INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 1 | APRIL, 2016 | 193-198

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.1/193-198

Management of shoot fly *Atherigona soccata* (Rondani) with different seed dressing chemicals

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ARITCLE INFO

Received : 17.12.2015
Revised : 26.02.2016
Accepted : 07.03.2016

KEY WORDS :
Sweet sorghum, Seed dressers, Germination, Shoot fly, Efficacy

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ABSTRACT

This investigation was carried out in Tamil Nadu Agricultural University, Coimbatore to test the bio efficacy of different seed dressing chemical on the management of sorghum shoot fly. The micro plot field experiments conducted in farm holdings at Chinnamatham palayam and Idikarai, Coimbatore District revealed the effectiveness of imidacloprid in checking shoot fly incidence by recording a mean minimum dead heart damage of 20 and 11 per cent in trial I and II, respectively. The experiments also showed maximum plant height of 39.2 and 39.7 cm in imidacloprid treated plots. In the laboratory, the assessment of seed dressing chemicals on the germination indicated maximum germination (92 %) of sweet sorghum seeds in imidacloprid treatment with maximum seedling vigour index (2401.2). Laboratory experiments showed no adverse effect of imidacloprid and thiamethoxam on seed germination.

How to view point the article : Sridhar, K., Sridharan, S. and Muthukumar, M. (2016). Management of shoot fly *Atherigona soccata* (Rondani) with different seed dressing chemicals. *Internat. J. Plant Protec.*, **9**(1) : 193-198.

INTRODUCTION

Sweet sorghum is considered as a multi-purpose industrial crop. In India, nearly 32 per cent of sorghum crop is lost due to insect pests (Borad and Mittal, 1983).The shoot fly, *Atherigona soccata* (Rondani) is one of the serious pest attacking sorghum in India. It causes severe damage during early stage of crop growth and effect losses up to 25 per cent in local and 25 – 62.5 per cent in introduced varieties (Amin, 1964). Thirumurthi *et al.* (1975) treated the seeds with carbofuran, disulfoton, phorate and acephate at 6 per cent a.i (w/w) basis and concluded that carbofuran treated seeds was highly effective against sorghum shoot fly. Vedamoorthy *et al.* (1967) concluded that phorate granules in combination with fertilizer or phorate granules alone at 2.2g/m row during sowing check shoot fly damage with 5.1 and 5.4 per cent deadhearts, respectively as against 85.8 per cent in untreated check. Hence, the present study was undertaken to test the bio efficacy of different seed dressing chemicals on the management of shoot fly and assess the impact of chemical seed dressers on the germination of seed and seedling vigour.

MATERIAL AND METHODS

Two micro plot field experiments were conducted at Chinnamathampalayam and Idikarai of Coimbatore district to test the bio efficacy of insecticides and biopesticides as seed dressers to control shoot fly

Field experiment I – Chinnamathampalayam (*Kharif*) :

The experiment was conducted to find out the bioefficacy of certain seed dressing chemicals *viz.*, chlorpyriphos, endosulfan, dimethoate, *Pseudomonas fluorescens*, thiamethoxam and imidacloprid on the management of shoot fly. The required quantity of the chemicals for 100 gram of the seeds was mixed using dilute solution of gum acacia. After mixing, the treated seeds were shade dried and used for sowing. The trial was laid out with seven treatments and three replication in RBD (Table A).

The observation on deadheart damage was recorded in 40 plants per plot selected at random. The data on deadheart damage was collected on 15, 21 and 30 days after sowing. From the number of plants showing dead heart damage and the total number of plants observed, per cent deadheart damage was worked out. The data gathered were statistically analysed for interpretation.

Biometric parameters :

The biometric observations on plant height and girth were recorded at 15, 21 and 30 days after sowing.

Plant height :

The height of the plant up to the tip of the top fully opened leaf from the ground level was measured using meter scale on 15, 21 and 30 days of sowing. In each replication ten plants were selected at random for recording the observation.

Field experiment II – Idikarai (summer) :

The efficacy of the seed dressing chemicals in checking the shoot fly incidence was assessed in the micro plot experiment laid out at Idikarai during summer. The incidence of shoot fly as dead heart damage was observed at 15, 21 and 30 days after sowing. The observation on dead heart incidence and biometric observations were recorded as described above.

Impact of seed dressing chemicals on germination under laboratory condition:

The effect of various seed dressing chemicals on seed germination, seedling vigour and other related parameters were assessed under laboratory condition using standard procedure.

The impact of seed dressing chemicals on the germination of seeds and seedling vigour was assessed under laboratory condition. The seeds of known quantity were mixed with the gum and then the desired quantity of the chemical was added to the gum coated seed and mixed well. The seeds were dried in shade and used subsequently for the experiment. The germination test using paper towel method was carried out at the

Table A : Details of micro plot experiments on shoot fly management

Particulars	Trial I	Trial II
Location	Chinnamatham palayam	Idikarai
Cultivar	SSV- 84	SSV- 84
Season	*Kharif*	Summer
Design	Randomized Block Dcesign	Randomized Block Design
Plot size	$1m^2$ (1×1m)	$1m^2$ (1×1m)
Spacing	45× 15 cm	45× 15 cm
Number of treatments	Seven	Seven
Number of replications	Three	Three
Seed treatments tested	T_1- Chlorpyriphos 20EC (Dursban) 4ml/kg (0.04%)	T_1- Chlorpyriphos 20EC (Dursban) 4ml/kg (0.04%)
	T_2– Endosulfan 35EC (Thiodan) 4ml/kg (0.04%)	T_2 – Endosulfan 35EC (Thiodan) 4ml/kg (0.04%)
	T_3 - Dimethoate 30EC (Rogar) 4ml/kg (0.04%)	T_3- Dimethoate 30EC (Rogar) 4ml/kg (0.04%)
	T_4- *Pseudomonas fluorescens* @ 10g/kg (0.1%)	T_4- *Pseudomonas fluorescens* @ 10g/kg (0.1%)
	T_5– Thiamethoxam 25WG (Cruiser) 1g/kg (0.01%)	T_5– Thiamethoxam 25WG(Cruiser) g/kg (0.01%)
	T_6– Imidacloprid 70WS (Gaucho) 1g/kg (0.01%)	T_6– Imidacloprid 70WS (Gaucho) 1g/kg (0.01%)
	T_7 - Untreated control	T_7 - Untreated control

Department of seed science and technology Tamil Nadu Agricultural University, CBE. In this method, the seeds were allowed for germination between two layers of paper. Twenty five seeds were placed between two layers of paper and rolled in towel. The rolled towels are placed in the germinator maintained with a temperature of 25± 2^0C and 93± 3 per cent relative humidity in upright condition as per the procedure indicated by ISTA (1993). Ten days after germination, the number of seedlings germinated and the per cent germination was worked out. Observations were also made on root length (cm), shoot length (cm), root weight (g), shoot weight (g), and vigour index (%). Ten normal seedlings from each treatment were taken at random and root length was measured from the collar region to the tip of the primary root. The mean value was expressed in centimetre (cm). Like wise from ten normal seedlings, shoot length was measured from the collar region to the tip of the plumule and the mean value was expressed in cm. The corresponding root and shoot weight were also recorded using electronic balance. The vigour index of the seedling [Vigor index = germination (%) × Total seedling length (cm)] was computed using the formula suggested by Abdul-Baki and Anderson (1973).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Evaluation of seed dressing chemicals on shoot fly management - Trial I :

The data on deadheart damage recorded 15, 21 and 30 DAS in different insecticide treatments of the micro plot experiment conducted at chinnamathampalayam are presented in Table 1.

Among the seed treatments, imidacloprid at 0.01 per cent was found superior to rest of the chemicals in checking the shoot fly incidence. The per cent dead heart recorded in imidacloprid, at 15, 21 and 30 DAS was 12.5, 22.5 and 25.0 per cent, respectively while untreated check showed respective per cent dead heart damage of 40, 45 and 52.5 per cent on the same periods of observation. Imidacloprid treatment was followed by thiamethoxam at 0.01 per cent on 15, 21 DAS where as on 30 DAS chlorpyriphos at 0.04 per cent was the next effective treatment. However imidacloprid was statistically superior to the rest of the treatments. The bio control agent *Pseudomonas fluorescens* used as seed dressers though least effective to insecticides was found superior to untreated check. Imidacloprid showed the maximum damage reduction of 56.3 per cent over untreated control.

Table 1 : Efficacy of seed dressing chemicals on the incidence of shoot fly and Plant height-Trial I (Chinnamathampalayam)

Treatments	Dosage	Per cent dead heart DAS			Mean #	Per cent damage reduction over untreated check	Plant height (cm) DAS			Mean #
		15	21	30			15	21	30	
Chlorpyriphos 20EC	0.04% (v/w)	27.5^{c} (31.6)	30.0^{c} (33.2)	32.5^{b} (34.8)	30.0 (33.2)	34.4	27.4 ^{c}	35.6 ^{b}	44.5 ^{c}	35.8
Endosulfan 35EC	0.04% (v/w)	30.0^{d} (33.2)	32.5^{d} (34.8)	37.5^{d} (37.8)	33.3 (35.2)	27.2	24.6 ^{f}	32.8 ^{d}	41.8 ^{e}	33.1
Dimethoate 30EC	0.04% (v/w)	35.0^{f} (36.3)	37.5^{f} (37.8)	40.0^{e} (39.2)	37.5 (37.7)	18.1	26.5 ^{d}	34.2 ^{c}	43.5 ^{d}	34.7
Pseudomonas fluorescens	0.1% (w/w)	32.5^{e} (34.8)	35.0^{e} (36.3)	42.5^{f} (40.7)	36.7 (37.2)	19.8	25.8 ^{c}	31.6 ^{e}	40 ^{f}	32.5
Thiamethoxam 25 WG	0.01% (w/w)	17.5^{b} (24.7)	27.5^{b} (31.6)	35.0^{c} (36.3)	26.7 (31.09)	41.7	26.2 ^{b}	35.5 ^{b}	46.5 ^{b}	36.7
Imidacloprid 70WS	0.01% (w/w)	12.5^{a} (20.7)	22.5^{a} (28.3)	25.0^{a} (30.0)	20 (26.5)	56.3	29.5 ^{a}	39.5 ^{a}	48.6 ^{a}	39.2
Untreated check	-	40.0^{g} (39.2)	45.0^{g} (42.1)	52.5^{g} (46.3)	45.8 (42.5)	-	22.5 ^{g}	30 ^{f}	38.5 ^{g}	30.3

- Mean of three replicates
DAS – Days after sowing
Figures in the parentheses are arc sine transformed value
In a column, means followed by a common letter are not significantly different by DMRT (P = 0.05)

Effect of seed dressing chemicals on plant height :

The effect of seed treatment chemicals on the growth of plants was studied by recording the plant height at 15, 21 and 30 days after sowing in all the treatments. The data (Table 1) revealed significant difference in the plant height between the treatments. The maximum mean height recorded was 39.2 cm and 36.7 cm in imidacloprid and thiamethoxam seed treatment, respectively. The mean heights of the plant in chlorpyrifos, endosulfan and dimethoate treatments were 35.8 cm, 33.1 cm and 34.7 cm, respectively. The plant height in the untreated check measured only 30.3 cm.

Efficacy of seed dressing chemicals on the incidence of shoot fly - Trail II :

The efficacy of seed dressing pesticides against shoot fly was assessed in the micro plot experiment under field condition at Idikarai village during summer.

The data on the shoot fly incidence in various treatments are presented in Table 2. All the seed treatments tested showed significant reduction in shoot fly damage as against the untreated control. Among the treatments evaluated, imidacloprid was found most effective, with a mean dead heart damage of 11 per cent as against 33.5 per cent dead heart noted in the untreated check. Imidacloprid treatment was significantly superior to other chemicals which showed the order of efficacy as thiamethoxam 22.1>chlorpyriphos 23.9> *Pseudomonas 25.8*> endosulfan 29.9> dimethoate 30.9. However, all the treatments were significantly superior to untreated control.

The superiority of imidacloprid seed treatment was

Table 2 : Efficacy of seed dressing chemicals on the incidence of shoot fly and plant height - Trail II (Idikarai)

Treatments	Dosage	Per cent dead heart DAS 15	Per cent dead heart DAS 21	Per cent dead heart DAS 30	Mean #	Per cent damage reduction over untreated check	Plant height (cm) DAS 15	Plant height (cm) DAS 21	Plant height (cm) DAS 30	Mean #
Chlorpyriphos 25 EC	0.04% (v/w)	11.8^{c} (20.0)	16.6^{c} (24.04)	21.6 ^{c} (27.6)	16.6 (23.9)	50.4	28.4^{c}	36.6^{b}	45.5^{c}	36.8
Endosulfan 35 EC	0.04% (v/w)	20^{e} (26.5)	25.0^{e} (30)	30.0^{e} (33.2)	25.0 (29.9)	25.3	26.6^{f}	33.8^{d}	42.8^{e}	34.4
Dimethoate 30 EC	0.04% (v/w)	21.6^{f} (27.6)	26.6^{f} (31.0)	31.6^{f} (34.2)	26.6 (30.9)	20.5	25.0^{d}	35.5^{c}	44.0^{d}	34.8
Pseudomonas fluorescens	0.1% (w/w)	14.1^{d} (22.1)	19.1^{d} (25.9)	24.1^{d} (29.4)	19.1 (25.8)	42.9	27.0^{e}	32.6^{e}	40.0^{f}	33.2
Thiamethoxam 25 WG	0.01% (w/w)	10.0^{b} (18.4)	15.0^{b} (22.7)	18.3 ^{b} (25.3)	14.4 (22.1)	57.0	28.0^{b}	36.5^{b}	47.5^{b}	37.3
Imidacloprid 70 WS	0.01% (w/w)	8.0^{a} (16.4)	10.0 ^{a} (18.4)	15.0 ^{a} (22.7)	11.0 (19.2)	67.1	30.5^{a}	39.5^{a}	49.0^{a}	39.7
Untreated check	-	22.5^{g} (28.3)	36.6 ^{g} (37.2)	41.6 ^{g} (40.1)	33.5 (35.2)	-	23.0^{g}	31.0^{f}	39.0^{g}	31.0

- Mean of three replicates DAS – Days after sowing

Figures in the parentheses are arc sine transformed value

In a column, means followed by a common letter are not significantly different by DMRT (P = 0.05)

Table 3 : Impact of seed dressing chemicals on germination

Treatments	Dosage	Per cent germination#	Root length (cm) #	Shoot length (cm) #	Root weight (g) #	Shoot weight (g) #	Vigour index#
Chlorpyriphos 20 EC	0.04% (v/w)	84.0^{c} (66.4)	17.5^{a}	10.20^{c}	0.032^{a}	0.08^{c}	2326.8
Endosulfan 35EC	0.04% (v/w)	76.0^{f} (60.6)	11.5^{f}	7.20^{f}	0.009^{g}	0.05^{f}	1421.2
Dimethoate30 EC	0.04% (v/w)	72.0^{g} (58.0)	12.1^{e}	6.60^{g}	0.012^{f}	0.04^{g}	1346.4
Pseudomonas fluorescens	0.1% (w/w)	80.0^{d} (63.4)	14.2^{c}	10.40^{b}	0.018^{c}	0.08^{b}	1968.0
Thiamethoxam 25 WG	0.01% (w/w)	88.0^{b} (69.8)	13.8^{d}	8.90^{d}	0.016^{d}	0.06^{d}	1997.6
Imidacloprid 70WS	0.01% (w/w)	92.0^{a} (73.8)	15.5^{b}	10.60^{a}	0.021^{b}	0.08^{a}	2401.2
Untreated check	-	78.0^{e} (62.0)	13.8^{d}	8.00 ^{e}	0.014^{e}	0.05^{e}	1700.4

- Mean of three replicates DAS – Days after sowing

Figures in the parentheses are arc sine transformed value

In a column, means followed by a common letter are not significantly different by LSD (P = 0.05)

noted at all the periods of observation 15, 21 and 30 DAS which showed a damage reduction of 67.1 per cent over the untreated control. Similarly, thiamethoxam at 1g/kg was effective next to imidacloprid and significantly superior over other treatments at all the periods of observation. It showed a damage reduction of 57.0 per cent over untreated check.

Impact of seed treatment chemicals on Plant height:

The impact of seed treatment with pesticides on plant height was measured at 15, 21, and 30 days after sowing in all the treatments plots. The data (Table 2) revealed statistical significance in the plant height among the treatments. Imidacloprid recorded the maximum mean plant height of 39.7 cm followed by 37.3 cm noted in thiamethoxam. The height of the plants in chlorpyriphos, endosulfan and dimethoate treatments were 36.8 cm, 34.4 cm and 34.8 cm, respectively. The height of plants in the untreated check measured only 31.5 cm.

Impact of seed treatment chemicals on germination under laboratory condition :

The data on the germination of seeds in different insecticide treatments are presented in Table 3. The seed germination recorded in various treatments showed statistical significance among the treatments. The maximum seed germination of 92 per cent was recorded in imidacloprid treatment. The seed germination recorded in untreated check was 78 per cent. Seeds treated with thiamethoxam and chlorpyriphos were superior next to imidacloprid with 88 and 84 per cent seed germination, respectively.

Maximum root length 17.5 cm and root weight of 0.032g was recorded in seedlings of chlorpyriphos treatment followed by imidacloprid. The minimum root length 12.1cm and root weight 0.012g was recorded in dimethoate treated seedlings. The maximum shoot length 10.6 cm and shoot weight 0.021g was recorded in seedling of imidacloprid treatment. The minimum shoot length 6.6 cm and shoot weight 0.012g was recorded in seedling of endosulfan treatment. Maximum seedling vigour index was noted in imidacloprid followed by chlorpyriphos treatment.

Efficacy of seed dressers on deadheart damage :

The performance of imidacloprid followed by thiamethoxam treatments in checking shoot fly incidence was in line with the findings of Patil *et al.* (1993) who reported the effectiveness of imidacloprid. Similarly, Mote *et al*. (1995) also showed the efficacy of imidacloprid in checking the shoot fly incidence. The efficacy of imidacloprid can be attributed to the systemic properties, acropetal distribution and excellent root systemic properties as indicated by Dewar (1992) and Rouchand *et al*. (1994). The efficacy of thiamethoxam 35 FS next to imidacloprid, observed in the present study was endorsed by the findings of Vadodaria *et al*. (2001) who confirmed the efficacy of thiamethoxam and imidacloprid as seed dresser against sucking pests of cotton. The results of Patil *et al.* (2004) on the performance of thiamethoxam on par with the imidacloprid as seed dresser in checking the sucking pests of cotton further confirm the present result. The boosted growth of the plants due to imidacloprid treatment was well supported by the reports of Kirtisharma *et al*. (1997).

Effect of seed dressers on the growth parameters:

The increased plant height and plant girth in the imidacloprid treated plots was similar to the reports of Kirtisharma *et al*. (1997) who recorded enhanced crop growth and plant girth in imidacloprid as compared to monocrotophos. Similar results were also reported by Gupta *et al*. (1998) and Mote *et al*. (1993).

Effect of seed dresser on the germination and vigour index:

Maximum seed germination with no adverse effects of imidacloprid in the present study was in consonance with the results obtained by Mote *et al*. (1994), which indicated that imidacloprid had not affected the germination. The increased seedling vigour obtained in imidacloprid treatment can be strengthened by the findings of Mote and Mohite (1995) who reported no adverse effect on germination of okra seeds besides increasing the root and shoot length in imidacloprid treated plots.

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