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Biological control of Maize Stem Borer, (*Chilo partellus*) in Koshi region of Bihar

Poonam Kumari[a], Arun Kumar[a]* & Dinesh Yadav[b]
[a]P.G.. Department of Zoology, B. N. Mandal University, Madhepura, Bihar, India
[b]Department of Zoology, T.P.College, B. N. Mandal University, Madhepura, Bihar, India

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Abstract- Maize stem borer damage varied from 10 to 30% in the state of Bihar. Most of the borer damage occurred when the crop was in early vegetative stage and by the time it reached tasseling, no further increase in damage was observed. The activity of adult moths started after the middle of March and continued to increase until the middle of May after which a decline in population was observed in June. This synchronizes with the infestation pattern observed for the spring maize. *Trichogramma* activity was first observed after the middle of July after which parasitism ranged from 14 to 40%. The samples collected from April to June did not indicate the presence of *Trichogramma*. Identification of *Trichogramma* species associated with maize stem borer indicated the presence of only *Trichogramma chilonis*. Preliminary studies conducted to evaluate the impact of *Trichogramma* releases showed its success in reducing the damage caused by maize stem borer.

Keywords : Maize, stem borer, *Trichogramma chilonis*, biological control, population dynamics.

INTRODUCTION

Bihar with an annual production of around 27 lakh tonnes is the second biggest maize producer in the country. It has 4.30 lakh hectares under this crop. The stretch from Purnea, Katihar and Bhagalpur to Madhepura, Saharsa, Khagaria and Samastipur, north of the Ganga and on either side of the Kosi-emerged as a corn belt. In the flood-prone areas of Kosi and parts of Seemanchal, rabi maize became the major crop. Maize cultivation has been overwhelmingly practiced by farmers across state especially in Seemanchal and Kosi region but the intra-state processing facilities remain sick which paves the path for Bihar's dependence on other states. Productivity of maize in Bihar is 2541 kg/ha, which is far greater than the all-India average productivity of 1907 kg/ha.[1] In the absence of adequate processing facility, the huge marketable surplus of Bihar, especially in rabi season depends completely on other states for its consumption. As a result, more than 80 per cent of Bihar maize goes outside the state for processing depriving it of value addition and higher income for the people. The maize crop is a fascinating picture on the ground but policy overlook has pushed it towards a less valued agricultural output.

*Corresponding author :
Phone : 9006991000
E-mail : prf.arunkumar@gmail.com

Maize is an important cereal crop consumed as food, used as a fodder crop for livestock and feed for poultry, besides its use in various industrial products. It is a good source of high quality edible oil. Maize production is severely hampered by maize stem borer, *Chilo partellus*, causing losses to the tune of 15-30%.[3] The damaged plants remain stunted and thus yield low fodder and grain production.

The gravid female of *C. partellus* lay eggs on the leaves and the larvae after hatching enter the stem though apical portion. Having entered the stem, the borer cannot be controlled effectively through chemicals. Systemic insecticides, though used, are not cost effective and cause environmental hazards. Biological control through the use of egg parasitoid *Trichogramma* can be very effective and economical control as it can eliminate the pest in the egg stage.[3,4]

Because of its ease of propagation and application, *Trichogramma* is an ideal choice for inundative releases against the crop borers. But since *Trichogramma* is effective only during a short temporal window when the eggs are laid, a study of biology of pest is necessary. It is important to know the natural prevalence of *Trichogramma* in maize at different times of the year. The current studies were aimed at establishing biological control of maize stem borer through *Trichogramma*. This paper presents the results of preliminary studies needed before establishing a successful biological control programme.

MATERIALS & METHODS

Estimating the damage extent by *C. partellus*

Five villages of Madhepura of Bihar where maize is grown in big way has been selected for study. In each village, farmer's fields having maize at different growth stages were selected and data on maize stem borer infestation were recorded. Maize crop was surveyed for maize stem borer damage based on the presence of dead hearts and shot hole symptoms. The observations were recorded at a weekly interval starting from the first week of July and were continued until crop harvest.

Preliminary studies were conducted to evaluate the success of *Trichogramma chilonis* in controlling maize stem borer damage. The experiment was planned as randomized complete block design with a total of four replications. Each block consisted of 0.25 acres where cultivar Shanker makka was sown in the first week of July. Four releases of *Trichogramma* were made starting from the first week of September. The releases were made at an interval of one week. The damage was recorded on the basis of dead hearts, a symptom of maize stem borer infestation.

RESULTS & DISCUSSION

The average bore damage varied from 10 to 30% in Kosi region. An increasing trend of damage over time was observed indicating the persistent presence of maize stem borer during the season. During August, damage was recorded which indicates the severity of borer damage. Maize stem borer leads to a severe reduction in yield. Neupane *et al.* (1985)[5] have reported a yield reduction up to 60% in case of severe infestation. A yield reduction of 2121 Kg/ha has been reported in spring maize by Mohyuddin and Attique (1978)[6] when 25.2% of the plants were infested while a yield reduction of 2860 kg/ha was observed in autumn when 33% plants were infested. The major loss in grain yield is due to dead-hearts and stunting of growth.

In the present findings most of the borer damage occurred when the crop was in the early vegetative stage and by the time it reached tasseling no further increase in damage was observed. This indicates the importance of emphasizing the application of biological control agent when the crop is 2-3 week old and continuing it for 4-6 weeks.

The activity of moth adults started after the middle of March and continued to increase until the middle of May after which a decline in moth population was observed in June. This synchronizes with the infestation pattern observed for the spring maize. During the months of July and August, 3-4 population peaks of moths were observed indicating the presence of overlapping moth generations during the growth period of summer maize.

The studies were initiated in July, data on *Trichogramma* prevalence was not present for that year before July. *Trichogramma* activity was first observed after the middle of July after which parasitism ranged from 14 to 44%. The samples collected from April to June did not indicate the presence of *Trichogramma* until June. Although a higher prevalence of *Trichogramma* was recorded late in the cropping season (late August to

September), no parasitoid was observed before the middle of July. This indicates that the natural populations of *Trichogramma* are not helpful in reducing the damage as they appear late where the damage is already done by *C. partellus*. Thus there is need of augmentative release earlier during the season to check the populations build up of *C. partellus*.

All the specimens collected at different locations belonged to one species i.e. *Trichogramma chilonis* Ishii. Neupane *et al.* (1985)[5] have also reported *Trichogramma chilonis* to be the most important egg parasitoid of *C. partellus*.

Preliminary studies conducted to evaluate the impact of *Trichogramma* releases in reducing the damage caused by maize stem borer showed that the application of *T. chilonis* led to 68% decrease in damage over that of control indicating a success of *T. chilonis* against maize stem borer (Table 2).

Table 1- Incidence of maize stem borer damage during the whole crop season at different area of Kosi region

Location	Crop stage	Infestation
1	Vegetative	8.68
	Vegetative	10.5
	Vegetative	11.25
2	Tasseling	11.6
	Tasseling	12.0
3	Silking	11.8
	Silking	12.2
	Silking	12.6
4	Earing	12.0
5	Grain filling	12.8
	Grain filling	14.0
	Grain filling	12.8
	Grain filling	13.0

Table 2. Effect of *T. chilonis* application on maize stem borer damage.

Sl.no.	Treatment	Percentage damage by stem borer
1	Control	32.33
2	Treated with *Trichogramma*	10.25

So far use of systemic insecticides has been considered the only effective way of controlling maize stem borer infestation.[7,8] Application of insecticides not only increases the cost of production but also disturbs the non target fauna *of* beneficial insects and microbes in the soil. *Trichogramma,* though an effective parasitoid, but present in small numbers in the nature. Augmentative releases of *T. chilonis* are recommended as a safer alternative to the use of insecticides for the management of maize stem borer.

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