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Seasonal Incidence of Insect-Pests of Field Pea

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ABSTRACT

During both seasons, aphid incidence peaked at 38.40 aphids/10cm shoot at the 5th SMW and 40.51 aphids/10cm shoot at the 4th SMW, respectively. While the activity of leafhoppers attained the peak of 14.20 leafhoppers/3 leaves during 7th SMW and 13.20 leafhoppers/3 leaves during 6th SMW during both seasons, respectively. During 2019-20, the whitefly population initiated at 5th WAS and persisted until the 13th WAS (1.44 to 11.28 whiteflies/3 leaves), whereas, in 2020-21, the population began in the 6th WAS and peaked during 12th WAS (12.21 whiteflies/3 leaves). Pod borer population started in 5th WAS and peaked (1.34 larvae/plant) in 10th WAS during 2019-20; in 2020-21, the population peaked (1.12 larvae/plant) during 11th WAS. The ladybird beetle population was active from 6th to 13th WAS and reached a peak (2.86 beetles/plant) during the 10th WAS in 2019-20. During the second season, the population of ladybird beetles started in the 7th WAS and peaked at 2.30 beetles/plant in 10th WAS. The spider appeared on the crop on the 5th WAS and remained active until 14th WAS, with the peak activity (0.34 and 0.30 spider/plant) reported during 6th SMW in both seasons. Significantly negative correlation was seen between evening relative humidity and leafhopper population during both seasons. Other insect-pests (aphid, leafhopper, whitefly and *H. armigera*) showed non significant impact of weather parameters during both seasons. Whereas, *H. armigera* larvae had positive correlation with bright sunshine hours and wind velocity during both seasons. Ladybird beetle showed highly significant and positive correlation with aphid, leafhopper and whitefly population during both seasons. Spider showed significant and positive correlation with aphid, leafhopper and whitefly population in both seasons.

Keywords Seasonal incidence, Population, Aphid, Whitefly, Field pea.

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INTRODUCTION

"Pulses" is a derivation from the Latin words *Puls* or *Pultis* meaning "thick soup." Pulse crops are small but important members of the legume family, which contains over 1,800 different species. Pulse crops are the seeds of a legume that are used as food and is an important source of protein which constitute a basic

ingredient in the diet of vast majority of poor and vegetarian population in India. Supplemented with cereals, pulses provide a perfect mix of vegetarian protein of high biological value. It has continued to be an integral component of sustainable crop production system, as these crops have ability of biological nitrogen fixation, low water requirement and capacity to withstand abnormal weather conditions.

Field pea (*Pisum sativum* Linnaeus var. arvense), is also known as 'Dry pea' and it is called 'matar' in India. It belongs to the family Fabaceae and sub-family Faboideae. Pea is a significantly important grain legume crop and has a global economic value because of its protein content both for human and animal food and nutrition source (Pniewski and Kapusta 2005). Pea is grown in most of the states in India during *rabi* season. It has good nutritive value with faster growth and high yielding capacity (Bhati and Patel 2001).

Studies on population dynamics of pests help in understanding the behavior and ecology of the pests which helps in the development of proper management strategies depending upon the stage of the crop pests. It is useful by introduction to knowing their peak period of infestation with the knowledge of correlation with weather parameters.

MATERIALS AND METHODS

An experiment on population dynamics was carried out at Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat. Seeds of these varieties/genotypes were obtained from the Pulses Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The field pea crop was sown in an area of 100 m^2 at a distance of 30 cm between two rows and 10 cm within plant. The experiment was conducted in Randomized Block Design with 3rd replications. During the study, the activity of insect pests viz., aphid, *A. craccivora*; leafhopper, *E. kerri*; whitefly, *B. tabaci* and pod borer, *H. armigera* were observed.

Twenty plants were selected randomly from the whole experimental plot and tagged. Number of sucking pests viz., aphid was recorded from 10 cm shoots, leafhopper and whitefly were counted from 3 leaves of each tagged plants. Numbers of larvae of pod borer were recorded randomly per plants. Whereas, natural enemies viz., ladybird beetle and spider were recorded from the same selected plants. The observations on insect pests were recorded during morning hours starting from second week after sowing (WAS) till maturity of the crop. The data thus obtained were correlated with weather parameters.

RESULTS AND DISCUSSION

The seasonal incidence of major insect pests of field pea and correlation study with weather parameters were carried out for two consecutive years. The results of which are summarized as under.

Year 2019-20

Aphid, *Aphis craccivora* Koch

The data on occurrence of aphid, *A. craccivora* on field pea is presented in (Table 1). The population of aphid commenced from 6th WAS i.e., 1st SMW and recorded 6.21 aphids per 10 cm shoot. The population gradually increased and reached the peak (38.40 aphids/10 cm shoot) during 10th WAS i.e., 5th SMW. Thereafter, the population started to decline gradually and at 8th SMW it recorded 8.55 aphids per 10 cm shoot. The pest was disappeared with a maturity of crop from 9th SMW.

Leafhopper, *Empoasca kerri* Pruthi

The activity of leafhopper, *E. kerri* on field pea (Table 1) commence from 5th WAS i.e., 52nd SMW with record of 3.01 leafhoppers per 3 leaves. The population gradually increased and reached the peak (14.20 leafhoppers/3 leaves) during 12th WAS i.e., 7th SMW. Thereafter, the population started to decline gradually and at 9th SMW it recorded 0.30 leafhopper/3 leaves.

Whitefly, *Bemisia tabaci* Gennadius

The data on the occurrence of whitefly, *B. tabaci* on field pea is presented in Table 1 the population of whitefly was commenced from 5th WAS i.e., 52nd

Table 1. Seasonal incidence of insect-pests and their natural enemies on field pea during *rabi* 2019-20.

WAS	SMW	No. of aphid/ 10 cm shoot	No. of leafhopper/ 3 leaves	No. of whitefly/ 3 leaves	No. of pod borer larvae/ plant	No. of ladybird beetle/ plant	No. of spider/ plant
2	49	0.00	0.00	0.00	0.00	0.00	0.00
3	50	0.00	0.00	0.00	0.00	0.00	0.00
4	51	0.00	0.00	0.00	0.00	0.00	0.00
5	52	0.00	3.01	1.44	0.36	0.00	0.03
6	1	6.21	4.28	2.84	0.47	0.75	0.06
7	2	16.20	7.82	3.92	0.59	1.23	0.11
8	3	24.53	9.52	4.64	0.62	1.76	0.19
9	4	31.23	10.06	7.84	0.84	2.21	0.26
10	5	38.40	12.18	11.28	1.34	2.86	0.32
11	6	29.46	13.88	9.88	1.10	2.54	0.34
12	7	17.80	14.20	5.67	0.87	2.10	0.24
13	8	8.55	8.19	3.26	0.54	1.45	0.16
14	9	0.00	0.30	0.00	0.00	0.00	0.09

SMW: Standard meteorological week, WAS: Week after sowing.

SMW which recorded 1.44 whiteflies per 3 leaves. The population gradually increased and reached the peak level (11.28 whiteflies/3 leaves) during 10th WAS i.e., 5th SMW. Thereafter, the population started to decline and it recorded 3.26 whiteflies per 3 leaves. The pest was disappeared with a maturity of crop from 9th SMW i.e., 14th WAS.

Pod borer, *Helicoverpa armigera* Hubner

The activity of *H. armigera* larvae on field pea crop also commence from 5th WAS i.e., 52nd SMW which recorded 0.36 larva of *H. armigera* per plant. The population gradually increased and reached the peak (1.34 larvae/plant) during 10th WAS i.e., 5th SMW. Thereafter, the population started to decline and at the maturity of crop (8th SMW) it recorded 0.54 larva per plant (Table 1). The pest disappeared with maturity of crop from 14th WAS (9th SMW).

Natural enemies

Ladybird beetles

The data presented in Table 1 revealed that the population of ladybird beetle was found active on field pea between 6th WAS to 13th WAS. It appeared in the crop at 6th WAS i.e., 1st SMW with 0.75 ladybird beetle per plant. Thereafter, its population increased gradually and reached peak level (2.86 ladybird beetles/plant) during 10th WAS i.e., 5th SMW and then ladybird beetle population showed decline and disappeared with maturity of crop from 14th WAS (9th SMW).

Spider

It is evident from the data (Table 1) that the spider population appeared during 5th WAS (0.03 spider/ plant) and found active on the crop till 14th WAS i.e., 9th SMW (0.09 spider/plant). The peak activity of spider was recorded on 11th WAS i.e., 6th SMW with 0.34 spider/plant. Thereafter, the population started to decline.

Influence of weather parameters on insect-pests of field pea

The correlation studies (Table 2) indicates non significant negative association between aphid and maximum temperature (r = -0.211), minimum temperature

Table 2. Correlation between field pea insect-pests and weather parameters during *rabi*, 2019-20.

Sl. No.	Pests	Weather parameters					
		Temperature (°C)		Relative humidity (%)		Bright sunshine (hours/day)	Wind velocity (km/hr)
		Maximum	Minimum	Morning	Evening		
1	Aphid	-0.211	-0.493	-0.478	-0.433	0.441	0.169
2	Leafhopper	0.018	-0.376	-0.236	-0.604*	0.513	0.15
3	Whitefly	-0.141	-0.494	-0.408	-0.485	0.497	0.076
4	Pod borer	-0.125	-0.53	-0.372	-0.55	0.467	0.032

*Significant at 5 % level of significance (r = 0.553).

(r = -0.493), morning relative humidity (r = -0.478) and evening relative humidity (r = -0.433) whereas, bright sunshine (r = 0.441) and wind velocity (r = 0.169) showed positive non significant impact. The data (Table 2) showed no significant impact of all the weather factors under study on incidence of leafhopper, *E. kerri* except evening relative humidity (r = -0.604) which established significant negative impact however, minimum temperature (r = -0.376), morning relative humidity (r = -0.236) showed negative and non significant correlation, whereas maximum temperature (r = 0.018), wind velocity (r = 0.150) and bright sunshine (r = 0.513) showed positive, but non significant impact on activity of leafhopper in field pea. The correlation studies (Table 2) indicates non significant negative association between whitefly and maximum temperature (r = -0.141), minimum temperature (r = -0.494), morning relative humidity (r = -0.408) and evening relative humidity (r = -0.485) whereas, bright sunshine (r = 0.497) and wind velocity (r = 0.076) showed positive non significant impact. The correlation studies (Table 2) indicates non significant negative association between *H. armigera* and maximum temperature (r = -0.125), minimum temperature (r = -0.530), morning relative humidity (r = -0.372) and evening relative humidity (r = -0.550) whereas, bright sunshine (r = 0.467) and wind velocity (r = 0.032) showed positive non significant impact.

It is evident from the data (Table 3) that ladybird beetle showed highly significant and positive correlation with aphid, *A. craccivora* (r = 0.958), leafhopper, *E. kerri* (r = 0.960) and whitefly, *B. tabaci* (r = 0.963) population. Thus, it can be concluded that with increase in population of aphid, *A. craccivora*, leafhopper, *E. kerri* and whitefly, *B. tabaci* harboured the population of ladybird beetle in field pea during *rabi*, 2019-20. Spider also showed highly significant and positive correlation (Table 3) with aphid, leafhopper and whitefly population which recorded r = 0.928, 0.930 and r = 0.951, respectively in field pea.

Table 3. Correlation between insect pest of field pea and their natural enemies during *rabi* 2019-20.

Sl. No.	Pests	Natural enemies	
		Lady bird beetle	Spider
1	Aphid	0.958**	0.928**
2	Leafhopper	0.960**	0.930**
3	Whitefly	0.963**	0.951**

**Significant at 1 % level of significance (r = 0.684).

Year: 2020-21

Aphid, *Aphis craccivora* Koch

The results on aphid, *A. craccivora* incidence on field pea are presented in Table 4. The aphid population commenced from 6th WAS i.e., 52nd SMW and 5.30 aphids per ten cm shoot was recorded. It increased and attained the peak (40.51 aphids/10 cm shoot) during 10th WAS i.e., 4th SMW. Afterwards the pest population gradually declined and it recorded 7.32 aphids per ten cm shoot. Thereafter pest was disappeared with maturity of crop from 15th WAS (9th SMW).

Leafhopper, *Empoasca kerri* Pruthi

The data on (Table 4) indicated that leafhopper population appeared from 52nd SMW (6th WAS).

Table 4. Seasonal incidence of insect-pests and their natural enemies on field pea during *rabi*, 2020-21.

WAS	SMW	No. of aphid/ 10 cm shoot	No. of leafhopper/ 3 leaves	No. of whitefly/ 3 leaves	No. of pod borer larvae/ plant	No. of ladybird beetle/ plant	No. of spider/ plant
2	48	0.00	0.00	0.00	0.00	0.00	0.00
3	49	0.00	0.00	0.00	0.00	0.00	0.00
4	50	0.00	0.00	0.00	0.00	0.00	0.00
5	51	0.00	0.00	0.00	0.00	0.00	0.00
6	52	5.30	3.04	1.67	0.35	0.00	0.00
7	1	12.45	3.99	2.24	0.40	0.64	0.04
8	2	17.80	7.12	3.13	0.44	1.00	0.90
9	3	29.49	8.98	3.92	0.58	1.54	0.18
10	4	40.51	9.79	7.21	0.72	2.30	0.21
11	5	34.00	10.47	9.17	1.12	2.12	0.28
12	6	21.50	13.20	12.21	0.90	1.85	0.30
13	7	12.39	7.12	8.30	0.78	1.46	0.23
14	8	7.32	4.00	3.01	0.47	1.10	0.18
15	9	0.00	0.21	0.00	0.00	0.00	0.10

SMW: Standard meteorological week, WAS: Week after sowing.

Leafhopper population showed gradual increase since appearance on crop and reached the peak 13.20 leafhoppers per 3 leaves during 6th standard meteorological week i.e., 12th WAS. Thereafter, the population declined gradually and recorded 0.21 leafhopper per 3 leaves at the maturity of the crop (9th SMW).

Whitefly, *Bemisia tabaci* Gennadius

The results (Table 4) indicated that the whitefly population on field pea commence from 6th WAS i.e., 52nd SMW (1.67 whitefly/3 leaves). The pest population increased gradually and reached to the peak (12.21 whiteflies/3 leaves) during the 6th SMW i.e., 12th WAS. Subsequently, its population decreased gradually during 8th SMW it recorded 3.01 whiteflies/3 leaves. Thereafter pest was disappeared at the maturity of crop.

Pod borer, *Helicoverpa armigera* Hubner

The activity of *H. armigera* larvae (Table 4) on field pea crop commenced from 6th WAS i.e., 52nd SMW which recorded 0.35 larva per plant. The population gradually increased and reached the peak (1.12 larvae/plant) during 11th WAS i.e., 5th SMW. Thereafter, the population started to decline during 8th SMW it recorded 0.47 larva/plant. Then after pest disappeared at the maturity of crop. Rien (2017) mentioned that the population of *A. craccivora* started from 1st SMW and reached its peak (62.30 aphids/plant) during 4th SMW. Shanibala and singh (2007) reported that the infestation of *A. craccivora* started appearing from the 3rd week of December (51st SMW). Biswal and Patel (2012) at Sardarkrushinagar reported that incidence of leafhopper commenced from 2nd WAS i.e., 2nd week of December and attained the peak (7.52 leafhoppers/3 compound leaves) in the 2nd week of February i.e., 12th WAS. These reports were in close agreement with the present finding. Bhowmik *et al*. (2018) revealed that whitefly population in field pea started from the 1st SMW. Further, the population of whitefly increased and attained its peak (5.80 adults whiteflies/plant) period during 6th SMW, then after population declined and whitefly was available up to 10th SMW. Pal *et al*. (2020) reported that *H. armigera* on field pea at Mohanpur, West Bengal commenced from 2nd week of January at flowering stage of the crop and remained up to harvesting stage of the crop i.e., 1st week of March. The pest population reached its peak activity during 6th SMW (2nd week of February) at fifty per cent maturity stage of the crop. The population *H. armigera* started 5th WAS i.e., fifth week of December and then increased gradually and reached its peak level of 0.66 larva/plant during second week of January 7th WAS (Biswal and Patel 2012). These reports were in concurrence with present findings.

Natural enemies

Ladybird beetle

The data presented in Table 4 revealed that the population of ladybird beetle was found active on field pea between 7th WAS to 14th WAS. It appeared on the crop at 7th WAS i.e., 1st SMW with 0.64 ladybird beetle/plant. Thereafter, its population increased gradually and reached peak (2.30 ladybird beetles/plant) during 10th WAS i.e., 4th SMW and then gradually declined with maturity of crop at 14th WAS (8th SMW).

Spider

It is evident from the data (Table 4) that spider population also appeared from 7th WAS (0.04 spider/plant) and was active on the crop till 15th WAS i.e., 9th SMW (0.10 spider/plant). The peak activity of spider was recorded during 12th WAS i.e., 6th SMW with 0.30 spider per plant upto with a gradual decline in its activity. Tamang *et al*. (2017) revealed that the highest population of ladybird beetle on green gram during 10th WAS in West Bengal. Bijjur and Verma (1995) observed 24 insect-pests and 11 natural enemies on pea at Delhi. Swathi *et al*. (2018) at Andhra Pradesh reported the peak incidence of spider during 8th WAS on blackgram. Thus, the activity of spider on different place and crops were slightly nearer to the present finding.

Influence of weather parameters on insect-pests of field pea

The correlation studies indicates non significant negative association between aphids and maximum temperature (r = -0.258), minimum temperature (r = -0.356) and evening relative humidity (r = -0.019) whereas, morning relative humidity (r = 0.218), bright sunshine (r = 0.243) and wind velocity (r = 0.068) showed positive non significant impact (Table 5). The data showed that there was no significant impact of all the weather factors under study on population of leafhopper however, minimum temperature (r = -0.221) and maximum temperature (r = -0.045) showed negative and non significant correlation, whereas morning relative humidity (r = 0.231), evening relative humidity (r = 0.190), bright sunshine (r = 0.308) and wind velocity (r = 0.107) showed positive but non significant impact on activity of leafhopper in field pea (Table 5). The correlation studies indicate there was no significant impact of all the weather factors. There was non significant negative association between whitefly and minimum temperature (r = -0.138). Whereas, maximum temperature (r = 0.194), morning and evening relative humidity (r = 0.090, 0.121), bright sunshine (r = 0.398) and wind velocity (r = 0.065) showed positive non significant correlation (Table 5). The correlation studies indicates non significant negative association between *H. armigera* and minimum temperature (r = -0.203) whereas, maximum temperature (r = 0.023), morning relative humidity (r = 0.134), evening relative humidity (r = 0.189), bright sunshine (r = 0.406) and wind velocity (r = 0.031) showed positive non significant impact (Table 5).

Table 5. Correlation between field pea insect-pests and weather parameters during *rabi,* 2020-21.

Sr. No.	Pests	Weather parameters					
		Temperature (°C)		Relative Humidity (%)		Bright sunshine (hours/day)	Wind velocity (km/hr)
		Maximum	Minimum	Morning	Evening		
1	Aphid	-0.258	-0.356	0.218	-0.019	0.243	0.068
2	Leafhopper	-0.045	-0.221	0.231	0.190	0.308	0.107
3	Whitefly	0.194	-0.138	0.090	0.121	0.398	0.065
4	Pod borer	0.023	-0.203	0.134	0.189	0.406	0.031

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

It can be seen from the data (Table 6) that population of ladybird beetle exerted highly significant positive correlation with aphid (r = 0.930), leafhopper (r = 0.939) and whitefly (r = 0.891) population. Spider constructed significantly positive correlation with leafhopper population which recorded r = 0.548 in field pea. Population of aphid (r = 0.449) and whitefly (r = 0.403) showed non significant and positive correlation with spider (Table 6).

Biswal and Patel (2012) at Sardarkrushinagar reported that the aphid population was adversely affected by morning relative humidity and favored by wind velocity. According to Rien (2017) at Jabalpur reported that correlation between *A. craccivora* with maximum and minimum temperature was non significant. Whereas, positive correlation with morning relative humidity. Above references relatively supported the present finding. Biswal and Patel (2012) also reported that leafhopper population increased with decrease in morning relative humidity and increase

Table 6. Correlation between insect-pests of field pea and their natural enemies during *rabi,* 2020-21.

Sl. No.	Pests	Natural enemies	
		Lady bird beetle	Spider
1	Aphid	0.930**	0.449
2	Leafhopper	0.939**	0.548*
3	Whitefly	0.891**	0.403

*Significant at 5 % level of significance (r = 0.532),
** Significant at 1 % level of significance (r = 0.661).

in wind velocity. Berragini *et al*. (2007) revealed that morning and evening relative humidity and evaporation showed non significant positive correlation with whitefly population in mungbean which was more or less similar with present finding. Kumar (2018) reported that larval population of *H. armigera* showed negative and positive correlation with maximum and minimum temperature, respectively during *rabi*, 2016-17. Whereas, positive correlated with relative humidity and rainfall. Dhaka *et al.* (2011) at Meerut reported that on vegetable pea, *H. armigera* was negatively correlated with minimum and maximum temperature and positive correlated with maximum and minimum relative humidity. Above references more or less similar with present finding. Pawar *et al.* (2017) recorded ladybird beetle and spider had highly significant and positive correlation with population of sucking pests viz., jassid (r = 0.83** and 0.78**) and whitefly (r = 0.71** and 0.86**) on cluster bean at Sardarkrushinagar (Gujarat). Srikanth and Lakkundi (1990) also found highly significant positive correlations between weekly aphid and predator population, which was more or less similar with the findings of present investigations.

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