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Studies on the insect pests of brinjal in Hoshiarpur District of Punjab, India

Amrit Deep Kaur, Sajad Ahmad Bhat and Kamlpred Kaur*

Department of Zoology, School of Agriculture and Natural Sciences, CT University, Ludhiana - 142024, Punjab, India.
**Department of Zoology, Punjabi University, Patiala 147002, Punjab, India.*
Email: amritdeepkaurgch@gmail.com; Sajadbio6@gmail.com: kamattiwana3300@gmail.com

ABSTRACT: Seventeen insect pests belonging to five orders were recorded from selected transects. Hemipterans were found to be very common and most abundant with seven insect pests. Neuroptera the least abundant with one pest was found during the experimental period, with orders like Lepidoptera, Orthoptera, and Coleoptera with three insect pests each. Wind speed and bright sunshine showed a negative correlation (r = - 0.126) and (r = - 0 .778) during 2021 and (r = -0.73 and r = -0.41) during 2022 respectively. Rainfall, humidity, and evaporation have a positive correlation (r = 0.368, r = 0.551, and r = 0.297) in 2021 and (r = .31, r = 0.89, and r = 0.81) during 2022 respectively. At maximum temperature (38.4°C) during April and May pest population was minimum. Rainfall and relative humidity favored the pest population. © 2024 Association for Advancement of Entomology

KEY WORDS: Abundance, temperature, rainfall, humidity, wind speed

The occurrence of most insect pests is dependent on certain weather conditions: Temperature, humidity, rainfall, and drought. Weather and temperature data are beneficial in predicting pests' life cycles. This article deals with the impact of weather conditions and climatic factors on the diversity of insect pests of brinjal. The study was carried out for two cropping periods in the Doaba region of Punjab Dist. Hoshiarpur. Brinjal was sown in the field for two kharif seasons [April to September 2021 and April to September 2022]. The meteorological data was obtained from the regional campus of Punjab Agriculture University. The site was visited twice a week and observations were taken for every season. Preserving and pinning of insects were done for identification of insects. The insects belonging to different orders along with their habitat (crop plant) were collected and identified. Relative abundance was calculated. The weekly data on weather conditions during the period of study was recorded. Randomly five plants were observed twice a week. Different species of insect pests were collected by hand picking, pitfall traps, colored traps, and insect collecting nets are used. After collecting the insect pests in seventy percent alcohol in glass vials for small and soft-bodied insects. Pinning was done for large-size insects. The preserved specimens were identified in the agriculture department at CT University with the help of keys (Zettler *et al.*, 2016; Schell *et al.*, 2007). The data collected were subjected to statistical analysis using ANOVA and correlation.

Seventeen insect pests belonging to five orders were recorded from selected transects.

* Author for correspondence

Hemipterans were found to be very common and most abundant insect pests. Hemipteran appeared to be the most crowded order with seven insect pests. Neuroptera to be least abundant with one pest was found to be during the study period. Hemipteran mainly sucks the sap from all parts of plants such as leaves, stems, and flowers. Both nymphs and adults are destructive when hemipteran sucks the sap causing leaves to turn yellow and progress by clinking, curling, and destruction. Leaves and growing tips of plants resulted in stunted growth and poor fruit formation.

Caterpillars bore into tender shoots and in developing fruits, resulting in the drying of the tip. Larvae make holes and deposit excreta in them. Due to this stems of plants wither and wilt. Coleopteran grubs and adults both feed on the upper surface of leaves by scrapping the leaf tissues and only veins remains intact . It causes severe damage to the leaves. Orthopterans both nymphs and adults eating the leaves of plants and causes damage to newer tender parts of plant. Neuroptetans either act as minor pests, both nymphs and adults attack the upper surface of leaves and suck sap from it, causing a yellowing of leaves in patches (Table1).

During the growing season 2021, the correlation analysis results clearly showed that the pest population fluctuation in Brinjal depends upon weather parameters. From the month, April to September in May and June temperature increases up to August, increased minimum temperature positively correlated with pest population (r =0.656) and maximum temperature is negatively correlated with pest population (r = - 0.059). Relative humidity (r = 0.489 and r = 0.551) morning and evening respectively, evaporation (r =0.297), and rainfall (r =0.368) were positively associated with the pest population. Increase in relative humidity, evaporation, and rainfall the pest population increases. Sunshine (r = -0.778), wind speed (r = 0.126), and maximum temperature (r = -0.059) showed a negative correlation with the pest population.

During the growing season of 2022, it is observed that *Epilachna* and *Aphis gossypii* cause a maximum attack on the brinjal crop. During August month *cordius janus* abruptly disappeared with the end of the rainy season but *Phenacoccus soleni* attacked brinjal crops severely and caused the destruction of plants. Attack of *Epilachna* continued from vegetative to reproductive phase of plant. Maximum infestation of aphids occurs during August and September. High density and diversity were observed during the July and August months of the year 2022. *Aphis gossypii* (Aphids) infestation was high during September and became the cause of major crop damage. High density and diversity of insect pests were observed during July and August when relative humidity and rainfall were high but temperature is low as compared to May and June, Insect pest infestation positively correlated with minimum temperature and negatively correlated with maximum temperature (as temperature increases the pest population decreases. Relative humidity (r = 0.896) and rainfall (r = 0.313) have a positive correlation with the insect population. With the increase in humidity and rainfall pest population increases, wind speed (r = -0.731), sunshine (r = -0.413), and evaporation (r = -0.811) have a negative correlation on pest population.

Phenacococcus soleni infestation was higher in brinjal from July to September and became the cause of major damage to the brinjal crop followed by *cordius janus*. *Epilachana* acts as a major pest that attacks crops from the growing to the maturation phase. Other insect pest acts as minor pests but the density and diversity of insect pests are high during July to September due to low temperature, high rainfall, and humidity. Pest density and diversity were low from mid-April to July's first week due to high temperatures and sunshine.

It can be concluded that *the Phenacococcus soleni* attack was maximum during July, August, and September of Kharif 2021, and the maximum *Aphis gossypii* population in Kharif was recorded during August and September 2022. Epilachana acts as a continuous pest from the vegetative to the reproductive stage. Correlation analysis results clearly showed that pest population fluctuation in Brinjal depends upon weather parameters during

Table 1. Diversity of insect pests on brinjal (Kharif Crop) during period of 2021-22.

No	Name	Order/ Family	Damage
1	Hadda beetle *Epilachna varivestis* (F)	Coleoptera/ Coccinellidae	Grubs and adults make leaves during April to September
2	Pumpkin beetle *Aulcophora frontalis* (Augustae)	Coleoptera/ Chrysomelidae	Adults feed on foliage and flowers during April to May
3	*Aphis gosspyii* (Glover)	Hemiptera/ Aphididae	Sucks the sap during September
4	Blister beetle *Hycleus phaleratus* (Pallas)	Coleoptera/ Meliodae	Grubs and adults feed on growing tips, chew and bore into stems, feed on fruits and flowers during May -September.
5	*Melanoplus bibittatus* (Stal)	Orthoptera/ Acrididae	Adults feed on leaves during July - September.
6	Cow bug *Oxyrachis tarandus* (Rafinesque)	Hemiptera/ Membracidae	Adults and nymphs suck the sap from leaves and stems during August - September
7	Mealy bug *Phenacoccus solani* (Ferris)	Hemiptera/ Pseudococcidae	Adults and nymphs suck the sap from leaves and stems during July to October
8	White fly *Bemisia tabci* (Genn)	Hemiptera/ Aleyroidide	Nymphs and adults suck cell sap from lower surface of leaves and growing tips during July to September
9	Red pumpkin bug *Cordius janus* (F)	Hemiptera/ Dinidoridae	Adults suck the sap during July to September
10	Dock bug *Coreus marginatus* (L)	Hemiptera/ Coreidae	Adults suck the sap from leaves and stems during August to September.
11	Leaf roller *Antoba eublemma olivacea* (Walker)	Lepidoptera/ Noctuidae	Caterpillars feed leaves by rolling leaves from tip towards inside during July to September
12	Shoot and fruit borer *Leucinodes orbanalis* (Guenee)	Lepidoptera/ Pyralidae	Caterpillars bores into tender shoots resulting in drying of tip. Larvae attacks the fruits during July to September
13	*Eretmocera impactella* (Walker)	Lepidoptera/ Scythridiae	Feed on leaves during July to September
14	Lacewing bug *Urentius hystricellus* (Richter)	Neuroptera/ Tingidae	Both Nymphs and adults suck sap from leaves and cause yellowing of leaves in patches, during July to September
15	Jassids *Amrasca biguttula biguttula*	Hemiptera/ Cicadellidae	Feeding on plant sap during July to September
16	Grasshopper *Gamphocerippus rufus* (L)	Orthoptera/ Acridiae	Adults feed on leaves during April to September
17	Grasshopper *Attactomorha crenulata* (F)	Orthoptera/ Pyrgomorphidae	Adults feed on leaves during April to September

both growing seasons 2021 and 2022. Insect pests have a negative correlation with a maximum temperature (r = -0.05) the year 2021 and (r = -0.78) the year 2022 and positive correlation with relative humidity (r = 0.551) during the year 2021 and (r = 0.313) during the year 2022. It is observed during both growing seasons with an increase in rainfall of 283.5 mm in the year 2021 and 10 mm during the year 2022. In July and August, the density and diversity of all pests increased but at the high temperature during May and June, maximum temperature (38°C) and maximum sunshine (6.5)

Table 2. Relative abundance of insect pests of brinjal (Kharif Crop) during April to September 2021-2022

Insect	year	April	May	June	July	August	September
Epilachna varivestis	2021	8.63 ± 1.60[a]	36.25± 5.23[c]	19.37 ± 3.1[b]	24.75± 3.45[b]	37± 5.17[c]	3± 1.13 [a]
	2022	2.37±0.53[a]	2.75±.25[a]	2.75±0.45[a]	9±1.25[c]	3.75± .81[b]	3.63 ± .59[a]
Autoba olivacea	2021	NF*	NF	NF	NF	NF	NF
	2022	1.50±0.5[a]	1.75±0.36[a]	1.75±0.36[a]	0±0[a]	7.75 ± 1.66[d]	3.75 ± .52[a]
Melanoplus bibittatus	2021	NF	NF	NF	NF	NF	NF
	2022	0± 0[a]	0±0[a]	0±0[a]	9.15±1.34[c]	3.12± .78[b]	2.25 ± .25[a]
Austroasca viridis	2021	6.875 ± .39 [a]	1.125± .22 [a]	3.125 ± .63 [a]	8.75± 2.12 [b]	5.375± .53 [a]	2.37± .56 [a]
	2022	NF	NF	NF	NF	NF	NF
Gamphocerippus rufus	2021	2.13± .51 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	1.75± .25 [a]	5.37± 1.42 [a]
	2022	3.87±0.74[b]	3.75±0.83[b]	2.50±0.59[b]	2±0.26[a]	2.6 ± .46[a]	1.37 ± .32[a]
Urentius hystricellus	2021	0 ± 0.00 [a]	3 ± .65 [a]	3.75± 1.04 [a]	2.5± .56 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]
	2022	NF	NF	NF	NF	NF	NF
Oxyrachis tarandus	2021	0 ± 0.00 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	6.5± 2.04 [b]	4± .77 [a]	7± .77 [a]
	2022	0±0[a]	0±0[a]	1±0.44[a]	1.87±0 .22[a]	0 ± 0[a]	1.12 ± .35[a]
Aulcophora frontalis	2021	0 ± 0.00 [a]	0 ± 0.00 [a]	2± .46 [a]	3.375± .56 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]
	2022	0±0[a]	0±0[a]	0±0[a]	3.12±0.78[b]	3.75 ± .67[b]	0 ± 0[a]
Phenacoccus soleni	2021	0 ± 0.00 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	19.63± 3.28 [b]	161.15± 9.15 [a]	161.15± 9.15 [e]
	2022	0±0[a]	0±0[a]	0±0[a]	7.87 ± 2.53[e]	1.75 ± .36[a]	0 ± 0[a]
Cordius janus	2021	0 ± 0.00 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	38.87 ± 11.60 [f]	79.63 ± 1.87 [a]	0 ± 0.00 [a]
	2022	0±0[a]	0±0[a]	0±0[a]	2 ± .614[b]	1 ± .35[a]	0 ± 0[a]
Attactomorpha crenulata	2021	3± .37 [a]	0 ± 0.00 [a]	0 ± 0.00 [a]	3±.37 [a]	6.25± .72 [a]	0 ± 0.00 [a]
	2022	NF	NF	NF	NF	NF	NF
Eretmocera impactells	2021	NF	NF	NF	NF	NF	NF
	2022	0±0[a]	0±0[a]	2.87±0.44[a]	2 ± 1.37[c]	0 ± 0[a]	0 ± 0[a]
Blister Beetle	2021	NF	NF	NF	NF	NF	NF
	2022	0± 0	1.75±0.36[a]	2±0.42[a]	11.12 ± 1.63[d]	11 ± 1.63[d]	8 ± .87[b]
Aphids	2021	NF	NF	NF	NF	NF	NF
	2022	0±0[a]	0±0[a]	0±0[a]	0 ± 0[a]	21.62 ± 2.40[e]	110.62 ± 17.17[f]
Leucinodes orbonalis	2021	NF	NF	NF	NF	NF	NF
	2022	0±0[a]	0±0[a]	1.12±0.35[a]	3.37 ± .71[b]	3 ± .59[a]	4.25 ± .65[b]
Bemisia tabaci	2021	NF	NF	NF	NF	NF	NF
	2022	0±0[a]	0±0[a]	0.75±0.31[a]	3 ± 1.37[c]	3 ± .32[a]	2 ± .1[a]
Gonocerus (Dock Bug)	2021	NF	NF	NF	NF	NF	NF
	2022	0±0[a]	0±0[a]	1.12±0.75[b]	3.37 ± 1.37[c]	3 ± .1[a]	4.25 ± .87[b]

Values are Mean ± SE. Figures followed with different super scripts indicate significant difference (P< 0.05) by using Duncan multiple range test. Values are Mean ± SE. *NF= Not Found; Figures followed with different super scripts indicate significant difference (P< 0.05) by using Duncan multiple range test showed a negative correlation (r = -0.78 and r = -0.41) respectively with insect pest population. Regarding crop production, changes in weather or climatic factors act as major factors. The pest population is favored by high relative humidity and rainfall from July to September a proactive and scientific approach will be required to deal with high pest populations during these months. Therefore, there is a great need for planning and formulation of strategies to prevent loss of crop yield during these months. During the experimental study of two years (2021-2022), *Mylabris pustulata* was observed very active and its population peaked during August and September. The study was supported by Bibha Kumari *et al.* (2022) with the same observations that the highest number of insect species was noticed in September and the lowest in May. *Mylabris flexuosa* were captured during mating in August and September (rainy season).

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