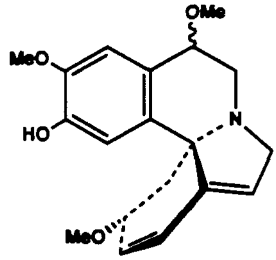
$C_{17}H_{17}O_4N$: 299.1157
SOURCES: *Erythrina arborescens*, *E. tahitensis* (5)
Minimal structural proof.

37 (+)-11-HYDROXYERYSOVINE



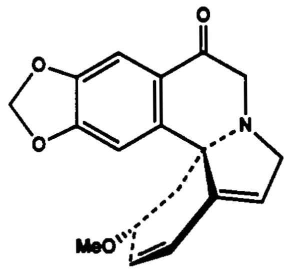
$C_{18}H_{21}O_4N$: 315.1470
SOURCES: *Erythrina arborescens*, *E. lysistemon*, *E. senegalensis* (5)
Minimal structural proof.

38 (+)-11-METHOXYERYSOVINE



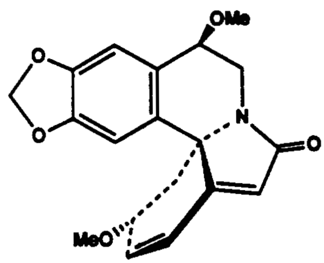
$C_{19}H_{23}O_4N$: 329.1627
SOURCES: *Erythrina lysistemon*, *E. abyssinica* (5)
Minimal structural proof.

39 (+)-11-OXOERYTHRALINE



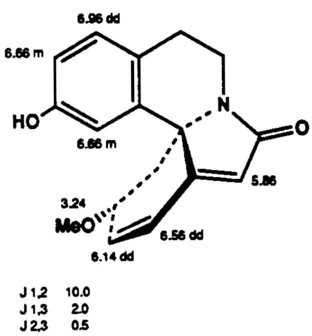
$C_{18}H_{17}O_4N$: 311.1157
SOURCES: *Erythrina zeberi* (5)
Minimal structural proof.

40 (+)-8-OXO-11β-METHOXY-ERYTHRALINE



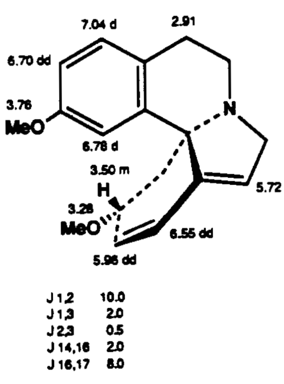
$C_{19}H_{19}O_5N$: 341.1263
SOURCES: *Erythrina lysistemon* (36,37)
Minimal structural proof.

41 (+)-COCCOLINE



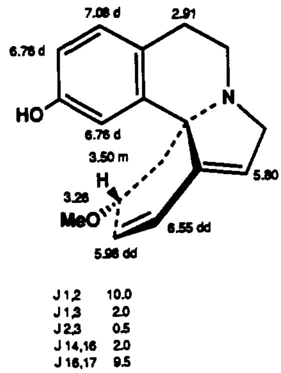
$C_{17}H_{17}O_3N$: 283.1208
MP: 245–246° (EtOAc) (55)
[α]D: +233° (*c* = 1.08, MeOH) (55)
UV: 231, 258 (55)
IR: (KBr) 1235, 1270, 1455, 1500, 1665, 2900 (55)
^{1}H NMR: (55)
MS: $[M]^+$ 283, 268, 252, 240, 222, 210, 181 (55)
SOURCES: *Cocculus laurifolia* (55)

42 (+)-COCCUVININE



$C_{18}H_{21}O_2N$: 283.1572
MP: 103–104° (hexane) (63)
UV: 228, 282 (63)
IR: (KBr) 1101, 1230, 1283, 1497, 1603, 2941 (63)
^{1}H NMR: (63)
MS: $[M]^+$ 283, 268, 252 (100), 225, 223, 212, 199 (63)
SOURCES: *Cocculus laurifolia* (63)

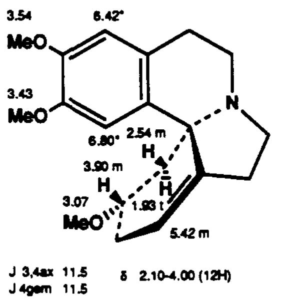
43 (+)-COCCUVINE



$C_{17}H_{19}O_2N$: 269.1416
MP: 137–138° (64)
UV: 228, 282 (64)
IR: 3450 (64)
^{1}H NMR: (64)
MS: $[M]^+$ 269, 254, 238 (100), 211, 209, 198, 185 (64)
SOURCES: *Cocculus laurifolia* (64)

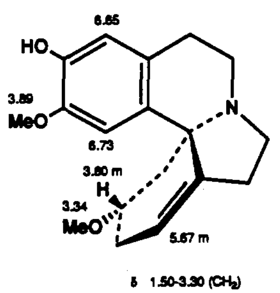
ALKENOIDS

44 (+)-DIHYDROERYSOTRINE



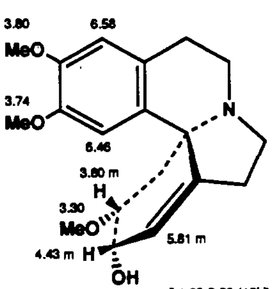
$C_{19}H_{25}O_3N$: 315.1834
Gum (30)
$[\alpha]^{25}D$: +220° (c = 0.8, EtOH) (30)
UV: 228 (3.86), 284 (3.51) (30)
^{1}H NMR: (90 MHz, C_6D_6) (56)
MS: $[M]^+$ 315, 284, 257 (100), 256 (30)
SOURCES: Semi-synthesis (30,56)

45 (+)-DIHYDROERYSODINE

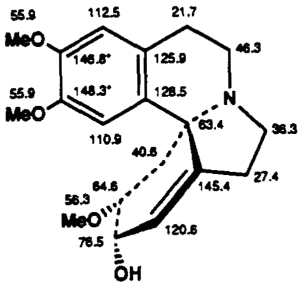


$C_{18}H_{23}O_3N$: 301.1678
MP: 208–209° (38)
$[\alpha]D$: +224° (38)
^{1}H NMR: (100 MHz) (11)
MS: TMSi derivative 373 (3), 342 (13), 315 (100), 314 (95), 300 (11), 210 (19) (11)
SOURCES: *Cocculus laurifolia* (38), synthesis (68)
Semi-synthesis (11)

46 (+)-ERYTHRATIDINE

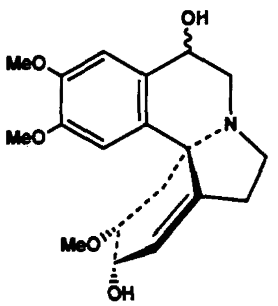


$C_{19}H_{25}O_4N$: 331.1783
MP: 120–120.5° (EtOAc/petroleum ether) (23)
$[\alpha]D$: +273° (c = 0.109, EtOH) (23)
UV: 232 (3.76), 284 (3.41) (23)
IR: 3387, 3509 (23)
^{1}H NMR: (23)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 331, 300, 273, 257 (100), 244 (23)
SOURCES: *Erythrina poeppigiana, E. coralloides, E. goldmanii, E. guatemalensis, E. steyermarkii, E. barqueroana, E. salviiflora, E. oliviae, E. falcata* (4), *E. arborescens, E. senegalensis, E. excelsa, E. livingstoniana, E.*



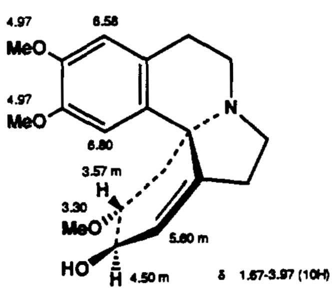
sigmoidea, *E. latissima*, *E. abyssinica*, *E. tahitensis*, *E. burana*, *E. perrieri* (5), *E. lysistemon* (12), *E. variegata* (2), *E. melanacantha* (36), *E. macrophylla* (50)

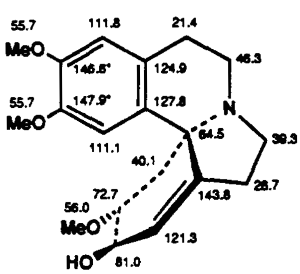
47 (+)-11-HYDROXYERYTHRATIDINE



$C_{19}H_{25}O_5N$: 347.1733
MS: TMSi derivative $[M]^+$ 491 (10), 476 (2), 401 (30), 400 (100), 385 (30), 370 (20), 356 (12), 345 (11), 307 (10), 197 (40), 73 (80) (21)
SOURCES: *Erythrina berteroana* (21), *E. poeppigiana* (50)
Minimal structural proof.

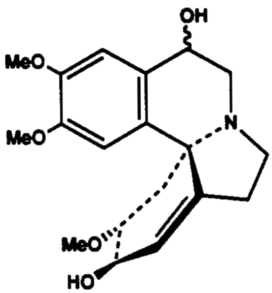
48 (+)-EPIERYTHRATIDINE





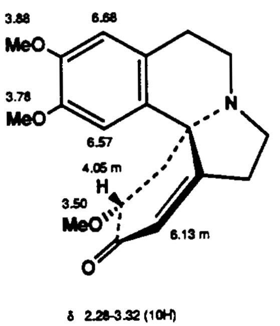
$C_{19}H_{25}O_4N$: 331.1783
MP: 67–68° (EtOAc/petroleum ether) (23)
$[\alpha]_D$: +142° (c = 0.148, $CHCl_3$) (23)
IR: 3427, 3574 (23)
^{1}H NMR: (23)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 331, 300, 273, 257, 244 (23)
SOURCES: *Erythrina fusca* (12), *E. variegata* (2)
Semi-synthesis (23)

49 (+)-11-HYDROXYEPIERYTHRATIDINE



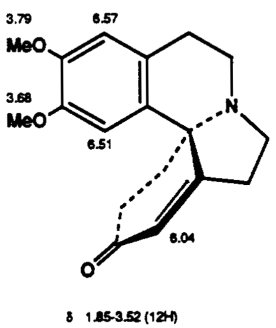
$C_{19}H_{25}O_5N$: 347.1733
MS: TMSi derivative $[M]^+$ 451, 433 (75), 345 (100) (2)
SOURCES: *Erythrina variegata* (2), *E. poeppigiana* (50), *E. subumbrans* (51)
Minimal structural proof.

50 (+)-ERYTHRATIDINONE



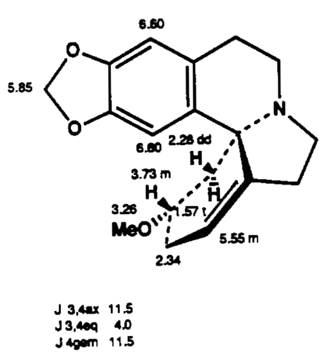
$C_{19}H_{23}O_4N$: 329.1627
MP: 119–120° (C_6H_6/petroleum ether) (23)
[α]D: +358° (*c* = 1.121, $CHCl_3$) (23)
UV: 284 (3.60) (23)
IR: 1675 (23)
^{1}H NMR: (23)
MS: $[M]^+$ 329, 301, 298, 286, 272, 271 (100), 243, 242, 228, 215, 214, 197 (23)
SOURCES: *Erythrina variegata* (23)

51 (+)-3-DEMETHOXYERYTHRATIDINONE



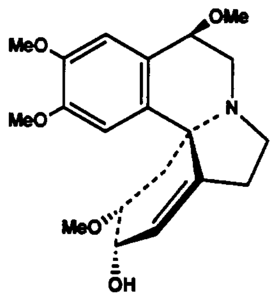
$C_{18}H_{21}O_3N$: 299.1521
MP: 111–112° (C_6H_6/petroleum ether) (23)
[α]D: +325° (*c* = 0.249, $CHCl_3$) (23)
UV: 284 (1.54) (23)
IR: 1667 (23)
^{1}H NMR: (23)
MS: $[M]^+$ 299, 272, 271 (100), 243, 242, 222, 215, 214, 212, 197 (23)
SOURCES: *Erythrina variegata* (23)

52 (+)-ERYTHRAMINE



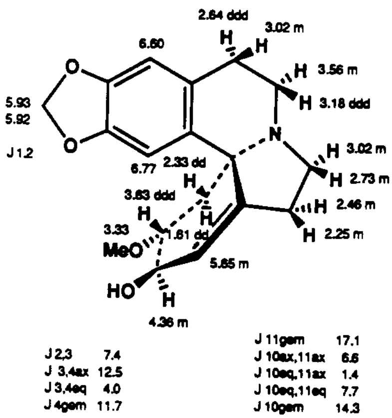
$C_{18}H_{21}O_3N$: 299.1521
MP: 120–121° (Et_2O) (39)
[α]D: +168° (*c* = 0.33) (39)
^{1}H NMR: (29,39)
MS: $[M]^+$ 299 (20), 268 (15), 241 (74), 240 (100) (40)
SOURCES: *Erythrina glauca* (39), *E. sandwicensis*, *E. subumbrans* (41), *E. crista-galli* (4), *E. arborescens*, *E. variegata* (5)
Semi-synthesis (39)

53 (+)-11-METHOXYERYTHRATIDINE



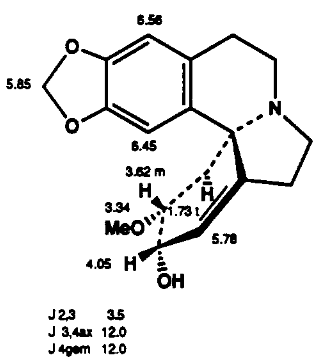
$C_{20}H_{27}O_5N$: 361.1889
SOURCES: *Erythrina macrophylla* (50), *E. brucei*, *E. cochleata* (19), *E. subumbrans* (51)
Minimal structural proof.

54 (+)-ERYTHRATINE



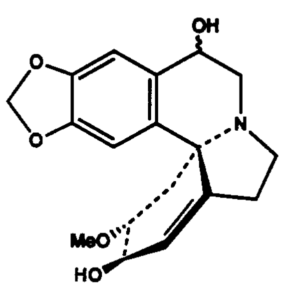
$C_{18}H_{21}O_4N$: 315.1470
MP: 174–179° (14)
$[\alpha]^{24}D$: +140° (c=0.4, EtOH) (14)
UV: 238, 292 (14)
IR: 3610 (14)
^1H NMR: (360 MHz) (69)
MS: $[M]^+$ 315, 297, 284, 282, 266, 257, 241 (100), 228 (14)
SOURCES: *Erythrina crista-galli* (14,39), *E. arborescens*, *E. variegata*, *E. abyssinica* (5), *E. glauca*, *E. fusca*, *E. folkersii*, *E. velutina*, *E. macrophylla* (13), *E. subumbrans* (51), *E. caffra* (69)

55 (+)-EPIERYTHRATINE



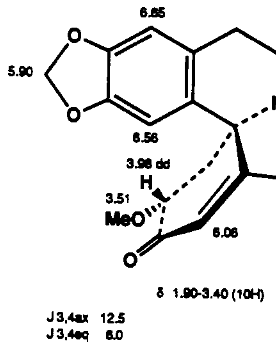
$C_{18}H_{21}O_4N$: 315.1470
MP: 147–150° (39)
$[\alpha]^{24}D$: +280° (c=0.345) (39)
IR: 3350, 3570 (39)
^1H NMR: (39)
SOURCES: *Erythrina subumbrans* (51)
Semi-synthesis (39)

56 (+)-11-HYDROXYERYTHRATINE



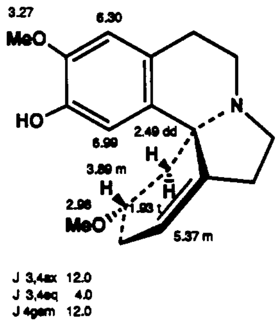
$C_{18}H_{21}O_5N$: 331.1420
SOURCES: *Erythrina macrophylla* (50), *E. subumbrans* (51)
Minimal structural proof.

57 (+)-ERYTHRATINONE



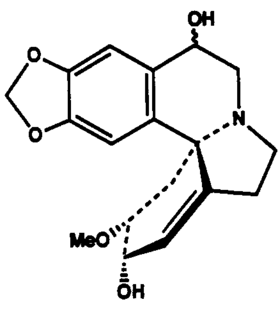
$C_{18}H_{19}O_4N$: 313.1314
MP: 136–137° (39)
$[\alpha]^{22.5}D$: +409° (c=0.35) (39)
UV: 294 (3.68) (39)
IR: 1675 (39)
^{1}H NMR: (39)
MS: $[M]^+$ 313, 270, 255 (100), 227, 226, 199, 198 (39)
SOURCES: *Erythrina glauca* (39), *E. crista-galli, E. lithosperma* (4)

58 (+)-DIHYDROERYSOVINE



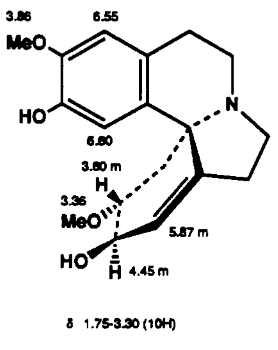
$C_{18}H_{23}O_3N$: 301.1678
Oil (42)
$[\alpha]D$: +223° ($CHCl_3$) (42)
UV: 232 (3.83), 299 (3.55) (42)
IR: 3500 (42)
^{1}H NMR: (C_6D_6) (42)
MS: $[M]^+$ 301, 243, 242 (42)
SOURCES: *Cocculus trilobus* (42)

59 (+)-11-HYDROXYEPIERYTHRATINE



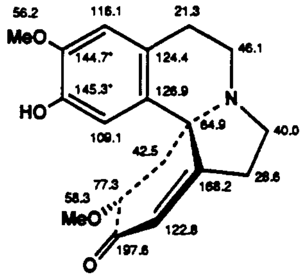
$C_{18}H_{21}O_5N$: 331.1420
SOURCES: *Erythrina subumbrans* (51)
Minimal structural proof.

60 (+)-ERYSOSALVINE



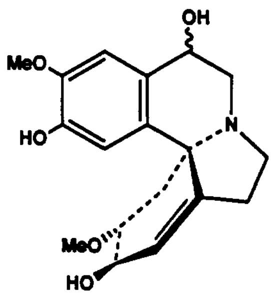
$C_{18}H_{23}O_4N$: 317.1627
^{1}H NMR: (60 MHz) (11)
MS: $[M]^+$ 317 (8), 286 (14), 259 (93), 258 (23), 243 (100), 242 (26) (11)
SOURCES: *Erythrina latissima, E. arborescens, E. livingstoniana, E. tahitensis, E. burana* (5), *E. oliviae, E. salviiflora* (4), *E. melanacantha* (51)

61 (+)-ERYSOSALVINONE



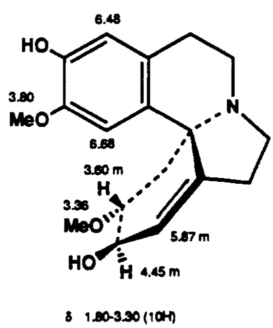
$C_{18}H_{21}O_4N$: 315.1470
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 315 (3), 257 (75), 256 (11), 229 (70), 228 (100), 242 (15) (11)
SOURCES: *Erythrina salviiflora* (11)
Minimal structural proof.

62 (+)-11-HYDROXYERYSOSALVINE



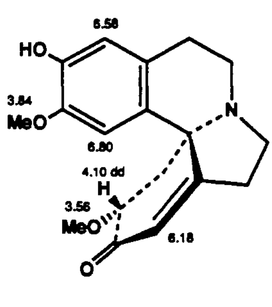
$C_{18}H_{23}O_5N$: 333.1576
MS: TMSi derivative $[M]^+$ 549 (7), 460 (20), 458 (100), 403 (41), 73 (95) (21)
SOURCES: *Erythrina berteroana* (21)
Minimal structural proof.

63 (+)-ERYSOTINE



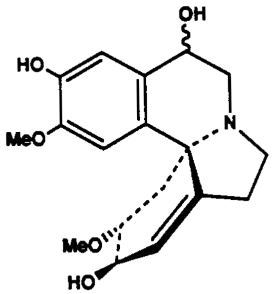
$C_{18}H_{23}O_4N$: 317.1627
MP: 225–227° (Et_2O) (11)
^1H NMR: (60 MHz) (11)
MS: $[M]^+$ 317 (8), 286, (14), 259 (93), 258 (23), 243 (100), 242 (26) (11)
SOURCES: *Erythrina salviiflora* (11), *E. oliviae* (4), *E. variegata* (5), *E. melanacantha* (36), *E. thollonia* (19)

64 (+)-ERYSOTINONE



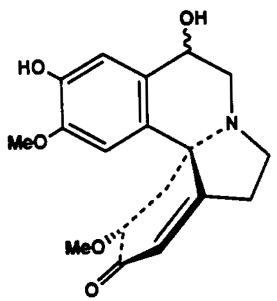
$C_{18}H_{21}O_4N$: 315.1470
MP: 177–179° (Et_2O) (11)
$[\alpha]^{25}D$: +342° (c = 0.28, EtOH) (11)
UV: 226 (11)
IR: 1675 (11)
^1H NMR: (100 MHz) (11)
MS: $[M]^+$ 315 (3), 257 (75), 256 (11), 299 (70), 228 (100), 242 (15) (11)
SOURCES: *Erythrina salviiflora* (11)

65 (+)-11-HYDROXYERYSOTINE



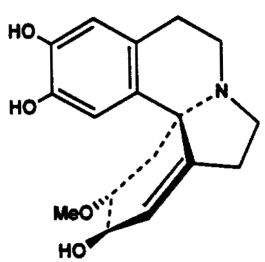
$C_{18}H_{23}O_5N$: 333.1576
MS: TMSi derivative [M]$^+$ 549 (7), 460 (20), 458 (100), 403 (41), 73 (95) (21)
SOURCES: *Erythrina berteroana* (21)
Minimal structural proof.

66 (+)-11-HYDROXYERYSOTINONE



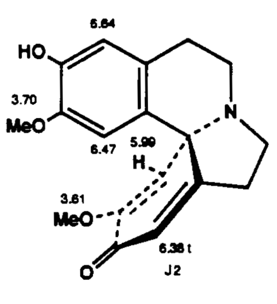
$C_{18}H_{21}O_5N$: 331.1420
SOURCES: *Erythrina macrophylla* (50)
Minimal structural proof.

67 (+)-ERYSOPITINE



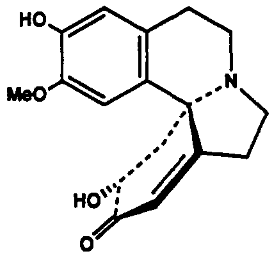
$C_{17}H_{21}O_4N$: 303.1470
MP: 168–171° (43)
$[\alpha]^{25}D$: +148° (c = 0.52, EtOH) (43)
UV: 285–287 (4.31) (43)
MS: [M]$^+$ 303 (92), 288 (18), 271 (100), 245 (41) (43)
SOURCES: *Erythrina variegata* (43)
Minimal structural proof.

68 (+)-ERYSODIENONE



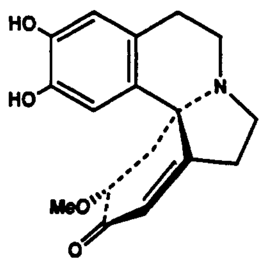
$C_{18}H_{19}O_4N$: 313.1314
MP: 222–225° (EtOH) (43)
UV: 240–242 (4.32), 285 (3.55) (43)
IR: 1614, 1655, 1672, 3286, 3533 (43)
^1H NMR: (39)
MS: [M]$^+$ 313 (62), 298 (17), 282 (100) (46)
SOURCES: *Erythrina lithosperma* (46), *E. variegata* (43)
Synthetic (39)

69 (+)-DEMETHYLERYSOTINONE



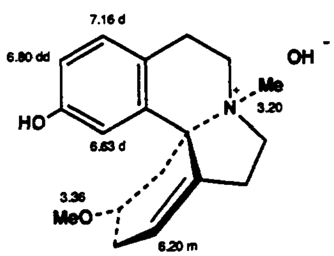
$C_{17}H_{19}O_4N$: 301.1314
MP: 191–194° (40)
UV: 231 (3.84), 283 (3.41) (40)
IR: 1670, 3400 (40)
MS: [M]$^+$ 301 (40)
SOURCES: Semi-synthesis (40)
Minimal structural proof.

70 (+)-ERYSOFLORINONE



$C_{17}H_{19}O_4N$: 301.1314
MS: TMSi derivative 445, 430 (9), 414 (4), 387 (26), 386 (9), 358 (37), 300 (14), 298 (14), 270 (100) (11)
SOURCES: *Erythrina salviiflora* (11), *E. subumbrans* (51)
Minimal structural proof.

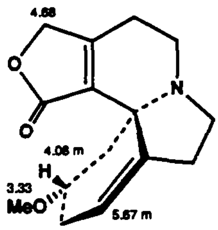
71 (+)-PACHYGONINE HYDROXIDE



J 14,16 2.0
J 16,17 8.0

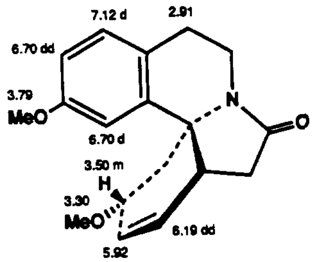
$C_{18}H_{25}O_3N$: 303.1834
MP: 265–267° (MeOH/EtOH) (dec) (52)
[α]D: +196.61° (c = 4.7, MeOH) (52)
UV: 228 (3.91), 285 (3.36); (+NaOH) 251, 307 (52)
^{1}H NMR: (52)
MS: [M]$^+$ 286, 285, 271, 270, 254, 227, 213, 212 (100) (52)
SOURCES: *Pachygone ovata* (Menispermaceae) (52)

72 (+)-COCCULOLIDINE



$C_{15}H_{19}O_3N$: 261.1365
MP: 144–146° (53)
[α]^{25}D: +273° (c = 1.0, $CHCl_3$) (53)
UV: 215 (53)
IR: 1650, 1760 (53)
^{1}H NMR: (53)
MS: [M]$^+$ 261 (53)
SOURCES: *Cocculus trilobus* (53)

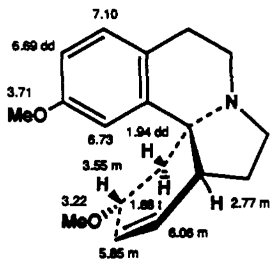
73 (+)-COCCOLININE



J 1,2 10.0
J 1,3 0.5
J 14,16 2.0
J 16,17 10.0

$C_{18}H_{21}O_3N$: 297.1365
MP: 174–175° (54)
UV: (MeOH) 230, 256, 284 (54)
IR: 1665 (54)
^{1}H NMR: (54)
MS: [M]$^+$ 297 (100), 282, 268, 266, 254, 238, 236, 210 (54)
SOURCES: *Cocculus laurifolia* (54)
The molecular formula given in Pande *et al.* (54) does not correspond to the structure proposed.

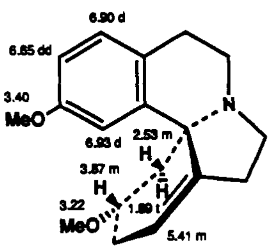
74 (+)-ISOCOCCULIDINE



J 3,4ax 10.0
J 3,4eq 6.0
J 4gem 12.0
J 14,16 2.5
J 16,17 8.0

$C_{18}H_{23}O_2N$: 285.1729
MP: 95–96° (C_6H_6/hexane) (55)
[α]D: +124° (*c* = 1.2, MeOH) (55)
UV: 230, 280 (55)
IR: (KBr) 882, 1104, 1241, 1470, 1603, 2784, 2904 (55)
^{1}H NMR: (55)
MS: [M]$^+$ 285, 270, 251, 241, 240, 226, 212, 200 (55)
SOURCES: *Cocculus laurifolia* (55)

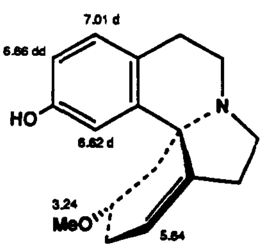
75 (+)-COCCULIDINE



J 3,4ax 12.0
J 4gem 12.0
J 14,16 2.5
J 16,17 8.5

$C_{18}H_{23}O_2N$: 285.1729
MP: 93–95° (petroleum ether) (56)
[α]D: +260° (55)
^{1}H NMR: (90 MHz, C_6D_6) (56)
MS: [M]$^+$ 285 (56)
SOURCES: *Cocculus laurifolia* (55)

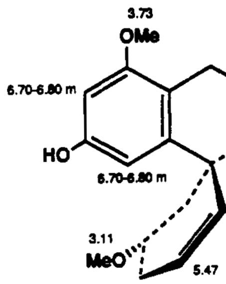
76 (+)-COCCULINE



J 14,16 3.0
J 16,17 8.0

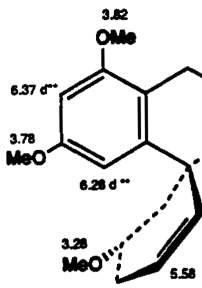
$C_{17}H_{21}O_2N$: 271.1572
MP: 220–221° (EtOAc) (55)
[α]D: +252° (*c* = 1.32, MeOH) (55)
^{1}H NMR: (57)
X-RAY: hydrobromide (66,67)
SOURCES: *Cocculus laurifolia* (55,58), *C. trilobus* (57)

77 (+)-COCCUTRINE



$C_{18}H_{23}O_3N$: 301.1678
MP: 263–265° (57)
[α]D: +232° (MeOH) (57)
[1]H NMR: (pyridine-d_5) (57)
X-RAY: hydrobromide (67)
MS: $[M]^+$ 301, 243 (100), 242, 226 (57)
SOURCES: *Cocculus trilobus* (57)

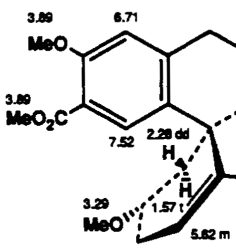
78 (+)-*O*-METHYLCOCCUTRINE



J 14,16 2.5

$C_{19}H_{25}O_3N$: 315.1834
Oil (57)
[1]H NMR: (57)
SOURCES: Semi-synthesis (57)

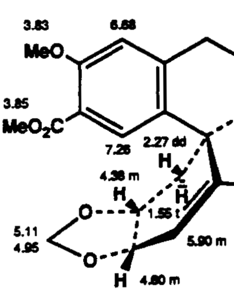
79 (+)-ERYTHROCULINE



J 3,4ax 12.0
J 3,4eq 4.0
J 4gem 12.0

$C_{20}H_{25}O_4N$: 343.1783
MP: 79–82° (Et_2O/pentane) (59)
$[\alpha]^{25}D$: +216° (c = 1.05, $CHCl_3$) (59)
UV: 214 (4.38), 238 (3.93 sh), 303 (3.49) (59)
IR: 1500, 1611, 1716 (59)
ORD: (EtOH) $[\theta]_{296}$ + 1150°, $[\theta]_{315}$ + 1250° (peak) (59)
[1]H NMR: (100 MHz, $CDCl_3$, TMS) (59)
MS: $[M]^+$ 343 (7), 328 (0.5), 312 (13), 285 (100) (59)
SOURCES: *Hyperbaena columbica* (Menispermaceae) (59), *Cocculus laurifolia* (60,61)

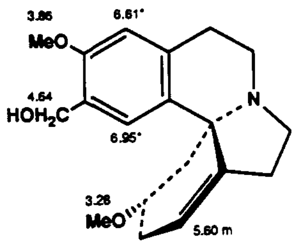
80 (+)-3-DEMETHOXY-2α,3α-METHYLENEDIOXYERYTHROCULINE



J 3,4ax 11.5
J 3,4eq 6.0
J 4gem 11.5

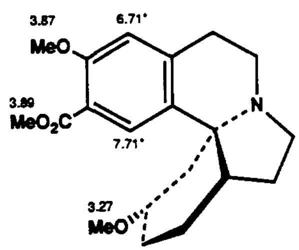
$C_{20}H_{23}O_5N$: 357.1576
MP: 94–97° (MeOH) (59)
$[\alpha]^{25}D$: +229° (c = 0.56, $CHCl_3$) (59)
UV: 215 (4.55), 238 (4.07), 305 (3.54) (59)
IR: (KBr) 1500, 1612, 1732 (59)
ORD: (EtOH) $[\theta]_{294}$ + 2100°, $[\theta]_{315}$ + 2400° (peak) (59)
[1]H NMR: (200 MHz, $CDCl_3$, TMS) (59)
MS: $[M]^+$ 357 (16), 342 (0.4), 326 (7), 300 (100), 285 (83) (59)
SOURCES: *Hyperbaena columbica* (59)

81 (+)-ERYTHROCULINOL



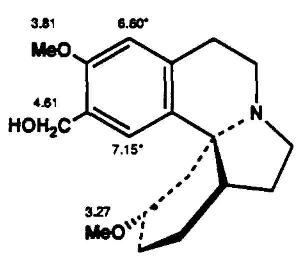
$C_{19}H_{25}O_3N$: 315.1834
MP: 150–152° (Me_2CO) (61)
$[\alpha]^{20}D$: +210° (*c* = 1.02, $CHCl_3$) (61)
UV: 280 (3.40), 284 (3.41) (61)
IR: 3600 (61)
^1H NMR: (61)
MS: $[M]^+$ 315, 284, 257 (100), 238, 226 (61)
SOURCES: Semi-synthesis (61)

82 (+)-DIHYDROERYTHROCULINE



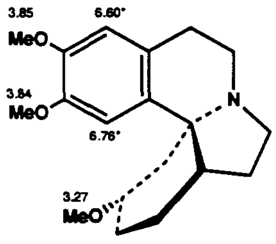
$C_{20}H_{27}O_4N$: 345.1940
UV: 304 (3.65) (61)
IR: 1710 (61)
^1H NMR: (61)
SOURCES: Semi-synthesis (61)

83 (+)-DIHYDROERYTHROCULINOL



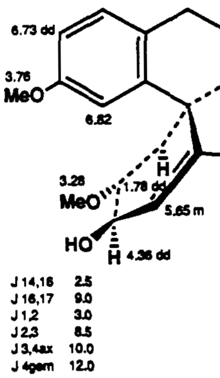
$C_{19}H_{27}O_3N$: 317.1991
IR: 3550 (61)
^1H NMR: (61)
SOURCES: Semi-synthesis (61)

84 (−)-TETRAHYDROERYSOTRINE



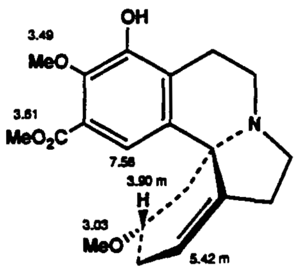
$C_{19}H_{27}O_3N$: 317.1991
Oil (61)
$[\alpha]^{25}D$: −24.0 (*c* = 0.83, EtOH) (61)
^1H NMR: (61)
SOURCES: Semi-synthesis (61)

85 (+)-COCCULITINE



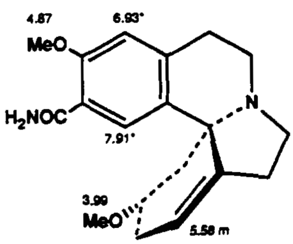
$C_{18}H_{23}O_3N$: 301.1678
MP: 142–143° (EtOAc) (62)
$[\alpha]^{25}D$: +93° (c=0.4, MeOH) (62)
UV: 235 (3.68), 287 (3.60) (62)
IR: 1250, 1465, 1500, 1608, 3400 (62)
^{1}H NMR: (62)
MS: $[M]^+$ 301, 270, 243, 227, 242, 220, 214, 181, 180, 149 (62)
SOURCES: *Cocculus laurifolia* (62)

86 (+)-ERYTHLAURINE



$C_{20}H_{25}O_5N$: 359.1733
$[\alpha]D$: +232° (c=0.83, EtOH) (65)
UV: 251 (3.78), 304 (3.46) (65)
IR: 1710, 3500 (65)
^{1}H NMR: (C_6D_6) (65)
MS: $[M]^+$ 359, 328, 301 (100) (65)
SOURCES: *Cocculus laurifolia* (65)

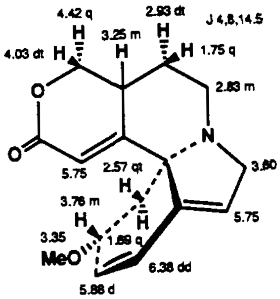
87 (+)-ERYTHRAMIDE



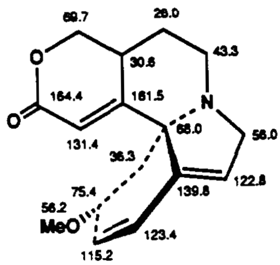
$C_{19}H_{24}O_3N_2$: 328.1787
MP: 87–89° (65)
$[\alpha]^{25}D$: +262° (c=0.16, EtOH) (65)
UV: 240 (3.96), 297 (3.51) (65)
IR: 1660, 3350, 3500 (65)
^{1}H NMR: (Me_2CO-d_6) (65)
MS: $[M]^+$ 328, 270 (100) (65)
SOURCES: *Cocculus laurifolia* (65)

LACTONIC DIENOIDS

88 (+)-α-ERYTHROIDINE

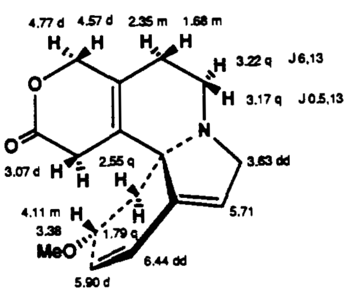


J 17ax,17a	5.5
J 17eq,17a	9.0
J 17gem	11.5
J 3,4ax	10.5
J 3,4eq	5.5
J 4gem	12.0

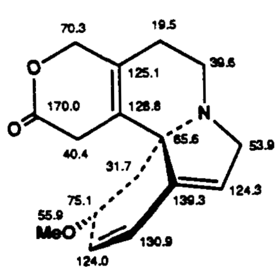


$C_{16}H_{19}O_3N$: 273.1365
$[\alpha]^{20}D$: +123.85° (c = 2.39, H_2O) (44)
UV: 226 (4.18) (44)
IR: (film) 650, 890, 1090, 1730, 2840 (44)
^{1}H NMR: (400 MHz) (21)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 273 (72), 258 (34), 242 (100) (21)
X-RAY: Hydrochloride (49)
SOURCES: *Erythrina berteroana* (21), *E. americana* (44), *E. poeppigiana*, *E. standleyana*, *E. coralloides*, *E. chiapasana*, *E. globocalyx*, *E. oliviae* (4), *E. thollonia* (19)

89 (+)-β-ERYTHROIDINE

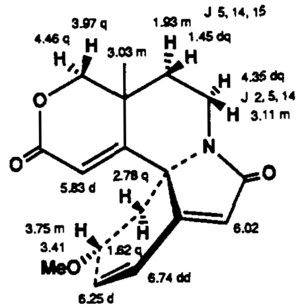


J 1,2	11.0	J 14gem	18.0
J 1,3	2.0	J 17gem	14.0
J 3,4ax	9.0	J 8gem	14.0
J 3,4eq	7.0	J 8α,7	3.5
J 4gem	13.0		



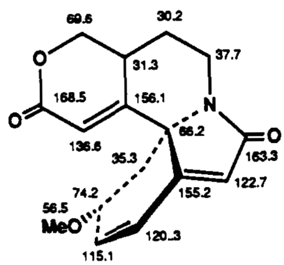
$C_{16}H_{19}O_3N$: 273.1365
MP: 100° (44)
UV: 235 (4.15) (44)
IR: (KBr) 645, 810, 1090, 1720, 2810 (44)
^{1}H NMR: (400 MHz) (21)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 273 (63), 258 (32), 242 (100) (21)
SOURCES: *Erythrina berteroana* (21), *E. americana* (44), *E. poeppigiana*, *E. standleyana*, *E. coralloides*, *E. chiapasana*, *E. globocalyx*, *E. oliviae* (4), *E. thollonia* (19), *E. arborescens*, *E. lithosperma* (5)

90 (+)-8-OXO-α-ERYTHROIDINE



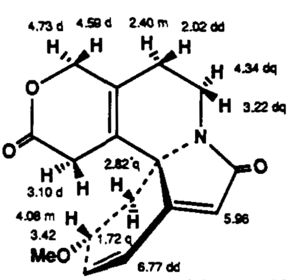
J 1,2	10.0
J 1,3	2.0
J 3,4ax	10.0
J 3,4eq	6.0
J 4gem	12.0

J 17ax,17a	6.0
J 17eq,17a	10.0
J 17gem	12.0



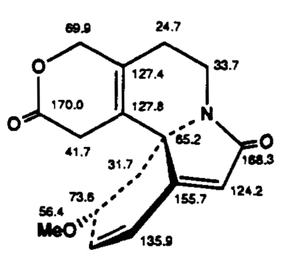
$C_{16}H_{17}O_4N$: 287.1157
MP: 183° (Me_2CO) (21)
[α]D: +137.9° (c = 0.116, EtOH) (21)
UV: 222 (4.19), 253 (4.16) (21)
IR: 1700, 1745 (21)
^{1}H NMR: (400 MHz) (21)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 287 (100), 272, 256 (47) (21)
SOURCES: *Erythrina berteroana* (21), *E. thollonia* (19)

91 (+)-8-OXO-β-ERYTHROIDINE



J 1,2	12.0
J 1,3	2.5
J 3,4ax	10.0
J 3,4eq	6.0
J 4gem	12.0

J 17gem	16.0
J 11gem	15.0
J 10ax,11ax	6.0
J 10eq,11ax	2.0
J 10ax,11eq	8.0
J 10eq,11eq	8.0
J 10gem	14.0

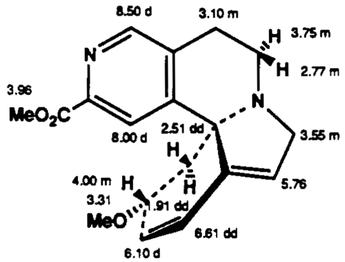


$C_{16}H_{17}O_4N$: 287.1157
Amorphous solid (21)
[α]D: +182° (c = 0.156, EtOH) (21)
UV: 254 (21)
IR: 1700, 1750 (21)
^{1}H NMR: (400 MHz) (21)
^{13}C NMR: (90.6 MHz) (12)
MS: $[M]^+$ 287 (100), 272 (27), 256 (46) (21)
SOURCES: *Erythrina berteroana* (21), *E. thollonia* (19)

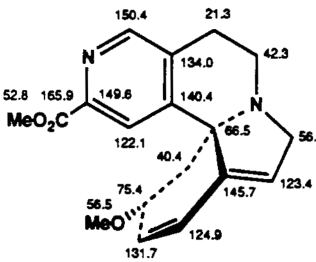
16-AZOERYTHRINANES

92 (+)-ERYMELANTHINE

$C_{18}H_{20}O_3N_2$: 312.1474
MP: 160–161° (16)
$[\alpha]^{22}D$: +87° (*c* = 0.11, MeOH) (16)
UV: 230 (3.90), 270 (3.48) (16)
IR: 820, 930, 1100, 1230, 1290, 1340, 1380, 1430, 1590, 1720, 2950 (16)
^1H NMR: (400 MHz) (16)
^{13}C NMR: (16)
MS: $[M]^+$ 312 (79), 297 (36), 281 (100), 279 (28), 221 (49), 193 (12) (16)
SOURCES: *Erythrina melanacantha* (16,36), *E. merilliana* (36)

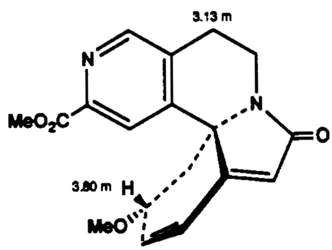


J 1,2	10.0
J 1,3	2.0
J 3,4ax	10.0
J 3,4eq	5.0
J 4gem	12.0
J 14,17	1.0



93 (+)-MELANACANTHINE
[(+)-8-Oxoerymelanthine]

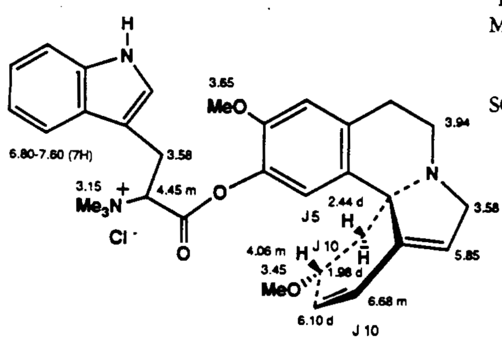
$C_{18}H_{18}O_4N_2$: 326.1266
^1H NMR: (36)
SOURCES: *Erythrina melanacantha* (36)
Minimal structural proof.



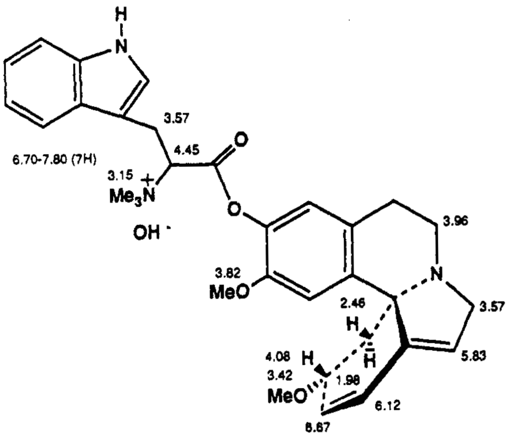
DIMERIC DIENOIDS

94 (+)-ERYSOPHORINE CHLORIDE

$C_{32}H_{38}O_4N_3$ Cl: 563.2551
MP: 260° (dec) (MeOH/Me_2CO) (33)
UV: 222 (4.38), 230 (4.24 sh), 284 (3.82), 292–294 (3.76) (33)
^1H NMR: (60 MHz, D_2O) (33)
MS: 298 (24), 283 (8), 267 (42), 246 (12), 240 (7), 218 (3), 217 (4), 215 (4), 214 (5), 170 (14), 130 (100), 102 (16) (33)
SOURCES: *Erythrina arborescens* (33)

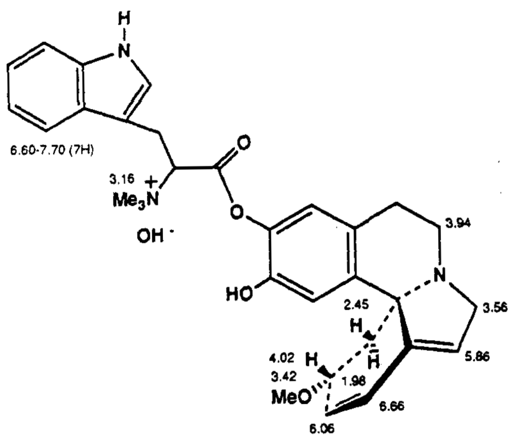


95 (+)-ERYSODINOPHORINE HYDROXIDE



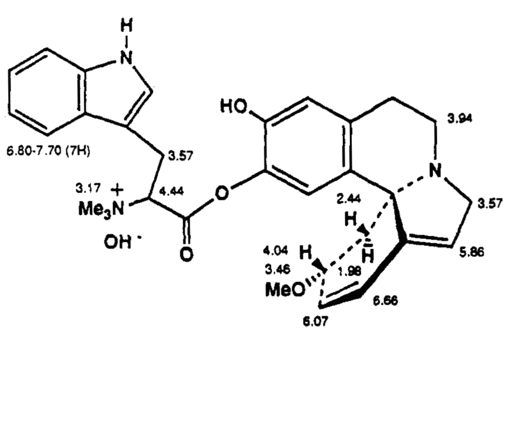
$C_{32}H_{39}O_5N_3$: 545.2889
Syrup (17)
UV: 220, 280, 288 (17)
IR: 1082, 1258, 1496, 1590, 1620, 1754, 3400 (17)
^{1}H NMR: (D_2O) (17)
MS: 298 (30), 285 (6), 283 (8), 267 (40), 240 (18), 227 (5), 215 (6), 214 (3), 187 (12), 170 (18), 143 (40), 130 (100) (17)
SOURCES: *Erythrina arborescens* (17)

96 (+)-ERYSOPINOPHORINE HYDROXIDE



$C_{31}H_{37}O_5N_3$: 531.2733
Syrup (34)
UV: 226, 282, 296 (34)
^{1}H NMR: (D_2O) (34)
MS: 285 (22), 284 (38), 269 (40), 253 (18), 227 (9), 215 (3), 214 (6), 201 (3), 187 (15), 143 (45), 130 (95), 58 (100) (34)
SOURCES: *Erythrina arborescens* (34)

97 (+)-ISOERYSOPINOPHORINE HYDROXIDE



$C_{31}H_{37}O_5N_3$: 531.2733
UV: 226, 286, 294 (35)
IR: 1090, 1285, 1500, 1552, 1618, 1760, 3400 (35)
^{1}H NMR: (D_2O) (35)
MS: 285 (20), 284 (33), 269 (42), 253 (20), 215 (4), 214 (5), 201 (5), 187 (18), 143 (40), 130 (96), 50 (100) (35)
SOURCES: *Erythrina arborescens* (35)

TABLE 1. Listing of Erythrina-Type Alkaloids

Dienoids
(+)-Coccoline [**41**]
(+)-Coccuvine [**43**]
(+)-Coccuvinine [**42**]
(+)-Crystamidine [**22**]
(+)-10,11-Dehydro-8-oxoerythraline [**22**]
(+)-Erysodine [**9**]
(+)-Erysoline [**8**]
(+)-Erysonine [**13**]
(+)-Erysopine [**14**]
(+)-Erysothiopine [**16**]
(+)-Erysothiovine [**15**]
(+)-Erysotramidine [**2**]
(+)-Erysotrine [**1**]
(+)-Erysotrine *N*-oxide [**25**]
(+)-Erysovine [**6**]
(+)-Erytharbine [**26**]
(+)-Erythraline [**18**]
(+)-Erythrartine [**3**]
(+)-Erythrartine *N*-oxide [**27**]
(+)-Erythrascine [**17**]
(+)-Erythravine [**4**]
(+)-Erythrinine [**19**]
(+)-Erythristemine [**5**]
(+)-Erythrocarine [**24**]
(+)-Glucoerysodine [**10**]
(+)-11α-Hydroxyerysodine [**30**]
(+)-11β-Hydroxyerysodine [**31**]
(+)-11β-Hydroxyerysotrine [**3**]
(+)-11-Hydroxyerysovine [**37**]
(+)-11β-Methoxyerysodine [**33**]
(+)-11-Methoxyerysopine [**32**]
(+)-11-Methoxyerysovine [**38**]
(+)-11-Methoxyerythraline [**20**]
(+)-11β-Methoxyglucoerysodine [**11**]
(+)-11β-Methoxyglucoerysovine [**7**]
(+)-*O*-Methylerythrartine *N*-oxide [**28**]
(+)-8-Oxoerysodine [**29**]
(+)-11-Oxoerysodine [**34**]
(+)-11-Oxoerysopine [**36**]
(+)-11-Oxoerysovine [**35**]
(+)-8-Oxoerythraline [**21**]
(+)-11-Oxoerythraline [**39**]
(+)-8-Oxoerythrinine [**23**]
(+)-8-Oxo-11β-methoxyerythraline [**40**]
(+)-Rhamnoerysodine [**12**]
Alkenoids
(+)-Coccolinine [**73**]
(+)-Cocculidine [**75**]
(+)-Cocculine [**76**]
(+)-Cocculitine [**85**]
(+)-Cocculolidine [**72**]
(+)-Coccutrine [**77**]
(+)-3-Demethoxyerythratidinone [**51**]
(+)-3-Demethoxy-2α,3α-methylenedioxy-erythroculine [**80**]
(+)-Demethylerysotinone [**69**]
(+)-Dihydroerysodine [**45**]
(+)-Dihydroerysotrine [**44**]
(+)-Dihydroerysovine [**58**]
(+)-Dihydroerythroculine [**82**]
(+)-Dihydroerythroculinol [**83**]
(+)-Epierythratidine [**48**]
(+)-Epierythratine [**55**]
(+)-Erysodienone [**68**]
(+)-Erysoflorinone [**70**]
(+)-Erysopitine [**67**]
(+)-Erysosalvine [**60**]
(+)-Erysosalvinone [**61**]
(+)-Erysotine [**63**]
(+)-Erysotinone [**64**]
(+)-Erythlaurine [**86**]
(+)-Erythramide [**87**]
(+)-Erythramine [**52**]
(+)-Erythratidine [**46**]
(+)-Erythratidinone [**50**]
(+)-Erythratine [**54**]
(+)-Erythratinone [**57**]
(+)-Erythroculine [**79**]
(+)-Erythroculinol [**81**]
(+)-11-Hydroxyepierythratidine [**49**]
(+)-11-Hydroxyepierythratine [**59**]
(+)-11-Hydroxyerysosalvine [**62**]
(+)-11-Hydroxyerysotine [**65**]
(+)-11-Hydroxyerysotinone [**66**]
(+)-11-Hydroxyerythratidine [**47**]
(+)-11-Hydroxyerythratine [**56**]
(+)-Isococculidine [**74**]
(+)-11-Methoxyerythratidine [**53**]
(+)-*O*-Methylcoccutrine [**78**]
(+)-Pachygonine hydroxide [**71**]
(−)-Tetrahydroerysotrine [**84**]
Lactonic Dienoids
(+)-α-Erythroidine [**88**]
(+)-β-Erythroidine [**89**]
(+)-8-Oxo-α-erythroidine [**90**]
(+)-8-Oxo-β-erythroidine [**91**]
16-Azoerythrinanes
(+)-Erymelanthine [**92**]
(+)-Melanacanthine [**93**]
(+)-8-Oxoerymelanthine [**93**]
Dimeric Dienoids
(+)-Erysodinophorine hydroxide [**95**]
(+)-Erysophorine chloride [**94**]
(+)-Erysopinophorine hydroxide [**96**]
(+)-Isoerysopinophorine hydroxide [**97**]

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