Efficacy and economics of biopesticides for the management of papaya mealybug, *Paracoccus marginatus* (Williams and Granara de Willink) in brinjal (*Solanum melongena* L.)

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ABSTRACT

Field experiments were conducted to study the bioefficacy of some biopesticides *viz.*, *Beauveria bassiana* (10 g l^{-1}), *Pseudomonas fluorescens* @ (10 g l^{-1}), Spinosad (45 SC @ 1ml l^{-1}), Fish Oil Rosin Soap (FORS) (@ 25 ml l^{-1}) against papaya mealybug, *Paracoccus marginatus* in brinjal. Among the biopesticides tested *P. fluorescens* recorded the lowest mean of mealybug population over control on first (22.3/3 leaves) and second (16.83/3 leaves) spraying. *P. fluorescens* treatment gave significantly higher yield (26.15 t ha^{-1}) than *B. bassiana* (25.95 t ha^{-1}) as against untreated check (20.5 t ha^{-1}). The highest cost: benefit ratio was recorded in the same treatment (1: 6.15) with a net income of Rs. 218965 /-.

Key words: Bioefficacy, biopesticides, *Paracoccus marginatus, Solanum melongena*

INTRODUCTION

Brinjal (*Solanum melongena* L.), also called aubergine or egg plant, is one of the top ten vegetables grown in the world. Asia accounts for about 94 per cent of the world egg plant area, with about 92 per cent of world output (FAO, 2007). India is the second largest brinjal producer in the world (about 84.5 lakh tons) (FAO, 2008). Brinjal occupies about 8.45% of the total area under vegetables in India (Patnaik *et al.,* 2004).

Incidence of insect pests is one of the prime factors in reduction of yield. The major pests include egg plant fruit and shoot borer, leaf hopper, whitefly, thrips, aphid, spotted beetles, leaf roller, stem borer, blister beetle, red spider mite, and disease like little leaf of brinjal. Recently, increased build up of various mealybug species in crop plants and in the wild species observed is mainly due to certain abiotic changes with change in environment. Among the mealybug species, recently, the papaya mealybug *Paracoccus marginatus* Williams and Granara de Willink (Pseudococcidae; Hemiptera) cause damage to brinjal from the early stage of the crop growth to harvest. Both nymphs and adults suck the sap from leaves causing withering and yellowing of leaves and sometimes resulting in sooty mould in the upper surface of the leaves. Fruit may drop prematurely on crop plants. Heavy infestation can cause defoliation and even death of the plant. Insecticidal sprays, the common practice for managing insect pests is difficult at early stages of crop growth due to inadequate coverage and limited efficacy as residue in the expanding leaves (Brian *et al.*, 2004). And also sole reliance on chemical control leads to problems of pest resistance, resurgence of pests, pesticide residues, destruction of beneficial fauna and environmental pollution. Under such circumstances, the use of biopesticides in pest management is considered an ecologically viable proposition which overcomes the problems referred to above. Considering the importance of ecofriendly pest management, the present study was carried to evaluate some biopesticides against papaya mealybug.

MATERIALS AND METHODS

To evaluate the bio-efficacy of various biopesticides against *P. marginatus* in brinjal, a field experiment was conducted during January, 2010 in brinjal crop at Bhavanisagar Research Station by adopting randomized block design

(RBD) consisting of five treatments including an untreated control which was replicated thrice with plot size of 3 cents. Two rounds of spraying were given starting from flowering stage at an interval of 10 days using knapsack hydraulic sprayer (Aspee®, Mumbai) with a spray fluid volume of 500 L ha^{-1}. Five plants were randomly selected from each plot avoiding those from margins. Pre and post treatment counts were recorded on 5, 7 and 10 days after spray. Second round of spray was taken up on 11^{th} day after first spraying and pest count recorded on 10^{th} day was taken as pre treatment count for second spray. A 10X hand magnifying lens was used for counting the mealybug population. At harvest, data on yield parameters were also recorded.

Statistical Analysis

The data obtained were statistically analyzed in a randomized block design and different parameters observed in the experiments were subjected to Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Results revealed that all the treatments with biopesticides in the present study significantly reduced the population of *P. marginatus* over untreated check. After first spraying, among the biopesticides, *P. fluorescens* recorded the lowest mealybug population corresponding to reduction of mealybug population of 22.3, 19.5, 25.4 in three leaves corresponding to 66.77, 71.57 and 72.42 per cent reduction of mealybug population over control on 3, 7 and 10 days after spraying, respectively (Table 1). This was followed by *B. bassiana* which recorded a mean reduction of mealybug population 52.80 per cent. This was in line with the findings of earlier studies.

Management of insect pests, plant diseases by different *Pseudomonas* strains either as bacterial suspension or through different formulations have been reported by many workers (Kloepper and Schroth, 1981; Zehnder *et al.,* 1997; Krishnamurthy and Gnanamanickam, 1998; Maurhofer *et al.,* 1998; Raupach and Kloepper, 1998; Vidhyasekaran and Muthamilan, 1999). Talc formulation of Pf1 alone reduced the population of leafhopper, whitefly and aphid in okra plants (Murugan *et al.,* 2005), leaf miner *Liriomyza trifolii* and whitefly damage in tomato plants (Murugan *et al.,* 2007). Similar trend was also noticed after the second spraying with *P. fluorescens* and *B. bassiana* which recorded a mean population reduction of 77.62 and 58.98 per cent, respectively. FORS and spinosad 45 SC were comparatively less effective recording a mean population reduction of 51.99 and 50.86 percent, respectively (Table 2). The reduction in mealybug population by Pf1 treatment may be due to the contribution of plant growth substances to the suppression of insect population and induction

Table 1. Bioefficacy of biopesticides against *P. marginatus* in brinjal-Location: Bhavanisagar

Treatment	Dose (g or ml/ litre of water)	PTC No/3 leaves	Days after first spraying						Mean	
			3		7		10			
			No. of mealy bugs	% reduction	No. of mealy bugs	% reduction	No. of mealy bugs	% reduction	No. of mealy bugs	% reduction
Spinosad 45 SC	1	45.8	37.2	43.81	35	48.98	40.8	49.35	37.67	47.38
FORS (Fish Oil Rosin Soap)	25	43.9	41.6	37.16	34.5	49.71	37	50.65	37.7	45.84
Beauveria bassiana	10	44	35	47.13	31	54.81	38	56.46	34.67	52.80
Pseudomonas fluorescens	10	43.5	22.3	66.77	19.5	71.57	25.4	72.42	22.3	70.26
Beauveria + *Pseudomonas*	5+5	45	39	41.09	33.8	50.73	41.5	51.09	38.1	47.64
Control	0	42.8	66.2	0.00	68.6	0.00	69.5	0.00	68.1	0.00

In a column means followed by a common letter (s) are not significantly different at P = 0.05 by LSD and PTC- pre treatment count

Table 2. Bioefficacy of biopesticides against *P. marginatus* in brinjal-Location: Bhavanisagar

Treatment	Dose (g or ml/ litre of water)	PTC No/3 leaves	Days after second spraying						Mean	
			3		7		10			
			No. of mealy bugs	% reduction	No. of mealy bugs	% reduction	No. of mealy bugs	% reduction	No. of mealy bugs	% reduction
Spinosad 45 SC	1	40.8	34.1	49.85	33	51.11	37	51.62	34.70	50.86
FORS (Fish Oil Rosin Soap)	25	37	33	51.47	32.6	51.70	34.6	52.80	33.4	51.99
Beauveria bassiana	10	38	28.6	57.94	28	58.52	32.6	60.47	29.73	58.98
Pseudomonas fluorescens	10	25.4	16.83	75.29	15.2	77.48	18.5	80.09	16.83	77.62
Beauveria + *Pseudomonas*	5+5	41.5	33.4	50.88	33	51.11	38.6	51.03	35.0	51.01
Control	0	69.5	68	0.00	67.5	0.00	67.8	0.00	67.77	0.00

In a column means followed by a common letter (s) are not significantly different at P = 0.05 by LSD and PTC – pre treatment count

of resistance possibly by the production of lipase enzyme (Mohanasundaram *et al.,* 2010).

Significant difference was also observed on the yield of brinjal between the control plot (20.50 t ha^{-1}) and other treated plots. Spinosad and FORS recorded the highest yield of 38.50 t ha^{-1}, 35.25 t ha^{-1} respectively, followed by *P. fluorescence* (26.15 t ha^{-1}), *B. bassiana* (25.92 t ha^{-1}) and combination of *P. fluorescence* and *B. bassiana* (25.80 92 t ha^{-1}). Interestingly, higher BCR was observed for FORS treatment (6.71) with a net income of Rs. 299985/-

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