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## INDOLE AND OXINDOLE ALKALOIDS FROM *CEPHALANTHUS OCCIDENTALIS*

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**Key Word Index**—*Cephalanthus occidentalis*; Rubiaceae; isorhynchophylline; rhynchophylline; dihydrocorynantheine; hirsutine; *anti*-isorhynchophylline *N*-oxide; rhynchophylline *N*-oxide.

*Plant.* *Cephalanthus occidentalis* L. (Rubiaceae).

*Source.* The Botanical Gardens, Gen. Foulkesweg 37, Wageningen, Netherlands. A reference sample is deposited in the Rijksherbarium, Leiden.

*Ethnobotany.* A tea, made from the inner bark, is used as an emetic by the Meskwaki Indians; the bark is said to be used as an astringent laxative and tonic.<sup>1</sup> The plant has been responsible for fatally poisoning cattle in parts of the U.S.A.<sup>2</sup>

*Previous work.* Extracts of leaf, stem bark, stem wood and bud were negative to alkaloid tests.<sup>3</sup>

*Plant parts examined.* *Fresh leaf* (6.5 g) was blended with MeOH and allowed to macerate for 2 days. The filtered extract was concentrated to dryness, the residue extracted with 2% H<sub>2</sub>SO<sub>4</sub> and thoroughly washed with Et<sub>2</sub>O. The acidic solution was made alkaline with conc. NH<sub>4</sub>OH, extracted with CHCl<sub>3</sub> which was washed with H<sub>2</sub>O, dried over Na<sub>2</sub>SO<sub>4</sub> and evaporated to dryness. The extraction was repeated and the crude alkaloid residues combined to yield 28.1 mg (0.43%). The slight ppt. produced by the addition of picric acid to the acidified (pH 2) ammoniacal layers, was negative to Dragendorff reagent and hence quaternary alkaloids are absent. *Air dried leaf* (2.4 g) was moistened with 10% NH<sub>4</sub>OH and extracted with EtOAc as previously described,<sup>4</sup> yielding total crude alkaloid 18.7 mg (0.77%). The marc was extracted with MeOH and the filtered extract concentrated to low bulk; tests with Dragendorff's reagent indicated that quaternary alkaloids were absent. *Fresh flower* (2.5 g) was extracted as described for the fresh leaf to yield total crude alkaloid 1.1 mg (0.05%); quaternary alkaloids were absent. *Air dried stem* (6.6 g) was extracted as described for dried leaf to yield total crude alkaloid 7.5 mg (0.11%); quaternary alkaloids were absent.

TLC indicated that there was no difference between the alkaloid content of the fresh and the dried leaves. The combined alkaloids from the fresh and the dried leaves (46.8 mg) were separated by preparative TLC (SG/GF<sub>254</sub>; CHCl<sub>3</sub>:EtOH, 95-5) and were identified

<sup>1</sup> UPHOF, J. C. Th. (1959). *Dictionary of Economic Plants*, p. 83. H. R. ENGELMANN Ed., Weinheim, New York.

<sup>2</sup> VON REIS ALTSCHUL, S. (1973). *Drugs and Foods from little known Plants*, p. 280. Harvard University Press, Cambridge, Mass.

<sup>3</sup> FONG, H. H. S., TROJANKOVA, M., TROJANEK, J. and FARNSWORTH, N. R. (1972). *Lloydia* **35**, 117.

<sup>4</sup> PHILLIPSON, J. D. and HEMINGWAY, S. R. (1973). *Phytochemistry* **12**, 1481.

by TLC (3 systems), GLC, UV and MS comparisons with reference alkaloids, as isorhynchophylline (23.5 mg, NMR spectrum identical to that of reference alkaloid), rhynchophylline (13.1 mg), dihydrocorynantheine (1.3 mg), hirsutine (1.5 mg) and base-line alkaloids (2.9 mg). *Anti*-isorhynchophylline *N*-oxide<sup>5</sup> (identified by TLC, GLC, UV and MS) and rhynchophylline *N*-oxide<sup>5</sup> (identified by TLC and UV) were separated from the baseline alkaloids by further preparative TLC (SG/GF<sub>254</sub>:MeOH). TLC indicated that these 6 alkaloids were also present in the stems and that isorhynchophylline and rhynchophylline were the major alkaloids of the flowers.

*Biological significance.* The presence of the *N*-oxides in extracts of the fresh leaf material suggests that they are natural products and are not formed as a result of the drying procedure.<sup>4</sup> The genus *Cephalanthus* L. is a member of the tribe *Naucleaeae* (Rubiaceae), parts of which are in a state of nomenclatural and taxonomic confusion.<sup>6</sup> Oxindole- and heteroyohimbine-type alkaloids are found in *Uncaria* and *Mitragyna*, two other genera of the *Naucleaeae* and their presence in *Cephalanthus* is an indication of the affinity of these three genera within the tribe.

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<sup>5</sup> PHILLIPSON, J. D., RUNGSIYAKUL, D. and SHELLARD, E. J. (1973). *Phytochemistry* **12**, 2043.

<sup>6</sup> BAKHUIZEN VAN DEN BRINK, Jr., R. C. (1970). *Taxon* **19**, 468, and references therein.