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Seasonal incidance and correlation studies of chilli whiteflies

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Abstract
An experiment to study the incidence of whitefly on chilli was conducted during *Kharif* season of 2017-18 at the experimental Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani with chilli variety PBNC-1 in non-replicated design. Incidence of whitefly initiated during 38th SMW (0.82 whitefly/leaf) and Thereafter the population increased gradually and reached its peak (7.42 whiteflies/leaf) during 41st SMW. Correlation studies revealed that, the correlation of whitefly with maximum temperature was highly significant and positive, whereas rainfall (r=- 0.495*) exhibited negative and significant correlation. Regression studies suggest that the weather parameters contributed significantly in the whitefly population during 2017-18.

Keywords: Seasonal incidence, whitefly and chilli

Introduction
Chilli, *Capsicum annum* L. is one of the important Solanaceous crops. *Capsicum annuum* is widely cultivated throughout the world, specially in tropical and subtropical regions. It is one of the important spice as well as vegetable crop grown all over the India. Chilli fruits are used for culinary purposes as fresh green or dried. It is eaten raw in salad, cooked as a vegetable, pickled or used for flavorings different dishes. Capsaicin an active component of chilli is responsible for burning sensation and is used for medicinal purposes having analgesic properties. Capsaicin extracts are also used for making pepper spray. Red chillies are a rich source of vitamins and minerals. They contain high amount of vitamin C and B6, and a small amount of beta carotene. Chillies have high amount of iron, potassium and magnesium (Anonymous, 2013) [1].

India is the largest producer of chillies in the world accounting for 13.76 million tonnes of production annually. In India, chilli was grown in an area 774.9 thousand hectare and production 1492.10 thousand tonnes and the productivity was 1.93 tonnes per hectare in 2014-15. (Geetha and Selvarani, 2017) [2]. The leading state in chilli production is Andhra Pradesh with a total production of 638298 tonnes from 195471 ha, followed by Karnataka, West Bengal and Madhya Pradesh.

Among many other reasons responsible for the lower yield, damage done by insect pests holds a major share. A survey conducted in Benin for finding production constraints in chilli, ranked the attack of insect pests on leaves, flowers and fruits as first among all other constraints (Orobiyi *et al.*, 2013) [4]. Among these insect attack of whiteflies is one of the important cause. Whitefly damages the plants in three ways-firstly by causing chlorosis, leaf withering, premature leaf fall and wilting, secondly by excreting honey dew, which leads to development of sooty mould thus reducing the effective leaf area for photosynthesis, third and the most important one is the transmission of chilli leaf curl virus which accounts for major yield losses. Various environmental factors like temperature, humidity, rainfall etc. have been observed to influence the population dynamics of insect pests.

Hence, present study was undertaken to record the whiteflies appearing on this crop in Parbhani region and it's relation with weather parameter.

Materials and Methods
The field experiments was conducted during *Kharif* season of the year 2017-18 to study seasonal incidence of Whitefly and it's correlation with weather parameters in Non-replicated design at the Research Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The seedlings of chilli cv., PBNC-1 were transplanted in 10 X 10 m^2 plot with 60cm x 45cm spacing which was divided in four quadrants. No insecticidal treatment was applied at any stage of the crop growth. Observations were recorded from five plant from each quadrant to assess whiteflies population from five leaves, one from top and two each from middle and bottom of randomly selected five plants

from each net plot for mites, whitefly and aphids whereas from five terminal leaves for thrips. (Pathipati *et al.* 2012) [6]. Data so recorded was subjected to correlation and multiple regression between whiteflies and weather parameter by Panse and Sukhatme (1967) [5] methodology and by using WASP software.

Results and Discussion

The data on seasonal incidence of whitefly *B. tabaci* during *kharif* 2017-18 (Table 1 and Fig. 1) denoted that whitefly population ranged from (0.0 to7. 42 whiteflies/leaf). The incidence of whitefly initiated during 38th SMW (0.82 whitefly/leaf). Thereafter the population increased gradually and reached its peak (7.42 whiteflies/leaf) during 41st SMW when the prevailing maximum and minimum temperature, morning and evening relative humidity, evaporation, bright sunshine hours and wind velocity were 31.2 and 22.2 ºC, 89.0 and 69.0 per cent, 3.3 mm, 5.3hrs and 2.5kmph, respectively. After that, population of whitefly declined gradually and it was not observed from 3rd SMW till harvest of the crop.

Table 1: Seasonal incidence of Whiteflies on chilli and Weather Parameter during 2017-18

Std. Met. Week	Duration	Whiteflies (No./Leaf)	Temperature (ºC)		Humidity (%)		Rainfall (mm)	EVP (mm)	BSS (Hrs.)	WV (Kmph)
			Max	Min	Morning (I)	Evening (II)				
32	08-14 Aug	0.00	32.2	23.0	85	59	16.1	4.8	3.6	3.7
33	15-21 Aug	0.00	28.7	22.7	92	77	141.0	2.9	3.0	4.4
34	22-28 Aug	0.00	29.2	9.4	90	77	98.2	3.5	4.1	5.0
35	29-04 Sep	0.00	17.4	9.6	88	67	29.8	3.8	6.8	3.0
36	05-11 Sept	0.00	13.7	22.7	82	60	78.9	3.9	6.6	3.0
37	12-18 Sep	0.00	30.5	22.7	87	72	79.2	2.8	4.9	2.5
38	19-25 Sep	0.82	31.5	22.3	87	61	6.6	4.6	6.0	3.1
39	26-02 Oct	1.48	34.2	22.5	77	48	0.0	6.2	8.5	3.4
40	03-09 Oct	6.20	33.2	21.6	82	65	57.6	5.4	7.0	3.4
41	10-16 Oct	7.42	31.2	22.2	89	69	111.2	3.3	5.3	2.5
42	17-23 Oct	6.56	32.6	20.2	79	46	1.4	4.7	6.5	2.2
43	24-30 Oct	6.42	32.6	16.4	77	32	0.0	4.3	8.9	2.0
44	31-06 Nov	5.42	30.9	14.5	78	31	0.0	4.5	9.2	2.6
45	07-13 Nov	5.86	30.8	12.2	79	31	0.0	4.8	9.6	3.4
46	14-20 Nov	3.24	31.4	14.4	76	32	0.0	4.7	8.7	2.9
47	21-27 Nov	3.20	32.0	17.0	77	42	0.0	4.5	7.4	2.4
48	28-04 Dec	3.12	29.9	10.2	77	31	0.0	3.9	9.2	2.9
49	05-11 Dec	2.86	30.4	14.4	75	42	0.0	4.5	7.4	4.7
50	12-18 Dec	2.72	31.0	12.5	78	31	0.0	4.7	8.6	2.8
51	19-25 Dec	2.04	29.3	7.9	75	27	0.0	4.0	8.4	3.8
52	26-31Dec	1.86	25.6	6.1	67	19	0.0	3.4	8.3	2.7
1	1-7 Jan	1.28	29.6	9.2	44	18	0.0	3.9	8.6	2.6
2	8-14 Jan	0.98	30.3	11.5	76	32	0.0	4.5	8.7	2.9
3	15-21 Jan	0.00	31.0	11.8	74	27	0.0	5.1	9.2	3.0
4	22-29 Jan	0.00	29.9	8.7	120	39	0.0	4.5	9.4	3.1

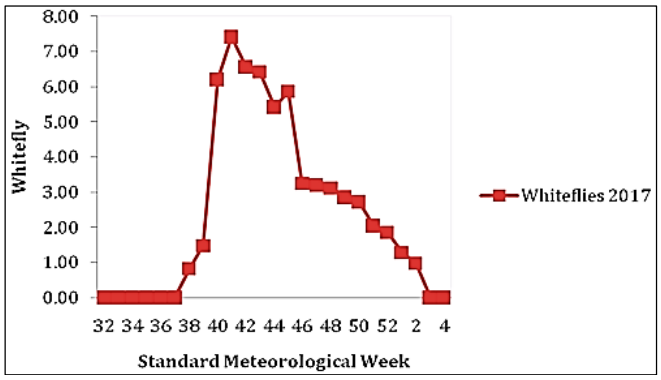

Fig 1: Seasonal incidence of Whiteflies on chilli

Correlation studies

The correlation of whitefly infesting chilli with weathers parameters was worked out to estimate correlation coefficient ('r' value) during 2017-18 and presented in Table 2.

During 2017-18, the correlation of whitefly with maximum temperature (r= 0.440*) was highly significant and positive, whereas rainfall (r=- 0.495*) exhibited negative and significant correlation. In case of minimum temperature, evaporation and bright sunshine hours showed positively non-significant correlation, whereas, negatively non-significant reaction of whitefly was recorded with wind velocity, morning relative humidity and evening relative humidity. In case of pooled data, whitefly infestation had significant and positive correlation with maximum temperature (r=0.377*), minimum temperature (r=0.425*) and evening relative humidity (r=0.337*). Rest of the factors was none significantly related with whitefly infestation.

Multiple regression studies

The partial regression coefficients during 2017 was worked out for different weather parameters with whitefly population and presented in Table 3. The multiple regression equation fitted with weather parameters in order to predict population on chilli as given below.

Regression equation 2017-18

$Y = -10.378 + (-0.041)\ X_1 + (0.212)\ X_2 + (0.252)\ X_3 + (-0.083)\ X_4 + (0.107)\ X_5 + (-1.198)\ X_6 + (1.271)\ X_7 + (0.474)\ X_8 + 1.755$ (R^2= 0.6700)

Where,

X_1 = rainfall
X_2 = maximum temperature
X_3 = minimum temperature
X_4 = morning RH
X_5 = evening RH
X_6 = evaporation
X_7 = bright sunshine hours

X_8 = wind velocity
R^2 = coefficient of determination

The coefficient of determination (R^2) represents the proportion of common variation in the two variables. The present investigations revealed that the weather parameters contributed for 67.00 per cent of total variation in the whitefly population during 2017 in chilli indicating that the predictions of the whitefly infestation by using weather parameters was reliable in 2017-18.

The present findings are similar with the findings of earlier research worker as Meena *et al.* (2013) studied the seasonal incidence of whiteflies on chilli var. Pusa Jwala at Rajasthan College of Agriculture Farm, Maharana Pratap University of Agriculture and Technology, Udaipur during *kharif* season of 2006-07 and reported that incidence of whitefly was appeared in the 3rd week of July (29th meteorological week) and continue up to fourth week of November (48th meteorological week). The population increased gradually and touched its peak with mean population of 6.9 whiteflies /3leaves /plant in 1st week of September (36th meteorological week) during 2006-07 while, the population of whitefly touched its peak with 6.7 whiteflies/3leaves/plant in the 2nd week of September (41st meteorological week) during 2007-08. Misal *et al.* (2016) reported that population whitefly on chilli was positively correlated with Tmax (r=0.778), Tmin (r=0.952*) and canopy temperature (r=0.965**) and negatively correlated with RH I (r = - 0.662), RH II (r=-0.281) and BS (r= -0.408). Baral (2017) found that whitefly, *B. tabaci* Genn. Population exhibited significant positive correlation with maximum temperature and evaporation, whereas negative and non-significant correlation with rainfall, morning and evening RH and minimum temperature. Shivanna *et al*. (2011) studied population dynamics and the impact of abiotic factors on population dynamics of sucking insect pests of transgenic cotton *viz*. leafhopper (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius) and revealed that revealed that maximum temperature showed significant positive effect on all the sucking pests. The minimum temperature showed negative and non-significant effect on whitefly and thrips population.

Table 2: Correlation of coefficient (r) between whiteflies population on chilli and weather parameters during 2017-18

Weather parameters	Correlation coefficient (r)
Rainfall (mm)	-0.495*
Maximum temperature (ºC)	0.440*
Minimum temperature (ºC)	0.155
Morning relative humidity (%)	-0.285
Evening relative humidity (%)	-0.241
Evaporation (mm)	0.272
Bright sunshine hours (hrs.)	0.306
Wind velocity (km/hr.)	-0.352

*Significant at 5% level
** Significant at 1% level

Table 3: Multiple regression of weather parameters and whiteflies on chilli (2017-18)

Weather parameters	Reg. coefficients	SE (b)	'T' Test
Rainfall (mm)	-0.040	0.010	-3.085
Maximum temperature (ºC)	0.277	0.454	0.183
Minimum temperature (ºC)	0.286	0.262	1.043
Morning relative humidity (%)	-0.169	0.114	-0.614
Evening relative humidity (%)	0.021	0.100	0.916
Evaporation (mm)	-1.498	0.885	1.292
Bright sunshine hours (hrs)	1.357	0.306	-0.842
Wind velocity (km/hr)	1.631	0.404	-2.636
Intercept	2017=-2.516		
Coefficient of determination (R^2)	2017=0.724		
T table (0.05)	2.120		

Conclusion

The results concluded that whiteflies was found to be major insect pests of chilli and their presence was moderate to high during the experimental period. Simple correlation and regression studies revealed that there was significant effect of different weather parameters on incidence of whiteflies on chilli. However, these findings are based upon one years studies and for confirmation and validation of results, further studies are necessary.

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