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Population dynamics of thrips, *Scirtothrips dorsalis* hood infesting *Bt* cotton ecosystem in middle Gujarat

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Abstract
A study on population dynamics of thrips, *Scirtothrips dorsalis* Hood on *Bt* cotton was conducted at Anand Agricultural University, Anand during *Kharif* 2017-18. The incidence of the pest started from last week of July to end of crop season with peak activity in 2nd week of December. The higher activity of this pest was noticed during November and December (8.24 to 14.24 thrips/leaf). The correlation coefficient data indicated that rainfall (r=-0.54**), wind speed (r=-0.61**), minimum temperature (r=-0.92**), morning relative humidity (r=-0.67**), evening relative humidity (r=-0.84**), morning vapour pressure (r=-0.92**) and evening vapour pressure (r=-0.82**) were highly significant negatively correlated with thrips population. The bright sunshine hour(r=0.57**) and evening vapour pressure deficit (r=0.65**) had highly significant positive correlated with the activity of thrips.

Keywords: Population dynamics, Bt cotton, thrips

1. Introduction
Cotton, the king of fibre reside one of the momentous and important cash crop exercising profound influence on economics and social affairs of the world. As per world cotton scenario, commercial cotton is grown in 77 countries and 123 countries are involved in the cotton related activities. The area under cotton cultivation in the world is about 29.22 million hectares with annual production of 105.71 million bales. India was leading in raw cotton production in the world during 2016-17 and production was upto 35.1 million bales of 480 lb from 10.5 million hectares with a productivity of 568 kg/ha. Gujarat, Maharashtra and Telangana occupy the major cotton growing states contributing around 70 per cent of the area and 67 per cent of cotton production in India. Gujarat ranks second in area (24.00 lakh ha) and first in production (95.00 lakh bales) in the country (Anon., 2017) [1]. Introduction of *Bt*. cotton has resulted in the suppression of major bollworms like *Helicoverpa armigera.* However, year after year the infestation of sucking pest is gradually increased. About 1326 species of insects have been reported on cotton worldwide, out of them, thrips (*Scirtothrips dorsalis* Hood), Whitefly (*Bemisia tabaci* Germadius) and leaf hopper (*Amrasca bigutula bigutula* Ishida) are widely distributed polyphagous pest in tropical and subtropical region of India (Puri *et al*., 1998) [7]. Among these, infestation of thrips in cotton ecosystem is also increased in Gujarat.
According to Sathe and Mithari (2015) [8], *T. tabaci* Lind. (Thysanoptera: Thripidae) is destructive, polyphagus pest of agricultural and other economically important crop plants including cotton. Thrips, *T. tabaci* damage immature cotton seedlings, flowers and stems. In the beginning of the season attack is severe because of low relative humidity. After its attack leaves of seedlings become wrinkled and distorted, the vegetative phase is delayed leading to late harvest of the crop causing higher losses not only to the farmer but also to the country's economy. Different species of thrips are found on cotton in Vietnam, though *S. dorsalis* and *Thrips palmi* Karny are the most important species. Both species are highly polyphagous, occurring on many annual crops and weeds. They especially cause economic damage to vegetable crops and transmit tospovirus diseases of vegetables (Capinera, 2001) [3]. Different weather factors found to have positive association with thrips population (Soni and Dhakad, 2016) [10] for their development and seasonal incidence. The knowledge about incidence of pest during cropping season and its possible dynamics helps in designing pest management strategies. Hence, present study on population dynamics of cotton thrips was undertaken during *Kharif* seasons of 2017-2018.

2. Materials and Methods

Field experiment was conducted at Anand Agricultural University, Anand during *kharif* season 2017-18. Cotton cultivar RCH-II was sown, with a spacing of 120 cm between two rows and 60 cm within the rows.The cotton plot was divided into equal six sectors. All recommended agronomical practices were followed to raise the cotton crop and plot was kept free from insecticidal spray.

2.1 Methods of Observations

Cotton plot was devided into six sectors and from each sector five plants were selected randomly to record the thrips population. The number of thrips per five leaves (three upper and two middle) were observed at weekly intervals. The population of thrips was recorded one week after germination till the last picking. The population of *S. dorsalis* correlated with minimum and maximum temperature, relative humidity, morning and evening vapour pressure, rainfall, sunshine hours, wind velocity, morning and evening vapour pressure deficit. The data obtained were analyzed by following standard statistical technique by Steel and Torrie (1980) [11].

3. Results and Discussion

The activity of *S. dorsalis* (Table 1 & Fig. 1) on *Bt* cotton was found during last week of July [31th Standard Meteorological Week (SMW)] to end of crop season during 2017-18. The pest first appeared (0.22 thrips/leaf) during last week of July and increased till last week of August (1.84 thrips/leaf). It was reduced (0.96 thrips/leaf) during first week of September. The thrips population was increased from second week of September to 2nd week of November (12.81 thrips/leaf). During second fortnight of November the population of thrips slightly reduced (11.71 and 11.16 thrips/leaf). Again, it was increased and reached to peak level (14.24 thrips/leaf) during 2nd week of December. The activity of this pest again decreasing trend from 3rd week December and it was 13.73 thrips/leaf during 1st week of January 2018. The higher (8.24 to 14.24 thrips/leaf) activity of this pest was noticed during 2nd week of October to end of crop season. The pest decline from second fortnight of December onward to maturity of the crop. Gosalwad *et al*. (2009) [4] noticed that thrips attained its peak on cotton in August and November. Shivanna *et al.* (2011) [9] reported that the cotton thrips found throughout the year except July and August. These report are accordance with the present findings.

The correlation coefficient data (Table 2) indicated that rainfall (r=-0.54**), wind speed (r=-0.61**), minimum temperature (r=-0.92**), morning relative humidity (r=-0.67**), evening relative humidity (r=-0.84**), morning vapour pressure (r=-0.92**) and evening vapour pressure (r=-0.82**) were highly significant negatively correlated with thrips population. The bright sunshine hour (r=0.57**) and evening vapour pressure deficit (r=0.65**) had highly significant positive correlated with thrips activity on cotton. Maximum temperature (r=-0.25) and morning vapour pressure deficit (r=0.31) had negative and positive association with thrips activity on *Bt* cotton, respectively but non-significant. Babu and Meghwal (2014) [2] mentioned that the incidence of thrips in *Bt* cotton was negatively correlated with maximum temperature (r = - 0.61) and sunshine hours (r = - 0.34). As per the report of Patel and Patel (2015) [6], population of thrips had significant positive correlation with bright sunshine hours (0.50**), maximum temperature (0.57**), mean temperature (0.49*), morning vapour pressure deficit (0.86**), evening vapour pressure deficit (0.63**), mean vapour pressure deficit (0.79**) and wind speed (0.44*). Patel *et al*. (2009) [5] revealed that bright sunshine hours (r=0.78**) and maximum temperature(r=0.39*), showed significant positive correlation, wher as morning (r=-0.71*), afternoon (r=-0.93**) and mean relative humidity (r=-0.91**), morning (r=-0.64**), afternoon (r=-0.81**)and mean vapour pressure (r = -0.73**) as well as rainfall(r= -0.57**) exhibited significant negative association with the thrips population on chilli. These findings are of conformity with the present investigation.

Table 1: Population fluctuation of *S. dorsalis* in *Bt* cotton during 2017-18

Month	Week	SMW	Date of observations	No. of thrips / leaf
July 2017	IV	30	24/07/2017	0.00
	V	31	31/07/2017	0.22
August 2017	I	32	07/08/2017	0.48
	II	33	14/08/2017	0.83
	III	34	21/08/2017	1.61
	IV	35	28/08/2017	1.84
September 2017	I	36	04/09/2017	0.96
	II	37	11/09/2017	2.64
	III	38	18/09/2017	2.92
	IV	39	25/09/2017	3.85
October 2017	I	40	02/10/2017	5.58
	II	41	09/10/2017	8.24
	III	42	16/10/2017	10.04
	IV	43	23/10/2017	10.64
	V	44	30/10/2017	11.10
November 2017	I	45	06/11/2017	12.10
	II	46	13/11/2017	12.81
	III	47	20/11/2017	11.71
	IV	48	27/11/2017	11.16
December 2017	I	49	04/12/2017	12.66
	II	50	11/12/2017	14.24
	III	51	18/12/2017	14.06
	IV	52	25/12/2017	13.44
January 2018	I	1	01/01/2018	13.73

Table 2: Correlation co-efficient between weather parameters and *S. dorsalis* incidence on cotton

Weather parameters	Correlation coefficient (r)
1	2
Bright sunshine hours, hr day^{-1} (BSS)	0.57**
Rainfall, mm (RF)	-0.54**
Wind Speed, kmhr^{-1}(WS)	-0.61**
Maximum Temperature, ^{0}C (MaxT)	-0.25
Minimum Temperature, ^{0}C (MinT)	-0.92**
Morning Relative Humidity, % (RH_1)	-0.67**
Evening Relative Humidity, % (RH_2)	-0.84**
Morning Vapour pressure mm of HG (VP_1)	-0.92**
Evening Vapour pressure mm of HG (VP_2)	-0.82**
Morning Vapour pressure deficit (VPD_1)	0.31
Evening Vapour pressure deficit (VPD_2)	0.65**

** Significant at 1 % level

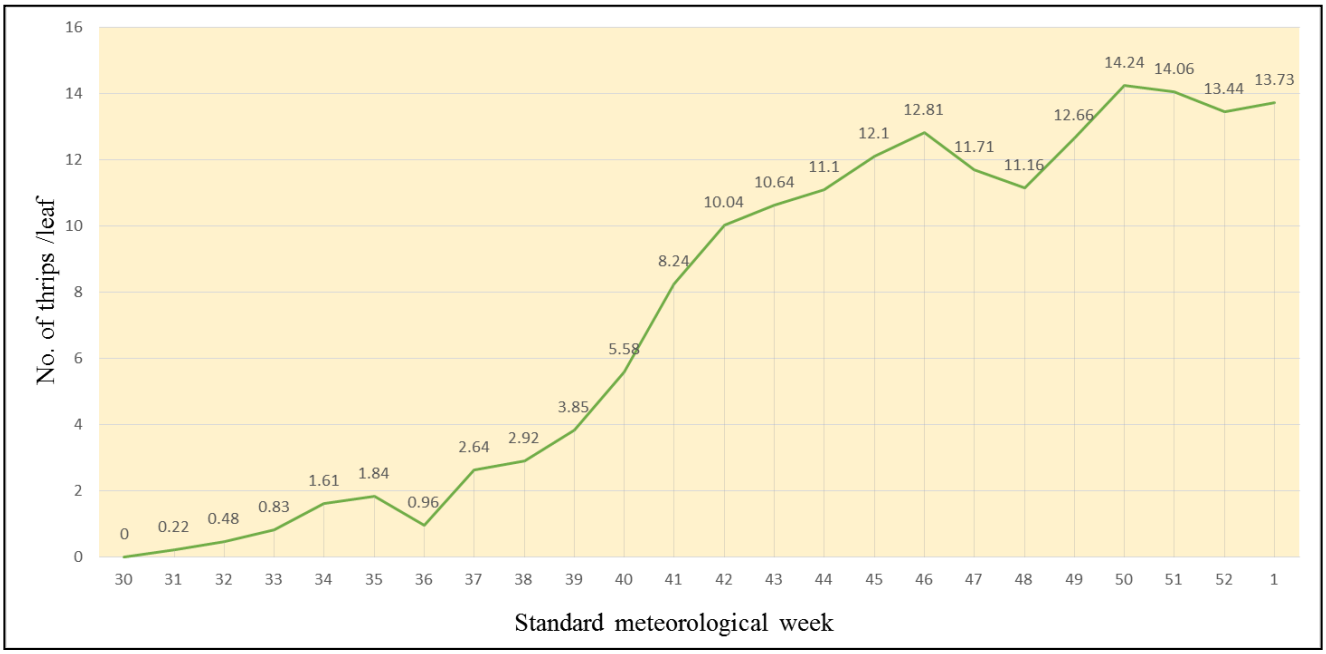

Fig 1: Population fluctuation of thrips on *Bt* cotton

4. Conclusion

The activity of *S. dorsalis* on *Bt* cotton was found during last week of July to end of crop season during 2017-18. The higher activity of this pest was noticed during 2nd week of October to end of crop season (8.24 to 14.24 thrips/leaf). The correlation coefficient data indicated that rain fall, wind speed, minimum temperature, morning relative humidity, evening relative humidity, morning vapour pressure, evening vapour pressure, bright sunshine hour and evening vapour pressure deficit were highly significant correlated with thrips population.

5. References

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