

Bio-efficacy of *Beauveria bassiana* against tea looper caterpillar, *Buzura suppressaria* Guen. (Lepidoptera : Geometridae)

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Abstract: Bio-efficacy of *Beauveria bassiana*, an entomopathogenic fungus, was evaluated against tea looper caterpillar, *Buzura* (= *Biston*) *suppressaria* Guen. (Geometridae : Lepidoptera) at Kamalpur and Hunterpara Tea gardens, West Bengal, India, during May – June, 2005 & 2006. Methomyl 40% SP and cypermethrin 25% EC, the planters' commonly used chemical pesticides were taken as standard checks. *B. bassiana* was used at 1.50 g, 2.00 g and 2.5 g/lit. of water while methomyl and cypermethrin were used at 0.75 mL, 1.00 mL and 1.50 mL and 0.50 mL, 1.00 mL and 1.50 mL/lit. of water, respectively. There was 88.00% reduction in the population build up of looper caterpillar at Kamalpur Tea Garden and 84.00% at Hunterpara Tea Garden at 3 days after spraying with 2.5 g *B. bassiana*/lit. of water. The dead caterpillars turned black and hanged under the leaves. However, the bioicidal activity of *B. bassiana* was found to be on par with the highest dose of methomyl and cypermethrin.

Key words: *Beauveria bassiana*; bio-efficacy; tea looper caterpillar

1 INTRODUCTION

Tea is a natural product made from leaves of tea plant, *Camellia sinensis* (L.) O. Kuntze. It has got world-wide popularity as a good beverage and health drink. Of 38 countries of the world, now engaged in tea cultivation, India ranks first in terms of production followed by China, Srilanka, Kenya, and Indonesia (Boriah, 2002). India is also the world's largest consumer of tea with annual consumption of over 600 million kg. In India, tea is commercially grown in 15 states of which West Bengal, with 22.10% share, stands second (Boriah, 2002).

Tea is a perennial crop grown as monoculture and thus offers excellent sites for feeding and reproduction of a wide variety of phytophagous arthropods. More than 300 insects and mites are associated with tea plants in India, attacking various parts like root, stem, leaf and bud. Of these, *Buzura* (= *Biston*) *suppressaria* Guen. (Geometridae : Lepidoptera), commonly known as looper caterpillar, has been causing appreciable damage to tea plantation unknown in West Bengal for some years back. The caterpillar feeds mainly on tender leaves and makes them skeletonised.

The use of synthetic insecticides has been the main tool of pest control on tea in India since long back. Large scale and sometimes indiscriminate use of such

pesticides for a long time have not only upset the natural tea ecosystem but also created pesticide residue problem in made tea. With the growing concern on the adverse effects of pesticides on the environment and the presence of pesticide residues in tea, attempts are being made to develop alternate strategies for management of tea pests, instead of sole dependence on hazardous chemical pesticides. This necessitates the need for searching of eco-friendly components of pest management including fungal, bacterial and viral pathogens which may effectively reduce damage to tea due to various pests.

Keeping this view in mind, the field trials were conducted at Kamalpur and Hunterpara tea gardens to evaluate the bio-efficacy of *Beauveria bassiana*, against tea looper caterpillar, *B. suppressaria* during May – June, 2005 & 2006. Methomyl 40% SP and Cypermethrin 25% EC, being widely used by tea planters, were included in the evaluation process to compare the entomopathogenic potential of *B. bassiana*, against the target pest under field conditions.

2 MATERIALS AND METHODS

The field experiments were conducted at two locations namely Kamalpur Tea Estate (Plains) situated at Siliguri and Hunterpara Tea Estate (Dooars) at Jalpaiguri, West Bengal, India to evaluate the bio-

efficacy of *B. bassiana*, an entomopathogenic fungus against looper caterpillar (*B. (= Biston) suppressaria* Guen. : Geometridae : Lepidoptera), infesting tea, following randomized block design. Besides the untreated control, methomyl 40% SP and cypermethrin 25% EC were also taken into consideration for comparison of the biocidal activity of *B. bassiana*. The doses for *B. bassiana* included 1.5 g, 2.0 g and 2.5 g/lit. of water, while for methomyl 40% SP and cypermethrin 25% EC, these comprised of 0.75 mL, 1.00 mL, 1.50 mL and 0.50 mL, 1.0 mL and 1.50 mL/lit. of water, respectively. There were three replications for each of the doses. Coinciding with the peak activity period of Looper caterpillar, three sprayings were given at 15 days interval with the help of Knapsac polythene Sprayer during May – June, 2005 & 2006.

Observations on the bio-efficacy of the three pesticides in inducing mortality vis-à-vis decreasing population build up of *B. suppressaria* were recorded at 1, 3, 5, 7 and 10 days after spraying (DAS) from fifteen randomly selected plants per plot of 5 m × 4 m size. The data thus obtained during 2005 and 2006 were pooled together separately for the two tea gardens and were subjected to Angular transformation for Duncan's Multiple Range Test (DMRT) to ascertain the test of significance of different treatments.

3 RESULTS AND DISCUSSION

Evaluation of *B. bassiana* along with methomyl 40% SP and cypermethrin 25% EC against looper caterpillar (*B. suppressaria*), infesting tea.

The results achieved on the bio-efficacy of different doses of *B. bassiana*, methomyl and cypermethrin against looper caterpillar at Kamalpur Tea Garden during May – June, 2005 and 2006 have been pooled together and have been presented in Table 1. The reductions in the population build up of looper caterpillar, when treated with *B. bassiana* at 1.5 g and 2.0 g/lit. of water was recorded to be 39.00% and 44.00% respectively (Table 1), over control at 10 days after spraying (DAS). But the biocidal activity of *B. bassiana* was found to be much accelerated when used at 2.5 g/lit. of water, thereby reducing the population build up of this caterpillar to the extent of 88.00% over control even at 3 DAS. Methomyl 40% SP at 1.0 mL/lit. and cypermethrin 25% EC at 1.5 mL/lit. of water, on the other hand, were able to produce similar reduction in population build up (88.00%) of the same pest but, at 5 DAS. Due to attack of *B. bassiana*, the dead caterpillars turned black and hanged under the leaves.

Table 1 Bio-efficacy of *Beauveria bassiana* against looper caterpillar (Kamalpur Tea Garden, May – June, 2005 & 2006)

Treatment	Dose	Pre-treatment population	Mean number of population build up at different days after spraying					Reduction over control (%)
			1 d	3 d	5 d	7 d	10 d	
<i>Beauveria bassiana</i> (g/lit. water)	1.50	29.40 (33.15) A [#]	24.15 (29.77) B	19.70 (26.71) B	13.80 (22.22) BC	9.70 (18.62) CD	12.70 (21.30) B*	39.00
	2.00	28.70 (32.71) A	22.50 (28.66) BC	18.30 (25.69) BC	11.70 (20.54) CD	8.20 (17.15) D	10.40 (19.28) C	44.00
	2.50	26.80 (31.50) A	18.75 (26.02) D	0.0 (4.05) F	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) F	88.00
Methomyl 40% SP (mL/lit. water)	0.75	29.30 (33.90) A	20.10 (26.99) CD	15.30 (23.42) D	12.40 (21.05) CD	10.90 (19.73) C	7.30 (16.22) D	54.00
	1.00	28.40 (32.52) A	20.00 (26.99) CD	10.30 (19.19) E	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) F	88.00
	1.50	28.70 (32.71) A	9.90 (18.81) E	0.0 (4.05) F	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) F	88.00
Cypermethrin 25% EC (mL/lit. water)	0.50	29.60 (33.27) A	22.70 (28.79) BC	18.40 (25.77) BC	16.10 (24.04) B	13.75 (22.18) B	10.20 (19.09) C	46.00
	1.00	29.10 (32.96) A	20.15 (27.03) CD	16.10 (24.04) CD	10.25 (19.14) D	8.75 (17.71) D	5.10 (13.69) E	61.00
	1.50	28.80 (32.77) A	18.10 (25.55) D	12.20 (20.88) E	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) F	88.00
Control	–	28.30 (32.46) A	29.30 (33.09) A	29.70 (33.34) A	30.10 (33.58) A	30.40 (33.77) A	31.30 (34.33) A	–
Standard error of mean	–	1.54	1.90	1.38	1.33	1.28	1.29	
CD at 0.05%	–	2.13	2.36	2.01	1.98	1.94	1.95	

* Figures in parentheses indicate Angular transformed values. # Means in a column with letter in common are not significantly different.

The same pesticides, when evaluated for their biocidal activity against the same pest at Hunterpara Tea Garden, during the same periods (May – June, 2005 and 2006), did not follow the same trend as was recorded at Kamalpur Tea Garden. In this case cypermethrin 25% EC at all doses did fail to exert adequate lethality towards looper caterpillar, thereby

producing reduction in its population build up in the range of 36.00% to 63.00% (Table 2) over control at 10 DAS. However, *B. bassiana* at 2.5 g/lit. of water and methomyl 40% SP at 1.0 mL/lit. of water were found to be equally effective, resulting 88.00% reduction in population build up of the pest at 3 and 1 DAS, respectively.

Table 2 Bio-efficacy of *Beauveria bassiana* against looper caterpillar (Hunterpara Tea Garden, May – June, 2005 & 2006)

Treatment	Dose	Pre-treatment population	Mean number of population build up at different days after spraying					Reduction over control (%)
			1 d	3 d	5 d	7 d	10 d	
<i>Beauveria bassiana</i> (g/lit. water)	1.50	14.70 (22.95) A#	12.60 (21.22) AB	10.30 (19.19) B	9.40 (18.34) B	7.20 (16.11) B	9.80 (18.72) B*	25.00
	2.00	14.80 (23.03) A	10.20 (19.09) CD	6.10 (17.05) CDE	4.20 (12.52) D	2.90 (10.62) D	1.80 (8.72) D	65.00
	2.50	15.30 (23.42) A	8.40 (17.36) D	0.0 (4.05) F	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) E	84.00
Methomyl 40% SP (mL/lit. water)	0.75	14.80 (23.03) A	8.40 (17.36) D	6.70 (15.56) DE	4.20 (12.52) D	2.10 (9.28) D	2.50 (9.97) D	60.00
	1.00	14.50 (22.77) A	0.0 (4.05) E	0.0 (4.05) F	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) E	84.00
	1.50	13.30 (21.81) A	0.0 (4.05) E	0.0 (4.05) F	0.0 (4.05) E	0.0 (4.05) E	0.0 (4.05) E	83.00
Cypermethrin 25% EC (mL/lit. water)	0.50	13.40 (21.89) A	11.30 (20.09) BC	9.70 (18.62) BC	8.20 (17.15) BC	7.90 (16.85) B	6.40 (15.23) C	36.00
	1.00	14.70 (22.95) A	10.20 (19.09) CD	8.30 (17.26) CD	6.70 (15.56) C	4.80 (13.31) C	2.40 (9.80) D	61.00
	1.50	14.10 (22.46) A	8.40 (17.36) D	6.40 (15.23) E	4.60 (13.05) D	2.40 (9.80) D	1.90 (8.91) D	63.00
Control	–	14.30 (22.62) A	14.80 (23.03) A	15.20 (23.34) A	15.90 (23.89) A	16.20 (24.12) A	16.70 (24.50) A	–
Standard error of mean	–	1.65	1.35	1.20	1.13	1.05	0.83	
CD at 0.05%	–	2.20	1.99	1.88	1.82	1.76	1.56	

* Figures in parentheses indicate Angular transformed values. # Means in a column with letter in common are not significantly different.

In nature the entomopathogens play important role in regulating population build up of harmful pests important to agriculture. The use of these pathogens for suppression of undesired insect pests is gaining momentum in recent times.

The results achieved on the bio-efficacy of various doses of *B. bassiana*, a fungus, in powder form, indicated appreciably higher reduction in the population build up of looper caterpillar, *B. suppressaria* in the range 39.00% to 88.00% at Kamalpur Tea Garden and 25.00% to 84.00% at Hunterpara Tea Garden, as compared to control. It may be pertinent to mention here that *B. bassiana*, when used at 2.5 g/lit. of water, exerted more lethality towards *B. suppressaria*, thereby reducing its population build up to the extent of 88.00% even at 3 DAS, indicating aggressive nature of the fungus. As the tea planters commonly use methomyl 40% SP and cypermethrin 25% EC for population suppression of looper caterpillar, these two chemical pesticides were also taken into consideration for comparing the bio-efficacy of *B. bassiana* against the

same pest. The results indicated on par activity of *B. bassiana* with Methomyl and Cypermethrin, tested at Kamalpur conditions (Table 1) and with little erratic effect arising out of cypermethrin when used at Hunterpara (Table 2) situations.

The literatures available so far indicated no use of *B. bassiana* against looper caterpillar infesting tea. However, Rahaman *et al.* (2006), while evaluating entomopathogenic potential of this fungal pathogen against tea mosquito bug (*Helopeltis theivora*) observed 52.52% to 61.56% reduction in infestation due to this pest.

The stable tea ecosystem favours meaningful use of biological agents for management of pests of economic importance to the crop. Appropriate and timely application of entomopathogens, one of the important components of biological pest control methods, may do away with the need for chemical control in tea ecosystem. Obviously, this method of pest management may also help getting rid of the pesticide residue problem in tea. Based upon the results achieved

through field trials for two years at two different tea ecosystems under West Bengal conditions, the present researchers were of the opinion that *B. bassiana* at 2.5 g/lit. of water may prove worthy as a component in IPM to keep down the population build up of looper caterpillar, *B. suppressaria*, a menacing pest of tea.

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球孢白僵菌对油桐尺蛾的生物效力

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摘要 : 分别在 2005 年和 2006 年的 5、6 月份 , 在 Kamalpur 和 Hunterpara 茶园、孟加拉西部以及印度地区对一种昆虫致病真菌球孢白僵菌对油桐尺蛾 *Buzura* (= *Biston*) *suppressaria* Guen. 的生物效力进行了评估。以农场主常用的化学杀虫剂 40% SP 灭多虫和 25% EC 氯氰菊酯作为标准检测物。试验中球孢白僵菌浓度为 1.50 g , 2.00 g 和 2.5 g/lit. of water ; 灭多虫和氯氰菊酯浓度分别为 0.75 mL , 1.00 mL 和 1.50 mL 和 0.50 mL , 1.00 mL 和 1.50 mL/lit. of water。在喷洒 2.5 g/lit. of water 球孢白僵菌 3 天后 , Kamalpur 和 Hunterpara 茶园中油桐尺蛾种群个体数分别降低了 88.00% 和 84.00%。死的毛虫变成黑色 , 垂悬在叶片上。并且发现球孢白僵菌的杀虫活性与高剂量的灭多虫和氯氰菊酯的相当。

关键词 : 球孢白僵菌 ; 生物效力 ; 茶园尺蠖蛾

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