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RESEARCH ARTICLE

IMPACT OF CLIMATIC FACTORS ON THE POPULATION DENSITY OF VEGETABLE SPIDER MITE, *TETRANYCHUS NEOCALEDONICUS* (ACARI: TETRANYCHIDAE) INFESTING CASSAVA.

T. R. Sobha¹, Ummukulsoom O. P² and T. P Shabana³.

1. Asst Professor of Zoology, Farook College, Kozhikode-673632. |
2. Research Student, PG & Research Department of Zoology.

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Abstract

Cassava, *Manihot esculenta* is primarily grown for its storage roots, which is edible. It is an important source of carbohydrate in the world. Beyond as a food source, cassava root can be used in various industries like production of plywood, bioethanol, paper, liquid glucose, sago flour etc. A study on the seasonal fluctuation in the population density of vegetable spider mite, *Tetranychus neocaledonicus* on the cassava was carried out from April, 2016 to March, 2017 in Puthuparamba, Malappuram district of Kerala. Result of the study indicated that feeding injury of the spider mite to the cassava leaf was marked by appearance of chlorotic spots. Latter large chlorotic patches are formed by fusion of this spots. There by reducing the vigor of the plant. The population density of these mites was showing a rapid decline from April to June. Then from July onwards a gradual rise was observed. The average number of spider mites present per 1cm² area of *M. esculenta* was 20.8. The effect of temperature, relative humidity, and rain fall on the population density of this mites were discussed in this paper. Temperature showed a positive correlation ($r = 0.944$) with the population density of spider mites. Whereas relative humidity showed a negative correlation ($r = -0.94$). Rain fall also exerted a negative impact on population density of spider mite ($r = -0.419$).

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Introduction:-

Mites exploit a wide variety of habitat and because of its miniature size (most of them are microscopic), go largely unnoticed. Arthropod pest may cause several losses in the agro ecosystem of cassava, *Manihot esculenta*, reducing productivity of this crop [1]. Spider mites are the members of the family Tetranychidae and the latter comprises about 1200 species under 71 genera, distributed world wide [2]. The first record of the *Tetranychus neocaledonicus* was from cotton in New Caledonia. But now it is wide spread in about 430 hosts [3,4,5,6]. *T. neocaledonicus* is considered as important pest in India infesting almost all vegetable crops. [7,8,9,10]. Feeding activity initiate from the midrib on the under side of the leaf. Webs formed by the mite will provide a secluded habitat for the mite colony. This dense webbing is the main reason that these mites are difficult to control. The growth of a spider mite population is modified with in a genetically defined spectrum by various environmental factors. Among the environmental factors are the climate, quantity and quality of food, predation and intra and inter specific competition [11]. This factor may act through a variety of mechanisms, which depends on the mode of life and behavior of mite species and may be species specific. In the present paper, impact of climatic factors such as the temperature,

Corresponding Author:-T. R Sobha.

Address:-Asst Professor of Zoology, Farook College, Kozhikode-673632.

relative humidity(RH) and rainfall on the population density of *T. neocaledonicus* has been discussed based on the data collected during the one year period of April 2016 to March 2017 on the cassava, *Manihot esculenta* grown in Puthuparamba of Malappuram district of Kerala.

Materials and Methods:-

Population density of spider mite (*T. neocaledonicus*) on the cassava was made during a period of 12 month from April 2016 to March 2017. Mite infested leaf samples were collected randomly from the cassava plant at periodic intervals and transported to the laboratory in polythene bags for microscopic observation. Quantitative assessment of population density of individual mite species made by enumerating the number of adult and immature stages per 1cm² area of cassava leaf. Data on average population of mite are presented at monthly intervals along with monthly average of temperature, relative humidity and rainfall of the area. For the present study temperature and relative humidity were recorded from the site by using thermo hygrometer and the rainfall data were collected from Agricultural Research Station (ARS), Anakkayam. The number of mites were correlated with the climatic factors like temperature, relative humidity and rainfall experienced in the study site by Karl Pearson correlation coefficient.

Results:-

The result of study revealed convincing evidence of population deterioration. All the three climatic factors namely temperature, RH, and rainfall though shared their role in this event, The population density of *T. neocaledonicus* on cassava leaves from 2016-2017 was expressed as average number of mites per unitcm² area. In general, the results of the study showed an overall performance of intermittent population fluctuation with respect to temperature gradients. The influence of temperature in all the months studied disclosed a very convincing trend, to establish a successive decrease in population from April to August. But from September onwards the mite population showed a gradual increase up to March and April (fig-1). Accordingly the maximum population density of *T. neocaledonicus* was recorded in March with a maximum density of 40 mites /cm² on the leaf surface. The impact of temperature on population density of the mite remained very striking, following a positive correlation trend. During the period of study, the population density of the mite showed high degree of positive correlation with temperature in the leaf sample ($r = 0.944$). Accordingly, the population density of the mite exhibit significantly of positive correlation during the entire .

Despite the positive impact of temperature on the population density of the mite, the other two climatic parameters studied namely the RH and rainfall exerted a negative impact bringing the population down very often. The population density of the mite reached the minimum when the RH reached the maximum, ie in June and July 2017. (fig-2) .Similarly, rainfall also exerted a negative effect with minimum number of mites on maximum precipitation in the same months of the year. (fig-3) . Normally when there was no rain- fall, a hike in population density could be observed. The population decreased drastically with respect to increase in rainfall coupled with prevalence of RH. The mite population followed a declining trend, even when the rainfall was very low, but at the same time prevalence of high RH noted. Analysis of correlation with RH and rain fall and mite population revealed a negative correlation with an r value of - 0.94 and -0.419 respectively. (Table-1).

Table1:- Correlation of the temperature, relative humidity and rainfall with population of *T. neocaledonicus*.

Weather parameter	Correlation coefficient with <i>T. neocaledonicus</i> population
Temperature	0.944
Relative humidity	-0.94

Figure 1:- Effect of temperature on mite population

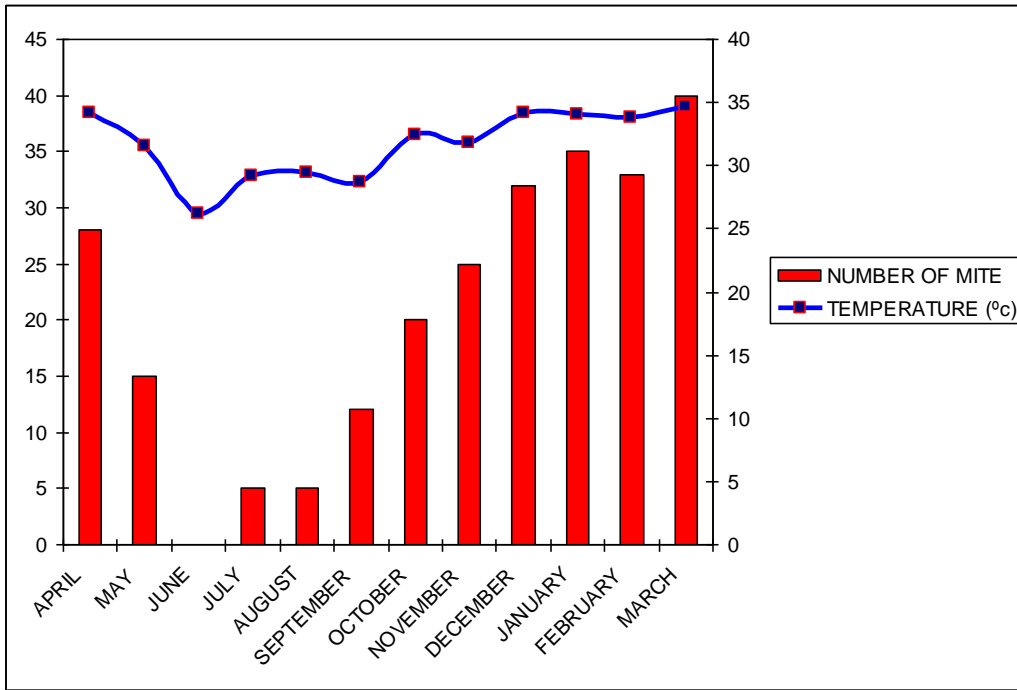


Figure2:- Effect of humidity on mite population.

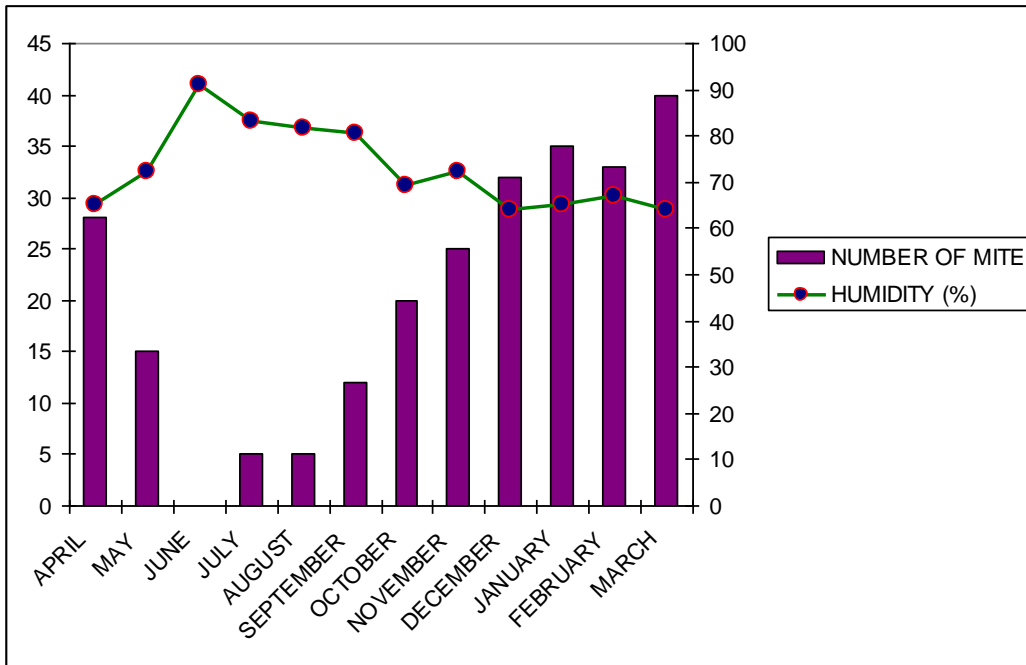
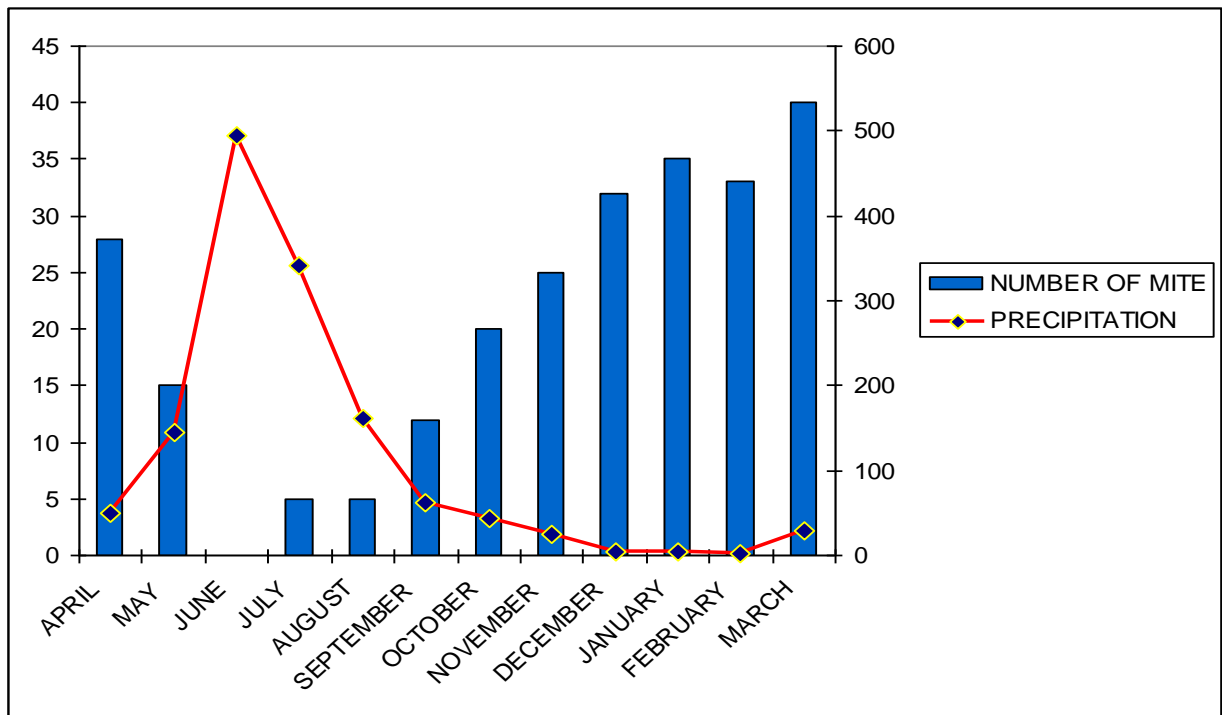


Figure3:- Effect of precipitation on mite population**Discussion:-**

Feeding injury of the spider mite to the host leaf was marked by appearance of characteristic spots and latter patches at the areas of suction of sap from plant cells. Initial symptoms of damage were manifested in the form of numerous white spots at the point of feeding on the leaf surface. Then large chlorotic patches are formed by fusion of this [12]. Injury to leaf impair photosynthesis and reduce plant vigor. Various life stages of these mites occur beneath a single web nest. This dense webbing is the mi rib areas in that these mites are hard to control.

Effect of various environmental factors like temperature, rainfall and relative humidity have been correlated with diversity and density of arthropods in tropical regions[13,14,15]. Abiotic factors plays a significant influence on population density. Rainfall contribute to the highest fraction of variance for the population density of spider mite. This was expected since the study area is characterized by heavy rain during the rainy season (494.6mm in June 2016). Further more, a negative correlation was seen between rainfall and density of spider mite, confirming this results. This may due to the fact that the mite colonies are washed off from the leaves due to the heavy rain[17,18].

The present survey showed a significant increase in spider mite population with an increasing temperature. This findings supporting the earlier works [19]. Relative humidity also play an important role in regulating the mite population. An increase in relative humidity would ensure a check in the population build up of spider mite [20].

Conclusion:-

The environmental factors affect the population of *T.neocaledonicus* directly through host quality changes. After showing a sharp decline from April to June, a gradual rise is observed from July to March. This gradual increasing trend suggest the amazing acclimatization ability of mite with unfavorable environmental conditions. The precipitation is the major factor in checking the population density of spider mite.

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