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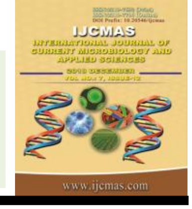

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Management of *Spodoptera litura* in Soybean through Biorational Approaches

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A B S T R A C T

Bio-rationals studies were carried out for *Spodoptera litura* in soybean with eight treatments. The results found that significantly reduction in *S.litura* population was found in experimental plots treated with chlorpyriphos 20EC @2ml/lit compare to rest of treatments. Chlorpyriphos 20EC @2ml/lit was statistically superior in controlling *S.litura* population and at par with NSKE 5% and Neem oil 5%. Trap crop (castor) found effective in reduction of *S.litura* population. It was statistically superior compare to rest of the treatments and at par with Pongamia oil 2% and intercrop (sorghum).

Introduction

Soybean [*Glycine max* (L.)] Merrill is one of the most important leguminous crop belonging to family Leguminoceae, sub-family Papilionoceae. It is the world's largest source of animal protein feed and the second largest source of vegetable oil.

It is considered as pulse crop but due to high oil content, now it is placed in oilseeds category. It originated from China (Nagata, T. 1960) where it also called 'yellow jewel' and introduced in India during 1870-80 (Andole, 1984).

Soybean crop attracts about 380 species of insects in many parts of the world (Luckmann, 1971). Only about a dozen minor insect pests were recorded on soybean in India in the early seventies, while in 1997 this number has increased to an alarming figure of 270, besides 4 other invertebrates and 10 vertebrates (Singh, 1999). In Maharashtra, particularly in Marathwada 19 species of insects have been identified attacking this crop (Munde, 1980). Among them leaf miner (*Aproaerema modicella* Devanter), stem fly (*Melanagromyza sojae* Zehnter), girdle beetle (*Obereopsis brevis* Swedenboard), leaf eating caterpillar (*Spodoptera litura* Fab.), *Helicoverpa armigera* (Hubner), green semilooper (*Chrysodeixis acuta* Walker) and sucking insect pests such as whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis craccivora* Koch) and Leaf hopper (*Empoasca Spp.*) are important. Yellow mosaic virus (YMV) transmitted by whitefly poses a serious limitation in soybean cultivation in the northern India (Adak *et al.,* 2012).

The Indian neem tree, *Azadirachta indica* (Meliaceae), is a promising source of botanical insecticides. Due to their relative selectivity, neem products can be recommended for many integrated pest management programs (Biswas *et al.,* 2002).

Materials and Methods

The present investigation will be carried out in field condition on the field of Department of Entomology, College of Agriculture, Badnapur during *Kharif*, 2017.

The experiment will be laid out in Randomized Block Design (RBD) in three replications with a plot size of 5.0 × 3.0 m. leaving a gang way of 1meter around plots. The soybean variety MAUS-71 will be sown at a spacing of 45×5cm. Normal sowing will perform during *Kharif* 2017 by following recommended package of practices. The treatments as detailed it will imposed with Knapsack sprayer (Hydraulic sprayer) using a spray fluid of 500 lit/ha. The first spray will given at 30 days after germination (DAG) when crop had adequate population of insect and second spraying will be given at 45 days after germination (DAG). Observation on larval population of leaf eating caterpillar was recorded at three randomly selected spots on one meter length crop in each treatment leaving the border rows. Larval count was made by shaking the plant gently over a white cloth placed between rows. The population data were transformed to $\sqrt{x+0.5}$ value before analysis. To compare the efficacy of treatment both standard check as well as untreated check will be maintain.

The need based application of Neem oil 5% will be given as and when needed after second spraying.

Treatments detail, NSKE 5%, Neem oil 5%, Pongamia oil 2%, mechanical control, trap crop (castor), intercrop (sorghum), chlorpyriphos 20EC @2ml/lit and untreated control.

Results and Discussion

Spodoptera litura

The initial larval population of *S.litura* before imposing the treatment ranged from 4.2 to 5.3 larvae per mrl and differences were non-significant. First day after Ist spray significat reduction of *S.litura* population is observed. At fifth day after spray chlorpyriphos 20EC @2ml/lit recorded the least larval population (2.3 larvar/mrl) which was significantly superior over the control followed by NSKE 5% (2.7 larvar/mrl) and Neem oil 5% (2.8 larvae/mrl). However, all treatments were significantly superior over untreated control, but pongamia oil 2% treated plot recorded highest larval population of 3.2 larvae/mrl. At seventh day after spraying similar trend was noticed.

The lowest *S.litura* were recorded in mechanical control 1st, 3rd, 5^{th,} and 7th day after Ist mechanical controls. Trap crop (castor) were found most effective in reducing *S.litura* larvae as shown in (Table 1 and Fig. 1). At fourteenth days after spray the chlorpyriphos 20EC @2ml/lit recorded the lowest larval population (3.1larvae/mrl) compared to untreated control and was superior. Untreated control recorded the highest population of (4.8 larvae/mrl).

Table.1 Management of *S.litura* on soybean through bio-rational approaches

Tr. No	Treatments	Average larvae/mrl												
		First spray							Second spray					
		1DBS	1DAS	3DAS	5DAS	7DAS	10DAS	14DAS 1DBS	1DAS	3DAS	5DAS	7DAS	10DAS	14DAS
T_1	NSKE 5%	5.0 (2.34)	4.8 (2.29)	4.2 (2.17)	2.7 (1.77)	0.9 (1.18)	1.6 (1.42)	3.3 (1.96)	3.1 (1.90)	2.7 (1.77)	2.0 (1.58)	0.6 (1.02)	1.4 (1.39)	2.8 (1.81)
T_2	Neem oil 5%	5.2 (2.39)	5.0 (2.34)	4.2 (2.15)	2.8 (1.81)	0.9 (1.18)	1.6 (1.43)	3.6 (2.01)	3.3 (1.96)	2.8 (1.81)	2.1 (1.61)	0.8 (1.13)	1.6 (1.43)	3.0 (1.87)
T_3	Pongamia oil 2%	5.3 (2.41)	5.1 (2.36)	4.2 (2.15)	3.2 (1.92)	1.1 (1.27)	1.9 (1.54)	3.9 (2.09)	3.6 (2.01)	3.0 (1.87)	2.3 (1.68)	0.8 (1.13)	1.9 (1.54)	3.3 (1.95)
T_4	Mechanical control.	5.3 (2.17)	0.5 (0.97)	0.6 (1.02)	1.0 (1.22)	1.4 (1.39)	2.3 (1.68)	4.1 (2.12)	0.3 (0.91)	0.6 (1.02)	0.8 (1.13)	1.4 (1.38)	2.1 (1.59)	3.4 (1.98)
T_5	Use of trap crop, castor.	4.2 (2.17)	4.2 (2.17)	4.1 (2.13)	3.7 (2.02)	3.0 (1.87)	2.7 (1.74)	2.1 (1.61)/	1.9 (1.54)	1.7 (1.44)	1.6 (1.42)	1.4 (1.36)	1.3 (1.34)	1.1 (1.27)
T_6	Intercrop (4 rows of soybean x 2 rows of sorghum).	4.2 (2.17)	4.2 (2.17)	4.2 (2.17)	3.8 (2.07)	3.1 (1.89)	3.0 (1.84)	2.7 (1.77)	2.7 (1.77)	2.4 (1.71)	2.3 (1.67)	2.2 (1.64)	2.0 (1.58)	1.8 (1.51)
T_7	Chlorpyriphos 20EC @2ml/lit.	5.1 (2.37)	4.8 (2.29)	3.7 (2.03)	2.3 (1.68)	0.3 (0.91)	1.2 (1.31)	3.1 (1.90)	3.0 (1.87)	2.3 (1.68)	1.3 (1.34)	0.3 (0.91)	1.3 (1.35)	2.3 (1.68)
T_8	Untreated control.	5.3 (2.38)	5.3 (2.36)	5.3 (2.40)	5.0 (2.32)	5.0 (2.30)	4.6 (2.24)	4.8 (2.28)	4.8 (2.26)	4.4 (2.21)	4.0 (2.10)	3.3 (1.95)	3.0 (1.86)	3.1 (1.83)
	SE(m) ±	0.14	0.14	0.15	0.14	0.13	0.14	0.13	0.12	0.13	0.12	0.11	0.09	0.14
	C.D. at 5%	**N S**	0.42	0.45	0.42	0.39	0.42	0.39	0.36	0.39	0.36	0.33	0.27	0.42
	C.V.	10.24	11.49	12.63	12.92	14.78	14.75	11.37	11.51	13.17	13.16	14.55	10.42	13.79

Fig. in parenthesis are $\sqrt{x+0.5}$ transformed values.

Table.2 Management of *S.litura* on soybean through bio-rational approaches

Tr. No	Treatments	Average larvae/mrl												
		Third spray						Simple pooled mean of three sprayings						
		1DAS	3DAS	5DAS	7DAS	10DAS	14DAS	1DBS	1DAS	3DAS	5DAS	7DAS	10DAS	14DAS
T_1	NSKE 5%	2.7 (1.76)	2.3 (1.68)	1.9 (1.54)	0.7 (1.07)	0.6 (1.02)	0.6 (1.02)	5.0 (2.34)	3.5 (2.00)	3.1 (1.88)	2.2 (1.64)	0.7 (1.11)	1.2 (1.29)	2.2 (1.60)
T_2	Neem oil 5%	2.8 (1.79)	2.3 (1.68)	2.0 (1.58)	1.1 (1.27)	0.8 (1.13)	0.6 (1.02)	5.2 (2.39)	3.7 (2.04)	3.1 (1.89)	2.3 (1.67)	0.9 (1.20)	1.3 (1.35)	2.4 (1.65)
T_3	Pongamia oil 2%	3.1 (1.88)	2.8 (1.80)	2.3 (1.66)	1.3 (1.35)	0.8 (1.13)	0.7 (1.08)	5.3 (2.41)	3.9 (2.10)	3.3 (1.95)	2.6 (1.76)	1.1 (1.25)	1.5 (1.41)	2.6 (1.71)
T_4	Mechanical control.	0.3 (0.91)	0.6 (1.02)	1.0 (1.22)	1.4 (1.39)	0.9 (1.17)	0.8 (1.13)	5.3 (2.17)	0.4 (0.93)	0.6 (1.05)	0.9 (1.20)	1.4 (1.38)	1.8 (1.49)	2.8 (1.75)
T_5	Use of trap crop, castor.	1.1 (1.27)	0.9 (1.16)	1.0 (1.22)	0.9 (1.18)	0.8 (1.12)	0.3 (0.91)	4.2 (2.17)	2.4 (1.66)	2.2 (1.60)	2.1 (1.57)	1.8 (1.48)	1.6 (1.42)	1.2 (1.26)
T_6	Intercrop (4 rows of soybean x 2 rows of sorghum).	1.7 (1.46)	1.6 (1.43)	1.6 (1.43)	1.4 (1.39)	1.2 (1.31)	0.7 (1.08)	4.2 (2.17)	2.9 (1.81)	2.7 (1.77)	2.6 (1.73)	2.2 (1.64)	2.1 (1.59)	1.7 (1.47)
T_7	Chlorpyriphos 20EC @2ml/lit.	2.1 (1.61)	1.6 (1.43)	1.0 (1.22)	0.3 (0.91)	0.6 (1.02)	0.7 (1.09)	5.1 (2.37)	3.3 (1.93)	2.5 (1.72)	1.5 (1.41)	0.3 (0.89)	1.0 (1.23)	2.0 (1.56)
T_8	Untreated control.	3.0 (1.86)	3.0 (1.85)	2.6 (1.73)	2.3 (1.66)	1.6 (1.42)	1.3 (1.34)	5.3 (2.38)	4.4 (2.19)	4.2 (2.16)	3.9 (2.08)	3.5 (1.99)	3.1 (1.86)	3.1 (1.85)
	SE(m) ±	0.13	0.12	0.10	0.10	0.08	0.05	0.14	0.07	0.08	0.08	0.10	0.06	0.06
	C.D. at 5%	0.39	0.36	0.30	0.30	0.24	0.15	**N S**	0.22	0.25	0.24	0.30	0.19	0.18
	C.V.	14.19	13.84	11.81	13.38	11.61	8.01	10.24	7.07	8.37	8.59	12.72	7.80	6.44

Fig. in parenthesis are $\sqrt{x+0.5}$ transformed values. DBS-Day before spraying DAS-Day after spraying

Fig.1 Population of *S.litura* after first spray.

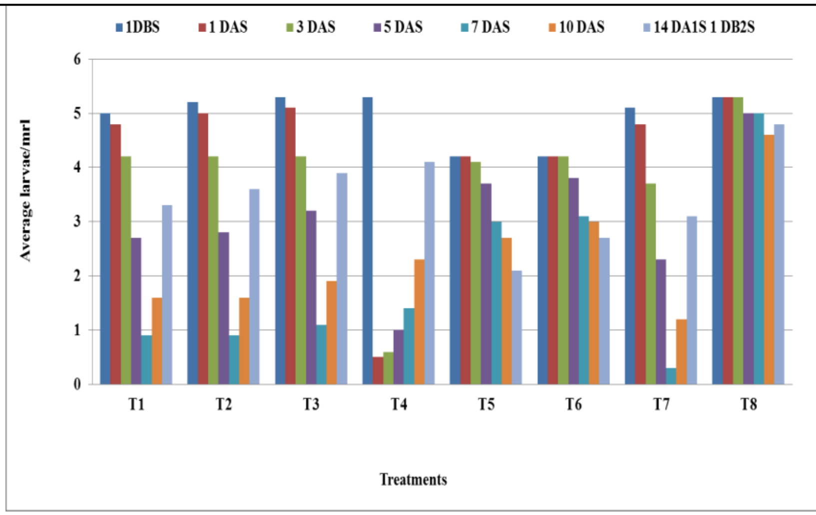


Fig.2 Population of *S.litura* after second spray.

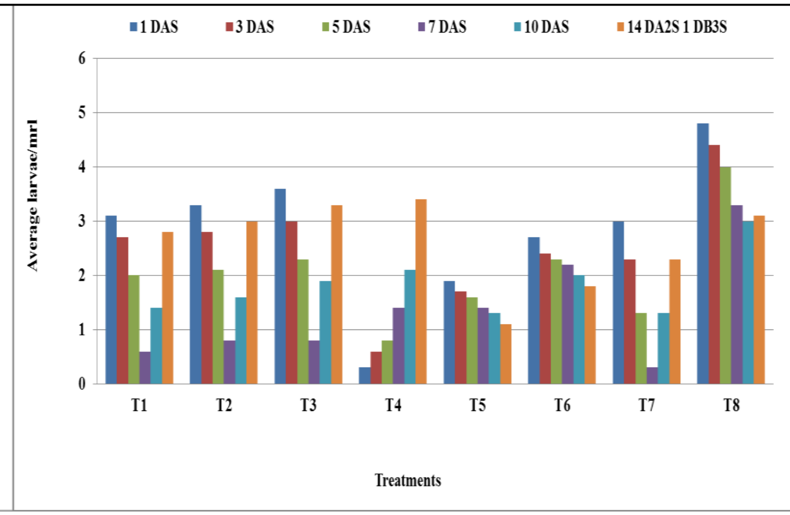


Fig.3 Population of *S.litura* after third spray.

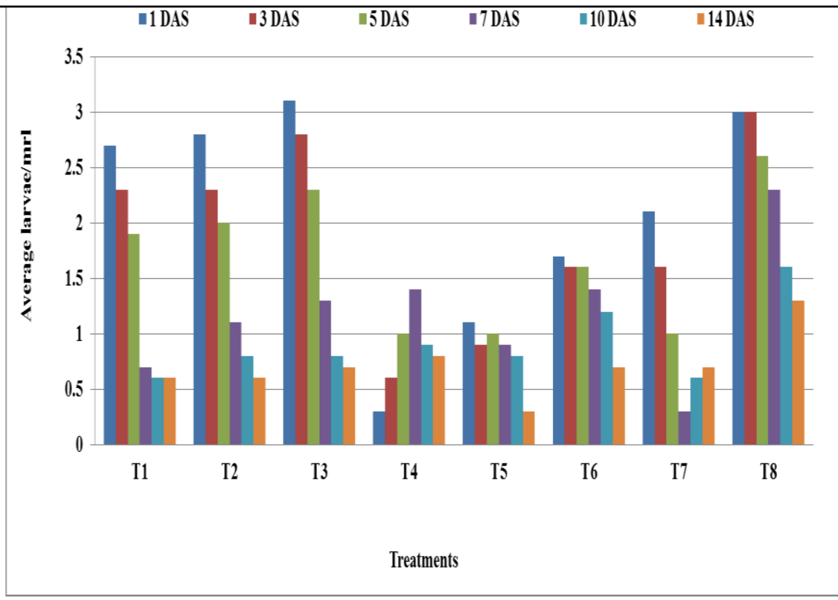
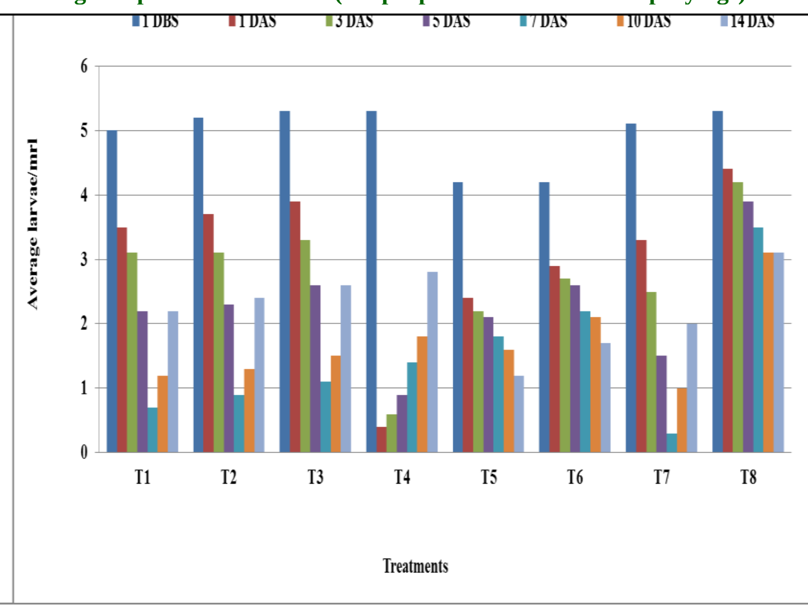


Fig.4 Population of *S.litura* (Simple pooled mean of three sprayings).



After second spray the larval population significantly varied among the treatments, highest larval population was recorded in untreated control where chlorpyriphos 20EC @2ml/lit recorded the lowest larval population and at par with NSKE 5% and Neem oil 5%. But pongamia oil 2% treated plot recorded highest larval population. At seventh day after spraying similar trend was noticed. The lowest *S.litura* were recorded in mechanical control 1st, 3rd, 5^{th,} and 7th day after IInd mechanical controls. Trap crop (castor) were found most effective in reducing *S.litura* larvae and lowest *S.litura (*1.1 larvae/mrl) were recorded in fourteenth days after IInd spray as shown in (Table 1 and Fig. 2).

After third spray chlorpyriphos 20EC @2ml/lit was significantly superior over all other treatments after first, third, fifth, seventh, tenth days after spraying and at par with NSKE 5% and Neem oil 5%. The lowest *Spodoptera* were recorded in mechanical control 1st, 3rd, 5^{th,} and 7th day after IIInd mechanical controls. Trap crop (castor) were found most effective in lowest *S.litura (*0.3 larvae/mrl) were recorded in fourteenth days after IIInd spray as shown in (Table 2 and Fig. 3).

The pooled data of three sprayings presented in (Table 2 and Fig. 4) revealed that. The larval population of *S.litura* was uniformly distributed in all the plots one day before spray. However significant reduction in the larval population was recorded Ist, 3rd and 5th days after treatment of IIIrd mechanical control while lowest larval population of *S.litura* registered with the treatment of chlorpyriphos 20EC @2ml/lit after 7th and 10th day after spray and which was at par with the NSKE 5%. However the least larval activity of *S.litura* noticed in the treatment of trap crop (castor) followed by chlorpyriphos 20EC @2ml/lit and NAKE 5%.

Sharma (2005) reported that, the hand picking reduced the *S.litura* population in soybean. Bhosle *et al.*, (2008) reported that the localized IPM module for soybean pests which collection and destruction of tobacco leaf eating caterpillar along with leaves effective in managing the pest. Nath *et al.*, (2011) studied that the azadirachtin was found to reduce feeding behavior of *S.litura* on soybean. Hence the present findings are in agreement with the earlier work of above scientist.

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