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Pharmacognostic studies on the root of *Spondias mangifera* Willd.

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Abstract

Spondias mangifera Willd. *(Syn. Spondias pinnata*.) of Family- Anacardiaceae, commonly known as Wild Mango (Hindi-Amara) is an important medicinal plant. It is traditionally used in North-East region of India as health tonic, refrigerant, aromatic and for the treatment of articular and muscular rheumatism, diarrhoea and dysentery. This paper deals with the Pharmacognostic evaluation of the root which includes macro- and micro-scopic evaluations, determination of physicochemical parameters in a systematic way. These findings will contribute additional information for authenticity of the plant to the herbalists including the natural herb users too.

Keywords: *Spondias mangifera* Willd. *(Syn. Spondias pinnata*.), Wild Mango; Macroscopic, Microscopic, Physico-chemical analysis.

1. Introduction

Spondias mangifera Willd. (Family- Anacardiaceae) is a tree up to 10.5 m high with straight columnar trunk and smooth ash gray coloured bark having characteristic pleasant smell of its wood [1]. About seventeen species of *Spondias* are in record, being native of Indo- Malaysia, South Eastern Asia and tropical America. In India, it is cultivated in Punjab, Maharashtra, Odisha, West Bengal and Assam for its edible fruits [2]. All plants emit foetid turpentine like odour when broken or brushed; smell however, varies from species to species and very characteristic [3]. Ethno medicinally, its bark used as tonic, refrigerant and for treatment of articular and muscular rheumatism and also, in diarrhoea and dysentery [4-6]. Bark pounded to paste used against stomach ache [7]. Leaves glabrous, aromatic, acidic and astringent, used as flavouring agent while its juice applied as drops against ear ache [5,8].

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The tribal women of Malaysia and India use internally hot aqueous root extract for regulating menstrual anomaly and paste prepared from roots used externally as massage balm for remission of muscular pain [5,6,9]. Juice, extracted from ripened fruits, popularly used as home remedy for biliousness [10].

Only a few pharmacological or biological test reports have been reported on this plant in the literature like methanol extracts of dried fruit (200 mg/ml) and ethanol (95%) extracts of dried leaf of *S. mangifera* possess antitumor-promoting activity [11,12]. Various extract of dried seed of the plant is also reported to have antipyretic, antihistamine, antispasmodic and hypotensive activity at various dose levels [13]. Similarly, *Valsaraj et al.* 1997; also reports the antibacterial activity of ethanol (80%) extract of dried stem bark [14] and 70% methanol extract of *Spondias pinnata* stem bark was studied *in vitro* for total antioxidant activity. It also reported hypoglycemic, diuretic and laxative activity of different extracts of bark [15,16] and root for hypoglycemic activity [17].

Only a few phytochemical have been reported on this plant in the literature. Cycloartanone 24-methylene, daucosterol, lignoceric acid, stigmast-4-en-3-one, β-amyrin, oleanolic acid and β-sitosterol was isolated from fruits and aerial parts of the plant, and also glycine, cystine, alanine and leucine present in fruits [18, 19].

Having several therapeutic efficacies reported as above, the present investigation focus on study of some pharmacognostic features of the root as a whole including its intact and powdered form.

2. Materials and Methods

2.1 Plant Material

Intact roots, collected carefully from experimental plants inhabiting in forests of Ganjam district, Odisha during June 2007, by excavating adjacent soil without causing damage to outer root profile i.e. periderm. Voucher specimens of plant bearing number [Sp. No: CNH/ I-I / (17) /2009 / Tech. II / 28], identified by Taxonomist of the Botanical Survey of India, Shibpur, Howrah, have been maintained in the Institutional herbarium of M.V.B.M. College of Pharmacy, Dumiyani, Rajkot for future reference. After authentication, fresh roots being collected in bulk, washed, dried in shade and powdered.

2.2 Chemicals and Instruments

Compound microscope, glass slides, cover slips, watch glass and other common glassware were the basic apparatus and instruments used for undertaking the study. Microphotographs were taken using a Leica DMLS microscope attached with Leitz MPS -32 camera. Solvents viz. petroleum ether, chloroform, acetone, methanol and reagents viz. phloroglucinol, glycerin, hydrochloric acid, sodium hydroxide, iodine, picric acid, ferric chloride, nitric acid, sulphuric acid and glacial acetic acid were procured from Ranbaxy Fine Chemicals Ltd., Mumbai, India.

2.3 Macroscopic and Microscopic Analysis

The macro and micro-scopic characteristics of intact root were observed [20]. Also, the behaviours of powdered roots materials with different chemical reagents were recorded; comparative microscopic observations under normal light and ultraviolet light separately at short and long wavelengths were also recorded [21-23].

2.4 Physico-chemical analysis

Physico-chemical analysis i.e. percentage of ash values, ethanol soluble, ether soluble and water soluble extractive values, performed according to the official methods prescribed [24]. The dried root powder, successively extracted using soxhlet apparatus with various solvents in

increasing order of polarity viz. petroleum ether (60-80^{0}C), chloroform, methanol and water. The dried fractional extractives were obtained after evaporation of the solvents under reduced pressure. The color, consistency and extractive values of the extracts were studied. The fluorescence analyses of all liquid extracts were studied under ultraviolet light at different wave lengths [25,26].

2.5 Preliminary phytochemical screening

Preliminary phytochemical screenings were carried out by using specific reagents through standard procedures [23,27,28].

3. Result and Discussion

3.1 Macroscopic characters of the root

The matured root even if is uneven in thickness but cylindrical, whitish grey with fissures. Taproot branched with true kinds of rootlets (ultimate branches-secondary and tertiary) found to be present. Rootlets penetratingly scattered profuse in the soil around the tap root towards ventricle. The powdered root is odorless and tasteless. Root bark can not be easily scraped. In fresh condition the cut surface of the root is smooth, shows white border (extra stelar) and yellow middle (i.e. stellar) region. In matured trees, root extended from 5 to 8 meters.

3.2 Microscopic characters (transverse section) of the root

Matured root measuring 5mm thick has wide periderm and solid vascular cylinder [Fig.-1]. The periderm is membranous with shallow irregular fissured crevices containing phellum and phellogen. The phellum cells are rectangular brick shaped, thin walled and arranged radially. Inner to the phellum narrow strip of phellogen is present [Fig.-2]. The cortex wide comprises tangentially elongated parenchyma cells. Secondary phloem wide, contains sieve tubes and phloem parenchyma. Accessory cambium is present between the secondary phloem and secondary xylem. Parenchymatous conjunctive tissues present in between endodermis towards the medulla region. Rays cells observed in two cells wide (i.e. biseriate) with a few uniseriate pattern. Xylem vessels are found between the medullary rays [Fig.-3]. Protoxylem occurs centrifugal while the Metaxylem centripetally located. Trachides have small simple pits, seen profusely on tangential wall. Primary xylem core elements are present towards centre on which the secondary xylem is prevalent.

3.3 Powdered characteristics of the root

The root powder consists of vessel elements, fibers and few cork cells [Fig-4 and 5]. The vessels elements are long and cylindrical. They have simple, horizontal perforations. The lateral pits are circular to elliptic and dense. The fibers are abundant in the powders which are with thick lignified striated secondary walls. Some fibers are narrow and long; but few are short and wide.

Physical constant values like colour, consistency and extractive values of the root after successive extraction are reported in [Table 1]. The aqueous extract shows maximum extractive value and petroleum ether extract shows the minimum. The fluorescence characteristic of different liquid extracts shows Brownish yellow (Petroleum ether extract), Greenish yellow (Chloroform extract), Deep green (Methanolic extract) and Green fluorescence (Aqueous extract) under ultraviolet light thereby ascertaining; rather confirming the presence of many fluorescence compounds in the extracts under study [Table 2]. The result of the preliminary phytochemical test of different extracts of the root shows presence of alkaloids,

carbohydrates, proteins, tannin, steroids, triterpenoids, saponin and flavonoids [Table 3]. The total ash, acid insoluble ash, water soluble ash and sulphated ash are reported in Table 4. The water soluble, ethanol soluble and ether soluble extractive values are reported in Table 5. Here, the aqueous extractive value is quantitatively more than that of the others. The behaviour of the powdered root are treated with different chemical reagents and observed separately under day light and ultraviolet light and the changes in colour were also noted and tabulated. [Table 6]

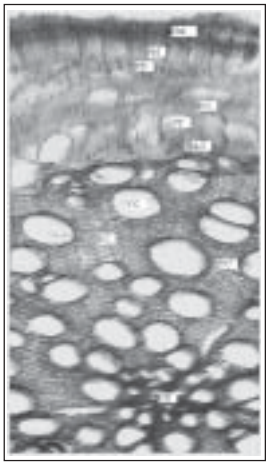

Fig.1: Sectorial T.S. of root of *Spondias mangifera* (PM- Phellum; PN- Phellogen; PD-Phelloderm; PC-Phloem Parenchyma; ST-Sieve Tubes; AC- Accessory Cambium; RC- Ray Cell; VC-Vessels; TC- Tracheids; PX- Primary Xylem Core Element).

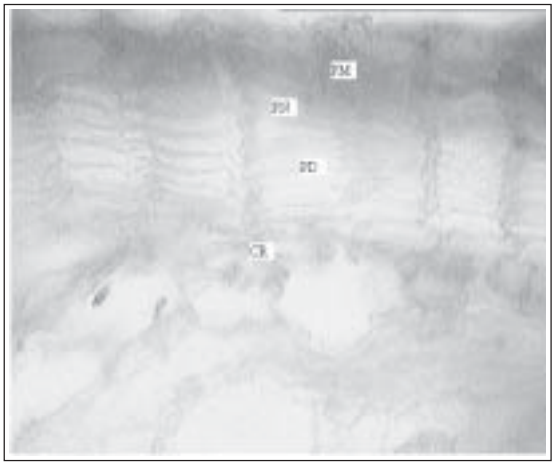

Fig. 2: Sectorial T.S. of root periderm of *Spondias mangifera*
(PM- Phellum; PN- Phellogen; PD-Phelloderm; CR-Cortex.).

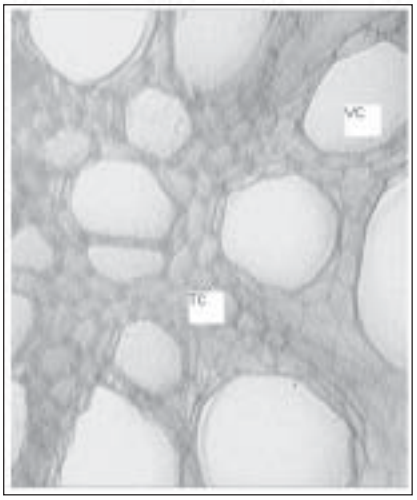

Fig -3: Sectorial T.S. of root secondary xylem of *Spondias mangifera*
(VC- Vessels; TC- Tracheids).

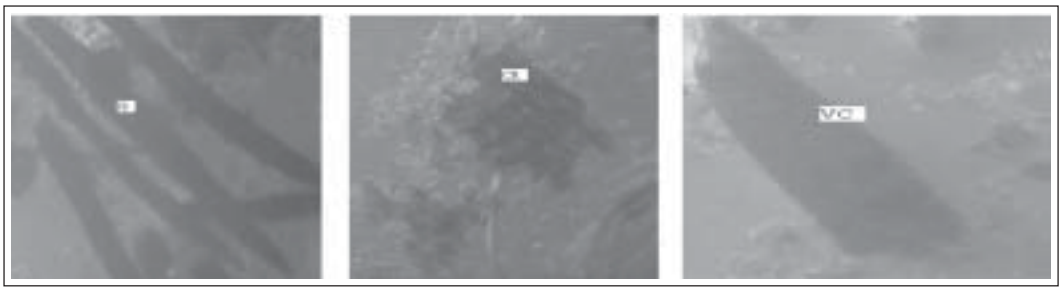

Fig. 4: Powder characters of root of *Spondias mangifera*
(FR - Fibers; CR - Cork cell; VC - Vessels).

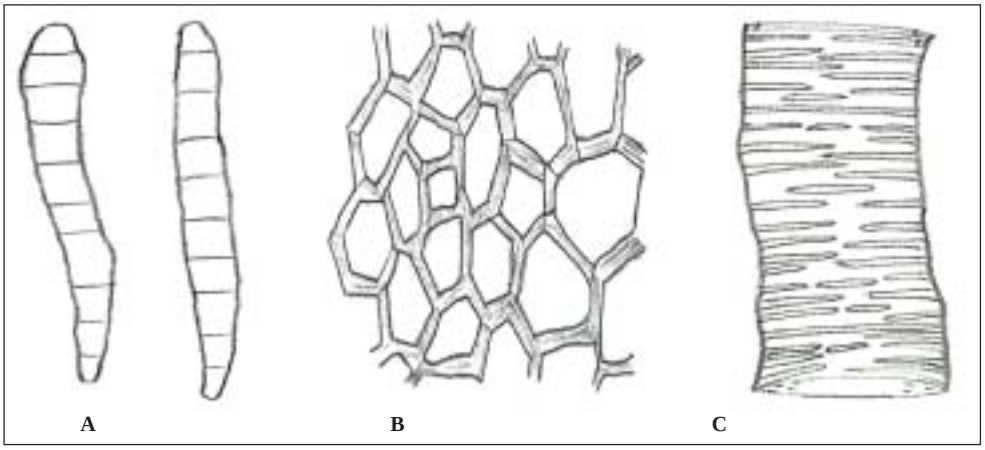

Fig. 5: Powder characters of root of *Spondias mangifera* (Line drawing)
(A- Fibers; B- Cork cell; C- Vessels)

Table 1: Data showing the color, consistency and extractive values of different factions of *Spondias mangifera* roots.

Sl. No	Solvent extract	Color	Consistency	% w/w of extracts
I.	Petroleum ether	Pale Green	Amber colored waxy residue	2.5
II.	Chloroform	Greenish yellow	Amber colored waxy residue	3.7
III.	Methanol	Dark Brown	Sticky with brown stain	5.6
IV	Aqueous	Pale Brown	Sticky with light brown stain	9.3

Table 2: Fluorescence characteristics of liquid extracts of *Spondias mangifera* roots under day light and ultraviolet light.

Sl. No.	Reagents	Day light	Ultraviolet light	
			Short UV	Long UV
I.	Petroleum ether	Greenish yellow	Brownish yellow	White
II.	Chloroform	Pale green	Greenish yellow	White
III.	Methanol	Yellowish brown	Deep green	Dark green
IV	Aqueous	Brown	Green	Dark green

Table 3: Preliminary phytochemical tests to identify presence of various phytoconstituents in different extracts of *Spondias mangifera* roots

Extract	Alkaloids	Carbohydrates	Glycosides	Gums and mucilages	Proteins and amino acids	Tannins and phenolic compoumds	Steroids and sterols	Triterpenoids	Saponins	Flavonoids
Pet. Ether	-	-	-	-	-	-	+	+	-	-
Chloroform	-	-	-	-	-	-	+	+	-	-
Methanol	-	-	-	-	-	+	-	-	+	+
Aqueous	+	+	-	+	+	+	-	-	+	+

(+): Present; (-): Absent.

Table 4: Ash values of the powder of *Spondias mangifera* roots.

S. No.	Type of ash	Percentage (w/w)
1	Total ash	4.8
2	Acid insoluble ash	2.5
3	Water soluble ash	1.48
4	Sulphated ash	6.3

Table 5: Extractive values of the powder of *Spondias mangifera* roots.

S. No	Types of extractive	Percentage (w/w)
1	Water soluble extractive	7.5
2	Ethanol soluble extractive	3.8
3	Ether soluble extractive	2.1

Table 6: Behaviour of powdered roots and treatment with different chemical reagents.

S. No	Reagents	Color of the powdered drug		
		Day light	Ultraviolet light	
			Near U V	Far U V
1	Saturated picric acid solution	Yellow	Reddish brown	Greenish yellow
2	Nitric acid	Reddish brown	Deep brown	Yellowish green
3	Hydrochloric acid	Chocolate brown	Black	Deep blue
4	Sulphuric acid	Deep brown	Reddish brown	Green
5	Glacial acetic acid	Straw color	Coffee brown color	Darkgreen
6	Iodine solution (N/20)	Brown	Black	Black
7	Ferric chloride (5% w/v aqueous solution)	Greenish yellow	Pale green	Buff
8	Powder as such	Light brown	Brown	Green

4. Conclusion

From the ongoing studies, it can be concluded that the above macroscopic and microscopic studies together may be used as a tool for identification of *Spondias pinnata* with its pharmacognostic characteristics, discriminating it from its other species diversity. The pharmacognostic and phytochemical parameters are also helpful for standardization of the plant material in the quality determination. Due to the presence of the fluorescence active substances and other phenolic compounds the species is recommended as potential anti-oxidant, anti-inflammatory, immunomodulatory and lowering of blood pressure from a natural resource.

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