

Bio-Efficacy of Entomopathogenic Fungi against Oriental Fruit Fly (*Dacus Dorsalis* H.) Infesting Guava in River Bed Area of Ganga

Arya Sunita¹, Dubey Rajesh Kumar²D.G. College, Kanpur, C.S.J.M. University, Kanpur, UP, India.¹Director, Prakriti Educational & Research Institute, Lucknow, UP, India.²

ABSTRACT : Studies conducted on the efficacy of entomopathogenic fungi against Oriental Fruit Fly (*Dacus Dorsalis* H.) Infesting Guava In River Bed Area Of Ganga showed the relatively lower pathogenicity. The highest concentration of *Beauveria bassiana* (7.6×10^8 conidia ml⁻¹) and *Metarhizium anisopliae* (2.3×10^8 conidia ml⁻¹) showed 22.0 and 28.9% mortality of maggots of *Dacus dorsolis*, respectively. After 10 days of treatment in laboratory condition. However, maximum % reduction in adult emergence of fruit fly was obtained in Chlorpyrifos 20 EC followed by the highest concentration of *M. anisopliae* @ 2×10^{10} conidia ml⁻¹ after 15 days of spraying in guava orchards.

KEYWORDS :- *Dacus dorsalis*, Bioefficacy, *metarhizium anisopliae*, *Beauveria bassiana*.

I. INTRODUCTION

Fungi, which induce disease symptoms in insects, include fungi from quick killers to absolute parasites that provide disease symptoms in the host. Absolute parasites are considered to be fungi which live in association with a host and benefit at the host's ex-penses (Smith et al., 1981). Entomopathogenic fungi cause lethal infections and regulate insect and mite population in nature by epizootics (Burgess, 1981; Carruthers and Soper, 1987; McCoy et al., 1988). They are host specific with a very low risk of attack-ing non-target organisms or beneficial insects. They are reported to infect a



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very wide range of insects including lepidopterous larvae, aphids and thrips, which are of great concern in agriculture worldwide (Roberts and Humber, 1981).

Biological control of crop pests requires the emanative release of natural enemies. This is especially true in biological control of pests affecting crops in enclosed condition like glasshouses and polyhouses. To be able to release the natural enemies in large numbers, they should be produced in mass. Mass production of natural enemies is possible if the conditions suitable for the multiplication of the species are created and procedures are standardized. In glass houses/polyhouses sucking pests, mainly thrips whiteflies, aphids and mites are dominant. To control them, growers are forced to use indiscriminate use of systemic/non systemic chemical pesticides, which have led to resistance to most of the commonly used pesticides (Lenteren et al., 1999). This has adversely affected the commercial successful green house IPM programmes. Hence, the option now is the use of biocontrol agents, mainly predatory mites and / or use of entomopathogenic fungi for the control of phytophagous mites

Oriental fruit fly (*Dacus dorsalis*) damage to fruit fly puncturing the skin of fruit with their ovipositor used to lay a bunch of eggs about 6.0 mm below the surface of skin. Subsequently larvae developed which reduce the quality and quantity of fruit. Fruit bagging, protein bait spraying, methyl eugenol trap, sterile male release and application of insecticides are main component of integrated pest management system of fruit fly. However, indiscriminate use of broad spectrum insecticides for the control of fruit fly, has not only resulted the mortality of this pest, but also hazards to environment and human beings. To reduce the fly population, the control of late larval and pupal stage can be the alternative way of management. The soil application of entomopathogenic fungi may be the possible and effective way of management of this noxious pest. Therefore, the present study was conducted to evaluate the bio-efficacy of Entomopathogenic fungi against *Daccus dorsalis* in laboratory as well as in field condition.

II. MATERIALS AND METHODS

The study was conducted at D.G.P.G. College, Kanpur and guava orchards of river bed area of Ganga to evaluate the bioefficacy of *B. bassiana* and *M. anisopliae* against oriental fruitfly infesting guava. For raising nucleus culture, maggot of *D. dorsalis* were collected from infested fruit and reared in the laboratory. For the bioefficacy tests, conidia were harvested from 10 day old culture, prior to use the culture was washed from the surface of the plates using 100 ml of sterile distilled water containing 0.02% tween 80[®] under aseptic conditions by gentle scrubbing with a sterile infection loop. The seven concentration of each entomogenous fungus were used after assessing the number of conidia in the suspension with as improved Neubaur Weber, England Haemocytometer. Conidial suspension with 2 ml volume was sprayed on 10 maggots in a Petri plate (9 cm dia.) lined with a filter paper by using a hand atomizer. After air drying, the treated maggots were carefully transferred to individual sterile round plastic vials containing fresh piece of fruit that was washed with sterile distilled water. Maggots were maintained in an incubator at $27 \pm 1^{\circ}\text{C}$ and $95 \pm 5\%$ RH. The observation on mortality were taken at 12 hrs interval.

Field trial was conducted during rainy season of 2010-2011 in RBD with three replications. There were 8 treatments including control. Each guava tree was considered as single treatment. Treatments were applied in soil along with the compost near the trunk of tree up to the one meter diameter. The control plot were sprayed with water along with the compost. Fruit fly adult population was recorded before, 10 and 15 days after application of treatments with the help of installed methyl eugenol based trap. The whole tree was covered with the muslin cloth to avoid fruit fly migration.

III. RESULTS AND DISCUSSION

Results revealed that on 5th day of treatment, 8.9% mortality of maggots was found due to *B. bassiana* @ 7.6×10^8 Conidia ml⁻¹, however, lower concentrations showed no mortality. After 10 days of treatment, the highest concentration of white muscardine fungus (7.6×10^8 Conidia ml⁻¹) showed only 22.0% mortality of maggots. In case of *M. anisopliae*, % mortality of maggots ranged from 0.0 to 13.0 after 5 days of inoculation, caused 29.9% mortality at highest concentration (2.3×10^8 conidia ml⁻¹) after 10 days of treatment. The results revealed that both entomogenous fungi were not found more effective against maggots of *D. dorsalis* under laboratory conditions. Purwar and Sachan

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(2005) and Bhatt and Kanaujia (2010) also tested entomopathogenic fungi against *Spodoppera litura* and *Spilarctia obliqua* and reported low toxicity.

Table 1 :Efficacy of Entomopathogenic fungi against maggot of *Dacus dorsalis*.

Conc. (Conidia ml ⁻¹)	<i>Beauveria bassiana</i>			Conc. (Conidia ml ⁻¹)	<i>Metarhizium anisopliae</i>		
	Mean% mortality (days after treatment)				Mean% mortality (days after treatment)		
	5	7	10		5	7	10
7.6x10 ⁸	8.9	17.7	22.0	2.3 x 10 ⁸	13.0	17.7	29.9
7.6x10 ⁷	0.0	10.0	17.8	2.3 x 10 ⁷	7.8	14.3	17.7
7.6x10 ⁶	0.0	6.7	16.7	2.3 x 10 ⁶	4.1	4.8	11.0
7.6x10 ⁵	0.0	6.7	6.8	2.3 x 10 ⁵	4.1	4.8	6.8
7.6x10 ⁴	0.0	3.3	6.8	2.3 x 10 ⁴	0.0	4.8	4.8
7.6x10 ³	0.0	0.0	3.5	2.3 x 10 ³	0.0	0.0	0.0
Control	0.0	0.00	0.00	Control	0.0	0.0	0.0
SE M ₊	1.27	2.57	2.93	SE M _±	2.18	2.82	3.53
CD (P=0.05)	3.92	7.68	8.61	CD (P=0.05)	6.61	8.54	8.64

Table 2 :Field Efficacy of Entomopathogenic fungi against *Dacus dorsalis* on guava

Treatments	Conc. (Conidia ml ⁻¹)	Average adult emergence of <i>D. dorsalis</i>					
		10 days of ferinoculation			15 days of ferinoculation		
		2010	2011	Mean	2010	2011	Mean
<i>Beauveria bassiana</i>	2.0x10 ¹⁰	21.06 (27.28)	25.27 (30.14)	23.16 (28.74)	29.53 (32.90)	28.97 (32.52)	29.25 (32.74)
	2.0x10 ⁹	18.07 (24.93)	22.56 (28.07)	20.32 (26.55)	22.00 (27.93)	28.32 (32.08)	25.16 (30.07)
	2.0x10 ⁸	14.80 (21.75)	18.83 (24.51)	16.82 (22.29)	17.19 (23.80)	27.86 (30.95)	22.52 (26.96)
<i>Metarhizium anisopliae</i>	2.0x10 ¹⁰	23.58 (28.34)	34.45 (35.78)	29.02 (31.95)	38.64 (38.42)	31.92 (34.49)	35.28 (30.43)
	2.0x10 ⁹	15.46 (22.78)	21.75 (27.78)	18.59 (25.49)	24.52 (29.63)	31.35 (33.99)	27.94 (31.91)
	2.0x10 ⁸	17.17 (22.91)	24.46 (29.48)	20.31 (26.75)	22.43 (27.81)	28.65 (32.20)	25.55 (30.55)
<i>Chlorpyriphos</i>	0.2%	70.46 (56.95)	53.95 (46.90)	62.20 (50.89)	82.62 (64.93)	67.14 (53.94)	74.88 (59.04)
Control		+50.70 (45.40)	+69.66 (56.58)	+60.18 (50.88)	+74.65 (59.77)	+85.69 (68.29)	+80.17 (63.61)
SE M _±		3.65 (2.74)	3.33 (2.33)	2.34 (1.56)	2.85 (2.70)	3.57 (2.50)	1.53 (1.05)
CD (P=0.5)		11.03 (8.28)	10.17 (7.04)	6.79 (4.69)	8.69 (6.25)	10.86 (7.62)	4.70 (3.40)

Note :- Parentheses values are angular transformed + indicated the % increase in fruit fly population.

Mahmoud (2009) reported that *M. anisopliae* gave higher adult mortality of *B. zonata* than *B. bassiana* and *L. muscarium*, reaching 94.4% in males and 76.8% in female in contact bioassay test and *M. anisopliae* killed 50% population in 6.23 - 8.93 days. Whereas *B. bassiana* killed 10.83 - 12.69 days. Sridevi *et al.* (2004) reported that the larval mortality of *Helicoverpa armigera* in different treatments of *Bacillus thuringiensis* var. Kurstaki, *B. bassiana*

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and their combinations differed significantly. The individual treatments of *B. bassiana* at 1.6×10^5 and 2.5×10^5 conidia ml^{-1} resulted 60.4 and 75.3% larval mortality, respectively. Pathogenicity of entomogenous fungi against lepidopterous insect pest were also evaluated (Jalali and Singh, 2003; Bhatt *et al.*, 2010).

After 10 days of spraying of different entomopathogenic fungi and insecticide in 2010 in field, the % reduction in adult emergence of *D. dorsalis* varied from 14.80 (*B. bassiana* @ 2.0×10^8 conidia ml^{-1}) to 70.46 (Chlorpyrifos, 20 EC) while in 2011, it ranged from 18.83 (*B. bassiana* @ 2.0×10^8 conidia ml^{-1}) to 53.95 (Chlorpyrifos 20 EC). On the basis of pooled mean data, significant differences were observed among the treatments. The highest concentration of *M. anisopliae* (29.02) showed significant reduction in adult emergence of *D. dorsalis* than other treatments except Chlorpyrifos 20 EC treated plot (62.20). The results indicated that the population of *D. dorsalis* increased gradually in control plot. Based on the observations taken after 15 days of spraying, maximum % reduction in adult emergence was in Chlorpyrifos 20 EC (74.88) treated plot and minimum was in *B. bassiana* @ 2×10^8 Conidia ml^{-1} (22.52) treated plot. It is evident that Chlorpyrifos 20 EC could be considered more effective to manage the fruit fly population by killing late larva and Pupa followed by *M. anisopliae* @ 2×10^{10} conidia ml^{-1} . On the basis of two year pooled mean data, among the entomogenous fungi maximum % reduction in adult emergence of *D. dorsalis* was observed in *M. anisopliae* @ 2×10^{10} Conidia ml^{-1} (35.28) after 15 days of spraying. However, all treatments were not significantly different from one another except chlorpyrifos 20 EC. Arya (2012) also studied the insect pests problem of guava in riverbed area of Ganga.

The results exhibited no entomopathogenic fungi reduced the adult emergence of *D. dorsalis* more than 50% in field condition. Bhatt *et al.* (2010) reported that *B. bassiana* proved most promising against the group of *Aeoleshes sosta* followed by *B. brongniartii* and *M. anisopliae*. Some studies also suggested that entomogenous fungi can be used with other components of IPM like botanicals host plant relationship and insecticides (Isaiah *et al.*, 2005, Haseeb, 2007; Manto and Yadav, 2010; Amutha and Banu, 2012).

On the basis of above results, it is apparent that both the fungi were not found more effective against *D. dorsalis*. However, more studies are needed for the use of entomopathogenic fungi with botanicals, bioagents or insecticides in integrated approach against *D. dorsalis* in guava orchards.

IV. CONCLUSION

The application of entomopathogenic fungi in bio-logical control is increasing largely because of greater environmental awareness, food safety concerns and the failure of conventional chemicals due to an increasing number of insecticide resistant species. In determining whether the use of entomopathogenic fungi has been successful in pest management, it is necessary to consider each case individually, and direct comparisons with chemical insecticides are usually inappropriate. Gelernter and Lomer (2000) concluded that for any microbial control agent to be successful, technical efficacy was essential but had to be combined with at least two other criteria from the following: practical efficacy (easy and cheap uptake), commercial viability (profitability), sustainability (long-term control) and/or public benefit (safety).

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