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Evaluation of Fungicides and Bio-Control Agents against Foliar and Soil Borne Diseases of *Melia dubia*

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ABSTRACT

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Malabar neem (*Melia dubia*), which is locally known as “Malaivembu”. The tree is found in forest plantations in India and is a fast growing tree crop with up to 20 m height. It produces greater bio-mass in relatively shorter period. The present study was carried out to evaluate commercially available fungicides and bio-fungicides *in-vitro*, for their efficacy against foliar and soil borne pathogens. Firstly five promising fungicides and four biocontrol agents were evaluated against fungal pathogens under laboratory conditions. During *in-vitro* studies PDA amended with fungicides with different treatments at different inhibitory concentrations, almost completely inhibited the growth of pathogens at 1500 ppm with varying degree of success whereas Carbendazim being the most effective treatment with maximum reduction in mycelial growth of tested fungi as compared to other fungicides and control followed by combined fungicide carbendazim+mancozeb. While antagonistic biocontrol agents, *Bacillus subtilis*, *Chaetomium globosum* and *Trichoderma viride* are most effective against *Pythium* sp., and *Pseudomonas fluorescens* are effective against *Phoma* sp. Further field evaluations of the biocontrol agents and fungicides are required.

Introduction

Malabar neem (*Melia dubia* Cav.) family Meliaceae is an indigenous species to the Western Ghats of southern India and common in moist deciduous forest of Kerala (Gamble, 1902). It also occurs in the tropical moist deciduous forests of the Sikkim Himalayas, North Bengal, Upper Assam and the Khasi hills of Odisha, Southeast Asia and Australia.

It is a fast growing multipurpose tree species, which is in high demand in plywood industry and high quality termite and fungal resistant timber and has potential to use in biomass power plants (power generation), apart from the urban landscaping and in a forestation. The intensive increase in the area of industrial wood under forest plantations has led to the outbreak of pests and diseases to a greater magnitude. Among the various factors,

diseases rank as a prime factor causing serious losses in *M. dubia*. In this situation the availability of disease free seeds and seedlings for planting is the prior need to meet out the industrial demand economic losses are caused by fungal pathogens. Nair *et al.*, (2002) reported *Colletotrichum dematium* and *Cylindrocladium ilicicola* were new pathogen records for *M. dubia*.

In out-planted seedlings of *M. dubia*, no major disease was recorded. Die-back of planted out seedlings was noticed and physiological stress due to drought may be the possible reason for the large-scale mortality. *Botryodiplodia theobromae* was found associated with the dried up shoots (Nair *et al.*, 2002). In this study, the collar rot of *M. dubia* caused by *Pythium* sp in nursery leads heavy losses in production, in the tropics *Lasiodiplodia theobromae* is an economically important fungus known to cause major losses in plantation.

However, the etiology of the diseases of *M. dubia* in Tamil Nadu has not been established. The existence of different pathogenic types based on morphological and cultural characters and pathogenicity has not been studied. These studies are needed to develop effective management of the diseases in *M. dubia*.

Disease management through biological means can result from the reduction of pathogen inoculum, protection of the infection court, reduction of infection of the reduction of the host, or reduction of disease progression or severity (Cook and Baker, 1983). So far no detailed study on foliar as well as soil borne diseases of *Melia dubia* in Tamil Nadu and their management in nursery and plantation. Based on their importance of diseases and their losses to pulpwood yield of *Melia dubia* the present study was under taken.

Materials and Methods

The present investigation was undertaken at the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore and Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam. The effectiveness of fungicides and antagonistic organisms against foliar and soil borne pathogens were studied under *in vitro* conditions.

In vitro evaluation of fungicides against foliar and soil borne pathogens

The *in vitro* efficacy of various fungicides against the pathogen was tested by Poisoned food technique (Schmitz, 1930). For that 100 ml of PDA medium was taken in 250 ml conical flask and sterilized. Three different concentrations of following each fungicide were mixed separately with the medium taken in conical flask and poured into sterilized petri dishes at 20 ml per plate. Mycelial disc of 10 mm diameter were cut from actively growing seven days old cultures of the pathogen and placed at the centre of each Petri dish containing poisoned medium. Three replications were maintained for each concentration of all fungicides. Medium without fungicide served as control. The radial growth of the fungal colony was recorded on seven days after inoculation.

The per cent inhibition of growth over control was calculated by the formula suggested by Vincent (1927)

$$\text{Per cent inhibition of growth} = \frac{C - T}{C} \times 100$$

Where,

C = Growth of pathogen in control (mm)

S. No.	Chemical Name	Trade Name	Concentration (ppm)
1.	Carbendazim	Bavistin	500, 1000, 1500
2.	Copper oxychloride	Fytolan	500, 1000, 1500
3.	Metalaxyl	Ridomil	500, 1000, 1500
4.	Propiconazole	Tilt	500, 1000, 1500
5.	Carbendazim + Mancozeb	Bavistin + Indofil M-45	500, 1000, 1500

***In vitro* evaluation of fungal antagonists against foliar and soil borne pathogens**

The effects of fungal antagonists like *Trichoderma viride* and *Chaetomium globosum* against pathogens of *M. dubia* were tested by dual culture method (Skidmore and Dickinson, 1976). For that 20 ml of PDA medium was transferred into sterilized petri plates. After solidification of the medium mycelial disc of 10 mm diameter was cut from actively growing culture of the fungal pathogens and placed in the centre of one half of the petri plates. The fungal antagonist was transferred and placed at the centre of the half of the same petri plates. Petriplate containing medium without biocontrol agent served as control. Three replications were maintained for each treatment. The radial mycelial growth of the pathogen and antagonist were taken daily till the control plates attained full growth. The nature of the reaction of the antagonist on the pathogen was studied by following the method given by Purkayastha and Bhattacharya (1982).

***In vitro* evaluation of bacterial antagonists against foliar and soil borne pathogens**

The standard culture of the bacterial antagonist's viz., *Pseudomonas fluorescens* and *Bacillus subtilis* was used to test the antagonistic effect against foliar and soil borne pathogens by dual culture method. Mycelial disc of actively growing culture of pathogen of 10mm diameter size was transferred to the centre of the petri plates containing PDA medium. The bacterium was inoculated as a line of streak on one side of the pathogen. The

inoculated Petri plates were incubated at room temperature and observations on the growth of the pathogen were taken at regular interval. Petriplate containing medium without biocontrol agent served as control. Three replications were maintained for each isolates. The radial growth of the pathogen and colonization of antagonist were taken daily till the control plates attained full growth (Purkayastha and Bhattacharya, 1982).

Results and Discussion

Melia dubia is affected by a number of diseases at all stages of its development i.e. from nursery to harvest. The foliar diseases are leaf spot, leaf blight and soil borne diseases are Collar rot and root rot were recorded in the present study and causing severe yield and quality loss in *M. dubia*. In India first report on *L. theobromae* was given by Nair *et al.*, (2002). In some nurseries, severe mortality of *M. dubia* seedlings was also observed due to *Pythium* sp. Hence the present study was carried out on the diseases of *M. dubia* and their management and the results are discussed below.

Evaluation of chemical fungicides against pathogens

In vitro* evaluation of fungicides against *Lasiodiplodia theobromae

Among the three concentration of fungicides tested the Carbendazim was found to be the most effective fungicide at all the three concentration tested viz., 500, 1000, 1500 ppm and recorded the mycelial growth of viz.,

14.00 mm, 0.61 mm and 0.00 respectively, followed by Propiconazole treatment which recorded the mycelial growth of 16.00, 12.00 and 5.50 mm at 500, 1000 and 1500 ppm respectively. Whereas in untreated control the maximum mycelial growth of 90 mm was recorded in all the concentration (Table 1). Khanzada *et al.*, (2004) reported in *Mangifera indica* that the mycelial growth of *Lasiodyplodia theobromae* was significantly inhibited by Carbendazim and Thiophanate-methyl when used at 1 ppm. Banik *et al.*, (1998) recorded Carbendazim at 400 ppm completely inhibited the linear growth of *L. theobromae* on Mango. Bhatt and Jadeja (2010) reported that stem rot disease in Mango caused by *L. theobromae* was inhibited by hundred per by Propiconazole at 1000 ppm.

***In vitro* evaluation of fungicides against *Pythium* spp**

Among the five fungicides tested, Carbendazim + Mancozeb and Propiconazole were found to be effective at all three concentrations and showed hundred per cent mycelial inhibition, followed by Carbendazim treatment which recorded the mycelial growth of 1.52, 0.95 and 0.00 at 500, 1000, 1500 ppm respectively. The untreated control recorded the maximum mycelial growth of 90 mm in all the concentrations tested against *Pythium* sp (Table 2). Sharma *et al.*, (1985) reported that damping-off diseases of *Ailanthus triphysa* was effectively controlled by two soils drenches of Mancozeb (0.05 and 0.02%). Rakesh Kumar *et al.*, (2010) reported that damping off disease of maize caused by *Pythium deliense* and *Pythium oligandrum* was effectively inhibited by Metalaxyl and Benzoid fungicide at 200 ppm.

In vitro* evaluation of fungicides against *Fusarium moniliformis

The treatments *viz.*, Carbendazim, Carbendazim + Mancozeb and Propiconazole

recorded 0.00 mm mycelial growth at all the three concentration tested by poison food technique and hundred per cent inhibition over control was recorded at all the three concentrations tested against *F. moniliformis*. The fungicide Metalaxyl was found to be less effective at all the three concentrations tested against *Fusarium moniliformis* under *in vitro* condition (Table 3). Bhanumathi and Ravishankar Rai (2007) reported that leaf blight disease in *Azadirachta indica* caused by *F. solani* was completely inhibited by Carbendazim at all three concentration *viz.*, 50, 100, 150 ppm. Rukhasana Bajwa *et al.*, (2003) reported that wilt disease in *Dalbergia sissoo* caused by *Fusarium solani* was completely inhibited by Metalaxyl at the concentration of 200 ppm. Irum Mukhtar (2007) reported that wilt disease in Chick pea caused by *Fusarium oxysporium* was completely inhibited by Carbendazim and Benomyl at all the three concentrations *viz.*, 0.1 per cent, 0.2 per cent and 0.3 per cent.

***In vitro* evaluation of fungicides against *Phoma* sp**

The results revealed that the fungicides Carbendazim, Carbendazim + Mancozeb and Propiconazole treatments completely arrested the growth of *Phoma* sp at all the three concentrations tested and recorded hundred per cent inhibition of mycelial growth as compare to untreated control. The Metalaxyl was found to be less effective at all the three concentrations tested against *Phoma* sp under *in vitro* condition. Among the five fungicides tested against the *Phoma* sp. revealed that the Carbendazim, Carbendazim + Mancozeb and Propiconazole treatments completely arrested the growth of *Phoma* sp at all the three concentrations tested and recorded hundred per cent inhibition of mycelial growth as compare to untreated control (Table 4).

The Metalaxyl was found to be less effective at all the three concentrations tested against

Phoma sp under *in vitro* condition. Mohanan *et al.*, (2005) observed that the application of Carbendazim (0.05 %) and Mancozeb was found to be effective against seedling blight of *Cassia fistula* caused by *Phoma glomerata* in nursery. Patil *et al.*, (2010) reported that leaf spot disease in Indian Bean caused by *Phoma* sp and recorded the minimum per cent disease intensity and maximum per cent disease control was achieved with the treatment of Carbendazim at 0.05 per cent in the field conditions.

In vitro* evaluation of fungicides against *Rhizoctonia solani

Among the fungicides tested, treatment with Carbendazim, Carbendazim + Mancozeb and Propiconazole recorded 0.00 mm mycelial growth at all the three concentrations namely *viz.*, 500, 1000 and 1500 ppm against *Rhizoctonia solani* by poison food technique and hundred per cent inhibition over control followed by Copper oxychloride (62.22 per cent inhibition at 1500 ppm). The Metalaxyl was found to be less effective in all the three concentrations tested against *Rhizoctonia solani* under *in vitro* condition (33.33 per cent inhibition at 1500 ppm) (Table 5). Ramesh (1998) reported that fungicides like Carbendazim and Metalaxyl were found to be more effective in inhibiting the growth of *R. solani* (93.75 % over control) at all the concentrations (0.1 %, 0.5 % and 0.025 %) tested against *R. solani* in *Tectona grandis*. Kumar *et al.*, (2011) reported that Bavistin was effective in inhibiting the growth of *R. bataticola* and reducing the incidence of *Jatropha* root rot.

***In vitro* evaluation on antagonistic effect of bio control agents against foliar and soil borne pathogens**

Even though chemical fungicides are very effective to manage the diseases, the continuous use of fungicides is not recommended for the management of a

disease. It may lead to the development of resistant strains of the pathogen, and may cause residual toxicity.

An alternative approaches is the use of bioagents for the management of plant diseases. Hence *in vitro* evaluation of fungal and bacterial antagonists against the soil borne and foliar pathogens of *Melia dubia* was carried out and results are discussed below. The inhibitory effect of standard cultures of fungal and bacterial antagonists against the foliar and soil borne pathogens of *Melia dubia* was studied under *in vitro* condition by dual culture Technique. Standard cultures of *Trichoderma viride* (TNAU-isolates), *Chaetomium globosum* (TNAU-isolates), *Bacillus subtilis* (TNAU-isolates) and *Pseudomonas fluorescens* (TNAU- isolates) were used for this study.

Evaluation of bacterial antagonists against foliar and soil borne pathogens

Effect of *Bacillus subtilis* against soil and foliar pathogens of *Melia dubia*

Antagonistic effect of *B. subtilis* was tested against foliar and soil borne pathogens of *M. dubia* under *in vitro* conditions. Fungal pathogens *viz.*, *Lasiodiplodia theobromae*, *Fusarium* sp., *Phoma* sp., and *Rhizoctonia solani* mycelial growth were successfully suppressed. Among the pathogens tested, the chromistan pathogen *Pythium* sp recorded the minimum mycelial growth of 47.00 mm and maximum per cent inhibition of 47.77 per cent as compare to untreated control (90.00 mm) (Table 6). Kumar *et al.*, (2011) reported that root rot of *Jatropha* caused by *Rhizoctonia bataticola* was tested, under *in vitro* conditions with *Pseudomonas maltophilia*, *P. fluorescens* and *Bacillus subtilis*. The inhibition by the different antagonists ranged from 38.9 to 58.9 per cent. Kumar *et al.*, (2011) recorded damping-off disease in Tomato caused by *Pythium aphanidermatum*

was inhibited to 65.33 per cent by the *Bacillus subtilis* and Maha Pancha Gavya (MPG).

Rhizoctonia solani mycelial growth were successfully suppressed.

Effect of *Pseudomonas fluorescens* against soil and foliar pathogens of *Melia dubia*

Among the pathogens tested, the *Phoma* spp recorded the minimum mycelial growth of 45.50 mm and maximum inhibition over control of 49.44 per cent.

The pathogens viz., *Lasiodiplodia theobromae*, *Fusarium* sp., *Pythium* sp., and

Table.1 *In vitro* evaluation of fungicides against *Lasiodiplodia theobromae*

S. No.	Fungicides	Mycelial growth (mm)*			Per cent inhibition over control		
		500 ppm	1000 ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
1	Carbendazim	14.00a (21.99)	0.61a (3.51)	0.00a (1.96)	84.40a (66.76)	99.38a (86.45)	100.00a (88.13)
2	Copper oxychloride	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	0.00c (1.96)	0.00d (1.96)	0.00d (1.96)
3	Carbendazim + Dithane	45.00c (41.14)	33.00c (35.08)	0.00a (1.96)	50.00b (45.01)	63.36c (52.75)	100.00a (88.13)
4	Propiconazole	16.00b (23.59)	12.50b (20.72)	5.50b (13.56)	82.22a (65.09)	86.14b (68.15)	93.91b (75.74)
5	Metalaxyl	90.00d (71.61)	90.00d (71.61)	80.25c (63.64)	0.00c (1.96)	0.00d (1.96)	10.86c (19.23)
6	Control (Untreated)	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	-	-	-

* Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Table.2 *In vitro* evaluation of fungicides against *Pythium* sp

S. No.	Fungicides	Mycelial growth (mm)*			Per cent inhibition over control		
		500 ppm	1000ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
1	Carbendazim	1.52b (6.87)	0.95a (4.57)	0.00a (1.96)	98.30b (82.83)	98.94a (85.12)	100.00a (88.13)
2	Copper oxychloride	55.00c (47.88)	39.00b (38.66)	15.00b (22.58)	38.88c (38.59)	56.66b (48.84)	83.33b (65.93)
3	Carbendazim + Dithane	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
4	Propiconazole	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
5	Metalaxyl	79.00d (62.75)	71.00c (57.44)	60.50c (50.91)	12.22d (20.47)	21.11c (27.37)	32.77c (34.94)
6	Control (Untreated)	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	-	-	-

* Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Table.3 *In vitro* evaluation of fungicides against *Fusarium moniliformae*

S.No	Fungicides	Mycelial growth (mm)*			Per cent inhibition over control		
		500 ppm	1000ppm	1500 ppm	500 ppm	1000ppm	1500 ppm
1	Carbendazim	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
2	Copper oxychloride	69.00c (56.18)	46.00b (42.72)	22.00a (27.99)	23.33c (28.90)	48.91b (44.37)	77.80b (61.89)
3	Carbendazim + Dithane	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
4	Propiconazole	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
5	Metalaxyl	60.00b (50.78)	58.50c (49.91)	53.50c (47.02)	33.33b (35.28)	35.00c (36.28)	40.55c (39.57)
6	Control (Untreated)	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	-	-	-

* Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Table.4 *In vitro* evaluation of fungicides against *Phoma* sp

S. No.	Fungicides	Mycelial growth (mm)*			Per cent inhibition over control		
		500 ppm	1000ppm	1500 ppm	500 ppm	1000 ppm	1500 ppm
1	Carbendazim	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
2	Copper oxychloride	56.00b (48.46)	53.00b (46.73)	48.00b (43.87)	37.77b (37.93)	41.11b (39.89)	46.66b (43.10)
3	Carbendazim + Dithane	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
4	Propiconazole	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
5	Metalaxyl	70.00c (56.81)	66.00c (54.35)	49.00b (44.44)	22.22c (28.14)	26.66c (31.10)	45.55b (42.46)
6	Control (Untreated)	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	-	-	-

* Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Table.5 *In vitro* evaluation of fungicides against *Rhizoctonia solani*

S. No.	Fungicides	Mycelial growth (mm)*			Per cent inhibition over control		
		500 ppm	1000ppm	1500 ppm	500 ppm	1000ppm	1500 ppm
1	Carbendazim	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
2	Copper oxychloride	45.00b (42.14)	38.00b (38.07)	34.00b (35.68)	50.00b (45.01)	57.77b (49.48)	62.22b (52.09)
3	Carbendazim + Dithane	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
4	Propiconazole	0.00a (1.96)	0.00a (1.96)	0.00a (1.96)	100.00a (88.13)	100.00a (88.13)	100.00a (88.13)
5	Metalaxyl	66.00c (54.35)	62.00c (51.96)	60.00c (50.78)	26.66c (31.10)	31.11c (33.92)	33.33c (35.28)
6	Control (Untreated)	90.00d (71.61)	90.00d (71.61)	90.00d (71.61)	-	-	-

*Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Table.6 Effect of *Bacillus subtilis* against soil and foliar pathogens of *Melia dubia*

S. No.	Fungicides	Mycelium growth (mm)*	Inhibition over Control
1	<i>Lasiodiplodia theobromae</i>	90.00c (71.61)	0.00c (1.96)
2	<i>Pythium</i> sp	47.00a (43.29)	47.77a (43.74)
3	<i>Fusarium moniliformae</i>	90.00c (71.61)	0.00c (1.96)
4	<i>Phoma</i> sp	71.50b (57.75)	20.55b (26.97)
5	<i>Rhizoctonia solani</i>	71.00b (57.44)	21.11b (27.37)
6	Control (Untreated)	90.00c	-

* Values are mean of three replications

In a column, means followed by a common letter is not significantly different at 5% level by DMRT

Values in parentheses are arcsine transformed values

Followed by *R. solani* recorded minimum mycelial growth of 58.00 mm and maximum per cent inhibition over control of 35.55 per cent as compare to untreated control (90.00 mm). Subhashini and Padmaja (2011) reported that damping off disease in Tobacco caused by *Pythium aphanidermatum* effectively controlled by *Trichoderma viride* and *Pseudomonas fluorescens* by dual culture techniques (Inhibition per cent of 54%). Biswas *et al.*, (2010) reported that sheath blight disease of rice caused by *Rhizoctonia solani* showed maximum inhibition (56.3%) of radial growth of mycelium over control by the antagonistic effect of *P. fluorescens*.

Evaluation of Fungal antagonists against foliar and soil borne pathogens

Effect of *Trichoderma viride* against soil and foliar pathogens of *Melia dubia*

Trichoderma harzianum being the most efficient followed by *T. viride*, *T. koningii* and *Gliocladium virens*. Among the soil borne pathogens tested, *T. viride* was found to be effective against *Pythium* sp which recorded the minimum mycelial growth of 45.00 mm and maximum per cent inhibition over control of 50.00 per cent as compare to untreated control (90.00 mm). Among the foliar pathogens tested, antagonist *T. viride* was found effective in reducing the mycelial growth of *F. moniliformis* (38.50 mm) and maximum per cent inhibition of 57.22 followed by *Phoma* sp which recorded the minimum mycelial growth of 41.00 mm and maximum inhibition of 54.44 per cent as compare to untreated control (90.00 mm). Kumar *et al.*, (2011) reported that root rot disease of *Jatropha* caused by *R. bataticola* recorded the highest mycelial growth inhibition (58.9%) under *in vitro* conditions by *Trichoderma harzianum* compared with *Pseudomonas maltophilia*, *P. fluorescens* and *Bacillus subtilis*.

Effect of *Chaetomium globosum* against soil and foliar pathogens of *Melia dubia*

The results revealed that the *Chaetomium globosum* was not effective against soil borne diseases of *M. dubia* which recorded the minimum inhibition over control ranged from 15.56 per cent to 35.56 per cent. Among the foliar pathogens tested, the *F. moniliformis* recorded the minimum mycelial growth 41.00 mm and maximum per cent inhibition over control of 54.44 per cent followed by *Phoma* sp. Shanthiyaa *et al.*, (2013) reported that late blight disease of Potato caused by *Phytophthora infestans* showed greater inhibition of mycelial growth when tested against *C. globosum* under *in vitro* condition.

The strength of a management practices for plant protection is well-defined as the persistence of its effectiveness in space and time. The durability of chemical fungicides has for occasion been deliberate because of the regular and recurrent apparition of resistance to fungicides in major plant pathogenic populations.

In contrast, the durability of antagonistic biological control has long been anticipated to be higher than that of chemical control. In the present study we attempted the efficacy of both chemicals and biological agents, comparably with cost and sustainability in the prolonged crop system, role of biocontrol agents are reliable and attractive alternative than the fungicides.

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