

### 3-HYDROXYMETHYL GLUTARIC ACID $\gamma$ -LACTONE FROM *ASTRAGALUS CANADENSIS*\*

S. C. GULATI, H. J. KLOSTERMAN and L. J. SCHERMEISTER

Departments of Biochemistry and Pharmacognosy, North Dakota State University,  
Fargo, North Dakota, U.S.A.

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*Plant.* *Astragalus canadensis* Linn. *Source.* North Central Cass County, North Dakota, U.S.A.

*Isolation.* Fresh or air-dried leaves (200 g) were macerated with 2 l. of H<sub>2</sub>O or 70% EtOH. The extract was passed over a column of Amberlite IR-400 (acetate form) and the resin eluted with 1 M HOAc. The concentrated eluate was extracted with Et<sub>2</sub>O and the Et<sub>2</sub>O soluble portion (2 g) was chromatographed on Bio-Rad AG-1 resin (acetate form, 200–400 mesh, 8% cross-linked) using a 0–2 M HOAc gradient. The fraction eluted by 1.55–1.60 M HOAc gave 50 mg of acidic crystals on evaporation. Recrystallization from Et<sub>2</sub>O and CHCl<sub>3</sub> gave 25 mg optically inactive crystals (I), m.p. 86–87°, neutral equivalent 144.2, analyzing for C<sub>6</sub>H<sub>8</sub>O<sub>4</sub>;  $\nu_{\text{max}}^{\text{KBr}}$  3000 (broad), 1770, 1710, 1170 and 1020 cm<sup>-1</sup>. After treatment with CH<sub>2</sub>N<sub>2</sub>, the broad band at 3000 cm<sup>-1</sup> disappeared and the sharp peak at 1710 cm<sup>-1</sup> shifted to 1730 cm<sup>-1</sup>. The IR spectra were indicative of a  $\gamma$ -lactonic acid which was converted to the corresponding methyl ester by CH<sub>2</sub>N<sub>2</sub>. The NMR spectrum of I (CDCl<sub>3</sub>, TMS = 0.00) showed two double doublets at  $\delta$  4.08 ( $J$  = 9 and 7 Hz, 1 H) and  $\delta$  4.55 ( $J$  = 9 and 6 Hz, 1 H), a multiplet at  $\delta$  2.2–3.3 ( $c$  = ca. 2.7, 5 H) and a singlet at 9.55 (1 H, disappears on addition of D<sub>2</sub>O).

The composition, melting point and spectral data suggested that I was 3-hydroxymethyl glutaric acid  $\gamma$ -lactone and this was confirmed by comparison with an authentic sample prepared by the method of Ghosh<sup>1</sup> (m.m.p., IR, NMR). The mass spectra failed to show the parent mass ion for the natural or synthetic acid or their methyl esters. The base mass peak of the acid was at 85  $m/e$  and 74  $m/e$  for the methyl ester, with smaller fragments consistent with the structure proposed for I.

This is the first reported natural occurrence of 3-hydroxymethyl glutaric acid  $\gamma$ -lactone, which is designated by the trivial name of homopilosinic acid, because of its structural relationship to pilosine, an alkaloid of *Pilocarpus jaborandi*.<sup>1</sup>

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<sup>1</sup> R. GHOSH, *J. Indian Chem. Soc.* **13**, 323 (1936).

*Key Word Index*—*Astragalus canadensis*; Leguminosae; 3-hydroxymethyl glutaric acid- $\gamma$ -lactone.