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Studies on population dynamics of major insect pests of pea

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Abstract

The seasonal incidence of major insect pests on pea *Pisum sativum* at different growth stages has been assessed in this study. Major pests observed include pea leaf miner *Chromatomyia horticola* gram pod borer *Helicoverpa armigera*, blue butterfly *Lampides boeticus*, pea aphid *Acyrtosiphon pisum*, Thrips *Caliothrips indicus* and Cut worms *Agrotis sp.* The peak incidence of *Acyrtosiphon pisum* (40.23 larvae/leaf) and percent leaf infestation of *Chromatomyia horticola* (35.43%) was during 16th SMW, respectively. While the peak incidence of *Helicoverpa armigera* (0.53 larvae/ plant) and *L. boeticus* (0.55 larvae/ plant), *Caliothrips indicus* (0.43) *Thysanoplusia orichalcea* (0.34) was at 12th SMW. Peak incidence of cut worm (0.35 larvae/plant) was on 9 SMW.

Keywords: *Pisum sativum*, population dynamics, insect pests, seasonal incidence, H.P

1. Introduction

India is one of the world's top producers of vegetable peas, accounting for 27% of global production and 33% of the world's area (Chaturvedi and Ali, 2002) [4], ranked fifth among major producers of vegetable peas (Rien *et al.*, 2021) [16]. India's pea production and acreage varied from 551.4 thousand hectares (ha) to 5604.6 thousand metric tons (MT), with an average productivity of 11.12 MT/ha (Srivastava *et al.*, 2023) [19]. It is cultivated in every state in the country during the Rabi season, and because to its flavor, nutritional content, rapid growth, and abundant production, this crop is highly valued globally. The largest pea-growing states include Uttar Pradesh, Madhya Pradesh, Jharkhand, Punjab, Himachal Pradesh, West Bengal, Haryana, Bihar, Uttarakhand, Orissa, and Karnataka (Anonymous, 2022) [1]. Although India is the world leader in pulse production, our country's productivity is extremely poor when compared to other developed countries. The invasion of various insect pests at different stages is regarded as a major obstacle in attaining the potential yield. In India, insect pests such as Pea pod borer, Gram pod borer, groundnut aphid, Pea leaf miner, Pea semilooper, Stem fly, Pod fly, Pea thrips, and tobacco caterpillar are causing havoc on crop yields, both qualitatively and quantitatively (Khaliq *et al.*, 2023; Keval *et al.*, 2020) [8, 7]. The annual loss of these pests is estimated to be approximately 540 million Indian rupees. Pea pod borer (*Etiella zinckenella*) is a serious pest of field pea, causing as much as 50.9% pod infestation, 77.64% seed damage, and a 23.9% decrease in seed output (Yadav *et al.*, 2019) [24]. Insect pest population dynamics and activities are strongly linked to a variety of abiotic environmental factors (Kumar and kumar, 2014) [10]. The seasonal incidence of certain insect pests is determined by local meteorological conditions. Almost all pests, with the exception of *Spodoptera litura*, have been found to thrive better in environments with higher relative humidity and rainfall (Tomar *et al.*, 2004) [21]. Therefore, gathering data on the most common pests that affect field pea will aid in planning the best course of action for control. The current study was conducted to determine the seasonal prevalence of significant insect pests on field pea.

2. Materials and Methods

A field experiment was conducted in a farmer's field close to the College of Horticulture and Forestry Thunag in Mandi H.P during rabi, 2023. Data on the seasonal occurrence of main pests were collected at weekly intervals beginning with the appearance of the pest and continuing until harvesting. Additionally, low-level pest activity was also recorded.

Regular observations were conducted during different standard weeks, to record the density of insect pests of pea namely; *Chromatomyia horticola*, *Acyrtosiphon pisum*, *Helicoverpa armigera*, *Thysanoplusia orichalcea*, *Lampides boeticus*, *Caliothrips indicus* and *Agrotis* sp. The incidence of the *A. pisum* and larvae was recorded by counting their number from the 50 randomly selected plants. The total number of healthy and damaged leaves on each plant was counted in order to determine the incidence of leaf miner. Fifty sample plants were observed every week to record the observations. Pest population during different weather weeks was analyzed at different crop stages.

3. Results and Discussion

The seasonal occurrence of main insect pests on the pea crop was monitored at weekly intervals starting with the pest's emergence and continuing until standard harvesting, i.e standard meteorological weeks (SMW) 8 through SMW 19. Major insect pest recorded from the crop were *Chromatomyia horticola*, *Acyrtosiphon pisum*, *Helicoverpa armigera*, *Thysanoplusia orichalcea*, *Lampides boeticus*, *Caliothrips indicus* and *Agrotis* sp. Similar to our findings, Keval *et al.*, 2020; Roy and Banerje, 2021; Tare *et al.*, 2023 identified aphids, borers, and thrips as the most common pea pests. The percent incidence of *Chromatomyia horticola* was recorded to be 9.45% leaf infestation during SMW12. After reaching a peak infestation of 35.43% infested leaves in SMW 16, its occurrence gradually decreased (Table 1). In contrast, the largest infestation was noted by Venkateshwarlu *et al.* (2011) [22] and Mondal and Kumar (2012) [13] during the third week of February and the second week of March. The local weather in this location could be the cause of this. According to Nitharwal M. (2013) [14], the first week of August marked the beginning of the insect pest incidence, which persisted throughout the crop season. The population of *Acyrtosiphon pisum* was first observed in SMW 11 (2.43 aphids per plant). Peak mean population of *Acyrtosiphon pisum* was recorded during SMW 16 (40.23 aphids per plant) and thereafter its population declined gradually. Its population persisted until SMW 19 crop maturity (11.23 aphids per plant). According to Biswal and

Patel (2015) [2], aphids, whiteflies, and thrips were the first to infiltrate and colonize field pea crops, followed by leaf miner, and remained active until the crop was harvested. According to Wale (2011) [23], there was a negative link between the aphid population and relative humidity and minimum and maximum temperatures, and a positive correlation with the former. Aphid populations grew when maximum temperature rose, but they were controlled by rising minimum temperature, rainfall, and relative humidity. The population of *Helicoverpa armigera*, was observed in pea crop at a very low level (below 1 individual / plant). Its mean population was 0.03, 0.13, 0.25, 0.53, 0.43, 0.32 and 0.02 individuals per plant observed between SMW 9 to SMW 15 (Figure 1). Its peak population was at 12 SMW i.e mid of March and declined gradually towards the maturity of the crop. These investigations support the findings of Chatar *et al.*, (2010) [3], who likewise observed a progressive drop in the *H. armigera* pest population as the crop reached maturity. In addition, Kumar and Nath (2003) [9] noted that pigeonpeas were infested with *H. armigera* from February through the early part of April. Yadav *et al.*, (2019) [24] found that *H. armigera* larval incidence starts increasing during third week of December to first week of March. The incidence of *Lampides boeticus* and *Thysanoplusia orichalcea* were found in pea crops between SMW 10 and SMW 15, with a high population of 0.34 and 0.55 larvae per plant in SMW 12 i.e. during mid of March. In line with our results, Dubey *et al.*, (1993) [5], Manisha *et al.* (2018) [11], Kaushik and Singh (1982) [6], and Prasad (1997) [15] also noted that *Helicoverpa armigera* pod borer activity peaks in February and March when feeding on pea. Additionally, the occurrence of pod borers in green pea has been observed by Mittal & Ram (2007) [12] and Singh & Mishra (2013) [18]. Very low levels of *Caliothrips indicus* incidence, ranging from 0.06 to 0.43 nymphs/plant, were also seen in pea crops which were maximum at 12 SMW 0.43 nymphs/plant. On the other hand, Roy and Banerjee noted that the middle of February had the highest occurrence of floral thrips. Cutworm infestations were found at 9 and 10 SMW, with 0.08 and 0.12 larvae/plant, respectively, and were considered to be a minor pest of this crop.

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

Standard Weeks	Crop stage	<i>Chromatomyia horticola</i> (% Leaf infestation)	Insect population per plant (Larvae and adult)					
			<i>Acyrtosiphon pisum</i>	<i>Helicoverpa armigera</i>	<i>Thysanoplusia orichalcea</i>	<i>Lampides boeticus</i>	<i>Caliothrips indicus</i>	<i>Agrotis</i> sp.
8	Seedling	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Seedling	0.00	0.00	0.03	0.00	0.00	0.00	0.08
10	Vegetative	0.00	0.00	0.13	0.17	0.00	0.00	0.12
11	Vegetative	0.00	2.43	0.25	0.23	0.19	0.21	0.00
12	Vegetative & flowering	9.45	9.56	0.53	0.34	0.55	0.43	0.00
13	flowering	12.23	11.34	0.43	0.29	0.51	0.21	0.00
14	Flowering & podding	10.34	14.78	0.32	0.17	0.43	0.11	0.00
15	Flowering & podding	21.40	20.13	0.02	0.12	0.03	0.06	0.00
16	Podding	35.43	40.23	0.00	0.00	0.02	0.00	0.00
17	Podding	22.67	32.13	0.00	0.00	0.00	0.00	0.00
18	Maturity	12.87	14.12	0.00	0.00	0.00	0.00	0.00
19	Maturity	11.23	12..12	0.00	0.00	0.00	0.00	0.00

*Mean of 50 sample plants

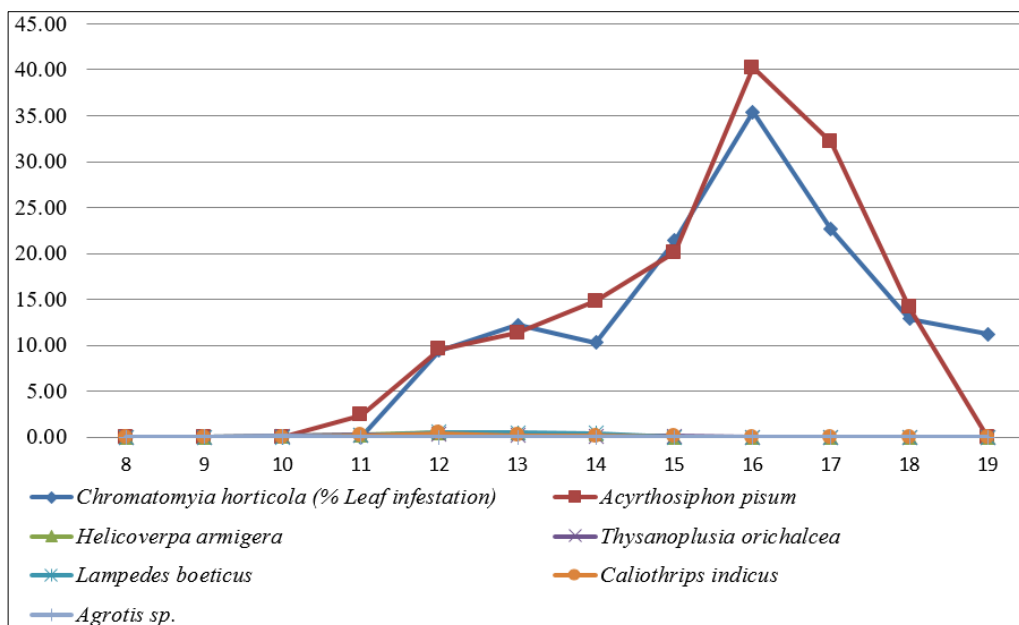


Fig 1: Seasonal activity of major insect pest on peas during different standard weeks

4. Conclusion

Seasonal activity of insect pests indicated a population of *Acyrthosiphon pisum*, % leaf incidence *Chromatomyia horticola* started from SMW 10 and 11. The peak incidence of *Helicoverpa armigera* and *L. boeticus* (*Caliothrips indicus*) *Thysanoplusia orichalcea* were at 12th SMW). Hence, the mid-week of March was identified as the crucial period for application of insecticidal measures. In order to assess the pest's status and choose the best time to implement management measures, studies on the seasonal activity of the main insect pests on peas should be conducted continuously for three years.

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