Studies on Constituents of Medicinal Plants. XXIII. Constituents of the Vines of Menispermum dauricum DC. (2)

[Chem. Pharm. Bull. 31(9)3091—3093(1983)]

Studies on Constituents of Medicinal Plants. XXIII.[1] Constituents of the Vines of *Menispermum dauricum* DC. (2)[2]

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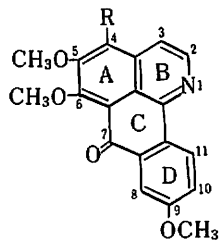
(Received January 25, 1983)

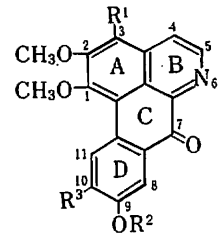
A new oxoisoaporphine-type compound, named dauriporphine, was isolated from the vines of *Menispermum dauricum* DC. (Menispermaceae) and the structure of this compound was elucidated as 4,5,6,9-tetramethoxy-7*H*-dibenzo[*de*, *h*]quinolin-7-one (I).

Keywords——*Menispermum dauricum* DC. (Menispermaceae); dauriporphine; oxoisoaporphine; 7*H*-dibenzo[*de*, *h*]quinolin-7-one; lupeol; β-sitosterol; ^{1}H-NMR

In a previous paper of this series, the authors have reported the structural elucidation of a new non-alkaloidal component of the vines of *Menispermum dauricum* DC. (Menispermaceae), named menisdaurin.[2] Several reports on alkaloidal compounds of this plant have been published.[4] Recently, an oxoisoaporphine-type alkaloid, named menisporphine (II), was isolated from this plant for the first time.[5] This paper deals with the isolation and the structural elucidation of a new alkaloidal component of this plant, named dauriporphine (I). The *n*-hexane-soluble fraction of the methanolic extract of the vines[2] was treated as mentioned in the experimental part to afford dauriporphine (I), $C_{20}H_{17}NO_5$ (*m/e* 351, M^+), yellow needles of mp 167 °C (negative ferric chloride reaction). Its infrared (IR) spectrum (cm^{-1}) shows a conjugated carbonyl band at 1640. Its ultraviolet (UV) and visible absorption spectra [(λ_{max}^{EtOH} nm, log ε): 210 (4.73, end absorption), 226 (4.58, sh), 258 (4.75), 285 (4.15, sh), 310 (3.91, sh), 344 (3.95, sh), 414 (4.20)] indicate a highly conjugated system similar to those of the oxoisoaporphine-type alkaloid menisporphine (II)[5] (formula A) or oxoaporphine-type alkaloids[6] (formula B) (Chart 1). On addition of alkali or acid to the



(formula A)
dauriporphine (I): R = OCH_3
menisporphine (II): R = H



(formula B)
subsessiline (III): $R^1 = OCH_3$, $R^2 = R^3 = H$
oxopurpreine (IV): $R^1 = R^3 = OCH_3$, $R^2 = CH_3$
1,2,9-trimethoxyoxoaporphine (V): $R^1 = R^3 = H$, $R^2 = CH_3$

Chart 1

ethanolic solution, no shift of these maxima was observed. The proton magnetic resonance (^{1}H-NMR) spectrum (δ-value, ppm, $CDCl_3$) (Table I) exhibits signals of four methoxyl groups at 3.95, 4.03, 4.16 and 4.24, three aromatic protons at 7.26 (dd, J=8.8, 2.7 Hz), 7.79

(d, J=2.7 Hz) and 8.72 (d, J=8.8 Hz), and a typical AB quartet at 7.84 (d, J=5.6 Hz) and 8.61 (d, J=5.6 Hz), assignable to the protons at C_3 and C_2 of oxoisoaporphine (formula A) or to those at C_4 and C_5 of oxoaporphine (formula B), respectively. Dauriporphine (I) does not exhibit a singlet in the aromatic region of its ^{1}H-NMR spectrum, indicating that ring A is fully substituted by three methoxyl groups, in view of the biogenetic consideration that alkaloids of isoquinoline-type almost all bear oxy groups at C_5 and C_6 of oxoisoaporphine (formula A) or at C_1 and C_2 of oxoaporphines (formula B). The δ-values of the aromatic protons of the pyridine ring of dauriporphine (I) (7.84 and 8.61) differ from those of the C_4- and C_5-protons of oxoaporphine-type compounds such as subsessiline (III) (8.17 and 8.91)[7] and oxopurpreine (IV) (8.13 and 8.91),[8] which have three methoxyl groups at C_1, C_2 and C_3. The C_4-proton of an oxoaporphine-type compound is assumed to be more strongly deshielded by the C=O group than the C_3-proton of an oxoisoaporphine-type compound. As expected, the C_4-proton of an oxoaporphine-type compound such as 1,2,9-trimethoxyoxoaporphine (V) (7.72)[9] resonates at lower magnetic field than the C_3-proton of an oxoisoaporphine such as menisporphine (II) (7.55). The aromatic proton of the pyridine ring of dauriporphine (I) (7.84) resonates at higher magnetic field than the C_4-proton of subsessiline (III) (8.17). In the case of oxoaporphine-type compounds (formula B), subsessiline (III) exhibits the C_4-proton signal at 8.17 and 1,2,9-trimethoxyoxoaporphine (V) at 7.72, so the deshielding effect of the methoxyl group at C_3 on the C_4-proton is 0.45 ppm. Dauriporphine (I) exhibits the signal of the aromatic proton of the pyridine ring at 7.84, while that of menisporphine (II) is at 7.55. The difference (0.29 ppm) could be assumed to be caused by the deshielding effect of the methoxyl group at C_4 of dauriporphine (I). These spectral data suggest that dauriporphine (I) is related to oxoisoaporphine-type alkaloids (formula A) such as menisporphine (II) rather than oxoaporphine-type alkaloids (formula B). The C_{11}-proton of an oxoisoaporphine-type compound (formula A) is expected to resonate appreciably downfield due to the ring-current effect of the pyridine skeleton. Therefore, the signal (8.72, d, J=8.8 Hz) of the aromatic proton of dauriporphine (I) which resonates in the lowest magnetic field, could be assigned to the C_{11}-proton. Thus, the fourth methoxyl group of dauriporphine (I) could be assumed to be located at C_9 (formula A) from the δ-values, the splittings and the coupling constants of the signals due to the three aromatic protons in its ^{1}H-NMR spectrum, as shown in Table I. The three aromatic protons of ring D of dauriporphine (I) resonate at nearly the same δ-values as the corresponding proton of menisporphine (II). Consequently, the ^{1}H-NMR spectrum of dauriporphine (I) could be interpreted as shown in Table I.

Table I. ^{1}H-NMR Data (δ-Value, J in Hz)

	C_2-H	C_3-H	C_8-H	C_{10}-H	C_{11}-H	Other protons	Solvent
Dauriporphine (I)	8.61 d, J=5.6	7.84 d, J=5.6	7.79 d, J=2.7	7.26 dd, J=8.8, 2.7	8.72 d, J=8.8	OCH_3: 3.95, 4.03, 4.16, 4.24	$CDCl_3$
	8.67 d, J=6.6	8.50 d, J=6.6	8.21 d, J=2.7	7.63 dd, J=8.8, 2.7	8.58 d, J=8.8	OCH_3: 4.15, 4.22, 4.48, 4.51	CF_3COOD
Menisporphine (II)[5]	8.65 d, J=5.5	7.55 d, J=5.5	7.86 d, J=2.5	7.33 dd, J=9.0, 2.5	8.79 d, J=9.0	C_4-H: 7.40 (s) OCH_3: —[a]	$CDCl_3$

a) Undescribed.
Abbreviations: s, singlet; d, doublet; dd, doublet of doublets.

These results suggest that dauriporphine is 4,5,6,9-tetramethoxy-7*H*-dibenzo[*de*, *h*]-quinolin-7-one (I) as shown in Chart 1. However, this conclusion requires confirmation, probably by direct synthesis of the compound in question.

Experimental

The following instruments were used for determining physical data: melting point, Yanagimoto micro melting point apparatus (a hot plate type) (values are uncorrected); UV spectra, Union Giken SM-401 recording spectrometer; IR spectra (in KBr pellet), Nippon Bunko IR-G spectrometer; ^{1}H-NMR spectra (δ-value, ppm), JNM-PX-100S at 100 MHz with $(CH_3)_4Si$ as an internal reference; mass spectrum (MS), JMS-01SG mass spectrometer (direct inlet) (the ionizing current was kept at 200 μA, while the ionizing energy was maintained at 75 eV and the source temperature at 160 °C. Thin layer chromatography (TLC) was carried out on glass plates coated with Silica gel G (Merck), and column chromatography was carried out using Silica gel 60 (Merck).

Isolation of Dauriporphine (I)——The *n*-hexane-soluble fraction (140 g) of the methanolic extract[2] of the vines was chromatographed over silica gel (column A) with benzene–AcOEt (10 : 1). The fraction of *Rf* 0.65—0.59 (TLC, benzene–AcOEt = 10 : 1) was chromatographed over silica gel with $CHCl_3$–AcOEt (20 : 1) and the fraction of *Rf* 0.71 (TLC, $CHCl_3$–AcOEt = 20 : 1) was again chromatographed over silica gel with AcOEt–$CHCl_3$–benzene (5 : 3 : 15). The fraction of *Rf* 0.66 (TLC, AcOEt–$CHCl_3$–benzene = 5 : 3 : 15) was crystallized from methanol to afford colorless needles of mp 215 °C, which were proved to be identical with lupeol by mixed fusion, and IR and TLC comparisons. The fraction of *Rf* 0.50 (TLC, benzene–AcOEt = 10 : 1), obtained from column A eluted with benzene–AcOEt (10 : 1) afforded β-sitosterol of mp 139 °C as colorless triangular crystals. Column A, after being eluted with benzene–AcOEt (10 : 1), was further eluted with benzene–AcOEt (5 : 1). The fraction of *Rf* 0.62—0.59 (TLC, benzene–AcOEt = 5 : 1) (1.25 g) was chromatographed over silica gel with $CHCl_3$–AcOEt (5 : 1) and the fraction of *Rf* 0.50 (TLC, $CHCl_3$–AcOEt = 5 : 1) was crystallized from methanol to afford yellow needles of mp 167 °C (I). Yield: 104 mg. UV $\lambda_{max}^{EtOH \cdot 0.05\ N\ NaOH}$ nm (log ε): 210 (4.74, end absorption), 226 (4.58, sh), 257 (4.74), 285 (4.14, sh), 310 (3.90, sh), 344 (3.95, sh), 414 (4.20). UV $\lambda_{max}^{EtOH \cdot 0.05\ N\ HCl}$ nm (log ε): 210 (4.72, end absorption), 226 (4.58, sh), 257 (4.74), 285 (4.19, sh), 310 (3.91, sh), 344 (3.95, sh), 414 (4.20). IR ν_{max} cm^{-1}: 1640, 1600, 1585, 1570, 1395, 1350, 1275, 1200, 1120, 1080, 1020, 910, 825. MS *m/e* (relative intensity): 351 (100, M^+), 336 (79, $M^+ - CH_3$), 308 (8, 336 − CO), 293 (41, $M^+ - OCH_2$–CO), 278 (12), 263 (13, 293 − OCH_2), 250 (9), 222 (10), 194 (15), 166 (5), 165 (15). *Anal.* Calcd for $C_{20}H_{17}NO_5$: C, 68.37; H, 4.88; N, 3.99. Found: C, 68.38; H, 4.85; N, 4.10.

Acknowledgement The authors thank Mr. Y. Itatani of this faculty and Dr. S. Yoshifuji of Hokuriku University for ^{1}H-NMR spectra, Miss Y. Arano for elemental analysis and Miss K. Ohafa for MS.

References and Notes

1) Part XXII: M. Takani, K. Ohya and K. Takahashi, *Chem. Pharm. Bull.*, **27**, 1422 (1979).
2) K. Takahashi, S. Matsuzawa and M. Takani, *Chem. Pharm. Bull.*, **26**, 1677 (1978).
3) Present address: *237–1 Taheiji 2-chome, Nonoichi-machi, Ishikawa 921, Japan.*
4) *a*) M. Tomita, Y. Okamoto, Y. Nagai, K. Kitayama and H. Yanagawa, *Yakugaku Zasshi*, **90**, 1179 (1970); *b*) M. Tomita, Y. Okamoto, T. Kikuchi, K. Osaki, M. Nishikawa, K. Kamiya, Y. Sasaki, K. Matoba and K. Goto (deceased), *Chem. Pharm. Bull.*, **19**, 770 (1971); *c*) Y. Okamoto, S. Tanaka, K. Kitayama, M. Isomoto, M. Masaishi, H. Yanagawa and J. Kunitomo, *Yakugaku Zasshi*, **91**, 684 (1971).
5) J. Kunitomo and M. Satoh, *Chem. Pharm. Bull.*, **30**, 2659 (1982).
6) R. H. F. Manske, "The Alkaloids," Vol. XIV, Academic Press, New York, 1973, p. 225.
7) J. W. Skiles and M. P. Cava, *J. Org. Chem.*, **44**, 409 (1979).
8) P. E. Sonnet and M. Jacobson, *J. Pharm. Sci.*, **60**, 1254 (1971).
9) J. Kunitomo, Y. Murakami and M. Sugisakon, *Yakugaku Zasshi*, **99**, 102 (1979).