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CHEMICAL INVESTIGATION OF THE LEAVES OF CADABA FRUTICOSA

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Cadaba fruticosa Linn. (N.O. Cappariaceae; vernacular, Habab or Khadab) is a straggling, branched shrub found in Sind near Karachi, Lasbella and Indus delta. In the indigenous systems of medicine, the different parts of this plant are used in the treatment of a variety of ailments. The leaves and roots of this plant are said to possess purgative, antihelminthic, antispasmodic, deobstruent, amenagogue and aperient properties. Their decoction is used in uterine disturbance and the leaves are employed in the form of poultice on sores.

As far back as 1890, Dymock¹ reported the presence of an alkaloid in the leaves which could not be obtained in crystalline form. However, no work on the chemical constituents of the plant has been carried out since then. As a result of the present investigation, a colourless crystalline hygroscopic substance, m.p. 98-100°C, provisionally named as cadabine has been isolated from the leaves of the plant. Cadabine yields a crystalline precipitate with Dragendorff reagent and may therefore have a simple molecular structure. Its picrate, m.p. 176-178°C, and gold chloride salt, m.p. 186°C, have also been prepared in crystalline form. Cadabine is too hygroscopic to be subjected to elemental microanalysis but from the analysis results of its picrate and gold chloride salt it appears to have the molecular formula $C_8H_{15}NO_3$.

Cadabine solution in water has no UV absorption between 200-350 nm. In the IR spectrum (KBr) cadabine shows strong peaks at 1625 cm^{-1} ($-\text{COO}^-$) and 3450 cm^{-1} (OH). From its chemical properties, cadabine appears to be a betaine but its melting point as well as that of its salts do not correspond with any of the betaines isolated from plant source.²

Experimental

Fresh undried leaves of *Cadaba fruticosa* (1.6 kg containing 80% water) were collected from the shrubs growing in the suburbs of Karachi. In a preliminary examination, the dark greenish residue obtained on the removal of the solvent from the alcoholic percolates of the fresh undried leaves was partitioned into water and ethyl acetate. The ethyl acetate portion which contained sterols,

resinous matter etc., was set aside for the isolation of nonalkaloidal constituents.

The aqueous extracts gave a crystalline orange yellow precipitate with Dragendorff reagent but no precipitate with ammonia or alkali.

The aqueous layer was evaporated in a dish to a thick syrup and taken up in 80% alcohol whereby an inorganic crystallisate remained undissolved. The crystallisate gave positive tests for Na^+ , K^+ , Cl^- and NO_3^- . Solvent from the filtrate was removed under reduced pressure and the syrupy residue was passed through a column of Amberlite 120 resin (H^+ form). The unabsorbed acidic and neutral fractions were washed completely with water and the column was subsequently eluted with 1N aqueous ammonia. The eluate was evaporated on the water bath, yielding a light brown syrupy residue with positive Dragendorff test.

The syrupy residue (about 4 ml) was repeatedly extracted with an excess of chloroform and the chloroform distilled when cadabine was obtained as almost colourless, hygroscopic crystals (needles), m.p. 98-100°C (yield 2 g, 0.6% on dry weight basis). The melting point was not raised by crystallisation from chloroform. Cadabine is soluble in water, alcohol, methanol and sparingly soluble in chloroform, insoluble in ether.

Cadabine Picrate.—It was prepared by treating a solution of cadabine (90 mg) in chloroform (45 ml) with a strong solution of picric acid in the same solvent. The yellow precipitate was filtered (190 mg), washed with chloroform and recrystallised from a very small quantity of methanol. Yellow needles, m.p. 176-78°C. After drying at 80°C it analysed for $C_{14}H_{18}N_4O_{10}$ ($C_8H_{15}NO_3$; $C_6H_3N_3O_7$). (Found C, 41.25; H, 4.30; N, 13.97%. $C_{14}H_{18}N_4O_{10}$ requires: C, 41.79; H, 4.47; N, 13.93%.)

Cadabine Gold Chloride Salt.—A solution of cadabine in water was treated with a 10% aqueous solution of HAuCl_4 . The yellow precipitate was filtered, washed with water, dried and crystallised from methanol, yellow prisms, m.p. 186°C. (Found after drying at 80°C, Au 36.41; Cl, 25.49%. Calc. for $C_8H_{15}NO_3 \cdot \text{HAuCl}_4 \cdot 2\text{H}_2\text{O}$: Au, 35.88; Cl, 25.86%.)

The hydrochloride and sulphate of cadabine are also very hygroscopic and could not be obtained in the crystalline form.

Further work on the constitution of cadabine is in progress.

References

1. W. Dymock, *Pharmacographia Indica* (Education Society Press, Bombay, 1890), vol. 1, p. 137.
2. K. Paech, M.V. Tracey, *Modern Methods of Plant Analysis* (Springer Verlag, Berlin, Goettingen, Heidelberg, 1955), vol. IV, p. 517.