

NEW ISOQUINOLONE ALKALOIDS FROM THE LEAVES  
OF CASSIA SIAMEA

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Piperidenol and monoterpene alkaloids have been isolated from *Cassia* species (1-7). This paper deals with the isolation and structure elucidation of two new alkaloids from the leaves of *Cassia siamea* Lam. Four fluorescing and Dragendorff's-positive spots were seen on a tlc chromatogram of the concentrated and processed alkaloid extract of the leaves. Preparative tlc resulted in the isolation of the four weakly-basic alkaloids that gave precipitates with Mayer's reagent. One of them, present only in small amounts, was identified by co-chromatography, mp, mmp, and ir spectra as the known isoquinolone siamine (1) (8).

The other three alkaloids were named siaminine A, B, and C. They showed from five to seven maxima in the uv spectra in the range from 230 to 355 nm, indicating a complex pattern of a highly conjugated chromophore. The ir spectra showed intense peaks at 3000-3050  $\text{cm}^{-1}$  assigned to the associated N-H stretching vibration of a lactam; while a peak at 1635  $\text{cm}^{-1}$  was consistent with the presence of a  $\delta$ -lactam carbonyl. The latter was clearly significant at  $m/z$  43 in the mass spectra. Another peak in the ir at 840  $\text{cm}^{-1}$  was assigned to the NH group, which was confirmed by the presence of a broad singlet in the pmr at 11.2 ppm (9-11).

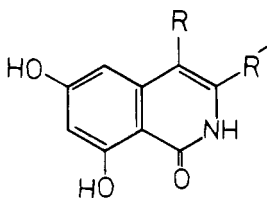
Siaminine A and B were isolated as their HCl salts. They have molecular formulas  $\text{C}_{11}\text{H}_{11}\text{O}_3\text{N}\cdot\text{HCl}$  ( $\text{M}^+$  at  $m/z$  341) and  $\text{C}_9\text{H}_7\text{O}_3\text{N}\cdot\text{HCl}$  ( $\text{M}^+$  at  $m/z$  213), respectively. Both gave green color with  $\text{FeCl}_3$ , and a complex formed on addition of  $\text{AlCl}_3$  (bathochromic shifts in the uv-spectra +25 nm). These indicated the presence of phenolic OH groups that were also suggested by the

presence of broad peaks at 3340-3400  $\text{cm}^{-1}$  in the ir spectra. The pmr of the acetylated derivatives of both showed two acetyl groups (two singlets, 3H each, at 2.35 and 2.54 and 2.33 and 2.50 ppm, respectively). These results suggested the presence of two OH groups. Bathochromic shifts in the uv with  $\text{AlCl}_3$ , not affected by addition of HCl, indicated that the two OH groups were not *ortho* to each other, and one of them must be attached to C-8 (chelate complex between  $\text{Al}^{+++}$ , OH at C-8 and  $-\text{C}=\text{O}$  in lactam group). Therefore, both siaminine A and B contained two OH groups, and one of them is attached to C-8.

Two singlets (3H each) at 2.17 and 2.28 ppm in the pmr spectrum of siaminine A (2) were attributed to two  $\text{CH}_3$  groups at C-3 and C-4, respectively. Also, two doublets (1H,  $J=2.5$  Hz) at 6.45 and 6.48 ppm were assigned to C-7-H and C-5-H, respectively. Thus, positions 3, 4, 5, 7, and 8 were substituted, and the only free position was C-6, to which the second OH must be attached. Therefore, the structure of siaminine A is suggested to be 4-methyl-siamine (3,4-dimethyl-6, $\beta$ -dihydroxyisoquinoline-1-one, 2). The close similarity between the uv, ir, and nmr spectral data of siamine (1) (8,11) and siaminine A are also in good agreement with this structure.

As discussed above, siaminine B (3) also contains two OH groups, and one is attached to C-8. On the other hand, positions 3, 4, 5, and 7 were substituted (two doublets, 1H each,  $J=7.5$  Hz, at 6.75 and 7.05 ppm, attributed to C-4-H and C-3-H, respectively; two doublets, 1H each,  $J=2.5$  Hz, at 6.87 and 6.96 ppm, assigned to C-7-H and C-5-

H, respectively). Therefore, the second OH must be attached to C-6. From the physical, chemical, and spectral analyses, it is clear that siaminine B is chemically related to siamine but differs in the absence of a methyl group at C-3. Siaminine B is, thus, a C-demethylated analog of siamine, and its structure is 6,8-dihydroxyisoquinoline-1-one (3).



- 1 R=H, R'=CH<sub>3</sub>
- 2 R=R'=CH<sub>3</sub>
- 3 R=R'=H

Siaminine C was isolated as its HCl salt. It gave a molecular ion peak at  $m/z$  317 and a base peak at  $m/z$  213 with the fragmentation pattern clearly similar to that of siaminine B. Insufficient material prevented a more detailed investigation.

It is of interest to note that isoquinolone alkaloids are well known and isolated from diverse plant sources (11, 12) such as Ranunculaceae, Menispermaceae, Berberidaceae, Papaveraceae, Hernandiaceae, Fumariaceae, Lauraceae, Monimiaceae, and Leguminosae. Siamine is the only isoquinolone alkaloid isolated previously from the Leguminosae (8). Siaminine A and siaminine B from the leaves of *C. siamea* are new isoquinolone alkaloids.

## EXPERIMENTAL

**GENERAL EXPERIMENTAL PROCEDURES.**—Uv spectra were recorded in MeOH using a Beckman DK-2 Instrument. Ir spectra were determined in KBr discs using a Beckman infrared spectrophotometer. Pmr spectra were run on a Varian EM 360-A 60 Brüker spectrometer at 60 MHz in CDCl<sub>3</sub> or DMSO, using TMS as internal standard. Electron impact mass spectra were recorded on an MS VG 12 F mass spectrometer at 70 eV. Melting points were determined with a Kofler hot stage apparatus and were uncorrected.

**PLANT MATERIAL.**—The plant was collected in May 1980, from the Experimental Station of

Ornamental Plants (Zohria Garden) at Cairo, Egypt. It was identified by the late Prof. F.Y. Amin, Prof. of Floriculture and Horticulture, Faculty of Agriculture, Assiut University, Assiut, Egypt.

**EXTRACTION AND FRACTIONATION.**—The powdered, defatted, leaves (1 kg) was extracted with 90% EtOH containing 1% tartaric acid at room temperature. The concentrated extract was alkalinized with NH<sub>4</sub>OH (pH 8) and extracted with CHCl<sub>3</sub>. The residue of the CHCl<sub>3</sub> extract was digested with C<sub>6</sub>H<sub>6</sub> until a colorless C<sub>6</sub>H<sub>6</sub> solution was obtained. Acid-base purification was carried out with 1 N H<sub>2</sub>SO<sub>4</sub> and dilute NH<sub>4</sub>OH and then extracted with CHCl<sub>3</sub>. The residue (1.7 g) was dissolved in 10 ml EtOH (96%) and used for preparative tlc (40 plates, Silica gel GF 254 Merck, 20×20 cm, CHCl<sub>3</sub>-EtOH, 9:1). Elution was accomplished with Me<sub>2</sub>CO, and trials for crystallization of the free bases failed; HCl salts were prepared.

**SIAMININE A HCl.**—Tlc, silica gel G, system 1: CHCl<sub>3</sub>-EtOH, 9:1, R<sub>f</sub>=0.73. mp 215°. Elemental analysis, found: C 54.04%; H 5.05%; N 5.70%; Cl 14.61%. C<sub>11</sub>H<sub>11</sub>O<sub>3</sub>N·HCl requires: C 54.65%; H 4.97%; N 5.79%; 14.73%. Uv λ max (MeOH) (nm, Log ε) 245 (3.91), 275 (3.75), 290 (3.81), 325 (3.19), 350 (3.14); + AlCl<sub>3</sub>+25 nm; + AlCl<sub>3</sub>/HCl+23 nm. Uv λ max of the base in MeOH (nm) (rel. int.): 244 (88), 265 (87), 286 (75), 345 (20); +N NaOH 250 (92), 258 (88), 312 (sh, 49), 330 (54), 390 (sh, 9); +N HCl 244 (86), 265 (87), 286 (73), 365 (13). Ir (cm<sup>-1</sup>) 840, 1600, 1635, 3000, 3340-3400. Ms  $m/z$  (rel. int. %) M<sup>+</sup> 241 (29.8), 213 (82.98), 190 (100), 184 (11), 162 (13), 103 (13.83), 78 (26.6), 60 (87.23), 43 (72.3). Pmr (DMSO) δ: 2.17 (3H, s, C-3-CH<sub>3</sub>), 2.28 (3H, s, C-4-CH<sub>3</sub>), 6.45 (1H, d, J=2.5 Hz, C-7-H), 6.48 (1H, d, J=2.5 Hz, C-5-H), 11.20 (1H, brd, NH).

The acetylated derivative of siaminine A has mp 310°. Pmr (CDCl<sub>3</sub>): 2.12 (3H, s, C-3-CH<sub>3</sub>), 2.26 (3H, s, C-4-CH<sub>3</sub>), two singlets (3H each) at 2.35 and 2.54 ppm (two acetates methyls), 6.40 (1H, d, J=2.5 Hz), 6.45 (1H, d, J=2.5 Hz, C-7-H).

**SIAMININE B HCl.**—Tlc, silica gel G, system 1, R<sub>f</sub>=0.47. mp 235°. Elemental analysis, found: C 50.28%; H 3.80%; N 6.50%; Cl 16.52%. C<sub>9</sub>H<sub>7</sub>O<sub>3</sub>N·HCl requires: C 50.70%; H 3.74%; Cl 16.66%. Uv λ max (MeOH) (nm, Log ε) 230 (3.71), 245 (3.67), 252 (3.74), 297 (3.12), 337 (3.16), 355 (3.14); + AlCl<sub>3</sub>+25 nm; + AlCl<sub>3</sub>/HCl+24 nm. Uv λ max of the base in MeOH (nm) (rel. int.) 230 (sh, 69), 248 (85), 258 (92), 290 (sh, 74), 298 (76), 340 (50), 360 (45); +N NaOH 250 (95), 284 (100), 344 (60), 360 (sh, 38), 374 (32); +N HCl 231 (sh, 62), 249 (80), 259 (87), 290 (sh, 69), 298 (70), 341

(45), 362 (40). Ir ( $\text{cm}^{-1}$ ) 840, 910, 1600, 1630, 3050, 3350-3400. Ms  $\text{M}^+$   $m/z$  213 (100), 184 (11.6), 149 (5.26), 106.5 (21), 83 (16.32), 57 (10.5), 43 (18.5). Pmr (DMSO)  $\delta$  6.75 (1H,  $d$ ,  $J=7.5$  Hz, C-4-H), 6.8 (1H,  $d$ ,  $J=2.5$  Hz, C-7-H), 6.96 (1H,  $d$ ,  $J=2.5$  Hz, C-5-H), 7.05 (1H,  $d$ ,  $J=7.5$  Hz, C-3-H), 11.22 (1H, *brd*, NH).

Pmr ( $\text{CDCl}_3$ ) for the acetylated derivative of siaminine B showed two singlets (3H each) at 2.33 and 2.50 ppm (two acetates methyls).

SIAMININE C HCl.—Tlc, silica gel G, system 1, Rf=0.21 mp 240°. Uv  $\lambda$  max (MeOH) (nm) 239, 255, 260 (sh), 315, 355 (sh). Ms  $\text{M}^+$   $m/z$  317 (21), 283 (22.9), 269 (24.7), 213 (100), 184 (18), 149 (14.2), 106.5 (28), 83 (19.04), 57 (55.3), 43 (18.25).

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