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Incidence and Chemical Control of Sorghum Shootfly, *Atherigona soccata* (Rondani) on Grain Sorghum

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ABSTRACT

Incidence of sorghum shootfly, *Atherigona soccata* (Rondani) started at third week of December and reached to its peak by 5th standard week. Among different factors minimum temperature and wind speed showed negative but significant relation with its infestation. Nine different Chemicals *viz*., phorate 10 G, carbofuran 3 G, fipronil 0.3 G, cartap hydrochloride 4 G, chlorpyriphos 20 EC, phosphamidon 40 SL, nimbecidine, *Bt* var. *kurstaki* and spinosad 45 SC were evaluated in the field @ 1.5 kg, 750 g, 75 g, 800 g a.i./ha, 0.06%, 0.08%, 0.3%, 1.0 g./lit and 0.018%, respectively, against shootfly during rabi, 2005-06. The results revealed that spraying of phosphamidon 40 SL @ 0.08% and chlorpyriphos 20 EC @ 0.06% and whorl application of phorate 10 G @ 1.5 g a.i. ha^{-1} were the most effective against *A.soccata*.

Key words :*Atherigona soccata*, Chemical control, Incidence, Sorghum shootfly.

Sorghum (Jowar), the third most important cereal crop after rice and wheat in India is a product of human ingenuity. It has immense potentiality to feed the large population of drought effected third world countries. Out of 150 insect species reported as pests of sorghum, shootfly, *Atherigona soccata* Rondani (Diptera : Muscidae) is one of the major pests causing significant losses in sorghum production in North India (Jotwani *et al.,* 1980 and Prem Kishore, 2001). Typical damage symptom is production of "dead heart" which gives offensive smell when pulled out. This is mainly a pest of seedling stage. Death of seedling induces production of side tillers, which may also be infested. Few scientists have worked on its chemical management (Patil *et al.,* 1992; Prem Kishore and Ganesh Rai, 1999; Balikai *et al.,* 2001; Prem Kishore *et al.,* 2003; Palta and Chauhan, 2004 and Karibasvaraja *et al.,* 2005a) and found some chemicals promising. In the present study four granular chemicals alongwith five liquid chemicals of different modes of action have been evaluated in the field against shootfly.

MATERIAL AND METHODS

Field experiment was conducted in a Randomized Block Design during *rabi* 2005-06 at College Farm, Agricultural College, Bapatla to evaluate the efficacy of nine insecticides *viz.,* phorate 10 G (1.5 kg a.i. ha^{-1}), carbofuran 3 G (750 g a.i. ha^{-1}), fipronil 0.3 G (75 g a.i. ha^{-1}), cartap hydrochloride 4 G (800 g a.i. ha^{-1}), chlorpyriphos 20 EC (0.06%), phosphamidon 40 SL (0.08%), nimbecidine (0.3%), Bt var. *kurstaki* (1.0 g L^{-1}) and spinosad 45 SC (0.018%) against shootfly of sorghum. First four granular insecticides were applied in leaf whorls and the remaining five was applied as foliar spray with a knapsack sprayer as and when pest infestation occurs. Two sprays were given in all. A popular local variety of sorghum was sown in plots of size 5 m x 4 m with a spacing of 45 cm x 15 cm. The crop was grown with recommended package of practices except plant protection. Overall there were ten treatments including untreated control, all replicated thrice.

Observations on the efficacy of insecticides were recorded as total number of "dead hearts" out of twenty randomly selected tagged plants in each plot leaving the border rows at one day before treatment application and at 2, 6 and 10 days after treatment (DAT). Destructive sampling method was adopted for taking the sampling. Then these data were converted to per cent population reduction over untreated check by following the modified Abbott's formula (Fleming and Retnakaran, 1985).

Per cent population reduction =

The data thus obtained was subjected to appropriate transformation and then analyzed to arrive at a meaningful conclusion.

For taking the observation on incidence of shootfly a 300 m^2 bulk plot was raised with 45 cm x 15 cm spacing . Incidence was recorded as number of “dead hearts” due to shootfly attack out of 100 randomly selected plants at five different locations at 7 days interval starting from 5th day after germination till harvest. The meteorological data available at College Farm, Bapatla was also collected simultaneously and simple correlation between the pest incidence and weather parameters were also carried out. While collecting data destructive sampling method was followed. The affected tillers out of 100 selected plants were pulled out leaving the remaining part which again produced side tillers, which were also susceptible to shootfly attack. When subsequent count was taken these affected plants were again taken into consideration due to their additional tillers attacked by shootfly. Hence, the cumulative number of dead hearts was more than that of the plants taken randomly under investigation (*i.e.,* 100).

RESULTS AND DISCUSSION

The initial infestation of the pest was noticed during third week of December (*i.e.,* 51st standard week), increased gradually from 3.00 to 43.00 per cent dead hearts and become nil from 10th standard week. Peak incidence of *A.soccata* was observed during the first week of February (5th standard week) with a pest infestation of 43.00 number of dead hearts per 100 plants and thereafter declined gradually with rise in temperatures above 31^{0}C (Table 1). However, Gowda *et al.* (1995) reported peak period of infestation during the fourth week of November and the third week of September from Bangalore during the year 1993. This may be due to the difference in sowing time, cropping pattern and change in ecological conditions in that area.

A significant negative correlation was observed between per cent dead hearts and minimum temperature and wind speed. Maximum temperature and evening relative humidity have shown non-significant negative relationship whereas all remaining factors (*viz*., morning relative humidity, percentage of coccinellids and spiders) were found to be positively non-significant (Table 2).

These results were in conformity with Taneja *et al.* (1986) and Gahukar (1987) who reported negative relationship of trap catches of shootfly with maximum temperature and positive relationship with morning relative humidity. Karibasavaraja *et al.* (2005b) also reported negative correlation with maximum and minimum temperatures.

Contrary to this Taneja *et al.* (1986) reported that evening relative humidity (minimum humidity) was positively correlated. Gahukar (1987) also reported the same and also added that minimum temperature was positively correlated with shootfly abundance.

The cumulative mean efficacy of two applications observed after 2, 6 and 10 days after treatment (Table 3) revealed that phosphamidon 40 SL @ 0.08% was on par with chlorpyriphos 20 EC @ 0.06%, phorate 10 G @ 1.5 kg a.i. ha^{-1} and cartap hydrochloride 4 G @ 800 g a.i. ha^{-1} were the most effective treatment in reducing the *A.soccata* infestation by 57.31, 56.26, 54.55 and 54.40 per cent, respectively.

These results are in close approximation with Palta and Chauhan (2004) who reported significantly lower dead hearts (12.90%) than untreated control (27.00%) when seed soaked with phosphamidon. Effectiveness of chlorpyriphos against Dipteran pest is reported by Kendappa *et al.* (2005). According to him there was significant reduction of *L.trifolii* on French bean (18.00%) as compared to control (51.85%) when applied with chlorpyriphos 20 EC @ 0.05 per cent. Effectiveness of phorate against *A.soccata* was in accordance with Palta and Chauhan (2004) whereas effectivity of cartap hydrochloride on other dipteran pest, *i.e., Hydrellia sasakii* Ferina in rice has been reported by Peter and David (1988).

The effectiveness of the remaining treatments were in the following order carbofuran 3 G (53.36%) >, fipronil 0.3 G (52.65%) > spinosad 45 SC (46.41%) > nimbecidine (34.38%) >, *Bt* var. *kurstaki* (34.35%) where carbofuran and fipronil was statistically on par and nimbecidine and *Bt* var. *kurstaki* was also at par with each other.

Hence, it may be concluded from the present study that superior control of shootfly of sorghum could be achieved by spraying of phosphamidon 40 SL @ 0.08% and chlorpyriphos 20 EC @ 0.06% or whorl application of phorate 10 G @ 1.5 kg a.i. ha^{-1} and cartap hydrochloride 4 G @ 800 g a.i. ha^{-1}. Next to the above insecticides carbofuran 3 G @ 750 g a.i. ha^{-1} or fipronil 0.3 G @ 75 a.i. ha^{-1} can give optimum control of the pest.

Table 1: Influence of abiotic and biotic factors on the incidence of shoot fly, *Atherigona soccata* Rondani on grain sorghum (*Rabi*, 2005-06)

Standard week	Temperature (^{0}C)		Relative humidity (%)		Average wind speed (Km h^{-1})	Natural enemy population/100 plants		No.of DH/100 plants
	Maximum	Minimum	Morning	Afternoon		Coccinellids	Spiders	
51st	29.58	20.23	84.57	77.86	4.50	0	0	3
52nd	29.23	15.99	91.23	66.14	2.72	0	0	9
1st	29.44	15.37	92.71	59.14	3.50	0	0	21
2nd	29.83	18.53	94.86	74.29	2.29	1	0	32
3rd	30.99	17.30	93.71	65.14	2.50	2	3	34
4th	30.83	16.31	78.57	61.86	3.65	1	2	39
5th	30.23	15.93	93.71	71.00	3.07	6	4	43
6th	31.30	16.90	91.00	56.71	3.36	23	10	28
7th	31.39	17.01	87.29	65.00	3.72	49	8	20
8th	33.01	18.21	82.57	54.29	3.86	33	8	14
9th	32.87	19.36	88.43	66.43	5.00	11	6	7
10th	32.09	21.63	82.14	74.57	5.86	13	10	0
11th	32.00	23.47	83.43	74.29	5.43	8	7	0
12th	33.71	21.76	81.14	66.43	4.79	3	5	0
13th	33.57	22.11	89.57	70.71	4.64	0	3	0
14th	33.11	25.93	79.29	78.14	7.36	0	1	0
15th	33.59	26.54	73.29	72.29	7.79	0	0	0
16th	32.60	23.60	85.00	71.14	5.00	0	0	0

Table 2 : Simple correlation between incidence of *A.soccata* and certain abiotic and biotic factors on grain sorghum (*rabi*, 2005-06)

Variables			Correlation coefficient (r)
X_1	-	Maximum temperature (^{0}C)	-0.5745 NS
X_2	-	Minimum temperature (^{0}C)	-0.7717 **
X_3	-	Morning relative humidity (%) (8.30 hrs)	0.5264 NS
X_4	-	Evening relative humidity (%) (17.30 hrs)	-0.4268 NS
X_5	-	Wind speed (km h^{-1})	-0.7346 **
X_6	-	Coccinellid (%)	0.1331 NS
X_7	-	Spider (%)	0.0161 NS

NS = Non significant

** Significant at 0.01%

Table 3. Mean efficacy of treatments after two applications against *A.soccata* on sorghum during *rabi*, 2005 - 06

Treatments	Dose/Conc.	Mean dead hearts one day before treatment/plot (%)	Mean reduction of infestation over untreated control (%)			Mean efficacy
			2 DAT	6 DAT	10 DAT	
T1 : Phorate 10 G	1.5 kg a.i.ha^{-1}	21.67	45.28 (42.28)^{a}	60.68 51.17)^{abc}	57.69 (49.45)^{a}	54.55 (47.61)^{abc}
T2 : Carbofuran 3 G	750 g a.i.ha^{-1}	21.32	44.14 (41.63)^{ab}	59.75 (50.62)^{bc}	56.20 (48.57)^{a}	53.36 (46.93)^{bc}
T3 : Fipronil 0.3 G	75 g a.i.ha^{-1}	20.67	44.40 (41.77)^{ab}	58.96 (50.17)^{c}	54.58 (47.64)^{a}	52.65 (46.52)^{c}
T4 : Cartap hydrochloride 4 G	800 g a.i.ha^{-1}	21.61	46.82 (43.17)^{a}	59.57 (50.52)^{bc}	56.81 (48.95)^{a}	54.40 (47.52)^{abc}
T5 : Chlorpyriphos 20 EC	0.06%	18.23	48.04 (43.87)^{a}	61.40 (51.59)^{ab}	59.34 (50.43)^{a}	56.26 (48.60)^{ab}
T6 : Phosphamidon 40 SL	0.08%	19.30	48.86 (44.35)^{a}	62.95 (52.51)^{a}	60.12 (50.85)^{a}	57.31 (49.20)^{a}
T7 : Nimbecidine 300 ppm	0.3%	22.07	30.34 (33.37)^{c}	45.16 (42.22)^{e}	27.64 (31.36)^{c}	34.38 (35.88)^{e}
T8 : *Bt* var.kurstaki	1.0 g L^{-1}	23.15	31.48 (31.13)^{c}	44.44 (41.81)^{e}	27.12 (31.36)^{c}	34.35 (35.87)^{e}
T9 : Spinosad 45 SC	0.018%	22.01	38.96 (38.62)^{b}	55.37 (48.08)^{d}	44.90 (42.07)^{b}	46.41 (42.94)^{d}
T10 : Control	-	29.84	0 (0.00)^{d}	0 (0.00)^{f}	0 (0.00)^{d}	0 (0.00)^{f}
F - Test			Sig.	Sig.	Sig.	Sig.
SEm (±)			1.15	0.47	1.72	0.68
CD (p=0.05)			3.43	1.39	5.11	2.01

Note: Values in parentheses are angular transformed values. In each column values with similar alphabets do not vary significantly.
Sig. = Significant DAT = Days after treatment

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