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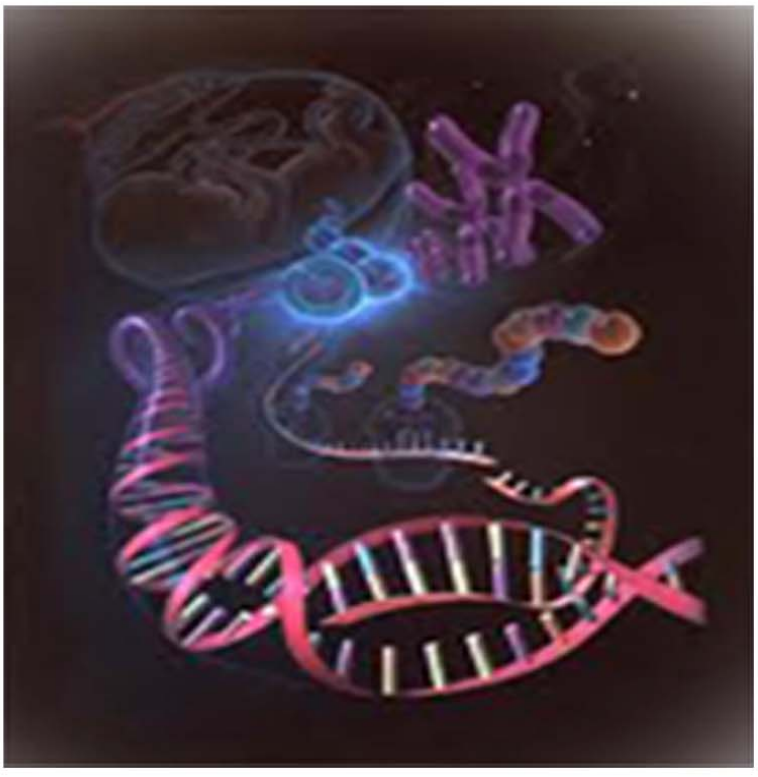

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Research Paper

POPULATION DYNAMICS AND FEEDING POTENTIALITY OF *TENUIPALPUS PERNICIS* (CHAUDHRI, AKBAR AND RASOOL) ON GUAVA (*PSIDIUM GUAJAVA*)

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This paper shows that *Tenuipalpus pernicis* is a dominant mite species on guava plants. A marked variation of population was observed throughout study period (from November, 2009 to October, 2011 (two consecutive years). It was found that The peak population was observed during June, in both the years, (27.50 ± 0.16 mites / 6.25 cm2, mean ± SD is calculated) when mean temperature, Relative humidity and rainfall were 30.01 ± 1.40^{0}C, 82.95 ± 2.45% and 0.35 ± 0.22 mm (mean ± SD) respectively. The population declined thereafter reaching the lowest in November in both the years (0.02 ± 0.07 mites / 6.25 cm2) when the mean temperature, relative humidity and rainfall were 26.31 ± 2.50^{0}C, 76.56 ± 4.72 %, and 0.81 ± 0.78 mm respectively. By following this population dynamics, cultivators can easily determine the proper time for mite control. It was also found that a significant depletion of important organic mineral and inorganic compounds occurred due to the infestation of this mite in the guava leaves. It was found that amount of chlorophyll, total protein, total carbohydrate, Mg, Zn, Cu , nitrate and nitrite were reduced by 2.79%,5.56%, 4.19%, 8.62%, 18.20%, 4.90%, 8.55%,16.78%, 10.35% respectively. It was also found that the amount of phenol increased slightly by 4.09% due to the infestation of this mite.

Keywords: Population dynamics, Guava plants, Mite, Infestation, Biochemical changes

INTRODUCTION

Guava is an economically important fruit of our country having enormous medicinal values. Among other serious pests, mites also cause considerable yield loss of this crop. It was known that 20-25% yield loss occurred in case of paddy due to *Oligonychus oryzae*; 20-30% in sugar cane due to *Oligonychus indicus*; 13-30% in brinjal, 23-25 % on lady's finger due to spider mites (Gupta, 2003). Since very little or no information was available about the population dynamics and feeding potentiality of *Tenuipalpus pernicis* on guava leaves, it was thought desirable to conduct a study regarding those matters. By following the population dynamics of this mite cultivators can

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easily adopt the proper time of control for this mite to protect their yield.

MATERIALS AND METHODS

In the present study, ten guava plants of almost the same age were selected for sampling and all were tagged. Ten leaves, one from each plant, 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 20x hand lens. Sampling was repeated at a four-week interval. The data on temperature, relative humidity and rainfall were collected for the entire study period by a digital device (Digital thermo-hygrometer of 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 the analysis of feeding potentiality, uninfested and infested leaves were collected from among the selected plants. Uninfested leaves were considered as control. Prior to collection, the plant was sprayed with very mild dose of Malathion to avoid mite and other insect infestation.

20 grams of both uninfested and infested leaves were dried for about 3 hours at 45^0C. Quantitative estimation of minerals (Mg, Cu, Zn), was done by dissolving the oven-dried samples in concentrated nitric acid (about 70%, Wt. per ml at 20^0c is about 1.4gm). Analysis was done by using atomic absorption spectrophotometer (Perkin-Elmer Spectrophotometer, Model-460). Standard flame method for metal detection was followed in this case.

The estimation of chlorophyll quantity in leaves was done following Arnon (1949). Total carbohydrates were estimated using anthrone reagent following the method of Hedge and Hofreiter (1962). The estimation of total protein was done following Lowry & Folin (1951). Phenol was estimated following the method of Spies (1955). Nitrate and nitrite was estimated by the method of Strickland and Parsons (1965). All the experiments were repeated five times. The results obtained during this study were subjected to statistical analysis.

RESULTS

For the study of population dynamics of *Tenuipalpus pernicis*, the data were collected in two consecutive years (Nov, 2009 to Oct, 2010 & Nov, 2010 to Oct, 2011) and the averages are given in the table-1. In this case, the average population of this mite was 10.50 ± 0.52 mites per 6.25 cm^2 to 20.32 ± 0.36 mites / 6.25 cm^2 during December to February in both the years. The peak population was observed during June, in both the years, (27.50 ± 0.16 mites / 6.25 cm^2, mean ± SD is calculated) when mean temperature, Relative humidity and rainfall were 30.01 ± 1.40^{0}C, 82.95 ± 2.45% and 0.35 ± 0.22 mm (mean ± SD) respectively.

The population declined thereafter reaching the lowest in November in both the years (0.02 ± 0.07 mites/6.25 cm^2) when the mean temperature, relative humidity and rainfall were 26.31 ± 2.50 ^{0}C, 76.56 ± 4.72 %, and 0.81 ± 0.78 mm respectively (Table 1). Increased precipitation in July to September, in both the years, probably acted adversely on the mite population. From November (in both the years) onwards the population again started to increase. The correlation coefficient (Table 2) of the mite density with temperature was positive but not significant, with Relative humidity, it was found to be negative and nonsignificant. Correlation with rainfall was found to be significant but it was negative.

Table 1: Population dynamics of *Tetranychus ludeni* on Guava plant per 6.25 cm² leaf area recorded form Nov. 2009 to Oct. 2011. Data are mean ± SD

Months	Average of Mite population (in two years)	Average Temp (°C)	Average Humidity (%)	Average Rainfall (mm)
Nov	0.02 ± 0.07	26.31 ± 2.50	76.56 ± 4.72	0.81 ± 0.78
Dec	10.50 ± 0.52	22.90 ± 1.56	68.71 ± 5.85	0.2 ± 0.0
Jan	12.32 ± 0.36	20.42 ± 1.73	70.34 ± 4.69	0.24 ± 0.67
Feb	20.30 ± 0.84	21.73 ± 1.61	68.08 ± 4.82	0.1 ± 0.0
Mar	21.4 ± 0.41	28.79 ± 1.39	65.37 ± 3.01	0.02 ± 0.01
Apr	20.93 ± 0.84	29.66 ± 2.01	68.92 ± 3.70	1.07 ± 0.76
May	25.40 ± 0.48	32.07 ± 1.00	73.75 ± 3.76	0.95 ± 0.36
Jun	27.50 ± 0.16	30.01 ± 1.40	82.95 ± 2.45	0.35 ± 0.22
July	9.73 ± 0.87	30.68 ± 2.92	79.88 ± 5.46	16.08 ± 3.98
Aug	4.33 ± 0.81	29.23 ± 2.51	84.78 ± 3.09	17.91 ± 7.53
Sep	1.83 ± 0.22	28.55 ± 2.72	84.76 ± 3.39	12.64 ± 5.32
Oct	0.09 ± 0.56	26.29 ± 2.07	75.52 ± 6.28	4.77 ± 2.83

Table 2: Correlation Between the Mite Density and Three Environmental Variables

	Temperature	Relative Humidity	Rainfall
mite population	0.301	–0.347	–0.613 *

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

A significant depletion in percentage content of organic, inorganic compounds and minerals were recorded in case Guava leaves (Figure 1 and Table 3). In case of total Chlorophyll, the control showed 15.36 ± 0.74 mg/gm while the infested leaves shows 14.93 ± 0.98 mg/gm of chlorophyll. Hence the percentage decreased was 2.79.

In case of total protein, the uninfested healthy leaves showed 30.72 ± 0.88 µg/gm while the infested leaves showed 29.01 ± 0.39 µg/gm of sample. Therefore, the percentage of depletion in case of total protein was recorded as 5.56. In case of total carbohydrate content, the uninfested healthy leaves showed 49.63 ± 0.63 mg/100mg

Figure 1: Biochemical Changes Due to Infestation of *Tenuipalpus pernicis* on Guava Plants

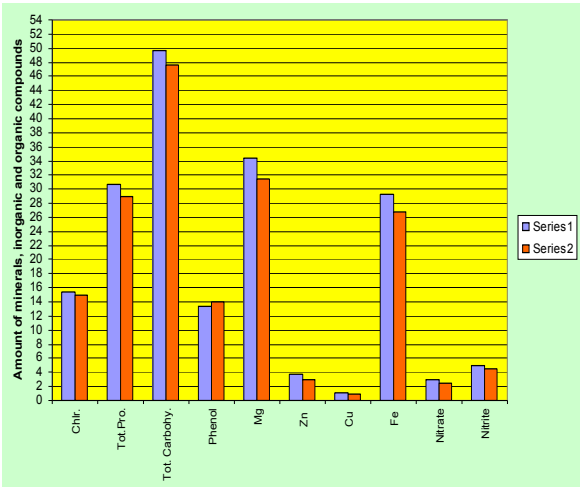

Table 3 : Increase or Decrease of minerals, inorganic and organic compounds in the leaves of Guava leaves due to mite feeding (10-20 mites per 4.0 sq. inch leaf area)

Name of Organic Components	Control(Amount ± SD) [n=5]	Infested (Amount ± SD) [n=5]	Percentage of decrease or increase (percentage ± SD) [n=5]
Chlorophyll	15.36 ± 0.74 mg/gm	14.93 ± 0.98 mg/gm	2.79 (d)
Total Protein	30.72 ± 0.88μg/gm	29.01 ± 0.39 μg/gm	5.56 (d)
Total Carbohydrate	49.63 ± 0.63 mg/100mg sample	47.55 ± 0.48 mg/100mg sample	4.19 (d)
Phenol	13.43 ± 0.04 μg/gm	13.98 ± 0.89 μg/gm	4.09 **(i)**
Mg	34.33 ± 0. 93 μg / ml	31.37 ± 0.12 μg / ml	8.62 (D)
Zn	3.68 ± 0.04 μg / ml	3.01 ± 0.23 μg / ml	18.20 (D)
Cu	1.02 ± 0.93 μg / ml	0.97± 0.28 μg / ml	4.90 (D)
Fe	29.33 ± 0.24 μg / ml	26.82 ± 0.53 μg / ml	8.55 (D)
Nitrate	2.92 ± 0.32 μg/ gm	2.43 ± 0.82 μg /gm	16.78 (D)
Nitrite	5.02 ± 0.49 μg / gm	4.50 ± 0.39 μg / gm	10.35 (D)

Note: (i) = Percentage increase, (d) = Percentage decrease, n = number of experiments

sample while infested leaves showed 47.55 ± 0.48 mg/100mg sample. Therefore, the percentage of decrease in case of total carbohydrate content in Guava leaves due to mite feeding was 4.79. In case of phenol, the uninfested healthy leaves showed 13.43 ± 0.04μg/gm while infested leaves showed the value of 13.98 ± 0.89 μg/gm. Therefore, the percentage of increase in case of phenol was 4.09.

In case of magnesium (Mg) the uninfested healthy leaves showed 33.34 ± 0.93 μg / ml while infested leaves showed the value of 31.37 ± 0.12 μg / ml. Therefore, the percentage of decrease in case of magnesium was 8.62.

In case of zinc (Zn), the uninfested healthy leaves showed 3.68 ± 0.04 μg / ml while infested leaves showed the value of 3.01 ± 0.23 μg / ml. Therefore, the percentage of decrease in case of zinc was 18.20. In case of copper (Cu), the uninfested healthy leaves showed 1.02 ± 0.93 μg / ml while infested leaves showed the value of 0.97 ± 0.28 μg / ml. Therefore, the percentage of decrease in case of copper was 4.90.

In case of iron, the uninfested healthy leaves showed 29.33 ± 0.24μg / ml while infested leaves showed the value of 26.82 ± 0.53 μg / ml. Therefore, the percentage of decrease in case of iron was 8.55.

In case of nitrate compounds, the uninfested healthy leaves showed 2.92 ± 0.32 μg/ gm while infested leaves showed the value of 2.43 ± 0.82 μg /gm. Therefore, the percentage of decrease in case of nitrate compounds was 16.78. In case of nitrite compounds, the uninfested healthy leaves showed 5.02 ± 0.49 μg / gm while infested leaves showed the value of 4.50 ± 0.39 μg / gm. Therefore, the percentage of decrease in case of nitrite compounds was 10.35.

DISCUSSION

From the present study it was found that population of *Tenuipalpus pernicis* was high during February to June (in both the years). Since very little information is known on

Seasonal fluctuation of mite population on medicinal plants either in India or elsewhere, it is not possible to compare the present results with those published earlier. 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 case of *Raoiella indica* Hirst on coconut, population was positively correlated with temperature and negatively correlated with RH and rainfall (Nageschandra and Channa Basavanna, 1984). In the present study the mite population is positively correlated with temperature but negatively correlated with RH and rainfall. However, Gupta *et al.,* (1976) reported negative correlation with Temperature, positive correlation with RH and rainfall in case of *Tetranychus telarius* on castor. Nageschandra & Channa Basavanna, 1984 reported peak population of *Raoiella indica* on coconut during March and April whereas in the present study it is found to be during February to June.

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.

Earlier workers reported that the decrease in chlorophyll level is due to mechanical damage of chloroplasts of leaves caused by mite feeding. According to Tomezynsk and Kropzynska (1985) the water stress induced by mite feeding may have an influence on chlorophyll metabolism of injured cells. Chatterjee and Gupta (1997) reported chlorophyll damage to the extent of 33.62% on *Luffa acutangula* due to infestation of *Tetranychus ludeni* Ghoshal, Gupta and Mukherjee (2005) reported chlorophyll loss as 13.45 ± 0.00 percent in case of jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks). Therefore, in view of the above reports, the chlorophyll loss as was seen in the present case was low. Chlorophyll loss due to mite feeding was also reported by many earlier workers.

In the present study, the increase in phenolic compounds was observed as 4.09%. Similar observation towards increase of phenolic compounds was also reported by Kielkiewiez (1981) and Ghoshal, Gupta and Mukherjee (2005).

As regards total protein, the reduction was seen to be 5.56 % which was indeed considerably low. Similar observation was recorded by Nangia *et al.* (1999) 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*.

Regarding total carbohydrate, the percentage decrease was 2.79. Usha *et. al.,*(1999) reported total reduction of total sugar, reducing sugar and non-reducing sugar level, in plants due to mite infestation.

In the present study, the percentage depletions among minerals like magnesium, zinc, copper and iron were 8.62, 18.20, 4.90 and 8.55 respectively. 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 as compared to observation made in the present case. 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 those obtained in the present study,

In case of nitrate and nitrite, the percentage reductions were 16.78 and 10.35 respectively as compared to 51.1% and 3.12% in case of *Luffa acutangula* by feeding of *Tetranychus ludeni* (Chatterjee and Gupta, 1997).

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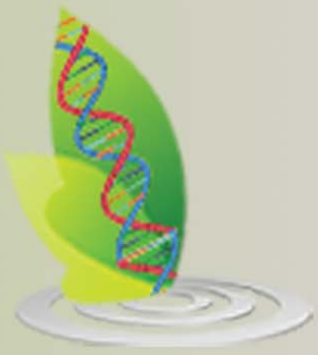

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