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*Full Length Research Paper*

# SCREENING OF NEW BT COTTON HYBRIDS AGAINST SUCKING PESTS

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## Abstract

A field experiment was conducted during kharif-2012 to study the reaction of different Bt cotton hybrids against sucking pests and their natural enemy population. Among the different hybrids tested Bio HY. 15-2 recorded the least incidence of leafhoppers (2.96 per 3 leaves) and aphids (1.20 per 3 leaves), BIO GHY 60-2 BGII recorded least population of thrips (4.64 per 3 leaves) and in KDCHH 553 BGII population of whitefly (0.37 per 3 leaves) was recorded lowest and founds best. Although per cent good opened bolls not differed significantly across the tested hybrids, KDCHH 6741 BGII (29.91%) recorded the highest bad opened boll percentage and found susceptible. With respect to population of coccinellids and green lace wings not differed significantly across the hybrids tested while the population of spiders recorded highest in BIO GHY 60-2 BGII (2.19 per plant) and least in Ankur yesh BGII (0.28 per plant). However, Ankur suvarna BGII (1833 kg/ha), KDCHH 553 BGII, 72SS 66 BGII and Ankur 4252 BGII (1750 kg/ha respectively) recorded the respective higher yield with all the constraints.

***Keywords:*** Screening; Bt Cotton Hybrids; Sucking Pests; Natural Enemies

## Introduction

Since from 1500 BC to 1700 AD India is very well known as cradle of cotton industry. Thus, India is got distinct of being the earliest country in the world to domesticate cotton and to utilize its fibre to manufacture fabric (Mayee., *et al.* 2004). In this regard cotton is one of the most important commercial crop of India. This crop is suffered from the damage of number of insect pests among them sucking pests have become quite serious from seedling to harvesting stage, their heavy infestation at times reduces the crop yield to a great extent. Although India ranks first with respect to area but in production second after china which produce 35.30 mil- lion hectares cotton lint with an average productivity of 491 kg per ha (Anon 2012). Textile exports and cotton account for nearly one third of total foreign exchange earnings of India crossing Rs. 60,000 crores (Pundhir., *et al*. 2009).

In India cotton ecosystem harbours about 162 insect pest spe- cies [1] and the monetary value of yield losses due to insect pests has been estimated to be Rs 2,87,000 million annually (Dhawan., *et al.* 2008). The extent of losses caused by sucking pests, bollworms and both sucking pests and bollworms have been worked out 12, 44, and 52 per cent (Dhawan., *et al.* 1988). In the absence of effective genetic resistance against these sucking pests, farmers solely depends on insecticides for their effective production management (Dhawan., *et al.* 2008). Cotton accounts for 50 per cent of pesticide consumption in the country despite being grown on area of 5 - 10 per cent (Dhawan., *et al.* 2008; David, 2008). Among the sap feeders leafhoppers *Amrasca biguttula biguttula* (Ishida), aphids *Aphis gossypii* (Glover), thrips *Thrips tabaci* (Linn) and whitefly *Bemisia tabaci* are the regular and key pest in major cotton growing ar- eas of Karnataka. Even though the recently introduced Bt cotton hybrids are resistant to bollworms, most of them succumb to the sucking pests scourge (Kalkal., *et al*. 2009; Raja., *et al*. 2007; Murugesan., *et al.* 2009). Hence, the development of the high yielding sucking pests tolerant genotypes becomes the need of the hour. In Integrated Pest Management Programme, resistant cultivar is to be used as a basement over which other tactics are to be pyramided over to have an effective management of the pest. Identification and use of tolerant/resistant cultivar may be of great relevance during these days as they are ecofriendly and cost - effective. With all the available reports the present investigation was carried out with the objective of identifying resistant sources to sucking pests of Bt cotton.

## Material and Methods

The field experiment were carried out during Kharif-2012 at Main Agricultural Research Station (MARS), Dharwad. Totally, seventeen newly released Bt cotton hybrids with one non Bt cultivar, DHH-11 (Standard check) was selected and recorded against major sucking pests in cotton viz., *Amrasca biguttula biguttula, Aphis gossypii, Thrips tabaci* and *Bemisia tabaci*. The experiment was laid out in Randomized Block Design (RBD) with three replications.

Different Bt cotton hybrids under experimentation were dibbled 90 cm apart with intra row spacing of 60 cm. The fertilizer application was at the rate of 80:40:40 in the form of Urea, DAP and MOP with two splits of N. Crop was kept weed free through regular inter- cultural operations and hand weeding. Harvesting of seed cotton from each subplot was done as the hybrids required. All these agronomic practices were followed as per package of practices except plant protection measures.

Population of sucking pests was recorded periodically at 60, 90 and 120 DAS (Days After Sowing). For sucking pests ten plants were selected at randomly for each genotype and six leaves (two each at upper, middle and lower plant canopy) and expressed total number of nymphs or adults on lower surface of the leaves. Natural enemies viz., coccinellids, *Chrysopa* sp, and spider were recorded on whole ten plants in each treatments. Before picking of seed cotton, number of good opened bolls (GOB's) and badly opened bolls (BOB's) were recorded from 10 randomly selected plants. The data have been averaged to per plant and presented as GOB/plant and BOB/ plant. The data thus collected was subjected to statistical analysis and mean values of treatments were separated by Duncan's Multiple Range Test (DMRT) [2].

## Result and Discussion

**Sucking pests:** In present investigation 17 newly released Bt cot- ton hybrids were compared with non Bt susceptible (Bunny Non- Bt) as standard check against major sucking pests like leafhoppers, aphids, thrips and whiteflies. The results revealed that the incidence of leafhoppers was least on Bio HY. 15-2 BGII (2.96 per 3 leaves) followed by Ankur yesh BGII (3.40 per 3 leaves), 72SS 66 BGII (3.46 per 3 leaves) and BIO HY. 1101-2 BGII (3.49 per 3 leaves) which were on par with each other and higher incidence was re- corded on VBCH 1545 BGII (7.61 per 3 leaves). While, the incidence of thrips was least in BIO GHY 60-2 BGII (4.64 per 3 leaves) followed by VBCH

1548 BGII (5.64 per 3 leaves), KDCHH 7101 BGII (5.68 per 3 leaves) and higher population was recorded in KDCHH 553 BGII (11.08 per 3 leaves).

The lower incidence of aphids was observed in Bio HY. 15-2 BGII (1.20 per 3 leaves) and KDCHH 7101 BGII (1.28 per 3 leaves) followed by 66 SS 33 BGII (1.67 per 3 leaves) and 72SS 66 BGII (1.69 per 3 leaves). However, higher incidence was noticed in BIO GHY 60-2 BGII (6.87 per 3 leaves). With respect to whitefly, least incidence was observed in KDCHH 553 BGII (0.37 per 3 leaves) followed by Ankur yesh BGII (0.58 per 3 leaves), 66 SS 33 BGII (0.62 per 3 leaves) and higher incidence was recorded in BIO GHY 60-2 BGII (2.29 per 3 leaves).

Several studies have carried out to evaluate the different Bt cot- ton cultivars for sucking pests resistance. Muhammed., *et al.* [3] evaluated 22 cotton genotypes for their comparative resistance to whitefly, jassid and thrips where the maximum mean seasonal population of 1.3 whitefly adults, 1.7 jassid adults and nymphs and 3.1 thrips adult and nymphs per leaf was observed and concluded that the leaf trichome density is the main reason for the lower incidence. He also reported that resistance is due to some of the morphological and biochemical factors viz., hair density and gossypol glands on midrib, vein and lamina which interfere with the pests oviposition and easy movement [4-8]. Similar results were also obtained with the studies of Khan., *et al.* [9] who evaluated 17 cultivars of cotton against sucking pests. In some cases light intensity on the plant canopy also plays an important role in dis- tributing the pest population in the plant and its ecosystem [10].

**Natural enemies:** The data on the population of natural enemies viz., (coccinellids, green lace wing and spiders) was recorded in different Bt-cotton hybrids are represented in table 1. Among the different hybrids tested the population of natural enemies like coccinellids and green lace wings not differed significantly. However, the population of spiders differs numerically significant and recorded higher in BIO GHY 60-2 BGII (2.19 per plant) followed by Ankur suvarna BGII (1.49 per plant) and least in Ankur yesh BGII (0.28 per plant).

| Treatments (Code) | Number of sucking pests/3 leaves | | | | Number of Coccinellids per plant | Number of green lace wings per plant | Number of spiders per plant |
|---|---|---|---|---|---|---|---|
| | Leafhopper | Aphid | Thrips | Whitefly | | | |
| Ankur suvarna BGII | **3.87 i (2.03) | **1.78 ij (1.44) | **7.83 d (2.66) | **1.82 b (1.41) | 0.39 b (0.94) | 0.00 b (0.71) | 1.49 abc (1.41) |
| Ankur yesh BGII (Ankur 3898 BGII) | 4.40 h (2.16) | 3.09 e (1.81) | 8.20 c (2.69) | 0.74 de (1.08) | 0.04 b (0.73) | 0.28 b (0.88) | 0.28 g (0.88) |
| Chiranjeevi | 4.49 fg (2.18) | 2.24 fgh (1.59) | 9.24 b (2.87) | 0.67 def (1.07) | 0.27 b (0.88) | 0.00 b (0.71) | 0.38 fg (0.94) |
| Ankur yesh BGII (Ankur 4151BGII) | 3.40 j (1.87) | 5.73 b (2.30) | 7.00 fg (2.45) | 0.58 ef (1.02) | 0.41 b (0.95) | 0.20 b (0.84) | 0.42 efg (0.96) |
| Ankur 4252 BGII | 3.86 i (2.03) | 2.83 e (1.75) | 6.48 hi (2.49) | 1.74 b (1.50) | 0.22 b (0.85) | 0.45 b (0.97) | 1.26 abcd (1.33) |
| Bio HY. 15-2 (BGII) | 2.96 k (1.67) | 1.20 k (1.29) | 6.33 ij (2.49) | 1.76 b (1.41) | 0.53 b (1.01) | 0.06 b (0.75) | 1.13 bcde (1.28) |
| BIO HY. 1101-2 BGII | 3.49 j (1.97) | 2.20 gh (1.64) | 6.52 hi (2.52) | 1.09 c (1.26) | 0.27 b (0.88) | 0.06 b (0.75) | 1.07 bcdef (1.25) |
| BIO GHY 60-2 BGII | 4.84 fg (2.23) | 6.87 a (2.39) | 4.64 l (2.08) | 2.29 a (1.58) | 0.21 b (0.84) | 0.34 b (0.92) | 2.19 a (1.64) |
| Bunny Non-Bt | 9.94 a (3.17) | 4.12 c (1.97) | 6.78 gh (2.45) | 1.79 b (1.51) | 1.93 a (1.56) | 1.19 a (1.30) | 1.79 ab (1.51) |
| KDCHH 6741 BGII | 4.44 h (2.17) | 2.06 hi (1.57) | 6.52 hi (2.50) | 1.24 c (1.30) | 0.44 b (0.97) | 0.28 b (0.88) | 1.06 bcdef (1.25) |
| KDCHH 5841 BGII | 6.48 d (2.54) | 2.10 h (1.59) | 6.04 j (2.34) | 1.60 b (1.40) | 0.40 b (0.95) | 0.37 b (0.93) | 1.41 abcd (1.38) |
| KDCHH 7101 BGII | 5.89 e (2.46) | 1.28 k (1.33) | 5.68 k (2.30) | 0.98 cd (1.20) | 0.13 b (0.79) | 0.42 b (0.96) | 0.46 efg (0.98) |
| KDCHH 553 BGII | 3.99 i (2.03) | 2.46 fg (1.68) | 11.08 a (3.05) | 0.37 f (0.93) | 0.37 b (0.93) | 0.17 b (0.82) | 0.40 efg (0.95) |
| DHH-11 | 5.09 f (2.22) | 3.02 e (1.78) | 8.22 c (2.77) | 0.76 de (1.10) | 0.40 b (0.95) | 0.37 b (0.93) | 0.76 cdefg (1.12) |
| 66 SS 33 BGII | 4.56 gh (2.15) | 1.67 j (1.47) | 7.49 e 2.70) | 0.62 ef (1.03) | 0.13 b (0.79) | 0.28 b (0.88) | 0.62 defg (1.06) |
| 72SS 66 BGII | 3.46 j (1.94) | 1.69 j (1.47) | 7.22 ef (2.60) | 1.57 b (1.38) | 0.38 b (0.94) | 0.15 b (0.81) | 1.15 bcde (1.28) |
| VBCH 1545 BGII | 7.61 b (2.76) | 3.51 d (1.92) | 6.14 j (2.43) | 1.67 b (1.43) | 0.61 b (1.05) | 1.08 a (1.26) | 1.23 abcd (1.32) |
| VBCH 1548 BGII | 6.81 c (2.61) | 2.52 f (1.70) | 5.64 k (2.35) | 0.97 cd (1.21) | 0.31 b (0.90) | 0.15 b (0.81) | 0.83 cdefg (1.15) |
| SEm± | 0.24 | 0.26 | 0.23 | 0.22 | 0.07 | 0.06 | 0.04 |
| CD (5%) | 0.68 | 0.75 | 0.65 | 0.64 | 0.21 | 0.16 | 0.11 |

**Table 1:** Screening of Bt cotton hybrids for their reaction against sucking pests and their natural enemies during Kharif-2012.

Note: Figures in the parentheses are √x+0.5 transformed values, DAS- Days After Sowing. ** Mean values of 3 readings.

**Per cent Good opened bolls (GOBs) and cotton yield in tested Bt-cotton hybrids:** Data on the per cent GOBs in different Bt-cotton entries were represented in table 2. The per cent GOBs among the Bt-cotton entries varied from 70.09 to 91.89 per cent. The highest GOBs percentage was

recorded in Ankur yesh BGII (91.89%) and it was found on par with remaining entries, compared to standard check Bunny Non-Bt which recorded 47.18 per cent GOBs.

| Treatments (Code) | % GOB* | % BOB* | Yield ( Kg/ha) (Unprotected) |
|---|---|---|---|
| Ankur suvarna BGII | 90.31 a (9.53) | 9.69 h | 1833 a |
| Ankur yesh BGII (Ankur 3898 BGII) | 85.56 a (9.27) | 14.44 fg | 1650 bcd |
| Chiranjeevi | 85.46 a (9.27) | 14.54 fg | 1638 bcd |
| Ankur yesh BGII (Ankur 4151BGII) | 91.89 a (9.61) | 8.11 h | 1731 ab |
| Ankur 4252 BGII | 89.35 a (9.48) | 10.65 gh | 1750 ab |
| Bio HY. 15-2 (BGII) | 91.61 a (9.60) | 8.39 h | 1638 bcd |
| BIO HY. 1101-2 BGII | 88.34 a (9.41) | 11.66 gh | 1699 abc |
| BIO GHY 60-2 BGII | 78.60 a (8.89) | 21.40 d | 1502 defg |
| Bunny Non-Bt | 47.18 b (6.90) | 52.82 a | 1027 i |
| KDCHH 6741 BGII | 70.09 a (8.39) | 29.91 b | 1361 gh |
| KDCHH 5841 BGII | 73.65 a (8.60) | 26.35 bc | 1527 def |
| KDCHH 7101 BGII | 77.04 a (8.80) | 22.96 cd | 1375 fgh |
| KDCHH 553 BGII | 90.87 a (9.56) | 9.13 h | 1750 ab |
| DHH-11 | 89.58 a (9.49) | 10.42 gh | 1561 cde |
| 66 SS 33 BGII | 89.37 a (9.48) | 10.63 gh | 1555 cde |
| 72SS 66 BGII | 90.91 a (9.55) | 9.09 h | 1750 ab |
| VBCH 1545 BGII | 83.45 a (9.16) | 16.55 ef | 1305 h |
| VBCH 1548 BGII | 80.92 a (9.02) | 19.08 de | 1416 efgh |
| SEM± | 0.18 | | |
| CD (5%) | 0.53 | | |

**Table 2:** Per cent Good and Bad opened bolls and yield of different Bt cotton hybrids.
Note: Figures in the parentheses are √x+0.5 transformed values,
*GOB: Good Opened Bolls; *BOB: Bad Opened Bolls.

## Conclusions

The incidence of sucking insect pests in presence of Bt genes was dependant on the non-incidence of bollworms or otherwise incidence of thrips, leafhoppers and whiteflies was highest in interspecific cotton hybrids followed by intraspecific genotypes. Hybrid lines which exhibiting resistance or tolerance mechanism for sucking pests can be used in introgression breeding for development of superior lines.

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