International Journal of Botany Studies
ISSN: 2455-541X
Impact Factor: RJIF 5.12
www.botanyjournals.com
Volume 3; Issue 1; January 2018; Page No. 08-10

Anatomy of *Abutilon ranadei* Woodr. & Stafp. A critically endangered species in Western Ghats

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Abstract
Abutilon ranadei Woodr. & Stapf. is belongs to family Malvaceae which is Critically endangered plant species in Western Ghats has been investigated anatomically. Examination was done by transverse section of Root, Stem, Petiole and Leaf.

Keywords: *Abutilon ranadei*, anatomy, Western Ghat

1. Introduction
Abutilon ranadei Woodr. & Stapf. was first collected by N.B. Ranade, ex-keeper of the herbarium at the College of Science, Pune Woodrow & Stapf. (1894) [1] described it as a new species and named it after Ranade. It is an endemic known so for only from four district of Maharashtra State. According to Cooke (1901) [2], it is a rare plant due to its narrow range of distribution and extreme rarity the species has been declared as endangered Nayar and Sastry, (1987) [3], Venkanna & Das Das (2000) [4] or even presumed extinct Ahmedullah and Nayar, (1986) [5]. However it was recollected from its type locality after a lapse of almost 95 years (Mistry & Almeida, 1989 [6]; Almeida, 1996 [7]; Walter and Gillett, (1997) [8]. Since then the species has been collected from eight new localities in Pune, Satara, Kolhapur and Ratnagiri district.
Any report on the anatomical study on *Abutilon ranadei* not appeared but a brief description about the genus is given in Anatomy of Dicotyledons (Metcalf & Chalk, 1965) [9] and other species *Abutilon theophrasti* anatomically studied root, stem and leaf (Aysegul, 2003 [10]; Yun and Taylor 2006 [11]), *Abutilon indicum* morphological anatomical studies of leaves (Ramadoss *et. al.*, 2012 [12]) and also some other genera of family Malvaceae Anatomical description of *Hibiscus* (Adedeji and Dloh, 2004) [13].
Several anatomical features are specific to specific taxa. Hence these may be used for delimitation of the species. These anatomical features having taxonomic values are used as criteria for separating the species, genera and even families. The anatomy of plant gives the criteria of epidermis, cortex, secondary phloem, Medullary rays, crystals, fibers and tanniniferous cells, which forms the important parameters in standardizations.
For the first time, the anatomical characteristics of the root, stem, petiole and leaf of *Abutilon ranadei* were studied during the present investigation.

2. Material and Methods
Morphology
The morphological characters of the plant were studied in detail and their herbarium sheets were prepared which are preserved in the Herbarium of Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. Fresh and dried plant samples were studied morphologically in the field as well as in the laboratory.

Anatomy and Maceration
The plants were collected from different localities of Western Ghats, Maharashtra and authentically identified. The samples were collected by large knife, chisel and saw without damaging the plants. The plant specimen was preserved in 70% alcohol for their maceration and anatomical work. The sample were collected in polythene bags or zip lock bags and brought to the laboratory within 2-3 days.
The anatomical characters of the plant were studied with the help of free hand transverse sections, taken with blades. From each part some sections were unstained while others were double stained. Both unstained and stained sections are permanently preserved. Permanent preparations were observed under microscope. Photographs were taken with the help of digital camera (Sony cyber) by micro photographic techniques. The stem was also studied by maceration techniques. The pieces of stem were boiled in Jeffery's fluid (Chromic acid 10% and Nitric acid 10% in equal proportion) as well as by Schultz's method. The macerated cells were studied in detail. Their photos were taken with the help of digital camera (Sony cyber). The dimensions of the cells in sections and those obtained during maceration were measured by ocular.

3. Results and Discussion
1. T. S. of Leaf
The transverse section leaf shows upper epidermis consists of a single layer of rectangular cells with a fairly thin, smooth cuticle. Trichomes and stellate glandular trichomes are cover it. The covering hairs are generally tufted with straight walls and acute apices. Glandular trichomes are differentiated in two types the long ones, with a unicellular stalk a multicellular glandular head; the short ones with multicellular stalk and glandular head. The former have a globe-like composed of 9-14 layers of cells. The latter with two celled stalk and 2-4

celled head are similar to the ones of the leaf of other *Althea*, other species of *Abutilon* and *Malva* species Warszawa *et al.* (2006) [14], Nighat *et al.* (2010) [15].

The mesophyll is clearly differentiated into palisade and spongy parenchyma. Upper epidermis, the mesophyll contains 3 layers of palisade which is composed of compactly arranged long cylindrical cells. The spongy mesophyll, being thinner than the palisade layer, is formed of thin walled, isodiametric Parenchymatous cells with few intercellular spaces. Mucilaginous cells are observed in the palisade and spongy parenchyma structure. (Plate No. 1d).

Both the epidermis of the midrib is similar to that of lamina except that the cells are similar. Glandular trichomes are also densely observed on the midrib. Upper epidermis is consisting of 5-8 layers of collenchymatic cells, is observed as the most striking characteristics of the leaf. The palisade parenchyma is suddenly interrupted. Between this prominence and the vascular bundle, mucilaginous and parenchymatous cells are observed.

A crescent-shaped vascular bundle is present in the center of midrib. The vascular bundle contains 2-4 layers of lignified radiating xylem with an arch of phloem consisting of thin walled, compactly arranged, small cells. The midrib is composed of Parenchymatous cells, contains starch grains, cluster crystals pith rare mucilage. Midrib, is lower epidermis and collenchyma cells are observed (Plate No. 1d).

2. T. S. of Petiole

The epidermis is outer most layers, which is composed by rectangular to barrel shaped cells, with cuticle, double layered and protective in nature, which is interrupted by several stellate hairs. The epidermis is multilayered cortex which is divided in to adaxial outer cortex and abaxial inner cortex. Outer cortex is 1-5 layered and composed of compactly arranged collenchymatous cells. Inner cortex is 7-9 layered and made up of loosely arranged Parenchymatous cells.

Vascular bundle is half moon shaped, which is separated by single layered Parenchymatous endodermis. It is bicollateral, metaxylem is at the center and protoxylem towards the periphery. Metaxylem consisting vessels. Phloem present on either side of xylem, which is in patch and Phloem cells are smaller ones. (Plate No. 1c).

3. T. S. of Stem

Epidermis is composed and single layer of isodiametric cells with convex outer and inner walls. Cuticle is thin and smooth. Glandular hairs are similar to those of the leaf with respect to form and abundance. Cluster crystals, scattered all over and the epidermis is uniseriate lines. Epidermis of stem covered in glandular trichomes, non glandular trichomes are observed as unicellular as well as bicellular simple and clustered. Number of multicellular trichomes is less than unicellular and bicellualr ones (Plate No. 1b).

The cortex contains a thick or thin layer of collenchyma cells. The cortex is composed of 5-8 layers, different sizes of parenchyma cells. Cortical parenchyma, a thinner layer than collenchyma, contains cluster crystals in the cells (Plate No. 1b).

Cortical parenchyma,5-6 layers of phloem sclerenchyma, consisting of more or less a complete ring of fibres, which are sometimes interrupted by the rays are present. The phloem is composed of crushed, irregular cells. Phloem and xylem layers, cambium with 5-6 layers of thin walled, crushed, rectangular cells are observed.

Xylem contains a continuous ring of 11-12 layers of cells. Tracheae with large central spaces are few, but tracheids with small central spaces are in compact groups of cells Medullary rays are either uniseriate or biseriate.

The pith is composed of thin walled and large, rounded parenchyma cells. Some of these cells are transformed into mucilaginous cells. Large cluster crystals are scattered in pith. Mucilaginous cells are less and small in cortical parenchyma but many and large in pith parenchyma (Plate No. 1b).

4. T. S. of Root

The epidermis is composed of unicellular, rectangular, suberized and deformed cells. Some simple and 2-4 celled trichomes are observed. The hypodermis is 2-4 layers are also observed. Thin walled rectangular cells and thick layer of cortical parenchyma. The cells contain starch grains and cluster crystals. In the cortex, phloem sclerenchyma makes a ring of triangle towers which is sometimes interrupted by phloem parenchyma.

Under these characteristic sclerenchymatous structures, phloem is observed with little and crushed cell groups. Adjacent to phloem, cambium is well marked by 7-8 layers of cells. Medullary rays are forwarded into the cortical parenchyma forming triangles. The cells contain either a few starch grains or none.

Xylem consists of radialy arranged vessels which nearly cover all of the inner part of the root. Tracheae with big central spaces are few. The smaller tracheids area abundant The rays are composed of 2-3 cell width parts pith is not very broad and consists of rounded Parenchymatous cells containing starch grains and cluster crystals. Mucilaginous cells are also present among the pith cells. But the number of the mucilaginous cells is fewer with respect to those found in leaf and stem because of the restricted area of the pith (Plate No. 1a).

In this study the anatomical structure of the root, stem, petiole and leaf of *Abutilon ranadei* were investigated for the first time.

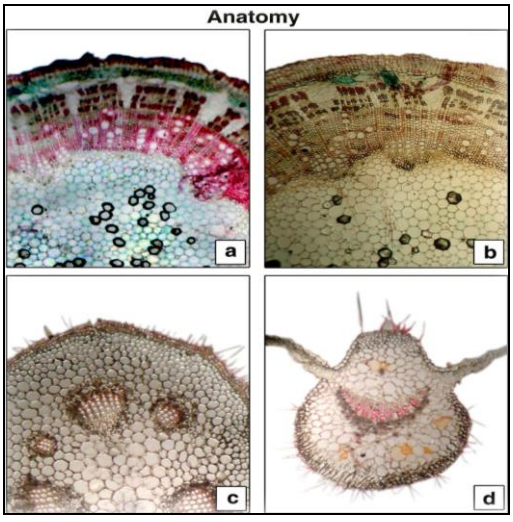

Fig 1: a. T.S. of Root, b. T.S. of Stem, c. T.S. of Petiole and d. T. S. of Leaf

4. Conclusion

Root anatomy has the characteristic layers of the dicotyledonous plants the most characteristic feature being phloem sclerenchyma in cortex. Parenchymatous cells of cortex and the pith are rich in starch grains and clustered crystals like the elements of the root of *Altheae* species. Moreover, 1-2 mucilaginous cells are present in the pith.

Leaf anatomy is very similar to that of *Malva sylvestris*; another member of the Malvaceae family (Yazgan *et al.*, 1986) [16]. But it can be differentiated from *Malva* sylvestris by its 2-yalered palisade parenchyma with big clustered crystals, mucilaginous cells and multicellular, long glandular hair. Neither the leaf of *Althea*nor *Malva* have these kinds of glandular cells. However, the characteristic elements of Malvaceae, such as short, multicellular glandular hairs, simple unicellular and multicellular tufted glandular hairs, tufted crystals and mucilaginous cells are observed in this species.

Clustered crystal and simple and clustered glandular hairs are observed in all of the studied organs of the plant. Multicellular and long glandular hairs of leaf and the stem are interesting. The towers of phloem sclerenchyma in the root are the characteristic elements to the plant.

5. Acknowledgement

The authors are thankful to Prof. and Head, Department of Botany, Dr. Babasaheb Ambedkar Marathwada University Aurangabad for the laboratory facility and constant encouragement. The authors are also thankful to Department of Biotechnology (DBT) New Delhi for the financial support.

6. References

1. Woodrow GM, Stapf O. *Abutilon ranadei*. Bull. Misc. Inform. Kew. 1894; 87:99.
2. Cooke T. The Flora of the Presidency of Bombay, Taylor & Francis, London, 1901, 1.
3. Nayar MP, Sastry ARK. Red Data Book of Indian Plants Botanical Survey of India, Calcutta, 1987, 1.
4. Venkanna P, Das Das SK. Malvaceae. In Flora of Maharashtra State Dicotyledons (Eds. Singh, N. P. & S. Karthikeyan), Botanical Survey of India, Calcutta. 2000; 1:299-303.
5. Ahmedullah M, Nayar MP. Endemic plants of Indian region Botanical Survey of India. Calcutta, 1986, 1.
6. Mistry MK, Almeida SM. Some rare, endangered and threatened plant species from Ratnagiri district, Maharashtra. J. Bombay Nat. Hist. Soc. 1989; 86:478-479.
7. Almeida MR. Flora of Maharashtra. Orient Press, Mumbai. 1996; 1:101-102.
8. Walter Kerry S. Harriet J Gillett. 1997-IUCN Red List of Threatened Plants. Published by IUCN, 1997.
9. Metcalf CR, Chalk L. Anatomy of Dicotyledons. The Clarendon Press, Oxford. 1965; 1:223-234.
10. Aysegul Guvenc, Aysemine Ozkan, Ceyda Sibel Erddurak, Maksut Coskun. Root, Stem and Leaf Anatomy of *Abutilon theophrasti* Medik. (Malvaceae). Pak. J. Bot. 2003; 35(3):351-359.
11. Yun JI, Taylor SE. Adaptive implications of leaf thickness for sun-grown and shade-grown *Abutilon theophrasti*. Ecology. 2006; 67(5):1314-1318.
12. Ramadoss Karthikeyan, Pannem Venkatesh, Nesepogu Chandrasekhar. Morpho anatomical studies of leaves of *Abutilon indicum* (Linn.) Sweet. Asian Pacific. J. of Tropical Biomedicine. 2012, S464-S469.
13. Adedeji O, Dloh HC. Comparative foliar anatomy of ten species in the genus *Hibiscus* Linn, in Nigeria. New Botanist. 2004; 31:147-180.
14. Warszawa Celka Z, Szkudlarz P, Biereznoj U. Marphological variation of hairs in *Malvaalcea* L. (Malvaceae). Biodiversity: Res. Conserv. 2006; 3(4):258-261.
15. NighatShaheen, Mir Ajab Khan, Ghazalah Yasmin, Muhammad Qasim Hayat, Shakira Munsif, Khalid Ahmad. Foliar Epidermal Anatomy and Pollen Morphology of the Genera *Alcea*and *Althaea*(Malvaceae) from Pakistan. Journal of Agriculture & Biology. 2010; 12(3):329-334.
16. Yazgan M, Uygunlar S, Demiray H, Ay G. Tibbi Bitkiler Anatomisi Uygulama Kilavuzu. Ege. Univ. Fen. Fak. Kitaplar Serisi, tzmir. 1986, 117.