Pharmacognostic and pharmacological study of *Fumaria vaillantii* Loisel: a review.

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ABSTRACT

*Fumaria vaillantii* L. syn *Fumaria indica* belongs to the family of Fumariaceae (fumitory). Its local name is ‘Parpata’ or ‘Pitpapra’ or ‘Parpatakam. It is found in India, Pakistan, Afghanistan, Central Asia, North Dakota and Colorado. Fumaria plants have been traditionally used against various diseases. In the present study, a review has been done on *Fumaria vaillantii* Loisel, extensively for treating a variety of ailments in various system of indigenous medicine.

Keywords: *Fumaria vaillantii* Loisel, Botanical Characteristic and Pharmacological activity.

1. Introduction

Use of medicinal plant to cure specific ailments has been invoked from ancient times. This Medico lore is passed over from generation to generation traditionally all over the world. Nature has bestowed mankind with several plants which contains natural substances which cure diseases & promote health. Such medicinal plants are also rich sources to develop secondary metabolites which are also potential in curing different ailments. In the past decades, there is increased attention and interest in use of herbal medicines globally [1].

Plants have also been used as medicines for thousands of years all over the world. WHO estimates indicate that 80% of the population, mostly in developing countries still relies on plant-based medicines for primary care WHO 1978. The different systems of medicinal usage practiced in India, Ayurveda, Siddha, Unani, Anchi and local health traditions, utilize a large number of plants for treatment of human and animal diseases. Those plants used were called as medicinal plants. India is a country with a vast reserve of natural resources and a rich history of traditional medicine. Medicinal plants contain numerous biologically active compounds which are helpful in improving the life and treatment of disease. Compounds such as carbohydrates, proteins, enzymes, fats, oils, terpenoids, flavonoids, sterols simple phenolic compounds etc. [2, 3] In the last few decades, the field of herbal medicine has gotten popularized in both developed and developing countries [4]. This is because the herbal medicines are cheap, and have natural origin with higher safety margins and lesser or no side effects [5].

1.1 Taxonomy

- **Kingdom**: Plantae
- **Subkingdom**: Tracheobionta
- **Superdivision**: Spermatophyta
- **Division**: Magnoliophyta
- **Class**: Magnoliopsida
- **Subclass**: Magnoliidae
- **Order**: Papaverales
- **Family**: Fumariaceae
- **Genus**: Fumaria
- **Species**: *F. vaillantii*
1.2 Vernacular Name

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2. Geographical distribution
The Fumaria is a genus of herbs distributed in Asia, Europe and Africa. The *F. indica* plants are distributed over the greater part of India up to 2438 m in the Himalayas, Baluchistan, Afghanistan, Persia, and Mongolia [5]. According to wealth of India, Indian plant bearing the name “Shahtraj” or “Pitpapra” has been wrongly referred as Fumaria officinalis Linn. or Fumaria paviflora lam. by many authors, which are common fumitory in Europe but not found in India [6]. The identification of Fumaria species is difficult due to the occurrence of inter-specific hybridization [7].

3. Pharmacognostic study
3.1 Morphological character
The seed is spherical to ellipsoid and has an apical pore and rib. The fruit is spherical to elliptic and is pointed in all studied *Fumaria* species. The seed shape in *Fumaria* species is determined by the ratio of a seed’s vertical diameter to a seed’s horizontal diameter. Therefore, the seed shape was spherical *F. vaillantii*. Seed color is a green with red stripes. The seed surface in *F. indica* is smooth or plicate. *F. vaillantii* has a scabrate and a wrinkled fruit surface [8]. Roots of *F. vaillantii* is of cream-buff colour about 3 mm thick, slender taproot with numerous roodlet and roothairs, tortuous; fracture, easy to break; taste, bitter; odour, non-characteristic [9].

3.2 Microscopic character
Microscopically, the lamina of the leaf has single layer epidermis on either side, consisting of thin walled, rectangular, oval shaped, parenchymatous cells; mesophyll is composed of thin walled, oval to polygonal, parenchymatous cells; vascular bundles are scattered throughout the mesophyll; anomocytic stomata are present on both the surfaces. Microscopically, the stem of *F. indica* is quadrangular to pentagonal in shape. The outer most single layered epidermis is covered with cuticle. The cortex is divided into two regions and endodermis is absent. Closed and bicollateral vascular bundles are either single or in group of two and arranged at the ridges. Each vascular bundle is capped with sclerenchyma. In root, epidermis are obliterated or crushed and cortex consists of thin walled, irregular shaped, parenchymatous cells; endodermis is not distinct; secondary phloem is well developed and consist of sieve tube, companion cell and phloem parenchyma [11].

4. Chemical Composition
The major chemical constituents of *F. vaillantii* are alkaloid such as protopine, narceime, tetrahydrocptisine, narulimidine, methyl furamate, narulimidine, bicuculline and fumariline [10]. The isoquinoline alkaloids adlumicide, adlumicideine, ciptisine, cryptopine, fumaricine, fumariline, fumaritine, fumarophycine, O-methylfumarophycine, parfunine, sinactine, N-methylstylopine are also present [11].

5. Pharmacological activity
5.1 Antioxidant activity
Antioxidant activity of the various extract such as chloroformic extract, ethyl acetate extract, n-butanol extract of *F. vaillantii* was determined using DPPH (1.1 diphenyl, 2 picrylhydrazly) method. They showed the antioxidant activity probably due to the presence of phenolics and flavonoids. The ethyl acetate extract showed the highest antioxidant activity as compared to rest of the two extract it showed 83.41% of inhibition of DPPH radical at 250 ul [12].

Another study was designed to investigate the antioxidant potential of crude methanolic extracts of some medicinally important aromatic plants in Refined bleached and deodorized (RBD) sunflower oil (SFO) at frying temperature. *Allthea rosea* L (Malvaceae), *Chenopodium album* L (Chenopodiaceae), *Cichorium intybus* L (Asteraceae) and *Fumaria indica* L (Fumariaceae) were selected due to intensive use in folk medicines. Oxidative stability of SFO was determined by measuring Peroxide value (PV), Iodine value (IV), Conjugated diene (CD), Conjugated triene (CT) and P-anisidine value at frying temperature, and plant extract of *Fumaria indica* L was found to be a potent source of natural antioxidant among all plant extracts due to higher concentration of flavonoids and phenolics. The overall order of antioxidant potential of all plant extracts was *Fumaria indica* L > *Cichorium intybus* L > *Chenopodium album* L > *Allthea rosea* L. [13]

5.2 Hepatoprotective Activity
For hepatoprotective activity 50% ethanolic water extract, and its three major fractions viz. hexane, chloroform and butanol and one major alkaloid protopine of *F. indica* were studied on D-GalN induced liver hepatitis. And the study results indicated that *F. indica* extracts, its fraction and protopine could inhibit D-GalN induced hepatitis by regulating various biochemical parameters such as SGPT, SGOT, ALP, BL and liver metabolites [14].

In another study methanolic extract of, *Fumaria vaillantii* was investigated against carbon tetrachloride (CCl₄) induced hepatocellular injury in rats, and the result revealed that CCl₄ administration caused severe acute liver damage in rats, demonstrated by significant elevation of serum AST, ALT levels and classic histopathological changes. It seems that post-treatment of methanol extract of it significantly reduces the ALT, AST and ALP levels in comparison with CCl₄ group. Histopathological studies also provided supportive evidence for the biochemical analysis [15].

On further investigation chemoprotective efficiency of *Fumaria indica* on antioxidant status on N- Nitrosodimethylamine (NDEA) AND CCl₄ induced hepatocarcinogenesis in wistar rat was determined and it was found that *F. indica* exert chemoprotective
effect by reversing the oxidant–antioxidant imbalance due to hepatocarcinogenesis [16].

| Mono methyl fumarate (MMF) is the active component of methanolic extract *Fumaria* sp. The effect of MMF and *F. vaillantii* on acetaminophen induced acute liver disease is that they exhibit significant hepatoprotective effect as compared to standard drug silybum marianum and silymarin [17].

5.3 Anti hypochlorhydric and Anti lipidperoxidative
Hypochlorhydria (pH ≥ 4.0) refers to suppression of hydrochloric acid secretion by the stomach. It affects the digestion and absorption of nutrients. *Helicobacter pylori* infection is associated with hypochlorhydria and it is a common agent for the destruction of parietal cells. Thus, in the present study protective effect of pre-administration followed by co-administration of aqueous extract of whole plant of *Fumaria vaillantii* L. (AEVF) and ripe fruit of *Benincasa hispida* (AEBH)/T. In ranitidine induced hypochlorhydric male albino rat and the data revealed that Pre-administration as well as co-administration of AEFV or AEBH or composite extract causes a significant decrease in gastric pH in compared to hypochlorhydric rat. The most effective response was noted in pre-administration followed by co-administration of AEBH, in comparison to composite extract. This may be due to the prevention of the gastric parietal cell degeneration or by stimulating the secretion of HCl [18].

5.4 Analgesic activity
The extract of *Fumaria vaillantii* was found to be better than the standard drug, as at higher doses the extract has a rapid onset of action and longer duration of action are the two factors which determine the efficacy of a drug. The extract of *Fumaria vaillantii* shows its effect in a dose dependent manner [19].

5.5 Antulcer
Aqueous extract of *Fumaria vaillantii* significantly protects gastric mucosa against the depletion of gastric wall mucus. The mucus gel adhering to the gastric mucosal surface protects the underlying epithelium against acid, pepsin and necrotizing agents such as ethanol and indomethacin. Cytoprotection caused by Aq- *Fumaria vaillantii* might be due to interaction with the adhering gastric mucus layer. Thus aqueous extract of *F. vaillantii* L causes, reduction in gastric acid secretion, acidity and ulcer formation [20].

The anti-*Helicobacter pylori* and protective effect of aqueous extract of *Fumaria vaillantii* was investigated in pylorus ligation, indomethacin and toxic induced ulcer lesion. The result showed that the plant has significant inhibition of gastric damage at dose of 100, 200 and 300 mg/kg body weight in different models of ulcer induction [21].

5.6 Anti-inflammatoary and anti-nociceptive activity
The anti-inflammatory activity of the 50% ethanolic extract of *F. indica* in different models of inflammation-acute exudative and proliferative phases of inflammation was studied. A dose of 400 mg / kg shows anti-inflammatory and anti-nociceptive effect to standard drugs. Caffeic acid is one of the phenolics present in *F. indica*, which was reported to possess anti-inflammatory activity *F. indica* has potential anti-inflammatory activity against both exudative (carrageenan and histamine induced inflammation) and proliferative (cotton pellet induced granuloma) phases of inflammation; the extract also showed anti-nociceptive activity, mediated both centrally and peripherally. *F. indica* extract significantly raised the pain threshold [22].

5.7 Anticholinesterase
Whole Plant CHCl₃ and Methanolic Extract of *F. vaillantii* is used treatment of Alzheimer’s disease, senile dementia, ataxia, myasthenia Gravis and Parkinson’s disease center around the reduction of cholinergic deficit by the use of AChE and BChE inhibitors [23].

5.8 Antifungal activity
Antifungal activity of the essential oil of *F. vaillantii* was assayed using the agar disc diffusion method using Mueller Hinton Agar and the measure of inhibition zones at different oil dilutions against *A. flavus* (PTCC=5004) and gentamycin was used as standard. And antifungal impacts of the *F. vaillantii* essential oil shows that the oil of this plant has an inhibitory effect in 1, 1/2, 1/4, 1/8 and 1/16 dilution with average diameter growth of 28, 22, 15, 12 and 8 mm respectively. The results of standard antibiotic gentamycin (8mg/ml) with a diameter of 19 mm had inhibitory effect. The results showed that the essential oil from Fumaria plant at 1 and 1/2 oil dilutions showed strong antifungal activity than gentamycin antibiotic on *A. flavus* and thymol exhibited good inhibition at 10% dilution [24].

5.9 Cognitive disorder
50% ethanolic extract of *F. indica* L. *F. indica* was evaluated for putative cognitive function modulating effects. *F. indica* showed dose – dependent decrease in brain AChE activity and increase in muscarinic receptor density, and such was also the case for its observed beneficial effects on the brain antioxidative status. *F. indica* also inhibited the scopolamine – induced overexpression of the three tested cytokines observed in a rat’s brain. *F. indica* possesses nootropic – like benefits effects on cognitive functions [25].

5.10 Antidiabetic Activity.
An herbal mixture comprising 50 gm each of *Tylophora hirsuta* leaves *Trigonella foenum graecum* seeds and aerial parts of *Fumaria indica*. This mixture has significantly reduced blood glucose level of diabetics [26].

5.11 Cytotoxic
Four extract of Fumaria indica viz aqueous, ethanol, chloroform and n-hexane were analyzed and found that carbohydrates, starch, flavonoids, tannins, alkaloids, anthraquinones and saponin were present in all the extracts. For cytotoxic effect the result was all the extracts with a sequence of n-hexane> chloroform> ethanol [27].

5.12 Anticolic
Anticolic study was conducted on infants investigation states that’s treatment with Fumaria extract, the frequency, length of crying and the occurrence of waking up due to colic pain were decreased in the study group, while they either remained unchanged or increased in the control group and there was a statistically significant difference between them [28].

5.13 Jaundice
Infusion of aerial parts of *Fumaria vaillantii* is used in the treatment of jaundice [29].

6. Conclusion
The use of herbal medicines is widespread among the patients in treating varieties of diseases. The review on
Fumaria vaillantii Loisel highlights the importance of its different pharmacological activities.

7. References
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