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Influence of weather parameters on the population of two spotted spider mite, *Tetranychus urticae* koch. on tomato

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Abstract
Tomato, *Solanum lycopersicum* L. is a prime vegetable crop of tropical and subtropical zone of the world. Tomato is cultivated throughout the year under varied agro ecosystems of India. It is obvious that the quality and quantity of the tomato was drastically reduced by various insect and non-insect pests. Among these pests, two spotted spider mite, *Tetranychus utricae* (Koch) cause drastic yield loss to the tomato crop. Study was carried out to document the influence of weather parameters on the population buildup of two spotted spider mite on tomato crop. In summer season, correlation coefficient between the population of two spotted spider mite and weather parameters indicated that the maximum and minimum temperature (r= +0.732) had a highly significant positive association. Relative humidity (r= -0.367) exhibits a significantly negative association. Whereas, the positively non-significant association was recorded in Hours of Bright Sunshine (r= +0.013), negative with Rainfall (r= -0.1913) and highly significant positive correlation with wind velocity (r= +0.547) respectively. The regression equation indicated that an increase in 1% relative humidity decrease the population of *T. urticae* at 0.675 numbers. An increase in 1°C of maximum and minimum temperature would lead to an increase of 1.342 and 1.592 numbers of two spotted spider mite. However, an increase in rainfall by 1mm/week resulted to decrease in the incidence level of mite by 0.02 is also to be related with the wind velocity. The adoption of pest management tactics is economically feasible to the farmers.

Keywords: tomato, two spotted spider mite, weather parameters

Introduction
Tomato, *Solanum lycopersicum* L. is a prime vegetable crop of tropical and subtropical zone of the world. Tomato is cultivated throughout the year under varied agro ecosystems of India. It is obvious that the quality and quantity of the tomato was drastically reduced by various insect and non-insect pests. Among these pests, two spotted spider mite, *Tetranychus utricae* (Koch) cause drastic yield loss to the tomato crop. The main non chemical method of pest management in the components of integrated pest management is to study the influence of weather parameters on the population buildup of *T. urticae.* To predict the population boost up during the particular mean standard week and adopt appropriate management tactics, which are economically cheaper and feasible for good quality tomatoes as farm produce.

Materials and Methods
The influence of various weather parameters on the population build up of two spotted spider mite was documented as field experiment in the farmer field located at Sivapuri village, Chidambaram Taluk, Cuddalore District. The tomato variety selected for the study as PKM 1, the normal package of practices as per the Tamil Nadu crop production guide.
The observations on the influence of weather parameters on the population of *T. urticae* were recorded at weekly intervals, beginning from 7th SMW of 2018 to 32nd SMW of 2018 for summer season. For the assessment of mite population randomly three leaves representing top, middle and bottom regions were selected from each plant and the number of nymphs and adult mites per 2cm^2 recorded using magnifying lens. The data were recorded separately considering canopy and leaf surface as followed by Sathyaseelan *et al.* (2020) [7]. Correlation and regression studies between population of *T. urticae* and prevailing various weather parameters were also made. The impact of abiotic factors *viz.* maximum temperature, minimum temperature, relative humidity, rainfall, hours of bright sunshine and wind speed made by calculating the simple correlation and regression (Shah and Shukla, 2014) [8].

Results and Discussions
Population dynamics of two spotted spider mites was monitored for summer season, the initial mite population incidence was observed from the 7thSMW of 2018, where the average population was recorded as 18.77 nos. /3 leaves. This study was continued up to 32ndSMW of 2018 to observe the *T. urticae* incidence on tomato under summer season (Table 1&2).
It was noticed that, there was a gradual increase in the mite population from 16thSMW of 2018 with a population of 21.00 mites and continued till 25thSMW of 2018 with an average population of 25.50 mites/ 3 leaves, thereafter an decrease in the population of mite was witnessed on 28thSMW of 2018 with an average density of 18.27 mites/3 leaves. Fluctuations in the population of mites were recorded from 26th SMW of 2018. Lowest population of 18.27 mites/3 leaves on 28thSMW of 2018.
In summer season, correlation coefficient between the population of two spotted spider mite and weather parameters indicated that the maximum temperature (r = +0.790) and minimum temperature (r= +0.732) had a highly significant positive association. Relative humidity (r= -

0.367) exhibits a significantly negative association with the population of mite. Whereas, the positively non-significant association was recorded in Hours of Bright Sunshine (r= +0.013). Rainfall (r= -0.1913) and wind velocity (r= +0.547) exhibits non-significant negative correlation and highly significant positive correlation, respectively Table (1.).

Multiple regression equations were fitted for regression analysis between the weather parameter (X) and incidence of *T. urticae* (Y) on mulberry during summer season.

Incidence of *T. urticae* (Y) = -12.210+ 1.342 X_1 + 1.592 X_2 - 0.675 X_3 + 0.120 X_4 - 0.02 X_5 - 0.006 X_6

Where,
X_1–Maximum temperature,
X_2–Minimum temperature,
X_3–Relative humidity,
X_4–HBSS,
X_5–Rainfall,
X_6–Wind velocity

The regression equation indicated that an increase in 1% relative humidity decrease the population of *T. urticae* at 0.675 numbers. An increase in 1°C of maximum temperature would lead to an increase of 1.342 numbers of two spotted spider mite likewise an increase in 1°C of minimum temperature increases the population by 1.592 mites. However, an increase in rainfall by 1mm/week resulted to decrease in the incidence level of mite by 0.02 is also to be related with the wind velocity.

The data on the influence of weather parameters on *T. urticae* provides the necessary information regarding the intensity of mite in relation to the environmental conditions. Such information would be helpful to adopt the appropriate integrated pest management strategies. The correlation study of mite with abiotic factors revealed a positive relationship with maximum and minimum temperature and negative relationship with relative humidity by Farazmand and Maafi (2018) [3] was in line with our research findings. Singh *et al.* (2018) [9] reported that the positive influence of weather parameters on the population buildup of mites and the rainfall had a negative effect on the mite population, the peak was attained at 18thSMW and 25thSMW was in accordance with our results. Similar result was reported by Kumar *et al.* (2015) [4].

Population fluctuations of mite depends on the climatic factors, present study revealed that there is a highly significant positive relationship between the mite and climatic conditions and it was justified by Desai *et al.* (2017) [2] also supports that significant correlation with maximum and minimum temperature, while negative non-significant correlation with average relative humidity and rainfall was as that of our present findings.

Rinkikumari and Shukla (2016) [6] reported that the population of two spotted spider mite was fluctuated during the month of January and attained the peak at 8thSMW, also had a non-significant positive correlation with average relative humidity. Similar results were recorded by Pokle and Shukla (2015) [5] who reported that the peak population was recorded at 15thSMW and 24thSMW. The weather parameter such as temperature (maximum and minimum) had a significant positive influence on the two spotted spider mite, this result was in line with okra by Baskaran and Sathyaseelan (2019) [1]. The knowledge acquired from the seasonal incidence was very much informative for the construction of integrated pest management module by the farmers economically cheaper and ecofriendly tomato crop.

Table 1: Correlation between the incidence of *T. urticae* and weather parameters during summer season

Weather parameters	Correlation Coefficient (r)
Max. Temperature (°C)	0.790**
Min. Temperature (°C)	0.732**
Relative Humidity (RH %)	-0.367*
Hours of Bright Sun Shine (HBSS)	0.013^{NS}
Rainfall (mm)	-0.191^{NS}
Wind Velocity (Kmph)	0.547**

Table 2: Influence of weather parameters on the incidence of *Tetranychus urticae* during summer season.

SMW	Period	Mean Popul.	Temperature (°C)		Relative Humidity (%)	HBSS (Hrs)	Rainfall (mm)	Wind speed (Kmph)
			Max.	Min.				
7	12 Feb – 18 Feb	17.98	31.70	21.70	89.00	8.80	0.00	2.70
8	19 Feb – 25 Feb	18.93	31.20	22.50	86.00	8.60	0.00	3.30
9	26 Feb – 04 Mar	19.80	33.20	22.80	88.00	7.90	0.00	3.30
10	05 Mar – 11 Mar	19.70	35.40	24.20	86.00	7.90	0.00	3.90
11	12 Mar – 18 Mar	19.37	33.60	22.10	85.00	8.20	0.00	2.30
12	19 Mar – 25 Mar	19.97	34.10	23.20	91.00	8.40	0.00	3.60
13	26 Mar – 01 Apr	20.83	34.70	22.50	89.00	9.10	0.00	2.90
14	02 Apr – 08 Apr	20.20	35.20	24.10	87.00	9.00	0.00	3.80
15	09 Apr – 15 Apr	22.10	35.80	24.40	87.00	9.20	0.00	3.50
16	16 Apr – 22 Apr	21.00	36.40	26.10	82.00	8.20	0.00	4.10
17	23 Apr – 29 Apr	22.43	36.20	25.80	85.00	7.10	0.00	2.60
18	30 Apr – 06 May	22.53	38.20	26.00	80.00	7.00	6.50	4.10
19	07 May – 13 May	22.07	39.20	26.50	82.00	7.80	0.00	6.00
20	14 May – 20 May	22.50	39.40	27.40	79.00	8.60	0.00	4.50
21	21 May – 27 May	23.43	38.30	27.50	83.00	8.90	0.00	5.90
22	28 May – 03 Jun	23.67	38.60	27.80	82.00	7.10	0.00	6.50
23	04 Jun – 10 Jun	23.90	38.40	27.90	77.00	7.50	0.00	6.70
24	11 Jun – 17 Jun	24.03	39.00	27.60	76.00	7.70	0.00	7.00
25	18 Jun – 24 Jun	25.50	39.30	27.40	76.00	4.90	0.00	6.20

26	25 Jun – 01 Jul	21.63	32.20	27.30	83.00	5.10	3.60	5.40
27	02 Jul –08 Jul	22.63	37.60	26.20	80.00	5.00	0.00	5.00
28	09 Jul – 15 Jul	18.27	35.40	25.20	84.00	2.70	18.20	5.20
29	16 Jul – 22 Jul	23.87	36.20	26.20	82.00	5.90	2.80	4.70
30	23 Jul – 29 Jul	19.80	34.60	25.40	83.00	4.10	5.20	4.00
31	30 Jul – 05 Aug	20.67	35.80	25.70	82.00	5.70	54.20	5.70
32	06 Aug – 12 Aug	18.97	34.00	26.50	66.00	4.80	5.40	6.20

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