CHEMICAL CONSTITUENTS OF THE FLORA OF JORDAN, II.[1] ALKALOIDS OF *LEONTIC LEONTOPETALUM*

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As part of our continuing study of the chemical constituents of the flora of Jordan, we investigated the alkaloids of *Leontic leontopetalum* L. (Berberidaceae). The plant is common to many parts of Jordan, and its tubers are used in folk medicine for the treatment of epilepsy. Previously, six alkaloids had been isolated from *L. leontopetalum* of Bulgarian origin. These were (+)-lupanine, leontiformine, leontiformidine, stylopine, palmatine, and tetrahydropalmatine (2). Another study on the same species collected in Lebanon resulted in the isolation of the 7,8-dioxygenated benzylisoquinoline alkaloids, petaline, and petaline methine (3,4).

In the present study, five known isoquinoline alkaloids have been isolated from the tubers of the plant for the first time. These are (+)-reticuline, (±)-juziphine (5), (±)-norjuziphine (6), (−)-magnocurarine chloride (7,8), and (−)-oblongine chloride (5,9). Three of the previously reported compounds in the plant were also isolated; these are (+)-lupanine (2,10,11), (+)-leontiformine (2), and (−)-petaline chloride (3,4). *Cis*- and *trans*-petaline methine also were obtained and probably are artifacts of isolation resulting from Hofmann elimination of petaline under mild conditions (3,4). It is noteworthy that oblongine chloride was the major alkaloid of Jordanian *L. leontopetalum*.

EXPERIMENTAL

GENERAL EXPERIMENTAL PROCEDURES.—The spectra were obtained with the following instruments: ir, Perkin-Elmer 577; uv, Pye Unicam sp 8-500; ^{1}H nmr, Varian 60; ms, Varian MAT 112; [α]D, Perkin-Elmer 141 Polarimeter; adsorbents for cc and tlc were from Merck.

PLANT MATERIAL.—The flowering plants were collected near the village of Al-Kastal, 25 km to the south of Amman on the highway to Queen Alia International Airport. A voucher specimen is deposited at the Herbarium of the Department of Biological Sciences, University of Jordan, Amman, Jordan.

EXTRACTION AND ISOLATION.—The dried, powdered tubers were defatted with petroleum ether, then extracted with cold EtOH. The concentrated ethanolic extract was dissolved in 5% HCl and filtered. The filtrate was extracted with $CHCl_3$. The $CHCl_3$ layer was extracted again with 5% HCl. The resulting acidic solutions were combined, basified with NH_3, and then extracted with $CHCl_3$. The dried $CHCl_3$ extract (K_2CO_3) was concentrated to give a crude alkaloidal mixture A (14 g). The basic aqueous solution was acidified with concentrated HCl (pH 2) and treated with Mayer's reagent. The precipitated quaternary alkaloids were dissolved in MeOH-Me_2CO-H_2O (2:6:1), and then passed through a column of Amberlite CG-400 (Cl^-) to give a mixture of quaternary chlorides B (63 g). Fraction A was chromatographed on a silica gel column to give *trans*-petaline methine (110 mg), (+)-leontiformine (32 mg), *cis*-petaline methine (30 mg), (+)-lupanine (970 mg), (±)-juziphine (40 mg), (+)-reticuline (110 mg), and (±)-norjuziphine (30 mg). Chromatography of fraction B on silica gel afforded (−)-petaline chloride (11.07 g), (−)-oblongine chloride (28.63 g), and (−)-magnocurarine chloride (1.91 g). The isolated alkaloids were identified by their uv, ir, nmr, and ms spectral data and chemical transformations.

Full details of the isolation and identification of the compounds are available on request to the authors.

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PYRROLIZIDINE ALKALOIDS FROM BORAGE (*BORAGO OFFICINALIS*) SEEDS AND FLOWERS

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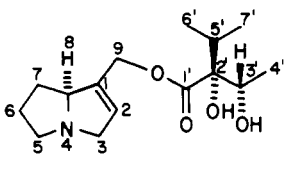
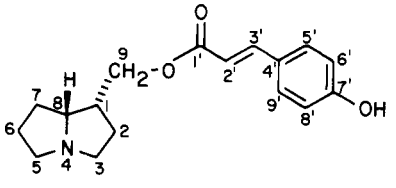
We recently reported (1) the isolation of the unsaturated pyrrolizidine alkaloid lycopsamine from leaves of borage (*Borago officinalis* L. Boraginaceae), a common garden herb used throughout the world in teas and salads. Also isolated was supinidine viridiflorate but only in trace amounts insufficient for determining optical rotation. (+)-Supinidine viridiflorate is named cynaustine; (−)-supinidine viridiflorate is amabiline (**1**) (2). Flowers of borage are used medicinally and in salads and beverages (3), while borage seed oil is known (3) to contain λ-linolenic acid and could be used as a dietary supplement. We have now analyzed seeds, seed oil, and flowers for pyrrolizidine alkaloids. The only alkaloid found in the flowers and the major seed alkaloid was thesinine (**2**), the *trans-p*-hydroxycinnamate of (+)-isoretronecanol. This is a rare pyrrolizidine, having been found only once previously (4) from *Thesium minkwitzianum*. Mature seeds were found to contain **2** and a smaller amount of the same unsaturated pyrrolizidine as the leaves (1). A sufficient amount of the latter was isolated so that an optical rotation measurement could be obtained. The alkaloid proved to be amabiline (**1**) and not cynaustine. One batch of immature seeds was also analyzed, and this material contained only thesinine. Three different samples of borage seed oil were analyzed, and no alkaloids were found. Amabiline was absent down to the 5 ppm level, but thesinine quantitation was too variable for low level determination. Unsaturated pyrrolizidines are suspect hepatotoxins (2), but saturated pyrrolizidines (such as the major seed component, thesinine) are not known to be toxic.

Because no spectral data have been published for **2** and little for **1**, ^{1}H- and ^{13}C-nmr data as well as physical properties are given below.



1



2

EXPERIMENTAL

Flowers were obtained from the previously described (1) locally grown borage. Seed was obtained from Dr. Dennis Jones, Director of Research and Quality Control, Horners' Inc., Montreal, Canada, and were grown in Europe. Seed oil was obtained from Dr. Brian Ladbrooke, POS, Saskatoon, Saskatchewan, Canada. Oil is prepared[1] by pressing the seed, which removes two-thirds of the oil. The seed is then extracted with hexane, the hexane evaporated, and the residue combined with the oil of the first pressing.

[1]B.D. Ladbrooke, private communication.