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Population Fluctuation and Feeding Potentiality of False Spider Mite *Tenuipalpus pernicis* (Chaudhri, Akbar and Rasool) on Papaya (*Carica papaya*) Plant

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Abstract

The false spider mite (*Tenuipalpus pernicis*) population was fairly good during November 2009—January 2010 in papaya (*Carica papaya*) and peak population was seen during May 2010 (32.8 ± 0.28 mites/6.25 sq cm) when mean temperature, RH, rainfall were 31.28 C, 72.62% and 1.05 mm, respectively. The population started declining thereafter, becoming minimum during August, 2010 when mean temperature, RH , rainfall were 28.91 C, 84.50%, and 15.53 mm respectively. Reasonably good rain during June and July 2010 probably acted adversely on the population of this mite. The correlation coefficients of the mite density with temperature and RH were positive while, with rainfall it was found to be negative but correlation with RH was found to be non-significant, they were significant in the other two cases. The amount of chlorophyll was decreased by 15.36% total protein and carbohydrate depletions were recorded as 17.07 and 14.99% respectively. The minerals showed marked depletion due to mite infestation. The Mg, Zn, Cu and Fe contents were decreased by 17.37, 17.57, 23.93 and 10.15% respectively.

Key words : False spider mite, *Tenuipalpus pernicis,* Population fluctuation, Feeding potentiality, Papaya.

Mites (Acarina) are serious pests of plants causing severe losses to economic crops (1). Since no significant study about the population dynamics and feeding potential of false spider mite *Tenuipalpus pernicis* has been made in India and elsewhere, it was thought desirable to investigate the feeding potential of this mite and the possible period or season of the year when they are abundantly found in the plants. Since very little or nothing is known as to what extent the feeding of false spider mites influences changes in the biochemical components of leaves of papaya, a preliminary study was made on this aspect.

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Methods

Collection was made directly from the infested leaves by examining those under 20 × lens in the field. The mites were collected with fine sable hairbrush moistened with 70% ethyl alcohol. Collected samples were kept in small glass vials (3 cm × 1 cm) in 70% ethyl alcohol. The specimens were picked up under binocular microscope by a fine brush and were put in a drop of lactic acid on a glass slide and then the same was covered with a broken piece of cover glass to minimize the weight of the glass on the specimens.

A good number of plantation of *Carica papaya* were chosen for this purpose. Ten trees of almost same age were selected for sampling and all those were tagged. From each tree, ten leaves of same size and age were plucked from all around the tree. Mites were examined from each of the leaf from 6.25 sp cm area from the ventral surface using a 20x hand lens. As such a total of 100 leaves were examined for this mite. This observation was repeated at three weeks interval. The relevant meteorological data regarding maximum and minimum temperatures, relative humidity and rainfall were collected for the entire study pe-

Table 1. Population of Tenuipalpus mites on *Psidium guajava* per 6.25 sq cm leaf area during November 2009 to October 2010.

Months	Phytophagous mites (number ± SD) (n=10)	Average temp (C) ± SD (n=30)	Average humidity (%) ± SD (n=30)	Average rainfall ± SD (mm) (n=30)
Nov 2009	17.9 ± 0.33	25.41 ± 2.10	75.00 ± 5.12	0.71 ± 0.08
Dec 2009	13.5 ± 0.56	21.10 ± 1.33	69.51 ± 6.35	0 ± 0.0
Jan 2010	15.4 ± 0.43	20.32 ± 2.33	72.97 ± 8.29	0.64 ± 0.22
Feb 2010	19.3 ± 0.65	23.50 ± 2.00	65.99 ±5.36	0 ± 0.0
Mar 2010	29.9 ± 0.87	28.56 ±2.07	62.33 ±4.87	0.033 ± 0.01
Apr 2010	26.2 ± 0.28	29.5 ± 2.66	67.58 ± 3.99	2.54 ± 0.93
May 2010	32.6 ± 0.93	31.38 ± 1.21	72.62 ± 4.56	1.05 ± 0.87
Jun 2010	30.8 ± 0.48	29.00 ± 1.34	83.50 ± 4.77	0.15 ± 0.22
july 2010	5.10 ± 0.72	30.6 ± 2.37	78.29 ± 7.01	12.92 ± 3.45
Aug 2010	4.5 ± 0.51	28.91 ± 2.22	84.5 ± 3.42	15.53 ± 6.21
Sep 2010	15.8 ± 0.48	27.10 ± 2.11	82.76 ± 3.22	10.49 ± 4.87
Oct 2010	13.8 ± 0.28	27.69 ± 2.14	72.79 ± 5.01	2.28 ± 1.11

riod by digital device. The meteorological data are given in Table 1. The data were statistically by analyzed to determine the simple correlation coefficients. It helps to determine the season in which the species was found most abundantly.

For biochemical analysis, heavily infested leaves and uninfested healthy leaves of papaya are to be collected. Out of those leaves (both uninfested and infested), 20 grams each of uninfested leaves and heavily infested leaves were oven dried for about 3 hours at 105 C for complete drying of leaves. Infestation status of the leaves can be easily concluded by the examination of damage symptoms, due to mite feeding, by hand lens.

Quantitative estimation of minerals like Mg, Cu, Zn, will be made by digesting the oven-dried samples in concentrated HNO_3. Before analysis, fresh uninfected leaves were collected to serve as control and those were processed separately for analysis.

The estimation of chlorophyll will be done following the method of Arnon (2). Total carbohydrate was estimated using anthrone reagent following the method of Hedge et al. (3). Before analysis, fresh uninfected leaves were collected to serve as control and those were processed separately for analysis. The results were statistically analyzed for the inference.

Table 2. Values of correlation coefficient (r) for papaya (*Carica papaya*). **= Non-significant.

	Temperature	Relative Humidity	Rainfall	Mite population
Temperature	1	–	–	–
Relative humidity	0.509	1	–	–
Rainfall	-0.568	-0.978	1	–
Mite population	0.607 (P<0.05)	0.298 **	-0.470 (P<0.01)	1

Results and Discussion

In *Carica papaya*, the false spider mite population was fairly good during November 2009—January 2010 and peak population was seen during May 2010 (32.8 ± 0.28 mites/6.25 sq cm) when mean temperature, RH, rainfall were 31.28 C, 72.62% and 1.05 mm, respectively.

The population started declining thereafter becoming minimum during August 2010 when mean temperature, RH, rainfall were 28.91 C, 84.50%, and 15.53 mm respectively.

Reasonably, good rain during June 2010 and July 2010 acted adversely on the population of this mites. From September 2010 onwards the population again started increasing, becoming fairly high during later months, attained peak during April—May, 2010 (Table 1). The mean temperature (n=30), RH (n=30), rainfall (n=30) during the period were 31.28 ^{o}C, 72.62% and 1.05 mm, respectively. Thereafter, population was low and became minimum during August, 2010. Probably high temperature (28.91^{0}C), high RH (84.50%) excessive rainfall (15.53 mm) did not favour the population

Table 3. Increase or Decrease of organic compounds in the leaves of papaya plant due to mite feeding (5—10 mites per 6.25 sq inch leaf area). (D) = Percentage decrease, n = Number of experiments.

Name of organic components	Control (amount±SD) (µg/g) (n=5)	Infested (amount±SD) (n=5)	Percentage of decrease or increase (n=5)
Chlorophyll	16.01±0.37	12.91±0.60 mg/g	15.36 (d)
Total protein	38.15±0.43	31.63±0.27 µg/g	17.07 (d)
Total carbohydrate	35.36±0.73 mg/100mg sample	30.05±0.09 mg/100 mg sample	14.99 (d)

Table 4. Decrease of minerals and inorganic components of papaya leaves due to mite feeding (5—10 mites per 6.25 sq inch leaf area). (D) = Percentage decrease, n = Number of experiments.

Name of minerals and inorganic components	Control (amount±SD) (n = 5) (µg/ml)	Infested (amount±SD) (n = 5) (µg/ml)	Percentage of decrease/ increase (percentage) (n = 5)
Mg (magnesium)	30.05 ± 0.04	24.83 ± 0.93	17.37 (D)
Zn (zinc)	3.56 ± 0.83	2.93 ± 0.78	17.57 (D)
Cu (copper)	2.04 ± 0.54	1.55 ± 0.23	23.93 (D)
Fe (iron)	32.60±0.05	29.29±0.52	10.15 (D)
nitrate	5.33 ± 0.36	4.20 ± 0.09	21.20 (D)
nitrite	4.01 ± 0.45 µg/g	2.49 ± 0.44 µg/g	37.68 (D)

growth of this mite. From September onwards, again the population of this mites started increasing (Table 1).

The correlation coefficients of the mite density with temperature and RH were positive while, with rainfall it was found to be negative but correlation with RH found to be non-significant, they were significant ($P<0.01$) in the other two cases (Table 2).

Tables 3 and 4 show marked depletion in percentage content of organic, inorganic compounds and minerals. The amount of chlorophyll decreased by 15.36%. The total protein and carbohydrate, the depletions recorded were 17.07 and 14.99% respectively. The minerals showed marked depletion due to mite infestation. Mg, Zn, Cu and Fe were decreased by 17.37, 17.57, 23.93 and 10.15% respectively. Nitrate and nitrite compounds were decreased by 21.20 and 37.68% (Table 4).

Since no study has been found on seasonal fluctuation of false spider mite population either in India or elsewhere, it is not possible to compare the present results. However, from some of the general studies made earlier on seasonal occurrence of phytophagous and predatory mites on agri-horticultural crops, it appears that in *Raoiella indica* Hirst on coconut, population was positively correlated with temperature and negatively correlated with RH and rainfall (4). It is contrary to the present findings where it was negatively correlated with temperature, RH and rainfall with phytophagous mites in relation to those factors and were positively correlated with predator. They reported peak population of this mite was during March and April. However, Gupta et al. (5) reported negative correlation with temperature, positive correlation with RH and rainfall in *Tetranychus telarius* on castor.

The present results showed peak population in May 2010 on papaya which was similar to earlier results. The result tallies with those of Dhooria and Butani (6, 7), who reported the peak population during May—June and during September. They also reported that temperature, RH were positively correlated while rainfall was negatively correlated with the mite population.

Infestation of mites is known to cause various biochemical changes including changes in minerals, inorganic and organic compounds in plants leading to their physiological and morphological changes (8, 9). Chatterjee and Gupta (10) reported chlorophyll damage to the extent of 33.62% on *Luffa acutangula* due to infestation of *Tetranychus ludeni*. Goyal and Sadana (11) reported chlorophyll loss as 63.12% mg/m^2 on *Coleus* sp. infested by *Brevipalpus obvatus*. Therefore, in view of these reports, the chlorophyll loss as was seen in the present case was low. Ghoshal et al. (12) reported chlorophyll loss of 13.45% in jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks).

In total protein, the reduction was found to be 17.07% which was indeed high. Similar observation was recorded by Nangia et al. (13) where depletion varied from 57.50% in Mysore local variety of mulberry leaves to 38.80% in RFS-175 variety, due to feeding of *Eotetranychus suginamensis*. Ghoshal et al. (12) reported depletion of total protein by 42.00%

in jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks). In iron and zinc the depletions were by 66.4 and 70% on *Luffa acutangula* due to feeding of *Tetranychus ludeni* (10) which were much higher as compared to observation made in the present study. Das (14) reported reduction in iron and zinc contents by 42.9 and 31.11% respectively in *Dolichotetranychus floridanus* on pineapple and those results are also on much higher side as compared to those obtained in the present study. In nitrate and nitrite compounds, the decrease was 21.20 and 37.68% respectively reported here as compared to 51.1 and 3.12% in *Luffa acutangula* by feeding of *Tetranychus ludeni* (10).

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