

Effect of certain Insecticide on the maize Stem borer (*C. partellus*) in Alluvial plain zone of Bihar, India

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Abstract

The maize stem borer (*Chilo partellus*) is a serious pest of maize crops in Bihar's alluvial plains, causing severe output losses. Effective management measures are required to limit the damage and assure long-term maize production. This study assesses integrated pest management (IPM) techniques, such as cultural, biological, and chemical control measures, for *C. partellus* management in the region. Field trials were carried out to determine the efficacy of various control methods. Cultural measures include timely planting, intercropping with non-host plants (e.g., cowpea), and thorough ploughing have been shown to minimise borer infestation. The introduction of *Trichogramma chilonis* (an egg parasitoid) was the most effective biological control agent in terms of larval population suppression. Furthermore, the use of neem-based bio-pesticides (Azadirachtin 0.15%) was successful in minimising larval damage. Chemical control measures, such as the use of chlorantraniliprole 18.5 SC and emamect in benzoate 5 SG, effectively eliminated pests while being environmentally safe. However, relying only on chemical pesticides raises worries about resistance development and environmental dangers. As a result, an integrated approach combining cultural practices, biological management, and the prudent use of chemical pesticides was shown to be the most successful technique for managing *C. partellus*. The study suggests that using an IPM technique adapted to Bihar's alluvial plains can dramatically reduce maize stem borer damage, increase crop production, and promote sustainable agriculture. Additional study is necessary to improve these tactics and provide more environmentally friendly pest control options.

Keywords: Chilo partellus, Maize stem borer, Integrated Pest Management, Biological control, Sustainable agriculture.

Introduction

Maize (*Zea mays L.*) is one of India's most significant cereal crops, used for food security, animal feed, and industrial purposes. The alluvial plain zone in Bihar provides excellent agro-climatic conditions for maize growing, contributing significantly to the state's agricultural economy (Dhillon *et al.*, 2021) [2]. However, insect infestations pose significant problems to maize production, notably the maize stem borer, *Chilo partellus*, which is a key limiting factor impacting crop productivity (Adhikari *et al.*, 2021) [1].

Chilo partellus is a harmful lepidopteran pest that infects maize plants in the early vegetative stage, digging into the stems and affecting nutrient circulation. Infestation causes stunted development, dead hearts, and major production losses, which can reach up to 30–80% in extreme situations. The warm and humid conditions of Bihar's alluvial plains promote the spread of this pest, necessitating strong control measures for long-term maize cultivation. Traditional management approaches, which mostly rely on chemical pesticides, have brought short-term respite while raising concerns about pesticide resistance, environmental degradation, and health risks. As a result, there is an increasing need to adopt an integrated pest management (IPM) approach that combines cultural, biological, and chemical control strategies to ensure effective and sustainable pest control. (Joshi *et al.*, 2005) [5].

Cultural methods including as intercropping, changing sowing timing, and field cleanliness have showed promise in lowering stem borer prevalence. Furthermore, biological control agents such as *Trichogramma chilonis* (egg parasitoid) and neem-based bio-pesticides provide environmentally benign alternatives to chemical pesticides. This study investigates alternative management options for *C. partellus* in Bihar's alluvial plain zone, focussing on the efficacy of IPM in minimising pest damage while guaranteeing environmental sustainability and economic viability for farmers.

Materials and methods

The goal of this research was to study alternative management options against *C. partellus* in Bihar's alluvial plain zone associated with maize crops (*Zea mays L.*) during Kharif cultivation of 2024. The material used, and methodology adopted during investigation are presented here,

Table 1

Crop	Maize
Name of variety	Samrat-55
Net plot size	7X5
Spacing (R XP)	60X20
Date of sowing	12/08/2024

Method of application: - Seed treatment was performed three hours before to planting, with the first dose of insecticides occurring after the third week after sowing and the second spray occurring 15 days following the first.

Methods of observations: - Weekly observations began on 20 DAS and continued until the crop reached maturity. Ten plants were chosen at random to determine the number of serious damages caused by stem borer in maize. The stem borer larval population is counted at 5-day, 10-day, 15-day, and 20-day intervals following each spray. At harvest, the grain yield of each plot was recorded.

Insecticides used in the study

Table 2

S.No	Treatments	Dose	Dose/ha
1	Imidacloprid48%FS	1.0ml/kg seed	20.0ml/ha
2	Thiamethoxam30%FS	8.0ml/kg seed	160.0ml/ha
3	Emamectinbenzoate5SG	0.4ml/ha	200ml/ha
4	Chlorantraniliprole 18.5 SC	0.3ml/ha	150ml/ha
5	Control	X	X

Result and Discussion

The first incidence of maize stem borer, (*C. partellus*) was observed during the 34thSMW, with 1.8 larvae per plant and a 30% plant damage rate. At the time, the crop was 25 days old and had 8 to 10 leaves on the corn plant. Following then, the population and percentage of plant damage increased steadily until the 36th SMW, when they peaked at 2.8 larvae per plant. Following that, a declining tendency was noted, with the population reaching its lowest level (1.0 larvae/plant) during the 38th SMW.

The application of imidacloprid (20.0 ml/ha) as a foliar spray, Thiamethoxam 30% FS (160.0 ml/ha) as a foliar spray, Emamectinbenzoate 5 SG 200 ml/ha, and Chlorantraniliprole 18.5 SC at a dose of 150 ml/ha as a foliar spray all help to significantly reduce the number of

maize stem borer in the farm. In contrast, the stem borer population in the control plot is growing daily and eventually destroying the entire field. The study also discovered that a large number of natural predators in and near maize fields such as dragon fly, king crow, beetles, wasp, preying mantid and pentatomid bug consume the stem borer and help to control its proliferation. However, there appeared to be a detrimental interaction between predators that fly and those that live on the ground. To learn more about how natural enemies and other variables impact the maize stem borer population, more study is required (*Shukla et al., 2005*) [7]. To achieve long-term and sustainable control of maize stem borer, it is essential to adopt a combination of pest management strategies, including the promotion of natural predators and parasitoids.

Although systemic insecticides have traditionally been regarded as the most effective control method, treatments such as Imidacloprid, Thiamethoxam, Emamectin benzoate, and Chlorantraniliprole have shown proven success in reducing larval populations. Nevertheless, reliance on insecticides raises production costs and negatively impacts non-target organisms like beneficial insects and soil microbes.

Biological control agents, including dragonflies, king crows, beetles, and mantids, contribute significantly to pest suppression, although conflicting interactions between ground-dwelling and flying predators may limit their overall effectiveness. The rapid pest escalation in untreated plots highlights the importance of timely pest management. Therefore, an integrated approach that balances chemical and biological controls, while conserving beneficial species, is vital for sustainable outcomes. *Trichogramma chilonis* is a valuable parasitoid, but its natural occurrence is limited. Consequently, augmentative releases of *T. chilonis* are suggested as a safer, eco-friendly alternative to chemical pesticides in maize stem borer management.





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