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Study the seasonal activity of insect pests in pea crop

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Abstract
The population of *Aphis craccivora* was first observed in SMW # 1 (1.37 aphids per plant). The peak population of *Aphis craccivora* was recorded during SMW # 4 (62.30 aphids per plant) and thereafter its population decline gradually. Its population remained high till the maturity of the crop in SMW # 8 (21.4 aphids per plant). *Acyrthosiphon pisum* appeared at a low level for the first time in SMW # 1 (0.47 aphids per plant) and the population remained low throughout the crop season (below 4.07 aphids per plant). The peaks population of *Acyrthosiphon pisum* was observed in SMW # 4 (4.02 aphids per plant) and in SMW # 6 (4.07 aphids per plant). Leaf infestation by *Liriomyza trifolii* was recorded to be 10% during SMW # 1. Its incidence increased gradually with peak infestation of 39.34% infested leaves in SMW #5. *Thysanoplusia orichalcea* was observed in pea crop at a very low level (below 1.0 individuals per plant). Its mean population was 0.15, 0.32, 0.45, 0.30, 0.12 and 0.10 individuals per plant observed between SMW # 51 (2016) and SMW # 4 (2017). *Helicoverpa armigera* was recorded in pea crop at very low level between SMW # 50 and SMW # 4 with peak populations of 0.65 larvae per plant in SMW # 1.

Keywords: *Aphis craccivora*, pea crop, conservation, Peak population

1. Introduction
Vegetable pea (*Pisum sativum*) is an important pulse crop of India. It is the second most important grain legume after soybean. It is growing in all states of the country during Rabi season and because of its taste, nutritive value, fast growth and high yield this crop is patronized throughout the world. It is used as a vegetable as well as pulse. The protein content in this crop is 19 to 27%, it has a high caloric value and is a great source of ascorbic acid. In addition to its food value it has proved to be an excellent source of fodder and its vines are used in silage making in off season for feeding livestock. The nitrogen fixing capacity of this crop restores soil fertility. India is one of the largest producers of vegetable pea in the world and stands in 5th place in the list of major vegetable pea producers. The Indian production contributes around 7% of the world's total produce with the production figures of 7.8 lakh tonnes. In India it is cultivated on 459 thousand hectare area with an annual production of 4329 thousand tonnes (Anonymous, 2014) [2]. In Madhya Pradesh, it is cultivated on 280.9 thousand hectare area with an annual production of 194.8 thousand tonnes and average yield of 693 kg/hectare (Anonymous, 2012-13) [1]. The crop is attacked by many insect pests, among which pea pod borer (*Etiella zinckenella*) and stem fly (*Melanagromyza phaseoli*) are serious pests in Uttar Pradesh (Bijjur & Verma 1995) [5]. They reported 57 species of insects attacking pea crops, with an annual monetary loss of 540 million Indian rupees. Pea pod borer (*Etiella zinckenella*) is a major pest of field pea causing as high as 50.9% pod infestation with 77.64% seed damage resulting in 23.9% loss in the seed yield (Yadav *et al*., 2000) [21]. Kushwaha (2002) [11] recorded insect pests on pea crop at Jabalpur Madhya Pradesh, which are as Pea pod borer, *Etiella zinckenella*; Pea aphid, *Acyrthosiphon pisum*; Gram pod borer, *Helicoverpa armigera*; Groundnut aphid, *Aphis craccivora*; Pea leaf miner, *Liriomyza spp.*; Pea semilooper, *Thysanoplusia orichalcea*; Stem fly, *Melanagromyza phaseoli*; Pod fly, *Melanagromyza obtus;* Pea thrips, *Caliothrips indicus;* Tobacco caterpillar, *Spodoptera litura.* Population dynamics and activity of insect pests is closely associated with various abiotic environmental influences. Seasonal incidence of different insect pests depends on climatic conditions of the area. Higher relative humidity and rainfall have been reported to be favourable for the development of almost all the pests except *Spodoptera litura* (Tomar *et al*., 2004) [19]. The pea leaf miner has been reported to increase with increasing maximum temperature (Singh and Saravanan, 2008) [16]. Aphid (*Aphis craccivora*) populations were reported to have a positive correlation with maximum temperature (Wale, 2011) [20].

2. Material and Methods

A field of 10 m × 10 m, with vegetable pea variety 'Arkel' was selected for recording the population dynamics and seasonal activity of major insect pests. Low level activity of minor pests was also recorded. The crop did not receive any pesticide treatment during the growing season. Regular observations were conducted during different weather weeks, to record the density of insect pests of pea namely: leaf miner (*Liriomyza trifolii*) pea aphids (*Acyrthosiphon pisum*) & pod borers (*Helicoverpa armigera, Etiella zinckenella*) etc. The sample unit for recorded sucking pests was 15 cm twig of the sample plant. The incidence of leaf miner was recorded counting the total numbers of healthy and damaged leaves in each plant. Sample unit for defoliators and borers was individual plant. Fifty sample plants were observed every week to record the observations. Pest population during different weather weeks was analyzed at different crop stages.

3. Result and Discussion

Random sampling was conducted on the pea crop from standard meteorological weeks (SMW) # 49 (2016) to SMW# 8 (2017). Insect pests recorded for the crop included *Aphis craccivora, Acyrthosiphon pisum, Liriomyza trifolii, Thysanoplusia orichalcea and Helicoverpa armigera.*

The population of *Aphis craccivora* was first observed in SMW # 1 (1.37 aphids per plant). Peak mean population of *Aphis craccivora* was recorded during SMW # 4 (62.30 aphids per plant) and thereafter its population declined gradually. Its population remained high till the maturity of the crop in SMW # 8 (21.4 aphids per plant). *Acyrthosiphon pisum* appeared at a low level for the first time in SMW # 1 (0.47 aphids per plant). The population remained low throughout the crop season (below 4.07 aphids per plant). The peak mean population of *Acyrthosiphon pisum* was observed in SMW # 4 (4.02 aphids per plant) and in SMW # 6 (4.07 aphids per plant). The incidence of *Liriomyza trifolii* was recorded to be 10% during SMW # 1. Its incidence increased gradually with peak of 39.34% infested leaves in SMW # 5. *Thysanoplusia orichalcea* was observed in pea crop at a very low level (below 1 individual / plant). Its mean population was 0.15, 0.32, 0.45, 0.30, 0.12 and 0.10 individuals per plant observed between SMW # 51 (2016) and SMW # 4 (2017). *Helicoverpa armigera* was recorded in pea crop at very low level between SMW # 50 and SMW # 4 with peak population of 0.65 larva per plant in SMW # 1. Overall picture of seasonal activity of insect pest indicated that the heavy population of *Aphis craccivora* during SMW # 1 and 39.34% leaf incidence of *Liriomyza trifolii* during SMW # 5 indicate make all essential to initiate insecticidal treatment in SMW # 2 to check the population of insect pests for preventing the losses.

Table 1: Seasonal activity of insect pests on vegetable pea during different standard weeks

Standard weeks	Crop stage	Crop age in days	*Aphis craccivora* (per plant)	*Acyrthosiphon pisum* (per plant)	*Helicoverpa armigera* (per plant)	*Thysanoplusia orichalcea* (per plant)	*Liriomyza trifolii* (Leaf infestation %)
49	Seedling	8	0.00	0.00	0.00	0.00	0.00
50	Seedling	15	0.00	0.00	0.07	0.00	0.00
51	Vegetative	22	0.00	0.00	0.22	0.15	0.00
52	Vegetative	29	0.00	0.00	0.30	0.32	0.00
1	Vegetative & flowering	36	1.37	0.47	0.65	0.45	10.00
2	flowering	43	10.70	0.90	0.27	0.30	20.30
3	Flowering & podding	50	34.02	1.82	0.30	0.12	16.60
4	Flowering & podding	57	62.30	4.02	0.05	0.10	22.96
5	Podding	64	46.67	2.82	0.00	0.00	39.34
6	Podding	71	46.00	4.07	0.00	0.00	20.43
7	Maturity	78	29.40	3.00	0.00	0.00	13.15
8	Maturity	85	21.40	2.00	0.00	0.00	0.00

*Mean of 50 sample plants

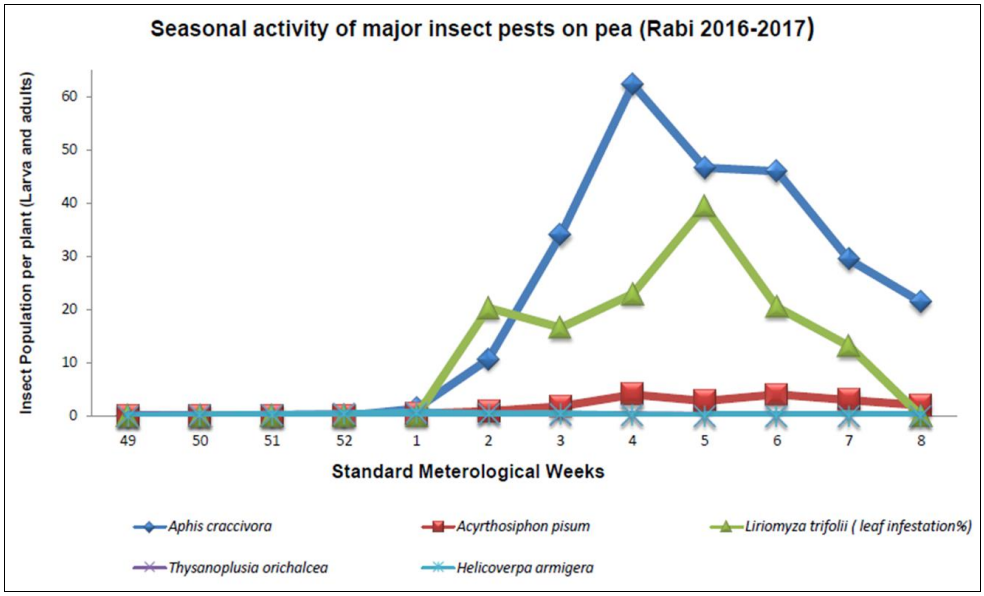

Fig 1: Seasonal activity of major insect pests on pea in Jabalpur during *Rabi* 2016-17

The incidence of *Liriomyza trifolii* was recorded to be 10% leaf infestation during SMW # 1. Its incidence increased gradually with peak infestation of 39.34% infested leaves in SMW # 5 when the average maximum and minimum temperatures were 25.3 ˚C and 7.5 ˚C respectively, with morning relative humidity of 92.1% and evening relative humidity of 37.7%. Present observations confirm the results of earlier workers (Ashlata, 2002; Singh and Saravanan, 2008) [3, 16] who have reported the incidence of leaf miner on pea throughout the crop season. They found that the maximum temperature and sunshine hours had positive correlation with population levels and the life cycle of leaf miner on pea crop. However, in present studies the correlation between percentage of leaf miner and meteorological parameters was non-significant. Mehta and Chandel (1998) [13] also reported high leaf miner incidence in majority of pea varieties. Bijjur & verma (1996) [6] and Sood *et al*., (1997) [18] had reported temperature as an important factor in governing leaf miner incidence level, however, in the present experiment no such correlation could be established. In present observations the population of *Aphis craccivora* was first observed in SMW # 1 (1.37 aphids per plant). The peak population of *Aphis craccivora* was recorded during SMW # 4 (62.30 aphids per plant) and thereafter its population declined gradually. Its population remained high till the maturity of the crop in SMW # 8 (21.4 aphids per plant). Prasad *et al*., (1983) [15] also reported *Aphis craccivora* to be a major pest of green pea at Delhi.

Acyrthosiphon pisum appeared at a low level for the first time in SMW # 1 (0.47 aphids per plant) the population remained low throughout the crop season (below 4.07 aphids per plant). The peak population of *Acyrthosiphon pisum* was observed in SMW # 4 (4.02 aphids per plant) and in SMW # 6 (4.07 aphids per plant) when the maximum and minimum temperatures were 27.1˚C and 9.7 ˚C and morning and evening relative humidities were 97.8% and 42.4% respectively. Biswal and Patel (2015) [7] also reported that aphid, whitefly and thrips were the first to enter and colonize field pea crop, followed by leaf miner and remained active till harvest of the crop. Dixon and Harrington (2000) [9] reported that the variation in aphid population was closely associated with temperature from January to July. Cool weather in January to February results in large number of aphids population. Their findings are in conformity to present observations where the peak populations were recorded at 9.7 ˚C mean minimum temperature. Population of *Acrythosiphon pisum* indicated more affinity with morning relative humidity with r value of 0.768 and the regression equation obtained was y = 0.205x-16.4 while Wale (2011) [20] observed negative correlation between aphid population and relative humidity. Wale (2011) [20] reported that the aphid population showed positive correlation with maximum temperature, and negative correlation with minimum temperature and relative humidity. Increasing maximum temperature promoted the buildup of aphid populations while increased minimum temperature, rainfall and relative humidity suppressed it. Bhaduria (1993) [4], Chakraborty & Dutta (1999) [8], Kushwaha (2002) [11], Mittal & Ram (2007) [14], and Singh & Mishra (2013) [17] have reported the incidence of pod borers in green pea. However, under Jabalpur conditions the borers incidence in green pea was almost absent.

Tomar *et al*., (2004) [19] reported the most favorable period of insect pests from first week of December to the second week of January for green pea. Relative humidity and rainfall were favorable for the development of almost all the pests (except *Spodoptera litura*). The maximum and minimum temperatures were negatively correlated with the population of all the insect pests. *Helicoverpa armigera* was recorded in pea crop at very low level between SMW # 50 and SMW # 4 with peak populations of 0.65 larvae per plant in SMW # 1. Dubey *et al*., (1993) [10] reported its activity in February and March and found that environmental factors (temperatures, RH, and rainfall) had an impact on the development of pest population. Martinovich (1993) [12] reported that the degree of infestation was related to time of occurrence of spring temperature, precipitation and RH. Dubey *et al*., (1993) [10] studied the *Helicoverpa armigera* on various crops, including pea in Jabalpur condition over two years. The peak activity was observed in February and March and they found that environmental factors (temperature, relative humidity and rainfall) had an impact on the development of pest population.

4. Conclusion

Seasonal activity of insect pests indicated a high population of *Aphis craccivora* during SMW # 1 and 39.34% leaf incidence of *Liriomyza trifolii* during SMW# 5. Hence, the last week of December was identified as the crucial period for application of insecticidal measures. Studies on seasonal activity of major insect pests on pea should be studied continuously for three years in order to establish the status of the pest and to determine the suitable time for adopting control measures.

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