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Field screening of different *Bt* and non *Bt* cotton genotypes against aphids (*Aphis gossypii* Glover)

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Abstract : An investigation was undertaken with an objective to evaluate the different *Bt* and non-*Bt* cotton genotypes against aphids (*Aphis gossypii* Glover) under field condition at the Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri. Sixteen genotypes (10 *Bt* genotypes + 6 non-*Bt* genotypes) with diverse morphological characters were selected and statistically laid out field trials were during *kharif* 2015 and 2016 to study their reaction to aphids. The aphid (*A. gossypii*) population ranged from 18.93 to 31.64 aphids/3 leaves on *Bt* cultivars and 17.37 to 26.77 aphids/3 leaves on non *Bt* cultivars. The *Bt* cultivars, Ajeet 155 and President gold recorded aphid infestation level of 18.93 and 19.73 aphids/3 leaves, respectively, and categorized as moderately resistant to aphid. Marvel recorded the aphid infestation intensity level of 31.64 aphids/3 leaves and were found highly susceptible to the aphid infestation. None of the *Bt* cotton cultivars were screened under in resistant category. Out of screened six non *Bt* cultivars, GISV-272, AKH-13-51 and Phule Yamuna recorded aphid infestation level of 17.37, 18.38 and 19.64 aphids /3 leaves, respectively, were moderately resistant to aphid. The non *Bt* cultivars, Phule 688, Phule 492 and Phule 388 recorded the aphid intensity level of 22.97, 24.21 and 26.77 aphids/3 leaves, respectively, and were found susceptible to the attack of aphids. None of the non *Bt* cotton cultivars were screened under in resistant category.

Keywords: Aphids, *A. gossypii*, field screening

Cotton belongs to genus *Gossypium* which is one among eight genera under tribe Gossypeae and family Malvaceae. There are four species of cotton which are generally cultivated *viz.*, *Gossypium arboreum* and *Gossypium harbaceum* L. which are called old world cotton; while *Gossypium barbadense* L. and *Gossypium hirsutum* L. are known as new world cotton.

Cotton, *Gossypium hirsutum* L., an important industrial crop of the world. India ranks first in acreage of cotton crop. India is the second largest producer of cotton in the world after China. Gujarat and Maharashtra continued as leading cotton producing states in the country for the last 20 years. Also, these two states occupy more than 50 per cent of the cotton cultivation area in the country for several years. The cotton plays a vital role in the Indian economy, sustains the Indian cotton textile industry, provides employment to millions of people and contributes substantially to the country's foreign trade. Cotton is the crop of Indian history, civilization, industry and most important commercial crop in our country.

Among the major constraints in cotton cultivation, pest damage is the most important one, causing heavy losses. Cotton crop is infested by several pests right from germination to harvest and the pest spectrum of cotton is quite complex. The crop is attacked by about 1326 species of insect and mite pests infesting at various stages of crop growth, across the globe (Hargreaves, 1984). About 200 insect pests are reported to attack cotton crop in India (Anonymous, 1992).

The cotton bollworm complex is most devastating, which causes significant reduction in cotton yield to the extent of 60-80 per cent. Among the bollworms, American bollworm *Helicoverpa armigera* (Hubner) is the most

Table 1. Categorization of cotton genotypes based on level of aphid infestation

Sr. No.	Level of aphid infestation/3 leaves	Category	Grades
1	10.00 and below	Resistant	R
2	10.01 to 20.00	Moderately resistant	MR
3	20.01 to 30.00	Susceptible	S
4	30.01 and above	Highly susceptible	HS

Table 2. Average population of aphids on *Bt* and non *Bt* cotton genotypes during *kharif* 2015-2016 and 2016-2017

Sr. No.	Cultivars	Average population of aphids/3 leaves		**Pooled mean**	Grades
		2015	2016		
***Bt* cultivars**					
1	Ajeet 155	26.55 (5.20)	11.30 (3.44)	**18.93 (4.41)**	MR
2	MRC 7351	28.53 (5.39)	13.28 (3.71)	**20.91 (4.63)**	S
3	MRC 7377	31.69 (5.67)	24.44 (4.99)	**28.07 (5.39)**	S
4	Bhakti (NCS-245)	29.54 (5.48)	16.29 (4.10)	**22.92 (4.84)**	S
5	Trinetra	31.08 (5.62)	21.93 (4.74)	**26.51 (5.20)**	S
6	Pancham	30.16 (5.54)	18.91 (4.41)	**24.54 (5.00)**	S
7	President gold	27.35 (5.28)	12.10 (3.55)	**19.73 (4.50)**	MR
8	Marvel	33.26 (5.81)	30.01 (5.52)	**31.64 (5.67)**	HS
9	NCS 954	30.81 (5.60)	19.56 (4.48)	**25.29 (5.07)**	S
10	Champion 504	32.39 (5.73)	27.14 (5.26)	**29.77 (5.50)**	S
	Mean	30.14 (5.54)	19.66 (4.49)	**24.90 (5.04)**	
	SE ±	0.09	0.10	**0.10**	
	CD at (p=0.05)	0.27	0.30	**0.29**	
Non *Bt* cultivars					
11	Phule Yamuna	25.33 (5.08)	13.94 (3.80)	**19.64 (4.49)**	MR
12	Phule-688	30.68 (5.58)	15.25 (3.97)	**22.97 (4.84)**	S
13	GISV-272	24.47 (5.00)	10.26 (3.28)	**17.37 (4.23)**	MR
14	AKH-13-51	25.11 (5.06)	11.64 (3.48)	**18.38 (4.35)**	MR
15	Phule-492	31.97 (5.70)	16.45 (4.12)	**24.21 (4.97)**	S
16	Phule-388	32.53 (5.75)	21.01 (4.64)	**26.77 (5.22)**	S
	Mean	28.35 (5.37)	14.76 (3.91)	**21.56 (4.70)**	
	SE ±	0.08	0.18	**0.13**	
	CD at (p=0.05)	0.24	0.53	**0.38**	

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

devastating. In India, apart from *H. armigera* cotton bollworm complex also constitutes spotted bollworm *Earias vittella* (Fabricius), spiny bollworm *Earias insulana* (Boisdual) and pink bollworm *Pectinophora gossypiella* (Saunders) pose greater threat to cotton production. Cotton crop is also affected by sucking pests *viz.*, leafhopper or jassid, *Amrasca biguttula biguttula* (Ishida), thrips, *Thripstabaci* (Lindeman), aphid, *Aphis gossypii* (Glover), mealybug, *Phenacoccus solenopsis* (Tinsley) and whitefly, *Bemisia tabaci* (Gennadius) are known to have occupied major pest status (Ghosh and Senapati, 2001) and account for the yield loss of 22.85 per cent.

Sucking pests have become quite serious from seedling stage to harvesting and their heavy infestation at times reduces the crop yield to a great extent. Sole reliance on insecticides is not only ecologically unsustainable but is also becoming economically unviable. Instead of this, the use of host plant resistance against the pest is one of the effective and ecofriendly alternative

Table 3. Categorization of cotton genotypes based on level of aphid infestation

Sr. No.	Level of aphid infestation/3 leaves	Category	Genotypes	
			Bt genotypes	Non *Bt* genotypes
1.	10.00 and below	Resistant	-	-
2.	10.01 to 20.00	Moderately resistant	Ajeet 155, President gold	Phule Yamuna, GISV-272, AKH-13-51
3.	20.01 to 30.00	Susceptible	MRC 7351, MRC 7377, Bhakti (NCS-245), Trinetra, Pancham, NCS 954, Champion 504	Phule-688, Phule-492, Phule-388
4.	30.01 and above	Highly susceptible	Marvel	-

methods for combating the pest problems. Use of resistant varieties has been recognized as an important tool in the biointensive pest management system and also is environmentally safe and economically sound method for pest management. Insect resistant varieties provide pest control at essentially no cost to farmers (Prem Kishore, 2001).Keeping this in view present study was undertaken.

MATERIALS AND METHODS

Experimental site

The research work was carried out in *Kharif* season of 2015 and 2016 at the Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri to evaluate the different *Bt* and non *Bt* cotton genotypes against aphids (*A. gossypii*, Glover) under field condition. There were sixteen (10 *Bt* genotypes+6 non *Bt* genotypes) genotypes with three replications each in randomized block design.

Bt and non *Bt* cotton seeds

Investigation was made on 10 *Bt* cotton genotypes *viz*; Ajeet 155, MRC 7351, MRC 7377, Bhakti (NCS-245), Trinetra, Pancham, President gold, Marvel, NCS 954 and Champion 504 and 6 non-*Bt* genotypes *viz*; Phule Yamuna, Phule 688, GISV 272, AKH-13-51, Phule 492 and Phule 388.The seeds of *Bt* and non *Bt* cotton genotypes were purchased from the market of Rahuri.

Observations

For field screening of different *Bt* and non-*Bt* cotton genotypes under natural conditions, the infestation of aphids were recorded at weekly interval during morning hours from five plants. The plants were selected randomly and tagged in each plot to record the population of aphids (both nymphs and adults) from three leaves, each one from top, middle and bottom canopies and mean populations/three leaves were worked out. Mean aphid infestation of each *Bt* and non *Bt* cotton genotypes were calculated and the grouping of genotype was made into four classes *viz.*, 1) Resistant, 2) Moderately resistant, 3) Susceptible, 4) Highly susceptible on the basis of critical difference values obtained after statistical analysis (Ausekar, 2010).

Statistical analysis

Statistical analysis after appropriate transformation of data was undertaken as per Gomez and Gomez (1976). Data from field experiments were analysed by randomized block design (RBD).

RESULTS AND DISCUSSION

Sixteen cotton genotypes (10 *Bt* genotypes and 6 non *Bt* genotypes) were screened in the field under natural conditions during *kharif* 2015 and 2016 season. The reaction of sixteen different genotypes of cotton to aphid infestation tested and revealed that none of the

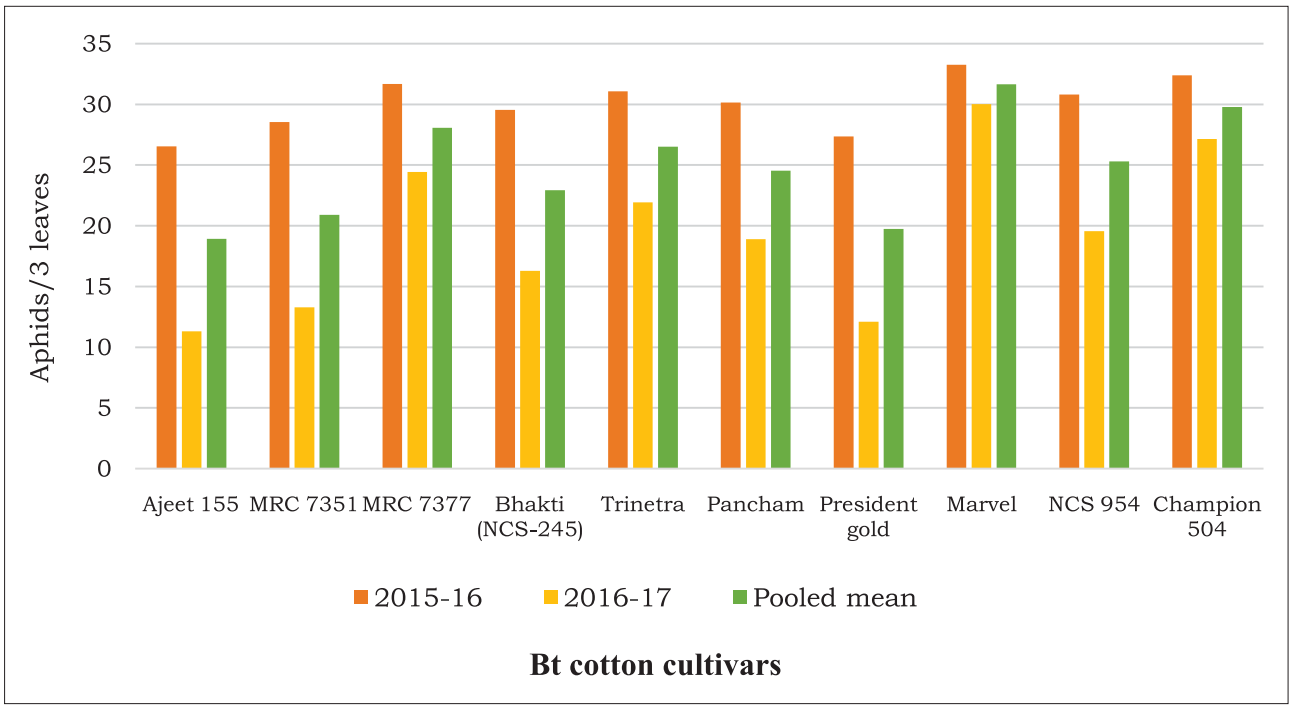

Fig. 1. Average population of aphids on *Bt* cotton genotypes during *kharif* 2015-16 and 2016-17

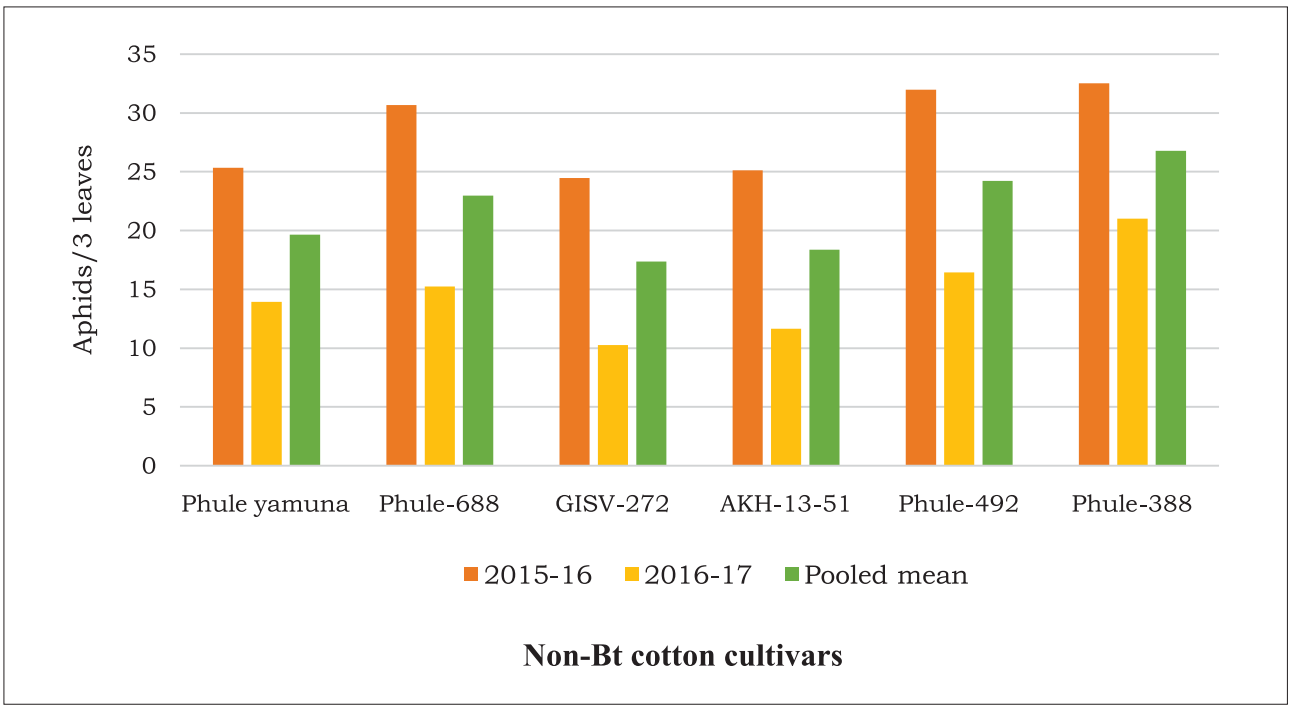

Fig. 2. Average population of aphids on non-*Bt* cotton genotypes during *kharif* 2015-16 and 2016-17

genotype was found completely free from the aphid infestation.

The overall pooled data of average population of aphids during *kharif* 2015 and 2016 presented in Table 2. and depicted in Fig. 1 and 2, which revealed that, the mean population of aphid during crop growth ranged from 18.93 to 31.64 aphids/3 leaves on *Bt* cultivars and 17.37 to 26.77 aphids/3 leaves on non *Bt* cultivars.

The lowest average population was

recorded on *Bt* cultivars, Ajeet 155 of 18.93 aphids/3 leaves. It was significantly superior over remaining *Bt* cultivars except President gold (19.73 aphids/3 leaves) and MRC 7351 (20.91 aphids/3 leaves). The highest mean population of 31.64 aphids/3 leaves was observed on the *Bt* cultivar Marvel followed by Champion 504 (29.77 aphids/3 leaves) and MRC 7377 (28.07 aphids/3 leaves).

In the non *Bt* cultivars, GISV-272 recorded minimum average population of 17.37 aphids/3 leaves and found most promising one. It was significantly superior over remaining non *Bt* cultivars except AKH-13-51 (18.38 aphids/3 leaves) and Phule Yamuna (19.64 aphids/3 leaves). The maximum mean population of 26.77 aphids/3 leaves was observed on the non *Bt* cultivars, Phule 388 followed by Phule 492 (24.21 aphids/3 leaves) and Phule 688 (22.97 aphids/3 leaves).

To determine the relative susceptibility/ resistance against aphid infestation, the *Bt* and non *Bt* genotypes were categorized (Table 3.) as per the scales given by Ausekar (2010).

The *Bt* cultivars, Ajeet 155 and President gold were moderately resistant to aphid by showing infestation level of 18.93 and 19.73 aphids/3 leaves, respectively. The *Bt* cultivars, MRC 7351, MRC 7377, Bhakti (NCS-245), Trinetra, Pancham, NCS 954 and Champion 504 recorded the aphid intensity level of 20.91, 28.07, 22.92, 26.51, 24.54, 25.29 and 29.77 aphids/3 leaves, respectively and were found susceptible to the attack of aphids. The remaining *Bt* cultivars *viz.*, Marvel recorded the aphid infestation intensity level of 31.64 aphids/3 leaves and were found highly susceptible to the aphid infestation. None of the *Bt* cotton cultivars screened found in the resistant category.

The non *Bt* cultivars, GISV-272, AKH-13-51 and Phule Yamuna showed infestation level of 17.37, 18.38 and 19.64 aphids/3 leaves, respectively, and categorized moderately resistant to aphid. The cultivars, Phule 688, Phule 492 and Phule 388 recorded the intensity level of 22.97, 24.21 and 26.77 aphids/3 leaves, respectively and were found susceptible to the attack of aphids. None of the non *Bt* cotton cultivars screened, under this test found the resistant category.

The previous workers not screened the genotypes used in the present study. These findings are in confirmation with Abro *et al.*, (2004), Vennila *et al.*, (2004), Radhika *et al.*, (2006), Prasad and Rao (2008), Ausekar, (2010), Babar *et al.*, (2013), Phulse and Udikeri, (2014), Rohith *et al.*, (2014) who evaluated different *Bt* cotton hybrids and non-*Bt* hybrids for their reaction to sucking pests under field condition and observed differential reaction of *Bt* and non-*Bt* cotton hybrids in terms of increased or decreased tolerance or susceptibility to sucking pests following *Bt* genes introgression.

CONCLUSION

Identification of resistance in *Bt* and non *Bt* cotton genotypes to aphids were most promising and emerged as less susceptible to aphids.

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