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Seasonal Incidence of Thrips *(Megalurothrips usitatus)* and Pod Bug *(Clavigralla gibbosa)* on *Kharif* Mungbean in Tropical Zone

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***Abstract*:** A two-year study (2022-2023) investigated the seasonal incidence of thrips (*Megalurothrips usitatus*) and pod bug (*Clavigralla gibbosa*) on *Kharif* mungbean in relation to weather parameters. The maximum thrips population during 2022 was observed in early, timely and late sown crops, with 2.60, 2.00 and 2.60 adults/10 flowers in 36th and 37th standard meteorological weeks (SMW), respectively. In 2023, peak thrips populations were 2.40, 0.60, and 1.32 adults/10 flowers for early, timely, and late sown crops during the 37th SMW. Correlation studies revealed a significant positive association of *M. usitatus* with temperature parameters in 2022 and with relative humidity and rainfall in 2023. The highest *C. gibbosa* populations in 2022 were 5.20, 3.50, and 4.26 adults/plant during the 37th SMW across early, timely, and late sown crops. In 2023, *C. gibbosa* first appeared in the early sown crop during the 33rd SMW (0.42 adults/plant), with peak at 3.80 adults/plant in the 38th SMW. Timely and late sown crops recorded peak *C. gibbosa* during the 37th SMW (2.76 and 3.34 adults/plant).

***Keywords*:** Correlation, *Clavigralla gibbosa,* Seasonal incidence, Mungbean, *Megalurothrips usitatus*

Mungbean (*Vigna radiata*), is one of India's most important pulse crops after chickpea and pigeon pea (Ved et al 2008). This crop is predominantly cultivated during the kharif season in the arid and semi-arid regions of India. During 2022-23 in Punjab, mungbean was grown over an area of 3.8 thousand hectares, with a total production of 3.0 thousand tonnes and an average yield of 7.80 quintals per hectare (Anonymous 2023).Despite its significance, mungbean production is constrained by numerous insect pests that cause severe yield losses. The major pests affecting mungbean include jassid (*Empoasca motti*), thrips (*Caliothrips indicus*), whitefly (*Bemisia tabaci*), semilooper (*Plusia orichalcea*), green bug (*Nezara viridula*), stem fly (*Ophiomyia phaseoli*), pod borers (*Helicoverpa armigera* and *Maruca testulalis*), tortricid moth (*Cydia ptychora*), galerucid beetle (*Madurasia obscurella*), and cutworm (*Agrotis ipsilon*) (Kumar et al., 2004 and Nitharwal and Kumawat 2013). These pests act as significant limiting factors in mungbean production, necessitating studies to understand their seasonal incidence and correlation with environmental factors. Main objective of this study to check the seasonal abundance of sucking insect pests on *kharif* mungbean.

MATERIAL AND METHODS

Mungbean variety, ML 1808 was sown at Entomological Research Farm, PAU, Ludhiana, during *Kharif* seasons of 2022-23. The crop was raised as per the PAU Package of Practices (Anonymous 2023). The seed was treated with rhizobium culture before sowing. There were three dates of sowing, 2 July (early sowing), 17 July (timely sowing), and 1 August (late sowing). The crop was kept free from insecticide spray. The crop was sown in plots measuring 5m x 10 m with spacing of 30 cm row to row and 10 cm plant to plant in randomized block design with five replications. Observations were recorded from initial occurrence of insect pests up to crop harvesting stage. The population of pod bug was recorded per plant and thrips from 10 flowers during flowering stage of crop at weekly interval during morning hours between 6:00 am to 8:00 am. Meteorological data regarding temperature (maximum and minimum), relative humidity and total rainfall were obtained from the Department of Climate Change and Agricultural Meteorology, PAU Ludhiana.

RESULTS AND DISCUSSION

In the early sown crop of 2022, the thrips (*Megalurothrips usitatus*) population gradually increased, peaking at 2.60 adults per ten flowers during the 36th SMW. The declining trend was observed from the 39th SMW, with the population reducing to 1.22 adults per ten flowers of mungbean. Similarly, in the early sown crop of 2023, the population peaked at 2.40 adults per ten flowers during the 37th SMW. Theis highlight the flowering stage as a critical period for thrips infestation, indicating that the reproductive phase of mungbean is particularly vulnerable. There was significant positive relationship between the thrips population and maximum temperature, minimum temperature, and mean temperature during 2022. In 2023, significant correlations were observed with relative humidity and rainfall (Table 1). Under timely sowing conditions, the peak thrips population during 2022 was 2.00 adults per ten flowers in the 36th SMW,

whereas in 2023, was 0.60 adults per ten flowers during the 37th SMW. In the late sown crop of 2022.Tthe adult population of *M. usitatus* first appeared during the 33rd SMW (1.40 adults per ten flowers), peaking at 2.60 adults per ten flowers in the 37th SMW. During 2023, the late sown crop recorded a peak of 1.32 adults per ten flowers in the 37th SMW. Mahipal et al. (2017), also reported peak thrips populations on cowpea during the first week of October (40th SW) and a gradual buildup from the fifth week of September (39th SW). Correlation studies for 2022 showed a positive and significant relationship between M. usitatus populations and maximum temperature, minimum temperature and mean temperature. In 2023, correlations were significant with maximum temperature, minimum temperature, mean temperature and rainfall. That abiotic factors contributed to 0.29 to 0.39 per cent (R^2) and 0.11 to 0.32 per cent (R^2) of the variability in the thrips population during the *Kharif* seasons of 2022 and 2023, respectively (Table 1, 2). In 2022, early sown crop adults population of *C. gibbosa* was first observed during 33th standard meteorological week (SMW) with population of 0.62 adults/ plant and increased gradually with a peak population of 5.20 adults/ plant during 37th SMW. During 2023 early sown crop the population of *C. gibbosa* was maximum 3.80 adults/ plant during 38th SMW. The population of *C. gibbosa* exhibited a positive but non-significant correlation with maximum temperature, minimum temperature, mean temperature and relative humidity. However, in 2023, the population showed positive and significant correlation with rainfall and with RH. The population of *Clavigralla gibbosa* was monitored during timely and late sown cowpea crops in 2022 and 2023. Under timely sowing, peak populations of 3.50 and 2.76 adults/plant were observed during the 37th SMW in 2022 and 2023, respectively. Correlation analysis revealed a positive but non-significant relationship between *C. gibbosa* population and maximum, minimum, and mean temperatures, as well as relative humidity during 2022. In 2023, a significant positive correlation was observed with rainfall (r = 0.326). For late-

Table 1. Correlation of population of Thrips, *Megalurothrips usitatus* with various weather parameters (2022 and 2023)

Weather parameters	2022			2023		
	Early sowing	Timely sowing	Late sowing	Early sowing	Timely sowing	Late sowing
Maximum temperature (°C)	0.452 (<.0001)***	0.481 (<.0001)***	0.527 (<.0001)***	0.195 (0.082)	0.142 (0.207)	0.320 (0.003)**
Minimum temperature (°C)	0.363 (0.0009)***	0.287 (0.009)**	0.330 (0.002)**	0.147 (0.191)	0.108 (0.338)	0.220 (0.049)*
Mean temperature (°C)	0.408 (0.0002)***	0.364 (0.0009)***	0.409 (0.0002)***	0.172 (0.125)	0.126 (0.262)	0.266 (0.016)*
R.H. (per cent)	0.095 (0.397)	-0.146 (0.194)	-0.064 (0.567)	0.223 (0.046)*	0.158 (0.159)	0.168 (0.136)
Rainfall (mm)	-0.139 (0.218)	-0.216 (0.054)	-0.202 (0.071)	0.233 (0.037)*	0.078 (0.486)	0.403 (0.0002)***

*Significant at 0.05 level (two- tailed), **Significant at 0.01 level (two-tailed), ***Significant at 0.001 level (two- tailed)

Table 2. Correlation of population of pod bug, *Clavigralla gibbosa* with various weather parameters (2022 and 2023)

Weather parameters	2022			2023		
	Early sowing	Timely sowing	Late sowing	Early sowing	Timely sowing	Late sowing
Maximum temperature (°C)	0.101 (0.370)	0.155 (0.167)	0.092 (0.414)	-0.004 (0.966)	0.059 (0.601)	-0.012 (0.913)
Minimum temperature (°C)	0.020 (0.859)	0.068 (0.544)	-0.038 (0.731)	-0.022 (0.843)	0.003 (0.977)	-0.150 (0.181)
Mean temperature (°C)	0.039 (0.727)	0.093 (0.407)	-0.007 (0.947)	-0.013 (0.905)	0.025 (0.823)	0.108 (0.340)
R.H. (per cent)	0.049 (0.665)	0.089 (0.428)	-0.008 (0.937)	0.238 (0.033)*	0.164 (0.145)	0.059 (0.600)
Rainfall (mm)	-0.133 (0.238)	-0.149 (0.184)	-0.177 (0.115)	0.339 (0.0021)**	0.326 (0.003)**	0.329 (0.002)**

*Significant at 0.05 level (two- tailed), **Significant at 0.01 level (two-tailed), ***Significant at 0.001 level (two- tailed)

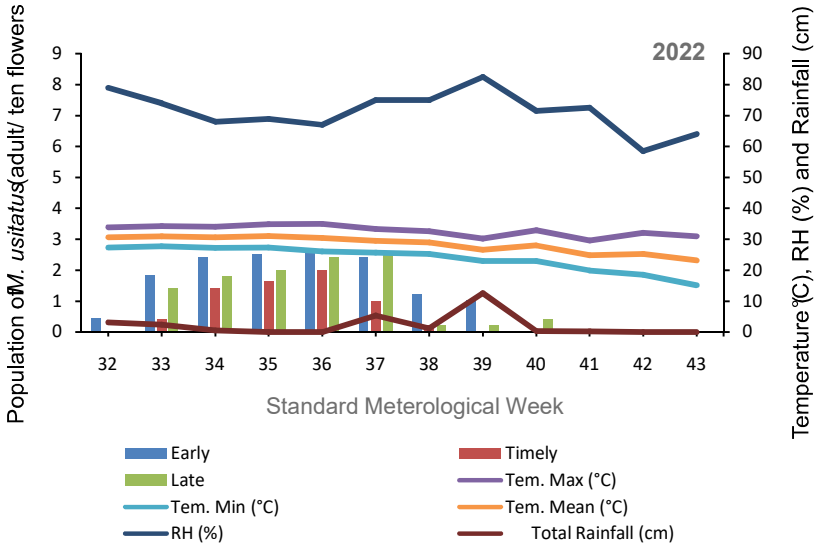

Fig. 1. Seasonal incidence of Thrips, *Megalurothrips usitatus* on *Kharif* mungbean (2022)

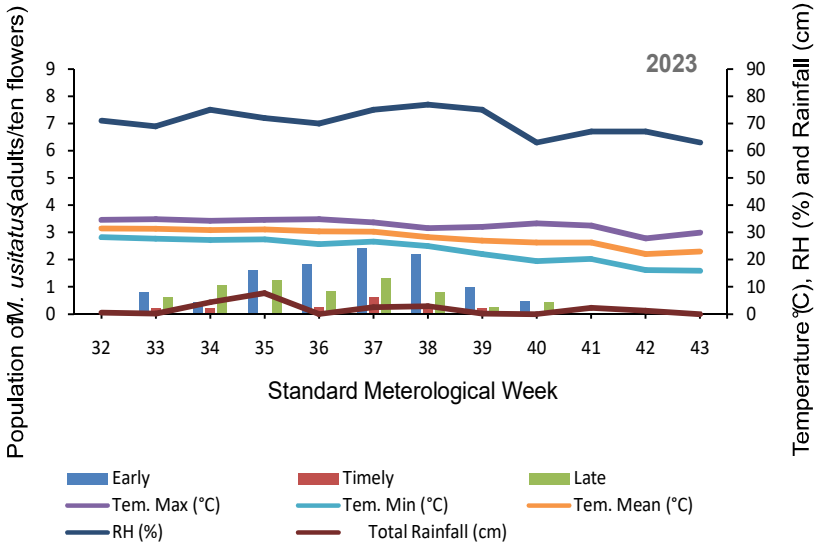

Fig. 2. Seasonal incidence of Thrips, *Megalurothrips usitatus* on *Kharif* mungbean (2023)

Table 3. Multiple regression equation of thrips and pod bug population with various environmental factors on different dates of sowing during 2022 and 2023

Date of sowing	Insect	Year	Multiple regression equation	Coefficient of determination R^2
Early sowing	Thrips	2022	$Y= -12.43+9.03X_1+8.60X_2-17.32X_3+0.03X_4-0.005X_5$	0.39
	Thrips	2023	$Y= -15.20-5.31X_1-5.81X_2+11.28X_3+0.12X_4+0.007X_5$	0.21
	Pod bug	2022	$Y= -11.4+18.75X_1+18.17X_2-36.80X_3+0.09X_4-0.006X_5$	0.46
	Pod bug	2023	$Y= -26.98-9.17X_1-10.06X_2+19.38X_3+0.27X_4+0.01X_5$	0.41
Timely sowing	Thrips	2022	$Y= -5.75+3.45X_1+3.22X_2-6.45X_3-0.01X_4-0.002X_5$	0.29
	Thrips	2023	$Y= -3.43-1.37X_1-1.48X_2+2.89X_3+0.03X_4-0.0008X_5$	0.11
	Pod bug	2022	$Y= -11.07+11.91X_1+11.40X_2-23.17X_3+0.08X_4-0.004X_5$	0.44
	Pod bug	2023	$Y= -15.61-5.59X_1-6.15X_2+11.87X_3+0.14X_4+0.008X_5$	0.30
Late sowing	Thrips	2022	$Y= -11.88+6.43X_1+5.97X_2-12.07X_3+0.01X_4-0.003X_5$	0.37
	Thrips	2023	$Y= -6.68-3.65X_1-3.91X_2+7.68X_3+0.03X_4+0.01X_5$	0.32
	Pod bug	2022	$Y= -10.42+16.95X_1+16.39X_2-33.22X_3+0.08X_4-0.006X_5$	0.48
	Pod bug	2023	$Y= -29.11-6.22X_1-7.37X_2+13.83X_3+0.25X_4+0.01X_5$	0.41

X_1=Max. Temp, X_2=Min. Temp, X_3=Mean Temp, X_4= RH, X_5=Rainfall

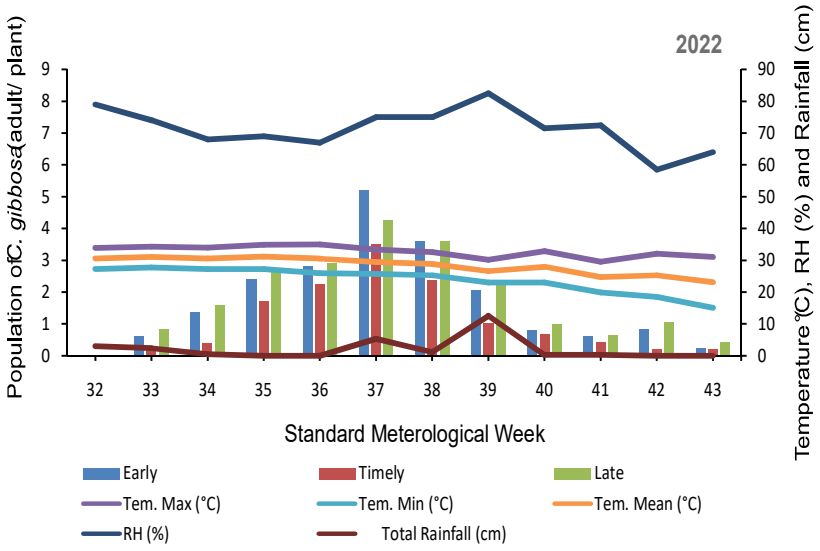

Fig. 3. Seasonal incidence of pod bug, *Clavigralla gibbosa* on *Kharif* mungbean (2022)

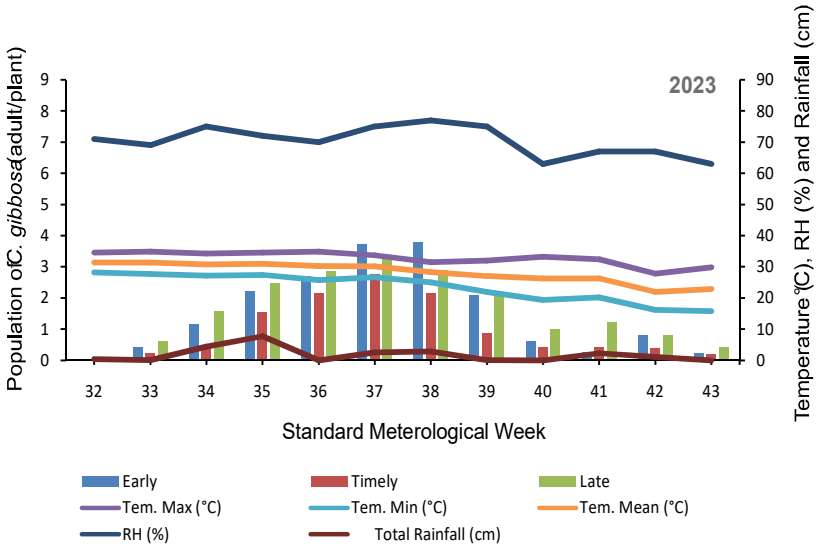

Fig. 4. Seasonal incidence of pod bug, *Clavigralla gibbosa* on *Kharif* mungbean (2023)

sown crops, peak populations of 4.26 and 3.34 adults/plant occurred during the 37th SMW in 2022 and 2023, respectively. Correlation analysis indicated a negative, non-significant relationship with minimum temperature, mean temperature, relative humidity, and rainfall in 2022, whereas in 2023, a positive but non-significant correlation was observed with relative humidity and mean temperature. The findings align partially with earlier studies. Singh et al. (2002) reported a positive correlation of *C. gibbosa* with maximum and minimum temperatures but an inverse relationship with relative humidity in cowpea crops. Kumar and Nath (2004) found that rainfall and high relative humidity favored *C. gibbosa* development in pigeonpea, while Nayak et al. (2004) recorded negative correlation of *Clavigralla* spp. with minimum temperature and relative humidity in black gram. Regression analysis demonstrated that weather factors explained 0.44-0.48% (R^2) and 0.30-0.41% (R^2) of population variation in 2022 and 2023, respectively. Contrastingly, Yadav and Singh (2013) emphasized the significance of crop developmental stages over climatic factors, suggesting that plant age plays a critical role in determining pod bug infestation levels.

CONCLUSION

The early sown crop consistently recorded higher thrips populations compared to timely and late sown crops. That weather parameters, particularly temperature, relative humidity, and rainfall, had varying degrees of influence on

thrips dynamics across different sowing conditions and years. The significant positive correlations with maximum temperature in 2022 and rainfall in 2023 underscored the role of abiotic factors in shaping population trends. Correlations between pod bug populations and abiotic factors were generally weak, rainfall and relative humidity had a significant positive influence during certain periods. Integrating pest monitoring with abiotic factor analysis and crop development stages can improve pest management strategies for mungbean crops.

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