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## Review Article

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## Pharmacological activity of *Fumaria indica* - A review

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### ABSTRACT

*Fumaria indica* (Hausskn.) Pugsley (Fumariaceae), known as “Fumitory”, is an annual herb found as a common weed all over the plains of India and Pakistan. Plant is used widely used in Unani and Ayurvedic system of medicine. Plant is used in isolation as well as in polyherbal formulations. *Fumaria indica* is used in aches and pains, diarrhoea, fever, influenza, liver complaints, vomiting, constipation, dyspepsia, blood purification, leucoderma, anthelmintic, diuretic, diaphoretic and, in combination with black pepper, for jaundice. The present review reveals various pharmacological activities of the plant which might be helpful in further investigations of the plant at molecular and phytochemical level for drug formulations against various diseases.

**Keywords:** *Fumaria indica*, Botanical description, Pharmacology.

### INTRODUCTION

*Fumaria* species are also commonly called “fumitory”, “earth smoke”, “beggary”, “fumus”, “fumittery” or “wax dolls” in English. These are annual weeds, growing wildly in plains and lower hills of India, Pakistan, Afghanistan, Turkey, Iran, Central Asia, North Dakota and Colorado. *Fumaria indica* (Haussk) Pugsley (synonyms: *F. parviflora*, *F. vaillantii*), is widely used in Ayurvedic system as well as unani system of medicine. In Ayurvedic system it is referred by the name of ‘Pitpapa’ and in Unani system it is known by the name of ‘Shahtra’. In recent past translation and decodification of Sanskrit literature has revealed *Fumaria* as an Ayurvedic plant mentioned in classical Ayurvedic texts- like Charak Samhita [1], Dhanvantari Nighantu [2] and Bhava Prakash [3]. In Ayurvedic system it is used for Daha – Burning sensation, Kaphaja Jwara – fever of Kapha origin, Pittaja Jwara – fever of Pitta origin, Pipasa – excessive thirst, Arochaka – anorexia, lack of interest in food, Chardi – vomiting, Raktapitta – bleeding disorders like nasal bleeding, Ulcerative colitis and menorrhagia, Mada – intoxication, Bhramai – dizziness, psychosis, Glani – tiredness, weakness of sense organs. Its red flowers are used in Atisara – dysentery, diarrhea.

Traditionally Indian Fumitory is used in aches and pains, diarrhoea, fever, influenza and liver complaints. The herb mixed with honey may be taken internally to prevent vomiting. A cold infusion of the plant is used to treat wasting diseases of children and to help cooling during fever and in the treatment of constipation and dyspepsia. It is used as a blood purifier for skin diseases and applied externally in leucoderma and as a fomentation for swollen joints. The dried plant is also used as an anthelmintic, diuretic and diaphoretic and, in combination with black pepper, for jaundice.

Diverse medicinal uses of the plant stand in confirmation to its pharmacological activity profile revealed in the recent past. Consolidation of its pharmacological activities and its correlation with its traditional uses would open new areas of research for discovery of drugs and various formulations.

### TAXONOMY

Kingdom : Plantae  
Division : Tracheophyta  
Class : Magnoliopsida  
Order : Ranunculales  
Family : Papaveraceae  
Subfamily : Fumarioideae  
Tribe : Fumarieae  
Subtribe : Fumariinae

Genus : *Fumaria*  
Species : *Fumaria indica*

**Fumaria indica** (Hausskn.) Pugsley in Journ. Linn. Soc. Bot. 44: 313.1919.

**Syn:** *Fumaria parviflora* var. *indica*, Basionym: *Fumaria vaillantii* var. *indica*

### Botanical Description

An erect herb ca. 7-3 cm tall, having, herbaceous branches. Stem is ridged having furrows, glabrous, pale, brown, brownish, sedge green. Radical leaves petiolate, petiole is 1-7 cm long, decompound, pinnatifid, lamina outline ovate, orbicular, 1.5-5x1-3 cm; pinnae lobes obovate, orbicular, attenuate, oblique, cuneate, petioles 1 to 15 mm long; lobule linear, oblong, 0.56x0.51 mm, acute, mucronate; both surfaces of leaves are sedge green. Cauline leaves petiolate, petiole is 0.8-6 cm long, decompound, pinnatifid, lamina outline elliptic, ovate, orbicular, 1.5-7x1-7cm; pinnae lobes obovate, orbicular, attenuate, oblique, cuneate, petiole is 1-13 mm long; lobule linear, oblong, 0.5-6x0.5-4mm, acute, mucronate; both surfaces of leaves are sedge green. Raceme is 0.7-4.5 cm long, 5-23 flowered, and peduncle is 0.2-1.7 cm long; bract lanceolate, 1-2.5x0.5-1 mm long, membranous. Flowers yellow, 4-6 mm long including spurs, downwardly curved, 1-1.5x0.5-1mm, petal lobe is longer than spur lobe (3-4.5:1-1.5mm long). Sepals 2, caudocous, imbricate; petal 4, 3-4.5x0.5-1 mm, imbricates, upper & lower petal tips are suborbicular while inner are coherent at tips, lower are narrow. Stamens 6, diadelphous, 3 on each side of carpel; filament 2.5-3 mm long, anther 0.2-0.5mm long, middle anther dithecous and lateral monothealous. Carpel ellipsoid, glabrous, ovary 1-1.5mm long, stigma 0.5-1 mm long, style 1.5-3 mm long. Nut suborbicular, rounded, rugose, 2x2mm; seeds somewhat rounded brown, 1 in number, 1mm in diameter [4].

**Flowering and fruiting Period:** March- June.

**Geographical Distribution:** India, Pakistan, Afghanistan & C. Asia; introduced elsewhere.

### Names in different languages

**English** –Fumitory, **Unani** - Shahtra, **Sanskrit**- Parpata/Suksmapatra, **Hindi**- Pitpapra, **Assamese** -Shahtraj, **Nepalese**- Kairuwa, **Kashmiri**- Shahterah, **Sinhalese**- Patha padagam

**Bengali** -Shotara/pipapapra/bandhania, **German**- Erdrauch, **Gujrati**- Pittapapdo, **Chinese**- Tuysa tu chian, **Marathi** - Pittapapra, **Kannada** - Parpataka/Kallu sabbasige, **Arabian**- Shahtraj, **Tamil** - Thara/Tura/Thusha, **Turkish** – Sahtere, **Telugu**- Parpatakamu.

### Morpho-anatomical and Physicochemical Features

Morpho-anatomical studies showed compound and pinnatifid leaf, 4 to 6 cm in length, linear and oblong in shape and anomocytic arrangement of stomata, thin walled parenchymatous cells, scattered, sclerenchymatous, capped vascular bundles and radiating medullary rays. Physicochemical studies showed foreign matter 0.2%, loss on drying 6.8%, total ash 16.77%, alcohol and water soluble extractives 8.92% and 20.26%, respectively, sugar 17.75%, starch 22.97% and

tannins 2.37%. Phytochemical evaluation revealed the presence of carbohydrate, alkaloids, flavonoids, saponins, tannins and sterol. Thin layer chromatography has revealed 12 spots with different Rf value under UV light 366λ [5].

## PHARMACOLOGICAL ACTIVITIES

### Hepatoprotective activity

Study found hepatoprotective potential of 50% ethanolic water extract of whole plant of *Fumaria indica* and its three fractions viz., hexane, chloroform and butanol against d-galactosamine induced hepatotoxicity in rats. Among fractions more than 90% protection was found with butanol fraction in which alkaloid protopine was quantified as highest i.e. about 0.2mg/g by HPTLC. The isolated protopine in doses of 10-20mg p.o. also proved equally effective hepatoprotectants as standard drug silymarin (single dose 25mg p.o.) [6].

Monomethyl fumarate, isolated from the methanolic extract of the whole plant of *Fumaria indica*, was characterized and screened for its antihepatotoxic activity in albino rats. The compound showed significant ( $P < 0.01$ ) antihepatotoxic activity against thioacetamide *in vitro*, and against hepatotoxicities induced by carbon tetrachloride, paracetamol and rifampicin *in vivo* to an extent almost similar to that of silymarin, a known antihepatotoxic agent [7].

### Antiviral activity

Study reported that two phytochemicals from *Fumaria indica*, i.e. Nartumicine and Oxysanguinarine act as dengue virus (DENV) inhibitors. They exhibited binding affinity  $\geq -8$  kcal/mol against DENV4-NS4B. Furthermore, DFT based analysis revealed high reactivity for these phytochemicals in the binding pocket of DENV4-NS4B, based on ELUMO, EHOMO and band energy gap [8].

### Gastroprotective activity

Study revealed that both Methanolic extract of *Fumaria indica* shows potent gastro-protective agents against chronic unavoidable stress-induced ulcers and strongly suggest that they act as regulators or modulators of monoamine, corticosterone and cytokine homeostasis [9].

*Fumaria indica* exhibited antisecretory, gastroprotective and in-vitro antacid capacity. Ethanol extract of *F. indica* at 200 mg kg(-1), orally showed inhibition of secretion in pyloric ligation model. GSH level (1.67 μg mg(-1) protein), gastric wall mucus (240.76 μg g(-1) wet glandular tissue) and percentage protection (77.59%) of ulcer were significantly ( $P < 0.05$ ) increased in absolute ethanol induced ulcer model. The in-vitro antacid capacity of ethanol extract of *F. indica* was compared with the standard [10].

### Ant-inflammatory and Analgesic activity

Study showed significant anti-inflammatory activities of *Fumaria indica* in carrageenan-induced edema and cotton pallet granuloma even after their lowest tested doses. Significant analgesic activities was also observed in hot plate and tale flick tests [11].

### Antihypertensive activity

Broad survey has revealed that *Fumaria indica* is one of the various herbs people have been using against hypertension with very satisfactory results [12].

### Cognitive Modulating Activity

*Fumaria 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. *Fumaria indica* also inhibited the scopolamine-induced overexpression of the three tested cytokines observed in rat's brain. It also possesses nootropic-like beneficial effects on cognitive functions [13].

### Antianxiety activity

Study strongly suggest that *Fumaria indica* is a functionally novel type of antianxiety agent, and that inhibition of cytokine expressions in the brain could be involved in its mode of action [13].

### Chemoprotective activity

Experimental observations powerfully supports that *F. indica* exerts chemopreventive effect by suppressing the tumor burden and restoring the activities of hepatic cancer marker enzymes on NDEA and CCl<sub>4</sub>-induced hepatocarcinogenesis in Wistar rats [14].

### Anti-inflammatory and anti-nociceptive activity

Oral administration of *F. indica* dry extract (100, 200 and 400 mg kg<sup>-1</sup>) exhibited dose dependent and significant anti-inflammatory activity in acute (carrageenan and histamine induced hind paw oedema,  $p < 0.05$ ) and chronic cotton pellet granuloma models of inflammation,  $p < 0.01$ ). A significant anti-nociceptive activity was evidenced in mice; 6.6-67.7% ( $p < 0.01$ ) protection in mechanical, 33.9-125.1% ( $p < 0.05$ ) protection in thermal induced pain and 22.2-73.9% ( $p < 0.05$ ) protection in acetic acid-induced writhing [15].

### Antifungal activity

The alkaloid fuyuziphine isolated from the whole plant of *Fumaria indica* showed inhibitive effect against spore germination of some plant pathogenic fungi (*Collectotrichum sp.*, *C. gloeosporioides*, *C. falcatum*, *Curvularia maculans*, *C. lunata*, *Erysiphe cichoracearum*, *Helminthosporium pennisetii*, *Oidium erysiphoides*, *Ustilago cynodontis*, *Alternaria chieranthi*, *A. melongenae*, *A. brassicicola* and *A. solani*). *Curvularia lunata*, *Oidium erysiphoides*, *Alternaria brassicicola* and *A. solani* did not germinate at 750 and 1000 ppm and *Collectotrichum gloeosporioides*, *C. falcatum*, *Curvularia maculans* were inhibited at 1000 ppm for 24 hr incubation. Germination of most fungi was significantly inhibited at 100-750 ppm [16].

### Anthelmintic activity

Ethanol extracts of the whole plant of *Fumaria parviflora* (Papaveraceae) showed an anthelmintic efficacy of up to 93%, relative to pyrantel tartrate [17].

Ethanol extract of *F. parviflora* caused a strong reduction of the faecal egg counts (100%) and a 78.2 and 88.8% reduction of adult *H. contortus* and *T. colubriformis* on day 13 post-treatment. The extract was as effective as the reference compound pyrantel tartrate [18].

### Spasmogenic and spasmolytic activity

The crude extract of *Fumaria indica* whole plant (Fi.Cr) and its fractions showed spasmogenic and spasmolytic. Data indicate that the presence of cholinergic and CCB constituents in *Fumaria indica* may explain the respective traditional use of *Fumaria indica* in constipation and diarrhea [19].

### Non-toxicity

No mortality or abnormal behaviour, was observed in acute toxicity study in mice at all the three dose levels. In sub-chronic toxicity study, *Fumaria indica* did not produce any significant change in body weight and daily food and water intake of rats when compared to vehicle treated rats. Further, haematological and biochemical parameters were also found normal. Histopathological study revealed normal architecture of kidney and liver of *Fumaria indica* treated rats [20].

### CONCLUSION

Extensive literature survey has revealed the promising pharmacological activity of *Fumaria indica*. Further investigation is needed so as to translate it into the formulation of modern drugs after proper scientific evaluation of biomolecules, their mechanism of action, toxicity and appropriate standardization.

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