The Pharma Innovation

Chetna Khandekar
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. YK Yadu
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Roshani Pisda
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Studies on the population dynamics of insect pests and natural enemies of soybean crop

Chetna Khandekar, Dr. YK Yadu and Roshani Pisda

Abstract

The experiment was conducted in the College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *Kharif* 2018–19. The population dynamics of insect pests and natural enemies of soybean were recorded in the variety JS-97-52. Throughout the study, seven species of insect pests were recorded *viz.,* stem fly (*Melanagromyza sojae),* girdle beetle (*Obereopsis brevis),* tobacco caterpillar (*Spodoptera litura* Fabricius), green semilooper (*Chrysodeixis acuta* Walker), white fly (*Bemisia tabaci* Gennadius), jassids (*Apheliona maculosa)* and thrips (Thrips), among the natural enemies, the predatory pentatomid bug (*Eocanthecona furcellata)* and the spider (*Oxyopes* sp.) and *(Neoscona* sp.) were recorded. The observations were recorded at weekly intervals during the morning hours without disturbing the pest fauna. Insect pests were observed from the third week of July to the last week of September. Results indicated that, the peak incidence of *C. acuta* and *S.litura* was achieved during the first week of September (35th SMW) with the mean of 1.5 and 1.4 larvae/mrl. The peak density of whitefly was observed in the last week of August (34th SMW) while, the peak density of thrips and jassids was observed during the second week of August (32nd SMW). The occurrence of predatory bugs started in the second week of August (32nd SMW), which was the peak period with a mean of 0.7, while the peak density of spiders was noticed in the first week of September (34th SMW) with a 2.0 mean.

Keywords: Soybean, SWM, mrl and insect-pests

Introduction

Soybean [*Glycine max* (L.) Merr.] (2n = 40) is a species of legume crop belonging to the family Fabaceae and native to eastern Asia. It is one of the most important oilseed commercial crops in India. Because of its high oil content, soybean is classified as an oilseed rather than a pulse, and it is more commonly used as a source of vegetable oil and industrial applications such as biodiesel. It is the cheapest source of protein. It contains 40% protein, 20% oil, 26.5% carbohydrate, 5.5% mineral nutrients, and 2% phospholipids. Soybean oil is one of the most popular edible oils; soya is also used as a milk product and available in the form of soya chunks, which are also called "meal markers" in India. Soybean is the world's leading source of vegetable oil. Soybean led the global market for vegetable oils, followed by olive, canola, sunflower and safflower, corn, palm, coconut, and others (Global Vegetable Oils Industry, 2013). India is the sixth largest soybean oil producing country in the world (USDA, 2016) [10]. India's contribution is about 13 percent of the world's oilseeds area, 7 percent of the world's oilseeds output, and 10 percent of the world's edible oil consumption (Alexander, 1974) [4]. Soybean contributes significantly to the Indian edible oil pool. Presently, soybeans contribute 43% to the total oilseeds and 25% to the total oil production in the country. Soybean can be grown in a variety of agroclimatic conditions. The insect pests and natural enemies of soybean crops are stem fly (*Melanagromyza sojae),* girdle beetle (*Obereopsis brevis),* tobacco caterpillar (*Spodoptera litura* Fabricius), green semilooper (*Chrysodeixis acuta* Walker), white fly (*Bemisia tabaci* Gennadius), jassids (*Apheliona maculosa),* and thrips (Thrips) (Fletcher, 1922). Among the natural enemies, the predatory pentatomid bug (*Eocanthecona furcellata)* and the spiders *Oxyopes* sp. and *Neoscona* sp. can be seen during the cropping period (Ahirwar, 2013) [2].

Material and Methods

Soybean variety JS- 97-52 was planted in rows 30 cm apart and 10 cm between plants in a 10×5 m2 plot. All the recommended agronomic practices were followed to grow the crop except the measures of insect pest control.

Corresponding Author:
Chetna Khandekar
Department of Entomology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

The population of different insect pests and natural enemies was recorded at weekly interval during morning hours without disturbing the pest fauna. For green semilooper, *C. acuta,* and tobacco caterpillar, *S. litura,* the number of larvae or caterpillars was counted through a direct visual counting method on randomly selected ten plants in a one-metre row length or by shaking the plants. The sucking pests, *i.e.,* whiteflies, jassids, and thrips, were recorded in three leaves, the upper, middle, and bottom parts of the plant, on randomly selected ten plants. Then, the mean number of sucking pests per plant was calculated. For the internal feeders, *viz.,* girdle beetle and stemfly, which were recorded in the per-metre row length of the field. Natural enemies, particularly spiders and predatory bug populations, were observed in ten randomly selected plants.

Results and Discussion
The populations of green semilooper, *C. acuta* first appeared on a soybean crop field during the third week of July, with a population mean of 0.1 larvae per metre row length, while *S. litura* first appeared during the last week of July, with a population mean of 0.1 larvae per metre row length. The peak density of *C. acuta* and *S. litura* was achieved during the first week of September (35th SMW), with a mean of 1.5 and 1.4 larvae per metre row, the seasonal mean of *C. acuta* and *S. litura* was 0.545 and 0.636. The population of whitefly ranged from 1.9 to 8.9 nymphs and adults per three leaves per plant, with the mean of 8.9 observed in the last week of August (34th SMW) and the seasonal mean of 4.62. The peak density of thrips and jassids was observed during the second week of August (32nd SMW) with mean of 4.6 and 1.8 nymphs and adults per three leaves per plant. The seasonal mean was 1.927 and 1.236 nymphs and adults per three leaves per plant, respectively. The girdle beetle's occurrence began in the last week of July and ended in the last week of September, with a mean of 0.2 and 0.7. The peak population was recorded in mid-September (37th SMW), with a seasonal mean of 0.327.

The infestation of stemflies was first noticed in the 3rd week of July and lasts until the end of September, but the peak density was recorded in the first week of September (35th SMW) with a 1.8 population mean and a seasonal mean of 0.545 (Table 1 and Fig.1).

The natural enemies *viz.,* the predatory pentatomid bug *Eucanthocona furcellata,* and the two species of spiders, namely, the lynx spider and orb weaver spider, were recorded. *Oxyopes* sp. is a hunting spider, whereas *Neoscona* sp. is a web-building spider. The occurrence of predatory bugs began in the second week of August (32nd SMW), which was also the peak period with a mean of 0.7 and a seasonal mean of 0.227. The appearance of spiders was started in the last week of July with a population mean of 0.4 spiders per plant. The peak density was noticed in the first week of September (35th SMW) with a 2.0 mean of spiders and a seasonal mean of 1.0 (Table 1 and Fig.1).

The effects of predatory complexes on insect pest activity revealed that the predatory bug, *Eucanthocona furcellata*, had a positive correlation with *S.litura* and *C. acuta* (Table 2). The correlation coefficient of predatory bug and *S. litura* showed positive and non-significant correlation at the 5% level of significance, *i.e.,* r = 0.575; the correlation coefficient of predatory bug and *C. acuta* showed positive and significant correlation at the 5% level of significance, with a value of (r = 0.607*) (Fig.2), while the correlation coefficient of predatory bugs and sucking pests was found non-significant at the 5% level of significance. Similarly, the correlation between lepidopteran pests (*S. litura* and *C. acuta*) and spiders was found to be a positive and significant correlation (r = 0.883*) at the 5% significance levels, respectively (Fig.3). The correlation between spiders and sucking pests, *B. tabaci* and *T. tabaci* was found to be positive and non-significant while, the correlation between spiders and *A. Maculosa* was found positive and significant with r value of 0.610* at the 5 percent level of significance (Fig 4).

Table 1: Population dynamics of insect pests and natural enemies on soybean (variety JS-97-52) during *kharif*, 2018-19.

| Date of observation | SMW | Incidence per meter row length | | | | | No. of sucking pests | | | | No. of predators percent | |
| | | No. of caterpillars/mrl | | | | | No. of sucking pests / three leaves | | | | | |
		O. Brevis	M. Sojae	S. litura	C. Acuta	Total	B. Tabaci	T. Tabaci	A. Maculosa	Total	Predatory bug	Spider
21-07-2018	29	0.0	0.1	0.0	0.1	0.1	1.9	0.5	0.3	2.7	0.0	0.0
28-07-2018	30	0.2	0.0	0.1	0.1	0.2	3.0	1.4	1.6	6.0	0.0	0.4
04-08-2018	31	0.0	0.4	0.1	0.3	0.4	3.3	2.3	1.1	6.7	0.0	0.9
11-08-2018	32	0.5	0.2	0.8	0.7	1.5	6.2	4.6	1.8	2.6	0.7	1.2
18-08-2018	33	0.2	0.0	0.7	0.8	1.5	6.9	2.4	1.1	10.4	0.4	0.9
25-08-2018	34	0.4	1.3	0.8	0.8	1.6	8.9	3.0	1.5	13.4	0.5	1.5
01-09-2019	35	0.6	1.8	1.4	1.5	2.9	4.1	2.6	1.5	8.2	0.3	2.0
08-09-2018	36	0.0	1.0	0.9	0.4	1.3	5.4	1.0	0.9	7.3	0.2	1.0
15-09-2018	37	0.7	0.7	0.8	0.5	1.3	3.7	1.2	1.5	6.4	0.2	1.1
22-09-2018	38	0.6	0.6	0.8	0.5	1.3	4.0	1.2	1.3	6.5	0.1	1.2
29-09-2018	39	0.4	0.0	0.6	0.3	0.9	3.5	1.0	1.0	5.5	0.1	0.8
Seasonal Mean	-	0.327	0.554	0.636	0.545	1.181	4.627	1.927	1.236	6.881	0.227	1.00

Table 2: Influence of natural enemies on the incidence of caterpillars and sucking pests on soybean during *kharif*, 2018-19

S. No.	Date of Observation	SMW	Predatory bug	Spider	No. of caterpillars/mrl		No. of sucking pests / three leaves / plant		
					S. litura	*C. acuta*	*B. tabaci*	*T. tabaci*	*A. maculosa*
1	21-07-2018	29	0.0	0.0	0.0	0.1	1.9	0.5	0.3
2	28-07-2018	30	0.0	0.4	0.1	0.1	3.0	1.4	1.6
3	04-08-2018	31	0.0	0.9	0.1	0.3	3.3	2.3	1.1
4	11-08-2018	32	0.7	1.2	0.8	0.7	6.2	4.6	1.8
5	18-08-2018	33	0.4	0.9	0.7	0.8	6.9	2.4	1.1
6	25-08-2018	34	0.5	1.5	0.8	0.8	8.9	3.0	1.5
7	01-09-2019	35	0.3	2.0	1.4	1.5	4.1	2.6	1.5
8	08-09-2018	36	0.2	1.0	0.9	0.4	5.4	1.0	0.9
9	15-09-2018	37	0.2	1.1	0.8	0.5	3.7	1.2	1.5
10	22-09-2018	38	0.1	1.2	0.8	0.5	4.0	1.2	1.3
11	29-09-2018	39	0.1	0.8	0.6	0.3	3.5	1.0	1.0
	Correlation coefficient (r)			Predatory bug	0.575	0.607*	N/S	N/S	N/S
				Spider	0.883*	0.883*	0.519	0.525	0.610*

*Significant at 5% level of significance.
Table value 0.602 at (n-2) degree of freedom
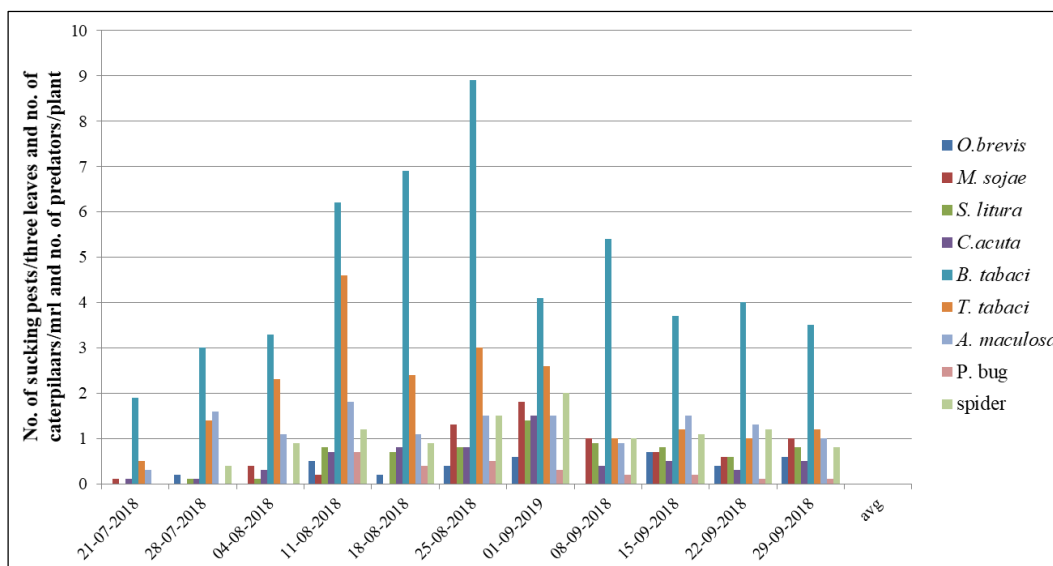

Fig 1: Population dynamics of insect pests and natural enemies on soybean (variety JS-92-57) during *kharif* 2018-19
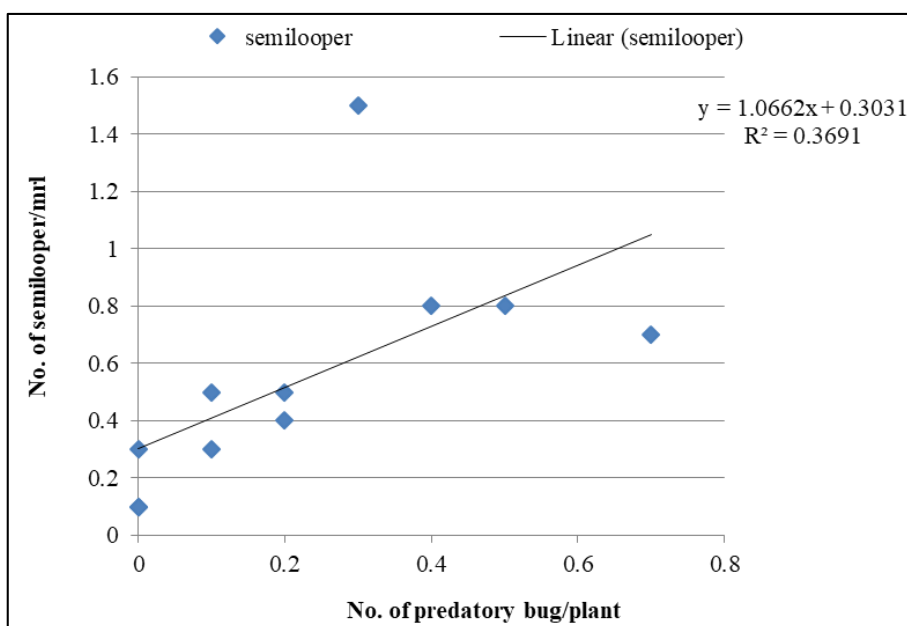

$$y = 1.0662x + 0.3031$$
$$R^2 = 0.3691$$

Fig 2: Regression line between semilooper and predatory bug
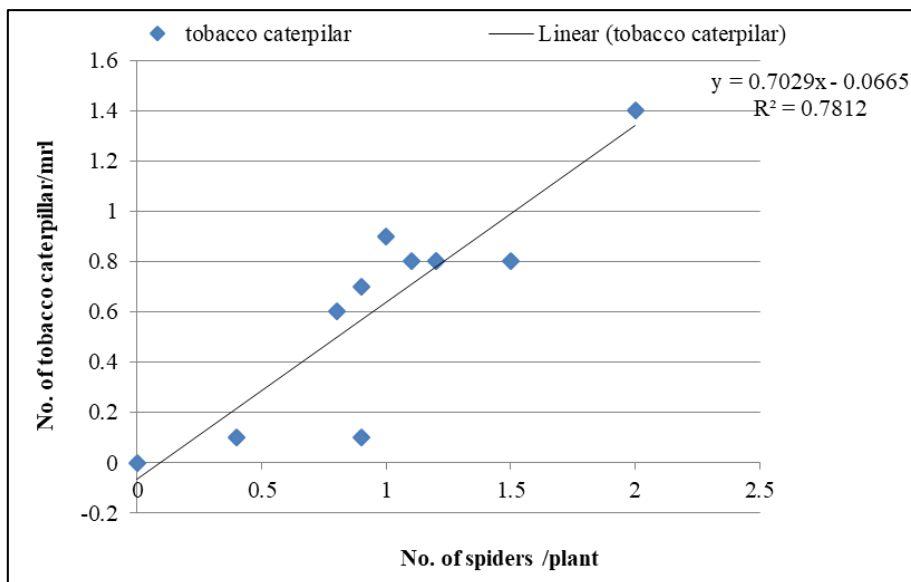
Fig 3: Regression line between tobacco caterpillar and spider
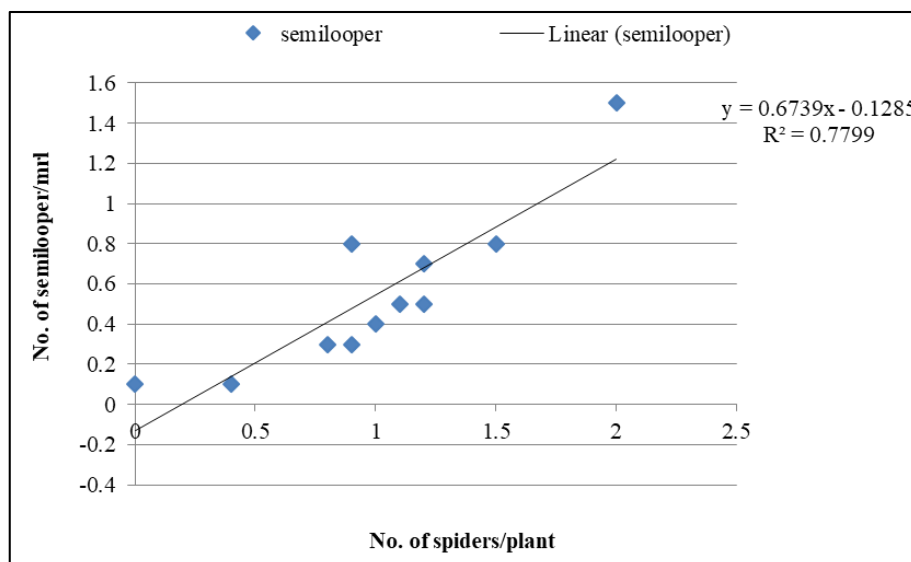

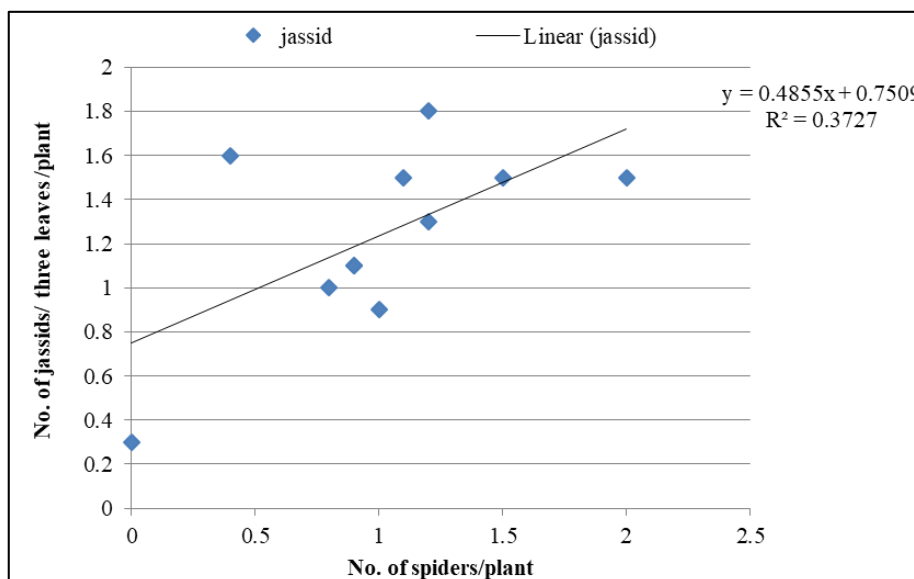**Fig 4:** Regression line between semilooper and spider

Fig 5: Regression line between jassid and spiders

Conclusion

During the course of the investigation, the following insect pests were observed in the soybean crop: stemfly, *M. sojae*; girdle beetle, *O. brevis*; tobacco caterpillar, *S. litura*; green semilooper, *C. acuta*; and sucking pests, *viz.,* whitefly, *B. tabaci*; thrips, *T. tabaci*; and jassids, *A. maculosa*. Some predatory insects, *viz.*, spiders *Oxyopes* sp and *Neoscona* sp. and predatory bugs *E. Furcellata* were also recorded. These insects were active throughout the different stages of the crop from the last week of July to last September.

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