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Seasonal incidence of whitefly on different crops in *Rabi* season

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Abstract
The present research was carried out to study the seasonal incidence of whitefly on different crops during *Rabi* season 2015-2016 at the Experimental farm, Adhartal and Horticulture field, Maharajpur, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh. Result showed that the incidence of whitefly was recorded on seven different crops in different stages of crop growth belonging to two families viz. Solanaceae (crops: Tomato, brinjal and chilli) and Fabaceae (Crops: Soybean, green gram, french bean, field pea) and correlation between whiteflies population and weather factors also be studied.

Keywords: Whitefly, tomato, brinjal, chilli and soybean

1. Introduction
Whitefly, *Bemisia tabaci* (Gennadius) was explained over a century ago as a pest of tobacco in Greece and has since become one of the important members of the order Hemiptera and family Aleyrodidae, Horowitz [16]. The fly is a polyghagous insect and is considered as one of the important insect pest of vegetables, some ornamentals and agronomic crops especially in the sub-tropical and tropical regions around the world.
The name of whitefly is derived from the generally white, wax like substance that coats their bodies, particularly the wings, Bogran and Heinz [7]. *Bemisia tabaci* has an extremely wide range of hosts. It has an association with almost 600 different species of plants which comprise a large number of annuals and perennials, Shah *et al*. [31].
They are small sucking pests, usually found on the underside of leaves, often in large numbers. Both nymph and adults of whitefly suck the cell sap from different parts of the plant causing loss of plant vigour and reduces crop yield, Attique *et al*. [2]. It excretes honeydew which results in blackening of plant leaves and block photosynthesis. Excretion of honey dew by all its life stages during heavy colonization encourages growth of sooty mould, a fungus that can cause serious indirect damage to some crops.
Bemisia tabaci commonly flies early in the morning up to midday and the adults have limited ability to direct their flight, Byrne *et al*. [8].
The population of whitefly varies in different seasons of the year. Atmospheric humidity, temperature, rainfall influences the whitefly population dynamics Horowitz [16]. Moreover host plants and natural enemies like predators and parasitoids regulate the population in the field. Whitefly is found to be high during summer season compared to spring and rainy seasons. They thrive best under hot and humid conditions and developed rapidly in warm weather and populations can build up quickly in situations where natural enemies are destroyed and weather is favourable. Spring and rainy seasons attribute to unfavourable conditions for the multiplication of the whitefly. Adult whitefly is killed by heavy rain and prolonged periods of rain can substantially reduce population.
Whitefly act as a vector for more than 100 plant viruses, which cause disease to many commercial crops in different parts of the world Jones [17]. *Bemisia tabaci* is considered as the most common and important whitefly vector of plant viruses categorized in the Gemini virus group Cohen [11]. It can cause huge damage to host crop plants by transmitting various viral diseases *i.e*. yellow tomato leaf curl virus, cucurbit yellow stunting disorder virus, okra yellow vein mosaic, bean golden mosaic, cotton leaf crumple, squash leaf curl, lettuce infectious yellows virus, cassava mosaic virus, tomato necrotic dwarf virus etc Holt *et al*. [15].
One of the important limiting factor in the cultivation of different crops is sucking pest, whitefly *Bemisia tabaci* (Gennadius) which is considered as important insect pest of most

vegetables, some ornamentals and agronomic crops. Shah *et al*. [31] reported that whitefly has association with almost 600 different species of plants which comprise large number of annuals and perennials causes significant damage to different cultivating crops. Sathe and Gangate [29] reported that cotton, brinjal, okra, tomato, cowpea, sunflower, mulberry, guava, mango, custard apple and several grasses have been attacked by whitefly.

To manage this insect pest, the crop should be visually inspected for signs of whitefly infestation, looking out for suspicious plants that look stunted or chlorotic. One of the most effective means developed to detect the presence of the adult whitefly is the yellow sticky trap. These traps are widely used for monitoring and management of whiteflies.

Regular monitoring of *B. tabaci* population should be done from the early stage of the crop. Trapping whiteflies using yellow sticky traps, both inside and outside the greenhouse, is a fundamental tool for a successful whitefly management program. The sticky traps are used to detect and monitor population levels and should be placed strategically throughout the greenhouse at 1 trap per every 100 sq metres.

The traps should be hung just above the canopy of the crop as whiteflies are attracted to the young growth of the plants. However, the trap location and trap height have effect on capture of whitefly Ajaln [1]. However, the abundance and population dynamics of whiteflies trapped on yellow sticky traps were varied depending on whiteflies species, area and crops Soto *et al*. [35], the present investigation was done to carried out seasonal incidence of whitefly on different crops in *Rabi* season.

2. Material and Methods

The present experiment entitled, "seasonal incidence of whitefly on different crops in *Rabi* season" was carried out at the Experimental farm, Adhartal and Horticulture field, Maharajpur, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh during *Rabi* season, 2015-2016.

The observations on the incidence of whitefly on soybean, green gram and brinjal were recorded from experimental farm, Adhartal and the observations on the incidence of whitely on tomato, chilli, field pea and french bean were recorded from Horticulture field, Maharajpur.

2.1 Methodology of observations

The population of whitefly was recorded at weekly intervals on randomly selected 10 plants from each crop with the help of cage. Cage was prepared by taking transparent fiber cylinder of different diameter 15, 20, 30 cm and length 20, 25, 35 cm, respectively. The body of the cylinders was coated with black paint and one end of the cylinder was left open. Without disturbing, an individual plant was inserted through it while the other end was kept covered with transparent glass. This was done in order to prevent the insects from escaping. The winged adult whiteflies settled on the inner surface of the glass which was counted.

In early stage of crop growth narrow diameter cages and in the later stages, cages having broader diameter with longer length having sufficient space to cover an individual plant were used for recording the observation.

The observations of whitefly was initiated after germination or transplanting of crops and was continued till the availability of insects or maturity of the crop. Daily meteorological data (Maximum and minimum temperature, morning and evening relative humidity, rainfall, number of rainy days, sunshine hours, evaporation, wind speed etc.) was obtained from JNKVV meteorological observatory.

2.2 Analysis of data

(i) Correlation and regression studies

Correlation and regression of the abiotic factors on whitefly and the population of whitefly trapped on yellow sticky traps were worked out by using the formula as suggested by Snedecor and Cochran [34].

$$\text{Correlation 'r'} = \frac{\sum x\,y - \frac{\sum x.\sum y}{n}}{\sqrt{\left\{\sum_x 2 - \frac{((\sum x)^2)}{n}\right\}\left\{\sum_y 2 - \frac{((\sum y)^2)}{n}\right\}}}$$

Regression $\hat{Y}$ = a + bx (R^2)

Where,

a = Intercept.

b = Regression coefficient.

R^2 = Coefficient of multiple determination.

(ii) Test of significance 'r' of correlation coefficient

$$\mathbf{t = \frac{r}{\sqrt{1 - r^2}}\sqrt{n - 2}}$$

Where,

'n' is the number of sets of observations and 'r' correlation coefficient, the value of 't' is based on (n-2) degree of freedom.

3. Results and Discussion

The incidence of whitefly were recorded on seven different crops in *Rabi* season 2015-2016 in different stages of crop growth belonging to two family viz. Solanaceae (crops: Tomato, brinjal and chilli) and Fabaceae (Crops: Soybean, green gram, french bean, field pea).

3.1 Incidence of whitefly on tomato, *Lycopersicon esculentum* Mill. (Family: Solanaceae)

The present study revealed that whitefly, *Bemisia tabaci* (Genn.) was first recorded from the 3rd week of December during 51st Standard Week (SW) (*i.e*. 17th to 23rd December, 2015) and the activity of the pest continued from 3rd week of December, 2015 (51st SW) to 2nd week of April, 2016 *i.e.* 15th SW (9th April to 15th April, 2016) up to maturity of crop. The peak activity of whitefly was observed (5.90 whiteflies/ plant) during 10th SW (*i.e.* 5th to 11th March, 2016) (Table-1).

The present findings are in conformity with the findings of Reddy and Kumar [28] and they also reported that *B. tabaci* to be an important sucking pest of tomato and was present throughout the growing period of the crop. Sayade [30] reported that whitefly was first recorded on the tomato crop at crop age of 39 days during 1st SW (1st week of January, 2012) and the pest was present throughout the growing stage of crop till maturity of the crop and available up to 14th SW *i.e.* 1st week of April. However Meena and Bairwa [24] reported that the initial incidence of *B. tabaci* was observed on tomato crops at 7days after transplanting of crop.

After 10th SW there was a decline in the whitefly population and it was available up to 15th SW (*i.e.* 9th April to 15th April, 2016) till maturity of the crop (Table-1).

Similar findings are reported by Mandloi *et al.* [22] reported that *B. tabaci* peaked during 26 Feb to 4th March 2013 (9th SW) with population 11.85/10 cm twig. Kharpuse and Bajpai [20] found that *B. tabaci* population peaked (13 flies/10 cm twig) during 1st week of March. High infestation levels were maintained from mid of February to mid of March. However Sayade [30] reported that the pest population attained its peak during 8th SW *i.e.* 3rd week of February, 2012.

In present study, wind velocity, rainfall, number of rainy days, morning vapour pressure and evening vapour pressure showed a significant positive correlation with whitefly population and other abiotic factors showed non-significant positive correlation with whitefly population (Table-2).

The present findings are in accordance with Sayade [30] who reported that morning relative humidity exhibited significant positive correlation *i.e.* morning relative humidity prevailing during February to March (above 70 % RH) seemed to increase the whitefly population. In contrary to the present findings Mandloi *et al.* [22] reported that association of *B. tabaci* was recorded positive with rainy days, evening relative humidity and maximum temperature while it was found negative with min temp and morning relative humidity.

3.2 Incidence of whitefly on brinjal, *Solanum melongena* L. (Family: Solanaceae)

In the present study, whitefly, *Bemisia tabaci* (Gennadius) was first observed on brinjal when the crop age was about 26 days old (after transplanting) and it was present on the crop during the entire cropping season up to maturity of crop.

Present findings are in accordance with those of Latif *et al.* [21], Birla [5]. They also reported whitefly to be an important sucking pest of brinjal which was present during the growing period the crop**.**

The results of the present study revealed that the first appearance of the whitefly on brinjal crop was recorded on 21st December, 2015 during the 51st standard week (SW) (*i.e.* 17th December to 23rd December, 2015) and the whitefly population started increasing from 1st SW (*i.e.* 1st January to 7th January, 2016) and reached at its peak (7.90 whiteflies / plant) during 9th SW (*i.e.* 26th to 4th March, 2016). After 9th SW there was a decline in the whitefly population and it was available up to 18th SW (*i.e.* 30th to 6th May 2016) (Table-1).

In contrary to present finding Naik *et al.* [25] reported that the peak period for whitefly incidence was 3rd week of February.

In present study, wind velocity, morning vapour pressure and evening vapour pressure showed a significant positive correlation (r = 0.49, 0.47 and 0.63 respectively) with whitefly population and other abiotic factors are showed non-significant with whitefly population (Table-2).

The present findings are in accordance with Mane and Kulkarni [23] who reported that temperature, relative humidity and number of rainy days showed positive correlation with whitefly population. On contrary, Chandrakumar *et al.* [9] reported that maximum temperature and rainfall showed significant negative correlation with whitefly population.

3.3 Incidence of whitefly on chilli, *capsicum annum* L. (Family: Solanaceae).

In the present study incidence of whitefly was first observed on chilli when the crop age was about 26 days (after transplanting) and the pest was present on the crop till the maturity of crop.

However Chintkuntalawar [10] reported the first incidence of whitefly on 7 days old crop (after transplanting) *i.e.* vegetative stage and remained active up to 1st week of April *i.e.* maturity stage of crop. The present findings coincides with the findings of Hilje *et al.* [14] and they reported that *Bemisia tabaci* mostly prefers for reproduction in chilli crop as a host.

The results of present study revealed that the first appearance of the whitefly on chilli crop was recorded on 22nd December, 2015 during the 51st standard week (SW) (*i.e.* 17th December to 23rd December, 2015) (Table-1).

Chintkuntalawar [10] recorded the first incidence of whitefly on chilli during the 45th SW (1st week of November, 2015) and reached its 1st peak during 49th SW (*i.e.*. 3rd to 9th December, 2009) and 2nd peak at 7th SW (*i.e.* 12th February to 18th February, 2010).

The present findings revealed that whitefly population started increasing from 52nd SW (*i.e.* 24th to 31st December) with slight fluctuation (2.90 whiteflies/ plant) during 5th SW and reached at its peak (8.90 whiteflies/ plant) during 10th SW (*i.e.* 5th to 11th March, 2016). After 10th SW there was a decline in the whitefly population and it was available up to 15th SW (*i.e.* 9th April to 15th April, 2016) till maturity of the crop (Table-1).

The present findings are in accordance with Chintkuntalawar[10] who reported that the population of whitefly on chilli was observed maximum during 49th SW (4.88 whiteflies/ 2 leaves) and after that the population trend gradually decreases up to 3rd SW and then the population reached its peak during 7th SW (12th February to 18th February, 2010).

In present study, morning relative humidity, evening relative humidity and evening vapour pressure showed a significant positive correlation (r = 0.50, 0.47 and 0.47 respectively) with whitefly population and other abiotic factors showed non-significant with whitefly population (Table-2).

The present findings are in accordance with Chintkuntalawar [10] who reported that percentage morning and evening vapour pressure exhibited positive correlation with whitefly population while maximum and minimum temperature, sunshine, rainfall, wind speed, morning vapour pressure and evaporation showed a negative correlation with whitefly population.

3.4 Incidence of whitefly on soybean, *Glycine max* L. (Family: Fabaceae)

In the present study incidence of whitefly, *Bemisia tabaci* (Gennadius) was first observed on soybean when the crop age was about 21 days and the pest was present on the crop till the harvesting of the crop.

The present findings are in accordance with Bhatt [4] who reported that whitefly appeared on soybean crop when crop age was 30 days after germination (DAG). However Patel [26] observed that the first incidence of whitefly in seedling stage when the crop age was about 13 days old and remain active during the entire cropping season. On contrary, Yadav *et al.* [37] reported the whitefly infestation at 7th DAG and remain active up to 77 DAG in MP.

The results in the present investigations revealed that the first appearance of the whitefly was recorded on 23rd December 2015 during the 51st standard week (SW) *i.e.* 17th to 23rd December, 2015 and the whitefly population started increasing from 52nd SW (*i.e.* 24th to 31st December, 2015) with slight fluctuation (2.90 adult whiteflies/ plant) during 6th SW (*i.e.* 5th to 11th February, 2016) and reached at its peak (8.90 adult whiteflies/ plant) during 11th SW (*i.e.*12th to 18th

March, 2016). After 52nd SW there was a decline in the whitefly population and was available up to 17th SW (*i.e.* 23rd to 29th April 2016) (Table-1).

The present findings are in close conformity with Sirothiya [33] who reported that the whitefly infestation was started from last week of January with an average population of 2.4 whiteflies/ plant and the population gradually increases up to 2nd week of February with 12.8 whiteflies/ plant. The peak population was observed in 4th week of March recording 13.8 whiteflies /plant. Yadav *et al*. [38] reported that the maximum population was observed at 21st and 35th DAG and concluded that the maximum temperature of 32.5 to 32.0^{0}C and relative humidity of 78 to 79 % seemed to be favorable for the pest.

In present study correlation studies between abiotic factors and whitefly population revealed that number of rainy days, morning vapour pressure and evening vapour pressure showed a significant positive correlation (r= 0.48, 0.61 and 0.50 respectively) with whitefly population and other abiotic factors are showed non-significant positive correlation with whitefly population (Table-2).

On contrary Yadav *et al*. [38] reported that rainfall had negative effect on whitefly population *i.e*. population decreases with increase in rainfall.

3.5 Incidence of whitefly on green gram, *Vigna radiata* L. (Family: Fabaceae)

The incidence of whitefly, *Bemisia tabaci* (Gennadius) was commenced on green gram when the crop age was about 30 days old (after germination) and the pest was present on the crop during the entire growing season and remained available up to the crop harvesting stage.

The present findings are in accordance with Kabir *et al*.[18], Berragani *et al*. [3] and they also reported whitefly, *Bemisia tabaci* as important sucking pest attacking green gram and the pest was present on the crop until the maturity of crop.

In present findings the first appearance of the whitefly was recorded on 30th December 2015 during the 52nd standard week (SW) *i.e.* 24th to 31st December, 2015 and available up to 16thth SW (*i.e.* 16th to 22nd April, 2016) (Table- 2).

In present findings the whitefly population started increasing from 1st SW (*i.e.* 1st to 7th January, 2016) with slight fluctuation (2.80 and 2.60 adult whiteflies/ plant respectively) during 7th SW (*i.e.* 12th to 18th February, 2016) and 8th SW (19th to 25th February, 2016) respectively and reached at its peak (8.90 adult whiteflies/ plant) during 11th SW (*i.e.* 12th to 18th March, 2016). After 1st SW the whitefly population trend gradually decreases and was available up to 16thth SW (*i.e.* 16th to 22nd April, 2016) (Table-1).

On contrary, Patil [27] reported that the peak population of whitefly on green gram (2.12 whiteflies /leaf) was observed during November. Kabir *et al*. [18] observed that the whitefly population was increased with plant age and it was reached maximum at 8th week after germination and then decline with plant age. The present findings are in contradiction with findings of Yadav and Singh [36] who reported the peak period of whitefly on green gram during 37th SW (2nd week of September).

In present study the variation in the period of peak activity of whitefly may be attributed to the late sowing of green gram in *Rabi* season 2015-16 and due to which incidence and peak activity of the pest was late in comparison to the early period of appearance and maximum activity.

Correlation studies revealed that wind velocity, rainfall, number of rainy days, morning vapour pressure and evening vapour pressure showed a significant positive correlation (r =0.63, 0.48, 0.47, 0.52 and 0.63 respectively) with whitefly population all other abiotic factoers showed non-significant correlation with whitefly population (Table-2).

The present findings are supported by Khan *et al*. [19] who reported that minimum temperature, relative humidity, rainfall showed significant positive correlation with whitefly population except maximum temperature had non-significant negative effect. The present findings are in accordance with Berragani *et al*. [3] who reported that there was a significant positive correlation between population of whitefly with morning relative humidity and evening relative humidity and significant positive correlation with average relative humidity during *Rabi* season.

3.6 Incidence of whitefly on french bean, *Phaseolus vulgaris* L. (Family: Fabaceae)

The incidence of whitefly, *Bemisia tabaci* (Gennadius) was observed on french bean when the crop age was about 26 days old (after germination) and was present on the crop till harvesting.

The present findings are in accordance with Sharma [32] who reported that the incidence of whitefly on french bean was appeared during the vegetative stage of crop at 25 days old crop during 48th SW *i.e.* last week of November, 2007 and the population continued till the maturity of the crop up to last week of February, 2008 at 109 days old crop.

Similar findings are supported by Gautam [12] who reported that the 1st appearance of whitefly was observed during the vegetative stage at 22 days old crop on 17th December *i.e.* during the 51st standard week and remained up to 3rd week of March *i.e.* maturity stage of crop.

In present findings, the first appearance of the whitefly was recorded on 14th December 2015 during the 50th standard week (SW) *i.e.* 10th to 16th December, 2015. The whitefly population started increasing from 51st SW (*i.e.* 17th to 23rd December, 2015) and reached at its peak (7.60 adult whiteflies/ plant) during 8th SW (*i.e.* 19th to 25th February, 2016). After 8th SW there was a decline in the whitefly population and was available up to 13th SW (*i.e.* 26th March to 1st April, 2016) (Table-1).

However Gautam [12] reported that the population reached its peak during 1st standard week and after that there was a decline in adult whitefly population and its 2nd peak period observed in 6th SW. The evening vapour pressure exhibited negative influence on the pest population.

Correlation studies revealed that evening vapour pressure showed a significant positive correlation (r = 0.54) with whitefly population/plant and all other abiotic factors showed non-significant correlation with whitefly population (Table-2).

The present findings are supported by Sharma [32] who reported that morning relative humidity had positive significant effect on whitefly population. On contrary Gautam reported that evening vapour pressure exhibited negative influence on the whitefly population on french bean.

3.7 Incidence of whitefly on field pea, Pisum sativum L. (Family: Fabaceae)

Whitefly, *Bemisia tabaci* (Gennadius) was first appeared on field pea when the crop age was about 25 days old (after germination) and present throughout the whole crop season and available till maturity of the crop.

The present findings are in accordance with Biswas and Patel [6] and they reported that whitefly, *B. tabaci* invade the field

pea crop at early stage *i.e.* 2nd weeks after sowing and remained active up to crop maturity.

In present findings the incidence of whitefly was first recorded on 22nd December, 2015 during the 51st standard week (SW) *i.e.* 17th to 23rd December, 2016. The activity of the pest continued from 3rd week of December, 2015 (51st SW) to 2nd week of March (10th SW) *i.e.* 5th to 11th March, 2016 (till maturity). The pest population started increasing from 52nd SW (*i.e.* 24th to 31st December, 2015) with slight fluctuation (2.80 adult whiteflies/ plant) during 3rd SW (*i.e.* 15th to 21st January, 2016) and attained its peak (5.80 adult whiteflies/ plant) during 6th SW (*i.e.* 5th to 11th February, 2016). After 6th SW there was a decline in the whitefly population and was available up to 10th SW (*i.e.* 5th to 11th March 2016) (Table- 1).

The present findings are in conformity with the findings reported by Biswas and Patel[6] who reported that the initial incidence of whitefly on field pea was observed during 49th SW (2nd week of December 2011). The peak period for whitefly incidence was observed during 6th SW (2st week of February 2012) and available up to 11th SW (2nd week of March 2012).

Correlation studies revealed that all abiotic factors showed non-significant correlation with whitefly population (Table- 2).

The present findings are in conformity with Meena and Bairwa [24] and they reported that evening relative humidity and rainfall showed negative and non-significant relationship with whitefly population. The present findings also supports the findings of Yadav and Singh [36] who reported that minimum temperature, rainfall and wind velocity showed non-significant negative correlation with whitefly population. The present findings are in contradiction with Berragani *et al.* [3] who reported that morning relative humidity, evening relative humidity and evaporation showed significant positive correlation with whitefly population. However Ghosh [13] also reported that maximum temperature and minimum relative humidity showed non-significant positive correlation with whitefly population. This differences may be due to different ecological condition and difference crop on which the experiment was conducted.

Table 1: Incidence of whitefly, *Bemisia tabaci* (Gennadius) on different crops during *Rabi* season 2015-16 at Jabalpur

Standard Weeks (SW)	Age of crops (days)							Mean adult whitefly counts/plant on different crops						
	Family Solanaceae			Family Fabaceae				Family Solanaceae			Family Fabaceae			
	Tomato	Brinjal	Chilli	Soybean	Green gram	French bean	Field pea	Tomato	Brinjal	Chilli	Soybean	Green gram	French bean	Field pea
49	7	12	12	7	9	12	11	-	0	-	-	-	0	-
50	14	19	19	14	16	19	18	0	0	0	0	-	0.4	0
51	21	26	26	21	23	26	25	0.2	1.1	0.5	0.5	0	1.8	0.4
52	28	33	33	28	30	33	32	0	1.1	1.1	1.2	0.2	2.9	1.8
1	35	40	40	35	37	40	39	0.3	1.3	1.9	0.9	0.9	1.6	2.4
2	42	47	47	42	44	47	46	0.5	1.5	2.8	1.6	1.4	1.8	3.1
3	49	54	54	49	51	54	53	1.2	1.4	3.2	2.1	2.4	2.6	2.8
4	56	61	61	56	58	61	60	1.8	2.7	3.8	2.8	2.9	3.5	3.9
5	63	68	68	63	65	68	67	2.3	3.5	4.4	3.6	3.4	4.8	4.7
6	70	75	75	70	72	75	74	1.9	4.2	5.2	2.9	2.8	5.4	5.8
7	77	82	82	77	79	82	81	2.6	5.4	6.4	3.8	2.6	6.8	3.4
8	84	89	89	84	86	89	88	3.8	6.2	4.8	4.2	3.6	7.6	2.6
9	91	96	96	91	93	96	95	5.1	7.9	3.6	5.7	4.2	5.2	1.4
10	98	103	103	98	100	103	102	5.9	6.8	2.8	6.8	5.4	4.6	0.4
11	105	110	110	105	107	110	H	5.3	6.2	2.4	8.9	4.8	3.2	H
12	112	117	117	112	114	117		3.4	5.1	2.1	7.4	4.6	2.7	
13	119	124	124	119	121	124		2.6	4.8	1.6	5.8	3.2	0.8	
14	126	131	131	126	128	H		1.1	3.6	1.2	4.7	2.4	H	
15	133	138	133	133	135			0.4	2.3	0.2	3.2	1.8		
16	CM	145	CM	140	142			CM	0.9	CM	1.4	0.4		
17		152		147	H				1.1		0.9	H		
18		159		H					1.2		H			
Total	-	-	-	-	-	-	-	38.4	89.2	48.0	68.3	47.0	55.7	32.7
Mean	-	-	-	-	-	-	-	2.13	4.05	2.66	3.10	2.61	3.27	2.51
Insect availability (in days)	-	-	-	-	-	-	-	112	133	107	126	112	105	77

CM= Crop matured. H= Harvested.

Table 2: Correlation (r) and regression coefficient (BYX) of abiotic factors on whitefly population on different crops during *Rabi* season 2015-2016.

Weather factors	Family Solanaceae						Family Fabaceae							
	Tomato		Brinjal		Chili		Soybean		Green gram		French bean		Field pea	
	R	Byx	R	Byx	R	byx	r	byx	R	byx	r	byx	r	byx
Max. temp.(°C)	0.27 NS	-	0.06 NS	-	-0.26 NS	-	0.23NS	-	0.14 NS	-	0.08 Ns	-	-0.17 NS	-
Min. temp.(°C)	0.42 NS	-	0.13 NS	-	-0.20 NS	-	0.32NS	-	0.26 NS	-	0.15 NS	-	-0.29 NS	-
Morning Relative Humidity (RH) (%)	0.24 NS	-	0.30 NS	-	0.50 *	0.08	0.13NS	-	0.24 NS	-	0.30 NS	-	0.08 NS	-
Evening RH (%)	0.27 NS	-	0.27 NS	-	0.47 *	0.06	0.11NS	-	0.26 NS	-	0.31 NS	-	-0.05 NS	-
Wind velocity (km/hr)	0.51 *	1.29	0.49 *	1.58	0.02 NS	-	0.43 NS	-	0.63 **	1.32	0.27 NS	-	-0.06 NS	-
Sunshine(hrs)	0.09 NS	-	-0.002 NS	-	-0.26 NS	-	0.14 NS	-	0.06 NS	-	-0.10 NS	-	0.26 NS	-
Rainfall (mm)	0.51 *	0.13	0.34 NS	-	0.00 NS	-	0.40 NS	0.18	0.48 *	0.10	0.03NS	-	-0.33 NS	
No. of rainy days	0.49 *	1.21	0.27 NS	-	-0.01 NS	-	0.48 *	1.55	0.47 *	0.98	-0.04 NS	-	-0.23 NS	
Morning Vapour Pressure (VP) (mm)	0.59 *	0.46	0.47 *	0.49	-0.05 NS	-	0.61 **	0.62	0.52 *	0.34	0.21 NS	-	-0.26 NS	
Evening VP (mm)	0.71 **	0.55	0.63 **	0.65	0.47*	0.34	0.50 *	0.48	0.63 Ns	0.40	0.54*	0.48	-0.16 NS	
Evaporation (mm)	0.11 NS	-	-0.12 NS	-	-0.35 NS	-	0.03 NS	-	-0.02 NS	-	0.08 NS	-	-0.04 NS	

* Significant at 5% level. ** Significant at 1% level. NS=Non-significant

4. Conclusion

Result showed that the incidence of whitefly was recorded on seven different crops in different stages of crop growth belonging to two families viz. Solanaceae (crops: Tomato, brinjal and chilli) and Fabaceae (Crops: Soybean, green gram, french bean, field pea) and correlation between whiteflies population and weather factors also be studied.

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