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# Seasonal activity of Major Sucking Insect Pests on Brinjal (*Solanum melongena* L.) and Correlation with Weather Parameter

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**ABSTRACT: The present investigation was carried out at Research Farm, College of agriculture, Gwalior (M.P.) during Summer 2021 and 2022. The maximum number of Leaf hopper (*Cestius phycitis* Distant) population (18.50 leaf hopper/plant) and (18.60 leaf hopper/plant) During 20th SMW, during both years. The maximum number of Whitefly (*Bemisia tabaci* G.) population (15.40 whiteflies/plant) and (16.20 whiteflies/plant) during 19th SMW and 21st SMW Summer 2021 and 2022 respectively. Correlation studies carried out during 2021 and 2022 between meteorological parameters and population of major sucking insect pest, leaf hopper and whitefly, both showed significant positive correlation between maximum temperature (r=0.61. r=0.61 during 2021 and r=0.76, r=0.72 during 2022), minimum temperature (r=0.84, r=0.86 during 2021 and r=0.93, r=0.93 during 2022) and evaporation (r=0.55, r=0.55 during 2021 and r=0.84, r=0.82 during 2022) respectively. Whereas, leaf hopper showed significant negative correlation (r= -0.56) with morning relative humidity during 2022.**

**Keywords:** Seasonal activity, sucking insect pest, peak population, Leaf hopper, Whitefly, correlation.

## INTRODUCTION

*Solanum melongena* L. (known as Bazingan in Egypt, aubergine in France and England, eggplant in the United States, and brinjal in India) is an economically important and popular vegetable crop in India and elsewhere (Daunay, 2008; Zayed *et al.*, 2017). Its fruits range in size, shape and color depending on the varieties. The fruits may be black, purple, purple white, white, yellow or purple. Eggplant has two main groups: long (called Bride) and oval or spherical (called Romy). The fruit should be harvested as soon as it reaches maturity. Any delay in harvest time may increase the bitterness and seeds within the fruit, rendering inferior quality fruit (Zayed *et al.*, 2017). In the world china highest producing country while India in the second position. In India 727 thousand ha. Area and 126.80 lakh MT production in 2018-19 and 736 thousand ha. Area and 127.77 lakh MT production in 2019-20 of brinjal crop (NHB, 2019-20). State wise West Bengal at first with 163.15 thousand ha. area and 30.27 lakh MT production followed by Odisha with 117.92 thousand ha. area and 20.13 lakh MT production, Gujarat with 70.88 thousand ha. area and 14.23 lakh MT production, Bihar with 58.22 thousand ha. area and 12.41 lakh MT production and Madhya Pradesh with 51.35 thousand ha. area and 10.73 lakh MT production in brinjal crop. (Horticultural Statistics at a glance, 2018). So far, the nutritional value of brinjal is concerned, it supplies per 100 g; 25 calories, 0.2 g total fat, 2 mg sodium, 229 mg potassium, 6 g total carbohydrate, 3 g dietary fiber, 3.5 g sugar, 1g protein, vitamins (B-6, B-12 and C), iron, magnesium, phosphorus, etc (USDA, 2013). Among sucking insect pests, jassids and whitefly cause damage from the initial stage of the crop growth. Both nymph and adult of the sucking insects suck the cell sap by congregating on the lower surface of the leaves and lower down the vigorous growth of the plants. The loss caused by sucking pests varies from 10-15 percent depending on the intensity of infestation (Chatterjee *et al.*, 2018).

## MATERIAL AND METHODS

The study on seasonal activity of major sucking insect pests of brinjal was carried out at the research farm of the Department of Entomology, College of Agriculture, RVSKVV, Gwalior during Summer season of 2021 and 2022, on brinjal variety Pusa Safed Baigen. In this experiment, plants were planted at a spacing 60 × 60 cm on plot size 9 × 3.6 $m^2$ area with 3 replications. No pesticide was used throughout the experiment. Population of leaf hopper and whitefly observed on ten plants (3 compound leaves per plant *viz*., top, middle and bottom) were selected randomly to count the number of sucking insect pests. The data of seasonal activity of major sucking insect pests on different dates were correlated with prevailing minimum and maximum temperature, morning and evening relative humidity, total rainfall and evaporation on the basis of correlation coefficients between the variables. Correlation and regression of the abiotic factors on major sucking insect pest population were worked out by using the formula as suggested by Snedecor and Cochran (1967).

## RESULT AND DISCUSSION

Leaf hopper appeared during 9$^{th}$ SMW (1.50 leaf hopper/plant) and remained active till maturity of the crop (14.90 leaf hopper/plant). The peak population of leaf hopper (18.50 leaf hopper/plant) was recorded on 20$^{th}$ SMW, when the minimum and maximum temperature and relative humidity morning and evening were 23.1°C, 36.9°C, 78.1% and 62%, respectively. Whiteflies appeared during 10$^{th}$ standard week (1.20 whiteflies/plant) and remained active till maturity of the crop (13.20 whiteflies/plant). The peak population of whitefly (15.40 whiteflies/plant) was recorded on 19$^{th}$ SMW, when the minimum and maximum temperature and relative humidity morning and evening were 23°C, 41.1°C, 64.2% and 33.2%, respectively during 2021. Whereas, next year of study leaf hopper appeared during 10$^{th}$ SMW (1.20 leaf hopper/plant) and peak population of (18.60 leaf hopper/plant) was recorded on 20$^{th}$ SMW, when the minimum and maximum temperature and relative humidity morning and evening were 28.63°C, 45.5°C, 45.70% and 22.5%, respectively. Whiteflies appeared during 10$^{th}$ standard week (0.7 whiteflies/plant) and peak population (16.20 whiteflies/plant) was recorded on 21$^{st}$ SMW, when the minimum and maximum temperature and relative humidity morning and evening were 26.1°C, 41.6°C, 63.7% and 36.8%, respectively.

Present finding was concurrence with the finding of Deole (2015). Who studied on brinjal crop and found that the activity of both jassid and whitefly was initiated in the first week of April and the peak activity of these insects was observed during first week of May. Present finding also supported by the finding of Kumar *et al.* (2022); Dhamdhree *et al.* (1995).

**Correlation and regression studies.** Correlation studies carried out between meteorological parameters and population of leaf hopper, showed positive correlation (r=0.61, r=0.84 and r=0.55) with maximum temperature, minimum temperature and evaporation respectively during 2021. Next year also observed positive correlation (r=0.76, r=0.93 and r=0.84) with maximum temperature, minimum temperature and evaporation respectively. While population of leaf hopper, showed negative correlation (r=-0.56) between morning relative humidity. Regression equation between the population of leaf hopper and maximum temperature, minimum temperature and evaporation were $\hat{Y}_1$ = -38.67+1.31$X_1$, $\hat{Y}_1$ = -13.08 + 1.17$X_2$ and $\hat{Y}_1$= -2.57 + 1.44$X_6$ respectively during the first year of study. Whereas the next year also observed regression equation between the population of leaf hopper and maximum temperature, minimum temperature, evaporation and morning relative humidity were $\hat{Y}_1$= -32.29 + 1.04$X_1$, $\hat{Y}_1$= - 11.17 + 0.94$X_2$, $\hat{Y}_1$= -5.24 + 1.21$X_6$ and $\hat{Y}_1$= 24.03 - 0.25$X_3$ respectively.

Correlation studies also carried out between meteorological parameters and population of whitefly, showed positive correlation (r=0.61, r=0.86 and r=0.55) with maximum temperature, minimum temperature and evaporation respectively during 2021. During 2022 also observed positive correlation (r=0.72, r=0.93 and r=0.82) with maximum temperature, minimum temperature and evaporation respectively. Regression equation between the population of whitefly and maximum and minimum temperature and evaporation was $\hat{Y}_2$= -35.48 + 1.17$X_1$, $\hat{Y}_2$= -13.17 + 1.07$X_2$ and $\hat{Y}_2$= -3.26 + 1.29$X_6$ respectively during the first year of study. While, regression equation between the population of whitefly and maximum and minimum temperature and evaporation was $\hat{Y}_2$= - 28.26 + 0.90$X_1$, $\hat{Y}_2$= - 10.90 + 0.85$X_2$, $\hat{Y}_2$= - 5.25 + 1.08$X_6$ respectively as par the next year of study.

Present finding concurrence with the Devi *et al.*,2015, they observed jassid population showed significantly positive correlation with maximum and minimum temperatures. Present finding also supported by the finding of Pal *et al.* (2019). Studied on population dynamics of major insect pests viz, jassid and shoot and fruit borer on brinjal. Jassid population showed significant positive correlation with maximum temperature (r= 0.77) and minimum temperature (0.79). Whereas, present findings are closely related with the findings of Sushmetha and Hariprasad (2020); Ayyanar *et al.*, (2022).

**Table 1: Weekly Metrological data and major sucking insect pest population observation during summer crop season, 2021.**

| SMW | Weeks | Temp. Max. | Temp. Min. | Humidity Morning | Humidity Evening | Rainfall (M.M.) | Evaporation (M.M.) | Aphid population |
|---|---|---|---|---|---|---|---|---|
| 9 | Feb.-march 26-4 | 32.6 | 12.8 | 75.7 | 38.7 | 0 | 6.6 | 0 |
| 10 | March- 5-11 | 34.6 | 14.6 | 75.9 | 36 | 0 | 6 | 0 |
| 11 | March- 12-18 | 32.9 | 15.4 | 79 | 47.1 | 0 | 5.5 | 1.1 |
| 12 | March- 19-25 | 36.3 | 17.2 | 72.3 | 47.7 | 7 | 7.1 | 1.4 |
| 13 | March-April 26-1 | 37.7 | 18.3 | 72.7 | 41.1 | 0 | 9.3 | 1.8 |
| 14 | April- 2-8 | 39.3 | 17.9 | 61.8 | 39.1 | 0 | 11.1 | 2.3 |
| 15 | April- 9-15 | 40 | 18.7 | 49.5 | 36.1 | 0 | 9.9 | 4.6 |
| 16 | April- 16-22 | 39.8 | 20.7 | 50.1 | 35.8 | 0 | 11.4 | 5.1 |
| 17 | April- 23-29 | 40.3 | 19.7 | 51.7 | 29 | 0 | 11.7 | 6.7 |
| 18 | April-May- 30-6 | 41.3 | 25.2 | 51.4 | 31.5 | 0 | 11.1 | 7.1 |
| 19 | May- 7-13 | 41.1 | 23 | 64.2 | 33.2 | 4.6 | 9.7 | 6.8 |
| 20 | May- 14-20 | 36.9 | 23.1 | 78.1 | 62 | 49 | 6.4 | 6.2 |
| 21 | May- 21-27 | 36.7 | 23.2 | 69.2 | 39.8 | 0 | 8.2 | 5.4 |
| 22 | May-June- 28-3 | 35.2 | 26.1 | 77.5 | 35.2 | 0 | 11.7 | 5.1 |
| 23 | June- 4-10 | 42.5 | 30.3 | 54 | 32.4 | 0 | 13.7 | 4.7 |

*SMW= Standard Metrological Weeks

**Table 2: Weekly Metrological data and major sucking insect pest population observation during summer crop season, 2022.**

| SMW | Weeks | Temp. Max. | Temp. Min. | Humidity Morning | Humidity Evening | Rainfall (M.M.) | Evaporation (M.M.) | Aphid population |
|---|---|---|---|---|---|---|---|---|
| 10 | March- 5-11 | 29.9 | 13.3 | 83 | 47 | 0 | 4.8 | 0 |
| 11 | March- 12-18 | 33.6 | 15.4 | 86 | 38 | 0 | 6.6 | 0 |
| 12 | March- 19-25 | 37 | 14.1 | 53.4 | 29.7 | 0 | 7.5 | 0.9 |
| 13 | March-April 26-1 | 40.1 | 17.1 | 61.1 | 32.4 | 0 | 10.2 | 1.7 |
| 14 | April- 2-8 | 41.9 | 17.4 | 52.5 | 19.1 | 0 | 11.5 | 2.1 |
| 15 | April- 9-15 | 43 | 21.4 | 40.7 | 19 | 0 | 13 | 3.2 |
| 16 | April- 16-22 | 43.3 | 22.3 | 46 | 22 | 0 | 13.1 | 4.4 |
| 17 | April- 23-29 | 37.2 | 22 | 45.5 | 20.4 | 0 | 13.8 | 5.6 |
| 18 | April-May- 30-6 | 43.9 | 26.1 | 48.4 | 24.7 | 0 | 14.5 | 6.9 |
| 19 | May- 7-13 | 43 | 27.5 | 56.2 | 26 | 0 | 14.1 | 7.4 |
| 20 | May- 14-20 | 45.5 | 28.63 | 45.7 | 22.5 | 0 | 18 | 7.6 |
| 21 | May- 21-27 | 41.6 | 26.1 | 63.7 | 36.8 | 3.8 | 12.3 | 6.3 |
| 22 | May-June- 28-3 | 44.7 | 28.2 | 46.4 | 26 | 0 | 16.2 | 5.2 |
| 23 | June- 4-10 | 45.1 | 30.93 | 40.14 | 23.57 | 0 | 20.9 | 4.9 |
| 24 | June- 11-17 | 42.9 | 31.29 | 53.57 | 37 | 0.143 | 16 | 4.3 |

**Table 3: Correlation coefficient of insect pests population/% infestation with meteorological parameters, during 2021 and 2022.**

| Weather factor | During 2021 | | | | During 2022 | | | |
|---|---|---|---|---|---|---|---|---|
| | Leaf hopper | | White fly | | Leaf hopper | | White fly | |
| | r | Regression Equation | r | Regression Equation | r | Regression Equation | r | Regression Equation |
| Max. Temp.(°C) | 0.61* | $\hat{Y}_1$=-38.67+1.31$X_1$ | 0.61* | $\hat{Y}_2$=-35.48+1.17$X_1$ | 0.76** | $\hat{Y}_1$=-32.29+1.04$X_1$ | 0.72** | $\hat{Y}_2$=-28.26+0.90$X_1$ |
| Min. Temp. (°C) | 0.84** | $\hat{Y}_1$=-13.08+1.17$X_2$ | 0.86** | $\hat{Y}_2$=-13.17+1.07$X_2$ | 0.93** | $\hat{Y}_1$=-11.17+0.94$X_2$ | 0.93** | $\hat{Y}_2$=-10.90+0.85$X_2$ |
| Morning RH (%) | -0.39 | - | -0.39 | - | -0.56* | $\hat{Y}_1$=24.03-0.25$X_3$ | -0.50 | - |
| Evening RH (%) | -0.16 | - | -0.18 | - | -0.36 | - | -0.28 | - |
| Rainfall (mm) | 0.31 | - | 0.29 | - | 0.28 | - | 0.38 | - |
| Evaporation (mm) | 0.55* | $\hat{Y}_1$=-2.57+1.44$X_6$ | 0.55* | $\hat{Y}_2$=-3.26+1.29$X_6$ | 0.84** | $\hat{Y}_1$=-5.24+1.21$X_6$ | 0.82** | $\hat{Y}_2$=-5.25+1.08$X_6$ |

*=Significant at 5%, **= Significant at 1%

X= weather factor ($X_1$= Min. Temp., $X_2$= Max. Temp., $X_3$= Morning RH, $X_4$= evening RH, $X_5$= Rainfall and $X_6$= Evaporation)

Y= Pests population ($Y_1$= Leaf hopper, $Y_2$= White fly)

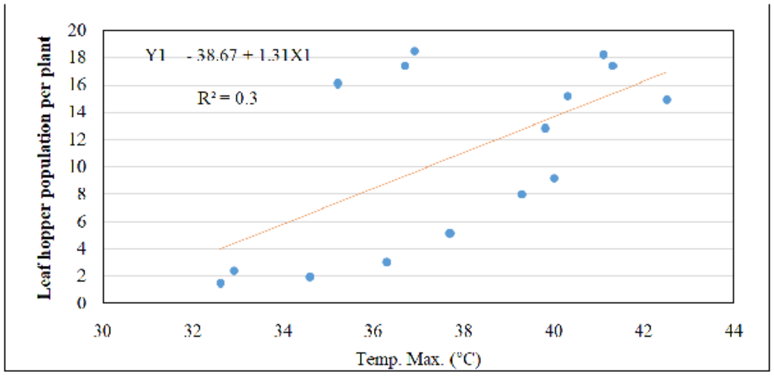


**Fig. 1.** Relation between max. temp. (°C) and incidence of leaf hopper, during 2021.

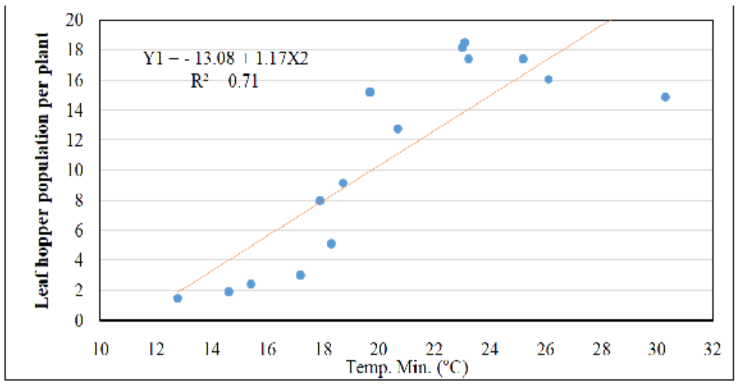


**Fig. 2.** Relation between min. temp. (°C) and incidence of leaf hopper, during 2021

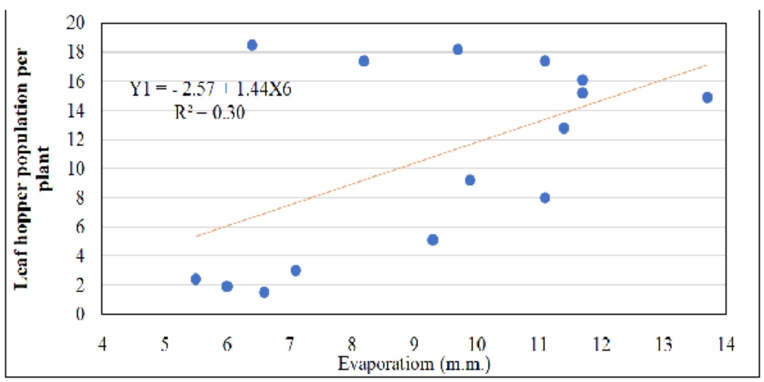


**Fig. 3.** Relation between evaporation (mm) and incidence of leaf hopper, during 2021.

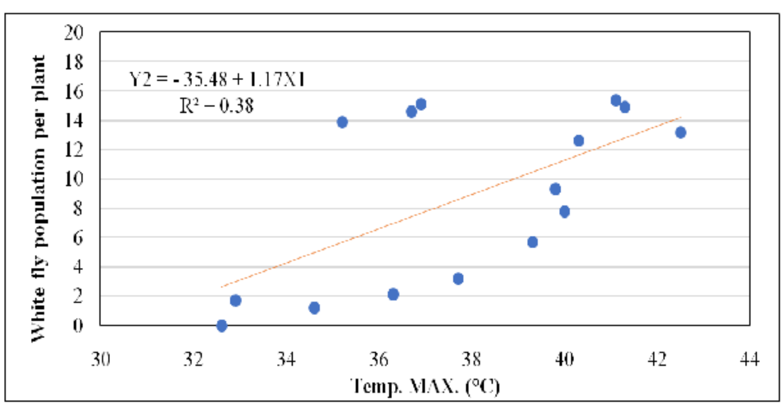


**Fig. 4.** Relation between max. temp. (°C) and incidence of white fly, during 2021.

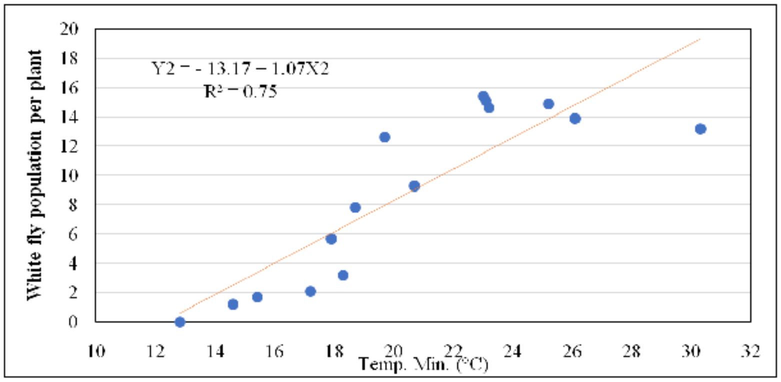


**Fig. 5.** Relation between min. temp. (°C) and incidence of white fly, during 2021.

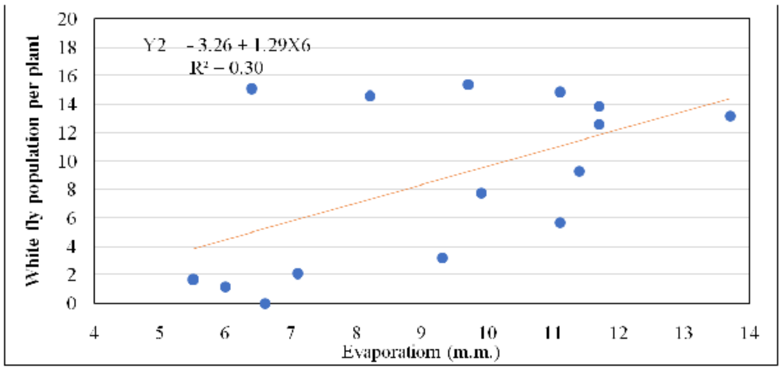


**Fig. 6.** Relation between evaporation (mm) and incidence of white fly, during 2021.

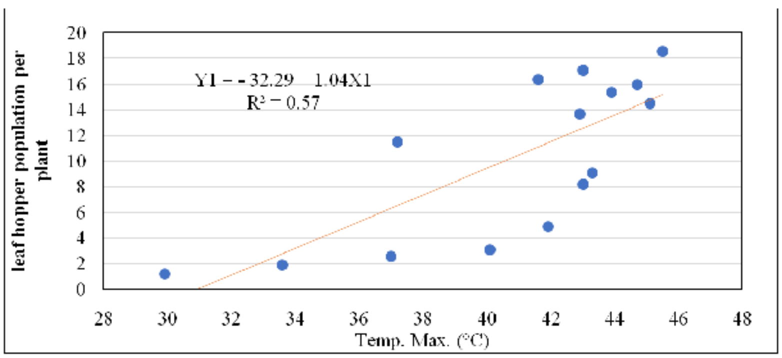


**Fig. 7.** Relation between max. temp. (°C) and incidence of leaf hopper, during 2022.

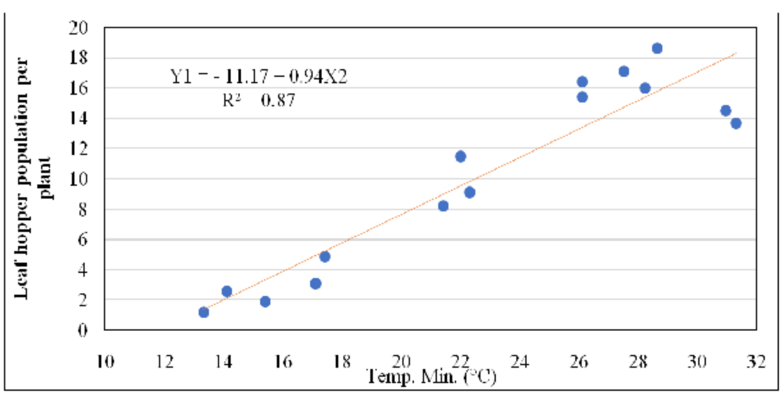


**Fig. 8.** Relation between min. temp. (°C) and incidence of leaf hopper, during 2022.

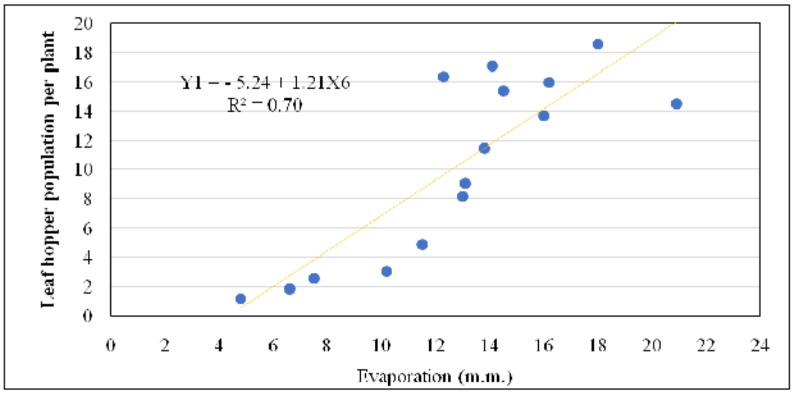


**Fig. 9.** Relation between evaporation (mm) and incidence of leaf hopper, during 2022.

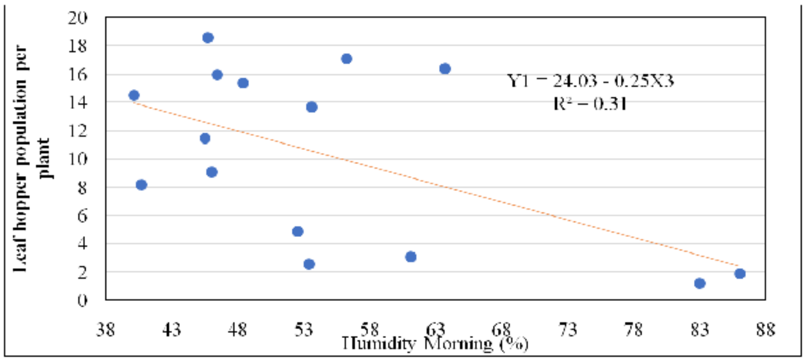


**Fig. 10.** Relation between morning humidity% and incidence of leaf hopper, during 2022.

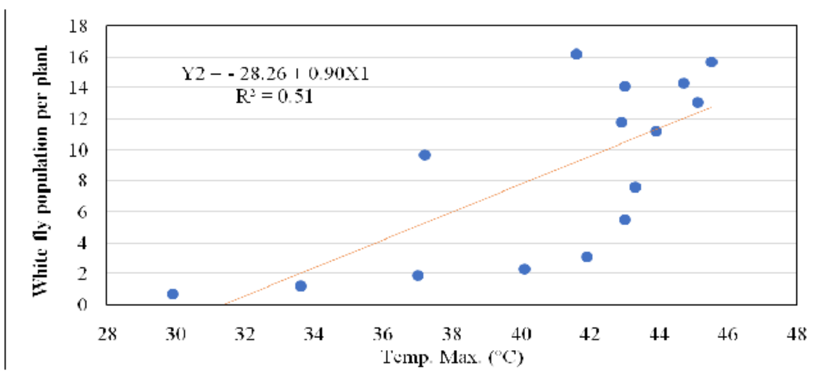


**Fig. 11.** Relation between max. temp. (°C) and incidence of white fly, during 2022.

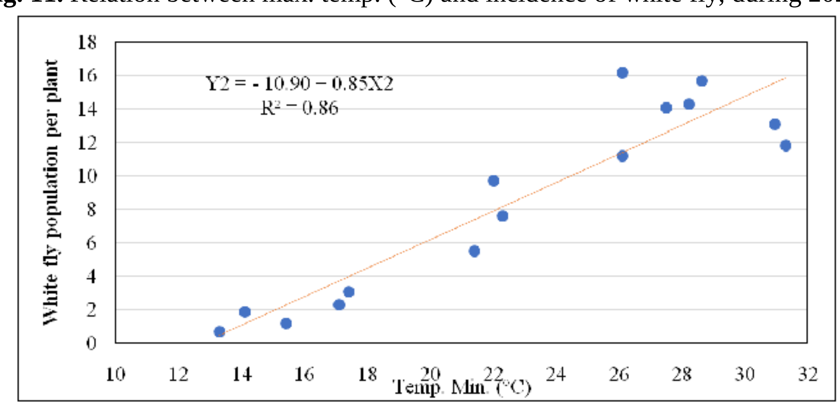


**Fig. 12.** Relation between min. temp. (°C) and incidence of white fly, during 2022.

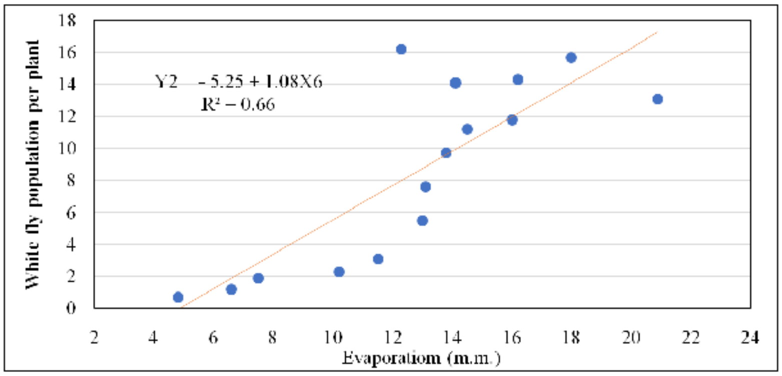


**Fig. 13.** Relation between evaporation (mm) and incidence of white fly, during 2022.

## CONCLUSION

The present Results concluded that various abiotic factors like temperature, relative humidity, rainfall and evaporation were affect the sucking insect pest population and their multiplication, as per the study of correlation find out that temperature and evaporation showed positive correlation. While, relative humidity and rainfall showed negative correlation.

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**Conflict of Interest.** None.

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