Indian Journal of Entomology 84(3): 647-650 (2022) DoI No.: 10.55446/IJE.2021.52

EFFICACY OF INSECTICIDES AGAINST SORGHUM SPOTTED STEM BORER *CHILO PARTELLUS* (SWINHOE)

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ABSTRACT

Efficacy of insecticides against spotted stem borer *Chilo partellus* (swinhoe) in sorghum was studied at the institutional farm, Regional Agricultural Research Station, Nandyal, Andhra Pradesh during rabi 2016-17 and 2017-18. Deadhearts were observed to be less with spinosad (4.0%) followed by carbofuran 3G (4.10%), chlorantraniliprole 18.5SC (4.95) and chlorantraniliprole 0.4G (4.86) applied at 25 days after sowing. The least infestation at 40 days after sowing was observed with chlorantraniliprole 18.5SC (6.2%), spinosad 45SC (7.0%), chlorantraniliprole 0.4G (7.3%) and carbofuran 3G @ 10 kg/ ha (8.0%). Lesser number of larvae in the stem tunnel were observed with chlorantraniliprole 18.5SC/ 0.4G, spinosad, carbofuran 3G, phorate 10G and flubendiamide. The incremental benefit cost ratio was maximum with carbofuran 3G (5.2:1), followed by chlorantraniliprole 0.4G (4.8:1) and chlorantraniliprole 18.5SC (4.2:1).

Key words: *Chilo partellus*, chlorantraniliprole, sorghum, tunnel damage, deadhearts, exit holes, carbofuran 3G, spinosad, leaf injury scale

Sorghum is the fifth most important cereal crop cultivated for food, feed and fodder in dry lands of India over 5.024 million ha (2017-18) with productivity of 956 kg/ ha (www. statistics.com). Sorghum is damaged by >150 insect species, of which the shoot fly, stem borer, grain midge, and a complex of earhead pests are the major ones. The spotted stem borer *Chilo partellus* is the most important pest worldwide (Jotwani and Young, 1971; Sharma, 1993). Larvae of *C. partellus* after hatching, enter in to the stem and feeds on the pith resulting in deadhearts initially; and with further attack the lower nodes are damaged making tunnels resulting in ill filled grains and chaffy earheads. Yield losses of 28% had been reported by this pest alone (Sharma and Gautam, 2010). This being an internal borer, it is difficult to control with single spray. Carbamate and organophosphate insecticides which are presently recommended against this are highly toxic to natural enemies and to the environment. The present study evaluates some novel insecticides including new generation granular formulations and spray fluids against this pest.

MATERIALS AND METHODS

The field trial was conducted during rabi 2016-17 and 2017-18 at the Regional Agricultural Research Station, Nandyal, Andhra Pradesh. Sorghum variety NTJ 5 was sown with spacing of 45x 15 cm in randomized block design in three replications with ten treatments including untreated control (Table 1). Insecticides evaluated were acephate 75SP, thiodicarb 75WP, spinosad 45SC, flubendiamide 48SC, chlorantraniliprole 18.5SC, profenophos 50EC, carbofuran 3G, chlorantraniliprole 0.4G, and phorate 10G. The treatments were done as per the standard protocol. The first application was given at 25 days after sowing (DAS) and the second at 15 days after the first spray. At 25 DAS, deadhearts were counted on whole plot basis and leaf injury scale was observed on twenty randomly selected plants following the visual rating scale of 1 to 9 given by Tefera et al. (2013) and Lavakumar Reddy et al. (2003). These data were obtained at pretreatment, seven and fourteen days after the treatment. After pretreatment data, deadhearts were removed and occurrence of fresh ones was observed at seven and fourteen days after treatment. Second spray was given at 15 days after the first spray i.e., at 40 days after sowing, and the % infestation (based on exit holes) were observed at pretreatment, seven and fourteen days after second spray. Number of larvae in the stem and damaged tunnel length were also observed by destructive sampling of ten randomly selected plants at 14 days after the second spray. Grain was harvested/ plot and the yield expressed as kg/ ha. The data obtained were subjected to statistical analysis for ANOVA and least significance difference (LSD).

RESULTS AND DISCUSSION

The pooled data of 2016-17 and 2017-18 revealed

Table 1. Efficacy of insecticides against *C. partellus* (2016-17, 2017-18)

Tr. No.	Insecticide	Dose g or ml/ ha	Deadhearts (%)			Leaf damage scoring			Infestation (%)			Larvae/ stem tunnel (No.) *	Damaged tunnel length (cm)*	Exit holes (No.)
			Pre treatment	7 DAT**	14 DAT**	Pre treatment	7 DAT	14 DAT	Pre-Treatment	7 DAT**	14 DAT**			
T1	Acephate 75SP	750 g	6.95	3.81 (11.26)^{a}	5.62 (13.71)^{c}	2.7	4.0	4.0	10.5	14.4 (22.30)^{c}	15.6 (23.26)^{c}	2.37 (1.84)^{b}	26.48 (5.24)^{a}	3.8
T2	Thiodicarb 75WP	750 g	8.36	4.74 (12.57)^{b}	8.18 (16.62)^{e}	3.3	4.3	3.7	9.4	14.5 (22.38)^{c}	16.2 (23.73)^{c}	2.01 (1.73)^{b}	30.22 (5.59)^{b}	3.1
T3	Spinosad 45SC	175 ml	6.85	3.43 (10.67)^{a}	4.00 (11.54)^{a}	3.7	3.7	2.0	6.0	6.5 (14.77)^{a}	7.0 (15.34)^{a}	1.42 (1.56)^{a}	21.63 (4.76)^{a}	1.9
T4	Flubendiamide 48SC	100 ml	7.34	2.66 (9.39)^{a}	6.78 (15.09)^{d}	3.3	4.3	3.3	8.2	11.2 (19.55)^{b}	11.6 (19.91)^{b}	1.78 (1.67)^{a}	22.78 (4.88)^{a}	2.8
T5	Chlorantraniliprole 18.5SC	150 ml	8.18	4.67 (12.48)^{b}	4.95 (12.86)^{b}	3.3	3.7	1.7	5.0	5.8 (13.94)^{a}	6.2 (14.42)^{a}	1.39 (1.55)^{a}	18.11 (4.37)^{a}	1.8
T6	Profenophos 50EC	1000 ml	6.35	3.09 (10.12)^{a}	8.59 (17.04)^{e}	3.0	4.3	4.0	12.0	13.6 (21.64)^{c}	14.5 (22.38)^{c}	2.25 (1.80)^{b}	27.91 (5.38)^{a}	4.3
T7	Carbofuran 3G	10 kg	5.45	4.02 (11.57)^{a}	4.10 (11.68)^{a}	3.7	4.7	2.7	5.5	7.2 (15.56)^{a}	8.0 (16.43)^{a}	1.56 (1.60)^{a}	20.28 (4.61)^{a}	2.6
T8	Chlorantraniliprole 0.4G	10 kg	6.73	4.09 (11.67)^{b}	4.86 (12.74)^{b}	3.7	4.0	2.0	5.2	6.3 (14.54)^{a}	7.3 (15.68)^{a}	1.41 (1.55)^{a}	23.30 (4.93)^{a}	2.3
T9	Phorate 10G	12.5 kg	8.90	4.61 (12.40)^{b}	6.72 (15.02)^{d}	4.3	4.3	3.0	7.0	10.4 (18.81)^{b}	10.4 (18.81)^{b}	1.65 (1.63)^{a}	20.73 (4.66)^{a}	3.3
T10	Control		6.14	8.55 (17.00)^{c}	11.08 (19.44)^{f}	4.0	4.7	6.7	15.6	25.6 (30.40)^{d}	34.5 (35.97)^{d}	4.28 (2.30)^{b}	34.54 (5.96)^{b}	5.8
	CD (p=0.05)		NS	2.25	0.88					2.01	2.17	0.27	1.15	
	CV(%)		10.6	11. 9	8.95					7.28	8.01	9.6	10.2	

**Fgures in parentheses angular transformed values; *figures in parentheses square root transformed values; DAT- Days after treatment that all the parameters like deadhearts, visual leaf injury score, plant infestation, number of larvae inside the stem and damaged tunnel length were significantly affected by the treatments. All the treatments were superior over untreated control. Deadhearts at pretreatment ranged from 5.5 to 8.9 without any significant differences among the treatments. At seven days after treatment, significantly less % deadhearts were observed with flubendiamide 48SC (2.66%), chlorantraniliprole 18.5SC (3.09), spinosad 45SC (3.43) against a maximum of 8.55 in untreated control. At 14 days after the spray spinosad was the best with 4.0% deadhearts followed by carbofuran 3G (4.10%), chlorantraniliprole 0.4G (4.86) and chlorantraniliprole 18.5SC (4.95). Lowest leaf injury score of 3.7 was observed with spinosad and chlorantraniliprole 18.5SC at seven days and score of 1.7 was in chlorantraniliprole 18.5SC at 14 days after treatment. The *C. partellus* infested plants were the least with chlorantraniliprole 18.5SC (5.8, 6.2%), chlorantraniliprole 0.4G (6.3, 7.3%), spinosad 45SC (6.5, 7.0%) and carbofuran 3G @ 10 kg/ha (7.2 and 8.0%) at seven and fourteen days after the treatment, respectively. Number of larvae inside the tunnel were less in chlorantraniliprole 18.5 SC (1.39), chlorantraniliprole 0.4G (1.41), spinosad (1.42), carbofuran 3G (1.56), phorate 10 G (1.65) and flubendiamide (1.78) at 14 days after the treatment (Table 1).

These findings are in agreement with those of Jawala Jindal et al. (2017) that significantly low leaf injury was in chlorantriniliprole 18.5SC over broad spectrum conventional insecticides in maize. The efficacy of chlorantraniliprole 0.4G against *C. partellus* in maize in terms of reduction in deadhearts combined with high grain yield in maize was observed by Ashwinder et al. (2018) and Arunkumara et al. (2017). Less stem tunnel damage was observed with chlorantraniliprole 18.5SC followed by carbofuran 3G (20.28) which was significantly superior. These results corroborate with those of Ramkumar and Tanweer Alam (2017) on the efficacy of chlorantraniliprole and carbofuran in maize. Bamaiyi and Joan (2011) observed that the tunnel damage was relatively less in carbofuran 3G treated plots as observed now. The exit holes caused by the adult emergence were less in chlorantraniliprole 18.5SC (1.8) followed by spinosad (1.9) and chlorantraniliprole 0.4G (2.3) Ramkumar and Tanweer Alam (2017). Khan et al. (2020a, b) proved the effectiveness of carbofuran 3G in reducing plant damage, deadhearts and larvae/ plant in maize. The gross yield varied from 4053 kg/ ha in untreated control as aginst 5236 kg/ ha with chlorantraniliprole 0.4G. The incremental benefit cost ratio was maximum with carbofuran 3G (5.2), followed by chlorantraniliprole 0.4 G (4.8) and chlorantraniliprole 18.5 SC (4.2). Singh et al. (2014) and Kumar et al. (2017) observed that the maximum cost benefit ratio was obtained with carbofuran 3G (Fig. 1).

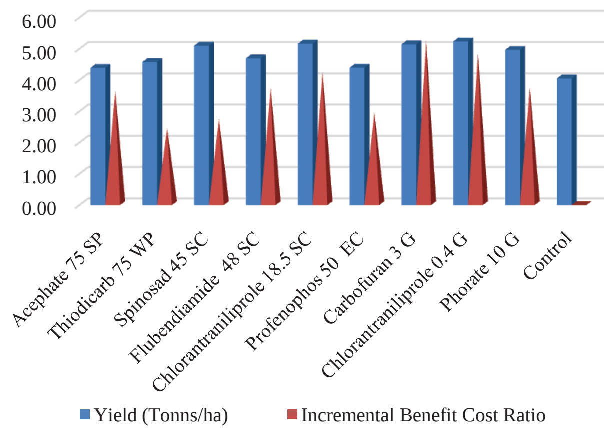

Fig 1. Effect of insecticides on yield and economics in sorghum

Thus, it is concluded that chlorantraniliprole 18.5SC, spinosad 45SC, chlorantraniliprole 0.4G and carbofuran 3G are effective against *C. partellus* in sorghum with higher yields and incremental benefit cost ratio.

ACKNOWLEDGEMENTS

The authors acknowledge the Acharya N G Ranga Agricultural University, Lam, Guntur, Andhra Pradesh, India for their guidance and support. This study was conducted at the Regional Agricultural Research Station, Nandyal for two years and the entire funding was given by Acharya N G Ranga Agricultural University under non plan entomology.

AUTHOR CONTRIBUTION STATEMENT: The authors, Dr A S R Sarma contributed in execution of the experiment and C V Chandra Mohan Reddy supplied the seed material.

CONFLICTS OF INTEREST/ COMPETING INTERESTS: The submitted manuscript is original work, neither published so far nor communicated elsewhere for publication, and there are no conflicts of interest.

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(Manuscript Received: January, 2021; Revised: September, 2021;
Accepted: September, 2021; Online Published: October, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e21015