



A Review on Cytomorphological, Medicinal, Phytochemical and Pharmacological Potential of Common Weed of Wheat Crop of Himachal Pradesh: *Fumaria Parviflora*

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Abstract

Fumaria parviflora, commonly known as “small-flowered fumitory,” is a ubiquitous weed found in various regions across the globe. Despite being considered a nuisance in farming areas, the plant possesses numerous therapeutic benefits acknowledged in conventional medical systems. Its extracts have shown promise in treating digestive disorders, respiratory ailments and skin conditions due to their anti-inflammatory and antimicrobial properties. Efforts to harness its medicinal potential could lead to the development of innovative treatments while addressing concerns related to its invasive nature. This review aims to gather and evaluate the body of research on the medicinal, phytochemical and pharmacological attributes of *Fumaria parviflora*. Phytochemical analyses have revealed the presence of diverse bioactive compounds in *F. parviflora*, including alkaloids, flavonoids, phenolic compounds, terpenoids and essential oils. These phytoconstituents exhibit various biological activities such as anti-inflammatory, antimicrobial, antioxidant, antidiabetic, hepatoprotective and anticancer effects. Despite the considerable therapeutic potential demonstrated by *F. parviflora*, further research is necessary to elucidate its action mechanisms, pharmacokinetics and safety profiles. Moreover, clinical trials are required to validate the effectiveness and security of *F. parviflora*-based human interventions. Harnessing the medicinal potential of natural products holds significant promise for the development of novel therapeutic agents across various ailments. Natural products, derived from plants, marine organisms, fungi and microorganisms, have been a rich source of pharmacologically active compounds for centuries. These compounds often possess unique chemical structures and biological activities that make them valuable candidates for drug discovery and development.

Keywords: Antioxidant, Bioactive compounds, *Fumaria parviflora*, Phytochemical, Pharmacological

Introduction

Fumaria parviflora, belonging to the Papaveraceae family and its Ayurvedic name is ‘Pitpapra’ is a small yearly herb with pale green coloration, as shown in figure 1(a), characterized by its diffuse growth and abundant branching, as shown in figure 1(b) (Jamaldeen *et al.*, 2022). It is extensively utilized in Ayurvedic and Traditional Yunani medicine across India. The species’ name comes from the

Latin “fumus terrae,” which means “smoke of the earth.” It is commonly referred to in India by vernacular names such as Pitpapda and Pitpapra (Kumar *et al.*, 2017). Additionally, it is known by alternative botanical designations including fine-leaf fumitory and Indian fumitory (Nowick, 2015). This plant is widespread in many parts of India, especially growing in wheat fields during wintertime. It can be found throughout the plains of Haryana, Punjab, and certain areas of Himachal Pradesh, primarily in lower, warmer regions up

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to an altitude of 1400 meters (Kumar et al., 2017). In wheat fields, it proliferates as a weed, frequently outpacing the density of the primary crop (Patterson, 1995). In some cases, pulling it up by hand is required to stop it from growing. Throughout history, *Fumaria parviflora* has been utilized for its diverse medicinal properties. Traditional practitioners have employed distinct plant sections, including the leaves, stems and roots, to treat a wide range of ailments (Guna, 2017). Its medicinal uses span across treating skin diseases, liver disorders, respiratory ailments, digestive issues and more. Phytochemical analysis on *Fumaria parviflora* shows the presence of several including copticine, protopine, paprafumicin, paparine, flavonoids, phenolic compounds, terpenoids and saponins (Jameel et al., 2014b). These phytoconstituents contribute to the plant's pharmacological activities and therapeutic effects. Pharmacological research has indicated that *Fumaria parviflora* exhibits a range of therapeutic effects, including antidiabetic, analgesic, anti-inflammatory, hepatoprotective, dermatological, antipyretic, antiparasitic, reproductive, anticholinesterase and smooth muscle relaxant properties. Given the growing interest in herbal medicine and natural products, there is a need for comprehensive reviews consolidating the medicinal, phytochemical and pharmacological aspects of *Fumaria parviflora* (Gohil and Daniel, 2014). Such reviews can provide valuable insights for further research, development and utilization of this common weed in the healthcare and pharmaceutical industries (Modi et al., 2016). This review aims to fulfill this need by presenting an in-depth analysis of the medicinal, phytochemical and pharmacological potential of *Fumaria parviflora*, contributing to the understanding and appreciation of its therapeutic significance (Qureshi et al., 2023).



Figure 1: *Fumaria parviflora* plant

Methodology

To comprehensively understand the cytological, medicinal, phytochemical and pharmacological potential of *Fumaria parviflora*, an thorough review was conducted utilizing a wide array of scientific literature sources. These sources included prominent databases such as ScienceDirect, PubMed, SpringerLink, Google Scholar, Scopus, SciFinder, ScienceDirect, Web of Science Books, as well as various research papers. Through this extensive literature review, a comprehensive database on *Fumaria parviflora* was compiled, encompassing its diverse attributes. This database

carefully records the supposed therapeutic benefits of *Fumaria parviflora*, detailing its traditional uses in folk medicine and any reported pharmacological activities. Additionally, the database elucidates the phytochemical properties of *Fumaria parviflora*. Moreover, the database includes a thorough exploration of the pharmacological activities associated with *Fumaria parviflora*. Furthermore, the database incorporates a detailed cytomorphological study of *Fumaria parviflora*, delving into its cellular characteristics such as chromosomal number and cellular organization. By integrating findings from cytology, phytochemistry and pharmacology, this comprehensive database provides a holistic understanding of the potential of *Fumaria parviflora* as a common weed of wheat crops in Himachal Pradesh.

Medicinal Properties of *Fumaria parviflora*

Fumaria parviflora, commonly known as Pitpapa due to its ability to cure pitta and rakta dosha. This herb's properties make it a valuable asset in Ayurvedic medicine for addressing imbalances associated with these doshas (Kumar et al., 2017). Dried powdered plant material is taken with warm water three times a day for fourteen days, which helps in the purification of blood. For 3-5 days, take half a cup of the plant's decoction every morning to relieve fever (Sultana et al., 2018). When intrinsic bleeding occurs, pitpapa juice and honey are combined, utilizing the medicinal qualities of the plant to stop the bleeding. For individuals suffering from bleeding piles, washing with pitpapa juice or a mixture of papata and ghee is recommended, offering potential relief and healing benefits (Kumar et al., 2017). Additionally, in situations of excessive thirst, water infused with pitpapa serves as a refreshing and hydrating solution when consumed repeatedly. Moreover, pitpapa juice processed with oil proves beneficial for external application on wounds or ulcers, aiding in their healing process. Embracing a holistic approach to wellness, *Fumaria parviflora* emerges as a valuable botanical resource in traditional medicine, offering remedies for a diverse range of ailments (Jowkar et al., 2011). The herb has a long history of usage in Ayurvedic medicine. It also purifies the blood in skin problems. The whole herb was traditionally used as a laxative, diuretic and diaphoretic, for detoxification, fever and leprosy. The plant extract was utilized as a bitter tonic and astringent, aimed at addressing issues like indigestion and certain types of skin infections associated with scrofula. Traditionally, *Fumarium parviflora* was also used to treat dermatological conditions, promote the function of the liver and gallbladder and treat scabies, antipyretic, diaphoretic, expectorant, antiscorbite, antibronchite, diuretic, appetizer and laxative, as shown in figure 2 (Fathiazad et al., 2013). In Turkish folk medicine, it was employed to combat the malfunction of the liver and kidneys. Still, in the Unani traditional system, it was recommended for the management of gastrointestinal and respiratory ailments, as well as for alleviating abdominal cramps, indigestion and asthma (Jameel et al., 2014a).

Phytochemical Properties

Numerous phytochemicals that are probably present

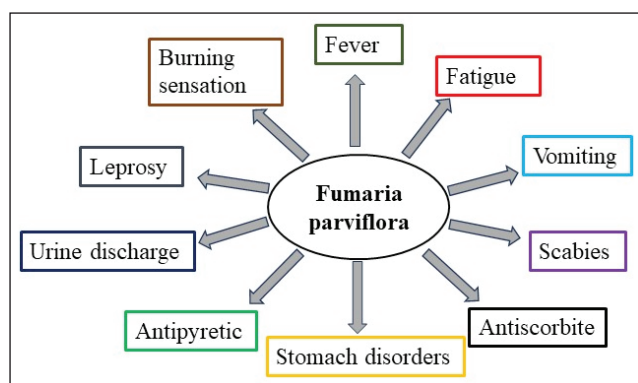


Figure 2: Medicinal effects of *Fumaria parviflora*

in *Fumaria parviflora* contribute to both its biological activity and possible therapeutic effects (Zhang *et al.*, 2020). Phytochemicals that are frequently observed in *Fumaria* species and possibly in *Fumaria parviflora*, include (Jamaldeen *et al.*, 2022): glycosides, phenol, caffeic acid, quercetin, kaempferol, isoquinoline, tannins, saponins, triterpenoids, sterols such as β -sitosterol, stigmasterol and campesterol, as well as β -alkaloids like perufe, adlumidicine, palmatine, berberine, dihydrosanguinarine, fumaricine, protopine oxyberberine, protocatechuic acid and caffeic acid. Some of them are shown in figure 3. Additionally, the plant contains fatty acids, sesquiterpenoids, essential oils and aromatic hydrocarbons. Protopine isoquinoline alkaloid and β -sitosterol were quantified using the HPTLC method, revealing percentages of 0.45-0.49% w/w for protopine and 0.22-0.27% w/w for β -sitosterol.

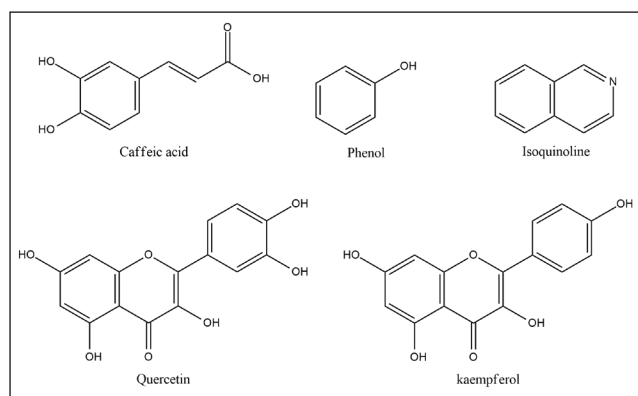


Figure 3: Some phytochemicals found in *Fumaria parviflora* plant

Pharmacological Activities

1. Antioxidant Properties

Flavonoids and phenolic compounds, abundant in *Fumaria parviflora*, are recognized for their antioxidant ability, aiding in the neutralization of detrimental free radicals within the body (Kumar *et al.*, 2018). These radicals can be found to help prevent damage caused by oxidative stress, which is linked to several chronic illnesses. Their protective effect against oxidative stress emphasizes how important they are for preserving cellular integrity and reducing the possibility of disorders associated with oxidative damage.

2. Anti-inflammatory Effects

Compounds within *Fumaria parviflora* species, such as alkaloids and flavonoids, exhibit promising anti-inflammatory effects (Figure 4), by modulating cytokine production and inflammatory pathways (Rizvi *et al.*, 2017a; Zhang *et al.*, 2020). Studies suggest that these compounds can suppress the release of inflammatory-promoting cytokines like interleukin-6 (IL-6) while enhancing the production of anti-inflammatory cytokines such as interleukin-10 (IL-10) (Rao *et al.*, 2007; Zahedipour *et al.*, 2022). By attenuating inflammation at the molecular level, *Fumaria parviflora* compounds offer the potential to alleviate symptoms associated with inflammatory conditions, including pain, swelling and tissue damage (Bhargava *et al.*, 2021; Jamaldeen *et al.*, 2022).

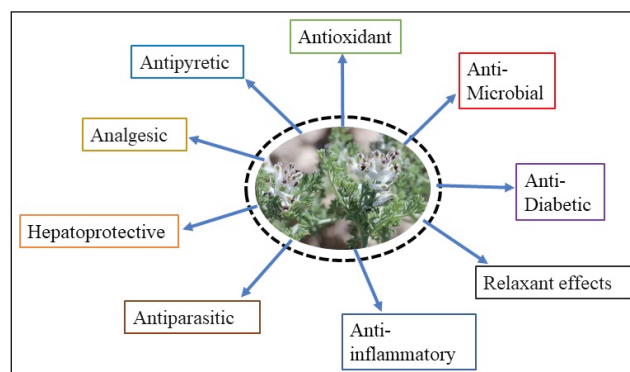


Figure 4: Pharmacological Properties of *Fumaria parviflora*

3. Antimicrobial Activity

According to research, *Fumaria parviflora* has antibacterial qualities, which could help them fight a variety of microbial illnesses (Naz *et al.*, 2013). These properties are likely linked to the existence of alkaloids and other secondary metabolites within the plant. However, these results highlight the potential of *Fumaria* species as natural enemies of microbiological infections, indicating that more research in this field is necessary (Jameel *et al.*, 2014c; Naz *et al.*, 2013).

4. Antidiabetic Potential

Fumaria parviflora species are beneficial in managing diabetes because they contain bioactive substances that may improve insulin sensitivity, control blood sugar, or protect pancreatic beta cells (Jameel *et al.*, 2014c; Kumar *et al.*, 2017). These results point to the need for a multimodal strategy to target many aspects of the pathophysiology of diabetes. However, these early results highlight the potential therapeutic benefit of *Fumaria* species in enhancing current diabetic mellitus treatments.

5. Hepatoprotective Effects

Fumaria species may exhibit hepatoprotective effects, implying their potential to safeguard the liver against harm. This protective capability is believed to stem from the presence of diverse phytochemicals within the plant, notably alkaloids and flavonoids (Alqasoumi *et al.*, 2009). Such compounds are thought to contribute to mitigating

liver damage, possibly by counteracting oxidative stress and supporting liver function. These findings suggest promising avenues for exploring *Fumaria* species as natural remedies for liver-related disorders (Rizvi et al., 2017b).

Cytomorphological Study of *Fumaria parviflora*

- Gametophytic chromosome counts of *Fumaria parviflora*, n=16.
- Sporophytic chromosome count of *Fumaria parviflora*, 2n=32 which is diploid.
- No record of the *Fumaria parviflora* has been found in India.
- This is worked out for the first time at the world level.
- This is reported with 2n=32 from various scientists outside India (Jeelani et al., 2011).

Conclusion

The review on the medicinal, phytochemical and pharmacological potential of the common weed *Fumaria parviflora* highlights its significant importance in traditional medicine and its emerging role in modern pharmacology. Through an extensive examination of existing literature, the review demonstrates that *Fumaria parviflora* possesses a diverse array of alkaloids, bioactive compounds, phenolic acids, flavonoids and terpenoids, which are involved in its pharmacological activities. The pharmacological studies discussed in the review indicate that *Fumaria parviflora* exhibits promising therapeutic properties, antimicrobial, hepatoprotective, antidiabetic and anticancer effects. These findings suggest its potential applications in the therapy and supervision of various diseases and health conditions. Furthermore, the review needs further research to fully elucidate the mechanisms of action underlying the observed pharmacological effects of *Fumaria parviflora*. Additionally, more studies are warranted to assess its safety profile, potential drug interactions and optimal dosage regimens.

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