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REVIEW ARTICLE

A STUDY ON SELECTED INDIVIDUAL TREE CANOPY OF *Pongamia pinnata,* (Linn.) Pierre; - IN URBAN GREENING WITH SPECIAL REFERENCE TO URBAN SOIL

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ABSTRACT

Urban greening refers to any vegetation effort including the planting of trees, shrubs, grass or agricultural plots whose design is intended to improve the environmental quality, economics opportunity or aesthetic value associated with a cities landscape. Urban Forestry and Urban Greening contribute significantly to the urban society's physical, social and economical wellbeing. For the present study .; tree were selected for the *Pongamia pinnata*, physico-chemical parameters of tree canopy soil, mineral profile of the litter formed by the selected tree canopy, microbial flora of the selected tree canopy soils were analyzed. Hence, the present study the aim is to improve our quality of life in an increasingly densely populated, fast-living world. People have to find then way back to natural and green open spaces that become more and more important for our personal development, wellbeing and recreation due to increasing urbanization.

INTRODUCTION

Impervious cover plays an important role in the landscape, particularly in urban areas. These surfaces such as roads, buildings, sidewalks and parking lots facilitate transportation and provide shelter. Trees, forests, open spaces, rivers and streams and associated natural resources improve our quality of life and provide us with a sense of community, improve our individual and community self-esteem and promote our physical and mental well- being. India is urbanizing at a very fast pace. The enhancement of urban green spaces or urban green forests is one of the ways, which has the potential to mitigate the adverse effects of urbanization economic or environmental costs. Urban greening includes the components of urban forestry, urban agriculture and agro-forestry. Urban greening is an integrated approach to the planting, care and management of all vegetation in cities, towns, townships and informal settlements in urban areas. Urban green spaces play a significant role for people to have social contacts or find rest in order to achieve this inner harmony and well being.

MATERIALS AND METHODS

Tamil Nadu is one of the 28 States of India. Its capital is Chennai (formerly known as Madras) the largest city. Tamil Nadu lies in the southern most part of the Indian Peninsula and is bordered by the union territory of Puducherry and the states of Kerala, Karnataka and Andhra Pradesh. Coimbatore is the city in Tamil Nadu, South India. The city is located on the banks of the Noyyal River surrounded by the Western Ghats and is administered by the Coimbatore Municipal. Nirmala college academic campus is located in the southern parts of the Western Ghats. The total area of the college campus is 20 acres. The temperature during both summer and winter varies between 28º c to 34º c. Soil in this area is red loamy soil which is more fertile than sandy soil. Its porosity allows high moisture retention and air circulation.

Collection of selected tree sample: For the present study .; were selected in the Nirmala college campus to find out the Morphology and propagation of the selected tree, Physico-chemical parameters of the tree canopy soil, mineral profile of the litter formed by the selected tree canopy, microbial flora of the selected tree canopy soils were analyzed. The data were then processed and represented both in Tables and charts.

Taxonomic Position

Division : Phanerogams
Class : Dicotyledons
Order : Fabales
Family : Fabaceae
Subfamily : Papilionaceae
Genus : *Pongamia*
Species : M. *Pinnata* (Linn.) Pierre.;

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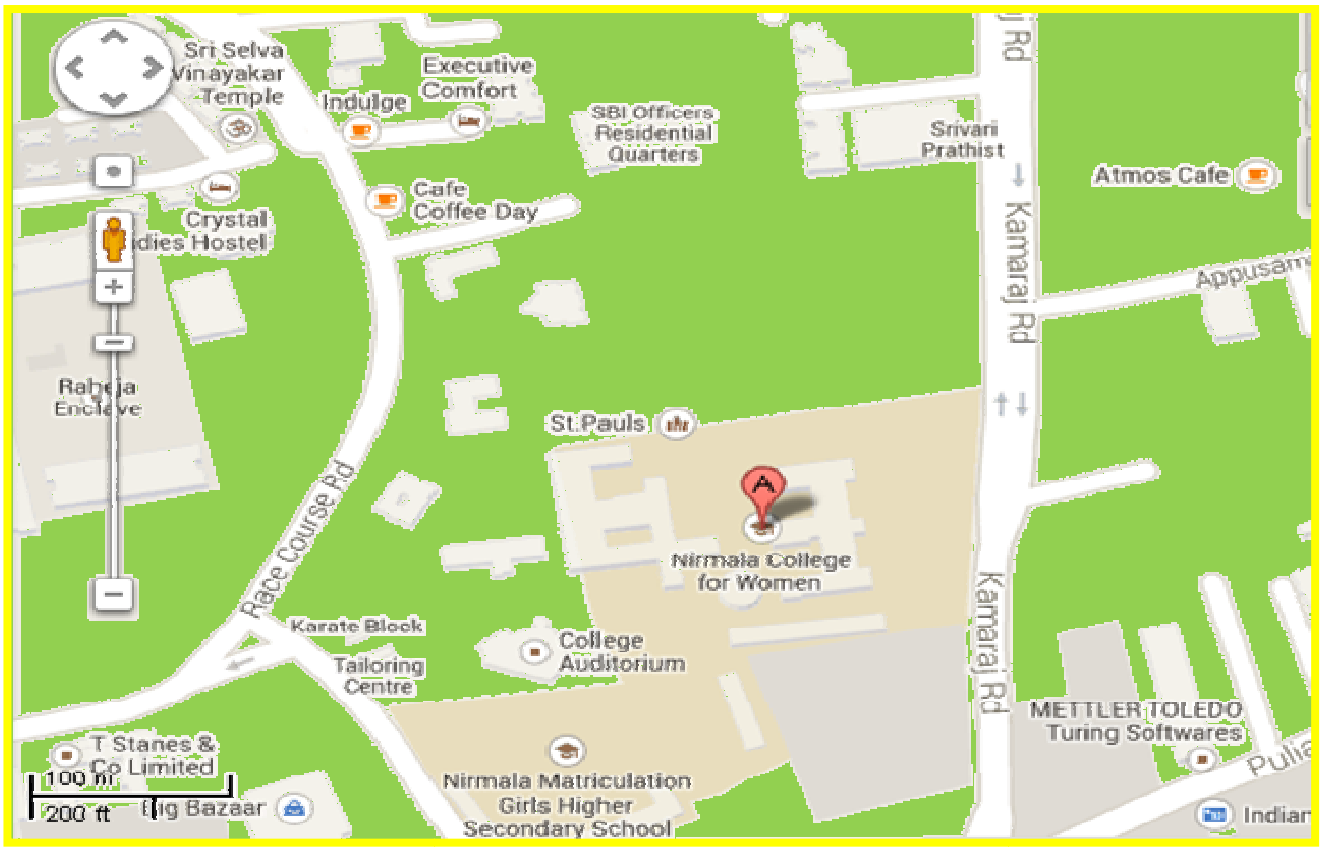

Plate 1. Location Map

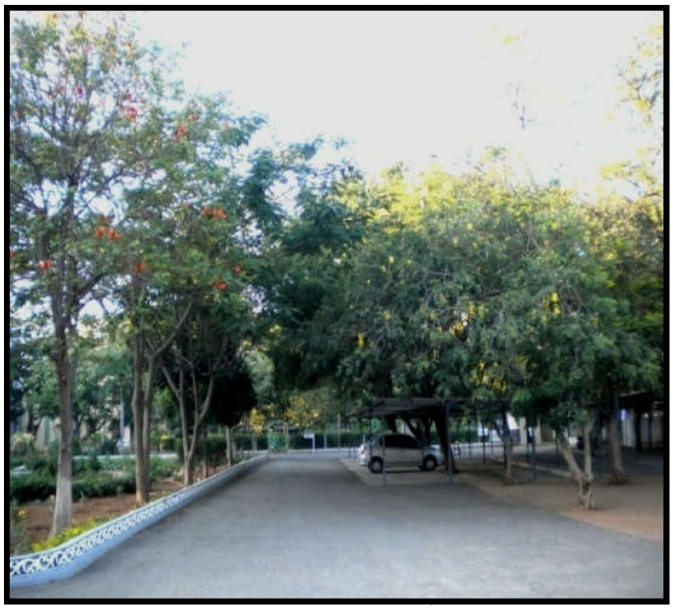

Plate 2. Study Area

Fig 1. Closed view of the selected sample

Pongamia pinnata (Linn.) Pierre.; is a native to India, Malaysia, Indonesia, Taiwan, Bangladesh, Srilanka and Myanmar. It is commonly known as Pongam tree, Indian beech. It is a medium sized glabrous, perennial tree grows in the littoral regions of south eastern Asia and Australia. In promoting the benefits of legumes in agriculture, the obvious advantage that legumes have over other plants is the formation of nodules resulting from a symbiotic relationship with nitrogen-fixing bacteria. It tolerates a wide range of soils and controls soil erosion. The seeds are used in folk remedies for tumours, bronchitis, chronic fever, leprosy, piles, ulcers, liver pain, whooping cough, chronic skin diseases and painful rheumatic joints.

All parts of the tree have been used as crude drug for the treatment of tumours, piles, skin diseases, wounds and ulcers. Seed cake left over after oil extraction has been used as 'green manure' as it is rich in protein and nitrogen in agricultural implements. In our country this oil used as a fuel for cooking and lamps, also as lubricant, pesticide and in soap making industries.

A. Morphological characteristics of the selected tree and propagation: Morphological characters of the selected tree species were recorded. The selected trees total height and width. Leaf, leaflet, flower, fruits - size and colours were measured.

B. **Biodiversity of the selected tree:** Biodiversity of species such as Ants, Crow, Sparrow, Pigeon, Dragon fly, Mynah, Butterflies, Lac insect, Lizards, Calottes, Chameleon, Spider, Worms, Honey comb, Honey bee, Wasp, Parrots, Grasshopper, Sparrow were observed and recorded during the study period.
C. **Average annual litter of dried leaves and logs of the selected tree canopy:** The litter of dried leaves and logs of the selected tree canopy were collected throughout the year and the average annual fallings were calculated.

Microbial analysis

Collection of the selected tree canopy soil sample: The tree canopy soil samples were collected during the year, 2014-2015. Soil with litter formation and ground vegetation from the selected tree canopy of *Albizzia lebbeck,* (L,) Benth.; were collected separately in sterile bags, air dried and sieved for further analysis. Barren land soil, taken from the same campus was kept as control. Soil was taken from the depth of (0-15 cm depth). Soil samples were packed in sterile bags and used for further analysis.

Isolation and culture of microorganisms

Preparation of nutrient medium: Potato-Dextrose Agar (PDA): 120 gms of freshly peeled potato is taken in to a flask and 150 ml of water is added to it. It is boiled for 10 minutes. Then the potato extract is taken and its volume is made up to 150 ml by adding distilled water. To this extract, 7.5 gms of Dextrose is added and thoroughly mixed. Then the solutions were poured in a 500 ml flask and stirred thoroughly. This content is heated in a water bath to dissolve the agar. This medium is dispensed in culture petridishes and kept in laminar air flow for solidifation.

Serial dilution method: For the enumeration of microbial population a set of ten selected soil samples (0-15 cm depth) were collected. Soil microbial communities have relied on culturing techniques using PDA (Potato Dextrose Agar) medium. Serially diluted samples were inoculated on petridishes containing PDA medium and incubated in the laboratory for 5 days at 30°C (Kanika Sharma, 2007). The bacterial and fungal colonies were counted using colony counter for three days and the culture was kept in the refrigerator at 4°C. 1 gm of 1% Crystal violet is dissolved in 10 ml of 95% ethyl alcohol and final volume is made up to 100 ml with distilled water. Bacterial colony appears blue and for identification.

Identification of Bacteria (Direct microscopic examination): An average volume of bacterial cell is 1 cubic micron. They are smallest forms among bacteria. After division the cells may either separate from each other or may remain joined together to form groups of two cells in *Diplococcus*, a tetrad of four cells in *Micrococcus tetragenus* and a chain of cells in *Streptococcus* (Bergey, 1957).

Identification of Fungus: The smear was simple stained to study the morphology of the cells. Basic stain for simple staining Safranin is used for identifying microbes and the data's were recorded. For each experiment replicas were repeated (Mani *et al.,* 2004).

Physicochemical parameters

Physicochemical parameters of the select tree canopy, litter and barren soils were analyzed.

1. **pH of the soil:** Part of the moist soil samples were air dried and sieved to obtain fine soil samples (2 mm). pH = Hydrogen-ion-concentration**,** The H^+ concentration i.e., pH = log ($1/H^+$). The pH of the medium, if found to be acidic, is brought to the required pH by adding 0.1 (N) NaOH drop wise and testing with pH paper after thoroughly mixing with a glass rod. Conversely, 0.1 (N) HCl is used to get an acidic pH of the medium.
2. **Moisture content of the soil:** Moisture content is the ratio of the mass of water in the sample to the mass of solids in the sample. Moisture content of the selected tree canopy litter samples were calculated and expressed in percentage (Conventional oven method ASTM, 2001).
3. **Water holding capacity and temperature of the soil:** Water holding capacity and temperature of the soil were analyzed as per the standard method.
4. **Mineral profile of the selected tree canopy soil samples:** Mineral like Potassium, Phosphorus, Calcium, Magnesium, Iron and Sodium were analyzed in the standard laboratory by employing Atomic Absorption Spectrophotometer by following the method of Issac and Johnson (1975) and the results were recorded.

Estimation of calcium and magnesium (Jackson, 1967)

5ml of triple acid digested extract was taken in a China dish. To this 10 ml of 10% NaOH and 0.1g of Murexide indicator powder (40 g of potassium sulphate or potassium chloride was ground with 10 g ammonium purpurate) were added and titrated against 0.02 N versenate (19 g of EDTA was dissolved in 5liters of distilled water) and standardized against 0.2 N Na_2CO_3 solution and adjusted until the colour changes from red to violet.

Calcium and Magnesium: 5ml of triple acid digested extract was taken in a China dish, to this 10 ml of ammonium chloride - ammonium hydroxide buffer pH 10 and few drops of Eriochrome Black T indicator (0.1 g of Eriochrome Black T was dissolved in 25ml of methanol containing 1g of hydroxylamine hydrochloride) were added and titrated against 0.02N versenate solution until the colour changes from red to blue.

Calculation

Percentage of calcium = Titre value of calcium*100/5*100/0.5*0.0004

Percentage of magnesium = Titre value of calcium + magnesium – titre value of calcium or
titre value of calcium + magnesium *0.96

Calcium and magnesium contents were expressed as mg/100 g of sample

Estimation of Sodium and Potassium: Sodium and potassium were estimated by using Flame Photometer, Model-EFL. The sodium and potassium contents were calculated by referring to the calibration curves of sodium and potassium, respectively, and expressed as mg/100 g on dry weight basis.

Table 1. Comparative morphological characters, Propagation and the biodiversity of the selected tree sample

Sample	Tree	Height in (m)	Breadth in (m)	Leaf		Inflorescence	Flower colour	Fruit		Seed shape and colour	Propagation	Biodiversity
				Type	Shape							
Pongamia pinnata	Medium sized, evergreen, deciduous	16.08	07.04	Impari pinnately compound	Ovate or Oblong	Recemose	Indehiscent pods	bean-like brownish-red seeds	Flattened and elliptical	Grafts and seedlings	Ants, Butterflies, Squirrels, Spider, Worms	Indehiscent pods

Table 2. Morphology of the Leaf/ Leaflet length

Sample	Simple/ compound	Leaf length in (cm)	Leaflet length in (cm)	Leaf/ Leaflet of the selected trees
Pongamia pinnata	Imparipinnately compound	22.02	07.05	

Table 3. Morphology of the inflorescence and flower of the selected trees

Sample	Simple/ compound	Leaf length in (cm)	Leaflet length in (cm)	Leaf/ Leaflet of the selected trees
Pongamia pinnata	Imparipinnately compound	22.02	07.05	

Table 4. Morphology of the fruits

Sample	Fruit				Fruit of the selected trees
	Type	Colour	Shape	Length in (cm)	
Pongamia pinnata	Pod	Sandal	Indehiscent pods	4.7	

Table 5. Dehiscent and indehiscent seeds of the selected trees

Sample	Pod
	Dehiscent / Indehiscent
Pongamia pinnata	Indehiscent

Table - 6 Biodiversity of the selected trees

Sample	Biodiversity of the selected trees
Pongamia pinnata	Ants, Butterflies, Squirrels, Worms.

Table 7. Average annual litter of dried leaves and logs of the selected tree canopy

Sample	January-March (gm)	April - June (gm)	July- September (gm)	October-December (gm)	Average annual litter of the selected tree canopy in (%)
Pongamiapinnata	109.00	200.00	95.00	73.00	1.19

Table 8. Enumeration of the Bacterial colony of the selected tree canopy soil

Sample	Number of Bacterial Colony								
	Day 1			Day 2			Day 3		
	10^{-3}	10^{-6}	10^{-9}	10^{-3}	10^{-6}	10^{-9}	10^{-3}	10^{-6}	10^{-9}
Control	3	3	2	5	4	3	5	7	6
Pongamia pinnata	3	3	2	5	6	6	9	6	5

Table 9. Bacteria present in the selected tree canopy soil

Sample	Bacteria		
	10^{-3}	10^{-6}	10^{-9}
Control	*Streptococcus sps*	*Staphylococcus sps*	*Streptococcus sps*
Pongamia pinnata	*Streptococcus sps*	*Pseudomonas sps*	*Diplococcussps*

Table 10. Enumeration of Fungal colony of the selected tree canopy soil

Sample	Number of Fungal Colony								
	Day 1			Day 2			Day 3		
	10^{-3}	10^{-6}	10^{-9}	10^{-3}	10^{-6}	10^{-9}	10^{-3}	10^{-6}	10^{-9}
Control	-	-	-	3	3	2	3	3	2
Pongamia pinnata	-	-	-	3	3	2	4	3	3

Table 11. Fungus present in the selected tree canopy soil

Sample	Fungi		
	10^{-3}	10^{-6}	10^{-9}
Control	*Aspergillus niger*	*Aspergillus glaucus*	*Aspergillus niger*
Pongamia pinnata	*Aspergillusglaucus*	*Aspergillus niger*	*Aspergillus niger*

Table 12. Moisture content and pH of the selected tree canopy soil

Sample	Fresh weight (gm)	Dry weight (gm)	Moisture content (%)	pH
Control	20	18.86	5.7	5.7
Pongamia pinnata	20	18.11	9.5	5.4

Table 13. Mineral profile of the selected tree canopy soil

Sample	Potassium (%)	Phosphorus (%)	Calcium (%)	Magnesium (%)	Iron (%)	Sodium (%)
Control	0.39	0.10	0.31	0.081	0.048	0.18
Pongamia pinnata	0.18	0.06	0.50	0.095	0.01	*0.73*

Table 14. Moisture content and pH of the selected tree canopy litter

Sample	Fresh weight (gm)	Dry weight (gm)	Moisture content (%)	pH
Pongamia pinnata	200.00	091.10	54.45	5.9

Table 15. Mineral profiles of the selected tree canopy litter

Sample	Potassium (%)	Phosphorus (%)	Calcium (%)	Magnesium (%)	Iron (%)	Sodium (%)
Pongamia pinnata	776	234	336	208	20	27

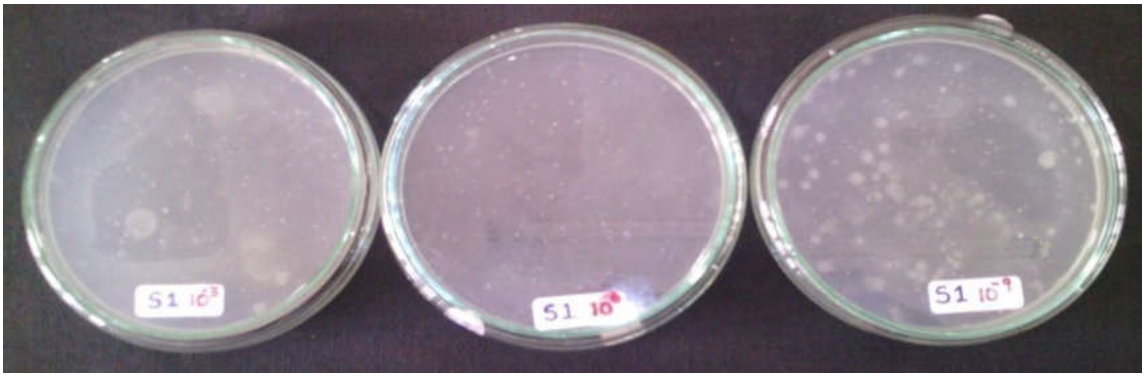

Plate 4. Distribution of Microbes present in the selected individual tree canopy soil

Phosphorus estimation (Dickman and Bray, 1940): One ml of triple acid digested extract was pipetted into 100 ml volumetric flasks. To this 50 ml glass distilled water was added, followed by 5 ml of ammonium molybdate sulphuric acid reagent (Solution A: 25 mg of ammonium molybdate was dissolved in 100 ml of distilled water. Solution B: 280 ml of conc. H_2 SO_4 was diluted to 800 ml). Solution A was added slowly with constant stirring to solution B and the volume was made up to 100 ml with glass distilled water). Blue colour was developed by adding six drops of 2.5% stannous chloride solution. The total volume was made up to 100 ml. The intensity of the blue colour was measured at 650 nm in a spectrophotometer. The phosphorus content present in the sample was calculated by referring to a standard curve of phosphorus and expressed as mg/100 g on dry weight basis.

Estimation of iron by atomic absorption spectrophotometer (Issac and Johnson, 1975)

Estimation: By feeding the sample to an Atomic Absorption Spectrophotometer the iron content was estimated at 246.8 nm wavelength and the readings were expressed in mg/100g of sample on dry weight basis.

Analysis of the selected tree canopy litter formed by the selected samples

Collection of tree canopy litter samples: From a composite of litter fall, the fallen fresh/dried leaves, wood logs, flowers, fruits and seeds were collected under the canopy of the ten trees separately and shade dried, packed in sterile bags then powdered and lumped in a composite of sample for chemical analysis. The maximum litter fall of various seasons during the year 2014 (January-March, April-June, July-September, October-December) were analyzed.

1. **pH and moisture content:** pH and moisture content of the litter were analyzed as per the standard methods.
2. **Mineral analysis of the selected tree canopy litter samples:** Mineral analysis of Potassium, Phosphorus, Calcium, Magnesium, Iron and Sodium minerals were analyzed in the recognized laboratory by employing Atomic Absorption Spectrophotometer. Mineral profiles of the litter formed by the selected tree canopy, the fallen fresh/dried leaves, wood logs, flowers, fruits and seeds were powdered and kept in airtight container then the mineral profiles were analyzed and the mineral profile of the selected tree canopy soil and litter samples were experimented and recorded by following standard methods of (Association of Official Agricultural Chemists) AOAC, (1990).

RESULTS AND DISCUSSION

Comparative morphology of the selected trees, leaves, inflorescence, flower, fruit, pod (dehiscent/indehiscent) and its propagation, Micro and Macrobial biodiversity were observed and represented in the following Tables.

Conclusion

India is urbanizing at a very fast pace. The enhancement of urban green spaces or urban green forests is one of the ways, which has the potential to mitigate the adverse effects of urbanization economic or environmental costs. Urban forestry is the art, science and technology of managing trees and forest resources in and around urban community ecosystems for physiological, sociological ecological and aesthetic benefits for society. Hence, the present study was undertaken to find out the comparative study of individual tree, leaves, inflorescence, flower, fruit, type of pod (dehiscent/indehiscent) and its propagation, Micro and Macrobial biodiversity of selected tree *Pongamia pinnata*.; were observed with reference to urban soil. The following parameters like comparative morphological characters such as leaves, inflorescence, flowers, fruit, pod and its propagation, urban soil, soil organic matter, macro and microbial biodiversity, physicochemical parameters of the soil and litter of the selected tree canopy were analyzed. Hence, the study on selected individual tree canopy of the soil and litter in urban greening to enrich the urban soil and to promote plant growth to the urban environment.

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