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Pharmacognostical Evaluation of Roots of *Simmondsia chinensis* Schneider

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ABSTRACT
Simmondsia chinensis Schneider commonly known as jojoba is a semi-arid evergreen shrub. Jojoba is unique among plants in the fact that its products (seeds) contain about 50 percent by weight oil. Jojoba liquid wax generally used in folk remedies for renal colic, sunburn, chaffed skin, hair loss, headache, wounds and sore throat. However, there are no reports on the roots of this plant. The present investigation deals with the pharmacognostical studies of the roots of the said plant. Pharmacognostical studies include microscopic, physico-chemical constants (ash & extractive values), fluorescence analysis and preliminary phytochemical evaluation.

Keywords: *Simmondsia chinensis*, physico-chemical parameters, phytochemical screening, fluorescence analysis.

INTRODUCTION

Simmondsia chinensis Schneider commonly known as jojoba is a semi-arid evergreen shrub. [1] It grows wild in desert of south-western United States and north-western Mexico. However, this plant is cultivated in Australia [2], Brazil, Argentina, Middle East countries [3] and India. [4] Jojoba is unique among plants in the fact that its products (seeds) contains about 50 percent by weight oil, which is more than amount in soyabean and somewhat more than in most oil seed crops. Interest in jojoba oil stems from its unusual properties that differ from all seed oils. The complete absence of glycerin makes it a liquid wax (JLW), not fat. [5]
Jojoba liquid wax contains a natural anti-oxidant postulated to be an allylic derivative of hydroxytoluene. [6] Jojoba liquid wax was used in folk remedies for renal colic, sunburn, chaffed skin, hair loss, headache, wounds and sore throat. [7] Animal studies demonstrate that Jojoba liquid wax can be classified as a non-toxic substance. [8] Jojoba liquid wax has shown moderate digestibility that increases when the wax is mixed with other oils. In addition, Jojoba liquid wax possesses moderate absorption when applied topically. [9] In human studies, sulphurized jojoba liquid wax was effective in the treatment of acne while the unmodified wax was used for treatment of psoriasis. [10] Furthermore, dermatological research suggests that Jojoba liquid wax may help to reduce inflammation. [11] A lot of works as suggested by literature survey had been carried out on seeds and seed oil but, there are no reports on roots of *Simmondsia chinensis*. The present study was therefore undertaken to investigate the pharmacognostical characters, fluorescence analysis and phytochemical analysis of the roots of this plant.

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MATERIAL AND METHODS

Plant material

The plant material was collected from Kutch district, Gujarat, July 2009. The plant material was identified and authenticated by the Dr. H. B. Singh, Head, Raw Materials Herbarium & Museum, NISCAIR, New Delhi, Ref. No. NISCAIR/ RHMD/Consult/-2009-10/1204/08. The dried roots were ground to a coarse powder and subjected to physico-chemical analytical parameters like ash values, extractive values and phytochemical screening.

Chemicals and instruments

Rotary microtome was used to take sections of the tubers. Compound microscope, glass slides, cover slips, watch glass and other common glassware were used in this experiment. Photographs were taken with using Zeiss Primo Star Microscopic Unit. Various solvents used mainly ethanol (95%), petroleum ether, chloroform and reagents used for staining different sections were procured from S D Fine chemicals, Mumbai, India.

Morphology

A systematic examination of the shape, size, surface, texture, taste and odour of the roots of *Simmondsia chinensis* was

carried out. The external features of root were observed under dissecting microscope.

Microscopy

The histological examination of the plant drug helps in identifying the shapes, size and position of different cells and tissues. The anatomical study helps in distinction of the drug from adulterants. [12] Material collected (were fixed in formalin – acetic acid – alcohol (10.5: 50: 35). The fixed material was preserved in 70% alcohol, washed thoroughly in 70% alcohol, dehydrated through xylene – alcohol series and embeded in paraffin. [13] Serial transverse sections were cut at 7-8 µm on a rotary microtome (Weswox Optik). Haupts adhesive was used for affixing the paraffin ribbons to the slide. The sections were stained in phloroglycerol. Slides were cleared in xylol and mounted in DPX mountant. Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Cannon Zeiss Primo Star Microscopic unit. [14]

Powder microscopic study

The shade dried plant materials were ground with a wood grinder and sifted through 40 mesh sieves. To study the ingredients of powder, a pinch of powder was bleached with 5% chloral hydrate and taken on slide and mounted with phloroglucinol, HCl and glycerine. The slide was observed under microscope.

Colour reactions

The powdered drug materials were treated with different chemical reagents so as to aid in detection of chemical constituents under ordinary day light by standard methods. [15] To study the behaviour of drugs a pinch of each drug was treated with different chemical reagents *viz* 1N HCl, 1N NaOH, acetic acid, 5% ferric chloride, picric acid, 1N HNO_3, 5% iodine and 1N HNO_3 followed by ammonia solution and colours were observed. [16]

Fluorescence behaviour

To study the fluorescence nature of powder, a pinch of powder after bleaching with 5% chloral hydrate was treated with different chemical reagents *viz*. 1N HCl, 1N NaOH, 50% HNO_3, 50% H_2SO_4, methanol, acetic acid, picric acid, 1N NaOH in methanol, nitro-cellulose in amyl acetate, 1N NaOH in methanol and nitrocellulose in amyl acetate, 1N HCl followed by nitrocellulose in amyl acetate and 1N NaOH followed by nitrocellulose in amyl acetate and observed under UV light. [16-17]

Physico-chemical parameters

The determination of various physico-chemical parameters such as total ash, acid insoluble ash, water soluble ash, sulphated ash, water soluble extractive and alcohol soluble extractive were determined and estimated in percentage by using method as recommended by Indian Pharmacopoeia. [18] Successive soxhlet extractives of the drug were carried out with various solvents and weight, color/consistency of extractives were observed. [17] Loss on drying for drug was also determined. [19-20]

Preliminary phytochemical screening

The powdered roots extracts were subjected to qualitative phytochemical tests for alkaloids, glycosides, carbohydrates, sterols, phenolic compounds and tannins, flavonoids, saponins, proteins and free amino acids. [21-22]

RESULTS AND DICUSSION

Macroscopic characters

It occurs as tap root system up to 15 feet. Externally it is blackish brown and internally reddish brown in colour. Surface is rough with striations. Odour is characteristic and taste is woody.

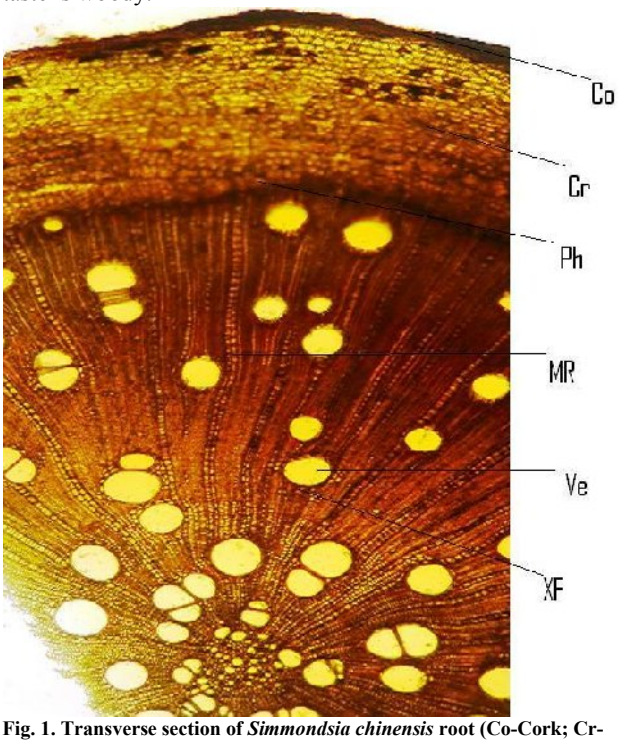

Fig. 1. Transverse section of *Simmondsia chinensis* root (Co-Cork; Cr-Cortex; Ph-Phloem; MR-Medullary rays; Ve-Vessel and XF-Xylem Fibres)

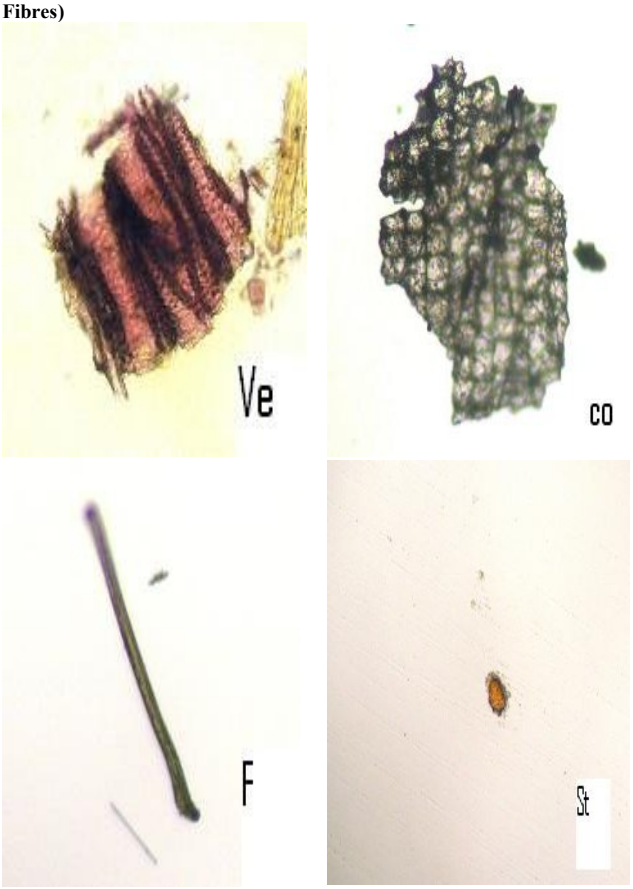

Fig. 2. Microscopic characterstics of powder of *Simmondsia chinensis* root Ve-Vessel, Co- Cork, F- Fibre and St-Starch

Table 1: Behavior of root powder with different chemical reagents

S. No.	Treatment	Colour
1.	Powder	Dark brown
2.	Powder + 1 NHCl	Yellowish brown
3.	Powder + 1N NaOH	Black
4.	Powder + Acetic Acid	Brownish black
5.	Powder + 5% Ferric chloride	Yellowish brown
6.	Powder + Picric acid	Greenish brown
7.	Powder + HNO_3 + Ammonia solution	Yellowish brown
8.	Powder + 5% Iodine	Brown
9.	Powder + 1N HNO_3	Reddish brown

Table 2: Fluorescent nature of *Simmondsia chinensis* root powder

S. No.	Treatment	Observations		
		Visible	Short UV (254 nm)	Long UV(366nm)
1.	Powder as such	Brown	Green	Dark brown
2.	Powder + 1N HCl	Yellowish brown	Greenish black	Light brown
3.	Powder + 1N NaOH	Black	Green	Dark brown
4.	Powder + 50% HNO_3	Reddish brown	Black	Greenish black
5.	Powder + 50% H_2SO_4	Brown	Greenish brown	Black
6.	Powder + Methanol	Creamish brown	Brown	Dark brown
7.	Powder + Acetic acid	Brownish black	Greenish brown	Black
8.	Powder + Picric acid	Yellowish brown	Brownish green	Black
9.	5% Iodine	Brown	Dark brown	Black
10.	5% Ferric chloride	Yellowish brown	Yellowish black	Black
11.	Ammonia	Brown	Greenish brown	Black

Table 3: Physico-chemical parameters of roots powder of *Simmondsia chinensis*

Physico-chemical parameters	Values [%(WW) ± SD]
Ash values	
Total ash	9.06 ± 0.002
Acid insoluble ash	3.73 ± 0.004
Water soluble ash	6.15 ± 0.007
Sulphated ash	9.16 ± 0.003
Extractive values	
Water soluble extractive	8.01 ± 0.011
Alcohol soluble extractive	9.46 ± 0.008

Data are mean ± SD values (n = 3)

Table 4: Yield of extract by successive solvent extraction

S. No.	Extract*	Values [%(W/W) ± SD]
1.	Petroleum Ether	02.13 ± 0.002
2.	Chloroform	03.31± 0.005
3.	Methanol	10.12 ± 0.010
4.	Water	05.76 ± 0.013

*Extraction period is 24 hrs, Data are mean ± SD values (n = 3)

Table 5: Loss on drying

Wt. of the crucible	Wt. of crucible+ Drug	Final wt.	%w/w
35.61g	37.33g	37.21g	6.98%
		37.20g	7.56%
		37.20g	7.56%

Table 6: Fluorescence nature of different extracts of *Simmondsia chinensis* by visible and ultra-violet (UV) radiations

S. No.	Extract	Observations		
		Visible	Short UV (254 nm)	Long UV (366nm)
1.	Petroleum ether	Yellow Brown	Brown	Black
2.	Chloroform	Brown	Greenish Brown	Black
3.	Ethanol	Brown	Dark Brown	Dark Brown
4.	Water	Black Brown	Brown	Black

Table 7: Preliminary phytochemical screening of roots extract of *Simmondsia chinensis*

S. No.	Plant Constituents	Petroleum Ether Extract	Chloroform Extract	Ethanol Extract	Water Extract
1.	Alkaloids	-	-	-	-
2.	Glycosides	-	-	-	-
3.	Protein & Amino acids	-	+	+	+
4.	Carbohydrates	-	-	+	+
5.	Tannins & Phenolics	-	-	+	+
6.	Flavonoids	-	+	+	+
7.	Steroids	+	+	-	-
8.	Saponins	-	-	-	-
9.	Fixed oil	+	-	-	-

+: Positive; -: Negative

Microscopic characters

Transverse section of the roots shows the following characteristics:

Cork is composed of 3-5 layers of tangentially elongated cells filled with brown matter. Phellogen is indistinct but seen as narrow layers of cells. Phelloderm 5-7 layers immediately below the phellogen. Cortex is composed of several layers of polyhedral parenchymatous cells. Phloem present as several thin patches around the well developed xylem. Secondary xylem is transverse by well develop medullary rays. Xylem consists of vessels, wood parenchyma. The vessel appears rounded or polygonal. Xylem fibres appear as rounded and polygonal structure with thick lignified walls. Medullary rays runs radially from the centre of the cortex through the phloem. Rays in the xylem region are lignified, pitted and are 1-3 cells wide although uniserate are prominent. In the phloem regions the ray cells are not lignified (Fig. 1).

Powder characters

Microscopic examination of powder shows the presence of cork cells, starch, vessels and fibres (Fig. 2). The behavior of roots powder with different chemical reagents, are shown in (Table 1).

The fluorescence analysis of powdered drug in day light, short UV and long UV were examined by reported method. The observations are given in (Table 2).

Physico-chemical parameters

The physico-chemical parameters are important for identifying adulterants and improper handling of drugs. The (Table 3) reveals the result of physico-chemical parameters of powdered drug, carried out by using standard procedures. *viz*. Ash values used to determine quality and purity of drug; the extractive values are useful to evaluate the chemical constituents present in crude drugs and also help in estimation of specific constituents soluble in particular solvent. The result of extractive values of powdered drug in different solvent obtained by successive extraction is given in (Table 4). Loss on drying is shown in (Table 5). The (Table 6) reveals the behavior analysis of different solvent extract of *Simmondsia chinensis* root, under visible light, short and long UV.

All the extracts obtained by successive extraction were subjected to qualitative chemical tests and the results are shown in (Table 7). Such preliminary phytochemical screening is helpful in prediction of the nature of drugs and also useful for detection of different constituents in different polarity solvent.

The present investigation including the morphoanatomical characters, physico-chemical values and pharmacognostical

studies will serve as standard reference for identification and distinguishing *Simmondsia chinensis* root from its substitute and adulterants. This report would assist in the identification of the crude drug in future.

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