Alkaloids of the Wood of *Cryptocarya chinensis*

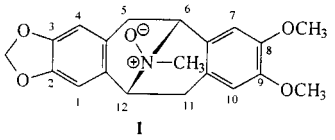
Tian-Shung Wu* and Fu-Wen Lin

Department of Chemistry, National Cheng Kung University, Tainan, Taiwan, Republic of China

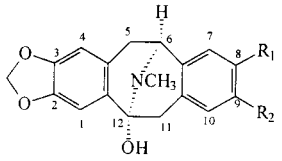
Received May 25, 2001

Four new pavine alkaloids, (+)-eschscholtzidine-*N*-oxide (**1**), (−)-12-hydroxycrychine (**2**), (−)-12-hydroxy-*O*-methylcaryachine (**3**), and (−)-*N*-demethylcrychine (**4**), and four new proaporphine alkaloids, isocryprochine (**5**), prooxocryptochine (**6**), isoamuronine (**7**), and (+)-8,9-dihydrostepharine (**8**), together with nine known compounds were isolated from an ethanol extract of the wood of *Cryptocarya chinensis*. Their structures were elucidated by spectral analysis (NMR and MS), and the structures of **2** and **5** were confirmed by X-ray crystallography.

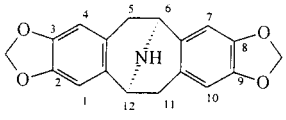
Cryptocarya chinensis (Hance) Hemsl. (Lauraceae) is an evergreen tree widely distributed in low-altitude forest in Taiwan and southern China.[1] This plant is not used as folk medicine in Taiwan. Past studies on this species revealed pavine and proaporphine alkaloids.[2−6] The pavine alkaloids were reported to possess biological activities such as immunological[7] and antiarrhythmic activities.[4] We report here the isolation and characterization of eight new compounds, named (+)-eschscholtzidine-*N*-oxide (**1**), (−)-12-hydroxycrychine (**2**), (−)-12-hydroxyeschscholtzidine (**3**), (−)-*N*-demethylcrychine (**4**), isocryprochine (**5**), prooxocryptochine (**6**), isoamuronine (**7**), and (+)-8,9-dihydrostepharine (**8**), from the ethanol extract of the wood of *C. chinensis*.



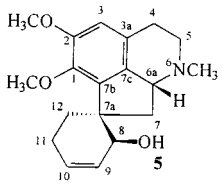
1



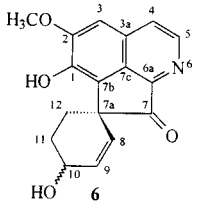
2 $R_1,R_2=OCH_2O$
3 $R_1=R_2=OCH_3$



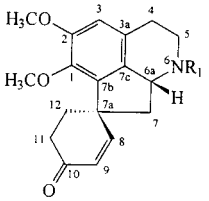
4



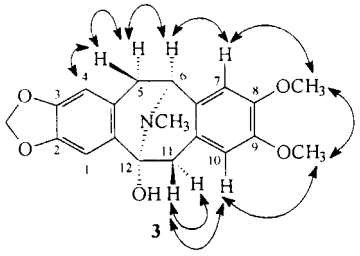
5



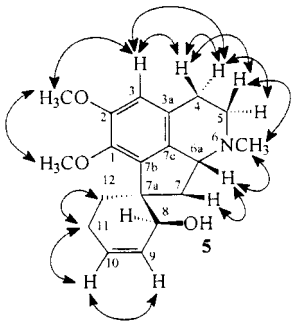
6



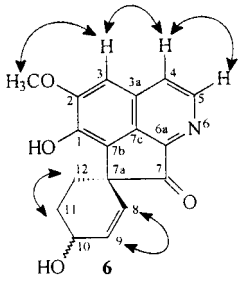
7 $R_1=CH_3$
8 $R_1=H$



3



5



6

Figure 1. NOESY correlations for compounds **3**, **5**, and **6**.

Results and Discussion

(+)-Eschscholtzidine-*N*-oxide (**1**) was obtained as optically active colorless needles. HRFABMS showed $[M + H]^+$ at *m*/*z* 356.1500, in agreement with the molecular formula $C_{20}H_{21}NO_5$. FABMS showed fragments characteristic of a pavine alkaloid at *m*/*z* 204 and 188.[3] In the ^{1}H NMR spectrum, aromatic singlets at δ 6.62, 6.60, 6.48, and 6.47 and two AMX resonances (δ 4.62, 3.85, and 2.90) were characteristic pavine signals (Table 1).[8] Methylenedioxy signals at δ 5.91 and 5.87 and methoxy signals at δ 3.82 and 3.77 were similar to those of (+)-eschscholtzidine.[2] The N-Me singlet at δ 2.92 in **1** was shifted 0.4 ppm downfield compared to (+)-eschscholtzidine, suggesting an oxygen atom on nitrogen. This was supported by the base peak at *m*/*z* 340 in FABMS due to the loss of an oxygen atom. On the basis of the above data and NOESY correlations (Figure 1), compound **1** was elucidated as (+)-eschscholtzidine-*N*-oxide.

* To whom correspondence should be addressed. Tel: 886-6-2747538. Fax: 886-6-2740552. E-mail: tswu@mail.ncku.edu.tw.

10.1021/np010258i CCC: $20.00
Published on Web 10/19/2001

Table 1. ^{1}H NMR Spectral Data of **1**−**4** ($CDCl_3$, 400 MHz, δ, multiplicities, *J*, Hz)

	1	**2**	**3**	**4**
H-1	6.62, s	6.33, s	6.55, s	6.58, s
2,3-OCH_2O−	5.90, 5.87, d, 1.6	5.89, 5.83, d, 1.6	5.89, 5.75, d, 1.6	5.87, 5.8, d, 1.6
H-4	6.48, s	5.96, s	6.35, s	6.42, s
H-5α	3.85, d, 18.2	3.20, dd, 15.8, 5.6	3.24, dd, 15.6, 5	3.35, dd, 14.3, 5.5
H-5*β*	2.90, dd, 18.2, 6.8	2.43, d, 15.8	2.45, d, 15.6	2.68, d, 14.3
H-6	4.62, d, 6.8	4.05, d, 5.6	4.08, d, 5	4.42, d, 5.5
H-7	6.60, s	6.92, s	6.95, s	6.58, s
8-OCH_3	3.82, s		3.82, s	
9-OCH_3	3.78, s		3.75, s	
8,9-OCH_2O−		5.78, 5.75, d, 1.4		5.87, 5.8, d, 1.6
H-10	6.47, s	6.54, s	5.98, s	6.42, s
H-11α	3.85, d, 18.2	3.05, d, 16.4	3.08, d, 16.2	3.35, dd, 14.3, 5.5
H-11*β*	2.90, dd, 18.2, 6.8	2.56, d, 16.4	2.59, d, 16.2	2.68, d, 14.3
H-12	4.62, d, 6.8			4.42, d, 5.5
N-CH_3	2.94, s	2.50, s	2.49, s	
OH		7.01, br s	7.14, br s	

Table 2. ^{1}H NMR Spectral Data for **5**−**8** ($CDCl_3$, 400 MHz, δ, multiplicities, *J*, Hz)

	5	**6**	**7**	**8**
H-3	6.58, s	7.15, s	6.61, s	6.68, s
H-4	2.95, m	7.67, d, 5.6	2.76, dd, 12.5, 7	2.77, br s
	2.77, dd, 17.2, 5.6			
H-5	3.08, dd, 11.6, 6.8	8.77, d, 5.6	3.72, m	3.62, m
	2.45, ddd, 11.6, 11.6, 5.6		3.07, m	3.07, m
H-6a	3.39, t, 8		3.72, m	4.14, m
H-7	2.59, dd, 7.6, 4.8		2.52, m	2.66, m
	1.63, dd, 19.2, 12		2.09, m	2.20, m
H-8	4.71, s	5.49, dd, 10, 3.2	6.92, d, 10.1	6.76, d, 10.4
H-9	5.66, d, 8	6.25, dd, 10, 3.2	5.97, d, 10.1	6.01, d, 10.4
H-10	5.83, d, 8	4.44, m		
H-11	2.09, m	2.29, m	3.31, m	2.85, m
			2.52, m	2.74, m
H-12	2.63, dd, 10.8, 6.8	2.06, m	3.07, m	3.07, m
	1.57, dd, 8.8, 4.8	2.29, m	2.09, m	2.03, m
1-OCH_3	3.82, s	3.72, s	3.71, s	3.77, s
2-OCH_3	3.80, s	4.02, s	3.85, s	3.85, s
N-CH_3	2.36, s		2.37, s	

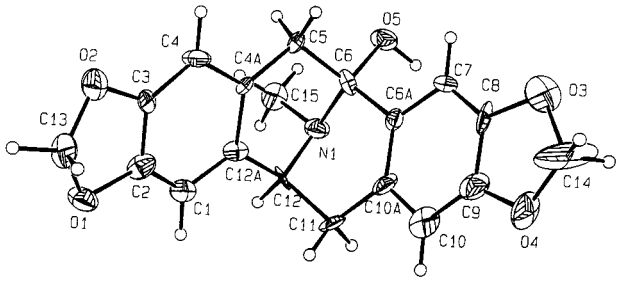


Figure 2. Single-crystal X-ray crystallographic diagram of **2**.

(−)-12-Hydroxycrychine (**2**) was isolated as colorless needles. HREIMS gave a molecular ion peak at *m*/*z* 339.1106, consistent with the molecular formula $C_{19}H_{17}NO_5$. The EIMS spectrum showed a base peak at *m*/*z* 204, which was characteristic of pavine alkaloids.[3] The ^{1}H NMR spectrum showed four aromatic singlets and AMX signals, two methylenedioxy signals, and one N−CH_3 signal (Table 1). Methylene protons at δ 3.06 and 2.56 indicated that one of the bridgehead carbons was substituted by a hydroxyl group (IR spectrum at 3020 cm^{-1}). The X-ray analysis further confirmed its constitution (Figure 2).[2]

(−)-12-Hydroxyeschscholtzidine (**3**) was also obtained as colorless needles. The NMR spectra were very similar to those of **2** and indicated that the only difference was that one of the methylenedioxy groups was replaced by two methoxyl groups (Table 2). The regiochemistry of the hydroxyl group was shown by the NOE correlations of 8-OCH_3 (δ 3.81) with H-7 and H-7 with H-6 (Figure 1).

(−)-*N*-Demethylcrychine (**4**) was isolated as a yellow powder having optical rotation $[\alpha]_D$ −74.3°. The IR spectrum of **4** showed NH absorption at 3156 cm^{-1}. In the ^{1}H NMR, aromatic singlets at δ 6.58 and 6.42, AMX patterns at δ 4.42, 3.35, and 2.68, and methylenedioxy absorptions (δ 5.87, 5.80) indicated a highly symmetrical pavine structure (Table 1). These data were very similar to those of crychine,[2] except that the NMe was replaced by an NH group in **4**.

Isocryprochine (**5**) was obtained as colorless needles. It gave a molecular ion peak at *m*/*z* 315.1833 in its HREIMS spectrum, consistent with the molecular formula $C_{18}H_{23}NO_3$. Its ^{1}H NMR spectrum exhibited an aromatic singlet at δ 6.58, olefinic signals at δ 5.83 and 5.66, and several aliphatic signals (Table 2). Partial structures $-CH_2-CH_2-CH{=}CH-CH-O-$, $-CH_2-CH_2-$, and $-CH_2-CH-$ were deduced from ^{13}C NMR and HMBC spectra (Table 3). Alkaloid **5** and cryprochine **4** are isomers. By comparison of their spectral data, **5** differs from cryprochine in the position of the hydroxyl group and the double bond. X-ray single-crystal diffraction established the structure of isocryprochine as **5** (Figure 3). The absolute configuration was not determined.

Prooxocryptochine (**6**) was obtained as an optically active yellow syrup by TLC. Its HRFABMS showed a protonated molecular ion peak at *m*/*z* 298.1080 $(M + H)^+$, which was consistent with the molecular formula $C_{14}H_{16}NO_4$. IR showed hydroxyl and carbonyl absorptions at 3256 and 1724 cm^{-1}. ^{1}H NMR showed an aromatic proton singlet at δ 7.11, olefinic multiplets at δ 6.25 and 5.49, and some aliphatic absorptions (Table 2), similar to cryprochine.[5] The

Table 3. $^2J,^3J$-Correlations of 1-Hydroxycryprochine (**5**)

C	δ, ppm	H (δ)
1	152.8	3 (6.58),
2	144.4	2-OCH_3 (3.80), 3 (6.58)
3	110.9	4α (2.77)
3a	126.3	4 (2.77, 2.95), 5β (3.08)
4	27.3	5β (3.08), 3 (6.58)
5	54.9	NCH_3 (2.36), 4β (2.95), 6a (3.39)
6a	66.4	7β (1.63), NCH_3 (2.36), 5β (3.08), 5α (2.45), 7α (2.59)
7	39.5	12α (2.63)
7a	53.1	12α (2.63), 7β (1.83), 9 (5.66)
7b	136.7	12α (2.63), 7α (2.59)
7c	135.4	3 (6.58), 6a (3.39), 4β (2.95)
8	73.4	12α (2.63), 7α (2.59), 7β (1.83), 12β (1.57)
9	130.4	
10	128.8	12β (1.57), 9 (5.66)
11	22.9	9 (5.66), 12β (1.57)
12	32.6	7β (1.83)
1-OCH_3	56.0	
2-OCH_3	60.8	
NCH_3	43.4	6a (3.39), 5β (3.08), 5α (2.45)

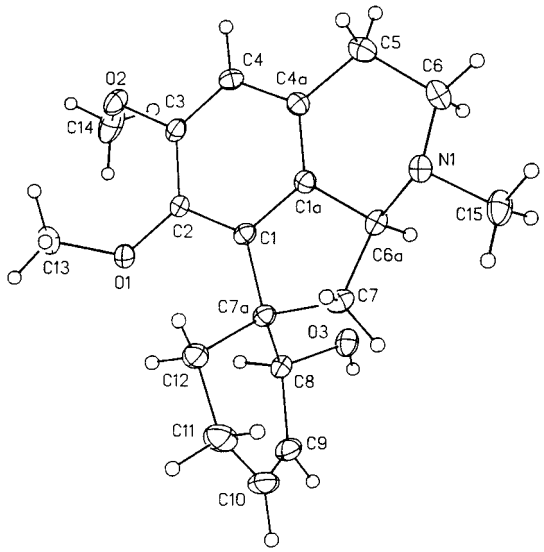


Figure 3. Single-crystal X-ray crystallographic diagram of **5**.

aliphatic signals, elucidated by ^{13}C, COSY, and HMQC experiments, gave the partial structure $-CH_2-CH_2-CH(-O-)-CH=CH-$. The presence of a pair of *ortho* aromatic protons at δ 8.77 and 7.67 and absence of CH_2-CH_2 and $CH-CH_2$ protons indicated that ring B was aromatized, leaving the carbonyl group at C-7. The NOE correlation between OMe and H-3 indicated that the methoxyl group was on C-2. The configuration at C-7a is probably as shown by analogy with **5**, **7**, and **8**. The configuration at C-10 was not determined.

Isoamuronine (**7**) was obtained as a yellow powder. It showed a molecular ion peak at *m*/*z* 313 in its EIMS, consistent with the molecular formula $C_{19}H_{23}NO_3$. The spectral data of **7** were in excellent agreement with those of isoamuronine (**7**), formed by oxidizing cryprochine.[5] This is the first report of isoamuronine (**7**) from a natural source.

(+)-8,9-Dihydrostepharine (**8**) was isolated as optically active colorless needles by TLC, having $[\alpha]_D$ +141.4°. It exhibited an IR absorption band for an NH group at 3414 cm^{-1}. The spectral data of **8** were identical with those of (+)-8,9-dihydrostepharine (**8**) formed by the controlled catalytic hydrogenation of (+)-stepharine.[9]

The known compounds cryprochine,[4] (−)-argemonine,[10] (+)-caryachine,[2] doryanine,[11] dl-caryachine,[2] neocaryachine,[4] *N*-demethylphyllocryptine,[12] crychine,[2] and (+)-eschscholtzidine[2] were isolated and characterized by comparison of their spectroscopic data (UV, IR, NMR, and MS) with the literature values.

Experimental Section

General Experimental Procedures. Melting points were determined on a Yanagimoto MP-S3 micro melting point apparatus and are uncorrected. Optical rotations were obtained on a Jasco Dip-370 polarimeter. IR spectra were recorded on a Shimadzu FT IR-8501 spectrophotometer as KBr disks. UV spectra were recorded on a Hitachi U-3210 spectrophotometer. ^1H NMR (400 MHz) and ^{13}C NMR (100 MHz) spectra were recorded with Varian Unity plus 400 and Bruker AMX-400 spectrometers ($CDCl_3$ and CD_3OD as solvents). Chemical shift values are in ppm (δ) with TMS as an internal standard. Mass spectra were recorded on a VG 70-250S mass spectrometer. X-ray crystallography was conducted on an Enraf-Nonius CAD4 instrument.

Plant Material. The wood of *C. chinensis* was collected from Kaohsiung Hsien in Taiwan in July 1986 and identified by Prof. C. S. Kuoh. A voucher specimen (Kuoh 860011) is deposited in the Herbarium of National Cheng Kung University, Tainan, Taiwan.

Extraction and Isolation. The plant material (20.3 kg) was powdered and refluxed with 95% EtOH (10 × 25 L). The filtrate was concentrated and treated with 3% HOAc, and the acidic water-soluble part was neutralized with NH_4OH(aq) and partitioned with $CHCl_3$. The $CHCl_3$ layer containing alkaloids was extracted by 2% NaOH solution. The water-soluble portion was neutralized with $(NH_4)_2SO_4$ and then partitioned with $CHCl_3$. The $CHCl_3$ condensate was filtered to give colorless crystals of dl-caryachine (0.2 g). The filtrate was evaporated and recrystallized from acetone to give l-caryachine (2.6 g). The mother liquor of l-caryachine was condensed and acidified with 2% H_2SO_4. The acidic solution was neutralized with 10% NaOH and further partitioned with ether. The ether condensate (23 g) was chromatographed on silica gel and eluted with a gradient of benzene and acetone (19:1−1:1) to afford fractions 1−8 and further eluted with a gradient of benzene and methanol (3:1−0:1) to afford fractions 9 and 10. Fraction 2 was rechromatographed on silica gel and eluted with *i*-Pr_2O−MeOH (19:1) to give (−)-6-hydroxycrychine (**2**, 0.36 g) and (−)-12-hydroxyeschscholtzidine (**3**, 0.53 g). Fraction 3 was rechromatographed on silica gel and eluted with *i*-Pr_2O−MeOH (19:1) to give (+)-eschscholtzidine-*N*-oxide (**1**, 24 mg). Fraction 4 was rechromatographed on silica gel and eluted with *i*-Pr_2O−MeOH (9:1) to give cryprochine (6 mg). Fraction 5 was rechromatographed on silica gel and eluted with $CHCl_3$−MeOH (19:1) to give (−)-argemonine (63 mg). Fraction 6 was rechromatographed on silica gel and eluted with $CHCl_3$−MeOH (19:1) to give isocryprochine (**5**, 39 mg), (+)-8,9-dihydrostepharine (**8**, 0.55 mg), and prooxocryptochine (**6**, 1.9 mg). Fraction 9 was rechromatographed on silica gel and eluted with $CHCl_3$−MeOH (9:1) to give successively isoamuronine (**7**, 1.2 mg), (+)-caryachine (3.9 mg), (−)-*N*-demethylcrychine (**4**, 1.4 mg), doryanine (19 mg), *N*-demethylphellocryptine (2.4 mg), crychine (1.9 mg), neocaryachine (2.1 mg), and dl-caryachine (3.0 mg).

(+)-Eschscholtzidine-*N*-oxide (1): colorless needles (MeOH); mp 193−194 °C; $[\alpha]_D$ +145.3° (c 0.1278, MeOH); UV (MeOH) λ_{max} (log ϵ) 290 (3.2), 225 (sh) (3.7) nm; IR (KBr) ν_{max} cm^{-1} 1622, 1510, 1504, 1251, 1118, 1028; ^1H NMR, Table 1; ^{13}C NMR ($CDCl_3$, 100 MHz) δ 149.2, 148.5, 147.9, 147.1, 124.4, 123.2, 121.6, 120.1, 110.9, 109.2, 108.3, 106.4, 101.1, 56.7, 56.3, 55.9, 55.6, 39.2, 33.6, 33.2; FABMS *m*/*z* (rel int) 356 $[M + H]^+$ (15), 340 (100), 204 (11), 188 (17); HRFABMS *m*/*z* 356.1500 (calcd for $C_{20}H_{21}NO_5$, 356.1497).

(−)-12-Hydroxycrychine (2): colorless needles (MeOH); mp 173−174 °C; $[\alpha]_D$ −143.0° (c 0.2764, MeOH); UV (MeOH) λ_{max} (log ϵ) 294 (3.91), 230 (3.77); IR (KBr) ν_{max} cm^{-1} 3020, 3008, 2896, 1481, 1238, 1089, 937; ^1H NMR, Table 1; ^{13}C NMR ($CDCl_3$, 100 MHz) δ 146.5, 146.3, 145.9, 134.5, 127.9, 125.9, 125.2, 108.3, 107.0, 104.7, 100.7, 83.6, 77.2, 61.4, 36.9, 36.7,

34.8; EIMS *m/z* 339 $[M]^+$ (95), 322 (100), 308 (18), 281 (15), 266 (10), 251 (14), 204 (85), 163 (35), 135 (28); HREIMS *m/z* 339.1106 (calcd for $C_{19}H_{17}NO5$, 339.1108).

X-ray Crystallography of 2. Crystal data: colorless crystal (0.25 × 0.13 × 0.16 mm) from acetone; $C_{19}H_{17}NO_5$, mol wt = 339, orthorhombic, space group $P2_12_12_1$, a = 11.6750 (11) Å, b = 12.5948 (19) Å, c = 27.7950 (7) Å, V = 4087.1 (13) Å^3, Z = 8, D_c = 1.491 g/cm^3, $F(000)$ = 1891.86, μ = 0.15 mm^{-1}, λ(Mo Kα) = 0.70930 Å, 7882 measured intensities ($0 \le h \le 13$), $k = 0 \rightarrow 14$, $l = 0 \rightarrow 33$), 7170 unique ($R_{int} = 0.021$) of which 2578 observed with $I \ge 2.5\sigma(I)$. Data collection and structure refinement: The intensity data were collected on a Picker diffractometer, using graphite-monochromated Mo Kα radiation and the $\theta-2\theta$ scan technique up to 49.8°. Cell parameters were refined from 24 well-centered reflections with $7.56° \le \theta \le 22.5°$. The structure was solved by direct methods using the NRCVAX System[13] and refined by full-matrix least-squares. The last least-squares cycle was calculated with 94 atoms, 524 parameters, and 2578 out of 7170 reflections. Weights based on counting statistics were used. The weight modifier K in KF_o^2 was 0.000100. For all reflections, $R_f = 0.220$, $R_w = 0.088$. The X-ray crystallographic data have been deposited with the Cambridge Crystallographic Data Centre.[14]

(−)-12-Hydroxyeschscholtzidine (3): colorless needles (MeOH); mp 201−202 °C; $[\alpha]_D$ −171.5° (*c* 0.1284, MeOH); UV (MeOH) λ_{max} (log ϵ) 288.4 (3.94), 224.8 (sh) (3.72); IR (KBr) ν_{max} cm^{-1} 3420, 1634, 1611, 1507, 1483, 1246, 1103, 1040; ^{1}H NMR, Table 1; ^{13}C NMR ($CDCl_3$, 100 MHz) δ 147.9, 147.8, 146.5, 145.9, 134.6, 126.7, 125.3, 124.8, 111.1, 110.0, 107.8, 107.0, 104.7, 100.7, 83.7, 61.2, 55.9, 55.6, 36.9, 36.3, 34.8; EIMS *m/z* (rel int) 355 $[M]^+$ (35), 338 (33), 204 (100), 163 (30), 152 (15); HREIMS *m/z* 355.1423 (calcd for $C_{20}H_{21}NO_5$, 355.1419).

(−)-*N*-Demethylcrychine (4): yellow powder (acetone); $[\alpha]_D$ −74.3° (*c* 0.02, MeOH); UV (MeOH) λ_{max} (log ϵ) 294 (3.92), 221 (sh) (3.75) nm; IR (KBr) ν_{max} cm^{-1} 3656, 1658, 1626, 1589, 1559, 1485, 1386, 1234, 1039; ^{1}H NMR, Table 1; EIMS *m/z* (rel int) 309 $[M]^+$ (38), 308 (33), 175 (100).

Isocryprochine (5): colorless needles (acetone); mp 186−187 °C; $[\alpha]_D$ −22.2° (*c* 0.0336, MeOH); UV (MeOH) λ_{max} (log ϵ) 285.4 (3.27), 227.0 (3.83) nm; IR (KBr) ν_{max} cm^{-1} 3103, 1475, 1276, 1072, 1024 cm^{-1}; ^{1}H NMR, Table 2; ^{13}C NMR ($CDCl_3$, 100 MHz) δ 152.8 (C-1), 144.4 (C-2), 136.7 (C-7b), 135.4 (C-7c), 130.4 (C-9), 128.8 (C-10), 126.3 (C-3a), 110.9 (C-3), 73.4 (C-8), 66.4 (C-6a), 60.8 (2-OMe), 56.0 (1-OMe), 54.9 (C-5), 53.1 (C-7a), 43.4 (NMe), 39.5 (C-7), 32.6 (C-12), 27.3 (C-4), 22.9 (C-11); EIMS *m/z* 315 $[M]^+$ (100), 298 (93), 283 (29), 255 (18), 245 (30), 203 (37); HREIMS *m/z* 315.1833 (calcd for $C_{19}H_{25}NO_3$, 315.1835).

X-ray Crystallography of 5. Crystal data: colorless crystal (0.70 × 0.22 × 0.20 mm) from acetone; $C_{19}H_{25}NO_3$, mol wt = 315.4, orthorhombic, space group $P2_12_12_1$, a = 8.898(3) Å, b = 10.822 (2) Å, c = 17.841 (5) Å, V = 1717.8 (8) Å^3, Z = 4, D_c = 1.220 g/cm^3, $F(000)$ = 680, μ = 0.076 mm^{-1}, λ(Mo Kα) = 0.71073 Å, 1778 measured intensities ($0 \le h \le 10$), $k = 0 \rightarrow 12$, $l = 0 \rightarrow 21$), of which 1327 were observed with $I \ge 3.0\sigma(I)$. Data collection and structure refinement: The intensity data were collected on a Nicolet R3m/V diffractometer, using highly oriented graphite crystal monochromated Mo Kα radiation and the $\theta-2\theta$ scan technique up to 50.0°. Cell parameters were refined from well-centered reflections with $2.93° \le \theta \le 14.65°$. For all reflections, $R_f = 0.0398$, $R_w = 0.0408$. The X-ray crystallographic data have been deposited with the Cambridge Crystallographic Data Centre.[14]

Prooxocryptochine (6): yellow syrup; $[\alpha]_D$ −17.2° (*c* 0.0193, MeOH); UV (MeOH) λ_{max} (log ϵ) nm 379, 331, 254, 229; IR (KBr) ν_{max} cm^{-1} 3256, 2931, 1724, 1662, 1550, 1541, 1506, 1498, 1481, 1278, 1051; ^{1}H NMR, Table 2; ^{13}C NMR ($CDCl_3$) δ 204.5, 153.8, 146.3, 135.2, 126.8, 120.9, 101.3, 133.2, 130.8, 141.7, 65.6, 63.8, 56.8, 28.5, 28.0, 26.0; FABMS *m/z* (rel int) 298 $[M + H]^+$ (32), 280 (5), 176 (100); HRFABMS *m/z* 298.1080 (calcd for $C_{17}H_{15}NO_4$, 298.1079).

Isoamuronine (7): yellow powder; UV (MeOH) λ_{max} (log ϵ) nm 286 (3.75), 250 (sh) (3.22) nm; IR (KBr) ν_{max} cm^{-1} 2925, 1717, 1631, 1593, 1564, 1457, 1386, 1247, 1122; ^{1}H NMR, Table 2; EIMS *m/z* (rel int) 313 $[M]^+$ (78), 270 (100), 204 (8), 128 (21).

(+)-8,9-Dihydrostepharine (8): colorless needles (MeOH); $[\alpha]_D$ +141.4° (*c* 0.0055, MeOH); UV (MeOH) λ_{max} (log ϵ) nm 285 (3.15), 249 (sh) (3.45), 224.2 (3.64); IR (KBr) ν_{max} cm^{-1} 3414, 2937, 1681, 1481, 1427,1386; ^{1}H NMR, Table 2.

Acknowledgment. The authors are grateful to the National Science Council of the Republic of China for financial support (NSC 86-2113-M-006-003) and Prof. C. S. Kuoh (Department of Biology, National Cheng Kung University, Tainan, Taiwan) for the plant identification. We also thank Miss S. F. Tung (Regional Instruments Center at the National Cheng Kung University) and Prof. S. L. Wang (Department of Chemistry, National Tsing Hua University, Hsinchu, Taiwan) for the X-ray diffraction measurements.

References and Notes

(1) Liao, J. C. *Flora of Taiwan*, 2nd ed.; Editorial Committee of the Flora of Taiwan, Taipei: Taiwan, 1996; Vol. 2, p 433.
(2) Lu, S. T.; Lan, P. K. *Yakugaku Zasshi* **1966**, *86*, 177−184.
(3) Lu, S. T. *Yakugaku Zasshi* **1966**, *86*, 296−299.
(4) Chang, W. T.; Lee, S. S.; Chueh, F. S.; Liu, K. C. S. *Phytochemistry* **1998**, *48*, 119−124, and references therein.
(5) Lee, S. S.; Liu, Y. C.; Chen, C. H. *J. Nat. Prod.* **1990**, *53*, 1267−1271.
(6) Lee, S. S.; Chen, C. H. *J. Nat. Prod.* **1993**, *56*, 227−232.
(7) Varadinova, T. L.; Shishkov, S. A.; Ivanovska, N. D.; Velcheva, M. P.; Danghaaghin, S.; Samadanghiin, Z.; Yansanghiin, Z. *Phytother. Res.* **1996**, *10*, 414−417.
(8) Velcheva, M. P.; Danghaaghiin, S.; Samdanghin, Z.; Yansanghiin, Z.; Hesse, M. *Phytochemistry* **1995**, *39*, 683−687, and references therein.
(9) Guinaudeau, H.; Freyer, A. J.; Shamma, M. *Tetrahedron* **1987**, *43*, 1759−1763.
(10) Hussein, S. F.; Nakkady, S.; Khan, L.; Shamma, M. *Phytochemistry* **1983**, *22*, 319−321.
(11) Dopke, W.; Flentje, H. *Tetrahedron* **1968**, *24*, 2297−2230.
(12) Noriaki, K.; Shigeo, M.; Michiko, K.; Yoshie, M.; Minoru, O. *Chem. Pharm. Bull.* **1997**, *45*, 470−475.
(13) Gabe, E. J.; Le, Page Y.; Charland, J. P.; Lee, F. L.; White, P. S. *J. Appl. Crystallogr.* **1989**, *22*, 384−387.
(14) Crystallographic data for compounds **2** and **5** have been deposited with the Cambridge Crystallographic Data Centre. Copies of the data can be obtained, free of charge, on application to the Director, CCDC, 12 Union Road, Cambridge CB2 1EZ, UK (fax: +44-(0)1223-336033 or e-mail: deposit@ccdc.cam.ac.uk).

NP010258I