CHEMICAL STUDIES ON FUMARIA PARVIFLORA LAMK

Part I.—Nonalkaloidal Constituents of the Plant

M. A. WAHID

Indigenous Drugs Research Division, North Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Peshawar

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An examination of the leaves and stem of *Fumaria parviflora* Lamk has disclosed the presence of pentatriacontane, glucose, tannin, fumeric acid and sufficient amount of potassium nitrate and potassium chloride.

Introduction

Fumaria parviflora Lamk, known in Pakistan by the names 'shahtarah' (Urdu), 'pitpapra' (Punjabi) and 'papra' or 'bansulpha' (Bengali), is a weed of cultivation and is commonly found in wheat or rice fields belonging to the family *Fumariaceae*. It is a small, much branched, annual, slender herb with much divided leaves and whitish or pink flowers with purple tips in terminal. [1,2,3] The plant is bitter, acrid and astringent. Interest in the investigation of this plant has been evoked by the fact that an infusion prepared from the leaves and stem is used in the indigenous system of medicine as alterative, diaphoretic, diuretic, febrifuge and tonic. Besides, it is said to be expectorant, laxative, blood purifier and cooling. It is an ingredient of some Unani preparations which are sometimes used for the eradication of certain skin diseases, stomach derangement, liver complaints and other ailments. [4,5,6]

The literature shows that no prior investigation of this herb has been reported for its chemical constituents. But *Fumaria officinalis* Linn or Fumitory, [7,8] a closely related species indigenous to England and some other European countries, has been investigated by a number of workers. Agarwal in 1937 reported the presence of pentatriacontane, glucose, inorganic salts and an already known alkaloid, protopine, from *F. officinalis*. [9] In 1938 Manske revealed that the same herb contains not less than seven alkaloids besides other neutral substances. [10]

The present plant after processing in the customary manner for alkaloidal compounds gave positive tests for the presence of alkaloids. A preliminary investigation showed that the dried overground portion of the flowering plant collected in February-March contained approximately 0.24 per cent of total alkaloids determined gravimetrically. Their isolation, characterization and chromatographic study will be reported at a later stage. In this communication only an account of the nonalkaloidal principles of the herb has been given. As a result of the present work it has been revealed that the plant contains a paraffin hydrocarbon, *n*-pentatriacontane (0.5%), glucose (5.4%) fumaric acid and more than 1 per cent inorganic salts comprising potassium chloride (30.3%) and potassium nitrate (69.7%), and about 1 per cent tannin. The diuretic property of the drug may be attributed to the presence of a fairly large amount of these potassium salts.

Experimental

Source of Plant Material.—The material used consisted of the overground portion of the plant *F. parviflora* Lamk comprising leaves and stem collected from the vicinity of the Peshawar University in the month of February-March and the same dried in the shade at room temperature. The herb was supplied by Mr. M. A. Kazmi who authenticated the specimen of *F. parviflora* for preservation in the Herbarium of the Indigenous Drugs Research Division, North Regional Laboratories, Peshawar.

Extractives.—A weighed and finely ground sample was extracted with different solvents in a continuous Soxhlet apparatus for about six hours taking fresh material each time. The total extractive obtained in each case was freed of the solvent, dried on a water bath at 100°C. and weighed. The results are given in Table 1.

Extraction and Isolation of the Constituents.—3000 g. of the air-dried herb consisting of overground portion of the mature flowering plants were dialysed with ten times hot rectified spirit. The combined dialysate on removal of the solvent below 45°C. under reduced pressure gave a thick dark green mass (615 g.; 20.5% on dry basis) with rhombic plates embedded with long needles in a fairly large amount.

Isolation of n-Pentatriacontane, $C_{35}H_{72}$.—The green extract on cooling deposited a flocculent crop of white crystalline precipitate which was filtered (FA). The filtrate was extracted with successive portions of petroleum ether until the extraction was complete (3000 ml.). Petroleum ether was recovered whereby waxy mass (91.56 g.; 3.05%) was obtained. It was dissolved in hot alcohol and saponified with 200 ml. of alcoholic potassium

hydroxide for about six hours. After saponification, most of the alcohol was distilled off under reduced pressure and the soap was dissolved in distilled water. The non-saponifiable matter was extracted with petroleum ether. The petroleum ether extract was washed with distilled water, dried over anhydrous sodium sulphate and filtered. Solvent was recovered from this filtrate when an orange coloured residue was left behind (15.9 g.; 0.53%). It was dissolved in warm alcohol, charcoaled and filtered hot. On cooling small needle shaped crystals were separated out which were filtered and washed with cold alcohol. It was then recrystallized in the same manner and dried over anhydrous calcium chloride; yield 0.5 per cent; m.p. 75-76°C. The substance was neutral, colourless and odourless, gave no test for steroids, and burned with a non-smoky flame, characteristic of saturated paraffin hydrocarbons. It was readily soluble in benzene, soluble in warm alcohol, sparingly so in boiling ether and insoluble in water. It did not decolourise bromine in chloroform. Its mixed m.p.

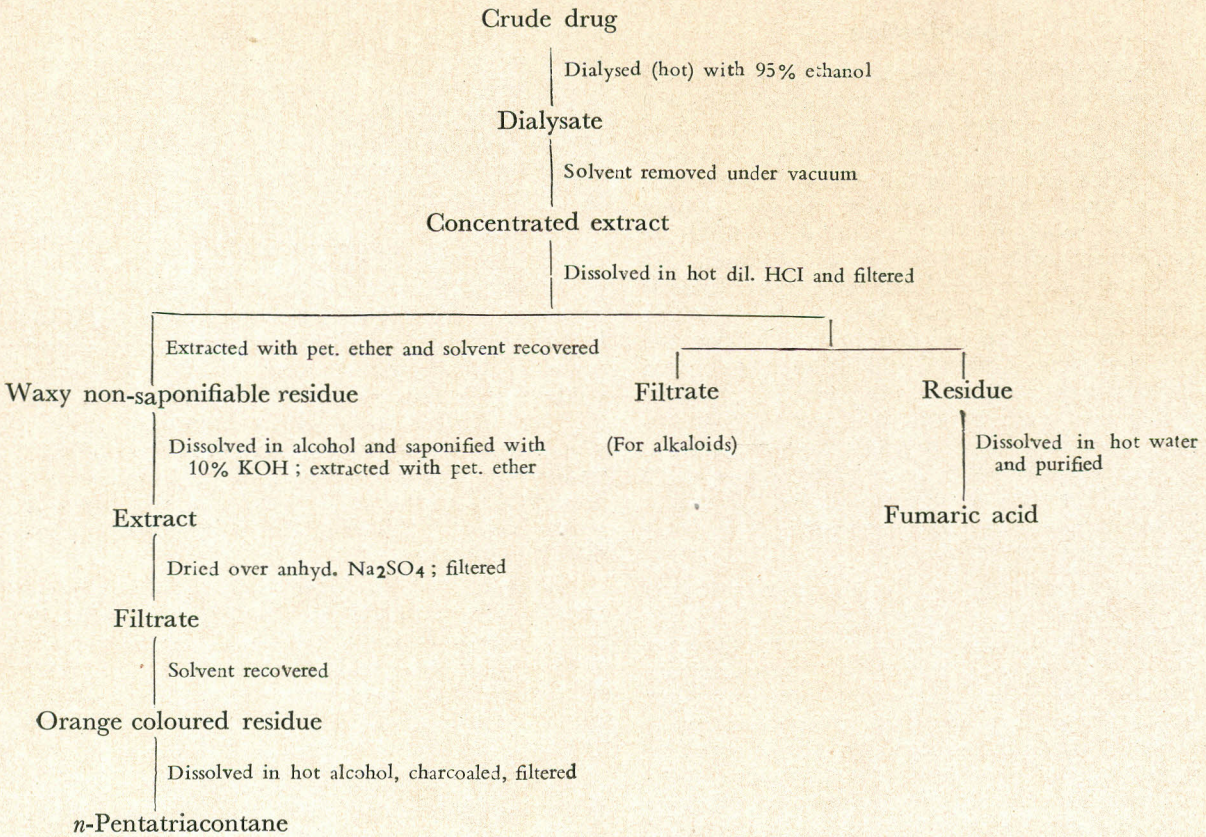

Fig. 1.—Scheme for isolation of *n*-pentatriacontane and fumaric acid.

TABLE 1.

Solvent	Extractive %	Remarks
Ether	4.75	Waxy green mass giving weak test for alkaloids.
Pet. ether (b. p. 40-60°C.)	3.33	Waxy green mass containing no alkaloids.
Benzene	4.85	Waxy yellow green mass giving alkaloids tests.
Chloroform	5.99	Yellow green sticky mass giving tests for the presence of sugars and alkaloids.
Ethyl acetate	7.81	Yellow green product giving test for alkaloids and sugars.
Alcohol (95%)	20.30	Yellow green mass giving tests for the presence of tannin, alkaloids and sugars. Inorganic crystals were deposited on cooling the concentrated extract.

with an authentic sample of pentatriacontane obtained from *F. officinalis* Linn. remained unaltered, one pound of which was made available to the author through the kind co-operation of Dr. J. L. Broadbent of the Smith, Kline & French Research Institute, London, to whom thanks are due.

Isolation of Inorganic Salts.—Defatted concentrated extract of the plant obtained after the extraction of chlorophyll and fats with petroleum ether was concentrated, cooled and filtered. A second copious crop of light brown crystals was obtained (FB). The two crops of crystals, F A and FB were combined, dried, extracted with chloroform to remove colouring matter, and then dissolved in a suitable quantity of distilled water and treated with animal charcoal to decolourise it. It was filtered and on cooling a mixture of rhombic plates and long needles was obtained. A second crop of these inorganic salts was obtained by further concentrating the mother liquor to a small volume (39 g., yield 1.3%). On qualitative examination it was found to be a mixture of potassium chloride and potassium nitrate. On quantitative analysis of a standard solution of the said mixture by titrating it with N/10 silver nitrate solution it was found to contain 30.3% potassium chloride and 69.7% potassium nitrate.

The defatted concentrated extract of the plant free of inorganic salts was found to contain more than 1 per cent tannin which were precipitated out with zinc acetate and potassium ferrocyanide. This tannin-free aqueous solution was diluted and found to contain a fairly large amount of reducing sugars. On treatment with phenylhydrazine an osazone, m.p. 206°C., was formed and identified to be glucosazone showing thereby that the herb contains glucose. Following the Lane-Eynons' standard method[11] for the determination of sugars it was found that the plant contains 5.4% glucose.

Isolation of Fumaric Acid.—A portion of the crude extract of the herb was dissolved in hot dillute hydrochlorie acid and filtered. The residue was extracted with hot distilled water, charcoaled and filtered hot. On cooling a crop of fumaric acid was obtained which was again crystallized in the same manner. Melting point, 286-287°C. of this acid with an authentic sample of fumaric acid obtained from *F. officinalis* did not disclose any difference.

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References

1. K.R. Kirtikar and B. D. Basu, *Indian Medicinal Plants*, Vol. I (Lalit Mohan Basv Allahabad, India, 1933), p. 138.
2. J. D. Hooker, *The Flora of British India*, (L. Reeve & Co., London, 1872), p. 128. K.L. Dey, *The Indigenous Drugs of India* (Thacker Spink & Co., Calcutta, 1896), p. 134.
3. C. J. Bamber, *Plants of the Punjab*, (Lahore, 1916), p. 355.
4. K. M. Nadkarni, *Indian Materia Medica*, 3rd ed., Vol. I, (Popular Book Depot, Bombay 7, India, 1954), p. 560.
5. R. N. Chopra, *Indigenous Drugs of India*, (The Art Press, Calcutta, India, 1933), p. 505.
6. R. N. Chopra, S. L. Nayar and I. C. Chopra, *Glossary of Indian Medicinal Plants*, C.S.I.R., New Delhi, India, 1956), p. 159.
7. R. C. Wren, *Potters' New Cycolopaaedia of Botanical Drugs and Preparations*, (Sir Issac Pitman and Sons Ltd., London, 1956), p. 127.
8. Martindale, *The Extra Pharmacopoeia*, Vol. I (The Pharmaceutical Press, London, 1958), p. 1371.
9. R. R. Agarwal, Proc. Nat. Inst. Sci. India, **3**, 319-323 (1937).
10. R. H. F. Manske, Can. J. Research **16B**, 438-444 (1938).
11. Lane and Eynon, J. Soc. Chem. Ind. (London), **42**, 32T (1923).