



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 2194-2197
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www.thepharmajournal.com
Received: 27-02-2022
Accepted: 30-05-2022

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Survey for the incidence and severity of leaf spot and blight disease of *Milletia pinnata* caused by *Fusicladium pongamiae* in avenue plantations of Mulugu Mandal

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Abstract

An intensive roving survey was carried out during the months of October and November in 2021, in the avenue plantations of different villages in Mulugu Mandal, Siddipet district to estimate the incidence and per cent disease index of leaf spot and blight disease of *Milletia pinnata*. The survey investigation reveals that the disease incidence ranged between 91% to 100% across different villages in Mulugu Mandal. However, the highest percentage of infection (100%) was observed in Lakshmakkapalle, Mulugu, Narsampally, Kotyal, Alinagar villages and lowest percentage of infection (91.48%) was observed in Annasagar. With respect to per cent disease index, the mean disease index ranged between 12.4% to 49.8%. The highest mean disease index (49.8%) was recorded in Vantimamidi village, whereas the lowest mean disease index (12.4%) was observed in Mulugu village.

Keywords: *Milletia pinnata*, *Fusicladium*, severity, incidence, leaf spot, leaf blight

Introduction

Karanj (*Milletia pinnata* (L.) Panigrahi, commonly known as Pungam, is a medium-sized evergreen, multi-purpose tree and also a fast-growing species, which belongs to humid tropics. It is known for producing seed oil which can be used as biodiesel and one of the nitrogen fixing trees (Sangwan *et al.*, 2010; Orwa *et al.*, 2009) [7, 5]. Distribution of Karanj is seen in the banks of river and along the coasts in India and Myanmar (Mukta N, Sreevalli Y (2010)) [4]. Within India, the species has been reported more widely in Western Ghats. Its diversity was found along the altitudinal gradients of the Orissa, Andhra Pradesh (Sunil *et al.*, 2012) [9]. Karanj is valued for its different parts, which are used as fuel, timber, and also known for its medicinal & industrial value, and biodiesel. (Das and Alam, 2001) [1]. It has many medicinal uses; mostly it is used in preparation of medicines of ayurveda, like bronchitis, diabetes, whooping cough, rheumatic joints and its leaves are used for getting rid of rheumatic pains (Gordhanbhai, 2010) [2]. Karanj is get affected by many biotic agents like insects (leaf galls, leaf minor) and microbial pathogens (leaf spot and blight, rust). There are many adverse effects of diseases on the nursery seedlings and trees in the plantations. One of the major diseases occurring on *Milletia pinnata* is leaf spot and blight disease which is caused by various agents such as *Fusicladium*, *Colletotrichum*, and *Dothiorella*. The present work mainly focuses on the severity of the leaf spot and blight disease with special reference to *Fusicladium pongamiae*.

The parasitic fungus, *Fusicladium pongamiae* is usually observed on the lower leaf of *Milletia pinnata* in the form of brown colored patches, and often resulting in curled leaf appearance. Microscopic observations reveal long spores of fungus assuming one or two- capsule shape. (Pathak, *et al.*, 2015) [6]. Availability of sufficient light, low temperatures, along with cool weather conditions are considered to be suitable for the growth and the development of disease. For the control and management of these diseases, many synthetic fungicides, chemicals and other bio-pesticides are being used (Kumar, 2012) [3]. The major road stretch of Hyderabad- Karimnagar highway in Mulugu Mandal mainly constitutes *Milletia pinnata*, which is a part of Telangana Ku Haritha Haram (TKHH) program.

As the mature trees of *Milletia pinnata* in avenue plantations in the surrounding villages were found to be infected and showing symptoms of leaf spot disease in the months of October and November, 2021 and also by considering the economic importance of *Milletia pinnata* and its widespread occurrence in the state of Telangana, it was deemed necessary

to study the incidence and severity of the disease and identify the causative organism. Therefore, an intensive roving survey was carried out in avenue plantations found in and around the different villages of Mulugu Mandal, Siddipet district.

Leaf spot and Blight disease



Fig 1: Chlorosis on the upper surface of leaf



Fig 2: Necrosis and conidial mat on lower surface of leaf

Materials and Methods
Study Area



Fig 3: Mulugu Mandal Map

In the month of September, we observed the initial symptoms of leaf spots on Pungam plants and during the months of October and November, 2021, all the roadside avenue plantations raised in the part of TKHH program in different villages (Table No. 2) from the Mulugu Mandal of Siddipet district, Telangana state were chosen for conducting the roving survey to investigate and estimate the incidence and severity of leaf spot and blight disease of *Milletia pinnata*. As it was a visual estimation, we have modified the disease rating scale based on the percentage of infected area and the infected leaves were classified into five categories along with their

description (Table 1).

Table 1: Numerical rating for infected leaves along with description

Numerical rating	Description
0	Healthy leaves
1	1-10% infected area of leaf
2	11-25% infected area of leaf
3	26-40% infected area of leaf
4	41-60% infected area of leaf
5	>60% infected area of leaf

Disease incidence

For recording the percentage of disease incidence, the total number of *Milletia pinnata* trees existing as part of avenue plantations in every village of Mulugu Mandal was recorded. The number of disease infected trees was recorded and the numerical rating was given as per Table 1. Further, based on ocular estimation, the percentage of infection within an area was calculated by using formula:

$$\text{Percent disease index} = \frac{\text{No. of plants infected}}{\text{Total no of plants observed}} \times 100$$

$$\text{Disease index (\%)} = \frac{\text{Sum of all numerical ratings}}{\text{Total no of leaves} \times \text{Maximum rating}} \times 100$$

Pathogen identification and test for pathogenicity

Infected leaves collected during survey were brought to the laboratory using paper envelopes. The infected leaves were surface sterilized using ethanol and dissected for the

Severity

Within the ten randomly selected trees of every village, the total number of infected and non-infected leaves was counted per each tree. Ten infected leaves of each tree were considered and rating was given based on numerical scale 0-5 as per Table 1 for calculating the severity using the following formula:

$$\text{Leaf infection (\%)} = \frac{\text{Total no of leaves in fected}}{\text{Total no of leaves present}} \times 100$$

identification of the organism based on conidial morphology by observing under microscope. Same leaf samples were used to isolate and pure culture the fungus on Potato Dextrose Agar (PDA) medium for further investigations.



Conidial spores of *Fusicladium pongamiae* (10*10)



Fusicladium pongamiae conidia 40X

Fig 4, 5: Conidial spores of *Fusicladium pongamiae*

Results and Discussion

Disease incidence: Within the Mulugu Mandal of Siddipet district, around 14 villages were surveyed for analyzing the percentage of disease incidence and disease severity of leaf spot and blight disease of *Milletia pinnata* in avenue plantations. Leaf spot and blight on *Milletia pinnata* was observed in all the surveyed villages and the incidence ranged

between 91.48% to 100%, indicating widespread prevalence. It was observed that all the plants were infected with the disease and shown 100 per cent incidence in Lakshmakkapalle, Mulugu, Narsampally, Kotyal and Alinagar. Whereas, among all the villages observed the lowest incidence (91.48%) was recorded in Annasagar village (Table 2).

Table 2: Incidence of leaf spot and blight disease in different villages of Mulugu Mandal

S. No.	Name of the village	No of trees observed	Number of trees infected	Disease incidence (%)
1	Vantimamidi	90	86	95.55
2	Lakshmakkapalle	16	16	100
3	RVM(Hospital)	164	163	99.39
4	Mulugu(highway)	43	42	97.67
5	Mulugu	26	26	100
6	Narsampally	97	97	100
7	Adavi Maseed	4	4	100
8	Kotiyal	12	12	100
9	Alinagar	27	27	100
10	Ksheerasagar	76	75	98.68
11	Vagnoothi	31	31	100
12	Gangadharapalle	43	42	97.67
13	Annasagar	47	43	91.48
14	Zapthisingaipalle	49	49	97.72

Disease Severity: Based on the disease severity rating scale the selected trees in all the surveyed villages the per cent disease index was ranged from 12.4% to 49.8%. The highest mean disease index of 49.8% was recorded in Vantimamidi followed by Narsampally (48%). The lowest mean disease index of 12.4% was recorded in Mulugu (Table 3).

Table 3: Per cent disease index of leaf spot and blight in in different villages of Mulugu Mandal

Village Name	1	2	3	4	5	6	7	8	9	10	Severity (%)
Vantimamidi	36	30	36	36	58	62	66	86	40	48	49.8
Lakshmakapalle	30	36	48	10	22	36	32	30	28	38	31
RVM(Hospital)	34	48	54	30	26	32	26	42	34	26	35.2
Mulugu (Highway)	10	10	18	16	14	14	20	12	12	20	14.6
Mulugu	6	6	10	10	14	30	8	14	16	10	12.4
Narsampally	18	46	60	46	58	52	60	50	42	48	48
Adavi Maseed	36	28	22	38	0	0	0	0	0	0	31
Kotiyal	18	18	18	30	24	18	42	18	20	22	22.8
Alinagar	20	18	20	18	20	22	18	24	24	20	20.4
Ksheerasagar	22	26	34	22	24	24	42	36	28	26	28.4
Vagunoothi	20	24	22	22	20	26	24	26	28	25	23.7
Gangadharapalle	30	18	18	22	22	20	26	24	24	20	22.4
Annasagar	18	20	20	30	22	20	18	20	16	32	21.6
Zaphisingaipalle	18	20	18	22	24	22	30	20	26	32	21.2

Symptoms observed: Leaf spot and blight symptoms observed both tender and matured leaves but blight symptoms mostly observed on matured leaves. On the upper surface of the leaves water-soaked yellow spots first appeared singly then with the time all the spots coalesced and leaves turn yellow (Chlorosis). On the lower surface of the leaves, it causes black patches and sometime leaf curled and heavy conidiation was observed. Later, all these yellow spots turn brown and showed necrotic symptoms, leaves dried and fall off early (Figure 1 & 2).

Pathogen: *Fusicladium pongamiae* produced numerous conidia in the presence of high humidity; leaves were dissected and observed under microscope. Fungal spores were found on lower leaf surface are long, one and two celled, septate and capsule shaped (Figure 4 & 5).

Millettia pinnata is known to be affected by few diseases, including leaf spot and blight, leaf rust and powdery mildew. Sydow & Sydow (1913) ^[10] reported *Fusicladium pongamiae* on the leaves of *Pongamia pinnata*. The survey undertaken in Mulugu Mandal during October to November 2021 specifically focusing on the avenue plantations clearly revealed that the major disease affecting *Millettia pinnata* leaves was leaf spot and blight disease and the causative organism was found to be *Fusicladium pongamiae*. It appears that the cool and dry season, in general, is suitable for growth of the fungus, as all the villages surveyed exhibited high prevalence as well as severity. The surveyed region is part of Central Agroclimatic Zone and in the months of October and November, prolonged leaf wetness is present. The period of leaf wetness is determined by the relative humidity, which seems to influence fungal growth, sporulation and disease development.

The ideal temperature for spore germination is 25-30 °C, which along with other climatic factors like temperature, rainfall, humidity and abundance of the host species seems to promote survival, development of the fungus. Heavy condition of the organism during the survey period suggests highly appropriate humidity and temperature conditions that

increase the tendency of healthy leaves for infection. Although the effect of *Fusicladium pongamiae* infection on *Millettia pinnata* vegetative growth, seed production and economic loss is not known, fungal pathogens attacking the leaves may adversely affect the entire plant body. To mitigate the injury caused by the fungal pathogen, it is necessary to be able to detect and identify the causative organism. The current survey may help foresters and field staff to understand about occurrence timing, specific infecting organism towards planning specific control measures. The knowledge of the given pathogen can be useful in reducing the fungal disease and further infection in avenue plantations.

Acknowledgement

The authors would like to extend their sincere gratitude to the field staff of Telangana State Forest Department, Gajwel Range, Siddipet, along with academic and laboratory staff of Dept. of Forest Resource Management, FCRI for their valuable support during the study for logistic support.

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