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RM Poul
Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

NE Jayewar
Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

RY Khandare
Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
RM Poul
Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

Evaluation of different newer insecticides against stem borer, *Chilo partellus* on sorghum

RM Poul, NE Jayewar and RY Khandare

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Abstract
Field experiment was conducted at AICSIP, sorghum Research Station, VNMKV, Parbhani (MS) during *Kharif* 2019-20 to evaluation of seven newer insecticides *viz.*, chlorantraniliprole 18.5% SC, flubendiamde 39.35% SC, emamectin benzoate 5% SG, cyantraniliprole 10.26% OD, thiomethoxam 12.6%+ lambda cyhalothrine 9.5% ZC, spinosad 45% SC and profenophos 50% EC were treated against stem borer, *Chilo partellus*. The results revealed that all the insecticidal treatments were significantly effective against stem borer over untreated control among them chlorantraniliprole 18.5% SC most effective treatment followed by flubendiamde 39.35% SC and emamectin benzoate 5% SG.

Keywords: Evaluation, stem borer, *chilo partellus*, chlorantraniliprole, flubendiamde, emamectin benzoate

1. Introduction
Sorghum [*Sorghum bicolor* (L.) Monech] is the fifth major cereal crop after rice, wheat, maize and barley. Extensively grown in the semi- arid tropics for its nutritious cereals and important dry land crop grown in marginal land, with minimum inputs. It is now recognized worldwide as smart crop capable of providing food, feed, fuel, juicy stalk and precious fodder especially under moderate inputs, especially in water scarce environment. It is main staple food for the world's poorest and most food-insecure people [10]. In India during *Kharif* 2017-18 area was 5.86 lakh hectares with production of 4.63 lakh tones and productivity of 980 kg/ha. In Maharashtra region during 2017-18 area was 4.10 lakh hectares with production of 4.17 and productivity of 1018 kg/ ha. In Marathwada predominant *Kharif* sorghum growing districts are Parbhani, Nanded, Latur and Hingoli [1]. Among the many reasons, insect-pests are one of the major yield reducing factors in sorghum on a global basis. Nearly 150 pest species have been reported as pests of sorghum worldwide [5].
The pest in succession is spotted stem borer, *Chilo partellus* which attacks a month old crop. The larva initially feed on tender leaf whorls and later bore in the stem causing 'deadheart'. Recently released hybrids and varieties of sorghum are found to be susceptible to stem borer and their yield potential cannot be fully realized without insecticidal umbrella. Spotted stem borer, *Chilo partellus* infests the sorghum crop from second week till maturity. Initially, the larvae feed on the axial surface of the whorl leaves, leaving the lower surface intact as transparent windows. As the severity of the feeding increases, the plant becomes ragged in appearance. When the larvae damage the growing point, typical dead heart symptom develops in younger plants (the entire whorl dries up) and also pinholes on the whorl of newly opened leaves are seen. Subsequently, the older larvae leave the whorl and bore into the stem at the base resulting in extensive tunneling. Peduncle tunneling results either in its breakage or complete or partial chaffy panicles affecting grain development [3]. The yield losses of 55 to 83% due to stem borer infestation have been recorded in Northern India in sorghum [6]. Also observed even up to 88% loss due to *Chilo partellus* in sorghum [9]. To overcome resistance problems, reduce doses of insecticides with selective mode of action and persistence against target pest. The present study to evaluate different newer insecticides against sorghum stem borer.

2. Materials and Methods
The experiment was conducted at the AICSIP, Sorghum Research Station, VNMKV, Parbhani (MS) during *Kharif* 2019-20 on sorghum variety Parbhani Shweta (PKV-801).

The experiment was laid out in Randomized Block Design with three replications and eight treatments including untreated control. The field was prepared following the recommended packages of practices with spacing of 45X15 cm with plot size 6.75 X 2.5 m. The observation on deadhearts due to stem borer recorded per plot. The pretreatment observations were recorded one day before insecticidal spray and post treatments observations were taken on 3, 7 and 14 days after each spray**.** The volume of spray water was worked out before insecticidal spray by spraying plain water on control plot. Spraying was done in early morning hours to avoid mid-day heat. Spraying was done by using knapsack sprayer with hollow cone nozzle.

2.1. Details of insecticides used in experiment.

Tr. No	Treatment details	Conc. (%)	Dose (ml or g/10lit. water)
T_1	Profenophos 50% EC	0.15%	30
T_2	Cyantraniliprole 10.26% OD	0.014%	10
T_3	Emamectin benzoate 5%SG	0.002%	4
T_4	Spinosad 45%SC	0.018%	4
T_5	Thiamethoxam 12.5% + Lambda cyhalothrin 9.5%ZC	0.011%	5
T_6	Chlorantraniliprole18.5% SC	0.005%	3
T_7	Flubendiamide 39.35% SC	0.009%	2.5
T_8	Untreated control	-	-

3. Results and Discussion

The deadhearts of stem borer, one day before spray revealed that the deadhearts ranged between 26.36 to 27.46% which was statistically non- significant indicating uniform distribution of the pest population (Table No. 1). The per cent deadhearts ranged between 17.83 to 27.60% after third day spraying. Significantly lowest per cent of deadhearts were recorded in the treatment chlorantraniliprole 18.5% SC (17.83%) which was at par with emamectin benzoate 5% SG (19.70 percent), flubendiamide 39.95% SC (19.83%), thiamethoxam 12.6% + lambda cyhalothrin 9.5% ZC (21.42%) and spinosad 45% SC (29.71%). Cyantraniliprole 10.26% OD (22.22%) and profenophos 50% EC (23.96%) followed them. In the untreated control (27.60%) the highest deadhearts due to stem borer were recorded.

After seven day spraying the deadhearts due to stem borer were ranged between 9.53 to 28.62%. The treatment chlorantraniliprole 18.5% SC (9.53%) recorded the minimum per cent of deadhearts which was significantly superior over all insecticides treatments, emamectin benzoate 5% SG (10.54%) and flubendiamide 39.35% SC (11.26%). These were followed by spinosad 45% SC (11.83%), thiamethoxam 12.6 + lambda cyhalothrin 9.5% ZC (12.43%) and cyantraniliprole 10.26% OD (12.86%). These treatments were also found at par with each other. The next best treatment was profenophos 50% EC (18.73%).The untreated control recorded statistically significantly highest deadhearts (28.62%).

After fourteen days spraying deadhearts count due to stem borer was ranged between 4.96 to 28.47%. The lowest per cent deadhearts were recorded in the treatment chlorantraniliprole 18.5% SC (4.96%), which was at par with emamectin benzoate 5% SC (5.37%), flubendiamide 39.35% SC (5.59%), spinosad 45% SC (6.22%) and thiamethoxam 12.6 + lambda cyhalothrin 9.5% ZC (6.63%). These treatments were followed by, cyantraniliprole 10.26% OD (6.92%) and profenophos 50% EC (13.58%).

The mean data on the stem borer deadhearts at 3, 7 and 14 days after application of insecticides indicated that minimum infestation was observed in the chlorantraniliprole @ 18.5% SC (10.77%) and followed by emamectin benzoate @ 5% SG (12.20%), flubendiamide @ 39.35% SC (12.23%), spinosad @ 45% SC (13.42%), thiamethoxam 12.6 + lambda cyhalothrin 9.5% ZC (13.49%), cyantraniliprole @10.26% OD (13.91%) and profenophos @ 50% EC (18.75%). The results of investigation indicated that the treatment chlorantraniliprole 18.5% SC was found most effective for the management of stem borer, however the untreated control constantly registered highest deadhearts count due to stem borer.

The findings of present investigations are in the conformity with above research workers. The foliar application of spinosad (0.002%) significantly reduced damage of *Chilo partellus*. The marginal increase in maize grain yield was in the order of 38.66 and 31.93%, respectively for the treatments spinosad (0.002%) and emamectin benzoate (0.002%) over untreated check [8]. Chlorantraniliprole 18.5% SC effective against stem borer *Chilo partellus* [7]. The insecticide chlorantraniliprole 0.4 G were found to be effective molecules against *Chilo partellus* [2]. Chlorantraniliprole 18.5% SC found highly effective in reducing the larval population and dead hearts of maize stem borer *Chilo partellus* in maize than other insecticides spraying [4].

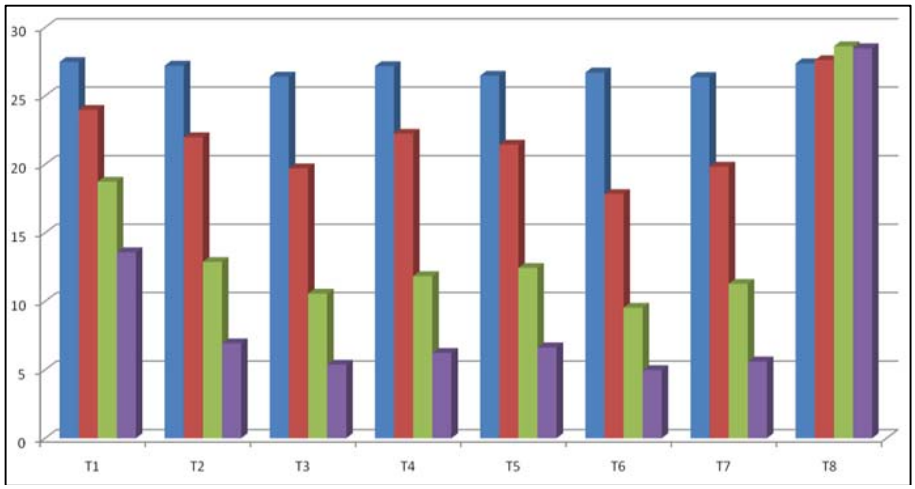

Fig 1: Percent deadhearts due to stem borer (*Chilo partellus*) on 1DBS, 3DAS, 7DAS and 14 DAS

Table 1: Evaluation of different insecticides against stem borer (*Chilo partellus*) on sorghum

Tr. No.	Treatment	Conc. (%)	Doses /10 lit of water	Deadhearts due to stem borer (%)				
				1DBS	3 DAS	7 DAS	14 DAS	Mean
T_1	Profenophos 50 EC	0.15	30 ml	27.46 (31.58)	23.96 (29.29)	18.73 (25.63)	13.57 (21.58)	18.75 (25.65)
T_2	Cyantraniliprole 10.26 OD	0.014	10 ml	27.20 (31.41)	22.22 (28.11)	12.86 (20.97)	6.92 (15.25)	13.91 (21.86)
T_3	Emamectin benzoate 5 SG	0.002%	4 g	26.40 (30.90)	19.70 (26.33)	10.54 (18.89)	5.37 (13.39)	12.20 (20.37)
T_4	Spinosad 45 SC	0.018%	4 ml	27.17 (31.40)	21.97 (27.94)	11.83 (20.11)	6.22 (14.41)	13.42 (21.48)
T_5	Thiamethoxam12.6 + Lambda cyhalothrin 9.5 ZC	0.011%	5 ml	26.46 (30.94)	21.42 (27.56)	12.43 (20.62)	6.63 (14.91)	13.49 (21.47)
T_6	Chlorantraniliprole 18.5 SC	0.005%	3 ml	26.69 (31.08)	17.83 (24.96)	9.53 (17.97)	4.96 (12.87)	10.77 (19.15)
T_7	Flubendiamide 39.35 SC	0.009%	2.5 ml	26.36 (30.88)	19.83 (26.40)	11.26 (19.60)	5.59 (13.67)	12.23 (20.46)
T_8	Untreated control	--	--	26.70 (31.04)	27.60 (31.68)	28.62 (32.32)	28.47 (32.22)	28.23 (32.06)
	S.E.±			1.28	0.98	0.68	0.70	0.88
	C.D. at 5%			NS	3.02	2.10	2.17	2.72
	C.V%			8.31	7.83	8.20	12.62	10.01

*Figures in parentheses are Angular transformed values

4. Conclusion

Concluded that among the insecticide chlorantraniliprole 18.5% SC 3ml/10lit most effective insecticides against management of stem borer, *Chilo partellus* on sorghum followed by emamectin benzoate 5% SG, flubendiamide 39.35% SC, thiamethoxam 12.6 + lambda cyhalothrin 9.5% ZC and spinosad 45% SC.

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