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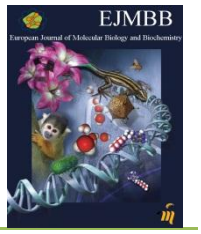

MANAGEMENT OF LEAF BLIGHT DISEASE IN *SOLANUM NIGRUM* USING FUNGICIDES AND BIOCONTROL AGENTS

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ABSTRACT

Leaf blight disease of *Solanum nigrum* caused by *Alternaria solani* is a serious fungal disease in Tamil Nadu state of India. Field experiment was conducted for the integrated management of leaf blight disease in *S. nigrum*. Spraying with fungicides and biocontrol agents was done on 30 and 40 days after sowing. The results revealed that spraying mancozeb (0.2%) on 30 DAS and *Pseudomonas fluorescens* (2 g/l) on 40 DAS recorded the lowest leaf blight disease intensity of 13.6% and 15.8% at 45 DAS and 60 DAS respectively. In control, the highest leaf blight disease intensity of 31.4 per cent and 42.4 per cent was recorded on 45 and 60 DAS respectively. In addition to disease reduction, the leaf yield was also found to be maximum of 22.9 t/ha in the treatment of spraying mancozeb (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS. In control, the lowest yield of 15.6 t/ha was observed.

INTRODUCTION

Solanum nigrum L. (black nightshade) is an important medicinal plant belonging to the family Solanaceae. It contains alkaloids *viz.*, solamargine, solanigrine and solasonine. The plant is used for asthma, ulcer, dropsy, cough etc. In India, *S. nigrum* is used as hepatoprotective agent. The leaf blight disease of *S. nigrum* caused by *Alternaria solani* is a serious fungal disease in Tamil Nadu state of India. The pathogen is greatly influenced by weather with the highest disease incidence reported in wet seasons and in areas with relatively high rainfall [1]. The growth of *Alternaria* was maximum in pH range of 6-6.5 and temperature range of 25-30°C [2]. *Alternaria* leaf spot is characterized by small spots which are initially water-soaked. These spots turn reddish-brown, may reach 1/8 inch in diameter and are roughly circular. Spores of *Alternaria* sp. are dark brown to black and appear in felty black masses on leaves.
They generally move by water splashing or air movement. Management of disease through fungicides alone leads to cause soil residual problem and health hazards, besides involving higher input cost. Biological control through the use of antagonistic microorganisms has recently emerged as a viable disease management strategy [3]. The main modes of action of the biocontrol agent include competition for nutrients and space, production of cell wall degrading enzymes, production of antifungal diffusible and volatile metabolites and mycoparasitism. Lemongrass oil is an aromatic perennial grass valued for its oil and was also proved fungicidal. Hence in the present study, the effect of fungicides, EC formulated lemongrass oil and biocontrol agent were evaluated against leaf blight disease of *S. nigrum.*

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MATERIALS AND METHODS

Isolation of pathogen and *invitro* screening against *A. solani*

The pathogen, *A. solani* was isolated from the infected leaves of *S. nigrum* using potato dextrose agar (PDA) medium and purified by single hyphal tip method [4]. The fungicides *viz*., mancozeb (0.2%), propiconazole (0.1%), essential oil *viz.*, EC formulated lemongrass oil (0.2%) and biocontrol agent *viz*., *P. fluorescens* (2 g/l) were evaluated against *A. solani* under *in vitro* conditions

by poisoned food technique [5]. The radial growth of *A. solani* was measured after seven days of incubation. The plates inoculated with pathogen alone served as the control. Four replications were maintained.

Field studies

Field experiment was conducted in the farmer's field at Kallipalayam, Coimbatore district, Tamil Nadu, India during 2011-2012 and 2012-2013 for the integrated management of leaf blight disease in *S. nigrum*. Spraying was done on 30 and 40 days after sowing using fungicides *viz.*, mancozeb (0.2%), propiconazole (0.1%); essential oil *viz.*, EC formulated lemongrass oil (0.2%) and biocontrol agent *viz.,Pseudomonas fluorescens* (2 g/l) and their combinations. The leaf blight disease intensity was recorded on 45 and 60 days after sowing. The leaf blight disease intensity was assessed using 0-9 disease rating scale as described by Pawelec *et al* [6], [0 : No visible disease damage; 1 : <5% leaf area damaged; 3 : 5-20% leaf area damaged; 5 : 20-40% leaf area damaged; 7 : 40-60% leaf area damaged; 9 : severe defoliation]. The green leaf yield was also recorded.

Per cent disease index (PDI) for each ecotype was calculated using the formula

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Number of leaves examined x Maximum grade available in the score chart}} \times 100$$

RESULTS AND DISCUSSION

Fluorescent pseudomonads have been widely used for the management of plant diseases [7]. *In vitro* studies on the inhibition of radial growth of *A. solani* revealed that mancozeb 0.2% significantly inhibited the growth of pathgen by recording least mycelial growth of 3.4 cm as compared to control 8.6 cm (Table 1). *P.fluorescens* (2 g/l) ranked next with the mycelial growth of 3.7 cm. Mohan [8] documented that palmarosa oil (0.05%) was effective in inhibiting the mycelial growth and spore germination of *Alternaria palandui*, the onion leaf blight pathogen. The results of the field experiments conducted on the management of leaf blight disease of *S. nigrum* showed that spraying mancozeb (0.2%) on 30 DAS and *Pseudomonas fluorescens* (2 g/l) on 40 DAS recorded the lowest leaf blight disease intensity of 13.6% and 15.8%at 45 DAS and 60 DAS respectively followed by spraying mancozeb (0.2%) on 30 DAS and 40 DAS which recorded the leaf blight disease intensity of 14.2%and 18.1% at 45 DAS and 60 DAS respectively. In the control, the highest leaf blight disease intensity of 31.4 per cent and 42.4 per cent was recorded on 45 and 60 DAS respectively (Table 2). Mancozeb was the best among all the treatments, resulting in the lowest disease severity on leaves of mustard [9]. In addition to disease reduction, the leaf yield was also found to be increased in the effective treatment. The maximum green leaf yield of 22.9 t/ha was recorded in treatment of spraying mancozeb (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS. In control, the lowest yield of 15.6 t/ha was observed (Table 3). Fluorescent pseudomonads are known to induce disease resistance against foliar diseases [10].

Table 1. *In vitro* screening of fungicides and biocontrol agents against *Alternaria solani*

S.No.	Treatments	Mycelial growth of *A. solani* (cm)*	Inhibition of mycelial growth over control (%)
1.	Mancozeb (0.2%)	3.4	60.5
2.	Propiconazole (0.1%)	3.9	54.7
3.	EC formulated lemongrass oil (0.2%)	4.5	47.7
4.	*Pseudomonas fluorescens* (2 g/l)	3.7	56.9
5.	Control	8.6	-

*Mean of four replications

Table 2. Integrated management of leaf blight disease in *Solanum nigrum*

Treatments	45 DAS		60 DAS	
	Mean PDI*	Disease reduction over control (%)	Mean PDI*	Disease reduction over control (%)
T_1 - Spraying EC formulated lemongrass oil (0.2%) on 30 and 40 DAS	19.7(15.8)	25.4	23.4(17.4)	44.8
T_2 – Spraying mancozeb (0.2%) on 30 and 40 DAS	14.2(13.3)	46.2	18.1 (15.1)	57.3
T_3 - Spraying *Pseudomonas fluorescens* (2 g/l) on 30 and 40 DAS	16.4 (14.3)	37.9	19.3 (15.6)	54.5
T_4 - Spraying mancozeb (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS	13.6(12.9)	48.5	15.8(14.0)	62.7
T_5 - Spraying propiconazole (0.1%) on 30 and 40 DAS	18.2(15.2)	31.1	21.8(16.7)	48.6
T_6 - Spraying EC formulated lemongrass oil (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS	16.8(14.5)	36.4	20.6(16.2)	51.4
T_7 – Control	31.4(18.6)	-	42.4(24.4)	-
CD (P=0.05)	1.61		1.73	

*Mean of three replications;
Figures in parentheses are arcsine transformed values

Table 3. Effect of different treatments on yield of *Solanum nigrum*

Treatments	Yield*(t/ha)	Yield increase over control (%)
T_1 - Spraying EC formulated lemongrass oil (0.2%) on 30 and 40 DAS	**17.9**	**12.8**
T_2 - Spraying mancozeb (0.2%) on 30 and 40 DAS	21.8	28.4
T_3 - Spraying *Pseudomonas fluorescens* (2 g/l) on 30 and 40 DAS	19.4	19.6
T_4 - Spraying mancozeb (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS	22.9	31.8
T_5 - Spraying propiconazole (0.1%) on 30 and 40 DAS	17.3	9.8
T_6 - Spraying EC formulated lemongrass oil (0.2%) on 30 DAS and *P. fluorescens* (2 g/l) on 40 DAS	18.6	16.1
T_7 – Control	15.6	-
CD (P=0.05)	1.8	

*Mean of three replications

Paul and Sharma [11] reported the production of two antibiotics – pyoluteorin and pyrrolnitrin by *P. fluorescens*, which inhibited the growth of *Phytophthora capsici*, the pathogen on black pepper. The beneficial effects of these bacteria, in most cases, have been related to their ability to produce plant growth hormones and or antimicrobial substances and to protect growing roots from deleterious root microbes present in the rhizosphere [12].

CONCLUSION

The results of the present study revealed that leaf blight disease of *S. nigrum* can be effectively managed by the integration of fungicides and biocontrol agents. The present investigation indicated the usefulness of antagonists for the control of *S. nigrum* leaf blight disease. Hence, this approach can be exploited as it is natural, safe, effective, persistent and durable alternative to chemical pesticides for controlling plant diseases.

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