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In vitro* evaluation of phyto-extracts in the management of Myrothecium leaf blight of cotton incited by *Myrothecium roridum

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Abstract

The *Myrothecium* leaf blight disease of cotton incited by *Myrothecium roridum* is causing losses in significant proportions in many cotton growing tracts of Odisha. Considering the importance and emerging scenario of the disease, management studies have been conducted for the control of the disease in an environmentally sustainable manner. The efficacy of Twelve plant extracts viz. *Azadirachta indica*, *Allium cepa*, *Ocimum sanctum*, *Aegle marmelos*, *Allium sativum*, *Cymbopogon flexiosus*, *Lantana camara*, *Ipomoea batatas*, *Pongamia pinnata*, *Nyctanathes arbortristis*, *Eucalyptus citriodora* and *Mentha arvensis* were evaluated under *in-vitro* at 10% and 20% concentrations by Poison food technique. The study revealed that all the plant extracts at both the concentrations were significantly superior in reducing the growth of *Myrothecium roridum* as compared to control. At 10% concentration *Nyctanathes arbortristis* was proved to be effective and recorded maximum reduction of growth by 74% and the least reduction of growth was recorded by *Aegle marmelos* i.e. 5.8%. At 20% concentration the cent per cent growth inhibition was recorded in plant extract of *Mentha arvensis* followed by *Nyctanathes arbortristis* with an inhibition of 79.8% at 20% concentration. The least inhibition was recorded by *Cymbopogon flexiosus* 48.6%.

Keywords: *Myrothecium*, cotton, leaf blight, phyto-extracts, management

1. Introduction

Cotton is one of the most important cash crops in India which sustains the Indian cotton textile industry with a highest net foreign exchange of about 30%. The production potential of the crop has not been fully exploited due to biotic and abiotic factors. The crop suffers from various diseases i.e. bacterial blight, grey mildew, alternaria leaf spot, myrothecium leaf spot, collar rot and wilt etc., of which foliar diseases take a heavy toll (Hosagaudar *et al.*, 2008) [3]. Among all the foliar diseases the incidence of *Myrothecium* leaf blight is growing consistently throughout the country and has been reported to cause losses in significant proportions in many cotton growing tracts of Odisha. The disease has been reported to cause loss in seed cotton up to 15-20 per cent (Taneja *et al.*, 1989, Tomar *et al.*, 2010) [8, 9]. The infection on leaves and petioles leads to defoliation while on bolls results in damage of the lint by way of staining the fibres, thus reducing the economic value of the lint (Shrivastava and Singh, 1973) [6]. The pathogen *M. roridum* is a common soil inhabiting fungus with a relatively wide host range that includes agronomic crops including cotton, tomato, cocoa, coffee, potato, soybean, cucurbits as well as various ornamental plants (Bharath *et al.*, 2006) [2]. Considering the importance and emerging scenario of the disease, management studies have been conducted for the control of the disease in an environmentally sustainable manner. Manas *et al.* (2005) [4] screened 21 plants and found that maximum inhibition of the radial growth and sporulation of *M. roridum* in Mulberry was recorded in the extracts of *Datura metel* (33.33%) followed by *Allium sativum* (25%), *Chromoleana odorata* (20%) and *Eucalyptus citriodora* (16.66%). Abid *et al.* (2017) [1] have tested the antifungal activity using solvent extracts of five medicinal plants and have observed *N. tabacum* followed by *M. azedarach* to be effective in inhibiting the radial growth of *Myrothecium roridum*.

2. Materials and Methods

Twelve number of locally available plant parts were taken to test their efficiency against the test pathogen. The botanicals used were *Azadirachta indica*, *Allium cepa*, *Ocimum sanctum*, *Aegle marmelos*, *Allium sativum*, *Cymbopogon flexiosus*, *Lantana camara*, *Ipomoea batatas*,

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Pongamia pinnata, *Nyctanathes arbortristis*, *Eucalyptus citriodora* and *Mentha arvensis*. Fresh plant materials of different plant species were thoroughly cleaned, surface sterilized with 2% sodium hypochlorite and washed well with sterile water. The predetermined plant parts were grounded along with sterile water at the rate of 1:1 w/v using pestle and mortar and the macerate was filtered through a Whatman No.1 filter paper under sterilized condition to get the clear plant extract (100%). The extract of each plant species at two concentrations viz., 10 and 20 per cent were tested against the test fungus by poison food technique (Nene and Thapliyal, 1971) [5]. Three replications were maintained for each plant extract. The colony diameter was recorded and per cent inhibition of growth over control was estimated. The efficacy of plant extracts or botanicals was expressed as per cent inhibition of radial growth over the control which was calculated by using the formula using the formula given by Vincent (1927) [10].

$$I = \frac{C - T}{C} \times 100$$

Where,

I = per cent inhibition.

C = growth of pathogen in control

T = growth of pathogen in treatment

The data obtained *in-vitro* on per cent growth inhibition of test fungus were analysed following Completely Randomized Design (CRD) Further, corresponding angular transformation were made for data and analysed statistically

3. Results and Discussion

The efficacy of plant extracts on growth of *M. roridum* was tested *in-vitro* at two different concentrations i.e. at 10% and 20 %. It is clear from the data in Table 1 that all the plant extracts at both the concentrations were significantly superior in reducing the growth of *Myrothecium roridum* as compared to control. The per cent growth inhibition by different plant extracts 15 DAI ranged from 5.8% to 71.9% and 48.6% to 100% at 10% and 20% concentration respectively. Maximum reduction of mycelium was observed at 20% concentration as compared to 10% concentration. All plant extracts were effective in reducing mycelial growth with the increase in concentration. At 10% concentration *Nyctanathes arbortristis* was proved to be effective and recorded maximum reduction of growth by 74%, this is followed by *Azadirachta indica* with 71.9% inhibition. The least reduction of growth of *M. roridum* was recorded in phytoextract of *Aegle marmelos* i.e. 5.8%. At 20% concentration the cent per cent growth inhibition was recorded in plant extract of *Mentha arvensis* followed by *Nyctanathes arbortristis* with an inhibition of 79.8% at 20% concentration. The least inhibition was recorded by *Cymbopogan flexiosus* 48.6%.

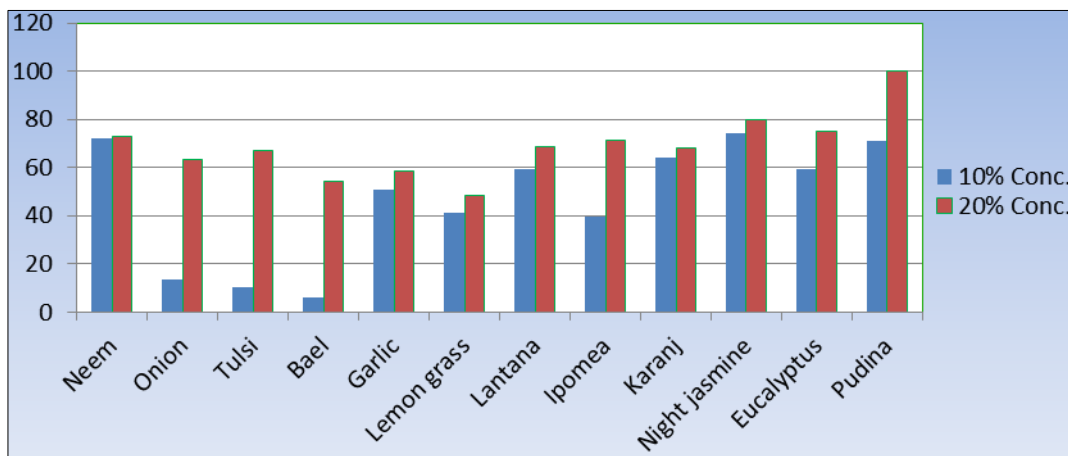
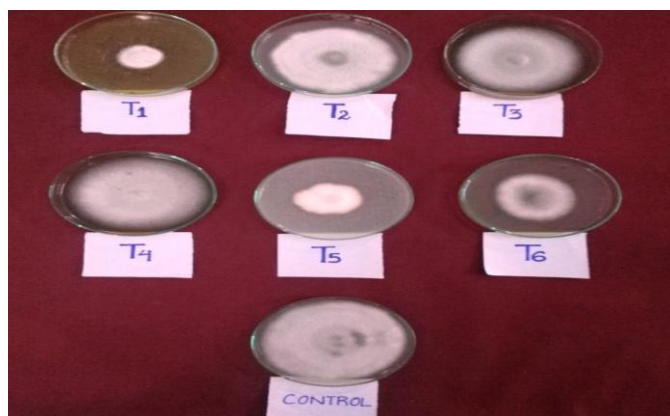


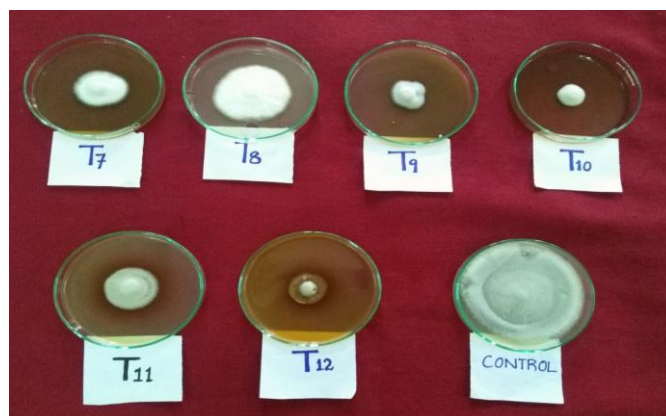
Fig 1: Efficacy of phyto-extracts on radial growth of Myrothecium roridum at 10% and 20% concentration

Plate 1: Efficacy of Phytoextracts at 10% concentration against *M. roridum in-vitro* (T₁-T₆)

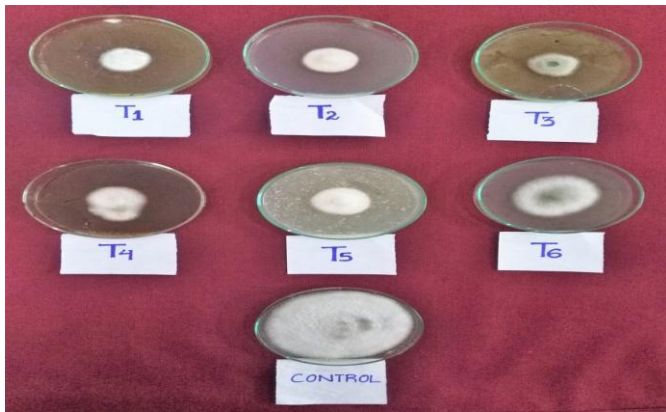


T₁ - *Azadirachta indica*; T₂ - *Allium cepa*; T₃ - *Ocimum sanctum*; T₄ - *Aegle marmelos*
T₅ - *Allium sativum*; T₆ - *Cymbopogan flexiosus*

Efficacy of Phytoextracts at 10% concentration against *M. roridum in-vitro* (T₇-T₁₂)

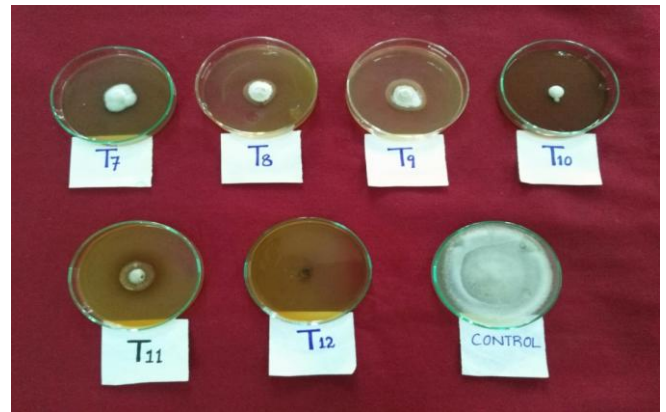


T₇ - *Lantana camara*; T₈ - *Ipomoea batatus*; T₉ - *Pongamia pinnata*; T₁₀ - *Nyctanathes arbortristis*; T₁₁ - *Eucalyptus citriodora*; T₁₂ - *Mentha arvensis*

Plate 1: Efficacy of Phytoextracts at 20% concentration against *M. roridum* In-vitro (T₁-T₆)

T₁ - *Azadirachta indica*; T₂ - *Allium cepa*; T₃ - *Ocimum sanctum*; T₄ - *Aegle marmelos*

T₅ - *Allium sativum*; T₆ - *Cymbopogon flexiosus*

Plate 2: Efficacy of Phytoextracts at 20% concentration against *M. roridum* in-vitro (T₇-T₁₂)

T₇ - *Lantana camara*; T₈ - *Ipomoea batatas*; T₉ - *Pongamia pinnata*; T₁₀ - *Nyctanathes arbortristis*; T₁₁ - *Eucalyptus citriodora*; T₁₂ - *Mentha arvensis*

Table 1: Efficacy of phyto-extracts on radial growth of *M. roridum*

T. No	Botanical Name	Common Name	Concentration 10%		Concentration 20%	
			Radial growth (mm)	%inhibition	Radial growth (mm)	%inhibition
T1	<i>Azadirachta indica</i>	Neem	24.83*	71.9 (57.99)	23.90*	72.8 (58.63)
T2	<i>Allium cepa</i>	Onion	76.53	13.3 (21.36)	32.53	63.1 (52.58)
T3	<i>Ocimum sanctum</i>	Tulsi	79.40	10.1 (18.53)	28.86	67.2 (55.06)
T4	<i>Aegle marmelos</i>	Bael	83.23	5.8 (13.94)	40.30	54.3 (47.47)
T5	<i>Allium sativum</i>	Garlic	43.33	50.9 (45.52)	36.76	58.3 (49.78)
T6	<i>Cymbopogon flexiosus</i>	Lemon grass	51.96	41.2 (39.93)	45.30	48.6 (44.20)
T7	<i>Lantana camara</i>	Lantana	35.86	59.4 (50.42)	27.60	68.7 (55.98)
T8	<i>Ipomoea batatas</i>	Ipomea	53.50	39.4 (38.88)	25.20	71.4 (57.69)
T9	<i>Pongamia pinnata</i>	Karanj	31.6	64.2 (53.37)	28.23	67.9 (55.49)
T10	<i>Nyctanathes arbortristis</i>	Night jasmine	22.96	74.0 (59.34)	17.83	79.8 (63.29)
T11	<i>Eucalyptus citriodora</i>	Eucalyptus	35.66	59.6 (50.53)	21.80	75.3 (60.20)
T12	<i>Mentha arvensis.</i>	Pudina	25.53	71.1 (57.48)	0.00	100.00 (90.00)
T13	Control		88.33		88.10	
	SE(m)±		1.359		0.122	
	CD (0.05)		4.477		0.356	

*Mean of three replication

4. Figures in the parenthesis are arc sin transformed value

Several studies have shown that extracts of plants have anti fungal properties in controlling the plant diseases. Manas *et al.* (2005) [4] have screened 21 plants and found that maximum inhibition of the radial growth and sporulation of *M. roridum* in Mulberry was recorded in the extracts of *Datura metel* (33.33%) followed by *Aliumsativum* (25%), *Chromolaena odorata* (20%) and *Eucalyptus citriodora* (16.66%). Antifungal activity of seven medicinal plant species against *Myrothecium* leaf spot of soyabean was tested under *in vitro* condition and have observed extract of neem leaves to be effective in inhibiting the mycelia growth of the fungus (Talukdar *et al.*, 2013) Abid *et al.*, (2017) [7, 1] tested the antifungal activity of five medicinal plants against *M. roridum* at various concentrations (0.01, 0.10, 1.0 and 10.0 µg / ml) and observed that maximum inhibition was recorded in *N. tabacum* and least inhibition was observed in the extract of *E. globosum*.

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