International Journal of Modern Developments in Engineering and Science
Volume 2, Issue 6, June 2023
https://www.ijmdes.com | ISSN (Online): 2583-3138

Development of IDM Module for the Management of Nursery Diseases in Teak

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***Abstract*: Teak, the most widespread timber tree is affected by several diseases in nursery stage. Among the diseases, root rot caused by *Lasidiplodia theobrommae* causes severe losses (38.0%) and affect the growth of teak. Among the seven fungicides tested, Propiconazole 25% EC completely inhibited (100 per cent) the myceilal growth of *L.theobrommae* at 1000 ppm under *in vitro* condition. Root dipping of the teak seedling in propiconazole (0.1%) along with soil application of the *T.viride* significantly reduced (10.10%) the incidence of root rot in teak nurseries whereas in control plots the incidence was 21.83%.**

***Keywords*: teak root rot, *L.theobrommae*, biocontrol, fungicides.**

1. Introduction

Teak (*Tectona grandis*) is one of the most important timber trees of India and South-east Asia. In India teak is distributed naturally in the Peninsular region below 24ºN latitude. Teak forests are found in Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka and Kerala besides Uttar Pradesh, Gujarat, Orissa, Rajasthan, Andhra Pradesh and Manipur.

In Teak grown nurseries, seedlings are affected by several pest and diseases. Among them root rot is a major disease cause loss upto 38.0%. Firdousi (2019) isolated the teak pathogens viz., *Uncinula tectonae*, *Olivea tectonae*, *Rhizoctonia solani*, *Armillaria mellae* and *Phellinus* sp in Jalgaon district (M.S). Kiran *et al*., 2021 from Kerala documented and characterized nine important fungal diseases in nursery seedlings of teak. In forests, use of fungicides is not common except in nursery stages. Management of nursery diseases by biocontrol agents in combine with fungicides were reported by several workers. Mohanan, 2009 developed management practices for the nursery diseases in teak.

The soil borne genus *Trichoderma* includes several species make them potential biocontrol agents against tree and plant Pathogens. With this view the present study was undertaken to develop IDM module using biocontrol agents and fungicides will support plant growth besides giving protection against diseases.

2. Materials and Methods

A. Documentation and Isolation of the Pathogen

Study was undertaken to document the important nursery diseases of teak in FC & RI, Mettuplayam during 2020-21. In Teak, several diseases *viz*., root rot, leaf spot, leaf blight and rust were observed and among them root rot were observed throughout the season with severe damage. Hence the root rot diseases were taken for the present study.

B. Isolation of Pathogen and Testing Pathogenicity

The diseased root samples collected from FC &RI nursery were used for the isolation of pathogen. Sections of 3 - 5 mm diameter were cut using sterilized scalpel from the infected roots. Infected root bits were surface sterilized in 1% sodium hypochlorite solution for three minutes and washed in three changes of sterile distilled water. Root bits were plated on PDA in sterilized Petri dish. Petri dishes were incubated at 28±2°C for the hyphal growth. Hyphal tip of cultures was transferred to obtain pure cultures. The pathogen was purified by hyphal tip method as described by Riker and Riker (1933) and cultures were maintained in PDA slants at 4ºC throughout the study.

To test the pathogenicity, the fungal discs of the pathogen was inoculated into the sand maize medium and kept for incubation for the growth of the fungus. After the full growth of the fungus, it was inoculated into pots @ 5g/kg of soil and observed for the development of symptoms.

C. Screening of Fungicides on the Mycelial Growth of L. theobromae under in-vitro Condition

The poisoned food technique (Schmitz, 1930) was followed to test the efficacy of different fungicides under *in-vitro* condition. Seven fungicides *viz*, Propiconazole, Tebuconazole, Hexaconazole, Azoxystrobin, Picoxystrobin, Iprovalicarb + Propineb, Metiram + Pyraclostrobin and Carbendazim were screened for their inhibitory activity against teak root rot pathogen, *L.theobrommae* by dual plate technique at 1000ppm concentration.

The required quantities of fungicides were added into the sterilized PDA medium to give required concentration and poured separately into each sterilized Petriplates under aseptic condition. The petriplates were inoculated with 8 mm mycelial disc from seven days old culture of pathogen and incubated at 28 ± 2ºC. Simultaneously, a control was maintained without adding fungicide by growing the fungus on PDA. Three replications were maintained for each treatment. The observations were made on mycelial growth of the pathogen.

The percent inhibition of the mycelial growth of test fungus

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Table 1
Treatment details

S.No.	Treatment details
1	SA of *T.asprellum* Tv1 @ 2g/kg of soil + RD with Propiconazole 25% EC
2	SA of *T.asprellum* Tv1 @ 2g/kg of soil + RD with Tebuconazole 25.9% EC
3	SA of *T.asprellum* Tv1 @ 2g/kg of soil + RD with Hexaconazole 5% EC
4	SA of *T.asprellum* Tv1 @ 2g/kg of soil + RD with Carbendazim 50% WP
5	SA of *T.asprellum* Tv1 @ 4g/kg of soil + RD with Propiconazole 25% EC
6	SA of *T.asprellum* Tv1 @ 4g/kg of soil + RD with Tebuconazole 25.9% EC
7	SA of *T.asprellum* Tv1 @ 4g/kg of soil + RD with Hexaconazole 5% EC
8	SA of *T.asprellum* Tv1 @ 4g/kg of soil + RD with Carbendazim 50% WP
9	Control

was calculated by using the following formula the results were analyzed statistically:

$$\text{Percent inhibition over control} = \frac{C - T}{C} \times 100$$

Where,
PI: Per cent inhibition
C: Mycelial growth of pathogen in control
T: Mycelial growth of pathogen in treated

Testing the efficacy of new molecules of fungicides and biocontrol agents for the management of disease in glass house condition

The fungicides that are found to be effective against pathogen under *in-vitro* condition were further evaluated under glass house condition for disease management.

Teak seedlings were dipped in different fungicide solution for 10 min before transplanting and were planted in polybags. In another set of treatments, along with seedling dip, *Trichoderma asperellum* was inoculated into the 2g/kg of soil. The incidence of disease were recorded at monthly interval *viz*., 30, 60 and 90 days after planting.

The treatment details are as follows (Table 1):

Treatment details:

No. of treatment: 9

No. of replications: 3

D. Statistical Analysis

The data obtained were statistically analyzed (Gomez and Gomez, 1984) and the package used for analysis was IRRISTAT version 92 developed by the International Rice Research Institute, Biometrics Unit, The Philippines.

3. Results

1) Isolation of Pathogen and Testing Pathogenicity

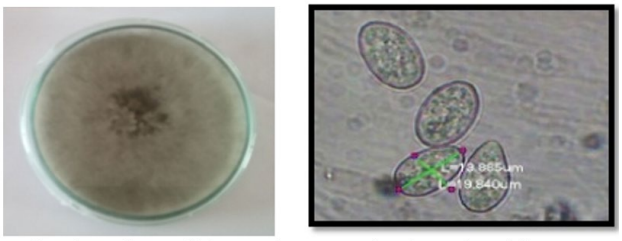
The incidence of nursery diseases were documented at FC &RI, Mettupalayam nursery during 2020. Several diseases were recorded (Table 2), among them the root rot incidence was noticed (Plate 1) throughout the season.

Table 2
Documentation of disease incidences in Teak and sandal nurseries at FC & RI, Mettupalayam

Tree	Disease	Incidence
Teak	Seedling rot	48.3 %
	Leaf spot	26.3 PDI
	Leaf blight	18.6 PDI

Fig. 1. Plate 1: Documentation of disease incidences in Teak and sandal nurseries during 2020 at FC & RI, Mettupalayam

Pathogen was isolated from infected samples and it had dark coloured septate mycelia, produced bicelled conidia, hence based on morphological character, it is confirmed as *Lasidiplodia theobrommae* (Plate 2).



Dark coloured mycelial growth Dark coloured conidia

Fig. 2. Plate 2: Morphological characters of the pathogen: Teak root rot pathogen: *Lasidiplodia theobrommae*

The root rot pathogen (*Lasidiplodia theobrommae*) was mass multiplied in sand maize medium and inoculated in the soil of one year old healthy seedlings @ 5g/kg of soil in nursery bags and kept for observation. The symptom of rotting was expressed 23 days after inoculation.

2) Screening of fungicides against root rot pathogen under in vitro condition

Seven fungicides *viz*, Propiconazole, Tebuconazole, Hexaconazole, Azoxystrobin screened for their inhibitory activity against teak root rot, *L.theobrommae*. by poisoined food technique at 1000ppm concentration.

The results of the study indicated that, among the fungicides tested, Propiconazole 25% EC, Tebuconazole 25.9% EC and Hexaconazole 5% EC were completely inhibited the growth of *L.theobrommae* (Table 3: Plate 3) at 1000 ppm concentration.

Table 3
Screening of fungicides for the mycelial growth of *L.theobrommae*

S.No.	Fungicide screened	Growth of pathogen (in mm)	% inhibition over control
1	Propiconazole 25% EC	0.00 (0.71)	100.0
2	Tebuconazole 25.9% EC	0.00 (0.71)	100.0
3	Hexaconazole 5% EC	0.00 (0.71)	100.0
4	Azoxystrobin 23.1% SC	20.00 (4.53)	77.78
5	Picoxystrobin 22.52% SC	20.00 (4.53)	77.78
6	Iprovalicarb + Propineb 5.5% + 61.25% WG	23.00 (3.67)	74.44
7	Metiram + Pyraclostrobin 55% + 5% WG	51.00 (7.18)	43.33
8	Carbendazim 50% WP	0.00 (0.71)	100.0
9	Control	90.00	-

Table 4
Testing the efficacy of fungicides in combined with bio control agents on the management of root rot in Teak

Tr.No.	Treatment Details	Seedling height (cm)	Incidence of Root rot (%)		
			30 Days	60 Days	90 Days
T_1	SD with Propiconazole 25% EC	19.8	8.5	11.6	13.3
T_2	SD with Tebuconazole 25.9% EC	18.5	9.8	12.8	15.2
T_3	SD with Hexaconazole 5% EC	19.1	8.7	12.5	14.5
T_4	SD with Carbendazim 50% WP	18.6	9.2	13.5	15.6
T_5	SD with Propiconazole 25% EC + SA of *T.asperellum* @ 2g/kg of soil	25.9	6.10	7.40	10.10
T_6	SD with Tebuconazole 25.9% EC + SA of *T.asperellum* @ 2g/kg of soil	24.9	8.60	9.20	12.90
T_7	SD with Hexaconazole 5% EC + SA of *T.asperellum* @ 2g/kg of soil	25.4	6.70	8.17	11.43
T_8	SD with Carbendazim 50% WP+ SA of *T.asperellum* @ 2g/kg of soil	24.6	7.40	9.34	12.93
T_9	Control	15.3	10.83*	15.50*	21.83*
	SED	0.784	0.618	0.703	0.730
	CD (P=05)	1.647	1.299	1.477	1.532

SD- Seedling Dip at 0.1% solution: SA- Soil Application

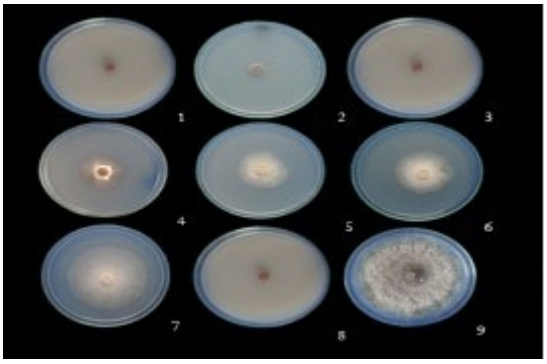


Fig. 3. Plate 3: *In vitro* Screening of fungicides for the mycelial growth of the pathogens

3) Testing the efficacy of new molecules of fungicides and biocontrol agents for the management of disease in glass house condition

Under glass house condition, the fungicides were tested against root rot pathogen. The incidence of disease were recorded at monthly interval *viz*., 30, 60 and 90 days after planting.

The results of the study indicated that, among the different treatments, seedling dip with propiconazole 0.1% along with soil application of *T.asperellum* @ 2g/kg of soil recorded minimum incidence (10.10%) followed by seedling dip with hexaconazole 0.1% along with soil application of *T.asperellum* @ 2g/kg of soil (11.43%) in teak while in control the incidence was 21.83% (Table 4).

4. Discussion

Several studies were conducted for the management of nursery diseases using fungicides and biocontrol agents. Surulirajan *et al.* (2014) reported that hexaconazole and propiconazole were found to be effective at 1000 ppm concentration against the radial mycelial growth of *L. theobromae*. In addition, working with *L. theobromae* by (Nath *et al.*, 2014) under *in-vitro* indicated that hexaconazole at 500 ppm, propiconazole and carbendazim at 250 ppm were completely inhibited the pathogen this was similar to the present study. Suresh, (2014) reported that Propiconazole and Carbendazim at 250 and 500 ppm gave 100 percent inbition and also Metiram + Pyraclostrobin showed 83.70 and 86.11 percent inbition at 250 and 500 ppm respectively.

In the present study, root dipping of the teak seedling in propiconazole (0.1%) along with soil application of the *T.viride* significantly reduced (10.10%) the incidence of root rot in teak nurseries whereas in control plots the incidence was 21.83% . This is in confirmation with the previous research work.

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