Evaluate the efficacy of different biopesticides with imidacloprid against maize spotted stem borer (*Chilo partellus swinhoe*) on maize under field conditions

ABSTRACT

Management of Maize stem borer *Chilo partellus* using different bio-pesticides in field conditionwas carried out during *Kharif 2023* at central Research field SHUATS Prayagraj,UP., India. The management of Maize stem borer was done using 8 different treatments and benefit cost ratios of all the treatments were calculated. Total two sprays were applied to protect the crop from *Chilo partellus* using randomized block design with three replications. The observations of *Chilo partellus* 24 hours before (Pre-treatment) and 3rd, 7th and 14th day after spraying (post-treatment) were recorded for computing the percent of larval population reduction. The data were subjected to statistical analysis after appropriate transformation for interpretation. The treatment with recommended insecticide cost benefit ratio and yield is in Imidacloprid 200 SL (T_7) (1:5.01) (40.49q/ha) followed by *Beauveria bassiana* (2CFU×10^8 ml) (T_1) (1:4.53) (38.45q/ha), *Bacillus thuringiensis* (10^8 CFU/ml) (T_4) (1:4.41) (37.7q/ha), *Metarhizium anisopliae* (T_2) (1:4.20) (36.79q/ha), *NPV* (T_3) (1:4.03) (35.98q/ha), NSKE @ 5% (T_5) (1:3.97) (34.6q/ha), Azadirachtin 0.03% (T_6) (1:3.85) (33.57q/ha) Lest monetary return and yield was obtained with control (T_0) (1:3.52) (28.4q/ha).

KeyWords: Biopesticides, *Chilopartellus*, Management , Maize stem borer , ImidAacloprid 200SL

INTRODUCTION

Maize (*Zea mays* L.) has become a staple food in many parts of the world, with total production surpassing that of wheat or rice. It is an important staple food crop in Asia and Africa. Maize occupies a pride place among cereal crops in India and due to its high yield potential is called the queen of cereals **(Kumar and Alam 2017)**.

Maize grain has elevated nutritive value as it contains about 72% starch, 10% protein, 4.8% oil, 5.8% fibreand 3% sugar. At present, out of the total maize produced, 55% is used for food purpose, about 14% for livestock, 18 % for poultry feed, 12 % for starch and one percent as seed **(Krishna and Kumar, 2018).** It is cultivated in nearly 201 m/ha with a production of 1162 m tonnes and productivity of 5754.7 kg/ha all over the world, having wider diversity of soil, climate, biodiversity and managementpractices **(FAOSTAT 2020)**. India produced 31.51 million tonnes in an area of 9.9 million hectares in 2020-21, whereas in *kharif* 2021-22, maize production was 21.24 million tonnes (1st advance estimates) in an area of 8.15 million hectares.

Out of 66 insects reported in maize field, there are 14 major pests such as Maize stem borer *Chilo partellus* Swinhoe), Fall Armyworm (*Spodoptera frugiperda* Smith), White grub **(Pokharel *et. al.*2021)**, etc. among which Maize stem börer *Chilo partellus* is more complex now a days.

Chilo partellus was first mentioned by **Charles Swinhoe in 1885 (CABI 2019).** *Chilo partellus* is cosmopolitan in nature having its origin in Asia and its severity was also reported in the African region. **(Pokharel *et. al.*2021)**. Stem borer can causesevere damage at different stages in the development of cereal crops from seedling to maturity. When infestation is severe, there is a physiological disruption of plant growth hence tassel emergence and grain formation are severely affected **(Addo-Bediako and Thanguane,2012)**. *Chilo partellus*, popularly known as stalk borer that occurs during monsoon season is a major pest throughout the country. *Chilo partellus* lays eggs 10-25 days after germination on the lower side of the leaves. The larva of the *Chilo partellus* enters the whorl and causes damage to the leaves. The losses ranging 26.7 to 80.4 per cent have been reported due to *Chilo partellus* Swinhoe.

Out of them, *Chilo Partellus* (Swinhoe) is a serious pest of maize throughout India during *kharif* season causing grain yield loss of 24.3 to 36.3 percent. Almost 75% damage of the crop occurs dueto attack of maize stem borer.

The applications of various insecticides with different modes of action strengthen insecticide resistance management strategy. Thus, to demonstrate these promising tools of pest management at farmers' fields and economic comparison of different insecticidal treatments is necessary **(Anonymous 2016).**

MATERIALS AND METHODS

The present investigation was conducted at the Central Research Farm, SHUATS, Prayagraj during *kharif season* 2022-23. The experiment was conducted during the *kharif* season 2022 at SHUATS, Central research farm, Prayagraj, is situated at 25.27°C north latitude 80.50°C East longitude. The research trails was laid out during the *Kharif* season of 2022 in Randomized Block Design (RBD) with three replications, seven treatments and untreated control.

In the experiment maize variety, Aarhoee was sown, The site selected was uniform, cultivable with typical sandy loam soil having good drainage. Each block were sub-divided into 2m×1m with maintaining 30cm borders as bund and the treatment were assigned randomly. The field trail was conducted with seven insecticides + biopesticides treatments in which include (T_1) *Beauveria bassiana* 10^8 CFU/ml@1g/lit, (T_2)*Metarhizium anisopliae@2*.5ml/lit, (T_3)Nuclear polyhedrosis virus @400-500ppm, (T_4) *Bacillus thuringiensis* 10^8CFU/m@750ml/ha,(T_5)Neem seed kernel extract 5% @5 ml/lit, (T_6) Azadirachtin 0.03%@5.0ml/l,(T_7) Imidachloropid 200SL 0.5ml/lit, (T_8) Control.

Application of treatments for the management of the *Chilo partellus* was initiated as soon as 5% ETL of Larval population observed in experimental field. Subsequent application was under taken at an interval of 3, 7, 14 days were made during experimental period. The observation was recorded on weekly intervals throughout the cropping season. To assess the incidence of stem borer at weekly intervals the total number of plants and number of plants Larval population observed (number of dead hearts and pin holes present on the leaves) was counted from each plot.

The percentage Larval population observed of the maize stem borer was calculated according to thefollowing equation:

$$\%\ \text{infestation} = \frac{Number\ of\ infested\ plant}{total\ no\ of\ plant} \times 100$$

Results and Discussion

The present study entitled "Efficacy of certain chemicals and biopesticides against maize stem borer, *Chilo partellus* (Swinhoe)" was undertaken the data so obtained through observation on various aspects were subjected to statistical analysis wherever necessary and the compiled mean data are present in the following pages.

The data on the Larval population first spray mean(3rd ,7th and 14th DAS)spray revealed that few treatments were significantly superior over control. Among all the treatments lowest larval population was recorded. The lowest percent of larval population was observed in theT6 Carbofuran 3G(5.63), T5 Emamectin benzoate 5% SG (6.30) ,T4 Cypermethrin 25% EC(6.58), T7 Spinosad 45% EC (7.10) ,T2 NSKE 5% (7.38), T3 Beauveria bassiana (1 x 108 CFU/ml) (7.73) ,T1 Neem oil(7.94),T0 Control (8.76) is found to be highest larval population than all treatments and is significally superior over the control T0 (8.76).

The data on the Larval population on second spray mean (3rd , 7 th and 14th DAS) revealed that few treatments were significantly superior over control. Among all the treatments lowest larval population was recorded. The lowest percent of larval population was observed in the T6 Carbofuran 3G(5.51), T5 Emamectin benzoate 5% SG (6.05) ,T4 Cypermethrin 25% EC(6.88), T7 Spinosad 45% EC (7.28) ,T2 NSKE 5% (7.63), T3 Beauveria bassiana (1 x 108 CFU/ml) (8.73) ,T1 Neem oil(8.13) ,T0 Control (9.18)is found to be highest larval population than all treatments .

When cost benefit ratio worked out, interesting result was achieved, among the treatment studied, the highest cost benefit ratio in T6 Carbofuran 3G(1:3.09) these results are similarly finding by **Prakash *et al.* (2017)** ,followed by T5 Emamectin benzoate 5% SG (1:2.93) these results are supported by **Rani *et al.* (2018)** ,T4 Cypermethrin 25% EC(1:2.78) these results are likely to be in **Reddy *et al.*(2021)** , T7 Spinosad 45% EC (1:2.31) these results are supported by **Malav *et al.*(2018),**T2 NSKE 5% (1:2.39) these results are supported by **Venkata *et al.* (2018)**, T3 Beauveria bassiana (1 x 108 CFU/ml) (1:2.31) these results are similarly findings by **Saranya *et al.* (2017)** . The lowest cost benefit ratio was recorded in T1 Neem oil(1;2.12) these results are supported by **Ramanujam *et al.* (2017)**.when compared to T0 control (1:2.01).

Table 1: Efficacy of different biopesticides with imidacloprid against maize spotted stem borer (*Chilo partellus swinhoe*) (1st and 2nd spray):

S. No.	Treatments	Dosage	Larval Population of *chilo partellus*										Yield(q/ha)	C:B Ratio
			First spray					Second spray				Overall mean		
			1DBS	3DAS	7DAS	14DAS	Mean	3DAS	7DAS	14DAS	Mean			
T_1	*Beauveria bassiana* (10^8 CFU/ml)	1g/lit	7.200	5.000^{e}	4.000^{e}	4.600^{ef}	4.533^{fg}	3.533e	3.133^{e}	2.267^{g}	2.978^{fg}	3.756^{de}	38.45	1:4.53
T_2	*Metarhizium anisopliae*	2.5ml/lit	6.133	5.667^{d}	5.267^{c}	5.467^{cd}	5.467^{de}	4.533^{d}	4.133^{d}	3.200e	3.955^{de}	4.711^{bcde}	36.79	1:4.20
T_3	*Nuclear polyhedrosis virus*	400-500ppm	6.667	6.133^{c}	5.600^{c}	5.867^{c}	5.867^{cd}	5.133^{c}	4.600^{d}	3.733d	4.489^{cd}	5.178^{bcd}	35.98	1:4.03
T_4	*Bacillus thuringiensis* (10^8CFU/m)	750 ml/ha	6.400	5.400^{d}	4.533^{d}	5.000d^{e}	4.978^{ef}	4.133^{d}	3.600^{e}	2.667^{f}	3.467^{ef}	4.223^{cde}	37.70	1:4.41
T_5	Neem seed kernel extract @5%	5 ml/lit	6.867	6.533^{b}	6.133^{b}	6.400^{b}	6.355^{bc}	5.533^{c}	4.867^{c}	4.133^{c}	4.844^{c}	5.600^{bc}	34.60	1:3.97
T_6	Azadirachtin (0.03%)	5 ml/lit	7.467	6.800^{b}	6.400^{b}	6.533^{b}	6.578^{b}	6.400^{b}	5.467^{b}	4.800^{b}	5.556^{b}	6.067^{b}	33.57	1:3.85
T_7	Imidachloropid 200SL	0.5 ml/lit	6.200	4.667^{e}	3.800^{e}	4.400^{f}	4.289^{g}	3.133^{e}	2.467^{f}	1.800^{h}	2.467^{g}	3.378^{e}	40.49	1:5.01
T_8	Control	-	7.667	7.800^{a}	8.767^{a}	8.900^{a}	8.489^{a}	9.200^{a}	9.400a	9.733^{a}	9.444^{a}	8.967^{a}	28.40	1:3.52
F-Test			NS	**S**	**S**	**S**	S	**S**	**S**	**S**	S	S		
S.Ed.(±)			NS	0.16	0.23	0.22	0.26	0.23	0.24	0.17	0.29	0.91		
CD (0.05)			NS	0.33	0.48	0.48	0.583	0.49	0.504	0.360	0.623	1.87		-

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