

Phytochemical effect due to feeding of *Oligonychus indicus* with the depletion of some important organic, minerals and inorganic compounds in the leaves of Coconut (*Cocos nusifera*)

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### Abstract

The present study showed that the significant depletion of important organic, minerals and inorganic compounds occurred due to mite infestation in the leaves of Coconut (*Cocos nusifera*). Among organic compounds, chlorophyll, total protein, phenol and total carbohydrate were selected for the study. Among minerals, Mg, Zn, Cu and Fe were selected and among inorganic materials nitrate and nitrite were selected for the study. It was found that amount of chlorophyll, total protein, total carbohydrate, Mg, Zn, Cu, Fe, nitrate and nitrite were reduced by 23.00, 19.32, 00.00, 29.81, 15.73, 18.03, 17.16, 6.75, 24.24, 51.66 percent respectively. It was found that mite feeding has no significant effect in the amount of phenol content.

### Introduction

Mites are a group of Arachnid Arthropod. They are the most important and significant pests of crops causing serious yield losses. Insect pests have received sufficient attention in India, mites have remained neglected probably due to their microscopic size, even though they have the potentiality of causing extensive damage to the agricultural and horticultural crops.

A good number of plant mites are injurious pests of agricultural and horticultural crops causing considerable yield loss to the farmers. 50-80% in mango due to *Aceria mangiferi*; 27-39% on chilli due to *Polyphagotarsoemus latus*; 10-15% in vegetables due to spider mites; 20-25% in 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 (1). Since very little or nothing is known as to what extent the feeding of different mite influences changes in the biochemical components of leaves of coconut, it was thought to undertake a preliminary study on this aspect.

### Methods

The estimation of chlorophyll was done following the method of Arnon (1949) (2). total carbohydrate was estimated using anthrone reagent following the method of Hedge *et al.* (1962) (3). Phenol was estimated following the method of Spies (1955) (4). Before analysis, fresh uninfected leaves were collected to serve as control and those were processed separately for analysis.

Quantitative estimation of minerals like Mg, Cu, Zn, Fe, will be made by digesting the oven-dried samples in concentrated HNO<sub>3</sub>. Before analysis, fresh uninfected healthy leaves were collected to serve as control and those were processed separately for analysis.

Heavily infested leaves as well as uninfested healthy leaves of Coconut were collected. Out of those leaves (both uninfested and infested), 20 grams each of uninfested leaves and heavily infested leaves are subjected to oven drying for about 3 hours at 105<sup>o</sup>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. The whole experiments were repeated five times. The results obtained during the study were subjected to statistical analysis for inference.

### Results and Discussion

As per Table- 1 & 2, a marked depletion in percentage content of organic, inorganic compounds and minerals were recorded in case Coconut. So far as the amount of chlorophyll is concern, the percentage decreased was 23.00.

**Table- 1: Increase or Decrease of organic compounds in the leaves of Coconut plant 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]
<b>In case of Coconut</b>			
Chlorophyll	10.00 ± 0.77 mg/gm	7.70 ± 0.60 mg/gm	23.00 (d)
Total Protein	56.15 ± 0.95µg/gm	45.30 ± 0.68µg/gm	19.32 (d)
Phenol	0.530 ± 0.56µg/gm	0.530 ± 0.09µg/gm	00.00 Same
Total Carbohydrate	32.10 ± 0.69 mg/100mg sample	22.53 ± 0.39 mg/100mg sample	29.81 (d)
(D)= Percentage decrease , n= Number of experiments.			

The percentage of depletion in case of total protein was recorded as 19.32. In case of phenol, the control and infested leaves showed no marked change. Therefore, mite infestation might cause negligible effect on phenol content in case of coconut leaves. The percentage of decrease in case of total carbohydrate content in coconut leaves due to mite feeding was found to be 29.81.

So far as the depletion of minerals is concern, marked depletion was observed in case of coconut due to mite infestation. The percentage depletions among minerals like magnesium, zinc, copper and iron were 15.73, 18.03, 17.16, 6.75 respectively. Among inorganic

compounds, the percentage decreases were quite high both in case of nitrate and nitrite compounds represented by 24.24, and 51.66 respectively.

**Table- 2: Decrease of minerals and inorganic components of Coconut leaves due to mite feeding. (10-20 mites per 4.0 sq. inch leaf area).**

Name of minerals and inorganic components	Control (Amount ± SD) [n=5]	Infested (Amount ± SD) [n=5]	Percentage of decrease / increase (Percentage ± SD) [n=5]
Mg (Magnesium)	40.35 ± 0.67 µg / ml	34.0 ± 0.93 µg / ml	15.73 (D)
Zn (Zinc)	2.55 ± 0.34 µg / ml	2.09 ± 0.83 µg / ml	18.03 (D)
Cu (Copper)	1.34 ± 0.32 µg / ml	1.11 ± 0.85 µg / ml	17.16 (D)
Fe (Iron)	42.50 ± 0.75 µg / ml	39.63 ± 0.06 µg / ml	6.75 (D)
Nitrate	4.33 ± 0.66 µg/ gm	3.28 ± 0.62 µg /gm	24.24 (D)
Nitrite	4.51 ± 0.79 µg / gm	2.18 ± 0.24 µg / gm	51.66 (D)

(D)= Percentage decrease , n= Number of experiments.

It was found that infestation 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 (5).

The decrease in chlorophyll level is due to mechanical damage of chloroplasts of leaves caused by mite feeding or it may be due to decolouration of chloroplasts (6). Kolodziej *et al.*, (1979) indicated positive correlation between increases in mite density with decrease of chlorophyll (7). Chatterjee and Gupta (1997) reported chlorophyll damage to the extent of 33.62% on *Luffa acutangula* due to infestation of *Tetranychus ludeni* (8). Goyal and Sadana (1983) reported chlorophyll loss as 63.12% mg/m<sup>2</sup> on *Coleus* sp. infested by *Brevipalpus obvatus* (9). Therefore, in view of the above reports, the chlorophyll loss as was seen in the present case was low. 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) (10).

As regards total protein, the reduction was seen to be 19.32 % which was not so high. 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* (11). Reduction of protein due to feeding by different species of mites. Ghoshal, Gupta and Mukherjee (2005) reported depletion of total protein as 42.00

percent in case of jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks) (10).

Regarding total carbohydrate, the percentage decrease was alarmingly high i.e. 29.81. Similar observation was made by Usha *et. al.*, (1999) reported total reduction of total sugar, reducing sugar and non-reducing sugar level, in plants due to mite infestation (12). Ghoshal, Gupta and Mukherjee (2005) reported depletion of total carbohydrate as 56.22 percent in case of jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks) (10).

The present study also deals with the depletion of mineral and inorganic components of coconut leaves infested by several mites. 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) (8), which were much higher as compared to observation made in the present case. Golek (1975), Sadana and Goyal (1984) reported changes in calcium, potassium and magnesium contents of leaves and the results obtained in the present study are in conformity with those (13, 9). 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 (14), Ghoshal, Gupta and Mukherjee (2005) reported depletion of magnesium, zinc, copper and iron as 8.33 percent, 22.22 percent, 13.88 percent and 8.66 percent, respectively in case of jute (*Corchorus capsularis* Linn.) infested by *Polyphagotarsonemus latus* (Banks) (10).

As regards nitrate and nitrite, the percentage reductions were 24.24 % and 51.66 % respectively as compared to 51.1% and 3.12% in case of *Luffa acutangula* by feeding of *Tetranychus ludeni* (8). Ghoshal, Gupta and Mukherjee (2005) reported depletion of nitrate and nitrite as 25.73 percent and 19.35 percent respectively in case of jute (*Corchorus capsularis* Linn.) due to the infestation of mite *Polyphagotarsonemus latus* (Banks) (10).

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