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EFFECT OF MICROBIAL PESTICIDES AGAINST THE LARVAE OF CITRUS LEAF MINER, *Phyllocnistis citrella* STAINTON IN CITRUS NURSERY

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ABSTRACT

The microbial pesticides viz., *Bacillus thuringiensis* (Berl.), *Beauveria bassiana* (Balsanco) Viegas, *Metarhizium anisopliae* (Metschnikoff) Sorkin, *Verticillium lecani* (Zimm.) Viegas and *Nomuraea rileyi* (Farlow) Samson were evaluated against the larvae of citrus leaf miner, *Phyllocnistis citrella* Stainton during 2010 at AICRP on Citrus, Tirupati. The results revealed that all the microbials proved pathogenic to citrus leaf miner larvae with varied mortality. *B. thuringiensis* was proved highly effective and recorded 96.76 per cent mortality on 10th day. In fungal treatments, the initial mortality was noticed on 6th day after treatment. *Nomuraea rileyi* offered superior control against citrus leaf miner by recording highest mortality of 79.36 per cent reduction in population. *M. anisopliae* also proved effective and occupied second position among the fungal pathogens (78.38%) and *B. bassiana* (64.79%) and *V. lecani* (59.17%) were proved less effective compared to *N. rileyi* and *M. anisopliae*.

KEY WORDS: Citrus, Citrus leaf minor, Microbial pesticides

INTRODUCTION

India is one of the major citrus producing countries in the world, sweet orange having an area of 21.9 lakh hectares with production of 262.9 tonnes annually with the productivity of 9.6 metric tonnes per hectare. In India, Andhra Pradesh occupies a prominent position covering an area of 4.58 lakh ha with an annual production of 686.6 lakh metric tonnes of fruits with productivity of 15.0 metric tones per hectare (Indian Horticulture Database - 2013). Pest problem is one of the major constraints in the citrus nurseries. According to Ramasubba Reddy *et al.,* (1989) 55 species of pests were reported on citrus in Chittoor district. Although a large number of pests attack citrus, citrus leaf miner (*Phyllocnistis citrella* Stainton) is one of the regularly occurring pests causing severe damage to nurseries and tender foliage of bearing trees. Though chemical control of insect pests offers effective results, indiscriminate application cause insect resistance, pest resurgence, secondary out break of pests and destruction of natural enemies. With a view of reduce adverse effects of chemical pesticides, certain microbials viz., *Bacillus thuringiensis* (Berl.), *Beauveria bassiana* (Balscano) Viegas, *Metarhizium anisopliae* (Metschnikoff) Sorkin, *Verticillium lecani* (Zimm.) Viegas and *Nomuraea rileyi* (Farlow) Samson were evaluated against *P. citrella* under field condition.

MATERIAL AND METHODS

Field studies were carried out at All India Coordinated Research Project on Tropical Fruits (Citrus), Tirupati during 2010 with six treatments, viz., *B.thuringiensis*, *B. bassiana*, *M. anisopliae*, *V. lecani* and *N. rileyi* and untreated check. The experiment was conducted on one year old sweet orange nursery in randomized block design with four replications. Each treatment consisted of bed size 2 × 1 m. The required quantity of powdered formulation (2 g L^{-1}) was mixed in water with surfactant labolene (1 ml L^{-1}) and used for spray. *N. rileyi* was mass multiplied on rice media and tested at spore suspension of 4×10^7 spores ml^{-1}. The observations on larval population were recorded on one day before spraying and 2, 4, 6, 8 and 10 days after spraying (DAS).

RESULTS AND DISCUSSION

Pathogenicity of microbials were tested against citrus leaf miner *Phyllocnistis citrella*. The data was presented in Table 1. *B. huringiensis* recorded initial mortality on 2nd day (35.43%) and the efficacy was increased 4 days after treatment (61.42%) and recorded 96.76 per cent mortality at 10 days after treatment (DAT). Among all the fungal treatments, *N. rileyi* recorded initial mortality

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Table 1. Effect of microbial pesticides against citrus leaf miner *Phyllocnistis citrella* larval population reduction (Field experiment) during 2010

S. No.	Treatments	Dosage	Precount	Population reduction (%)*				
				2 DAS	4 DAS	6 DAS	8 DAS	10 DAS
1.	*Bacillus thuringiensis*	2 g lit^{-1}	16.25	35.43 (36.53)	61.42 (51.61)	82.84 (65.54)[a]	90.51 (72.35)[a]	96.76 (79.65)[a]
2.	*Beauveria bassiana*	2 g lit^{-1}	18.00	0 (0.00)	0 (0.0)	31.29 (34.00)[c]	47.85 (43.77)[d]	64.79 (53.62)[c]
3.	*Verticillium lecanii*	2 g lit^{-1}	16.50	0 (0.00)	0 (0.00)	29.87 (33.13)[c]	45.18 (42.24)[d]	59.17 (50.29)[c]
4.	*Metarhizium anisopliae*	2 g lit^{-1}	18.00	0 (0.00)	0 (0.00)	39.40 (38.88)[b]	56.79 (48.85)[c]	78.38 (62.54)[b]
5.	*Nomuraea rileyi*	4×10^7 spore ml^{-1}	17.75	0 (0.00)	0 (0.00)	37.79 (37.93)[b]	61.15 (51.45)[b]	79.36 (63.33)[b]
6.	Untreated check	-	19.25	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	CD at 5%			0.48	0.93	1.59	2.62	4.90

*Average of 4 replications
Figures in the parenthesis are angular transformations
DAS - Days after spraying

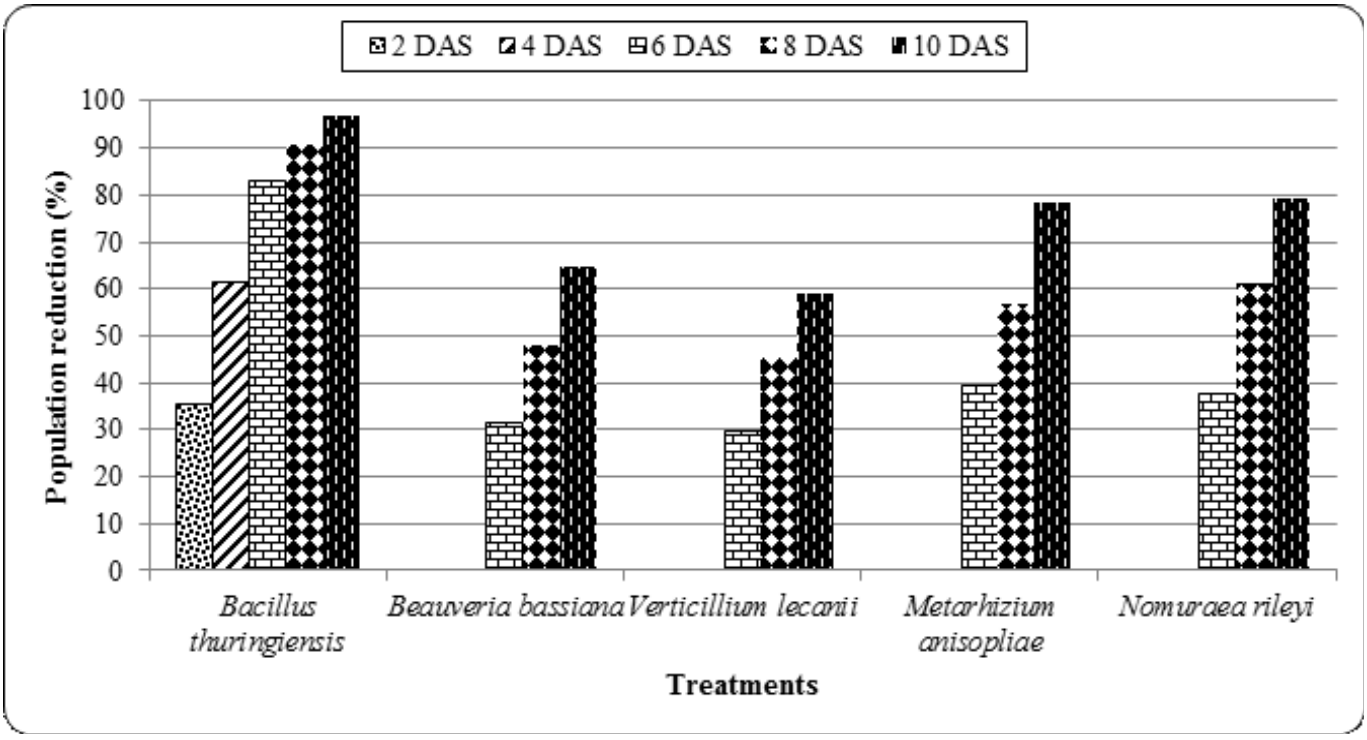

Fig. 1. Effect of microbial pesticides against citrus leaf miner *Phyllocnistis citrella* larval population reduction during 2010

on 6th day and highest population reduction on 10th day (79.36%). *M. anisopliae* also proved highly effective with 78.38 per cent mortality, while population reduction was comparatively low in *B. bassiana* (64.79%) in 10th day and *V. lecani* recorded 59.17 per cent mortality on 10th day. Among five fungal treatments *V. lecani* was found less effective and recorded low population reduction. The observations recorded on microbial pesticides revealed that *B. thuringiensis* infected larvae showed lack of mobility, rectal and oral discharge and the body colour changed rapidly from brown to black. The superiority of *B. thuringiensis* in the control of citrus leaf miner in the present study was supported with the findings of Carladias *et al.,* (2005) and Koteswara Rao (2004). Shapiro *et al.* (1998) reported that the organo silicon surfactant has direct or indirect toxicity and helps in the penetration of microbials against soft bodied insects and mites. Khyami - Horani and Atteyat (2002) reported that *B. thuringiensis* var. *kurstaki* showed highest toxicity after 3 days after application, when it was combined with sun spray oil or surfactant surfix. Observations were recorded on fungal treated larvae become limp and lost the elasticity. Two days after death, larval body became hardened and was covered with mycelium. Rajagopal *et al.,* (1988) made similar observation on the groundnut leaf miner larvae treated with *B. bassians*.

CONCLUSIONS

The microbial pesticides viz., *Bacillus thuringiensis* (Berl.), *Beauveria bassiana* (Balsanco) Viegas, *Metarhizium anisopliae* (Metschnikoff) Sorkin, *Verticillium lecani* (Zimm.) Viegas and *Nomuraea rileyi* (Farlow) Samson were evaluated against the larvae of citrus leaf miner, *Phyllocnistis citrella* Stainton. All the microbials proved pathogenic to citrus leaf miner larvae with different per cent mortality. *B. thuringiensis* was proved highly effective and recorded 96.76 per cent mortality on 10th day. In fungal treatments, the initial was observed mortality started on 6th day after treatment. *Nomuraea rileyi* offered superior control against citrus leaf miner by recording highest mortality of 79.36 per cent reduction in population. *M. anisopliae* also proved effective and occupied second position among the fungal pathogens (78.38%) and *B. bassiana* (64.79%) and *V. lecani* (59.17%) were proved less effective compared to *N. rileyi* and *M. anisopliae*.

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