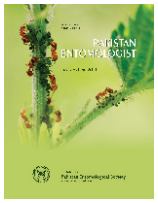
Pakistan Entomologist

Journal homepage: www.pakentomol.com



EXISTENCE OF A NATURAL POPULATION OF *TRICHOGRAMMA* SPP. (HYMENOPTERA: TRICHOGRAMMATIDAE) IN SUGARCANE PLANTED NEAR AND AWAY FROM COTTON

Muhammad Hasnain[1]*, Sajid Nadeem[2], Muhammad Ishfaq[3], Muhammad Kashif Nadeem[3], Muhammad Hamed[2], Dilbar Hussain[4], Syed Faisal Ahmad[3] and Noor Abid Saeed[2]

[1]Entomological Research Station, Multan
[2]Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad
[3]Pest Warning and Quality Control of Pesticides, Punjab. Lahore
[4]Entomological Research Institute, Faisalabad

ARTICLE INFORMATION

Received: January 31, 2013
Received in revised form: January 6, 2014
Accepted: February 15, 2014

***Corresponding Author**:
Muhammad Hasnain
Email: hasnain_acoubl@yahoo.com

ABSTRACT

Sugarcane (*Saccharum officinarum* L.), is a cash crop of Pakistan that is grown to meet the raw material demands of local sugar industry. Insect pests of this crop, mainly the borers, causes the decline of quality and yield. Among the biological pest control strategies, the parasitoids, *Trichogramma* spp., are widely known as bio-control agent of sugarcane borers. An experimental field trial was carried out at five locations in Vehari District of Pakistan. The percent parasitism of 2,000 eggs of the host insect *Sitotroga cerealella* set out on paper cards in each field by naturally occurring *Trichogramma* spp. estimated the degree of parasitism in each field. Percent parasitism of *S. cerealella* host eggs by *Trichogramma* spp. in sugarcane fields was higher in fields that were isolated from cotton fields (2.7 to 16.5%) than in cane fields surrounded by cotton fields (0.0 to 5.6%). It was concluded from the present study that naturally occurring population of parasitoids, *Trichogramma* is affected in sugarcane crop grown near cotton growing areas and this may be due to higher use of insecticides in the cotton growing areas.

Keywords: Biological control, Chacidoidea, Crambidae, Lepidoptera,

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.), is a cash crop of Pakistan that is grown to meet the raw material demands of local sugar industry. It contributes 3.7% in value added of agriculture and 0.8% to GDP. In Pakistan, during the year 2011, sugarcane was grown on an area of 1046 thousand hectares, 5.9% higher than that of last year with production of 58.3 million tons (Anonymous, 2012). Many factors that are responsible for less production in Pakistan, as compared to other countries, include: shortage of irrigation water; amount of fertilizer applied; shifting of arable land to other crops; and, severe attack of insect pests at early and mature stages of crop. Among insect pests, a complex of crambid borers are the most injurious and these cause losses of cane yield (Ashraf and Fatima, 1980). Borers may cause heavy losses to the crop of sugarcane by reducing the yield up to 80% (Kalra and Sidhu, 1955).

Injurious attack of insect pests in this crop is the factor that cause decline not only the quality but also in yield. Pests of sugarcane include Gurdastpur borer, *Acigona steniella* Hampson, sugarcane top borer, *Scripophaga nivella* F; sugarcane stem borer, *Chilo infuscatellus* Snellen and sugarcane root borer, *Emmalocera depressella* Swinhoe (Lepidoptera: Crambidae). Pesticide sprays are a common practice for control of these pests. Injudicious and indiscriminate use of insecticides not only creates resistance in insect pests but also destroys beneficial insects fauna like parasites and predators due to theirnon-target toxic effects (Hussain *et al*., 2012). Moreover, larvae of sugarcane borers have the concealed feeding habit deep inside the canes, hence pesticides can not penetrate deeply to control them properly, and efficacy of insecticides is typically low. Biological control of borer pests with the help of predators and parasitoids are an alternate control method. Among these biological control agents, *Trichogramma* (Hymenoptera:

Cite this article as: Hasnain, M., S. Nadeem, M. Ishfaq, M.K. Nadeem, M. Hamed, D. Hussain, S.F. Ahmad and N.A. Saeed, 2014. Existence of a natural population of *Trichogramma* Spp. (Hymenoptera: Trichogrammatidae) in sugarcane planted near and away from cotton. Pak. Entomol., 36(1):57-60.

Trichogrammatidae) is a widely known egg parasitoid of these borers that is gaining rapid importance in the integrated pest management of borers. It is the most widely used natural enemy due to its small size and ease of rearing under laboratory conditions and has enormous parasitizing potential on eggs of the targetted hosts including the sugarcane borer complex (Cheng, 1986; Smith, 1996; Nadeem and Hamed, 2011; Ahmad *et al*., 2012). *Trichogramma* is a polyphagous egg parasitoids of lepidopterous pests of crops including the sugarcane, and has been in practice to control the borers of sugarcane as an effective bio-control agent since last two decades in the province of Punjab and Sindh in Pakistan (Hashmi and Rahman, 1985). Different species of *Trichogramma* can be mass reared under laboratory conditions on eggs of *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae) that are cultured on different cereals at optimum temperatures. These parasitoids can be accumulated and stored for future use under low temperature conditions (Nadeem and Hamed, 2008; Hamed *et al*, 2009; Nadeem *et al*., 2010; Hamed and Nadeem, 2012).

The effective biological control programme by the use of *Trichogramma* includes the proper strain selection and their potential efficiency against target pests in a particular set of environmental conditions (Hassan, 1994). According to Ashraf *et al*. (1995) *T. chilonis* can be included in integrated pest management programmes to control sugarcane borers and its inundative release has reduced the borer infestation to 4.2% as compared to check plots (16.2%). Goebell *et al*. (2006) has worked on sustainable pest management strategy to sugarcane farmers against high infestation of borers and evaluated the release rate of *T. chilonis* per hectare in sugarcane fields. Nadeem *et al*. (2009a) observed no parasitoid population of *Trichogramma* from a field of sugarcane with a history of long term use of insecticides. Whereas, eggs were parasitized in the range of 9 to 16% in insecticide free conditions. The present study was undertaken to compare the levels of parasitism by *Trichogramma* at selected locations in the sugarcane crop under two field conditions, hereafter referred to as "cane isolated from cotton" and "cane surrounded by cotton".

MATERIALS AND METHODS

A field trial was carriedout on farmer's fields in the Vehari district to estimate the naturally occurring population of *Trichogramma* in sugarcane crop sown in cotton growing areas. Crop was sown in February- March 2007 at five locations in villages at Luddan, 65 KB, Khadar Adda, Machi Wal and 65 EB. Standard agronomic practices like irrigations, weeding, hoeing and recommended doses of fertilizers were applied as per requirement of the crop. No plant protection measures were adopted during the entire period of crop. Five sugarcane fields at each 5 sites i.e., Luddan, 65/KB, Khadar, Machi Wal and 65 EB, were selected surrounded by cotton and isolated from cotton by fodder and other crops. Cards having 2000 pasted fresh factitious host eggs (*S. cerealella*) were taken from bio-control laboratories of Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad during the first week of September, 2007 and clipped on leaves of canes in each field by making 3 repeats. After 24 hrs, egg cards of *S. cerealella* were collected from each replicate and brought to the laboratory where they were placed at 25±2°C and 65% RH to complete the development of parasitoids inside the host eggs. After 3 days, the number of eggs parasitized by *Trichogramma* was counted and the mean percent parasitism and standard error of the mean (n=3) (SE) (Steel *et al*., 1997) were calculated for each of the five fields at five sites.

RESULTS AND DISCUSSION

Percent parasitism by *Trichogramma* spp. on *S. cerealella* host eggs measured at the five fields and five sites in "cane surrounded by cotton" fields and "cane isolated from cotton" fields indicated various levels of natural control by the parasitoids (Table 1, 2). At site 65 KB, the host eggs showed 2.5 to 5.6% parasitism (F = 3.52; df = 4; P = 0.48) of *Trichogramma* spp. in "cane surrounded by cotton" fields. Whereas, 13.1 to 16.5% parasitism (F = 8.19; df = 4; P = *0.003*) on host eggs were observed at the 65 KB site in"cane isolated from cotton" fields. A similar trend was observed at the Khadar site where parasitism rate was 2.3 to 4.8% (F = 2.98; df = 4; P = 0.07) and the Machiwal site where parasitism rate was 2.5 to 3.7% (F = 6.76; df =4; P = 0.007) in "cane surrounded by cotton" fields. While, parasitism rates were 9.5 to 13.7% (F = 3.77; df = 4; P = 0.04) at the Khadar site and 11.7 to 14.0% (F = 9.304; df = 4; P= 0.002) at the Machiwal site in "cane isolated from cotton" fields. Low parasitism from 0.0 to 1.5% (F = 4.97; df = 4; P = 0.018) and 3.9 to 6.0% (F = 26.05; df = 4; P = 0.000) were observed at the Luddan site in "cane surrounded from cotton" and "cane isolated from cotton" fields, respectively. Similarly, a low rate of parasitism was also measured in 65 EB where, percent parasitism ranged from 0.0 to 1.3% (F = 8.15; df = 4; P = 0.003) and from 2.7 to 4.3% (F=28.91; df = 4; P = 0.000) in "cane surrounded by cotton" and "cane isolated from cotton" fields, respectively.

Low prevalence of *Trichogramma* in sugarcane did not naturally control borers in any of the study sites and the need of parasitoid's augmentation is apparent to achieve sufficient natural control of sugarcane borers. The sugarcane fields surrounded by cotton where pesticides are used have lower parasitism rates by *Trichogramma* spp. Comparable parasitism rates were reported by Nadeem *et al*. (2009b) in a survey study in district Faisalabad where 9 to 16% parasitism on host eggs by *Trichogramma* obtained in sugarcane crop.

CONCLUSION

It is concluded from the present study that naturally occurring population of parasitoids, *Trichogramma* is affected in sugarcane crop by cotton located in vicinity of sugarcane. The heavy use of insecticides may be a factor in these lower parasitism rates sites. The percent parasitism is insufficient in cotton growing areas to combat with pests and grower's may need to supplement parasitoid populations with inundative releases to effectively control borers in sugarcane grown near cotton.

Table 1
Parasitism by *Trichogramma* on host eggs in "cane surrounded by cotton" fields at five sites in five fields per site.

Fields	Sites				
	65 KB	Khadar	Luddan	Machi Wal	65 EB
1	3.2±1.19 a	2.4 ±0.42 ab	0.2±0.17 b	3.7±1.08 a	1.3±0.42 ab
2	2.6±1.22 a	2.3±0.49 ab	0.0±0.00 b	2.8±0.98 a	0.7±0.09 ab
3	2.5±0.58 ab	3.4±0.84 a	1.4±0.49 bc	2.6±0.69 ab	0.0±0.00 c
4	4.5±1.21 a	3.5±0.73 a	1.5±0.26 ab	3.2±0.91 a	0.0±0.00 b
5	5.6±1.27 a	4.8±1.26 a	00±0.00 b	2.5±0.73 ab	0.0±0.00 b
Average	3.7±0.13 a	3.3±0.15 a	0.40±0.09 b	3.0±0.07 a	0.50±0.24 b

Means in the same row and followed by the same letter(s) are not significantly different based on overlap of confidence intervals (±SE).(*P*=0.05; ± SE (Standard Error of mean (n=3)).

Table 2
Parasitism by *Trichogramma* on host eggs in "cane isolated from cotton" fields at five sites and five fields per site.

Fields	Sites				
	65 KB	Khadar	Luddan	Machi Wal	65 EB
1	13.1±2.44 a	09.5±1.49 ab	5.2±0.73 bc	13.6±2.29 a	2.7±0.36 c
2	16.5±1.20 a	13.7±1.46 a	3.9±1.03 b	14.0±1.78 a	4.3±0.51 b
3	16.2±1.31 a	12.1±0.81 ab	6.0±0.58 c	13.0±1.51 b	3.8±0.32 c
4	14.3±2.09 a	09.5±1.61 a	4.6±0.35 b	11.7±2.06 a	3.3±0.41 b
5	13.7±0.84 a	12.6±1.26 a	5.4±0.61 b	12.5±1.19 a	2.8±0.35 b
Average	14.8±0.30 a	11.5±0.15 a	5.0±0.11b	12.9±0.42a	3.3±0.30bc

Means in the same row and followed by the same letter(s) are not significantly different based on overlap of confidence intervals (±SE).(*P*=0.05; ± SE (Standard Error of mean (n=3)).

REFERENCES

Ahmad, S., M. Ashfaq, M. Hassan and S. Sahi, 2012. Potential of parasitoid *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) against the sugarcane stem borer, *Chilo infuscatellus* (Lepidoptera: Pyralidae) under field conditions. Int. J. Biodiv. Conser., 4(1): 36-38.

Anonymous, 2012. Agricultural Statistics of Pakistan. Ministry of Food Agriculture and Livestock (Economic Wing), Islamabad, pp.19.

Ashraf, M. and B. Fatima, 1980. Status of research work on sugarcane borers in Pakistan. The Nucleus, 17: 9-17.

Ashraf, M., B. Fatima, and S.S. Ali, 1995. Significance of *Trichogramma chilonis* (Ishii) in controlling the sugarcane borers. Proc. Pak. Congr. Zool., 15: 171-176.

Cheng, W.Y., 1986. Research on *Trichogramma chilonis* (Ishii) and its utilization for the control of sugarcane borers in Taiwan. Plant Prot. Bull., 28: 41-58.

Goebell, R., E. Tabone, G. Barreault, H. Karimjee and P. Caplong, 2006. Bio-control of the sugarcane stem borer *Chilo sacchariphagus* (Lepidoptera: Crambidae) in Reunion Island: Optimization of the techniques for a wider use in infested sugarcane areas. VIth ISSCT Entomology workshop "Advances and challenges in sugar cane pest management" May 14-20, Cairns, Australia.

Hamed, M. and S. Nadeem, 2012. Effect of cereals on the development of *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae) and subsequent quality of the egg parasitoid *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae). Pak. J. Zool., 44(4): 923-929.

Hamed, M., S. Nadeem and A. Riaz. 2009. Use of gamma radiation for improving the mass production of *Trichogramma chilonis* and *Chrysoperla carnea.* Biocontr. Sci. Tech., 19(1): 43-48.

Hashmi, A.A. and A. Rahman, 1985. Pest management model of sugarcane borers in Sindh. Pak. Intern. Pest Cont., 27: 88-91.

Hassan, S.A., 1994. Strategies to select *Trichogramma* Species for the use in biological control with other egg parasitoids. CAB International, UK., pp. 55-73.

Hussain, D., A. Ali, M.M. Hassan, S. Ali, M. Saleem and S. Nadeem, 2012. Evaluation of toxicity of some new chemistry insecticides to egg parasitoid *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammitidae). Pak. J. Zool., 44(4): 1123-1127.

Kalra, A.H. and A.S. Sidhu, 1955. Studies on biology of sugarcane top borer, *Scripophaga nivella* Fabr. in the Punjab. Indian Sugar, 15: 37-43.

Nadeem, S. and M. Hamed, 2011. Biological control of sugarcane borers with inundative releases of *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) in farmer fields. Pak. J. Agric. Sci., 48(1): 71-74.

Nadeem, S., M. Ashfaq, M. Hamed and S. Ahmed, 2010. Optimization of short and long term storage duration for *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) at low temperatures. Pak. J. Zool., 42(1): 63-67.

Nadeem, S., M.K. Nadeem, M. Ashfaq and S. Ahmed, 2009a. Survey of naturally occurring *Trichogramma* spp. (Hymenoptera:

Trichogrammatidae) in sugarcane at district Faisalabad. Proc. Pak. Congr. Zool., 29: 11-14.

Nadeem, M.K., S. Nadeem, M. Ashfaq and S. Ahmed, 2009b. Comparision of *Trichogramma chilonis* (Ishii) (Hymenoptera: Trichogrammatidae) survival in sprayed and unsprayed cotton in field conditions. Proc. Pak. Congr. Zool., 29: 27-31.

Nadeem, S. and M. Hamed, 2008. Comparative development and parasitization of *Trichogramma chilonis* Ishii and *Trichogrammatoidea bactrae* Nagaraja under different temperature conditions. Pak. J. Zool., 40(6): 431-434.

Smith, S.M., 1996. Biological control with *Trichogramma*: Advances, success and potential of their use. Ann. Rev. Entomol., 41: 375-406.

Steel, R.G.D., J.H. Torrie and D.A. Dickey, 1997. Principles and Procedures of Statistics: A Biometric Approach, 3rd Ed. McGraw Hill Inc., New York.