Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7406

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **7 (2):** 119-126 (2019)

Research Article

Seasonal Incidence of Lepidopteran Pod Borers Infesting Pigeon Pea

D. J. Bhadani[1*] and J. J. Patel[2]

[1]Ph.D. Scholar (Agril. Entomology), Department of Entomology, N. M. College of Agriculture, NAU, Navsari- 396 450, Gujarat (India)

[2]Associate Professor, Department of Entomology, College of Agriculture, NAU, Bharuch- 392 012, Gujarat

*Corresponding Author E-mail: dhavalbhadani8141@gmail.com

Received: 5.02.2019 | Revised: 8.03.2019 | Accepted: 13.03.2019

ABSTRACT

The larval population of H. armigera was recorded higher during 2nd week of November. The larval population of E. atomosa was higher during 4th week of November In case of L. boeticus, the higher population was noticed during 5th week of October. Bright sunshine hours, maximum temperature and evaporation were significantly positively correlated while, wind speed, rainfall and rainy days showed significant negative correlation with larval population of H. armigera. Maximum temperature and bright sunshine hours showed significant positive correlation with larval population of E. atomosa. The larval population of L. boeticus significantly positively correlated maximum temperature, bright sunshine hours and evaporation whereas, wind speed was significantly negatively correlated with larval population in average of two years results.

Key words: *Population, H. armigera, E. atomosa, L. boeticus, Correlation*

INTRODUCTION

Pigeon pea *(Cajanus cajan* (L.) Millspaugh) is one of the major pulse crops of the tropics and subtropics. It is the second most important pulse crop of India, after chickpea. It is commonly known as *arhar* in Hindi, *tuver* in Gujarati and popularly known as red gram in English. It is used as *dal* (split seed); green seeds are used as a vegetable. It is an agricultural crop of rainfed-drylands, which can be grown on mountain slopes to reduce soil erosion.

India has the largest acreage and production of pigeon pea. It is grown in an area of 5.00 m ha and production of 3.84 m tonnes in Asia with production shared by 82.1 per cent of global production. In India, the area grown under this crop is 4.65 m hectares with an annual production of 3.02 m tonnes leading to a productivity of 662 kg/ ha [1].

Pigeon pea is tasty, not only to people, but also to insect pests. A large number of insect pests (more than 300 species) are noticed to attack pigeon pea[2]. Insects that attack the reproductive structures of plant cause the maximum yield losses[3].

Cite this article: Bhadani, D.J. and Patel, J.J., Seasonal Incidence of Lepidopteran Pod Borers Infesting Pigeon Pea, *Int. J. Pure App. Biosci.* **7(2):** 119-126 (2019). doi: http://dx.doi.org/10.18782/2320-7051.7406

The most economical pests those attack at flowering and podding stage are pod borer, *Helicoverpa armigera* (Hubner) Hardwick; blue butterflies, *Lampides boeticus* L. and *Catochrysops strabo* (Fabricius); plume moth, *Exelastis atomosa* (Walsingham) and pod fly, *Melanagromyza obtusa* Malloch[4]. Pod borers cause huge annual losses, especially to the poorest farmers who cannot afford chemical control. Damage to pods due to the borer complex was reported to be 20 to 72 per cent[5]. The pod damage in long duration pigeon pea genotype was mostly accounted by pod bug and lepidopteron pod borer in the range of 16.0% to 19.0% and 4.0% to 7.66%, respectively. In Middle Gujarat, the pod damage due to *H. armigera* has been found to the tune of 39.20 per cent in BDN-2 variety of pigeon pea[6].

Of the various insect pests attacking pigeon pea, pod borer complex are considered the primary biotic constraints to pigeon pea production in South Gujarat. The pod borer complex shows vital fluctuations in pigeon pea under natural environmental situations. The information on influences of abiotic factors on population dynamics is very scanty under South Gujarat situations. Therefore, it is necessary to study the effect of abiotic factors on fluctuation in population of pod borer complex in pigeon pea. The information provides a base in the sound eco-based management programme.

MATERIAL AND METHODS

In order to study the population fluctuation of lepidopteran pod borers in pigeon pea under field conditions in relation to abiotic factors, a field experiment was conducted during *Kharif* 2017 and 2018.

2.1 Methods of recording observations

Pigeon pea (*cv*. Vaishali) were sown during 04.07.2017 and 27.06.2018 for the year 2017 and 2018, respectively and the crop were raised successfully by adopting recommended agronomical practices. The whole plot was kept without insecticide umbrella to allow pod borer to multiply throughout the season. For recording observations on larval population of pod borers (gram pod borer, plume moth and blue butterfly), the whole experimental plot was divided into five sectors and 10 plants were selected from each sector. The larval population of pod borers was counted from the same selected 10 plants from each sector at weekly interval commencing from bud initiation to removal of the crop.

2.2 Correlation study

In order to find out the specific impact of different weather parameters on pod borer complex of pigeon pea, the data on larval population recorded in the experimental plot of population fluctuation were correlated with the different meteorological parameters [bright sunshine hours (BSSH), rainfall (RF), rainy days (RD), maximum temperature (MaxT), minimum temperature (MinT), mean temperature (MeT), morning relative humidity (MoRH), evening relative humidity (EvRH), mean relative humidity (MeRH), morning vapour pressure (MoVP), evening vapour pressure (EvVP), mean vapour pressure (MeVP), wind speed (WS) and evaporation (EP)] recorded at standard meteorological weeks at Department of Meteorology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The correlation between different weather parameters and infestation of lepidopteran pod borers in pigeon pea was worked out by standard statistical procedure[7] at Department of Agricultural Statistics, N. M. College of Agriculture, Navsari Agricultural University, Navsari.

RESULTS AND DISCUSSION

3.1 *H. armigera*

The results presented in Table 1 and Fig. 1 revealed that larval population initiated (0.4 larvae/plant) during 38th SMW (Standard Meteorological Week) *i.e.* 4th week of September gradually increased and reached to the highest (6.2 larvae/plant) peak during 45th MW *i.e.* 2nd week of November during 2017-18. During 2018-19, larval population reached to first (5.2 larvae/plant) and second peak during 43rd SMW 5th week of October and 45th SMW *i.e.* 2nd week of November. In average results of two years, the larval population of *H.*

armigera initiated (0.2 larvae/plant) during 37th SMW *i.e.* 3rd week of September gradually increased and reached to the highest (6.0 larvae/plant) peak during 45th SMW *i.e.* 2nd week of November.

The egg laying by *H. armigera* on pigeon pea initiated from first week of November and continued till March. Maximum eggs were laid during January[8]. The activity on pod borer larvae was started from first week of October on pigeon pea and remained active throughout the crop season. The highest pod borer larval population was recorded during fourth week of November[9]. However, the maximum larval population of *H. armigera* at 16th and 18th week after sowing[10].

Correlation studies

The correlation data presented in Table 2 indicated that the larval population of *H. armigera* was significantly positively correlated with maximum temperature (r = 0. 442*), bright sunshine hours (r = 0.591**) and evaporation (r = 0.399*) during 2017-18. During 2018-19, larval population of *H. armigera* was significantly positively correlated with bright sunshine hours (r = 0.560**), maximum temperature (r = 0.758**) and evaporation (r = 0.586**) showed significant positively correlated with larval population whereas, rainfall (r = -0.399*), rainy days (r = -0.437*), evening relative humidity (r = -0.407*), mean relative humidity (r = -0.408*) and wind speed (r = -0.741**) was significantly negatively correlated with larval population. Bright sunshine hours (r = 0.651**), maximum temperature (r = 0. 644**) and evaporation (r = 0.573**) were significantly positively correlated while, wind speed (r = -0.614**), rainfall (r = -0.403*) and rainy days (r = -0.421*) showed significant negative correlation with larval population of *H. armigera* in average results of analysis.

Maximum and minimum temperature as well as maximum and minimum relative humidity did not influence the larval population of *H. armigera* on pigeon pea as the results were found non significant[11]. Maximum and minimum temperature, morning and evening relative humidity, morning and evening vapour pressure and wind speed showed non significant effect on larval population[12]. The population of *H. armigera* on pigeon pea exhibited a significant positive correlation with maximum temperature (r = 0.753**) and sunshine hours (r = 0.644*) whereas a significant negative correlation was found with average relative humidity (r = - 0.683*)[13]. Larval population of pod borer had positive significant correlation with mean temperature, while negative non significant correlation with relative humidity. Thus, above reports are more or less similar to the results of present findings[14].

3.2 *E. atomosa*

The larval population of *E. atomosa* appeared (1.4 larvae/plant) during 40th SMW *i.e.* 2nd week of October during 2017-18. Population increased up to first week of November (2.8 larvae/plant), and reached to the highest (4.6 larvae/plant) peak during 47th SMW *i.e.* 4th week of November. During 2018-19, larval population reached to the first peak (2.4 larvae/plant) during 44th SMW *i.e.* 1st week of November and the highest peak during 47th SMW *i.e.* 4th week of November. The larval population initiated (0.7 larvae/plant) during 40th SMW *i.e.* 2nd week of October gradually increased and reached to the highest (4.2 larvae/plant) peak during 47th SMW *i.e.* 4th week of November in results of average of two years. (Table 1 and Fig. 2)

The activity of *E. atomosa* from November when pod formation started, 43rd SMW (4th week of October), and remained till 4th SMW (4th week of January)[12,15]. which was totally unmatched with present findings might be due to experiment conducted at Anand in Gujarat have different climatic condition than south Gujarat condition and sowing period is also different for both the regions. Larval population during the entire period ranged from 0.4 to 5.5 larvae/5 plants. Whereas, the seasonal incidence of *E. atomosa* studied at Rajasthan and revealed that the plume moth (*E. atomosa*) 40th SMW on pigeon pea crop[14]. which gave close conformity to present findings.

Table 1: Population of lepidopteran pod borers in pigeon pea

Month and week		SMW	(Mean larvae/plant)								
			H. armigera			*E. atomosa*			*L. boeticus*		
			2017-18	2018-19	Ave.	2017-18	2018-19	Ave.	2017-18	2018-19	Ave.
August	III	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	IV	34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
September	I	35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	II	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	III	37	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	IV	38	0.4	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
October	I	39	1.8	2.2	2.0	0.0	0.0	0.0	0.0	0.2	0.1
	II	40	3.4	2.6	3.0	1.4	0.0	0.7	0.4	0.6	0.5
	III	41	2.6	2.8	2.7	0.5	0.5	0.5	0.8	1.4	1.1
	IV	42	4.5	3.6	4.1	0.8	1.4	1.1	2.4	2.6	2.5
	V	43	4.9	5.2	5.1	1.2	1.6	1.4	4.6	4.0	4.3
November	I	44	5.8	4.9	5.4	2.8	2.4	2.6	3.8	4.2	4.0
	II	45	6.2	5.8	6.0	1.3	1.6	1.5	2.8	3.6	3.2
	III	46	5.4	5.6	5.5	2.8	2.2	2.5	1.4	3.2	2.3
	IV	47	4.5	4.2	4.4	4.6	3.8	4.2	2.6	2.2	2.4
December	I	48	4.4	4.0	4.2	3.2	2.8	3.0	2.4	1.8	2.1
	II	49	1.5	3.2	2.4	0.8	1.4	1.1	0.0	0.6	0.3
	III	50	2.2	2.4	2.3	0.0	0.8	0.4	0.0	0.0	0.0
	IV	51	1.0	0.0	0.5	0.0	0.2	0.1	0.0	0.0	0.0
	V	52	1.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
January	I	1	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
	II	2	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0
	III	3	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	IV	4	0.1	1.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
	V	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean			**2.06**	**2.00**	**2.04**	**0.78**	**0.75**	**0.76**	**0.85**	**0.98**	**0.91**

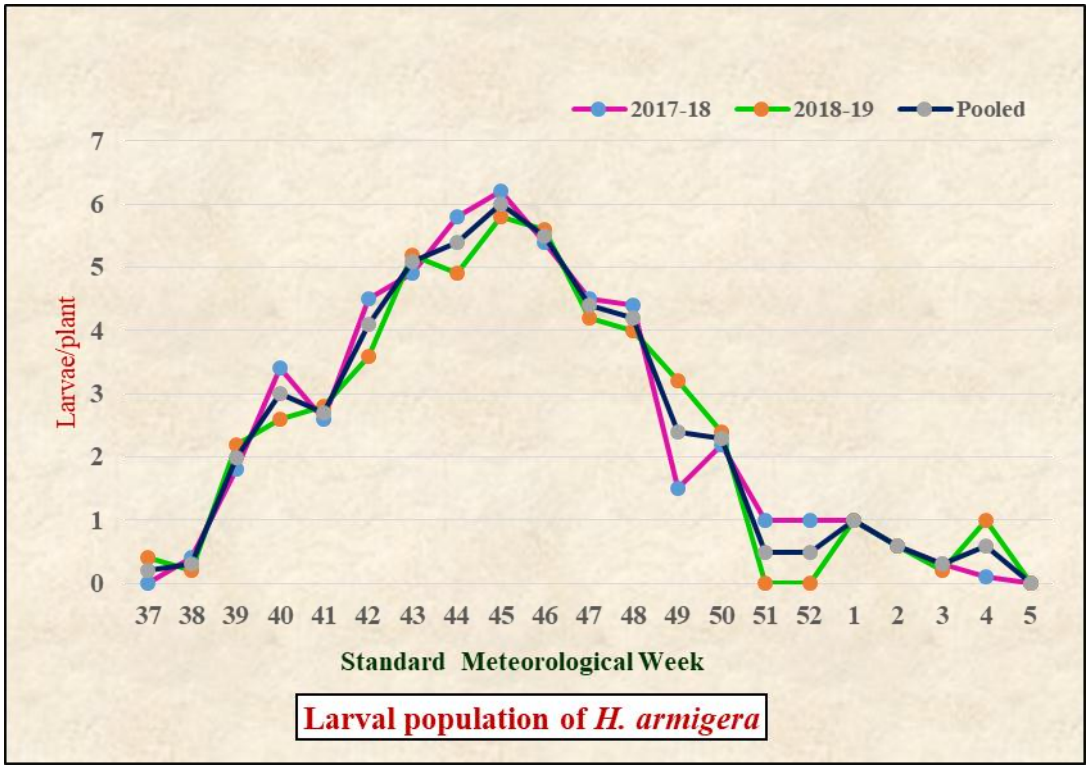

Fig. 1: Larval population of *H. armigera*

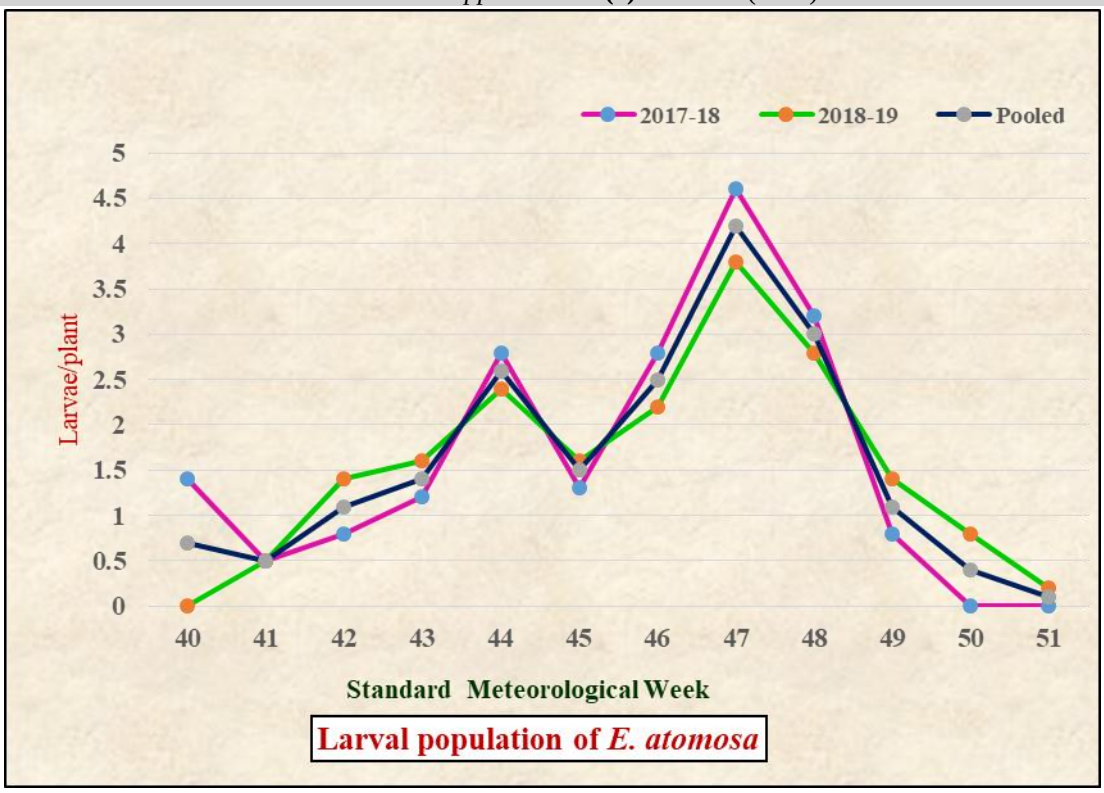

Fig. 2: Larval population of *E. atomosa*

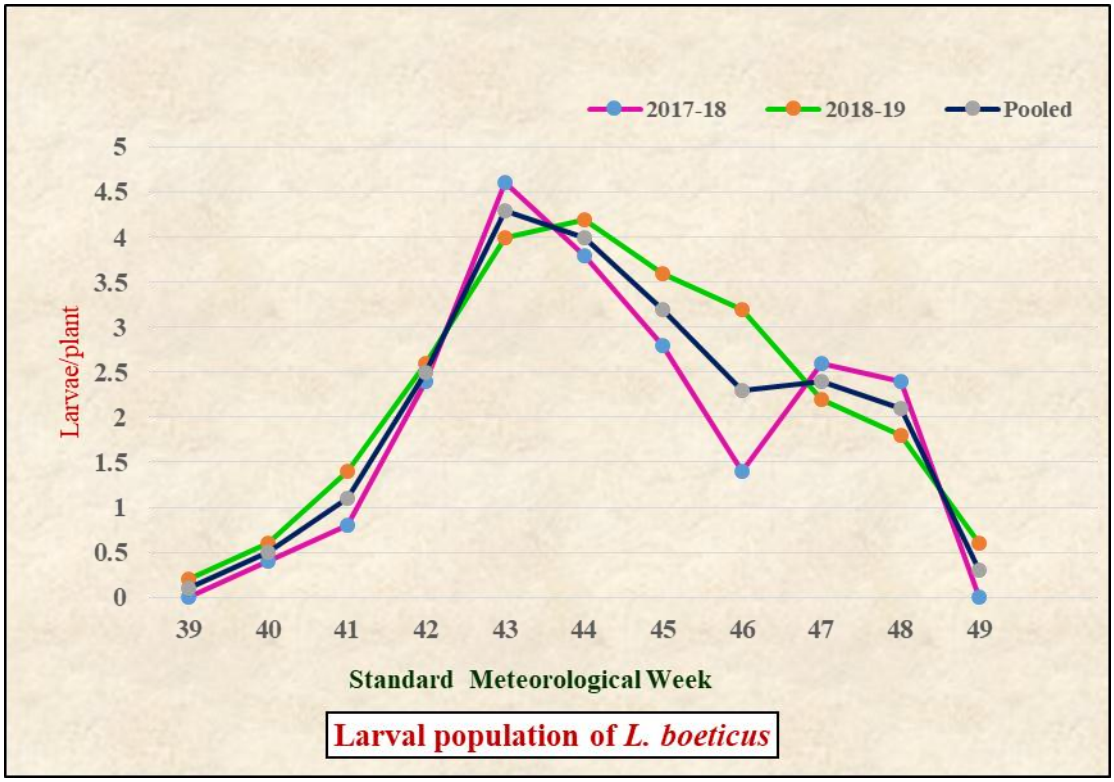

Fig. 3: Larval population of *L. boeticus*

Table 2: Relationship between weather parameters and larval population of lepidopteran pod borers infesting pigeon pea

Weather parameters	*H. armigera*			*E. atomosa*			*L. boeticus*		
	2017-18	2018-19	Average	2017-18	2018-19	Average	2017-18	2018-19	Average
MoRH	-0.039	-0.308	-0.131	-0.037	-0.257	-0.128	-0.039	-0.376	-0.172
EvRH	-0.328	-0.407*	-0.304	-0.316	-0.260	-0.269	-0.264	-0.263	-0.249
MeRH	-0.227	-0.408*	-0.263	-0.218	-0.284	-0.239	-0.186	-0.333	-0.241
MaxT	0.442*	0.758**	0.644**	0.333	0.548**	0.481*	0.410*	0.722**	0.612**
MinT	-0.056	-0.090	-0.047	-0.108	-0.142	-0.102	-0.013	-0.011	0.002
MeT	0.211	0.284	0.271	-0.120	0.146	0.157	0.219	0.327	0.290
MoVP	-0.149	-0.161	-0.129	-0.190	-0.223	-0.189	-0.109	-0.077	-0.083
EvVP	-0.149	0.266	0.029	-0.219	0.205	-0.060	-0.091	0.389	0.074
MeVP	-0.150	0.011	-0.055	-0.207	-0.054	-0.130	-0.100	0.117	-0.010
BSSH	0.591**	0.560**	0.651**	0.395*	0.367	0.425*	0.553**	0.518**	0.610**
RF (mm)	-0.332	-0.399*	-0.403*	-0.222	-0.279	-0.277	-0.224	-0.275	-0.277
RD	-0.360	-0.437*	-0.421*	-0.247	-0.306	-0.295	-0.248	-0.301	-0.288
WS (km/hrs)	-0.362	-0.741**	-0.614**	-0.239	-0.588**	-0.470*	-0.285	-0.628**	-0.502**
EP(mm/day)	0.399*	0.586**	0.573**	0.150	0.340	0.321	0.442*	0.469*	0.530**

* Significant at 5% level of significance ** Significant at 1% level of significance

Correlation studies

The larval population of *E. atomosa* showed significant positive correlation with bright sunshine hours (r = 0.395**) during 2017-18. Maximum temperature (r = 0. 548**) showed significantly positively correlated whereas, wind speed (r = -0.588**) was significantly negatively correlated with larval population of *E. atomosa* during 2018-19. In average results, maximum temperature (r = 0. 481*) and bright sunshine hours (r = 0.425**) showed significant positive correlation with larval population. However, wind speed (-0.470*) showed significant negative correlation with larval population. (Table 2)

Rainfall, maximum and average relative humidity as well as wind velocity had non significant negative correlation, while temperature, water evaporation and bright sunshine showed non significant positive correlation with the plume moth[5]. There were non significant effect minimum temperature, morning and evening relative humidity, morning and evening vapour pressure and wind speed on larval population of *E. atomosa* on pigeon pea[12]. There were negatively non significant correlation with morning relative humidity (r = 0.47) but wind velocity (r = - 0.25) and maximum temperature (r = - 0.25) with population of *E. atomosa*[16]. The population of *E. atomosa* exhibited a highly significant positive correlation with maximum temperature, whereas a highly significant negative relationship was found with average relative humidity. The other abiotic factors did not show any significant impact on incidence of the pest[17]. Study revealed that larval population of *E. atomosa* had negative non significant correlation with relative humidity[14]. Above all the reports made by various research workers are in close association with the results of present findings.

3.3 *L. boeticus*

The results of weekly larval population of *L. boeticus* in pigeon pea revealed that larval population of *L. boeticus* reached to the first as

well as highest (4.6 larvae/plant) peak during 43th SMW *i.e.* 5th week of October during 2017-18. The larval population reached to the highest (4.2 larvae/plant) peak during 44th SMW *i.e.* 1st week of November during 2018-19. The larval population reached to the highest (4.3 larvae/plant) peak during 43th SMW *i.e.* 5th week of October in results of average of two years. (Table 1 and Fig. 3)

The activity of *L. boeticus* in pigeon pea from October to December with its peak activity during end of November[15,18]. It was commenced from 42nd SMW (3rd week of October), which was gradually increased up to 48th SMW (4th week of November). Thus, larval population during the entire period ranged from 0.6 to 7.1 larvae/5 plants[12,14]. These all the reports are more or less similar to the results of present findings.

Correlation studies

The correlation data presented in Table 2 revealed that the larval population of *L. boeticus* significantly positively correlated with maximum temperature (r = 0. 410*), bright sunshine hours (r = 0.553**) and evaporation (r = 0.442*) during 2017-18. Maximum temperature (r = 0. 722**), bright sunshine hours (r = 0.518**) and evaporation (r = 0.469*) were significantly positively correlated whereas, wind speed (r = -0.628**) was significantly negatively correlated with larval population of *L. boeticus* during 2018-19. Maximum temperature (r = 0. 612**), bright sunshine hours (r = 0.610**) and evaporation (r = 0.530**) were significantly positively correlated whereas, wind speed (r = -0.502**) was significantly negatively correlated with larval population of *L. boeticus* in average results.

Evening and mean relative humidity as well as morning vapour pressure had significant negative correlation with this pest[9] while, sunshine hours had non significant positive correlation with the population of blue butterfly, while relative humidity and wind velocity had negative non significant relation with the population of this pest[15]. The activity of *L. boeticus* on pigeon pea crop showed non significant effects with weather parameters[12] whereas, larval population of pod borer had positive significant correlation with mean temperature, while negative non significant correlation with relative humidity. In present investigation also maximum temperature, bright sunshine hours, evaporation and wind speed were responsible for activity of *L. boeticus* population[14]. Thus, above reports are corroboration with the present findings.

REFERENCES

1. Anonymous., Faostat.fao.org/download/Q/QC/E. (2017).
2. Prasad, D. and Singh, A., Advances in Plant Protection Sciences. Akansha Publishing House, New Delhi. p. 421 (2004).
3. Rangaiah, P. V. and Sehgal, V. K., Insects on T-21 pigeon pea and losses caused by them at Pantnagar, Northern India. *Int. Pigeon pea Newsletter*. **3:** 40-43 (1984).
4. Reed, W., Lateef, S. S., Sithananthan, S. and Pawar, C. S., *Pigeon pea and chickpea Insect Identification Handbook. Information Bulletin no. 26.* International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India. p. 120 (1989).
5. Lateef, S. S. and Reed, W., Review of crop losses caused by insect pests of the pigeon pea internationally and in India. *Ind. J. Ent.* (Special issue), **2:** 284-291 (1983).
6. Patel, P. S. and Patel, J. R., Screening of pigeon pea germplasm to pod-borers and pod fly. *Legume Res.*, **13(2):** 91-94 (1990).
7. Steel, R. G. D. and Torrie, J. H., *Principle and procedures of statistics*. Second Edition, Megraw Hill Book Company, Inc., New York. (1980).
8. Borah, S. R., Seasonal population trend of eggs of *Helicoverpa armigera* Hubner in pigeon pea. *J. Agri. Sci. North East India*, **15(2):** 203-206 (2002).
9. Jha, A., Population Dynamics, Life Tables and Management of Pigeon pea Pod Borers. Ph. D. Thesis submitted to A.A.U., Anand, p. 141 (2003).

10. Pawar, R. B., Madandure, A. N., Jayewar, N. E. and Jangwad, N. P., Population dynamics and key mortality factors of *Helicoverpa armigera* on pigeon pea. *Crop Prot. Prod.*, **4(1):** 14-20 (2007).
11. Yadav, K., Screening of pigeon pea genotypes against important insect pests and their management. Thesis submitted to Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana. (2013).
12. Ghetiya, L. V., Population dynamics and management ofpod borer complex in pigeon pea, *Cajanus cajan* (L.) Millspaugh. Ph.D. Thesis submitted to Anand Agricultural University, Anand. (2010).
13. Keval, R., Khamoriya, J., Chakravarty, S. and Ganguly, S., Seasonal Incidence of Gram Pod Borer, *Helicoverpa armigera* (Hübner) and Tur Pod Fly, *Melanagromyza obtusa* (Malloch) on Late Maturing Pigeon pea in Varanasi Region of Indo-Gangetic Plain. *J. Exp. Agril. Int.*, **19(1):** 1-8 (2017).
14. Rathore, H. K., Vyas, A. K., Ahir, K. C., Saini, A. and Kumar, P., Population dynamics of major insect pests and their correlation with weather parameters in pigeon pea (*Cajanus cajan* Mill.). *The Bioscan*, **12(1):** 01-04 (2017).
15. Kumar, A. and Nath, P., Study the effect of meteorological factors on the population of insect pests infesting UPAS 120 cultivars of pigeon pea. *J. Maharashtra Agric. Uni*., **30(2):** 190-192 (2005).
16. Joshi, B., Seasonal incidence and screening of Germplasm against pod borer complex in Pigeon pea (*Cajanus cajan* L.). M.Sc. Thesis submitted to Indira Gandhi Krishi Vishwa Vidyalaya Raipur. (2014).
17. Rawat, R., Ram K., Ganguly, S. and Chakravarty, S., Seasonal incidence of plume moth, *Exelastis atomosa* (Lepidoptera: Pterophoridae) on long duration pigeon pea, *Cajanus cajan. Flora and fauna.* **23(2):** 445-452 (2017).
18. Kumar, A. and Nath, P., Pest complex and their population dynamics on an early variety of pigeon pea UPAS-120 at Varanasi. *Indian J. Ent*., **64(4):** 453-460 (2003).