INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2003/05–4–552–554
http://www.ijab.org

# Some Studies of Varietal Resistance in Spring Maize Against *Chilo partellus* (Swin.) with and without Release of *Trichogramma chilonis*

SOHAIL AHMED[1], RASHAD RASOOL KHAN AND MUHAMMAD KHAN,
*Department of Agricultural Entomology, University of Agriculture, Fasialabad-38040, Pakistan*
[1]corresponding author: E-mail: saha786@fsd.paknet.com.pk

## ABSTRACT

The varietal resistance factor combined with a biological control agent was studied in six maize varieties *viz.* Agaiti-85, Akbar, Golden, EV-1098, Pak-afgoyee and EV-5089. The experiment was laid out in Randomized Complete Block Design with three replications at two different sites. One site had *Trichogramma* impregnated cards placed in the plots of each variety in each replication one week after sowing (WAS), while other was without cards placed in the plots of each variety. Data obtained on the basis of percent maize borer infestation revealed that there was no significant difference among the varieties at different weeks after sowing except at 8th WAS and 7th and 8th WAS with and without *Trichogramma* cards, respectively. It was concluded from the present study that *Trichogramma chilonis* was not an effective egg parasitoid to suppress the maize infestation by *Chilo partellus.*

**Key Words**: Maize; Varietal resistance; *Trichogramma; C. partellus*

## INTRODUCTION

Per hectare yield of maize in Pakistan has not increased despite introduction of high yielding varieties; the major obstacle in achieving this goal is the attack/infestation by pest insects. The notable among pest insects are maize and jowar stem borer (*Chilo partellus* Swin.), shoot fly (*Atherigona soccata*) armyworm (*Mythimna*) and many spp. of aphids, results in total failure of crop in case of severe infestation of *C. partellus* and *A. soccata* (Singh & Sharma, 1984). In order to prevent infestation by stem borer and shootfly, insecticides particularly granular formulations are recommended as whorl treatment at 0.75 kg a.i./ha at 25 and 45 days after sowing (Halimie *et al*., 1989). Besides granular application, insecticide sprays are also recommended to avoid pest insect outbreak (Shams & Afzal, 1989). However, insecticides generally are regarded as hazardous to the environment owing to targeting non-pest insects and residue problems. The alternatives to insecticides suggested have not been proven satisfactory. In the absence of alternative to potent insecticides, there is need to integrate various control measures (Kumar, 1997).

The varietal resistance in maize plants against *C. partellus* constitutes an important part of pest control strategy. With the introduction of hybrid maize, this part of insect pest management is not clearly defined. However, Kisan and Azam varieties with 11.64 and 12.15% infestation level, respectively, were resistant to *C. partellus* (Khan *et al*., 1999). In another study, Azam (2.46% infestation) was non-significantly different to Ihsan and Sarhad White (3.33 and 4.67%), respectively) (Ullah *et al*., 1992).

The use of biocontrol agents in the Pakistan to suppreess the incidence of *C. partellus* has been advocated by many workers. *Apanteles flavipes* (Cam.) (Hym.: Braconidae), a larval parasite, was one of the most important agents studied and applied / released for the control of *C. partellus* (Alam *et al*., 1972; Attique *et al*., 1980; Beg & Inayatullah, 1980; Goraya *et al*., 1982; Shami & Mohyuddin, 1987). However, the possible use of egg parasite, such as *Trichogramma chilonis*, is not tried in Pakistan but its effectiveness on maize pest insects has been reported else where (Mohyuddin, 1981. Rawat *et al*., 1994. Chen *et al*., 1996; Cheng *et al*., 1995. Lisowicz & Kot, 1999).

In the present study, locally developed maize varieties *viz.*, Agaiti-85, Akbar, Golden, EV-1098, Pak-afgoyee, EV-5089 were screened out for their resistance to *C. partellus*, concurrently with release of *Trichogramma* in order to elucidate the influence of this parasite on host-pest relationship.

## MATERIALS AND METHODS

The experiments were carried at Entomological Research Area, University of Agriculture, and at PARS, Jhang Road, Faisalabad.

The experiments were laid down as Randomized Complete Block Design with six varieties *viz.*, Agaiti-85, Akbar, Golden, EV-1098, Pak-afgoyee, EV-5089, replicated thrice. The plot size was 4.5 x 8.5m2. All varieties were sown on July, 2002 and standard agronomic practices including weeding were carried out.

The cards impregnated with eggs of *Trichogramma*

*chilonis* were obtained from Entomological laboratories of Nuclear Institute for Agricultur and Biology, Faisalabad. The cards were placed in the plots of each variety, one week after sowing at PARS, Faisalabad whereas the varieties at Entomological Research Area, University of Agriculture, Faisalabad, were without cards.

The characteristic for varietal resistance was percent borer infestation. The observations were started after 4th week after sowing (WAS) till harvesting from 15 randomly selected plants from each variety in each block at weekly interval. The infestation with time was recorded with holes in the new growth.

The mean percent borer's infestation was subjected to Duncan's Multiple Range test at 5% level of significance for comparison among different varieties at each week interval, after obtaining ANOVA from Minitab (version II).

## RESULTS

Table I shows the mean percent borer's infestation at different weeks after sowing (WAS) with Trichogramma impregnated cards. There was non significant difference among varieties at first two weeks of observation i.e., 5th and 6th WAS. However, in these two weeks Pak-afgoyee recorded the least borer's infestation. 7th and 8th WAS shoed significant difference among varieites regarding the infestation. Pak-afgoyee and EV-1098 registered least borer's infestation (8.9 and 4.4%) respectively in 7th and 8th WAS. The mean infestation percentage of *Chilo partellus* on Pak-afgoyee at 5th, 6th, 7th, 8th, 9th, 10th and 11th weeks was 6.7, 8.9, 11.1, 17.2, 13.1, 8.9 and 6.7, respectively. Agiti-85 had persistently high infestation level than other varieties at all intervals. The highest percentage (31.1%) amongst varieties was shown by Agaiti-85 at 8th week after sowing.

Table II shows the mean percent borer's infestation at different weeks after sowing (WAS) without *Trichogramma* impregnated cards. It was at 8th WAS that a significant difference of borer's infestation among varieties was observed. Agiti-85 and EV-5089 had non-significant difference between each other. Similarly, EV-1098 and Pak afgoyee had non-significant difference between each other. Pak-afgoyee on numerical basis harboured least borer's infestation at all WAS intervals here too.

## DISCUSSION

The desirability of integrating host–plant resistance and biological control of arthropod pests is not a new idea in the field of applied Entomology. Integration is derived from the fact that host–plant resistance can be used to supplement biological control where the later weaken or is inadequate. Secondly, biological control agents are used prior or after the chemical control. The objective of both strategies is to reduce the number of insecticide application (Bosch & Stern, 1962). The recent trend in this regard is the integration of bio-pesticides and biological control agents (Brunner, 1998). Similar studies were extended in the control of maize borer (*Chilo partellus*). However, these are not yet conclusive, therefore the present project was designed to determine impact of *Trichogramma* (egg parasitoid) in suppressing and eliminating need for chemical control on maize borer in different maize varieties.

Natural enemies such as *T. chilonis* Ishii, *A. flavipes* Cam. and *Bracon chinensis* Szep. recorded from *Chilo partellus* on maize in Pakistan (Mohyuddin, 1981). The

**Table I. Borer infestation on different varieties at the weeks after sowing in plots with *Trichogramma* impregnated cards**

| Varieties | Weeks after sowing | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5th | 6th | 7th | 8th | 9th | 10th | 11th |
| Agaiti-85 | 8.9±2.2 a | 6.7±0.0 a | 20.0±3.8 a | 13.3±3.8 a | 8.9±2.2 a | 6.7±0.0 a | 4.4±2.2 a |
| Akbar | 6.7±0.0 a | 4.4±2.2 a | 11.1±2.2 ab | 6.7±0.0 ab | 2.2±2.2 a | 2.2±2.2 a | 2.2±2.2 a |
| Golden | 2.2±2.2 a | 6.7±0.0 a | 15.5±2.2 ab | 8.9±2.2 ab | 4.4±2.2 a | 6.7±0.0 a | 2.2±2.2 a |
| EV-1098 | 4.4±2.2 a | 8.9±2.2 a | 11.3±3.8 ab | 4.4±2.2 b | 6.7±0.0 a | 4.4±2.2 a | 2.2±2.2 a |
| Pak-afgoyee | 2.2±2.2 a | 4.4±2.2 a | 8.9±2.2 b | 6.7±0.0 ab | 2.2±2.2 a | 2.2±2.2 a | 2.2±2.2 a |
| EV-5089 | 6.7±3.8 a | 8.9±2.2 a | 17.8±2.2 ab | 11.1±2.2 ab | 6.7±3.8 a | 4.4±2.2 a | 2.2±2.2 a |

**Table II. Borer infestation on different varieties at the weeks after sowing in plots without *Trichogramma* impregnated cards**

| Varieties | Weeks after sowing | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5th | 6th | 7th | 8th | 9th | 10th | 11th |
| Agaiti-85 | 6.7±3.8 a | 8.9±2.2 a | 17.8±2.2 a | 15.5±2.2 a | 8.9±2.2 a | 6.7±0.0 a | 4.4±2.2 a |
| Akbar | 2.2±2.2 a | 4.4±2.2 a | 11.1±2.2 a | 8.9±2.2 ab | 4.4±2.2 a | 2.2±2.2 a | 2.2±2.2 a |
| Golden | 4.4±2.2 a | 6.7±3.8 a | 11.1±2.2 a | 11.1±2.2 ab | 6.7±0.0 a | 2.2±2.2 a | 4.4±2.2 a |
| EV-1098 | 2.2±2.2 a | 4.4±2.2 a | 11.1±4.4 a | 4.4±2.2 b | 2.2±2.2 a | 4.4±2.2 a | 2.2±2.2 a |
| Pak-afgoyee | 2.2±2.2 a | 2.2±2.2 a | 11.1±2.2 a | 4.4±2.2 b | 4.4±2.2 a | 2.2±2.2 a | 2.2±2.2 a |
| EV-5089 | 4.4±2.2 a | 6.7±0.0 a | 15.5±2.2 a | 13.3±3.8 a | 8.9±2.2 a | 4.4±2.2 a | 4.4±2.2 a |

Values are mean ± SE. Difference in mean values was determined by DMR Test. Means sharing same letter in a column are not significantly different at 5% level of significance

potential of these natural enemies as biocontrol agent is not fully realized. Whereas *Trichogramma* spp. have been found effective against *Ostrinia nubilalis* and *C. partellus* recorded elsewhere (Rawat *et al*., 1994; Cheng *et al*., 1995; Bonhof *et al*., 1997; Lisowicz & Kot, 1999).

Maize crop in Pakistan receives insecticides for the control of maize stem borer (Rehman *et al*., 1998; Javed *et al*., 1998). There is no attempt so for published to integrate the *Trichogramma chilonis* on *C. partellus* and host-plant resistance.

From the present studies of varietal resistance of six varieties *viz.* Agaiti-85, Akbar, Golden, EV-1098, Pak-afgoyee and EV-5089 were not significantly different among themselves regarding borer infestation on different WAS. However, though non-significantly, Pak-afgoyee recorded lowest (6.7%) and Agaiti-85 highest infestation percentage. These results are contrary to that found by Ghani (1999). Maize borer infestation in plots with and without Trichogramma impregnated cards was not significantly different on various varieties at different weeks. However though non-significantly Pak-afgoyee recorded the lowest (2.2 and 2.2%) and Agaiti-85 (20 and 17.8%) infestation percentage respectively. Rawat *et al*. (1994) found that the inundative release of *Trichogramma chilonis* were effective against *C. partellus* on maize and this parasitoid can be used for biological control of the pest. Similar results were obtained by Cheng *et al*. (1996). Our results are different from all these.

The present studies clearly show that *Trichogramma chilonis* impregnated cards placed in plots of different maize varieties were not effective in suppressing borer infestation. All the plots of different varieties with and without *Trichogramma* impregnated cards received insecticides application at similar interval and level of infestation at post – treatment intervals was not significantly different (data not shown). This needs further investigation to be carried out.

Thus it is concluded from results present at here that *Trichogramma chilonis* is not effective egg parasitoid of maize stem borer *C. partellus* in the existing agro-ecosystem.

## REFERENCES


Alam, M.M., M.N. Beg and M.A Ghani, 1972. Introduction of *Apanteles* spp. against graminaceous borers into Pakistan. *Tech. Bull. Commonwealth Instt. Biol. Control*, 15: 1–10.

Attique, M.R., A.I. Mohyuddin, C. Inayatullah, A.A. Goraya and M. Mushtaque, 1980. The present status of biological control of *Chilo partellus* (Swin.) (Lep.: Pyralidae) by *Apanteles flavipes* (Cam.) (Hym.: Braconidae) in Pakistan. *In: Proc. Ist Pakistan Cong. Zool*., pp: 301–5. Islamabad, Pakistan.

Beg, M.N. and C. Inayatullah, 1980. Studies on *Apanteles flavipes* a parasite of graminaceous borers. *Pakistan J. Agric. Res*., 1: 50–3

Bonhof, M.J., W.A. Overholt, A. Huis, A.V. Polaszek and H.A. Van, 1997. Natural enemies of cereal stem borers in East Africa: a review. *Insect Sci. Applic*., 17: 19–35

Bosch, R. and V.M. Stern, 1962. The integration of chemical and biological control of arthropod pests. *Rev. Appl. Entomol*., 7: 367–81

Brunner, J.F., 1998. Pest–management–Novel chemical and biological control. *41st Ann. IDFTA Conf*. Feb. 21–25, p. 199. Pasco, Washington, USA.

Chen, B.H. and Y.U. Jihzu, 1996. Effect of releasing *Trichogramma embryophagum* (Hymenoptera: Trichogrammatidae) on controlling Asiatic corn borer (Lepidoptera: Pyralidae) in Taiwan. *J. Agri. Res. China*, 45: 401–10

Cheng, W.Y., S.M. Chen, and Z.T. Wang, 1995. Differences in occurrence of *Trichogramma chilonis* and *T. ostrinia* between spring cane and sweet corn fields. *Rept. Taiwan Sugar Res. Instt*., 150: 23–41

Ghani, H., 1999. Varietal resistance of maize cultivars against *Chilo partellus* (Swinhoe). *M.Sc. (Hons.) Thesis*, pp: 44–5. Deptt. Agri. Entomol., Univ. Agric., Faisalabad, Pakistan.

Goraya, A.A., M. Mushtaque and M.R. Attique, 1982. Suitability of *Apanteles flavipes* (Cam.) (Hym: Braconidae) as biocontrol agent for graminaceous stem–borers in Pakistan. *In: Proc. 18th Ann. Conven. Pakistan Soci. Sugar Tech*. Rawalpindi, Sept. 4–5. pp: 177–82

Halimie, M.A., M.S. Mughal, S.A. Mehdi and Z.A. Rana, 1989. Response of different timings of carbofuran (Furadan 3G) on the maize borer incidence and yield of the crop. *J. Agric. Res., Lahore*, 27: 337–40

Javed, H.I., H. Rehman, M. Aslam and A. Rehman, 1998. Economical method of Furadan application against maize stem borer, *Chilo partellus* (Swinhoe). *Sarhad J. Agric*., 14: 153–6

Khan, N.A., D. Ahmed, M.A. Khan and M. Anwar, 1999. Managameent of maize stem borer. *Sarhad J. Agri*., 15: 467–71

Kumar, H., 1997. Resistance in maize to *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae): role of stalk damage parameters, and biological control. *Crop Protect*., 16: 375–81

Lisowicz, F. and J. Kot, 1999. Effectiveness of *Trichogramma* spp. in controlling the european corn borer (*Ostrinia nubilalis* Hbn.) on maize. *Prog. Plant Protect*, 39: 493–5

Mohyuddin, A.I., 1981. A review of biological control in Pakistan. *Proceed 2nd Pak. Cong. Zool*., pp 31–79.

Rahman, H., H.I. Javed and M. Aslam, 1998. Efficacy of seed dressing and other insecticides for control of *Chilo partellus* (Swin.). *Sarhad J. Agri*., 14: 641–4

Rawat, U.S., A.D. Pawar and V. Joshi, 1994. Impact of inundative releases of *Trichogramma chilonis* Ishii in the control of maize stem borer, *Chilo partellus* (Swinhoe) in Himachal Pradesh. *Plant. Protect. Bull. Faridabad*, 46: 28–30

Shami, S. and A.I. Mohyuddin, 1987. Host selection by Indonesian strain of *Apanteles flavipes* (Cam.) and its suitability for various graminaceous borers in Pakistan. *Proceed. 23rd Ann. Conven. Pakistan Soci. Sugar Tec*hn., Rawalpindi, 25–27 July pp. 286–91.

Shams, M. R. and M. Afzal, 1989. Effect of synthetic pyrethroids/ organophos– phates on maize shoot fly: *Atherigona soccata* (Rond.) and maize borer: *Chilo partellus* (Swin.). *J. Agric. Res., Lahore*, 27: 65–70.

Singh, J.P and Y.P. Sharma, 1984. incidence of *Chilo Partellus* (Swin.) on maize and jawar in Punjab. *Res. Bull. Punjabi. Univ. Sci.*, 35: 105–14

Ullah, K., I. Ali, F. Shah and K. Parvez, 1992. Comparative study of some insecticides and maize cultivars against maize stem borer, *Chilo partellus* (Swin.). *Sarhad J. Agri*., 8: 199–204


**(Received 21 August 2003; Accepted 15 September 2003)**