Research Article

Pharmacognostic and Physicochemical Analysis of Roots of *Stereospermum suaveolens*

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ABSTRACT

Stereospermum suaveolens belonging to the family Bignoniaceae, popularly known as padhri, is a medicinal plant widely used in traditional system of medicine. The root of this plant is used in traditional and folklore medicine for the management of various ailments. The present study is undertaken to evaluate pharmacognostic and physicochemical analysis of roots of *Stereospermum suaveolens*. The fresh root is used for the study of macromorphological and microscopical characters; whereas the dried root powder is used for determination of powder microscopy, physicochemical parameters, fluorescence analysis and phytochemical screening. Microscopic characters when observed revealed the presence of typical root characteristics such as thick periderm which consists of cork, phellogen and phelloderm. Physicochemical parameters such as total ash value, acid insoluble ash value, water soluble ash value, extractive values, pH and loss on drying of root powder are determined. Fluorescence study imparted characteristic colours to the root powder when observed under visible and UV light. Preliminary phytochemical studies of ethanolic extract of *Stereospermum suaveolens* ascertained the presence of flavonoids, saponins, phenolic compounds and tannins. The findings of the present study lay down standards which could be useful to detect the authenticity and for detailed evaluation and investigation of this plant.

Keywords: Fluorescence study, Microscopical characters, Physicochemical parameters, *Stereospermum suaveolens*.

INTRODUCTION

Plants have formed the sophisticated traditional medicine systems that have been in existence for thousands of years.[1,2] The use of plants as medicaments is dated back to early man.[3] Medicinal plants have a long-standing history in many indigenous communities and continue to provide useful tools for treating various ailments. The practices of traditional medicine are based on hundreds of years of belief and observations, which predate the development and spread of modern medicine.[4] Since crude plant drugs form the basis for the manufacture of numerous medicinal preparations, accurate determination of drug identity and safety forms an essential part of its study. It becomes extremely important to make an effort towards standardization of plant material.[5]

The process of standardization can be achieved by stepwise pharmacognostic studies that help in identification and authentication of a plant material.6 Correct identification and quality assurance of the raw material are the important prerequisites in herbal therapy to ensure its quality, efficacy and safety. Pharmacognosy is a simple and reliable tool, by which complete information of the crude drug can be obtained. Most of the regulatory guidelines and pharmacopeias suggest macroscopic and microscopic evaluation and chemical profiling of herbal materials for quality control and standardization.[7, 8]

Stereospermum suaveolens belonging to the family Bignoniaceae, popularly known as padhri, is a medicinal plant widely used in traditional system of medicine. It is a large deciduous tree found throughout the moist parts of India.[9] The various parts of the plant are used in Ayurveda and folklore medicine for the treatment of various ailments. The flower of the plant is considered in treating bilious diarrhea and burning sensation. The fruit is also taken with honey to control hiccups. Leaf juice when boiled with oil, cures diseases of the ear, teeth and rheumatism. Bark has antibacterial and anti-tuberculosis properties. Traditionally root is used in the remedies of diseases like in "kapha", and "amlapitta", inflammations, heating, dyspnoea, body ache, vomiting, eructation, piles, acidity, diarrhoea, gonorrhoea, liver disorders, malaria and other fevers. Root is also useful in excessive thirst, cough, asthma and weight gain.[10] Moreover the roots of *Stereospermum suaveolens* are reported to contain p-coumaric acid, triacontanol, cetyl alcohol, oleic, palmitic, stearic acid, lapachol, dehydroalpha- lapachone and dehydrotectol in root heartwood; β-sistosterol and n-triacontal in root bark.[11] Previous scientific studies evidenced that plant possess anti-inflammatory, anticancer, hepatoprotective, antihyperglycemic, antioxidant activities.[12-14] In consideration with the diverse use of roots of *Stereospermum suaveolens* for the management of many ailments in traditional and folklore system of medicine, the present study is focused on the pharmacognostic standardization parameters such as organoleptic, microscopic, macroscopic analysis along with the determination of ash and moisture content,

extractive values and fluorescent characteristics of the roots of *Stereospermum suaveolens* as described in the World Health Organization guidelines.

MATERIALS AND METHODS

Collection and authentication of plant material

The roots of *Stereospermum suaveolens* were collected from Tirumala hills, Chittor district of Andhra Pradesh. The plant was identified, authenticated and certified by Botanist Dr. Madhavachetty, Herbarium keeper, Department of botany, Sri Venkateswara University, Tirupati, India and a specimen (No. 1587) has been deposited in Department of Botany, Sri Venkateswara University, Tirupati, India. Fresh roots were used for macroscopic and microscopic evaluation. Remaining roots were shade dried and powdered in Wiley mill.

Macroscopic evaluation

Various organoleptic and macroscopic characters like color, shape, odour, taste and texture were evaluated.[15]

Microscopic studies

Fresh roots were fixed in FAA (formalin+ acetic acid + 70% ethanol) solution for 24hours. Then the roots were dehydrated with graded series of tertiary butyl alcohol and castled in paraffin blocks. The paraffin-embedded specimens were sectioned with the help of rotary microtome. The thickness of the sections was 10–12 µm. Dewaxing of the sections was carried out by customary procedure. The sections were stained with safranin. Photographs of different magnifications were taken with Nikon Labphoto 2 microscopic Unit.[16]

Powder microscopy

The root powder was cleared with sodium hydroxide, stained and mounted in glycerine medium. Photomicrographs of different cellular components were taken.[17, 18]

Physicochemical analysis

Various physicochemical parameters such as total ash value, acid insoluble ash value, water soluble ash value, extractive values, pH and loss on drying are analysed for powdered root as per WHO guidelines.[19,20]

Flourescence analysis

The fluorescence character of plant powder was studied by taking one gram of crude drug in a watch glass and subjected to fluorescent analysis by observing as such and after treatment with different reagents in daylight and UV light.[21]

Preparation of ethanolic extract

The root powder was defatted with petroleum ether (60-800C). The defatted marc was air-dried and macerated with ethanol for 24 hours. Macerated material was refluxed for 3hours, then filtered and subjected to distillation under reduced pressure to get the semi-solid residue and it was stored in desiccators.

Preliminary phytochemical studies

The prepared ethanolic extract was subjected for preliminary phytochemical studies under standard methods for identifying the presence of various phytoconstituents like steroids, alkaloids, saponins, tannins, terpenoids, flavonoids, aminoacids, glycosides, carbohydrates, fats and phenols.[22]

RESULTS AND DISCUSSION

Macroscopic study of root

The roots of *Stereospermum suaveolens* was outer dark brown and yellow pale yellow to cream in colour. They have characteristic odour and bitter in taste. The root surface is rough and firm due to scaling off of longitudinal striation and inner side of root is soft.

Microscopic analysis of root

The root is circular in sectional view with wide and deep fissures. The thin root is about 1.2mm thick while the thick one is about 2.35mm thick. Microscopic characters when observed revealed the presence of typical root characteristics such as thick periderm which consists of cork, phellogen and phelloderm. The vascular cylinder is central in position and is composed of outer thick cylinder of secondary phloem and central compact dense secondary xylem. Secondary phloem includes sieve elements and parenchyma cells while secondary xylem includes compact cluster of vessels and fibres. The vessels are mostly circular and occasionally elliptical in shape. The narrow vessels are 35µm in diameter while the wide vessels are up to 90µm wide. The vessels have thick lignified walls. Xylem fibres occupy the ground parenchyma cells of xylem cylinder. The fibres are four to six sided with thick lignified walls and wide lumen. [Fig:1]

Powder microscopy

Root powder microscopy exhibited the xylem fibres and vessel elements. Xylem fibres are abundant and appear long with uniform thickness. Fibres are of 1mm long and 10µm thick. Cell walls are very thick and lignified. Vessel elements are equally abundant as the fibres and are 60-120 µm long, narrow and cylindrical. Occasionally some vessel elements found to be very narrow and have terminal tails. Pits present on the lateral walls are horizontally elongated or coalesced laterally forming horizontal canal like pits. [Fig:2]

Physicochemical analysis

Studies of physicochemical constants can serve as a valuable source of information and are usually used in judging the purity and quality of the drug.[23] Different physicochemical parameters like ash values, extractive values, pH and loss on drying were calculated in terms of air dried sample. The results were summarized in Table: 1. The ash values are particularly important in finding out

foreign inorganic matter such as metallic salts and or silica (earthy matter) or any other impurities present along with the crude drug. The extractive values give an idea about the chemical constitution of the drug and is useful in the estimation of specific constituents soluble in that particular solvent used for the extraction as well as the determination of exhausted materials.[6] In the present study, the extractive value of alcohol is higher than water. The determination of moisture content indicates the storage capacity of crude drug as moisture content is responsible for its decomposition due to microbial attack or chemical changes. Excess moisture in a crude drug, at relatively high temperature, will lead to activation of enzymes and provide suitable conditions for the proliferation of microorganisms.[24]

Flourescence analysis

The fluorescence characteristics of root powder under day and UV light was studied and results were tabulated in Table: 2. Fluorescence study is an essential parameter for first line standardization of crude drug. The fluorescent light is always of greater wavelength than the exciting light. Light rich in short wavelengths is very active in producing fluorescence and for this reason ultraviolet light produces fluorescence in many substances which do not visibly fluorescent in daylight. Fluoresence study of root powder helps in the qualitative evaluation which can be used as a reference data for the identification of adulterants.[25]

Preliminary phytochemical studies

Phytochemical evaluation is useful for the quality assessment of plant materials. Preliminary phytochemical studies of ethanolic extract of *Stereospermum suaveolens* ascertained the presence of flavonoids, saponins, phenolic compounds and tannins which are expressed in Table:3.

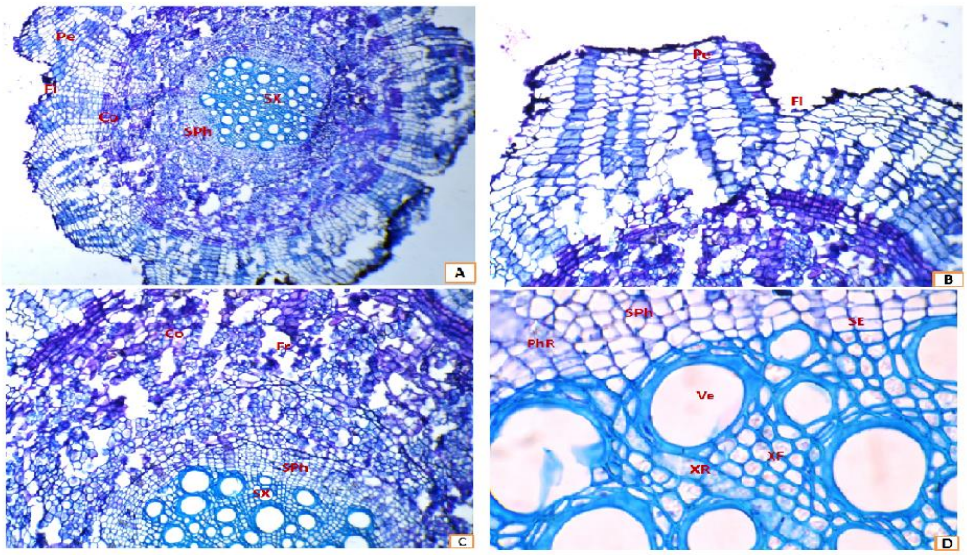

Figure 1: Microscopic examination of roots of *Stereospermum suaveolens*.

Fig 1,A: T.S. of root entire view; Fig:1,B: T.S. of root showing thick periderm; Fig 1,C: T.S. of thick root a sector enlarged; Fig 1,D: T.S of secondary xylem and secondary phloem. Pe-Periderm, Fi-Fissure, Co-Cortex, SX-Secondary xylem, SPh-Secondary phloem, Ve-Vessel, XF-Xylem fibre, XR-Xylem ray, PhR-Phloem ray, SE-Sieve elements.

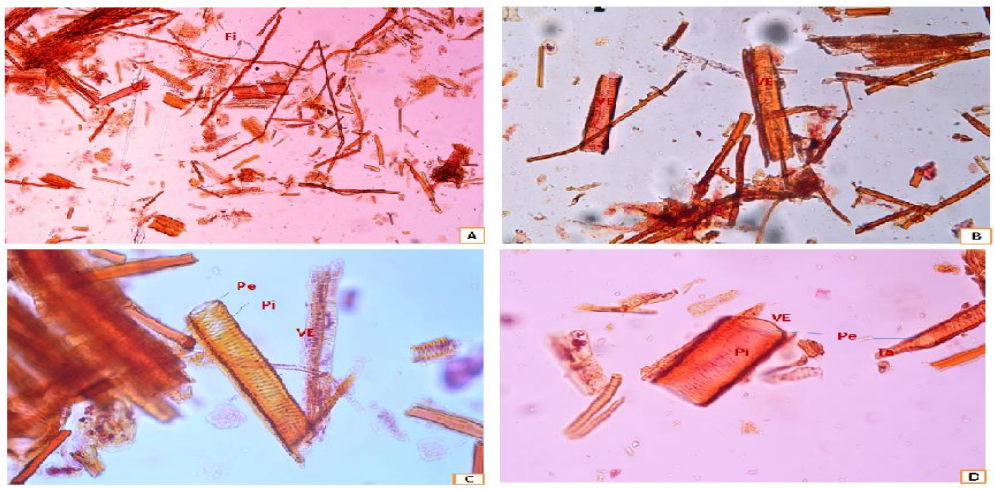

Figure 2: Powder microscopy of roots of *Stereospermum suaveolens*.

Fig 2 A,B: Powder microscopy of roots showing fibres and vessel elements, Fig 2 C,D: Powder microscopy showing vessel elements with pits and perforations. Fi -Fibres, VE- vessel elements, Pi-Pits, Pe-perforations.

Table 1: Physicochemical analysis of roots of *Stereospermum suaveolens*

S.No.	Parameters		Values
1.	Ash values	Total ash vale	4.5%w/w
		Acid insoluble ash	1.0%w/w
		Water soluble ash	3.2%w/w
2.	Extractive values	Alcohol soluble extractive	8.8%w/w
		Water soluble extractive	7.4%w/w
3.	pH	1%	6.84
		10%	6.33
4.	Loss on drying		16.5%

Table 2: Flouresence analysis of root powder of *Stereospermum suaveolens*

S.No	Reagent	Day light	UV light (366nm)
1.	Drug powder as such	Pale brown	Yellow
2.	Powder+ conc. H_2SO_4	Brownish black	Dark violet
3.	Powder+dil. H_2SO_4	Pale yellow	Yellow
4.	Powder+conc. HCl	Muddish brown	Yellow
5.	Powder+dil.HCl	Pale brown	Yellow
6.	Powder+conc.HNO_3	Muddy brown	Light brown
7.	Powder+dil.HNO_3	Light brown	Yellow
8.	Powder+methanol	Brownish orange	Golden yellow
9.	Powder+chloroform	Pale brown	Yellow
10.	Powder+Petroleum ether	Pale brown	Yellow
11.	Powder+10%Ferric chloride	Reddish brown	Greenish yellow
12.	Powder+10%NaOH	Brownish orange	Golden yellow
13.	Powder+ Ammonia solution	Pale brown	Yellow
14.	Powder +CH_3COOH	Light reddish brown	Yellow
15.	Powder+ Distilled water	Pale brown	Yellow

Table 3: Preliminary phytochemical screening of ethanolic extract of roots of *Stereospermum suaveolens*

S.No	Phytoconstituents	Name of the test	Observation
1.	Alkaloids	Dragendroff's test	-
2.	Amino acids	Ninhydrin test	-
3.	Saponins	Froth test	+
4.	Flavonoids	Shinoda test	+
5.	Steroids	Liebermann Burchard test	-
6.	Tannins	Lead acetate test	+
7.	Phenols	Ferric chloride test	+
8.	Fats and oils	Saponification test	+

CONCLUSION

The findings of the present study lay down standards which could be useful to detect the authenticity of this medicinally useful plant. Microscopic evaluation, physicochemical analysis and preliminary phytochemical reports can be useful to substantiate and authenticate the drug. The present work may also serve as a useful supplement for further detailed evaluation and investigation of this plant.

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