Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(4): 1237-1240

Received: 21-05-2018
Accepted: 23-06-2018

Parul Suyal
M.Sc. Scholar, Department of Entomology, GBPUA & T, Pantnagar, Uttarakhand, India

Neeta Gaur
Assistant Professor, Department of Entomology, GBPUA & T, Pantnagar, Uttarakhand, India

Rukesh Pramod KN
Ph.D. Scholars, Department of Entomology, GBPUA & T, Pantnagar, Uttarakhand, India

Ashish Devrani
Ph.D. Scholars, Department of Entomology, GBPUA & T, Pantnagar, Uttarakhand, India

Correspondence
Parul Suyal
M.Sc. Scholar, Department of Entomology, GBPUA & T, Pantnagar, Uttarakhand, India

Seasonal incidence of insect pests and their natural enemies on soybean crop

Parul Suyal, Neeta Gaur, Rukesh Pramod KN and Ashish Devrani

Abstract
Investigation was carried out during Kharif, 2017 at GB Pant University of Agriculture & Technology, Pantnagar, India to study seasonal incidence of insect pests and their natural enemies on soybean crop. The density of defoliators *i.e. Spodoptera litura* and *Spilosoma obliqua* increased gradually to a peak of 12.5 and 3.9 larva/meter row length during the last week of August and *Thysanoplusia orichalcea* with 6.1 larva/mrl during first week of September and exhibit positive correlation with maximum temperature and RH%. The peak density of sucking pest (*Bemisia tabaci* and *Aphis gossypii*) was observed during mid of August and exhibit positive correlation with maximum temperature, RH% and evaporation. Stem fly infestation persisted till maturity of the crop. Natural enemies *i.e. Coccinella septumpunctata* and *Eocanthecona furcellata* occurred during third week of August. Results revealed that temperature, relative humidity and evaporation act as limiting factor for population buildup of insect pests in soybean ecosystem.

Keywords: Seasonal incidence, soybean, defoliators, sucking pest, natural enemies, weather parameters

1. Introduction
Soybean [*Glycine max* (L.) Merrill] is among the major oilseed crop around the world. Almost every parts of soybean plants are used for various purposes especially in livestock and poultry feeds [10]. Because of its multi-dimensional uses it is known as "*Golden Bean*" or "*Miracle bean*". It is well established fact that soybean is cheap source of high quality protein and edible oil and these characteristics have made soybean to fit well in sustainable agriculture [7]. Researchers have confirmed that seed yield and quality are being adversely affected by attack of major insect pests *viz*., tobacco caterpillar, Bihar hairy caterpillar, green semilooper, girdle beetle, stemfly, white fly and aphids. Population density of insect pests and their natural enemies fluctuates with changing weather conditions. Abiotic factors regulate seasonal incidence, population count and development rates of the pests and natural enemies. As the cultivation of soybean have expanded around the world, crop become susceptible to different environmental and biotic stress which has increased the pest infestations. Among these temperature and relative humidity play key role that regulates population dynamics, development rates and seasonal incidence of pest and their natural enemies. Such information is essential in developing integrated pest management systems with ecological and economical balance. With this aim the experiment was carried out to study the incidence of insect pest on soybean and their natural enemies and their correlation with the weather parameters.

2. Materials and Methods
The field experiment was carried out at Norman E. Borlaug Crop Research Centre, Pantnagar, India during *kharif*, 2017. The observation was recorded at 7 days of interval.
Observations on defoliators and natural enemies was made at three randomly selected spots of one meter row length in each plot. Sucking pest population was recorded from randomly selected ten plants from one meter row length area. From each plant, insect count was recorded from top three leaves, two middle and two lower leaves. To record the stem fly infestation, ten plants were randomly uprooted from each plot. Selected plants were split opened by knife and tunnels length made by maggots were measured with scale. Tunneling percent and infestation percent was calculated on the basis of average tunnel length and plant height. Girdle beetle infestation was recorded at five random spots of one meter row length. The numbers of infested plants were counted from total number of plants present in a meter row length and percent infestation was calculated.

Tunneling and infestation percent calculated via given formula [4].

$$\text{Tunneling \%} = \frac{\text{Length of tunnel}}{\text{Length of total stem}} \times 100$$

$$\text{Infestation \%} = \frac{\text{No. of plants infested}}{\text{Total no. of uprooted plants}} \times 100$$

Results and Discussion

The observations on seasonal incidence of insect-pests and natural enemies on soybean were recorded at Pantnagar from 30th standard mean week (last week of July) onwards till 43rd standard mean weeks (last week of October). The peak activity of defoliators *i.e. S. litura* and *S. obliqua* were noticed after second fortnight of August with larval population of 12.5 and 3.9 larva/mrl, respectively. Whereas, peak incidence of *T. orichalcea* was noticed during first week of September with larval population of 6.1 larva/mrl. Peak incidence of sucking pest *i.e. B. tabaci* and *A. gossypii* were observed during third and fourth week of August with mean population of 8.2 and 21.5, respectively. Peak incidence of *O. brevis* was observed during last week of September with infestation of 5.7 infested plant/mrl. Seasonal incidence of *M. sojae* was noticed from first week of August and persisted till maturity (Table 1).

Correlation studies as given in Table 2 revealed that all defoliators showed positive correlation with maximum temperature, relative humidity and evaporation. Population of *T. orichalcea* showed significant positive correlation with evaporation with r value 0.637 and regression equation y= 0.1634x + 3.1361, R^2= 0.4064 (Fig. 1). *B. tabaci* population showed positive correlation with all the weather parameters except the sunshine hours, which showed a negative correlation. *B. tabaci* significant positive correlation with evaporation with r value 0.638 and regression equation y= 0.185x + 2.84, R^2= 0.41 (Fig. 2). Aphid population showed positive correlation with the maximum temperature, evening R.H., wind velocity and evaporation and negative correlation with the minimum temperature, morning RH, rainfall and sunshine hours.

Incidence of soybean stem fly showed that stem tunneling was significantly positively correlated with sunshine hours with r value 0.738 and regression equation y= 0.0702x + (-0.001), R^2= 0.5449 (Fig. 3). Also, the stem tunneling was significantly negatively correlated with maximum RH%, rainfall and wind velocity with r value -0.599, -0.690 and 0.767, respectively with regression equation y= -0.3095x + 91.885, R^2= 0.359 and y= -2.2696x + 258.62, R^2= 0.4766 and y= -0.0519x + 8.3344, R^2= 0.5887, respectively (Fig. 4). Girdle beetle infestation showed non-significant positive correlation with maximum and minimum temperatures, morning R.H., rainfall, sunshine hours and evaporation. But evening R.H. and wind velocity were negatively correlated with infestation percent. Natural enemies, (Table 3) *C. septempunctata* showed positive correlation with temperature and evening R.H. and negative correlation with other parameters. *E. furcellata* showed negative correlation with minimum temperature, rainfall and wind velocity and positive correlation with other parameters. Regression values indicate that fluctuation in pest population is governed by weather parameters.

The present findings are in close conformity with the findings of Netam *et al*. 2013b who reported that the peak activity of lepidopteron pest during last week of August and also reported that infestation of the pest was positively correlated with maximum temperature and evening relative humidity [8]. Ahirwar *et al*. (2015) found that *S. litura* showed positive correlation with maximum and minimum temperature, evening relative humidity and rainfall [1]. Yeotikar *et al*. (2015) found that population of *T. orichalea* showed significant positive correlation with wind velocity [12].

Table 1: Seasonal incidence of insect pests and natural enemies on soybean variety JS-335 during *kharif*, 2017

Month	SMW	Infestation %	No. of larvae/ mrl			Mean population/plant		Infested plant/ mrl	No. of predators/ (mrl)	
		M. sojae	*S. oblique*	*S. litura*	*T. orichalcea*	*B. tabaci*	*A. gossypii*	*O. brevis*	*E. furcellata*	*C. septumpunctata*
July	30	0	0	0	0	0	0	0	0	0
Aug.	31	30	0	0	0	1.2	0.7	0	0	0
	32	50	1.3	0.3	0	6.2	2.7	0	0	0
	33	60	0	1.7	0.7	8.2	9.2	0	1.2	0.6
	34	90	3.9	0.6	4.4	4.2	21.5	0.5	1.8	1.7
	35	100	0	12.5	4.2	3.6	17.2	2	1.4	0.9
Sept.	36	100	0	10.7	6.1	7.1	7.7	3.6	3.8	1
	37	80	0	8.8	3.9	3.4	1.1	4	2.1	1.2
	38	90	0	7	2.4	4.2	0.5	2.3	1.7	1.1
	39	100	0.4	3.7	1.6	3.1	0	5.7	1.7	0.8
Oct.	40	90	0	1.4	0	2.4	0	4.2	1.9	2.9
	41	100	0	0.3	0.3	2.2	0	0	1.7	1
	42	100	0	0	0.5	4.6	0	0	1.2	0.8
	43	100	0	0	0	1	0	0	0	0.8

SMW=standard meteorological week, **mrl**=meter row length

Table 2: Correlation between seasonal incidences of insect pests with weather parameters

Insect-pest	Temperature (ºC)		Relative Humidity (%)		Sunshine (Hrs)	Wind velocity (Km/hr)	Rainfall (mm)	Evaporation (mm)
	Mini.	Maxi	Mini.	Maxi.				
S. litura	-0.101	0.165	0.223	0.202	0.327	-0.091	0.170	0.177
S. obliqua	-0.420	0.405	-0.254	0.523	-0.200	0.226	-0.097	0.010
T. orichalcea	-0.541	0.509	0.300	0.568	0.041	0.250	0.280	0.637 *
B. tabaci	0.141	0.413	0.442	0.293	-0.209	0.357	0.232	0.638 *
A. gossypii	-0.226	0.420	-0.211	0.124	-0.237	0.281	-0.290	0.460
M. sojae	0.253	-0.512	-0.498	-0.599*	-0.690**	0.738**	0.767**	-0.530
O. brevis	0.448	0.160	0.002	-0.134	0.688	-0.147	0.169	0.626

Table 3: Correlation between seasonal incidence of natural enemies with weather parameters

Natural enemies	Temperature (ºC)		Relative Humidity (%)		Sunshine (Hrs)	Wind velocity (Km/hr)	Rainfal l (mm)	Evaporation (mm)
	Mini.	Maxi.	Mini.	Maxi.				
C. septumpunctata	0.166	0.250	-0.011	0.109	-0.170	-0.233	-0.229	-0.379
E. furcellata	-0.218	0.190	0.081	0.038	0.258	-0.222	-0.129	0.235

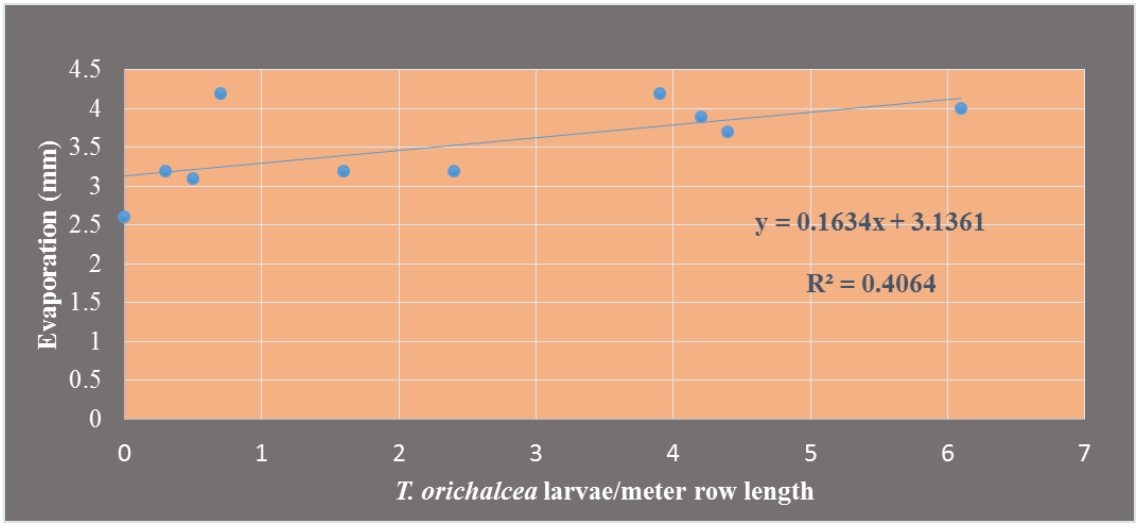

Fig 1: Regression of *T. orichalcea* larval population on Evaporation.

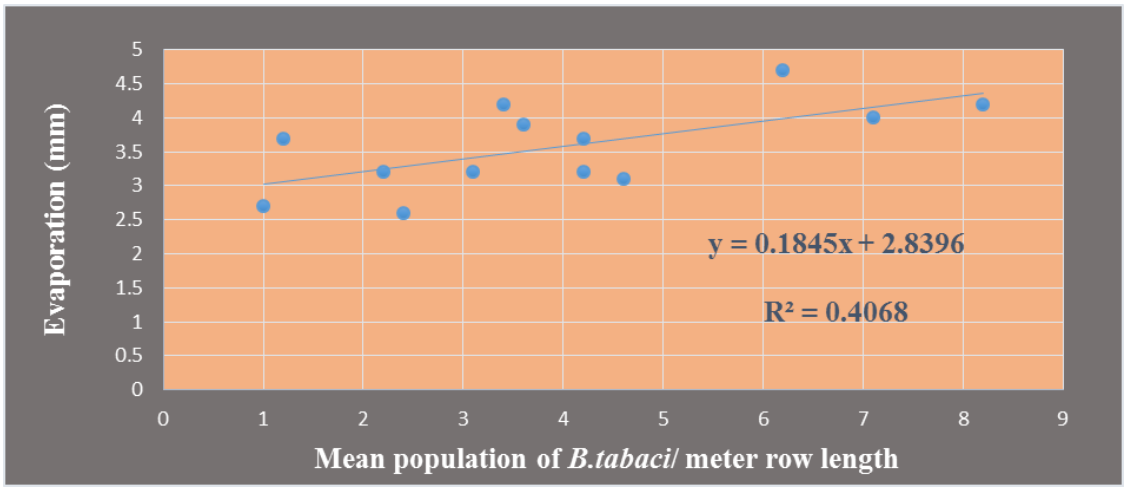

Fig 2: Regression of *B. tabaci* mean population on Evaporation.

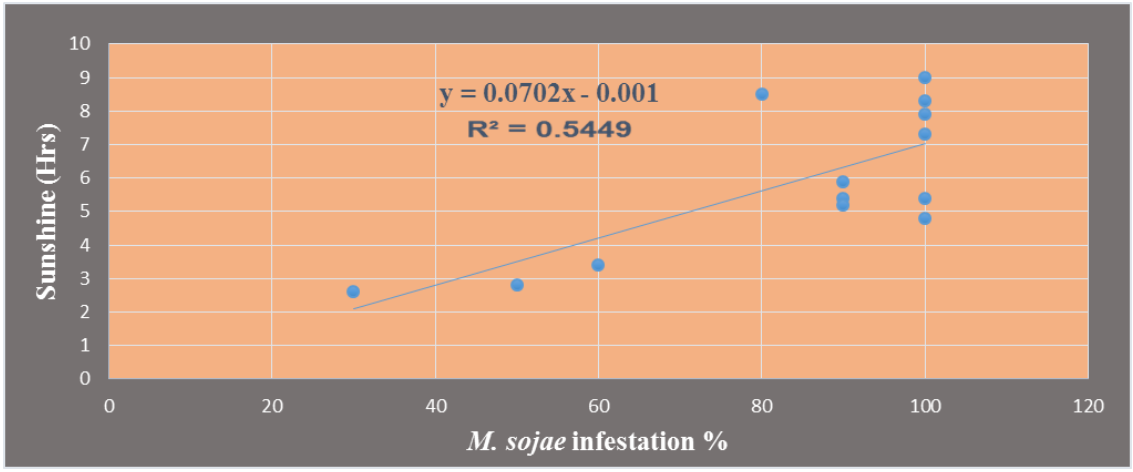

Fig 3: Regression of infestation percent of *M. sojae* on Sunshine.

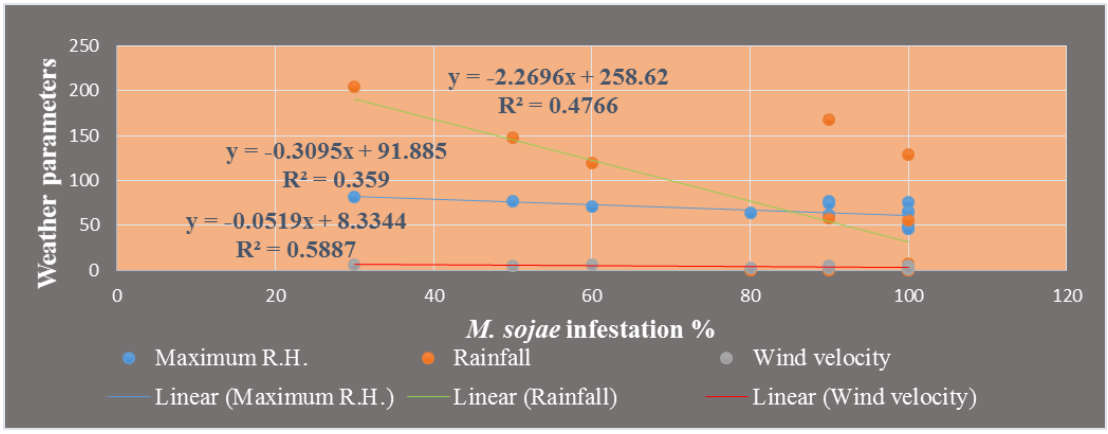

Fig 4: Regression of infestation percent of *M. sojae* on Rainfall, Wind velocity and Maximum R.H.

Marabi *et al*. (2017) reported that the temperature and evaporation were found to be significantly positively correlated with whitefly population during *kharif* season [10]. Mangang *et al*. (2017) reported similar findings at par with present results that evening R.H. showed positive correlation but morning R.H. and sunshine hours showed negative correlation, statistically non-significant with peak aphid infestation [5]. Jagrati *et al*. (2016) in their correlation studies revealed that sunshine hours showed significant positive correlation with stem tunneling [3]. Yadav *et al*. (2013) found that girdle beetle infestation was significantly positively correlated with maximum temperature but non- significantly negatively correlated with evening relative humidity [11]. Ahirwar *et al*. (2015) recorded the population of lady bird beetle on second week of August and population showed statistically non-significant positive correlation with temperatures, but negatively correlated with relative humidity which is in close conformity with the present findings [1]. Pillai and Agnihotri (2011) as they reported that the incidence of *E. furcellata* was positively correlated with maximum and minimum temperature and evening R.H [9]. Chakravarty *et al*. (2017) reported the predatory bug population was positively correlated maximum temperature and rainfall which partially support the present findings [2].

Conclusion

Studies on seasonal incidence of insect pests and their natural enemies of soybean crop provide basic information about seasonal occurrence of insect pest and their predators. Statistically significant correlation and regression values indicate that population of pests fluctuates with weather parameters. This provides an opportunity for the development of management strategies significant for the control of these pests. These results will support in devising the pest monitoring system and ecological sound integrated pest management modules.

References

1. Ahirwar R, Devi P, Gupta R. Influence of ambient weather on the incidence of major insect pests and their bioagents of soybean crop (*Glycine max* L. Merrill). International Journal of Plant Protection. 2015; 8(2):234-240.
2. Chakravarty S, Agnihotri M, Jagdish J. Seasonal abundance of predatory bugs, *Eocanthecona furcellata* (Wolff.) and *Rhynocoris fuscipes* (F.) and its olfactory responses towards plant and pest mediated semiochemical cues in Pigeonpea ecosystem. Legume Research: An International Journal. 2017; 40(2).
3. Jagrati U, Saxena AK, Shrivastava SK. Effect of Weather Parameters and Parasitoid on Population Build up of Stem Fly *Melanagromyza sojae* (Zehntner) on Soybean at Jabalpur. International Journal of Agriculture Sciences. 2016; 8(10):1122-1125.
4. Laxmigudi R, Gopali J, Hosamani A, Yelshetty S. Estimation of avoidable loss due to stem fly, *Ophiomyia phaseoli* (Tryon) and its management by using new molecules as seed dressers in greengram. Karnataka Journal of Agricultural Sciences. 2014; 27(1).
5. Mangang CNJS, Devi KN, Singh KL, Singh AD. Seasonal incidence of insect pests on soybean in relation to weather parameters. Legume Research-An International Journal. 2017; 40(6):1139-1140.
6. Marabi RS, Das SB, Bhowmick AK, Pachori RV, Sharma HL. Seasonal population dynamics of whitefly (*Bemisia tabaci* Gennadius) in soybean. Journal of Entomology and Zoology Studies. 2017; 5(2):169-173.
7. Netam HK, Gupta R, Soni S. Bioefficacy of Insecticides as Seed Treatment against Early Sucking Pests of Soybean Crop. International Journal of Science and Research. 2013a; 2(1):688-690.
8. Netam HK, Gupta R, Soni S. Seasonal Incidence of insect pests and their biocontrol agents on soybean. Journal of Agriculture and Veterinary Sciences. 2013b; 2(2): 07-11.
9. Pillai KA, Agnihotri M. Population dynamics of the predatory bug *Eocanthecona furcellata* (Wolff.). Indian Journal of Applied Entomology. 2011; 25:162-163.
10. Singh C. Modern techniques of raising field crops. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, 1983, 523.
11. Yadav SS, Nayaka MK, Srivastava AK, Gupta MP, Tomar DS. Population dynamics of insect defoliators of soybean and correlation with weather parameters. Annals of Plant Protection Science. 2013; 22(1):190-239.
12. Yeotikar SG, More DG, Chavan RD, Gaikwad BB. Correlation and regression between weather parameters and major insect pests of soybean. Journal of Entomological Research. 2015; 39(3):227-230