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Seasonal activity of aphid (*Myzus persicae* sulzer) on brinjal (*Solanum melongena* L.) and correlation with abiotic factor

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Abstract
The present investigation entitled "Seasonal activity of Aphid (*Mayzus persicae* Sulzer) on Brinjal (*Solanum melongena* L.) And correlation with abiotic factor" has been proposed to be carried out at Research Farm, College of agriculture, Gwalior (M.P.) during summer season 2021 and 2022. Aphid first appeared on the crop on 11th SMW and 13th SMW during summer 2021 and 2022. Thereafter infestation continued till 23th SMW to 24th SMW. The peak population (7.10 aphids/plant) of aphid was recorded on 18th SMW**,** while the second-year peak population was observed on 20th SMW with 7.60 aphids per plant. Correlation studies carried out during 2021 and 2022 between meteorological parameters and population of aphid, showed positive correlation between maximum temperature (r=0.67 and r=0.74), minimum temperature (r=0.77 and r=0.84) and evaporation (r=0.59 and r=0.78) respectively. Whereas showed negative correlation (r= -0.52 and -0.60) between morning relative humidity and aphid population as per both year of study.

Keywords: Seasonal activity, summer season, aphid, peak population, correlation

Introduction
Brinjal (*Solanum melongena* L.) is one of the most economically important horticultural crop grown in many geographical parts of India. Various pests which attack brinjal crop are brinjal shoot and fruit borer (BSFB), stem borer, whitefly, leafhopper, aphid, Epilachna beetle, lacewing bug and red spider mite (Borkakati *et al.* 2019) [3]. Among these, BSFB (*Leucinodes orbonalis*) is one of the most destructive pest and is of prime importance. The yield reduction due to its attack could be as high as 70 per cent (Dhandapani *et al.* 2003) [5]. Climate change is the long-term changes in the weather patterns in a region. Apart from having direct effects on plant productivity, it can also influence productivity through indirect effects mediated by changes in pests and diseases (Thomson *et al.* 2010) [16]. Climate can act directly on an insect either as a mortality factor or by determining insect growth rate and/or development (Bale *et al.* 2002) [2]. Climate affects the abundance and distribution of any species affecting the insect migration and outbreaks (Parmesan, 2007; Speight *et al.* 2008) [10, 15].
Brinjal crops are damaged by several insect pests that can cause considerable damage, which renders the fruit unfit for human consumption (Singh and Abrol 2001) [14]. Aphids are one of the most harmful non-indigenous threats to agriculture. The direct consequences of aphid infestation include production losses, decline in quality and increased agricultural risks (Miller *et al.* 2009) [8]. Aphid population has been increasing in the last few years, and they have attained the status of a common pest in Pakistan (Aheer *et al.* 2008) [1]. The nymphs and adults suck the sap from the leaves and tender shoots, and plants become weak, pale and stunted, which reduces the fruit size (Ghosh *et al.* 2004) [6]. Meteorological parameters play a pivotal role in the biology of pests. Temperature is the most crucial abiotic factor that affects the life economy of any organism. However, no single climatic factor governs the activity of pests because the effects of weather elements on pests are generally confounded (Narendra *et al.* 2001) [9]. The level of sunshine, rainfall, relative humidity and wind speed are the other chief weather parameters that largely control the activity of a given insect species. The association between pest activity and abiotic factors can help to derive predictive models that facilitate the forecasting of pest incidence (Chandra kumar *et al.* 2008) [4].

Material and Methods

The experiments on the seasonal activity of aphid (*Mayzus persicae* Sulzer) of brinjal was conducted at the Research form, College of agriculture, Gwalior, during summer 2021 and 2022. For observing aphid seasonal activity and correlation with abiotic factor, the brinjal variety Pusa Safed Baigen was transplanted in separate field plot measuring 9x3.6 M size on 14th and 21st February during 2021 and 2022, respectively. Ten plants were selected randomly in each plot for recording the population of the pest. Observation were recorded regularly on these plants weekly interval, starting from 15 days after transplanting in respective years till harvest of the crop. Observation on seasonal activity of aphid was recorded on randomly selected ten plants in each replication taking three compound leaves (*viz*., top, middle and bottom) per plant. Nymph and adults both were counted randomly as mention above and their average population was recorded in table. The data of seasonal activity of aphid 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.

Result and Discussion

- **Incidence of aphid [*Mayzus persicae* Sulzer] during 2021 and 2022**

As par the first year of observation, Aphid appeared on the crop on 11th SMW (1.10 aphids/plant) and infestation continued till 23th SMW. The peak population (7.10 aphids/plant) of aphid was recorded on 18th SMW**,** when the minimum and maximum temperature and relative humidity morning and evening were 25.2 °C, 41.3 °C, 51.4% and 31.5%, respectively. Whereas as the second year of study Aphid appeared on the crop on 13th SMW (0.90 aphids/plant) and infestation continued till 24th SMW. The peak population (7.60 aphids/plant) of aphid was recorded on 20th 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. Present finding was supported by the finding of Dhandge *et al.* 2018 [17]. As par their two year of study, they also noticed Aphid incidence was started from 10th SMW during both year of study, in summer 2016 peak population of aphid was observed at 17th SMW, while the next year at 16th SMW.

- **Correlation and Regression equation of Aphid population with Metrological parameter**

Correlation studies carried out both year between meteorological parameters and population of aphid, showed positive correlation between maximum temperature (r=0.67 and r=0.74), minimum temperature (r=0.77 and r=0.84) and evaporation (r=0.59 and r=0.78) respectively. Whereas showed negative correlation (r= -0.52 and r= -0.60) between morning relative humidity and aphid population.

Regression equation between the population of aphid and maximum and minimum temperature, evaporation and morning relative humidity during summer 2021 were $\hat{Y}_3$= - 17.61 + 0.57X_1, $\hat{Y}_3$= -4.37 + 0.40X_2, $\hat{Y}_3$= -1.45 + 0.57X_6 and $\hat{Y}_3$= 11.79 – 0.12X_3 (Fig 1, 2, 3 and 4). While in 2022 were $\hat{Y}_3$= - 13.32 + 0.42X_1, $\hat{Y}_3$= - 4.04 + 0.35X_2, $\hat{Y}_3$= - 2.03 + 0.47X_6 and $\hat{Y}_3$= 10.20 - 0.11X_3 (Fig 5, 6, 7 and 8) respectively. From the above equation it was concluded that with every one °C increase in maximum and minimum temperature, there was increase in 0.57 and 0.40 aphid population per plant respectively, while 1mm increase in evaporation, there was increase in 0.57 aphid population per plant. Whereas 1% increase in morning relative humidity, there was decrease in 0.12 aphid population per plant during summer 2021. Whereas during summer 2022, every one °C increase in maximum and minimum temperature, there was increase in 0.42 and 0.35 aphid population per plant respectively, while 1mm increase in evaporation, there was increase in 0.47 aphid population per plant. Whereas 1% increase in morning relative humidity, there was decrease in 0.11 aphid population per plant. There were no significant relationship of rainfall and evening relative humidity with aphid population during both year of study.

Present investigation was collaborative with the finding of Saikia *et al.* (2020) [12] who also observed significant positive correlation (r=0.66) of aphid population with maximum temperature and $\hat{Y}$=-5.47+0.28X regression equation. Similarly, Shakeel *et al.* (2014) [13], Humane *et al.* (2021) [7] and Saha *et al.* (2020) [11] also observed the seasonal activity of aphid on brinjal crop.

Acknowledgement

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Table 1: Weekly Metrological data and Aphid 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 Aphid 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 Summer 2021 and 2022

Weather factor	Aphid, during summer 2021		Aphid, during summer 2022	
	R	Regression Equation	R	Regression Equation
Max. Temp.(°C)	0.67**	$\hat{Y}_3$=-17.61+0.57X_1	0.74**	$\hat{Y}_3$=-13.32+0.42X_1
Min. Temp. (°C)	0.77**	$\hat{Y}_3$=-4.37+0.40X_2	0.84**	$\hat{Y}_3$=-4.04+0.35X_2
Morning RH (%)	-0.52*	$\hat{Y}_3$=11.79–0.12X_3	-0.60*	$\hat{Y}_3$=10.20–0.11X_3
Evening RH (%)	-0.23	-	-0.47	-
Rainfall (mm)	0.24	-	0.24	-
Evaporation (mm)	0.59*	$\hat{Y}_3$=-1.45+0.57X_6	0.78**	$\hat{Y}_3$=-2.03+0.47X_6

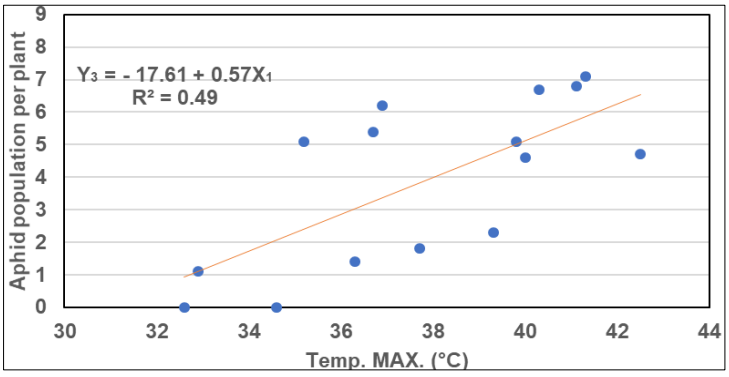

Fig 1: Relation between maximum temperature (°C) and incidence of aphid, 2021

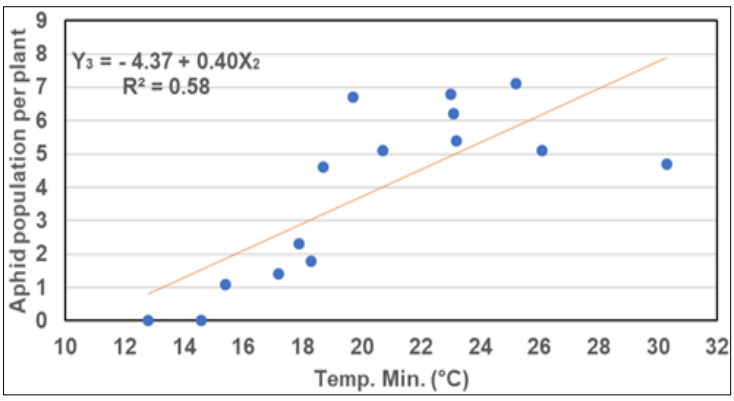

Fig 2: Relation between minimum temperature (°C) and incidence of aphid, 2021

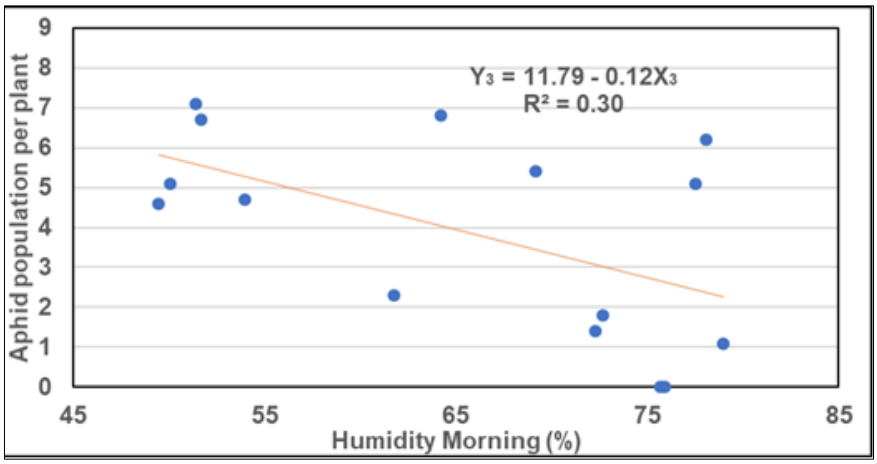

Fig 3: Relation between morning humidity (%) and incidence of aphid, 2021

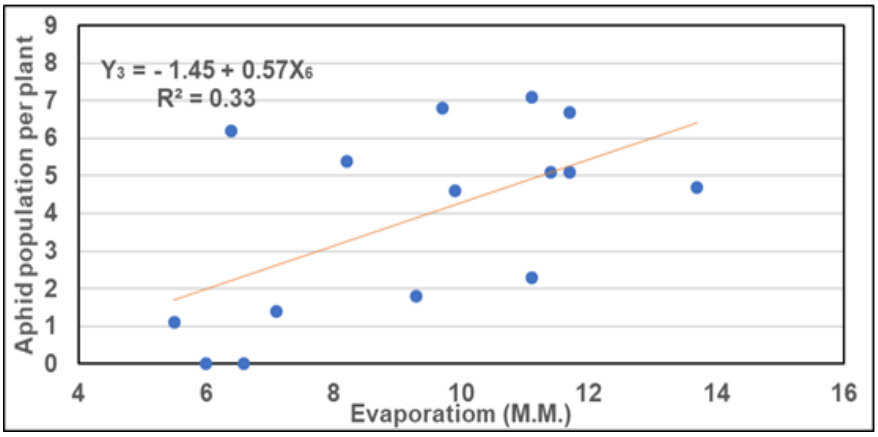

Fig 4: Relation between minimum temperature (°C) and incidence of aphid, 2021

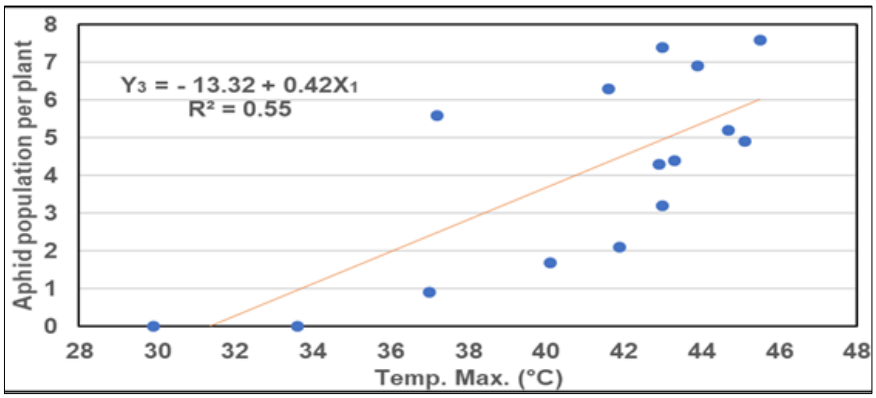

Fig 5: Relation between maximum temperature (°C) and incidence of aphid, 2022

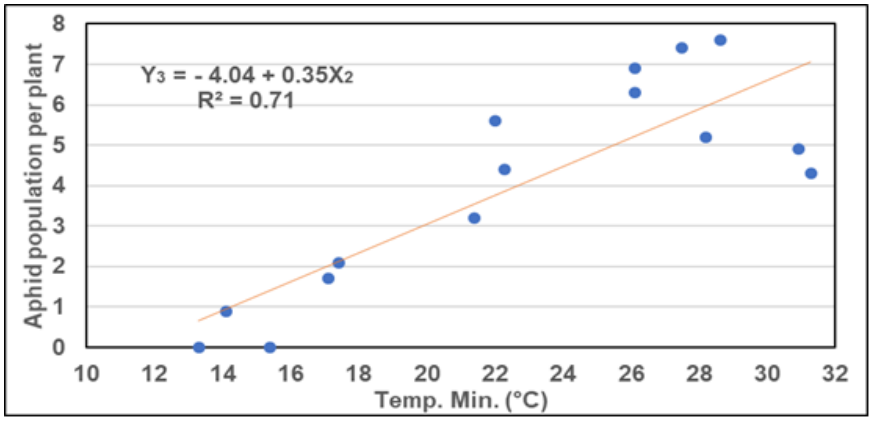

Fig.6 Relation between minimum temperature (°C) and incidence of aphid, 2022

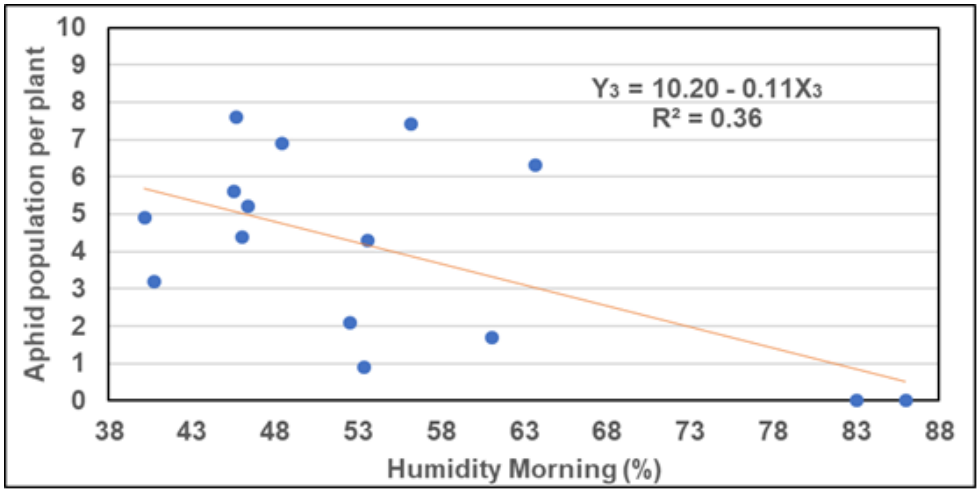

Fig.7 Relation between morning humidity (%) and incidence of aphid, 2022

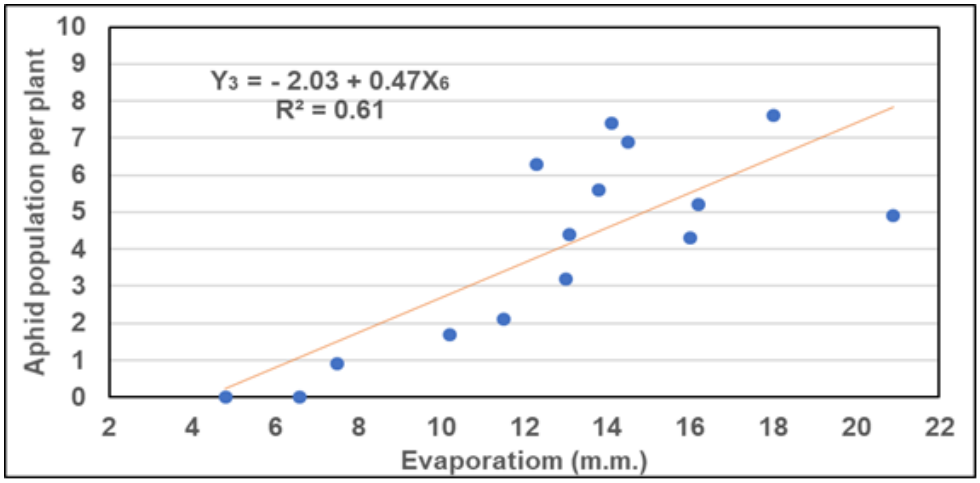

Fig.8 Relation between minimum temperature (°C) and incidence of aphid, 2022

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