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Seasonal Incidence of Whitefly, *Bemisia tabaci* (Gennadius) on Tomato in Gird Region of Madhya Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried out during the cropping season 2022-23 and 2023-24 at Entomological Research Field, College of Agriculture, Gwalior, Madhya Pradesh, India. The objective of the investigation was to study the seasonal incidence of whitefly, *Bemisia tabaci* (Gennadius) on tomato in this region and to examine the influence of weather factors on its incidence. The incidence of whitefly was first observed on 51st SMW (17th - 23rd December) and the peak incidence was noted on 9th SMW (26th February - 4th March), during 2022-23 and 2023-24 cropping season. The result of correlation studies revealed maximum temperature and minimum temperature found significant positive correlation with whitefly population in both consecutive years. While, morning RH found significant negative correlation with incidence of whitefly, during 2023-24. However, evening RH found significant and negative corelation with whitefly population in both the years.

Keywords: Whitefly; Bemisia tabaci (Gennadius); correlation; regression; population; tomato.

1. INTRODUCTION

"Tomato, *Solanum lycopersicum* L. is one of the important vegetable crop grown in India. It is grown as an offseason vegetable in India and farmers fetch good income" [1]. "The fruit can be eaten raw or cooked. Tomato in large quantities is used to produce soup, juice, ketchup, puree, paste and powder" [2]. Tomato fruit content water (93.1%), fat (0.3g), calorie (23), vitamin 'A' (320I.U), vitamin 'B_1' (0.07 mg), vitamin 'B_2' (0.01mg), carbohydrates (3.6%), nicotinic acid (0.4mg), vitamin 'C' (31mg), fibre (0.7%), calcium (20 mg), phosphorus (36 mg), protein (1.9%), and iron (0.8mg) [3].

"Several factors are responsible for the reduction of the quality and the production of tomato. Insect pests are one of the major causes that limit the production of tomato" [4]. "The incidence of insect-pests may vary from season to season and crop growth stages. The population fluctuation of the insects largely governed by different weather factors prevail during the crop growing period. In India, about 16 pests reportedly feed on tomato, commencing from germination to harvesting stage which reduces its yield and also degrades quality" [5]. "Among different insect pests, whitefly, *Bemisia tabaci* (Gennadius) is an important sucking pest and it is found damaging tomato crop all over the country. Whitefly, *Bemisia tabaci* (Gennadius) alone can cause 10-90% damage" [6]. "It causes damage to plants directly by sucking the cell sap from leaves and also induces physiological disorders by injecting some phytotoxins into leaves" [7]. "Besides, whitefly also acts as vector for many of viral diseases in various crops like leaf curl virus in tomato" [8].

Weather conditions have a significant impact on whitefly that attack tomato plants. Changes in temperature, humidity, rainfall and other meteorological parameters can directly and indirectly affect the seasonal incidence, distribution and behaviour of whitefly attacking tomato plants. Due to different agro-climatic conditions between regions, insects show different trend in the incidence and extent of crop damage. For effective pest control, studying the impact of various factors responsible for seasonal fluctuations can help predict their occurrence in a particular area [9]. Keeping this in view, therefore, the present investigation was carried out to study the Seasonal Incidence of Whitefly, *Bemisia tabaci* (Gennadius) on Tomato in Gird Region of Madhya Pradesh.

2. MATERIALS AND METHODS

The present experiment was carried out during 2022-2023 and 2023-24 cropping season at Entomological Research Field, College of Agriculture, Gwalior, Madhya Pradesh, India. The variety, Pusa Ruby shown in 10m × 10m area with 50cm × 50cm spacing. Weekly observations on whitefly were taken on three leaves (Upper, middle and lower) at randomly selected ten plants in the field. All the above observations were started from the first appearance of the insects and continued till their availability or final harvesting of the tomato fruits. The simple correlation and regression studies were also carried out for the number of whitefly and abiotic factors, *viz.,* maximum temperature (°C), minimum temperature (°C), morning relative humidity (%), evening relative humidity (%) and rainfall (mm). The above abiotic factors were collected from the meteorological observatory, College of Agriculture, Gwalior (M.P.).

3. RESULTS

3.1 Whitefly, *Bemisia tabaci* (Gennadius)

Activity of whitefly/three leaves recorded during both the years 2022-23 and 2023-24 cropping season in different standard meteorological weeks is presented in Table 1 and Fig. 1.

3.2 In 2022-23 Cropping Season

The recorded data on the pest population indicated that whitefly was first observed during 51th SMW (17th - 23rd December) with 0.40 whitefly/three leaves. The population of whitefly reached its peak during 9th SMW (26th February - 4th March) with 7.90 whitefly/three leaves. However, from 10th SMW (5th - 11th March) onwards the population started declining with 6.50 whitefly/three leaves and reached to its minimum during 15th SMW (9th - 15th April) with mean population 4.70 whitefly/three leaves.

3.3 Correlation

According to the correlation studies (Table 2), whitefly population was found significantly positively impacted by maximum temperature (r = 0.74) and minimum temperature (r = 0.74) at 5 % level of significance.

While, the morning relative humidity and rainfall were shown that they had non-significantly negative effects on the number of whitefly/three leaves (r = -0.36 and r = -0.02).

However, the evening relative humidity had significant correlation but negative effects on the number of whitefly population (r = -0.51).

3.4 In 2023-24 Cropping Season

The recorded data on the pest population indicated that whitefly was first observed during 51th SMW (17th - 23rd December) with 0.30 whitefly/three leaves. The population of whitefly reached its peak during 9th SMW (26 February - 4 March) with 7.20 whitefly/three leaves. However, from 10th SMW (5th - 11th March) onwards the population started declining with 6.70 whitefly/three leaves and reached to its minimum during 15th SMW (9th - 15th April) with mean population 3.10 whitefly/three leaves.

3.5 Correlation Studies

According to the correlation studies (Table 3), whitefly population was found significantly positively impacted by maximum temperature (r = 0.71) and minimum temperature (r = 0.59) at 5 % level of significance.

While, the morning relative humidity and evening relative humidity had significant correlation but negative effects on the number of whitefly population (r = -0.67 and r = -0.58, respectively).

However, rainfall was shown that they had non-significantly negative effects on the number of whitefly/three leaves (r = -0.28).

4. DISCUSSION

During the cropping season 2022-23 and 2023-24, the activity whitefly was first observed during 51th SMW (17th - 23rd December). Present finding are fully conformity with finding of Kotak et al. [10] Patil et al. [11] and Singh et al. [3] who found that incidence of whitefly was started in December. Similarly, Kumar and Singh [12] observed the infestation of whitefly at 25 DAT. The population of whitefly reached its peak during 9th SMW (26th February - 4th March). The current findings are supported by the Mandloi et al. [13] Panse et al. [14] and Patil et al. [11] who noted that the peak incidence of whitefly in February - March. However, the incidence of whitefly started declining and reached to its minimum during 15th SMW (9th - 15th April). The current results are completely supported by Kachave et al. [1] and Kumar and Singh, [12] who noted decreasing trend after peak incidence of whitefly.

4.1 Correlation Studies

The main finding of the study indicates that the whitefly population was influenced by maximum temperature and minimum temperature indicating a positive significant relationship in both the year. The positive correlation between temperature and whitefly population can be related to the enhanced rate of development and reproductive success of whitefly. The scientific evidences supporting the current findings, such as Dhanda et al. [15] Kachave et al. [1] Patidar and Vaishampayan et al. [16] and Patil et al. [11] who found the significant positive correlation with maximum temperature and whitefly population. Similarly, Sharma et al. [17] Sharma et al. [18] Singh et al. [3] and Fatima et al. [19] reported

Table 1. Seasonal incidence of whitefly, *Bemisia tabaci* (Gennadius) on tomato during cropping season 2022-23 and 2023-24

SMW	Period		2022-23	2023-24
	From	To		
50	10 Dec.	16 Dec.	0.00	0.00
51	17 Dec.	23 Dec.	0.40	0.30
52	24 Dec.	31 Dec.	1.80	1.40
1	1 Jan.	7 Jan.	0.90	0.70
2	8 Jan.	14 Jan.	1.50	1.10
3	15 Jan.	21 Jan.	1.10	2.20
4	22 Jan.	28 Jan.	2.50	2.50
5	29 Jan.	4 Feb.	2.70	3.60
6	5 Feb.	11 Feb.	3.40	2.70
7	12 Feb.	18 Feb.	3.10	4.50
8	19 Feb.	25 Feb.	5.20	4.80
9	26 Feb.	4 Mar.	7.90	7.20
10	5 Mar.	11 Mar.	6.50	6.70
11	12 Mar.	18 Mar.	6.20	6.10
12	19 Mar.	25 Mar.	5.20	5.60
13	26 Mar.	01 Apr.	5.10	5.20
14	02 Apr.	08 Apr.	4.80	4.70
15	09 Apr.	15 Apr.	4.70	3.10

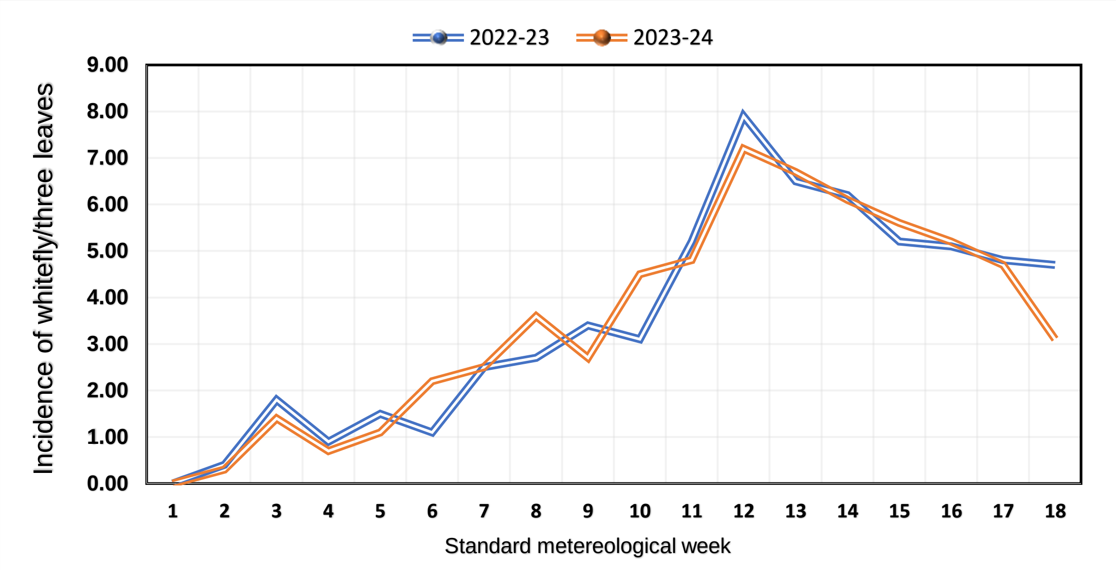

Fig. 1. Seasonal incidence of whitefly, *Bemisia tabaci* (Gennadius) on tomato during cropping season 2022-23 and 2023-24

Table 2. Correlation between whitefly, *Bemisia tabaci* (Gennadius) and prevailing weather parameters during cropping season 2022-23

Weather parameters	Whitefly	
	Correlation coefficient	Regression equation
Maximum temperature (°C)	0.74*	$\bar{Y}$ = 0.29x - 4.61 (R^2 = 0.55)
Minimum temperature (°C)	0.74*	$\bar{Y}$ = 0.32x - 0.15 (R^2 = 0.55)
Morninhg RH (%)	-0.36^{NS}	-
Evening RH (%)	-0.51*	$\bar{Y}$ = -0.13x + 9.91 (R^2 = 0.26)
Rainfall (mm)	-0.02 ^{NS}	-

**Significant at 5% level of significance, NS: Non-significant*

Table 3. Correlation between whitefly, *Bemisia tabaci* (Gennadius) and prevailing weather parameters during cropping season 2023-24

Weather parameters	Whitefly	
	Correlation coefficient	Regression equation
Maximum temperature (°C)	0.71*	$\bar{Y}$ = 0.25x - 3.45 (R^2 = 0.51)
Minimum temperature (°C)	0.59*	$\bar{Y}$ = 0.30x + 0.52 (R^2 = 0.35)
Morninhg RH (%)	-0.67*	$\bar{Y}$ = -0.15x + 16.53 (R^2 = 0.45)
Evening RH (%)	-0.58*	$\bar{Y}$ = -0.10x + 8.82 (R^2 = 0.34)
Rainfall (mm)	-0.28 ^{NS}	-

**Significant at 5% level of significance, NS: Non-significant*

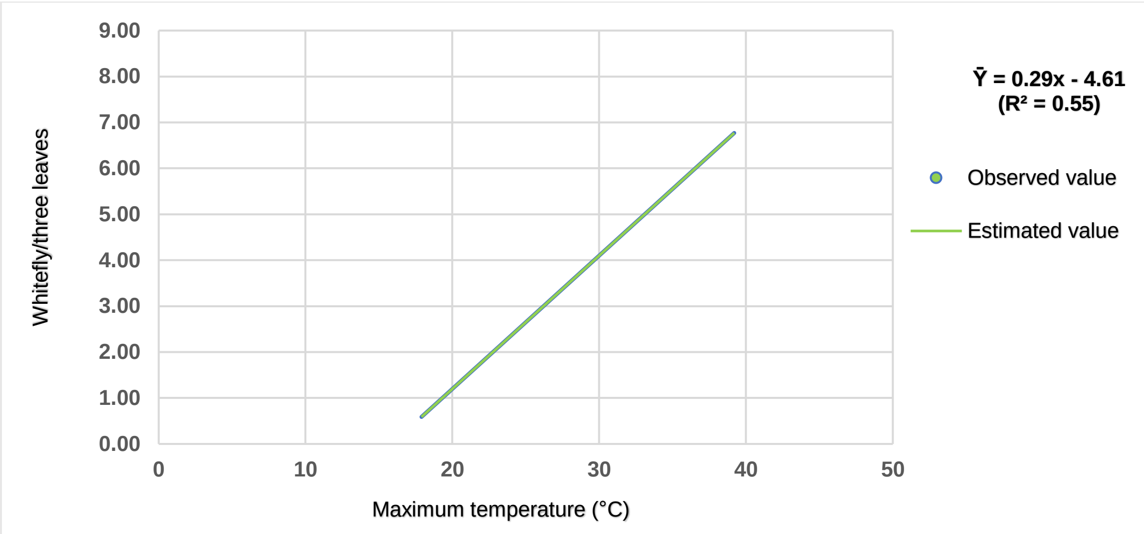

Fig. 2. Regression between whitefly, *Bemisia tabaci* (Gennadius) and maximum temperature (°C) during 2022-23

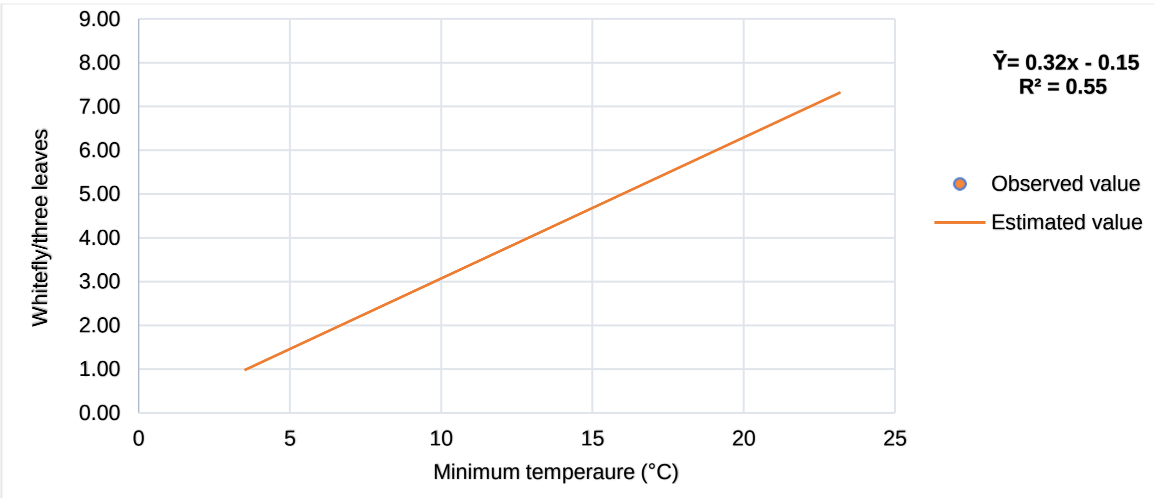

Fig. 3. Regression between whitefly, *Bemisia tabaci* (Gennadius) and minimum temperature (°C) during 2022-23

that both maximum and minimum temperature exhibited significant positive correlation with whitefly population. Whereas, Wade et al. [20] recorded that the population of whitefly increased with minimum temperature increases. The present findings are not supported with the findings of Chavan et al. [21] and Kotak et al. [10] who reported that the both maximum and minimum temperature found significant negative effect on whitefly population. According to the current research, 2022-23, incidence of whitefly and morning RH found non-significant negative correlation. Present findings are the full conformity with findings of Kachave et al [1] Vyshnavi et al. [22] Fatima et al [19] and Goudia et al. [4] as they found that the whitefly population was non-significantly negative impacted by morning RH. During 2023-24, morning RH found significant negative correlation with whitefly population. Similar results were also reported by Sharma et al [17] Dhanda et al. [15] and Singh et al. [3] who recorded that the significant negative correlation with whitefly population and morning RH. In the present investigation evening RH found significant negative correlation with whitefly population in both years. The current finding is somewhat compatible with that of Sharma et al. [17] Sharma et al. [18] Dhanda et al. [15]

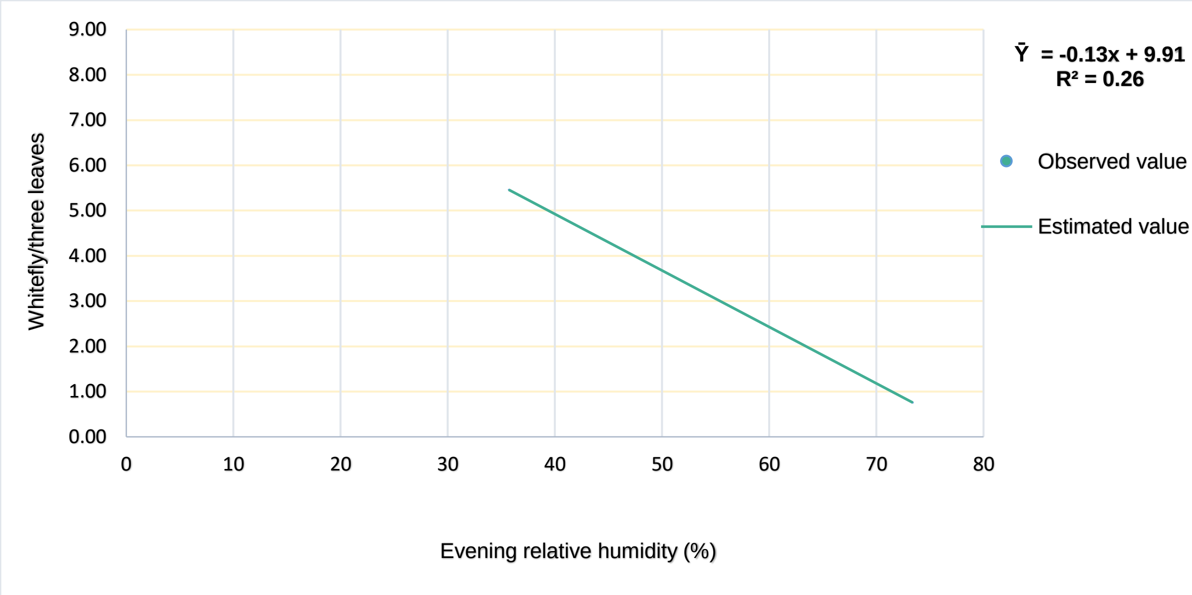

Fig. 4. Regression between whitefly, *Bemisia tabaci* (Gennadius) and evening relative humidity (%) during 2022-23

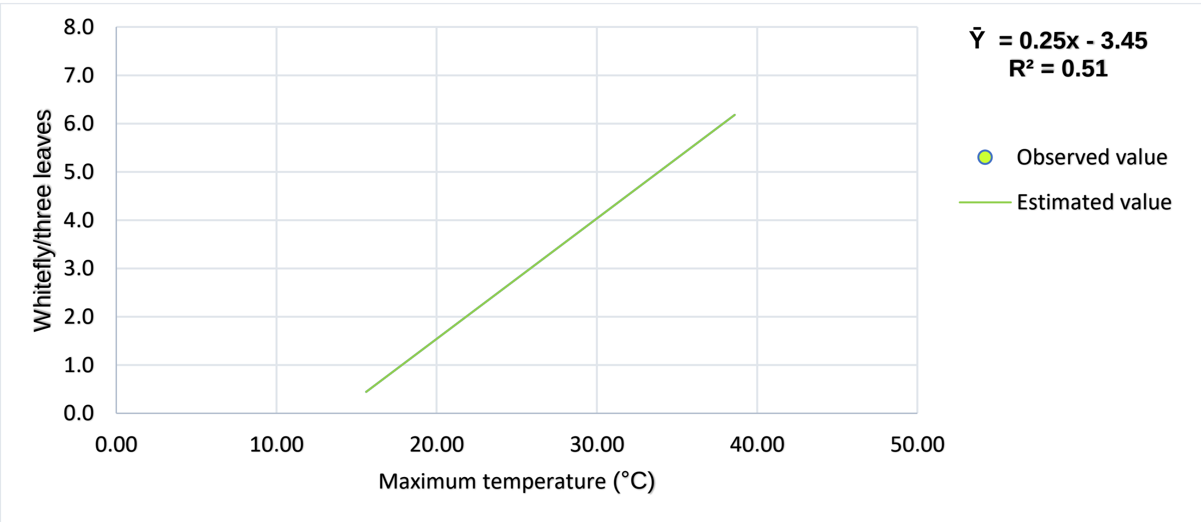

Fig. 5. Regression between whitefly, *Bemisia tabaci* (Gennadius) and maximum temperature (°C) during 2023-24

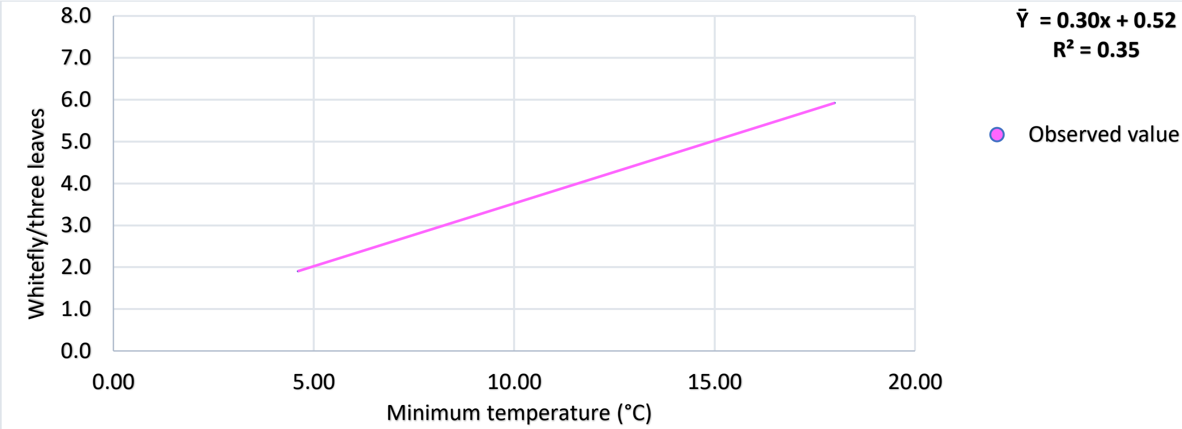

Fig. 6. Regression between whitefly, *Bemisia tabaci* (Gennadius) and minimum temperature (°C) during 2023-24

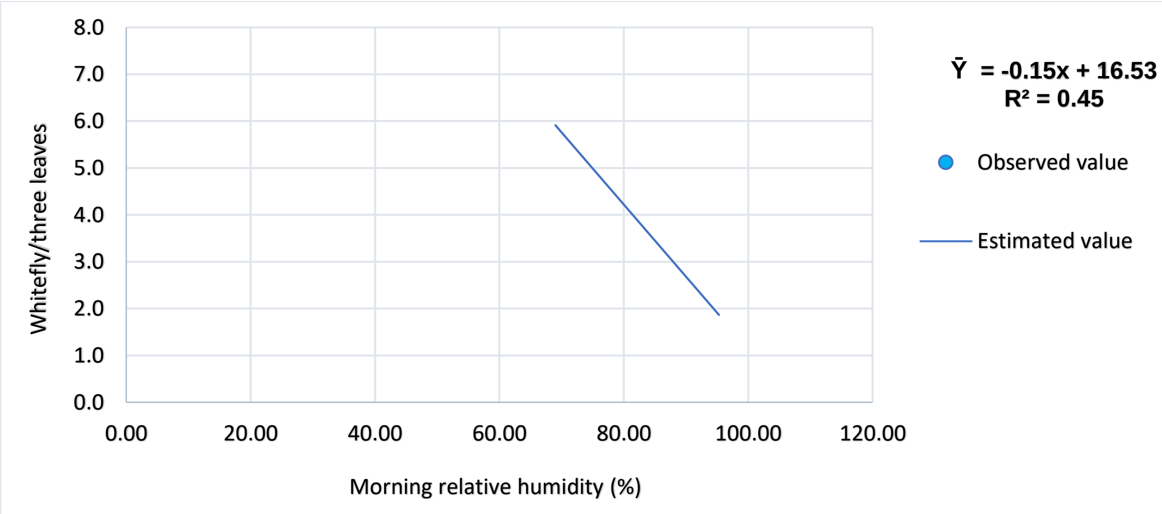

Fig. 7. Regression between whitefly, *Bemisia tabaci* (Gennadius) and morning RH (%) during 2023-24

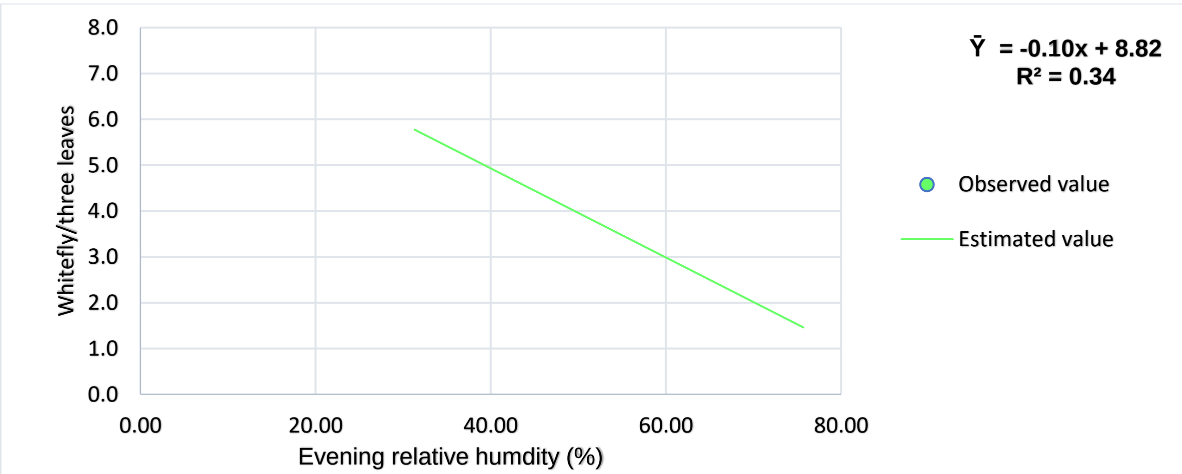

Fig. 8. Regression between whitefly, *Bemisia tabaci* (Gennadius) and evening RH (%) during 2023-24

Kachave et al. [1] Goudia et al. [4] Patil et al. [11] and Singh et al. [3] as they computed that population of whitefly was negative and significantly correlated with evening RH. In contrast, Chavan et al. [21] and Fatima et al. [19] reported that the whitefly infestation in this experiment grew as the evening relative humidity increased but non-significantly. During 2022-23 and 2023-24 on analysing the data, it can be referred that the correlation studies, whitefly was found non-significantly negative impacted by rainfall at the 5% level of significance. The present findings are the full conformity with the findings of Sharma et al. [18] Goudia et al. [4] and Patil et al. [11] reported that the rainfall showed non-significant negative correlation with whitefly population. These results also disagree with those of Panse et al. [14] who reported that rainfall showed non-significant but positive correlation with whitefly infestation [23].

5. CONCLUSION

During cropping season 2022-23 and 2023-24, the incidence whitefly was started at vegetative stage (51st SMW) of the crop with 0.40 and 0.30 whitefly/three leaves, respectively and highest population was found in 9th SMW. The population of whitefly found significant positive correlation with maximum and minimum temperature in both consecutive years. While, morning RH found significant negative correlation with whitefly population during 2023-24. However, evening RH found significant negative corelation with whitefly incidence in both the years. Understanding the seasonal incidence of whitefly in tomato crop is essential for implementing timely and targeted pest control measures. As the meteorological parameters play a vital role in the biology of this pest, the interaction between pest activity and abiotic factors will help in deriving at predictive models that aids in forecast of pest incidence.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kachave DR, Sonkamble MM, Patil SK. Population dynamics of major insect pests infesting to tomato, *Lycopersicon esculentum* (Miller). Journal of Pharmacognosy and Phytochemistry. 2020;9(3):344-348.
2. Chula MP, Jat SL, Kumar A, Nitharwal RS. Seasonal incidence of tomato fruit borer, *Helicoverpa armigera* (Hubner) and their correlation with abiotic factors. Journal of Pharmacognosy and Phytochemistry. 2017;6(4):1445-1447.
3. Singh JK, Chauhan S, Kumar P, Kumar R. Seasonal Incidence of Insect Pests of Tomato (*Lycopersicum esculentum* Miller). International Journal of Environment and Climate Change. 2023;13(10):1369-1375.
4. Goudia N, Jena MK, Singh RR. Dynamics of pests, natural enemies and pollinators of *Lycopersicon esculentum* Mill and correlation with weather parameters. International Journal of Environment and Climate Change. 2023;13(6):128-142.
5. Yadav A, Singh DR, Biswas SK, Umrao RS, Singh M, Yadav A, Kumar A. Population dynamics of tomato fruit borer *(Helicoverpa armigera* Hubner) Infesting tomato (*Lycopersicon esculentum* Mill) crops and their correlation with diverse meteorological factors under field condition. Biological forum - An International Journal. 2023;15(9):397-402.
6. Anu BC, Saha, T. Akhtar S, Kumari K. Screening of tomato genotypes for tolerance or susceptibility against sucking pests under field condition. Journal of Entomology and Zoology Studies. 2020;8(2):742-745.
7. Jayewar, NE, Kadam DR and Bhosle BB. Climatic factors influencing whiteflies infesting chilli. International Journal of Chemical Studies. 2019;7(4):2585-2588.
8. Kumar P, Naqvi AR, Meena RS, Mahendra. Seasonal incidence of whitefly, *Bemisia tabaci* (Gennadius) in tomato (*Solanum lycopersicum* Mill). International Journal of Chemical Studies. 2019;7(3):185-188.
9. Borgohain A, Rajkumari P, Borah N, Borah BK. Seasonal incidence of major insect

pests of Chilli and their correlation with weather parameters. International Journal of Environment and Climate Change. 2024;14(5):336-341.

10. Kotak JN, Acharya MF and Devananda KM. Population dynamics of leaf miner *Liriomyza trifolii* (Burgess) and whitefly *Bemisia tabaci* (Gennadius) on tomato. Journal of Entomology and Zoology Studies. 2019;7(5):1276-1279.
11. Patil RR, Gundannavar KP, Guruprasad GS, Kulkarni VR. Documentation of different pests and their natural enemies on tomato. Journal of Farm Sciences. 2023; 36(1):81-86.
12. Kumar S, Singh SK. Incidence of insect pests on tomato under the influence of weather factors. Environment and Ecology. 2022; 40 (3): 1144-1149.
13. Mandloi R, Pachori R, Prajapati S, Patel S. Seasonal incidence of insect complex on tomato (*Solanum lycopersicon* L.). Journal of Entomological Research. 2015; 39 (4): 347-352.
14. Panse RK, Bisen S, Dongre R, Kadam DM, Kuldeep DK, Rajak SK. Pest Population Fluctuation in Tomato (*Solanum lycopersicum* L.) Crop and their Correlation with Weather Parameters. International Journal of Current Microbiology and Applied Sciences. 2020; 11: 4055-4059.
15. Dhanda S, Yadav SS, Yadav S, Kumari, S. The population dynamics of insect-pest infesting tomato and their relation with different abiotic factor. Journal of Entomology and Zoology Studies. 2020; 8(6): 1158-1161.
16. Patidar N, Vaishampayan S. Succession and population dynamics of major insect pest of tomato in relation to weather parameters in Jabalpur region. International Journal of Pharmacognosy and Pharmaceutical Sciences. 2023; 5(1): 92-100.
17. Sharma D, Maqbool A, Ahmad H, Srivastava K, Kumar M, Vishav V. and Singh J. Effect of meteorological factors on the population dynamics of insect pests of tomato. Vegetable Science. 2013; 40 (1): 90-92.
18. Sharma D, Maqbool A, Jamwal VVS, Srivastava K, Sharma A. Seasonal dynamics and management of whitefly (*Bemesia tabaci* Genn.) in tomato (*Solanum esculentum Mill.*). Biological and Applied Sciences. 2017;60: 1678-4324.
19. Fatima K, Khan J, Chauhan A, Chauhan U, Saini N, Maurya SV, Gaurav N. Seasonal incidence of *Helicoverpa armigera*, *Aphis gossypii* and *Bemisia tabaci* on *Solanum lycopercicum* (tomato). European Chemical Bulletin. 2023; 12:(5), 4392 – 4397.
20. Wade PS, Wankhede SM, Hatwar NK, Shinde BD, Sanap PB. Seasonal incidence of major pests infesting tomato (*Solanum lycopersicum* L.). Journal of Entomology and Zoology Studies. 2020; 8(3): 1546-1548.
21. Chavan SM, Kumar S, Arve SS. Population dynamics and development of suitable pest management module against major insect pests of tomato (*Solanum lycopersicum*). Journal of Applied Horticulture. 2013; 15(2): 150-155.
22. Vyshnavi S, Kumar PD, Kumar M. Population dynamics of whitefly, *Bemisia tabaci* Gennadius in tomato and its management using novel insecticides under polyhouse condition. Pest Management in Horticultural Ecosystems. 2022; 28(1): 54-58.
23. Mondal B, Mondal P, Das A, Bhattyacharyya K. Seasonal incidence of different insect pests of tomato (*Lycopersicon esculentum Mill.*) and their correlation with abiotic factor in lateritic zone of West Bengal. Journal of Entomology and Zoology Studies. 2019; 7(1): 1426-1430.

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