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Status of whitefly (*Bemisia tabaci* Gennadius) population on Bt cotton in Marathwada region of Maharashtra under changing climate

AG Lad, RY Khandare and YB Matre

Abstract

The research was conducted during *kharif* seasons of 2017-18, 2018-19 and 2019-20 at Seven major cotton growing districts (*viz.* Parbhani, Hingoli, Nanded, Jalna, Aurangabad, Osmanabad & Beed) in Marathwada region of Maharashtra under Crop Pest Surveillance and Advisory Project (CROPSAP). The severity of whitefly population is becoming a major concern to transgenic cotton farmers. Keeping this in view scientific survey of white fly (*Bemisia tabaci* Gennadius) incidence on Bt cotton was carried out from last Three years (2017-18 to 2019-20), in Seven major cotton growing districts (*viz.* Parbhani, Hingoli, Nanded, Jalna, Aurangabad, Osmanabad & Beed) in Marathwada region of Maharashtra under Crop Pest Surveillance and Advisory Project (CROPSAP) by using ICT tools and total 171 ETL based advisories were issued twice in a week to monitor the pest. On the basis of taluka wise roving survey, the district wise mean data stated that during 2017-18, Nanded district was severely infested by whiteflies (1.65) followed by Jalna (1.09) and Parbhani (0.70). During 2018-19, Jalna district recorded highest population of whitefly (1.02) followed by Parbhani (0.54) and Hingoli (0.42). Whereas during 2019-20, Parbhani district recorded highest population of whitefly (0.22) followed by Jalna (0.19) and Aurangabad (0.17). On the basis of three years survey data, the severity of whiteflies incidence was more during 2017-18.

Keywords: Cotton, *Bemisia tabaci*, CROPSAP, ETL, Districts, ICT etc.

Introduction

Cotton is a cash crop that is grown in three agro-climatic zones in India. Cotton (*Gossypium* spp.) is a gift to human civilization from the Indian subcontinent. Cotton, by far the most important natural fiber or vegetable wool, has been commercially grown for home consumption and export in roughly 111 nations worldwide, earning it the nicknames "White Gold" and "King of Fibers." Cotton is grown in 70 countries throughout the world covering 33.14 million hectares. China, India, United States and Pakistan are the world's top cotton producers contributing for 70% of global cotton production and area. With 35.29 per cent of the world's cotton acreage, India is one of the largest producers of cotton in the world accounting for about 26% of the world cotton production. The yields per kg hectare which is presently 464 kg/ha is still lower against the world average yield of about 764 kg/ha followed by China (15.23 per cent). In India cotton is cultivated on area of 129.57 lakh hectares and production of 371.00 lakh bales with lint productivity 486.76 kg per hectare as compared to world average of 764 kg per hectare (Anonymous, 2021-22) [3].

India is unique to grow all the four cultivated spp. (*Gossypium hirsutum*, *G. barbadense*, *G. arboreum* and *G. herbaceum*) and intra as well as inter specific hybrids under diverse agro-ecological conditions. Cotton crop is subjected to damage by 162 species of pests right from germination to the final picking (Dhaliwal and Arora, 1998) [6]. In Maharashtra about 25 pests are reported to cause damage to cotton crop at different growth stages (Thakare *et al.*, 1983) [14]. The important sucking pests are aphids *Aphis gossypii* (Glover), Jassids *Amrasca biguttula biguttula* (Ishida), Whiteflies *Bemisia tabaci* (Gennadius), Thrips *Thrips tabaci*, Mealy bugs *Phenacoccus solenopsis* (Tinsley). The bollworms include spotted bollworm *Earias vitella* (Fab.), American bollworm *Helicoverpa armigera* (Hubner) and Pink bollworm *Pectinophora gossypiella* (Saund.). The losses in cotton due to sucking pests, bollworms and both together have been reported as 11.60%, 44.50% and 52.10%, respectively (Dhawan and Sindhu, 1986) [7].

Among the sucking pests, whitefly is one of the notorious and key pest due to its polyphagous nature and ability to adapt to diverse cropping system (Chaudhry and Guitchounts., 2003)^[5], (Singh., 2017)^[13] Constantly sucking the cell sap results in 50% reduction in boll production hindering the photosynthesis by secreting honey dew on which sooty mould develops (Ahmed *et al.*, 1998)^[11]. Acts as a major vector of leaf curl virus disease causing average yield loss of 38.7% (Nelson *et al.*, 1998)^[11]. Several pest control techniques are utilized to manage the dreaded pest but the most common and quicker one is the chemical control which is generally adopted by our farming community. Therefore the objective of the study was coined to have a proper knowledge on the seasonal incidence, population dynamics and insecticidal management of whitefly infesting cotton because without proper knowledge on seasonal incidence of the pest and proper selection of insecticide desirable management cannot be achieved. (Pal *et al.*, 2020)^[12].

Material and Method

The talukawise survey was carried out in six major cotton growing districts *viz.* Parbhani, Nanded, Hingoli, Beed, Jalna and Aurangabad of Marathwada to record the status of thrips under “Crop Pest Surveillance and Advisory Project (CROPSAP)” during 2009-10 to 2013-14. During the survey eight fields from each taluka were observed and the incidence of whiteflies were recorded from 10 randomly selected plants from each fields from villages of all six districts and fifty eight talukas of Marathwada *viz.* Parbhani (Parbhani, Purna, Palam, Gangaked, Sonpeth, Pathri, Selu, Manvat, Jintur), Hingoli (Hingoli, Vasmat, Kalamnuri, Sengaon, Aundha Nagnath), Nanded (Ardhapur, Nanded, Loha, Bhokar, Mukhed, Naigaon, Mudkhed), Beed (Parli, Ambejogai, Kej, Majalgaon, Georai, Dharur, Vadavani), Jalna (Partur, Mantha, Jalna, Badnapur, Bhokardan, Ambad), Aurangabad

(Phulambri, Soygaon, Kannad, Vaijapur, Khultabad, Sillod, Aurangabad, Gangapur) of Marathwada. Depending upon the stages of crop population of whiteflies were recorded from three leaves (bottom, middle and top).

Result and Discussion

The survey of incidence of whitefly on Bt cotton was carried out during 2017-18 to 2019-20 in seven major cotton growing districts of Marathwada under Crop Pest Surveillance and Advisory Project (CROPSAP).

The data on population dynamics of whiteflies during 2017-18 presented in table no. 1 and revealed that in Parbhani district first incidence of whitefly was noticed in 31st MW and it goes on increasing upto 38th MW and attains its peak (2.28). The whiteflies infestation fluctuates in between 0.01 to 2.28 with a average of 0.70. Whereas in hingoli district whiteflies incidence was noticed in 31st MW and attains its peak 36th MW (0.16) thereafter whitefly activity was decreased up to end of season with a average of 0.05. Similarly, in Nanded district whitefly activity was noticed from 31st MW and attains its peak in 38th MW (3.98). Thereafter it goes on decreasing in the end of season. The whitefly population fluctuates in between 0.17 to 3.98 with a average of 1.65. In Jalna district the activity of whiteflies was recorded from 31st MW and it ranges in between 0.35 to 1.77. Attains its peak with severity in 37th MW and it remains active throughout season with a average of 1.09. In Aurangabad district the first incidence was recorded in 31st MW and attains its peak in 36th MW (0.44). It ranges in from 0.01 to 0.44 with a average of 0.20. Whereas in Beed district the infestation starts from 32nd MW and its peak activity noticed during 38th MW (0.82) with a average of 0.52. Overall, incidence of whitefly was highest in Nanded (1.65) per plant followed by Jalna (1.09) and Nanded (0.70).

Table 1: Population of Whiteflies on cotton in Marathwada during 2017-18

SMW	Whiteflies No. / 3 Leaves / Plant					
	AURANGABAD	BEED	HINGOLI	JALNA	NANDED	PARBHANI
31	0.01	0.00	0.01	0.56	0.17	0.13
32	0.29	0.23	0.03	0.60	0.36	0.33
33	0.22	0.34	0.04	0.84	0.68	0.72
34	0.29	0.50	0.17	1.05	0.89	0.41
35	0.34	0.56	0.10	1.58	1.23	0.59
36	0.44	0.62	0.16	1.59	2.33	0.66
37	0.28	0.71	0.10	1.77	2.89	1.19
38	0.27	0.82	0.07	1.57	3.98	2.28
39	0.36	0.64	0.05	1.45	3.31	1.83
40	0.34	0.79	0.04	1.41	3.46	1.70
41	0.20	0.71	0.04	1.18	2.63	1.21
42	0.24	0.79	0.04	1.34	2.25	1.03
43	0.21	0.69	0.04	1.16	1.37	0.72
44	0.15	0.54	0.01	1.05	1.55	0.40
45	0.12	0.47	0.00	0.98	1.38	0.36
46	0.11	0.43	0.00	0.71	1.14	0.16
47	0.06	0.51	0.00	0.81	1.24	0.14
48	0.06	0.38	0.01	1.00	0.96	0.09
49	0.07	0.48	0.01	0.72	0.85	0.06
50	0.02	0.27	0.00	0.35	0.24	0.01
Mean	0.20	0.52	0.05	1.09	1.65	0.70

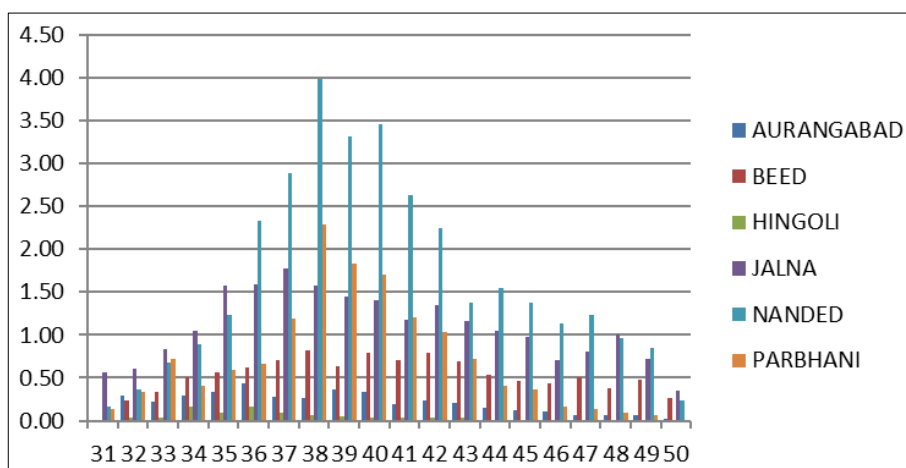


Fig 1: Population of Whiteflies on cotton in Marathwada during 2017-18

The data on population dynamics of whitefly during 2018-19 revealed that in Parbhani district, the population of whiteflies was noticed during 26th MW. The peak population was recorded in 39th MW (1.37). The population ranged in between (0.02 to 1.37) with a average of 0.54. In Hingoli district population of whiteflies was noticed in 26th MW and attains its peak (1.46) then it goes down decreasingly. The population ranged in between, 0.01 to 1.46 with a average population of 0.23. In Nanded district the infestation was recorded in 26th MW (0.99) and attain pick activity in same SMW. The population ranges from 0.02 to 0.99 with average of 0.40. Similarly, in Jalna district the whiteflies incidence was noticed in 26th MW and attains its peak in (19.10).The

whiteflies population fluctuates in between 0.01 to 19.10 with a season average of 1.02. In Osmanabad district the infestation was recorded in 26th MW (1.00) and attain pick activity in same SMW. The population ranges from 0.02 to 1.00 with average of 0.15. In Aurangabad district incidence of whiteflies was noticed in 26th MW and reaches a maximum population of 1.13 with a average of 0.30. whereas, in Beed district the incidence of whiteflies was noticed in 26th MW (0.12) and reaches its highest at 1.46 and population decreasing gradually with a season average 0.23 whiteflies / 3 leaves (Table no.2).

Overall, incidence of whitefly was highest in Jalna (1.02) per plant followed by Parbhani (0.54) and Hingloli (0.42).

Table 2: Population of Whiteflies on cotton in Marathwada during 2018-19

SMW	Whiteflies No. / 3 Leaves / Plant						
	AURANGABAD	BEED	HINGOLI	JALNA	NANDED	OSMANABAD	PARBHANI
26	1.13	1.46	1.27	19.10	0.99	1.00	1.00
27	0.56	0.03	0.07	0.82	0.24	0.12	0.21
28	0.12	0.41	0.10	0.30	0.11	0.37	0.06
29	0.12	0.06	0.10	0.21	0.19	0.25	0.15
30	0.17	0.16	0.24	0.35	0.25	0.22	0.43
31	0.22	0.17	0.37	0.56	0.32	0.17	0.51
32	0.24	0.20	0.41	0.52	0.29	0.17	0.93
33	0.21	0.23	0.56	0.44	0.39	0.14	0.56
34	0.26	0.22	0.58	0.41	0.41	0.13	0.43
35	0.31	0.22	0.76	0.43	0.63	0.11	0.80
36	0.35	0.28	0.64	0.50	0.75	0.19	0.76
37	0.30	0.34	0.87	0.53	0.91	0.14	1.13
38	0.40	0.39	0.97	0.71	0.68	0.11	1.07
39	0.50	0.35	0.90	0.46	0.83	0.13	1.37
40	0.54	0.34	0.83	0.47	0.85	0.18	1.28
41	0.39	0.30	0.64	0.31	0.59	0.06	0.91
42	0.43	0.20	0.39	0.26	0.50	0.08	0.69
43	0.43	0.20	0.44	0.21	0.44	0.11	0.66
44	0.35	0.13	0.34	0.17	0.29	0.08	0.43
45	0.10	0.14	0.43	0.14	0.35	0.02	0.48
46	0.27	0.11	0.16	0.17	0.28	0.05	0.22
47	0.21	0.04	0.13	0.11	0.15	0.05	0.11
48	0.09	0.06	0.07	0.09	0.11	0.02	0.32
49	0.05	0.04	0.05	0.08	0.11	0.02	0.02
50	0.07	0.06	0.02	0.01	0.05	0.02	0.00
51	0.07	0.10	0.01	0.02	0.03	0.03	0.00
52	0.08	0.01	0.00	0.02	0.02	0.04	0.00
Mean	0.30	0.23	0.42	1.02	0.40	0.15	0.54

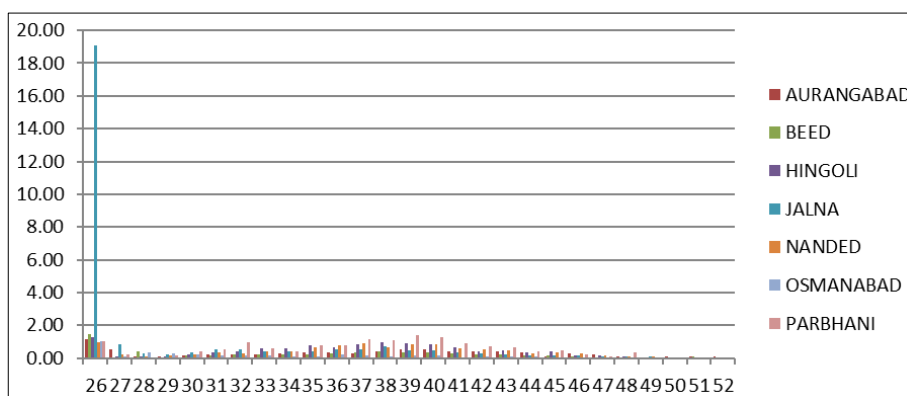


Fig 2: Population of Whiteflies on cotton in Marathwada during 2018-19

The data presented in table no. 3 represents population of whiteflies during 2019-20 and revealed that in Parbhani district incidence of whiteflies was noticed in 31st MW and reaches its maximum in 42nd MW (0.64). The population of

whiteflies was fluctuates in between 0.03 to 0.64 whiteflies /leaf with a average of 0.22. Similarly, in Hingoli district, the incidence was started from 31st MW and attains its peak in 41st MW then its goes down decreasingly.

Table 3: Population of Whiteflies on cotton in Marathwada during 2019-20

SMW	Whiteflies No. / 3 Leaves / Plant							
	AURANGABAD	BEED	HINGOLI	JALNA	LATUR	NANDED	OSMANABAD	PARBHANI
28	0.00	0.00	--	--	--	--	--	--
29	0.01	0.02	--	0.03	--	--	--	--
30	0.03	0.02	--	0.05	--	0.00	0.01	--
31	0.02	0.01	0.09	0.07	0.07	0.03	0.06	0.03
32	0.10	0.04	0.02	0.08	0.11	0.02	0.29	0.08
33	0.10	0.05	0.06	0.15	0.16	0.07	0.07	0.07
34	0.16	0.05	0.06	0.19	0.29	0.09	0.01	0.09
35	0.18	0.11	0.07	0.17	0.04	0.09	0.05	0.13
36	0.22	0.12	0.12	0.20	0.08	0.14	0.07	0.28
37	0.19	0.11	0.07	0.18	0.10	0.31	0.07	0.14
38	0.20	0.25	0.26	0.23	0.24	0.32	0.04	0.44
39	0.25	0.25	0.13	0.19	0.35	0.25	0.02	0.43
40	0.25	0.18	0.26	0.30	0.29	0.31	0.04	0.51
41	0.31	0.23	0.27	0.25	0.09	0.31	0.03	0.45
42	0.12	0.31	0.11	0.59	0.00	0.30	0.00	0.64
43	1.28	0.00	0.00	--	0.00	0.03	0.00	0.39
44	0.41	0.01	0.00	--	--	0.08	0.00	0.18
45	0.00	0.00	0.00	--	--	0.04	0.00	0.13
46	0.31	0.00	0.00	--	--	0.01	0.00	0.12
47	0.06	0.03	0.00	--	--	0.00	0.00	0.34
48	0.00	0.00	0.00	--	--	0.02	0.00	0.08
49	0.00	0.03	0.00	--	--	0.00	0.00	0.07
50	0.00	--	0.00	--	--	0.00	0.03	0.03
51	0.00	--	0.00	--	--	0.00	0.08	0.03
52	0.12	--	0.00	--	--	0.00	0.04	0.07
Mean	0.17	0.08	0.07	0.19	0.14	0.11	0.04	0.22

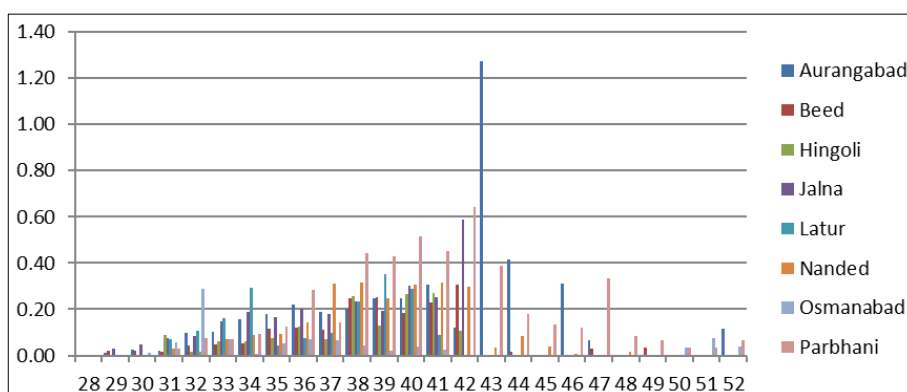


Fig 3: Population of Whiteflies on cotton in Marathwada during 2019-20

The population of whiteflies ranges from 0.02 to 0.27 with a average of 0.07. Similarly in Nanded district the incidence started from 31st SMW and reaches the pick period in 38th SMW (0.32) and population fluctuates in between 0.01 to 0.32 with a average of 0.11. In Jalna district whitefly incidence was noticed in 29th SMW and reaches its peak (0.59) in 42nd MW. During the season, population of whiteflies fluctuates in between 0.03 to 0.59 with average of 0.19. In Aurangabad district the infestation starts from 29th MW and reaches its peak in 43rd MW with a average of 0.17. Similarly in Beed district the infestation starts from 29th MW and attains its peak in 38th and 39th SMW (0.25) with average of 0.08. Whereas, in Osmanabad district the incidence of whiteflies was noticed in 30th MW (0.12) and reaches its highest at 1.46 and population decreasing gradually with a season average 0.23 whiteflies / 3 leaves (Table no.2).

During the year infestation was competitive highest in Parbhani (0.22) per plant followed by Jalna (0.19) and Aurangabad (0.17). The present findings are similar with those of Mehra and Rolania (2020) who reported that the Peak population of whitefly adults (20.3 whitefly adults/leaf) was observed during 9th to 18th September. Nymphal population (34.1 whitefly nymphs/leaf) was observed maximum during 19th to 28th September. The occurrence of whitefly was noticed during the fourth week of July (0.20 whitefly per plant) which continued till late December. Pal *et al.* (2020)^[12] reported that the occurrence of whitefly was noticed during the fourth week of July (0.20 whitefly per plant) which continued till late December. Highest whitefly population was found during fourth week of September (12.24 whitefly per plant). Bhattacharyya *et al.* (2019)^[4] reported that maximum activity of whitefly (4.50 whiteflies /leaf) was observed during 39th SMW (Sep.24-30). Muchhadiya *et al.* (2014)^[10] reported that whitefly was found damaging the *Bt* cotton throughout the season, however, their peak activity was found on 47th SMW (3.48/3 leaves. Kumar *et al.*, (2022)^[8] reported that Whitefly population (adults/3 leaves) remained below ETL in June and crossed ETL at few locations during July-August and thereafter remained below ETL in all locations.

Conclusion

The population of whiteflies ranges from 0.02 to 0.27 with a average of 0.07. Similarly in Nanded district the incidence started from 31st SMW and reaches the pick period in 38th SMW (0.32) and population fluctuates in between 0.01 to 0.32 with a average of 0.11. In Jalna district whitefly incidence was noticed in 29th SMW and reaches its peak (0.59) in 42nd MW. During the season, population of whiteflies fluctuates in between 0.03 to 0.59 with average of 0.19. In Aurangabad district the infestation starts from 29th MW and reaches its peak in 43rd MW with a average of 0.17. Similarly in Beed district the infestation starts from 29th MW and attains its peak in 38th and 39th SMW (0.25) with average of 0.08. Whereas, in Osmanabad district the incidence of whiteflies was noticed in 30th MW (0.12) and reaches its highest at 1.46 and population decreasing gradually with a season average 0.23 whiteflies / 3 leaves (Table no.2).

During the year infestation was competitive highest in Parbhani (0.22) per plant followed by Jalna (0.19) and Aurangabad (0.17).

Declaration: The author declare that they have no conflict of interest

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