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Effect of Date of Transplanting on the Population Dynamics of Rice Sheath Mite, *Steneotarsonemus spinki* Smiley (Acari : Tarsonemidae) on Rice Variety IET-4786 under West Bengal Condition

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ABSTRACT

The rice sheath mite, *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae), is becoming a serious pest of rice crop in West Bengal *vis-a-vis* India as well as outside India. Mite infestation was noticed on leaf sheath as well as grains with brownish patches, leading to a higher proportion of chaffy grains in panicles with substantial yield losses. West Bengal ranks first in rice cultivation regarding area and production in India and produces about 14 million tons in 6.2 million ha land area. An experiment was conducted to study the effect of six different dates of transplantation (at seven day intervals) of rice variety IET-4786 on mite population and grain yield. The study was conducted from July to November 2019 at Rice Research Station, Chinsurah, West Bengal during *kharif* season. Sheath mite population increased gradually, reaching the maximum level in September 23 on plants of the first four planting dates, and on October 7, on plants of the last two planting dates. The result revealed that peak incidence of mite occurred at the ripening stage of the first three planting dates, but significantly higher number of mite population and damage symptoms in all plants were observed in the last two planting dates, at the panicle emerging to flowering stage. Poor grain yield was obtained from plants of the last two planting dates, which could be due to the sheath mite attack.

Key words : Rice sheath mite, *Steneotarsonemus spinki,* Population dynamics, Varieties.

Introduction

Rice (*Oryza sativa* L.) is an important cereal crop and staple food for more than 65% of the world's population (Mathur *et al.,* 1999). It is cultivated in almost all tropical, sub-tropical and temperate countries of the world. West Bengal ranks first in area and production of rice in India. About 78% of total area under rice is concentrated under high and medium productivity groups, which accounts for nearly 84% of total production of rice in the state (Anon., 2000). Of the several species of mites reported so far on rice (Rao *et al.*, 1993; Rao and Prakash, 1995), rice sheath mite (*Steneotarsonemus spinki*

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Smiley: Family Tarsonemidae) infests leaf sheath causing brown discoloration. Infestation of this mite on rice panicles causes chaffy grains and also discoloration of filled grains. This mite has been reported from Taiwan (Chen *et al.*, 1979), Cuba (Ramos and Rodriguez, 1998), the Philippines (Sogawa, 1977) and Madagascar (Gutierrez, 1967). In India, it has been reported from Odisha (Rao and Das, 1977; Rao and Prakash, 1992) and from east and west Godavari districts of Andhra Pradesh (Rao *et al.*, 2000; Anon., 2001). The sheath mite in association with the sheath rot fungus (*Acrocylindrium oryzae*) causes grain discoloration, ill-filled and chaffy grains and often inflicts heavy losses in rice (Ghosh *et.al.*, 2012, Saha *et.al.*, 2016; Mukhopadhyay, *et.al.,* 2017; Saha and Gupta, 2018). The mite was first reported in 2007 from the state of West Bengal as one of the major yield reducing species, that can cause yield loss to the extent of 25-30% in most popular high-yielding varieties (HYVs) like IET 4094 and IET 4786 (Karmakar, 2007). A perusal of available literature reveals that scanty of information is available on effect of date of transplanting on the population dynamics of rice sheath mite. Hence, the present investigation was taken up to study the effect of six different dates of transplanting (at seven day intervals) of rice variety IET-4786 on sheath mite population and grain yield.

Materials and methods

A field experiment was conducted on the susceptible rice variety IET- 4786 in wet (*kharif*) seasons of 2019 at Rice Research Station, Chinsurah, Hooghly, West Bengal, located at 22°52 N latitude and 88°24E longitude with an elevation of 8.62 m above MSL. The experiment was laid out in a randomized complete block design (RCBD) with four replications keeping individual plot size of 5 m x 5 m for each of the six dates of transplanting (D_1–D_6, Table- 1). The seedlings were transplanted at six different dates at 7 days interval commencing from 2.7.2019. The last date of transplanting was completed on 06.08.2019. Recommended doses of fertilisers were applied where half of the nitrogen (N) and full doses of phosphate and potash were given at the time of final land preparation and remaining half of N was given equally at 16 and 30 days after transplanting (DAT). Seedlings of 21 days were transplanted to the main field at a spacing of 20 cm x 15 cm. For recording data on mite population, ten tillers from each plot were collected in polythene bags, kept tied with rubber bands and brought to the laboratory during the period from vegetative to reproductive stages of the cultivars. Mature and immature populations of mites in 1 sq.cm area of flag leaf sheath were counted under a stereo zoom binocular microscope. Mean mite population in 1 sq. cm of leaf sheath of forty leaves for each of the cultivars was considered for statistical analysis. The proportion of tillers expressing damage symptoms was also recorded. Observations ended on October 13, when the proportions of plants of the last four planting dates showing damage symptoms were close to 100% and when plants of the first two planting dates were harvested soon afterward. The total weight of the harvested grains from each plot was recorded after cleaning and sun drying. The F test following analysis of variance (ANOVA)

technique was performed and the least significant difference (LSD) test at 5% was used by following Gomez and Gomez, 1983.

Results and discussion

The result of experiment during *kharif* 2019 has been presented in Table-1 and Table-2. No mite was observed on leaf lamina but very scanty mite population was observed as early as 13.09.2019 in D_1, D_2 and D_3 plots where no symptoms of damage were expressed. However, their population gradually increased and attained peak stage during 03.10.2019 in D_1, D_2 and on 13.10.2019 in D_3, D_4, D_5 and D_6 date of transplanted crops. The result revealed that peak incidence of mite occurs at the ripening stage of D_1 and D_2 (03.10.2019) but significantly higher number of mite population and maximum damage symptoms were observed in D_5 and D_6 when the crop in those dates of transplanting (DOT) were flowering to panicle emerging stage only. Poor yield (3.40 tons/ha) were obtained from D_6 where peak incidence of mite (69.76 mites/ sq. cm) occur during panicle emergence stage (13.10.2019). Yield were generally higher for plants of earlier transplanting crops D_1 and D_2 (Table- 2).

Although the rice sheath mite was first detected on D_1 plants but the mite population level was very low, probably because of prevailing weather conditions. D_1 plants started being exposed to high mite population densities (46.76 mites/ cm^2) after 92 days of the transplanting. Plants of the last transplanting date D_6 started to be exposed to high mite densities just 102 days after they were transplanted and this was the reason for the significant reduction in yield at progressively later transplanting dates. The results of this study are compatible with what has been observed by the authors in many parts of India as well as in the different parts of the world in the last decade.

In an earlier study conducted in India (Rao & Prakash, 2003) correlated rice sheath mite with the level of rice sterility. Quite a high variation in responses was observed between different regions in which the studies were conducted. In another study in Vietnam (Thuy *et al.,* 2012), a study was conducted regarding relationship of panicle rice mite (PRM) with agronomic characters of dominant rice cultivars like IR 50404 by artificial inoculation of 1, 2, 4, 8, 16 and 32 adult female mites per panicle at 30 and 45 days after sowing, respectively during summer and autumn crops of 2010. The mite population was also assessed at 13 and 28 days after introduction. This revealed the occurrence of 527 mites per tiller and 835 mites per tiller, respectively from the 32 adult female mites per panicle treatment. The highest yield loss of 89.3% was sustained at introduction of 32 mites per tiller at 30 days after sowing. The yield loss was less when low release of 1-2 mites per tiller was made. The % of empty grains increased as the density of panicle rice mite increased. The peak population of *Steneotarsonemus* sp. was more during heading to milky grain stage. The population was negatively correlated with rainfall and positively correlated with sunshine hours (Mutthuraju *et al.* 2014). Karmakar & Gupta (2011) also conducted a trial on rice sheath mite in West Bengal and mite was found on plants of all sampling dates when the first sample was taken (August 5), with the population

density being highest on D_1 plants. Thereafter, the population gradually increased, attained the highest levels on September 25 on D_1 and D_2 plants, and on October 5 (last sampling date) on plants of the other planting dates. Concurrently with the increasing population densities, an increase in the proportion of infested plants with the progress of time was observed. For all dates of transplanting, mite population density was relatively low (maximum of 6.0 mites/cm^2) until September 15, being highest on D_1 plants, which were older than others. However, a pronounced increase in density was observed on plants of all transplanting dates starting on September 25, when population densities were e" 12.0 mites/cm^2. This implied that the exposure of plants to progressively later transplanting to higher population levels for longer parts of their phenology. Yield was generally higher for plants of earlier transplanting; the only exceptions being yields of D_3 and D_4, which were not significantly different from each other. The results obtained in the present study were consistent with earlier researchers (Karmakar & Gupta, 2011) and also supported the findings and hence confirm the previous observations.

Table 1. Population dynamics of rice sheath mite, *Steneotarsonemus spinki* on rice variety IET 4786 at different dates of transplanting during *Kharif* 2019

Dates of transplanting	No. of mite per 1 sq.cm						
	14.08.2019	24.08.2019	03.09.2019	13.09.2019	23.09.2019	03.10.2019	13.10.2019
D_1 (02.07.2019)	06.58 (14.06)	08.42 (16.86)	09.46 (17.42)	11.68 (19.48)	15.39 (23.10)	53.41 (46.76)	32.55 (34.49)
D_2 (09.07.2019)	07.55 (15.74)	09.28 (17.44)	11.61 (19.79)	13.27 (21.16)	17.36 (24.82)	58.97 (50.17)	38.43 (38.11)
D_3 (16.07.2019)	03.64 (10.79)	05.24 (13.23)	07.11 (14.45)	08.21 (16.65)	14.67 (22.52)	48.47 (44.12)	50.16 (47.03)
D_4 (23.07.2019)	02.23 (08.51)	04.16 (11.74)	05.44 (11.44)	07.28 (15.65)	10.87 (19.25)	47.28 (43.74)	58.41 (49.04)
D_5 (30.07.2019)	01.01 (05.77)	01.59 (07.24)	02.17 (08.47)	04.49 (12.23)	06.27 (14.70)	45.56 (42.75)	61.29 (51.72)
D_6 (06.08.2019)	0.00 (0.71)	01.21 (06.31)	02.41 (08.91)	04.85 (12.72)	05.89 (17.05)	48.31 (44.03)	69.76 (56.83)
F- test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
Sem±	0.054	0.041	0.044	0.076	0.084	0.341	0.355
CD at 5%	0.167	0.129	0.138	0.231	0.256	1.031	1.070

* Values in parentheses are angular transformed.

Table 2. Expression of damage symptoms due to infestation of rice sheath mite, *Steneotarsonemusspinki* on rice variety IET 4786 at six different dates of transplanting during *Kharif* 2019

Dates of trans-planting	Per cent hill infested with damage symptoms							Yield in tons/ ha
	14.08.2019	24.08.2019	03.09.2019	13.09.2019	23.09.2019	03.10.2019	13.10.2019	
D_1 (02.07.2019)	-	-	-	13.28 (21.17)	21.78 (27.82)	78.76 (62.76)	82.48 (65.26)	5.41
D_2 (09.07.2019)	-	-	-	11.46 (17.74)	23.48 (20.93)	81.24 (64.13)	86.21 (68.20)	5.12
D_3 (16.07.2019)	-	-	-	09.25 (17.71)	28.41 (32.28)	85.33 (67.48)	92.16 (73.43)	4.76
D_4 (23.07.2019)	-	-	-	07.34 (15.71)	25.16 (30.11)	90.45 (71.49)	98.23 (82.15)	4.10
D_5 (30.07.2019)	-	-	-	03.22 (10.14)	18.53 (25.50)	79.96 (63.41)	90.45 (71.50)	3.89
D_6 (06.08.2019)	-	-	-	04.28 (11.43)	15.24 (22.47)	54.55 (47.61)	77.18 (61.46)	3.40
F- test Sem± CD at 5%	-	-	-	Sig. 0.92 2.86	Sig. 0.81 2.54	Sig. 1.76 5.34	Sig. 1.82 5.58	Sig. 0.058 0.178

* Values in parentheses are angular transformed.

Conclusion

From the above study, It may be concluded that the peak incidence of mite occurs at the ripening stage of early transplanted crops (within 1st week of july) but significantly higher number of mite population and maximum damage symptoms were observed in late transplanted crops (last of july to first week of august) at their flowering to panicle emerging stage only

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