

Evaluation of Eco-Friendly Management Components against Shoot and Fruit Borer, *Leucinodes orbonalis* guenee

P. K. Bareliya^{1*}, Rudra Pratap Singh², Raja Ram Yadav³ and Ankit Kumar⁴

¹M.Sc. Student, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, (U.P.).

^{2,4}Faculty of Agriculture, BU, Ajmer, (Raj.)

³Technical Assistant, Jhansi, (U.P.).

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ABSTRACT

Study the ecofriendly pest management through non-chemical natural resources particularly using antagonistic fungal bioagents and botanical as well as plant growth promoter, botanical based Neem seed oil, and marketed insecticide quinalphos against Shoot and Fruit Borer. The highest reduction in shoot (19,45%) and fruit (23.30%) damage caused by borer at 7 days after spraying of Quinalphos 25 EC, followed by boric acid-based *B. bassiana* (23.04, 23.69), neem seed oil (24.83, 26.95), Bentonite fine powder-based *M. anisopliae* (23.87, 28.45), clay soil-based *T. Viride* (25.68, 29.20) and control (34.25, 29.20).

Key words: Brinjal, Shoot and fruit borer and Ecofriendly pest management.

INTRODUCTION

Brinjal, *Solanum melongena* Linnaeus, commonly known as egg plant is an important vegetable crop cultivated since ages. It is widely grown all over the Globe including India for its immature tender fruits. South-East Asia, probably India, is the native of brinjal. Brinjal is quite rich in certain nutritive elements like 4.0 per cent carbohydrate, 1.4 per cent protein, 0.3 per cent fat, 0.047 per cent phosphorus, 0.018 per cent calcium, 0.009 per cent iron and many other vitamins with 92.7 per cent moisture⁴. Due to its nutritive value, consisting of minerals like iron, phosphorous, calcium and vitamins like A, B and C, unripe fruits are used primarily as

vegetable in the country. It is also used as a raw material in pickle making¹⁵ and as an excellent remedy for those suffering from liver complaints.

A major constraint in vegetable production is poor and inadequate control of pests and diseases, which cause high yield losses¹⁶. Vegetable crop is attacked by several insect pests from the time of planting till the harvest. Brinjal is attacked by 53 species of insect pests⁵ of which 8 are considered as major pests causing enormous damage to the crop in every season in every year. Shoot and fruit borer, *L. orbonalis* (Lepidoptera: Pyralidae) is the key pest throughout Asia.

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In India, this pest has a countrywide distribution and has been categorized as the most destructive and the most serious pest causing huge amount of losses of brinjal¹¹. The damage is sometimes 70% of the fruit has been reported to be affected by larvae of this pest⁹. The yield loss due to the pest is to the extent of 70-92 per cent⁸.

Bio-pesticides have high target selectivity, environmental compatibility, economic viability, novel mode of action and are considered much safer to environment and other beneficial organisms as well as rational approach at a long run. Like all microorganisms, entomopathogenic fungi have specific biological characteristics that influence their activity in the environment¹⁰. Organic farming has driven the search for effective and ecofriendly alternative to manage the pest.

MATERIAL AND METHODS

The Department of Entomology is situated in main campus of the university on the right side of Kanpur road at a distance of 12 km from Jhansi Railway Station. In addition to the lab work, micro-plot research work has been carried out behind the Institute of Agricultural Sciences, Bundelkhand University Jhansi.

In present investigation total five management components were selected, out of which three fungal bio-control agents viz., *Trichoderma viride*, *Beauveria bassiana*, *Metarrhizumanisopliae* were developed and produced in lab, one botanical based Neem seed oil and another marketed insecticide Quinalphos 25% EC were purchased from market for both lab and field work. All three above fungal biocontrol agents were procured from Indian Type Culture Collection (ITCC), Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi while rest others neem oil and quinalphos was collected in local market.

RESULT AND DISCUSSION

The tests of 3 bioformulation of clay fine soil powder based of *T. viride*, boric acid based *B. bassiana*, Bentonite fine powder based *M.*

anisopliae were found significantly suitable with maximum shelf life, dispersibility, easy to use by farmers. Keeping above paramount merits of above developed biopesticides of *T. viride*, *B. bassiana* and *M. anisopliae* were selected to use in present *in-vivo* microplot experiment along with neem seed oil and Quinalphos 25 EC as management components against Brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae) through foliage application at 7, 14 and 21 days time intervals. Results showed that highest reduction in shoot (19.45%) and fruit (23.30%) damage caused by borer (BSFB), *Leucinodes orbonalis* Guenee at 7 day after spraying (DAS) was recorded in the treatment of Quinalphos 25 EC, followed by boric acid based *B. bassiana* (23.04, 23.69), neem seedoil (24.83, 26.95), Bentonite fine powder based *M. anisopliae* (23.87, 28.45), clay soil based *T. viride* (25.68, 29.20) and control (34.25, 29.20). In similar fashion at 14 days after spraying (DAS), Quinalphos 25 EC treated plants depicted highest reduction in shoot (23.10) and fruit (17) damage, followed by boric acid based *B. bassiana* (25.25, 30.09), neem seed oil (28.47, 22.40), Bentonite fine powder based *M. anisopliae* (27.97, 26.10), clay soil based *T. viride* (23.10, 17.0) and control (36.12, 41.48) while at 21 days after spraying (DAS) also given similar trend to protect the shoot and fruits of brinjal plants with *Leucinodes orbonalis* pest treated with Quinalphos 25 EC (26.74, 11.25), followed by boric acid based *B. bassiana* (29.47, 14.80), neem seed oil (32.89, 16.89), Bentonite fine powder based *M. anisopliae* (31.86, 18.49), clay soil based *T. viride* (32.94, 23.72) and control (39.43, 48.27) by its various known mechanism of dominating and interaction on colonizing surface body (Table-1 and Table-2). Application of all above management components significantly improved the plant growth parameters including high productivity and quality (Table-1 and 2). The possible reason for this may be attributed to either individual effect of the *T. viride*, *B. bassiana*, *M. anisopli*, neem seed oil and quiolphos

raising the defense mechanism against *Leucinodes orbonalis* pest. Mechanism of damaging various stages of life cycle of *Leucinodes orbonalis* pest viz. eggs, larvae and adult by toxic chemical molecules present in Quinalphos 25 EC and neem seed oil, may be due its certain mode of action by destroying the process of synthesis of chemical in cells, nervous system, stomach poisoning etc while other microbial biopesticide may be showing their adverse effect on various part of life cycle of *Leucinodes orbonalis* pest by coming in physical body contact, releasing toxic chemical, colonization on insect body to harvest food materials for survival^{2,14,3}. Neem oil seed cake is known to possess multifarious properties like insecticidal, fungicidal and nematocidal properties, besides, being a rich source of NPK contents. This oilseed cake has mostly been used as an organic amendment thus making the hosts more tolerant to the disease attack. The oilseed cake also has been used as a medium favourable for the proliferation of fungal bioagents. Among all above 3 fungal biopesticide, *B. bassiana* and *M. anisopliae* having egg and host parasitic nature (Bonilla et al.⁶, as results spores of above fungus used to come in contact of insect body, eggs etc. and start to germinate and multiple on host for getting food and nutrients which is making more weaker, susceptible and inactive to insect pest while *T. viride* having multifarious nature to invade the pest by releasing several toxic chemicals, hormones, enzymes, antibiotic by its different mode of action on various stages of insect^{13,1}. The outstanding results as observed in all the above treatments may be due to their strong antagonistic nature and multifarious properties. Singh et al.¹⁴ were used three insecticides, i.e. endosulfan (0.05%), cypermethrin (0.05%) and malathion (0.05%),

to determine the suitable control measure against the brinjal [aubergine] shoot and fruit borer (*L. orbonalis*) to obtain higher yield. The minimum (21.5%) infestation was observed with endosulfan, followed by cypermethrin (24.13%) and malathion (25.17%). The total yield of healthy brinjal fruits was highest (350 q/h) with endosulfan-treated plants and lowest (112.5 q/h) with the control. A high profit was obtained from endosulfan (0.07%) applied schedule followed by cypermethrin (0.05%) for each rupee.

Chiranjeevi⁷, was conducted a field experiment against shoot and fruit borer (*Leucinodes orbonalis*) on brinjal. The treatments were (T1) neem seed kernel extract (NSKE) at 4%, profenofos and cypermethrin; (T2) no spray, profenofos at 0.1%, cypermethrin/NSKE, profenofos and cypermethrin at 0.005%; (T3) NSKE, 5 sprays from flower initiation; (T4) profenofos, 5 sprays from flower initiation; (T5) Cypermethrin, 5 sprays from flower initiation; (T6) stem application with imidacloprid at 1 ml/litre at 30 days after transplanting; and (T7) untreated control. Cypermethrin and profenofos, applied at 5 sprays, and alternate spraying with NSKE, profenofos and cypermethrin along with IPM package resulted in the best control of the pest and the highest yield (213.87, 208.25 and 203.98 q/ha, respectively). Raja et al.¹², the management of brinjal shoot and fruit borer, *L. orbonalis* indicated the efficacy of Neem oil (4%), NSKE (5%), endosulfan (0.07%) + neem oil (2%), endosulfan (0.07) + NSKE (5%), endosulfan (0.07%) and carbaryl (0.05%) reduced fruit borer damage by 10.13, 11.56, 11.37, 11.41, 11.68 and 11.81%, respectively, against 36.9% infestation recorded in the untreated control.

Table 1: Bioefficacy of biopesticide, neem seed oil and insecticides against *L. orbonalis* G. on shoot infestation of brinjal

Treatment	Dosage	Shoot borer damage (%)						
		1 DBS	7 DAS	Decrease over control	14 DAS	Decrease over control	21 DAS	Decrease over control
<i>Metarrhizumanisopliae</i>	15g	30.39	23.87	21.45	27.97	7.96	31.86	4.83
Neem seed oil	1%	31.67	24.83	21.59	28.47	32.89	32.89	3.85

<i>Beauveria bassiana</i>	15g	29.38	23.04	21.57	25.25	29.47	29.47	0.30
<i>Trichoderma viride</i>	15g	30.02	25.68	12.45	29.31	32.94	32.94	9.72
Quinalphos 25 EC	1ml	31.54	19.45	38.33	23.10	26.75	26.74	15.18
Untreated check		31.25	34.24		36.12		39.43	
SE m+		-	1.24	-	0.843		1.474	
CD at 5%		NS	3.86	-	2.59	-	4.54	
Data were analyzed after arc sine transformation								
DBS – Day before spraying								
DAS – Days after spraying								

Table 2: Bioefficacy of biopesticide, neem seed oil and insecticides against *L. orbonalis* G. on fruit infestation of brinjal:

Treatment	Dosage	Fruit borer damage (%)						
		1 DBS	7 DAS	Decrease over control	14 DAS	Decrease over control	21 DAS	Decrease over control
<i>Metarrhizumanisopliae</i>	15g	34.10	28.45	30.28	26.10	23.46	18.49	45.78
Neem oil	1%	32.70	26.95	27.48	22.40	31.49	16.89	49.14
<i>Beauveria bassiana</i>	15g	33.42	23.69	32.71	18.30	43.24	14.80	55.71
<i>Trichoderma viride</i>	15g	32.02	29.20	25.00	25.82	19.36	23.72	25.92
Quinalphos 25 EC	1ml	32.80	23.30	43.19	17.00	48.17	11.25	65.70
Untreated check		33.25	36.50		41.48		48.27	
SE m+		-	0.157	-	0.316		1.213	
CD at 5%		NS	1.24	-	1.68	-	2.83	
Data were analyzed after arc sine transformation								
DBS – Day before spraying								
DAS – Days after spraying								

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