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Studies on bio efficacy of systemic fungicides against powdery mildew pathogen of Sandalwood

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Abstract

Sandal (*Santalum album* L.) a economically valued medicinal tree species affected by powdery mildew disease causing huge seedling mortality in the nursery. To identify the best systemic fungicide against, *In vitro* evaluation of two concentrations (100 ppm and 300 ppm) each of six different systemic fungicides were tested against conidial germination inhibition of *Pseudoidium santalacearum* causing powdery mildew by following spore germination method. Maximum inhibition of conidial germination was recorded in 300 ppm of Hexaconazole 5% SC (51.48%) followed by Propiconazole 25% EC (300 ppm) [46.33%]. Azoxystrobin 23% EC at 100 ppm resulted least conidial germination inhibition (20.12%). Maximum mean per cent inhibition was in Hexaconazole 5% SC (46.41%) followed by Propiconazole 25% EC (42.35%) and minimum inhibition per cent was recorded by Azoxystrobin 23% EC (25.89%).

Keywords: *Santalum album*, spore germination, powdery mildew

Introduction

Sandal (*Santalum album* L.) a valuable tree species belongs to family Santalaceae. It is one of the most important commercial and most precious tree species of Indian culture and heritage and Sandalwood oil is used for multiple purposes (Srinivasan *et al.*, 1992) [5]. The total extent of its distribution is around 9600 km² and of which 8200 km² (90%) lies in the states of Karnataka and Tamil Nadu (Dutt and Verma, 2005) [1]. *S. album* grows well under annual rainfall of 600-1600 mm and it attains a height up to 10-15 m and 1-2 m girth at full maturity (Jain *et al.*, 1999) [2].

Powdery mildew disease *Pseudoidium santalacearum* in the nursery pose a serious threat to quality seedling production and supply (Yu and Cen, 1990) [7]. So identifying a best fungicide is warranted for which laboratory bioassays is a necessity.

Material and Methods

In the present study, efficacy of different systemic fungicides at two concentrations was tested against *Pseudoidium santalacearum* by spore germination technique. Required concentrations (100 ppm and 300 ppm) of each fungicide were prepared by adding 0.01g and 0.03 g respectively into 100 ml distilled water. For each concentration, 3 replications were maintained and simultaneously a check was also maintained by suspending conidia in normal distilled water. 100 µl of fungicide solution was suspended in fungicide solution on a clean cavity slide and gently mixed so that spores get distributed uniformly. Each concentration was replicated thrice in a separate cavity slide. Untreated check was maintained by taking conidia in sterile distilled water. These cavity slides were kept in the petridishes lined with moistened blotting paper and incubated at 25±1 °C for 24 hr. After 24 h., 300 spores per microscopic field for each cavity was observed under 10 X. Total number of spores and germinated spores in each microscopic field were recorded and per cent germination was calculated.

$$\text{Per cent germination} = \frac{A}{B} \times 100$$

Where

A- No. of conidia germinated

B- No. of conidia observed

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The average of three cavities (three replications) was found out and per cent inhibition of spore germination was calculated with the following formula given by Vincent for each fungicide

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

Where

I = Per cent spore germination inhibition,
C = No. of spores germinated in control
T = No. of spores germinated in treatment

Results

Among the fungicides tested, the highest conidial germination inhibition was recorded in Hexaconazole 5% SC (Contaf) at 300 ppm (51.48%) followed by 300 ppm of Propiconazole 25 per cent EC (Tilt) (46.33%) [Table 1]. The conidial inhibition was lowest in Azoxystrobin 23% EC (Amistar) at 100 ppm (20.12%) followed by Tebuconazole 25 per cent EC (Folicure) at 100 ppm (25.74%). The mean conidial inhibition per cent was maximum in Hexaconazole 5% SC (Contaf) (46.41%) followed by Propiconazole 25% EC (42.35%) and minimum conidial inhibition per cent was recorded in Azoxystrobin 23% EC (Amistar) (25.89%).

Discussion

Fungicides constitutes the predominate part of the control measures used against powdery mildew. Among various fungicides tested, Hexaconazole 5% SC showed highest conidial germination inhibition followed by Propiconazole 25% EC. Several workers reported that, Hexaconazole and Propiconazole were found to be effective in reducing powdery mildew incidence in different species (Sharmila *et al.*, 2004; Longchar, 2008) [3]. Among the triazole group of fungicides, Hexaconazole found managing the powdery mildew disease very effectively. Hexaconazole is an ergosterol (vital constituent of the cell and its nonexistence causes irreparable damage) inhibiting fungicide by which the fungus dies. They change the sterol content and saturation of the polar fatty acids leading to alterations in membrane fluidity and behavior of membrane bound enzymes (Nene and Thapiyal, 1993). The best performance of the systemic fungicide Hexaconazole 5% SC may be due to possibility of high pathotoxicity with long lasting ant pathogenic activity.



Fig 1: *Pseudoidium santalacearum* before germination (at 10 X)

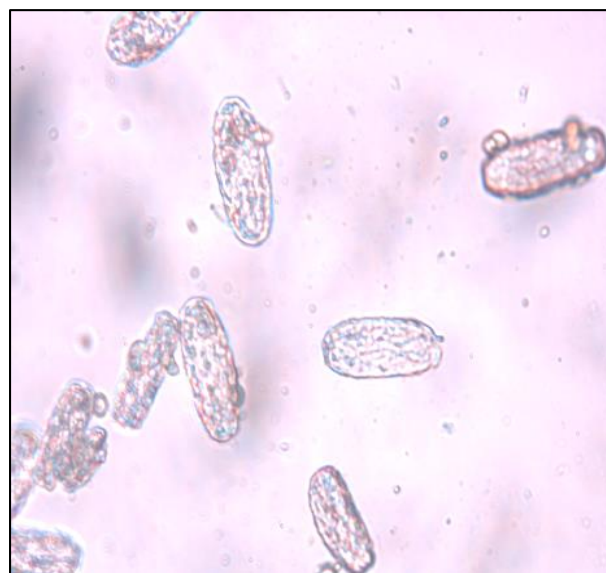


Fig 2: *Pseudoidium santalacearum* before germination (at 40 X)



Fig 3: *Pseudoidium santalacearum* with germ tube initiation (at 40X)



Fig 4: *Pseudoidium santalacearum* with germ tube development (at 40X)



Fig 5: *Pseudoidium santalacearum* with germ tube after 24 hrs (at 40X)



Fig 6: *Pseudoidium santalacearum* with germ tube (at 40X)

Table 1: *In vitro* evaluation of systemic fungicides against *Pseudoidium santalacearum* causing powdery mildew of *Santalum album*

Treatment Details			Conc. (ppm)	Spore germination Inhibition (%)	Mean Inhibition (%)
Treatment	Trade name	Chemical name			
T ₁	Control	Control	-	0.00	0.00
T ₂	Bavistin	Carbendazim 50% WP	100	28.39 (32.20)*	32.84
T ₃	Bavistin	Carbendazim 50% WP	300	37.29 (37.64)	
T ₄	Contaf	Hexaconazole 5% SC	100	41.34 (40.01)	46.41
T ₅	Contaf	Hexaconazole 5% SC	300	51.48 (45.85)	
T ₆	Score	Difenconazole 25% EC	100	28.39 (32.19)	32.91
T ₇	Score	Difenconazole 25% EC	300	37.44 (37.72)	
T ₈	Tilt	Propiconazole 25% EC	100	38.38 (38.28)	42.35
T ₉	Tilt	Propiconazole 25% EC	300	46.33 (42.90)	
T ₁₀	Folicure	Tebuconazole 25% EC	100	25.74 (30.49)	29.79
T ₁₁	Folicure	Tebuconazole 25% EC	300	33.85 (35.58)	
T ₁₂	Amistar	Azoxystrobin 23% EC	100	20.12 (26.65)	25.89
T ₁₃	Amistar	Azoxystrobin 23% EC	300	31.67 (34.24)	
			SE (m) ±	0.41	
			C.D at 1%	1.21	

*Figures in the parentheses indicate arcsine values

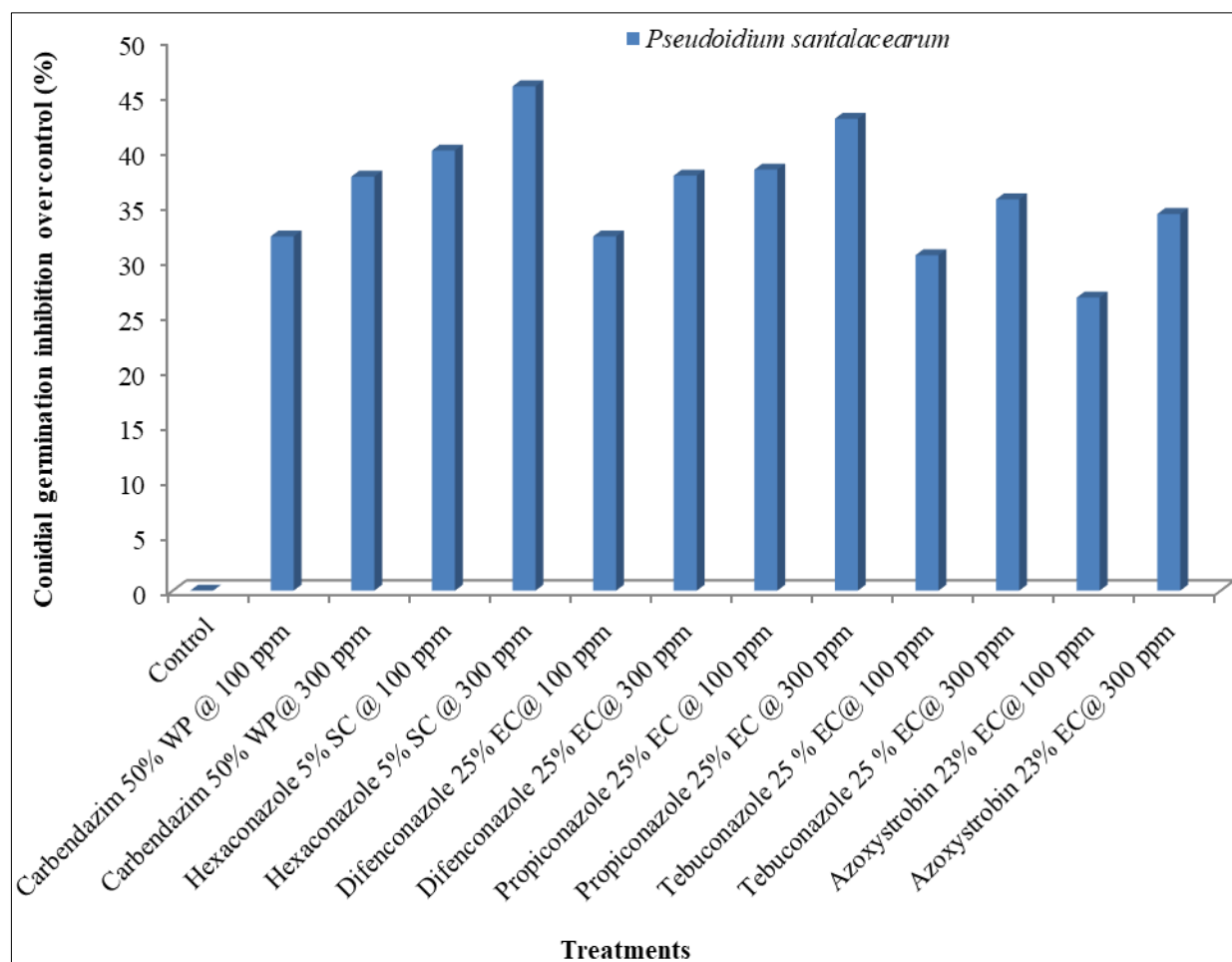


Fig 7: *In vitro* efficacy of systemic fungicides against *Pseudoidium santalaceara* causing powdery mildew in *Santalum album*

Conclusion

The present study revealed that, systemic fungicides with high concentration was observed best against controlling powdery mildew disease of *Santalum album*. Hexaconazole 5% EC at 300 ppm found effective fungicide against conidial germination inhibition of *Pseudoidium santalacearum* pathogen causing powdery mildew disease.

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