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A QUINOLINE ALKALOID FROM *ACANTHOSYRIS PAULO-ALVINII*

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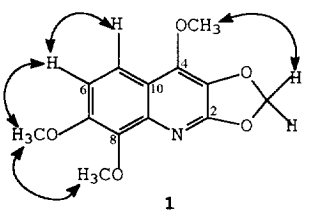
Key Word Index—*Acanthosyris paulo-alvinii*; Santalaceae; norterpenoids; quinoline alkaloid.

Abstract—Leaves of *Acanthosyris paulo-alvinii* afforded the new alkaloid 2,3-methylenedioxy-4,7,8-trimethoxyquinoline (**1**), as well as the known compounds loliolide (**2**) and 3-hydroxy-5,6-epoxy-β-ionone (**3**). ^{13}C NMR spectroscopic assignments are reported. © 1997 Elsevier Science Ltd

INTRODUCTION

Acanthosyris paulo-alvinii Barroso (Santalaceae) is a Brazilian representative of this genus which is comprised of four species. This tree is scattered in the Atlantic forest in the south of the State of Bahia (Brazil) and is known as 'mata-cacau' due to its phytotoxic effect of inhibiting the growth of *Theobroma cacao* [1, 2]. There have been no phytochemical studies on this genus. A NAPRALERT search indicated an ethnomedical use of *A. falcata* as an anti-inflammatory, cicatrizant, analgesic and ocular antiseptic [3].

This paper reports studies on the leaves of *A. paulo-alvinii* which afforded the new quinoline alkaloid **1**, and the two norisoprenoids loliolide (**2**) [4] and 3-hydroxy-5,6-epoxy-β-ionone (**3**) [5], for which ^{13}C NMR spectroscopic data are reported for the first time.



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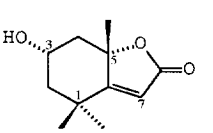

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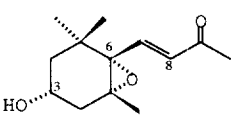

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RESULTS AND DISCUSSION

Alkaloid **1** reacted positively to Dragendorff's reagent. Its molecular formula $C_{13}H_{13}O_5N$ was suggested through a molecular ion at *m/z* 263 in EIMS, as well as ^{13}C NMR spectroscopic data. This formula was further confirmed by HR-mass spectrometry (obsd. 263.0783).

The ^1H NMR spectrum revealed the presence of three methoxyl groups, a methylenedioxy group and a pair of doublets at δ 7.11 ($J = 9.2$ Hz) and 7.71 ppm ($J = 9.2$ Hz) indicating one pair of *ortho* related aromatic protons. These findings were corroborated by the ^{13}C NMR spectra, which displayed the carbon signals of a methylenedioxy (δ 99.0), three methoxyl groups (δ 56.7, 59.4, 61.6 ppm) and two methine sp^2 carbons at 111.8 and 116.8 ppm, respectively. Besides these, the spectra showed the presence of seven sp^2 quaternary carbons. HMQC and HMBC experiments (Table 1) established the spatial relationships between the above groups. The correlations observed for H-5 with C-4 and C-7, which both bear methoxyl groups, and those displayed for H-6 with C-7 and C-8, afforded the location of three methoxyl groups. In the same way, it was possible to correlate the methylenedioxy protons with C-2 (Table 1). These observations were supported by NOE difference experiments. Thus, irradiation of H-5 and H-6 led to a 4% enhancement of H-6 and H-5, and of the methoxyl resonance at C-7, respectively. On the other hand, both the methylenedioxy protons and the methoxyl group at C-4 were enhanced by 1.8% when each was separately irradiated. NOESY studies also confirmed

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Table 1. NMR Spectral Data of **1**

Position	^{13}C (δ)	^{1}H (δ)*	HMBC
2	159.6		
3	122.1		
4	141.7		
5	116.8†	7.71	130.6, 138.3, 141.7, 151.3
6	111.8†	7.11	116.8, 143.0, 151.3
7	151.3		
8	143.0		
9	138.3		
10	130.6		
OCH_2O	99.0†	6.04	122.1, 159.6
4-OCH_3	59.4†	4.28	141.7
7-OCH_3	56.7†	3.97	151.3
8-OCH_3	61.6†	4.03	143.0

* Chemical shifts with reference to $\delta_{TMS} = 0$ ppm. Multiplicity in ^{13}C spectrum determined by DEPT 135°.

† Correlations obtained from HMQC.

the location of the methoxyl groups at C-7 and at C-8 through correlations displayed between δ 3.97 (OCH_3 at C-7) with the resonance at δ 7.11 (H-6) and at δ 4.03 (OCH_3 at C-8). Compound **1** was subjected to cytotoxicity evaluation in a panel of human cancer cell lines [7]. No activity was observed.

The other two compounds isolated from the $CHCl_3$ phase, loliolide (**2**) and 3-hydroxy-5,5-epoxy-β-ionone (**3**) were identified by comparison of their spectral data with literature values [3, 4]. These substances are known phytotoxic agents found in allelopathic plants [6].

EXPERIMENTAL

General. ^{1}H (300 MHz), ^{13}C (75 MHz), HMBC and HMQC (500 MHz) NMR spectroscopy: $CDCl_3$ as int. standard; CC: silica gel (230–400 mesh—Merck); LH-20 Sephadex (Pharmacia) ($CHCl_3$–MeOH); TLC and Prep. TLC: silica gel PF_{254} (Merck), respectively 0.25 and 1.5 mm.

Plant material. Leaves of *Acanthosyris paulo-alvinii* Barroso were collected in the vicinity of CEPLAC, Mata de Ilheus—Bahia (Brazil). A voucher is deposited at the CEPEC Herbarium of CEPLAC, under number 15716.

Isolation. The powdered leaves (1.3 kg) were extracted with EtOH. The concd extracts were partitioned successively between hexane/EtOH–H_2O (9:1) and $CHCl_3$/EtOH–H_2O (6:4). The $CHCl_3$ phase (4.47 g) was cc on silica gel eluting with $CHCl_3$–MeOH. The fr. eluted with $CHCl_3$/MeOH (9:1) and containing the alkaloid was submitted to gel permeation on Sephadex LH-20 with $CHCl_3$/MeOH (1:4) followed by prep. TLC with $CHCl_3$/MeOH (9:1) affording the pure alkaloid (15.6 mg).

2,3-*Methylenedioxy*-4,7,8-*trimethoxy-quinoline* (**1**). Needles, mp 112–114° (uncorr.); UV λ_{max} nm: 272 (log ε 3.33), 243 (log ε 4.01); IR ν_{max} cm^{-1}: 2922, 2851, 1607, 1491, 1379, 1275, 1093, 1042; HREIMS: 263.0783 ($C_{13}H_{13}O_5N$ requires 263.0794); EIMS *m/z* (rel. int.): 263 (39), 248 (62), 233 (60), 190 (70), 97 (70), 57 (100). ^{1}H and ^{13}C NMR spectra: Table 1.

Loliolide (**2**). CIMS (Methane) *m/z* 197 $[M+H]^+$; ^{1}H NMR (300 MHz, $CDCl_3$): 1.20 (*s*, 6H, Me at C-1), 1.79 (*s*, 3H, Me at C-5), 4.34 (*dd*, $J = 4$ Hz and ind., H-3), 5.69 (*s*, H-7); ^{13}C NMR (75 MHz, $CDCl_3$)*: 19.8 and 29.2 (Me at C-1), 26.9 (Me at C-5), 35.6 (C-1), 45.5 and 46.2 (C-2 and C-4), 66.8 (C-3), 87.4 (C-5), 112.7 (C-7), 172.3 (C-6), 182.6 (C-8).

3-*Hydroxy*-5,6-*epoxy*-β-*ionone* (**3**). CIMS (Methane) *m/z* 225 $[M+H]^+$; ^{1}H NMR (300 MHz, $CDCl_3$): 0.99 (*s*, 3H, Me at C-5) 1.29 (*s*, 3H, Me at C-1), 1.48 (*s*, 3H, Me at C-1), 2.28 (*s*, 3H-10), 3.91 (*m*, H-3), 6.28 (*d*, $J = 15$ Hz, H-8), 7.03 (*d*, $J = 15$ Hz, H-7); ^{13}C NMR (75 MHz, $CDCl_3$)†: 24.9 (Me at C-5), 26.4 and 30.6 (Me at C-1), 28.1 (C-10), 35.1 (C-1), 40.5 (C-2), 47.2 (C-4), 66.1 (C-3), 67.7 (C-5), 69.4 (C-6), 123.4 (C-8), 142.3 (C-7), 197.5 (C-9).

*,† Assignments determined from HMQC and HMBC spectra.

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