

ROLE OF GURDASPUR BORER (*BISSETIA STENIELLUS HAMPSON*) IN SUGARCANE RATOON CROP FAILURE AND ITS INTEGRATED CONTROL AT MARDAN

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ABSTRACT

Gurdaspur borer causes great losses to sugarcane especially ratoon crop. On one way it damages the crop and on the other way its infestations paves way for certain diseases like red rot, stem rot and ratoon stunting disease. Experiments were conducted at Sugar Crops Research Institute, Mardan during 2003-2004 in sugarcane ratoon crops with the objective to see the effect of different control measures i.e. Mechanical (T1), Cultural (T2), Biological (T3) and Chemical (T4) individually and in combinations (T5 and T6) against gurdaspur borer. Results showed that borer infestation was significantly reduced (0.90, 1.16, 1.36, 2.30, 2.94 and 2.96 % in T6, T5, T1, T4, T3 and T2), respectively as compared to the highest infestation (4.78%) recorded in check (T7) plots during 2003. During 2004, significantly lower infestation 0.93, 1.04, 1.36, 2.27, 2.70 and 3.49 % was recorded in T6, T5, T1, T4, T3 and T2, respectively against the highest (5.31 %) in check (T7) plots. Among all the treatments the highest cane and sugar yield was recorded from plots that received combined application of Mechanical, Cultural and Chemical control measures (68.98 and 9.48 tons ha⁻¹), respectively.

Key Words: Sugarcane, Gurdaspur Borer, *Bissetia steniellus*, Ratoon Crop, IPM.

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INTRODUCTION

Sugarcane is one of the most important cash and industrial crops of Pakistan. It is mostly grown in three provinces of the country namely Sindh, Punjab and NWFP. In NWFP, 80-90 % crop is grown in Peshawar valley. Sugarcane needs hot and humid climatic conditions for its ideal growth. NWFP has a particular set up of severe climatic conditions (restricting winters) which restrict the growth period up to eight months (March–October). This period include preliminary/tillering period (March-June), grand growth period (July - September) being the ideal period of the growth of the crop. There is also a 3rd period known as sugar accumulation period from November to February (Qayum, 1998).

Sugarcane is the main source of white sugar in Pakistan; it is the fourth major crop after wheat, cotton and rice. Sugar industry is regarded as the second largest industry after textile and pays around Rs.15 billions in various taxes annually. It contributes 2 % in the country's GDP and its contribution in manufacturing sector is around 12.80 % (Ashraf, 2003). The average cane yield of Pakistan which ranges from 44 - 47 tons ha⁻¹ is much below the competing countries such as India (69 tons ha⁻¹), USA (80 tons ha⁻¹) and Egypt (107 tons ha⁻¹). Lower cane yield in ratoon crop is not only due to the climatic barriers but also involves improper cultural practices, lack of irrigation, adaptation of uncertified seed, late sowing and harvesting, imbalance nutrition, bad ratooning, insect pests and diseases. Due to these constraints, the present yield of sugarcane in the country is nearly 80% lower than the demonstrated achievable potential (Riaz, 2003).

In sugarcane growing areas until recently it was observed that roughly 1st ratoon crop gives 24-30% more yield against plant crop and yield of 2nd ratoon was equal to plant crop. However, for the last several years it has been observed that the ratoon crop gives 50% less yield than plant crop. Attack of insect pests especially borers have major contribution in such low yield. Different borers i.e. stem borer, root borer, top borer and gurdaspur borer attack this crop in different periods. Among these borers, gurdaspur borer have great importance because of its infestation in the grand growth period (July to September). According to Atwal (1994), dry tops are produced due to the attack of gurdaspur borer from July to September and large patches of dried canes appear due to its attack. In case of severe infestation 70-75% losses have been seen. Mehla *et al.* (2002) stated that gurdaspur borer is a serious pest of sugarcane; its larvae feed gregariously by making spiral galleries in the top internodes. They suggested

control measures as removal and destruction of infested canes and use of *Trichogramma chilonis* as biological control agent. Similarly, Agarwal (1980), Jan (1981, 1990, 1991, 1992, 1993, 1995 and 1999), Irshad (1982), Jalani *et al* (2000), Madan and Aslam and Alam (2001), Anwar *et al.* (2004, Khan and Khan (2006) and Gul *et al.* (2008) also used different control methods against gurdaspur borer in sugarcane and achieved good results. Therefore, the present study was conducted to tackle the problem of Gurdaspur borer in sugarcane ratoon crop failure with special reference to integrated pest management.

MATERIALS AND METHODS

The experiment was conducted at Sugar Crops Research Institute, Mardan. Ratoon crops of variety Mardan-93 were maintained for 2003 - 2004. The experiment comprised of seven treatments including check and was laid out in randomized complete block design having four replications. Plot size was maintained as $20 \times 6.75 \text{ m}^2$. The experiment was repeated twice for confirmation of the results. Different IPM strategies were applied as under.

(T1) Mechanical Control

Plants infested by Gurdaspur borer (dry tops) were rouged from July to September during first week of each month. Infested plants along with borers' larvae and egg clusters along with leaves were collected and fed to the livestock.

(T2) Cultural Control

Balanced application of fertilizers, DAP and SOP (2.0 bags each/acre before 1st hoeing) and Urea (1.5 bags/acre during earthing-up) was made. Irrigation applied at ten days interval during March to June and at twenty days interval during July to September, strong earthing-up during May was maintained.

(T3) Biological Control

In these plots, parasitized eggs of the parasitoid, *Trichogramma chilonis* were pasted on ivory cards @ 12000 /acre from April to September in 1st week of each month and applied. The parasitoid was reared on eggs of *Sitotroga cerealella* in the Lab. as per standard procedures of (Aslam and Alam, 2001).

(T4) Chemical Control

Carbofuran 3G was applied @ 8 kg/acre during last week of March and then at earthing-up in the month of May.

(T5) T1 +T2 +T3

The plots in this treatment received application of Mechanical (T1), Cultural (T2) and Biological (T3) control measures in combination at proper time.

(T6) T1+T2+T4

In this treatment, Mechanical (T1), Cultural (T2) and Chemical control (T4) were used in combination at proper time.

(T7) Check

Plots in this treatment were left untreated to infestation of the borer.

After treatments, infestation of Gurdaspur borer (July to September) was recorded by counting the number of infested plants at monthly interval during last week of each month. Square-root transformation technique was applied to percent borers' infestation data as suggested by Gomez and Gomez (1984).

Cane yield in tons/ha was recorded at the time of harvest. Commercial Cane Sugar percentage (CCS %) data were recorded after cane juice analysis of each treatment in sugar analysis laboratory at Sugar Crops Research Institute, Mardan as per method developed by Chen, 1985. For this purpose samples of 20 canes were randomly collected from each treatment at the time of harvest. Sugar yield tons/ha was calculated with the help of the following formula.

$$\text{Sugar yield} = \frac{\text{Cane yield} \times \text{CCS}\%}{100}$$

Data obtained were statistically analyzed and LSD test was used.

RESULTS AND DISCUSSION

Results of the experiments conducted at Sugar Crops Research Institute (SCRI) Mardan to check the infestation of Gurdaspur borer, *Bissetia steniellus* Hampson (Crambidae; Lepidoptera), using Mechanical control (T1), Cultural control (T2), Biological control (T3), Chemical control (T4), combination of T1, T2, T3 (T5) and combination of T1, T2, T4 (T6) and the untreated check (T7) are presented in Table-I, while the resultant effect of these treatments on cane yield (tons/ha), Commercial Cane Sugar (CCS %) and sugar yield (tons/ha) are presented in Table II.

Table I Percent infestation of Gurdaspur borer in sugarcane ratoon crop at SCRI Mardan during 2003 and 2004

Treatments	Percent borer infestation							
	2003				2004			
	July	August	September	Mean	July	August	September	Mean
(T1) Mechanical control	1.32 c	1.38 d	1.37 d	1.36 d	1.83 d	1.91 d	0.35 d	1.36 d
(T2) Cultural control	2.78 b	3.07 b	3.03 b	2.96 b	4.13 b	4.24 b	2.09 b	3.49 b
(T3) Biological control	2.72 b	3.12 b	2.97 b	2.94 b	3.98 b	2.50 c	1.63 c	2.70 c
(T4) Chemical control	2.73 b	2.03 c	2.15 c	2.30 c	2.37 c	2.42 c	2.02 b	2.27 c
(T5) T1+T2+T3	1.16 c	1.08 e	1.23 d	1.16 e	1.22 e	1.42 e	0.49 d	1.04 d
(T6) T1+T2+T4	0.72 d	0.90 e	1.08 e	0.90 e	1.15 e	1.40 e	0.23 d	0.93 d
(T7) Check	4.08 a	5.07 a	5.19 a	4.78 a	5.78 a	6.02 a	4.12 a	5.31 a
SE	0.18	0.12	0.08	0.21	0.13	0.23	0.17	0.33
LSD (0.05) value	0.295	0.195	0.143	0.345	0.212	0.383	0.288	0.541

Figures in columns having same letters are non-significantly different at $\alpha = 0.05$

Table II Cane yield, commercial cane sugar percentage (ccs %) and sugar yield (t ha⁻¹) in sugarcane ratoon field during 2003 and 2004

Treatments	Cane yield (t/ha)			CCS (%)			Sugar yield (t/ha)		
	2003	2004	Mean	2003	2004	Mean	2003	2004	Mean
	(T1) Mechanical control	68.14 d	51.43 f	59.78 b	13.30 a	13.45 a	13.37 a	9.06 a	6.91 f
(T2) Cultural control	69.36 b	53.77 d	61.56 b	13.15 a	13.30 a	13.22 a	9.12 a	7.15 d	8.13 bc
(T3) Biological control	68.27 d	52.61 e	60.44 b	13.30 a	13.35 a	13.32 a	9.07 a	7.02 e	8.05 c
(T4) Chemical control	69.00 bc	55.84 c	62.42 b	13.55 a	13.65 a	13.60 a	8.34 a	7.62 c	8.49 c
(T5) T1+T2+T3	68.73 c	56.80 b	62.76 b	13.50 a	13.60 a	13.55 a	9.27 a	7.72 b	8.50 b
(T6) T1+T2+T4	72.47 a	65.49 a	68.98 a	13.70 a	13.80 a	13.75 a	9.85 a	9.03 a	9.48 a
(T7) Check	63.29 e	48.80 g	56.04 c	12.51 a	12.60 a	12.55 a	7.91 a	6.14 g	7.03 d
SE	0.27	0.25	2.33	0.78	0.79	0.05	0.54	0.04	0.34
LSD (0.05) value	0.386	0.353	3.053	NS	NS	NS	NS	0.052	0.445

Figures in columns having same letters are non-significantly different at $\alpha = 0.05$

NS= Non significant

Results presented in Table I showed that during 2003, mean infestation of Gurdaspur borer (dry tops) July to September was 0.90, 1.16, 1.36, 2.30, 2.94, 2.96 and 4.78 % in T6, T5, T1, T4, T3, T2 and T7, respectively. During 2004, mean infestation of the borer (July to September) was recorded as maximum (5.31%) in T7 (check) plots followed by 3.49, 2.70, 2.27, 1.36, 1.04 and 0.93 % in T2, T3, T4, T1, T5 and T6, respectively. Analysis of the data showed significantly lowest infestation (0.93%) in T6 and highest (5.31%) in check (T7) plots. Best performance of these methods for the control of sugarcane borers including Gurdaspur borer are also recommended by Agarwal (1980), Irshad and Shah (1982), Anonymous (1988), Jena *et al.* (1997), Madan (2001), Jan (1993, 1995), Jan *et al.* 1999, Jalani *et al.* (2000), Anwar *et al.* (2004), Khan and Khan (2006) and Gul *et al.* (2008). Generally, role of gurdaspur borer in sugarcane ratoon failure is because the borer hibernates in the stubbles of plant crop from October to June and breaks its dormancy period in last week of June. Adults come out mostly after a shower of monsoon rain in first week of July being the suitable conditions (maximum temperature with high humidity) for its attack. Ratoon crop of sugarcane developed after harvesting of plant crop is a very easy target for this borer because the nests of this borer already exist in those stubbles from which ratoon crop is grown in the following year. Secondly the infestation of this borer starts during millable cane stage/grand growth period (July – September), which is the very limited period of extensive growth of the crop in this area. According to Atwal (1994), newly hatched larvae of this borer make one hole on top internodes and gregariously feed there. After a few days these larvae shift in ones or twos to the adjoining clumps/plants. Initially the attack could be identified as dry tops in limited patches but with the passage of time the crop may be totally destroyed in the whole field. Jan (1981, 1990, 1991, 1992, 1993 and 1995) reported Gurdaspur borer, *Bissetia steniellus* as a serious pest of sugarcane in district Peshawar lowering the sugar recovery by 4-5 units in Khazana Sugar Mills area. He further reported that average infestation of Gurdaspur borer ranged from 1.10 to 23.50 % in districts Peshawar, Charsadda, Mardan and Sawabi. He

also reported that attack of Gurdaspur borer was injurious in the grand growth period (July through September) and specially targeted ratoon fields in the above mentioned districts.

Results (Table II) revealed that mean cane yield ($t\ ha^{-1}$) for 2003 and 2004 was 62.76, 62.42, 61.56, 60.44 and 59.78 ($t\ ha^{-1}$) in T5, T4, T2, T3 and T1, respectively. Analysis of the data further revealed that, non-significant yield improvement was recorded in non-chemical and chemical control methods (T1- T4) tested alone and combination of non-chemical methods T1+T2+T3 (T5). Khan (1999) and Khan and Khan (2006) also tested non chemical and chemical methods against sugarcane borers including gurdaspur borer and reported that yield parameters were non significantly improved compared to check plots. Highest significant cane and sugar yield amongst all treatments were recorded in T6, which was the 2nd combination of cultural, mechanical and chemical control (T1+T2+T4). The reason of such highest yield was the share of an insecticide (Furadon 3 G) combined treated with other non-chemical methods. Significantly the lowest yield ($56.04\ t\ ha^{-1}$) was recorded in check (T7). The highest ($68.98\ t\ ha^{-1}$) yield was recorded in T6 amongst all treatments. Mean CCS % for both years ranged from 12.55 to 13.75 % in T7 and T6, respectively. However, all treatments for this parameter showed non-significant differences. Mean for both years regarding sugar yield was highest ($9.48\ ha^{-1}$) in T6 followed by 8.50, 8.49, 8.13, 8.05 and $7.98\ ha^{-1}$ in T5, T4, T2, T3 and T1, respectively. Analysis of the data showed non-significant differences between sugar yield recorded for T1-T4 and T2 and T5. Significantly the lowest sugar yield ($7.03\ t\ ha^{-1}$) was recorded in check (T7). Arif et al (2001) and other workers mentioned above also tested different IPM techniques against sugarcane borers and reported increase in cane and sugar yields in ratoon crop.

CONCLUSION

It is concluded that all control methods such as Mechanical, Cultural, Biological and Chemical individually and in combination significantly reduced infestation of Gurdaspur borer and increased sugar and cane yield. However, combined application of mechanical, cultural, and chemical control proved as the best control measure against Gurdaspur borer infestation and significantly increased cane and sugar yield. To minimize economic losses to sugar industry and to get higher return, growers are therefore advised to use the above methods in combination.

REFERENCES

- Agarwal, R.A. 1980. Integrated control of insect pests complex in Sugarcane. Indian Sug. 27: 649-658.
- Anonymous. 1988. Development of integrated pest management programme for sugarcane pests. Ann. Tech. Rep. CIBC Rawalpindi. 48p.
- Anwar, M.S., A.W. Ali, T. Ahmad and A.A. Chattah. 2004. Integrated management of sugarcane insects. Pak. Sug. J. XIX(6): 28-31.
- Arif, M.H., J.W. Mathew and A. Shahzad. 2001. Effect of trash mulching on the infestation of stem borer *Chilo infuscatellus* Snellen, its natural enemies and on over all sugar productivity on the Habib Sugar Mills area at Nawabshah, Sindh. Pak. Sug. J. XVI (3): 6-14.
- Ashraf, Z. 2003. Sugar industry-facing collapse. Daily "The Nation". 29th Dec. 16p.
- Aslam, K. and M.M. Alam. 2001. Some facts regarding the use of Trichogramma against the sugarcane borers. Proc. 36th Ann. Conv. Pak. Soc. Sugar Tech. Lahore. 36:103-107
- Atwal, A.S. 1994. Pests of sugarcane. Agricultural pests of India and South East Asia. Kulyani Pub. Ludhiana. pp.330-337.
- Chen, J.C.P. 1985. Chemical methods in sugar analysis. Cane sugar hand book. John Wiley & Sons New York. pp.674-688.
- Gomez, K.A. and A.A. Gomez. 1984. Problem Data. Statistical procedures for agricultural research. John Wiley & Sons New York. pp. 272-315.
- Gul, F., M. Naeem and M. Inayatullah. 2008. Effect of different control methods on the infestation of borers in sugarcane plant and ratoon crops. Sarhad J. Agric. 24 (2): 273-278.
- Irshad, M. and M.M. Shah. 1982. Mechanical control of *Acigona Steniellus* Hampson. in sugarcane. Entomol. Newslet. (12): 8-11.
- Jalani, S.M.I., A. Ghani, G.M. Aheer and Z. Sikandar. 2000. Evaluation of different methods for the control of sugarcane borers (Lepidoptera: Pyralidae). Pak. Sug. J. XV (3): 11-14.
- Jan, A. 1981. Insect pests of sugarcane in NWFP (Pakistan). The Daily Frontier Post, May 5, pp.4-5 and May 7, pp.4-5.
- Jan, A. 1990. Pests scouting for insect pests of sugarcane and their natural enemies. Ann. Tech. Rep. SCRI, Mardan. 62 p.

- Jan, A. 1991. Loss assessment, distribution and biology of sugarcane borers. Ann. Tech. Rep. SCRI, Mardan. 50p.
- Jan, A. 1992. Incidence, distribution and biology of sugarcane borers. Ann. Tech. Rep. SCRI, Mardan. 68 p.
- Jan, A. 1993. Studies on the bad ratooning in sugarcane varieties, distribution and management of sugarcane borers in Peshawar valley. Ann. Tech. Rep. SCRI, Mardan. pp. 64-78.
- Jan, A. 1995. Distribution, varietal resistance and integrated control of various insect pests of sugarcane in Peshawar valley. Ann. Tech. Rep. SCRI, Mardan. pp. 61-81.
- Jan, A., G. Ahmad, F. Gul and D. Khan. 1999. Control of sugarcane borers in Peshawar valley (NWFP). Proc. Pak. Soc. Sug. Tech. pp. 111-113.
- Jena, B.C., N.C. Patnaik and P.R. Mishra. 1997. Control of stalk borer menace in sugarcane through crop management. Indian Sug. 47(9): 745-748.
- Khan, M. 1999. Integrated pest management approach for the control of sugarcane borers. Pak. Sug. J. XIV (3): 2-5.
- Khan, M. and P. Khan. 2006. Integrated control of sugarcane borers in Peshawar Valley (NWFP). Pak. Sug. XXI: 7-9.
- Madan, Y.P. 2001. Integrated Pest Management in sugarcane. Indian Sug. 50 (12): 867-871.
- Mehla, M., B. L. Sharma, and G. Olla. 2002. Gurdaspur borer in sugarcane. Indian Daily "THE HINDU". Jan 17, 2002.
- Qayum, A. 1998. Comparative performance of sugarcane varieties and genotype x environment interactions. Ph.D Dissert. Sindh Agric. Univ. Tandojam. 192 p.
- Riaz, S. 2003. Scenario of sugar production. Daily "The Nation", 7th July. 17p.