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Eco-Friendly Management of Tobacco Leaf Caterpillar *Spodoptera Litura* (Fab.) in Soybean Ecosystem

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Abstract: *The study on eco-friendly management of major defoliators on soybean was carried out during Kharif season 2014-15 under field condition of the Entomology Section, College of Agriculture Nagpur. Overall, fenvalerate 20 EC @ 0.50 ml/l was found most effective in terms of recording maximum mortality of larvae of tobacco leaf caterpillar, Spodoptera litura (Fab.), but comparable with the findings with other eco-friendly newer molecules of indoxacarb 15.8 EC @ 0.60 ml/ lit, spinosad 45 SC @ 0.25 ml/lit and safer alternative to synthetic pyrethroids. As regards to soybean grain yield, the application of fenvalerate 20 EC, indoxacarb 15.8 EC and spinosad 45 SC were found to be most effective treatments recording higher yield of 21.05 q/ha, 20.10 q/ha and 19.02 q/ha, respectively.*

Keywords: *Eco-friendly Management, Spodoptera litura (Fab.), Soybean.*

INTRODUCTION

Soybean (*Glycine max* L.) is one of the miracle 'Golden Bean' of the 20th century. It possess a very high nutritional value and on an average it contains 20 per cent oil and 40 per cent protein. Pattern of soya protein is virtually equivalent to that of milk and egg [Bishoni (3)]. Soybean agro-ecosystem is being adopted rapidly by farmers of Vidarbha and it becomes second major *Kharif* crop.

The tobacco leaf eating caterpillar, *Spodoptera litura* (Fab.) is recognized as a serious cosmopolitan pest with considerable host range of economically agricultural crops such as cotton, groundnut, soybean, tomato and many other crops [Matsumura and Naito (6)]. It damages the soybean crop extensively by skeletonising the leaves and thus reducing the photosynthetic capacity of the plant. Many insecticides have been involved for the management of this notorious pests [Purwar and Yadav (9) and Harish (4)]. Indiscriminate use of pesticide cause to suppress the natural enemies and increasing pest population of other crops pests has led to potential problems such as environmental outbreak of secondary pests, soil hazards, pesticides resistance, resurgence, *etc*. This focus to the development of management practices, which can nullify all the negative aspects of pesticides application with increased doses of the prevailing insecticides.

There is large scope for developing ecologically safe and effective pest management approach and in this view, botanicals as well as biopesticide have become more attractive and are considered to provide an eco-friendly alternative. These botanicals and biopesticides has a vital role in insect pest management by their various inhibitory actions on insect physiology, life stages and behaviour. They are best alternative to chemical insecticides against major defoliators on soybean. They are locally available, relatively cheap, biodegradable and easy to handle which enable to minimize input cost of management for major defoliators of soybean and keep balance of ecosystem. As the agriculture shift towards the organic farming, they have much better scope in the pest management tactics and evaluated to find out the superior alternative against *S. litura*.

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MATERIAL AND METHODS

The investigation on management of major defoliator on soybean (*Glycine max* L.) was conducted during *Kharif* season 2014-15 at the experimental field of Entomology Section, College of Agriculture Nagpur. It was laid out in randomized block design with eight treatments and three replications. Neem seed extract 5%, Neem oil 2%, *Beauveria bassiana* 1×10^8 CFU @4 g/lit, spinosad 45 SC @ 0.25 ml/lit, indoxacarb 15.8 EC @ 0.60 ml/lit, emamectin benzoate 5 SG @ 0.3 g/lit, fenvalerate 20 EC @ 0.50 ml/lit were used under field condition along with control (water spray) on soybean variety JS-335 during the course of present investigation.

Seed treatment with Rhizobium @ 20 g/kg of seed was done before sowing as well as other standard package of practices for crop production were followed. Total three sprays were given at an interval of 15 days after emergence of crop with the help of knapsack sprayer. The observation on tobacco leaf eating caterpillar recorded on randomly selected one meter row length (mrl) at five places from each plot. Pre-treatment observations were recorded 24 hours before the application of treatments and the post-treatment observations were recorded at 7 and 14 days after application of treatment.

RESULTS AND DISCUSSION

The bio-efficacy of different pesticides on cumulative mean on number of *S. litura* larvae (Table 1) showed that all the treatments were significantly superior over control (water spray) at 7 and 14 days after three treatments. The minimum number of larvae (0.07 and 0.04/mrl) after three spraying was noticed in the application of fenvalerate 20 EC @ 0.50 ml/l at 7 and 14 days after treatment, respectively. The superiority of this treatment was found comparable with the results of indoxcarb 15.8 EC @ 0.60 ml/l (0.08 and 0.05/mrl) and spinosad 45 SC @ 0.25 ml/l (0.10 and 0.06/mrl), emamectin benzoate 5 SG @ 0.3 g/l (0.11 and 0.08/mrl) at 7 and 14 days after treatment, respectively and effective against *S. litura* in soybean. While, Neem oil 2% recorded 1.29 *Spodoptera* larvae/mrl. This superiority trend was found at all three phases of spraying *i.e.* 30, 45 and 60 days after sowing. Whereas, NSE @ 5% (1.35/mrl) and *Beauveria bassiana* 1×10^8 CFU @ 4 g/l (1.4/mrl) were least effective in reducing larval population/mrl. Maximum mean larval population was recorded in control (1.51 and 1.74/mrl) at 7 and 14 days after treatment, respectively.

The present investigation is in accordance with the very strong ovicidal action of indoxacarb and thiodicarb against *S. litura* with 86.6 and 95.5% mortality in Guntur was reported by Ahmad *et al.* (1). Kaur *et al.* (5) reported indoxacarb and spinosad as more lethal and sublethal effects on *S. litura* by effecting its survival, development and reproduction with more lethalness of indoxacarb as compared to that of spinosad. Ahmed *et al.* (2) reported emamectin benzoate is quite effective against a number of lepidopteran insect pests including *S. exigua* and *S. litura.*

With regards to grain production, the application of fenvalerate 20 EC recorded maximum yield of 21.05 q/ha with an increase of 10.69 q/ha yield over control. The application of indoxacarb 15.8 EC exhibited the yield of 20.10 q/ha of with an increase 9.74 q/ha grain yield over control, followed by spinosad 45 SC which recorded yield of 19.02 q/ha with 8.66 q/ha increase yield over control. The treatment of emamectin benzoate 5 SG recorded 18.30 q/ha yields with 7.94 q/ha increase yield over control. There was no major difference between fenvalerate 20 EC and indoxacarb 15.8 EC, spinosad 45 SC as well as emamectin benzoate 5 SG in exhibiting total yield and increased yield over control. The spraying of Neem oil 2% yielded 14.52 q/ha with 4.16 q/ha increase yield over control, followed by *Beauveria bassiana* $1x10^8$ CFU 4 g/l (T4) which recorded 13.03 q/ha yield with 2.67q/ha increase yield over control and the treatment of Neem seed extract yielded 12.28 q/ha with 1.92 q/ha increase yield over control.

Due to lack of literature on tested pesticide on soybean, the evaluated treatments results compared with other crop pest findings. The results are comparable with the studies of Murugaraj *et al.* (7) who studied emamectin benzoate 5 SG which found highly effective in reducing the larval population and fruit damage as well as in increasing the yield of tomato. While, Prasad and Devappa (8) reported

Table 1
Cumulative mean of different treatments on number of *Spodoptera litura* larvae and grain yield in soybean ecosystem

Treatments	*No. of Spodoptera litura larvae**								*Grain yield (q/ha)*	*Increase yield over control (q/ha)*
	7 DAT				*14 DAT*					
	30 DAS	*45 DAS*	*60 DAS*	*Mean*	*30 DAS*	*45 DAS*	*60 DAS*	*Mean*		
T_1 : NSE @ 5%	0.53(1.01)	1.33(1.35)	1.60(1.45)	1.15(1.28)	0.80(1.14)	1.53(1.42)	1.73(1.49)	1.35(1.36)	12.28	1.92
T_2 :Neem Oil @ 2%	0.40(0.95)	1.13(1.28)	1.53(1.42)	1.02(1.23)	0.77(1.13)	1.47(1.40)	1.63(1.46)	1.29(1.34)	14.52	4.16
T_3 :Spinosad 45 SC @ 0.25 ml/1	0.17(0.82)	0.09(0.77)	0.03(0.73)	0.10(0.77)	0.11(0.78)	0.08(0.76)	0.00 (0.71)	0.06(0.75)	19.02	8.66
T_4 :*Beauveria bassiana* 1 × 10^8 CFU @ 4 g/1	0.43(0.96)	1.20(1.30)	1.80 (1.52)	1.14(1.28)	0.67(1.08)	1.60(1.45)	1.93(1.56)	1.4(1.38)	13.03	2.67
T_5 : Indoxcarb 15.8 EC @ 0.60 ml/1	0.13(0.79)	0.06(0.75)	0.05(0.74)	0.08(0.76)	0.09(0.77)	0.05(0.75)	0.00(0.71)	0.05(0.74)	20.10	9.74
T_6 :Emamectin benzoate 5 SG @ 0.3 g/1	0.20(0.84)	0.08(0.76)	0.06(0.75)	0.11(0.78)	0.16(0.81)	0.07(0.75)	0.00(0.71)	0.08(0.76)	18.30	7.94
T_7 :Fenvalerate 20 EC @ 0.50 ml/1	0.11(0.78)	0.07(0.75)	0.02(0.72)	0.07(0.75)	0.08(0.76)	0.04(0.73)	0.01(0.71)	0.04(0.73)	21.05	10.69
T_8 : Control (Water spray)	0.80(1.14)	1.53(1.42)	2.20(1.64)	1.51(1.42)	1.07(1.25)	1.87(1.54)	2.27(1.66)	1.74(1.50)	10.36	-
SEm(±)	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.8	-
CD @ 5%	0.20	0.20	0.21	0.20	0.22	0.91	0.20	0.20	2.14	-
CV %	12.86	11.45	11.10	11.69	13.42	10.65	10.39	10.72	10.31	-

* Figures in parenthesis indicate square root (x + 0.5) transformation.

DAT-Days after treatment, DAS- Days after sowing.

emamectin benzoate 5 SG as effective in reducing dead hearts and also fruit damage in brinjal as well as yield was also higher in this treatment.

It can be concluded from the above findings that though the synthetic pyrethroid is superior against *S. litura* on soybean, but other newer molecules like spinosad, emamectin benzoate and indoxacarb are also equally effective as well as eco-friendly to soybean eco-system with bio-efficacy at lower doses.

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