

Macro-microscopic and physico-chemical details of *Rostellularia procumbens* (L.) Nees var. *simplex* (D. Don) Yamasaki

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SUMMARY

Rostellularia procumbens var. *simplex* is used in several Ayurvedic drugs for the treatment of asthma, cough, bone diseases and rheumatism. The botanical, macro-, microscopic characters, macerate, powder analysis, histochemical tests and physicochemical details are presented.

Key words : Macro-microscopic characters, Macerate, Physical constants fluorescence studies.

The genus *Rostellularia* is distributed in India and Sri Lanka. The genus consists of 21 species (Gamble and Fischer, 1967). The genus *Rostellularia procumbens* is being pharmacologically and chemically screened in recent years (Mruthyunjaya Swamy *et al.*, 1998; Chen *et al.*, 1998; Weng *et al.*, 2004). However in *R. procumbens* var. *simplex* pharmacognostical work is lacking. Some of the medicinal properties attributed to *Rostellularia procumbens* var. *simplex* are whole plant is used as medicine in asthma, cough, rheumatism, backache, flatulence and lumbago. Decoction of the leaves is sometimes used in the diseases of the bone (Anonymous, 1959). A perusal of the literature revealed that no pharmacognostical work has been carried out (Gurudeva and Yoganarasimhan 2009). Hence, the present work to cover the morphology of the taxon, macro-, microscopic characters of the root, stem and leaves, physical constants and fluorescence were studied.

MATERIALS AND METHODS

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

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Physical constants were carried out by standard methods (Kokoski *et al.*, 1958; Chase and Pratt, 1949; Krebs *et al.*, 1969) and fluorescence studies followed by standard procedures (Khandelwal *et al.*, 1996).

Taxonomy:

Diffuse herb, branchlets strigose-hispid, upto 30 cm. Leaves elliptic, 4-4.5 x 1.5 cm scabrous above, glabrescent to strigose below, acute at both ends, petiole upto 0.5 cm spikes terminal, 1-2 cm, bracts obovate, 4 x 2 mm, scarios, midrib broad, shortly excurrent, margin ciliate acute, bracteoles lanceolate, 4x0.7 cm, midrib, broad, margin thinly scarios, ciliate, acute. Calyx lobes-4, some times with a 5th rudimentary lobe, sub-equal, lanceolate 4 mm, midrib ridged, scarios, closely ciliate, acute. Corolla 6x3 mm across, tube 3.5 mm, upper lip 3.5 mm, truncate shortly, emarginate, lower lip sub orbicular, 5x5 mm puberulous without. Stamens 2 to 3 mm anthers, 0.7 mm. Ovary 1.5 mm, pubescent, style 4 mm, capsule oblong, 4 x 1.5 mm sparsely hairy, pointed, seeds 1mm across (Plate:1)

Herbarium specimen examined:

Author (212) collected on 23rd November 2006, on way to Japalitheertham, Tirumala hills, Chittoor district of Andhra Pradesh and it is authenticated with D.Rangacharyulu(2292) deposited at the Herbarium of S.V.University, Tirupati.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below:

Root:

Macroscopical characters:

Fairly thick, 1.1 mm thickness, tap root is small,

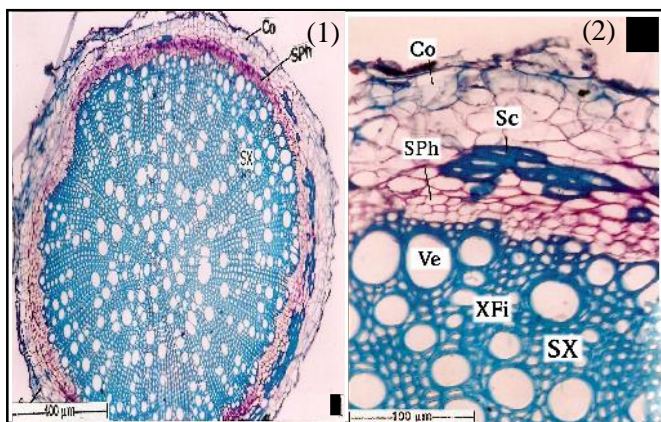


Plate 1 : *Rostellularia procumbens* (L.) Nees var. *simplex* (D.Don) Yamasaki (Acanthaceae)

lateral roots are very slender, hairy, bitter and no specific odour.

Microscopical characters :

Transverse section of the root is circular in outline and shows epidermis, cortex and vascular cylinder. Epidermis of the root is broken and periderm is formed in the region where epidermis is removed. Cortex is narrow having 2 to 3 layers of tangentially stretched parenchyma. Discontinuous patches of sclereids are observed inner to the cortex. Secondary phloem occurs all around the xylem cylinder. Secondary xylem is solid and dense with uneven outline (Fig. 1.1). It consists of wide vessels thick walled and libriform fibres. Vessels are diffuse in distribution and are mostly solitary, include both wide and narrow vessels. Widest vessel is 30 mm in diameter, the narrow vessel is 15 mm diameter (Fig. 1.2).



Rostellularia procumbens var. *simplex*
 Fig.1: Microscopical characters of root
 1. T.S. of root - Entire view
 2. T.S. of root - A sector enlarged

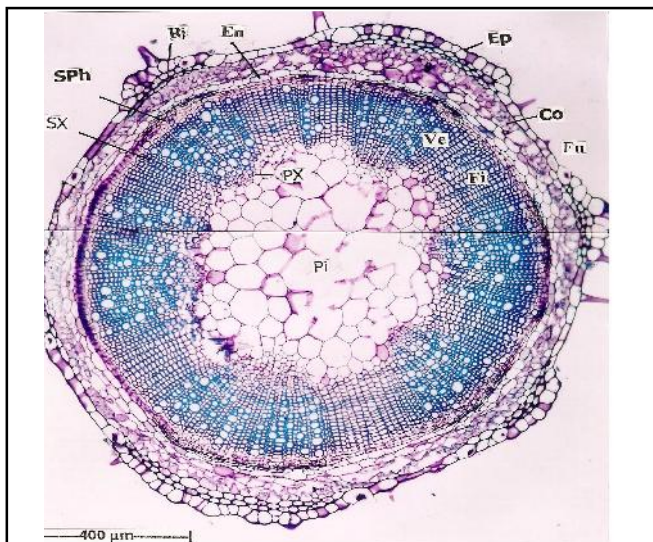
Stem:

Macroscopical characters: Stems are branched, woody, 2 cm thickness, easily peelable and slightly bitter to taste.

Microscopical characters:

Transverse section of the stem shows wide ridges and shallow furrows (Fig. 2). It consists of epidermis, cortex and wide stelar region. Epidermis is thin with narrow tabular cells in the furrow region, in the ridged region epidermal cells are dilated and radially elongated. 1-2 layers of colleen-chymatous hypodermis is present beneath the epidermis of the ridges. In furrows the cortex is made up of three layers of chlorenchyma.

A distinct endodermis is present around the vascular cylinder, it consists of barrel shaped thin walled cells. Secondary phloem is narrow and made up of 4 layers of cells. Secondary xylem is prominent and continuous. It consists of alternating radial bands of vessels and fibres. Vessels are circular, narrow thin walled, solitary and diffuse in distribution. Fibres are in regular radial rows, they are thick walled and lignified. Xylem cylinder is 170 mm thick. Primary xylem occurs in ten or more points



Rostellularia procumbens var. *simplex*
 Fig. 2 : Microscopical characters of young stem

around the pith. Central portion is occupied by wide pith cavity due to disintegration of pith cells.

Leaf:

Macroscopical characters: Leaves elliptic, 4 - 4.5 x 1.5 cm across, acute at both ends and taste bitter.

Microscopical characters

Transverse section of the leaf shows epidermis, mesophyll and vascular bundle. Leaf has prominent lateral vein (Fig. 3.1) and midrib (Fig. 3.2) with uniformly thin lamina prominent conical adaxial cone and semicircular abaxial part (Fig. 3.1). Midrib has slightly broad adaxial hump and flat rectangular abaxial part. Epidermis is made up of squarish cells with thin cell walls. A small group of 2 to 3 layers of collenchyma cells are present in midrib zone just beneath the epidermis. Palisade parenchyma cells are horizontally transcurrent across the adaxial part. Abaxial midrib has prominent layer of epidermis with thick walls and prominent cuticle. Mesophyll made up of thin walled, compactly arranged parenchyma. Lateral vein is 350 mm in vertical plane and 200 mm in horizontal plane. Midrib is 450 mm and 350 mm horizontally. Vascular bundle of the lateral vein is single top-shaped and collateral (Fig. 3.1). The vascular bundle of the midrib is slightly broader and bundle sheath is absent.

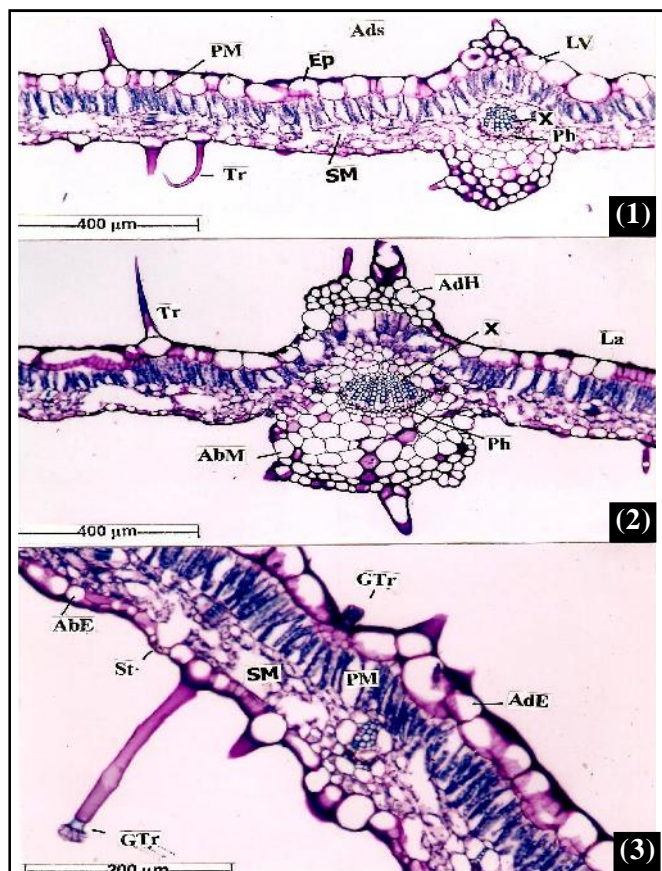
Lamina is 150 mm thick it has thick adaxial epidermis with large squarish cells which are 30-40 mm thick. Abaxial epidermis is thin walled and stomatiferous. Mesophyll consists of single layer of thin walled, loosely arranged palisade parenchyma and 4 to 5 layers of spongy parenchyma with wide air cavities (Fig. 3.1-2). Palisade zone is 80 mm in length.

Epidermal trichomes

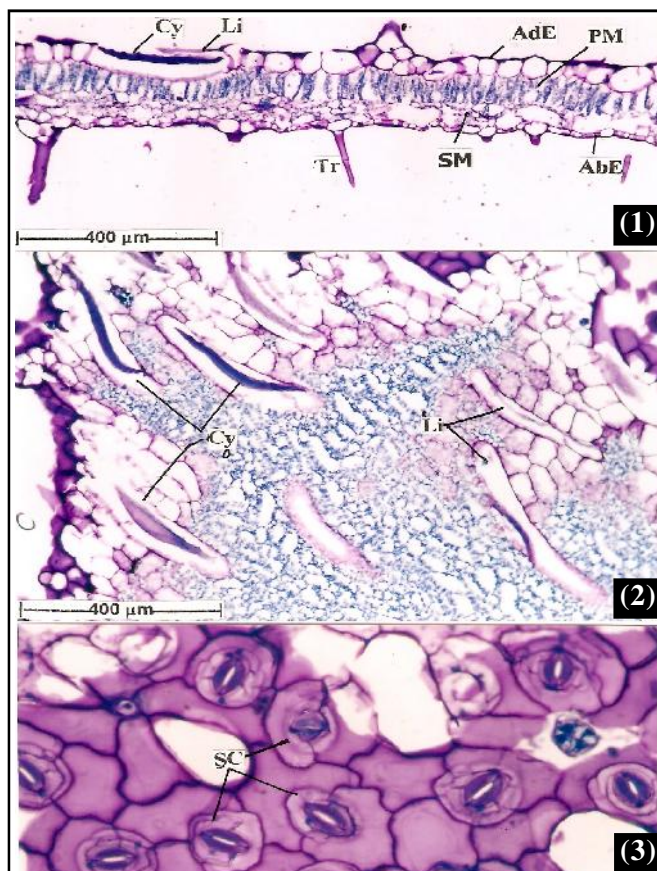
Two types of trichomes are present on the lamina and veins.

Nonglandular or covering trichomes:

This type of trichomes are more abundant. It is two or three celled, uniseriate, unbranched and thin walled pointed tip (Fig. 3.1-2). Trichome may be straight or curved. Basal epidermal cell of trichome is dilated. Trichome is about 220 mm long.



Rostellularia procumbens var. simplex
 Fig. 3 : Microscopical characters of leaf
 1. T.S. of leaf through lateral vein with lamina
 2. T.S. of leaf through midrib with lamina
 3. T.S. of leaf with short glandular trichome in the adaxial side larger glandular trichome in the abaxial side



Rostellularia procumbens var. simplex
 Fig. 4 : Distribution pattern of cystolith and stomatal morphology
 1. T.S. of lamina showing cystoliths
 2. Paradermal section showing cystolith distribution
 3. Abaxial epidermis with stomata

Glandular trichomes:

These are two types. One type of trichome is small spherical type situated in shallow cavity of the epidermis, it has a short stalk and globular multicellular body with dense content (Fig. 3.3). Second type of trichome has long, unicellular, uniformly thick short stalk cell and a crown of rosette cells (Fig. 3.3). This type is less frequent and occurs mostly on the lower epidermis. Trichome is 450 μm long, terminal rosette of cells 30 μm wide.

Cystoliths:

Calcium carbonate cystoliths are abundant in the epidermal cells of leaf and young stem. Cystoliths are long and cylindrical with warty surface. They occur in the enlarged epidermal cells called lithocysts. Cystoliths are 220 μm long and 20 μm width (Fig. 4.1-2).

Stomata:

Stomata occur only in lower epidermis of lamina and on young stem (Fig. 4.3). Stomata slightly raised above the

epidermal level. Stomata are diacytic. Most of the stomata have more than one circle of subsidiary cells. The stomata are 11 μm^2 . The guard cells are 90 x 50 μm size.

Whole plant-macerate:

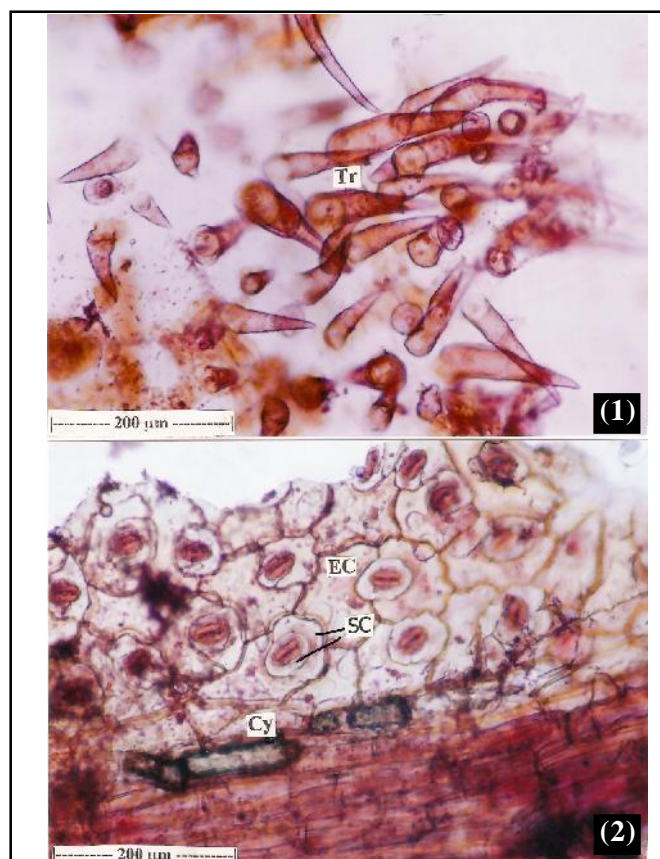
Maceration of whole plant shows the following elements:

Epidermal trichomes (Fig. 5.1):

Trichomes are one to three celled, uniseriate, unbranched, broad at the base, narrow and conical at the tips, walls thin and smooth, 150 - 180 μm long - 40 μm broad at the base and 10 μm broad at the apex.

Vessel elements (Fig. 5.2):

Long, narrow and cylindrical, perforation plate simple, horizontal, tails absent, lateral wall pits circular, dense and alternate, length of the vessel elements 240-340 μm , width 20-25 μm .

**Rostellularia procumbens var. simplex****Fig. 5 : Whole plant - Macerate**

1. Narrow and wide fibres
 2. Two long cylindrical vessel elements
- NFi – Narrow fibers; WFi – Wide fibers;
VE – Vessel elements; PP – Perforation plate

**Rostellularia procumbens var. simplex****Fig. 6 : Whole plant - Macerate**

1. Epidermal trichomes
 2. Abaxial epidermis with diacytic stomata
- Tr – Trichome; EC – Epidermal cells;
SC – Subsidiary cells; Cy- Cystoliths

Fibres (Fig. 5.1; 6.2):

Both wide and narrow fibres observed. Wide fibres thin walled with wide lumen, 320 μm long and 15 μm wide (Fig. 5.1). Narrow fibres thick walled with narrow lumen, long with gradually tapering ends (Fig.6.2), 450 μm long and 10 μm wide. Pits not evident both in the narrow and wide fibres.

Stomata (Fig. 6.2):

Stomatal type diacytic, epidermal cells slightly lobed, thin walled, guard cells 30x20 μm in size.

Cystoliths (Fig.7.1,2):

Elongated, cylindrical, either straight or curved, occur in lithocyst, cystolith surface minutely spiny and 150-400 μm x 40 μm in size.

Powder analysis :

The powder is green in colour. It is bitter to taste. The observations are given in Table 1.



Rostellularia procumbens var. simplex

Fig.7 : 1-2 Whole plant - Macerate

1. Two cystoliths

2. Cystolith in the lithocyst

Cy – Cystolith; Li - Lithocyst

Table 1 : Powder analysis

Treatments	Observation
Powder treated with water	Non-sticky
Powder shaken with water	Foam like froth
Powder treated with 5% aqueous NaOH	Green
Powder treated with 60% aqueous sulphuric acid	Dark green
Powder pressed between filter paper for 24 hours	No oil stain

Histochemical tests :

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

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	No Effervescence	-
Section	Phloroglucinol + dil. HCl + Alcohol	Lignin	Magenta	+
Section	Conc. HCl	Crystals	No Effervescence	+

+ = Present ; - = Absent

Physico-chemical constants:**Physical constants:**

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

Table 3 : Physical constants

Total ash%	15.47
Water soluble ash%	4.79
Alkanyity of water soluble ash%	5.26
Acid in soluble ash (%)	1.14
Extractive values (%)	
a) Alcohol soluble extract	1.05
b) Water soluble extract	2.09
c) Hexane soluble extract	0.44
d) Chloroform soluble extract	0.92

Fluorescence analysis:

Fluorescence analysis was carried out by standard procedures. The results are given in Table 4.

Conclusions:

It is evaluated for its identification, botanical, macro-

Table 4 : Fluorescence analysis

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

, microscopic and physico-chemical details. Whole plant possess medicinal properties. It is not only used in several Ayurvedic preparations but also used in the preparations of Siddha system of medicine.

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