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Physicochemical Investigation of *Prosopis spicigera* fruits (Linn.) from Khandesh region of Maharashtra, India

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Abstract:
The evaluation of crude drug is an important task to get an idea about quality, purity of herbal crude drugs so pharmacognostical and phytochemical investigations are considered as valuable parameters for determination of quality, purity and correct identity of medicinal plants. The Khandesh region of Maharashtra, densely populated by various tribe's communities like Pawara, Kokani, Bhils, Mavach, and Vasave etc. The tribes reside isolated form from each other so, illiteracy ratio is quite high and unfortunately less number of modern medical facilities are available for treatment of public health so tribes strongly believe in herbal treatment given by local traditional healers. The healers used *Prosopis spicigera* as a medicine in liver disorders. The *Prosopis spicigera* (Linn.) Druce is a traditional multipurpose plant used by tribes in the treatment of various diseases without any scientific rational data. For the rationalization of *Prosopis spicigera* in a scientific way, the fruits were investigated pharmacognostically and phytochemically and outcomes confirmed the presence of various inorganic elements within proper range. The fruit extracts were screened for conventional phytochemical investigation revealed the presence of flavonoids, tannins, alkaloids, phenolic compounds, sterols and carbohydrates. Thus the present study provides scientific, rational data on the basis of pharmacognostical and phytochemical findings, which can be supported to plant to get a valuable place in modern herbal medicines and in the proposed Pharmacopoeia of Indian medicinal plants.

Keywords: King of desert, Nutritional plant, khandesh plant, *Prosopis spicigera*

INTRODUCTION

Since antiquity plants have been playing a great role in the development of medicine and for public health. In India, People from rural areas are still relay on the Indian traditional medicine systems like Ayurveda, Siddha and Unani for the treatment of various ailments. Near about 422,000 flowering plants reported from the world [1], out of that more than 50,000 are used for medicinal purposes [2].In India, more than 43% of the total flowering plants are reported to be of medicinal importance [3]. Nearly 1100 species were recognized as sources of raw materials for Ayurvedic and Unani formulations [4]. About 25% of drugs in the modern pharmacopoeia were derived from plants as a phytomedicines and many others were synthetic analogues built on prototype compounds isolated from plants [5]. The Satpuda region of Khandesh, Maharashtra, particularly Dhule and Nandurbar districts are characterized for their valuable flora. This region is densely populated by various tribe's communities as well as an unfortunately very less number of modern medical facilities are available to them in the treatment of public health. So tribes belong to these areas still believed on herbal based treatment [6].

Prosopis is a genus of flowering plants in the pea family, Leguminosae. It contains around 45 species of spiny trees and shrubs, which are found in subtropical and tropical regions of the Americas, Africa, Western Asia, and South Asia. The *Prosopis spicigera* (Linn.) Druce belongs to leguminosae family, is promising

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multipurpose traditional plant used by traditional medical practitioners in the treatment of various diseases [7,8]. The plant is commonly known as Shami in Marathi and also known as “wonder tree” and “king of desert” as all the parts of the tree are useful[9,10].

Nutritional and medicinal properties of plants have been known for a long time, however, their disease preventing and health promoting aspects are realized in recent times. Plant fruits play a vital role in the health of human beings providing carbohydrates, fats, proteins, vitamins and minerals [11]. Various health agencies have established dietary recommendations for prevention of chronic diseases, cancer and atherosclerosis [12,13], also reputed for the treatment of asthma, leprosy, dysentery, anthelmintic, astringent, and valuable in the treatment of jaundice, [14]. Various phytoconstituents like gallic acid, stigma sterol, campestral, sitosterol, lavone derivatives like prosogerin A, B, C, D, and E, alkaloids spicigerine, prosophylline, glycosides, diketones, phenoloc content, free amino acids, patulitrin, spicigerin, sugars and vitamins etc. has been isolated from the pods and various parts of plant [15.16,17,18].

MATERIAL AND METHODS

Collection and Authentication of the plant material

The fruits and other morphological parts of *Prosopis spicigera* were collected from the Khandesh region of Maharashtra, with the help of local tribes. The specimen was prepared and authenticated by Dr. D. A. Patil, Department of Botany, S.S.V.P. College of Science, Dhule, Maharashtra, India.

PHARMACOGNOSTICAL INVESTIGATION

Organoleptic characters

The Fresh fruits are green in color while dried fruits are brownish in color. Fruits have characteristic and sweet taste and slightly aromatic and faint odour. Fruits are 10-20cm long, turgid, straight, cylindrical, glabrous, and narrowed gradually into a short stalk. The dried drug powder shows dark reddish brown color.

HISTOLOGICAL FINDINGS OF FRUITS

Histological studies were carried out in transverse sections of fruits and confirmed the presence of pericarp includes epicarp, mesocarp, endocarp, endosperm, xylem and phloem by using different staining agents [19].

Histochemistry

Micro-chemical tests and behaviour of specific reagent towards plant drug tissue, was performed as per standard method. Histochemical color reactions of powdered drug were carried out with Phloroglucinol, Conc. HCl, sudan red III, alcoholic picric acid solution, ferric chloride solution, and dragendorff’s reagent, etc. for the detection of Lignin, oil globule, proteins, tannins, and alkaloids with a respective location. The results of the same are reported in the Table 1.

Table 1. Histochemistry

Reagent	Test	Inference	Histological zone
Phloroglucinol + conc. hydrochloric acid	Lignin	+	Lignified reticulate parenchyma and vascular bundles
Sudan red III	Oil globules	+	Endosperm and cuticle
Alcoholic picric acid	Proteins	+	Endosperm region
Aqs. Ferric chlorides	Tannins and phenolics	+	Endocarp region
Dragendroff’s reagent	Alkaloids	+	Endocarp region

(+) Indicates present of components and compounds

PHYSICOCHEMICAL EVALUATION

Ash values

Ash value like total ash, acid insoluble ash, water soluble ash and sulphated ash were determined as a part of a qualitative evaluation of the plant. Total ash was determined to measure the total amount of material remaining after ignition. Acid insoluble ash was determined to measure amount of silica in the plant.

Water soluble ash was determined to measure percentage of solubility in water. Results of ash values were matched with standard data of other species of Prosopis genus. The results of the same are reported in the Table 2.

Table 2: Ash value

Ash values	Ash value (%w/w) For fruit powder
Total ash	6.5 % w/w
Acid insoluble ash	01 %w/w
Water soluble ash	02 % w/w
Sulphated ash	9.5 % w/w

Extractive values

This method determines the amount of active constituents extracted by using various solvents. The powder drug was extracted out by the cold maceration method; the powder drug was kept for 24 hours in the solvents like petroleum ether, benzene, chloroform, acetone, ethanol, methanol, and finally with water as an aqueous extract. Percentage of dry extract was calculated in terms of air-dried flower powder. The results of the same are reported in the Table 3.

Table 3: Extractive values

Solvent	(Extractive values) % w/w) for fruit
Ether	0.161
Benzene	0.109
Chloroform	0.219
Acetone	0.185
Ethanol	01.045
Methanol	01.498
Water	03.205

Loss on Drying

The percentage of moisture was determined according to the standard method for quality and purity of drug [20]. The results of the same are reported in the Table 4.

Qualitative test for determination of inorganic elements

Total ash was investigated for qualitatively determination of presence various inorganic compounds and elements like Calcium, Potassium, Magnesium, Sodium, Iron, Phosphate, etc. [21]. The results of the same are reported in the Table 5.

Table 4: Loss on drying

Fresh fruits % w/w.	**Dried fruit powder %** w/w.
16.33	06.66

Table 5: Qualitative determination of inorganic elements

Element	Result
Calcium	-
Magnesium	-
Sodium	-
Potassium	+
Iron	+
Sulphates	+
Phosphates	-
Chlorides	+
Carbonates	-
Nitrate	-

(+) Indicates present while (-) indicates absence of inorganic elements

Fluorescence analysis

Fluorescence analysis of the powder drug was carried out with different chemical reagents colour changes were observed in day light, at 254 nm and at 365 nm in UV cabinet The dry powder drug was studied on a glass slide whereas the different extracts were studied by adsorbing the extracts on Whatmann filter paper[22]. The results of the same are reported in the Table 6.

PHYTOCHEMICAL EVALUATION

Preparation of extract and phytochemical test

Cold maceration extraction method was employed for extraction of fruits powder by using non-polar, semipolar and polar solvents. Then all extracts were concentrated in rotary vacuum evaporator (Roteva-

Equitron, Mumbai) under reduced pressure and then dried by vacuum dryer.

Table 6: Fluorescence analysis findings in day and UV light

Treatment	Colour in day light	Colour in UV (254nm)	Colour in UV (365nm)
Dry powder	Dark brown	Greenish yellow	Greenish brown
Powder + Alcoholic HCl	Reddish brown	Light green	Yellowish brown
Powder + Aq.0.1N HCl	Reddish brown	Greenish brown	Dark brown
Powder + Aq. NaOH	Brown	Greenish yellow	Black
Powder + Alcoholic NaOH	Light brown	Greenish brown	Brown
Powder + 50% H2SO4	Reddish brown	Greenish yellow	Dark brown

Table 7: Preliminary phytochemical test

Chemical Test	PE	Ben	Chl	Ace	Eth	Meth	Aqs
Tannins	--	--	--	++	++	++	++
Steroids	++	++	++	--	--	--	--
Triterpenoids	--	--	--	--	++	++	++
Flavonoids	--	--	--	++	++	++	++
Alkaloids	++	--	++	--	++	--	--
Carbohydrates	--	--	--	--	++	++	++
Proteins	--	--	---	--	--	--	++

(+) Indicates presence while (-) indicates absence of phytochemicals; PE-Petroleum ether, Ben-Benzene, Chl-Chloroform, Ace-Acetone, Eth-Ethanol, Meth-Methanol, Aqs-Aqueous.

Phytochemical tests were performed on all extracts as part of investigation for confirmation of the presence of active phytochemical constituents like carbohydrate, proteins, terpenoids, flavonoids, tannins, glycoside, alkaloids, etc. [23].The results of the same are reported in the Table 7.

RESULTS

The *Prosopis spicigera* fruits and other morphological parts are authenticated by standard method. The plant can be easily identified on the basis of its morphological characters like e color, odor, taste and extra features. The plant fruits are investigated by various pharmacognostical and phytochemical parameters as standardization part. Histological studies are carried out in transverse sections of fruits and confirmed the presence of pericarp includes epicarp, mesocarp, endocarp, endosperm, xylem and phloem by using different staining agents. Physicochemical parameters confirmed presence of inorganic elements like calcium, potassium, magnesium, sodium, iron, phosphate, and ash values are also in limits, extractive values are determined for to get an idea about affinity of powder drug towards specific solvents and findings are found satisfactory. Phytochemical screening confirmed the presence of active phytochemical constituents like carbohydrates, triterpenoids, and proteins are in ethanolic, methanolic and aqueous extracts, tannins and flavonoids are in acetone, ethanolic, methanolic, and aqueous extracts, steroids are in petroleum-ether, benzene and chloroform extracts while alkaloids are in petroleum-ether, chloroform, ethanolic, methanolic, and aqueous extracts.

DISCUSSION

Since antiquity plants have been playing a great role in the development of medicine and public health. In India 80% population from rural areas are still relay on the Indian traditional systems of the medicine like Ayurveda, Siddha and Unani entirely and Homeopathy partially depends either on plant materials or their derivatives for the treatment of various ailments.

The khandesh region of Maharashtra is occupied by various tribal communities and they are residing as an isolated form on hills, in valleys from each other, so a very least modern medical facilities are available to

them for the treatment of health problems including chronic and acute diseases, as well as in this region literacy ration is quite low which cause underprivileged ratio high. Ultimately tribes have great faith on herbal treatment.

In spite of the advent of the modern medicines, tribal population is still practicing the art of herbal medicine as well as various underprivileged tribal communities are earning money by selling medicinal plants as an income source rather than use as a curative agent in various ailments.

The *Prosopis spicigera* (L.) Druce fruits and other parts are widely used by tribes in the treatment of various diseases, without knowing quality and quality crude drug. The local healers are not familiar with standardization of drug and if they continue the plant as a medicine, which may cause adverse effects to the patient. The standardization of a crude drug is an integral part for determination of quality, purity and identity. Comprehensive literature survey on the fruits of the plant confirmed very least scientific work has been done in concern to standardization. So the present was focussed on standardization of fruits by pharmacognostical and phytochemical evaluation parameters. The macroscopical, microscopical study, result of ash values, extractive values, loss on drying, histochemisry, phytochemical tests, confirmed fruits of the plant are of standard quality, purity and rational. The fruits of the plant can be continued as a medicine without side effects.

CONCLUSION

Since antiquity in folklore remedies, the *Prosopis spicigera* has been used as a valuable medicinal plant in the treatment of various diseases without any rational data. Now plant has bee exploited rationally and findings can be supported to the plant as a promising medicinal plant and in spite of this plant can get valuable place in the proposed Pharmacopoeia of Indian medicinal plants.

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