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Research Article

PHARMACOGNOSTIC STUDIES ON *TALINUM PORTULACIFOLIUM* (FORSSK.) ASCH. EX SCHWEINF.

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ABSTRACT

Objective: The present study was undertaken to establish the micromorphological characters of *Talinum portulacifolium* (Forssk.) Asch. ex Schweinf. belonging to the family Portulacaceae.

Methods: The fresh plant parts were selected for micromorphological studies, and the air-dried plant powder was used for powder analysis as per the standard techniques.

Results: Results revealed the presence of diagnostic characters like calcium oxalate crystals in the parenchyma cells of the leaf, which are druses with spiny surface that occurs in ordinary parenchyma cells. Stomata are paracytic which are present in both adaxial and abaxial surfaces of the leaf. The powder contains fragments of leaf epidermis, densely distributed stomata in laminar portions of the leaf.

Conclusion: The present study provides the valuable information and also acts as pharmacognostical standards to standardize the study plant scientifically.

Keywords: *Talinum portulacifolium*, Portulacaceae, Pharmacognosy, Powder microscopy, Druses, Calcium oxalate crystals, Paracytic stomata.

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INTRODUCTION

The therapeutic potential of herbs has been well recognized by various indigenous systems of medicine. The use of natural plant substances to treat and prevent illness has existed since prehistoric times and still flourishes today in many societies and cultures with many plants still in common use. Besides their therapeutic use, herbs are disease preventers and also used as dietary supplements. Herbal medicines are naturally occurring therapeutic compounds in biological organisms. The use of natural plant substances to treat and prevent illness has existed since prehistoric times and still flourishes today in many societies and cultures with many plants still in common use [4,5]. The World Health Organization estimated that 80% of people worldwide rely on herbal medicines partially for their primary health care [6]. Indian system of medicine such as Ayurveda, Unani, and Siddha depends on medicinal plants for herbal drugs. Traditionally used medicinal plants produce the variety of compounds of known therapeutic properties [7].

Talinum portulacifolium (Forssk.) Asch. ex Schweinf. is the medicinal plant under the family Portulacaceae. This family is cosmopolitan and has 19 genera, and it is distributed from Rajasthan, India, southwards into the peninsular region [8,9]. It is used as a green leafy vegetable due to its rich source of Vitamin A and mineral content [10]. It is used as antihistaminic, anticholinergic, spasmolytic, and antiulcerogenic [11,12]. Leaf powder is used to treat diabetes, hepatitis, aphrodisiac, and mouth ulcers. The fresh leaves are used as stomachic. Root has tonic properties, used in the treatment of cough, pulmonary tuberculosis, and gastritis. It is also used to treat dehydrating diarrhea [13]. Ethanolic extract of *T. portulacifolium* is effective in managing the complications associated with diabetes mellitus, such as hyperlipidemia and prevents the lipid metabolism [14]. The objective of the study is to observe the micromorphological characters of *T. portulacifolium* (Forssk.) Asch. ex Schweinf.

METHODS

Collection and identification

The fresh plant material was collected from Pungambadi, Erode district, Tamil Nadu, South India. The plant material was identified using the local floras [15,16]. The study plant was confirmed with the help of type specimens available in the Herbarium of Botanical Survey of India, Southern region center, Coimbatore, Tamil Nadu. The Herbarium number in BSI was BSI/SRC/5/23/2016/Tech./1358. The herbarium was deposited in the herbarium of Vellalar College for Women (Autonomous), Erode, Tamil Nadu.

Morphological observations

Macroscopical characters such as shape, size, color, and odour were also examined [17].

Sectioning

The whole plants of *T. portulacifolium* were fixed in FAA (formalin 5 ml: acetic acid 5 ml:70% Ethyl alcohol - 90 ml). The materials were left in FAA for a few days and then they were dehydrated employing tertiary butyl alcohol series as per the procedure [1]. Paraffin infiltration and embedding in wax blocks were done in the usual method [2]. Serial paraffin sections of 10–12 µm thickness were prepared with the help of Spencer Rotary Microtome. These sections were stained with Toluidine blue as per the schedule [3]. Sections were also stained with fast green. Microscopic observations were studied in both normal and polarized lights.

Photomicrographs

Photomicrographs were taken with NIKON ALPHA PHOTO - 2 microscopic units using normal and polarized lights.

Powder microscopical analysis

Freshly collected aerial parts were cleaned to remove adhering dust and then shade dried. The shade dried plants were mechanically ground to coarse powder and passed through 80 mesh sieve and used for further analysis.

RESULTS AND DISCUSSION

Macroscopic observations

The study plant *T. portulacifolium* is given in Fig. 1. It shows the habit of the study plant and flowering twig. Macroscopical observations of the study plant are summarized in Table 1.

Microscopical observations
The microscopical observations of root, stem, leaf, and powder characteristics are as follows:

Root
Root is circular in transectional view and the periderm peels off as thin irregular flakes (Fig. 2a). Thin superficial periderm is followed by thick cortex, thick continuous cylinder of xylem, secondary phloem, and deeply grooved secondary xylem cylinder.

Secondary xylem exhibits an anomalous cylinder of xylem which is cleaved deep up to the center forming radial segments. The segments are narrow toward the center and become gradually wider toward the periphery. The radical segments of the secondary xylem include vessels and fibers. The vessels are circular, wide, and thin walled and are random in arrangements. The fibers occur in between the vessels and are small, thin walled with wide lumen. In between the radial segments of the secondary xylem, the xylem rays are highly dilated, and the ray cells are large and radially elongated. Calcium oxalate crystals are abundant in the xylem rays. Mucilage is found in these ray cells. The same crystals were obtained in the *Portulaca grandiflora* [18].

Starch grains
Starch grains are abundant in the xylem rays and phloem parenchyma of the root. When the starch grains are viewed in polarized light, the grains are circular with (+) shaped polari marks (Fig. 2b).

Fig. 1: Study plant

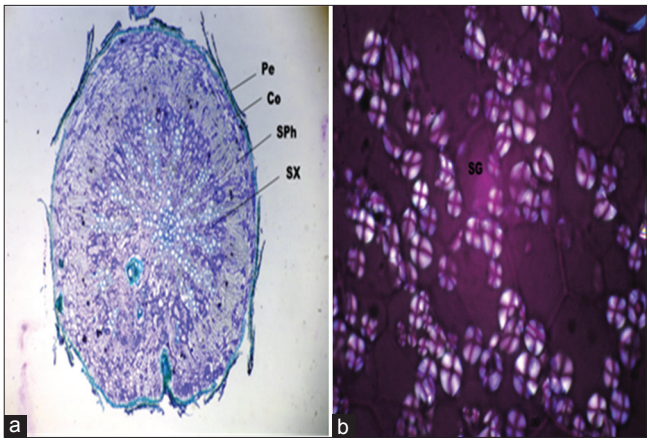

Fig. 2: Root, (a) T.S of root, (b) Starch grains enlarged in polarized light

Stem
The mature stem is 4.5 mm thick and consists of rectangular, narrow, and thick-walled epidermal cells. The cortical cells are horizontally elliptical, thin walled, and compact (Fig. 3a and b). Some of the cells contain mucilage. The stem has many large collateral vascular bundles. It supports the results of *P. grandiflora* and *Portulaca quadrifida* [18]. Each vascular bundle consists of wide, circular, and thick-walled xylem elements (vessels) which are in clusters or in short radial multiples. Phloem consists of sieve elements and companion cells. The sieve elements are smaller and angular. Phloem parenchyma cells are wide, polygonal, and compact. On the outer edge of the phloem segment occurs a thick mass of fibers, which are thick walled and lignified with wide lumen.

Leaf
The leaf consists of deep adaxial groove of the midrib and prominent triangular abaxial cone (Fig. 4a). The lamina is even, smooth and stomata are paracytic which are dispersed among the epidermal cells (Fig. 4b and c). The stomata are paracytic type in leaf. It is consonance with the study of *P. grandiflora* [18] and *Portulaca oleracea* [19]. The mesophyll tissue is not differentiated into palisade and spongy mesophyll tissues. There is a small, more or less circular vascular bundle located in the upper part of the midrib. The vascular bundle is collateral, 180 µm thick and consists of adaxial wide cluster of vessels. The vessels are circular or angular, thick walled, and 30 µm in diameter. The phloem is arc-shaped band located beneath the xylem strand, and the phloem elements are small, thin walled, and darkly stained.

Crystal distribution
Calcium oxalate crystals are abundant in the mesophyll tissue of the leaf. Similar results were obtained in the *P. grandiflora*, *Portulaca*

Table 1: Macroscopical characters

S. No.	Parts of the plant	Characters noted	Observation
1.	Leaf	Phyllotaxy	Alternate
		Shape	Obovate
		Size	6.8×2.3 cm
		Texture	Fleshy
		Appearance	Glabrous
		Base	Attenuate
		Margin	Entire
		Apex	Obtuse
		Petiole	2–3 mm
		Odour	Characteristic odour
		Taste	Agreeable
		Color	Green
2.	Stem	Shape	Cylindrical
		Size	3 mm
		Texture	Smooth
		Odour	Characteristic odour
		Taste	Agreeable
		Fracture	Soft
		Color	Green
3.	Flower	Inflorescence	Terminal
		Color	Pink
		Size	1.5 cm across
		Pedicel	1.5 cm
		Stamens	Many
		Filaments	Unequal
		Ovary	Superior
4.	Fruit	Type	Capsule
		Size	2 mm
		Color	Bright yellow
5.	Seed	Shape	Lens shaped
		Size	1 mm
		Number	Many
		Color	Dark yellow to Brown

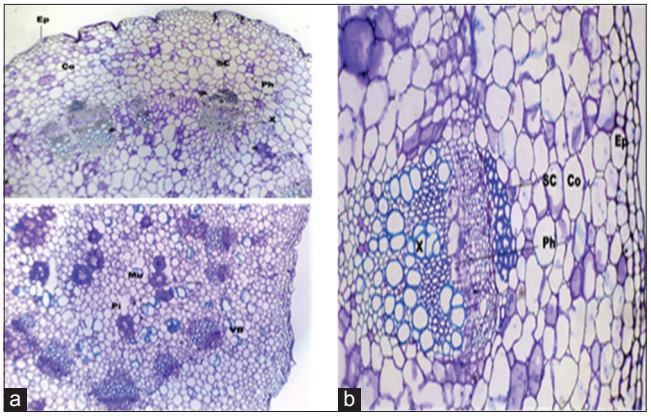

Fig. 3: Stem, (a) T.S of mature stem - A sector enlarged, (b) T.S of mature stem secondary vascular tissues enlarged

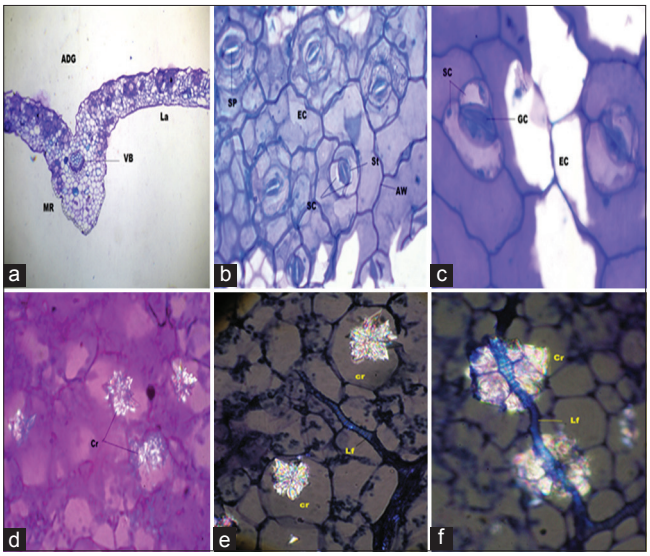

Fig. 4: Leaf, (a) T.S of lamina through midrib, (b) Paradermal section of lamina showing stomata, (c) Two stomata enlarged, (d) Druses in leaf mesophyll tissues, (e) Druses, (f) Druses enlarged

oleracea, and *Gardenia jasminoides* [18,20]. The crystals are druses, which are spherical bodies with spiny surface. Such druses have also been reported in *Talinum triangulare* [21]. The druses are located within dilated circular parenchyma cells. The druses are 80 µm in diameter and are diffuse in distribution and solitary in each cell (Fig. 4d-f).

Secretory canals

The secretary canals are wide, thin walled, non-septate, anastomosing, and 10 µm wide and unlimited in growth. They penetrate the mesophyll tissue of the leaf and possess mucilage substance. The same mucilaginous substance was reported in the *T. triangulare* [21].

Powder microscopic observation

Small fragments of leaf epidermis are seen in the powder. The same observation was reported in *T. triangulare* [21]. They exhibit densely distributed stomata which are paracytic. Small pieces of lamina present in the powder, which shows the broadly reticulate venation. The vein islets are wide and polyhedral in outline. Calcium oxalate crystals are abundant in the lamina. Large crystals are seen in the leaf tissue. Thick bundles of parenchyma cells are very common in the powder. Parenchyma cells of the vascular rays are scattered and these cells are wide, rectangular, and thin walled, and possess dense accumulation of starch grains (Fig. 5a-d).

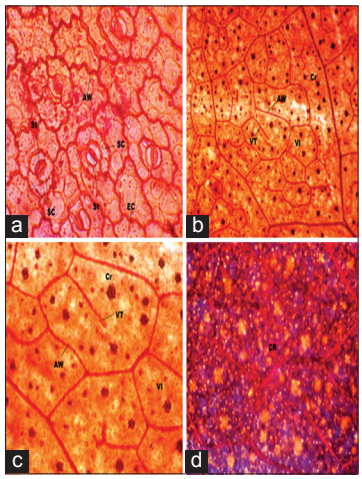

Fig. 5: Leaf powder, (a) Fragments of leaf epidermis, (b) Venation part of the lamina, (c) Vein islets and Vein termination enlarged, (d) Distribution of calcium oxalate in leaf tissue

CONCLUSION

The macroscopical and microscopical observations of the study plant *T. portulacifolium* leaf tissue revealed the druses and calcium oxalate crystals which are the specific diagnostic key character of *T. portulacifolium*. Starch grains are present in the ray parenchyma cells of the root, and star-shaped crystals are abundant in the leaf tissue. The stomata present in the epidermal cells of the leaf are paracytic. Preliminary study shows the presence of alkaloids, amino acids, flavonoids, and other secondary metabolites. It is a multivitamin source of plant that showed the rich amount of calcium, sodium, and potassium. Hence, microscopical observation of the study plant *T. portulacifolium* helps for the future pharmacological studies.

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AUTHOR'S CONTRIBUTION

Plant collection, macroscopical analysis, and writing the manuscript were done by Hemalatha K. and Abirami P. had conducted manuscript revision and manuscript finalizing in its final form. All the authors had read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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