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POPULATION DYNAMICS OF WHITEFLY (BEMISIA TABACI GENNADIUS) AND LEAFHOPPER (AMRASCA BIGUTTULA BIGUTTULA ISHIDA) IN BT AND NON-BT COTTON

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Abstract

The present study was carried out to find the population dynamics of whitefly and leafhopper in Bt cotton and Non-Bt cotton agroecosystem in the Hanumangarh district of Rajasthan during the 2022-23, Kharif season. Cotton plants are infested by various sucking insect pests during the growth period. Among all the sucking insect pests whiteflies and leafhoppers cause a noxious effect on cotton plants. During kharif 2022-23, whitefly infestation starts from the 24th SMW in Bt cotton as well as in Non-Bt cotton plants and it remains active till the 45th SMW. The highest activity of whitefly was recorded during the 31st SMW in both types of cotton fields. On the other side, the infestation of leafhoppers started from the 25th SMW in Bt cotton and the 26th SMW in Non-Bt cotton, and its peak activity was recorded during the 33rd SMW and 35th SMW. The leafhopper population remains active till the 43rd SMW and 45th SMW, in Bt cotton and Non-Bt cotton, respectively.

Keywords: - whitefly, leafhopper, dynamics, SMW, cotton

1. Introduction

Cotton is a major cash crop in India, commonly known as the King of Natural Fibers, White Gold, Silver Fiber, etc. (Kadam et al, 2014). Every part of the cotton plant is useful for the human being in different ways. It plays a crucial role in the agricultural, social as well as industrial sectors of the country. Cotton is grown under rainfed and irrigated conditions but in India near about 60 percent of the cotton crop is cultivated under rainfed conditions. Among all the countries, India ranks first in cotton production and also in the area, which is 341.91 lakh bales of 170 kg and 125.10 lakh hac., respectively, till 2022-2023. India is chiefly divided into 3 cotton growing zones viz. north zone, central zone, and south zone. Rajasthan is situated under the north cotton growing zones of India. During 2021-2022, a total of 17.08 lakh hac., area of the north zone under cotton cultivation which produces 54.96 lakh bales of 170 kg., apart from that Rajasthan contributed a total of 7.56 lakh hac., area and 24.36 lakh bales of 170 kg. (Anonymous, 2023). One of the main reasons for the low yield of cotton is the damage caused by insect infestation. A total of 148 insect pest species were cataloged during the cotton developing period, of which only 17 of the major cotton insect pests were reported **(**Abbas MA, 2001). The cotton insect pests are mainly categorized into 3 parts viz. sucking insect pests, bollworms, and foliage insect pests. These sucking insect pests cause serious damage to cotton crop and it includes the whitefly (Bemisia tabaci Gennadius), thrip (Thrips tabaci Lindemann), leaf hopper (Amrasca biguttula biguttula Ishida), aphid (Aphis gossypii Glover), and mealy bug (Phaenococcus solenopsis Tinsley). Among the other insect pests American bollworms, pink bollworms, and spotted bollworms also damage the cotton plant, especially bolls. The tobacco caterpillar is another insect pest

that attack on foliage part of the cotton plant (Kalkal et al, 2015). All these insect pests are very harmful to cotton crops, so in the last few years, various efforts have been made to prevent them. Due to the arrival of Bt cotton, cotton bollworm has been prevented to a great extent, but it has not been able to control the sucking insect pest. Therefore, various types of sucking insect pest attacks occur during the cotton growing season and they reduce crop production to a great extent. The whitefly (Bemisia tabaci Gennadius) and the leafhopper (Amrasca biguttula biguttula Ishida) are the most significant sucking insect pests of cotton (Mohapatra LN, 2008). Whiteflies significantly decrease growth and vitality by sucking sap from plants. In particular, cotton leaf curl disease, which is caused by viruses, is also spread by it (Akram et al., 2013). both nymphs and adults of leafhoppers draw sap from leaves and injure the underside of leaves by inserting its noxious spit into tissues, which results in the loss of foliage and juvenile bolls and a substantial decrease in fruiting potential (Ratanoara et al., 1994). Both these sucking insect pests from this process cause a lot of damage to the cotton crop, so for better management during the cultivation of the cotton crop, it is very important for us to see their population dynamics, so that we can control them easily. This study was conducted to complete this purpose so that accurate data related to whitefly and leafhopper could be obtained.

2. Materials and Methods

To study the population dynamics of whitefly and leafhopper, a field experiment was carried out in four different villages (7DBL, 8DBL, 5AG, Rampuriya) of Tibbi tehsil of Hanumangarh district, Rajasthan, during the kharif season of the year 2022-23. Quadrates of 10m x 10m were made at all the selected locations. Three replicates of Bt cotton and non-Bt cotton plants were taken at the selected location to obtain accurate data on population dynamics. Five plants were chosen at random from every quadrant and given fiber cloth tags to identify them. Periodic (once in a week) observations on the incidence of sucking insect pests (whitefly and leafhopper) were made. The top, middle, and bottom leaves of each plant were chosen to count the number of whitefly and leafhopper. Five randomly chosen plants per plot were monitored each evening between 4 and 6 pm during each metrological week.

3. Results and Discussion

3.1 Population dynamics of whitefly

The data on population dynamics of whitefly in Bt cotton and Non-Bt cotton, during kharif 2022-23 is presented in Table 1 & figure 1 and Table 2 & figure 2. The occurrence of the whitefly population in Bt cotton and Non-Bt cotton lie between 0.00 to 132.26 whitefly per 3 leaves and 0.00 to 140.69 whitefly per 3 leaves, respectively, from 24th SMW to 46th SMW. The first incidence of the whitefly population was recorded in the 24th SMW in both types of cotton fields. In Bt cotton, the first incidence population was 24.86 whitefly per 3 leaves while in Non-Bt cotton it was 22.84 whitefly per 3 leaves. A little variation was noticed in the initial population number of whitefly in Bt cotton and Non-Bt cotton. After the first incidence of whitefly, it gradually increased in number and reached a peak in 31st SMW in both types of cotton fields. The highest number of whitefly was recorded during kharif 2022-23 is 132.26 whitefly per 3 leaves for Bt cotton and 140.69 whiteflies per 3 leaves for Non-Bt cotton. After the 31st SMW population gradually declined in Bt cotton except in the 40th SMW, where a slightly high number of whitefly was recorded than in the previous SMW. On the other side in Non-Bt cotton, there was a similar trend recorded to Bt cotton, because the number of whiteflies also declined throughout the period except for the 35th SMW. During the study period, it was noticed that the 29th to 32nd SMW was most suitable for whiteflies when a number of more than 100 whiteflies per 3 leaves was recorded in both cotton fields. The activity of whitefly was recorded till 45th SMW in Bt cotton as well as in Non-Bt cotton. Pal et al. (2020) observed the highest activity of leafhoppers from the 27th SMW to the 33rd SMW, which is similar to our findings. Shera et al. (2013); Selvaraj & Ramesh (2012) recorded a similar activity of whiteflies during the 30th SMW. Shahid et al. (2012) observed the highest whitefly population in August month and it reached a peak on 10, August.

3.2 Population dynamics of leafhopper

The data on population dynamics of leafhoppers in Bt cotton and Non-Bt cotton, during kharif 2022-23 is presented in Table 1 & figure 1 and Table 2 & figure 2. The population of whitefly in Bt cotton and Non-Bt cotton lie between 0.00 to 6.96 leafhopper per 3 leaves and 0.00 to 7.96 leafhopper per 3 leaves, respectively, from 24th SMW to 46th SMW. The occurrence of whitefly in Bt cotton started from 25th SMW when 0.67 leafhopper per 3 leaves was recorded. There is a slight difference seen between the first incidence of leafhopper in both types of cotton fields. In Non-Bt cotton, whitefly infestation started from the 26th SMW (1.26 leafhopper per leaves). The peak occurrence of leafhopper was noticed during 31st SMW to 33rd SMW in Bt cotton whereas in Non-Bt cotton it was 33rd SMW to 37th SMW. In Bt cotton, the maximum population observed was 6.96 leafhoppers per 3 leaves during the 33rd SMW, and in Non-Bt cotton, it was 7.96 leafhoppers per 3 leaves during the 35th SMW. The number of leafhoppers gradually increased in Bt cotton, till 33rd SMW, and then it gradually declined till

36th SMW. After the 36th SMW leafhopper population again increased during the 37th SMW to 41st SMW but after the 41st SMW it continuously declined in Bt cotton. Whereas in Non-Bt cotton leafhopper population gradually increased, till 35th SMW. A little population fluctuation was seen during the 36th SMW to 39th SMW in Non-Bt cotton. After the 39th SMW, the leafhopper population continuously declined and it was recorded as lowest in the 45th SMW (0.20 leafhopper per 3 leaves).

A lot of work done by various scientists on the population dynamics of leafhoppers. The present findings of our study about the first incidence of leafhoppers in cotton fields are nearly similar to Hole et al. (2015); Soni & Dhakad (2016). Janu et al. (2017) recorded leafhopper occurrence from the 26th SMW and the highest number of leafhoppers was noticed during the 28th and 33rd SMW. Kalkal et al. (2015) observed the peak population of leafhoppers during the 28th SMW to 32nd SMW and Shera et al. (2013) reported the same during the 35th SMW, which is similar to our findings in Bt cotton and Non-Bt cotton.

4. Conclusion

In the present research work, it is concluded that the leafhopper and whitefly population remained active between 24th SMW to 45th SMW in Bt cotton and Non-Bt cotton. Our findings show that Non-Bt cotton plants are more susceptible to whitefly and leafhopper than Bt cotton because, during the study period, a comparatively high number of whiteflies and leafhoppers were recorded in the Non-Bt cotton field. The peak activity of whiteflies in both types of cotton fields was observed during the same standard meteorological week, whereas in the case of leafhoppers, it was different. With the aid of methodical techniques and results from pest surveillance, research initiatives have been scheduled to comprehend pest dynamics. The understanding of prediction models for pest dynamics that will aid farmers in their pest control tactics can be employed in conjunction with this research endeavor.

5. Acknowledgment

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Table.1. population of whitefly and leafhopper in bt cotton during 2022-23

SMW	Period	Mean population per 3 leaves	
		Whitefly	Leafhopper
24	11June-17 June	24.86	0.00
25	18 June-24 June	27.39	0.67
26	25 June- 1 July	31.30	0.98
27	2 July-8 July	48.60	1.20
28	9 July-15 July	78.00	0.45
29	16 July-22 July	101.20	1.58
30	23 July-29 July	108.77	2.26
31	30 July- 4 Aug.	132.26	3.78
32	5 Aug.-11 Aug.	112.90	4.87
33	12 Aug.-18 Aug.	90.45	6.96
34	19 Aug.-25 Aug.	88.00	1.33
35	26 Aug.-1 Sept.	86.36	0.36
36	2 Sept.-8 Sept.	40.69	0.85
37	9 Sept.-15 Sept.	25.89	1.20
38	16 Sept.-22 Sept.	7.08	1.78
39	23 Sept.-29 Sept.	6.89	2.23
40	30 Sept-6 Oct.	10.45	2.34
41	7 Oct.-13 Oct.	9.87	2.02
42	14 Oct.-20 Oct.	6.22	0.35
43	21 Oct.-27 Oct.	4.00	0.21
44	28 Oct-3 Nov.	2.26	0.00
45	4 Nov.-10 Nov.	1.08	0.00
46	11 Nov.-17 Nov.	0.00	0.00

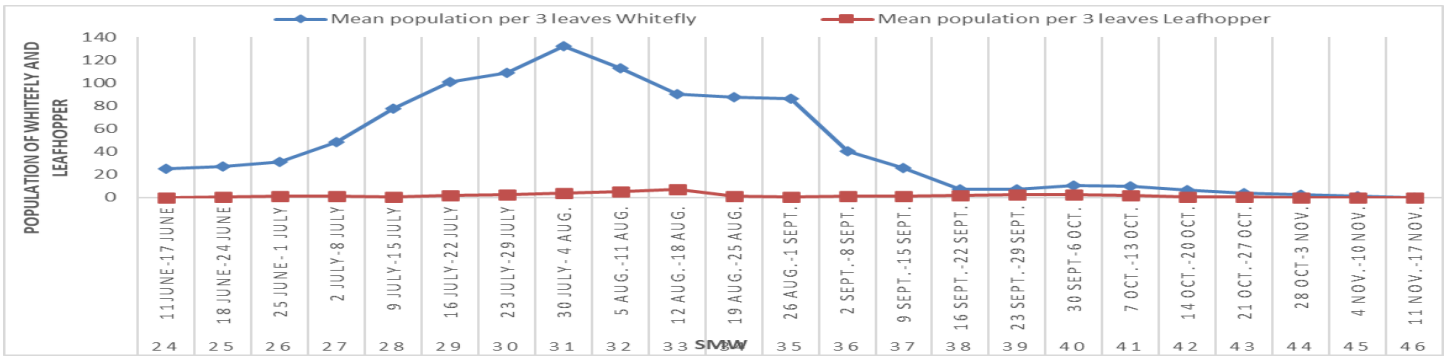

Fig.1. population of whitefly and leafhopper in bt cotton during 2022-23

Table.2. population of whitefly and leafhopper in non-bt cotton during 2022-23

SMW	Period	Mean population per 3 leaves	
		Whitefly	Leafhopper
24	11June-17 June	22.84	0.00
25	18 June-24 June	30.01	0.00
26	25 June- 1 July	28.28	1.26
27	2 July-8 July	60.07	1.44
28	9 July-15 July	90.10	1.49
29	16 July-22 July	109.19	1.97
30	23 July-29 July	117.34	2.80
31	30 July- 4 Aug.	140.69	1.20
32	5 Aug.-11 Aug.	111.20	3.97
33	12 Aug.-18 Aug.	102.00	4.44
34	19 Aug.-25 Aug.	87.22	5.27
35	26 Aug.-1 Sept.	92.31	7.96
36	2 Sept.-8 Sept.	44.33	4.18
37	9 Sept.-15 Sept.	36.20	7.11
38	16 Sept.-22 Sept.	18.00	2.14
39	23 Sept.-29 Sept.	12.33	3.19
40	30 Sept-6 Oct.	9.45	2.24
41	7 Oct.-13 Oct.	9.00	2.11
42	14 Oct.-20 Oct.	5.62	1.14
43	21 Oct.-27 Oct.	3.11	0.87
44	28 Oct-3 Nov.	3.00	0.61
45	4 Nov.-10 Nov.	2.26	0.20
46	11 Nov.-17 Nov.	0.00	0.00

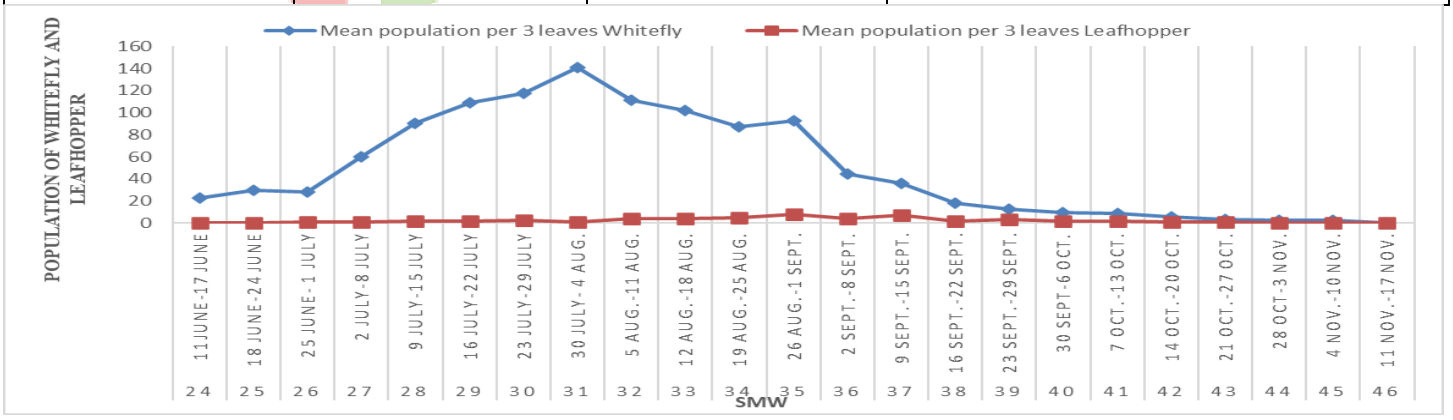

Fig.2. population of whitefly and leafhopper in non-bt cotton during 2022-23

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