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Seasonal incidence of insect pests on field pea in relation to some abiotic factors in lower Gangetic plains of West Bengal

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ABSTRACT

The field experiment was laid out in the 'A-B' Block Farm of Bidhan Chandra Krishi Viswavidyalaya during rabi season of two consecutive years (2016-17 and 2017-18) to determine the seasonal incidence of insect pests on two varieties of field pea viz. Rachna and HUDP 15 in lower Gangetic plains on West Bengal as well as to find out the impact of weather parameters on their incidence pattern. The experiment concludes four species of insects viz. gram pod borer, pulse aphid, flower thrips and hairy caterpillar causing noticeable damage and four other insect pest species were also recorded having minor importance. Peak larval population of gram pod borer was recorded at 9 weeks after sowing (WAS). Peak populations of flower thrips and pulse aphid were recorded at 11 WAS and hairy caterpillar reached its peak at 5 WAS. Gram pod borer population was non-significantly correlated with all the weather parameters in both the years of study irrespective of crop variety except it showed significant and positive correlation with wind speed in Rachna variety during first year only. Flower thrips population was significantly and positively correlated with maximum temperature and wind speed in both the varieties, however, only in case of HUDP 15, the correlation with minimum humidity was significant and negative during first year. However, the thrips population was significantly and negatively correlated with maximum humidity in both the varieties in second year. All the weather parameters showed non-significant correlation with aphid population in both varieties in two years besides a significant and positive association with wind speed during first year only. During 1st year, both the humidity was significantly and positively correlated with the hairy caterpillar population and bright sunshine hour was significantly and negatively correlated with the pest population in both varieties. Maximum temperature showed significant and negative correlation with the pest population in field pea var. HUDP 15 only. However, both the temperatures were significantly and negatively correlated with the hairy caterpillar population in field pea var. HUDP 15 only during 2nd year of experimentation.

Keywords: Abiotic factors, field pea, insect pests, *Pisum sativum,*seasonal incidence

Field pea [*Pisum sativum* Linn.] is one of the most popular pulse crops and has various uses for human consumption. The protein content in this crop is 19 to 27%. It has high caloric value and is a great source of ascorbic acid. The cooked 100 gm green pea contains, 74% moisture, 7% protein, 18 g carbohydrates, 22 mg calcium, 122 mg phosphorus and 2 mg Iron with vitamin A and vitamin C. In addition to its food value it has proved to be an excellent source of fodder and the vines used in silage making in off season. The nitrogen fixing capacity of this crop restores soil fertility (Singh *et al.*, 2002). India produced 0.74 million tonnes of field pea from an area of 0.90 million ha with productivity of 821 kg ha^{-1} during 2015-16 (Anon., 2017). It is cultivated mostly in Uttar Pradesh, Madhya Pradesh, Jharkhand, Maharashtra, Rajasthan, Bihar, Assam and Chhattisgarh in India. The major reasons for its low yield are cultivation on marginal land and imbalanced fertilizer application and attack of diseases and insect pests (Zohary and Maria, 2000). Peas are infested by a number of insect pests throughout its vegetative and production phases. The knowledge on the nature of incidence pattern of pests of crops in a locality is the primary requisite for a well developed pest management system. A number of works has so far been carried out on some bio-ecological aspects of insect pests of field pea in different parts of the country as well as in other countries (Dhamdhere *et al.*, 1970; Prasad *et al.,* 1983; Sorensen *et al.*, 2000; Kushwaha, 2002; Shantibala and Singh, 2003 etc.). However, no such report is available from West Bengal especially the incidences of different insect pests on field pea particularly on relativity newer and widely cultivated popular varieties and hence the present investigation was undertaken to determine the seasonal activity of insect pests on two popular varieties of field pea during *rabi* season and to find out the correlation between the weather parameters and the incidence pattern of the insect pests recorded on field pea in lower Gangetic plains on West Bengal.

MATERIALS AND METHODS

To study the 'seasonal incidence of insect pests on field pea in relation to some abiotic factors in lower

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Gangetic plains of West Bengal' an experiment was laid out in the 'A-B' Block farm of Bidhan Chandra Krishi Viswavidyalaya situated at Kalyani, Nadia, West Bengal during *rabi* season of two consecutive years (2016-17 and 2017-18). Seeds of field pea (Variety: Rachna and HUDP-15) were sown in two plots for each variety having plot size 10 x 10 m. Spacing of row to row and plant to plant was 30 and 10 cm, respectively and width of irrigation channel was 50 cm. For counting natural incidence of insect pests on these crops, simple observations were done without using any chemical pesticides. Five plants were randomly chosen as sample plants from each plot and were marked. The observation was taken during morning hours at weekly intervals. In case of aphids, total number of adults and nymphs were counted from top 5 cm twig of sampled plants, however, in case of flower thrips, total number of adults were counted from 10 flowers of sampled plants. Total number of larvae is counted from each sampled plant for pod borer and caterpillar. First observation was taken at 21days after sowing (DAS) and continued up to harvest of the crop resulting in twelve numbers of observations on the whole.The mean population was worked out in each case.Afterwards the pest population was correlated with weekly mean of six meteorological parameters taken into consideration *viz*. maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, wind speed, and bright sunshine hour. Rainfall, though an important weather parameter, was excluded because very less amount of rainfall has been recorded during the period of observation in both the years of experimentation. The meteorological records were collected from AICRP on Agrometeorology, Directorate of Research, BCKV.

RESULTS AND DISCUSSION

Enumeration of insect pests recorded on field pea

The investigation recorded three insect species on field pea causing noticeable damage viz. gram pod borer [*Helicoverpa armigera* Hubn. (Lepidoptera: Noctuidae)], pulse aphid [*Aphis craccivora* Koch (Hemiptera: Aphididae)], flower thrips [*Megalurothrips usitatus* Bagnall (Thysanoptera: Thripidae)] and hairy caterpillar [*Spilosoma (=Spilarctia) obliqua* Walker (Lepidoptera: Arctiidae)]. Four other insect pest species were also recorded on field pea having minor importance. They were whitefly [*Bemicia tabaci* Genn. (Aleyrodidae: Hemiptera)], blue butterfly [*Catochrysops strabo* Fab. (Lepidoptera: Lycaenidae)], pea aphid [*Acyrthosiphon pisum* Harris (Hemiptera: Aphididae)] and pea leaf miner [*Chromatomyia horticola* Goureau (Diptera: Agromyzidae). Shantibala and Singh (2003) recorded 19 species of insect pests from pea crop in Manipur including *Acrythosiphon pisum, Aphis craccivora, Bemisia tabaci, Spilarctia obliqua, Helicoverpa armigera, Phytomyza horticola*. They recorded blue butterfly and flower thrips also but the species were different (*Lampides boeticus* and *Megalurothrips distalis*). Mittal and Ujagir (2007) from Pantnagar, Uttaranchal, India recorded another species of blue butterfly *i.e*. *Euchrysops cnejus* as major pests of pea crop.

Seasonal incidence of insect pests recorded on field pea

Gram pod borer: Gram pod borer population has been recorded on field pea from 11.01.17 to 08.03.17 in Rachna whereas it was recorded up to 22.02.17 in HUDP 15 during 2016-17 (Table 1). Peak larval population was recorded at 9 weeks after sowing (WAS) *i.e*. on 01.02.17 (7.2/ plant in Rachna and 4.8/ plant in HUDP 15). However, during 2017-18 the pest population has been recorded from 13.01.18 to 10.03.18 in both the varieties and the peak population was recorded at 9 WAS *i.e*. on 03.02.18 (8.6/ plant in Rachna and 6.6/ plant in HUDP 15) (Table 2).The present findings showed the peak activity of gram pod borer during first week of February in both years of experimentation. Dubey *et al*. (1993) also observed the peak activity of *Helicoverpa armigera* in February to March on pea. However, Prasad (1997) obtained maximum adult catches of *Helicoverpa armigera* in late March.

Flower thrips: During first year of experimentation, flower thrips population has been recorded on field pea from 25.01.17 to 08.03.17 in HUDP 15, but the pest initiated its incidence from 01.02.17 in variety Rachna (Table 1). Peak population was recorded at 11 WAS *i.e*. on 15.02.17 (23.4/ 10 flowers in Rachna and 27.0/ 10 flowers in HUDP 15). During second year, thrips population has been recorded from 20.01.18 to 10.03.18 in both the varieties (Table 2). Peak population of thrips was recorded at 11 WAS *i.e*. on 17.02.18 (16.4/ 10 flowers in Rachna and 19.2/ 10 flowers in HUDP 15).The present study reported the maximum incidence of flower thrips during middle of February in both the years. However, Chakraborty and Dutta (1999) observed the peak incidence of flower thrips during middle to end of January on pea in Assam, but they recorded a different species of flower thrips *viz*. *Megalurothrips distalis*.

Pulse aphid: Pulse aphid population during 2016-17 has been recorded on field pea from 18.01.17 to 01.03.17 in HUDP 15, however, the pest was recorded in Rachna from 25.01.17 up to 15.02.17 (Table 1). Peak population of both adults and nymphs of aphid was recorded in both the varieties at 11 WAS *i.e*. on 15.02.17 (15.0/ top 5 cm twig in Rachna and 21.8/ top 5 cm twig

Table 1: Mean population of insect pests recorded on two test varieties of field pea during 2016-17

Date of observation	Population of *Helicoverpa armigera* (larvae/ plant)		Population of *Megalurothrips usitatus* (adults/ 10 flowers)		Population of *Aphis craccivora* (adults + nymphs/ top 5 cm twig)		Population of *Spilosoma obliqua* (larvae/ plant)	
	Rachna	HUDP 15	Rachna	HUDP 15	Rachna	HUDP 15	Rachna	HUDP 15
21.12.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
28.12.16	0.0	0.0	0.0	0.0	0.0	0.0	6.4	8.0
04.01.17	0.0	0.0	0.0	0.0	0.0	0.0	8.2	12.6
11.01.17	0.4	0.2	0.0	0.0	0.0	0.0	1.2	6.2
18.01.17	1.6	1.0	0.0	0.0	0.0	2.4	0.0	0.0
25.01.17	3.8	2.4	0.0	1.8	1.6	8.8	0.0	0.0
01.02.17	7.2	4.8	1.2	5.6	7.4	11.6	0.0	0.0
08.02.17	6.4	3.2	15.8	19.8	13.8	17.8	0.0	0.0
15.02.17	5.8	1.6	23.4	27.0	15.0	21.8	0.0	0.0
22.02.17	2.2	0.4	12.4	13.6	0.0	1.6	0.0	0.0
01.03.17	1.4	0.0	9.8	11.8	0.0	0.4	0.0	0.0
08.03.17	0.8	0.0	5.2	8.6	0.0	0.0	0.0	0.0
Correlation with meteorological parameters (Correlation coefficient values)								
Tmax	0.156	-0.089	0.582*	0.622*	0.130	0.099	-0.363	-0.515*
Tmin	-0.085	-0.302	0.460	0.472	-0.022	-0.121	-0.026	-0.157
RH-I	-0.467	-0.358	-0.356	-0.390	-0.207	-0.309	0.627*	0.754*
RH-II	-0.415	-0.223	-0.501	-0.521*	-0.283	-0.384	0.849*	0.882*
WS	0.551*	0.191	0.960*	0.943*	0.818*	0.777*	-0.297	-0.390
BSH	0.328	0.345	0.039	0.126	0.068	0.143	-0.742*	-0.672*

* Significant at 5% level

Table 2: Mean population of insect pests recorded on two test varieties of field pea during 2017-18

Date of observation	Population of *Helicoverpa armigera* (larvae/ plant)		Population of *Megalurothrips usitatus* (adults/ 10 flowers)		Population of *Aphis craccivora* (adults + nymphs/ top 5 cm twig)		Population of *Spilosoma obliqua* (larvae/ plant)	
	Rachna	HUDP 15	Rachna	HUDP 15	Rachna	HUDP 15	Rachna	HUDP 15
23.12.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.12.17	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.8
06.01.18	0.0	0.0	0.0	0.0	0.0	0.0	7.4	14.6
13.01.18	0.6	0.2	0.0	0.0	0.0	0.0	3.2	10.8
20.01.18	1.8	1.0	0.2	0.6	0.0	0.0	0.0	3.0
27.01.18	4.8	3.2	1.2	2.0	1.8	2.6	0.0	0.0
03.02.18	8.6	6.6	5.8	7.2	3.2	5.4	0.0	0.0
10.02.18	5.2	4.8	11.8	15.4	9.4	12.0	0.0	0.0
17.02.18	3.0	2.4	16.4	19.2	16.8	25.4	0.0	0.0
24.02.18	1.8	1.4	4.8	6.0	2.2	11.6	0.0	0.0
03.03.18	1.2	0.6	3.2	3.8	1.2	8.4	0.0	0.0
10.03.18	0.4	0.2	2.4	3.0	0.0	2.8	0.0	0.0
Correlation with meteorological parameters (Correlation coefficient values)								
Tmax	0.067	0.091	0.383	0.385	0.213	0.476	-0.449	-0.565*
Tmin	-0.201	-0.150	0.294	0.287	0.162	0.388	-0.409	-0.551*
RH-I	-0.416	-0.406	-0.517*	-0.516*	-0.430	-0.497	0.344	0.339
RH-II	-0.314	-0.279	-0.345	-0.344	-0.215	-0.389	0.389	0.375
WS	-0.247	-0.269	-0.064	-0.097	-0.090	-0.014	0.091	0.036
BSH	0.078	0.047	0.049	0.034	0.065	0.045	-0.003	-0.112

* Significant at 5% level

in HUDP 15). However, during 2017-18 the pest has been recorded from 27.01.18 to 10.03.18 in HUDP 15, but in Rachna up to 03.03.18 (Table 2). Peak population was recorded in both the varieties at 11 WAS *i.e*. on 17.02.18 (16.8/ top 5 cm twig in Rachna and 25.4/ top 5 cm twig in HUDP 15).

Hairy caterpillar : This pest has been recorded in first year from 21.12.16 to 11.01.17 in HUDP 15, however, it was recorded from 28.12.16 in case of Rachna (Table 1). The pest reached its peak on 04.01.17 *i.e*. at 5 WAS in both the varieties (8.2/ plant in Rachna and 12.6/ plant in HUDP 15). During 2nd year, it has been recorded from 30.12.17 to 20.01.18 in HUDP 15, however, the pest was recorded up to 13.01.18 in case of Rachna (Table 2). Hairy caterpillar was recorded maximum on 06.01.18 *i.e*. at 5 WAS in both the varieties (7.4/ plant in Rachna and 14.6/ plant in HUDP 15).

Impact of abiotic factors on the incidence of insect pests recorded on field pea

From Table 1 it can be said that gram pod borer population was significantly and positively correlated with wind speed in Rachna variety of field pea, however, the correlation was positive but non-significant in HUDP 15 during 2016-17. Minimum temperature and both the humidity showed negative non-significant correlation in both the varieties. Bright sunshine hour showed non-significant positive correlation in both the varieties. But, maximum temperature showed non-significant positive correlation in Rachna and negative correlation in HUDP 15. However, during second year of experimentation, gram pod borer population was non-significantly correlated with all the weather parameters irrespective of variety (Table 2). Here, maximum temperature and bright sunshine hour showed positive correlation with the pest population and minimum temperature, both the humidity as well as wind speed showed negative correlation in both the varieties.

Flower thrips population was significantly and positively correlated with maximum temperature and wind speed in both the varieties during 1st year, however, only in case of HUDP 15, the correlation with minimum humidity was significant and negative (Table 1). Minimum temperature and bright sunshine hour showed non-significant positive correlation with pest population in both the varieties, whereas, maximum humidity showed non-significant negative correlation with the pest population in both varieties. During 2nd year, thrips population was significantly and negatively correlated with maximum humidity in both the varieties (Table 2). Both temperatures and bright sunshine hour showed non-significant positive correlation with pest population in both the varieties, whereas, minimum humidity and wind speed showed non-significant negative correlation with the pest population in both varieties.

Among all the weather parameters, only wind speed showed significant and positive correlation with pulse aphid population in both varieties during first year of study (Table 1). Minimum temperature and both the humidity showed non-significant negative correlation with the pest population and maximum temperature as well as bright sunshine hour showed non-significant positive correlation with the pest population in both the varieties. However, during second year, all the weather parameters showed non-significant correlation with aphid population in both varieties (Table 2). Both temperatures and bright sunshine hour showed positive correlation with the pest population and both humidity and wind speed showed negative correlation with the pest population in both the varieties.

During 1st year, both the humidity was significantly and positively correlated with the hairy caterpillar population and bright sunshine hour was significantly and negatively correlated with the pest population in both varieties (Table 1). Maximum temperature showed significant and negative correlation with the pest population in field pea var. HUDP 15 only. The correlations of the rest weather parameters were revealed non-significant. However, both the temperatures were significantly and negatively correlated with the hairy caterpillar population in field pea var. HUDP 15 only, whereas, the association was non-significant in another variety *i.e*. Rachna during 2nd year of experimentation (Table 2). Both humidity and wind speed showed non-significant and positive correlation with the pest population and bright sunshine hour was non-significantly and negatively correlated with the pest population in both varieties.

The results reflected that gram pod borer, flower thrips and pulse aphid population were significantly and positively correlated with wind speed. Bijjur and Verma (1996) also reported that the population build up of the pests of pea crop got affected in general by wind speed, light rainfall *etc*. The results showed that flower thrips population was negatively correlated with maximum humidity in both the varieties (in second year the correlation was significant), but Chakraborty and Dutta (1999) revealed a positive significance impact of morning relative humidity on thrips population in Assam, though the thrips species was different.

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