Botanical and phytochemical standardization of *Fumaria vaillantii* Loisel.

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*Fumaria vaillantii* Loisel. (Family-Fumariaceae), a well-known crude drug is used in Indian system of traditional medicine for diverse pharmacological activities like anthelmintic, antipsoriatic, hypoglycemic, hepatoprotective activity, etc. This study presents pharmacognostic and phytochemical evaluation of whole plant of *F. vaillantii* to establish identification markers. Microscopy shows presence of starch grains, anomocytic stomata, parenchyma with thick and beaded wall, septate fibre with narrow lumen and blunt tips and vessels with pitted and spiral thickenings. Total ash was ≥ 5 % and alcohol soluble extractive value was two times higher than petroleum ether soluble extractive. Presence of protopine and rutin in methanol extract of whole plant at Rf 0.51 and 0.26 was observed and amount were 1.21± 0.07 and 1.03±0.6 mg/g, respectively. This helps in laying down botanical and phytochemical standards of *F. vaillantii*.

**Keywords:** *Fumaria vaillantii*, Fumitory, HPTLC profile, Pharmacognosy, Pittapapda, Protopine, Rutin.

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**Introduction**

*Fumaria vaillantii* Loisel. syn. *F. indica* (Haussk.) Pugsley of Fumariaceae family is known as Fumitory and Parpat or Pittapapda in Sanskrit. The plant is a small herb growing as weed in wheat fields after harvest having dissected leaves and pink flowers in racemes. It is major constituent of many common household, Ayurvedic medicinal preparations like Parpatadi-kwath, Parpatadi-arishta, Parpatadi-arka and Sharabat-Pittapapda. The plant has been evaluated for diverse pharmacological activities like anthelmintic, antipyretic, antipsoriatic, antidiarrhoeal, cardiovascular, hypoglycemic and hepatoprotective activity. The whole plant contain several alkaloids and flavone heterosides like adlumine, biculline, chailanthifoline, cryptopine, fumariline, fumaritine, perfumine, protopine, paprafumicin and paprarine, fumaric acid, monomethyl fumarate, rutin, etc.

In the present study, botanical and phytochemical standardization of whole plant of *F. vaillantii* using macroscopy, microscopy features, physicochemical and phytochemical analysis was undertaken to establish identification and authentication of this valuable, traded drug Fumitory.

**Materials and Methods**

The whole plant material was collected from wheat fields of Junnar, Pune (Maharashtra, India) during winter season of 2006-2007. The plant sample was identified and authenticated at Agharkar Research Institute, Pune and deposited in crude drug repository of the Institute vide voucher specimen number AHMA-WP-058. Sample was powdered, passed through 80-mesh sieve; stored in an airtight container at 25°C and used for further studies.

**Macroscopic and microscopic studies**

Macroscopic characters were studied as per standard method. For microscopic studies, manual transverse sections were prepared; stained with safranin and light green and photographed with ‘Olympus CX31’ camera. Powder was analyzed as per standard method. A small quantity of powdered material was washed with water to remove sugar, cleared by heating gently with saturated chloral hydrate solution, cooled and mounted in glycerin for microscopic observations.

**Physico-chemical studies**

Physico-chemical values as percentage of total ash, acid insoluble, water-soluble ash, and petroleum ether, alcohol, and water soluble extractives were calculated as per Indian Pharmacopoeia and sugar, starch, tannin and alkaloids were determined.

**HPTLC studies**

Powdered whole plant material (1g) was extracted with 3×10 ml methanol. The extract was concentrated...
under reduced temperature and pressure using rotary evaporator and yield 0.567 g. Known quantity of extract was dissolved in methanol and used as test solution for HPTLC. Protopine (gift sample from Chemistry group, Agharkar Research Institute, Pune; ≥ 98.0%) and rutin (Sigma-Aldrich Steinheim, Germany, ≥ 98.0%) used as reference solution. The known quantities of methanol extract along with reference protopine and rutin solution were applied on HPTLC (per-coated silica gel G F$_{254}$ Merck) aluminium plates with band width 6 mm, by means of a Linomat IV sample applicator (Camag, Switzerland). Plate was eluted to a distance of 8.5 cm at room temperature (25°C) in a solvent system [ethyl acetate:methylethyl ketone:formic acid:water (5.5:3.5:0.5:0.5, v/v/v/v)] in previously saturated twin through chamber (CAMAG). Dried plate was scanned at 293 nm (with $\lambda_{max}$ of protopine) and 363 ($\lambda_{max}$ of rutin) using a Camag Scanner 3 (CAMAG) with software CATS 4. Photo-documentation was done under UV 366 nm (CAMAG) using Olympus-CAMEDIA c-7070. Results of all experiments were reported as mean ± SD of three replicates.

**Results and Discussion**

**Macroscopic characteristics**

Root of *F. vaillantii* is cream to buff coloured, about 3 mm thick, slender tap root with numerous rootlets and root hairs, tortuous; fracture easy to break; taste, bitter; odour not characteristic. Stem light green in colour, smooth, 2 to 4 mm in diam.; fracture easy to break; taste, bitter and slightly acrid; odour not characteristic. Leaves compound, multifid, 5 to 7 cm long, divided into narrow segments; segments 4 to 5 mm long and about 1 mm broad, linear or oblong, glaucous, acute or sub-acute; petiole, very thin, 2.5 to 4.0 cm long; taste bitter; odour not characteristic (Plate 1).

Inflorescence 10 to 15 flowered raceme, peduncle up to 3 mm, pedicels up to 2 mm, flowers 6 to 7 mm

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Plate 1 — Macroscopic characters of whole plant of *Fumaria vaillantii*
long, bract much longer than the pedicels; sepals 2, white, minute, 0.4 to 0.5 mm long, triangular, ovate, acuminate; corolla in 2 whorls, petals 4, very small, each 3 to 4 mm long; inner petals with a purplish green tip; outer petals with narrow spur, without purple spots; stamens 3+3, staminal sheath subulate above, 3 to 4 mm long, stigma bi-lipped. Fruit is capsule, 2 mm long, sub-round to obovate, obtuse or sub-truncate, obscurely apiculate, rugose when dry; nutlets globose, single seeded (Plate 1).

**Microscopic characteristics**

**Root**

The T.S. of root is circular in outline with corrugated margin exhibiting narrow cortex encircling the vascular tissue. A single layered epidermis is followed by 5 to 6 layers of thin-walled, rectangular, cortex parenchymatous; some cells occasionally show brownish contents, starch grains scattered throughout, cortex shows occasionally transversely cut vascular bundles; crushed secondary phloem 5 to 6 layered with central wide zone of xylem traversed with uniseriate medullary rays (Plate 2a).

**Stem**

The T.S. of stem is a pentagonal in outline, having prominent angles showing presence of chlorenchymatous tissue, raised out as corners. A single layer epidermis composed by thin-walled, oblong, rectangular parenchymatous cells, covered with thin cuticle; cortex narrow, composed of 2 to 4 layers of chlorenchymatous cells; vascular bundles distributed in parenchymatous ground tissue, conjoint, collateral, grouped of 5 to 6 at each angle, arranged in a ring; vascular bundle is capped with sclerenchymatous tissue; phloem is 2 to 3 layered; xylem consists of vessels, tracheids, fibres and xylem parenchyma; pith parenchymatous gets obliterated to form central cavity (Plate 2b).

Leaf, lamina

The T.S. of lamina shows a layer of upper and lower epidermis, composed of thin-walled, rectangular, parenchymatous cells traversed with anomocytic stomata; mesophyll cells oval to polygonal, thin walled, filled with green pigments; vascular bundles scattered throughout the mesophyll (Plate 2c).

Physico-chemical study

The physico-chemical observations of whole plant were as follows: total ash, 5.55; acid insoluble ash, 2.78; water soluble ash, 0.83; petroleum ether soluble extractive, 6.76; alcohol soluble extractive, 13.22; water soluble extractive, 15.57; crude fibre, 9.06; starch, 2.85; sugar, 6.19; and moisture contents, 71.23%; and tannin, 67.44 and alkaloid, 95.32 mg/10 g (values given are mean ± SD of six replicate).

HPTLC studies

A densitometric HPTLC analysis (Fig. 1) was performed for development of characteristic fingerprint profile, which may be used as markers for quality evaluation and standardization of the drug. Two bands at Rf 0.51 and 0.26 were comparable with standard protopine and rutin observed at identical Rf 0.51 and 0.26. Calibration curve of marker protopine and rutin was 200-1000 ng and 150-750 ng, respectively. Amount of protopine and rutin in methanol extract of whole plant was 1.21±0.07 and 1.03±0.6 mg/g, respectively.

Powder

Powder of the whole plant of *F. vaillantii* shows fragments of parenchyma; pollen grains oblate-spheroidal, tri-porate, pore circular, operculate, annulate, ornamentation-fossulate-foveolate; starch grains; fragments of fibers, thick-walled, septate, with narrow lumen and blunt tips; vessels with pitted and spiral thickenings; fragments of testa in surface view showing elongated parenchyma having beaded wall; fragments of epidermal cell in surface view showing wavy wall traversed with anomocytic stomata (Plate 3).

Plate 3 — Powder microscopy of whole plant of *Fumaria vaillantii*: a-fragment of epidermis of leaf in surface view showing stomata, b-elongated cells showing stomata, c-parenchyma of testa in surface view, d-pollen grains, e-starch grains, f-fragment of collenchymatous cells, g-vessels showing different types of thickenings, h-septate fibres, i-isolated sclerenchymatous cells, j-fragment of parenchyma.
Conclusion

The macroscopic, microscopic and physico-chemical characters are useful for pharmaceutical industries for identification and authentication of commercial samples. The HPTLC profile using rutin and protopine as a marker are useful for the industries to the quality control, ensures batch to batch consistency of the raw drug.

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Fig. 1 — HPTLC profile of whole plant methanol extract Fumaria vaillantii along with rutin and protopine as marker.
Rutin-Std 1, Protopine-Std 2, Methanol extract of F. vaillantii-FUP.

