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EFFECT OF *METARRHIZIUM ANISOPLIAE* ON *SPODEPTERA LITURA* AND COMPATIBILITY WITH CHEMICALS

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Abstract: Bioeffcicacy of *Metarrhizium anisopliae* was tested against *Spodoptera litura*. The spore suspension @ 2.5 x 10^9 spore/ ml recorded highest mortality (90%) after ten days of spraying where as lower concentration resulted less mortality. While the cultural filtrate resulted maximum mortality 26.66% after ten days. The compatibility studies of insecticides and fungicides by poisoned food technique revealed that spinosad, diamethoate and copper oxychloride were found most compatible. Where as carbendazim, thiram and wettable sulphur were toxic to the *Metarrhizium anisopliae*.

Introduction

Spodoptera litura is an important polyphagous and voracious plant chewer. In India it is distributed in various states and occurs very often in Madhya Pradesh, Gujrat. Beside cotton crop it is reported to occur on 120 host plants. 70% losses has been reported in black gram and rice in Andhra Pradesh during 1983.(Krishnaiah *et al.*1983). Various insecticides are used to combat this pest but continuous use of insecticides resulted the development of resistance in *Spodoptera liture*.(Armes *et al.,*1997). Biological agents play an important effective role in Integrated Pest management (IPM) which includes biopesticides derived from fungi, bacteria and viruses.

Among several existing entomopathogenic fungi *Metarrhizium anisopliae* is commonly known green muscardine fngus and reported to pathogenic to more than 300 insect species. The Success of biocontrol technology depends on its mass production and compatibility with commonly used insecticides and fungicides in context of IPM.

Material and Methods

The present investigation was conducted at Department of Plant Pathology, College of Agriculture, Nagpur during 2005-06. Pure culture was obtained from Department of Plant Pathology, College of Agriculture, Nagpur. The test insects were collected from cotton, sunflower and castor crops.

For preparation of spore suspension 15 days old growth of *Metarrhizium anisopliae* from SDA + Y medium was scraped gently by adding twenty ml distilled sterile water in plats. The obtained suspension was decanted off and filtered through muslin cloth followed by Whatman's No.1 filter paper. Final volume of 100 was made by adding sufficient quantity of distilled sterile water and diluted up to 1:1000 with serial dilution method and number of spores per ml was worked out.

Culture filtrate from the fungal growth in SDB+Y medium for 15 days was passed through muslin cloth and then through Whatman's No.2 filter paper using suction pump and this stock culture was used for further experiments by making appropriate dilution.

The mortality of *Spodoptera litura* was studies by direct spray and leaf dip method . Two ml of each concentration mixed with 0.02% Tween 80 was sprayed on ten larvae of equal size, then these treated larvae were transferred in separate petriplate containing castr leaves as food. Water sprayed larvae serve as control.

The leaf dip method suggested by Ma June (2000) was used. The leaf disc of castor leaf were cut in to 6cm diameter and cleaned with wet cotton and dipped in each concentration. Then ten larvae of *Spodoptera litura* were released in each petriplate. Each experiment was replicated three times. The plates were then incubated at 25+ 1 ^{0}C and 90% Rh.

Compatibility of five commonly used insecticides viz. quinolphos 25EC, diamethoate 30EC, spinosad 45 EC, phorate 10G, imidaclopride 70WSby poisoned food technique. The insecticide were tested at three concentration i.e.recommended dose, half of recommended dose and one level above of recommended dose and per cent inhibition over control was calculated. Similarly, different fungicides viz. carbendazim, mancozeb, copper oxychloride, thiram, metalaxyl and wettable sulphur were also assayed for compatibility studies with *Metarhizium anisopliae*.

Result and Discussion

The experiment was conducted to study the effect of spore suspension (topical application) of *Metarhizium anisopliae* on *Spodopetra litura* . The mortality was recorded after 24 hr interval up to ten days. From the data (Table) it is revealed that larval mortality ranged from 0 to 90 per cent after 3,5,7 and 10 days. At 10 days all the treatment found efficient in increasing per cent mortality. The spore concentration 2.5 x 10^9 was found best among other concentration and gave 90.00% mortality followed by 2.5 x 10^8 (76.66%).The per cent mortality has decreased with lower concentration. The results are in close agreement

with the findings of Gutierrez *et al.* (1995). In vitro studies on assessment of toxicity of culture filtrate against *S.litura* revealed that there was 10.00 per cent mortality at 3rd day which increased up to maximum 26.66% at 10th day incubation. The spore suspension was found to be potentially more pathogenic than the culture filtrate. The highest mortality 93.33% was recorded at concentration of $2.5x10^9$ spore/ml, where as lowest 23.33% was observed at $2.5x10^4$ spore/ml after ten days of treatment.The present investigation are on the line of results reported by Yewale (2001).

Six chemicals insecticides were tested against *Metarhizium anisopliae*, among all the treatment tested spinosad showed least inhibition 23.82, 5.71abd 48.88% at all three levels. Diamethoate, phorate and imidaclopride were also found safe with 24.00 to 16.00, 23.33 to 15.90 and 22.66 to 13.74 mm radial mycelial growth respectively. It is indicated that *Metarhizium anisopliae* growth are not adversely affected in presence of spinosad, diamethoate and imidaclopride. Jayraman (2005) reported that spinosad is the most compatible insecticide.

Regarding the compatability of fungicides with *Metarhizium anisopliae*, copper oxychloride found to most compatible and recorded less per cent growth inhibition 28.66,33.00, 23.00 mm and 5.71, 54.28% at all three levels followed by mancozeb with 29. 62, 14.82, 51.42 % inihibition. Carbendazim recorded higher inhibition at recommended dose (70.48%) and double dose concentration (84.77%) and found most inhibitory followed by thiram. Similar findings were reported by Autkar (2004) and Jayraman (2005).

Table 1: Effect of spore suspension, spraying of spore suspension of *Metarhizum anisopliae* on *Spodeptera litura*.

Treatment	Concentration of spores / ml	Percent cumulative mortality days after treatment (10 DAT)	Percent cumulative mortality days after treatment (Leaf dip method) (10 DAT)
T1	$2.5x10^9$	90.00 (72.28)*	93.33 (77.70)*
T2	$2.5x10^8$	76.66 (61.21)	76.66 (61.21)
T3	$2.5x10^7$	63.33 (52.76)	60.00 (50.76)
T4	$2.5x10^6$	50.00 (45.00)	56.66 (48.84)
T5	$2.5x10^5$	43.00 (41.15)	40.00 (39.23)

T6	$2.5x10^4$	23.33 (28.77)	23.33 (28.77)
T7	Control	6.66 (12.58)	3.33 (6.74)
F test		Sig	Sig
SE ±		6.09	3.47
CD P = 0.05		13.06	10.53

* Figures in parenthsis are arsin transformed values.

Table.2: Effect of culture filtrate of *Metarhizum anisopliae* on *Spodeptera litura*.

Treatment	**Concentration of cultural filtrate**	**Percent cumulative mortality days after treatment (10 DAT)**
T1	100	26.66 (5.13)*
T2	10	23.33 (4.80)
T3	0.8	13.33 (3.59)
T4	0.6	0.00 (0.70)
T5	0.4	0.00 (0.70)
T6	0.2	0.00 (0.70)
T7	0.1	0.00 (0.70)
T8	Control	0.00 (0.70)
F test		Sig
SE ±		0.487
CD P = 0.05		1.31

* Figures in parenthsis are Square root transformed values.

Table 3: Compatibility of *Metarhizium anisopliae* with different insecticides and fungicides (7 days after treatment)

Treatment	**Recommended dose**			**Half dose**			**Double dose**		
	Conc. %	**Radial mycelial growth in mm***	**% growth inhibition**	**Conc. %**	**Radial mycelial growth in mm***	**% growth inhibition**	**Conc. %**	**Radial mycelial growth in mm***	**% growth inhibition**
Inecticides									
Quinolphos	0.05	13.66	60.97	0.025	21.00	40.00	0.1	8.01	77.14
Diamethoate	0.03	24.00	31.42	0.015	31.66	9.54	0.06	16.00	54.28
Spinosad	0.01	26.66	23.82	0.005	33.00	5.17	0.02	17.89	48.88
Phorate	10 kg/ha	23.33	33.34	5	31.37	10.37	20	15.90	54.57
Imidaclopride	0.5	22.66	35.25	0.25	31.00	11.42	1	13.74	60.74
Control		35.00			35.00			35.00	
F test		Sig			Sig			Sig	
SE $\pm$		0.43			0.61			0.46	
CD P = 0.05		1.32			1.87			1.45	
Fungicides									
Mnacozeb	0.25	24.63	29.62	0.125	29.81	14.82	0.50	17.00	51.42
Wettable sulphur	0.3	14.00	60.00	0.15	24.00	31.42	0.60	8.66	75.25
Carbendazim	0.1	10.33	70.48	0.05	19.66	43.82	0.20	5.33	84.77

Copper oxychloride	0.25	28.66	18.11	0.125	33.00	5.71	0.50	23.00	34.28
Thiram	0.3	11.00	68.57	0.15	20.66	40.97	0.60	4.00	88.57
Metalaxyl	0.2	18.33	47.62	0.1	25.33	27.62	0.40	10.33	70.48
Control		35.00			35.00			35.00	
F test		Sig			Sig			Sig	
SE $\pm$		0.39			0.45			0.79	
CD P = 0.05		1.20			1.37			2.40	

*** Average of three replication**

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