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BIOLOGICAL CONTROL OF SUGARCANE BORERS WITH INUNDATIVE RELEASE OF *TRICHOGRAMMA CHILONIS* (ISHII) (HYMENOPTERA: TRICHOGRAMMATIDAE) IN FARMER FIELDS

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Releases of *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae), were made in farmer's fields in Shorkot, District Jhang, Punjab, Pakistan on three sites covering eight locations for the biological control of sugarcane borers, (*Scirpophaga nivella* F.; *Chilo infuscatellus* Snellen; *Emmalocera depressella* Swin. and *Acigona steniella* (Hampson) in 2005. Perusal of data revealed that an average borer damage decreased to 43.1% at Chak 496/JB, 42.3% at Chak 701/43-GB and 35.1% at Chak 411/JB in biological control plots in comparison to check plots. Comparison of borer damage between bio-control and check fields in different sites showed effectiveness of *T. chilonis* to suppress the borer damage below to economic threshold level.
Keywords: Biological control, *Trichogramma chilonis,* sugarcane borer management

INTRODUCTION

Sugarcane, *Saccharum officinarum* L., is one of the important cash crops which provides raw material to sugar industry, the 2nd largest industry after textile in Pakistan having share of in valueaded of agriculture is 3.6 and to GDP is 0.8%. During the year 2009, sugarcane was grown on an area of 1029 thousand hectares of 17.1% less than under crop during past year with total production of 50.0 million tons a decrease of 21.7% in production as compared to the previous years, but the yield remained 48635 Kg/ha with 5.6% less/ha which is below the yield potential of existing sugarcane cultivars (Anonymous, 2009). There are many factors which are responsible for this low yield, among them severe attack of insect pests at early and mature stages of crop are the most significant one. Sugarcane borers are the most injurious among the pests attacking this crop (Ashraf and Fatima, 1980). These includes top borer, *Scirpophaga nivella* F. (Lepidoptera: Pyralidae); stem borer, *Chilo infuscatellus* Snellen (Lepidoptera: Crambidae); root borer, *Emmalocera depressella* (Swinhoe) (Lepidoptera: Pyralidae) and Gurdaspur borer, *Acigona steniella* (Hampson) (Lepidoptera: Crambidae). Borers may reduce the yield up to 80% (Kalra and Sidhu, 1955). The damage caused by borers not only reduces the crop yield but also affects the sucrose contents of cane. Naqvi *et al*. (1978) have reported a gross negative correlation between the intensity of infestation and sucrose contents and recorded reduction of sucrose beyond 10% borer infestation on internode basis. The damage is done by larvae which feed inside the cane and are difficult to control with insecticides. More over the heavy use of pesticides created problems like pest resurgence, outbreak of secondary pests, environmental pollution. To overcome these problems, the cultural control and biological control can give effective pest control (Huffaker, 1980). Biological control of these borers with parasitoids and predators is therefore gaining importance.

Among parasitoids*, Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) is a polyphagous egg parasitoid of lepidopterous pests of crops. It has been used as an effective bio-control agent against sugarcane borers for the last two decades in provinces of Punjab and Sindh in Pakistan (Hashmi and Rahman, 1985). *T. chilonis* releases have given successful control of *A. stenella* Hampson (Hamid *et al*., 1998) and *C. infuscatellus* Snellens (Shahid *et al*., 2007). Effective release rate of *T. chilonis* for sugarcane borers is 15000 to 30000 parasitoids per acre (Khan and Alam, 2001) *T. chilonis* have been exploited against havoc of lepidopterous pests as triumph of integrated pest management of sugarcane borers (Cock, 1985; Cheng, 1986; Ashraf *et al*., 1993; Goebell *et al*., 2006). *T. chilonis* is a species specific, long lasting affects, economical, environment friendly and easy to handle. Inundative releases of *Trichogramma* during 1989-91 in experimental plots of BL-4 variety reduced the borer infestation to 4.2% as compared to 16.2% in check plots (Ashraf *et al*., 1995). Mustafa *et al*. (2006) released 16 cards of *T. chilonis* per acre

fortnight and each card having 400-500 eggs per card, in farmer fields from April to September 2003 and recorded internode damage from 3.9 to 10.5% in treated and 9.6 to 18.6% in untreated plots. Present study was therefore conducted to see the effectiveness of *T. chilonis* as bio-control agent against sugarcane borers in farmer fields on different locations.

MATERIALS AND METHODS

Studies were conducted at farmer's fields in Shorkot District Jhang, Punjab, Pakistan during 2005 at three different sites having eight locations in each site *viz*., Chak No. 496/JB, 701/43-GB and 411/JB located distant apart from each other. At each site 25 acres were treated with *T. chilonis* and 8 acres were kept as untreated check. No pesticides were used in the cropped area. Standard agronomic practice includes irrigation, weeding, hoeing and recommended doses of fertilizers were applied as per requirement of the crop. After the appearance of moths, the weekly releases of *T. chilonis* from March to September were made in bio-control plots with tricho cards having 2000-2500 parasitoids eggs near to emerge installed on lower side of leaves opposite to the direction of sun. These tricho cards prepared in bio-control laboratories of Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad by pasting parasitoids eggs on light green paper cards. The borer's damage was recorded from 8 locations at each site before harvesting. Combined percent damage was recorded by dividing each field into two parts and 25 randomly selected mature canes from each part of the field were examined on internode basis as described by Hall (1986). Data under study was subjected to statistical analyzed by using MSTATC software program using ANOVA techniques, followed by Duncan's new multiple range test to means (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Results about sugarcane borer damage to canes in bio-control fields (75 acres) where parasitoids, *T. chilonis* were released and in comparison to check fields (25 acres) on three sites at 8 different locations are presented and discussed as under.

At Chak no. 496/JB, in treated plots borer damage (F=1.1209, df= 7, P =0.4033) was in the ranged from 7.6-12.2% at 8 locations with a mean damage of 10.2% (Table 1) which was at par with the economic threshold level. The borer damage in check plots (F =5.2118, df= 7, P =0.8946) ranged 15.9-20.3% with a 17.9% mean damage. Reduction in borer damage in bio-control plots ranged 28.4-52.2 % with a mean reduction of 43.1%. At Chak no. 701/43-GB, borer damage in bio-control plots (F =5.3192, df= 7, P =0.0039) ranged 9.4-12.7% with a mean damage of 10.9% (Table 2). The borer damage in check plots (F =1.6536, df= 7, P =0.2003) ranged 16.2 to 21.6% with a 18.9% mean damage. Reduction in borer damage was ranged from 35.6 to 48.3% with a mean of 42.3%. At Chak no. 411/JB borer damage in bio-control plots (F =2.4479, df= 7, P =0.0730) ranged 9.0 to 15.4%, with a mean damage of 11.4% (Table 3). The borer damage in check plots (F =2.7950, df =7, P =0.0482) was in the range of 15.4 to 20.8% with a 17.6% mean damage. Reduction in borer damage in bio-control fields ranged 29.9 to 46.4% with a mean of 35.1%.

Table 1. Percent borer damage at Chak No. 496/JB

Locations	Total crop area (acres)	Bio-control plot area (acres)	Check plot area (acres)	Borers damage in bio-control plots (%)	Borers damage in check plots (%)	Reduction in borer damage (%)
1	16	15	1	7.6±1.1 ab	15.9±1.8 ab	52.2
2	3	2	1	10.7±0.8 a	20.3±1.1 a	47.5
3	2	1	1	9.3±1.6 a	18.4±1.6 a	49.4
4	3	2	1	11.6±1.7 a	19.4±2.2 a	40.2
5	2	1	1	12.2±1.7 a	18.5±2.8 a	34.0
6	2	1	1	11.8±1.2 a	16.5±1.5 a	28.4
7	2	1	1	9.5±2.2 a	16.9±1.8 a	43.7
8	3	2	1	8.9±0.8 a	17.6±1.0 a	49.4
Total/Mean	33	25	8	10.2±0.57	17.9±0.53	43.1±2.96

Mean ±SE, sharing similar alphabets in each column do not differ significantly at P <0.05.

Table 2. Percent borer damage at Chak No. 701/43-GB

Locations	Total crop area (acres)	Bio-control plot area (acres)	Check plot area (acres)	Borers damage in bio-control plots (%)	Borers damage in check plots (%)	Reduction in borer damage (%)
1	8	7	1	9.5±1.3 cd	16.2±1.0 b	41.3
2	8	7	1	12.7±0.5 ab	21.6±1.9 a	41.2
3	3	2	1	11.3±0.6 abc	20.2±2.0 ab	45.8
4	3	2	1	11.6±0.4 abc	19.4±1.4 ab	40.2
5	3	2	1	13.2±0.5 a	20.5±0.8 ab	35.6
6	2	1	1	9.4±0.6 d	17.8±1.6 ab	47.1
7	4	3	1	10.5±0.4 bcd	17.3±1.1 ab	39.3
8	2	1	1	9.5±1.1 cd	18.4±1.8 ab	48.3
Total/Mean	33	25	8	10.9±0.5	18.9±0.64	42.3±1.53

Mean ±SE, sharing similar alphabets in each column do not differ significantly at *P* <0.05.

Table 3. Percent borer damage at Chak No. 411/JB

Locations	Total crop area (acres)	Bio-control plot area (acres)	Check plot area (acres)	Borers damage in biocontrol plots (%)	Borers damage in check plots (%)	Reduction in borer damage (%)
1	9	8	1	10.9±1.7 b	16.8±1.3 bc	35.1
2	10	9	1	11.6±1.2 b	17.2±0.7 bc	32.5
3	2	1	1	12.2±1.1 ab	18.9±0.9 ab	35.4
4	2	1	1	15.4±0.8 b	20.8±1.2 a	25.9
5	3	2	1	10.8±1.9 b	16.6±1.1 bc	34.9
6	2	1	1	11.3±0.5 b	19.0±1.3 ab	40.5
7	2	1	1	9.0±0.8 b	16.8±0.7 bc	46.4
8	3	2	1	10.7±1.9 b	15.4±0.7 c	30.5
Total/Mean	33	25	8	11.4±0.64	17.6±0.61	35.1±2.20

Mean ±SE, sharing similar alphabets in each column do not differ significantly at *P* <0.05.

Comparison of results among the sites showed the effectiveness of *T. chilonis* in suppression of borer pests in bio-control plots were at par to economic threshold level. Further more as our results showed that on large scale area at farmer field the bio-control with *T. chilonis* is successful. Our results are in the line to the results reported by Ashraf *et al*. (1993) that borer damage in canes on inter node basis at the time of harvest was in the range of 4 to 35.5% with an average of 14.1%. The inundative releases of *T*. *chilonis* in experimental plots reduced the borer infestation to 4.2% as compared to check plots with 16.2% infestation. The results of present study was in agreement to the findings of Ashraf *et al*. (1995) who reported that the borer damage on internodes basis ranged from 4.2 to 6.8% in treated plots by *T. chilonis* as compared with 15.7 to 24.6% in the control on variety BL-4. Results reported by Rana *et al*. (2007) are nearly at par to our findings that got 11.33 and 12.65% borer damage to canes in year 2002 and 2003 in check plots, respectively, while 6.75 and 6.4% in year 2002 and 2003 in *T. chilonis* released plots respectively. Mishra *et al*. (1997) have reported borer damage of 9.8 and 12.6% in 1994 and 1995, respectively; these results are in the line of our study. It was inferred from the present study that inundative weekly releases of *T. chilonis* in sugarcane crop for suppression of borer pests has gave effective control measure without any side effects to the crop and environment.

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