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Abhishek Shukla
Department of Entomology
Navsari Agricultural University,
Navsari, Gujarat, India

PD Ghoghari
Main Rice Research Center,
Navsari Agricultural University,
Navsari, Gujarat, India

GG Radadia
Navsari Agricultural University,
Navsari, Gujarat, India

GD Hadiya
Navsari Agricultural University,
Navsari, Gujarat, India

Correspondence
Abhishek Shukla
Department of Entomology
Navsari Agricultural University,
Navsari, Gujarat, India

Efficacy of some pesticides against rice sheath mite, *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae)

Abhishek Shukla, PD Ghoghari, GG Radadia and GD Hadiya

Abstract
An experiment was conducted during kharif 2014-15 to 2016-17 at Main Rice Research Centre, Navsari Agricultural University, Navsari to test the efficacy of some pesticides against rice sheath mite, *Steneotarsonemus spinki* Smiley. Among all the pesticides tested, diafenthiuron 50 WP@0.05% were found most effective in controlling the *S. spinki*. The next best treatment was chlorfenapyr 10 SC@0.015% and fenpyroximate 5 SC@0.005% in terms of a cent reduction of sheath mite population. The highest grain and straw yield was recorded in the treatment diafenthiuron 50 WP@0.05% which were followed by chlorfenapyr 10 SC@0.015% and fenpyroximate 5 SC@0.005%. In terms of ICBR the treatment diafenthiuron 50WP@0.05% was found most superior over the rest of the treatments.

Keywords: Sheath mite, *Steneotarsonemus spinki* Smiley, rice

1. Introduction
Rice (*Oryza sativa* L.), the staple food of nearly half of the humanity is mainly grown and consumed in Asian countries such as India, China, Japan, Indonesia, Thailand, Pakistan, Bangladesh, North and South Koreas, Myanmar, Philippines, Sri Lanka etc. India is number one in an area with approximately 44.5 million hectares of rice and it ranks second in production with approximately 91 million tones [1]. Low yields of rice have been attributed to a number of factors. Traditionally, insect pests, diseases and weeds are the triple evils responsible for low yields of rice in India. Of late, mites are also assuming the major pest status. Among different species of mites associated with rice crop, the sheath mite or panicle mite and the leaf mite are most important. The sheath mite, *Steneotarsonemus spinki* Smiley which belongs to family Tarsonemidae infests flag leaf sheath causing brown discoloration. Infestation of this mite on panicle causes chaffy grains and also discoloration of filled or ill-filled grains [2]. Grain sterility is one of the most common effect due to feeding of this mite on rice and also act as carrier of various pathogenic fungi like *Acrocylindrium (Sarocladium) oryzae*, *Fusarium moniliformae*, *Helminthosporium oryzae* etc [2]. Its attack is common in states like Karnataka, Andhra Pradesh, Orissa, Gujarat [3] and West Bengal [4]. Severe crop losses due to infestation of sheath mite were reported from China (30 to 90%), Cuba (70%) and predicted loss up to 30 to70% in Brazil [5].

2. Materials and Methods
The field experiment was laid out in randomized block design during *kharif* 2014-15 to 2016-17 with three replications at the Main Rice Research Centre, Navsari Agricultural University, Navsari, Gujarat, India. There were eight treatments including untreated control. The rice variety GNR-3 was used for the experiment. The spacing was 20 x 15 cm whereas the gross plot size was 5.4 x 3.6 m^2, with the net plot size of 5.1 x 3.2 m^2. All the recommended agronomic packages of practices were followed to raise the crop. The treatments were applied first at the time of panicle initiation (flag leaf initiation) and the second spray of various pesticide treatments was imposed 15 days after the first treatment. The observations in the sheath mite population were recorded before spray and after 1, 3,7,14 days after spray on 2 cm leaf sheath (mobile stages). The yield data on grain and husk were recorded plot wise (kg per plot) and were converted as on hector basis. The economics of each treatment were also worked out.

3. Results and Discussion

The three year data on the efficacy of various pesticidal treatments against *S. spinki* was presented year wise as well as pooled over as under:

During the year 2014-15, the pre-treatment population of sheath mite was ranging between 9.77 to 11.44 mites per sheath (Table 1). One day after the first spray the lowest sheath mite population was recorded in treatment T_7 (chlorphenpyr 10 SC@0.015%) (2.78 mite per sheath) and it was statistically superior over the rest of the treatments. However, it was followed by other treatments *viz.* T_5 (difenthuron 50 WP@0.05%) (4.33 mite per sheath), T_1 (fenazaquin 10 EC@0.02%) (4.66 mite per sheath) and T_4 (buprofezin 25 SC@ 0.05%) (4.89 mites per sheath). The maximum sheath mite population was recorded in T_8 (control) (10.78 mites per sheath). Three days after first spray, the maximum reduction in sheath mite population was noticed in the treatment T_7 (chlorphenpyr 10 SC@0.015) (0.67 mite per sheath) and it was at par with the other treatments *viz*. T_2 (fenpyroximate 5 SC@0.005%) (1.11 mites per sheath) and T_5 (diafenthiuron 50 WP@0.05%) (1.11 mites per sheath), However, the maximum sheath mite population was recorded T_8 (control) (9.66 mites per sheath), further, 7 and 14 days after the first spray the sheath mite population was zero in the treatments *viz.* T_7 (chlorphenpyr 10 SC@0.015), T_5 (diafenthiuron 50 WP@0.05%), T_4 (buprofezin 25 SC@ 0.05%) and T_2 (fenpyroximate 5 SC@0.005%) and all are statistically at par with each other, while the maximum sheath mite population was observed in T_8 (control). The overall mean data on the efficiency after the first spray showed that the maximum reduction in sheath mite population was recorded in the treatment T_7 (chlorphenpyr 10 SC) (0.86 mite per sheath) and was at par with T_5 (diafenthiuron 50 WP) (1.36 mites per leaf). The maximum sheath mite population was recorded in T_8 (control) (7.47 mites per sheath). Further, one day after the application of second spray, the sheath mite population was lowest in case of T_2 (fenpyroximate 5 SC@0.005%) (0.78 mite per sheath) and was followed by T_1 (fenazaquin 10 EC@0.02%) (1.56 mites per sheath). The maximum sheath mite (8.56 mites per sheath) was recorded in T_8 (control). Three days after second spray, the maximum reduction in sheath mite population was recorded in T_2 (fenpyroximate 5 SC@0.005%) (0.22 mite per sheath) and was found at par with others T_1 (fenazaquin 10 EC@0.02%), T_4 (buprofezin 25 SC@ 0.05%) and T_5 (diafenthiuron 50 WP@0.05%), while maximum sheath mite population was recorded in T_8 (6.00 mites per sheath). Seven days after the second spray, the maximum reduction was noticed in T_2 (fenpyroximate 5 SC@0.005%) (0.22 mite per sheath) and maximum sheath mite population was recorded in T_8 (control) (4.22 mites per sheath). Further, 14 days after the second spray, the treatments T_5 (diafenthiuron 50 WP@0.05%) and T_2 (fenpyroximate 5 SC@0.005%) maintains their superiority over the rest of the treatments and were at par with each other. However, the overall mean efficacy of various treatments after the second spray showed that highest reduction in sheath mite population was recorded in treatment T_5(diafenthiuron 50 WP@0.05%) (0.36 mite per sheath) and was at par with T_1 (Fenazaquin 10 EC@0.02%),T_2 (fenpyroximate 5 SC@0.005%) and T_4 (buprofezin 25 SC@ 0.05%) while maximum sheath mite population was noticed in T_8 (control) (5.75 mites per sheath).

In the year 2015-16, the sheath mite population before the first spray was ranging between 39.00 to 41.67 per leaf (Table 2). One day after the first spray, the highest reduction in sheath mite was recorded in treatment T_7 (chlorphenpyr 10 SC@0.015%) (22.67 mites per sheath). However, the maximum sheath mite population was recorded in T_8 (control) (40.33 mites per sheath). Three days after first spray, the maximum reduction in sheath mite was recorded in the treatment T_7 (chlorphenpyr 10 SC@0.015%) (16.67 mites per sheath) and it was statistically superior over rest of the treatments, however, it was followed by another treatments T_5 (diafenthiuron 50 WP@0.05%) (21.00 mites and was at par with T_2 (fenpyroximate 5 SC@0.005%) (20.67 per sheath). The maximum sheath mites population was recorded in the treatment T_8 (control) (40.34 mites per sheath). Seven days after first spray the maximum reduction in sheath mite population was recorded in treatment T_7 (chlorphenpyr 10 SC@0.015%) (8.67 mites per sheath) and it was statistically superior over the rest of the treatments, however the highest sheath mite population was recorded in the treatment T_8 (control) (39.67 mites per leaf). Further, 14-days after first spray the lowest sheath mite population was observed in treatments T_7 (chlorphenpyr 10 SC@0.015%) (3.34 mites per sheath) and was found statistically superior over the rest of the treatments, while it was followed by T_5 (diafenthiuron 50 WP@0.05%) (6.33 mites per sheath). The maximum sheath mite population was recorded in case of T_8 (control) (38.67 mites per sheath). After one day of application of second spray the highest sheath mite population was noticed in treatment T_8 (control) (39.68 mites per sheath), while the lowest sheath mite population was recorded in T_7 (chlorfenapyr10 EC 10 SC@0.015%) (2.34 mites per leaf) and it was statistically superior over rest of the treatments, however it was followed by T_5 (diafenthiuron 50 WP@0.05%) (4.00 mites per leaf). Three days after the application of various treatments, the maximum reduction in sheath mite population was recorded in T_7 (chlorfenapyr10 EC 10 SC@0.015%) (1.35 mites per sheath) and was found at par with other treatment T_5 (diafenthiuron 50 WP@0.05%) (6.68 mites per sheath) whereas maximum sheath mite population was recorded in T_8 (control) (38.67 mites per sheath). Seven days after application of second spray the highest sheath mite population was recorded in T_8 (control) (38.34 mites per sheath), whereas the lowest sheath mite population was recorded in case of T_7 (chlorfenapyr 10 EC 10 SC@0.015%) (0.67 mite per sheath) and T_5 (diafenthiuron 50 WP@0.05%) (0.33 mite per sheath) and both were statistically at par with each other. Further, 14-days after second spray, the highest reduction in sheath mite population was recorded in treatment T_7 (chlorfenapyr10 EC 10 SC@0.015%) (0.34 mite per sheath) and was found at par with treatment T_5 (diafenthiuron 50 WP@0.05%) (1.00 mite per sheath). The maximum sheath mite population was recorded in case of T_8 (control) (38.67 mites per sheath).

During the year 2016-17, the pre-treatment population of sheath mite ranges between 30.34 to 33.00 mites per sheath (Table 3). One days after the application of various treatments the maximum reduction in the sheath mite population was recorded in the treatment T_5 (diafenthiuron 50 WP@0.05%) (20.68 mites per sheath) and it was statistically superior over the rest of the treatments. Three days after the spray, the maximum reduction in the sheath mite population was recorded in the treatment T_5 (diafenthiuron 50 WP@0.05%) (9.0 mites per sheath) and was found statistically superior over the rest of the treatments. Seven days after the spray, the higher reduction in sheath mite population was recorded in the treatment T_5 (diafenthiuron 50 WP@0.05%) and maximum in the T_7 (control). Ten days after the spray the

treatment T_5 (diafenthiuron 50 WP@0.05%) maintains its superiority over the rest of the treatments. The maximum reduction was recorded in T_5 (diafenthiuron 50 WP@0.05%) (3.68 mites per sheath) and was found statistically superior over the rest of the treatments. Furthermore, 14-days after spray, the maximum reduction in the sheath mite population was recorded in T_5 (diafenthiuron 50 WP@0.05%) (0.33 mite per sheath) and was statistically superior over the rest of the treatments. The maximum sheath mite population was recorded in the control (T_8) *i.e.* 34.67 mites per sheath. The data on overall mean of efficacy of various treatments showed that maximum reduction in sheath mite population was recorded in the treatment T_5 (diafenthiuron 50 WP@0.05%) (7.94 mites per sheath) in comparison with the highest sheath mite population in the T_8 (control) (34.60 mite per sheath).

The pooled over data of three years were presented in the Table 4 showed that the pre-treatment count of sheath mite, which were ranging between 22.92 to 24.30 mites per sheath. One day after application of first-spray, the maximum sheath mite population was recorded in T_8 (control) (24.67 mites per sheath), whereas the lowest sheath mite population were recorded in T_7 (chorfenpyr 10 SC@0.015%) (13.71 mites per sheath) and it was statistically at par with other treatment T_5 (diafenthiuron 50 WP@0.05% *i.e.* 14.33 mites per sheath). Three days after application of first the spray the maximum reduction in the sheath mite population is noticed in case of T_7 (chlorfenapyr10 EC 10 SC@0.015%) (9.00 mites per sheath) and was statistically superior over rate of the treatments. Seven days after first spray the lowest sheath mite population was recorded in case of treatment T_7 (chlorfenapyr10 EC 10 SC@0.015%) (4.56 mites per sheath) and it was found at par with another treatment T_5 (diafenthiuron 50 WP@0.05%) (6.22 mites per sheath), however the maximum sheath mite population was record in T_8 (Control) (23.37 mites per sheath). Further, 14-days after the first spray, the highest reduction in sheath mite population was recorded in the treatment T_7 (chorfenpyr 10 SC@0.015%) which was 2.45 mites per sheath, and it was statistically superior over rest of the treatments. The maximum sheath mite population was recorded in T_8 (22.89 mites per sheath). One day after the second spray the highest sheath mite population was recorded in the treatment T_8 (control) (22.86 mites per leaf), whereas the lowest sheath mite population was recorded in the treatment T_7 (chlorfenapyr10 EC 10 SC@0.015%) (4.22 mites per sheath) and was found statistically superior over rest of the treatments. Three days after the application of second spray, the lowest sheath mite population was recorded in treatment T_7 (chlorfenapyr10 EC 10 SC@0.015%) (1.78 mites per sheath) was found at par with T_5 (diafenthiuron 50 WP@0.05%) (1.08 mites per sheath), however the maximum number of sheath mites were recorded in case of T_8 (control) (20.89 mites per sheath). Seven days after second spray, the treatment T_7 (chlorfenapyr10 EC 10 SC@0.015%) maintain its superiority over rest of the treatments in terms of reduction of sheath mite population (1.22 mites per sheath), however it was statistically at par with T_5 (diafenthiuron 50 WP@0.05%) (0.33 mite per sheath). Further, 14-days after the application of second spray, the maximum reduction was recorded in T_5 (diafenthiuron 50 WP@0.05%) (0.33 mite per sheath) and was found at par with other treatments *viz.*, T_7 (chlorfenapyr10 EC 10 SC@0.015%) (0.89 mite per sheath), T_1 (fenazaquin 10 EC@0.02%) (0.39 mite per sheath) and T_2 (fenpyroximate 5 SC@0.005) (0.96 mite per sheath). Reddy *et al.* [6] reported that diafenthiuron 50 WP in combination with propiconazol as an effective treatment against the sheath mite of rice. The effectiveness of diafenthiuron 50SC @450 g a.i./ha against *S. spinki* was also reported by Banua and Reddy [7] among the other effective pesticides chlorfenapyr 10SC was also found effective. Nakum [8] while testing various acaricides against *S.* spinki recorded lowest egg and adult population with higher yield. Thus, the present findings are in agreement with the earlier reports. Further, fenpyroximate also showed its superiority in controlling the sheath mite infesting paddy in past also Mutthuraja and Srinivasa [9] from Karnataka also reported fenpyroximate as effective against sheath mite.

The highest grain and straw yield was obtained from the treatment T_5 (diafenthiuron 50 WP@0.05%) (5451.34 kg/ha grain and 4973.00 kg/ha straw) whereas the lowest grain and straw yield of 3914.11 kg/ha and 3862.00 kg/ha, respectively were recorded in case of T_8 (control) (Table 5). The economics is calculated by considering the profit increase over the untreated control of different treatments (Table 6). The treatment T_5 which comprises of diafenthiuron 50 WP@0.05% registered higher net income (Rs. 87969.76) and BCR (1: 6.60) and followed by T_7 (chlorfenapyr 10 SC@0.015%) with net income (Rs. 86217.17) and BCR (1:5.04) as well as T_2 (fenpyroximate 5 SC@0.005%) (Net gain of Rs. 77344.01 and BCR-1:5.47). In an experiment against sheath mite of rice the maximum straw yield was obtained in the treatment of chlorfenpyr 10 SC 0.015 @ 75 ml/ha (6115 kg/ha) [10]. The present studies were also supported by Nakum [8] who reported highest rice grain (5024 kg/ha) and straw yield (6515 kg/ha) when the crop was sprayed with chlorfenpyr 10 SC @ 1.00 ml/litre.

Table 1: Efficacy of various pesticides against rice sheath mite (Year 2014-15)

Treatments	Conc. (%)	Pre-treatment count (2cm leaf sheath)	Sheath mite population after I spray				Sheath mite population after II spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1:Fenazaquin 10 EC	0.02	3.26 (10.10)	2.27 (4.66)	1.31 (1.22)	0.84 (0.22)	0.78 (0.11)	1.43 (1.56)	1.12 (0.78)	0.91 (0.33)	0.91 (0.33)
T_2:Fenpyroximate 5 SC	0.005	3.25 (10.11)	2.46 (5.52)	1.27 (1.11)	0.71 (0.00)	0.71 (0.00)	1.12 (0.78)	0.84 (0.22)	0.84 (0.22)	0.84 (0.22)
T_3:Propargite 57 EC	0.057	3.47 (11.44)	2.48 (5.67)	1.74 (2.56)	0.91 (0.33)	0.97 (0.44)	2.48 (5.78)	1.82 (2.89)	1.41 (1.56)	1.50 (1.78)
T_4:Buprofezin 25 SC	0.05	3.25 (10.11)	2.32 (4.89)	1.39 (1.44)	0.71 (0.00)	0.84 (0.22)	1.55 (1.89)	1.13 (0.78)	0.91 (0.33)	0.97 (0.44)
T_5:Diafenthiuron 50 WP	0.05	3.22 (9.89)	2.19 (4.33)	1.27 (1.11)	0.71 (0.00)	0.71 (0.00)	1.24 (1.11)	0.90 (0.33)	0.71 (0.00)	0.71 (0.00)
T_6:Wettable Sulphur 80 WP	0.02	3.20 (9.78)	2.46 (5.55)	1.77 (2.67)	1.07 (0.67)	1.31 (1.22)	2.84 (7.67)	2.03 (3.78)	1.71 (2.44)	1.65 (2.22)
T_7:Chlorfenapy	0.015	3.22	1.81	1.07	0.71	0.71	2.97	1.87	1.78	1.68

r 10 SC		(9.89)	(2.78)	(0.67)	(0.00)	(0.00)	(8.33)	(3.00)	(2.67)	(2.33)
T_8: Control	--	3.27 (10.22)	3.36 (10.78)	3.19 (9.66)	3.15 (9.45)	3.13 (9.33)	3.01 (8.56)	2.54 (6.00)	2.17 (4.22)	2.17 (4.22)
SEm±	--	0.71	0.06	0.07	0.05	0.06	0.12	0.15	0.09	0.05
CD @ 5%	NS	NS	0.19	0.20	0.15	0.17	0.38	0.44	0.27	0.16
CV (%)	--	3.78	4.46	7.16	7.66	8.37	10.36	16.42	11.62	7.10

*Figures present in parenthesis are original values whereas those out side are arc sin transformed vales

Table 2: Efficacy of various pesticides against rice sheath mite (Year 2015-16)

Treatments	Conc. (%)	Pre-treatment count (2cm leaf sheath)	Sheath mite population after I spray				Sheath mite population after II spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1:Fenazaquin 10 EC	0.02	4.05 (19.33)	3.53 (12.00)	3.53 (12.00)	2.96 (8.33)	2.67 (6.67)	2.40 (5.33)	2.18 (4.33)	1.84 (3.00)	1.10 (1.00)
T_2:Fenpyroximate 5 SC	0.005	4.14 (20.33)	3.58 (12.33)	3.58 (12.33)	3.24 (10.00)	2.67 (6.67)	2.32 (5.00)	2.02 (3.67)	1.74 (2.67)	1.17 (1.00)
T_3:Propargite 57 EC	0.057	4.37 (20.67)	3.97 (15.33)	3.97 (15.33)	3.66 (13.00)	3.48 (11.67)	3.33 (10.67)	3.07 (9.00)	2.84 (7.67)	2.72 (7.00)
T_4:Buprofezin 25 SC	0.05	4.41 (21.67)	4.06 (16.00)	4.06 (16.00)	3.72 (13.33)	3.24 (10.00)	2.91 (8.00)	2.48 (5.67)	2.11 (4.00)	1.77 (2.67)
T_5:Diafenthiuron 50 WP	0.05	4.06 (21.67)	3.39 (11.00)	3.39 (11.00)	2.79 (7.33)	2.54 (6.00)	2.03 (3.67)	1.56 (2.00)	1.05 (0.67)	0.71 (0.00)
T_6:Wettable Sulphur 80 WP	0.02	4.26 (19.67)	4.10 (16.33)	4.10 (16.33)	3.81 (14.00)	3.76 (13.67)	3.58 (12.33)	3.44 (11.33)	3.13 (9.33)	3.07 (9.00)
T_7:Chlorfenapyr 10 SC	0.015	4.02 (21.67)	3.19 (9.67)	3.19 (9.67)	2.34 (5.00)	2.11 (4.00)	1.58 (2.00)	1.22 (1.00)	0.88 (0.33)	0.71 (0.00)
T_8: Control		4.71 (21.67)	4.67 (21.53)	4.67 (21.33)	4.64 (21.00)	4.60 (20.67)	4.56 (20.33)	4.53 (20.00)	4.52 (20.00)	4.41 (19.00)
SEm±		0.09	0.08	0.08	0.12	0.13	0.13	0.14	0.18	0.17
CD@5%		0.26	0.23	0.23	0.35	0.40	0.41	0.44	0.56	0.51
CV (%)		3.50	3.51	3.51	5.90	7.30	8.20	9.80	14.00	14.77

*Figures present in parenthesis are original values whereas those out side are arc sin transformed vales

Table 3: Efficacy of various pesticides against rice sheath mite (Year 2016-17)

Treatments	Conc. (%)	Pre-treatment count (2cm leaf sheath)	Sheath mite population after I spray				Sheath mite population after II spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1:Fenazaquin 10 EC	0.02	6.31 (39.34)	5.52 (30.00)	5.21 (26.65)	4.10 (16.35)	3.02 (8.67)	2.90 (8.00)	2.54 (6.00)	1.95 (3.34)	1.34 (1.34)
T_2:Fenpyroximate 5 SC	0.005	6.39 (40.34)	5.43 (29.00)	4.60 (20.67)	3.83 (14.33)	3.07 (9.00)	3.02 (8.67)	2.34 (5.00)	1.77 (2.67)	1.46 (1.67)
T_3:Propargite 57 EC	0.057	6.39 (40.33)	5.84 (33.67)	5.52 (30.00)	4.41 (19.00)	3.62 (12.66)	3.18 (9.67)	2.77 (7.34)	2.26 (4.66)	1.93 (3.34)
T_4:Buprofezin 25 SC	0.05	6.42 (40.67)	5.37 (28.34)	5.11 (25.67)	3.85 (14.34)	3.13 (9.34)	2.85 (8.34)	2.26 (4.66)	1.68 (2.34)	1.46 (1.67)
T_5:Diafenthiuron 50 WP	0.05	6.28 (39.00)	4.81 (22.67)	4.64 (21.00)	3.44 (11.34)	2.61 (6.33)	2.11 (4.00)	1.77 (6.68)	1.34 (0.33)	1.22 (1.00)
T_6:Wettable Sulphur 80 WP	0.02	6.42 (40.67)	5.96 (35.00)	5.64 (31.34)	4.60 (20.67)	4.34 (18.34)	3.98 (15.34)	3.67 (13.00)	3.44 (11.34)	3.24 (10.00)
T_7:Chlorfenapyr 10 SC	0.015	6.47 (41.34)	4.81 (22.67)	4.14 (16.67)	3.02 (8.67)	1.95 (3.34)	1.68 (2.34)	1.34 (1.35)	1.05 (0.67)	0.88 (0.34)
T_8: Control		6.49 (41.67)	6.39 (40.33)	6.39 (40.34)	6.36 (39.67)	6.26 (38.67)	6.34 (39.68)	6.26 (38.67)	6.23 (38.34)	6.24 (38.67)
SEm±		0.09	0.08	0.08	0.12	0.13	0.14	0.15	0.13	0.14
CD@5%		0.26	0.23	0.23	0.35	0.40	0.42	0.46	0.38	0.42
CV (%)		3.50	3.51	3.51	5.90	7.30	7.38	9.06	8.81	10.70

*Figures present in parenthesis are original values whereas those out side are arc sin transformed vales

Table 4: Efficacy of various pesticides against rice sheath mite (Pooled)

Treatments	Conc. (%)	Pre-treatment count (2cm leaf sheath)	Sheath mite population after I spray				Sheath mite population after II spray			
			1 DAS	3 DAS	7 DAS	14 DAS	1 DAS	3 DAS	7 DAS	14 DAS
T_1:Fenazaquin 10 EC	0.02	4.54 (22.92)	3.77 (16.89)	3.35 (13.29)	2.64 (8.30)	2.15 (5.15)	2.24 (4.96)	1.95 (3.70)	1.57 (2.22)	1.12 (0.89)
T_2:Fenpyroximate 5 SC	0.005	4.59 (23.59)	3.82 (17.06)	3.15 (11.37)	2.59 (8.11)	2.15 (5.22)	2.15 (4.82)	1.73 (2.96)	1.45 (1.85)	1.16 (0.96)
T_3:Propargite 57 EC	0.057	4.74 (24.15)	4.10 (19.34)	3.75 (15.96)	3.00 (10.78)	2.69 (8.26)	2.99 (8.71)	2.56 (6.41)	2.17 (4.63)	2.05 (4.04)
T_4:Buprofezin 25 SC	0.05	4.69 (24.15)	3.92 (17.41)	3.52 (14.37)	2.76 (9.22)	2.40 (6.52)	2.43 (6.08)	1.96 (3.70)	1.57 (2.22)	1.40 (1.59)
T_5:Diafenthiuron 50 WP	0.05	4.52 (23.52)	3.46 (14.33)	3.10 (11.04)	2.31 (6.22)	1.95 (4.11)	1.79 (2.93)	1.41 (3.07)	1.03 (0.33)	0.88 (0.33)
T_6:Wettable Sulphur 80 WP	0.02	4.62 (23.37)	4.17 (19.41)	3.84 (16.78)	3.16 (11.78)	3.14 (11.08)	3.47 (11.78)	3.05 (9.37)	2.76 (7.70)	2.65 (7.07)
T_7:Chlorfenapyr 10 SC	0.015	4.57 (24.30)	3.27 (13.71)	2.80 (9.00)	2.02 (4.56)	1.59 (2.45)	2.08 (4.22)	1.48 (1.78)	1.24 (1.22)	1.09 (0.89)
T_8: Control	--	4.82 (24.52)	4.81 (24.67)	4.75 (23.78)	4.72 (23.37)	4.66 (22.89)	4.64 (22.86)	4.44 (20.89)	4.31 (20.85)	4.28 (20.63)
SEm± T	--	0.08	0.10	0.13	0.19	0.22	0.40	0.36	0.42	0.45
SEm± YT	--	0.07	0.08	0.08	0.10	0.11	0.13	0.15	0.14	0.13
CD T @ 5%	-	---	0.30	0.40	0.59	0.67	1.22	1.10	1.28	1.36
YT @ 5%	--	0.21	0.23	0.24	0.30	0.34	0.38	0.42	0.42	0.39
CV%	-	2.70	3.56	4.08	5.95	7.48	8.43	10.95	11.86	12.18

*Figures present in parenthesis are original values whereas those out side are arc sin transformed vales

Table 5: Effect of pesticides on the yield parameters of paddy

Treatment	Grain Yield Kg/Plot				Grain Yield Kg/ha				Straw Yield Kg/Plot				Straw Yield Kg/ha				
	2014-15	2015-16	2016-17	Pooled	2014-15	2015-16	2016-17	Pooled	2014-15	2015-16	2016-17	Pooled	2014-15	2015-16	2016-17	Pooled	BCR
T_1:Fenazaquin 10 EC	8.79	10.40	8.24	9.15	4524.00	5351.33	4241.00	4705.44	8.15	8.82	9.25	8.74	4191.0	4536.0	4760.0	4495.67	1.01
T_2:Fenpyroximate 5SC	8.86	9.19	9.07	9.04	4557.40	4728.60	4664.00	4650.00	8.18	10.49	9.03	9.23	4206.0	5395.0	4645.0	4748.67	5.47
T_3:Propargite 57 EC	6.80	10.51	7.82	8.38	3496.33	5408.00	4021.00	4308.44	8.12	9.45	8.19	8.59	4175.0	4861.0	4214.0	4416.67	2.43
T_4:Buprofezin 25 SC	8.93	8.83	9.30	9.02	4595.70	4540.30	4784.00	4640.00	8.22	9.71	7.92	8.62	4229.0	4995.0	4076.0	4433.33	4.80
T_5:Difenthiuron50WP	10.66	10.64	10.49	10.60	5483.33	5472.70	5398.00	5451.34	9.48	10.24	9.28	9.67	4876.0	5270.0	4773.0	4973.00	6.60
T_6:WettableSulphur 80WP	7.90	8.81	8.58	8.43	4063.60	4531.00	4412.38	4335.66	8.05	9.26	9.03	8.78	4140.0	4765.0	4645.0	4516.67	4.74
T_7:Chlorfenapyr 10 SC	10.44	11.18	9.88	10.50	5368.00	5753.00	5080.33	5400.44	9.70	10.25	8.32	9.42	4989.0	5272.0	4282.0	4847.67	5.04
T_8: Control	6.35	10.98	5.50	7.61	3265.00	5646.33	2831.00	3914.11	7.35	8.03	7.14	7.51	3780.0	4133.0	3673.0	3862.00	--
SEm T±	0.18	0.47	0.46	0.83	108.62	223.54	92.52	3328.32	0.23	0.21	0.31	0.25	117.18	106.53	157.05	129.22	--
YT±	--	--	--	0.39	--	--	--	153.37	--	--	--	0.25	--	--	--	128.76	--
CD T @5%	0.55	1.42	1.40	--	329.49	678.10	280.67	--	0.69	0.63	0.93	0.76	355.45	323.12	476.46	392.06	--
YT@5%	--	--	--	1.19	--	--	--	465.26	--	--	--	0.71	--	--	--	367.64	--
CV (%)	3.68	8.11	9.13	7.48	4.26	7.47	3.53	5.68	4.48	3.76	6.00	4.79	4.48	3.76	6.00	4.79	--

5. Conclusion

The sheath mite, *S. spinki* is a serious pest of rice. On the basis of the study it can be concluded that the pesticide diafenthiuron 50 WP@0.05% was most effective in controlling the sheath mite of rice and it was followed by other pesticides like chlorfenapyr 10 SC@0.015% and fenpyroximate 5 SC@0.005%.

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