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Efficacy of bio-pesticides along with plant product against the incidence of leaf eating caterpillar and stem borer in soybean

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Abstract
An experiment was conducted during *kharif* season of 2015 on soybean crop to test the bio-efficacy of bio-pesticide along with plant product against leaf eating caterpillar and stem bore. The result revealed that two spray of trizophos 40 EC proved to be the most effective against all the larval population followed by first spray of neem oil and second spray of triazophos. The highest net profit and incremental cost benefit ratio was observed in plots treated with triazophos Rs.10425/ha and 1:5.36) followed by *Beauveria bassiana* (and) triazophos (Rs. 8410.46/ha and 1:4.26). The maximum seed yield of 964.45 kg/ha was recorded with the application of two sprays of triazophos. The minimum yield was recorded in plot treated with two spray of *Metarhizium anisopliae* (826.89 kg/ha).

Keywords: Soybean, leaf eating caterpillar, stem borer, bio-pesticide, plant product

Introduction
Soybean [*Glycine max* (L.) Merrill] is the world's most important crop, which contribute to 25% of the global edible oil, about two-thirds of the world's protein concentrate for livestock feeding. In India cultivated area of soybean is 108.83 lakh ha with the annual production of 104.37 lakh tonnes and productivity of 959 kg/ha. Madhya Pradesh is known as 'Soybean State' which covers about 55.46 lakh ha area with the production of 60.25 lakh tonnes and productivity of 1086 kg/ha. In Tikamgarh district area, production and productivity of soybean crop is 0.28 lakh ha, 0.25 lakh tonnes, and 885 kg/ha respectively [1]. The low productivity of soybean both at national and state level may be attributed to a-biotic and biotic stresses. Insect pests are major threat to soybean production by increasing cost of cultivation and impairing quality of produce [2]. In Madhya Pradesh, girdle beetle was first reported on soybean crop during 1969 with about 13.5 percent plant infestation, presently, it has also started damaging up to 80 percent of soybean plants in some endemic areas while, green semi looper may cause damage up to 35 percent flowers and about 24 percent pods [3]. Leaf eating caterpillar *Chrysodeixis acuta, Spodoptera litura* and stem borer *Obereopsis brevis* (Swedenbord) are the important insect pests in Bundelkhand region, which cause considerable loss to soybean during kharif season. The green semi looper, *Chrysodeixis acuta* (Walker) and tobacco caterpillar, *Spodoptera litura* (Fabricious) are major insect pests feeding on foliage, flower and pods causing significant yield loss while, stem fly, *Melanagromyza sojae* (Zehn) is a major pest during seedling to reproductive stages [4]. Indiscriminate use of synthetic chemical insecticides was undertaken to control the pests in soybean. This had led to many serious problems like environmental contamination by way of pesticide residues, development of resistance in pests to pesticides, pest resurgence *etc*. Integrated pest management (IPM) is perceived as the only alternative to combat these problems [5]. Therefore, it is necessary to consider those strategies which are eco-friendly and environmentally safe as well as control the pests efficiently. In this context, the relevance use of bio-pesticide, and use of judicious and need based chemical insecticides are in corporate under this study. Keeping this point in view, present investigation was conducted to evaluate the bio-efficacy of bio-pesticide along with plant product to evolve optimal need-based management.

Materials and Methods
The field experiment was laid out at research farm of JNKVV, College of Agriculture Tikamgarh (M. P.), India, during *kharif* season of 2015 in a Randomized Block Design with

three replications. The cultivar JS-95-60 was sown on 9th July, 2015 with row to row and plant to plant distance as 30 cm and 15 cm respectively. All the agronomical practices were followed to raise a good crop. The treatment were *Metarrhizium anisopliae* @ 1 kg/ha, *Beauveria bassiana* @ 1 kg/ha, Neem oil @ 5 L/ha, Triazophos 40EC, *Metarrhizium anisopliae* @ 1 kg/ha followed by triazophos 40EC, *Beauveria bassiana* @ 1 kg/ha followed by triazophos 40EC, Neem oil @ 5 L/ha followed by triazophos 40EC and control (Untreated). Different treatment comprising of eight bio-pesticide and plant product including untreated check were applied with the help of manually operated hand knapsack sprayer. Pre-treatment observation was recorded on one day before treatment. Post treatment observations were recorded at 3, 7 and 10 days after first and second spray. Observations on larval population of leaf eating caterpillar (Tobacco caterpillar, green semi looper) made at three randomly selected spots of one meter row length in each treatment leaving border rows. Larvae counts were made by shaking the plant gently over a white cloth placed between the rows. Average number of larvae found per meter row length (mrl) was worked out. Whereas the observations on girdle beetle were recorded at randomly selected 3 places of one meter row length in each plot leaving border rows. The data were presented in number of plant infested. Length of tunneling was also recorded at physiological maturity and percent tunneled was computed. Incremental cost benefit ratio (ICBR) was also worked out to compare the economics of different treatments. The analysis of variance was worked out after transplanting the data into angular value.

Results and Discussion

Green semi looper (*Chrysodeixis acuta)*

The results pertaining to the efficacy of insecticides on *Chrysodeixis acuta* larval population on a day before and at 3, 7 and 10 days after spraying are given in (table-1). Pre-treatment observation was recorded one day before first and second spray showed that there were no significant differences observed in the larval population of green semi looper. It is evident that all the insecticides were capable of keeping the population of larvae at the minimum level and significant differences were noted among the treatments at 3, 7 and 10 days after application of insecticides as compared to control (Untreated Check). Pooled statistical analysis of all the three observations (3, 7 and 10 DAS) of 1st spray indicated that all the insecticidal treatments were significantly effective in reducing the larval population of green semi looper as compared to control (T_8) (4.22 larvae/mrl). Treatment (T_4) having both sprays of triazophos proved to be most effective in controlling the incidence of green semi looper (0.52 larvae/mrl) followed by two sprays of *Beauveria bassiana* (T_2) (1.04 larvae/mrl) and first spray of neem oil and second spray of triazophos (T_7) (1.07 larvae/mrl). Whereas the pooled analysis of all the three observations (3, 7 and 10 DAS) of 2nd spray exhibited that all the insecticidal treatments were significantly effective in reducing the larval population of green semi looper as compared to control (T_8) (1.00 larvae/mrl). Among the various treatments neem oil (and) triazophos (T_7) proved to be most effective in reducing the incidence of green semi looper (0.00 larvae/mrl). However, rest of the treatments was also at par with T_7. A similar result was also reported by [6] who reported that the treatment with triazophos 0.06 percent was the most effective against the pest.

Tobacco caterpillar (*Spodoptera litura*)

Pre-treatment observation was recorded one day before first and second spray showed that there were no significant differences observed in the larval population of tobacco caterpillar. Larval population of tobacco caterpillar ranged from 0.11 to 0.44 larvae/meter row length. The population variation in various treatments did not differ significantly (Table-2). Pooled statistical analysis of all the observations (3, 7 and 10 DAS) of the first spray indicated that all the insecticidal treatments were found to be significantly effective in reducing the larval population of tobacco caterpillar as compared to control (T_8) (0.56 larvae/mrl). *Beauveria bassiana* (T_2) proved to be most effective and significantly superior in controlling the incidence of tobacco caterpillar (0.00 larvae/mrl). However, two spray of Triazophos 40 EC @ 1200 ml/ha (T_4) was found at par with two sprays of *Beauveria bassiana* (T_2). Whereas the pooled statistical analysis of all the observations (3, 7 and 10 DAS) of the second spray indicated that all the insecticidal treatments were found to be significantly effective in reducing the larval population of tobacco caterpillar as compared to control (T_8) (0.52 larvae/mrl). Neem oil (and) triazophos (T_7) (0.00 larvae/mrl) as well as triazophos (T_4) (0.00 larvae/mrl) proved to be most effective and significantly superior in reducing the incidence of tobacco caterpillar. Rests of the treatments were also at par with T_7. Similar results was also reported by [7] and [8] who recited that the both sprays of triazophos followed by first spray of neem oil and second spray of triazophos were significant superior in reducing the *Spodoptera litura* population.

Girdle beetle (*Obereopsis brevis*)

Pre-treatment observation was recorded one day before first and second spray showed that there were no significant differences observed in the larval population of girdle beetle. The number of plants damaged due to girdle beetle ranged from 2.44 to 2.56 per meter row length (table 3). Pooled statistical analysis of all the observations (3, 7 and 10 DAS) of the first spray indicated that all the insecticidal treatments were found to be significantly effective in reducing the number of girdled plants as compared to control (T_8) (3.33 girdle/mrl). Triazophos proved to be most effective in reducing the incidence of girdle beetle (T_4) (2.44 girdle/mrl) followed by first spray of neem oil and second spray of triazophos (T_7) (2.56 girdle/mrl) and first spray of *Beauveria bassiana* and second spray of triazophos (T_6) (2.59 girdle/mrl). *Metarhizium anisopliae* (and) triazophos proved least effective but was at par with T_1, T_2 and T_3. Pooled statistical analysis of all the three observations (3, 7 and 10 DAS) of second spray indicated that all the insecticidal treatments were found to be significantly effective in reducing the number of girdles as compared to control (T_8) (4.07 girdle/mrl). Triazophos proved to be most effective in controlling the incidence of girdle beetle (T_4) (2.67 girdle/mrl) followed by first spray of neem oil and second spray of triazophos (T_7) (2.74 girdle/mrl) and first spray of *Beauveria bassiana* and second spray of triazophos (T_6) (2.78 girdle/mrl). The present findings are in agreement with [9] and [10] who reported that *Obereopsis brevis* infestation (13.31%) was lowest with 825 ml triazophos/ha in 2000 and with 1000 ml triazophos/ha in 2001 (11.90%).

Seed yield and economics of different treatment

Significantly higher seed yield was recorded in all the insecticidal treatments (826.89 to 964.45 kg/ha) as compared to untreated plots (T_8) (625.56 kg/ha) (table 4). Maximum seed yield (964.45 kg/ha) was recorded in the plots treated with two sprays of triazophos (T_4) followed by rest of the treatments were also at par with T_4 except T_1. However, Singh *et al.* (1998) have also reported that the highest seed yield was recorded in triazophos 40 EC (23.75 q/ha), followed by deltamethrin. The Triazophos 40 EC gave maximum net profit and incremental cost benefit ratio (Rs.10425/ha and 1:5.36) followed by *Beauveria bassiana* followed by trizophos (Rs. 8410.46/ha and 1:4.26) and *Metarhizium anisopliae* followed by trizophos (Rs. 6990.58/ha and 1:3.54). The minimum net profit and cost benefit ratio (Rs. 1070.52/ha and 1:0.15) was recorded. in the plot treated with neem oil. Similar results was also reported by Ganore (2012) who observed that the highest cost benefit ratio was registered in triazophos 40 EC @800 ml/ha (1:4.06/ha) followed by *Beauveria bassiana* @1 kg/ha (1:2.15/ha) (table 4).

Table 1: Efficacy of bio-pesticide and plant product against green semi looper on soybean

S. No.	Treatment	No. of larvae/meter row length after first spray					No. of larvae/meter row length after second spray				
		Before Spray	Days after Spray			Mean	Before Spray	Days after Spray			Mean
			3	7	10			3	7	10	
1	*Metarrhizium anisopliae* @ 1 kg/ha (2 spray)	2.11 (1.62)	2.33 (1.68)	1.11 (1.27)	2.22 (1.65)	1.89 (1.55)	1.67 (1.47)	0.33 (0.91)	0.00 (0.71)	0.00 (0.71)	0.11 (0.78)
2	*Beauveria bassiana* @ 1 kg/ha (2 spray)	1.56 (1.43)	1.56 (1.43)	1.00 (1.22)	0.56 (1.03)	1.04 (1.24)	1.44 (1.39)	0.33 (0.91)	0.00 (0.71)	0.00 (0.71)	0.11 (0.78)
3	Neem oil @ 5 L/ha (2 spray)	1.89 (1.55)	1.44 (1.39)	0.78 (1.13)	0.44 (0.97)	0.89 (1.18)	2.78 (1.81)	0.44 (0.97)	0.11 (0.78)	0.11 (0.78)	0.19 (0.83)
4	Triazophos 40EC @ 1200 ml/ha (2 spray)	2.22 (1.65)	0.78 (1.13)	0.22 (0.85)	0.56 (1.03)	0.52 (1.01)	1.56 (1.43)	0.22 (0.85)	0.00 (0.71)	0.00 (0.71)	0.07 (0.76)
5	*Metarrhizium anisopliae* @ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	2.56 (1.75)	2.78 (1.81)	0.67 (1.08)	1.44 (1.39)	1.63 (1.46)	2.89 (1.84)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
6	*Beauveria bassiana*@ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	2.44 (1.72)	2.67 (1.78)	0.44 (0.97)	0.78 (1.13)	1.30 (1.34)	2.67 (1.78)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.04 (0.73)
7	Neem oil @ 5 L/ha followed by triazophos 40EC @ 1200 ml/ha	1.67 (1.47)	2.22 (1.65)	0.56 (1.03)	0.44 (0.97)	1.07 (1.25)	1.33 (1.35)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
8	Control	2.33 (1.68)	4.22 (2.17)	4.11 (2.15)	4.33 (2.20)	4.22 (2.17)	3.11 (1.90)	2.22 (1.65)	0.44 (0.97)	0.33 (0.91)	1.00 (1.22)
	SEm ±	0.09	0.14	0.09	0.12	0.10	0.17	0.08	0.03	0.02	0.08
	C.D (at 5%)	NS	0.42	0.28	0.36	0.31	NS	0.23	0.09	0.07	0.22

Figures in parenthesis are √x+ 0.5 transformed values.

Table 2: Efficacy of bio-pesticide and plant product against tobacco caterpillar on soybean

S. No.	Treatment	No. of larvae/meter row length after first spray					No. of larvae/meter row length after second spray				
		Before Spray	Days after Spray			Mean	Before Spray	Days after Spray			Mean
			3	7	10			3	7	10	
1	*Metarrhizium anisopliae* @ 1 kg/ha (2 spray)	0.22 (0.85)	0.22 (0.85)	0.11 (0.78)	0.00 (0.71)	0.11 (0.78)	0.11 (0.78)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.04 (0.73)
2	*Beauveria bassiana* @ 1 kg/ha (2 spray)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.89 (1.18)	0.33 (0.91)	0.11 (0.78)	0.00 (0.71)	0.15 (0.80)
3	Neem oil @ 5 L/ha (2 spray)	0.11 (0.78)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.04 (0.73)	0.78 (1.13)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.04 (0.73)
4	Triazophos 40EC @ 1200 ml/ha (2 spray)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.11 (0.78)	0.04 (0.73)	0.67 (1.08)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
5	*Metarrhizium anisopliae* @ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	0.22 (0.85)	0.00 (0.71)	0.22 (0.85)	0.44 (0.97)	0.22 (0.85)	0.89 (1.18)	0.11 (0.78)	0.11 (0.78)	0.00 (0.71)	0.07 (0.76)
6	*Beauveria bassiana*@ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	0.22 (0.85)	0.00 (0.71)	0.11 (0.78)	0.44 (0.97)	0.19 (0.83)	0.78 (1.13)	0.22 (0.85)	0.00 (0.71)	0.00 (0.71)	0.07 (0.76)
7	Neem oil @ 5 L/ha followed by triazophos 40EC @ 1200 ml/ha	0.22 (0.85)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.04 (0.73)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
8	Control	0.44 (0.97)	0.67 (1.08)	0.44 (0.97)	0.56 (1.03)	0.56 (1.03)	1.00 (1.22)	0.78 (1.13)	0.56 (1.03)	0.22 (0.85)	0.52 (1.01)
	SEm ±	0.07	0.07	0.05	0.04	0.05	0.11	0.08	0.04	0.02	0.03
	C.D (at 5%)	NS	0.19	0.14	0.13	0.14	NS	0.23	0.11	0.07	0.09

Figures in parenthesis are √x+ 0.5 transformed values

Table 3: Efficacy of bio-pesticide and plant product against girdle beetle on soybean

S. No.	Treatment	No. of larvae/meter row length after first spray					No. of larvae/meter row length after second spray				
		Before Spray	Days after Spray			Mean	Before Spray	Days after Spray			Mean
			3	7	10			3	7	10	
1	*Metarrhizium anisopliae* @ 1 kg/ha (2 spray)	2.56 (1.75)	2.56 (1.75)	2.78 (1.81)	3.00 (1.87)	2.78 (1.81)	3.11 (1.90)	3.11 (1.90)	3.11 (1.90)	3.11 (1.90)	3.11 (1.90)
2	*Beauveria bassiana* @ 1 kg/ha (2 spray)	2.56 (1.75)	2.56 (1.75)	2.78 (1.81)	2.89 (1.84)	2.74 (1.80)	3.00 (1.87)	3.11 (1.90)	3.33 (1.96)	3.33 (1.96)	3.26 (1.94)
3	Neem oil @ 5 L/ha (2 spray)	2.56 (1.75)	2.56 (1.75)	2.78 (1.81)	2.89 (1.84)	2.74 (1.80)	3.00 (1.87)	3.00 (1.87)	3.00 (1.87)	3.00 (1.87)	3.00 (1.87)
4	Triazophos 40EC @ 1200 ml/ha (2 spray)	2.44 (1.72)	2.44 (1.72)	2.44 (1.72)	2.44 (1.72)	2.44 (1.72)	2.56 (1.75)	2.56 (1.75)	2.67 (1.78)	2.78 (1.81)	2.67 (1.78)
5	*Metarrhizium anisopliae* @ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	2.56 (1.75)	2.56 (1.75)	2.67 (1.78)	2.78 (1.81)	2.67 (1.78)	2.89 (1.84)	2.89 (1.84)	2.89 (1.84)	2.89 (1.84)	2.89 (1.84)
6	*Beauveria bassiana*@ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	2.56 (1.75)	2.56 (1.75)	2.56 (1.75)	2.67 (1.78)	2.59 (1.76)	2.67 (1.78)	2.78 (1.81)	2.78 (1.81)	2.78 (1.81)	2.78 (1.81)
7	Neem oil @ 5 L/ha followed by triazophos 40EC @ 1200 ml/ha	2.56 (1.75)	2.56 (1.75)	2.56 (1.75)	2.56 (1.75)	2.56 (1.75)	2.67 (1.78)	2.67 (1.78)	2.78 (1.81)	2.78 (1.81)	2.74 (1.80)
8	Control	2.44 (1.72)	3.22 (1.93)	3.33 (1.96)	3.44 (1.99)	3.33 (1.96)	3.56 (2.01)	4.00 (2.12)	4.11 (2.15)	4.11 (2.15)	4.07 (2.14)
	SEm ±	0.04	0.04	0.04	0.05	0.02	0.06	0.06	0.05	0.05	0.01
	C.D (at 5%)	NS	0.11	0.11	0.14	0.04	NS	0.16	0.14	0.15	0.03

Figures in parenthesis are √x+ 0.5 transformed values

Table 4: Seed yield and economics of different treatments in soybean

Treatments	Grain yield kg/ ha	Additional yield kg/ha over control	Additional profit Rs/ha	Cost of treatments Rs/ha	Net profit Rs/ha	ICBR ratio
Metarrhizium anisopliae @ 1 kg/ha (2 spray)	826.89	201.33	7348.55	2000	5348.55	1:2.67
Beauveria bassiana @ 1 kg/ha (2 spray)	845.56	220.00	8030.00	2000	6030.00	1:3.02
Neem oil @ 5 L/ha (2 spray)	846.67	221.11	8070.52	7000	1070.52	1:0.15
Triazophos 40EC @ 1200 ml/ha (2 spray)	964.45	338.89	12369.49	1944	10425.49	1:5.36
Metarrhizium anisopliae @ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	871.11	245.55	8962.58	1972	6990.58	1:3.54
Beauveria bassiana@ 1 kg/ha followed by triazophos 40EC @ 1200 ml/ha	910.00	284.44	10382.06	1972	8410.06	1:4.26
Neem oil @ 5 L/ha followed by triazophos 40EC @ 1200 ml/ha	856.67	231.11	8435.52	4472	3963.52	1:0.89
Control	625.56	-	-	-	-	-

Selling rate of soybean (Rs/qt.): 3650
Labour charge of two sprays (Rs): 600
Rate of insecticide Rs/liter-*Metarhizium anisopliae* @ Rs. 700/-, *Beauveria bassiana* @ Rs.700/-, Neem oil @ Rs.640/-, Triazophos @ Rs.560/-

Conclusion

It is concluded from the study that all the insecticidal treatment were found significantly effective in reducing the larval population as compared to untreated plots. The two sprays of triazophos (T_4) was found most effective against all insect pests followed by first spray of neem oil and second spray of triazophos (T_7) and two sprays of *Beauveria bassiana* (T_2). The maximum seed yield was recorded in plots treated with triazophos (T_4) followed by *Beauveria bassiana* (and) triazophos (T_6) and *Metarhizium anisopliae* (and) triazophos (T_5). Maximum net profit was recorded in plots treated with triazophos (T_4) followed by *Beauveria bassiana* (and) triazophos (T_6) and *Metarhizium anisopliae* (and) triazophos (T_5). Maximum incremental cost benefit ratio was also recorded in plots treated with triazophos (T_4) followed by *Beauveria bassiana* (and) triazophos (T_6) and *Metarhizium anisopliae* (and) triazophos (T_5).

References

1. SOPA. 2016. www.sopa.org/crop.
2. Singh CB, Chatar DD, Singh MP, Chourey P. Incidence and damage of major pest of soybean in Madhya Pradesh. Flora and Fauna (Jhansi). 2000; 17(2):273-277.
3. Singh OP, Singh KJ. Green semi looper *Chrysodeixis acuta* as a pest of flowers and pods and its effect on grain yield of soybean in Madhya Pradesh. J Agric. Sci. 1987; 4(1):87-88.
4. Gupta MP. Efficacy and economics of biorationals and admixtures against incidence of major insect pest of soybean. Ann. Pl. protect. Sci. 2008; 16(2):282-288.
5. Roe MS, Raman GV, Srimannarayana G, Venkateshawaralu B. Evaluation of some IPM packages in the management of pod borer complex of soybean. Pestology. 1999; 23(8):41-43.
6. Joshi MD, Patel VN. Eco-friendly approach against *Spodoptera litura* Fabricius on soybean. Journal of Entomological Research. 2011; 35(1):51-52.
7. Purwar JP, Yadav SR. Field efficacy of pest controlling agent from different origins against tobacco caterpillar (*Spodoptera litura*) on soybean. Indian J Ent. 2003; 65(3):382-385.
8. Ganore AV. Ecofriendly management of major insect pest of soybean. M.Sc. (Agri.) Thesis, JNKVV, Jabalpur (M.P.), India, 2012, 28-90.
9. Choudhary HR, Bajpai NK. Effect of triazophos against insect pests of soybean (*Glycine max*) in south eastern plain zone of Rajasthan. Indian J Agri. Sci., 2007; 77(1):62-64.
10. Gangrade GA, Singh OP. Soybean plant response to the attack of *Obereopsis brevis* Swed. (Col., Cerambycidae). J appli. Ent. 2009; 79(1-4):285-290.