

RESEARCH ARTICLE :

Performance of BG-I and BG-II Bt cotton hybrids against mealybug *Phenacoccus solenapsis* Tinsley

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SUMMARY : Among all Bt cotton hybrids mealy bug population ranged from 0.38 to 0.70 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on Paras Atal BG-I (0.38) which was at par with VBCH-1505 BG-I (0.49), Paras Brahma BG-I (0.39), ACH-155 BG-I (0.49), Ranjeet Bt BG-I (0.42), GK-205 BG-I (0.45), ACH-21-1 BG-I (0.41), SP-1037 BG-I (0.43), Mallika BG-II (0.49), Sigma BG-II (0.49), TCH-4 BG-II (0.46), TCH-9 BG-II (0.42) and NSPL-9899 BG-II (0.44). Maximum mealy bug population was observed on VBCH-1006 BG-I (0.70), followed by ACH-177 BG-I (0.62), ACH-33 BG-I (0.59), Kanak BG-I (0.58), Cash BG-I (0.63), SP-499 BG-I (0.60), Bunny BG-II (0.64), VBCH-1505 BG-II (0.66), RCH-515 BG-II (0.64), VBCH-1501 BG-II (0.56), MRC-7326 BG-II (0.61), ACH-177 BG-II (0.61), ACH-11 BG-II (0.56), PRCH-505 BG-II (0.68) and NSPL-405 BG-II (0.60) which were at par with each others. The per cent plants infested by mealy bug on BG-I and BG-II Bt cotton ranged from 1.36 to 1.76 per cent. Among all Bt cotton hybrids (BG-I and BG-II) mealy bug infestation ranged from 1.33 to 1.76 per cent. Minimum mealy bug infestation was observed on Paras Atal BG-I (1.33) which was found significantly superior over rest of the hybrids except Paras Atal BG-I (1.36), ACH-21-1 BG-I (1.39) and TCH4 BG-II (1.40) which were at par and each others. Maximum mealy bug infestation was observed on VBCH-1006 BG-I (1.76) than rest of the hybrids.

KEY WORDS :

Mealy bug,
Phenacoccus solenapsis Tinsley, Bt cotton

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BACKGROUND AND OBJECTIVES

Although India stands first in acreage of cotton however the yield well below the other cotton growing countries. Though, there are several reasons attributed to this low yield, losses due to pests assume significant importance as cotton crop is a heaven for insects. A total of 1326 species of insects have been recorded on cotton (Kranti *et al.*, 2005).

The main thrust of Indian cotton growers

has so far been towards the repeated application of synthetic pesticides to combat these pests. Thus, this crop alone consumes about 44.5 per cent of the total insecticide consumption of India, whereas it occupies only about 6 per cent of the total area in the country. Often, excessive use of pesticides intensifies pest problems and complicates pest control strategies besides causing massive ecological disruption and endangerment to human health. The three R^s resistance,

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resurgence and residue are the most potential problems associated with the indiscriminate use of chemicals in cotton agro-ecosystem and have made cotton cultivation unprofitable (Anonymous, 1999).

India has the largest area under cotton in the world, representing 20 to 25 per cent of the global total, it ranks only third in terms of production next to China and the USA. The yield of cotton in India is one of the lowest with about 300 kg/ha as against the world average of 580 kg/ha. Among the factors responsible for low yields, the losses due to pests are more important. More than 160 species of insect pests have been reported to attack the cotton crop at various stages of its growth, causing losses upto 60 per cent, requiring major efforts to save the crop from pests. Recently, the mealy bug has taken upper hand among sucking pests in cotton in North India (Punjab, Haryana and Rajasthan) and moderate incidence in Central (Gujarat and Maharashtra) and South India. *Phenacoccus solenopsis* and *Maconellicoccus hirsutus* (Green) are the two species of the mealy bugs infesting cotton in India. The dominant and wide spread species is *P. solenopsis*. It has been noticed in isolated patches in Karnataka (Raichur and Bellary districts) as reported by Hanchinal *et al.* (2009). It has many alternative hosts *viz.*, sunflower, vegetables, weeds, ornamentals etc. (Saini *et al.* 2009 and Anonymous, 2009). Keeping this in view present investigation was undertaken.

RESOURCES AND METHODS

The field experiment was conducted during *Kharif* season of the year 2008-2009 and 2009-2010 to study the performance of BG-I and BG II Bt cotton hybrids against Mealy bug. The experiment was designed in Randomized Block Design (RBD) having Forty (40) treatments replicated twice with a plot size of 1.80 m x 6.00 m (2 Rows of 10 plants) in 90 cm x 60 cm spacing.

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).

$$\text{Intensity of infected plant} = \frac{\text{Cumulative total of grade}}{\text{No. of infested plants}} \times 100$$

List of BG-I and BG-II Bt cotton hybrids evaluated against incidence of Aphids and Jassids

Treatment No.	Bt cotton hybrids (BG-I)	Treatment No.	Bt cotton hybrids (BG-II)
1	Bunny Bt	21	VBCH -1505 (Dyna) BG-II
2	Mallika Bt	22	Sigma BG-II
3	VBCH -1505(Dyna) Bt	23	RCH-2 BG-II
4	RCH-2 Bt	24	RCH-515 BG-II
5	VBCH-1006 Bt	25	VBCH -1501 BG-II
6	Paras Brahma Bt	26	TCH-4 BG-II
7	ACH-155 Bt	27	TCH-9 BG-II
8	ACH-177 Bt	28	Paras Atal BG-II
9	ACH-33 Bt	29	Paras Brahma BG-II
10	Ranjeet Bt	30	MRC-7326 BG-II
11	Super Bunny Bt	31	MRC-7351 BG-II
12	Kanak Bt	32	ACH-155 BG-II
13	Cash Bt	33	ACH-177 BG-II
14	GK-205 Bt	34	ACH-33 BG-II
15	ACH-21-1 BG-I	35	ACH-11 BG-II
16	Ankur -3032 Bt	36	PRCH-505 BG-II
17	SP-1037 Bt	37	NSPL-405 BG-II
18	SP-499 Bt	38	NSPL-999 BG-II
19	Bunny BG-II	39	PRCH-504 BG-II
20	Mallika BG-II	40	UPLHH-2 BG-II

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Average population of mealy bugs/2.5 cm apical shoot on BG- I and BG-II Bt cotton hybrids :

The data from Table 1 revealed that during 2008-2009 average population of mealy bugs/2.5 cm on BG-I ranged from 0.43 to 0.81. ACH-21-1 (0.43) was found significantly superior over rest of hybrids except Ranjeet

Bt (0.45), GK-205 (0.48) and SP-1037 (0.48) which were at par with each others. Maximum mealy bug population was observed on VBCH-1006 (0.81) than rest of hybrids except SP-499 (0.68), ACH-177 (0.68), Cash (0.69), Kanak (0.67), RCH-2 (0.65), Bunny (0.60) and Super

bunny (0.59) which were at par with each other. Where as during 2009-2010 average population of mealy bug on BG-I ranged from 0.34 to 0.58 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on Paras Brahma (0.34) and at par with Bunny (0.43), RCH-

Table 1 : Average population of Mealy bugs / 2.5 cm apical shoot on BG-I and BG-II Bt cotton hybrids

Sr. No.	Name of hybrids	Mealy bugs / 2.5 cm apical shoot		
		2008-09	2009-10	Pooled
1.	Bunny BG-I	0.60 (1.05)	0.43 (0.96)	0.52 (1.01)
2.	Mallika BG-I	0.54 (1.02)	0.51 (1.00)	0.53 (1.01)
3.	VBCH –1505(Dyna) BG-I	0.52 (1.01)	0.46 (0.98)	0.49 (0.99)
4.	RCH-2 BG-I	0.65 (1.07)	0.38 (0.94)	0.52 (1.01)
5.	VBCH-1006 BG-I	0.81 (1.14)	0.58 (1.04)	0.70 (1.09)
6.	Paras Brahma BG-I	0.44 (0.97)	0.34 (0.92)	0.39 (0.94)
7.	ACH-155 BG-I	0.57 (1.03)	0.41 (0.95)	0.49 (0.99)
8.	ACH-177 BG-I	0.68 (1.09)	0.56 (1.03)	0.62 (1.06)
9.	ACH-33 BG-I	0.64 (1.07)	0.53 (1.01)	0.59 (1.04)
10.	Ranjeet bt BG-I	0.45 (0.97)	0.38 (0.94)	0.42 (0.96)
11.	Super Bunny BG-I	0.59 (1.04)	0.42 (0.96)	0.51 (1.00)
12.	Kanak BG-I	0.67 (1.08)	0.49 (0.99)	0.58 (1.04)
13.	Cash BG-I	0.69 (1.09)	0.56 (1.03)	0.63 (1.06)
14.	GK-205 BG-I	0.48 (0.99)	0.41 (0.95)	0.45 (0.97)
15.	ACH-21-1 BG-I	0.43 (0.96)	0.39 (0.94)	0.41 (0.95)
16.	Ankur –3032 BG-I	0.57 (1.03)	0.42 (0.95)	0.50 (1.00)
17.	SP-1037 BG-I	0.48 (0.99)	0.38 (0.94)	0.43 (0.96)
18.	SP-499 BG-I	0.68 (1.09)	0.52 (1.01)	0.60 (1.05)
19.	Bunny BG-II	0.71 (1.09)	0.56 (1.03)	0.64 (1.07)
20.	Mallika BG-II	0.56 (1.03)	0.42 (0.96)	0.49 (0.99)
21.	VBCH –1505(Dyna) BG-II	0.72 (1.10)	0.59 (1.04)	0.66 (1.07)
22.	Sigma BG-II	0.57 (1.03)	0.40 (0.95)	0.49 (0.99)
23.	RCH-2 BG-II	0.59 (1.04)	0.47 (0.98)	0.53 (1.01)
24.	RCH-515 BG-II	0.72 (1.10)	0.55 (1.02)	0.64 (1.07)
25.	VBCH –1501 BG-II	0.66 (1.08)	0.46 (0.98)	0.56 (1.03)
26.	TCH-4 BG-II	0.54 (1.02)	0.35 (0.92)	0.46 (0.97)
27.	TCH-9 BG-II	0.45 (0.97)	0.38 (0.94)	0.42 (0.96)
28.	Paras Atal BG-II	0.40 (0.95)	0.35 (0.92)	0.38 (0.94)
29.	Paras Brahma BG-II	0.56 (1.03)	0.43 (0.96)	0.50 (1.00)
30.	MRC-7326 BG-II	0.67 (1.08)	0.55 (1.02)	0.61 (1.05)
31.	MRC-7351 BG-II	0.54 (1.02)	0.45 (0.97)	0.50 (1.00)
32.	ACH-155 BG-II	0.58 (1.04)	0.43 (0.96)	0.51 (1.00)
33.	ACH-177 BG-II	0.63 (1.06)	0.58 (1.04)	0.61 (1.05)
34.	ACH-33 BG-II	0.55 (1.02)	0.43 (0.96)	0.49 (0.99)
35.	ACH-11 BG-II	0.60 (1.05)	0.51 (1.01)	0.56 (1.03)
36.	PRCH-505 BG-II	0.76 (1.12)	0.59 (1.04)	0.68 (1.08)
37.	NSPL-405 BG-II	0.65 (1.07)	0.54 (1.02)	0.60 (1.05)
38.	NSPL-999 BG-II	0.49 (0.99)	0.38 (0.94)	0.44 (0.97)
39.	PRCH-504 BG-II	0.56 (1.03)	0.40 (0.95)	0.48 (1.00)
40.	UPLHH-2 BG-II	0.63 (1.06)	0.43 (0.96)	0.53 (1.01)
	S.E. \pm	0.035	0.017	0.018
	C.D. (P=0.05)	0.098	0.048	0.051

* Figures in parentheses are $\sqrt{X+0.5}$ transformed values

2 (0.38), Ranjeet Bt (0.38), Super Bunny (0.42), GK-205 (0.41) ACH-21-1 (0.39), Ankur-3032 (0.42) and SP-1037 (0.38). Maximum mealy bug population was observed on VBCH-1006 (0.58) than rest of hybrids except Mallika (0.51), ACH-177 (0.56), ACH-133 (0.53), Kanak (0.49), Cash (0.56) and SP-499 (0.52) which were at par with each others.

On the basis of two years pooled average population of mealy bug on BG-I ranged from 0.39 to 0.70 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on Paras Brahma (0.39) and was at par with VBCH-1505 (0.49), ACH-155 (0.49), Ranjeet Bt (0.42), GK-205 (0.45), ACH-21-1 (0.41) and SP-1037 (0.43). Maximum mealy bug population was observed on VBCH-1006 (0.70), than rest of hybrids except ACH-177 (0.62), ACH-33 (0.59), Cash (0.63) and SP-499 (0.60) which were at par with each others.

During 2008-09 among BG-II mealy bug population ranged from 0.40 to 0.76 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on Paras Atal (0.40) which was followed by Mallika (0.56), Sigma (0.57 mealy bugs/ 2.5 cm shoot length), RCH-2 (0.59), TCH-4 (0.54), TCH-9 (0.45), Paras Brahma (0.56) MRC-7351 (0.54), ACH-155 (0.58), ACH-33 (0.55), NSPL-999 (0.49) and PRCH-504 (0.56) which were at par with each others. Maximum mealy bug population was observed on PRCH-505 (0.76) than rest of hybrids except Mallika (0.56), Sigma (0.57), RCH-2 (0.59), TCH-4 (0.54), Paras Brahma (0.56), MRC - 7351 mealy bugs/ 2.5 cm shoot length (0.54), ACH-155 (0.58), ACH-33 (0.55), NSPL 405 (0.49) and PRCH-504 (0.56 mealy bugs/ 2.5 cm shoot length) which were at par with each other. Where as During 2009-10 among BG-II cotton hybrids mealy bug population on Bt cotton hybrids ranged from 0.35 to 0.59 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on TCH-4 (0.35) and Paras Atal (0.35), followed by TCH-9 (0.38), Paras Brahma (0.43), NSPL-999 (0.38), PRCH -504 (0.40) and UPLHH-2 (0.43). Maximum mealy bug population was observed on PRCH-505 (0.59) than rest of hybrids except ACH-177 (0.58), Bunny (0.56), VBCH-1505 (0.59), RCH-515 (0.55), MRC-7326 (0.55), ACH-11 (0.51) and NSPL-405 (0.54) which were at par with each other.

On the basis of pooled data among BG-II cotton hybrids population was ranged from 0.38 to 0.68 mealy bugs/2.5 cm shoot length. Minimum mealy bug population

was observed on Paras Atal (0.38) which was followed by Mallika (0.49 mealy bugs/2.5 cm shoot length), Sigma (0.49) TCH-4 (0.46), TCH-9 (0.42), ACH-33 (0.49) and NSPL-999 (0.44). Maximum mealy bug population was observed on PRCH-505 (0.68) and at par with Bunny (0.64), VBCH-1505 (0.66), RCH-515 (0.64), VBCH-1501 (0.56), MRC-7326 (0.61), ACH-177 (0.61), ACH-11 (0.56) and NSPL 405 (0.60).

Among all Bt hybrids during 2008-09 minimum mealy bug population was observed on Paras Atal (0.40) followed by Mallika BG-I (0.54), VBCH-1505 BG-I (0.52), Paras Brahma BG-I (0.44), ACH-155 BG-I (0.57), Ranjeet Bt BG-I (0.48), ACH-21-1 BG-I (0.43), Ankur 3032 BG-I (0.57) SP-1037 BG-I (0.48), Mallika BG-II (0.56), Sigma BG-II (0.57 mealy bugs/2. TCH-9 BG-II (0.45), Paras Brahma BG-II (0.56) 5 cm shoot length), RCH-2 BG-II (0.59), TCH-4 BG-II (0.54) TCH-9 BG-II (0.45), Paras Brahma BG-II (0.56), MRC-7351 BG-II (0.54), MRC-7326 BG-II (0.67), ACH-33 BG-II (0.55), NSPL 405 BG-II (0.56) and NSPL-999 BG-II (0.49) which were at par with each other. Where as Maximum mealy bug population was observed on VBCH-1006 BG-I (0.81) and at par with Bunny BG-I (0.60), RCH-2 BG-I (0.65) ACJ-177 BG-I (0.68), ACH-33 BG-I (0.64), Super Bunny BG-I (0.69), SP-499 BG-I (0.68), Bunny BG-II (0.71), VBCH-1505 BG-II (0.72), RCH-2 BG-II (0.59), RCH-515 BG-II (0.72) VBCH-1501 BG-II (0.66), MRC-7326 BG-II (0.67), ACH-155 BG-II (0.58) ACH-177 BG-II (0.63), ACH-II BG-II (0.60), PRCH -505 BG-II (0.76), NSPL-405 BG-II (0.65) and UPLHH-2 BG-II (0.63).

Whereas among all Bt cotton hybrids during 2009-2010 mealy bug population ranged from 0.34 to 0.59 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed in Paras Brahma BG-I (0.34) which was at par with Bunny BG-I (0.43), RCH-2 BG-I (0.38), VBCH BG-I (0.58), ACH-155 (0.41). Ranjeet Bt BG-I (0.38), Super Bunny BG-I (0.42), GK-205 BG-I (0.41), ACH-21-1 BG-I (0.39), Ankur 3032 BG-I (0.42), SP-1037 BG-I (0.38), Mallika BG-II (0.42), Sigma BG-II (0.40) TCH-9 BG-II (0.38), Paras Atal BG-II (0.35), Paras Brahma BG-II (0.43), ACH-155 BG-II (0.43), ACH-33 (0.43), NSPL-999 BG-II (0.38), PRCH-504 BG-II (0.40), UPLHH-2 BG-II (0.43). Maximum mealy bug population was observed on PRCH-505 BG-II (0.59) followed by Mallika BG-I (0.51), VBCH-1006 BG-I (0.58), ACH-177 BG-I (0.56), ACH-33 BG-I (0.53,

Kanak BG-I (0.49), Cash BG-I (0.56), SP-499 BG-I (0.52), Bunny BG-II (0.56), VBCH-1505 BG-II (0.59), RCH-515 BG-II (0.55), MRC-7326BG-II (0.55), ACH-177 BG-II (0.58), ACH-II BG-II (0.51) and NSPL-405 BG-II (0.54) which were at par with each other.

Pooled data revealed that among all Bt cotton hybrids mealy bug population ranged from 0.38 to 0.70 mealy bugs/2.5 cm shoot length. Minimum mealy bug population was observed on Paras Atal BG-I (0.38) which was at par with VBCH-1505 BG-I (0.49), Paras Brahma BG-I (0.39), ACH-155 BG-I (0.49), Ranjeet Bt BG-I (0.42), GK-205 BG-I (0.45), ACH-21-1 BG-I (0.41), SP-1037 BG-I (0.43), Mallika BG-II (0.49), Sigma BG-II (0.49), TCH-4 BG-II (0.46), TCH-9 BG-II (0.42) and NSPL-9899 BG-II (0.44). Maximum mealy bug population was observed on VBCH-1006 BG-I (0.70), followed by ACH-177 BG-I (0.62), ACH-33 BG-I (0.59), Kanak BG-I (0.58), Cash BG-I (0.63), SP-499 BG-I (0.60), Bunny BG-II (0.64), VBCH-1505 BG-II (0.66), RCH-515 BG-II (0.64), VBCH-1501 BG-II (0.56), MRC-7326 BG-II (0.61), ACH-177 BG-II (0.61), ACH-11 BG-II (0.56), PRCH-505 BG-II (0.68) and NSPL-405 BG-II (0.60) which were at par with each other.

The present findings are in conformity with the findings of Anonymous (2008b) that only seven entries viz., MRCH-7201 BG-II, Dyna, Ole Bt, PCH-115, GK-209, Tulsi-117 and Jai Bt recorded mealy bug infestation of low level (grade I), RCH-20 Bt (25.3/plant), Bunny Bt (21.9/plant) and Mallika Bt (22.8/plant) recorded high population of mealy bug as compared to other five entries, RCH-708 Bt (6.4/plant), MECH-184 Bt (6.9/plant), MRC 6918 Bt (7.2 / plant) and RCH-2 Bt (13.6/plant).

Per cent plant infested by mealy bug in BG-I and BG-II cotton hybrids :

The data from Table 2 revealed that during 2008-2009 BG-I plants infested by mealy bug ranged from 1.40 to 1.93 per cent. Minimum infestation was observed on ACH-21-1 (1.40) at par with Paras Brahma (1.41), Super Bunny (1.45), Ranjeet Bt (1.46) and GK-205 (1.48), which were at par with each other. Maximum infestation was observed on VBCH-1006 (1.93) than rest of the hybrids. Whereas revealed that among BG-I Cotton hybrids mealy bug infestation ranged from 1.30 to 1.58 per cent. Minimum mealy bug infestation was observed on Paras Brahma (1.30) and was at par with, RCH-2 (1.33), Ranjeet Bt (1.36), Super Bunny (1.39), GK- 205

(1.40), ACH-21-1 (1.38), Ankur 3032 (1.40) and SP 1037 (1.39). Maximum mealy bug infestation was observed on VBCH-1006 (1.58) followed by Mallika (1.51), ACH-177 (1.57), ACH-33 (1.52), Kanak (1.48), Cash (1.55) and SP-499 (1.50) which were at par with each other. Whereas during 2009-10 among BG-I Cotton hybrids mealy bug infestation ranged from 1.30 to 1.58 per cent. Minimum mealy bug infestation was observed on Paras Brahma (1.30) and was at par with, RCH-2 (1.33), Ranjeet Bt (1.36), Super Bunny (1.39), GK- 205 (1.40), ACH-21-1 (1.38), Ankur 3032 (1.40) and SP 1037 (1.39). Maximum mealy bug infestation was observed on VBCH-1006 (1.58) followed by Mallika (1.51), ACH-177 (1.57), ACH-33 (1.52), Kanak (1.48), Cash (1.55) and SP-499(1.50) which were at par with each other.

Both years pooled data revealed that among BG-I plants infested by mealy bug ranged from 1.36 to 1.76 per cent. Minimum mealy bug infestation was observed on Paras Brahma (1.36) at par with Ranjeet Bt (1.41), Super bunny (1.42), GK-205 (1.44) and ACH-21-1 (1.39). Maximum mealy bug infestation was observed on VBCH-1006 (1.76) than rest of hybrids. During 2008-09 among BG-II per cent infestation by mealy bug ranged from 1.35 to 1.75 per cent. Minimum mealy bug infestation was observed on Paras Atal (1.35) which was found significantly superior over rest of the hybrids. Maximum mealy bug infestation was observed on RCH-515 (1.75) and was at par with VBCH-1505 (1.72), Bunny (1.70), MRC-7326 (1.65) and VBCH-1501 (1.65). Whereas During 2009-2010 among BG-II Bt cotton hybrids per cent mealy bug infestation was from 1.30 to 1.60 per cent. Minimum mealy bug infestation was observed on Paras Atal (1.30) and TCH-4 (1.30) which were found significantly superior over rest of hybrids except Mallika (1.40), Sigma (1.35), TCH-9 (1.36), ACH-155 (1.40), ACH-33 (1.40), NSPL-999 (1.35), PRCH-504 (1.38) and UPLHH-2 (1.40). Maximum mealy bug infestation was observed on PRCH-505 (1.60) and was at par with, VBCH-1505 (1.56), NSPL-405 (1.52), RCH-515 (1.57), MRC-7326 (1.53), ACH-177 (1.55), ACH-11 (1.50).

On the basis of pooled data among BG-II Bt cotton hybrids mealy bug infestation ranged from 1.33 to 1.67 per cent. Minimum mealy bug infestation was on Paras Atal (1.33) which was found significantly superior over rest of the hybrids except TCH-4 (1.40) and was at par with each other. Maximum mealy bug infestation was

observed on PRCH 505 (1.67) followed by RCH-515 (1.66), Bunny (1.64), VBCH-1505 (1.64), MRC-7326 (1.59), ACH-177 (1.58) and NSPL 405 (1.58).

Among all Bt cotton hybrids mealy bug infestation ranged from 1.35 to 1.93 per cent. Minimum infestation

was observed on Paras Atal BG-II (1.35) which was at par with ACH-21-1 BG-I (1.40). Maximum mealy bug infestation was observed in VBCH-1006 BG-I (1.93) than rest of hybrids. Whereas during 2009-10 among all Bt cotton hybrids mealy bug infestation ranged from 1.30

Table 2 : Average plants infested by mealy bugs in BG-I and BG-II Bt cotton hybrids

Sr. No.	Name of hybrids	Plants infested by mealy bugs (%)		
		2008-09	2009-10	Pooled
1.	Bunny BG-I	1.56 (0.89)	1.40 (0.80)	1.48 (0.85)
2.	Mallika BG-I	1.50 (0.86)	1.51 (0.87)	1.51 (0.86)
3.	VBCH -1505(Dyna) BG-I	1.73 (0.99)	1.43 (0.82)	1.58 (0.91)
4.	RCH-2 BG-I	1.62 (0.93)	1.33 (0.76)	1.48 (0.85)
5.	VBCH-1006 BG-I	1.93 (1.11)	1.58 (0.91)	1.76 (1.01)
6.	Paras Brahma BG-I	1.41 (0.81)	1.30 (0.74)	1.36 (0.78)
7.	ACH-155 BG-I	1.55 (0.89)	1.45 (0.83)	1.50 (0.86)
8.	ACH-177 BG-I	1.69 (0.97)	1.57 (0.90)	1.63 (0.93)
9.	ACH-33 BG-I	1.63 (0.93)	1.52 (0.87)	1.58 (0.90)
10.	Ranjeet bt BG-I	1.46 (0.84)	1.36 (0.78)	1.41 (0.81)
11.	Super Bunny BG-I	1.45 (0.83)	1.39 (0.79)	1.42 (0.81)
12.	Kanak BG-I	1.70 (0.97)	1.48 (0.85)	1.59 (0.91)
13.	Cash BG-I	1.69 (0.97)	1.55 (0.89)	1.62 (0.93)
14.	GK-205 BG-I	1.48 (0.85)	1.40 (0.80)	1.44 (0.82)
15.	ACH-21-1 BG-I	1.40 (0.80)	1.38 (0.79)	1.39 (0.80)
16.	Ankur -3032 BG-I	1.54 (0.88)	1.40 (0.80)	1.47 (0.84)
17.	SP-1037 BG-I	1.54 (0.88)	1.39 (0.80)	1.47 (0.84)
18.	SP-499 BG-I	1.65 (0.95)	1.50 (0.86)	1.58 (0.90)
19.	Bunny BG-II	1.70 (0.97)	1.58 (0.91)	1.64 (0.94)
20.	Mallika BG-II	1.55 (0.89)	1.40 (0.80)	1.48 (0.85)
21.	VBCH -1505(Dyna) BG-II	1.72 (0.99)	1.56 (0.89)	1.64 (0.94)
22.	Sigma BG-II	1.55 (0.89)	1.35 (0.77)	1.45 (0.83)
23.	RCH-2 BG-II	1.60 (0.92)	1.42 (0.81)	1.51 (0.87)
24.	RCH-515 BG-II	1.75 (1.00)	1.57 (0.90)	1.66 (0.95)
25.	VBCH -1501 BG-II	1.65 (0.95)	1.44 (0.82)	1.55 (0.89)
26.	TCH-4 BG-II	1.50 (0.86)	1.30 (0.74)	1.40 (0.80)
27.	TCH-9 BG-II	1.48 (0.85)	1.36 (0.78)	1.42 (0.81)
28.	Paras Atal BG-II	1.35 (0.77)	1.30 (0.74)	1.33 (0.76)
29.	Paras Brahma BG-II	1.53 (0.88)	1.42 (0.81)	1.48 (0.85)
30.	MRC-7326 BG-II	1.65 (0.95)	1.53 (0.88)	1.59 (0.91)
31.	MRC-7351 BG-II	1.53 (0.88)	1.42 (0.81)	1.48 (0.85)
32.	ACH-155 BG-II	1.56 (0.89)	1.40 (0.80)	1.48 (0.85)
33.	ACH-177 BG-II	1.60 (0.92)	1.55 (0.89)	1.58 (0.90)
34.	ACH-33 BG-II	1.50 (0.86)	1.40 (0.80)	1.45 (0.83)
35.	ACH-11 BG-II	1.58 (0.91)	1.50 (0.86)	1.54 (0.88)
36.	PRCH-505 BG-II	1.73 (0.99)	1.60 (0.92)	1.67 (0.95)
37.	NSPL-405 BG-II	1.63 (0.93)	1.52 (0.87)	1.58 (0.90)
38.	NSPL-999 BG-II	1.45 (0.83)	1.35 (0.77)	1.40 (0.80)
39.	PRCH-504 BG-II	1.52 (0.87)	1.38 (0.79)	1.45 (0.83)
40.	UPLHH-2 BG-II	1.60 (0.92)	1.40 (0.80)	1.50 (0.86)
	S.E. \pm	0.019	0.024	0.015
	C.D. (P=0.05)	0.053	0.066	0.041

* Figures in parentheses are Arcsine transformed values

to 1.60 per cent. Minimum mealy bug infestation was observed on Paras Brahma BG-I (1.30), TCH-4 BG-II (1.30) and Paras Atal BG-II (1.30) followed by Bunny BG-I (1.40), RCH-2 BG-I (1.33), Ranjeet Bt- BG-I (1.36), Super Bunny BG-I (1.39), Mallika BG-II 1.40 per cent,

Sigma BG-II (1.35), TCH-9 BG-II (1.36), ACH-155 BG-II (1.40), ACH-33 BG-II (1.40), NSPL 999 BG-II (1.35) PRCH-504 BG-II (1.38) and UPLHH-2 BG-II (1.40). Maximum mealy bug infestation was observed on PRCH-505 BG-II (1.60) and at par with Mallika BG-I

Table 3 : Grading of mealy bugs infested plants (pooled) on BG-I and BG-II Bt cotton hybrids

Sr. No.	Name of Hybrids	Grade of Mealy bugs infested plants		
		2008-09	2009-10	Pooled
1.	Bunny BG-I	1.10 (1.26)	0.80 (1.14)	0.95 (1.20)
2.	Mallika BG-I	1.00 (1.22)	0.90 (1.18)	0.95 (1.20)
3.	VBCH-1505(Dyna) BG-I	1.08 (1.26)	0.86 (1.17)	0.97 (1.21)
4.	RCH-2 BG-I	1.16 (1.29)	0.78 (1.13)	0.97 (1.21)
5.	VBCH-1006 BG-I	1.45 (1.40)	0.95 (1.20)	1.20 (1.30)
6.	Paras Brahma BG-I	1.00 (1.22)	0.70 (1.10)	0.85 (1.16)
7.	ACH-155 BG-I	1.00 (1.22)	0.80 (1.14)	0.90 (1.18)
8.	ACH-177 BG-I	1.25 (1.32)	0.85 (1.16)	1.05 (1.24)
9.	ACH-33 BG-I	1.10 (1.26)	0.95 (1.20)	1.03 (1.23)
10.	Ranjeet Bt BG-I	1.06 (1.25)	0.90 (1.18)	3.27 (1.84)
11.	Super Bunny BG-I	1.00 (1.22)	0.75 (1.12)	0.87 (1.17)
12.	Kanak BG-I	1.20 (1.30)	0.80 (1.14)	1.00 (1.22)
13.	Cash BG-I	1.15 (1.28)	0.90 (1.18)	1.02 (1.23)
14.	GK-205 BG-I	1.00 (1.22)	0.96 (1.21)	0.98 (1.22)
15.	ACH-21-1 BG-I	0.95 (1.20)	0.80 (1.14)	0.88 (1.17)
16.	Ankur-3032 BG-I	1.06 (1.25)	0.75 (1.12)	0.91 (1.19)
17.	SP-1037 BG-I	1.03 (1.24)	0.80 (1.14)	0.92 (1.19)
18.	SP-499 BG-I	1.10 (1.26)	0.90 (1.18)	1.00 (1.22)
19.	Bunny BG-II	1.26 (1.33)	0.95 (1.20)	1.11 (1.27)
20.	Mallika BG-II	1.00 (1.22)	0.80 (1.14)	0.90 (1.18)
21.	VBCH-1505(Dyna) BG-II	1.40 (1.38)	1.00 (1.22)	1.20 (1.30)
22.	Sigma BG-II	1.00 (1.22)	0.80 (1.14)	0.90 (1.18)
23.	RCH-2 BG-II	1.10 (1.26)	0.87 (1.17)	0.99 (1.22)
24.	RCH-515 BG-II	1.10 (1.26)	0.95 (1.20)	1.03 (1.23)
25.	VBCH-1501 BG-II	1.20 (1.30)	0.85 (1.16)	1.03 (1.23)
26.	TCH-4 BG-II	1.05 (1.24)	0.75 (1.12)	0.90 (1.18)
27.	TCH-9 BG-II	0.90 (1.18)	0.78 (1.13)	0.84 (1.16)
28.	Paras Atal BG-II	0.90 (1.18)	0.75 (1.12)	0.83 (1.15)
29.	Paras Brahma BG-II	0.95 (1.20)	0.83 (1.15)	0.89 (1.18)
30.	MRC-7326 BG-II	1.30 (1.34)	0.95 (1.20)	1.13 (1.17)
31.	MRC-7351 BG-II	1.00 (1.22)	0.85 (1.16)	0.93 (1.29)
32.	ACH-155 BG-II	1.00 (1.22)	0.86 (1.17)	0.93 (1.20)
33.	ACH-177 BG-II	1.20 (1.30)	0.98 (1.22)	1.09 (1.26)
34.	ACH-33 BG-II	1.10 (1.26)	0.80 (1.14)	0.95 (1.20)
35.	ACH-11 BG-II	1.00 (1.22)	0.90 (1.18)	0.95 (1.20)
36.	PRCH-505 BG-II	1.06 (1.25)	1.00 (1.22)	1.03 (1.24)
37.	NSPL-405 BG-II	1.08 (1.26)	0.95 (1.20)	1.02 (1.23)
38.	NSPL-999 BG-II	1.16 (1.29)	0.75 (1.12)	0.96 (1.21)
39.	PRCH-504 BG-II	1.05 (1.24)	0.80 (1.14)	0.93 (1.19)
40.	UPLHH-2 BG-II	1.10 (1.26)	0.82 (1.15)	0.96 (1.21)
	SE ±	0.168	0.018	0.103
	C.D. (P=0.05)	NS	NS	NS

* Figures in parentheses are $\sqrt{X+0.5}$ transformed values

NS=Non-significant

(1.51), VBCH-1006 BG-I (1.58), ACH-177 BG-I (1.57), ACH33 BG-I (1.52), Kanak BG-I (1.48), Cash BG-I (1.55), SP-499 BG-I (1.50), RCH 515 BG-II (1.57), MRC 7326 BG-II (1.53), ACH-177 BG-II (1.55), ACH-II BG-II (1.50) and NSPL 405 BG-II (1.52).

Pooled data revealed that among all Bt cotton hybrids mealy bug infestation ranged from 1.33 to 1.76 per cent. Minimum mealy bug infestation was observed on Paras Atal BG-I (1.33) which was found significantly superior over rest of the hybrids except Paras Atal BG-I (1.36), ACH-21-1 BG-I (1.39) and TCH4 BG-II (1.40) which were at par and each other. Maximum mealy bug infestation was observed on VBCH-1006 BG-I (1.76) than rest of the hybrids. As the mealy bug incidence on Bt cotton is new and the published research work on this is scanty. Hence, it was not possible to discuss the results properly.

Grading of mealy bug infested plants on BG-I and BG-II cotton hybrids :

The data on grading of mealy bug infested BG-I plants during 2008-2009 revealed that grade ranged from 0.95 to 5.64 per cent. All the varieties are statistically non significant with each other. Similarly during 2009-2010 among BG-I hybrids ranged from 0.70 to 0.96 per cent and all the hybrids were statistically non-significant.

During 2008-09 among BG-II Bt cotton hybrids mealy bug infested grade ranged from 0.90 to 1.40. Similarly during 2009-2010 among BG-II hybrids mealy bug infested plant grade ranged from 0.75 to 1.00 per cent and all the hybrids were statistically non significant. Among all Bt cotton hybrids during 2008-2009 grade of mealy bug infested plant ranged from 0.90 to 5.64 per cent and all Bt cotton (BG-I and BG-II) hybrids were statistically non-significant. Similarly during 2009-2010 mealy bug infested plants grade ranged from 0.70 to 1.00 per cent and all Bt cotton hybrids (BG-I and BG-II) were statistically non-significant.

Pooled data on grading of mealy bug infested plants on BG-I and BG-II (Table 3) revealed that among BG-I mealy bug infested plant grade ranged from 0.87 to 1.20 per cent and all the hybrids are statistically non significant.

Among BG-II mealy bug infested plant grade ranged from 0.83 to 1.20. Among all Bt cotton hybrids pooled data revealed that grade of mealy bug infested plants ranged from 0.83 to 1.30.

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