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Short Research Article

Relative Incidence of Insect-Pest Complex in Bt and non-Bt Cotton Cultivars

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Abstract

An investigation was carried out to find out the relative incidence of pest complex in three cottoncultivars viz., in MECH 162 *Bt,* MECH 162 non-Bt. The treatments were replicated nine times in randomized block design. The incidence of leafhopper, aphid and whitefly was found in all the three cultivars throughout the crop season, but the worm, *Helicoverpa armigera* and spotted bollworm, *Earias vittella* infestation was comparatively less in MECH 162 *Bt*cotton than other cultivars. The maximum incidence of *H. armigera* was recorded during 14th and 15th week after sowing in all three cultivars.

1. Introduction

Cotton is an important commercial crop playing a key role in economic and social affairs of the world. This crop is grown in about 38 mha area in the world. India ranks first with an area of 9 mha and ranks third in the production (Venugopal et al., 2002). The major reasons for low productivity are rainfed cultivation and damage inflicted to the plants by various insect peststhorough out the growth period.

With the introduction of Bt-cotton, India entered the new era of cotton cultivation, which may reduce the number of sprays on the crop and may contribute to drastic reduction in the cost of production. Hence, studies were undertaken to find out the relative incidence of pest complex in MECH 162 Bt, MECH 162 non-Bt and Brahma cultivars.

2. Materials and Methods

The experiment was carried out during *kharif* 2002 at College Farm, College of Agriculture (ANGRAU), Rajendranagar, Hyderabad. There were three treatments viz., MECH 162 Bt, MECH 162 non-Bt and Brahma hybrid and each treatment was replicated nine times in randomized block design in a plot size of 10.8×4.5 m^2. The MECH 162 Bt-cotton plots were surrounded by five rows of MECH 162 non-Bt to serve as refugia. The MECH 162 non-Bt was sown as per the norms of GEAC. The seeds were sown at a spacing of 90×90 cm^2.

The absolute count of various bollworms were collected on five plants per replication at weekly interval whereas for, and, for sucking pests like leaf hopper and whitefly population, actual counts were taken on three leaves $plant^{-1}$ (3rd, 5th and 7th leaves) on main stem from the top (Patil, 1999) from five randomly selected plants $replication^{-1}$ (i.e.,15 leaves $replication^{-1}$). For aphid, populations counts were taken from three leaves selected at random from top, middle and bottom parts of each plant of each plant (Sharma et al., 1999).

3. Results and Discussion

3.1. Cotton leaf hopper (*Amrasca biguttula biguttula*)

The leaf hopper incidence started at 3rd weeks after sowing (WAS) of the crop period and it varied from 6.84 to 81.84 15 $leaves^{-1}$ $replication^{-1}$ in all the three cultivars studied. The highest incidence of leaf hoppers (59.84 15 $leaves^{-1}$) was observed at 7th WAS in MECH 162 Bt, whereas 61.16 and 81.84 leaf hoppers 15 $leaves^{-1}$ in MECH 162 non-Bt and Brahma respectively was recorded at 14th WAS. The lowest incidence of leaf hoppers was recorded at 10th WAS. Among the three cotton cultivars, MECH 162 non-Bt-cotton recorded more leafhopper population, followed by Brahma and MECH 162 Bt (Table 1). The incidence of cotton leafhopper was similar

in MECH 162 Bt and MECH 162 non-Bt also. In the case of MECH 162 Bt-cotton, the δ-endotoxin was only effective against lepidopteran pests and not against sucking pests. The results obtained in the present study are in conformity with the work of Kranthi (2002).

3.2. Cotton aphid, Aphis gossypii

The aphid appeared from 3 WAS and continued to infest cotton cultivars up to19th WAS. In general, the lowest incidence was observed on Brahma hybrid in comparison to other two cultivars. The peak incidence was recorded at 17th WAS (November-December) in all the three cultivars (Table 1).

3.3. White fly, Bemisia tabaci

The incidence of whitefly was observed from 3rd WAS to 19th WAS and the number of whitefly population varied from 1.34 to 38.34 15 leaves^{-1} and the lowest incidence of whitefly was observed in MECH 162 Bt and Brahma hybrid on 8th WAS and highest incidence in 13th WAS (Table 1). Generally, the whitefly incidence was very low in all the three cultivars throughout the crop period.

3.4. Spotted bollworm, Earias vittella

The spotted bollworm was the first bollworm to make its appearance at 4th WAS in all three cultivars and continued to attack cotton crop till 14th WAS in present experimentation. The highest number of *Earias* larvae 4.84 15 plants^{-1} at 11th WAS in MECH 162 non-Bt, whereas in Brahma hybrid 7.00 larvae 5 plants^{-1} were observed at 11th WAS (Table 2). The bollworm incidence was low in MECH 162 Bt than other cotton cultivars, because of the inherent toxicity of the Bt-cotton against the bollworms (lepidopteran pests). The results obtained in present work are in conformity with Kranthi (2002).

3.5. American bollworm, Helicoverpa armigera (Hubner)

The American bollworm larval occurrence was first recorded at 6th WAS in all the cultivars. The mean larval population varied from 0.34 to 8.16 5 plants^{-1} in MECH 162 Bt, 0.84 to 9.34 5 plants^{-1} in MECH 162 non-Bt and 1.50 to 7.84 5 plants^{-1} in Brahma with a peak at 14th WAS and 15th WAS (November) in all the cultivars (Table 2). The highest number of 9.34 larvae 5 plants^{-1} was observed in MECH 162 non-Bt. Cui and Xia, (2000) also reported that Bt-cotton was resistant to cotton bollworms and cotton semilooper and their peak activities were lesser than those of non-Bt transgenic variety.

The larval incidence of *Helicoverpa* was very low from 6th to 9th WAS in MECH 162 Bt-cotton, followed by MECH 162 non-Bt and Brahma (Table 2). The MECH 162 Bt-cotton recorded less population of bollworm than other cultivars, since MECH 162 Bt-cotton contained Cry 1Ac toxin which was resistant against *H. armigera.* Similar observations were also made by Henneberry et al. (2001), Kranthi (2002) and Barwale et al. (2002) who reported that the Bt transgenic cottons were highly resistant to *H. armigera* and some lepidopteran pests.

In the case of MECH 162 Bt-cotton, the bollworm attained a peak at 14th and 15th WAS and thereafter declined because of the expression of delta endotoxin in transgenic cotton declines with increasing age of the crop. This finding is in conformity with Greenplate (1999) who recorded increased activity of *Helicoverpa*after 90 days age of the crop.

3.6. Tobacco caterpillar, Spodoptera litura

The *S. litura* activity was observed from 7th WAS in all the cultivars. The mean larval population varied from 1.50 to 8.50 5 plants^{-1} replication^{-1} in MECH 162 Bt 2.66 to 7.50 5 plants^{-1} in MECH 162 non-Bt and 2.50 to 7.16 5 plants^{-1} in Brahma, respectively. The highest incidence of *S. litura* at 12th WAS was observed in all the three cultivars (Table 2). In general, the tobacco caterpillar incidence remained similar in all the cultivars. In Bt-cotton, the Cry 1Actoxin effectively controlled. *H. armigera,* pink bollworm and spotted bollworm and was less effective against tobacco caterpillar.The result obtained

Table 1: Incidence of sucking pests in MECH 162 Bt, non-MECH 162 Bt, and Brahma cultivars (*Kharif*, 2002)

Treatments	Mean leaf hopper population 15 leaves^{-1}				Mean aphid population 15 leaves^{-1}		Mean whitefly population 15 leaves^{-1}				
	7 WAS	8 WAS	14 WAS	15 WAS	17 WAS	19 WAS	7 WAS	9 WAS	11 WAS	14 WAS	16 WAS
MECH 162 Bt	59.84 (7.71)	41.84 (6.49)	56.34 (7.51)	36.66 (6.04)	818.16 (28.54)	664.66 (25.70)	7.00 (2.62)	5.66 (2.45)	14.84 (3.74)	26.16 (5.13)	38.34 (6.21)
MECH 162 non-Bt	56.66 (7.53)	44.34 (6.67)	61.16 (7.81)	34.00 (5.85)	740.34 (27.18)	512.91 (22.62)	10.50 (3.30)	7.66 (2.80)	22.34 (4.67)	27.16 (5.25)	30.84 (5.55)
Brahma hybrid	42.34 (6.43)	49.34 (7.04)	81.84 (9.04)	25.16 (5.00)	662.84 (25.71)	652.16 (25.44)	3.00 (1.77)	1.84 (1.42)	5.84 (2.37)	10.84 (3.20)	19.66 (4.40)
SEm±	0.35	0.12	0.27	0.29	0.47	0.81	0.25	0.21	0.34	0.24	0.19
CD (*p*=0.05)	1.04	0.36	0.81	0.86	1.41	2.42	0.76	0.63	1.02	0.72	0.56

WAS: Weeks after sowing; Figures in parentheses are square root transformed values

Table 2: Incidence of boll worm complex in MECH 162 BT., Non-MECH 162 Bt. and Brahma cultivars (*Kharif*, 2002)

Treatments	Mean number of *E. vittella* larvae 5 plants^{-1}	Mean number of *H. armigera* larvae 5 plants^{-1}							Mean number of *S. litura* larvae 5 plants^{-1}
	6 WAS	8 WAS	6 WAS	7 WAS	8 WAS	9 WAS	15 WAS	17 WAS	19 WAS	9 WAS
MECH 162 Bt	2.50 (1.65)	4.34 (2.19)	0.66 (1.04)	0.84 (1.13)	0.84 (1.13)	2.41 (1.66)	5.66 (2.41)	1.16 (1.27)	0.34 (0.89)	1.84 (1.46)
MECH 162 non-Bt	5.00 (2.34)	5.50 (2.43)	1.00 (1.19)	2.34 (1.63)	5.66 (2.47)	4.50 (2.14)	9.34 (3.13)	5.16 (2.17)	0.84 (1.13)	2.81 (1.76)
Brahma hybrid	5.34 (2.40)	6.16 (2.57)	2.34 (1.67)	2.16 (1.58)	5.00 (2.30)	5.00 (2.34)	7.84 (2.85)	4.84 (2.27)	1.50 (1.41)	4.84 (2.29)
SEm±	0.13	0.08	0.09	0.11	0.14	0.16	0.16	0.10	0.08	0.13
CD (p=0.05)	0.39	0.24	0.27	0.33	0.42	0.47	0.49	0.29	0.25	0.40

WAS: Weeks after sowing; Figures in parentheses are square root transformed values

in the present study confirmed the reporting of Barwale et al., (2002).

4. Conclusion

The sucking pest incidence started at 3rd weeks after sowing (WAS) till 19th week of the crop period. Among the three cotton cultivars, MECH 162 non-Bt cotton supported more sucking pest population whereas, Brahma and MECH 162 Bt proved to resistant to sucking pests. The bollworms were noticed from 4th WAS till 14th WAS; low in MECH 162 Bt. The highest number of *Earias* larvae were highest at 11th WAS in MECH 162 non-Bt. The larval incidence of *Helicoverpa* was very low from 6th to 9th WAS in MECH 162 Bt-cotton, followed by MECH 162 non-Bt and Brahma.

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