The specific characters of the new species of *Lernaea* are as follows:

Cephalic (anchor) arms are four and unequal branching, dorso-lateral arms are longer than ventro-lateral. The arms are simple straight (unlobed) in young and become highly branching (lobed) and asymmetrical in adult. Head almost circular, projects anteriorly, neck distinct and show swelling at the region of second pair of legs. First antennae longer with four joints bear 21 spines and second antennae, three-jointed, bear 10 spines. The pregenital prominence is in the form of undivided single bulged lobe. The anal lamina bears one outer and one inner spine as well as long straight spine (seta).

The detailed investigations on the morphology, life-history, incidence of the parasites and control are under progress and the papers on the above will be communicated later.

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CHEMISTRY AND PHARMACOLOGY OF THE MAJOR ALKALOID OF *FUMARIA INDICA* (HAUSSK) PUGSLEY

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ABSTRACT

The chemical and pharmacological studies show that the smooth muscle relaxant and hydrocholeretic effects of *F. indica* are due to protopine which is present as the major alkaloid in the plant. As a smooth muscle relaxant protopine was found to be slightly weaker than papaverine.

FUMARIA (Papaveracea) is a genus of herbs distributed in Asia, Europe and Africa. Practically all the species are known by the name *fumitory*. According to *The Wealth of India*[1] the Indian plant bearing the name 'Shehterah' or 'Pit-papra' has been wrongly referred to by many authors as *Fumaria officinalis* Linn. or *Fumaria parviflora* Lam., which are the common fumitory of Europe, and are not found in India. In the revision of the genus *Fumaria*, Pugsley[2] considered the correct name of the Indian species to be *Fumaria indica* (Haussk), and gave the distinguishing features of this species from the other allied ones, namely, *F. vaillantii* Loisel and *F. parviflora* Lam. The chemical evidence, recorded in this paper, also indicates that they are distinctly different species.

The plant, *F. indica*, is distributed over the greater part of India upto 8,000' on the Himalayas and Baluchistan. In the indigenous systems of medicine, the plant is regarded as a laxative, diuretic, alterative, diaphoretic and is said to be beneficial in dyspepsia, liver complaints and scrofulous skin affections.[1-3]

Pharmacological studies by Bhattacharya *et al.*[4] revealed that the water-soluble fraction of 90% ethanol extract and the total tertiary alkaloidal fraction of *F. indica* possessed relaxant and non-specific antispasmodic activity on isolated intestines and uterii of different species of animals, and on intravenous administration showed a moderate but prolonged hydrocholeretic effect. In view of this pharmacological activity of the plant, coupled with its extensive use in removing hepatic obstructions

and fevers in clinical cases by Ayurvedic physicians, we undertook a detailed chemical investigation of the plant. Only one alkaloid, protopine, has been reported to have been isolated so far from the Indian species of *Fumaria* by previous workers.[5,6]

In a recent short communication,[7] we have reported the occurrence of seven isoquinoline alkaloids in *F. indica*, of which four are previously unreported in nature. We report here the isolation of the major alkaloid, protopine, its characterisation and pharmacological actions.

Chemical.—Dried and milled whole plant of *Fumaria indica* (4 kg), collected locally, was extracted exhaustively by cold percolation with rectified spirit. The solvent-free dark-brown gummy residue was made into a slurry with methanol (500 ml). The slurry was poured into water and sufficient hydrochloric acid was added to make the solution distinctly acidic to congo (6 l water, 120 ml conc. HCl). Steam under pressure was passed through the solution for about 4 hr to remove methanol completely. The solution was kept in the cold for 3 days, and filtered from the separated gummy material. The clear acidic solution was extracted exhaustively with chloroform (20 × 1 l) to separate chloroform-soluble base hydrochlorides (A) from chloroform-insoluble base hydrochlorides (B). The two fractions, A and B, were then fractionated into phenolic and non-phenolic bases separately. The individual alkaloids were isolated by repeated chromatographic resolution over Brockmann neutral alumina, monitoring at every stage for homogeneity over silica gel G chromatoplates using different solvent mixtures as developers and Dragendorff's reagent for the staining.

The dark-brown residue (26·5 g) left after removal of solvent from the chloroform solution of base hydrochlorides (A) was repeatedly boiled with dilute hydrochloric acid (2%), and the solution filtered from insoluble residue. The combined acidic solution was extracted with ether, and then basified with excess potassium hydroxide. When the precipitate of non-phenolic bases (3·06 g) became granular on standing, it was filtered off, washed with water, and dissolved in a mixture of chloroform and methanol. The clear filtrate on concentration yielded light-brown plates, which were repeatedly crystallised from chloroform-methanol mixture after treatment with activated charcoal, when protopine, $C_{20}H_{19}O_5N$, was obtained as plates and prisms (600 mg), m.p. 207-209°, R_f 0·35 (methanol), 0·00 (chloroform-methanol, 50 ml : 1 drop). Protopine could also be obtained by adding ether to the methanolic solution of the precipitate of non-phenolic bases, or by concentrating the benzene-soluble portion of the precipitate.

Anal.—Calcd. for $C_{20}H_{19}O_5N$: C, 67·98; H, 5·42; N, 3·96. Found: C, 67·70, 68·05; H, 5·59, 5·66; N, 3·97, 4·25.

Spectroscopic Data.—Infrared $\nu_{max.}$ 1660 cm^{-1} [CO absorption due to conjugation[8] between $>CO$ and $>NCH_3$]: ultraviolet $\lambda_{max.}^{EtOH}$ 240 (shoulder), 290 (log ϵ 3·95) mμ [lit.[9] $\lambda_{max.}^{EtOH}$ 293 (log ϵ 3·93) mμ]; n.m.r. δ 1·92 (3 H), 2·55 (2 H), 2·88 (2 H), 3·58 (2 H), 3·78 (2 H), 5·86 (2 H), 5·90 (2 H), 6·52, 6·6, 6·62 (4 H, complex[10]); mass spectrum m/e 353 (M^+, 38), 338 (8), 322 (7), 309 (17), 295 (11), 281 (29), 267 (41), 252 (27), 237 (12), 223 (11), 209 (16), 204 (12), 190 (88), 177 (21), 176 (11), 163 (94), 149 (83), 148 (100), 134 (45), 89 (38), 76 (27), 42 (20).

The aqueous acidic solution (B) left after removal of chloroform-soluble base hydrochlorides was made distinctly alkaline with ammonium hydroxide, and extracted exhaustively with chloroform (20 × 1 l). The combined chloroform extract on removal of solvent yielded a dark-brown gummy mass (8·85 g) which on crystallisation from chloroform-methanol mixture afforded the major portion of protopine as plates (1·6 g), m.p. 206-208°. The yield of the seven alkaloids from *F. indica* whole plant (4 kg) as reported by us[7] is as follows: (1) protopine, 2·45 g; (2) tetrahydrocoptisine, 40 mg; (3) a tautomeric form of fumariline,[11] a homogeneous gum, $C_{20}H_{17}O_5N$, (M^+ 351), 58 mg; (4) a racemic mixture of bicuculline and its optical antipode (not known in nature), $C_{20}H_{17}O_6N$, m.p. 234-235°, $[\alpha]_D^{20} \pm 0$, 37 mg; (5) bicuculline, 8 mg; (6) *fumarilicine*, a homogeneous gum, $C_{20}H_{19}O_5N$ (M^+ 353), 12 mg; (7) *narceimine*, $C_{22}H_{21}O_9N$, m.p. 264-265°, 44 mg.

Pharmacological.—In view of the earlier observation[4] that the total tertiary alkaloids of *F. indica* have smooth muscle relaxant and hydrocholeretic activities, pharmacological studies were conducted on the major alkaloid, protopine, present in *F. indica*. Papaverine hydrochloride was used as a control.

(*a*) *Smooth Muscles.*—Protopine produced a moderate to marked relaxation of isolated ileum of guinea-pig, rabbit and albino rat in concen-

trations of 0·5 to 5·0 mcg/ml. It also inhibited spontaneous activity of isolated uterus of albino rat in concentrations of 2 to 10 mcg/ml. Protopine was found to be approximately equipotent to papaverine. Protopine was found to have a non-specific spasmolytic action against spasms induced by DMPP, acetylcholine bromide, histamine dihydrochloride, barium chloride, 5-hydroxytryptamine, creatinine sulphate and oxytocin on isolated ileum of guinea-pig and albino rat and uterus of albino rat. A comparison of spasmolytic ED 50 of protopine and papaverine in different test preparations showed that protopine was about 50% to 90% as potent as papaverine. Protopine in doses of 5 mg/kg I.V. produced marked relaxation of intestine *in situ* of anaesthetised dog without producing any significant effect on blood pressure. In equivalent dose papaverine produced intestinal relaxation along with significant hypotension.

(*b*) *Biliary Secretion.*—In anaesthetised dog (with cystic duct ligated and common bile duct cannulated), protopine in the dose of 5 mg/kg I.V. produced a 2·5-fold rise in biliary flow at 1 hr after drug administration. The effect lasted for more than 2½ hr. Protopine did not significantly increase the solid constituents of the bile. Papaverine in the dose of 10 mg/kg had no such hydrocholeretic effect.

(c) *Miscellaneous.*—Protopine did not have any significant effect on perfused frog heart, and faecal and urinary output in albino rats. It was devoid of any acute toxicity upto a dose of 50 mg/kg I.P. in albino rats.

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SECOND GENERAL CONGRESS OF THE SOCIETY FOR THE ADVANCEMENT OF BREEDING RESEARCHES IN ASIA AND OCEANIA (SABRAO)

IT is proposed to hold the Second Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania from February 19 to February 25, 1972, at the Indian Agricultural Research Institute, New Delhi, India. The Congress is being organised under the auspices of the Indian Society of Genetics and Plant Breeding.

The proceedings of the Congress would include, *inter alia*: (*i*) Presentation of papers including authoritative reviews by invited speakers; (*ii*) Pre and Post-Congress tours to research institutes in India in different regions concerned with different areas of scientific research; (*iii*) An Exhibition, the themes of which will be "High Yielding Varieties", "Breeding for Nutritional Quality" and "New Trends in Animal Improvement"; (*iv*) Special lectures on topics of wide interest will also be arranged.

For further particulars, please write to Dr. M. V. Rao, Secretary, Organizing Committee, Second General Congress, Cummings Laboratory, Indian Agricultural Research Institute, New Delhi-12, India.