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Seasonal influence on the population density of *Stylophoronychus vannus* (Rimando, 1968) (Acari: Tetranychidae) infesting bamboos in Kerala

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ABSTRACT

Stylophoronychus vannus (Rimando, 1968), is a tetranychid mite dwelling mainly on bamboo plants. The impact of climatic factors on the population density of this mite on a selected species of bamboo, (*Bambusa vulgaris* var. *striata*) growing in the Nilambur region of the Malappuram district was studied during the period of November, 2012 to October, 2013. Results of the study indicated a general preference of the mite to inhabit on the adaxial surface of bamboo leaves and its feeding activity induced visible symptoms like the development of chlorotic spots and patches on the leaf surface. As observed during the study, temperature was found to exert an increase in the population density, with an average of 30 mites per leaf, when the temperature was maximum. The mite population showed a decreasing trend with the onset of monsoon season, and then showed a slow recovery afterwards. The paper also discusses the effect of relative humidity and rainfall on the population density of *S. vannus*. Statistical analysis of the data enabled to record a significant positive correlation between temperature and mite population (r = 0.748) whereas relative humidity and rainfall showed a negative correlation (r = -0.09 and r = -0.39 respectively).

Keywords: *Stylophoronychus,* Temperature, Rainfall, Relative Humidity, Population.

I. INTRODUCTION

Tetranychid mites, the commonly called spider mites, represent one of the most important groups of phytophagous acari inducing severe damage to almost all categories of economic plants. These mites have a broad host plant range, high fecundity and rapid developmental rate which together raise them to the status of major pests (Smiley and Baker, 1995). Spider mite feeding in general, destroys the plant epidermis and the underlying mesophyll tissue, and during heavy infestation, leads to blotching, stippling and bronzing of the leaves, which in turn cause premature defoliation in host plants.

Since 1990, bamboos were reported to be under the serious threat of phytophagous mites (Zhang *et. al.,* 1998a). *Stylophoronychus vannus* (Rimando, 1968), was recognized as a typical spider mite pest showing specific preference to monocots. It was first described in association with bamboos from Philippines (Rimando, 1968). Subsequently, several additional records were made on the infestation of the species on bamboos from various countries like China, India, Japan and Thailand (Meyer, 1987). Over the past few years, extensive studies were undertaken in several countries to explore the bamboo associated mites (Zhang *et al.,* 2000; Ripka, 2011; Kontschan and Nemenyi, 2013; Ripka *et.al.,* 2015 and Kiss *et.al*., 2017). Still, much of the faunal diversity of bamboo mites remains as unexplored in many countries including India where bamboos constitute a very important traditional crop of tremendous commercial utility. Therefore, the present work was undertaken with an intention to gather information on the impact of the most common climatic factors like temperature, relative humidity and rain fall on the population density of *S. vannus* on *Bambusa vulgaris* var. *striata*, which is commonly called as the yellow bamboo.

II. MATERIALS AND METHODS

The materials required for the present study were collected from the Nilambur teak museum of

Malappuram district for one year period, from November, 2012 to October, 2013. Mite infested leaf samples (n= 50) of *B. vulgaris* were collected randomly at monthly intervals, and transported to the laboratory in polythene bags for microscopic observation. Quantitative assessment of the population density of the various life stages of the species was made following Per Leaf Counting method. For counting, the leaf samples were immersed for 5-7 minutes in a petriplate containing 70% alcohol. Then the leaves were thoroughly washed in 70% alcohol to extract the entire mite population from the leaf samples. The mite specimens thus extracted from the leaves in to the petriplate were then examined under a stereo zoom microscope for counting and recording the number of mites. The density of mite population was calculated for the various months and presented graphically. The data on population density of the species were subjected to statistical analysis following SPSS software version 16 in order to correlate the impact of the various climatic factors like Temperature, Rainfall and Relative Humidity on the population density of the species. Data on Temperature, Relative humidity and Rain fall were availed from the nearest meteorological station at Karipur, Malappuram Dt.

III. RESULTS AND DISCUSSION

Earlier records on the infestation of *S. vannus* showed its limited distribution in India, confining to two states alone, viz. Arunachal Pradesh and West Bengal. The present recovery of the species on *B. vulgaris* enabled to extend its distribution pattern to one more state of India viz. Kerala. The results of field sampling carried out during the study revealed the preference of the mite to occupy the adaxial surface of bamboo leaves. Unlike various other species of tetranychids studied so far, the species was not found to form colonies, and instead wandered on the leaf surface of *B. vulgaris* (Fig.1).

Figure 1. *Stylophoronychus vannus* (Rimando, 1968)

The results of the present study enabled to assess the population fluctuation of *S. vannus* in relation to the variations in the abiotic factors like temperature, relative humidity and rainfall. The species was found to exhibit the maximum population density in the month of May, where the mean number per leaf reached 30. A gradual decrease in mite population was observed from June onwards, and the mean number was one per leaf (Fig. 2). From August onwards, the mite population again showed an increasing trend. A gradual increase in the population of the species was observed as the temperature got increased (Fig.3).

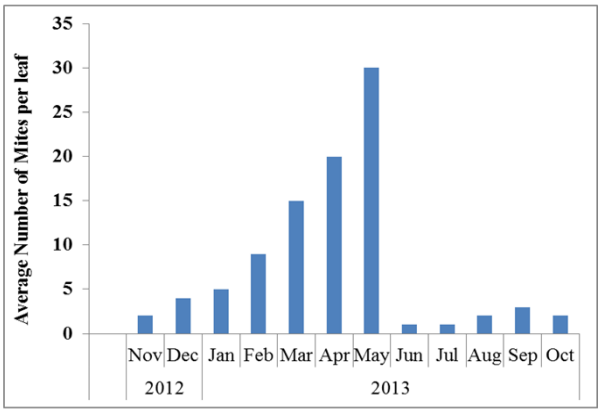

Figure 2. Average Number of mites per leaf of *Bambusa vulgaris* during the study period 2012-13.

The maximum number of mites (30) was observed in the month of May when the temperature was also at the peak (31.35^{o}C) whereas the mite population decreased when the temperature was declined to 27.2^{o}C. When these results were correlated statistically, a significant positive correlation was found between the temperature

and the population density of these mites with an r-value of 0.75.

The significant increase observed in the population density of *S. vannus* with the increase in temperature supports the earlier findings of Stavrinides *et al.,* (2010) where they studied the effect of plant water stress and leaf temperature on the population densities of *T. pacificus* and *Eotetranychus willamettei.*

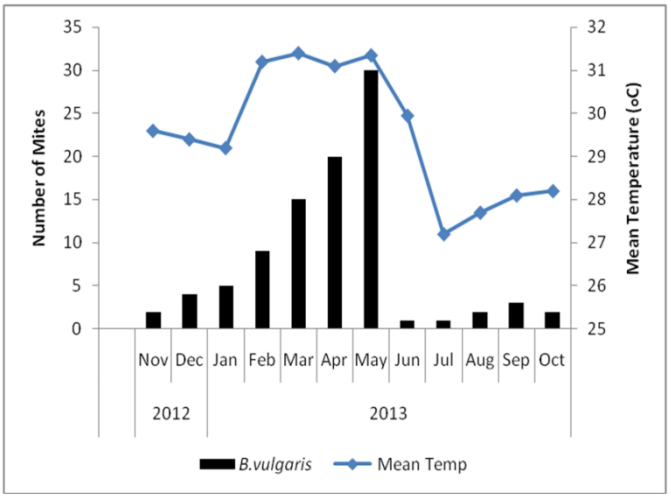

Figure 3. Effect of Temperature on the population density of *Stylophoronychus vannus.*

Similar results were also obtained by Chinniah *et al.,* (2007) while studying the effect of temperature on the population density of *T. urticae* on Okra plant. Silva *et al.* (1999) also proved an increase in population of *T. ludeni* at high temperature on cotton plants. A significant positive correlation was also established between temperature and populaion density of *T. neocaledonicus* infesting cassava (Sobha *et al*. 2017) and the present observation seems to support the above.

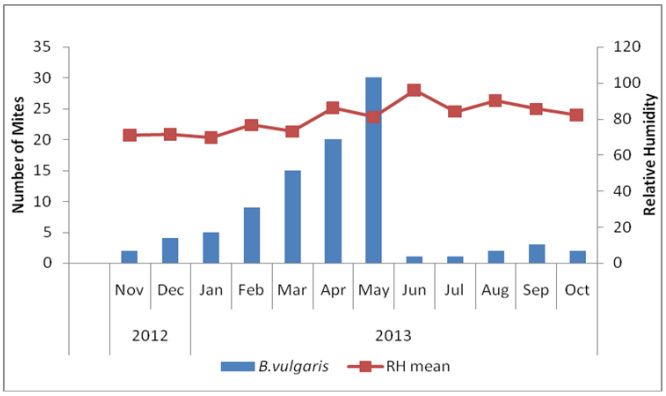

Figure 4. Effect of Relative Humidity on the population density of *Stylophoronychus vannus.*

The relative humidity was not found to exert any drastic effect on the population density of the species, as evident from the fig.4. Results of correlation studies done between the relative humidity and mite population enabled to record a slight negative correlation (r = -0.09), indicating that variations in relative humidity do not exert any drastic changes in mite population. This observation seems to contradict the suggestion made by Boudreaux (1958) that an increase in relative humidity would ensure a check in the population build up of spider mites.

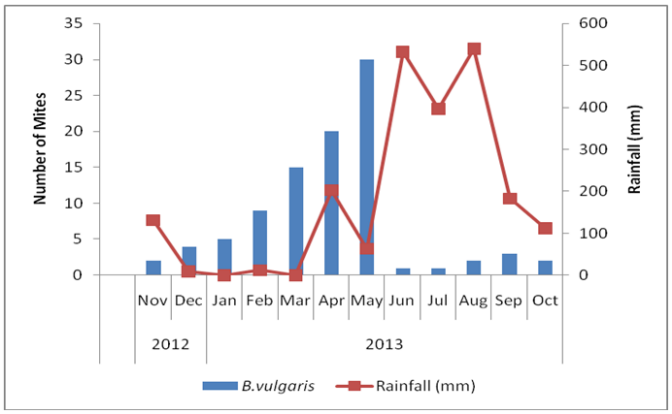

Figure 5. Effect of Rainfall on the population density of *Stylophoronychus vannus.*

During the present study, rainfall was found to exert a tremendous pressure on the population density of these mites. As presented in fig. 5, the mite population experienced a gradual increase from November, 2012 to May, 2013 and then showed a drastic decline in June-July, 2013 with the advent of monsoon season. When the data on population density were subjected to statistical analysis, a negative correlation was observed between rainfall and mite population with an r value of –0.39, confirming the negative impact of rainfall on *S. vannus*. The present observation on the population decline of the species during rainy season was in concordance with the earlier findings of Onzo *et al.* (2005) and Hanna *et al.* (2005) where they found a similar decline in population during the monsoon season. According to Yaninek *et.al.,* (1989), heavy rain could induce a drastic reduction in mite population by causing a washing effect on plant mites, including the spider mites. These findings were also in concordance with the results of Sobha *et.al.,* (2017), where they found a positive correlation (r value= 0.944) between temperature and population density of *T. neocaledonicus*

and a negative correlation of -0.94 for relative humidity and population density of *T. neocaledonicus.* They also found a negative correlation of -0.419 between temperature and population of *T. neocaledonicus.*

Like all other arthropods, the population of spider mites was also found to be influenced by the three abiotic factors such as temperature, rainfall and relative humidity (Muthuraj and Jesudasan, 2011; Teodoro *et al.,* 2008), and their diversity and density are determined by these environmental factors. Thus the results of the present study revealed that the abiotic factors play vital roles in regulating the population density of *S. vannus.* After a sharp decline of population in June, a gradual increase was observed subsequently. Probably, this increasing trend would suggest the ability of the mites to get acclimatized with the less favorable weather conditions and gradually resuming multiplication after an initial decrease in numbers and thus suggesting the major role played by these climatic factors on the population expansion of these mites.

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