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Original Research Article

Population Dynamics of Mealy Bugs *Phenacoccus solenopsis* Tinsley on BG-I and BG-II Bt Cotton

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A B S T R A C T

Population dynamics of mealy bug/2.5 cm shoot length during *kharif* 2008-2009 on BG-I and BG-II Bt cotton hybrids ranged from 0.15 to 2.30 and 0.10 to 2.60 mealy bug/2.5 cm shoot length. The incidence of mealy bugs was started from 32nd MW with a peak of 2.30 and 2.60 mealy bug/2.5 cm shoot length during 46th MW, respectively. While during 2009-2010 and BG-I and BG-II Bt cotton mealy bugs population ranged between 0.10 to 2.10 and 0.10 to 2.50 mealy bug/2.5 cm shoot length. The incidence of mealy bugs started from 33rd MW reaching highest incidence (2.10 and 2.50 mealy bug/2.5 cm shoot length) in 39th MW, respectively. The per cent plant infested by mealy bugs during *kharif* 2008-2009 on BG-I and BG-II Bt cotton ranged between 0.64 to 9.92 and 0.10 to 9.78 per cent. The incidence of mealy bugs started from 32nd MW and attain its peak (9.92 and 9.97 mealy bug/2.5 cm shoot length) in 47 and 46th MW, respectively on BG-I and BG-II Bt cotton hybrids. During 2009-2010 to on BG-I and BG- II Bt cotton plant infested by mealy bugs ranged between 0.19 to 9.97 and 0.20 to 10.17 per cent. The infestation started from 33rd MW and reached to its peak (9.97 and 10.17) in 44th and 43rd MW, respectively.

Keywords

Population Dynamics, Mealy bugs *Phenacoccus solenopsis*, BG-I and BG-II Bt Cotton

Introduction

Cotton, the commercial crop is the backbone of the textile industry as it employs vast majority of population directly or indirectly and earns the foreign exchange too. The insect pests spectrum of cotton is quite complex and as many as 1326 species of insect pests have been listed on this crop throughout the world. However, main losses in cotton production are due to its susceptibility to about 162 species of insect pests.

Mealybug was noticed to appear on cotton crop in India from 2003-04 onwards (Jhala *et al.*, 2008). This coincided with the introduction of Bt. cotton, its rapid adoption by the farmers, effective control of the bollworms and reduction in pesticide use. The pest became a threat to Bt cotton by 2006 and 2007 in Punjab, Haryana, Rajasthan, Gujarat and Maharashtra (Tanwar *et al.*, 2007) and caused significant losses in cotton production. The species was identified as *Phenacoccus solenopsis* (Tinsley) (Hemiptera: Pseudococcidae) which is a new species to cotton in India. Roving survey carried out in Baroda during November 2006 revealed that 25-30% cotton fields were infested with mealybug and 20-90% plants were adversely affected

causing a reduction of 50% yield in highly infested fields (Jhala *et al.,* 2008). In Punjab the losses caused by the mealybug were estimated to be Rs. 159 crores to cotton growers during kharif season 2007 (Anonymous, 2008). Study carried out in Punjab of Pakistan during 2007-08 indicated losses to the tune of 3.1 million bales from the targeted output of 14.3 million bales due to mealybug (Anonymous, 2007).

As the pest was invading fast in newer areas, therefore, there was an urgent need to collect information on its distribution, infestation and natural enemies in different cotton growing zones which would help in formulating the integrated management strategy for this species. Keeping this in view present study was undertaken which would help in formulating the integrated management strategy for mealy bug in cotton.

Materials and Methods

The experiment was conducted during *kharif* 2008-2009 and 2009-2010, at the experimental farm of the Department of Entomology Marathwada Agricultural University, Parbhani (Maharashtra) to study population dynamics of mealy bugs on BG-I and BG-II Bt cotton hybrids. The sowing was done by adopting 90 cm x 60 cm spacing, using seed of Bunny Bt hybrid by on 12-7-2008 and 22-7-2009 after receiving optimum rains. The experiment was conducted in unprotected plot which was non replicated with a plot size of 9.00 m x 9.90 m and each plot was divided in four quadrants. Population of mealy bug was recorded at weekly interval. Five plants were randomly selected from each plot. The observation were recorded as intensity of incidence by 0 - 4 scale as given below on five randomly selected plants from each plot of BG-I and BG-II Bt cotton hybrids.

0 = No mealy bugs

1 = About 1-10 mealy bugs scattered on the plant

2 = One branch infested heavily with mealy bugs

3 = Two or more branches infested heavily with mealy bugs, upto 50% plant affected.

4 = Complete plant affected

Intensity: The intensity of mealy bug was worked out by adopting formula as given below (Jeyakumar *et al.,* 2009).

$$\text{Intensity of infested plant} = \frac{\text{Cumulative total of grade}}{\text{No. of infested plants}}$$

The data pertaining to population dynamics of mealy bugs was compared with various environmental factors. The relations between weather parameters and major insect pests of BG-I and BG-II Bt cotton were studied. Simple correlation and simple regression studies were carried out

Population dynamics of Mealy bugs *Phenacoccus solenopsis* Tinsley

Number of mealy bugs per 2.5 cm apical shoot length

The data on population dynamics of mealy bugs (Table 1) during *kharif* 2008-2009 on BG-I Bt cotton ranged between 0.15 to 2.30 mealy bugs/2.5 cm shoot length. The incidence of mealy bugs started from 32nd MW (0.40 mealybugs/2.5 shoot length) with peak (1.10 mealybugs/2.5 shoot length) in 35th MW, later higher mealy bug population was noted from 45th MW to 48th MW with peak of 2.30 mealybugs/2.5 shoot length during 46th MW. Thereafter population of

mealy bugs declined till 1st MW (0.25 mealy bugs/2.5 shoot length) and no incidence was recorded in 2nd MW. On BG-II Bt cotton mealy bug population ranged between 0.10 to 2.60 mealy bugs/2.5 cm shoot length. The incidence of mealy bugs started from 32nd MW (0.50 mealy bugs/2.5 shoot length) with peak (1.20 mealy bugs/2.5 shoot length) in 35th MW. The peak activity of mealy bugs was noticed from 45th MW to 48th MW with peak of (2.60 mealy bugs/2.5 shoot length) during 46th MW. Thereafter population of mealy bugs declined till 1st MW (0.10 mealy bugs/2.5 shoot length) and no incidence was observed in 2nd MW. During 2009-2010 (Table 1) BG-I Bt cotton mealy bugs population ranged between 0.10 and 2.10 mealy bugs/2.5 shoot length. The incidence of mealy bugs started from 33rd MW (0.40 mealy bugs/2.5 shoot length). Reaching highest incidence (2.10 mealy bugs/2.5 shoot length) in 39th and 43rd MW the population of mealy bugs noticed till 48th MW (1.00 mealy bugs/2.5 shoot length). Thereafter no incidence was recorded till end of season. While on BG-II Bt cotton the mealy bug incidence ranged between 0.10 to 2.50 mealy bugs/2.5 shoot length. The incidence of mealy bugs started from 33rd MW (0.30 mealy bugs/2.5 shoot length) reaching the highest 2.50 mealy bugs/2.5 in 39th MW. Thereafter population decreased upto (0.20 mealy bugs/2.5 shoot length) in 49th MW. From 50th MW no incidence of mealy bugs was observed till end of season.

These trends of mealy bug infestation in present studies were more or less similar to those of Dhawan (2007) who reported severe incidence of the mealy bug *P. solenopsis* on cotton in Punjab for first time. Anonymous (2008b) also recorded high population of mealy bugs on Bunny Bt (21.9/plant) and Mallika Bt (22.8/plant) as compared to other entries. Bhosle *et al.*, (2009b) reported that the mean number of mealybugs/2.5 cm apical shoot ranged from 8.88 to 20.41 in Marathwada region with highest (20.41) found in Parbhani district, from October to November of the crop season 2007-2008. Similarly Saroja *et al.*, (2009) recorded heavy infestation of mealy bugs during the second week of October 2008 and continued till end of November. Since the pest is new, very less work is conducted by the researchers in India.

Plants infested by mealy bugs *P. solenopsis*

The data on plants infested by mealy bugs (Table 1) during *kharif* 2008-2009 on BG-I Bt cotton ranged between 0.64 to 9.92 per cent. The incidence of mealy bugs started from 32nd MW (1.26 per cent). The 1st peak incidence (3.02 per cent) was observed in 34th MW. Afterwards it decreased upto 36th MW (1.72 per cent) and no incidence was observed during 37th - 38th MW. Later higher mealy bug infested plants were noted from 44th MW to 48th MW with second peak of 9.92 per cent during 47th MW. Thereafter incidence of mealy bugs declined till 1st MW (1.72 per cent) and no incidence was recorded from 2nd MW. On BG-II Bt cotton also similar trend was observed ranging from 0.10 to 9.78 per cent. The mealy bug infestation of plants started from 32 MW (1.30 per cent). The 1st peak was noticed in 34th MW (3.11 per cent). Afterwards it decreased upto 37th MW and then mealy bugs infested plants were noted from 38th to 1st MW with second peak of 9.78 per cent during 46th MW. Thereafter incidence of mealy bugs declined till 1st MW (0.10 per cent) and no incidence was recorded in 2nd MW. During *kharif* 2009-2010 (Table 1) on BG-I Bt cotton plant infested by mealy bugs ranged between 0.19 to 9.97 per cent. The infestation started from 33rd MW by reaching 1st peak (8.33 per cent) in 39th MW. The second peak (9.97 per cent) was

noticed in 44th MW thereafter declined upto 50th MW (0.70 per cent). On BG-II Bt cotton infestation ranged between 0.20 to 10.17 per cent. The 1st incidence was recorded in 33rd MW (1.2 per cent) reached first peak (8.38 per cent) in 39th MW while second peak was attained in 43rd MW (10.17 per cent) and decreased to 0.20 in 50th MW. Thereafter no incidence was recorded.

The present findings are more or less in agreement with another research workers like Bhosle *et al.,* (2009) who reported that the percentage of mealy bug infested plants was highest in Parbhani (52.08 per cent) and lowest in Hingoli district (11.14 per cent) of Marathwada region from October to November during the crop season 2007-2008. Similarly Brar *et al.,* (2009) observed 8.06 per cent infested plants. Saroja *et al.,* (2009) recorded heavy infestation of mealy bug during the second week of October 2008 and continued till end of November with the range of 21 to 61 per cent of plant infested during October last week.

Grading of plants infested by mealy bugs *P. solenopsis*

The data on grading of infested plants (0 to 4 scale) by mealy bug (Table 2) in *kharif* 2008-2009 on BG-I Bt cotton ranged between 1 to 1.80 grade. The incidence of mealy bugs started from 32nd MW (1.05 grade) with peak (1.80 grade) during 36th MW. The next peak incidence was noted from 39th to 51st MW with highest grade 1.80 in 46th MW. No incidence was recorded in 2nd MW. On BG-II Bt cotton the grading ranged between 0.40 to 1.90 grade. The incidence of mealy bugs started from 32nd MW (1.20 grade) with peak (1.85 grade) in 36th MW. Thereafter higher incidence (1.90 grade) was noted during 46th MW. Then the mealy bug incidence declined till 1st MW and no incidence was recorded in 52nd and 2nd MW. During *kharif* 2009-2010 the incidence of mealy bug on BG I Bt cotton ranged between 1.00 to 2.00 grade. The incidence of mealy bugs started from 33rd MW with grade of 1.00, reaching highest incidence in 39th MW. The second peak was observed in 42nd MW. The incidence of mealy bug was nil in 34th, 35th and 40th MW and from 51st MW no mealy bug infestation was noticed till end of season. Similarly on BG-II Bt cotton mealy bugs grade ranged between 0.10 to 2.20 grade and incidence starting from 33rd MW (1.10 grade) reaching 1st peak (2.05 grade) in 39th MW. The second peak was observed from 41st. However third peak was noticed in 49th MW and mealy bug grade declined upto 0.10 in 50th MW and thereafter no incidence of mealy bugs was recorded.

The above findings are in conformity with the earlier research workers like Bhosle *et al.,* (2009a) who recorded the highest grade of 2.74 in Parbhani based on 0-4 scale grading followed by Jalna (2.39), Aurangabad (2.03), Nanded (1.86) and Hingoli (1.12) district in Marathwada region from October to November of the crop season 2007-2008. Jeyakumar *et al.,* (2009) also recorded the mealy bug incidence using 0-4 grade scale to express the mealy bug intensity. Hanchinal *et al.,* (2009) assessed the incidence of *P. solenopsis* on 0 to 4 scale range and observed the population ranged between 1.00 to 4 grade in the Tungabhadra project area while in the parts of Karnataka incidence ranged between 0.00 to 3.00 grade with severe incidence at the end of the cropping season. Likewise Brar *et al.,* (2009) observed intensity grade of the infested plants which was only 1.07 per cent with total of 37 plants that reached the 4th grade of infestation.

The probable reason for variation in the range of mealy bug infestation reported by

different researchers and present investigations may be due to crop stage (succulency of plant parts) and initiation of mealy bug incidence.

Leaves infested by mealy bugs *P. solenopsis*

The leaves infested by mealy bugs during *kharif* 2008-2009 was presented in (Table 3) The leaves infestation on BG-I Bt cotton ranged from 0.10 to 4.32 per cent. The leaves infestation started in 33rd MW (0.92 per cent) and decreased upto 0.10 per cent in 36th MW and was nil during 37th and 38th MW. Afterwards the infestation gradually increased reaching to the peak of 2.38 per cent in 41st MW. The second peak was observed from 45 to 49th MW with maximum of 4.32 per cent in 48th MW. Later the infestation decreased gradually upto 1st MW and it was nil in 2nd MW. On BG-II Bt cotton it ranged from 0.30 to 4.42 per cent.

The leaves leaf infestation was started in 33rd MW with 0.98 per cent and decreased upto 0.30 per cent in 36th MW and it was nil during 37th and 38th MW. Thereafter infestation gradually increased reaching to the peak of 2.40 per cent in 41st MW. The second peak was observed from 45th to 49th MW with maximum 4.42 per cent in 48th MW with. Later the infestation decreased gradually upto 1st MW and no infestation noticed in 2nd MW.

During 2009-2010 (Table 3) on BG-I Bt cotton leaves infestation by mealy bugs ranged between 0.35 to 4.60 per cent. The infestation of mealy bugs started from 33rd MW (0.80 per cent). No infestation was observed in 34th and 35th MW. The peak was noticed during 36th to 39th MW with highest peak of 4.60 per cent in 38th MW. However second peak was recorded during 41st to 46th MW with a peak of 3.34 per cent in 42nd MW. While no incidence was recorded in 47th MW. The third peak was observed in 49th MW (2.92 per cent), thereafter no mealy bug infestation was recorded till end of season.

While on BG-II Bt cotton leaves infestation by mealy bugs ranged between 0.20 to 5.10 per cent starting from 33rd MW (1.00 per cent) and nil during 34th and 35th MW. While the peak was noticed during 36th to 39th MW with highest peak of 5.10 per cent in 39 MW. No infestation was recorded in 40th MW. While second peak was recorded during 41st to 49th MW with a peak of 3.70 per cent in 45th MW. From 50th MW there was no incidence till end of season.

The present findings are in agreement with those of Bhosle *et al.,* (2009a) who reported that the mealy bug infested leaves ranged from 11.37 to 49.95 per cent in Marathwada region from October to November of the crop season 2007-2008. Hanchinal *et al.,* (2009) reported severe incidence of *P. solenopsis* at the end of the cropping season in the Tungabhadra project area and in the parts of Karnataka.

Bolls infested by mealy bugs *P. solenopsis*

The data on bolls infested by mealy bugs during 2008-2009 (Table 3) on BG-I Bt cotton ranged between 2.26 to 4.75 per cent. In this season the infestation started from 36th MW (2.74 per cent) and was nil in 37th and 38th MW. Thereafter boll infestation increased gradually and reaches to the peak (4.65 per cent) in 40th MW. The season peak was noticed in 45th MW (4.75 per cent) then decreased gradually upto 52nd MW (2.26 per cent) except 48th and 50th MW, where the boll infestation observed was 4.25 and 3.80 per cent respectively. Boll infestation was nil during 1st and 2nd MW.

Table.1 Population dynamics of mealy bugs *P. solenopsis* [mealy bug/2.5 cm shoot and Plant infested (%)] on BG-I and BG-II Bt cotton

MW	Duration	No. of mealy bugs / 2.5 cm shoot length				Plant infested by mealy bugs (%).			
		2008-09		2009-10		2008-09		2009-10	
		BG-I	BG-II	BG-I	BG-II	BG-I	BG-II	BG-I	BG-II
30	23-29 July	0.00	0.00	-	-	0.00	0.00	-	-
31	30-05 Aug.	0.00	0.00	-	-	0.00	0.00	-	-
32	06-12 Aug.	0.40	0.50	-	-	1.26	1.30	-	-
33	13-19 Aug.	0.15	0.20	0.40	0.30	1.12	1.20	1.35	1.20
34	20-26 Aug.	0.60	0.50	0.00	0.10	3.02	3.11	0.19	0.30
35	27-02 Sept.	1.10	1.20	0.20	0.30	2.50	2.41	0.40	0.50
36	03-09 Sept.	0.45	0.50	0.60	0.50	1.73	1.84	2.83	2.81
37	10-16 Sept.	0.00	0.10	0.10	0.30	0.00	0.52	3.68	3.64
38	17-23 Sept.	0.00	0.00	0.95	1.00	0.00	2.95	7.87	7.83
39	24-30 Sept.	0.40	0.50	**2.10**	**2.50**	3.78	5.10	8.33	8.38
40	01-07 Oct.	1.85	1.60	0.30	0.40	4.65	1.75	1.57	1.51
41	08-14 Oct.	0.25	0.45	0.35	0.50	1.60	1.81	3.10	3.28
42	15-21 Oct.	0.25	0.50	0.10	0.15	1.62	2.35	1.60	1.69
43	22-28 Oct.	0.40	0.60	2.10	2.20	2.37	4.63	9.92	**10.17**
44	29-04 Nov.	0.50	0.30	1.85	1.80	4.34	6.90	**9.97**	10.04
45	05-11 Nov.	1.25	1.10	1.80	1.95	6.16	7.90	9.65	1.36
46	12-18 Nov.	**2.30**	**2.60**	0.00	0.20	7.87	**9.78**	1.28	1.12
47	19-25 Nov.	1.25	1.05	0.80	0.60	**9.92**	3.21	1.00	0.64
48	26-02 Dec.	1.80	2.10	1.00	0.80	3.15	1.36	0.60	8.62
49	03-09 Dec.	0.60	0.80	0.00	0.20	1.25	2.05	8.30	0.83
50	10-16 Dec.	0.40	0.30	0.00	0.00	1.96	0.53	0.70	0.20
51	17-23 Dec.	0.25	0.60	0.00	0.00	0.64	0.78	0.00	0.00
52	24-31 Dec.	0.50	0.40	0.00	0.00	0.91	1.39	0.00	0.00
1	01-07 Jan.	0.25	0.10	0.00	0.00	1.72	0.10	0.00	0.00
2	08-14 Jan.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table.2 Grading of mealy bug infested plants on BG-I and BG-II Bt cotton

MW	Duration	Grading of mealy bug infested plants			
		2008-09		2009-10	
		BG-I	BG-II	BG-I	BG-II
30	23-29 July	0.00	0.00	-	-
31	30-05 Aug.	0.00	0.00	-	-
32	06-12 Aug.	1.05	1.20	-	-
33	13-19 Aug.	1.20	1.35	1.00	1.10
34	20-26 Aug.	1.10	1.05	0.00	0.00
35	27-02 Sept.	1.20	1.25	0.00	0.00
36	03-09 Sept.	**1.80**	1.85	1.30	1.20
37	10-16 Sept.	0.00	0.40	1.20	1.50
38	17-23 Sept.	0.00	0.00	1.80	1.70
39	24-30 Sept.	1.25	1.30	1.95	2.05
40	01-07 Oct.	1.20	1.25	0.00	0.00
41	08-14 Oct.	1.35	1.45	0.50	0.60
42	15-21 Oct.	1.40	1.60	**2.00**	**2.20**
43	22-28 Oct.	1.00	1.10	0.85	1.90
44	29-04 Nov.	1.20	1.05	1.70	1.75
45	05-11 Nov.	1.65	1.70	1.75	1.60
46	12-18 Nov.	1.80	**1.90**	1.10	1.00
47	19-25 Nov.	1.35	1.20	1.00	0.85
48	26-02 Dec.	1.30	1.10	1.05	1.1
49	03-09 Dec.	1.10	1.05	1.95	2.05
50	10-16 Dec.	1.05	1.00	1.10	0.10
51	17-23 Dec.	1.00	0.80	0.00	0.00
52	24-31 Dec.	0.00	0.00	0.00	0.00
1	01-07 Jan.	1.10	1.20	0.00	0.00
2	08-14 Jan.	0.00	0.00	0.00	0.00

Table.3 Population dynamics of mealy bugs *P. solenopsis* (leaves and bolls infested (%)) on BG-I and BG-II Bt cotton

MW	Duration	Leaves infested by mealy bugs (%)				Bolls infested by mealy bug (%)			
		2008-09		2009-10		2008-09		2009-10	
		BG-I	BG-II	BG-I	BG-II	BG-I	BG-II	BG-I	BG-II
30	23-29 July	0.00	0.00	-	-	0.00	0.00	-	-
31	30-05 Aug.	0.00	0.00	-	-	0.00	0.00	-	-
32	06-12 Aug.	0.00	0.00	-	-	0.00	0.00	-	-
33	13-19 Aug.	0.92	0.98	0.80	1.00	0.00	0.00	2.84	2.75
34	20-26 Aug.	0.95	0.86	0.00	0.00	0.00	0.00	0.00	0.00
35	27-02 Sept.	0.84	0.92	0.00	0.00	0.00	0.00	0.00	0.00
36	03-09 Sept.	0.10	0.30	1.45	1.20	2.74	2.00	2.30	2.00
37	10-16 Sept.	0.00	0.00	0.35	1.46	0.00	0.00	2.43	2.50
38	17-23 Sept.	0.00	0.00	**4.60**	1.32	0.00	0.00	**4.93**	**4.80**
39	24-30 Sept.	1.36	1.23	4.14	**5.10**	4.26	3.90	4.22	4.50
40	01-07 Oct.	1.40	1.52	0.00	0.00	4.65	4.25	0.00	0.00
41	08-14 Oct.	2.38	2.40	0.69	0.73	3.05	2.75	0.10	0.00
42	15-21 Oct.	1.74	1.68	3.34	3.40	2.35	2.50	3.93	3.25
43	22-28 Oct.	1.83	2.00	3.09	3.00	2.37	2.50	4.35	4.25
44	29-04 Nov.	0.92	0.69	2.96	2.50	3.34	3.25	4.00	4.50
45	05-11 Nov.	2.45	2.52	2.63	3.70	**4.75**	**4.50**	3.70	3.50
46	12-18 Nov.	3.38	3.80	1.10	1.25	3.66	3.25	2.46	2.60
47	19-25 Nov.	2.86	2.64	0.00	0.20	3.65	3.80	0.85	0.75
48	26-02 Dec.	**4.32**	**4.42**	0.83	0.75	4.25	4.05	1.95	2.00
49	03-09 Dec.	1.35	1.38	2.92	3.00	2.08	3.50	3.87	3.75
50	10-16 Dec.	1.10	1.22	0.00	0.00	3.80	3.00	0.70	0.75
51	17-23 Dec.	0.81	0.64	0.00	0.00	2.70	2.50	0.00	0.00
52	24-31 Dec.	0.67	0.93	0.00	0.00	2.26	2.00	0.00	0.00
1	01-07 Jan.	0.74	0.39	0.00	0.00	0.00	0.00	0.00	0.00
2	08-14 Jan.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

On BG-II Bt cotton bolls infested by mealy bugs ranged from 2.00 to 4.50 per cent, starting from 36th MW (2.00 per cent) and was nil in 37th and 38th MW and from 39th MW boll infestation again started at its peak (4.25 per cent) in 40th MW. The second peak was noticed in 45th MW (4.50 per cent) then decreased gradually upto 52nd MW (2.00 per cent) except 47th and 48th and 49th MW, where the boll infestation observed was 3.80, 4.05 and 3.50 per cent, respectively and no boll infestation was observed in 1st and 2nd MW. During 2009-2010 (Table 3) per cent boll infestation by mealy bugs ranged between 0.10 and 4.93 per cent. First boll infestation was noticed in 33rd MW (2.84 per cent) and it was nil during 34th and 35th MW. From 36th MW boll infestation increased gradually reaching to peak (4.93 per cent) in 38th MW. No boll infestation was observed in 40th MW. While second peak was recorded in 43rd MW. Thereafter boll infestation decreased gradually till 50th MW (0.70 per cent) except 49th MW (3.87 per cent). From 51st MW no mealy bug infested boll was recorded. On BG-II Bt cotton, it ranged between 0.75 and 4.80 per cent. Initial boll infestation was recorded in 33rd MW (2.75 per cent) and it was nil during 34th, 35, 40 and 41 MW. From 36th MW onwards boll infestation increased gradually reaching to peak (4.80 per cent) in 38th MW. The second peak was observed in 44th MW (4.50 per cent) thereafter boll infestation decreased upto 50th MW (0.75 per cent) except 48th and 49th MW recording boll infestation 2.00 and 3.75 per cent, respectively. No infestation was observed from 51st MW to the end of season.

Considering the mealy bug population / 2.5 cm apical shoot length, intensity of grade, percentage of plant infestation, leaf infestation and boll infestation, the incidence of mealy bug was severe in *kharif* 2008-2009 as compared to *kharif* 2009-2010

which may be due to more activity of predominant parasitoids *Promuscidea unfasciativentris* and *Aenacius bambawalei* which were reported by Tanwar *et al.*, (2008) from the Marathwada region specially from Parbhani district.

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