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Evaluation of different insecticides on maize stem borer, *Chilo partellus* (Swinhoe)

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Abstract
Management of Maize stem borer *Chilo partellus* (Swinhoe) using various insecticides in field condition was carried out during *Kharif* 2019-2020 at central Research field SHUATS Prayagraj, UP., India. The management of Maize Stem borer *Chilo partellus* (Swinhoe) was done using 8 different treatments and benefit cost ratios of all the treatments were calculated. Single spray was applied to protect the crop from *Chilo partellus* using randomized block design with three replications. The observations of *Chilo partellus* before 24 hours (Pre- treatment) and 3rd, 7th and 14th day after spraying (Post-treatment) were recorded for computing the percent of pest reduction. The data were subjected to statistical analysis after appropriate transformation for interpretation. The treatment with recommended insecticide Fipronil 0.3% G was of the most effective treatment followed with Carbofuran 3G and Spinosad 45% SC The next best treatments were found to be Chlorantraniliprole 0.4G, Cypermethrin 10% EC. Indoxacarb and Profenophos were found to be least effective against *Chilo partellus* (Swinhoe). The highest Benefit cost ratio was recorded with Fipronil (1:1.70) and Carbofuran (1:1.60) followed by the Spinosad (1:1.46), Chlorantraniliprole (1:1.39), Cypermethrin (1:1.28), Indoxacarb (1:1.15), Profenophos (1:1.07).

Keywords: *Chilo partellus*, fipronil, insecticides, *Zea mays*

Introduction
Maize (*Zea mays* L.) is an important cereal crop with high economic value after wheat and rice in the world [1, 5]. *Zea mays* (Linnaeus) which belongs to family Poaceae. Maize, known as 'Queen of cereals' because of its immense yield potential, it is the highest yielding cereal crop of world [19] and is particularly important in countries like India where food security is most vulnerable due to ever increasing population that has outnumbered the available resources. It has short growing season and is drought resistant that make it very easy to grow everywhere in different climatic conditions of the world [2].

It is one of the most versatile crops grown under a wide range of agro-ecological locations of tropical, sub -tropical and temperate regions of the world. It is used as human food, animal feed, fodder, for production of starch, oil, liquor, dextrose and dyes etc. In India, about 28% of maize produced is used for food purpose, about 11% as livestock feed, 48% as poultry feed, 12% in wet milling industry (starch and oil production) and 1% as seed [19].

Insect pest's infestation are causing a major threat to maize crop due to its high susceptibility throughout the crop duration. Maize plant is attacked by 140 species of insect pests causing varying degree of damage [18]. Many insect pests like maize stem borer, European corn borer, pink borer, shoofly, cutworms and aphid attack maize crop and adversely affect its production. Among them, maize stem borer *Chilo partellus* (Swinhoe) (Lepidoptera: Pyralidae) is most common destructive insect pests of maize crop [4, 22].

In general, the borer caused minor damage, pin holes on leaves. In severe cases, dead hearts are formed, the condition in which the plants do not bear any ear at all. At our context, till now, yield loss caused by maize stem borer yet to be estimated in combined with the relationship of stem tunnelling as well as leaf damage to monitory value. However, some researchers have reported that borer can culminate yield loss of 20-87% [7, 13].

The stem borer attack can weaken the maize plant resulting in lodging as well as breaking and dead heart, which ultimately reduces maize yield. For effective management of stem borers infesting maize, effective chemicals and their timing of application (early whorl stage) is significant as this pest is internal feeder and control at different stage offers narrow scope for chemical control [16].

Application of various insecticides with different mode of action strengthen insecticide management resistance strategy. Thus, to demonstrate the pest management with different insecticide treatment is necessary. So, the best one can be identified for the management of Maize stemborer, through their comparative effective of chemical insecticides the present investigation was therefore undertaken with.

Materials and Methods

A Field experiment was conducted during *Kharif* 2019 at Central Research Field, Department of Entomology, SHUATS, Prayagraj (U.P.). The climate is typically semi-arid and subtropical. The maximum temperature reaches up to 48 oC in summer and drops down to−2 oC in winter. The site selected was uniform, cultivable with typical sandy loam soil having good drainage. The trial was laid out in Randomized Block Design. The experiment was carried out on Maize variety is King9999. It was sown with seed rate of 20-25Kg/ha at spacing 60×20 cm. There were 8 treatments each replicated thrice. The treatments consist of Fipronil 0.3%G (12Kg/ha), Carbofuran 3G (20Kg/ha), Spinosad 45%SC (45g/ha), Chlorantraniliprole 0.4G (10Kg/ha), Cypermethrin 10%EC (550ml/ha), Indoxacarb 14.5 SC 500ml/ha and Profenofos 40% EC (500ml/ha). Recommended doses of nitrogen, phosphorous and potassium were applied.

Application of treatments for the management of the *Chilo partellus* was initiated as soon as 5% ETL of infestation observed in experimental field. 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 infested plants (number of dead hearts and pin holes present on the leaves) were counted from each plot. Observations on number of larvae were recorded on 3, 7 and 14 days of each spray and were subjected to statistical analysis.

Results and Discussion

The observations were recorded on weekly intervals throughout the cropping season. Different pest per plant was counted and recorded at weekly intervals on plants. The observations on number of stemborer were done by counting the number of dead hearts and pin holes present on leaves. While recording observations on stem borer the middle whorl of the plant was gently plucked and observed the pest. The data on percent of dead hearts showed that all the insecticides were significantly superior over control in reducing the infestation percent of stem borer which were recorded at 3, 7 and 14 DAS mean after insecticidal application Fipronil was found significantly superior (7.767%), these findings are supported by Deepak singh *et al.* [8] and Singh *et al.* [19] followed by Carbofuran (9.400%) similar findings were also reported by Malav *et al.* [12] and Devananda *et al.* [9], Spinosad (10.700%) was next best treatment these similar findings are with those of Karthikeyan *et al.* [11] and Sarsawati *et al.* [17], Next best treatment proved to be Chlorantraniprole (12.333%) these similar findings are with those of Omprakash *et al.* [14] and Pallavi *et al.* [15], Cypermethrin (13.33%) was found next best these similar findings are with those of Malav *et al.* [12] followed by Indoxacarb (14.33%) and Profenophos (14.35%) these similar findings are with those of Wajid *et al.* [20] and Amol *et al.* [3] was found least effective when compared with other treatments given in Table1and graphical representation in Fig1.

Conclusion

Results showed that Fipronil 0.3%G proved to be most effective and economical for managing maize stem borer damage due to their mode of action compared to other insecticides. Recommended dose of chemicals be useful in devising proper integrated pest management strategy against maize stem borer.

Table 1: Evaluation of different Insecticides treatments on the incidence maize stem borer (*Chilo partellus)* infestation after first spray.

S. No	Treatment	Mean % of Plant Infestation				
		1DBS	3DAS	7DAS	14DAS	MEAN
T1	Fipronil	16.63	10.73	6.80	5.83	7.76
T2	Carbofuran	13.66	11.73	8.76	7.80	9.40
T3	Spinosad	17.60	13.70	9.76	8.76	10.70
T4	Chlorantraniprole	13.70	14.66	10.73	11.73	12.33
T5	Cypermethrin	12.70	15.66	11.73	12.73	13.33
T6	Indoxacarb	12.70	16.63	12.73	13.70	14.33
T7	Profenophos	13.66	17.60	12.70	12.70	14.33
T0	Control	13.66	15.66	15.63	23.46	18.20
	F- TEST	NS	S	S	S	S
	S-Ed	1.118	0.878	0.876	0.998	0.853
	CD	-	4.055	4.036	5.24	3.82

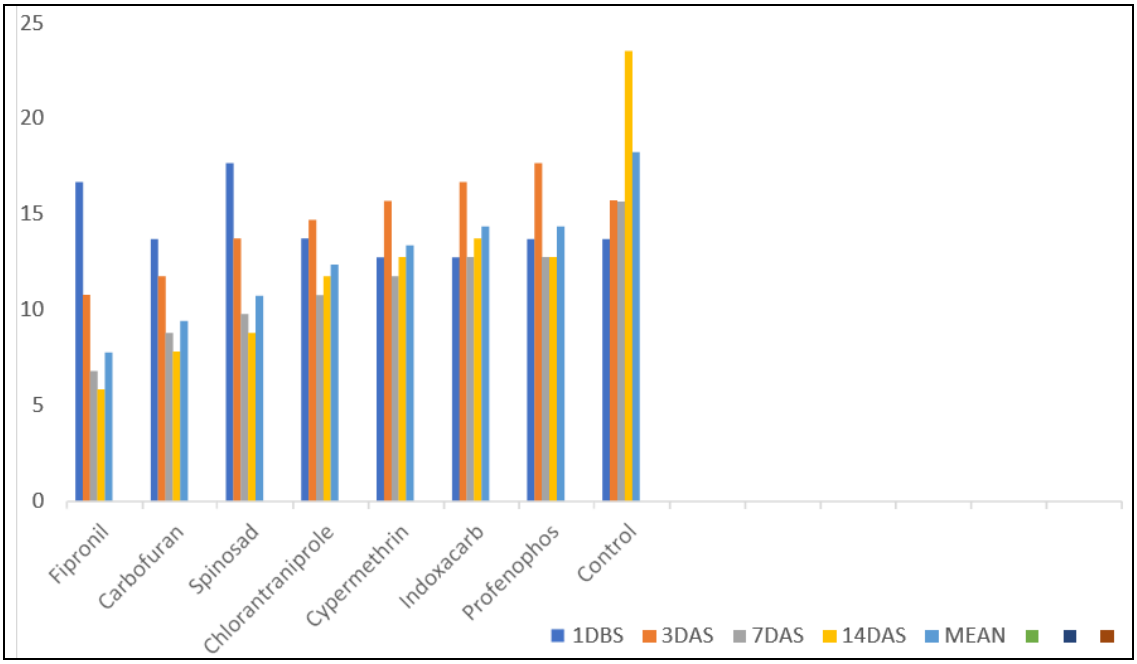

Fig 1: Graphical representation on evaluation of different insecticides on maize stem borer after first spray

Table 2: Evaluation of different Insecticides on Maize stem borer (*Chilo partellus*) percent mean reduction.

S. No	Treatment	%Mean reduction					
		1DBS	3DAS	7DAS	14DAS	Mean	%Mean Reduction
T1	Fipronil	16.63	10.73	6.80	5.83	7.76	57.36
T2	Carbofuran	13.66	11.73	8.76	7.80	9.40	48.35
T3	Spinosad	17.60	13.70	9.76	8.76	10.70	41.20
T4	Chlorantraniprole	13.70	14.66	10.73	11.73	12.33	32.2
T5	Cypermethrin	12.70	15.66	11.73	12.73	13.33	26.75
T6	Indoxacarb	12.70	16.63	12.73	13.70	14.33	21.26
T7	Profenophos	13.66	17.60	12.70	12.70	14.35	21.15
T0	Control	13.66	15.66	15.63	23.46	18.20	0
	F- TEST	NS	S	S	S	S	
	S-Ed	1.118	0.878	0.876	0.998	0.853	
	CD	-	4.055	4.036	5.24	3.82	

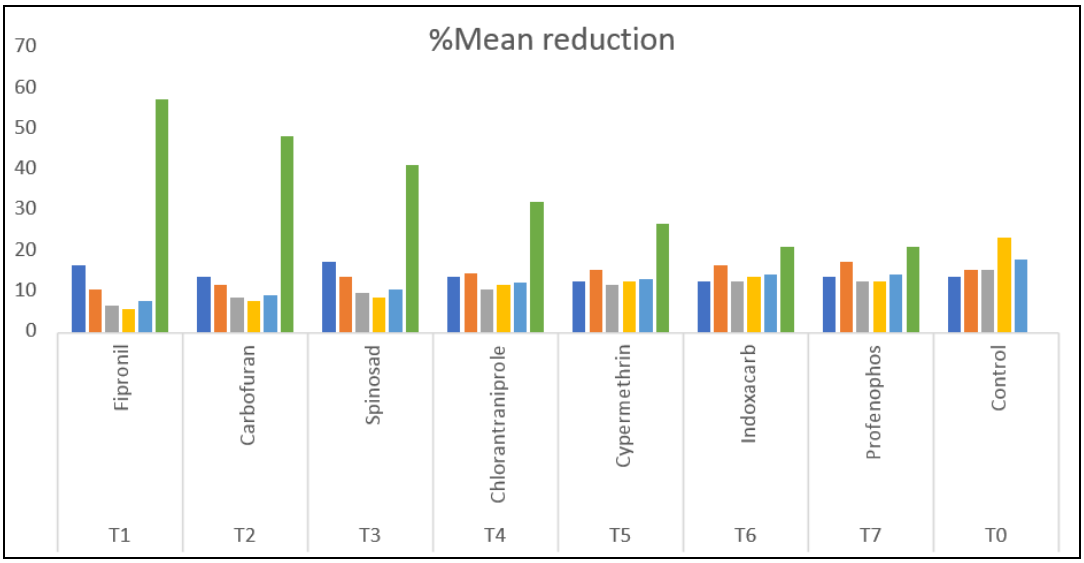

Fig 2: Graph representing the % Mean reduction

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