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Efficacy of insecticides against larval population of defoliators of soybean

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Abstract
An experiment was conducted during 2018-19 and 2019-20 at Regional Sugarcane and Rice Research Station, Rudrur, to assess the chemical control of soybean pests, using popular insecticides *viz.*, Acephate, Monocrotophos, Quinalphos, Triazophos, Profenophos, Thiodicarb, Chlorantraniliprole, Emamectin benzoate, Thiamethoxam+ Lambda cyhalothrin and were compared with untreated control using Randomized Block Design with three replications. Significant differences were noticed among all treatments. Emamectin benzoate 5.0% SG @ 0.4 g/l was found effective against defoliators followed by Chlorantraniliprole 18.5% SC @ 0.3 ml/l.

Keywords: soybean, insecticides, defoliator (*Spodoptera litura* & *Chrysodexis acuta*), yield kg/ha

Introduction
Soybean is one of the most popularly grown protein rich oilseed crops. Soybean is reported to be attacked by about 350 species of insects in many parts of the world (Luckmann, 1971) [7]. Infestation of defoliators is becoming the most important production constraint, posing threat to soybean. *Spodoptera litura* cause 30 to 50 per cent damage to younger parts and also pods (Anon, 2007) [9, 1] where as *Chrysodexis acuta* cause 19% defoliation (Musser and Catchot, 2009). Continuous cultivation of soybean crop with simultaneous increase in area has led to increase in insect pests and also growing popular varieties in larger area results in secondary infestation of insect pests and also indiscriminate use of several broad spectrum insecticides cause elimination of natural enemies, risk to human beings and animals besides environmental pollution. Insecticide utilization in insect pest management is very important under farmer field conditions to manage the pest below economic injury level. In view of number of insecticides present in the market to control pests of soybean, it is necessary to identify the best chemical to control the major insect pests of soybean at an affordable cost and also avoid pest resurgence. Hence, this study was conducted for evaluating the effectiveness of nine insecticides for the management of major insect pests of soybean crop

Materials and Methods
Field experiment was carried out during *Kharif* 2018 and 2019 at Regional Sugarcane and Rice Research station, Rudrur, Nizamabad. The popular variety JS 335 was sown as a row to row distance of 45 cm and 10 cm between plants with plot size of 5x5 m^2. The experiment was laid out in Randomized Block Design with 9 treatments in three replications along with untreated control to compare the efficacy of insecticides against major insect pests of soybean, *viz.*, Acephate (75% SP) @ 1.5 gr, Monocrotophos 36%SL @1.6 ml, Quinalphos 25%EC @ 2ml, Triazophos 40% EC @ 2ml, Profenophos 50%EC @ 2ml, Thiodicarb 75%WP @1.5 gr, Chlorantraniliprole 18.5%SC @ 0.3ml, Emamectin benzoate 5% SG @0.5gr, Thiamethoxam+ Lambda cyhalothrin @ 0.5 ml and untreated control (water spray). Two times spray was done on 10^{th}& 45^{th} days after germination of the crop. Observations on larval population of defoliators were recorded per meter row length leaving boarder rows. White fly population was recorded on randomly selected ten plants from each plot. Insect count was recorded from five leaves, three from upper and two from middle part of the plant (AICRIP of soybean, Sharma (1996) [12]. Grain yield in all the treatments was recorded at harvesting and expressed as kg/ha. Data obtained were subjected to analysis of variance (ANOVA) after transformation of data through OPSTAT software and as per the procedure suggested by Gomez and Gomez (1984) [2].

Results and Discussion

Soybean is attacked by defoliators and whitefly during crop growth period. The mean pest population in different treatments for the both years under study was considered and results are discussed.

Comparative efficacy of insecticides against the incidence of defoliators of soybean

The larval population in different observations was averaged for both the years under study and data were used for description.

The observations on the larval population of defoliators (*Spodoptera litura* and *Chrysodexis acuta*) were recorded 1 day before and 5 and 10 days after treatment imposition in meter row length.

One day before the application of insecticides after first spray

The data presented in Table 1 indicated that during 2018 larval population of combined defoliaters ranged from 1.24 to 2.54 larvae/mrl, where as it ranged from 1.42 to 3.21 larvae/mrl during 2019.Observations were recorded one day before the application revealed that all the treatments had more or less similar number of defoliaters and ranged from 2.19 to 2.68 larvae/mrl which were uniformly distributed in all the plots. Statistically a non-significant variation was recorded in the defoliator population.

Five days after the application of insecticides after first spray

The data presented in Table 1 indicated that during 2018 larval population of tobacco caterpillar ranged from 0.64 to 1.94 larvae/mrl as compared to 2.85 larvae/mrl in control where as it ranged from 0.87 to 2.23 larvae/mrl during 2019 as compared 3.03 larvae/mrl in control. At 5 days after spray T7 (Chlorantraniliprole 18.5%SC) recorded the least larval population (0.75 larvae/mrl) was significantly superior over other treatments, T9 (Thiamethoxam+ Lambda cyhalothrin) and T8 (Emamectin benzoate 5% SG) which were found to be the next best treatments (1.36 and 1.55 larvae/mrl, respectively) and were on par with each other, followed by T4 (Triazophos 40% EC) and T3 (Quinalphos 25% EC) which recorded 1.69 and 1.77 larvae/mrl, respectively. However, all the insecticide treatments were significantly superior over untreated check. These results were similar with Longchar *et al*., 2018 [6].

Ten days after the application of insecticides

The data presented in Table 1 indicated that during 2018 larval population of defoliator ranged from 0.85 to 2.32 larvae/mrl as compared to 3.01 larvae/mrl in control where as it ranged from 1.10 to 2.85 larvae/mrl as compared to 3.09 larvae/mrl in control during 2019.

The pooled results of second spray revealed that the larval population of defoliators one day before imposing the treatments ranged from 1.79 to 2.86 larvae/mrl (Table2) which were significantly different from each other. Five days after spray T8 (Emamectin benzoate 5% SG) was found superior control over other treatments recorded least larval population (0.59 larvae/mrl). T7 (Chlorantraniliprole 18.5%SC), T3 (Quinalphos 25% EC), T5 (Profenophos 50%EC) and T9 (Thiamethoxam+ Lambda cyhalothrin) were on par with each other. All treatments were significantly superior over the untreated control. These findings were similar with Harish, 2009 [4].

Overall pooled results of first and second spray results revealed that the T8 (Emamectin benzoate 5% SG) followed by T7 (Chlorantraniliprole 18.5%SC) was best control the larval population of defoliaters. The application of novel molecules induce the feeding cessation in time span when compared with broad spectrum insecticides (Hanning *et al*., 2009) [3].

Emamectin benzoates against soybean insect pests were lacking. It was effective in controlling *Heliothis zea* and *Spodoptera litura* in tomato (Jansson *et al.*, 1996 and Murugaraj *et al.*, 2006) [5, 8]. It also shows the effective control of cotton boll worm complex by lower square and boll damage (Sontakke *et al*., 2007) [13]. It also found effective in reducing dead hearts and fruit damage in brinjal (Prasad and Devappa 2006) [11].

Effect of various treatments on yield of soybean

The data presented in Table 3 indicated that during 2018 soybean yield ranged from 795 to 1535 kg/ha as compared to 661 kg/ha in control, where as it ranged 1267 to 2250 kg/ha as compared to 767 kg/ha in control during 2019.

The maximum pooled yield of two years was recorded in Emamectin benzoate (1726kg/ha) with benefit cost ratio of 2.32 followed by Chlorantraniliprole (1646kg/ha) with benefit cost ratio of 2.21 which were superior over control. The minimum yield of 714 kg/ha with benefit cost ratio of 0.95 was recorded in control. Yadav et al., (2018) [14] found indoxacarb treated plot recorded highest yield as compared to control. Patil et al., (2014) [10] results revealed that Chlorantraniliprole treated plot recorded maximum yield (1988kg/ha) as compared to control. Harish (2009) [4] results as maximum grain yield (2276.67kg/ha) was recorded in Emamectin benzoate treated plot as compared to control.

Table 1: Pooled data on efficacy of certain insecticides against defoliators of soybean before and after first spray during *Kharif*, 2018 and 2019

Treatments	Mean no. of defoliators/larvae/mrl before and after first spray								
	Before first spray			5 days after first spray			10 days after spray		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1: Acephate 75% SP	1.89(1.70)	3.03 (2.01)	2.46(1.86)	1.42 (1.56)	2.23 (1.80)	1.83(1.68)	1.68(1.64)	2.33(1.83)	2.01(1.73)
T_2: Monocrotophos 36% WSC	2.31(1.82)	2.78(1.94)	2.55(1.88)	1.67(1.64)	2.07(1.75)	1.87(1.70)	2.10(1.76)	2.23(1.80)	2.17 (1.78)
T_3: Quinalphos 25% EC	2.54(1.88)	2.07(1.75)	2.31(1.82)	1.94(1.71)	1.60(1.61)	1.77(1.66)	2.32(1.82)	1.80(1.67)	2.06(1.75)
T_4: Triazophos 40% EC	1.54(1.59)	2.87(1.97)	2.21(1.79)	1.28(1.51)	2.10(1.76)	1.69(1.64)	1.40(1.55)	2.27(1.81)	1.84(1.68)
T_5:Profenophos 50% EC	2.19(1.79)	2.80(1.95)	2.50(1.87)	1.84(1.68)	2.00(1.73)	1.92(1.71)	2.04(1.74)	2.70(1.92)	2.37(1.83)
T_6:Thiodicarb 75% WP	2.11(1.76)	3.23(2.06)	2.68(1.92)	1.74(1.65)	2.27(1.80)	2.00(1.73)	1.81(1.68)	2.85(1.96)	2.33(1.82)
T_7: Chlorantraniliprole 18.5% SC	1.24(1.50)	3.13(2.03)	2.19(1.79)	0.64(1.28)	0.87(1.37)	0.75(1.32)	0.85(1.36)	1.10(1.45)	0.98(1.41)
T_8 : Emamectin benzoate 5% SG	2.00(1.73)	3.27(2.06)	2.64(1.91)	1.56(1.60)	1.53(1.59)	1.55(1.60)	1.71(1.64)	1.60(1.65)	1.72(1.65)
T9: Thiamethoxam + lambda-cyhalothrin	1.73(1.65)	3.23(2.06)	2.48(1.86)	1.25(1.50)	1.47(1.57)	1.36(1.54)	1.33(1.53)	1.73(1.61)	1.46(1.57)

T10: Untreated control	2.39(1.84)	2.97(1.99)	2.68(1.92)	2.85(1.96)	3.03(2.01)	2.94(1.98)	3.01(2.00)	3.17(2.04)	3.09(2.02)
SEm (±)	0.16(0.05)	0.20(0.05)	0.14(0.04)	0.13(0.04)	0.18(0.05)	0.10(0.03)	0.13(0.04)	0.17(0.05)	0.11(0.03)
CD (P = 0.05%)	0.47(0.14)	0.61 (0.16)	N/A	0.39(0.12)	0.53(0.15)	0.31(0.09)	0.40(0.12)	0.49(0.13)	0.33(0.09)

* Figures in parenthesis are square root transformed value

Table 2: Pooled data on efficacy of certain insecticides against defoliators of soybean before and after second spray during *Kharif*, 2018 & 2019

Treatments	Mean no. of defoliators/larvae/mrl before and after second spray								
	Before first spray			5 days after first spray			10 days after spray		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1: Acephate 75% SP	2.33(1.82)	2.47(1.86)	2.40(1.84)	1.70(1.63)	2.07(1.75)	1.88(1.69)	1.76(1.65)	2.23(1.79)	2.00(1.71)
T_2: Monocrotophos 36% WSC	2.61(1.90)	2.00(1.73)	2.31(1.82)	2.31(1.82)	1.63(1.62)	1.97(1.72)	2.35(1.83)	1.60(1.61)	1.98(1.72)
T_3: Quinalphos 25% EC	1.92(1.70)	1.67(1.63)	1.79(1.67)	1.45(1.57)	1.40(1.54)	1.43(1.56)	1.52(1.59)	1.50(1.57)	1.51(1.58)
T_4: Triazophos 40% EC	3.21(2.05)	2.50(1.87)	2.86(1.96)	2.58(1.89)	2.17(1.77)	2.38(1.83)	2.62(1.90)	2.20(1.79)	2.41(1.85)
T_5: Profenophos 50% EC	2.14(1.77)	1.63(1.62)	1.89(1.70)	1.80(1.67)	1.23(1.49)	1.52(1.59)	1.85(1.68)	1.33(1.53)	1.59(1.61)
T_6: Thiodicarb 75% WP	3.03(2.01)	2.00(1.73)	2.32(1.82)	2.40(1.84)	1.37(1.54)	1.86(1.66)	2.42(1.84)	1.20(1.48)	1.81(1.68)
T_7: Chlorantraniliprole 18.5% SC	2.25(1.80)	1.77(1.66)	2.01(1.73)	1.67(1.63)	1.17(1.47)	1.42(1.55)	1.71(1.64)	1.20(1.48)	1.45(1.57)
T_8 : Emamectin benzoate 5% SG	1.42(1.55)	2.73(1.93)	2.08(1.74)	0.74(1.32)	0.43(1.20)	0.59(1.26)	0.82(1.35)	0.60(1.26)	0.71(1.31)
T9: Thiamethoxam + lambda-cyhalothrin	2.70(1.92)	1.73(1.65)	2.22(1.79)	2.00(1.72)	1.10(1.45)	1.55(1.59)	2.03(1.73)	1.30(1.50)	1.67(1.62)
T10: Untreated control	2.84(1.96)	1.80(1.67)	2.32(1.82)	3.22(2.05)	2.40(1.84)	2.81(1.95)	3.43(2.10)	2.37(1.83)	2.9(1.97)
SEm (±)	0.21(0.06)	0.14(0.04)	0.38(0.11)	0.26(0.08)	0.14(0.05)	0.15(0.05)	0.27(0.08)	0.20(0.06)	0.24(0.07)
CD (P = 0.05%)	0.62(0.17)	0.42(0.13)	0.13(0.04)	0.79(0.23)	0.43(0.14)	0.45(0.14)	0.81(0.23)	0.60(0.19)	0.71(0.21)

* Figures in parenthesis are square root transformed values

Table 3: Effect of insecticidal treatments on grain yield of soybean (Kg/ha)

Treatments	2018 (Kg/ha)	2019 (Kg/ha)	Pooled (Kg/ha)	Additional yield over control (Kg/ha)	Gross Returns (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
T_1: Acephate 75% SP	1253	1783	1519	805	56355	28755	2.04
T_2: Monocrotophos 36% WSC	970	1550	1260	546	46746	19146	1.69
T_3: Quinalphos 25% EC	1213	1267	1240	526	46004	18404	1.66
T_4: Triazophos 40% EC	933	1467	1200	486	44520	16920	1.61
T_5: Profenophos 50% EC	1416	1450	1433	719	53164	25564	1.92
T_6:Thiodicarb 75% WP	795	1500	1148	434	42591	14991	1.54
T_7: Chlorantraniliprole 18.5% SC	1535	1917	1646	932	64035	36435	2.21
T_8 : Emamectin benzoate 5% SG	1041	2250	1726	1012	61067	33467	2.32
T9: Thiamethoxam + lambda-cyhalothrin	1061	1550	1306	592	48453	20853	1.75
T10: Untreated control	661	767	714	-	26489	-	0.95
SE. m (±)	1.45	269	60	-	-	-	-
CD (P = 0.05%)	4.35	90	180	-	-	-	-

Conclusion

It may concluded from the present investigation that the incidence of defoliaters in soybean. The approaches for chemical management of defoliaters were found effective than control. The chemical insecticide Emamectin benzoate 5% SG@ 0.5 g/l found effective in controlling defoliaters larval population, to reduce leaf damage and pod infestation and also produce the maximum grain yield followed by Chlorantraniliprole 18.5% SC@ 0.3 ml/l, Acephate 75% SP @ 1.5 g/l, Profenophos 50% EC @ 2 ml/l respectively.

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References

1. Anonymous. Soybean. www.ikisan.com 2007, 1-7.
2. Gomez KA and Gomez AA. Statistical Procedures for Agricultural Research. John Wiley and Sons New York 1984.
3. Hanning GT, Ziegler M, Marcon PG. Feeding cessation effects of Chlorantraniliprole a new anthranilic diamide insecticide, in comparison with several insecticides in distinct chemical classes and mode of action groups. Pest Management Science 2009;65:969-974.
4. Harish G. Evaluation of biorational pesticides against lepidopteran defoliaters in soybean. Karnataka Journal of Agricultural Sciences 2009;22(4):914-917.
5. Jansson RK, Peterson RF, Halliday WR, Mookerjee PK, Dybas RA. Efficacy of solid formulations of Emamectin benzoate controlling lepidopterous pests. Florida Entomologist 1996;79:434-449.
6. Longchar PS, Imtinaro L, Pankaj N, Longkumer IY. Evaluation of Novel Insecticides against *Spodoptera litura* in Soybean (*Glycine max* L. Merill) Crop. International Journal of Pure and Applied Bioscience 2018;6(2):1129-1133.
7. Luckman WH. The insect pests of soybean. World farm 1971;13(5):18-22.
8. Murugaraj P, Nachiappan RM, Selvanarayanan V. Efficacy of Emamectin benzoate (Proclaim 05 SG) against tomato fruit borer, *Helicoverpa armigera* (Hubner). Pestology 2006;30:11-16.
9. Musser FR, Catchot A. Soybean Insect Losses for Missippi, Tennessee and Arkansas. Midsouth. Entomology 2009;3:9-36.
10. Patil UM, Kulkarni AV, Gavkare O. Evaluating the efficacy of novel molecules against soybean defoliators. The bioscan 2014;9(1):577-80.
11. Prasad Kumar, Devappa V. Bio efficacy of Emamectin benzoate 5% SG (Proclaim) against brinjal shoot and fruit borer. Pestology 2006a;30:17-19.

12. Shamra AN. Comparision of two screening procedures and classification of soybean genotypes into insect resistant groups. International Journal of Pest Management 1996;42(4):307-310.
13. Sontakke BK, Das N, Swain LK. Bio efficacy of Emamectin benzoate against boll worm complex in cotton. Annals of Plant Protection Sciences 2007;15:1-3.
14. Yadav P, Yadav VK, Banerjee S, Gupta MP. Effectiveness of some Insecticides against Larval Population of Two Major Defoliators of Soybean. International Journal of Current Microbiology and Applied Sciences 2018;7(2):1066-1072.