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EFFICACY OF *TRICHOGRAMMA CHILONIS* ISHII IN COMPARISON WITH TWO COMMONLY USED INSECTICIDES AGAINST SUGARCANE STEM BORER *CHILO INFUSCATELLUS* SNELLEN (LEPIDOPTERA: PYRALIDAE)

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ABSTRACT

Relative effectiveness of egg parasitoid *Trichogramme chilonis* and the two commonly used insecticides, Basudin 60 EC and Furadan 3G against sugarcane stem borer *Chilo infuscatellus* was evaluated in sugarcane fields under RCB design. Results revealed that highest mean percent parasitism was observed in (Trichocard released plot (T3) 50.46 followed by check plot) (T4) 12.54 while in Basudin treated plot (T1) mean percent parasitism was 8.70 and in Furadan treated plot (T2) the mean percent parasitism was 7.91. All these treatments were found effective for the management of sugarcane stem borer. However the cost and benefit analysis shows that maximum return (84.788) was obtained from Trichocards released plots so, trichocards are recommended for the management of sugarcane stem borer instead of insecticides. Moreover, this practice may have significant role to protect the soil and conserve the natural resources from insecticides contamination.

Key words: *Trichogramma chilonis* Ishii, insecticide, *Chilo infuscatellus*, Control.

INTRODUCTION

The importance of sugarcane (*Saccharum officianarum L.*) in the agrarian economics of Pakistan needs no emphasis because of its higher value as a cash crop, a major source of white sugar, shakkar and gur (Hussain *et al*., 2007). Sugarcane crop is currently facing severe crisis in the country and both farming community and the industry are striving for its sustainable existence and growth. The major challenges faced by the crop are lower than average per area production, low sugar recovery and higher cost of production. Regardless of pronounced developments in sugarcane research and expansion in sugar industry, our national average sugarcane yield is 49.00 tones per hectare, whereas, the potential is between 150-250 tones per hectare (Arian *et al*., 2011). There are several reasons for this low yield but different types of borers are the most serious pests of sugarcane, of which the stem borer (*Chilo infuscatellus*) is the most notorious and destructive one. The stem borer is active from March to November and passes the winter as full grown larvae in the stubble. The damaged plants attacked by this pest produce dead hearts during growing season till the formation of canes; its attack is confined to internodes only. It reduce sugarcane yield from 30-70 percent (Shahid *et al*., 2007). Among biological agents for stem borer, moth-egg parasitoid, Trichogramma species is now most widely used for its control. A Trichogramma wasp belongs to the family Trichogrammatidae of order Hymenoptera; these are tiny (0.5 mm long) parasitoids that attack the eggs of over 200 species, mostly Lepidopterans (Farmanullah *et al*., 2011). These occur naturally but in most crop production system, the number of moths' eggs destroyed by native population of *Trichogramma sp* is not sufficient to prevent pest population from damaging level. Trichogramma wasp are reared and released in the affected fields as a biological control agent. (Knutson, 2000 and Shenhmar *et al*. 2003)

Studies indicated that phenology of egg parasitoid *T. chilonis* is not well synchronized with its host, *Chilo infuscatellus*. The host starts oviposition in the March and continues till the end of September. *Trichogramma chilonis* started parasitizing host eggs at July when stem borer had already completed its 3-generations it continues to parasitized eggs till October but its incidence increased from July onward so the releases must be started as soon as the host eggs oviposition started in the field, depending on the prevailing temperature of the locality (Muhammad *et al.* 2007).

The present studies were carried out at Bhalwal areas to study the efficacy of widely used insecticides (Basudin 60 EC and Furadan 3G) in comparison with *Trichogramma chilonis* and calculate cost benefit ratio for the treatments.

MATERIALS AND METHODS

The effectiveness of the *Trichogramma chilonis* in comparison with two commonly used insecticides i.e. Basudin 60EC and Furadan 3G were evaluated against sugarcane stem borer *Chilo infuscatellus*, the experiment was laid out in RCB design with four treatments replicated three times and was conducted from February to December 2006 in Bhalwal Sargodha, Punjab Pakistan, The data recorded were statistically analyzed through 2-way ANOWA in MSTAT C package (Michigan State University, 1991), and means for different parameters were separated by applying least significant difference (LSD) test at 0.05 % level of probability to know their significance status (Steel *et al*., 1997) followed the procedure as applied by Ahmad, *et al*. 2009.

Pesticide application and trichocards releases: For this purpose 200 acres of land under sugarcane cultivation was selected at Noon Sugar Mills area. The field was divided into 3 plots each plot was sub divided into 4 plots. A buffer area of 5 acres was maintained between the treatments. Basudin 60 EC @ 500 ml/acre was applied with irrigation water (by making a hole in the led of the Basudin pack and were placed up side down above irrigation water channel at the entry point to sugarcane field). Furadan 3G @ 14 kg/acre was applied (by broadcast method) to sugarcane field. Soon after the application of the treatments, plots were irrigated to make the poisons available to the plant. Similarly the parasitoid cards (Trichocards each of 1½ x 2½ inches) of *Trichogramma chilonis* from which adult were ready to emerge within about 24 hours were stapled in the fields @ 30 cards/acre each card having almost 3500 *Sitotroga cerealella* eggs parasitoized by *Trichogramma chilonis* .

Percent infestation: For % infestation the data was recorded on 50 canes that were randomly selected from 5 different places in each plot and was taken on the inter node damage by dissecting 50 canes from each plot from mid June onward till October. The percent infestation was determined by this formula.

$$\text{Percent Infestation} = \frac{\text{No. of dead hearts}}{\text{Total No. of canes}} \times 100$$

Percent parasitism: To determine the percent parasitism of *T. chilonis*, 100 canes (25 canes from each corner of the plot) were examined for borer eggs at 15 days interval. The leaves with egg batch of sugarcane stem borer *C. infescatellus* were cut in size of 2 inch from the cane and kept in the Petri dish with moist tissue paper to keep the leaf of sugarcane fresh and then were brought to laboratory for rearing and hatching of the eggs for the emergence of parasitoid (*T. chilonis*). The percent parasitism was determined by the following formula.

$$\text{Percent parasitism} = \frac{\text{No. of eggs parasitized}}{\text{Total No. of eggs}} \times 100$$

Benefit Cost Analysis of the Treatments: Cost benefit ratio was determined by using J.C. Headly (1982) rules by having (PY),

which is: P = Unit price
Y = Physical yield of given quantity

When the cost benefit ratio equals to 1, then the cost of prevention will be equal to cost of damage. In order to find out the cost/benefit analysis of the treatment versus control. Total yield was converted into yield/ha. The yield/ha were then multiplied with unit price of the cane to get gross income of the treatment. The incremental return was obtained by subtracting the gross income from the check plot income. The cost of treatment was calculated on hectare basis. The application cost (Technical labour etc) was added to cost of treatment to get total cost. The net benefit was obtained by subtracting the total cost of treatment from the grass income of the treatments. Cost Benefit ratios were calculated through gross income divided by total cost. The greater the C. B ratio indicated the efficiency of the treatment.

RESULTS AND DISCUSSION

Efficacy of selected and commonly used insecticides Basudin 60EC and Furadan 3G was evaluated in comparison with *Trichogramma chilonis* application, data were obtained for the percent infestation by sugarcane stem borer and percent parasitism of *Chilo infascatellus* eggs by *Trichogramma chilonis* and their comparison in terms of cost benefit ratio are presented in tables 1-3.

Percent infestation: The percent infestation in Basudin treated plot (T1) varies from 1.26 to 0.61 with a mean of 0.84 while in Furadan treated plot (T2) percent infestation varies from 1.19 in April to 0.69 in August with an average of 0.99. The percent infestation in (T3) trichocard released plot varies from 2.29 April to 0.23 Sept with an average of 1.08 as compared to check plot (T4) having maximum percent infestation 9.98 in June to 4.99 in Sept. Though the results of all the 3 treatments were non significant to each other. However they will significantly different from the check plot (T4) and Basudin (T1) was more effective than Furadan (T2) and finally the Trichocard (T3) was having its impact. Since the two chemicals (Basudin and Furadan) and the trichocards were non significant to each other in case of percent infestation by sugarcane stem borer, it is suggested that chemical control of sugarcane stem borer be replaced by trichocard release. In this case our results coincide with (Muhammad *et al.,* 2007). where he worked on effectiveness of *Trichogramma chilonis*

against sugarcane borer and achieves similar results, besides; this is more environment friendly and carry no health problem. (Selvaraj *et al.,* 1994) also worked on the effectiveness of the same biological agent against this pest and achieve positive results. Moreover, the cost/benefit ratio show that Trichocards are very cheapest and do not need any equipment or skilled person for application.

Percent parasitism: The analysis of data revealed that maximum percent parasitism was observed in trichocard released plot (T3) varies from 22.02 to 74.28 with an average of 50.96 followed by control plot (T4) where parasitism varies from 4.480 in April to 20.39 in Sep. with an average of 12.54. Similar results were also achieved by Shahid *et al*., (2007), Rachappa and Naik, (2000), Aheer; (1994) with a little variation that may be due to small experimental area while in our case we applied the same dose on large area. While the percent parasitism in Basudine treated plot (T1) varies from 3.84 in April to 15.57 in September with an average of 8.70 while in Furadan treated plot (T2) the percent parasitism varies from 4.18 to 14.88 with an average of 7.91 was recorded.

Table-1. Percentage infestation in case of insecticide application along with the releases of *Trichogramma chilonis*.

S/No.	Treatment	Dose	April	May	June	July	Aug	Sep	Seasonal Mean
1.	Basudine	2-3 litres/acre	1.26^{b} ± 0.61	0.28^{b} ± 0.16	1.06^{b} ± 0.30	1.02^{b} ± 0.24	0.86^{b} ± 0.24	0.61^{b} ± 0.48	0.84^{b} ± 0.35
2.	Furadan	5 kg/acre	1.19^{b} ± 0.63	0.96^{b} ± 0.09	0.99^{b} ± 0.58	1.24^{b} ± 0.76	0.69^{b} ± 0.76	0.89^{b} ± 0.47	0.99^{b} ± 0.20
3.	Trichocards	30 cards per acre	2.29^{b} ± 0.66	1.09^{b} ± 0.38	1.36^{b} ± 0.23	1.04^{b} ± 0.32	0.49^{b} ± 0.32	0.23^{b} ± 0.13	1.08^{b} ± 0.72
4.	Control	No treatment	8.49^{a} ± 2.34	9.36^{a} ± 1.85	9.98^{a} ± 0.38	7.81^{a} ± 0.94	6.01^{a} ± 0.94	4.99^{a} ± 1.59	7.77^{a} ± 1.94
	LSD		2.709	1.747	7.686	1.225	1.365	1.776	1.137

Means in column followed by the same letters are non significant at 5% level of probability.

Table-2. Percentage parasitism in case of insecticide application along with the releases of *Trichogramma chilonis*.

S/No.	Treatment	Dose	April	May	June	July	Aug	Sep	Seasonal Mean
1.	Basudine	2-3 litres/acre	3.84^{b} ± 0.59	6.88^{b} ± 1.69	7.28^{c} ± 1.38	8.48^{c} ± 2.03	10.19^{c} ± 1.52	15.57^{c} ± 0.58	8.70^{b} ± 3.96
2.	Furadan	5 kg/acre	4.18^{b} ± 0.43	4.84^{b} ± 0.90	6.45^{b} ± 0.67	7.60^{c} ± 2.01	9.51^{c} ± 1.15	14.88^{c} ± 0.96	7.91^{b} ± 3.92
3.	Trichocards	30 cards per acre	22.02^{a} ± 2.06	33.97^{a} ± 2.98	45.63^{a} ± 2.17	57.87^{a} ± 5.08	69.02^{a} ± 3.04	74.28^{a} ± 1.96	50.46^{a} ± 20.35
4.	Control	No treatment	4.48^{b} ± 0.75	8.21^{b} ± 1.59	8.99^{b} ± 1.7	14.75^{b} ± 0.87	18.42^{b} ± 1.43	20.39^{b} ± 0.92	12.54^{b} ± 6.28
	LSD		2.457	4.321	2.641	4.595	3.366	4.760	9.99

Means in column followed by the same letters are non significant at 5% level of probability.

Table- 3: Cost/Benefit analysis of insecticides and Trichocards.

Treatments	Seasonal mean percent infestation[1]	Estimated Yield/ha (monds-40kg)	Gross income @ Rs.40/40kg	Estimated cost/ ha			Incremental Return	Net Benefit	Cost /Benefit Ratio
				Treatment Cost	Cost of Application	Total Cost			
Basudin 60EC	0.84b	1836.93	73477.2	1358.5	123.5	1482	5134.8	71995.0	49.579
Furadan 3G	0.99b	1834.16	73366.4	1482	247	1729	5024.0	71637.4	42.432
Trichocards	1.08b	1832.49	73299.6	741	123.5	864.5	4957.2	72435.1	84.788
Control	7.77a	1708.56	68342.4	-	-	-	-	68342.4	-

As the result in the percent infestation of all the treated plots are non significant to each other and insecticide has negative effect on the natural parasitism of *Trichogramma chilonis*. Therefore, Trichocards should be used for the management of *Chilo infescatolus* in sugarcane crop.

Cost Benefit Analysis of Insecticides and Trichocards: As from the results of it is obvious that Basudin 60EC, Furadan 3G and Trichocards affected all the treatments non significantly and maximum net return was recorded for Trichocard release as compared to other treatment. The Furadan 3G was less economical as compared to Basudin 60EC. Furthermore, the cost benefit ratio of the treatments show that Trichocards are more economical because maximum ratio of cost/benefit was recorded 4.73 as compared to insecticides, Basudin 60 EC, with cost benefit ratio of 2.46 and Furadan 3G of 1.90 as compared to check plot with cost benefit ratio of 1.

Conclusion and Recommendations: Based on these results, it is concluded that Trichocard release was the best and environment friendly substitute for the chemical control in managing the deadly sugarcane stem borer, and triple release in comparison to single and double release had more impact on reducing the sugarcane stem borer infestation that resulted high Cost Benefite Ratio so triple release of Trichocard is recommended.

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