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SEASONAL ABUNDANCE AND FEEDING EFFICIENCY OF THE FALSE SPIDER MITE *TENUIPALPUS PERNICIS* (CHAUDHRI, AKBAR AND RASOOL) ON GUAVA (*PSIDIUM GUAJAVA*)

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ABSTRACT: The false spider mite (*Tenuipalpus pernicis*) population size was average in November, 2007 — January, 2008 on guava (*Psidium guajava*) (17.9 ± 0.33 mites / 6.25 cm^2 and 15.4 ± 0.43 mites / 6.25 cm^2 respectively). It peaked during May, 2008 (32.8 ± 0.28 mites / 6.25 cm^2, mean ± SD is calculated) when the mean temperature, RH and rainfall were 31.28 ^{0}C, 72.62% and 1.05 mm, respectively. The population density started to decline thereafter with the minimum in August, 2008 (4.5 ± 0.51 mites / 6.25 cm^2) when the mean temperature, RH and rainfall were 28.91^{0}C, 84.50% and 15.53 mm. respectively. Heavy precipitation in June and July probably adversely affected the mite population.
Correlation of the mite density with temperature and relative humidity (RH) were positive while that with rainfall was negative. Correlation with RH was non-significant.
We quantified the decrease in chlorophyll, proteins, carbohydrates and minerals in guava leaves due to mite infestation.

KEY WORDS: seasonal abundance, spider mite, *Tenuipalpus pernicis*

INTRODUCTION

Mites (Acarina) are serious pests of plants causing severe losses to economic crops (Gupta, 2003). Since no thorough study about the seasonal population dynamics, feeding potential of the false spider mite *Tenuipalpus pernicis* is not available. Similarly very little is known to what extent the feeding of false spider mites influences changes in the biochemical components of guava leaves, we conduct a preliminary study on these topics.

MATERIALS AND METHODS

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

Ten guava trees of almost the same age were sampled and all those were tagged. From each tree, ten leaves of the same size and age were randomly collected. An area of 6.25 cm^2 on the ventral surface of each leaf was examined for mites using a 20× hand lens. Sampling was repeated at a three-week interval. The relevant meteorological data on temperature, relative humidity and rainfall were collected for the entire study period by a digital device (Digital thermo-hygrometer by Citizen biotech). The data were subjected to a Pearson correlation analysis to determine the degree of association between simple correlation coefficients (Statistical Package used: SPSS, ver-12).

For biochemical analysis, heavily infested leaves as well as uninfested healthy leaves of guava were collected, 20 grams of both uninfested and infested leaves were dried for about 3 hours at 105^{0}C. Quantitative estimation of minerals (Mg, Cu, Zn), were made by dissolving the oven-dried samples in concentrated nitric acid.

The estimation of chlorophyll quantities in leaves was done after Arnon (1949). Total carbohydrates were estimated using anthrone reagent following the method of Hedge et al. (1962). Before analysis, fresh uninfested leaves were collected to serve as the control. The results obtained during this study were subjected to a statistical analysis for conclusion.

RESULTS

In *Psidium guajava*, the false spider mite population size was average i.e., 17.9 ± 0.33 mites / 6.25 cm^2 to 15.4 ± 0.43 mites / 6.25 cm^2 during November, 2007 — January, 2008. A population size peak was observed during May, 2008 (32.8 ± 0.28 mites / 6.25 cm^2, mean ± SD is calculated) when mean temperature, RH and rainfall were 31.28 ± 1.21 ^{0}C, 72.62 ± 4.56% and 1.05 ± 0.87 mm (mean ± Sd is Calculated respectively).

The population declined thereafter reaching the minimum in August, 2008 (4.5 ± 0.51 mites / 6.25 cm^2) when the mean temperature, RH and rainfall were 28.91± 2.22 ^{0}C, 84.50 ± 3.42 %, and 15.53 ± 6.21 mm respectively (Table 1).

Increased precipitation in June and July, 2008, probably acted adversely on the mite population.

Table 1.
Population size of *Tenuipalpus pernicis* on *Psidium guajava* per 6.25 cm^2 leaf area recorded form Nov. 2007 to Oct. 2008. Data are given as mean ± SD

Months	Mites (n=100)	Average Temp (0C)	Average Humidity (%)	Average Rainfall (mm)
Nov 2007	17.9 ± 0.33	25.41 ± 2.10	75.00 ± 5.12	0.71 ± 0.08
Dec 2007	13.5 ± 0.56	21.10 ± 1.33	69.51 ± 6.35	0 ± 0.0
Jan 2008	15.4 ± 0.43	20.32 ± 2.33	72.97 ± 8.29	0.64 ± 0.22
Feb 2008	19.3 ± 0.65	23.50 ± 2.00	65.99 ± 5.36	0 ± 0.0
Mar 2008	29.9 ± 0.87	28.56 ± 2.07	62.33 ± 4.87	0.033 ± 0.01
Apr 2008	26.2 ± 0.28	29.5 ± 2.66	67.58 ± 3.99	2.54 ± 0.93
May2008	32.6 ± 0.93	31.28 ± 1.21	72.62 ± 4.56	1.05 ± 0.87
Jun 2008	30.8 ± 0.48	29.00 ± 1.34	83.50 ± 4.77	0.15 ± 0.22
July2008	5.10± 0.72	30.6 ± 2.37	78.29 ± 7.01	12.92 ± 3.45
Aug 2008	4.5 ± 0.51	28.91 ± 2.22	84.5 ± 3.42	15.53 ± 6.21
Sep2008	15.8 ± 0.48	27.10 ± 2.11	82.76 ± 3.22	10.49 ± 4.87
Oct2008	13.8 ± 0.28	27.69 ± 2.14	72.79 ± 5.01	2.28 ± 1.11

Table 2.
Correlation between the mite density and three environmental variables

	Temperature	Relative Humidity	Rainfall
Mite Population	0.247	–0.398	–0.470 *

* = Significant, according to the J.P Guilford's product moment coefficient of correlation table.

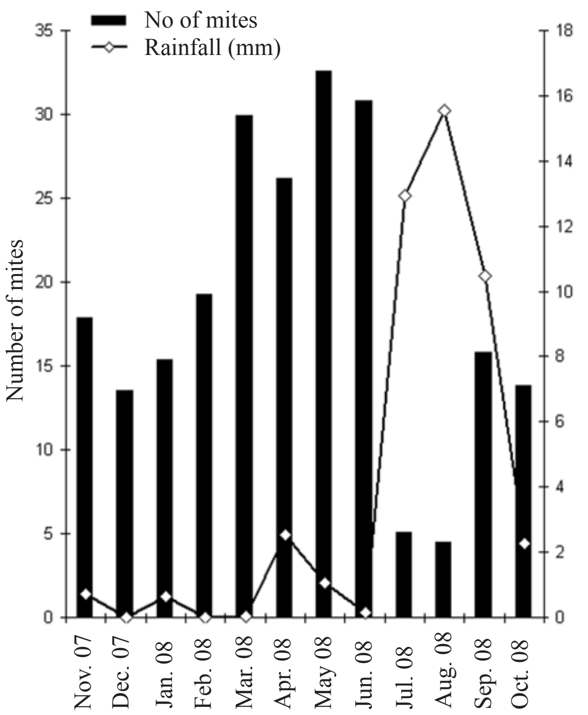

Fig. Correlation between mite population desnity and rainfall

From September 2008 onwards the population again started to increase.

The correlation coefficient of the mite density with temperature was positive while, with relative humidity and rainfall it was found to be negative. Correlation with rainfall was found to be significant but it was non-significant in the other two cases (Fig.).

We record depletion of organic and inorganic compounds in leaves due to mite damage (Tables 3 and 4).

DISCUSSION

Several general studies on seasonal occurrence of phytophagous mites are available. For *Raoiella indica* Hirst on coconut, population density was positively correlated with temperature and negatively correlated with RH and rainfall (Nageschandra and ChannaBasavanna 1984), which is contrary to the present findings where it was positively correlated with temperature, RH and negatively correlated with rainfall. Gupta et al. (1976) reported negative correlation with temperature and positive correlation with RH and rainfall for *Tetranychus telarius* on castor. Nageschandra and ChannaBasavanna (1984) reported a peak of population density of *Raoiella indica* in February on guava and in other months for other crops. Contrary to this, Dhooria and Butani (1983) reported peak population of *Eutetranychus orientalis* on *Citrus* during May-June as well as in September while Lal (1982) reported peak population during January-April. According to him, hot dry wind favored its population growth and the same was also reported by Dean (1959), Lal and Mukherji (1979), Puttaswamy and ChannaBasavanna (1981), Lal (1982), and Sugeetha and Shrinivasa (1999).

Table 3.
Variation of organic compounds in Guava leaves due to mite damage
(5–10 mites per 6.25 cm^2 leaf area)

Name of organic components	Control	Infested	Difference (%)
Chlorophyll (mg/g.)	16.01 ± 0.37	12.91 ± 0.60	–15.36
Total Protein (µg/g)	38.15 ± 0.43	31.63 ± 0.27	–17.07
Total Carbohydrate (mg/100mg)	35.36 ± 0.73	30.05 ± 0.09	–14.99

Table 4.
Variation of inorganic compounds in guava leaves due to mite damage
(5–10 mites per 6.25 cm^2 leaf area)

Inorganic component	Control	Infested	Change (%)
Mg (µg / ml)	30.05 ± 0. 04	24.83 ± 0.93	–17.37
Zn (µg / ml)	3.56 ± 0.83	2.93 ± 0.78	–17.69
Cu (µg / ml)	2.04 ± 0.54	1.55 ± 0.23	–24.01
Fe (µg / ml)	32.60 ± 0.05 l	29.29 ± 0.52	–10.15
Nitrate (µg / gm)	5.33 ± 0.36	4.20 ± 0.09	–21.20
Nitrite (µg / gm)	4.01 ± 0.45	2.49 ± 0.44	–37.90

Dhooria and Gupta (1975) and Kumari and Sadana (1995) reported peak population of *Brevipalpus phoenicis* on guava during November-December. Therefore, the present report does not totally agree with published data.

The present results showed a peak in population density in May, 2008 which is similar to results of Dhooria and Butani (1983). These authors show two peaks in May-June as well in September. Our results, however, disagree with those of Dhooria and Gupta (1975) who reported a peak in December. Most of the previous studies reported that phytophagous mite population was reduced drastically with low temperature and rainfall (Oatman and McMurtry 1966; Dhooria and Butani 1983) and similar observations were made in the present study also as phytophagous mite population was always low on the guava plant during the monsoon months of June-July.

The peak population of different phytophagous mites on *Psidium guajava* was reported during February and the minimum was reported in July (Ghoshal, Gupta and Mukherjee 2006). They also reported that temperature, RH positively correlated while rainfall negatively correlated with the mite population.

It was found that 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 (Herbert and Butler 1973; Golek 1975; Shree and Nataraj 1993). The decrease in chlorophyll level is due to mechanical damage of chloroplasts of leaves caused by mite feeding or it may be due to discoloration of chloroplasts. According to Tomezyk and Kropzynska (1985) the water stress induced by mite feeding may have an influence on chlorophyll metabolism of injured cells or due to cell disturbances and removal of chloroplasts. Reports of previous workers are given in tabular form.

In case of iron and zinc the depletions were by 66.4% and 70% on *Luffa acutangula* due to feeding of *Tetranychus ludeni* (Chatterjee and Gupta 1997) which were much higher when compared to our observations (10.15% in case of iron and 17.57% in case of zinc). Similarly to the present study, Golek (1975), Sadana and Goyal (1984) reported changes in magnesium contents in leaves. Das (1987) reported reduction in iron and zinc contents by 42.9% and 31.11% respectively in case of *Dolichotetranychus floridanus* on pineapple and those results are also on much higher side as compared to our data (10.15% in case of iron and 17.57% in case of zinc). Ghoshal, Gupta and Mukherjee (2006) reported depletion of magnesium, zinc, copper and iron as 8.33, 22.22, 13.88 and 8.66%, respectively in case of jute (*Corchorus capsularis* Linn.) infested by *Polyphagotarsonemus latus* (Banks).

The decrease of nitrate and nitrite compounds was 21.20 and 37.68% respectively, as compared to 51.1% and 3.12% found for *Luffa acutangula* infested with *Tetranychus ludeni* (Chatterjee and Gupta, 1997). Ghoshal, Gupta and Mukherjee

(2006) reported depletion of nitrate and nitrite as 25.73 and 19.35% respectively in case of jute due to the infestation of mite *Polyphagotarsonemus latus* (Banks).

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