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INFLUENCE OF BT COTTON FED HERBIVORES ON THE FECUNDITY AND LONGEVITY OF *CHRYSOPERLA CARNEA* (STEPHENS)

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ABSTRACT

An experiment was conducted to study the influence of Bt cotton fed herbivores on the fecundity and longevity of *Chrysoperla carnea* (Stephens) and it was found that there was non-significant Bt cotton mediated effect on the performance of *C. carnea* indicating the safety of Bt cotton to non-targets. However, influenced performance of *C. carnea* was found due to prey suitability. The results revealed that fecundity and longevity of *C. carnea* was significantly influenced by different prey herbivores. High fecundity of *Chrysoperla* was also found on Bt cotton fed aphids as 418 eggs/female, followed by eggs and neonates of Helicoverpa as 360.60 eggs/female, followed by nymphs of jassids as 342.40 eggs/female. The maximum longevity of *Chrysoperla* adult male and female was recorded on Bt cotton fed aphids (26.00 and 39.20 days) than on other preys. Whereas jassids fed on Bt cotton showed least prey suitability as prey to its predator, *Chrysoperla carnea*. Thus, the data on fecundity and longevity revealed that the aphids were the most suitable prey for *C. carnea* followed by *H. armigera*, whereas, leafhopper was least suitable prey among the tested ones.

INTRODUCTION

Bt cotton, expressing Cry proteins derived from the soil bacterium *Bacillus thuringiensis* are the only insecticidal genetically engineered (GE) plants that are currently grown commercially in India. In 2007, more than 42 million hectares of *Bt*-transgenic cotton and maize varieties, expressing either lepidopteran or coleopteran specific Cry proteins, were grown worldwide (James 2007). One of the widely discussed environmental impacts of genetically modified (GM) crops is their potential effect on non-target organisms including biological control agents (Dale *et al*., 2002; Conner *et al*., 2003). Before approving field release of transgenic plants, regulatory authorities require data on their environmental safety. Insect-resistant plants may have the potential to harm beneficial non-target natural enemies such as predators and parasitoids. When pest control has negative impacts on natural enemies, this may result in disruption of biological or integrated control, leading to pest outbreaks (Ito *et al.*, 2005).

Transgenic crops may have several types of environmental impacts (Wolfenbarger and Phifer, 2000),

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and some of the less obvious ones, such as indirect effects on beneficial organisms and on ecological interactions, are overlooked or understudied (Lovei and Arpaia, 2005). Transgenic crops may have a direct toxicological effect on populations of non-target organisms (Wolfenbarger and Phifer, 2000). Other indirect effects can emerge when predators consume prey that accumulate insecticidal proteins produced by the transgenic crop (Dutton *et al.*, 2002). Therefore, to study any possible impact of *Bt* cotton on fecundity and longevity of Chrysoperla, the present investigation was planned.

MATERIAL AND METHODS

A laboratory experiment was conducted in Biocontrol laboratory at Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2010-11 with 6 treatments replicated 5 times in Completely Randomized Design. The population of preys, Aphids, *Aphis gossypii*, Leaf hoppers, *Amrasca biguttula* biguttula Ishida and *H. armigera* were collected from the field and brought to laboratory and were offered to their natural enemy Green lacewing, *Chrysoperla carnea* for feeding to study the prey suitability for *Chrysoperla carnea* among the herbivores, aphids, leaf hoppers and *Helicoverpa*. Initial culture of *C. carnea* was procured from Entomology section, College of Agriculture, Nagpur and was reared in laboratory on eggs of Rice moth, *Corcyra cephelonica* until required in the experimentation. The preys were provided twice, once during morning at 9 hrs and thereafter in the evening at 17.00 hrs. The number of preys consumed and not consumed were recorded daily. The data on all relevant observations, thus obtain were subjected for appropriate statistical CRD analysis as per Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Influence of different preys on Adult longevity of *C. carnea*

The data presented in Table 1 revealed that the male longevity of *C. carnea* has been significantly influenced by different preys irrespective of Bt. The longevity of *Chrysoperla* male adult with non-Bt cotton fed aphids was 26.53 days which was significantly maximum as compared to other treatments except T_1 and T_4 with Bt fed Cotton aphids and *Bt* cotton fed *Helicoverpa* wherein *Chrysoperla* male took 26.00 and 25.93 days to complete the adult period, respectively. It was fol-

Table 1. Influence of different preys on adult longevity of *C. Carnea*

Treatment	Adult male longevity in days						Adult female longevity in days					
	R_1	R2	R3	R4	R5	Mean	R1	R2	R3	R4	R5	Mean
Aphids Bt cotton fed	25.67	26.33	26.00	26.00	26.00	26.00	39.67	38.67	39.67	38.67	39.33	39.20
Jassids Bt cotton fed	24.33	23.33	23.67	24.00	23.00	23.67	33.67	34.67	35.33	35.33	36.00	35.00
Helicoverpa eggs and neonates (Bt cotton fed)	25.67	26.00	25.67	25.33	27.00	25.93	35.67	36.67	38.33	37.00	37.33	37.00
Aphids non-Bt cotton fed	25.00	26.00	27.33	27.33	27.00	26.53	37.33	39.67	38.67	38.00	37.33	38.20
Jassids non-Bt cotton fed	24.00	23.00	23.67	23.67	24.67	23.80	34.67	37.00	36.67	33.33	34.33	35.20
Helicoverpa eggs and neonate (non-Bt cotton fed)	24.33	24.67	26.00	27.00	25.00	25.40	37.00	34.67	35.67	37.33	36.67	36.26
'F' Test						Sig.						Sig.
SE(m) ±						0.331						0.469
CD at 5%						0.975						1.371

Table 2. Influence of different preys on fecundity of C. carnea

Treatment	No. of eggs laid/ female *Chrysoperla*					
	R1	R2	R3	R4	R5	Mean
Aphids Bt cotton fed	418.33	419.00	417.33	416.33	419.00	418.00
Jassids Bt cotton fed	321.00	330.33	348.33	357.67	354.67	342.40
Helicoverpa *eggs and neonates* (Bt cotton fed)	337.33	353.33	372.00	359.33	381.00	360.60
Aphids non-Bt cotton fed	417.33	414.00	416.00	416.33	413.67	415.47
Jassids non-Bt cotton fed	340.67	344.33	344.67	340.67	342.33	342.53
Helicoverpa eggs and neonate (non-Bt cotton fed)	366.00	357.67	362.00	360.33	366.00	362.40
'F' Test						Sig.
SE(m) ±						4.328
CD at 5%						12.637

lowed by treatment T_6 which recorded 25.40 days and was at par with treatment T_4. The results obtained in the present studies were in accordance with some of the earlier reports by Geethalakshmi *et al.* (2000) and Dhepe (2001).

Influence of different preys on female longevity of *C. carnea*

Maximum *Chrysoperla* female longevity was observed on Bt cotton fed aphids recording 39.20 days followed by 38.20 days on non-*Bt* cotton fed aphids, both being at par with each other. The next superior prey was eggs and neonates of *H. armigera* fed on *Bt* cotton recording 37.00 days female longevity and was at par with treatment T_4. Treatment T_3 was followed by treatment T6 where the *Chrysoperla* was provided with eggs and neonates of *H. armigera* fed non-Bt cotton recording 36.26 days *Chrysoperla* female longevity. Significantly short female longevity of *Chrysoperla* was recorded on jassids both on *Bt* and non-Bt fed cotton recording 35.00 and 35.20 days and both the treatments were at par with Treatment T_6. Prolonged female longevity may lead to more fecundity and hence, cotton aphids were found to be the most accepted prey for *Chrysoperla* as compared to other two hosts tested in the experiment (Table 1). However, Khulbe *et al.* (2005) reported more prolonged (49.67 days) adult longevity on neonates of *H. armigera* which is contradictory to the present findings. As far as *Bt* cotton (plant) mediated effect on the longevity of *Chrysoperla* female was concerned, the data was statistically non-significant.

Influence of different preys on fecundity of *C. carnea*

The data in Table 2 revealed significant differences among the preys recording significantly maximum egg laying of 418.00 eggs closely followed by 415.47 eggs when *C. carnea* was provided with *Bt* and non-*Bt* cotton fed aphids, both being at par with each other and significantly superior over rest of the preys. The next preferred prey was eggs and neonates of *H. armigera* on which the *Chrysoperla* showed fecundity of 362.40 and 360.60 eggs per female when *Helicoverpa* was fed on non-*Bt* and *Bt* cotton. However, as far as cotton jassids as prey of *Chrysoperla* was concerned, similar trend was observed as in other observations where significantly minimum egg laying was observed irrespective of the host plants on which jassids fed. Thus, more fecundity on aphids followed by *Helicoverpa* and then jassids indicated the prey preference of *Chrysoperla* in that order. Results on similar line were obtained by some of the earlier workers as Dhepe (2001) observed highest fecundity of 422.08 eggs/female on on *A. gossypii* than *A. craccivora* (165.00 eggs/female) which supports the present findings.

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