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Efficacy of new insecticide molecules against spotted stem borer *Chilo partellus* (Swinhoe) in maize

■ M. Lavakumar Reddy*, P. Lakshmi Soujanya[1], J.C. Sekhar[1], D. Sreelatha **and** V. Narsimha Reddy

Maize Research Centre (PJTSAU), Agricultural Research Institute, Rajendranagar, **Hyderabad (Telangana) India**

[1]Winter Nursery Centre, ICAR- Indian Institute of Maize Research, **Hyderabad (Telangana) India**

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*Corresponding author:
mlkreddy2003@yahoo.co.in

ABSTRACT

Management of spotted stem borer *Chilo partellus* (Swinhoe) on maize (DHM 117) by insecticides with different concenterations was conducted at Maize Research Centre, Hyderabad, Telangana during *Kharif* 2015 and 2016. The observations based on leaf injury rating, grain yield and cost benefit ratio showed that flubendiamide 480 SC @0.1 ml followed by flubendiamide 480 SC @0.2 ml and deltamethrin 2.8 EC @ 0.8 ml/l of water proved highly effective and economical in reducing the *C. partellus* damage.

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INTRODUCTION

Maize (*Zea mays* L.) is the most widely grown cereal crop in India after rice and Wheat. Maze is grown for various purposes including fodder, food and as a basic raw material for industrial products. The productivity of maize is challenged by various biotic and abiotic factors. Among biotic factors, over 130 insect pests cause varying degree of damage from seedling to maturity stage of maize crop. Out of these insect pests, stem borers cause yield losses ranging from 25.7 to 78.9 per cent (Chatterjee *et al.*, 1969). The spotted stem borer, *Chilo partellus* (Swinhoe) is the key pest throughout India during *Kharif* (rainy season) and pink borer, *Sesamia inferens* (Walker) is serious in peninsular India during *Rabi* (winter) season (Siddiqui and Marwaha, 1993). *C. partellus* is an important pest in Asian and African countries like Afghanistan, Bangladesh, East Africa, Iraq, Japan, Indonesia, Nepal, Malawi, Pakistan, India, Sudan, Taiwan, Thailand and Uganda (Siddiqui and Marwaha, 1993 and Arabjafari and Jalali, 2007) and has a wide host range in cultivated and wild species (Khan *et al.*, 1997 and Van den Berg *et al.*, 2001).

Adult moth of spotted/striped stem borer lay 20-25 creamy white oval scale like eggs in clusters at night. Fecundity is around 250-300. Immediately after hatching, dirty greyish white larva with black head crawl over the leaf for about 15-30 minutes and then feed on the surface of tender leaves and bore downwards through the whorl and reach the growing point of the plant. As the whorl opens, pin holes or shot holes (occur in a parallel fashion)

are seen on the leaf surface. The larvae cut the growing point resulting in drying up of the central shoot and subsequent formation of "dead heart" which on pulling comes out easily. Larvae feed on the tissues (pith) inside the stem and tunnels are formed due to which not only plant vigour is lost but also reduction in grain yield. With slight wind, plant collapses and dries. Losses in yield vary from 26.7 to 80.4 per cent and are attributed to early infestation (10-20 days old plants) on the growing plant. Caterpillars also damage by boring into immature cobs and tassels. Keeping in view of the importance of maize crop, and the economic losses caused by the spotted stem borer during *Kharif* season, the present study aimed to test the efficacy of new insecticide molecules against *C. partellus* for its management.

MATERIAL AND METHODS

A field experiment was laid out during *Kharif* 2015 and 2016 with single cross maize hybrid DHM-117 at Maize Research Centre, ARI, Rajendranagar, Hyderabad, Telangana. The trial was laid out in a Randomized Block Design with 9 treatments, each replicated thrice with a plot size of 9 m^2 (4 rows of 3 meter length). A spacing of 0.75 and 0.20 m between row to row and plant to plant was followed, respectively. Also a distance of 0.75 and 1 m was kept between treatments and replications. Recommended agronomical practices were followed in raising the crop and the details of the treatments are given in Table 1.

The middle two rows of each treatment were artificially infested with ten second generation neonate larvae per plant at 12 days after germination (DAG). Treatments were imposed two days after infestation by the foliar application of respective insecticides.Leaf injury rating was recorded on 1-9 scale (Sarup *et al*., 1979) on middle infested 2 rows plants at 25 days after infestation. In control, spray was done with water. The grain yield from individual treatment was recorded separately during harvest and expressed as q/ha. While comparing the yield from different treatments, the per cent increase in yield over control was calculated using the following formula (Pradhan, 1969).

$$\text{Increase in yield over control (\%)} = \frac{T - C}{C} \times 100$$

where,

T = Yield from treated plot

C = Yield from control plot

Data were subjected to statistical analysis by using ANOVA. Economics of different insecticides were worked out as per the market price of the commodities. The benefit cost ratio was also calculated by dividing net profit over control by the total cost.

RESULTS AND DISCUSSION

The results of two years pooled data (Table 1) indicated that all the insecticidal treatments were

Table 1: Relative efficacy of different insecticidal treatments (dose) against *Chilo partellus* (Pooled analysis of two years data)

Treatments		Leaf injury at 25 DAI (1-9 scale)	Grain yield (q/ha) at 15% moisture	Increased grain yield over control q ha^{-1}	Per cent increase in grain yield over control (%)	Total Monitory value over control (Rs. ha^{-1})	Total cost of the treatment (Rs. ha^{-1}) insecticide+ Labour charges	Net monitory returns over control (Rs. ha^{-1})	Net cost benefit ratio (1: ↓)
T_1	Chlorantraniliprole 20 SC @ 0.3 ml/l	3.3	43.3	12.22	39.28	16680.3	3300	13380	4.1
T_2	Chlorantraniliprole 20 SC 0.4 ml/l	3.0	40.0	8.89	28.58	12134.9	4133	8002	1.9
T_3	Flubendiamide 480 SC 0.1 ml/l	3.3	46.7	15.50	49.82	21157.5	1150	20008	17.4
T_4	Flubendiamide 480 SC 0.2 ml/l	2.8	47.8	16.67	53.58	22754.6	1500	21255	14.2
T_5	Novaluron 10EC 0.75 ml/l	3.6	43.3	12.22	39.28	16680.3	2750	13930	5.1
T_6	Novaluron 10EC 1.0 ml/l	3.5	38.9	7.78	25.01	10619.7	3400	7220	2.1
T_7	Deltamethrin 2.8 EC 0.4 ml/l	3.7	38.9	7.78	25.01	10619.7	930	9690	10.4
T_8	Deltamethrin 2.8 EC 0.8 ml/l	3.3	42.2	11.11	35.71	15165.2	1060	14105	13.3
T_9	Control water spray	5.4	31.1						
	Over all mean	3.5	41.4						
	S.E.±	0.3	0.21						
	C.D. (P=0.05)	0.71	0.44						

Monetary value @Rs.1365 per quintal prevailing during August, 2017 DAI: Days after infestation

significantly superior over untreated control in reducing the stem borer damage. The mean leaf injury rating ranged from 2.8 to 3.7 in the insecticide treated plots as compared to 5.4 in the untreated control on 1-9 rating scale. Among the insecticidal treatments, flubendiamide 480 SC @ 0.2 ml/l (2.8), followed by chlorantraniliprole 20 SC @0.4 ml/l (3.0), chlorantraniliprole 20 SC @0.3 ml/l (3.3) flubendiamide 480 SC @ 0.1 ml/l (3.3) and deltamethrin 2.8 EC @ 0.8 ml/l (3.3) were found to be significantly effective over rest of the treatments in suppressing *C. partellus* damage, respectively. Anuradha (2013) also reported that chlorantraniliprole was effective against maize stem borer when applied @ 40, 50 and 60 g a.i. ha^{-1}.

Grain yield (q/ha):

The pooled grain yield data (Table 1) also revealed that the insecticidal treatments gave significantly higher grain yield over control (31.11 q ha^{-1}). The per cent increase in grain yield over control amongst the treatments, ranged from 25.01 to 53.58. Flubendiamide 480 SC @ 0.2 ml/l and flubendiamide 480 SC @ 0.1 ml/l were most effective against stalk borer which reflected in significantly higher grain yield (47.8 and 46.7 q ha^{-1}) resulting in 53.58 and 49.82 per cent increase over control, respectively. Devi and Singh (2016) reported that flubendiamide @ 24 g a.i. ha^{-1} was quite effective against yellow stem borer *Scirpophaga incertulas* in rice.

Economic estimation of different insecticides against *C. partellus*:

The cost benefit ratio (CBR) of different insecticidal treatments has been worked out aiming at economical and equally effective treatment against *C. partellus* to obtain maximum profit ha^{-1} (Table 1). The data revealed that, CBR was highest with flubendiamide 480 SC @ 0.1 ml (17.4) followed by flubendiamide 480 SC @ 0.2 ml (14.2) and deltamethrin 2.8 EC @ 0.8 ml per litre of water (13.3), respectively.

Conclusion:

The effectiveness was observed with all the insecticides *viz.*, chlorantraniliprole, flubendiamide, novaluron and deltamethrin (each at different doses) against stem borer *Chilo partellus*. However, flubendiamide 480 SC @ 0.1 ml/l of water was found to be effective, economical and also attained highest cost benefit ratio among all the treatments. Hence, flubendiamide 480 SC@ 0.1 ml/l of water can be recommended for the management of stem borer.

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