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Impact of abiotic factors on population dynamics of sucking pests of *Bt* cotton under high density planting system

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ABSTRACT : Studies were carried out to investigate population dynamics and the impact of abiotic factors on population dynamics of sucking insect pests of transgenic cotton *viz.,* aphid (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), thrips (*Thrips tabaci* Linnman) and whitefly (*Bemisia tabaci* Gennadius) under unprotected condition. The results of the field study revealed that the sucking pest population was found throughout the year. The peak population of leafhopper, aphid, whitefly and thrips were 48.30 and 45.15, 21.30 and 16.10, 58.30 and 45.30 and 32.60 and 28.10/3 leaves , respectively, during *kharif,* 2015 and 2016, Studies on population dynamics of sucking pests clearly indicated that sucking pests incidence varied throughout the season. On the basis of population dynamics of sucking pest *viz.,* aphid, leafhopper, thrips and whitefly population during *kharif* 2015 and 2016 the incidence was more in *kharif* 2015 than *kharif* 2016 due to seasonal variation in weather parameters.

Key word : Abiotic factors, high density planting system, population dynamics, sucking pest

Cotton is a major fiber crop of global significance, cultivated in more than seventy countries in the world. Cotton crop is playing an important role in economic, political and social affairs of the world. Cotton belongs to the family "*Malvaceae*" and genus "*Gossypium*" Cotton crop as commercial commodity, plays an important role in industrial activity of nation, in terms of both employment generation and foreign exchange, Hence it is popularly known as "White Gold" and "Friendly Fiber".

Cotton is being cultivated in 70 countries of the world with a total coverage of 33.14 m ha. China, India, USA and Pakistan are the major cotton producing countries in the world accounting for 70 per cent of the world's cotton area and production. India is the largest cotton growing country in the world with 35.29 per cent of world cotton area followed by China (15.23%). China and India are the major cotton consuming countries in the world (around 55%). USA and India constitute 27 and 19.5 per cent of the worlds cotton exports , respectively. China is the major importer in the world with around 28 per cent of the total imports (11.00M bales of 480 kg). Among the major cotton growing countries, Australia tops the productivity level of 2151 kg lint/ha followed by Turkey (1484 kg lint/ ha) and Brazil (1465 kg lint/ha). In production, India ranks second next to China. In India, cotton is

cultivated in an area of 11.70 M ha with a production of 29.00 M bales of seed cotton during 2015-16. Average productivity of cotton in India is 540 kg lint/ha, which is low when compared to world average of 766 kg lint/ha (Anonymous, 2015-2016).

Gujarat, Maharashtra and Telangana are the major cotton growing states contributing around 70 per cent of the area and 67 per cent of cotton production in India. As per the CAB estimates, the cotton productivity is expected to be around 503 kg lint/ha during the year 2015-2016. The year was not congenial for cotton due to both abiotic and biotic stresses which pulled down the area as well as productivity. In Maharashtra, the present cotton growing situation is showing improvement after release of *Bt* cotton and is cultivated in an area of 38.27 lakh ha with total production 71.25 lakh bales with an average productivity of 342 kg/ha (Anonymous, 2015-2016). The area under transgenic cotton is upto 99 per cent.

Among the insect pests, a complex of sucking pests *viz.,* green leafhopper, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover), whitefly, *Bemisia tabaci* (Gennadius) and thrips, *Thrips tabaci* (Linnman) occupy major pest status and cause considerable damage in *Bt* cotton. Information on seasonal activity of sucking pests on *Bt* cotton helps to take up effective management strategies. Keeping this in view present study was undertaken..

MATERIALS AND METHODS

The field experiment was carried out during *kharif* 2015 and 2016 at Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Transgenic cotton Balwan (NSC 8899) BG-II sown and the crop was raised as per the package of practices recommended by the VNMKV, Parbhani. The observations were made on number of leafhoppers, aphids, whiteflies and thrips on five randomly selected plants from each quadrants at weekly interval starting from 30 DAS from top, middle and bottom 3 leaves, throughout the crop season (*kharif* and *rabi*).

RESULTS AND DISCUSSION

The data on population of aphid *A. gossypii* during *kharif* 2015-2016 (Table 1 and Fig. 1) revealed that aphid population in high density planting system of *Bt* cotton ranged between 6.15 and 48.3 aphids/ 3 leaves. The incidence of aphids started from 27th SMW (6.15 aphids/ 3 leaves) with its first peak (16.30 aphids/ 3 leaves) in 28th SMW. The incidence of aphid population was severe during 40th to 44th SMW and reached to highest population during entire season (48.30 aphids/ 3 leaves) 42 SMW. During *kharif* 2016-2017 the aphid populations in high density planting system of cotton ranged between 1.60 to 45.15 aphids/ 3 leaves. The incidence of aphids started from 29th SMW (6.45 aphids/ 3 leaves). Thereafter 32th SMW aphid population was reached to first peak (24.30 aphids/ 3 leaves). The second peak of aphid incidence was observed 33nd SMW (31.05 aphids/ 3 leaves). The aphid population 46 SMW recorded to highest during entire season with 45.15 aphids/ 3 leaves.

The present findings of peak incidence of thrips is more or less similar as sowing period may vary confirming with those of Chavan *et al.,*

(2010). Who observed two peak incidence of aphid: first peak from second week of August to first week of September and second from first week of November to last week of November. Rathod (2014) reported that the incidence of aphid started from 29th SMW (1.2 aphids / 3 leaves) and its first peak was observed 32nd SMW (18.25 aphids/ 3 leaves) and the aphid incidence was recorded more during August and November months.

The data on population fluctuation of leafhopper *A. biguttula biguttula* during *kharif* 2015-2016 and presented in Table 1 and Fig. 1. It ranged from 1.45 to 21.3 leafhoppers/ 3 leaves. The incidence of leafhopper started from 28th SMW (1.45 leafhoppers/ 3 leaves). The first peak of leafhopper incidence was reported during 30th SMW (6.15 leafhoppers/ 3 leaves). The second peak of leafhopper incidence was reported during 31th SMW with population 7.90 leafhoppers/ 3 leaves. Thereafter population declined in 32nd SMW and again reappeared 35th SMW and reached to highest 21.30 leafhoppers/ 3 leaves during entire season.

During *kharif* 2016-2017 (Table 1 and Fig. 1) the leafhopper population ranged between

Table 1. Population dynamics of sucking pests of *Bt* cotton under HDPS in relation to weather parameters during *kharif* 2015-2016 and 2016-2017

Month	SMW	Sucking pests population/plant/3 leaves							
		Aphid		Leafhopper		Thrips		Whitefly	
		2015	2016	2015	2016	2015	2016	2015	2016
June	25	0.00	-	0.00	-	0.00	-	0	-
	26	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
July	27	6.15	0.00	0.00	0.00	0.90	0.00	0	0.00
	28	16.30	0.00	1.45	0.00	10.20	0.00	0.9	0.00
	29	18.30	4.90	3.15	2.10	18.60	0.15	2.4	0.15
	30	42.30	2.90	6.15	1.90	26.90	2.10	3.15	2.10
August	31	38.50	1.60	7.90	0.30	28.30	0.60	7.9	1.05
	32	18.10	24.30	6.80	6.45	18.10	18.10	6.8	12.05
	33	12.60	31.05	9.45	8.0	8.20	28.20	12.3	10.20
	34	32.20	27.15	16.45	9.20	32.30	22.10	16.4	8.10
September	35	18.10	4.30	21.30	4.15	58.30	15.45	25.3	6.10
	36	8.80	36.80	10.05	16.10	8.30	45.30	22.1	12.10
	37	6.20	10.45	8.75	8.60	5.15	13.95	20.6	2.80
	38	4.30	4.90	9.80	1.80	2.45	1.80	15.45	5.30
	39	15.10	3.45	8.75	0.90	48.10	2.10	16.1	2.60
October	40	18.60	1.80	7.80	0.15	50.10	0.50	17.45	1.25
	41	20.30	2.10	4.80	1.75	46.20	12.10	20.75	6.30
	42	48.30	8.60	4.40	4.90	48.75	22.10	28.6	15.15
November	43	46.30	10.20	3.75	3.10	32.80	28.20	30.2	22.30
	44	42.40	18.30	6.20	3.45	26.10	26.10	32.6	28.10
	45	32.60	29.05	3.80	4.05	18.20	12.20	30.1	26.30
	46	26.30	38.10	3.05	4.60	14.20	9.45	18.2	20.20
	47	18.20	25.15	1.90	3.24	3.65	5.15	12.1	15.30
December	48	16.40	20.30	1.60	2.10	3.80	3.15	5.65	6.10

0.30 and 16.10 leafhoppers/ 3 leaves. The incidence of leafhopper started from 29th SMW (2.10 leafhoppers/ 3 leaves). The first peak incidence was observed in 32nd SMW (6.45 leafhoppers/3 leaves). The second peak incidence was observed in 34th SMW (9.20 leafhoppers/3 leaves). Subsequently the population of leafhopper was increased during 36th SMW and reached to the maximum population 16.10 leafhoppers/ 3 leaves during entire season.

While Babu *et al.,* (2014) recorded the jassid population which ranged from 6.6 to 22.2 jassid/3 leaves and maximum population observed during standard SMW of 34-37th.

The data on population dynamics of thrips, *T. tabaci* in high density planting system of cotton during *kharif* 2015-2016 are given in Table 1 and Fig. 1 which ranged between 4.30 and 58.30 thrips/3 leaves. The incidence of thrips started from 28th SMW (4.30 thrips/ 3 leaves). The first peak of thrips population 18.60 thrips/ 3 leaves was observed in 29th SMW and the second peak of thrips population 26.90 thrips/ 3 leaves in 30th SMW. Thereafter population declined to 8.20 thrips/ 3 leaves in 33rd SMW. Subsequently population of thrips was reappeared and reached maximum population of entire season (58.30 thrips/ 3 leaves) from 35th SMW and declined upto 36th to 38 SMW and reached to (2.45 thrips/ 3 leaves).

During *kharif* 2016-2017 (Table 1 and Fig. 1) population ranged from 0.15 to 45.30 thrips/ 3 leaves. The incidence of thrips started from 29rd SMW (0.15 thrips/ 3 leaves) in 29th SMW. Thereafter population declined upto 0.60 thrips/ 3 leaves upto 31th SMW. The first peak population was recorded during 32nd (18.10 (thrips/ 3 leaves) and second peak was observed 33rd SMW. Thereafter population decreased 34th SMW and reappeared and reached to maximum during entire season in 45.30th SMW.

The present findings of peak incidence of thrips are more or less similar to those of Babu *et al.,* (2014) who recorded that the thrips population range from 0.00 to 87.0 thrips/ 3 leaves and heights incidence observed during 39 to 41 SMW. Panwar *et al.,* (2015) recorded that thrips occurrence started with peak 9.35 thrips/ leaf and 8.33 thrips/ leaf in 31st SMW. The present findings are also supported by those of Chavan *et al.,* (2010) and Rajput *et al.,* (2010).

The data on population fluctuations of whitefly, *B. tabaci* in high density planting system of cotton during *kharif* 2015-2016 (Table 1 and Fig. 1) ranged from 0.90 to 32.60 whiteflies/ 3 leaves. The incidence of whiteflies started from 28th SMW (0.90 whiteflies/ 3 leaves). The first peak of whitefly was observed in 33rd SMW (12.30 whitefly/ 3 leaves). The activity of whiteflies was more from 42nd to 45th SMW with highest population (32.60 whiteflies/ 3 leaves) in 44th week of October. While, during *kharif* 2016-2017 (Table 1 and Fig. 1) it ranged from 0.15 to 28.10 whiteflies/3 leaves. The incidence of whiteflies started from 29th SMW (0.15 whiteflies/3 leaves). The incidence of whiteflies started from 29th SMW (0.15 whiteflies/3 leaves). The incidence of whiteflies increased to first peak 12.05 whiteflies/3 leaves in 32nd SMW. The maximum population of whitefly was observed during 44th SMW reaching up to 28.10 whiteflies/ 3 leaves.

The present findings are similar with the findings of other workers (Chavan *et al.,* 2010; Soujanya *et al.,* 2010; Babu *et al.,* 2014) recorded

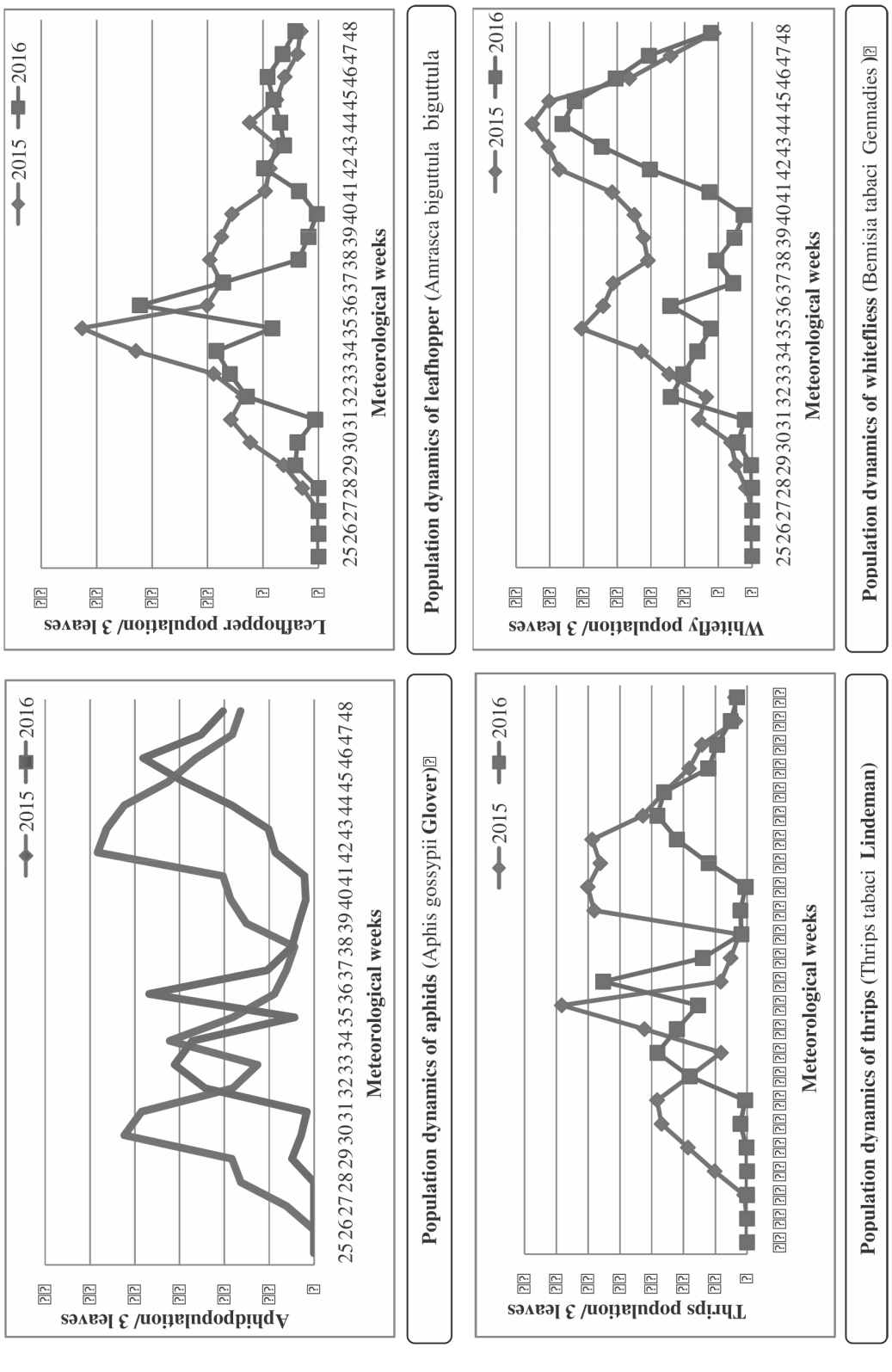

Fig. 1 Population dynamics of sucking pests of *Bt* cotton under HDPS in relation to weather parameters during *kharif* 2015 and 2016-17

3.9 to 42.0/ leaves and maximum was observed during 37-39th SMW. Bhute *et al.,* (2015) reported incidence of whitefly (52.75-63.00/3 leaves) during 45th SMW.

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