Physico-chemical and Phyto-chemical Evaluation of 'Shahtra' (*Fumaria officinalis* Linn.) – An important Unani drug

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Abstract

The entire dried plant of *Fumaria officinalis* Linn. commonly known as Shahtra is used as a important medicinal drug of herbal origin in Unani system of Medicine. The plant possesses many medicinal properties and it is an important component of some marketed herbal formulations. There are various other species of *Fumaria* that are sometime used in place of *F.officinalis* . So phytochemical and physico-chemical studies on the whole plant of *F.officinales* has been undertaken for its pharmacopoeial standardization in order to lay down standards for the quality control, genuinity and purity.

The main aspects included in the study are organoleptic characters, physico-chemical constants, qualitative determination of organic chemical constituents, thin layer chromatographic profile and IR spectral study of the drug.

Key Words: Standardization, *Fumaria officinalis*, Physico-chemical and Phytochemical, IR spectrum.

Introduction

Fumaria officinalis Linn. (Fumariaceae) known as Common Fumitory, Shahtra in Persian or Pitpapra in Hindi (Ainslie, 1826; Chopra, 1958; Evans and Trease, 2009) is a perennial herb which has been used in the traditional medicine since a long time in various health ailments. There are seventeen wild species belonging to this genus in Turkey. Practically all the species are known by the name of Fumitory. Two species are widespread in India *F.officinalis* and *F.parviflora. F.officinalis* occur as a pale green, much branched annual herb up to 2 ft. high, with leaves divided into narrow segments (Anonymous, 1956).

Fumaria species have been used in traditional medicine as an infusion prepared from the stem and the leaves are used in various health ailments (Chopra, 1958). Examples include the treatment of skin rashes and other skin diseases like pyoderma and folliculitis. In addition the herb has been used for conjunctivitis, hypertension, as a diuretic, for hepatoprotection, as a laxative, digestive tonic, for sclerosis of the liver and as a vermifuge. The main medicinal use of fumitory, however, is in eruptive skin diseases taken internally as an infusion (Anonymous, 1956, Karim, 1880, Ghani, 1921, Baitar, 1991). The biological activity of *Fumaria* is mostly associated with the presence of isoquinoline alkaloids in the plant (Anonymous, 1956). In the last few years,

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a large number of scientific reports have described the properties of *Fumaria*. The plant has also been evaluated pharmacologically and shown to possess antihelminthic, antipyretic and hypoglycemic properties (Erdogan, 2009; Wasu and Muley, 2009; Hentschel *et al*., 1995; Brinkhaus *et al*., 2005).

Ethno-medicinal Uses:

Traditionally, whole herb of *F.officinalis*, which also features in a number of commercial Indian preparations is used for liver disorders (Evans and Trease, 2009), for digestive problems, certain metabolic disease, to purify blood (Hakeem, 1343H). It is extremely useful in syphilis, scrofula, leprotic affections (Ainslie, 1826), used as diuretic, tonic, diaphoretic, alterative, blood purifier (Ainslie, 1826; Chopra, 1958; Hakeem, 1343H, Nadkarni, 2000).

A review of literature reveals that *F.officinalis* has been in use in treating various health ailments including ‘‘colicky pain affecting the gallbladder and billiary system, together with the gastrointestinal tract’’ (Heidari, 2004). Various pharmacological studies have been done like its use in Irritable Bowel Syndrome (Brinkhaus, 2005). Brine shrimp Lethality Bio assay done (Krishnaraju, 2005).

The biological activity of *Fumaria* is mostly associated with the presence of isoquinoline alkaloids in the plant (Anonymous, 1956). In the last few years, a large number of scientific reports have been described the properties of *Fumaria*.

Thus keeping in mind the medicinal importance of the drug various physico-chemical and phytochemical studies on the whole plant of *F.officinalis* were carried out for its standardization, in order to lay down standards for its purity, quality control and quality assurance.

Chemical Constituents

Phytochemical investigation revealed the presence of several alkaloids such as adlumidiceine, copticine, fumariline, perfumine, protopine fumaric acid (considered at one time as a treatment of psoriasis), fumaranine, fumaritine, paprafumicin and paprarine (Erdogan, 2009) and other biologically active compounds like isoquinolone alkaloid including fumaricine, sanguinarine (Evans and Trease, 2009).

It is a major source of fumaric acid (isomer with malic acid), alkaloids (including fumarine and protopine), tannic acid, mucilage, resin. It contains pentatriacontane (0.5%), an alkaloid principle identical with protopine (0.13%),

tannins, phlobaphenes and sugars. Potassium salts predominate among the ash constituents and diuretic property is attributed to their presence (Anonymous, 1956). Cryptopine (0.31%) is a major constituent in total alkaloids (1.25%) from aerial parts of Turkish plant. Phytochemical investigations revealed the presence of several alkaloids such as adlumidiceine, copticine, fumariline, perfumine, protopine, fumaranine, fumaritine, paprafumicin and paprarine (Ainslie, 1826; Anonymous, 1987; Rastogi and Mehrotra, 1998).

Material and Method

Collection of plant material: The whole plant of *F. officinalis* was collected from Dawakhana Tibbiya College, AMU, Aligarh and identified in the Pharmacognosy Section of Department of Ilmul Advia, AMU, Aligarh. Voucher specimens were preserved in the herbarium of Medicinal Plant Lab in the Department of Ilmul Advia, F/O Unani Medicine, Aligarh Muslim University, Aligarh (V.No-SC-0118/09-F).

Chemical parameters: First the organoleptic characters were identified. The dried powder of the whole plant of *F. officinalis* was used for chemical analysis. Various physico-chemical studies like total ash, acid insoluble ash, water soluble ash, sulphated ash, alcohol and water soluble matter, moisture content, successive extractive values using soxhlet extraction method, bulk density and pH studies were carried out as per guidelines of WHO (Anonymous, 1998) and Govt. of India (Anonymous, 2008). Qualitative analysis of the drug was conducted to identify the organic chemical constituents present in the drug (Overtone, 1963; Harborne, 1973).

Besides this, IR spectral study was also done. For IR spectroscopy the alcoholic extract of the drug was obtained by refluxing powdered drug (5.0 gm) with absolute alcohol (50 ml) for 5 hours and removing the solvent under reduced pressure. Then IR spectrum of alcoholic extract was determined in KBr pellets with Perkin Elmer 1600 FTIR spectrometer.

The thin layer chromatographic analysis was conducted (Stahl, 1969; Harborne, 1973) on precoated silica gel $60F_{254}$ TLC plates. The plates were visualized in Day light, Iodine vapour, in short UV and Long UV. They were also derivatised using vanillin-sulphuric acid and heated at 105^{o}C.

Observations

A. *Organoleptic characters:* The powder of the whole plant was light green, without any characteristic odour, slightly bitter in taste. Summarized in Table-1.

Table 1: Organoleptic Characters of *Fumaria officinalis* Linn.

S.No.	Organoleptic parameters	Observations
1.	Colour	Light Green
2.	Smell	Odourless
3.	Taste	Slightly bitter

B. *Physico-chemical constants:* The analytical values of different physico-chemical constants were determined and are depicted in Table-2.

Table-2: Physico-chemical Constants

S.No.	Parameters	Analytical values (%)*
1.	Ash values	
	a) Total ash (w/w)	10.46
	b) Acid Insoluble ash (w/w)	2.82
	c) Water soluble ash (w/w)	7.72
	d) Sulphated ash	15.25
2.	Moisture content (v/w)	5.92
3.	Solubility	
4.	Alcoholic soluble matter (w/w)	2.18
5.	Water soluble matter (w/w)	5.38
6.	Successive extractives	
	a) Petroleum ether (60-800C)	4.52
	b) Di-ethyl ether	2.55
	c) Chloroform	1.11
	d) Absolute alcohol	14.66
	e) Distilled water	24.10
	Bulk density	0.37
	Loss in weight on drying at 1050C (%)	12.35
7.	pH- values	
	1% Aqueous solution	6.74
	10% Aqueous solution	6.92
8.	Total Alkaloid Content (%)	0.13

*Values are average of three experiments.

C. *Qualitative analysis of organic chemical constituents of drug:* The phytochemicals present in the drug were identified on the basis of different chemical tests given for various plant constituents, results have been summarized in Table-3.

Table 3: Qualitative Analysis of Phytochemicals

S.No.	Chemical Constituent	Tests/Reagents	Inference
1.	Alkaloids	Dragendorff's reagent	+
		Wagner's reagent	+
		Mayer's reagent +	
2.	Carbohydrates	Molisch Test	+
		Fehling's Test	+
		Benedict Test +	
3.	Flavonoids	Mg ribbon and dil.Hcl	–
4.	Glycosides	NaOH Test	+
5.	Tannins / Phenols	Ferric Chloride test	+
		Liebermann's test	+
		Lead Acetate test +	
6.	Proteins	Xanthoproteic test	+
		Biuret test	+
7.	Starch	Iodine Test	–
8.	Saponins	Frothing with NaHCO3	+
9.	Steroids / Terpenes	Salkowski Reaction	+
10.	Amino acids	Ninhydrin Solution	+

Indications: ' ' Absence and '+' Presence of constituents

D. *IR spectral study of the drug*: IR spectrum of the alcoholic extract of the drug Shahtra was recorded and major characteristic bands were noted, which are given in Table-4.

Table 4: IR Spectral Details of Alcoholic Extract of Drug

IR , υ (cm^{-1})	3383, 2926, 2858,1733,1634, 1523, 1395, 1065, 541,409

E. *Thin layer chromatographic profile:* Thin layer chromatographic analysis of alcoholic extract was carried out using different solvent systems and visualizing agents and R_f values were calculated to standardize the drug for its identity and purity. The results obtained are given in Table-5.

Table 5: TLC Profile of Alcoholic Extract of Shahtra

Extract	Solvent System	Visualizing agent	No. of Spots	R_f values
Alcohol	Chloroform: Methanol (10 : 1) Toulene: Ethyl acetate: Formic acid (5:4:1)	Day light	4	0.21,0.26,0.38,0.62
		Iodine Vapour	7	0.21,0.26,0.38,0.62,0.69,0.73, 0.76
		UV Short	4	0.21,0.26,0.38,0.62
		UV Long	4	0.21,0.38,0.62,0.69
		Day light	4	0.28,0.79,0.83,0.97
		Iodine Vapour	5	0.28,0.38,0.79,0.83,0.97
		Vanilline-H_2SO_4	8	0.07 (Br.Gr),0.15(L.Gr.), 0.22(L.Gr.),0.29(Y),0.39(L.Y), 0.46(L.P),0.85(Gr.P.),0.97(Br.)
		UV Short	4	0.28,0.79,0.83,0.97
		UV Long	2	0.25(Flouroscent green),0.97

G: Green; Y: Yellow; Br.: Brown; P: Purple; L: Light; D: Dark

Discussion

With the tremendous increase in the global use of medicinal plants, several concerns regarding the efficacy and safety of the herbal medicines have also been raised. Hence it has become necessary to standardize the efficacy and safety measures so as to ensure supply of medicinal plant materials with good quality. As the basic source of the raw materials (herbal drugs) for the pharmaceutical companies of indigenous origin comes from various forest zones, lands and plains. The bulk of raw materials (root, leaves, rhizomes, bark, flowers, fruits, exudates and seeds) are collected annually from these wild sources and a small amount comes from cultivation. Unskilled persons are usually the collectors of the drugs from the land. So, the genuinity and authenticity of the drug collected, always remains a big question mark. There are more chances of possible adulteration. Therefore standardization of the drug is of prime importance before discovering any biological activity. Correct identification and quality assurance of the raw material is, therefore an essential step to ensure reproducible quality of herbal medicine, which contributes to its safety and efficacy.

The standardization is a prerequisite in quality control of any drug used for the welfare of human kind. However in making any assay, allowance must be

given to experimental error, which is about 5%, and for error due to natural variations due to difference of variety and of habitat (Wallis, 1985).

If herbal remedy is effective quality assurance is needed to ensure that the product has expected effects. Quality implies certification in respect of authentification, standardization, composition, stability and safety. It also ensures that the herbal product is free from adulterants and contaminants.

In view of the above, the present standardization study has brought out many diagnostic characters of herbal drug *Fumaria officinalis* (Shahtra) concerning organoleptic, physico- chemical and phytochemical aspects on the basis of which the drug can be identified from its possible adulterants and other wasteful matter present in the commercial sample.

Physico-chemical parameters like ash values, extractive values, moisture content, soluble matter etc. gives indication of quality of drug. If adulteration is caused by siliceous matter, then ash content changes, if drug is improperly stored, the moisture content may change. Estimation of the moisture content present in the drug is an important parameter that not only gives an idea regarding the adulteration but also satisfy the basic consideration that accurate scientific works where the drug is to be sold is within guaranteed assay.

In the same manner idea of the pH values of the aqueous extract of the drug helps in knowing the drug receptor site interactions. It also affects the stability and therapeutic activity (through drug absorption) of the drug.

Phytochemical screening is helpful to know the chemical constituents present in the drug. Generally Infra Red (IR) spectroscopy is used for the determination of different functional groups present in a compound IR spectrum has a region known as finger print region (3383-1733 cm^{-1}) characteristic of a particular compound. This region can be compared with the finger prints of other species of the same genus, which differ from species. To check the purity of the drug, the IR spectrum of the commercial sample may be compared with the authentic sample. If characteristic bands are similar the test drug would be genuine. So, major bands in the alcoholic extract of the drug were recorded and reported (Table-4), which will be helpful in confirming the identity and purity of the drug.

Thin layer chromatography is one of the important parameter used for detecting the adulteration and judging the quality of the drug. The R_f values were calculated using different visualizing agents (Table-5). If the drug is adulterated there might be appearance of the other compounds present in adulterant, in turn may increase the number of spots. On the other hand the exhausted or deteriorated drugs may lose the component and the number of

spots appeared might be less.

This study assumes great significance as it will provide a key of diagnostic characters which serves as an important tool in laying down the standards for quality assurance.

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