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HERNANDIA ALKALOIDS. II. HERNANDALINE, A NEW, ELABORATED APORPHINE STRUCTURAL TYPE

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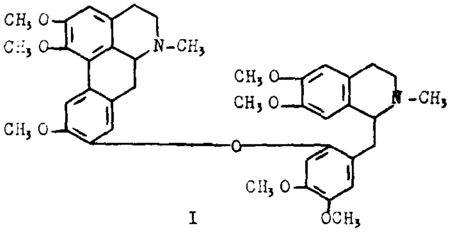
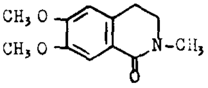
Recently we reported the characterization and structure determination of the new, natural aporphines nandigerine, N-methylnandigerine, ovigerine, N-methylovigerine, and hernovine from Hernandia ovigera L.[1]; in addition the known isocorydine and the dimeric base thalicarpine[2] (I) were isolated. We now wish to describe the isolation of three additional compounds from this plant. They are laurotetanine, N-methyl-6,7-dimethoxyisoquinolone (II) and a new base, hernandaline (III). Compound (III) represents



I

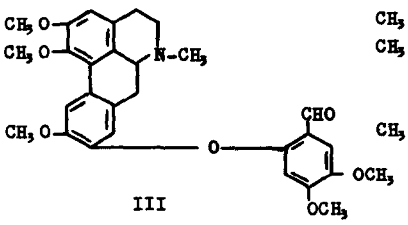


II

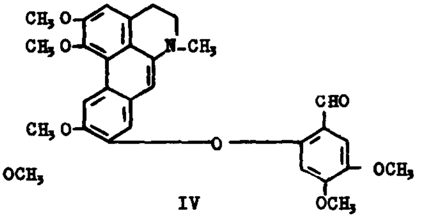
the first example of a naturally occurring, elaborated aporphine, intermediate to the aporphine - benzylisoquinoline dimeric type.

Hernandaline (III), $C_{29}H_{31}NO_7$, crystallized as needles from ethanol, m.p. 170-171.5°, $[\alpha]^{25}_{D}$ +35.6° ($\underline{c}$, 0.10 in $CHCl_3$), λ^{EtOH}_{max} 216 mμ (log ε 4.36), 278 (4.40) and 304 (4.20); its molecular weight (505) was confirmed by mass spectrometry. The infrared spectrum of hernandaline showed a conjugated carbonyl group at 5.98μ (KBr).

Its NMR spectrum revealed the presence of an N-methyl group (2.49), five methoxyls (3.90, 3.90, 3.90, 3.81 and 3.72), four aromatic protons (6.48, 6.65, 6.79, 7.40 and 8.20) and an aldehyde proton. The presence of this group in hernandaline was confirmed by sodium borohydride reduction which afforded an amorphous product showing neither the 10.41 NMR peak nor the 4.98μ carbonyl band in the infrared. The presence of a low-field aromatic proton in the NMR spectra of both hernandaline (8.20) and its reduction product (8.21) strongly implied that hernandaline contained an aporphine nucleus unsubstituted at C-11[3]. The above data suggested structure (III) as a likely formulation for



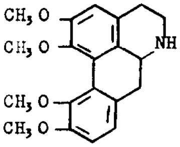
III



IV

hernandaline. This postulate was confirmed by synthesis from precursors of known structure. Thus, the reaction of (+)-N-methyllaurotetanine (50 mg.) with excess (100 mg.) 6-bromoveratraldehyde in the presence of copper in pyridine afforded crystalline hernandaline (III, 59 mg.), m.p. 168-169°, $[\alpha]^{25}_{D}$ +33.8° (c, 0.10 in $CHCl_3$), spectrally identical (IR, UV) with the natural product[4].

In the course of a broad chemotaxonomic survey of the genus Hernandia, we have isolated and characterized eleven alkaloids from the bark of the Jamaican species, H. catalpifolia[5]. These include the following bases which also occur in H. ovigera: isocorydine, hernovine, ovigerine, N-methylovigerine, N-methylnandigerine, and nandigerine, the latter being the major alkaloid of the plant. In addition, H. catalpifolia contains norisocorydine, O,O-dimethylcorytuberine, N-methyllaurotetanine, laurolitsine and a new base, catalpifoline (V), $C_{20}H_{23}NO_4$, m.p. 174-175°, $[\alpha]_D^{25}$ +220° (c, 0.10 in EtOH). The structure of catalpifoline was proven by its identity with the diazomethane alkylation product of hernovine[1,16]



V

Although there is considerable similarity in the alkaloidal constituents of the East Indian H. ovigera and of the West Indian H. catalpifolia, it is interesting to note the absence of the benzylisoquinoline-aporphine dimer thalicarpine as well as hernandaline (III) in the West Indian species.

REFERENCES

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2. M. Tomita, H. Furukawa, Sheng-Teh Lu, and S. M. Kupchan, Tetrahedron Letters, 4309 (1965).
3. W. H. Baarschers, R. R. Arndt, K. Pachler, J. A. Weisbach, and B. Douglas, J. Chem. Soc., 4778 (1964).
4. Mild permanganate oxidation of thalicarpine (I) has been reported to give, along with N-methyl-6,7-dimethoxy-1,2,3,4-tetrahydroisoquinolin-1-one, aldehyde (IV), which is structurally a 6a, 7-dehydro derivative of hernandaline; N. M. Mollov and H. B. Dutschewska, Tetrahedron Letters, 853 (1966).
5. We are grateful to Mr. G. Proctor of the Institute of Jamaica, Kingston, Jamaica for botanical identification of this species.
6. All molecular formulae indicated in this paper were supported by acceptable elemental analyses. Melting points are uncorrected. All NMR spectra were run in $CDCl_3$, with $(CH_3)_4Si$ as standard; data are recorded in δ (delta) units.