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A review on effect of pests on *Milletia pinnata* (L.)– An avenue tree in an urban environment of Tirupati, Andhra Pradesh, India

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Abstract

The *Milletia pinnata* (L.) is suitable to grow in special environment like intense heat and sunlight and because of its long tap root and thick network of lateral roots it can tolerate extreme drought conditions. The dense shade of the tree decreases the surface water evaporation and nitrogen fixation is promoted by the roots. Avenue trees like *Milletia pinnata* apart from having medicinal values it is a part of urban forestry in terms of atmospheric carbon reduction. The tree species of *Milletia pinnata* from the Tirupati urban area, Andhra paradesh have been found to have light brown patches, snaky patches and green hook-like out-growths (galls) which affect the ability of carbon sequestration and in removing particulate matter from the atmosphere. The present article shows the observations made due to the infection of pests such as moths, flies and mites on *M. pinnata* for a period of 12 months in the Tirupati urban area, Andhra Pradesh, India. This preliminary work highlights the environmental problems due to insect infestation on *M.pinnata* and can help researchers to carry out further studies to find out the root cause and preventive measures to be under taken to control this infestation.

Keywords: *Milletia pinnata* (L.), particulate matter, carbon sequestration, avenue tree, infection

Introduction

Avenue tree like *Milletia pinnata* (L.) apart from having medicinal values it is also most effective in providing shade and is a part of urban forestry in terms of atmospheric carbon reduction [1]. The *Milletia pinnata* is one of the extensively grown avenue tree from India. The tree has been previously known as *Pongamia* and at present it is placed in the genus *Milletia* [2, 3, 4]. It has been widely known as *Pongamia pinnata* in the earlier literature reviews.

Classification

Kingdom: Plantae
Phylum: Magnoliophyta
Order: Fabales
Family: Fabaceae
Genus: *Milletia*
Species: *pinnata*

M. pinnta is a deciduous, fastly growing tree which is native to India and distributed throughout Asia. The tree grows up to 15-25 meters in height and it has a large and wide spreading canopy. In early summer the leaves are soft, shiny, burgundy in color and as the season progresses they mature to a glossy, deep green color. The branches bares clusters of purple to pink colored flowers. Which mature into brown seed pods. The tree is resistant to extreme heat and sunlight and it can tolerate drought due to its presence of matty lateral roots and thick long taproot [5]. *M. pinnata* usually flowers during the months of March and April. The *M. pinnata* which is one of the avenue tree from the Tirupati urban area, Andhra Pradesh is infested by moths, flies and mites due to which leaf surface area is being reduced. The present article shows the observations made and the consequences of giving shelter to the tiny little creatures by the trees.

Materials and Methods

Study Area

The present study has been done in different places of the Tirupati urban area (Andhra Pradesh, India) for a period of one year from December 2018 to November 2019. During this period of twelve months, *Milletia pinnata* L. (Pongamia) was observed for the activity of insect pests which were causing damage to the leaf surface area and the symptoms have been compared with earlier literature available.

Observation

It was observed that after the two months of new leaf development, in the month of April, light brown patches started appearing on the leaves. Later on gradually by the month of December the symptoms started spreading the entire leaf thus reducing the leaf surface area (fig.1&2). Apart from light brown patches, green hook – like growths (galls) and snaky patches were also observed on the leaves. When these symptoms were compared with the earlier literature [6], it was found that *M. pinnata* is acting as host for arthropods like tiny moths, flies and mites in both rural and urban areas in Indian subcontinent.

The tiny moth called *Cameraria virgulata*, (a leaf-mining microlepidopteran) just a few millimetres long, lay eggs singly on leaves.

Fig: 1 & 2: *M. pinnata* with brown patches on leaves

Classification
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Gracillariidae
Genus: *Cameraria*
Species: *C. virgulata*

Each emerging larva burrow under the epidermis of the leaf, chewing the upper leaf tissues with its mandibles: thus getting its food and making a 'safe home' for itself in the process. Consequently these 'homes' appear to us as translucent, round patches on the leaves (fig.3). The dry translucent part is the 'lifted epidermis' of the leaf and the black powdery material is the fecal matter of the larva (fig.4). The larvae of another tiny fly *Chromatomyia horticola*, a leaf-mining dipteran (fly), belonging to the Agromyzidae is making slender serpentine mines on the *M. pinnata* leaves.

Fig 3: Leaf with translucent round patches

Fig 4: Leaf with black powdery fecal matter of the larva.

Classification
Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Diptera
Family: Agromyzidae
Genus: *Phytomyza*
Species: *P.horticola*

The Gracillariidae induced mines are round whereas the Agromyzidae induced mines are snaky which In turn helps in recognizing the insects whose larvae have made these mines (fig.5).
A mite called *Aceria pongamiae*, a plant-feeding Eriophyoidea (mite) belonging to the Eriophyidae induces the galls on the leaves.

Classification
Kingdom: Animalia
Phylum: Arthropoda
Class: Arachnida
Order: Trombidiformes
Family: Eriophyidae
Genus: Aceria
Species: *A. pongamiae*

Fig 5: Leaves showing snaky mines

Fig 6: Leaves with galls

Remarkably these plant feeders do not destroy the whole leaves of *M. pinnata*. The leaf mining microlepidopteran larvae are tiny and they eat only leaves, which results in minimal damage to *M. pinnata* trees. After shedding the leaves, the trees will develop new leaves. The trees may have evolved over time to resist these organisms and, possibly the arthropods feeding produces no toxic compounds which could induce cell and organ death (fig.6). But the translucent lifted epidermis of the leaf due to tiny moths like *Cameraria virgulata* forms the irregular patches. A large number of such patches finally covers the entire leaf thus reducing the leaf surface area. The automobile pollution in urban area may Effect the pedestrians along the main roads due to the high pollution concentration. The plants can trap and remove fine particulate matter thus reducing the air pollution which in turn reduces atmospheric temperature [6, 7].

Milletia pinnata is usually grown as an avenue tree in the urban areas as the tree provides shade with dense canopy and helps in reducing fine particulate matter in the atmosphere [8]. The translucent lifted epidermis forms the irregular patches on the *M. pinnata* leaf which almost cover the entire leaf, thus reducing the available green surface area. Reduction in the leaf surface area may affect the accumulation of particulate matter by the tree [9] and decrease the amount of carbon sequestration thus increasing the atmospheric temperature.

Conclusion

The impact of pests such as *Chromatomyia horticola*, *Cameraria virgulata* and *Aceria pongamiae* on *M. pinnata* has been analyzed and found that the tree is providing shelter to these little creatures but their relationship with this tree is not known. The damage caused by these insect pests to the leaf surface area reduces the carbon sequestration and accumulation of particulate matter by the tree thus increasing the atmospheric pollution. To prevent these insects from infecting the trees, seeds can be sterilized before sowing them in the nursery bags [10]. Further studies can be done to find out the prevention and control methods for these pests caused by insects.

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