Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2025; 13(1): 07-10

Received: 04-10-2024
Accepted: 09-11-2024

MM Godase
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

YS Saindane
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

BV Deore
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

US Surve
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

ST Aghav
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Corresponding Author:
MM Godase
Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Biorational management of insect pest of soybean (*Glycine max*)

MM Godase, YS Saindane, BV Deore, US Surve and ST Aghav

DOI: https://doi.org/10.22271/j.ento.2025.v13.i1a.9435

Abstract
An experiment entitled "Biorational management of insect pest of soybean (*Glycine max*)" was conducted at the Post Graduate Research Farm, Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist: Ahmednagar (Maharashtra) during *Kharif*, 2023. During the course of study, Eight treatments *viz*., *Metarhizium anisopliae* 1.15% WP @ 5.0 g/L, *Beauveria bassiana* 1.15% WP @ 5.0 g/L, *Bt* var. *kurstaki* @ 2.0 g/L, Azadirachtin 10000 ppm @ 2.0 ml/L, Neem oil @ 2.0 ml/L, Pongamia oil @ 2.0 ml/L, Intercrop with sorghum (2:1), Trap crop- Castor and standard check Chlorantraniliprole 18.5% SC with untreated control were evaluated in Randomized Block Design (RBD) with three replications during *Kharif*, 2023. The observations on leaf eating caterpillar (*Spodoptera litura*), green semilooper (*Chrysodeixis acuta*), whitefly (*Bemisia tabaci*), aphid (*Aphis craccivora*), leaf hopper (*Empoasca spp*.), stem fly (*Melanagromyza sojae*) and girdle beetle (*Obereopsis brevis*) were recorded. While, incidence of pests other than leaf eating caterpillar and green semilooper was recorded minimum. So, observations recorded with leaf eating caterpillar (*Spodoptera litura*), green semilooper (*Chrysodeixis acuta*) causes severe damage to soybean crop. The observations on leaf eating caterpillar (*Spodoptera litura*), green semilooper (*Chrysodeixis acuta*) for evaluation of bioefficacy of different biorationals were recorded a day before initiation of treatment application and at 3rd, 7th and 10th days after each spray. Two sprays were given at 15 days interval. The results on evaluation of bioefficacy of biorationals against leaf eating caterpillar (*Spodoptera litura*) and semilooper (*Chrysodeixis acuta*) revealed that, the standard check chlorantraniliprole 18.5% SC consistently proved to be most promising by recording least population (2.23 larvae/mrl). Among biorationals *Beaveria bassiana* 1.15%WP (1x10^8 cfu/g) with (3.00 larvae/mrl) and *Metarhizium anisopliae* 1.15% WP (1x10^8 cfu/g) with (3.05 larvae/mrl) were found most effective and at par with each other in control of leaf eating caterpillar (*Spodoptera litura*) population over untreated control. Whereas, pongamia oil (4.60 larvae/mrl), intercrop- sorghum (4.65 larvae/mrl) and trap crop- castor (4.71 larvae/mrl) was found least effective treatments in control of leaf eating caterpillar (*Spodoptera litura*).

Keywords: Biorational, *Spodoptera litura*, *Chrysodeixis acuta*, *Beauveria bassiana*, *Metarhizium anisopliae*

Introduction
Soybean [*Glycine max* (L.) Merrill] belongs to the family Leguminaceae, sub family Papilionaceae. It is one of the major oilseed crop in the world. It is a fascinating crop with innumerable possibilities of not only improving agriculture, but also supporting industries. Soybean is one of the most important crop which is grown for oil and protein in both the *Rabi*and *Kharif* seasons. Soybean also known as the "wonder crop" of the twenty-first century. InIndia, the area under soybean cultivation is 112.83 lakh ha with the annual production of 127.37 lakh tonnes and productivity of 968 kg/ha (Anonymous, 2023) [4]. It is a major oilseed crop in India and is grown in the states of Madhya Pradesh, Maharashtra, Karnataka, Uttar Pradesh, Rajasthan, Tamil Nadu, Andhra Pradesh and Uttarakhand. It is one of the important oilseed crop of the Leguminaceae family and genus *Glycine*. It contains 20% oil and contributes more than 50% tothe global production of edible oil. Soybean contains 40% protein, rich in all essential amino acids and vitamin A, B and D. It is a major oilseed crop grown primarily for its seeds throughout the world. Soybean is in high demand in the market due to its high protein level and good quality oil, which contains vital fatty acids. Soybean is recognized as a valuable food material and it isone of the world‟s least expensive and high-quality protein source as 100 g of edible soybean contains protein (43.20 g), fat (19.50 g), calcium (240 mg), iron (11.50 mg), carbonate (426 mg), thiamine (0.73 mg), riboflavin (0.39

mg), niacin (3.20 mg) and energy (432 cal). Commercial products of soya proteins are soya flour (less than 65% protein), soya protein concentrate (65 to89% protein) and soya protein isolate (90% or more protein) (Pandya, 1988). It is mostly used for human consumption, industrial applications and cattle feed. This crop is now grown over 50 countries and is the most widely produced and consumed oilseed crop in the world.

The use of synthetic insecticides in crop protection programmes around the world has resulted in disturbances of the environment, pest resurgence, pest resistance to pesticides and lethal effect to non-target organisms in the agro-ecosystems in addition to direct toxicity to users. Therefore, it has now become necessary to search for alternative means of pest control, which can resist, which has amplified the condition, resulting in prevention of pest outbreak. Use of biopesticides for the control of insect pests in the recent years offered several advantages over the chemical pesticides *viz*., safety towards natural enemies (predators), targeted activity to the desired pest and effective at lower quantities there by provides lower exposure and to quick deposition on leaves, no residue problems on the plant and allowing field re-entry immediately after application and amenability to use in rotation with chemical pesticides as part of IPM programmes. So, the main motto of the study is to evaluate combination of microbial biopesticides to minimize pesticide impact in the environment.

Material and Methods

The present investigation entitled, "Biorational management of insect pest of soybean (*Glycine max*)" was conducted at Post Graduate Research Farm, Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Kharif*, 2023. The experiment conducted with following treatments :

Treatment	Name Of Treatment	Dose (g or ml/L of water)
T_1	*Metarhizium anisopliae* 1.15% WP($1x10^8$ cfu/g)	5 g
T_2	*Beaveria bassiana* 1.15% WP ($1x10^8$ cfu/g)	5 g
T_3	*Bt.var kurstaki*	2 g
T_4	Azadirachtin 10000 ppm	2 ml
T_5	Neem oil 2%	2 ml
T_6	Pongamia oil 2%	2 ml
T_7	Intercrop	Sorghum (2:1)
T_8	Trap Crop	Castor
T_9	Chlorantraniliprole 18.5% SC	0.2 ml
T_{10}	Untreated Control	-

Methodology

The experiment was conducted at PG farm Department of Entomology, MPKV, Rahuri during *Kharif*, 2023 to study the field efficacy of different biorationals against major pests of soybean. The variety KDS 726 (Phule Sangam) was sown at a spacing of 45 cm between rows and 5 cm between plants in 4 x 4 m plots.

Observation on larval population of leaf eating caterpillar [*Spodoptera litura* (Fabner), green semilooper *Chrysodeixis acuta* (Fabner)] in one meter row length of soybean plants atrandomly selected spots in each treatment plot leaving the border rows. Pre-count was taken at one day before first spray and post counts at 3, 7 and 10 days after each spray. The post treatment observations taken after 14 days were considered as pre-treatment count for second application. The yield (kg/plot) obtained from individual treatment was registered separately for assessing the effect of different treatments on yield. The data on yield (kg/plot) were converted into (q/ha).

The experimental data on efficacy was analysed statistically by applying Randomized Block Design (RBD). The data was translated into square root transformation and the results obtained from field observations were analysed statistically as per methodology given by Panse and Sukhatme (1985) [10]. The significance of treatments was assessed by determining the standard error (S.E.) and critical difference (C.D.) at 5% level significance.

Results and Discussion

The cumulative data of pertaining to effect of Bioefficacy of biorationals against leaf eating caterpillar (*Spodoptera litura*) and semilooper (*Chrysodeixis acuta*) of soybean recorded at 3rd, 7th and 10th days presented in table 1 and 2.

1. Bioefficacy of biorationals against leaf eating caterpillar (*Spodoptera litura*) of soybean

from the cumulative data on survival population of *Spodoptera litura* result show that, all the treatments evaluated were significantly superior over untreated control in reducing the *Spodoptera litura* population recorded at 3rd, 7th and 10th days after each spray. Among all the treatments, standard check with spraying of chlorantraniliprole 18.5% SC @ 0.2 ml/L proved to be significantly superior to all the remaining ones and recorded minimum of mean 2.13 larvae/mrl. The next effective treatments were spraying of *Beauveria bassiana* 1.15% WP @ 5.0 g/L, and *Metarhizium anisopliae* 1.15% WP @ 5.0 g/L which were at par with each other with mean 3.00 and 3.05 larvae/mrl, respectively. Treatment with spraying *Bt* var. *kurstaki* @ 2.0 g/L, azadirachtin 10000 ppm @ 2.0 ml/L and neem oil @ 2.0 ml/L were at par with each other with 3.69, 3.87, 3.82 larvae/mrl, respectively. Treatment with pongamia oil @ 2.0 ml/L, intercrop with sorghum (2:1), trap crop- castor was least effective in order with mean 4.60, 4.71, 4.65 larvae/mrl, respectively. While, maximum population (6.62 larvae/mrl) was recorded in untreated control of soybean plot.

The results of present investigations was discussed in the light of findings of previous workers. Ansari and Sharma (2005) [5] reported that *Beauveria Bassiana* and *Bacillus thuringiensis* recommended for insect pest control in soybean. Ahirwar *et al.* (2009) [2] reported the efficacy of *Metarhizium anisopliae*, *Beauveria Bassiana* and *Bacillus thuringiensis* to control major pest in soybean. Results of present investigation are in line with Dhepe *et al.* (2018) [8]. Chaware *et al.* (2019) [7] found that *Metarhizium anisopliae* and *Beauveria Bassiana* were most effective against green semilooper in soybean.

Table 1: Effect of different biopesticides on survival population of Leaf eating

Tr. No.	Treatment	Dose (g or ml/L)	No. of *Spodoptera litura* larvae/mrl				
			Precount	3 DAS	7 DAS	10 DAS	Mean
1	*Metarhizium anisopliae* 1.15% WP (1x10^8 cfu/g)	5 g	5.40 (2.42)	3.98 (2.31)	2.23 (1.65)	2.93 (1.84)	3.05 (1.87)
2	*Beaveria bassiana* 1.15% WP (1x10^8 cfu/g)	5 g	5.28 (2.39)	3.91 (2.09)	2.24 (1.65)	2.84 (1.81)	3.00 (1.85)
3	*Bacillus thuringiensis* var. *kurstaki*	2 g	5.13 (2.37)	4.94 (2.33)	2.73 (1.79)	3.39 (1.97)	1.69 (2.05)
4	Azadirachtin 10000 ppm	2 ml	5.33 (2.41)	5.16 (2.37)	2.88 (1.83)	3.58 (2.01)	3.87 (2.08)
5	Neem oil 2%	2 ml	5.27 (2.40)	5.05 (2.35)	2.93 (1.85)	3.49 (2.17)	3.82 (2.07)
6	Pongamia oil 2%	2 ml	5.87 (2.51)	5.61 (2.48)	4.01 (2.12)	4.19 (2.20)	4.60 (2.25)
7	Trap crop – Castor	-	6.03 (2.55)	5.76 (2.50)	3.97 (2.11)	4.40 (2.20)	4.71 (2.29)
8	Intercrop – Sorghum (2:1)	-	6.08 (2.56)	5.69 (2.49)	4.01 (2.12)	2.27 (2.20)	4.65 (2.27)
9	Chlorantraniliprole 18.5% SC	0.2 ml	4.96 (2.33)	2.92 (1.84)	1.42 (1.37)	2.05 (1.57)	2.13 (1.59)
10	Untreated control	-	6.44 (2.63)	6.54 (2.65)	6.60 (2.66)	6.73 (2.69)	6.62 (2.67)
	S.E. ±		0.09	0.04	0.03	0.03	0.04
	C.D.at 5%		NS	0.11	0.09	0.09	0.12

caterpillar (*Spodoptera litura*) of soybean
Figures in the parentheses are (√x + 0.5) transformations

2. Bioefficacy of biorationals against green semilooper (*Chrysodeixix acuta*) of soybean

from the cumulative data on survival population of *Chrysodeixix acuta* result show, all the treatments evaluated were significantly superior over untreated control in reducing the *Chrysodeixix acuta* population recorded at 3rd, 7th and 10th days after each spray. Among all the treatments, treatment with spraying of chlorantraniliprole 18.5% SC @ 0.2 ml/L proved to be significantly superior to all the remaining ones and recorded minimum of mean 1.19 larvae/mrl. The next best treatments were *Beauveria bassiana* 1.15% WP @ 5.0 g/L, and *Metarhizium anisopliae* 1.15% WP @ 5.0 g/L which were at par with each other with mean 2.00 and 2.03 larvae/mrl, respectively. Treatment with spraying of *Bt* var. *Kurstaki* @ 2.0 g/L, azadirachtin 10000 ppm @ 2.0 ml/L and neem oil @ 2.0 ml/L were at par with each other with 2.59, 2.71, 2.63 larvae/mrl, respectively. Treatment with of pongamia oil @ 2.0 ml/L, intercrop with sorghum (2:1), trap crop- castor was least effective in order with mean 3.22, 3.41, 3.29 larvae/mrl, respectively. While, maximum population (4.58 larvae/mrl) was recorded in untreated control of soybean plot.

Results of the present investigation are in agreement with the findings of Ahiwar (2013) [1] who reported that *B. bassiana* was most effective against *C. acuta*. Bochare *et. al* (2018) [6] who reported that *Beauveria bassiana* and *Metarhizium anisopliae* was most effective in reducing the population of *Chrysodeixix acuta* on soybean.

Table 2: Effect of different biopesticides on survival population of green semilooper (*Chrysodeixis acuta)* of soybean

Tr. No.	Treatment	Dose (g or l/L)	No. of *Chrysodeixix acuta* larvae/mrl				
			Precount	3DAS	7DAS	10DAS	Mean
1	*Metarhizium anisopliae* 1.15% WP (1x10^8 cfu/g)	5 g	2.94 (1.85)	2.56 (1.75)	1.53 (1.42)	2.00 (1.58)	2.03 (1.58)
2	*Beaveria bassiana* 1.15% WP (1x10^8 cfu/g)	5 g	2.73 (1.79)	2.67 (1.78)	1.45 (1.39)	1.89 (1.54)	2.00 (1.57)
3	*Bacillus thuringiensis* var. *kurstaki*	2 g	3.24 (1.93)	3.12 (1.90)	2.19 (1.63)	2.44 (1.71)	2.59 (1.75)
4	Azadirachtin 10000 ppm	2 ml	3.51 (2.00)	3.23 (1.93)	2.28 (1.68)	2.62 (1.76)	2.71 (1.79)
5	Neem oil 2%	2 ml	3.25 (1.93)	3.10 (1.89)	2.25 (1.65)	2.54 (1.74)	2.63 (1.76)
6	Pongamia oil 2%	2 ml	3.69 (2.04)	3.54 (2.04)	2.99 (1.87)	3.13 (1.90)	3.22 (1.94)
7	Trap crop - Castor	-	3.92 (2.09)	3.75 (2.06)	3.19 (1.92)	3.30 (1.95)	3.41 (1.97)
8	Intercrop – Sorghum (2:1)	-	3.74 (2.05)	3.64 (2.03)	3.06 (1.88)	3.18 (1.91)	3.29 (1.94)
9	Chlorantraniliprole 18.5% SC	0.2 ml	2.69 (1.78)	1.50 (1.41)	0.87 (1.16)	1.20 (1.30)	1.19 (1.29)
10	Untreated control	-	4.54 (2.24)	4.57 (2.27)	4.54 (2.24)	4.63 (2.26)	4.58 (2.26)
	S.E. ±		0.09	0.03	0.03	0.02	0.03
	C.D.at 5%		NS	0.09	0.08	0.07	0.08

Figures in the parentheses are (√x + 0.5) transformations

Conclusion

- Biorational treatment *Beaveria bassiana* 1.15%WP (1x10^8 cfu/g) and *Metarhizium anisopliae* 1.15% WP (1x10^8 cfu/g) were found most effective and at par with each other in control of leaf eating caterpillar (*Spodoptera litura*), Green semilooper (*Chrysodeixis acuta*) population over untreated control.
- *Bacillus thuringiensis* var. *kurstaki*, azadirachtin 10000 ppm, neem oil 2% which were found next effective in order and at par with each other.
- The standard check chlorantraniliprole 18.5% SC was found significantly superior over all the treatments.
- The treatments pongamia oil 2%, use of trap crop- castor, use of intercrop- sorghum were found least effective over the untreated control.

Future Scope of Research on Pest Management in Soybean Crops

Based on the findings of the study, several avenues for future research can be explored to further optimize pest managemen in soybean cultivation:

1. **Biological Control Agents:** Research on biological control agents such as parasitoids, predators, and entomopathogenic fungi to manage soybean pests like aphids, whiteflies, and spider mites.
2. **Microbial Pesticides:** Development of microbial pesticides using bacteria, fungi, and viruses to control soybean pests and diseases.
3. **Plant Growth-Promoting Rhizobacteria (PGPR):** Investigation of PGPR to improve soybean plant health, increase yield, and reduce pest and disease susceptibility.

4. **Botanical Pesticides:** Research on botanical pesticides derived from plants, such as neem, pyrethrum, and rotenone, to manage soybean pests.
5. **Biorational Management of Disease:** Investigation of biorational management methods, such as biological control agents and plant activators, to control soybean diseases.
6. **Genomics and Biotechnology:** Use of genomics and biotechnology to develop new biorational management tools and strategies for soybean pests and diseases.

Acknowledgement
The authors thank the Head, Department of Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, for Providing necessary help and guidance during investigation.

References

1. Ahirwar KC, Marabi RS, Bhowmick A, Das SB. Evaluation of microbial pesticides against major foliage feeders on *Glycine max* (L.) Merrill. J Biopesticides. 2013;6(2):144-148.
2. Ahirwar KC, Marabi RS, Bhowmick AK, Das SB. Evaluation of microbial pesticides against major foliage feeders on soybean. Indian J Biopesticides. 2009;6(2):144-148.
3. And Phytochem. 7(6):1347-1350.
4. Anonymous. Economic survey of India; c2023.
5. Ansari MM, Sharma AN. Compatibility of *Bacillus thuringiensis* and *Beauveria bassiana* with new insecticides recommended for insect pest control in soybean. J Pestology. 2005;29(9):18-20.
6. Bochare GD, Undirwade DB, Shinde SS, Dhandge SR. Evaluation of microbials and botanicals against defoliators of soybean. Int J Pure Appl Biosci. 2018;6(5):667.
7. Chaware GG, Neharkar PS, Ughade, Chaudhari. Evaluation of entomopathogenic fungi on larval abundance of defoliators on soybean. J Entomol Zool Stud. 2019;7(3):376-379.
8. Dhepe VR, Lande GK, Ughade JD, Barkhade UP. Evaluation of biopesticide against the major foliage feeder on soybean. J Pharmacogn Phytochem. 2018;7(6):1347-1350.
9. Pandya. Soybean Processing and Utilization in India: Proceedings of the National Central Institute of Agricultural Engineering, Soybean-431; c1988.
10. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: Indian Council of Agricultural Research; c1985.