

Foliar epidermal traits in some species of genus *Ficus*

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Abstract

Present paper deals with the foliar epidermal features of some species of genus *Ficus*. Leaf epidermal studies were carried out on five species of genus *Ficus* i.e. *F. benghalensis*, *F. religiosa*, *F. amplissima*, *F. glomarata* and *F. carica* commonly growing in and around of Akole tehsil of Ahmednagar district. The study includes the characterization of foliar epidermis such as shape of epidermal cells, presence and type of stomata and trichomes and stomatal index plays a key role in the identification of these species

Keywords: Epidermal traits; *Ficus* species; Microscopy

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INTRODUCTION

In taxonomy, one of the principle aims is to provide a system of classification of living organisms based on evolutionary trends. For this construction there is a need of characters that are drawn from various sources and microscopic characters are one of them. Moreover, in taxonomic classification when gross morphological characters are inadequate, 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. Among angiosperms, epidermal characters after taxonomically important evidence (Linsabauer, 1930; Metcalf and Chalk, 1950; Tomlinson, 1961; Stace, 1965; Ghose and Davis, 1973; Verhoeven and Schiff, 1973) have listed numerous features of

epidermis that are now being used frequently in taxonomic studies. These characters include, hairs, trichomes, stomata, epidermal cell type, crystals etc. are of taxonomic importance, also relatively constant for Species to species. Hickey (1973) has proposed detailed terminology to describe for various architectural features of dicotyledonous leaves. Cuticular characters like epidermis and stomata have been of great use in taxonomy of several taxa. The size and Shape of Epidermal Cells would be of use in Classification of different Levels. Majority of the flowering plants can be readily identified with as much ease by their vegetative characters as by their floral structures. The Significance of data on epidermal features in traditional has long been recognized because the variations within a species genus or family are usually reflected in anatomical features. As well, Carlquist (1961) regarded that the leaves of plants provide a variety of anatomical characters, which can be employed as useful taxonomic characters. trichome characters are taxonomically significant in determining the phonetic relationship at even generic level. The genus *Ficus* belongs to family Moraceae is commonly distributed in tropical countries of the world. Most of the species are of their habits also used in ayurvedic and folk medicine in India. In the present work, foliar epidermal traits of five species of genus *Ficus* i.e. *F. benghalensis*, *F. religiosa*, *F. amplissima*, *F. glomarata* and *F. carica* have been studied and compared to work out their utilities as taxonomic features in identification of these taxa.

MATERIALS AND METHODS

The plant specimens viz. *Ficus benghalensis*, *Ficus glomerata*, *Ficus religiosa*, *Ficus amplissima* and *Ficus carica* were collected from the forest as well as from the urban area of Akole tehsil of Ahmednagar Distric (MS), India. The collected plant specimens are identified with floras (Cook, 1958, Pradhan and Singh 1999). 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

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

Species	Leaf Abaxial (upper Surface)						Leaf Adaxial (Lower Surface)							
	Epidermal Cell		Stomatal Number		Stomatal Index (µm)		Stomatal Type	Epidermal Cell		Stomatal Number		Stomatal Index (µm)		Stomatal Type
	Side	Surface	Range	Mean	Range	Mean		Side	Surface	Range	Mean	Range	Mean	
<i>Ficus religiosa</i>	C	Sm	-	-	-	-	-	St,,C	S	15-19	17	4.34-5.77	5.01	Paracytic
<i>Ficus glomerata</i>	St,C	Sm	-	-	-	-	-	St,C	S	40-48	43.4	21.97-30.37	25.55	Anomocytic
<i>Ficus amplissima</i>	St,C	Sm	-	-	-	-	-	St,C	Sm	16-19	18.2	9.19-13.04	10.80	Paracytic
<i>Ficus benghalensis</i>	St	Sm	-	-	-	-	-	St,C	Sm	48-55	51.8	14.54-18.03	16.07	Anomocytic
<i>Ficus carica</i>	St	Sm	-	-	-	-	-	Sn	Sm	35-44	40	21.47-26.99	24.57	Anomocytic

Table 2: Size of Stomata (µm)

Species	Lower Epidermis											
	Length in Range (Stomata)		Mean	Breadth In Range (Stomata)		Mean	Length In Range (Pore)		Mean	Breadth in Range (Pore)		Mean
<i>Ficus religiosa</i>	19.08-32.72		26.72	13.63-24.54		20.72	13.63-19.08		15.81	5.45-8.18		6.54
<i>Ficus glomerata</i>	16.36-24.54		20.72	10.90-19.08		15.27	8.18-13.63		10.36	2.72-8.18		5.45
<i>Ficus amplissima</i>	32.72-46.35		40.35	24.54-35.45		31.08	21.81-27.27		25.63	5.45-8.18		6.54
<i>Ficus benghalensis</i>	19.08-27.27		22.90	16.36-21.81		19.08	5.45-13.63		9.81	5.45-10.90		8.18
<i>Ficus carica</i>	10.90-24.54		17.45	8.18-19.08		13.63	8.18-13.63		10.90	2.72-5.45		4.36

Epidermal Cell Complex

The epidermal cells on both the surfaces in the intercostals zones of leaves of genus *Ficus* are generally polygonal, uneven shaped with straight and curved sinuous walls. The cell walls were thin in majority of the species. The walls both on adaxial and abaxial surfaces were straight and rounded in *Ficus benghalensis*, *F. religiosa*, *F. glomerata* and *F. amplissima* and the epidermis Cell walls were straight and rounded on adaxial and wavy on abaxial surface in *Ficus carica* (Table 1). In majority of species under present study the epidermal

cells on adaxial surface were large (Table 1). The epidermal cell frequency (µm) varied between 32.72 and 82.99 on adaxial surface and between 22.90 and 49.08 on the abaxial surface in all the species studied (Table 1).

Stomatal Complex

The stomata in all the species of *Ficus* studied are hypostomatic. The stomata were anomocytic in *F. glomerata*, *F. benghalensis* and *F. carica*, while paracytic in *Ficus religiosa* and *Ficus amplissima*. The stomatal number 17 in *F. religiosa*, 43.4 in *F. glomerata*, 18.2 in *F. amplissima*, 51.8 in *F. benghalensis* and 40 in *F. carica*

(Table 1).The Stomatal Index 5.01 in *Ficus religiosa*, 25.55 in *F.glomerata*, 10.80 in *F. amplissima*; 16.07 in *F. benghalensis* and 24.57 in *F.carica* (Table 1).The size ie. 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 two species of *Ficus* i.e. *F.benghalensis* and *F.carica*.The trichomes were uniseriate and unbranched.The types of trichomes were uniseriate macroform,conical hairs in *Ficus carica*.

CONCLUSION

The present study on the foliar leaf anatomical study of genus *Ficus* 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 (Metcalf and Chalk, 1950). The present study on foliar epidermal features, on the leaf of *Ficus* will help to identify the correct species of the plant, since no such scientific data are available for the same. Hence based on the foliar anatomical features the key is prepared for the taxonomy of genus *Ficus*.

Indented Key

1. Stomata paracytic:
 2. Lower stomatal surface smooth ---- *F. amplissima*
 2. Lower stomatal surface striated ---- *F. religiosa*
1. Stomata anomocytic:
 3. Trichome present; stomatal surface smooth:
 4. Stomatal index 16.07 ---- *F. benghalensis*
 4. Stomatal index 24.57 ---- *F. Carica*
 - 3.Tirchome absent;stomatal surface striated ---- *F.glomerata*

Bracketed Key

- | | |
|----|---|
| 1a | Stomata paracytic ----- 2 |
| 1b | Stomata anomocytic ---- 3 |
| 2a | Lower stomatal surface smooth --- <i>F. amplissima</i> |
| 2b | Lower stomatal surface striated --- <i>F. religiosa</i> |
| 3a | Trichome present; stomatal surface smooth --- 4 |
| 3b | Tirchome absent; stomatal surface striated ---- <i>F. glomerata</i> |
| 4a | Stomatal index 16.07 ---- <i>F. benghalensis</i> |
| 4b | Stomatal index 24.57 ----- <i>F. carica</i> |

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