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Research Article

Relative efficacy of insecticides in the management of Rice Gallmidge, *Orseolia oryzae*

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Abstract

The field experiments were carried out during *Kharif* and *Rabi*, 2017-18 to assess the relative efficacy of some insecticides including granular and foliar applications against gallmidge infesting rice. The experimentation was laid out in RBD with nine treatments that were replicated thrice. The damage of gallmidge in terms of per cent silver shoots and per cent reduction over control was recorded. Among the various treatments evaluated, application of carbofuran 3G @ 1.0 Kg a.i. ha^{-1} at 10 DAS and 10 DAT has exhibited highest per cent reduction of silver shoots over control with 64.74, 68.0 and 60.19 per cent at 30, 40 and 50 DAT during *Kharif*, 2017 and with 65.63, 72.93 and 77.55 per cent at 30, 45 and 50 DAT during *Rabi*, 2017-18 respectively. The pooled mean revealed that next better treatment in order of efficacy was application of Phorate 10 G @ 1.0 Kg a.i. ha^{-1} at 10 DAS and 10 DAT with 57.53 and 69.4 per cent reduction of silver shoots over control during *Kharif* and *Rabi*, 2017-18 respectively. The foliar application of monocrotophos 36 SL and chlopyriphos 20 EC at 10 DAT has resulted in 56.05, 62.47 and 46.14, 59.14 mean per cent silver shoots reduction over control during *Kharif* and *Rabi*, 2017-18 respectively. Hence, formulating sequential application of granular formulation of insecticide followed by foliar application may combat with the pest infestation and may act as a superlative insecticide resistance management strategy.

Keywords: Rice, Gallmidge, Insecticides, Management

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Introduction

Rice is one of the most cultivated grain crops in India as well as in Asian countries and a staple diet in major parts of India. It constitutes about 52% of the total food grain production and 55% of total cereal production in our country [1]. In India, rice is grown in 43.86 million ha, the production level is 104.80 million tones and the productivity is about 2390 kg ha^{-1}. In Andhra Pradesh it is cultivated in an area of 38.09 lakh ha with a production of 127.24 lakh tons and 4234 kg ha^{-1} productivity [2]. Insect pests constitute one of the major yield reducing factors with respect to biotic constraints in rice [3]. Among the various insect pests infesting rice, the gallmidge is considered as an economic pest and major constraint in achieving the yield potentials of a wide range of susceptible rice varieties [4]. The galls formed by this pest are popularly known as 'silver shoot' or 'onion shoot'. The pest infests the rice even in the nursery but usually tillers are preferred. Early gall infestation results in stunting, bushy appearance of the rice plant, with as many as 50 small tillers per hill [5]. The gall midge remains inactive as a prepupa in wild rice or weeds during the dry season. At the onset of the monsoons, it becomes active and completes one or two generation in grasses before it moves to the rice crop [6]. In India crop losses from 10-100% have been reported by this pest [7]. In recent years, rapid development of virulent biotypes of gallmidge capable of overcoming the host plant resistance has been posing problem [8] and it is difficult to manage the pest. Nearly 6 biotypes of gall midge so far were identified and characterized in India [9] based on the reaction of 14 standard differentials of 4 groups. Because of cultivating high yielding varieties year after year which are susceptible to pest attack insecticides remain as sole dependable weapon to the farmer in order to mitigate the insect population especially during epidemics. In this context, present trial was conducted to evaluate the relative efficacy of various insecticides both at nursery and tillering stage against gallmidge for effective management of the pest.

Material and Methods

To assess the field relative efficacy of various insecticides (granular and foliar sprays) experiment was conducted at Agricultural Research Station, Garikapadu during *Kharif* and *Rabi*, 2017-18 in Randomized Block Design with nine treatments including untreated control which were replicated thrice. The insecticide treatments include three granular formulations which were imposed twice at 10 days after sowing and 10 days after transplantation. Other treatments include foliar sprays at 10 days after transplantation encompassing SL (Soluble liquid Concentrate), EC (Emulsifiable Concentrate) and SC (Suspension Concentrate) formulations *viz*., T_1: Carbosulfan 5G; T_2: Fipronil 0.3G; T_3: Carbofuran 3G; T_4: Phorate 10G; T_5:Cartaphydrochloride 4G; T_6: Monocrotophos 36 SL; T_7: Chlorpyriphos 20 EC; T_8: Fipronil 5 SC and T_9: Control.

Starting from 10 days after imposition of treatments observations on per cent silver shoot incidences were recorded on randomly selected 20 hills at 15 days interval. Data on per cent silver shoots (SS) both in nursery and main field were recorded and the per cent reduction over control was calculated as per the formulae hereunder.

$$\text{SS per cent} = \frac{\text{Total number of silvershoots in 20 hills}}{\text{Total number of tillers in 20 hills}} \text{ X } 100$$

$$\text{Per cent reduction over control} = \frac{\text{C-T}}{\text{C}} \text{ X } 100$$

C= Per cent damage in control plots; T= Per cent damage in treated plots.

All the data was transformed with suitable transformation method before analysis and subjected to analysis of variance. Significant differences in means were separated using Duncan's multiple range test (P= 0.05).

Results and Discussion

The incidence of rice gallmidge in terms of per cent silver shoots varied from 2.0 to 20.15 and 2.55 to 42.8 during *Kharif* and *Rabi*, 2017-18 respectively. The peak incidences were recorded during 30, 40, 50 and 30, 45, 50 days after transplantation during *Kharif* and *Rabi*, 2017-18 respectively.

During *Kharif*, 2017 the treatments were imposed as per schedule and among all, the granular application of carbofuran 3G (T_3) @ 1.0 Kg a.i. ha^{-1} at 10DAS and 10DAT was observed to be highly effective in suppressing the injury by gallmidge to the rice crop in terms of per cent silver shoots. T_3 harboured less per cent silver shoots with 2.5, 2.0 and 3.0 at 30, 40 and 50 DAT respectively. At 30 DAT the per cent silver shoots were found less in carbofuran 3G treated plots (2.50) and found on par with application of phorate 10 G @ 1.00 Kg a.i. ha^{-1} (3.00) and fipronil 0.3G (3.15) at 10DAS and 10DAT with 64.74, 61.37 and 60.40 per cent reduction over control. Foliar application of monocrotophos 36 SL @ 0.50 L a.i. ha^{-1} and chlorpyriphos 20 EC @ 50 L a.i. ha^{-1} at 10 DAT also found on par with carbofuran 3G with 57.72 and 57.03 per cent reduction over control. At 40 DAT also carbofuran 3G (3.0) only recorded less per cent silver shoots with 68.0 per cent reduction over control and all other treatments also exhibited significant reduction over control. The order of efficacy of various treatments represents $T_3 > T_4 > T_2 > T_6 > T_5 > T_8 > T_7 > T_1$. Similar trend was also observed during 50 DAT where in highest per cent reduction over control was recorded in T_3-carbofuran 3G (60.19) and is found on par with T_6- monocrotophos 36 SL (56.65) and T_4- phorate 10 G (54.86) and T_2-Fipronil 0.3G (55.93). Among all the treatments, the highest per cent silver shoots damage was recorded in untreated control plots with 18.95, 20.15 and 19.50 at 30, 40 and 50 DAT respectively. Granular application of carbosulfan 5G did not exhibit or meagrely shown efficacy in reduction of gallmidge infestation (**Table 1** and **Figure 1**).

Table 1 Efficacy of various insecticides against rice gallmidge during *Kharif*, 2017

Treatments	Dose	%Silver shoots (per 20 hills) *					
	Kg a.i./ha	30 DAT	% ROC	40 DAT	% ROC	50 DAT	% ROC
T_1: Carbosulfan 5G	1.00	11.5 (19.82)	23.20	19.5 (26.21)	2.00	18.3 (25.33)	3.35
T_2: Fipronil 0.3G	0.075	3.15 ^{ab} (10.22)	60.40	4.5 ^{ab} (12.25)	54.06	4.0 ^{ab} (11.54)	55.93
T_3: Carbofuran 3G	1.25	2.50^{a} (9.10)	64.74	2.0 (8.13)	68.0	3.0 (9.97)	60.19
T_4: Phorate 10G	1.00	3.00 ^{ab} (9.97)	61.37	3.8 ^{ab} (11.24)	56.35	4.2 ^{ab} (11.83)	54.86
T_5:Cartaphydrochloride 4G	0.75	8.25 (16.69)	35.33	4.65^{ab} (12.45)	53.33	6.85 (15.17)	42.12
T_6: Monocrotophos 36 SL	0.50	3.58^{ab}(10.91)	57.72	4.5 ^{ab} (12.32)	53.80	3.88^{ab} (11.36)	56.65
T_7: Chlorpyriphos 20 EC	0.50	3.70^{ab} (11.09)	57.03	6.8 (15.12)	43.30	7.8 (16.22)	38.11
T_8: Fipronil 5 SC	0.05	6.35 (14.60)	55.28	5.35 ^{b} (13.37)	49.86	4.85^{a} (12.72)	51.46
T_9: Control	-	18.95 (25.81)	-	20.15 (26.67)	-	19.50 (26.21)	-
Ftest		Sig		Sig		Sig	
CD(0.05)		2.25		1.60		0.74	
CV%		21.59		24.66		38.45	

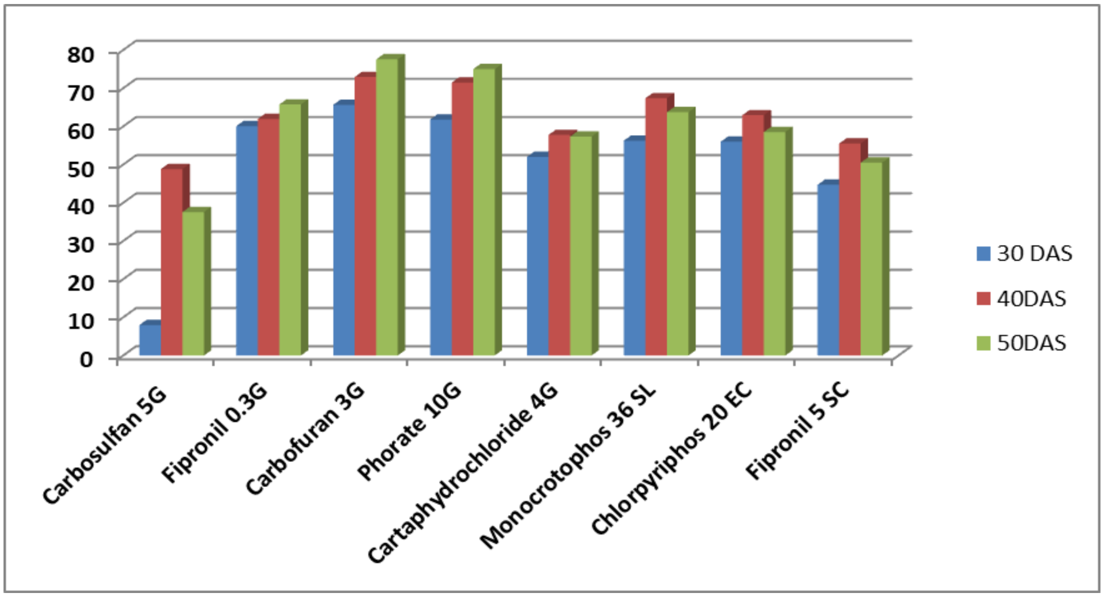

Figure 1 Efficacy of various insecticides against rice gallmidge during *Kharif*, 2017

During *Rabi*, 2017-18 the peak incidences of gallmidge infestation was recorded at 30, 45 and 50 DAT. At 30 DAT, all the treatments exhibited significant reduction over control but did not differ among themselves. The order of efficacy of various treatments with respect to per cent reduction of silver shoots over control represents T_3 (65.63) > T_4 (61.77) > T_2 (60.07) >T_6 (56.26) > T_7 (55.89) > T_5 (52.01) > T_8 (44.70) > T_1 (7.98). The maximum and minimum per cent silver shoots were observed in T_9-control (34.5) and T_3-carbofuran 3G (4.58) respectively. Similar trend was also observed at 45 DAT where in the carbofuran treated plots has expressed less infestation of per cent silver shoots with 72.93 per cent reduction over control. However at 50 DAT carbofuran 3G and phorate 10G exhibited highest per cent control over other treatments with 77.55 and 74.98 per cent respectively. The untreated control (T_9) and carbosulfan 5G (T_1) exhibited highest silver shoots among all the treatments. At 30, 45 and 50 DAT the per cent silver shoots recorded were 34.5, 37.5, 42.8 and 29.88, 10.95, 18.55 in untreated control plots and carbosulfan treated plots respectively (**Table 2** and **Figure 2**).

Table 2 Efficacy of various insecticides against rice gallmidge during *Rabi*, 2017-18

Treatments	**Dose**	**%Silver shoots (per 20 hills) ***					
	Kg a.i./ha	**30 DAT**	**% ROC**	**40 DAT**	**% ROC**	**50 DAT**	**% ROC**
T_1: Carbosulfan 5G	1.00	29.88 (33.10)	7.98	10.95 (19.32)	48.83	18.55 (25.51)	37.56
T_2: Fipronil 0.3G	0.075	6.15 (14.36)	60.07	4.50 (14.36)	61.97	5.85 (14.0)	65.73
T_3: Carbofuran 3G	1.25	4.58 (12.36)	65.63	3.15 (10.22)	72.93	2.55 (9.17)	77.55
T_4: Phorate 10G	1.00	5.65 (13.75)	61.77	3.50 (10.78)	71.45	3.15 (10.22)	74.98
T_5:Cartaphydrochloride 4G	0.75	8.80 (17.26)	52.01	7.55 (15.95)	57.75	8.98 (17.44)	57.32
T_6: Monocrotophos 36 SL	0.50	7.35 (15.73)	56.26	4.55 (12.32)	67.37	6.55 (14.83)	63.71
T_7: Chlorpyriphos 20 EC	0.50	6.55 (14.83)	55.98	5.85 (14.00)	62.92	8.50 (16.95)	58.52
T_8: Fipronil 5 SC	0.05	11.58 (19.89)	44.70	8.35 (16.80)	55.50	11.95 (20.22)	50.51
T_9: Control	-	34.5 (35.97)	-	37.5 (37.76)	-	42.8 (40.86)	-
Ftest		Sig		Sig		Sig	
CD(0.05)		6.70		5.83		4.79	
CV%		20.20		20.19		14.85	

Visalakshmi and coworkers [10] evaluated various integrated pest management modules against major pests infesting rice and stated that lower incidence of gall midge was observed in module III and module I and the reason could be due to application of carbofuran 3G @ 1 Kg a.i. ha^{-1} in the nursery. Investigations by [5] are in disagree with the present results who inferred that nursery application of isazophos 3G @ 0.75 Kg a.i ha^{-1} recorded lower gall midge infestation (79.73) followed by fipronil 0.3G @ 0.075 Kg a.i ha^{-1} (63.08) and carbofuran 3G @ 1.0 Kg a.i ha^{-1}.

The present results are in accordance with the findings of [11] who reported that at 20 DAT the per cent hill and tiller damage was recorded to be minimal in carbofuran 3G treated plots (11.66 & 8.86) followed by chloropyriphos 40EC (12.49 & 9.97) and phorate 10G (13.33 & 10.42) Similar trend was also observed at 40 DAT where in carbofuran 3G recorded less per cent hill and tiller damage (4.99 & 4.63) followed by chloropyriphos 40EC (5.83 &

4.79) and phorate 10G (6.66 & 5.59). [12] also revealed that application of carbofuran 3G @ 1.5 Kg a.i. ha^{-1} and quinalphos spray @ 5 Kg a.i. ha^{-1} at 25 and 40 DAT were effective in controlling the gall midge with 79% increase in yield compared to control. Broadcasting of carbofuran @ 1.0 Kg a.i.ha^{-1} at 30 DAT was most effective treatment in controlling the gall midge [13].

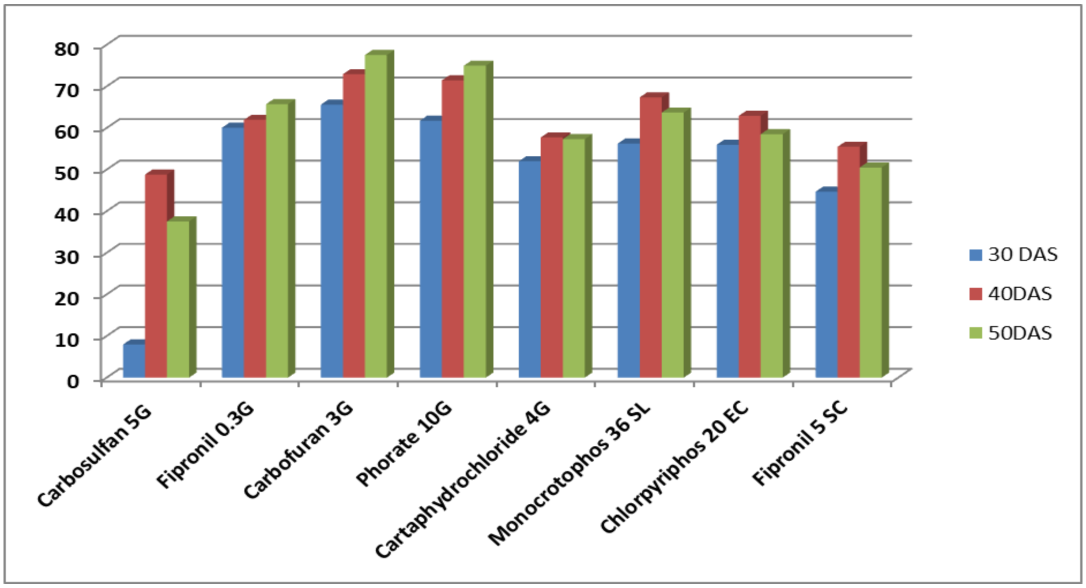

Figure 2 Efficacy of various insecticides against rice gallmidge during *Rabi*, 2017-18

Conclusion

Based on the results of the present study, it may be concluded that application of carbofuran 3G @ 1.0 Kg a.i. ha^{-1} or phorate 10G @ 1.0 Kg a.i. ha^{-1} at 10 DAS and 10 DAT resulted in highest suppression of gallmidge infestation in rice. However, foliar sprays of monocrotophos 36 SL and chlorpyriphos 20 EC at 10 DAT also exhibited superior efficacy. Hence, keeping in view the resurgence of the pest and resistance to insecticides sequential application of granular formulation followed by foliar spray may be suggested to combat with the damage of gallmidge infesting rice.

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