Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(4): 663-666
© 2017 JEZS
Received: 25-05-2017
Accepted: 26-06-2017

Krishna Karmakar
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya AINP on Agril. Acarology, Directorate of Research Kalyani, Nadia, West Bengal-741235, India

Suvash Chandra Bala
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya AINP on Agril. Acarology, Directorate of Research Kalyani, Nadia, West Bengal-741235, India

Sunil Kr. Ghosh
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya AINP on Agril. Acarology, Directorate of Research Kalyani, Nadia, West Bengal-741235, India

Correspondence
Krishna Karmakar
Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya AINP on Agril. Acarology, Directorate of Research Kalyani, Nadia, West Bengal-741235, India

Population dynamics of sheath mite, *Steneotarsonemus spinki* Smiley infesting rice cultivar IET- 4786 and its management under Gangetic Basin of West Bengal

Krishna Karmakar, Suvash Chandra Bala and Sunil Kr. Ghosh

Abstract
The present investigation was conducted to study the population dynamics of rice sheath mite and their sustainable management at District Seed Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani during kharif season of 2013. Very low mite population was noticed during August and 1st week of September. Thereafter, the mite population start to increase gradually and their peak population attained during the period of 25.9.13 to 15.10.13 at dough to ripening stage of the crop. The highest population of mite observed at ripening stage of the crop. Both the temperature and relative humidity have been found to be positive correlation with mite population. The mite population was observed to be infested the crop at the late tillering stage during 3rd week of August. Acaricides found to be least effective against the mite for sustainable management of sheath mite however; profenophos provided higher mortality followed by dicofol. The highest yield was also obtained from profenophos treated plots (4.80 t/ha) which was at par with dicofol treated plots (4.65 t/ha).

Keywords: Incidence, rice sheath mite, Climatic parameters, correlation, profenophos, dicofol

1. Introduction

Rice is the staple food of nearly half of the world population. India is the largest rice growing country, with the production of 91.5 million t in 43.7 million ha [1]. West Bengal is one of the main rice producing Indian states, where about 14 million t are produced in 6.2 million ha [6]. The rice sheath mite, *Steneotarsonemus spinki* Smiley, has been one of the most destructive mite pests in the Bengal Basin, that appear during wet season causing significant yield loss in some of the susceptible rice cultivars and it is a regular mite pest occurs in kharif rice under Gangetic Plains of West Bengal causing 15 to 60% yield loss in susceptible rice cultivars depending on the time of transplanting [5]. It colonizes leaf sheath, causing chaffy and sterile grains and characteristic brownish patches on the affected plant parts. Feeding of this mite on reproductive parts of rice flowers results in grain sterility [16]. These mites have also been reported as vector/carrier of pathogenic fungi like *Acrocylindrium* (*Sarocladium*) *oryzae*, *Fusarium moniliformae,* and *Helminthosporium oryzae* [15]. The occurrence of rice sheath mite has been reported from many countries like, Madagascar [4], Philippines [22], Taiwan [3] and Cuba [11]. In India, it was reported first time from Orissa [21]. Thereafter it has been reported from peninsular India [16, 18 and 20]; covering various aspect of sheath mite. Recently, it has been reported from eastern India that sheath mite prefer some of the susceptible rice cultivars where the mite causes devastating yield loss and a significant positive correlation has been established with the mite population and yield loss [5]. The extent of crop loss has been reported as 30–90% in China [23] and 30–70% in Cuba [12]. The rice sheath mite, (*Stenotarsonemus spinki)* alone and in association with sheath rot fungus, (*Acrocylindrium oryzae)* causes grain discoloration, ill-filled, chaffy grains and often cause heavy losses [9].

Parathion and dicofol were highly effective against *S. spinki* and reduced the mite numbers by 97 – 99.9 % and resulted in only 7.3 to 7.7 % sterility of rice [7, 8]. The other compounds such as azomite, diazinon and isoprocarb (MIPC) were less effective, reducing the mite numbers by 45 – 82.9 % and causing 13.5 – 39.8 % sterility of rice. Untreated control showed 34-fold increase in mite numbers and resulted in a grain sterility of 72.0%. Dicofol was recommended for the control of *S. spinki* because of high mammalian toxicity of parathion. However, from Maruteru, Andhra Pradesh, reported that dicofol @ 500 g a.i. /ha, ethion @ 500g a.i. /ha,

spiromesifen @ 72 g a.i. /ha and profenophos @ 500 g a.i. /ha were relatively better against sheath mite [2] and from Cuttack also reported that profenophos was effective against sheath mite [19]. Prabhakara [10] found that a treatment schedule inclusive of application of dicofol (0.05%) between 75 and 90 days after planting significantly reduced the extent of mite infestation as well as mite population (on leaf blade and panicle) for 15 – 20 days and the proportion of ill filled or chaffy grains was also significantly low. Considering the graveness of sheath mite infestation in rice the present work conducted with a view to study the population fluctuation during the growing season of rice to understand the seasonal variation of mite population and the impact of different acaricides molecules against the mite to optimize the yield of rice under Gangetic Basin of West Bengal.

2. Materials and methods

Two sets of experiment was conducted on rice sheath mite at field level using standard rice cultivars IET-4786 at District Seed Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani during kharif 2013 season to study the population dynamics of mite and to assess the efficacy of acaricide molecules against the mite species respectively. Seedlings of 25 days old were transplanted in the main field of 25m x 15m on 15th of July, 2013. Recommended agronomic practices were followed for general cultivation of rice. Data on mite population (post embryonic stages) was counted 40 days after transplanting at regular 10 days interval. One sheath from each of the plant of 10 selected hills was taken along the diagonal line of the plot for counting the mean mite population. Mite population was counted from each of the leaf sheaths taking leaf-sheath pieces of one square centimeter from three places along the leaf-sheath and was washed in alcohol vials separately and thus mean (number of 30 observations) mite population/cm^2 was considered for presenting data in the Table-1.

To find out the relationship of mite population that occurred in the susceptible rice cultivar IET-4786 was correlated with the corresponding mean weather parameters viz., maximum and minimum temperature, maximum and minimum relative humidity and total rainfall.

Eight pesticides were tested against rice sheath mite during two consecutive years of 2012 and 2013 during the month of August and September after observing natural infestation of mite. The experiment was conducted in the District Seed Farm of BCKV, Kalyani on susceptible rice cultivar IET-4786 by transplanting the 25 days old rice seedling in the main field on 15th July of each year in 4m x 5m plots with four replications for each of the treatments. Recommended agronomic practices were followed for general cultivation of rice. Two round of spraying was applied in each year at 25 days interval. The mite mortality percent has been corrected and transformed into angular value for statistical analysis of the data.

2.1 Statistical analysis

All data analyzed to determine treatment differences by Duncan's Multiple Range Test (DMRT) using SPSS computer software and significance of treatments was considered at P=0.05% level.

3. Results and Discussion

3.1 Role of abiotic factors on population fluctuation of *Steneotarsonemus spinki* Smiley

Population fluctuation: No mite population was observed at the early tillering stage of the crop in the month of August and very low mite population was noticed only in susceptible cultivars during August and 1st week of September (Table-1). Thereafter, the mite population start to increase gradually and their peak population attained during the period of 25.9.13 to 15.10.13 at dough to ripening stage of the crop. The highest population (35.60mites/cm^2) of mite observed at ripening stage of the crop during 12th October, 2013.

The weather parameters viz., maximum and minimum temperature, maximum and minimum relative humidity and total rainfall were found to be influenced profoundly on the occurrence of sheath mite. Maximum and minimum temperature, maximum and minimum relative humidity and total rainfall have been observed to be a positive co-relationship with the mite population. The mite population grow tremendously at high temperatures and high humidity during last fortnight of September and sometimes continue to 1st fortnight of October which was observed to be the common weather pattern during these period in the Bengal Basin that favours to build up profuse mite colonization those synchronize with the panicle emergence stage of the short and medium durational rice cultivars and hence, is the reason to cause severe yield loss due to sheath mite infestation table-1. Therefore, present observation might be corroborated with earlier findings [12-18, 10].

Table 1: Population dynamics of rice sheath mite on rice cultivars IET- 4786 in respect of prevailing weather parameters during Kharif, 2013 at BCKV, Kalyani, West Bengal.

Date of observation	Mean mite population/cm^2 leaf sheath	Temperature (^{0}C)		Relative humidity (%)		Total mean rainfall (cm)
		Max.	Min.	Max.	Min.	
07.08.13	0	33.33	26.43	96.00	84.57	4.19
14.08.13	0	32.91	25.73	96.86	83.71	9.38
21.08.13	0.2	30.87	25.87	96.86	84.71	19.24
12.09.13	0.2	33.75	26.02	96.30	77.20	11.78
15.09.13	0.6	34.20	25.80	96.57	77.57	10.71
18.09.13	1.2	32.81	26.14	95.14	80.29	6.09
21.09.13	6.5	34.17	25.93	95.86	78.29	7.58
24.09.13	12.8	34.99	26.23	93.56	68.33	8.10
27.9.13	25.3	33.29	24.94	98.00	79.86	6.66
1.10.13	28.4	33.44	24.86	96.00	83.29	12.26
3.10.13	29.5	32.96	24.53	96.86	75.14	4.51
6.10.13	31.2	29.56	22.01	96.80	77.50	8.50
9.10.13	33.4	32.29	24.94	98.0	79.86	6.66
12.10.13	35.6	31.89	24.82	97.7	79.56	7.12
15.10.13	32.7	31.44	24.86	96.00	83.29	12.26
18.10.13	25.8	31.86	24.77	97.23	82.59	5.34
21.10.13	12.2	32.96	24.53	98.86	75.14	4.51
Pearson's *r*	--	0.09	0.02	0.22	0.84	0.41

From the experiment it was clearly observed that the occurrence of the mite population highly correlated with the host phenology and the prevailing weather parameter. High temperature and high relative humidity influenced mite population. In both the years the mite population was observed to be infested the crop at the late tillering stage during 3rd week of August.

3.2. Management by using acaricides against sheath mite (*Steneotarsonemus spinki* Smiley)

The data on mean mite mortality percent presented in the Table-2. It was observed that the acaricides tested against the mite was not so effective against the mite except profenophos which imparted relatively higher mortality than other pesticides tested (Table-2). The highest yield was also obtained from profenophos treated plots (3.80 t/ha) which was

at par with dicofol (3.65 t/ha) and the lowest yield was obtained from untreated control plots. Therefore, the result of the present study might be well supported by the earlier works done by [2, 10, and 19] where similar pattern of acaricidal efficacy has been mentioned.

Table 2: Efficacy of acaricides against rice mite, *S. spinki* Smiley infesting rice.

Treatments	Doses ml/lit	% mite mortality				% tillers with Damage symptoms	Yield in t/ha
		1st round		2nd round			
		3DAS	7DAS	3DAS	7DAS		
Spiromesifen	1	70.16^{a} (57.20)*	62.47^{a} (52.52)	78.80^{a} (62.52)	65.56^{a} (54.37)	45.55^{e} (42.73)	3.30
Profenofos	1.5	65.22^{b} (54.16)	57.33^{b} (49.51)	79.20^{a} (63.22)	64.21^{b} (53.56)	55.05^{d} (54.06)	3.80
Fenpyroximate	1.0	45.64^{c} (42.79)	0.00^{g} (4.25)	45.78^{c} (42.87)	0.00^{f} (4.25)	90.50^{ab} (72.54)	3.15
Fenazaquin	1.0	42.69^{d} (41.09)	5.41^{f} (14.07)	50.56^{b} (45.61)	10.23^{e} (19.12)	84.73^{b} (67.40)	3.25
Propergite	1.5	19.28^{g} (26.40)	36.35^{c} (37.38)	19.49^{f} (26.56)	0.00^{f} (4.25)	92.23^{ab} (74.35)	3.32
Hexythiazox	1.0	36.52^{e} (37.47)	14.98^{e} (23.17)	36.63^{d} (37.54)	14.97^{d} (23.16)	90.30^{ab} (72.34)	3.35
Dicofol	2.5	27.10^{f} (31.69)	26.77^{d} (31.48)	26.28^{e} (31.16)	18.46^{c} (25.81)	78.59^{c} (62.79)	3.65
Control	-	0.00^{h} (4.25)	0.00^{g} (4.25)	0.00^{g} (4.25)	0.00^{f} (4.25)	100.00^{a} (90.0)	3.01

Similar alphabet represents the homogeneous means as resulted by Duncan's multiple range tests;
* Values in the parentheses are angular transformed.

4. Conclusion

It is concluded that the highest population (35.60 mites/cm^2) of mite observed at ripening stage of the crop and temperature, relative humidity and total rainfall have a positive co-relationship with the mite population. The mite population grows tremendously at high temperatures and high humidity during last fortnight of September. The Acaricide profenophos provided higher mortality followed by dicofol and the highest yield was also obtained from profenophos treated plots which were at par with dicofol.

5. Acknowledgement

The authors are thankful to Coordinator of AINP on Agril. Acarology Project, Bangaluru and Vice-Chancellor, Bidhan Chandra Krishi Viswavidyalaya, West Bengal for providing fund and facilities for preparation of this manuscript.

6. References

1. Anonymous. Department of Agricultural Research and Education, Indian Council of Agricultural Research, New Delhi, Annual report 2006-2007.
2. Bhanu V, Redy SP, Zaherudin SM. Evaluation of some acaricides against leaf mite and sheath mite in rice. Indian Journal of Plant Protection. 2006; 34:132-13.
3. Chen CN, Cheng CC, Hsiao KC. Bionomics of *Steneotarsonemus spinki*, Smiley attacking rice plant in Taiwan. Recent Advances in Acarology. Academic Press, New York, U.S.A. 1979; 1:111-117.
4. Gutierrez J. *Steneotarsonemus madecassus* n.sp. agent d'une deformation des panicles de riz a Madagascar (Acarina: Tarsonemidae). Bull. Ent. Soc. France. 1967; 72:323-330.
5. Karmakar K. *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae) A yield reducing mite of rice crops in West Bengal, India. International Journal of Acarology. 2008; 34:95-99.
6. Karmakar K, Gupta SK. Impact of the date of transplanting on population dynamics of the rice sheath mite, *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae), on the rice cultivar IET-4786 in the Gangetic Plains of West Bengal, India, Zoosymposia. 2011; 6:131-134.
7. Lo KC, Ho CC. Studies on the cause of the empty head of rice in Taiwan. Journal of Agricultural Research. China. 1979; 28(3):193-197.
8. Lo KC, Ho CC, Lin KC. Screening of chemicals for the control of rice tarsonemid mite *Steneotarsonemus spinki*. Journal of Agricultural Research. China. 1981; 30(3):303-307.
9. Natalie AH, Boris AC, Eric MMD, Miguel AP, Ronald O. The panicle rice mite, *Stenotarsonemus Spinki* Smiley, a ediscovered pest of rice in the United States. Crop Protection. 2009, 1-14.
10. Prabhakara H. M.Sc. (Ag) Thesis. Univ. Agric. Sci. Bangalore. 2002, 137.
11. Ramos M, Rodriguez H. *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae). New report for Cuba.Revista-de-protection-vegetal. 1998; 13:25-28.
12. Ramos M, Rodríguez H. Ciclo de desarollo de *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae) en laboratório. Revista de Protección Vegetal. 2000; 15(2):751-752.
13. Ramos M, Rodriguez H. Ciclo de desarrollo de *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae) en laboratorio. (Developmental time of *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae) in laboratory). Revista de Proteccion Vegetal. 2000; 15(2):130-131.
14. Ramos M, Rodriguez H. Aspectos biologicos y ecologicos de *Stenotarsonemus Spinki* Smiley en arroz, en Cuba. Manejo Integrado de Plagas. 2001; 61:48-52.
15. Rao J, Prakash A, Ghosh SK. Mites in rice ecosystem". Pub. Applied Zoolists Research association, Div.of Entomology, CRRI, Cuttack, India, 1999, 98.
16. Rao J, Prakash A. Infestation of tarsonemid mite *Steneotarsonemus spinki* Smiley in rice in Orissa. Journal of Applied Zoological Researches. 1992; 3(2):103.
17. Rao J, Prakash A. Miticidal activity of methanolic seed extract of *Trichilia trifoli* P. Br. (meliaceae) Journal of Applied Zoological Research. 1995; 6(1):68.

18. Rao J, Prakash A. Interaction of rice tarsonemid mite *Steneotarsonemus spinki* Smiley with rice pathogenic fungi to deteriorate paddy seed quality. Journal of Applied Zoological Research. 1996; 7(2):165-166.
19. Rao J, Prakash A. Selection of effective insecticides and less susceptible rice varieties for the control of rice panicle mite, *Steneotarsonemus spinki* Smiley. Entomon. 2006; 31(1):69-72.
20. Rao PRM, Bhavani B, Rao TRM, Reddy PR. Spikelet sterility/grain discoloration in rice in Andhra Pradesh, India. International Rice Research Notes. 2000; 25:40
21. Rao YS, Das PK. A new mite pest of rice in India International Rice Research Newsletter. 1997; 2:8.
22. Sogawa K. Occurrence of the rice tarsonemid mites at IRRI, Philippines. International Rice Research Newsletter. 1977; 2(5):17.
23. Xu GL, Wu HJZ, Huan L, Mo G, Wan M. Study on reproductive characteristics of rice mite, *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae). Systematic and Applied Acarology. 2001; 6:45-49.