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Impact of Climatic Factors on the Population Density of Spider Mites (Acari: Tetranychidae) Infesting Hedge Bamboos

C P Vibija[1], N Ramani[2]

[1]Research Scholar, Division of Acarology, Department of Zoology, University of Calicut, Kerala 673635, India

[2]Professor, Division of Acarology, Department of Zoology, University of Calicut, Kerala 673635, India

Abstract: ***Bambusa multiplex (Lour.) Raeusch. ex Schult. & Schult. f. is an easy to maintain, hedge bamboo, as well as being very hardy, clumping variety, it is by far the best bamboo for growing potted indoors. A study on the seasonal fluctuation in the population density of spider mites (Schizotetranychus spp.) on this bamboo was carried out in the Calicut University Campus from November, 2012 to October, 2013 in the Malappuram district of Kerala. Results of the study indicated that spider mites live on the undersides of leaves in colonies, being protected by silken webs and inducing damage by puncturing the leaf tissue and sucking the plant sap resulting in chlorosis of the infested leaves thereby decreasing the vigour of the plants. The population density of these mites was generally showing an increasing trend up to May and then due to the onset of rainfall it was decreased drastically. The average number of spider mites present per leaf of B. multiplex was 5.02. The effects of temperature, relative humidity and rainfall on the population density of these mites were discussed in the paper. Temperature showed a positive correlation (r = 0.77) with the population of spider mites whereas relative humidity showed a least negative correlation (r = -0.18). Rainfall exerted a tremendous negative impact on the population density of spider mites (r = 0.46).***

Keywords: *Schizotetranychus*, Tetranychidae, Seasonal fluctuation, *B. multiplex*, Population density

1. Introduction

Spider mites are the members of the family Tetranychidae and the latter comprises about 1,200 species under 71 genera, distributed globally [1]. Species of *Schizotetranychus* are reported from many bamboos as serious pests, including ornamental bamboos too [2, 3]. They are highly polyphagous, colonizing the underside of host plant leaves, under the protective silken webs, and induce damage by puncturing the plant cells to feed. The growth of a spider mite population is modified within a genetically defined spectrum by various environmental factors. Among the environmental influences are the climate, food availability and quality, predation and inter and intra specific competition [4]. Density is one of the factors regulating population abundance in arthropods [5]. This factor may act through a variety of mechanisms, which depend on the mode of life and behavior of invertebrates and may be species specific. In the present paper, impact of climatic factors such as the temperature, relative humidity (RH) and rain fall on the population density of spider mites has been discussed, based on the data collected during the one year period of November, 2012 to October, 2013, on the hedge bamboo, *Bambusa multiplex* (Lour.) Raeusch. ex Schult. & Schult. f. grown in the Calicut University Campus of Malappuram Dt. of Kerala.

2. Materials and Methods

Mite infested leaf samples were collected randomly from the bamboo plants at periodic intervals and transported to the laboratory in polythene bags for microscopic observation. Quantitative assessment of population density of individual mite species was made following Per Leaf Counting method. The leaf samples of each plant were immersed for 5-7 minutes in a petriplate containing 70% alcohol. The leaves were thoroughly washed in 70% alcohol to extract the entire mite population from the leaf surface. The mite specimens thus extracted from the leaves in to the petriplate were then examined under the stereo zoom microscope. In order to study the population density of individual species, the numbers of different life stages viz. the eggs, larvae, nymphal stages and adults, were counted. The number of mites was correlated with the climatic factors like temperature, relative humidity and rainfall experienced in the study site.

3. Results

The population density of spider mites on bamboo leaves from 2012 to 2013 was expressed as average number of mites present per leaf as shown in Figure 1. The average number of the spider mites present per leaf was 5.02 on *B. multiplex*. In general, the maximum population density of the mites was contributed by the eggs, followed by the adults. Immatures showed the lowest density.

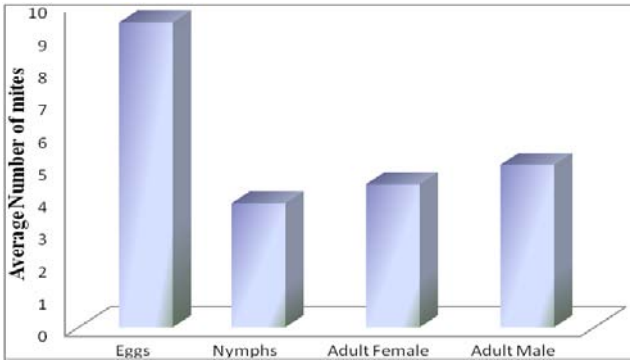

Figure 1: The average number of mites per leaf of *B. multiplex* during 2012-2013.

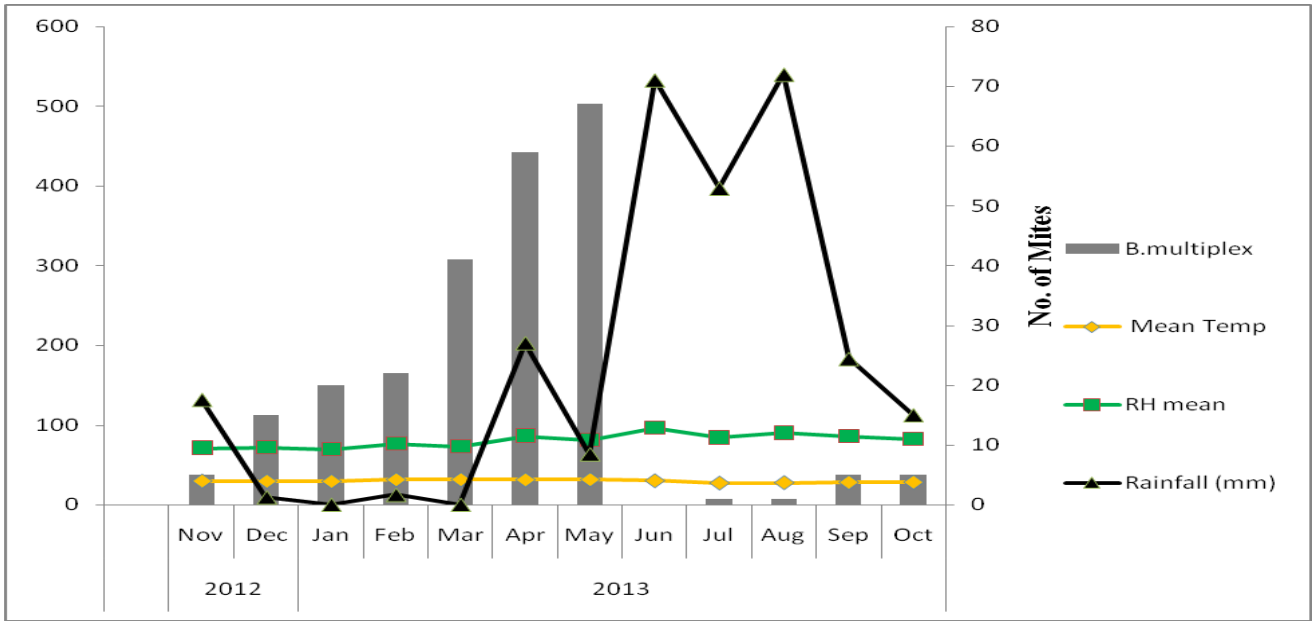

Figure 2: Effect of Temperature, Relative Humidity and Rainfall on the number of mites on the leaves of *B. multiplex*

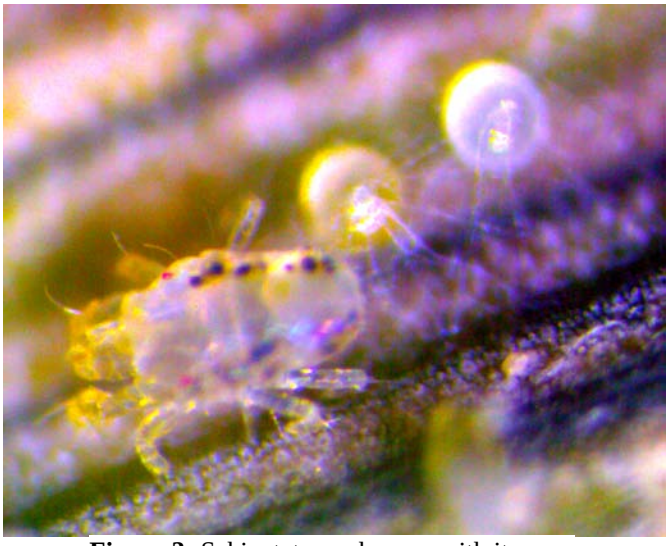

Figure 3: Schizotetranychus sp. with its eggs

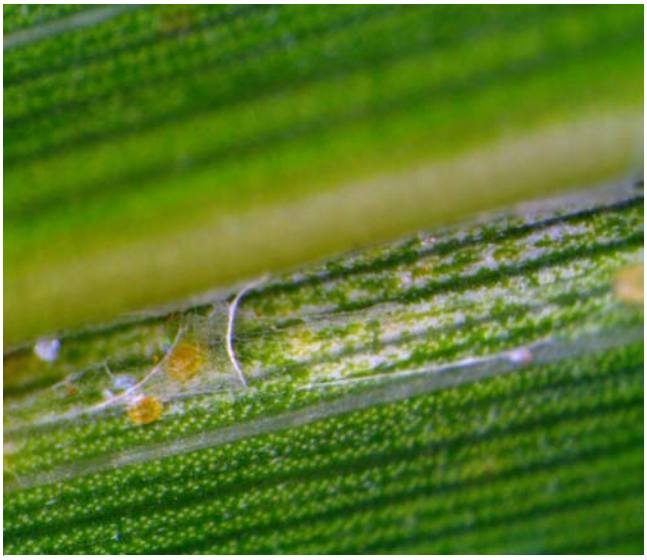

Figure 4: Spider mites forming web near the mid-vein of the leaf where a linear depression is typically found.

Figure 5: Chlorotic patches appearing on leaves due to mite infestation

Figure 2 shows the pattern of seasonal fluctuation of population density of spider mites on *B. multiplex*. As shown in the figure, the mite population showed a gradual increase from November, 2012 to May, 2013 and then exhibited a drastic decline in June-July, 2013. From August onwards, the mite population density followed an increasing trend.

The number of mites present on bamboos was found positively correlated with an increase in temperature (r = 0.77). A weak negative correlation was found between relative humidity and mite population density on *B. multiplex* (r = -0.18). Figure 2 depicts the effect of rainfall on mite population. As the rainfall increased, mite population showed a decreasing trend on bamboo (r = -0.46).

4. Discussion

Bamboo spider mites initially infest leaves along the midvein or edge of the leaf where a linear depression is typically

found. This depression provides the proper nest building site [6] (Fig 3 and Fig 4). These mites pierce individual plant cells on the underside of the leaf and suck out the cell contents, causing the discoloration on the upper leaf surface [7] (Fig 5 and Fig 6). Leaf damage would impair photosynthesis and reduce plant vigor. All life stages of these mites exist beneath a single web nest. This dense webbing is the main reason that these mites are difficult to control.

Seasonal changes in diversity and density of arthropods in tropical regions have been correlated with alterations in local environmental factors like temperature, rainfall and relative humidity [8-10]. The main mechanisms influencing population densities of spider mites were abiotic factors. Rainfall explained the highest fraction of variance for the population density of these mites. This was expected since the study area is characterized by heavy rains during the wet season (532.9mm in June 2012).

Figure 6: Bronzing of leaves due to excessive feeding of mites

Furthermore, a negative correlation was seen between the density of spider mites and rainfall, confirming these results. This negative relationship might be due to the fact that heavy rains might have washed off the mite colonies from the leaves [11]. This was also reported by the earlier works where the abundance of spider mites decreased in periods of high rainfall [12, 13].

A significant increase in spider mite population was observed with an increase in temperature during the present survey, thereby supporting the earlier findings [14]. Despite this, the mite population was not found significantly influenced by an increase in relative humidity. An increase in relative humidity would ensure a check in the population build up of spider mites [15]. Though the hatching process was not found affected, the survival of newly emerged nymphs was found adversely affected by the moist atmosphere.

5. Conclusion

Weather parameters, affect the spider mite population directly through physiological and mechanical ways and also indirectly through host quality changes. After a sharp decline of population in June, a gradual increasing trend could be 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.

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Author Profile

Vibija C.P. studied M.Sc (Zoology) from University of Calicut, Malappuram and done M.Phil in Environmental Science from Mahatma Gandhi University. Currently doing Ph.D from Division of Acarology, Department of Zoology, University of Calicut, Malappuram, Kerala, India.