



## Comparative Pharmacognostical and Analytical Studies of Root Barks of Species Used as *Patala* in Ayurvedic System of Medicine

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### ABSTRACT

Herbal drug market is becoming more and more competitive day by day. *Dashamoola* is important group of ten plants whose roots are used for variety of purposes. *Patala* is one of the plants from this *Dashamoola* group. Its commonly accepted botanical source is *Stereospermum suaveolens* (Roxb.)DC. *Stereospermum suaveolens* (Roxb.)DC is identified as NT (Near threatened) species thus there is need to evaluate substitute for it to increase the source plants.<sup>1</sup> *Radermachera xylocarpa* (Roxb.) K. Schum. can be used as substitute for *Stereospermum suaveolens* (Roxb.)DC.<sup>2</sup> Free hand selections and organoleptic examination was done of all samples, microscopic characters, ash values, LOD, extractive values, Tannin content & other phyto-chemical analysis. Transverse section of both the samples show presence of stone cells, micro-crystals of ca-oxalate, simple and compound starch grains, brown content (Tannin). Phytochemical study reveals presence of a wide range of phytoconstituents like Glycosides, Steroids, alkaloids, Tannins and Flavonoids in both extracts. The quantitative estimation of Tannin in *S. suaveolens* root bark is 2.511%w/w and *R.xylocarpa* root bark 9.207 %w/w.

**Keywords:** *Patala*; *Stereospermum suaveolens*(Roxb.)DC.; *Radermachera xylocarpa* b.&hk;Root barks; Pharmacognosy, Analytical study.

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## INTRODUCTION

*Patala* an Ayurvedic drug has been used more extensively as one of the *Dashamoola* and *Brihat panchamoola* groups.<sup>3</sup> *Stereospermum suaveolens* (Roxb.)DC. is the commonly accepted botanical source of *Patala* in authoritative books on the *Materia Medica* of India.<sup>4</sup> These medicinally important plants are facing threat of extinction due to various reasons like habitat destruction, illegal trade and over exploitation etc. As uprooting also destroys plant forever, substitution of a particular plant as well as part used is need of an hour, not only to overcome the scarcity of the medicinal plants but also to preserve it. *Radermachera xylocarpa*(Roxb.) K. Schum. belonging to the family Bignoniaceae is a medium sized deciduous tree which may be an unauthorized substitute for it.<sup>5</sup> Although phytochemical studies of stem, leaves of *Stereospermum suaveolens*(Roxb.)DC and bark, wood, leaves, pods of *Radermachera xylocarpa* (Roxb.) K. Schum. have been carried out but comparative studies of these species is yet to be described. Thus our efforts have led to the pharmacognostical, physicochemical and phytochemical comparison of these species with quantitative analysis of Tannin content in their respective root barks.

## MATERIALS AND METHOD

### Collection of drugs

*Radermachera xylocarpa* (Roxb.) K. Schum. was collected from the botanical garden of Sasoi, Jamnagar, Gujarat, India in the month of March 2014. Voucher specimen (Phm-6123/ 2014) of the herbarium was deposited in the Pharmacognosy laboratory of the institute. While *Stereospermum suaveolens* (Roxb.)DC was collected from the 'Shobha Vana' botanical garden from Moodbidri Karnataka in April 2014. Botanical name were confirmed by studying the morphological characters of various parts and comparing them with various characters described in floras and books. After identification and confirmation of the species, these two plant samples were collected, cleaned to remove adherent soil and dirt. The herbarium of respective drugs were prepared and stored in the pharmacognosy laboratory for further documentation. Collected roots were separated and washed with running fresh water and root barks are separated shade dried and pulverized using an electric blender. The powder was sieved through mesh size 60 and stored in an airtight food grade plastic container for further use.

### Morphological study:

Collected root samples were observed carefully for its identical morphological characters. Morphological characters like colour, shape, size were noted down.

### Microscopic evaluation

Fresh root bark samples were taken for detailed microscopic study.<sup>6,7</sup> Free hand sections were taken, cleared with chloral hydrate and observed under microscope for the presence of any crystal. Then, the sections were stained with phloroglucinol and hydrochloric acid and observed for lignified elements like fibres, vessel etc. Microphotographs were taken by using Carl Zeiss Trinocular microscope attached with camera. Same procedure was followed for detailed powder microscopy.<sup>8</sup>

### Physicochemical Evaluation (Table 3)

Physicochemical study like LOD, ash value, water soluble extractive value, alcohol soluble extractive value and ph of both the samples was carried out as per the standard protocols.<sup>9</sup>

### Phytochemic Evaluation: (Table 4)

Phytochemical analysis of methanolic extract of sample drugs was carried out for Steroids, glycosides, tannins, proteins, flavonoides, alkaloides and saponins according to standard procedure.<sup>10</sup>

### Quantitative Tannin Evaluation

For the comparative Tannin estimation of both the sample drugs Indigocarmine method (Titration method) was used.<sup>11</sup>

## RESULTS AND DISCUSSION

Morphological characters including its shape, surface, colour etc. were studied by observing the root barks. Results were depicted in the Table 1. Organoleptic characters of the powders of barks like colour, taste, odour and touch were recorded and results were depicted in the Table 2.

**Table 1: Showing the morphological characters of the *S.suaveolens* and *R.xylocarpa* root barks**

Morphological characters	<i>S. Suaveolens</i>	<i>R. Xylocarpa</i>
Shape	It is cylindrical, about 30 to 33 cm in length and 1.0 to 1.5 cm in width.	Cylindrical, It is about 15 to 17 cm in length and 0.8cm in breadth.
Surface	Surface rough longitudinally grooved, furrowed and cracked exhibiting few lateral root scars.	Woody, hard and heavy surface shallowly fissured, but not exfoliating, and devoid of prominent lenticels.
Colour	Camel brown externally and creamish internally.	It is greyish to greyish brown. In fresh barks the official part is soft, juicy and whitish but turns dull brown on exposure
Fracture	Fracture outer short, inner splintery.	The rind has an outer thicker easily friable corky portion and a thin membranous but tough papery inner part. Its inner part is tangentially lamellate.

**Table 2: Comparative organoleptic characters of root bark powders:**

Test	<i>S. suaveolens</i>	<i>R. xylocarpa</i>
Colour	Dark brown	Light brown
Taste	Taste bitter acrid	The root bark is bitter and slightly mucilaginous
Odour	Characteristic	Woody, slightly aromatic
Touch	Rough	Fine smooth

**Microscopic characters of transverse section of *S. suaveolens* root bark: (Plate 1)**

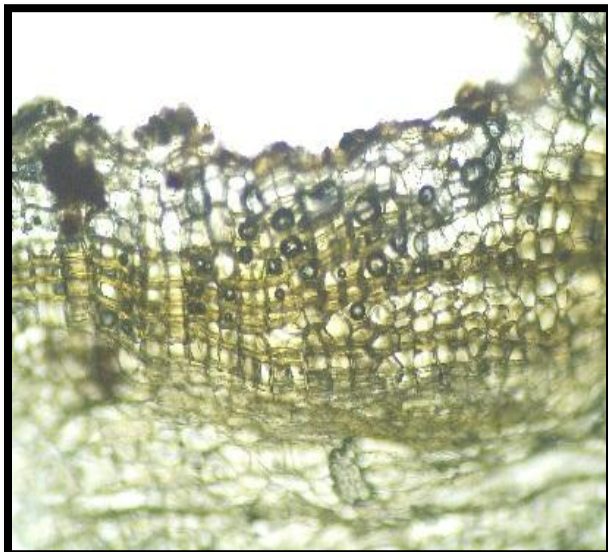
Diagrammatic sketch shows that outer cork and inner wide cortex.

**Cork:**

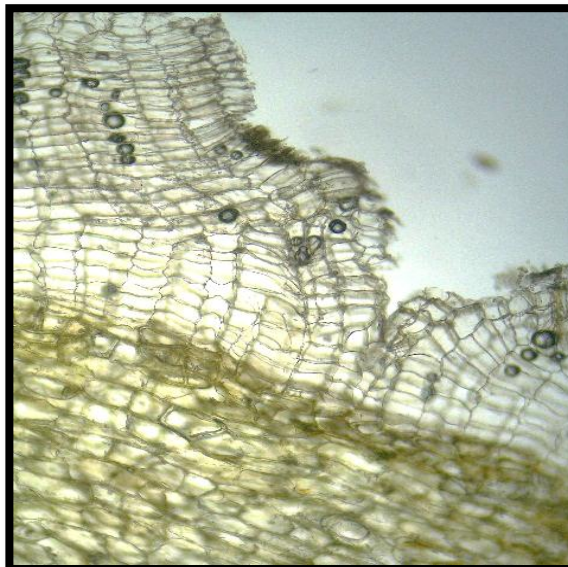
Bark fairly thick and composed of several rows of regular cork cells (Phellem), strips of collapsed bast elements, and schleroid, stone cells groups, indicating the formation of successive layers of phellogen in the deeper parts of the cork. The cork cells are very narrow and tangentially elongated, outer rows are thick walled and contain reddish brown content.

**Cortex:**

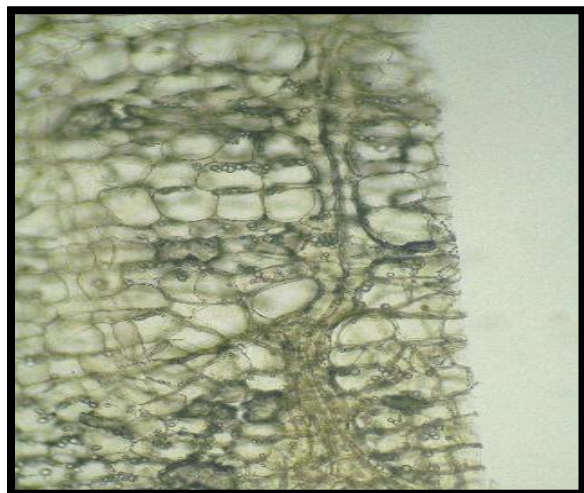
Secondary cortex is prominent, characteristically wide parenchymatous 8-10 celled pericyclic fibers randomly distributed all over the cortical region. Isolated groups of 6-10 stone cells also observed in the cortical region. Bi-seriate medullary rays reach up to middle cortical region. Parenchyma cells composed of simple and compound starch grains. Also some of the parenchyma cells consist of oil globules and dark brown content (Tannin), micro-crystals of calcium oxalate. These Starch grains can be distinguished from the oil globules. Secondary phloem composed of phloem fibers and sieve plates. After staining cork, pericyclic fibers and stone cells found to be lignified.



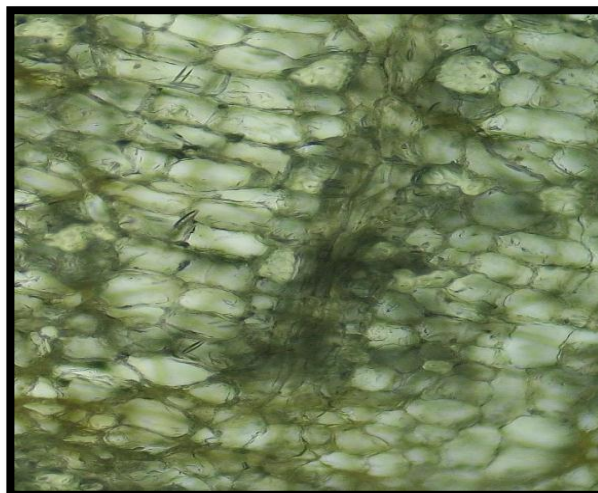
**A1: Cork with several layers along with tannin**



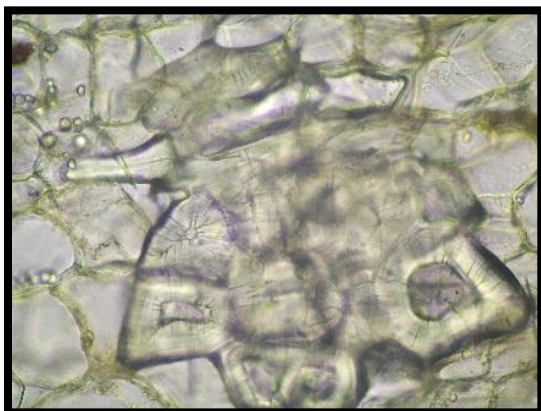
**B1: Cork with several more layers along with tannin**



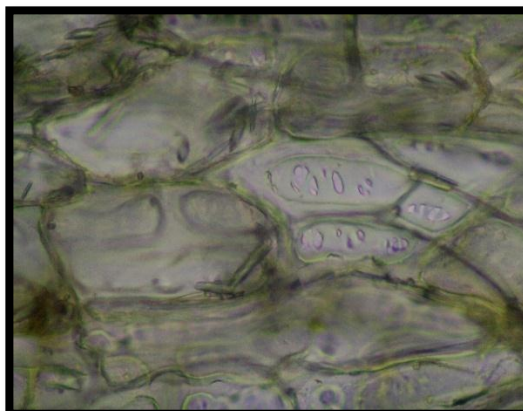
**A2: Cortical cells passing through medullary rays**



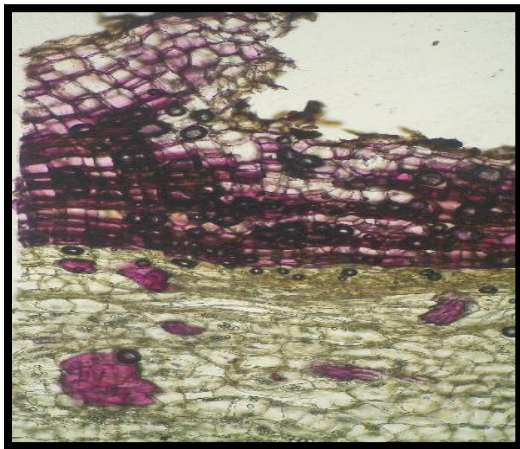
**B2: Cortical cells passing through medullary rays**



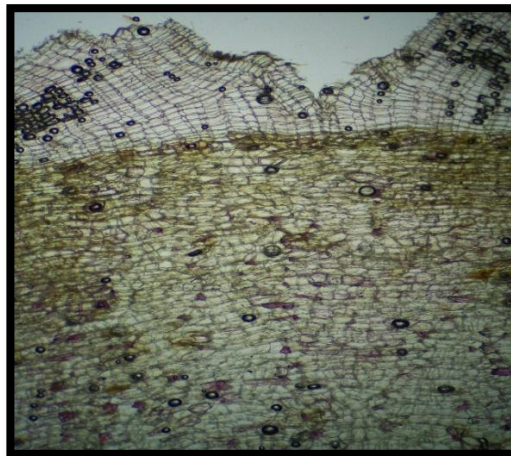
**A3: Group of stone cells**



**B3: Group of stone cells along with microcystals**



**A4: Lignified cork along with isolated group of stone cells**



**B4: Lignified cork with corticle cells**



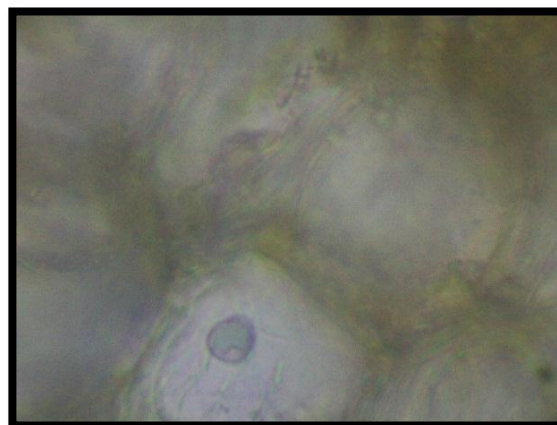
**A5: Group of pericyclic fibres along with starch grains**



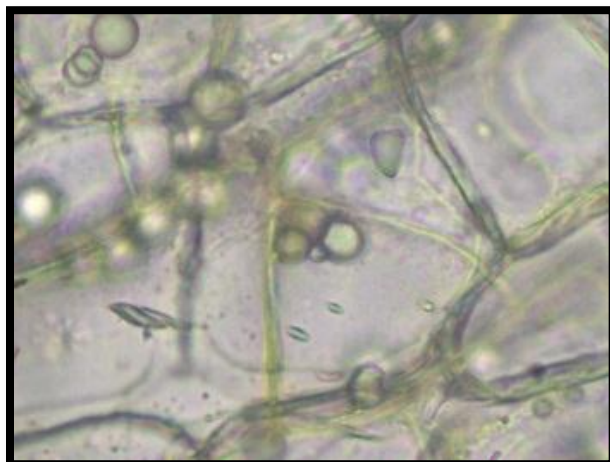
**B5: Group of pericyclic fibres along with bi-cilliary medullary rays**



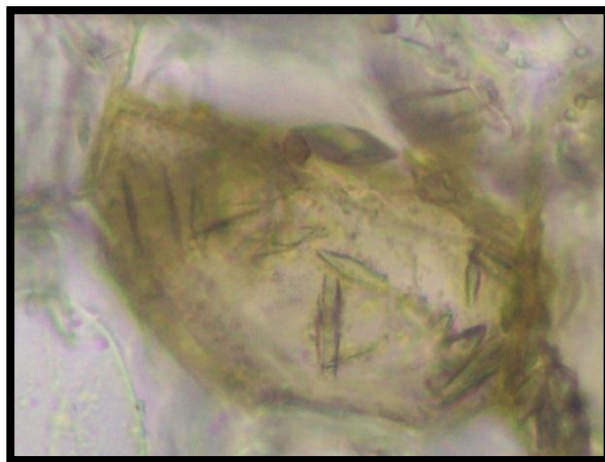
**A6: Starch grains along with oil globule**



**B6: Simple starch grain**



**A7: Oil globules with micro-crystal**



**B7: Parenchyma cells with micro-crystals of ca-oxalate and brown content**

**Plate 1. Microphotographs of Root bark**

**Microscopic characters of transverse section of *R. xylocarpa* root bark :( Plate 1)**

**Cork:**

Bark composed of 20 to 30 rows of thin walled rectangular cells twice as long as broad, somewhat wavy due to compression, cork is lignified.

**Cortex:**

It has a wide zone composed of several rows of thin walled oblong cells of various sizes. Isolated 5-8celled group of stone cells and 5-10celled group of pericyclic fibers are present. Stone cells are seen more nearer to cork. Parenchyma cells filled with brown content (Tannin), Pitted schleroid with wide lumen, micro-crystals of ca-oxalate, oil globules. This brown content is more nearer to cortical cells below the cork. Bi-seriate medullary rays are seen reaching upto the cork. Medullary rays also filled with cigar and rod shaped micro-crystals. Secondary phloem made up of sieve elements and phloem fibers. Rarely simple and compound starch grains were observed. After staining cork, pericyclic fibres, stone cells found to be lignified.

**Microscopic characters of *S. suaveolens* root bark powders (Plate 2)**

Simple starch grains with hilum, Prismatic crystals of ca-oxalate, compound starch granules, Micro-crystals, Septate fibres, Stone cell, Tannin content, Parenchyma cells with starch grain, Cork in tangential view, Cork in surface view. Lignified fibres, Stone cell, Lignified cork in surface, lignified parenchyma, lignified septate fibre.

**Microscopic characters of *R. xylocarpa* root bark powders (Plate 2)**

Cork in surface view, Simple starch grains, Stone cells, Fibre, Cigar shaped, Prismatic, Rhomboidal crystals, Oil globules. Lignified fibres, Fragment of lignified parenchyma cells,

Cork in tangential view, Cork in surface view (not lignified), Stone cell filled with wide lumen, Group of stone cells.



AP1: *S.Suaveolens* root bark powder



BP1: *R.xylocarpa* root bark powder



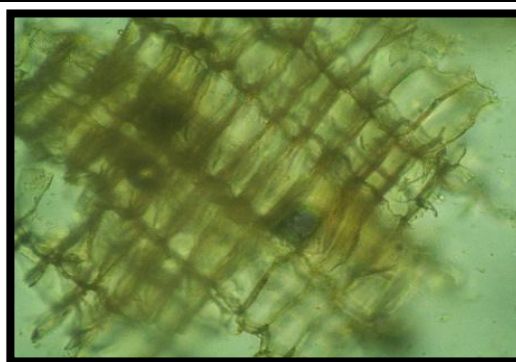
AP2: Cork in surface view



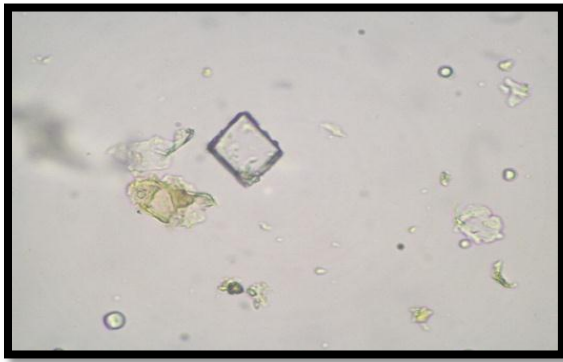
BP2: Cork in surface view



AP3: Cork in tangential view



BP3: Cork in tangential view



AP4:Prismatic cristan of ca-oxalate



BP4:Prismatic cristan of ca-oxalate



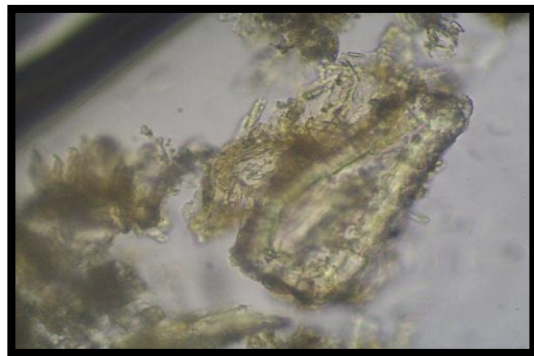
AP5:Septate fibre unstained



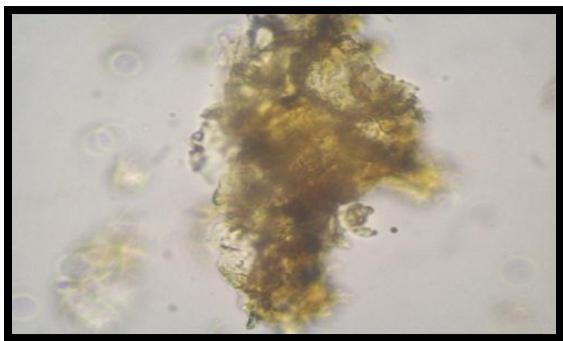
BP5:Fibre



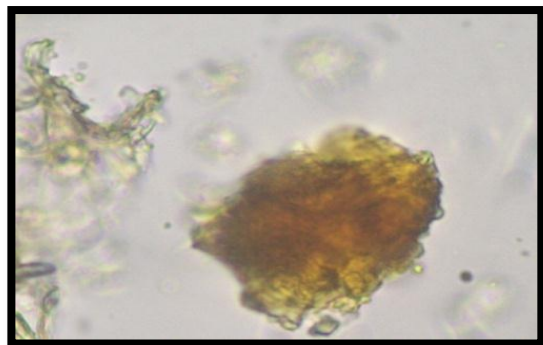
AP6:Stone cell



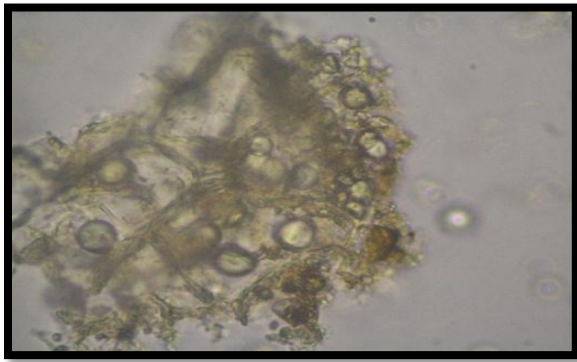
BP6:Stone cell



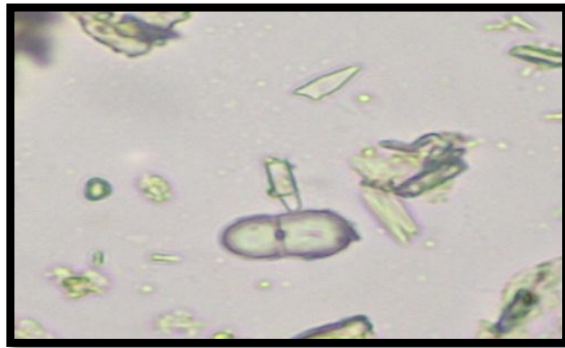
AP7:Tannin content



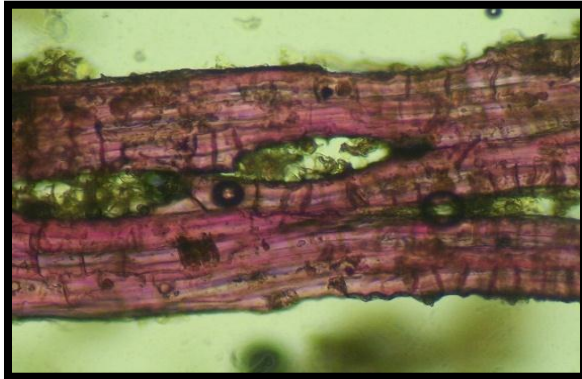
BP7:Tannin content



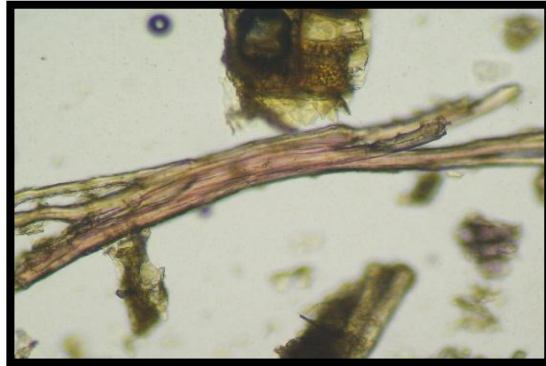
**AP8:Parenchyma cells with starch grain**



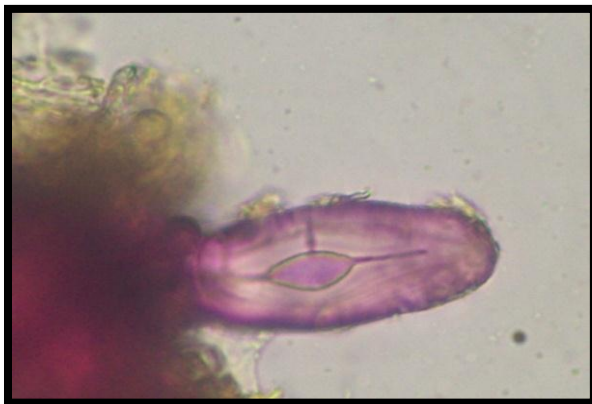
**BP8:Compound starch grain**



**AP9:Lignified septate fibres**



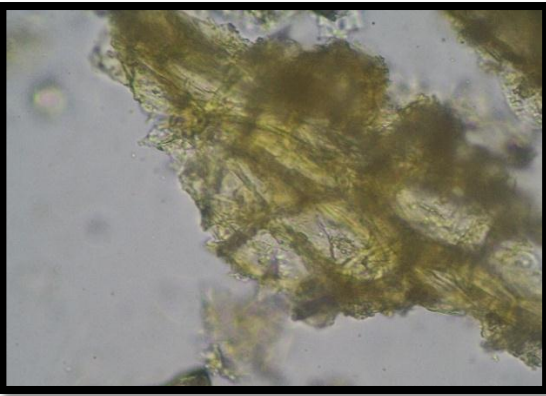
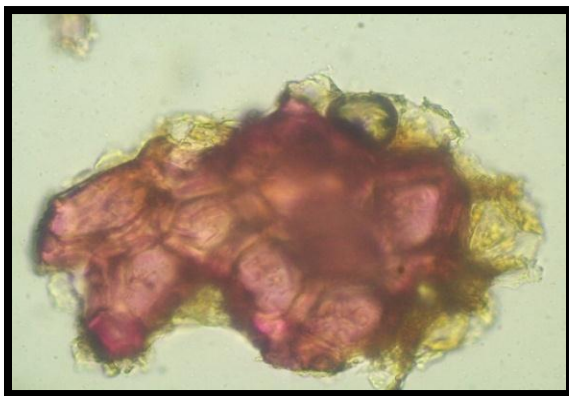
**BP9:Lignified fibres**



**AP10:Lignified stone cell**



**BP10:Lignified group of stone cell**



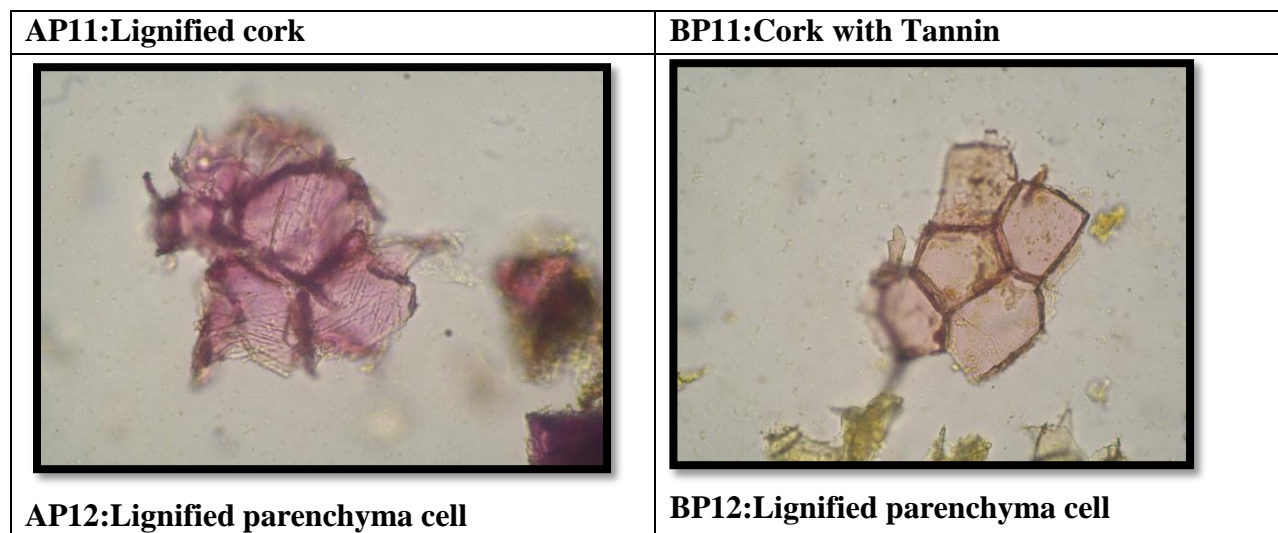


Plate.2. Microphotographs of Powder

**Physicochemical tests (Table 3)**

Physicochemical analysis of root barks of *S. suaveolens* and *R. xylocarpa* revealed loss on drying 8.4% w/w and 7.4% w/w, total ash content 10.1% w/w and 10.9% w/w, water soluble extractive 31.1% w/w and 31.2% w/w, alcohol soluble extractive 12.5% w/w and 4.4% w/w respectively and pH (5% aqua solution v/w) 6.5 for both the samples.

**Table 3: Observation of Physico-chemical analysis of *S. suaveolens* and *R. xylocarpa* Root bark powders.**

Sr. No	Physico-chemical Parameters	Sample 1 ( <i>S. suaveolens</i> )	Sample 2 ( <i>R. xylocarpa</i> )
1.	Loss on drying (% w/w)	8.4	7.4
2.	Ash value (% w/w)	10.1	10.9
3.	Water soluble extract (% w/w)	31.1	32.2
4.	Alcohol soluble extract (% w/w)	12.5	4.4
5.	pH	6.5	6.5

**Phytochemical analysis (Table 4)**

The pharmacological action of the crude drug largely depends on the metabolites present in it. In the present investigation, the qualitative screening by using prepared extracts revealed the presence of a wide range of phytoconstituents like Glycosides, Steroids, Alkaloids, Tannins and Flavonoids in both extracts.

**Table 4: Observation of Phyto-chemical analysis of *S. suaveolens* and *R. xylocarpa* Root bark powder methanolic extract.**

Sr. No	Active constituent	Test	Methanolic extract of Sample 1 ( <i>S. suaveolens</i> )	Methanolic extract of Sample 2 ( <i>R. xylocarpa</i> )
1	Glycoside	Keller-killiani test	+	+
2	Tannins	Lead acetate solution	+	+

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3	Steroid	Salkowski reaction	+	+
4	Alkaloid	Dragendorff's test	+	+
5	Proteins	Buret test	-	-
6	Saponin	Foam test	-	-
7	Flavonoids	Shinoda test	+	+

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### Qualitative tannin content

The quantitative estimation of Tannin in *S. suaveolens* root bark is 2.511%w/w and *R. xylocarpa* root bark 9.207 %w/w. Pharmacognostical and Analytical study of the two source plants of *Patala* show some similar as well as some distinct characters. *S. suaveolens* and *R. xylocarpa* belonging to same family shows some similar characters like habit, flower aestivation etc. and differ in the characters like white with yellow tinged corolla and slightly curved with large hard tubercles on capsule which are the key characters of *R.xylocarpa* whereas, dull purple or crimson coloured corolla and cylindrical straight capsule are the key characters of *S. suaveolens*. Transverse section of the root barks of two species shows some similar and some dissimilar characters. Presence of starch grains with hilum, brown content, stone cells, pericyclic fibres and calcium oxalate crystal are some of common characters present in both samples. Powder microscopy of *S. suaveolens* and *R. xylocarpa* root barks shows almost all similar findings like cork in tangential view, cork in surface view, Prismatic crystals of ca-oxalate, stone cells, fibres, starch granules and parenchyma cells. Among physicochemical parameters alcohol soluble extract of *S. suaveolens* is higher than that of *R. xylocarpum* root bark which shows higher alcohol soluble extracts in *S. suaveolens* root bark than that of *R. xylocarpa* root bark. Water extract of both the samples having PH value 6.5 which indicates alkaline nature of drug. The phytochemical constituents of both samples are found to be similar as glycosides, tannins, steroids, alkaloid and Flavonoids. Proteins and saponin test shows negative result in both the samples. The quantitative estimation of Tannin in *S. suaveolens* root bark is 2.511%w/w and *R.xylocarpa* root bark 9.207 %w/w.

### CONCLUSION

Observed pharmacognostical evaluations reveals that both the section as well as powder microscopy showed same characters likewise physicochemical and phytochemical reveals more or less similar findings which provide a set of qualitative and quantitative standards. Hence *Radermachera xylocarpa*(Roxb.) K. Schum. can be used instead of *Stereospermum suaveolens*(Roxb.)DC when later is unavailable. The study can serve as the reference work for the future works on *Patala*.

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