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Review Article

A Review on Ethnobotanical, Phytochemistry, Bioactivities and Medicinal Mysteries of *Fumaria officinalis* (Common Fumitory)

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Abstract: Plant preparations are said to be medicinal or herbal when they are used to promote health beyond basic nutrition. It is indeed quite interesting to observe that our ancients were duly equipped with the vast, in depth and elaborated knowledge of drugs from the vegetable origin but unfortunately they possessed a scanty knowledge with regard to the presence of chemically pure compounds in most of them. *Fumaria officinalis* (*F. officinalis*, Fumariaceae) is a well-known traditional herb rich in biochemically active components. *F. officinalis* (common fumitory or earth smoke) is the most common species of the genus *Fumaria* in Western and Central Europe. Fumitory was officially recognized in 1986 by the French Health authorities as an herbal medicine which was traditionally used in renal and digestive elimination functions. By accurately looking to the name of fumitory, it is said to be derived either from the fact that its whitish, blue-green colour gives it the appearance of smoke rising from the ground, or according to Pliny and Olivier de Serres (XIV century) because the juice of the plant brings on such a flow of tears that the sight becomes dim as with smoke and hence its reputed use in affections of the eye. This herb has been known since antiquity and was described in herbals from the Middle-Ages. It was mainly the Mediterranean genus which was once used as medicine and wound healing. In a meanwhile traditionally fumitory has been used as digestive and diuretic. This review highlights the traditional, ethnobotanical, phytochemical, pharmacological information available on *F. officinalis*, which might be helpful for scientists and researchers to find out new chemical entities responsible for its claimed traditional uses.

Keywords: *Fumaria officinalis*, Fumariaceae, Fumitory, Mediterranean genus, Ethnobotanical, Phytochemical, Pharmacological.

INTRODUCTION

The genus Fumaria (Fumariaceae) consists of 46 species in the world and Fumaria species are known as fumitory, earth smoke, beggary, fumus, vapor, fumittery or wax dolls in English (Orhan, I. *et al.*, 2010). As per data available over three-quarters of the world population relies mainly on plants and plant extracts for their health care needs. More than 30% of the entire plant species, at one time or other was used for medicinal purposes. Treatment with medicinal plants is considered very safe as there is no or minimal side effects. These remedies are in sync with nature, which is the biggest advantage. The ancient scholars only believed that herbs are only solutions to cure a number of health related problems and diseases (Rajagopal, P.L. *et al.*, 2018). Fumitory is on the United Kingdom General Sales List (GSL) and is approved by the German Commission E Monograph. It has been used in Europe and universal, as a traditional medicine for more than 30 years without safety problems. Phytochemical studies revealed the attendance of several alkaloids such as adlumidiceine, copticine, fumariline, perfumine, protopine (Popova, M.E. *et al.*, 1982), fumaranine, fumaritine, paprafumicin and paprarine (Rahman, A.R. *et al.*, 1992). Fumarity has also been evaluated for pharmacologically effects, therapeutic effects and shown to possess antihelmantic (Hördegen, P. *et al.*, 2003), antipyretic (Khattak, S.G. *et al.*, 1985) and hypoglycemic properties (Akhtar, M.S. *et al.*, 1984). It was usually thought to be good and causes healing effects for the eyes and to remove skin blemishes. Nowadays herbalists use it to treat skin

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diseases and conjunctivitis; as well as to cleanse and pure the kidneys. This plant has been extremely valued since at least Roman times for its tonic and blood cleansing effect upon the body the smoky or fumy origin of its name comes from the translucent colour of its flowers giving them the appearance of smoke or of hanging in smoke, and the slightly grey-blue haze colour of its foliage, also resembling smoke coming from the ground, particularly after morning dew (Hördegen, P. *et al.*, 2003). In this article we have gathered a briefly and targeted pack of information about *F. officinalis* which hope to be useful in near future for scientist society. 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 (Gowher, G. 2017).

Taxonomy

Kingdom: Plantae
Subkingdom: Tracheobionta
Superdivision: Spermatophyta
Division: Magnoliopsida
Class: Magnoliopsida
Subclass Magnoliidae
Order: Papaveraceae
Family: Fumariaceae – Fumitory family
Genus: Fumaria L.
Species: *Fumaria officinalis* L. ssp. *officinalis*

Common Name

Arab- Buklat-ul-malik, Shahtara
Sanskrit-Khsetra parpati, Yavanaparpata
Tamil-Tura
Telugu -Chata-rashi
Hin-Pit-parapara
Kannada-D
Urdu-Shahterah
English- Common Fumitory, Earth-Smoke, Wax doll, Hedge fumitory

Botanical Description

It is an herbaceous annual plant that grows weakly erect and scrambling, with stalks about 10-50 cm (3.9-19.7 in) long. It has slender green leaves (Reader's Digest Field Guide to the Wild Flowers of Britain. 1981). Its pink 7-9 mm (0.28-0.35 in) flowers appear from April to October in the northern hemisphere[10], or May to September in the UK (Reader's Digest Field Guide to the Wild Flowers of Britain. 1981). They are two lipped and spurred, with sepals running a quarter the length of the petals (Richard, F. *et al.*, 1974). The plant commonly has more than 20 and up to 60 flowers per spike (Popova, M.E. *et al.*, 1982). The fruit is an achene containing one seed. It is approximately globular, slightly wider than high and with an apical notch (Murphy, R.J. 2009).

Geographical Distribution

The Fumaria is a genus of herbs distributed in Asia, Europe and Africa. It is native to temperate regions of North Africa, Europe and parts of Western Asia. It is found in North Africa, within Macaronesia, Canary Islands, Algeria, Egypt, Libya, Morocco and Tunisia. Within Western Asia it is found in the Caucasus, Cyprus, Iraq, Israel, Lebanon, Siberia, Syria and Turkey. In Eastern Europe, it is found within Belarus, Estonia, Latvia, Lithuania and Ukraine. In middle Europe, it is in Austria, Belgium, Germany, Hungary, Netherlands, Poland, Slovakia and Switzerland. In northern Europe, in Denmark, Ireland, Norway, Sweden and United Kingdom. In southeastern Europe, within Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Italy, Macedonia, Montenegro, Romania, Serbia and Slovenia. Also in southwestern Europe, it is found in France, Portugal and Spain (Taxon: Fumaria officinalis L. 2017).

Alkaloids

The main alkaloid of *F. officinalis* is protopine. It is the major secondary metabolite extracted from *F. officinalis* and purified by column chromatography. Urine samples were composed from horses and a human volunteer that had been administered with either *F. officinalis* or protopine free base. In other hand, urine and plant samples were acetylated and analysed by GC-MS after solid-phase extraction. It was recognised that the urinary metabolites of protopine were identified as4,6,7,13-tetrahydro-9,10-dihydroxy-5-methyl-benzo[e]-l,3-benzodioxolo[4,5-1] [2]benzazecin-12(5H)-one,4,6,7,13-tetrahydro-10-hydroxy-9-methoxy-5-methyl-benzo[e]-1,3-benzodioxlo[4,5-1][2]benzazecin-12(5H)-oneand4,6,7,13- tetrahydro-9-hydroxy-10-methoxy-5-methyl- benzo[e]-1, 3-benzodioxolo[4,5-l][2]benzazecin-12(5H)-one, chelianthifolia, isochelianthifoline and 2-O- desmethylcheli-anthifoline[13]. Some important alkaloids which have discovered and identified by gas chromatography mass spectrophotometry method from the *F. agraria*, *F. bastardii*, *F. capreolata*, *F. sepium*, *F. densiflora*, *F. faurei*, *F. officinalis* subsp. *officinalis*, *F. parviflora*, *F. petteri* subsp. calcarata and *F. macrosepala*, are the isoquinoline alkaloids such as protopine, cryptopine, sinactine, stylopine, bicuculline, adlumine, parfumine, fumariline, fumarophycine, fumaritine, dihydrofumariline, parfumidine and dihydrosanguinarine (Sharma, U.R. *et al.*, 2012). The isoquinoline alkaloids in *F. officinalis* mostly have shown the biological activity (Hentschel, C. *et al.*, 1995; Gilani, H.A. *et al.*, 2005). Traditionally, the juices of *F. officinalis*, after undergoing evaporation process, could be used to treat chronic eczema, dermatological problems and cutaneous eruptions (Dermaderosian, A., & Beutler, J.A. 2005; Duke, J.A. 2002).

Etymology

The "smoky" or "fumy" origin of its name comes from the translucent color of its flowers, giving them the appearance of smoke or of hanging in smoke, and the slightly gray-blue haze color of its foliage, also resembling smoke coming from the ground, especially after morning dew. The plant was already called *fūmus terrae* (smoke of the earth) in the early 13th century, and two thousand years ago, Dioscorides wrote in *De Materia Medica* (Περὶ ὕλης ἰατρικῆς) and Pliny the Elder in *Naturalis Historia* that rubbing the eyes with the sap or latex of the plant causes tears, like acrid smoke (*fūmus*) does to the eyes. Its Greek name is *kapnos* (*καπνός*, for *smoke*) and the name *fumewort* now applies mostly to the genus *Corydalis*, especially the similar looking *Corydalis solida* (formerly *Fumaria bulbosa*), which was thought to belong to the same genus as fumitory (The Names of Plants, 4TH Edition Gledhill, D. 1985–2008).

Herbalism

It was traditionally thought to be good for the eyes, and to remove skin blemishes. In modern times herbalists use it to treat skin diseases, and conjunctivitis; as well as to cleanse the kidneys. However, Howard (1987) warns that fumitory is poisonous and should only be used "under the direction of a medical herbalist (Howard, M. 1987).

Pharmacological Activity

Table 1 Pharmacological activity of *F. officinalis*

System	Effect	Description	Active compounds	References
			Drank	Lombardi Satriani
All	Anti-malaria		different types	
				(1951)
			of decoctions	
		Bactericidal activity		
		against the Gram-		
	Anti-bacterial	positive organisms		Preininger (1975)
		Bacillus anthracis		
		and *Staphylococcus*		
		has been reported		
		Antibacterial		
		activities of aqueous	Extract	Dulger *et al.*, (2004)
		extract of *F. officinalis*		
				Boucard *et al.*,
Digestive	Amphocholeretic activity			Boucard, M., & Laubenheimer, B. (1966
				Reynier, M. *et al.*, (1977)
	Fumitory extract inhibited the formation of		Extract	Lagrange, E. (1973)
	gall bladder calculi in animals			
	Management of disorders of			Gruenwald *et al.*, 2007
	hepatobiliary tract, spastic discomfort in		Extract	Gruenwald *et al.*, (2007); Duke 2002
	the area of the gallbladder bile ducts as			
	well as gastrointestinal tract			
		Plantago major with		Denden S *et al.*,
	Antiallergic and choleretic	*F. officinalis* ethanolic	Extract	Denden, S. (2010); Ali
		extracts together		Nazarizadeh *et al.*, 2013
		(Ethanolic extract)		

	Ameliorate bile duct blockage in animals			Zacharewicz *et al.*,1979
	and assist in the management of similar		Extract	Boucard *et al.*, 1966
	disorders in humans. Biliary dyskinesia			
	Antibilious, the alkaloid in it increases			
	the secretion of bile, and also at times		Alkaloid	Bisset *et al.*, (2001)
	of increased pathologic bile, reduces its			
	secretion			
	Antispasmodic			Ivancheva *et al.*, 1999
	Colicky pain affecting the gallbladder			Hentschol *et al.*, 1995
	and biliary system, together with the			
	gastrointestinal tract			
	Extracts inhibited formation of			Lagrange *et al.*, 1973
	gallbladder calculi in animals		Extracts	
Liver	Hepatoprotective activity	Effect from each side of his body	Ethanolic extract	Uday Raj Sharma *et al.*, (2012)
	Cytoprotective effect		Alkaloids	Taborska *et al.*, (1996)
Cardiovascular	Cardiovascular activity		Alkaloid fractions	Gorbunov *et al.*, (1980)
	In dogs reduced ischaemia caused by			
	experimental ligation of the circumflex			Rao *et al.*, (1998)
	artery			

System	Effect	Description	Active compounds	References
	Hypotensive, bradycardic and sedative		Protopine	Goetz *et al.*, (2009)
	activities in small doses in animals			
	Larger doses cause excitation		Protopine	Preininger *et al.*, 1975
	and convulsions			
Cell	Cytotoxicity effects		Protopine	Saglam *et al.*, (2003)
				British

						Herbal		
Eye		The use as an eye lotion in conjunctivitis				Pharmacopoeia (BHP)		
Respiratory		Has been used in Afghanistan for the				Delaveau (1980)		
		treatment of asthma						
Muscle		Antispasmodic activity on smooth				Reynier *et al.*, (1977)		
		muscle has been reported						
		Valuable agent in cutaneous eruptions						
Skin		such as eczema and psoriasis, in scabies			Syrup	Mir Heidari (1993)		
		and also in syphilis.						
		In Iranian folk medicine in skin diseases.				Amin (1991)		
		Anti-scabies, anti-scorbite, anti-bronchite						
		Leprosy, scabs, tatters, and itches, and			Juice or syrup	Baker *et al.*, (1993)		
		such like breakings-out of the skin			or seed			
		The immunocompromised condition of			Chronic	Baker *et al.*, (1993);		
Immune system						Blank *et al.*, (1993)		
		chronic alcoholics			alcoholics			
		Significant antioxidant activity				Memnune *et al.*, (2009);		
						Howard (1987)		
		Reduced glutathione, a free radical						
		scavenger, plays a key role in the				Reynier *et al.*, (1977)		
		activation of T cells and macrophages						

Clinical Trials

Ones clinical study which choloethiasis, hepatopathy and post operation cholecystectomy syndrome were dimensioned and shown that *F. officinalis* water extract could have therapeutic aspects on them[47]. Another test showed very positive amphocholeretic effects on biliary syndrome by *F. officinalis* extract[48]. The effect of water extract of fumitory on choleretic activity has been measured by a clinical trial on 1969 by Heully *et al.*, (1969).

CONCLUSIONS

F. officinalis plant has been explored exhaustively for their phytochemical and pharmacological activities. From the foregoing accounts, it is evident that *F. officinalis* plant has been used ethno-medicinally as a valuable therapeutic agent for a variety of diseases, as we have illustrated in this article. Moreover, numerous research works have proven its uses beyond the ethno-medicinal ones in experimental animals. Various compounds which were separated from this plant may be responsible for its pharmacological activities.

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