



Systematic Petiole Anatomical Studies of Few Species of the Genus Ficus

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Abstract:

The present research was made on anatomy of petiole of *Ficus benghalensis* L., *Ficus carica* L. and *Ficus racemosa* L. The aim was to contribute with more information concerning the knowledge of anatomy. All three species belongs to the family Moraceae. The genus Ficus is remarkable for the large variation in the habits of its species. Some species of Ficus shows noticeable development of aerial roots, they may start life as epiphytes. Less reports were available on petiole anatomical studies, hence present efforts were undertaken to investigate the microscopic studies. The conjoint, collateral and open vascular bundles observed. Perimedullary phloem patches with laticifers present in pith region. Perimedullary phloem associated with some xylem vessels. Latex ducts, laticifers, tannin cells, crystals and trichomes were few main characters found in present investigation of petiole anatomy of selected plants.

Keywords: *Ficus benghalensis* L., *Ficus carica* L., *Ficus racemosa* L., Anatomy, Crystals, tannin cells etc.

Introduction

Moraceae is one of the largest family in dicotyledon, distributed all over India and various part of the world mostly in tropical region. Linnaeus (1753) founded genus Ficus with 7 species out of which 4 are found in India. Genus Ficus includes more than 1000 species, it consist of important group of tree with medicinal values and also religious importance. Genus Ficus includes Trees, shrubs, climbers, stranglers, or sometimes woody epiphytes, evergreen or deciduous, with latex. Monoecious species with male, gall (sterile female) and female flowers in each fig or dioecious with either male and gall flowers or only female flowers in each fig.

The genus is remarkable for the large variation in the habits of its species. Some species of Ficus shows remarkable development of aerial roots and they may start life as epiphytes. Moraceae is one of the largest family in dicotyledonous, distributed all over India and various part of the world mostly in tropical region. In Moraceae Large number of species are found to be economically important mostly for fruits, timber, medicine etc. Anatomy is very helpful for individual identification for example microscopical methods are important in establishing the identity of herbarium specimen which are not accompanied by flowers or fruits.

Vernacular Names of *Ficus benghalensis* L.: English- Banyan, Hindi- Bat, Bargad and Bar, Marathi- Vad, Sanskrit- Borh, Nyagrodha.

Vernacular Names of *Ficus carica* L.: English- Common Fig, Marathi- Anjir.

Vernacular Names of *Ficus racemosa* L.: English- Gular fig or Cluster fig, Hindi- Gular, Marathi- Umbar, Sanskrit- Udumbara.

Kingdom - Plantae
Subkingdom - Tracheobionta
Super division - Spermatophyta
Division - Magnoliophyta
Class - Magnoliopsida
Subclass - Hamamelididae
Order - Urticales
Family - Moraceae
Genus - *Ficus*

Species- *benghalensis* L.

Materials and Methods

Material collection

The plant material of *Ficus benghalensis* L., *Ficus carica* L. and *Ficus racemosa* L. was collected from different localities in Amravati, various river sides, in the month of January 2017. It is found throughout the year, grows in evergreen except dry local region, tree found near watery area like near valley, river side area. Vegetative study was carried out and confirmation was made with standard floras.

Method

Morphology of the plant material was observed and studied. The required samples petiole were cut and fixed in F.A.A., Hand cut sectioning had been taken with the help of raiser.

Result and discussion

Macroscopic study

Ficus benghalensis L.

Large tree, grows up to 30 m in height, sometime epiphytic, aerial root sending down to earth, rough, whitish brown, grey, leaf simple, alternate, 10-16 cm long and 7-10 cm broad, petiole 1-5 cm stout, stipules ovate 2-3 cm long coriaceous, ovate orbicular-ovate or elliptic, entire margin apices obtuse, upper surface glabrous and pubescent to lower. Reticulate venation, Inflorescence hypanthodium type. Fruit a syconium, globose, red coloured when ripe.

Ficus carica L.

Large shrub or small tree deciduous, grows up to 4-10 m in height, aerial erect, solid cylindrical, branching from base, smooth, dull white, leaf simple alternate, 5 ranked or 2/5, 8-30 cm long and 12-25 cm broad, petiole filiform terete 2-5 cm, stipules two caduceus leaving scar on falling, ovate, margine crenate, serrate, apices acute, subacute and obtuse, surface rough hairy base and upper pubescent hairs, Reticulate unicosted venation, base cordate. Inflorescence hypanthodium type. Fruit a syconium, globose, yellowish purple coloured when ripe.

Ficus racemosa L.

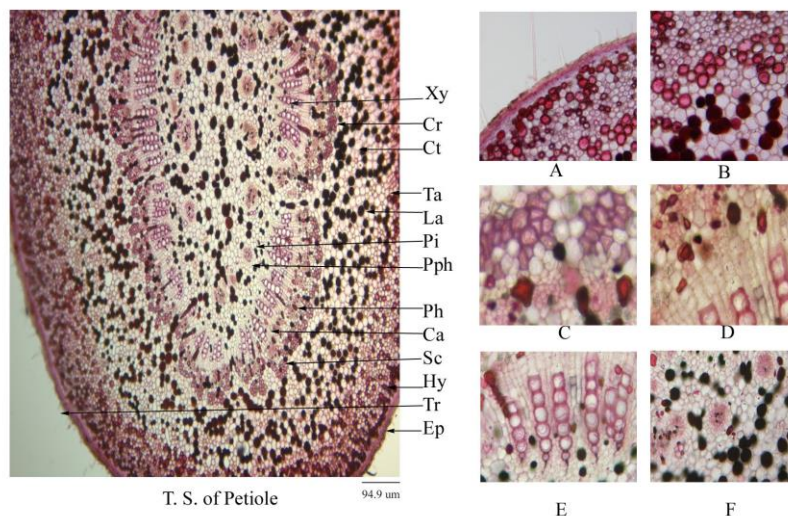
Large tree, sometime epiphytic, grows up to 20 m in height, stem aerial erect, solid, hairy (Glabrous, pubescent or scaberulous), grey, reddish brown, rough, leaf simple, alternate, 4.5-15 cm long and 3.5-7 cm broad, petiole glabrous, 1-3 cm, stout, stipules ovate, lanceolate, pubescent, 2-3 cm long, ovate oblong elliptic lanceolate, entire margine apices bluntly pointed, surface pubescent hairy (when mature both side glabrous). Reticulate unicosted venation, base acute or rounded three nerved. Inflorescence hypanthodium type. Fruit a syconium, sub-globose, orange red coloured when ripe.

Microscopic study

• Transverse section of petiole *Ficus benghalensis* L.

Outline of transverse section showed oval shaped structure. Trichomes unicellular, nonglandular present abundantly. Cuticle very thick. Epidermis single layered; cells oval, rectangular, squarish and barrel shaped. Recorded average $6.51 \pm 0.66 \times 8.43 \pm 1.32 \mu\text{m}$ and range $5.75-6.9 \times 6.9-9.2 \mu\text{m}$. Hypodermis 7-10 layered composed of angular collenchyma, cells compactly arranged, thick walled; circular, oval and polygonal in shape. Recorded average $10.73 \pm 4.78 \times 9.96 \pm 3.51 \mu\text{m}$ and range $6.9-16.1 \times 6.9-13.8 \mu\text{m}$. Ground tissue composed of parenchyma; cells thin walled, circular, oval and polygonal in shape. Recorded average $22.2 \pm 10.86 \times 21.4 \pm 9.57 \mu\text{m}$ and range $13.8-34.5 \times 13.8-32.2 \mu\text{m}$.

Many vascular bundles arranged to form oval shaped structure. Sclerenchyma fibres forms cap like structure above each vascular bundle; 3-6 layered in patches, cells with thick walled narrow lumen, compactly arranged, polygonal to wedge shaped. Recorded average $9.96 \pm 1.32 \times 8.05 \pm 1.15 \mu\text{m}$ and range $9.2-11.5 \times 6.9-9.2 \mu\text{m}$. Phloem 8-10 layered, cells thin walled, compactly arranged; circular, oval, triangular and polygonal in shape. Recorded average $4.21 \pm 0.66 \times 4.6 \pm 1.15 \mu\text{m}$ and range $3.45-4.6 \times 3.45-5.75 \mu\text{m}$. Vascular cambium 5-7 layered; cells compactly arranged, tangentially elongated to squarish shaped. Recorded average $9.96 \pm 1.32 \times 4.21 \pm 0.66 \mu\text{m}$ and range $9.2-11.5 \times 3.45-4.6 \mu\text{m}$. Xylem vessels present in rows forming cylinder. Vessels thick walled, circular to oval in shape. Recorded average $16.86 \pm 7.02 \times 16.1 \pm 6.8 \mu\text{m}$ and range $9.2-23 \times 9.2-20.7 \mu\text{m}$.



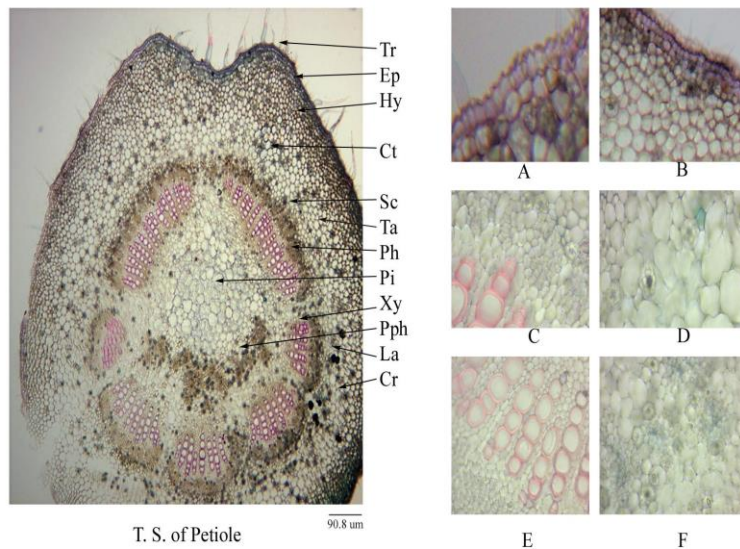
T. S. of Petiole: (M-4X) Tr- Trichome, Ep- Epidermis, Hy- Hypodermis, Ct- Cortex, Sc- Sclerenchyma fibres, Ph- Phloem, Ca- Cambium, Xy- Xylem, Pi- Pith, Cr- Crystals, La- Laticifers, Ta- Tannin cells, Pph- Perimedullary phloem patches
A- Epidermis, B- Hypodermis and cortex, C- Sclerenchyma fibres, D- Phloem, E- Xylem, F- Perimedullary phloem patches

The conjoint, collateral and open vascular bundles observed. Perimedullary phloem (phloem that present at the medullary or pith region and other than phloem of vascular bundle) patches with laticifers present in pith region. Perimedullary phloem associated with some xylem vessels. Crystal containing idioblasts, sphaeraphides, tannin sacs, laticifers, found abundantly in all the tissues.

- **Transverse section of petiole *Ficus carica* L.**

Outline of transverse section showed circular structure with notch at one side. Unicellular, non glandular trichomes of variable length present abundantly. Thick cuticle. Epidermis single layered, cells rectangular, squarish, barrel shaped. Recorded average $9.96 \pm 1.32 \times 8.43 \pm 1.32 \mu\text{m}$ and range $9.2-11.5 \times 6.9-9.2 \mu\text{m}$. Hypodermis 8-10 layered composed of angular collenchyma, cells compactly arranged thick walled, circular, oval and polygonal in shape. Recorded average $13.03 \pm 9.29 \times 12.2 \pm 8.07 \mu\text{m}$ and range $4.6-23 \times 4.6-20.7 \mu\text{m}$. Ground tissue composed of parenchyma; cells thin walled with wavy outline, loosely arranged, circular, oval and polygonal in shape. Recorded average $40.63 \pm 26.8 \times 39.86 \pm 28.1 \mu\text{m}$ and range $11.5-64.4 \times 9.2-64.4 \mu\text{m}$.

Ficus carica L.

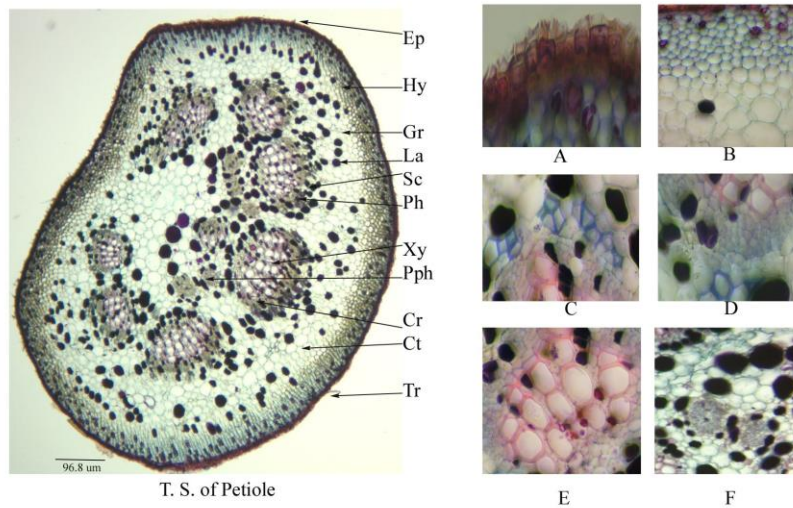


T. S. of Petiole: (M-4X) Tr- Trichome, Ep- Epidermis, Hy- Hypodermis, Ct- Cortex, Sc- Sclerenchyma fibres, Ph- Phloem, Xy- Xylem, Pi- Pith, Cr- Sphaeraphide crystals, La- Laticifers, Pph- Perimedullary phloem patches, Ta- Tannin cells
 A- Epidermis, B- Hypodermis and cortex, C- Sclerenchyma fibres and phloem, D- Crystals, E- Xylem, F- Perimedullary phloem patches

Many vascular bundles arranged to form circular structure. Sclerenchyma fibres forms cap like structure above each vascular bundle; 2-4 layered in patches, cells with thick walled narrow lumen, compactly arranged, polygonal to wedge shaped. Recorded average $9.96 \pm 3.51 \times 11.5 \pm 6.085 \mu\text{m}$ and range $6.9-13.8 \times 6.9-18.4 \mu\text{m}$. Phloem 5-6 layered, composed of thin walled compactly arranged, cells circular, oval, triangular and polygonal in shape. Recorded average $4.6 \pm 1.15 \times 5.75 \pm 1.99 \mu\text{m}$ and range $3.45-5.75 \times 4.6-8.05 \mu\text{m}$. Vascular cambium not observed. Xylem vessels present in row and form a cylinder. Vessels thick walled, circular and oval in shape. Recorded average $18.4 \pm 4.6 \times 17.63 \pm 3.51 \mu\text{m}$ and range $13.8-23 \times 13.8-20.7 \mu\text{m}$. The conjoint, collateral and closed vascular bundles observed. Some perimedullary phloem patches present at central pith. Sphaeraphides crystals, tannin cells observed in all the tissues abundantly. Laticifers noted specially at phloem region and all the tissues.

- **Transverse section of petiole *Ficus racemosa* L.**

Outline of transverse section bean shaped. Small, few, nonglandular unicellular simple, trichomes present. Cuticle thin. Epidermis single layered cells rectangular, squarish and oval in shape. Recorded average $4.52 \pm 0.13 \times 4.21 \pm 0.66 \mu\text{m}$ and range $4.37-4.6 \times 3.45-4.6 \mu\text{m}$. Hypodermis 7-8 layered composed of angular collenchyma, thick walled, circular, oval and polygonal in shape. Recorded average $10.73 \pm 2.65 \times 12.26 \pm 3.51 \mu\text{m}$ and range $9.5-13.8 \times 9.2-16.1 \mu\text{m}$. Ground tissue composed of parenchyma; cells thin walled with wavy outline, loosely arranged; circular, oval and polygonal in shape. Recorded average $29.1 \pm 19.1 \times 31.4 \pm 23 \mu\text{m}$ and range $13.8-50.6 \times 13.8-57.5 \mu\text{m}$.

Ficus racemosa L.

T. S. of Petiole: (M-4X) Tr- Trichome, Ep- Epidermis, Hy- Hypodermis, Ct- Cortex, Sc- Sclerenchyma fibres, Ph- Phloem, Xy- Xylem, Pi- Pith, Cr- Crystals, La- Laticifers, Pph- Perimedullary phloem patches
 A- Epidermis, B- Hypodermis and cortex, C- Sclerenchyma fibres and phloem, D- Cambium, E- Xylem, F- Perimedullary phloem patches

Some large and many small scattered vascular bundles observed. Externally each vascular bundle surrounded by sclerenchyma. Sclerenchyma 2-4 layered in patches, thick walled cells, compactly arranged, triangular, polygonal in shape. Recorded average $11.5 \pm 2.3 \times 11.5 \pm 2.3 \mu\text{m}$ and range $9.2-13.8 \times 9.2-13.8 \mu\text{m}$. Phloem 5-7 layered, composed of thin walled, compactly arranged; cells circular, oval triangular and polygonal in shape. Recorded average $5.36 \pm 1.32 \times 4.98 \pm 0.66 \mu\text{m}$ and range $4.6-6.9 \times 4.6-5.75 \mu\text{m}$. Vascular cambium not observed. Xylem vessels arranged in rows, in radial multiple of 4-6. Vessels thick walled; circular to oval shaped. Recorded average $29.1 \pm 25.85 \times 32.96 \pm 21.3 \mu\text{m}$ and range $6.9-57.5 \times 18.4-57.5 \mu\text{m}$. The conjoint, collateral and closed vascular bundles observed. Some perimedullary phloem patches present at centre. Laticifers noted specially at phloem and all the tissues.

Conclusion

The Information in present paper provides detail Anatomical data which will be very useful for researchers and students. Trichomes were simple non-glandular types observed. Perimedullary phloem patches with laticifers present in pith region of all the petioles of selected plants. Perimedullary phloem associated with some xylem vessels. Laticifers, Latex ducts, tannin cells, crystals of various types and trichomes were few main characters found in present investigation of petiole anatomy of selected plants.

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