HORDENINE FROM *STAPELIA GIGANTEA*

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Stapelia gigantea N.E. Br. (Asclepiadaceae) is a fleshy cactus-like plant indigenous to tropical southern Africa and is cultivated in the United States as an ornamental (1). Because of its large showy flowers, *S. gigantea* has been called the starfish plant and the Zulu giant. An odor from these flowers attracts large numbers of various blowfly species (2) and, hence, the name carrion flower. Members of the genus *Stapelia* have no apparent medicinal use and have not been investigated chemically to any great extent. The most comprehensive chemical study involved the steroidal glycosides from *S. gigantea* seeds (3). The chemistry of the iridoids from various *Stapelia* species have been examined (4) as well as certain stapeliad anthocyanins (5).

The absence of a literature citation concerning alkaloids from the genus *Stapelia* prompted a test for alkaloids in the intensely bitter tasting sticky sap from *S. gigantea*. Because of the positive results of this test, 2.46 kg of the fresh succulent above-ground portions of the plant were extracted and processed to give an alkaloid fraction. A tlc analysis of this extract revealed the presence of just one Dragendorff-positive substance. Combined gc-ms detected one compound that gave a fragmentation pattern highly suggestive of hordenine (*N*,*N*-dimethyltyramine). Chromatographic (tlc and gc) comparisons of the extract with reference solutions of hordenine correlated quite well. Treatment of the condensed alkaloid fraction with 5% HCl in absolute ethanol gave 112 mg of a crystalline derivative with a melting point that compared favorably with reference hordenine hydrochloride. The ir and nmr spectra of the isolated hydrochloride confirmed the presence of hordenine in *S. gigantea*.

Considering the known biosynthetic pathway leading to hordenine in barley (6), in peyote (7), and in *Citrus* cultivars (8), the occurrence of tyramine and *N*-methyltyramine in *S. gigantea* would also be expected. However, these phenethylamines were not detected during careful tlc and gc analyses of the alkaloid extract. A gc quantitation revealed hordenine to be present in *S. gigantea* at very low concentrations (0.024% on a fresh weight basis) and, therefore, tyramine and *N*-methyltyramine may be present in the plant but never accumulate to detectable levels.

This paper reports the first isolation of an alkaloid from the genus *Stapelia* and the first phenethylamine to be isolated from a member of the Asclepiadaceae.

EXPERIMENTAL[1]

PLANT MATERIAL.—The plant used in this study was identified as *Stapelia gigantea* N.E. Br. by Dr. Dale Thomas (Department of Botany, Northeast Louisiana University) and representative specimens are being maintained in the greenhouse of the Northeast Louisiana University School of Pharmacy.

EXTRACTION AND FRACTIONATION.—The fresh, succulent, above-ground plant parts (2.46 kg) were homogenized with 95%

[1]Melting points were determined using a Fisher model 355 Digital Melting Point Analyzer and are uncorrected. The ir spectra were determined on a Perkin-Elmer model 257 spectrophotometer in KBr pellets while the pmr spectra were recorded in deuterium oxide on a Perkin-Elmer model R-24A spectrometer.

ethanol and processed as usual (9) to give an alkaloid fraction.

CHROMATOGRAPHY.—All analytical thin layer chromatography (tlc) employed 0.25 mm silica gel layers with chloroform-methanol-conc. ammonium hydroxide (100:10:1) as the developing solvent. Gas chromatography (gc) was carried out over 3% OV-17 on Gas Chrom Q with an initial temperature of 140° and programming to 265° at 4° per minute. The same gc system was combined with a Du Pont 321 Dimaspec low-resolution mass spectrometer interfaced with a 320 data reduction system.

HORDENINE ISOLATION AND IDENTIFICATION.—Hordenine was identified in the alkaloid extract by tlc, gc, and mass spectral comparisons with reference material. Hordenine was crystallized directly from the alkaloid extract as the hydrochloride, mp 178–179° [lit. (10) mp 178–180°].

The isolated hydrochloride gave a melting point as well as ir and nmr spectra identical to that of reference hordenine hydrochloride.

QUANTITATION OF HORDENINE.—An internal standard (50 mg of *N*-methyl-4-methoxyphenethylamine hydrochloride) was added to an ethanolic extract of 300 g of fresh *S. gigantea*. After the condensed extract was partitioned, the alkaloid fraction was assayed quantitatively by gc as previously described (11).

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