



SEASONAL INCIDENCE OF *HELICOVERPA ARMIGERA*, *APIS GOSSYPPII* AND *BEMISIA TABACI* ON *SOLANUM LYCOPERCICUM* (TOMATO)

Kaneez Fatima¹, Joya Khan³, Aman Chauhan², Utkarsh Chauhan², Neha Saini², Sakshi³,
Veena Maurya^{4*}, Naveen Gaurav^{2*}

Abstract

The maximum population of the tomato was recorded at 0.28/3 fruit in 47 SW at a temperature ranging between 17^oC-28^oC and R.H. 41.8-89% in 2014 and 0.43/3fruit in 47 SW. When temperature ranged between 18-32^oC and R.H. 45-82% in season 2015. The population of fruit borer (*Helicoverpa armigera*) was continuously increasing till their harvesting. It became maximum at 8 SW at a temperature range of (17.40-25.50^oC) and R.H. (38-40%) in season 2014-15 and (19.20-26.60^oC) and R.H. (42.28-79.40%) in season 2015-16. At this temperature range and R.H. 6.28/3 fruit in 2014-15 and 8.26/3 fruit in 2015-16. The incidence of *A. gossypii* was recorded at 45 SW in both the season at a temperature range of (21.40-30.10^oC) and R.H. (38.10-88%) in seasons 2014-15 and (22.40-29.5^oC) and R.H. (42.10-88%) at season 2015-16. At this temperature range and R.H. the population of Aphid were 0.84/3 leaves and 1.20/3 leaves during both seasons. The population of *A. gossypii* went to increasing and reach its maximum at 6 SW or 1st week of February at a temperature range of (17.10-24.20^oC) and R.H. (30.28-84.20%) in season 2014-15 and in 2015-16 the population of *A. gossypii* maximum at temperature (13.20-24.20^oC) and R.H. (41.30- 79%). The population of *B. tabaci* went to increasing and reach its maximum at 6 SW during both the season at a temperature range of (17.10-24.20^oC) and R.H. (39.28- 84.20%) in seasons 2014-15 and (16.20-25.80^oC) and R.H. (43.10- 81.20%) in season 2015-16. At this temperature range and R.H. was 11.40/3 leave in 2014-15 and 12.20/3 fruit in 2015-16.

Keywords: Abiotic factor, tomato, abiotic factor, fruit borer, *Helicoverpa armigera*, *Apis gossypii*, *Bemisia tabaci*

¹Department of Microbiology, Galgotias University, Greater Noida-201310, Uttar Pradesh

^{2*}Department of Biotechnology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Patel Nagar, Dehradun- 248001, Uttarakhand, India, Email: veena.gzb@gmail.com, naveensri17@gmail.com
Contact: +918755710017

³Department of Microbiology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Patel Nagar, Dehradun- 248001, Uttarakhand, India

^{4*}Department of Zoology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Patel Nagar, Dehradun- 248001, Uttarakhand, India, Email: veena.gzb@gmail.com
Contact: +918708534623

***Corresponding Authors:** Dr. Veena Maurya and Dr. Naveen Gaurav

^{4*,2*}Department of Zoology and Department of Biotechnology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Patel Nagar, Dehradun- 248001, Uttarakhand, India, Email: veena.gzb@gmail.com, naveensri17@gmail.com
Contact: +918755710017, +918708534623

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INTRODUCTION

Tomato is one of the most different crops in the world due to its climatic adaptation. It is a rich source of minerals like potassium, vitamins, and organic acids mainly citric and maleic acids. Tomato contains almost all the 20 amino acids mainly glutamic acid aspartic acid, glycine, tryptophan, and tyrosine. Tomato may help in curing cancer and sores in the mouth and is a good appetizer for the patient suffering from constipation when used as a soup. It is also used in the treatment of edema disease during pregnancy. Different insect pests viz., aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*), and fruit borer (*Helicoverpa armigera*) attack tomato crops. The young larvae feed on tender foliage, advanced stage larvae attack the fruits. *Apis gossypii* is the most serious pest of tomatoes throughout the country. Both nymphs and adults are found in large numbers sucking the cell sap from leaves and tender apical shoots. The plant is infested due to aphids becoming weak, pale, and stunted in growth which results in reduced fruit size. Sharma, K.C. Bhardwaj (2008) reported the management of *Helicoverpa armigera* in tomatoes (Montejo *et al*, 2019; Huda *et al*, 2020).

MATERIALS AND METHODS

S. lycopersicum Cv." HISAR Lalima" was sown in a nursery plot, one-month-old seedlings were transplanted at a distance of 30x30 cm, at the local garden of Sh. B.P. Jain Delhi Road, Rohtak Haryana during Rabi season 2014-15 and 2015-16 and replicated thrice. By providing agronomic practices followed throughout the season. No insecticides were applied at any stage of crop growth. The infestation of insect pests was recorded from sowing to harvest of the crop. Observation of the population of insect pests was on randomly selected tomato plants in the experimental area from the insect pest appearance until the harvest of crops at weekly intervals. The infestation of *H. armigera*, *B. tabaci*, and *A. gossypii* on the plant was recorded by counting randomly selected 10 plants from each replication. Singh and Kaushik, (1990) have been reported that the population of insect pest leaf hopper and white fly were recorded on three layers (middle, upper, and lower) from each selected plant. It was correlated with the meteorological weather parameter such as temperature (maximum and minimum), RH (RH_{morn} and RH_{evng}) rainfall RF, and wind speed, and this data was collected from Krishi Vigyan Kendra Rohtak Haryana.



Sample crop of *Solanum lycopersicum*

RESULT & DISCUSSION

The results revealed that the incidence of *H. armigera* was recorded at 47 SW in both the season at a temperature range of (17.08-28.32°C) and RH (41.80-89%) in season 2014- 2015 and (18.70-29.32°C) and RH (45.80-82%) at season 2015-2016 (Table1& 2). At this temperature range and RH, the population of aphids was 0.28/3 fruit and 0.42 /3 fruit during both seasons. Ravi *et al* (1997) have reported the seasonal incidence of chickpea pod borer, *H. armigera*, and its larval parasitoid on chickpea crops. The population of fruit borers was continuously increasing till their harvesting. It became a maximum at 8SW at a temperature range of (17.40-25.50°C) and RH (38-40%) in season 2014-2015 and (19.20-

26.60°C) and RH (42.28-79.40%) in season 2015-2016. At this temperature range and RH 6.28/3 fruit in 2014-15 and 8.26/3 fruit in 2015-2016 (Table 1 & 2).

The population of *H. armigera* exhibits a positive significant correlation with maximum temperature ($r=0.523$ and 0.522) and RH_{morn} ($r=1.280$ and 1.122) and RH_{evng} ($r=0.441$ and -0.448) negative non-significant correlation with minimum temperature ($r=-0.260$ and -0.241) during both the season. Meena and Raju (2014) have reported that the population of fruit borer showed a negative non-significant correlation between maximum and minimum temperature and RH_{morn} and RH_{evng}. Wind speed showed a positive non-

significant correlation ($r = -0.107$) with *H. armigera* in 2014-2015 and a negative significant correlation ($r = -0.501$) in 2015-16 (Table 3 & 4). Whereas rainfall showed a positive non-significant correlation ($r = -0.223$ and 0.409) during both seasons.

Aphid (*Aphis gossypii*)

The results revealed that the incidence of *A. gossypii* could be recorded at 45 SW in both the season at a temperature range of (21.40-30.10°C) and RH (38.10-88%) in season 2014- 2015 and (22.40-29.50°C) and RH (42.10-88%) at season 2015-2016 (Table 2 & 3). At this temperature range and RH, the population of aphids was 0.84/3 of leaves and 120/3 of leaves during both seasons. Hath and Das (2004) have been recorded the maximum population of *A. gossypii* on tomatoes during the first week of March. The population of *A. gossypii* went on increasing and reach its maximum at 6SW or 1st week of February at a temperature range of (17.10-24.20°C) and RH (39.28-84.20%) in the season 2014-2015 and 2015-16 the population of *A. gossypii* maximum at the temperature range and RH (13.20-24.20°C) and RH (41.20-79%). At this temperature range and RH 11.24/3 leave in 2014-15 and 12.52/ 3 leaves in 2015-2016 (Table 1 & 2). After that, the population of *A. gossypii* went on decreasing during both seasons.

The population *A. gossypii* was positively significantly correlated with the maximum temperature ($r = 0.402$ and 0.447) and RH mm (0.883 and 0.350) and negatively non-significantly correlated with minimum temperature (-0.216 and -0.226) and positively non-significant correlation

with RH morning (-0.298 and 0.438) during both the year (Table 3 & 4). Wind speed ($r = 0.101$ and 0.392) showed a positive non-significant correlation whereas rainfall (0.141 and 0.474) also showed a positive non-significant correlation with the population of *A. gossypii* during both the season. Jat *et al* (2006) reported that mean temperature had a non-significant positive correlation with the density variation of aphids.

Whitefly (*Bemisia tabaci*)

The results revealed that the incidence of *B. tabaci* could be recorded at 45 SW in both the season at a temperature range of (21.40-30.10°C) and RH (38.10-88%) in season 2014-2015 and (22.20-29.50°C) and RH (42.10-88%) at season 2015-2016 (Table 1 & 2). At this temperature range and RH, the population of *B. tabaci* was 0.76/3 leaves and 0.60/3 leaves during both seasons. Meena and Bairwa (2014) have reported that the incidence of whitefly started in the 4th week of October and reached its maximum during the 1st week of November. Prasad *et al* (2008) also revealed that the incidence of whitefly was more during 44 to 48 SW. Yadav *et al* (2007) also reported that the maximum population of whitefly was observed on 9th-week-old plants of tomato. The population of *B. tabaci* went on increasing and reach its maximum at 6 SW during both the season at a temperature range of (17.10-24.20°C) and RH (39.28-84.20%) in the season 2014-2015 and a temperature range (16.20-25.80°C) and RH (43.10-81.20%) in Season 2015-2016. At this temperature range and RH 11.40/3 leave in 2014-15 and 12.20/3 leaves in 2015-2016 (Table 1 & 2). After that, the population of *B. tabaci* went on decreasing during both seasons.

Table 1: Seasonal incidence of Insect pest on tomato (*Solanum lycopersicum*) during 2014-15

Standard week (SW)	Observation Date	Temperature T (°C)		Relative Humidity (RH) (%)		Wind Speed (km/hr)	Rainfall (mm)	<i>Helicoverpa armigera</i>	<i>Aphis gossypii</i>	<i>Bemisia tabaci</i>
		Max.	Min.	Max.	Min.					
45	09.11.2014	30.10	21.40	88	38.10	2.20	0	0.0	0.84	0.76
46	16.11.2014	29.40	19.02	82.56	40.04	4.80	0	0.0	2.46	0.94
47	23.11.2014	28.32	17.08	89	41.80	8.80	0	0.28	2.80	1.24
48	30.11.2014	28.10	16.10	90.48	32.20	12.60	0	0.84	3.24	1.82
49	07.12.2014	25.45	16.80	78.40	31.40	10.20	3.23	1.20	3.84	2.20
50	14.12.2014	25.00	15.40	82.30	34.64	21.20	0	1.42	4.50	3.10
51	21.12.2014	24.20	12.50	86.89	44.80	24.10	0	1.82	5.80	2.60
52	28.12.2014	24.00	12.10	89.28	48.80	21.30	0	1.98	6.20	4.80
01	03.01.2015	22.40	10.40	84.80	35.80	10.20	4.0	2.21	6.82	5.60
02	10.01.2015	21.20	11.80	83.05	34.10	28.10	0	2.84	7.44	8.20
03	17.01.2015	20.00	8.80	88.30	42.80	23.10	0	3.14	7.84	9.20
04	24.01.2015	19.18	8.20	84.08	38.70	21.10	28.20	4.25	8.68	9.80
05	01.02.2015	23.00	16.20	88	50.10	14.20	0	4.80	9.24	10.20
06	08.02.2015	24.20	17.10	84.20	39.28	12.28	10.80	5.24	11.24	11.40
07	15.02.2015	25.10	18.20	80.54	35.02	15.20	0	5.80	10.10	8.10
08	22.02.2015	25.50	17.40	76.40	38.40	10.24	0	6.28	7.20	6.20
09	02.03.2015	26.80	18.80	79.20	41.30	13.23	0	6.10	5.40	4.20

Table 2. Seasonal incidence of Insect pest about weather parameters on tomato (*Solanum lycopersicum*) during 2015-16

Standard week (SW)	Observation Date	Temperature T (°C)		Relative Humidity (RH) (%)		Wind Speed (WS) (km/hr)	Rainfall (RF) (mm)	<i>Helicoverpa armigera</i>	<i>Aphis gossypii</i>	<i>Bemisia tabaci</i>
		Max.	Min.	Max.	Min.					
		Max.	Min.	Max.	Min.					
45	08.11.2015	29.50	22.40	88	42.10	0.48	0	0	1.20	0.60
46	15.11.2015	31.40	20.20	85.56	43.04	1.20	0	0	1.82	0.82
47	22.11.2015	29.32	18.70	82	45.80	4.20	0	0.42	2.84	1.42
48	29.11.2015	28.80	17.10	84.48	40.20	10.80	0	0.86	3.86	1.86
49	06.12.2015	27.45	15.20	78.40	34.40	08.22	0	1.32	4.10	2.44
50	13.12.2015	26.00	13.49	76.30	34.64	14.20	0	1.82	4.62	3.82
51	20.12.2015	25.90	12.70	89.80	52.80	18.04	0	2.12	6.24	4.69
52	27.12.2015	23.80	12.40	87.28	51.80	24.80	0	2.76	7.20	5.82
01	02.01.2016	22.50	10.20	80.20	42.80	08.20	2.2	3.28	8.24	6.42
02	10.01.2016	21.30	8.30	82.50	43.10	02.10	0	4.50	8.48	8.49
03	17.01.2016	22.00	9.40	76.30	35.70	12.40	0	4.92	9.16	9.32
04	24.01.2016	20.10	10.80	74.08	36.20	16.80	0	5.20	10.48	8.49
05	01.02.2016	24.20	13.20	79	41.20	14.04	24.20	5.82	12.52	9.32
06	08.02.2016	25.80	16.20	81.20	43.10	12.08	12.20	6.20	9.28	12.20
07	15.02.2016	24.80	18	80.21	46.30	12.24	0	6.87	6.40	9.20
08	22.02.2016	26.60	19.20	79.40	42.28	08.80	0	8.26	4.28	7.80
09	02.03.2016	27.20	18.20	81	48.10	10.02	0	3.89	3.20	6.20

Fig 1: Graphical representation of each Seasonal incidence of Insect pest about weather parameters on tomato (*Solanum lycopersicum*) during 2014-15

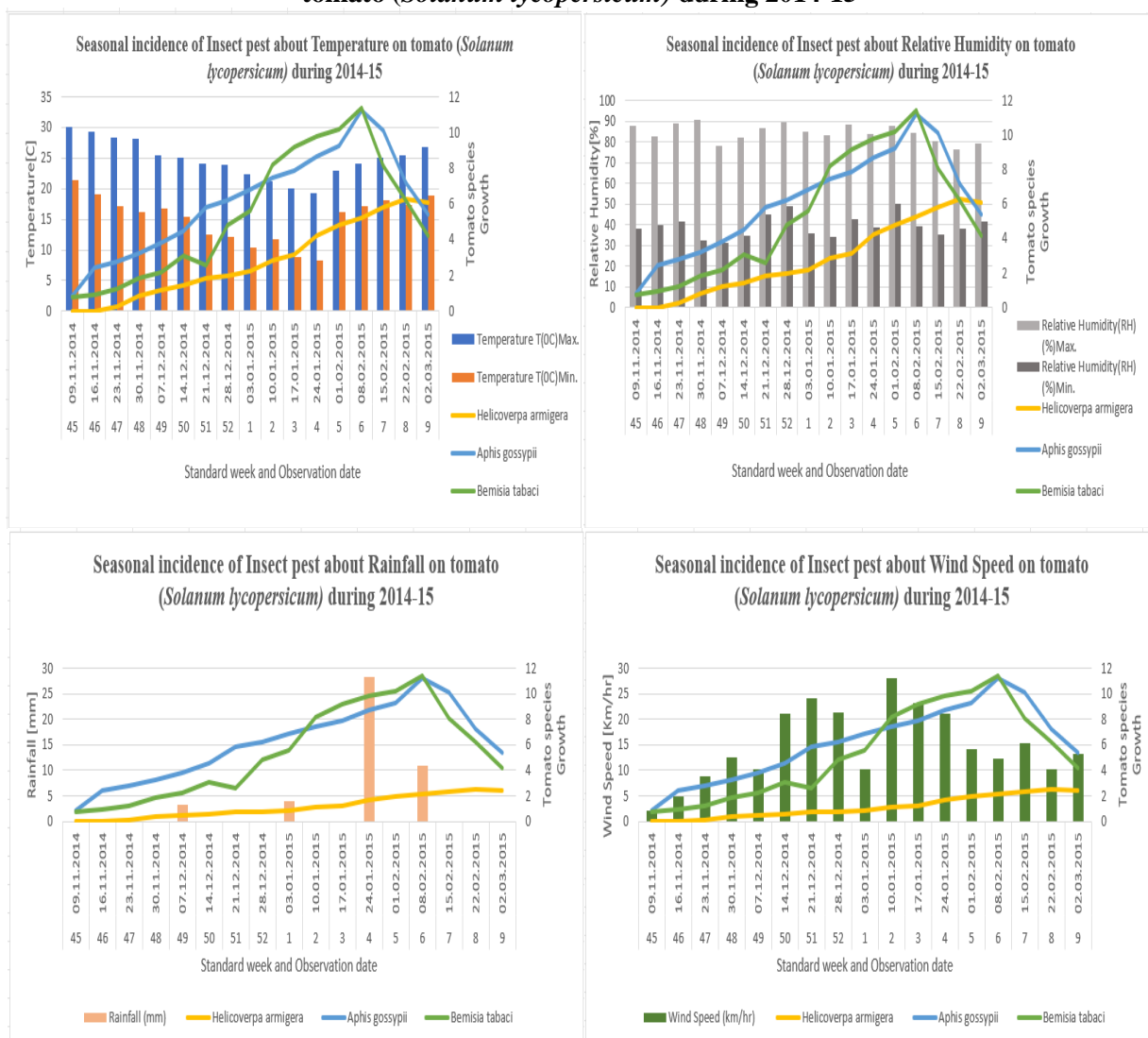
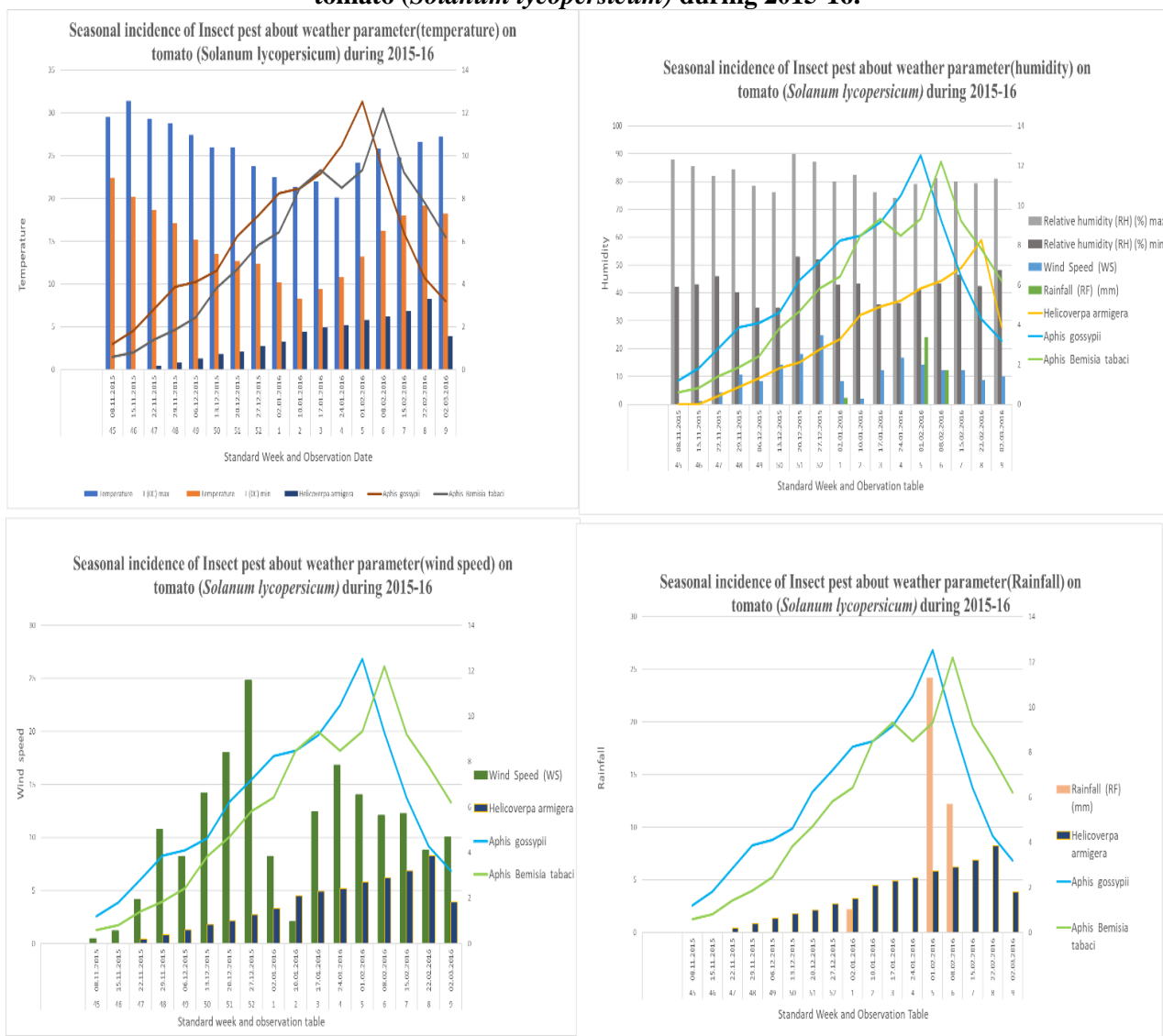


Fig 2: Graphical representation of each Seasonal incidence of Insect pest about weather parameters on tomato (*Solanum lycopersicum*) during 2015-16.



The correlation studies between the population of *B. tabaci* showed a positive significant correlation with the maximum temperature ($r=0.507$ and 0.474), and minimum temperature ($r =0.764$) in 2014-15 whereas in 2015-16 ($r=-0.695$) showed negative non-significant correlation and RH_{morn} ($r=1.401$ and 1.009) and positively non-significant correlation with RH_{evng} ($r=0.396$ and 0.389) during both the year. Meena and Bairwa (2014) have recorded that the whitefly population showed a positive significant correlation with the maximum and minimum temperature whereas the whitefly showed a positive non-significant correlation with RH_{morn} but with RH_{evng} showed a negative non-significant correlation. Wind speed (r 0.650 and -0.141) showed a positive significant correlation in 2014-15 and a positive non-significant correlation in 2015-16 (Table 3 & 4) whereas rainfall ($r=0.101$ and 0.452) also showed a positive non-significant correlation with the population of *B. tabaci*.

Table 3: Correlation of insect pests with weather parameters on tomato, *Solanum lycopersicum* during 2014-15

Insect Pest	T (°C) Max.	T (°C) Min.	RH _{morn}	RH _{evng}	Wind speed(km/hr)	Rainfall (RF) (mm)
<i>Helicoverpa armigera</i>	0.523	-0.260	1.280	-0.441	0.107	-0.223
<i>Aphis gossypii</i>	0.402	-0.216	0.883	-0.298	0.101	-0.141
<i>Bemisia tabaci</i>	0.507	0.764	-0.401	0.396	0.650	0.101
Standard deviation	0.065	0.578	0.878	0.447	0.315	0.168456

Table 4: Correlation of insect pests with weather parameters on tomato, *Solanum lycopersicum* during 2015-16

Insect Pest	T (°C) Max.	T (°C) Min.	RH _{morng}	RH _{evng}	Wind speed (km/hr)	Rainfall (RF) (mm)
<i>Helicoverpa armigera</i>	0.522	-0.241	1.22	-0.448	0.501	-0.409
<i>Aphis gossypii</i>	0.447	-0.226	0.350	-0.438	0.392	-0.474
<i>Bemisia tabaci</i>	0.474	0.695	1.009	0.389	0.141	0.452
Standard deviation	0.037987	0.536122	0.453818	0.480381	0.184609	0.516885

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