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Phytochemistry, Vol. 24, No. 1, pp 203–204, 1985.
Printed in Great Britain

0031-9422/85 $3.00 + 0.00
Pergamon Press Ltd.

APORPHINE ALKALOIDS FROM *PHOEBE PITTIERI*

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(*Revised received* 20 *June* 1984)

Key Word Index—*Phoebe pittieri*; Lauraceae; alkaloids; 1,2,3-trimethoxy-9,10-methylenedioxynoraporphine; 1,2,9-trimethoxy-10-hydroxynoraporphine (norlirioferine); norpurpureine; reticuline.

Abstract—The wood and bark of *Phoebe pittieri* afforded 1,2,3-trimethoxy-9,10-methylenedioxynoraporphine and 1,2,9-trimethoxy-10-hydroxynoraporphine (noraporphine), which are new alkaloids, and norpurpureine and reticuline, which have not been reported from this source before.

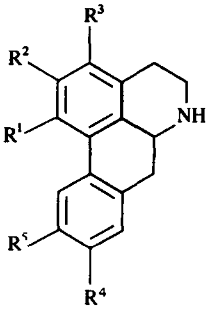
INTRODUCTION

Phoebe pittieri belongs to the Lauraceae which is well known as a rich source of isoquinoline alkaloids. A short review of previous work on the genus *Phoebe* has recently appeared [1]. Extracts of the wood and bark of *P. pittieri* were shown to have some antibacterial and antifungal properties (preliminary work done at our laboratory). This plant has not been studied previously and in this communication we report two new alkaloids, 1,2,3-trimethoxy-9,10-methylenedioxynoraporphine (**1**) and 1,2,9-trimethoxy-10-hydroxynoraporphine (**2**) (norlirioferine), as well as the known alkaloids norpurpureine (**3**) and reticuline (**4**), which have not been reported from this source before

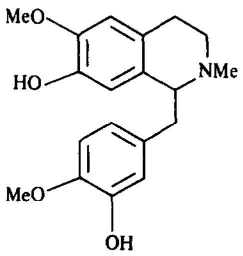
RESULTS AND DISCUSSION

Compound **1**, $C_{20}H_{21}NO_5$, $[M]^+$ 355 had a methoxy group located at C-1 because according to the literature this is the one that appears further upfield in the ^1H NMR spectrum [2]. The methylenedioxy group was located at positions other than 9 and 10 because it appears as a singlet while if it is located at positions 9 and 10 it is usually split into two doublets because of the asymmetry of the twisted biphenyl system [2–4]. The ^1H NMR spectrum shows clearly two individual protons at δ6.70 and 6.83 for protons at positions 8 and 11, respectively, as reported in the literature [3]. The ^{13}C NMR data for model compounds [3, 5–7] also support the proposed structure **1**.

Compound **3** was identified as norpurpureine on the basis of published data (UV, ^1H NMR) for this compound [1, 4]. Norpurpureine has been isolated previously



1 $R^1 = R^2 = R^3 = OMe$, $R^4 = R^5 = O-CH_2-O$
2 $R^1 = R^2 = R^4 = OMe$, $R^3 = H$, $R^5 = OH$
3 $R^1 = R^2 = R^3 = R^4 = R^5 = OMe$



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from *Annona purpurea* (Annonaceae) and recently from *P. mollicella* [1].

Structure **2** was assigned to compound **2** based on spectroscopic data (see Experimental) and comparison with a similar compound (lirioferine) [8], isolated recently in our laboratories. The data were similar except for the lack of a methyl signal in the ^{1}H NMR and ^{13}C NMR spectra. Alkaloid **4** was identified as reticuline from spectroscopic data (see Experimental) and by its conversion to perchlorate, a solid, mp 202–203° (lit 202°) (comparison with spectroscopic data for lirioferine isolated in our laboratory) and by comparison with the spectroscopic data published for reticuline perchlorate [9].

EXPERIMENTAL

Plant material was collected on the road to the Irazu Volcano (5 km before reaching the crater), Costa Rica. The plant was identified by L. Poveda; voucher specimens have been deposited at the herbarium of the National Museum, No. 89740.

UV spectra were recorded in MeOH. ^{1}H NMR and ^{13}C NMR spectra were recorded with TMS as internal standard in $CDCl_3$.

Silica gel S (Riedel-de-Häen, 0.063–0.10 mm) was used for column chromatography and silica gel G (Merck) for TLC.

Isolation of alkaloids **1** *and* **3**. Powdered wood of *P. pittieri* (1.9 kg) was extracted exhaustively with EtOH and concd under red. pres. to yield a syrupy residue (110 g), which was partitioned between 5% HCl and $CHCl_3$. The $CHCl_3$ fraction was concd under red. pres. to give a brown residue (5 g), which upon chromatographic analysis showed two main alkaloids. The acidic aq. fraction was alkalized to pH 9–10 with NH_3 and extracted with $CHCl_3$.

The $CHCl_3$ extracts were concd under red. pres. to yield an alkaloidal fraction (3 g), which showed the same two main alkaloids and traces of other minor alkaloids. The $CHCl_3$ fraction was crudely fractionated by silica gel CC using $CHCl_3$ and $CHCl_3$–MeOH mixtures to elute the compounds. Several fractions eluted with $CHCl_3$–MeOH (49:1) were combined and subjected to prep. TLC on silica gel using EtOAc–NH_4OH (99.1), which afforded the two major compounds **1** and **3** as slightly coloured oils.

Compound **1** (1,2,3-trimethoxy-9,10-methylenedioxynoraporphine): UV λ_{max}^{MeOH} nm (log ε): 315 (4.18), 312 (4.17), 280 (4.21), 272 sh (4.00). ^{1}H NMR: δ7.83 (*s*, H-11), 6.70 (*s*, H-8), 5.94 (*s*, O–CH_2–O), 3.93 (*s*, OMe-2), 3.89 (*s*, OMe-3), 3.73 (*s*, OMe-1). ^{13}C NMR: δ145.14 (C-1), 125.28 (C-1a), 129.49 (C-1b), 149.92 (C-2), 149 16 (C-3), 128.09 (C-3a), 23.69 (C-4), 42.67 (C-5), 53.94 (C-6a), 37.06 (C-7), 131.12 (C-7a), 107.94 (C-8), 145.79 (C-9), 146.24 (C-10), 108.29 (C-11), 122.60 (C-11a), 100.65 (C-9, 10 O–CH_2–O), 60.53 (C-1 OMe), 60.24 (C-2 OMe), 60.83 (C-3 OMe). MS *m/z* (rel. int.): 355 $[M]^+$ (96), 354 (100), 340 (21), 338 (10), 326 (9), 324 (33), 311 (7), 309 (9), 295 (12), 194 (1), 132 (3).

Compound **3** was identified as norpurpureine on the basis of published data (UV and ^{1}H NMR) for this compound [1, 4].

Isolation of alkaloids **2** *and* **4**. An alkaloidal extract from the bark of *P. pittieri* (850 g) was prepared by partitioning an alcoholic extract of this material between HCl and Et_2O, alkalizing the acidic fraction with NH_3 to pH 9–11 and extracting with Et_2O. The conc. alkaloidal fraction (3.5 g) was fractionated crudely by silica gel CC and some of the alkaloid-rich fractions were re-chromatographed on a silica gel column to yield alkaloids **2** and **4**.

Compound **2** (*norlirioferine*) Mp 94–96°; UV λ_{max}^{MeOH} nm (log ε): 312 sh (3.89), 302 (3.95), 281 (3.83), 220 (4.36). UV $\lambda_{max}^{MeOH-KOH}$ nm: 330 sh (log 3.91), 315 (3.98), 310 sh (3.95), 280 sh (3.80). ^{1}H NMR: δ8.08 (*s*, H-11), 6.79 (*s*, H-8), 3.89 (*s*, OMe-9)*, 3.88 (*s*, OMe-2)*, 3.66 (*s*, OMe-1). ^{13}C NMR: δ144.08 (C-1), 126.63 (C-1a), 127.93 (C-1b), 151.91 (C-2), 110.69 (C-3), 128.85 (C-3a), 29.24 (C-4), 43.14 (C-5), 53.76 (C-6a), 36.66 (C-7), 129.72 (C-7a), 111.33 (C-8), 145.25 (C-9), 144.90 (C-10), 113.96 (C-11), 123.77 (C-11a), 60.13 (C-1 OMe), 55.86 (C-2 OMe), 55 98 (C-9 OMe).

MS *m/z* (rel. int.): 327 $[M]^+$ (68.3), 326 (100), 312 (22.6), 310 (18.1), 298 (6.3), 295 (17.3), 283 (8.9), 281 (7.9), 267 (11.4), 162 (0.3), 136 (1.6).

Compound **4** (*reticuline*). Mp 71–74°; UV λ_{max}^{MeOH} nm (log ε): 283 (3.44), 223 sh (3.79), 210 (4.09). UV $\lambda_{max}^{MeOH-KOH}$ nm (log ε): 288 (3.45), 228 sh (3.79). ^{1}H NMR: δ6.77 (1H, *d*, J_2 = 1.5 Hz, H-2′), 6.73 (1H, *d*, J = 8.0 Hz, H-5′), 6.60 (1H, *dd*, J_1 = 8.0, J_2 = 1.5 Hz, H-6), 6.54 (1H, *s*, H-5), 6.39 (1H, *s*, H-8), 3.85 (6H, *s*, OMe), 3.25–2.55 (6H, *m*, aliphatic protons), 2.47 (3H, *s*, NMe). ^{13}C NMR: δ145.19 (C-6, C-3′), 143.33 (C-7), 132.88 (C-8a), 129.84 (C-1′), 124.88 (C-4a), 120.79 (C-6′), 155.59 (C-5), 113.67 (C-5, C-4′), 110.51 (C-8, C-2′), 64.51 (C-1), 55.92 (C-6, C-3′ OMe), 46.81 (C-3), 42.38 (N-Me), 40.98 (C-9), 25.83 (C-4). MS *m/z* (rel. int.): 328 $[M-1]^+$ (0.5), 192 (100), 177 (18.3), 149 (7.1).

Acknowledgements—This work was supported by National Science Foundation Developing Countries Program Grants INT 82-07455 and 83-12021, the Vicerrectoría de Investigación of the University of Costa Rica and the Organization of American States (OAS). Spectral assistance was provided by the Colorado State University Regional NMR Center, funded by the National Science Foundation, Grant No. CHE-8208821. Exact mass measurements were performed by the Midwest Center for Mass Spectrometry, a National Science Foundation Regional Instrumentation Facility (Grant No. CHE-8211164).

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*Signals may be reversed.