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COMPATIBILITY OF *Paecilomyces lilacinus* WITH NOVEL INSECTICIDES

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ABSTRACT

Different concentrations (1000 ppm, 1500 ppm and 2000 ppm) of novel seven insecticides were evaluated at section of Plant Pathology, BTC, College of Agriculture and Research Station, IGKV, Bilaspur, (Chhattisgarh) during 2022-2023 under *in- vitro* condition .The mean mycelia growth was recorded maximum at 7th DAI for all three concentrations in treatment T_4 Thiamethoxam 75% SG (44.56 mm) and the least mycelia growth was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (16.56 mm). The least per cent inhibition of all three concentrations was found in treatment T_4 Thiamethoxam 75% SG (40.83%) and maximum per cent inhibition was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (78.01%) over control. The average number of conidia ml^{-1} of *P. lilacinus* at 15th DAI were recorded and found maximum sporulation in treatment T_4 Chlorantraniliprole 18.5% SC (3.33×10^7).Least sporulation was recorded in treatment T_7 (Indoxacarb 14.5% SC and treatment T_5 Carbosulfan 25% EC (1.00×10^7), while no sporulation was recorded in treatment T_3 Thiomethoxam 75% SG (0.00×10^7).

(Key words: Compatibility, *Paecibmyces lilacinus*, insecticides)

INTRODUCTION

The wide spread use of chemical insecticides in plant protection has led to an increase in insect's resistance of these chemical products. Currently, over 500 arthropod species have developed resistance to one or more types of chemicals (Mota-Sanchez *et al.,* 2002; Verma *et al.,* 2023). Another problem arises for the introduction of invasive species to new area or continents, where they lack their coevolved natural enemies or predators. In this situation there is a need to exploration of new, alternative methods that are safer for the environment to control pest's outbreaks.

In recent years, the utilization of fungi for biological pest control has been adopted in agriculture. *Paecilomyces lilacinus* is a common soil hyphomycetes. It is also known as egg parasite of plant parasitic nematodes and is currently being developed as biocontrol agent. The genus *Paecilomyces* belongs to the genus *phylum Deuteromycota* with two important species i.e. *Paecilomyces fumosoroseus and Paecilomy ceslilacinus*.

The genus *Paecilomyces* is characterized by hyaline to yellowish septate hyphae, often with smooth walls. The conidiophores are verticillated or irregularly branched and phialides have a wide base and an elongated neck. The conidia are unicellular; hyaline and arranged in chains, with the youngest conidium located at the basal end (Borba and Brita , 2015; Nirmalkar *et al.*,2020).

Several species of *Paecilomyces* are known to produce secondary metabolites with diverse chemical structures and biological activities. These metabolites exhibit properties such as herbicidal, insecticidal, bactericidal, fungicidal, nematicidal and cytotoxic effects. *Paecilomyces* is a fungi parasite and just after pathogen-antagonist recognition and interaction, enzyme complexes are secreted. The penetration can occur through mechanical means, involving the development of appressoria or through enzymatic process. Enzymes like cellulase, glucanase, laccase, leucinoxin, lipase, pectinase, protease, chitinase or xylanase are released and they play crucial roles in the infection process.

MATERIALS AND METHODS

An experiment was conducted at BTC CARS Bilaspur, C.G. (Latitude 22.1032601 and Longitude 82.1389713), during *kharif*, 2022–2023 to evaluate the bioefficacy of *Paecilomyces lilacinus* against cowpea (*Aphis cracivora*). The cultivar open pollinated was grown under a pot experiment.

In-vitro compatibility of *P.lilacinus* with different insecticides

The appropriate PDA medium component were weighed and diluted in 100 ml of distilled water. Four flasks of 100 ml medium each were produced for four different agrochemical concentrations (1000, 1500 and 2000 ppm) was tested. After cotton plugging was autoclaved at 121^{o}C with a 15 psi for 15 to 20 minutes. After sterilization of media allowed to cool at room temperature specified amount

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agrochemicals was applied into medium. The medium was poured onto petri dishes and allowed to solidify. After solidification, the plates were inoculated with pure culture of *P. lilacinus*, and a control plate (without insecticides) was kept for comparison. The plates were kept for incubation at 25±2°C at 5th and 7th day radical growth was recorded while at 15th day sporulation was calculated using following formula.

$$\text{Per cent inhibitition} = \frac{\text{Control - treatment}}{\text{Control}} \text{x100}$$

Sporulation/No. of conidia cm²= average no. of spore dilution factor ×4000×10

Insecticides used for compatibility

Seven different insecticides were used i.e. Emamectinbenzoid (5% SG), Flonicamid (50% WG), Thiomethoxam (75% SG),Chlorantraniliprole (18.5% SC), Carbosulfan (25% EC), Imidacloprid (17.8% SL), Indoxacarb (14.5% SC) and without insecticides served as Control

Statistical analysis

To compare different numerical observations, the data was statistically analyzed using the appropriate design, i.e., CRD, factorial CRD, RBD, with the desired transformation as applicable. (Hoplins *et al.,* 1998).

RESULTS AND DISCUSSION

Compatibility of novel insecticides on mycelial growth and sporulation of *Paecilomyces lilacinus* at 5th DAI

Determination of mycelial growth of three different concentrations (1000 ppm, 1500 ppm and 2000 ppm) of novel insecticides at 5th day of DAI. Data presented in Table1 revealed that the mean mycelial growth of was recorded maximum at 5th DAI for all three concentrations in treatment T_4 Chlorantraniliprole 18.5% SC (28.33 mm), least mycelial growth was recorded in treatment T_3 Thiamethoxam 75% SG (5.11 mm). In all three concentrations maximum mean mycelial growth was found in 1000 ppm (22.46 mm) and least mean mycelial growth was recorded in 2000 ppm (18.81mm).

The least per cent inhibition of all three concentrations (1000 ppm, 1500 ppm and 2000 ppm) at 5th day was found in treatment T_4 Chlorantraniliprole 18.5% SC (33.33%) and the maximum per cent inhibition was recorded treatment T_3 Thiamethoxam 75% SG (87.97%) over control. In all three-concentration maximum mean per cent inhibition was found in 2000 ppm (54.76%) and least mean inhibition was recorded in 1000 ppm (47.16%).

1000 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Chlorantraniliprole 18.5% SC (34.00 mm and 20.00%) and the least mycelial growth and highest per cent inhibition was recorded in treatment T_3 Thiamethoxam 75% SG (7.33 mm and 82.75%) over control. All treatments significantly differed from each other.

1500 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Chlorantraniliprole 18.5% SC (26.00 mm and 38.82%) and the least mycelial growth and highest per cent inhibition was recorded in treatment T_3 Thiamethoxam 75% SG (4.00 mm and 90.59%) over control. All treatments significantly differed from each other.

2000 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Chlorantraniliprole 18.5% SC (25.00 mm and 41.18%) and the least mycelial growth and highest per cent inhibition was recorded in treatment T_7 Thiamethoxam 75% SG (4.00 mm and 90.59%) over control. All treatments significantly differed from each other.

Compatibility of novel insecticides on mycelial growth and different sporulation of *Paecilomyces lilacinus* at 7th DAI

Mycelial growth of three different concentrations (1000 ppm, 1500 ppm and 2000 ppm) of novel insecticides at 7th day of DAI was recorded. Data presented in Table 2 revealed that the mean mycelial growth was recorded maximum for all three concentrations in treatment T_4 Thiamethoxam 75% SG (44.56 mm) and the least mycelia growth was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (16.56 mm). In all three concentrations maximum mean mycelial growth was found in 1000 ppm (42.20 mm) and least mean mycelial growth was recorded in 2000 ppm (31.91 mm).

The least per cent inhibition of all three concentrations (1000 ppm, 1500 ppm and 2000 ppm) at 7th day was found in treatment T_4 Thiamethoxam 75% SG (40.83%) and maximum per cent inhibition was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (78.01%) over control. In all three concentrations maximum mean per cent inhibition was found in 1000 ppm (43.95%) and least mean mycelial growth was recorded in 2000 ppm (57.62%).

1000 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Thiamethoxam 75% SG (56.00 mm and 25.63%) and the least mycelial growth and highest per cent inhibition was recorded in treatment $_3$ Chlorantraniliprole 18.5% SC (22.00 mm and 70.78%) over control. All treatments significantly differed from each other.

1500 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Thiamethoxam 75% SG (43.33 mm and 42.45%) and the least mycelial growth and highest per cent inhibition was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (17.33 mm and 76.78%) over control. All treatments significantly differed from each other.

2000 ppm

The highest mycelial growth and least per cent inhibition was recorded in treatment T_4 Thiamethoxam 75%

Table 1. Compatibility of novel insecticides on mycelial growth and different sporulation of *Paecilomyces lilacinus* at 5th DAI

Treatments	Mycelial growth (mm)				% Inhibition			
	1000 ppm	1500 ppm	2000 ppm	Mean	1000 ppm	1500 ppm	2000 ppm	Mean
T_1 - Emamectin Benzoid (5%SG)	25.00	20.00	19.33	**21.44**	41.18 (39.91)	52.94 (46.68)	54.52 (47.59)	**49.54**
T_2 - Flonicamid (50%WG)	19.00	15.00	7.50	**13.83**	55.29 (48.04)	64.71 (53.56)	82.35 (65.16)	**67.45**
T_3 - Thiomethoxam (75% SG)	7.33	4.00	4.00	**5.11**	82.75 (65.47)	90.59 (72.22)	90.59 (72.22)	**87.97**
T_4 - Chlorantraniliprole (18.5%SC)	34.00	26.00	25.00	**28.33**	20.00 (26.54)	38.82 (38.53)	41.18 (39.91)	**33.33**
T_5 - Carbosulfan (25%EC)	20.00	19.33	13.00	**17.44**	52.94 (46.68)	54.51 (47.59)	69.41 (56.43)	**58.95**
T_6 - Imidacloprid (17.8%SL)	25.00	23.67	19.67	**22.78**	41.18 (39.91)	44.31 (41.73)	53.73 (47.14)	**46.41**
T_7 - Indoxacarb (14.5%SC)	18.33	18.00	11.33	**15.89**	56.86 (48.95)	57.65 (49.40)	73.33 (58.92)	**62.61**
T_8 - Control	42.50	42.50	42.50	**42.50**	0.00 (0.33)	0.00 (0.33)	0.00 (0.33)	**0.00**
Mean	**23.90**	**20.98**	**17.88**		**43.77**	**50.64**	**57.94**	
		Factor A (ppm)	**Factor B (Insecticides)**	**AxB**	**Factor A**	**Factor B**	**AxB**	
SEm(±)		0.44	0.73	1.26	0.64	1.05	1.83	
CD at 5%		1.32	2.11	3.76	1.98	3.04	5.49	

Table 2. Compatibility of novel insecticides on mycelial growth and different sporulation of *Paecilomyces lilacinus* at 7th DAI

Treatments	Mycelial growth (mm)				% Inhibition				Sporulation ($Xx10^7$)
	1000 ppm	1500 ppm	2000 ppm	Mean	1000 ppm	1500 ppm	2000 ppm	Mean	
T_1 - Emamectin Benzoid (5%SG)	38.33	33.67	26.00	**32.67**	49.09 (44.47)	55.29 (48.04)	65.47 (54.01)	**56.62**	1.33
T_2 - Flonicamid (50%WG)	42.33	33.67	25.33	**33.77**	43.78 (41.42)	55.29 (48.04)	66.36 (54.55)	**55.14**	2.66
T_3 - Thiomethoxam (75% SG)	22.00	17.33	10.33	**16.56**	70.78 (57.28)	76.98 (61.35)	86.28 (68.29)	**78.01**	0.00
T_4 - Chlorantraniliprole (18.5%SC)	56.00	43.33	34.33	**44.56**	25.63 (30.41)	42.45 (40.65)	54.40 (47.52)	**40.83**	3.33
T_5 - Carbosulfan (25%EC)	28.67	29.00	25.33	**27.67**	61.93 (51.90)	61.49 (51.64)	66.36 (54.55)	**63.26**	1.00
T_6 - Imidacloprid (17.8%SL)	44.00	43.33	31.00	**39.44**	41.57 (40.14)	42.45 (40.65)	58.83 (50.09)	**47.61**	1.66
T_7 - Indoxacarb (14.5%SC)	31.00	27.67	23.33	**27.33**	58.83 (50.08)	63.26 (52.69)	69.01 (56.18)	**63.70**	1.00
T_8 - Control	75.30	75.30	75.30	**75.30**	0.00	0.00	0.00		6.66
Mean	**42.20**	**37.37**	**31.91**		**43.95**	**50.37**	**57.62**		
		Factor A (ppm)	**Factor B (Insecticides)**	**AxB**		**FactorA (ppm)**	**FactorB (Insecticide)**	**AxB**	
SEm(±)		2.88	4.71	8.02		2.38	3.78	6.57	
CD at 5%		0.96	1.57	2.72		0.77	1.26	2.19	

Data given in parenthesis shows arcsine transformation

SG (34.33 mm and 54.40%) and the least mycelial growth and highest per cent inhibition was recorded in treatment T_3 Chlorantraniliprole 18.5% SC (10.33 mm and 86.28%) over control. All treatments significantly differed from each other.

Sporulation (Conidia ml^{-1})

The average number of conidia ml^{-1} of *P. lilacinus*at 15th DAI was recorded and found maximum sporulation in treatment T_4 Chlorantraniliprole 18.5% SC (3.33×10^7). Least sporulation was recorded in treatment T_7Indoxacarb 14.5% SC and treatment $_5$ Carbosulfan 25% EC (1.00×10^7). No sporulation was recorded in treatment T_4 Thiomethoxam 75% SG (0.00×10^7).

Various researchers worked on compatibility of insecticides in various ppm and agreed with our findings. The trends of results were similar to previous researchers. Widylingshih *et al.* (2012); Anjali (2022); Dhanja *et al.* (2019) and Alizadesh *et al*, (2007) through the Imidachloprid and Thiamethoxam did not show any inhibitory effects on *P. lilacinus*. Gopalan and Venkatachalam (2014) found that Imidachloprid was found best compatible against *P. lilacinus*. Dhanya *et al.* (2019) reported chlorantraniliprole inhibited the growth of *P. lilacinus.*

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