

Pharmacognostical studies of a market sample of parpataka *Rostellularia prostrata* (Roxb. ex. C.B. Clarke) R.Br.

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SUMMARY

Rostellularia prostrata is used as Ayurvedic drugs for the treatment of fevers, acute bleeding, respiratory infections and post-partum treatment. The botanical, macro-, microscopic characters, macerate, histochemical details and phytochemical details are presented.

Key words : Macro-, Microscopical characters, Macerate, Phytochemical, Fluorescence studies

Parpataka is an important ayurvedic drug esteemed as a specific remedy for all types of fevers. It is bitter, light, cooling and constrictor. It is useful in the treatment of Raktapitta (haemorrhage), jwara (fever), thrishna (thirst), bhrama (giddiness), daaha (burning sensation) (Lakshmiapati, 1973). The drug is diuretic, anthelmintic, digestive and constipating. The accepted botanical source of the drug is *Fumaria indica* (Anonymous, 1978). The whole plant possess medicinal properties (Sharma, 1983 and Nesamony, 1985).

Some of the plants used as parpataka are *Polycarpha corymbosa* (L.) Lam., *Glinus oppositifolius* (L.) A DC., *Mollugo nudicaulis* Lam., *Hedyotis corymbosa* (L.) Lam. and its allied species, *Glossocardia bosvallea* (L.f) DC., *Rostellularia procumbens* and *Rungia repens* (L.) (Nees Chunekar, 1999; and Vaidya, 1982). In addition to above mentioned taxa *Rostellularia prostrata* also used by the local physicians and tribes for curing acute bleeding and fevers in respiratory infections. It has been used in post-partum treatment (Sudhakar, 2001).

During a market survey of crude drugs, it was observed that a drug locally known as pararpata is extensively used as Ayurvedic preparation. Hence, it became necessary to identify this market sample of the drug botanically.

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MATERIALS AND METHODS

The plant material was collected from Tirupati. The voucher herbarium specimen was processed followed by standard procedures (Jain, and Rao, 1977). Macro- and microscopical studies were carried out (Johansen, 1940; Wallis, 1985) during the year 2005.

Fluorescence analysis was carried out by standard methods (Kokoski *et al.*, 1958; Chase and Pratt, 1949; Krebs *et al.*, 1969; Khandelwal *et al.*, 1996). The powder of the drug was examined under visible and ultra-violet light the results are given in Table 2.

Taxonomy:

A small pale prostrate herb. The branches long and diffusely spreading from a stout root stock some times almost woody. Branchlets striate, bending above nodes, 15-30 cm. Leaves ovate or (sub) orbicular, 1-2.5 x 5-2 cm, base rounded to acute, apex obtuse to acutely apiculate, petiole 0.7 cm, spikes linear terminal or at the forks of dichotomy 8mm, the flowers pale pink, bracts and bracteoles lanceolate 2.5 mm scarious, ending in one or two hairs. Calyx lobes 4, almost free, lanceolate, 3 mm, scarious, acute ending in 1 or 2 hairs. Corolla 4 x 2 cm across, tube 2 mm. Stamens 2, 2.5 mm, anther cells 0.5 mm. Ovary 1.2 mm, style 3 mm, hairy below. Capsule oblong 4x1.2 mm and minutely puberulous, seeds papillose when wet (Plate 1).

Herbarium specimen examined:

Author (210) Collected on 22nd Feb. 2006, Tirupati, Andhra Pradesh and it is deposited at the Herbarium of S.V.University, Tirupati.

RESULTS AND DISCUSSION

The results obtained from the present investigation



are presented below:

Macro and microscopical characters of root:

Macroscopical characters:

Slender, wiry, small tap root with many lateral roots. The outerzone not peelable, no specific taste and smell.

Microscopic characters (Fig.1). Transverse section of the root is circular in outline and shows epidermis, cortex and vascular zone. The root shows well developed secondary growth. The epidermis is broken and obliterated. Cortex is made up of narrow thin walled parenchymatous cells. Secondary phloem is fairly wide continuous. Secondary xylem is a wide, dense circular cylinder. Growth rings are fairly distinct and are diffuse porous. The vessels are narrow, circular, thick walled, solitary or in radial chains. Xylem rays are thin and less conspicuous. Xylem fibres are thick walled and lignified.

Macro and microscopical characters of stem:

Macroscopical characters: Erect, prostrate, procumbent 0.1 – 0.2 cm thick and prostrate stems produces roots at each node, where they contact with soil, the outerzone not peelable, no specific odour and taste.

Microscopical characters (Fig.2):

Transverse section of the stem is angular in cross-

sectional view and it possess six ridges and wide shallow furrows. It shows epidermis, cortex and well-developed vascular zone. Epidermis is uniseriate and stomatiferous, some of the cells bear cystoliths. The cortex has small patches of collenchyma along the ridges, rest of the cortex

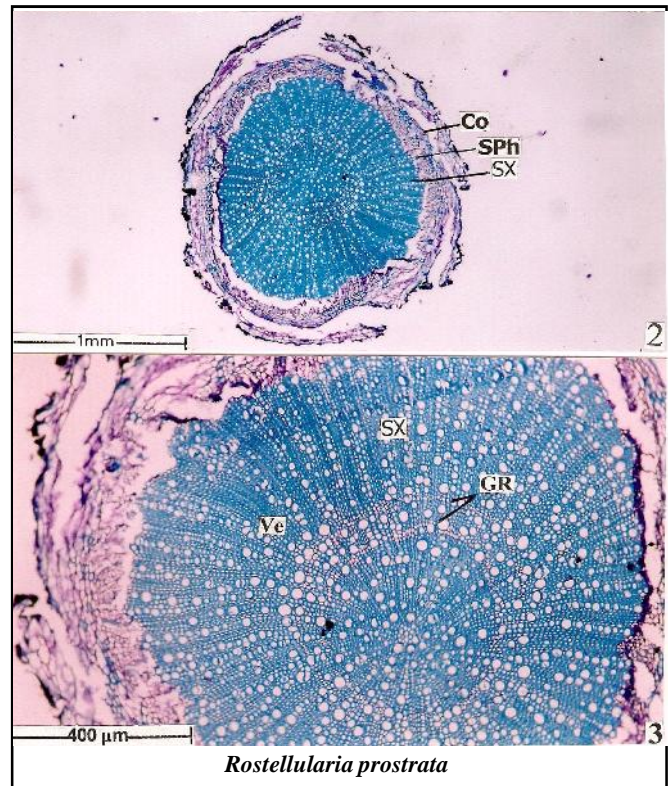


Fig.1: Microscopical characters of root
T.S. of root – Entire view
T.S. of root – Enlarged view

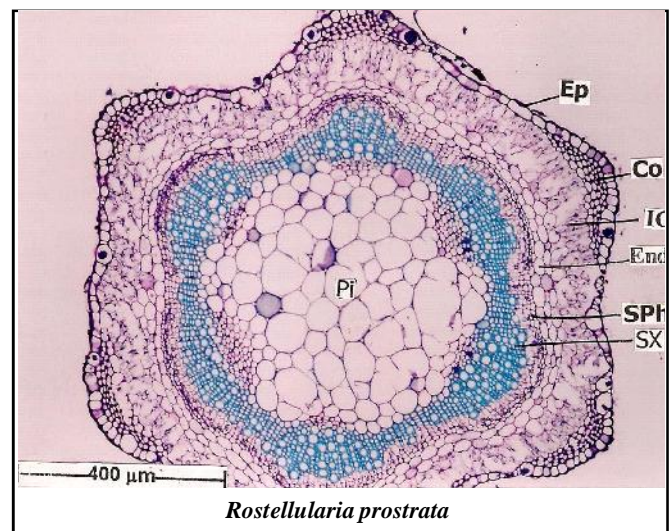


Fig. 2 : Microscopical character of stem
T.S. of stem – Entire view – Enlarged

is made up of compactly arranged chlorenchyma cells. Endodermis is made up of fairly distinct, barrel shaped, thick walled cells. The vascular cylinder also ridged parallelly arranged to the ridges of the stem (Fig.2). Secondary xylem is thicker in the ridges and thinner along the furrows. It is surrounded by a thin zone of secondary pholem. The pith is wide filled with large thin walled and loosely arranged parenchyma cells with smaller intercellular spaces.

Stem and root maceration (Fig. 3 and 4):

Macerate exhibits vessel elements and fibres.

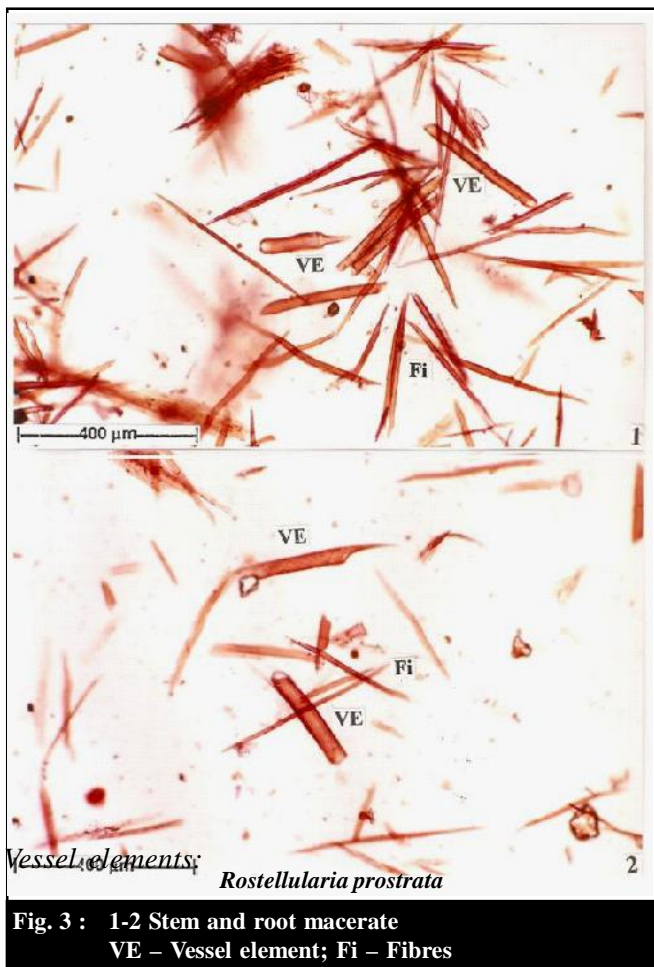


Fig. 3 : 1-2 Stem and root macerate
VE – Vessel element; Fi – Fibres

Narrow, long and cylindrical, perforation plate simple, horizontal or oblique, tails long or absent, lateral wall pits elliptic, abundant, alternate vessel elements length – 180-400 m (Fig. 3 and 4).

Fibres (Fig. 3 and 4):

Long with tapering ends, walls thick, lateral wall pits not evident. Some of the fibres have narrow lumen, while others have wide lumen, both are equal in abundance.

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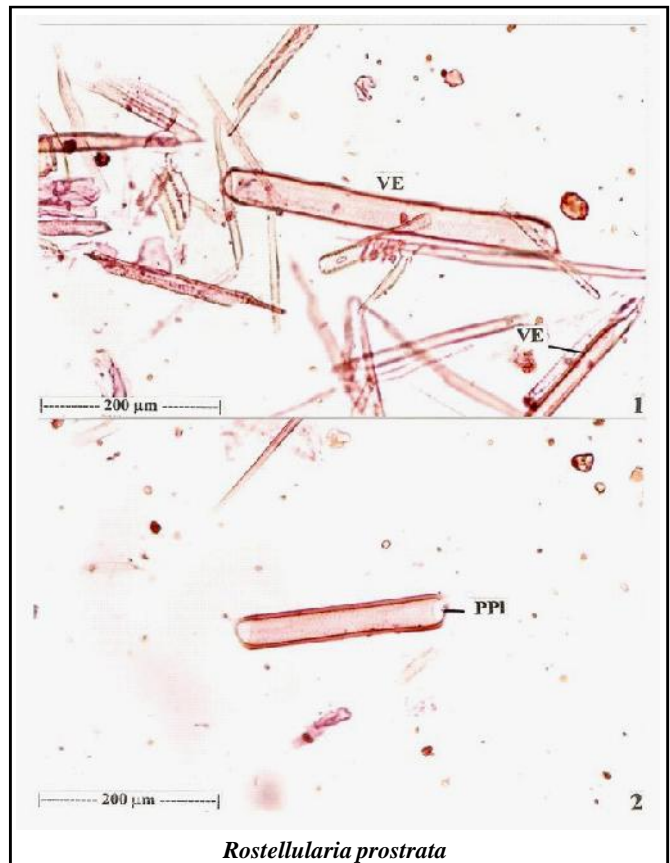


Fig. 4 : 1-2 Stem and root macerate
VE – Vessel element; PP – Perforation plate

Narrow fibres are 250-350 m long, wide fibres are 200-300 mm long.

Macro and microscopical characters of leaf:

Macroscopical characters: Opposite, ovate, petiolate, 0.5 cm, acute no specific odour and taste, small and large leaves are present 0.5 – 2.2 x 1.2 cm.

Microscopical characters:

The leaf has prominent mid rib and fairly thick, even and smooth lamina (Fig. 5). The midrib is 400 µm thick in vertical plane. It has broadly conical adaxial part and hemispherical abaxial part. Epidermis of the midrib is made up of thin walled small squarish cells. The palisade zone is transcurrent along the adaxial part above the vascular bundle. The abaxial part of the midrib possess compactly arranged, angular, thin walled ground parenchyma cells (Fig.5). The vascular bundle is single, conjoint, collateral and top shaped. Distinct bundle sheath is evident.

Lamina (Fig.5):

The lamina is 200 µm thick, the adaxial epidermal

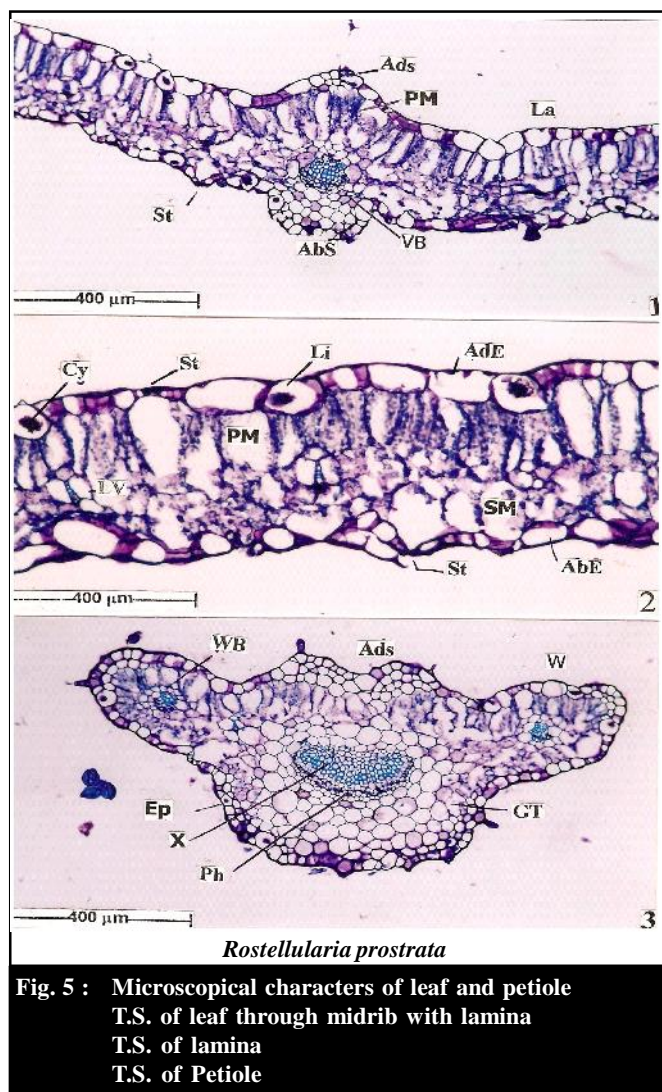


Fig. 5 : Microscopical characters of leaf and petiole
T.S. of leaf through midrib with lamina
T.S. of lamina
T.S. of Petiole

layer is wide and the epidermal cells are broadly rectangular, thin walled and stomatiferous, some of the epidermal cells are modified into dilated, circular lithocysts containing cystoliths. The mesophyll tissue consists of broad zone of palisade parenchyma cells and spongy parenchyma cells. The palisade parenchyma cells are broad and elongated. The lateral veins are less prominent consisting of small strand of xylem and phloem. The abaxial epidermal layer is made up of narrow tabular cells and consists of stomata.

Petiole (Fig.5):

The petiole is thick with broad, midrib and short wings. The adaxial part is two ridged and the abaxial part is broadly hemispherical. The epidermal layer is made up of fairly broad and distinct cells, some of the cells being modified into lithocysts. The adaxial part is made up of horizontal, transcurrent band of palisade parenchyma cells, rest of the petiole is made up of circular, thin walled, compactly

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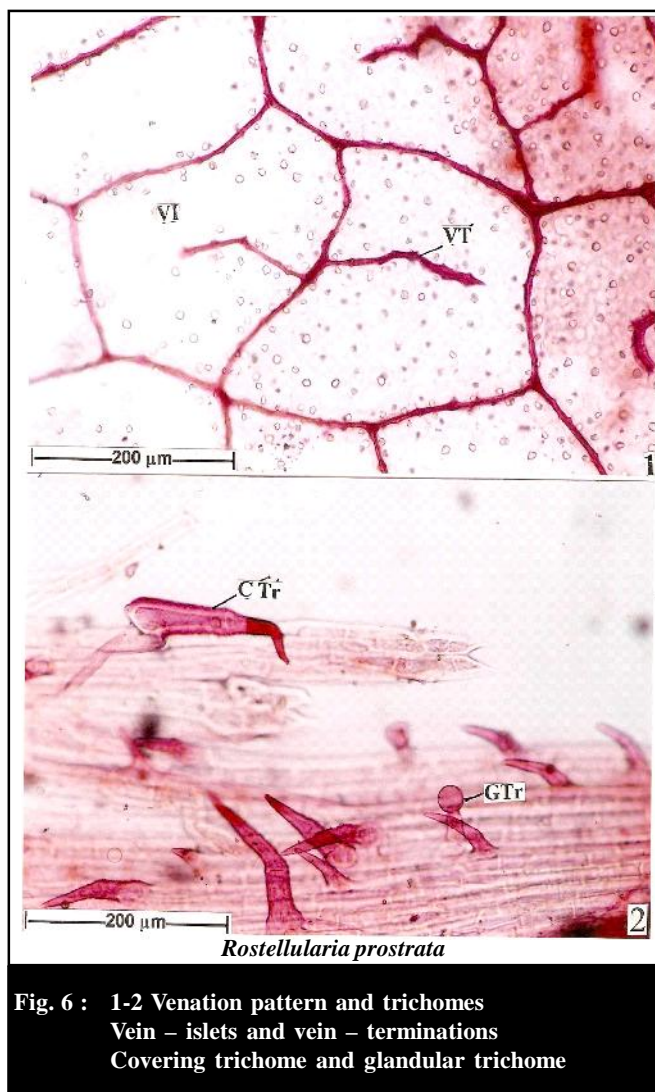


Fig. 6 : 1-2 Venation pattern and trichomes
Vein – islets and vein – terminations
Covering trichome and glandular trichome

arranged parenchyma cells. The vascular strand is broadly planoconvex with short dense xylem rays and thin arc of phloem. There are small, less prominent, sub marginal vascular strands are present on either side of the wing (Fig.5). The wing bundles are circular and collateral.

Venation (Fig.6):

The lateral veins and veinlets are thin and prominent. They form wide, polygonal vein islets. The vein terminations are mostly present in all vein islets. The terminations are long, thin and unbranched.

Trichomes (Fig.6):

Epidermal trichomes are fairly abundant especially along the veins. There are two types of trichomes.

Grandular or covering trichomes:

These are more common type, they are 2 to 3 celled, thick walled with pointed, mostly bent upper part.

Glandular trichomes:

These are less frequent. They have short cylindrical stalk and a spherical body which is unicellular and densely cytoplasmic.

Cystoliths (Fig.7):

Calcium carbonate cystoliths are abundant in the epidermal cells of all aerial parts. The cystoliths are cylindrical, elongated, conical and bluntly at the ends. The surface is warty and the cystoliths are 300-400 μm long and 500 μm thick.

Leaf-maceration-powder microscopy:**Cystoliths:**

Elongated, cylindrical, spindle shaped, calcium carbonate cystoliths are abundant in the powder. They occur in specialized, modified cells called lithocysts (Fig. 8). The surface of the cystolith has longitudinal, thin ridges. The cystolith is 550 μm long and 55-60 μm thick in the

middle portion.

Epidermal trichome (Fig. 8):

Non-glandular covering trichomes are common in powder. Trichomes, multicellular, uniseriate and unbranched, 2 or 3 celled basal cell wide and rectangular, terminal cell abruptly pointed, cell walls thick, cell lumen wide, wall outer surface minutely warty, 250 μm long, basal cell 120 x 50 μm , terminal cell 25 μm at the base 10 μm at the tip.

Powder analysis:

The powder is green in color. It has no characteristic colour and taste observation are given in Table 1.

Histochemical tests:

The sections were treated with different reagents and the observations are provided in Table 2.

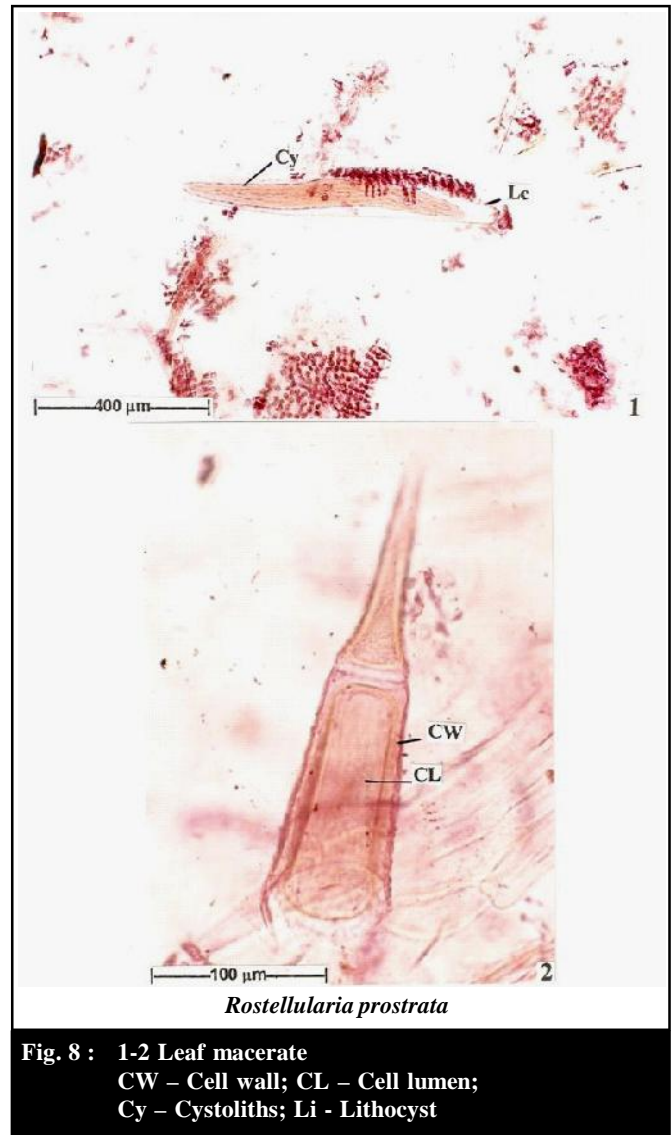
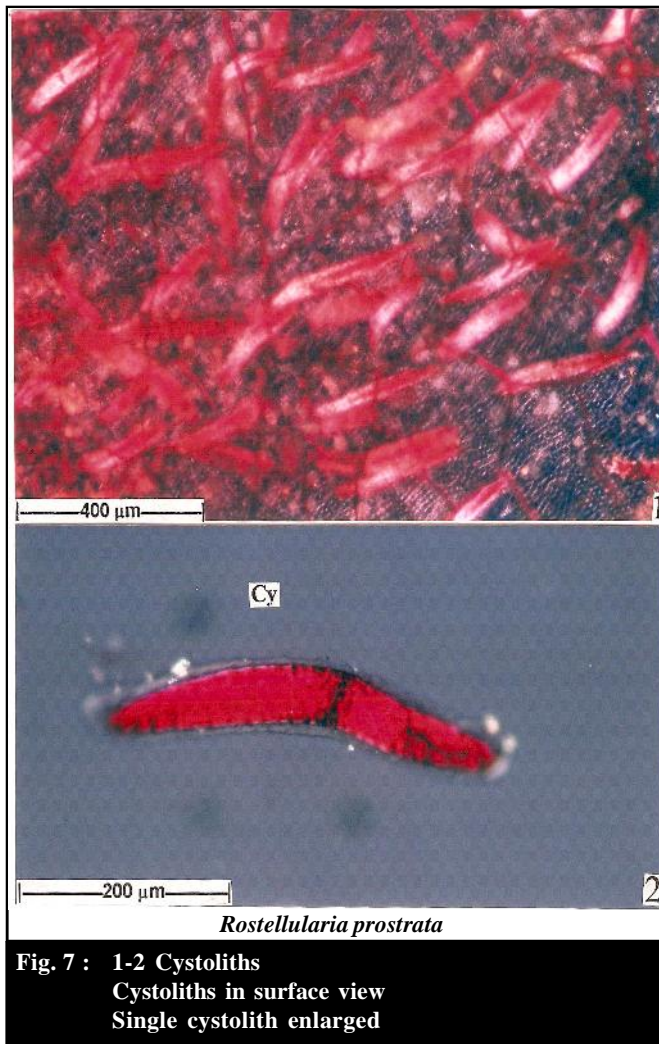


Table 1 : Powder analysis	
Treatments	Observation
Treated with water	Non-sticky
Shaken with water	Foam like froth
Treated with 5% aqueous NaOH	Green colour
Treated with aqueous sulphuric acid	Green colour
Powder pressed between filter paper for 24 hrs	No oil stain

Table 2 : Histochemical tests				
Drug	Reagents	Test for	Reaction	Results
Section	Iodine solution	Starch	Blue colour	+
Section	Ferric chloride solution	Tannin	Black	+
Section	Sudan III solution	Oil globules	-	-
Section	Phloroglucinol + dil. HCl + Alcohol	Lignin	Magenta	+
Section	Conc. HCl	Crystals	-	+

+ = Present
- = Absent

Table 3 : Physical constants	
Total ash %	20.17
Water soluble ash %	4.74
Alkanity of water soluble ash %	2.82
Acid in soluble ash %	2.13
Extractive values %	
a) Alcohol soluble extract	0.75
b) Water soluble extract	3.19
c) Hexane soluble extract	0.26
d) Chloroform soluble extract	0.42

Phytochemical studies:

Physical constants (Proximate analysis):

The physical constants were determined by standard methods¹⁴ are given in Table 3.

Table 4 : Fluorescence studies			
Experiments	Visible / day light	UV Light	
		254 nm	365 nm
Drug powder	Green	Green	Brown
Drug powder + 1 N NaOH (aq.)	Green	Yellowish green	Black
Drug powder + 1 N NaOH (alc.)	Green	Yellowish green	Yellowish green
Drug powder + 1 N HCl	Brown	Black	Black
Drug powder + 50% H ₂ SO ₄	Dark green	Yellowish green	Green
Drug powder + 50% HNO ₃	Orange	Yellowish green	Black
Drug powder + Picric acid	Yellow	Yellow	Yellow
Drug powder + Acetic acid	Green	Yellowish green	Yellowish green
Drug powder + Ferric chloride	Brown	Green	Black
Drug powder + HNO ₃ + NH ₃	Reddish orange precipitate	Yellowish green	Green

Fluorescence studies:

The results of fluorescence are given in Table 4.

Conclusion:

Rostellularia prostrata is one of the important ayurvedic drug used in the treatment of fevers particularly and in post-partum diseases. In this paper macro-, microscopical characters of the root, stem and leaf along with the macerate and fluorescence analysis are presented.

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