

ples were air dried, then subjected to steam distillation, according to the usual techniques (10). The yields are reported in Table 1. The oils obtained were dried with anhydrous Na₂SO₄, filtered, and sealed in glass vials under N₂ atmosphere.

The volatile oils were each analyzed by glc on a Carlo Erba (FID) instrument, using a 30 m × 0.25 mm fused silica capillary column containing a 0.25 μm film of SE-54. Hydrogen was used as the carrier gas, adjusted to a linear velocity of 33 cm/sec (measured at 150°); split flow was adjusted to give a 20:1 ratio, and septum sweep was a constant 10 ml/min. Splitless injection of 2 μl, of a 1:1000 *n*-hexane solution was followed by a delay of 30 sec before beginning purge. Injection was done with the oven at 50°. After a 3 min initial wait, the temperature was programmed at 6°/min to 230°.

The oils were submitted to gc/ms separation on a Finnigan 4021 quadrupole mass spectrometer, which includes an INCOS data system, coupled to a gc equipped with an identical 30m SE-54 fused silica capillary column. Injection and oven-programming temperature were the same as above except a 4°/min gradient was used. The ms was in EI mode at 70eV. The quadrupole filter was scanned from 34 to 434 daltons once every second and resulting spectra were stored on a disc for latter recall.

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UNSATURATED PYRROLIZIDINES FROM BORAGE (*BORAGO OFFICINALIS*), A COMMON GARDEN HERB

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Borage (*Borago officinalis* L., Boraginaceae) is of Mediterranean origin but is cultivated throughout the world. Commercial seed catalogs suggest use of the leaves to prepare salads or drinks. Most members of the family contain toxic pyrrolizidine alkaloids, and a high degree of cytotoxicity was recently reported for *B. officinalis* (1). The species is said to contain alkaloids (2,3), but none has been characterized. As part of our program in the testing of possible natural toxins in the human food chain, we have analyzed *B. officinalis* and found it to contain lycopsamine and supinidine viridiflorate (cynaustine or amabiline). These unsaturated pyrrolizidines are suspected poisons, but the low alkaloid level may account for the lack of acute toxicity reports during borage use. A mixture of lycopsamine and intermedine has, however, been reported to carcinogenic (4).

EXPERIMENTAL

Dried *B. officinalis* was purchased from a local store and from the Indiana Botanical Gardens, Hammond, Indiana. Seed was purchased from Stokes Nursery, and plants were grown to maturity for identification (CSU Herbarium No. 53478; D. Wilken, Department of Botany). Alkaloid isolations from garden-grown leaves and stems indicated similar alkaloid content whether fresh or dried. Roots contained the alkaloids as the free base, while fresh leaves had mainly *N*-oxides. A purchased, dried, bulk sample of plant fragments (496 g) yielded 48 mg of a crude alkaloid mixture (Zn reduction procedure). Tlc [with *o*-chloranil-Ehrlich's reagent visualization (5)] showed two major and four trace alkaloids. One major alkaloid was identified as lycopsamine by 360 MHz pmr, ms, and tlc comparison with a standard and with literature (6) values. The second was tentatively identified as supinidine viridiflorate (either cynaustine or amabiline) (6,7) by 360 MHz pmr and ms. A standard sample was not available for this identification.

Full details of isolation and identification are available from the senior author.

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SESQUITERPENE LACTONES OF ONE CHEMICAL RACE OF
HELIANTHUS MAXIMILIANI

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Three distinct sesquiterpene lactone chemical races of the widely distributed perennial sunflower *Helianthus maximiliani* Schrader (Asteraceae, Heliantheae) have been established by tlc surveys (1). As part of an extended study of *H. maximiliani*, we report here three *trans trans*- $\Delta^{1,10}$, $\Delta^{4,5}$ -germacradienolides from a north-central Texas population that represents one of these races whose chemistry has not previously been reported. Earlier studies have described a race producing heliangolides (2) and a race which produces guaianolides and germacrolides (3).

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