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A Zwitterionic Alkaloid from *Daphniphyllum Teijsmanni* Zollinger

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Synopsis. A zwitterionic alkaloid, the hydration product of daphnilactone-B, has been isolated from the fruits of the plant *Daphniphyllum teijsmanni* Zollinger, and its structure also been determined on the basis of its spectral and chemical properties.

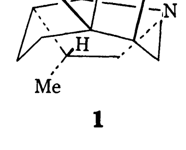
Many alkaloids have been isolated from the bark and leaves of the plant *Daphniphyllum macropodum* Miquel.[1)] Further examination of the alkaloidal components in the fruits of the plant *Daphniphyllum teijsmanni* Zollinger led to the isolation of several alkaloids including daphnilactone-B (**1**) as a major product.[1,2)] The present paper deals with the zwitterionic alkaloid related with daphnilactone-B.

As described in the previous paper,[2)] an oily material containing alkaloidal components was chromatographed on alumina, and eluted successively with hexane, hexane–benzene (1: 1), benzene, benzene–$CHCl_3$ (1: 1) and $CHCl_3$ to give six alkaloids. Further elution with EtOAc–MeOH (9: 1) afforded colorless plates of a new alkaloid (**2**) in 0.00042% overall yield.

This alkaloid (**2**) has a molecular formula [$C_{22}H_{33}O_3N$ (m/e 359 (M^+)); mp (decomp) 247—248 °C] with the following spectral data: ν_{max} (Nujol) 3300, 1595, and 1575 sh.cm^{-1}; δ (CD_3OD-D_2O) 1.09 (3H, d, J=6.0 Hz), 3.40—4.05 (5H, complex), 3.70 (1H, d, J=10.5 Hz), 4.27 (1H, d, J=10.5 Hz) and 5.74 ppm (1H, br.s, $Wh \simeq 5$ Hz). The IR and NMR spectra of **2** indicate the presence of a hydroxymethyl group (ν_{max} 3300 cm^{-1}; δ 3.70 and 4.29 ppm). Furthermore, the IR absorption band at 1595 and 1575 sh.cm^{-1} may be due to the CO group of a carboxylate. This is confirmed by the following chemical evidence.

When treated with anhydrous MeOH containing HCl gas (room temp., 5 hr), this alkaloid was readily converted into a mixture of two compounds. The major product was proved to be identical with daphnilactone-B (**1**) (mp, mass and IR spectra), and the remaining one was the expected methyl ester (**3**) which had been already obtained on treatment of **1** with NaOMe.[2)] Action of 90% HCOOH on **2** also converted it to daphnilactone-B.

Biogenetically, this zwitterionic alkaloid (**2**) may be regarded as a precursor of daphnilactone-B (**1**), although we can not rule out a possibility, in which the former is produced from **1** in the course of isolation.



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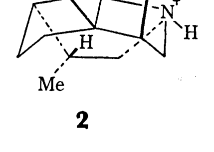

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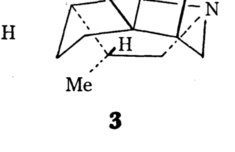

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Experimental

All mps are uncorrected. The IR and mass spectra were recorded on a JASCO Model IR-S and on a Hitachi RMU 6C mass spectrometer, respectively. The NMR spectra were obtained on a Nihondenshi JNM-PS 100. Chemical shifts are given in ppm from TMS as an internal standard. Only prominent peaks are cited.

Isolation of the Zwitterionic Alkaloid (2). The fruits of the plant *Daphniphyllum teijsmanni* Zollinger (10 kg) were extracted with MeOH (10 l) at room temperature for 2 weeks and treated according to the procedure described in Ref. 2 to give an oil (12 g), which was chromatographed on alumina (Nakarai Chemical Co. Ltd., *ca.* 300 mesh) (60 g) and eluted with hexane, hexane–benzene (1: 1), benzene, benzene–$CHCl_3$ (1: 1) and $CHCl_3$ to afford methyl homodaphniphyllate, daphnilactone-B, daphniphylline, yuzurimine, methyl homosecodaphniphyllate and yuzurimine-B.[2)] Further elution with EtOAc–MeOH (9: 1) afforded a crystalline solid, which was recrystallized from water–acetone to give colorless plates of **2**, mp (decomp) 247—248 °C (Found: m/e 359.24395. Calcd for $C_{22}H_{33}O_3N$: m/e 359.24603).

Formation of Daphnilactone-B (1) and the Methyl Ester (3). To a solution of **2** (50 mg) in anhydrous MeOH (2 ml) was added one drop of ether saturated with HCl gas. The reaction solution was stirred at room temp. for 5 h, and then concentrated under reduced pressure below 5 °C to leave a solid which was dissolved in $CHCl_3$ containing small amounts of $NaHCO_3$ and subjected to preparative tlc (Kieselgel 60 PF_{254}: hexane–Et_2O–Et_2NH (10: 10: 1)]. From the less polar fraction daphnilactone-B (**1**) (30 mg) was isolated (mp, IR and mass spectra), and the methyl ester (**3**) (5 mg) was obtained from the more polar fraction (IR and mass spectra).[2)]

Conversion of 2 to Daphnilactone-B (2). A solution of **2** (73 mg) in 90% aq. HCOOH (1 ml) was stirred at 85 °C overnight, and then diluted with small amounts of water. The aqueous solution was made basic with Na_2CO_3 and extracted with $CHCl_3$. The extract was washed with sat. NaCl aq., and then dried over Na_2SO_4. Removal of the solvent gave a colorless oil, which was chromatographed on basic alumina (2 g) and eluted with $CHCl_3$ to afford daphnilactone-B (28 mg) (mp, and IR spectrum).[2)]

References

1) S. Yamamura and Y. Hirata, "The Alkaloids," Vol. XV, ed. by R. H. F. Manske, Academic Press, New York (1975), p. 41.

2) M. Toda, H. Niwa, H. Irikawa, Y. Hirata, and S. Yamamura, *Tetrahedron*, **30**, 2683 (1974).