

# Leaf epidermal traits of some species of *Terminalia* and their taxonomic implications

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## Abstract

The present paper deals with the leaf epidermal studies on four species of genus *Terminalia* growing in and around of Ahmednagar district (MS), India. Comparative foliar analysis of four species namely *T. bellerica*, *T. chebula*, *T. cattapa* and *T. tomentosa* was carried out by using light microscopy, and following routine scraping method. The study includes the characterization of foliar epidermis such as shape of epidermal cells, presence and type of stomata and trichomes and stomatal index. Such study would be useful in order to investigate their taxonomic relationship and to identify epidermal features that can be recognized and employed as useful taxonomic characters.

**Keywords:** Epidermal traits; *Terminalia* species; Microscopy.

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## INTRODUCTION

Genus *Terminalia* L. belongs to family Combretaceae comprising of nearly 200 species distributed throughout the humid, semi-humid, tropical and subtropical regions of the world (Deshmukh *et al*, 2009). Nearly about 24 species of *Terminalia* have been reported from various states/union Territories of India (Srivastav, 1991). *Terminalia* has various applications in pharmaceutical, indigenous medicine therapies and other chemical industries (Srivastav, 1991; 2003). Amongst all *Terminalia* species, *T. tomentosa*, *T. bellerica*, *T. chebula*, and *T. catappa* exhibited very high medicinal and economic properties and economic properties. Many times gross morphological characters are inadequate in classification of plants; hence in such cases the microscopic morphological characters are employed for taxonomic purpose. These characters such as hairs/

trichomes, epidermal cell type, stomata type etc of leaves. Leaves, probably anatomically the most varied organ of angiosperms have provided very valuable help in taxonomic matters. In the present work, foliar epidermal traits of four species of genus *Terminalia* i.e. *T. bellerica*, *T. chebula*, *T. tomentosa* and *T. catapa* have been studied and compared to work out their utilities as taxonomic features in identification of these taxa.

## MATERIALS AND METHODS

The plant specimen's viz. *Terminalia bellerica*, *Terminalia chebula*, *T. tomentosa* and *terminalia catapa* were collected from in and around of Ahmednagar district (MS) India. The collected plant specimens are identified with floras (Cook, 1958, Pradhan and Singh 1999). The specimens are preserved in the form of herbarium at department of botany S.M.B.S.T College, Sangamner. Foliar materials for epidermal studies were collected fresh from plants, growing in their natural environments. Samples of the material for slide preparations were taken identical regions of each leaf, generally from mid-away between the leaf base and apex of lamina including the mid rib. The epidermal peels were obtained using a sharp pointed forceps. In materials when peeling proved difficult a thin layer of nail varnish was spread over the leaf surface and allowed to dry. Some times in case of thick leaves they were macerated in Jeffrey's fluid. Peels were made from both adaxial and abaxial surfaces of leaf of each sample. The stripes were thoroughly washed with

distilled water, stained with 1% saffranin and then mounted in a drop of pure glycerol on a glass slide. A cover glass was placed over the drop and sealed with nail polish or DPX. 10 slides were prepared for each of the species. The slides were examined with light microscope and the epidermal features studied. The features observed includes: type of stomata, nature of the epidermal cells; nature of trichomes (if present); nature of distribution and dimension of stomata. The stomatal dimension considered were the length and breadth and also the stomatal number and stomata index (SI) which is given as formula (Salisbury, 1927, 1932).

$$SI = \frac{S}{E + S} \times 100$$

Where,

S- The number of stomata per field of view.

E- The corresponding number of epidermal cells.

## RESULTS AND DISCUSSION

### Epidermal Cell Complex

The epidermal cells on both the surfaces in the intercostals zones of leaves of genus *Terminalia* are

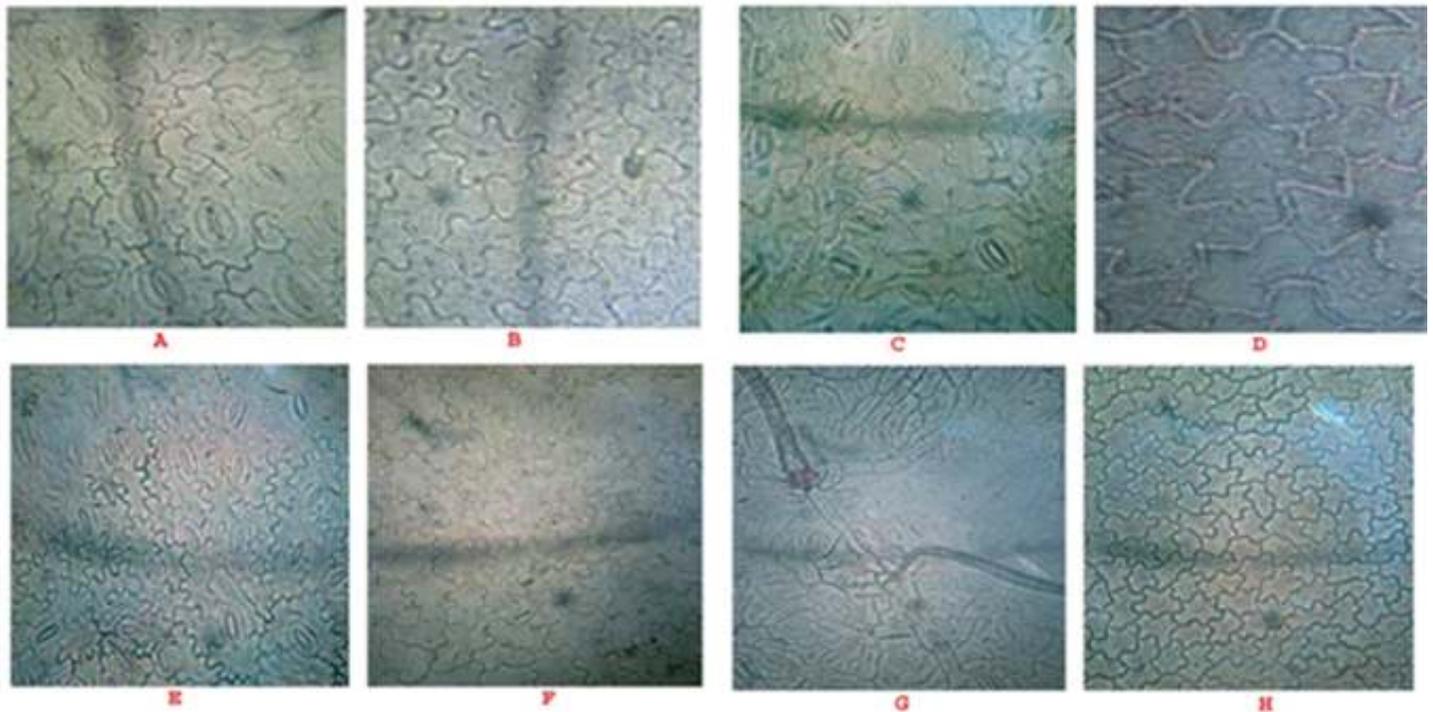
generally polygonal, uneven shaped with undulate and straight walls. The cell walls were thin in majority of the species (Fig.1). The walls both on adaxial and abaxial surfaces were undulate in all species except in *T. catappa* where it is straight at lower side (Fig.1-GandH). In all the species under present study, the epidermal cells on adaxial surface were large.

### Stomatal Complex

The stomata in all the species of *Terminalia* studied are hypostomatic except in *T. tomentosa* where it is on both side. The stomata were anomocytic in species (Fig.1-EandF). The stomatal number 38 in *Terminalia bellerica*, 23.66 in *T. chebula*, 40 in *T. tomentosa* and 36.33 in *T. catappa* (Table 2). The Stomatal Index 44.14 in *Terminalia bellerica*, 25.16 in *T. chebula*, 25.96 in *T. tomentosa* and 21.91 in *T. catappa*. The upper epidermis of *T. tomentosa* 4.81 (Table 2). The size i.e. length and breadth also counted were presented in table (2).

### Trichome Complex

The epidermal trichome complex showed great diversity in structure and distribution. In the present study the trichomes occur only in one species of *Terminalia* i.e. *T. catappa*. The trichomes were uniseriate and unbranched.



**Figure 1:** Photomicrographs (400x) of Adaxial and Abaxial layer of leaf epidermis of the genus *Terminalia* [A and B: lower and upper epidermis of *Terminalia bellerica*; C and D: lower and upper epidermis of *Terminalia chebula*; E and F: lower and upper epidermis of *Terminalia tomentosa*; G and H: lower and upper epidermis of *Terminalia catappa*].

**Table 1:** Data of Foliar Epidermal cells and Stomata in genus *Terminalia*

Species	Leaf Abaxial (upper Surface)							Leaf Adaxial (Lower Surface)						
	Epidermal Cell		Stomatal Number		Stomatal Index ( $\mu\text{m}$ )		Stomatal Type	Epidermal Cell		Stomatal Number		Stomatal Index ( $\mu\text{m}$ )		Stomatal Type
	Anticlinical cell wall	Surface	Range	Mean	Range	Mean		Anticlinical cell wall	Surface	Range	Mean	Range	Mean	
<i>T. bellerica</i>	undulate	Thin areas	-	-	-	-	-	undulate	Thin areas	35-41	38	43.20-45.05	44.14	Anomocytic
<i>T. chebula</i>	undulate	Thin areas	-	-	-	-	-	undulate	Absent	19-31	23.66	22.89-29.52	25.16	Anomocytic
<i>T. tomentosa</i>	undulate	Thin areas	4-5	4.66	4.34-5.15	4.81	Anomocytic	undulate	Thin areas	38-42	40	25.80-26.08	25.96	Anomocytic
<i>T. catappa</i>	undulate	Thin areas	-	-	-	-	-	straight	papillae	34-39	36.33	21.25-22.80	21.91	Anomocytic

**Table 2:** Size of Stomata ( $\mu\text{m}$ )

Species	Stomata			
	Length		Breadth	
	Range	Mean	Range	Mean
<i>T. bellerica</i>	33.32-39.99	37.76	26.66	26.66
<i>T. chebula</i>	26.66-33.32	28.74	13.33-19.99	17.77
<i>T. tomentosa</i>	26.66-33.32	28.88	19.99	19.99
<i>T. catappa</i>	26.66-26.86	26.66	19.99	19.99

## CONCLUSION

The present study on the foliar leaf anatomical study of genus *Terminalia* provides useful information on its correct identity at species level by using these anatomical features. Anatomical structures are most likely to provide concerning the interrelationship of larger groups such as families, or in helping to establish the real affinities of genera of uncertain taxonomic status. So far as the foliar anatomical studies of leaves are concerned. Quantitative microscopy plays an important role in determining the different species in particular genus or even the adulteration of other leaves in a particular genuine sample. The number of stomata, epidermal cells and stomatal index give the constant figure so far as the different species of leaves are concerned. Not only we get definite idea about the different species in a particular genus but with the help of quantitative microscopy we can go a step forward in identifying leaves of different plants. Moreover different types of stomata, epidermal cells and trichomes are playing great role in the identification of different plants at species level. Stomatal frequency as well as their distribution on leaf surfaces is often correlated with plant habit. According to Shanmukh Rao and Ramayya (1981) that the trees and shrubs possess hypostomatic and herbs possess amphistomatic leaves. In the present study all these species have

hypostomatic leaves. The epidermal trichome complex showed great diversity in structure and distribution. The trichome diversity has been used as lot of identification of plants from ordinal rank to specific level (Metcalfe and Chalk, 1950). Hence based on the foliar anatomical features the key is prepared for the taxonomy of genus *Terminalia*.

### Indented Key

1. Epidermal cell wall pattern undulate:
2. Stomatal index less than 30:
3. Trichomes present -*T. tomentosa*
3. Trichomes absent -*T. chebula*
2. Stomatal index more than 30 -*T. bellerica*
1. Epidermal cell wall pattern straight -*T. catappa*

### Bracketed Key

- 1a Epidermal cell wall pattern undulate -2
- 1b Epidermal cell wall pattern straight -*T. catappa*
- 2a Stomatal index less than 30 -3
- 2b Stomatal index more than 30 -*T. bellerica*
- 3a Trichomes present -*T. tomentosa*
- 3b Trichomes absent -*T. chebula*

The present study on foliar epidermal features, on the leaf of *Terminalia* will help to identify the correct species of the plant, since no such scientific data are available for the same.

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