



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: III Month of publication: March 2019

DOI: <http://doi.org/10.22214/ijraset.2019.3379>

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Comparative Morphological, Anatomical Study and Stomatal Density in different Urban Areas of *Pongamia pinnata*, (L.) Pierre.; and *Thespesia populnea*, Cav.; in Coimbatore with Special Reference to Environmental Factors

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Abstract: *Plants are made up of shoot system and root system. Shoot system is above the ground level includes stem, leaves, flower and fruit. Root system includes root, underground organs and rhizomes (Jeffrey, 1917). Leaves are green, flat, thin, expanded lateral appendages of stem.*

Leaf cell have epidermis, Mesophyll and vascular tissues. Epidermis is outer layer which secrete a waxy coating called cuticle for retain water. Stomata occupy in epidermis which allows plants to exchange gases and retain water. In general stomatal density refers the number of stomata in a unit area.

*Light, moisture, temperature, humidity, carbon dioxide contents are some factors that may create significant changes in ecosystem. Comparative morphological, anatomical characters and study on stomatal density with respect to urban areas in Coimbatore evaluated the influence of environmental factors on stomatal density. The most significant variation occurred in *Pongamia pinnata*, (L.) Pierre.; and *Thespesia populnea*, Cav.; Morphological and anatomical characters variations were least but not insignificant.*

Leaf sizes of samples were reduced in different urban areas. Stomata density of samples reflect important changes in atmospheric composition as well as other kinds of environmental stresses. This diagnostic character raises the question of their value in phylogeny reconstruction.

Keywords: *Morphological, Anatomical characters, Leaf size, Stomatal density, urban area, Environmental factors.*

I. INTRODUCTION

Plant morphology examines ultrastructure with aid of electron microscope through overlapping plant anatomy. Plant anatomy in general study of internal structure of plants but now often investigated at cellular level and often includes sectioning of tissues and observation through microscope.

Middle layer Mesophyll composed of palisade and spongy mesophyll tissues. Leaf vascular tissues are found in spongy mesophyll which have of xylem and phloem for transport of water and nutrients (Jeffrey, 1917).

Number of stomata present in a unit area term as stomatal density. In general stomatal density sensitive to environmental conditions due to that decreases the amount which occurs in high concentrated. Pollution is one of the major problems that affect by our planet. Most of the cities are victims of air pollutions due to human uncontrolled population and pollution creating by them. Vehicles expel high amount of air pollutant to outside that contaminating air.

When peoples respire it creates respiratory problems (Richard, 1987). In traffic area numbers of stomata will less due to rising carbon dioxide. Plants commonly respond to increase atmospheric CO₂ by adjusting their uptake of CO₂ and their water loss. When trees does not get much light there is more stomata so intake of CO₂ enough to complete photosynthesis. On other hand plant get lot of light has a low stomatal density because it is opens more during the course of the day and able to complete photosynthesis more often. Shade leaves are larger and thinner than normal sun leaves and often appear darker green.

II. MATERIALS AND METHODS

A. Study Area (Plate-1)

Tamil Nadu a south Indian state located extreme south of the sub-continent. Coimbatore is a major city in Tamil Nadu located on the banks of the Noyyal river and surrounded by the Western Ghats. Coimbatore has an average elevation of 2 metres covers population of 11, 87,604. The selected areas are Ramanathapuram, Sungam, Race course, souripalayam Pirivu, Singanallur and puliyakulam. The six areas connected to each other for bus transport. Air pollution, lack of proper waste management infrastructure and degradation of water bodied are the major environmental issues in Coimbatore.

B. Selected Sample (Plate-2)

The selected leaf samples collected during in the month of October, 2018. These plants are identified by using Flora of the Presidency of Madras, J.S. Gamble, (reprinted 2014). After that observed the morphological and anatomical characters.

- 1) *Morphological Observation (Jeffrey, 1917)*: The morphological characters were observed like hair, trichomes, special glands, surface, length, structure or shape of leaves by using simple microscope.
- 2) *Anatomical Observation (Jeffrey, 1917)*: After morphological observation determine anatomy of leaves by using staining.
- 3) *Measuring of Stomatal Densities (Jeffrey, 1917)*: Fresh leaves are collected and lower epidermis spread a thin layer of nail polish on the surface leave to dry. Place a strip of clear stick tape on nail polish peel. Place impression on slide. Using Razar blade removes excess part. Take stomata and Label the side with the plant name. Observed by using microscope having magnification 400X and 100X (Raynor, 1985).
- 4) *Statistical Data Analysis (Jeffrey, 1917)*: For compare to epidermal cells count the number of stomata at least five areas. Take photographs through the eyepiece. The equation used to find the area was πr^2 . Record the data and calculate stomatal density by using graph compare

Plate-1: Studied area of the selected samples

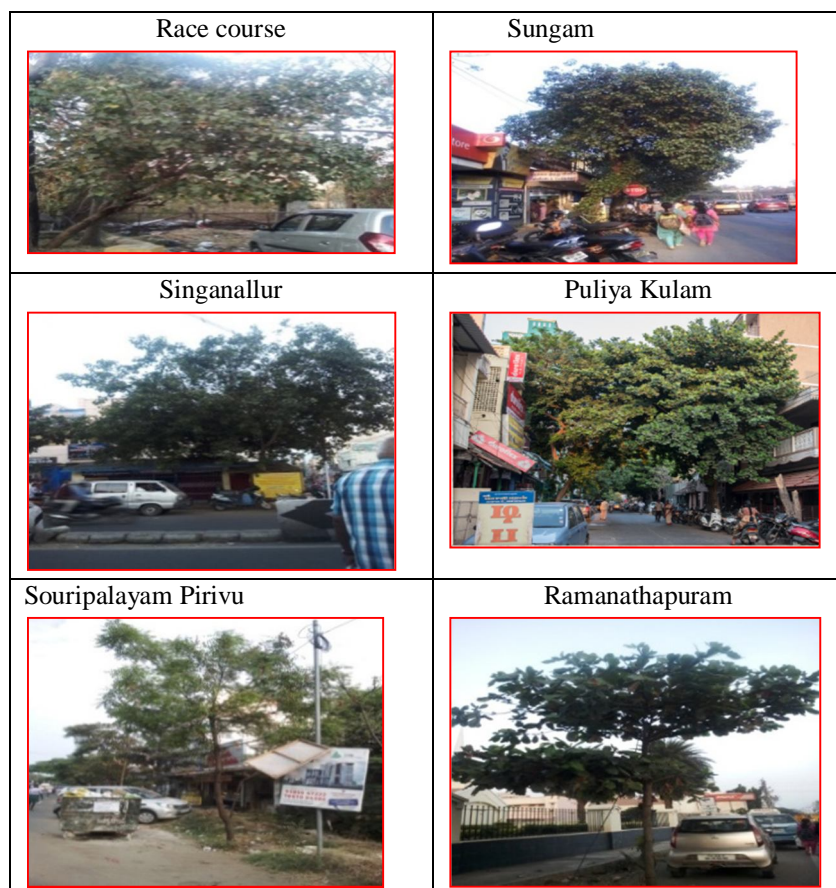
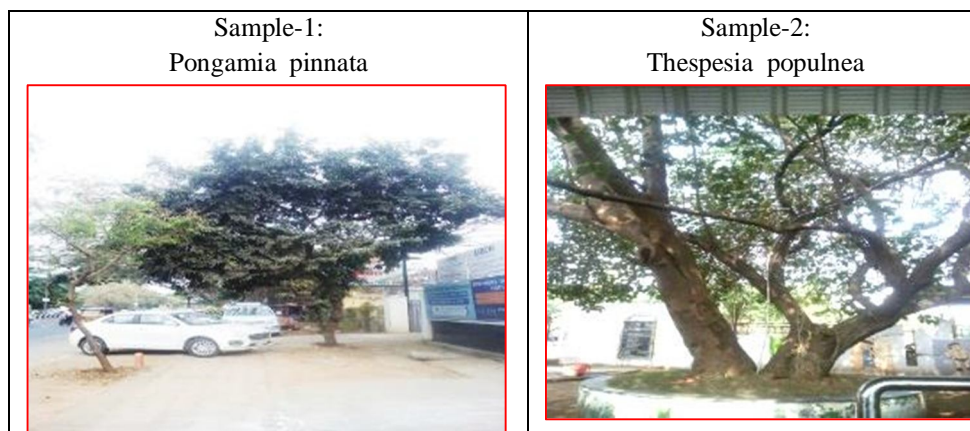


Plate-2: Habit of selected samples



C. *Sample- 1: Pongamia Pinnata, (L.) Pierre.; (Plate-2)*

Systematic Position

Division : Mangoliophyta
 Class : Mangoliopsida
 Order : Fabales
 Family : Leguminosae
 Genus : *Pongamia*

Species : *P. pinnata, (L.) Pierre.;*

1) *Plant Description*

- a) Native to tropical sub-tropical areas. It is medium sized, evergreen, glabrous tree with straight crooked trunk and broad crown of spreading branches, bark thick greyish brown with white wood.
- b) Leaves alternate, imparipinnate with long slender leaf stalk, hairless pinkish-red on young.
- c) Inflorescence raceme like with fragrant flower, calyx companulate, corolla white or pinkish white Pods smooth, hard, indehiscent, seed on reniform, rather thick.

2) *Uses*

- a) Oil is used as active against microbes. Aliments are used against piles, skin diseases and wound. *Pongamia pinnata* is cultivated as ornamental in garden along the avenues and roadsides.
- b) It acts as a host plant for lac insect, leaves serve as green manure and as fodder. Seeds contain pongam oil, bitter, red brown, thick, non-drying oil

D. *Sample: 2-Thespesia Populnea, Cav.; (Plate-2)*

Systematic Position

Division : Mangoliophyta
 Class : Mangoliopsida
 Sub class : Dilleniidae
 Order : Malvales
 Family : Malvaceae
 Genus : *Thespesia*

Species : *T. populnea, Cav.;*

1) *Plant Description*

- a) Native to pantropical distribution which introduced to the Pacific Islands by Austronesian voyagers.
- b) It is shrub or medium sized evergreen tree have younger parts with peltate scale. Bark greyish, twigs densely covered with brown to silvery scale.
- c) Leaves simple, alternate, petiole long. Flowers solitary with long peduncle axillary, Bracteoles five, Calyx companulate, scaly, truncate, entire.

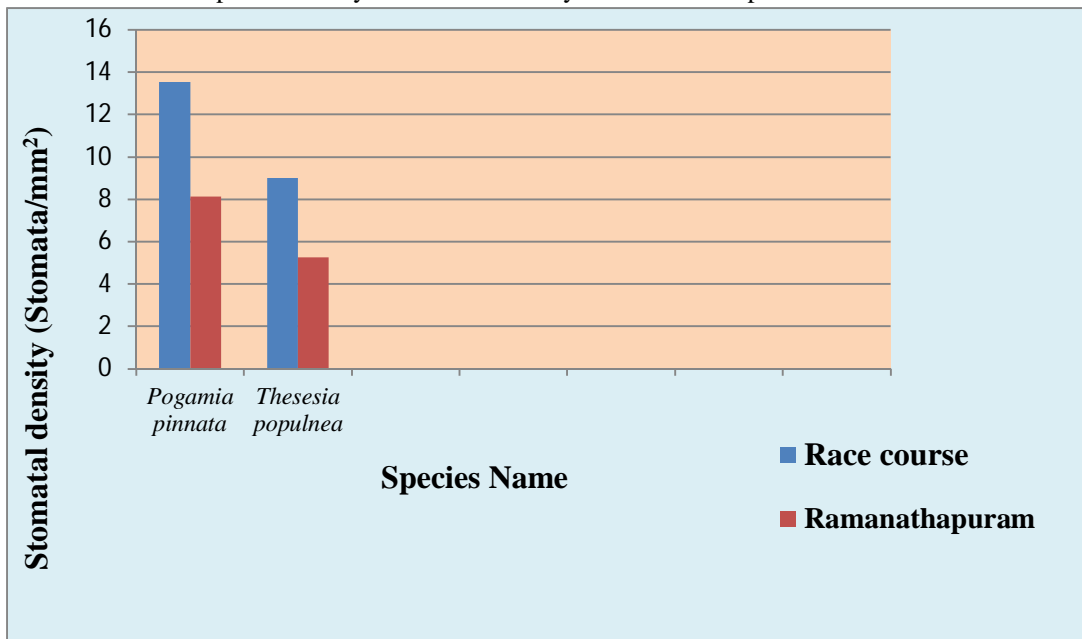
- d) Corolla, five companulate, wide, pale yellow with dark purple Centre. Staminal tube toothed at the top except at the swollen base with the free ends of the filaments.
 - e) Fruit fleshy, a globose capsule, seeds very few, large.
- 2) Uses
- a) Wood hard, dark leaves and flower are used against skin disease, dysentery, cholera and bladder problems etc. leaves have antifungal, antiviral, anti-helminthic properties.
 - b) It often used as traditional medicine where bark, root leaves and fruit are used to treat ailments. Fruit used against herpes, urinary tract problems, abdominal swellings

III. RESULTS AND DISCUSSION

Morphological structure of leaves and dust retaining capacity determined the significant difference among the samples in same places. Plants species exhibit significant reduction at all polluted areas in their leaf length, width, area and petiole length during different seasons at urban areas compare to other non-urban areas. Some kinds of morphological and anatomical characters like gall appearance on *Pongamia pinnata*, (L.) Pierre.; and stout petiole on *Thespesia populnea*, Cav.; Which have coriaceous leaves with opposite leaf arrangement. The samples occurred in urban areas possess observable reduce in their leaf size. In split of difference in surface properties cross sections of leaves did not reveals anatomical abnormalities.

Sample s collected from urban areas shows comparative variations in stomatal density. Among them samples from Ramanathapuram had least stomatal densities where had high traffic compare to other studied areas. In Race course most of the plants shows high stomatal density that means less influence of pollution. *Pongamia pinnata*,(L.) Pierre. ; shows high variation Stomatal density. Stomatal density shows differences in successive leaves of shoot as well as among the leaf of plants which growing under the various light intensities.

Chart-1: Comparative study of stomatal density of selected samples in different urban area



IV. CONCLUSION

The results shows that the plants which are occur near to the polluted area or which have affected by pollution gradually change their morphological appearance like leaf size, shape, structure. Stomatal pore size will be reduced due to the extreme effect of pollutants. *Pongamia pinnata* (L.) Pierre.; shows greater response towards the environment so which is a good indicator of climatic changes. The changes in leaf size, stomata per unit area reduced due to it. This cleared by compare them by same plants from less traffic area. *Thespesia populnea*, Cav.; shows better result than others. Which have enormous changes due to environmental conditions. So these studies reveal that plants also have changes so when should start to take necessary action for future generation if not if will enter to a great loss.



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