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Seasonal occurrence and management of tobacco leaf eating caterpillar *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae) on soybean

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Abstract
The study on Seasonal Occurrence and Management of Tobacco Leaf Eating caterpillar *Spodoptera litura* (Fab.) on Soybean was carried out during *Kharif* season 2018-19 under field condition of the Entomology Section, College of Agriculture Nagpur. Seasonal incidence of *S. litura* initiated during 30th standard week (0.20 larvae/mrl) gradually attained maximum (1.60 larvae/mrl) during 35th standard week. Population was decreased from 36th standard week onwards. Overall spinosad 45 SC @ 0.01% and fenvalerate 20 EC @ 0.01% was found statistically most significant in controlling the *S. litura* larval populations on soybean at 3rd, 7th and 14thdays after treatment. As regards to soybean grain yield, the application of spinosad 45 SC @ 0.01% and fenvalerate 20 EC @ 0.01% were found to be most effective treatments recording higher yield of 13.46 q/ha, 12.82 q/ha, respectively.

Keywords: *S. litura*, seasonal incidence, management, soybean

Introduction
Soybean (*Glycine max* L.) belongs to the family Leguminaceae. Soybean is native of Asia however, it has emerged as a domesticated crop around the eleventh century BC in China (Hymowitz, 1970) [4]. Majority of the world's soybean has been cultivated in the United States and South American countries. In India, soybean cultivation has picked up momentum during the past 15 years. Soybean agro-ecosystem is being adopted rapidly by farmers of Vidarbha and it becomes second major *Kharif* crop. It is a unique crop with high nutritional value, thus it also known as "Miracle bean, Golden bean, and Crop of the planet. Soybean contains only a moderate amount of oil has attained a greater importance as an oilseed in the recent years on account of its easy adaptability and resilience for cultivation in a wide variety of climatic conditions as well as its capability to give high yields compared to any other oilseed. Soybean has become the largest producing oilseed, contributing for nearly 60% of total world oilseeds production.

The major soybean defoliator tobacco leaf eating caterpillar, *Sopdoptera litura* (Fab.) damages the crop at vegetative stage and in severe case, it completely defoliate the crop and dramatic yield loss. *Spodoptera litura* larvae even damages the soybean pods accounting to 30 to 50 per cent impairment (Chaturvedi *et al*, 1998, Mandal *et al*, 1998, Singh *et al*, 2000, Patil 2002 and Sastawa *et al*, 2004) [2, 6, 13, 8, 11]. Seasonal incidence pattern may greatly vary due to changing climatic situations also the rising temperature may fasten the life cycles of insect pest thus in turn lead to much early incidence than expected.

Soybean cultivators are facing severe problem of lepidopteran insect pests on soybean. The generally used chemical pesticides regularly to control the pest problem having heavy cost. Therefore, promotion and development of botanicals along with chemical insecticides are economical method of pest management which helps to minimize the pest attack and indiscriminate use of pesticides.

Keeping this view, the studies were undertaken to test the effectiveness of some newer group of molecules against these pest in soybean. Knowing the onset of incidence of *S. litura* on soybean may help the cultivators to develop efficient management strategies beforehand and might also save the crop from adverse effect of some notorious pest of soybean, secondly this will reduce the indiscriminate use of insecticides in the soybean eco-system.

2. Materials and Methods
Defoliatoron soybean (*Glycine max* L.) was conducted during Kharif season 2018-19 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 oil @ 2%, neem

seed extract (NSE) @ 5%, quinalphos 25 EC @ 0.05%, fenvalerate 20 EC @ 0.01%, emamectin benzoate 5 SG @ 0.02%, indoxacarb 15.8 EC @ 0.01%, spinosad 45 SC @ 0.01%were used under field condition along with control (water spray) on soybean variety JS-335 during the course of present investigation.

Seed treatment with Thiram @ 3 g/kg and Rhizobium @ 2.50 g/kg of seed was done before sowing as well as other standard package of practices for crop production were followed. For recording seasonal incidence of *S. litura* on soybean a separate plot of 5 x 5 m^2 area was sown and observations recorded from 15 DAS at 7 days interval till the harvest of crop. The treatments were imposed soon after the incidence of *S. litura*. Total three sprays were given at an interval of 15 days after emergence of crop with the help of knapsack sprayer when. 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 3, 7 and 14 days after application of treatment.

Results and Discussions

Incidence of *S. litura* initiated during 30th standard week (0.20 larvae/mrl) and gradually attained maximum (1.60 larvae/mrl) during 35rd standard week. Population gradually decreased from 36th standard week onwards.

The results on efficacy of botanical and chemical insecticides practiced against *S. litura*observedthe cumulative mean number larvae of *Spodoptera* /mrl recorded at 3, 7 and 14 DAT after three treatments, respectively and were presented in Table 2 and graphically illustrated in Numerically minimum cumulative average number of *Spodoptera* larvae (0.13, 0.09 and 0.06 larvae/mrl) and (0.13, 0.10 and 0.06 larvae/mrl) were recorded in the treatment of spinosad 45 SC @ 0.01% and fenvalerate 20 EC @ 0.01% and were found superior over other treatments. The next effective treatments were emamectin benzoate 5 SG @ 0.02 (0.21, 0.15 and 0.10 larvae/mrl), indoxacarb 15.8 EC @ 0.01% (0.23, 0.18 and 0.13 larvae/mrl) and found at par with the treatment of fenvalerate and spinosad and followed by quinalphos 25 EC @ 0.05% (0.46, 0.33 and 0.33 larvae/mrl). However, the treatments of neem oil @ 2% recorded (0.97, 1.06 and 1.19 larvae/mrl) whereas, neem seed extract (NSE) @ 5% (1.02, 1.11 and 1.26 larvae/mrl) were found least effective in reducing larval population. Maximum mean larval population was recorded in control (1.34, 1.52 and 1.62 larvae/mrl).

Table 1: Seasonal incidence of *Spodoptera litura* on soybean during *Kharif* 2018

Std. MT Week	larvae/mrl
	S. litura
(jul)27	0.00
(Jul)28	0.00
(Jul)29	0.00
(Jul)30	0.20
(Aug)31	0.20
(Aug)32	0.40
(Aug)33	0.80
(Aug)34	1.20
(Sept)35	1.60
(Sept)36	1.00
(Sept)37	0.80
(Sept)38	0.40
(Sept)39	0.40
(Oct)40	0.10
(Oct)41	0.10
(Oct)42	0.00

The findings of the present study were strongly supported by the previous workers (Kothalkar, 2014; Patil *et al.* 2014; Matti *et al.*, 2016) [5, 9, 7] who reported that Spinosad 45% SC @ 0.01% and Fenvalerate 20 EC@ 0.01% were effective in reducing the larval population of tobacco leaf eating caterpillar. The fairly effective treatment of emamectin benzoate 5 SG @ 0.02 in the present study was comparable with the previous studies of Ahmed and Sayyad (2006) [1], Harish (2008) [3], Satyanarayana *et al.* (2010) [12] and Matti *et al.* (2016) [7].

The results on efficacy of botanical insecticides are on similar line with the results reported by Rathikannu (2005) who reported the highest population reduction of S. litura (53.34 per cent) after application of NSKE 5%.

Table 2: Cumulative mean population of *Spodoptera* larva in different treatments at 3, 7 and1 4 days after three spraying

Tr. No.	Treatment Name	3 DAT				7 DAT				14 DAT			
		1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean
T_1	Neem oil @ 2%	0.55 (0.74)	0.92(0.95)	1.45(1.20)	0.97 (0.98)	0.51(0.71)	1.11(1.05)	1.57(1.25)	1.06(1.02)	0.60(0.77)	1.32(1.14)	1.64(1.28)	1.19 (1.09)
T_2	Neem seed extract (NSE) @ 5%	0.58 (0.76)10.01	1.00(1.00)	1.47(1.21)	1.02(1..00)	0.49(0.70)	1.25(1.11)	1.59(1.26)	1.11(1.05)	0.65(0.80)	1.41(1.18)	1.73(1.31)	(1.26(1.12)
T_3	Quinalphos 25 EC @ 0.05%	0.51(0.71)	0.45(0.67)	0.42(0.64)	0.46(0.67)	0.45(0.67)	0.37(0.60)	0.33(0.57)	0.38(0.61)	0.40(0.63)	0.35(0.59)	0.23(0.47)	0.33(0.57)
T_4	Fenvalerate 20 EC @ 0.01%	0.20(0.44)	0.12(0.34)	0.08(0.28)	0.13(0.36)	0.15(0.38)	0.08(0.28)	0.06(0.24)	0.10(0.31)	0.09(0.30)	0.06(0.24)	0.04(020)	0.06(0.24)
T_5	Emamectin benzoate 5 SG @ 0.02%	0.31(0.55)	0.19(0.43)	0.13(0.36)	0.21(0.45)	0.21(0.45)	0.13(0.36)	0.11(0.33)	0.15(0.38)	0.14(0.37)	0.10(0.31)	0.06(0.24)	0.10(0.31)
T_6	Indoxacarb 15.8 EC @ 0.01%	0.33(0.57)	0.21(0.45)	0.14(0.37)	0.23(0.47)	0.22(0.46)	0.19(0.43)	0.12(0.34)	0.18(0.42)	0.17(0.41)	0.13(0.36)	0.09(0.30)	0.13(0.36)
T_7	Spinosad 45 SC @ 0.01%	0.23(0.47)	0.08(0.28)	0.07(0.26)	0.13(0.36)	0.17(0.41)	0.05(0.22)	0.04(0.20)	0.09(0.30)	0.09(0.30)	0.04(0.20)	0.05(0.22)	0.06(0.24)
T_8	Control (water spray)	0.83(0.91)	1.30(1.14)	1.89(1.37)	1.34(1.15)	0.82(0.90)	1.57(1.25)	2.16(1.16)	1.52(1.23)	0.99(0.99)	1.64(1.28)	2.24(1.49)	1.62(1.27)
F Test		Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SEm(±)		0.03	0.04	0.07	0.04	0.02	0.05	0.07	0.04	0.03	0.06	0.07	0.05
CD @ 5%		0.09	0.13	0.21	0.14	0.07	0.16	0.21	0.14	0.09	0.18	0.22	0.16

Figures in parentheses are indicate square root transformation value

Conclusion

During *Kharif* 2018, insect pest was recorded on soybean at Nagpur (MH). Among these, two defoliators, *Thysanoplusia orichalcea* and *Spodoptera litura* (Fabricius). Incidence of *S. litura* initiated during 30th standard week (0.20 larvae/mrl) gradually attained maximum (1.60 larvae/mrl) during 35th

standard week. Population was decreased from 36th standard week onwards.

The results on cumulative mean number of larvae per mrl in soybean at 3 DAT was found statistically significant over control (T8:1.34 larvae/mrl). However, numerically minimum cumulative average number of larvae of *Spodoptera litura* was recorded at 3 DAT in the treatment of spinosad 45 SC @ 0.01% (T7:0.13 larvae/mrl) and fenvalerate 20 EC @ 0.01% (T4:0.13 larvae/mrl), followed by the treatments of emamectin benzoate 5 SG @ 0.02% (T5:0.21 larvae/mrl), indoxacarb 15.8 EC @ 0.01% (T6: 0.23 larvae/mrl), quinalphos 25 EC @ 0.05% (T3:0.46 larvae/mrl), neem oil 2% (T1:0.97 larvae/mrl), neem seed extract (NSE) @ 5% (T2:1.02 larvae/mrl) respectively.

The results on cumulative mean number of larvae per mrl in soybean at 7 DAT was found statistically significant over control (T8:1.52 larvae/mrl). However, numerically minimum cumulative average number of larvae of *Spodoptera litura* was recorded in the treatment of spinosad 45 SC @ 0.01% (T7:0.09 larvae/mrl) followed by the treatments of fenvalerate 20 EC @ 0.01% (T4:0.10 larvae/mrl), emamectin benzoate 5 SG @ 0.02% (T5:0.15 larvae/mrl), indoxacarb 15.8 EC @ 0.01% (T6:0.18 larvae/mrl), quinolphos 25 EC @ 0.05% (T3:0.38 larvae/mrl), neem oil @ 2% (T1:1.06 larvae/mrl), neem seed extract (NSE) @ 5% (T2:1.11 larvae/mrl).

The results on cumulative mean number of larvae per mrl in soybean at 14 DAT was found statistically significant over co ntrol (T8:1.62 larvae/mrl). However, numerically minimum cumulative average number of larvae of *Spodoptera litura* was recorded in the treatment of spinosad 45 SC @ 0.01% (T7:0.06 larvae/mrl) and fenvalerate 20 EC @0.01% (T4:0.06 larvae/mrl)followed by the treatments of, e mamectin benzoate 5 SG @ 0.02% (T5:0.10 larvae/mrl), indoxacarb 15.8 EC @ 0.01% (T6:0.13 larvae/mrl), quinalphos 25 EC @ 0.05% (T3:0.33 larvae/mrl), neem oil @ 2% (T1:1.19 larvae/mrl), neem seed extract (NSE) @ 5% (T2:1.26 larvae/mrl).

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