Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7 (2): 19-23

Received: 11-01-2019
Accepted: 15-02-2019

Indhusri Chavan
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Pradeep S
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Narayanaswamy H
Department of plant pathology, College of Agriculture, Shivamogga, Karnataka, India

Manjunatha M
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Sridhara S
Department of Agronomy, College of Agriculture, Shivamogga, Karnataka, India

Kalleshwara swamy CM
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Correspondence
Indhusri Chavan
Department of Agricultural Entomology, College of Agriculture, Shivamogga, Karnataka, India

Biochemical basis of resistance in arecanut genotypes against *Raoiella indica* Hirst

Indhusri Chavan, Pradeep S, Narayanaswamy H, Manjunatha M, Sridhara S and Kalleshwara Swamy CM

Abstract
The experiment was carried out to assess the biochemical basis of resistance in response to the infestation by arecanut mite *Raoiella indica.* The impact of plant biochemical characters on the *R. indica* infestation, the various biochemical content of different arecanut genotypes were revealed that Thirthahalli local which scored highest mite population, significantly recorded higher nitrogen (5.97 %) crude protein (14.87 %) and moisture (56.71 %) content and lower levels of Phosphorous (0.16 %), potassium (0.87 %), crude fiber (26.16 %). Correlation studies revealed that there was positive and highly significant correlation was observed between *R. indica* population and nitrogen (r = 0.985*), crude protein (r = 0.979*) and moisture content (r = 0.986*) of the leaf. While potassium (r = -0.973*), crude fiber (r = -0.961*), Phosphorous (r = - 0.973*) and phenol (r = - 0.956*) showed significant negative correlation. From the above results, it was proven that none of the genotypes screened were found to be completely resistant to mites. However, Vittal dwarf (11.80/cm^2 of leaflet) and Sumangala (13.12/cm^2 of leaflet) recorded significantly less number of mites, whereas Thirthahalli local (28.80/cm^2 of leaflet) recorded the highest mite per cm^{2}of leaflet.

Keywords: biochemical analysis, arecanut mite, genotypes, leaflet

Introduction
Arecanut (*Areca catechu* L.), is highly profitable commercial plantation crop in India. Areca is used for preparing ayurvedic and Chinese medicines which are believed to cure unusual kind of diseases. Areca nut is known colloquially known as supari in hindi and other languages in India, puwak in Sri Lanka, gua in Sylheti (Bangladesh) and mak in Thailand. It forms a major source of income along with other agricultural crops. However, the farmers encountered considerable crop losses intermittently, owing to lack of knowledge on the bionomics, relative distribution pattern and ecological aspects of the pests. Arecanut is attacked by an array of insect and non-insect pests. The pests infest all parts of the palm *viz.*, stem, leaves, inflorescence, root and nuts. As many as 102 insect and non-insect pests have been reported to be associated with arecanut palm [1] among which few causes considerable economic loss to the crop. Of these, mite *Raoiella indica* is the serious pest, mainly in young areca plantations and active infestation of leaves occurs after the onset of hot weather [2].

Raoiella indica feeds on the underside of palm fronds of various hosts in the orders Arecales and Zingiberales. The mite attained economic significance when it was first reported as an invasive species in the Caribbeans in 2004 [3]. It was reported as a serious pest of economically important fruit-producing trees like the coconut, *Cocos nucifera* and banana, *Musa* spp[4 & 5] and it formed the first mite species in which feeding was observed through the stomata of its host plants [6]. Through this specialized feeding habit, *R. indica* interfere with the photosynthesis and respiration processes of its host plants. Mite infested palms displayed stunted growth and withering of leaves [7]. In the present investigation the biochemical constituents of arecanut genotypes were studied which may help in better understanding of biochemical defense against mite pests.

Material and Methods
An experiment was conducted during the summer season of 2017 and 2018 at Areca Research Center (ARC), ZAHRS, Shivamogga with eight genotypes *viz.*, Mangala, Sreemangala, Sumangala, Mohithnagar, Thirthahali local, Tarikere local, Bheemsamudra and Vittal dwarf. The two year old areca seedlings were planted in plastic pots containing one part of FYM: two

parts of sand: three parts of red soil mixture. Two seedlings of each genotype are considered as treatment and replicated thrice. The experiment was laid out in a Randomized Complete Block design (RCBD). Observation was recorded by selecting five leaflets from each seedling representing top, middle and bottom fronds at fortnightly interval.

Extraction of plant tissues

Five gram of fresh tender areca leaf was weighed and cut into small pieces, grounded thoroughly in a mortar with 20 ml of 80 per cent alcohol. Later, it was filtered through muslin cloth twice. Then, refiltered through Whatman No 41 filter paper later, extract was stored in a refrigerator at 4°C and used for further analysis. Heavy metals, salts and dark pigments from the extract were precipitated by disodium hydrogen phosphate. Two ml of saturated lead acetate solution was added drop by drop to 25 ml of the coloured alcoholic extract with three ml of saturated solution of disodium hydrogen phosphate till the precipitation was completed. The above solutions were mixed thoroughly and kept overnight. Next day, it was filtered through Whatman No 41 filter paper and volume made up to 25 ml with 80 per cent alcohol and stored in a refrigerator at 4°C for further analysis.

Estimation of biomolecules were followed by standard procedure *viz.*, nitrogen (Micro-Kjeldahl method), phosphorous (Vanadomolybdate method), Potassium (Flame photometric method), Fibre (Weendes method), Phenols (Folin - Ciocalteu's reagent method) and Soluble protein (Lowry method). The amount of biomolecules present in areca leaf sample was calculated from a standard formula given by respective methods.

Results and Discussion

The impact of plant biochemical constituents of different arecanut genotypes against *R. indica* was studied and presented hereunder.

During 2017

The mean population of mites varied from 12.65 to 27.36 on different arecanut genotypes. During January first fortnight significantly lowest mite counts per cm^2 of leaflet were recorded in Vittal dwarf (3.54/cm^2 leaflet), Sumangala (3.85/cm^2 leaflet) and Bheemsamudra (4.32/cm^2 leaflet) and were found to be on par with each other (Table 1). Whereas, Thirthahalli local (11.23/cm^2 of leaflet) and Mangala (9.80/cm^2 of leaflet) scored significantly highest number of mites. In the second fortnight of January, the genotypes *viz.*, Vittal dwarf, Sumangala and Bheemasamudra retained their superiority and recorded significantly lowest mite population of 4.20, 4.42 and 5.43 mites per cm^2 of leaflet respectively. A more or less similar trend was noticed in subsequent fortnightly interval period and on second fortnight April where mite buildup was maximum, it was observed that both Vittal dwarf (23.41/cm^2 of leaflet) Sumangala (24.32/cm^2 of leaflet) recorded significantly less number mites/ cm^2 of leaflet compare to other genotypes. Highest number of mite per cm^2 of leaflet was recorded in Thirthahalli local (41.43/cm^2 leaflet) and Mangala (36.20/cm^2 leaflet) were found to be on par with each other.

Among different arecanut genotypes screened Thirthahalli local recorded significantly higher per cent of nitrogen (5.25%), crude protein (14.26%) and moisture content (56.21%), followed by Mangala (5.03% nitrogen, 3.99 % crude protein and 55.62% moisture content). While lowest per cent of nitrogen (2.16%), crude protein (5.62%) and moisture (42.19%) were recorded in Vittal dwarf. The other bio chemical constituents *viz.*, phosphorous, potassium, crude fiber and phenol content were significantly highest in case Vittal dwarf (0.49, 2.69, 34.61 and 5.62 per cent respectively) (Table 4).

Correlation between biochemical constituents and mite population revealed that, there was highly significant positive correlation was found between nitrogen (r = 0.968*), crude protein (r = 0.961) and moisture content (r = 0.979*) with mite incidence (Table 3). Whereas, phosphorus (r = -0.967*) potassium (r = -0.988*) crude fiber (r = -0.963*) and phenol (r = -0.981*) were significant negatively correlated (Table 4).

During 2018

During January first fortnight mite population on different arecanut genotypes ranged from 3.34 to 10.83/cm^2 of leaflet. Significantly lowest mite population was observed in Vittal dwarf (3.34/cm^2 of leaflet), Sumangala (3.63/cm^2 of leaflet), Sreemangala (5.42/cm^2 of leaflet). Whereas, Thirthahalli local (14.23/cm^2 of leaflet) and Mangala (10.83/cm^2 of leaflet) recorded significantly highest number of mites per cm^2 of leaflet when compared to other genotypes (Table 2). A similar trend was continued in the subsequent fortnight interval period. During second fortnight of April, the *R. indica* incidence was maximum. Among the genotypes, Vittal dwarf (22.03/cm^2 of leaflet), Sumangala (25.77/cm^2 of leaflet) and Bheemasamudra (28.05/cm^2 of leaflet) maintained superiority over other genotypes by recording less number of mites per cm^2 of leaflet. The mean observation showed that Vittal dwarf found to be superior recording least mite counts of 11.80 per cm^2 of leaflet, followed Sumangala 13.12 per cm^2 leaflet.

Among eight different genotypes screened, Vittal dwarf has recorded significantly higher per cent of phosphorous (0.44%), potassium (2.47%), crude fiber (37.80%) and phenol (6.07%). Similarly, it also has recorded lowest per cent of nitrogen (2.93%), crude protein (9.94%) and moisture content (44.52%). The trend was vice-versa in Thirthahalli local which was recorded significantly highest number of mite counts per cm^2 of leaflet (Table 5).

Correlation studies of biochemical constituents with mite population revealed that, the mite population was significantly positive association with nitrogen (r = 0.986*), crude protein (r = 0.965) moisture content (r = 0.981*). Wherein, phosphorous (r = -0.961*) potassium (r = -0.983*), crude fiber (r = -0.956) and phenol (r = -0.935*) exhibited significant negative correlation (Table 5).

Pooled analysis

The pooled data showed that none of the genotypes was found to be resistant to mites. However, the mean number of mites counts per cm^2 of leaflet were comparatively less in case of Vittal dwarf (12.22/cm^2 of leaflet) followed by Sumangala (13.15/cm^2 of leaflet). The highest number of mites were recorded in Thirthahalli local (28.61/cm^2 of leaflet) followed by Mangala (24.16/cm^2 leaflet) and Mohith nagar (22.26/cm^2 of leaflet) (Table 3).

Biochemical results showed that among the different screened genotypes, Vittal dwarf has recorded significantly lower per cent of nitrogen (2.55%), crude protein (9.00%) and moisture content (43.36 %). While highest per cent of nitrogen (5.97%), crude protein (14.87%) and moisture (56.71%) were recorded in Thirthahalli local (Table 6).

Correlation studies revealed that there was positive and significant correlation was observed between *R. indica* population and nitrogen (r = 0.985*), crude protein (r = 0.979*) and moisture content (r = 0.986*) of the leaf. While, potassium (r = -0.973*), crude fiber (r = -0.961*), phosphorous (r = -0.973*) and phenol (r = -0.956*) showed significant negative correlation (Table 6).

From the above results, it was proven that none of the genotypes screened were found to be completely resistant to mites. However, Vittal dwarf (11.80/cm^2 of leaflet) and Sumangala (13.12/cm^2 of leaflet) recorded significantly less number of mites, whereas Thirthahalli local (28.80/cm^2 of leaflet) recorded highest mite per cm^{2}of leaflet. These results are in collaboration with [8] who reported that among different genotypes screened, Sumangala recorded the lowest infestation (78.2 %) and Thirthahalli recorded highest infestation (94.7 %). Similar results were observed [9] that, Thirthahalli local recorded highest number of mites (1900.00/plant) followed by Mangala (1296.67/plant), Kadur local (916.67/ plant) and Sagara local (876.67 mites/plant) whereas, Mohithnagar (558.33 mites/ plant) followed by Sreemangala (400.00 mites/plant) recorded comparatively less number of mites.

Biochemical analysis results revealed that highly susceptible variety Thirthahalli local recorded significantly high percentage of nitrogen (5.97 %), crude protein (14.87 %) and moisture content (56.71 %) [10]. The protein is an important nutrient for arthropods development. Protein is also an important nutrient for insect reproduction, particularly in contributing to higher rate of offspring production [11]. Since no studies have been made earlier by others on the effect of biochemical characters on mite incidence on arecanut genotypes, but few reports are available on other hosts. According to [12] who reported that anatomical features and chemical composition of Musa cultivars seem to influence *R. indica* feeding and reproduction. Correlation studies showed that there was a highly significant positive correlation observed nitrogen (r = 0.985*), crude protein (r = 0.979*) and moisture content (r = 0.986*) these results were in line with [13] who investigated correlations of mite populations in association with crude protein, nitrogen, moisture, calcium and phosphorus content of coconut leaflets. They found that coconut genotypes with higher levels of nitrogen and crude protein had higher population densities of the mite; no significant effect of calcium or phosphorus content was found in association with mite incidence. They reported that genotypes of coconut with higher moisture content in leaflets were more susceptible to herbivory by *R. indica.*

Table 1: Screening of different arecanut genotypes against *Raoiella indica* during 2017

Genotypes	Mean number of mites /cm^2 of leaflet								Mean
	Jan I FN	**Jan II FN**	**Feb I FN**	**Feb II FN**	**Mar I FN**	**Mar II FN**	**Apr I FN**	**Apr II FN**	
Mangala	9.80 (3.20)$^{a\#}$	12.40 (3.58)^{b}	16.09 (4.03)^{ab}	24.43 (4.98)^{b}	27.89 (5.32)^{b}	32.40 (5.73)^{ab}	34.45 (5.90)^{b}	36.20 (6.05)^{ab}	24.20
Sree mangala	6.20 (2.58)^{b}	7.40 (2.80)^{cd}	12.34 (3.58)^{c}	20.43 (4.57)^{cd}	24.41 (4.98)^{cd}	27.32 (5.26)^{c}	30.40 (5.53)^{cd}	33.56 (5.83)^{bcd}	20.25
Sumangala	3.85 (2.08)^{c}	4.42 (2.21)^{f}	7.46 (2.81)^{d}	10.32 (3.28)^{e}	14.42 (3.86)^{f}	18.33 (4.33)^{d}	22.45 (4.78)^{e}	24.32 (4.97)^{e}	13.19
Mohith nagar	6.53 (2.64)^{b}	8.94 (3.06)^{c}	14.56 (3.87)^{b}	23.40 (4.88)^{b}	26.54 (5.19)^{bc}	29.06 (5.43)^{bc}	33.15 (5.79)^{bc}	35.42 (5.98)^{bc}	22.20
Thirthahalli local	11.23 (3.42)^{a}	15.24 (3.96)^{a}	18.23 (4.32)^{a}	28.30 (5.36)^{a}	31.90 (5.69)^{a}	34.07 (5.93)^{a}	38.50 (6.24)^{a}	41.43 (6.47)^{a}	27.36
Tarikere local	5.98 (2.54)^{b}	6.72 (2.68)^{de}	12.29 (3.56)^{c}	18.90 (4.40)^{d}	22.54 (4.79)^{de}	26.53 (5.19)^{c}	30.32 (5.55)^{cd}	30.56 (5.57)^{cd}	19.23
Bheemsamudra	4.32 (2.19)^{c}	5.43 (2.43)^{ef}	10.89 (3.37)^{c}	17.98 (4.29)^{d}	21.34 (4.67)^{e}	25.82 (5.12)^{c}	27.57 (5.29)^{d}	29.45 (5.47)^{d}	17.85
Vittal dwarf (VTLAH- 1)	3.54 (2.00)^{c}	4.20 (2.16)^{f}	6.82 (2.70)^{d}	9.89 (3.22)^{e}	14.20 (3.83)^{f}	17.64 (4.25)^{d}	21.56 (4.69)^{e}	23.41 (4.88)^{e}	12.65
S. Em ±	0.08	0.04	0.09	0.11	0.09	0.12	0.10	0.14	
CD@ 5%	0.25	0.13	0.29	0.16	0.29	0.38	0.32	0.45	
CV (%)	6.63	7.24	6.80	6.57	6.87	7.21	6.37	6.83	

FN: Fortnight; # Figures in paranthesis are square root transformed values; In each column, means followed by the same alphabet are not statistically different from each other;

Table 2: Screening of different arecanut genotypes against *Raoiella indica* during 2018

Genotypes	Mean number of mites / cm^2 of leaflet								Mean
	Jan I FN	**Jan II FN**	**Feb I FN**	**Feb II FN**	**Mar I FN**	**Mar II FN**	**Apr I FN**	**Apr II FN**	
Mangala	10.83 (3.35)$^{ab\#}$	11.59 (3.47)^{b}	14.56 (3.87)^{b}	22.99 (4.84)^{ab}	28.40 (5.37)^{b}	30.45 (5.55)^{ab}	35.60 (6.00)^{a}	38.52 (6.21)^{ab}	24.11
Sree mangala	5.42 (2.43)^{cd}	7.14 (2.76)^{cd}	11.55 (3.47)^{b}	21.43 (4.68)^{ab}	25.41 (5.09)^{bc}	26.20 (5.16)^{b}	29.61 (5.45)^{ab}	34.40 (5.90)^{abc}	20.14
Sumangala	3.63 (2.02)^{d}	4.02 (2.09)^{e}	7.13 (2.75)^{c}	12.04 (3.51)^{c}	14.02 (3.79)^{d}	18.14 (4.28)^{c}	20.22 (4.53)^{c}	25.77 (5.12)^{cd}	13.12
Mohith nagar	7.53 (2.83)^{bc}	9.94 (3.23)^{bc}	12.06 (3.54)^{b}	22.40 (4.77)^{ab}	27.44 (5.28)^{b}	28.16 (5.35)^{b}	34.65 (5.92)^{a}	36.42 (6.07)^{abc}	22.32
Thirthahalli local	14.23 (3.84)^{a}	17.34 (4.22)^{a}	20.23 (4.55)^{a}	27.50 (5.29)^{a}	36.90 (6.11)^{a}	38.46 (6.24)^{a}	39.23 (6.29)^{a}	44.42 (6.69)^{a}	28.80
Tarikere local	4.32 (2.12)^{d}	6.45 (2.63)^{d}	11.23 (3.42)^{b}	19.34 (4.45)^{b}	24.54 (5.00)^{bc}	27.43 (5.28)^{b}	29.67 (5.47)^{a}	32.43 (5.73)^{abc}	19.43
Bheemsamudra	4.82 (2.30)^{cd}	5.89 (2.51)^{de}	11.04 (3.39)^{b}	19.98 (4.51)^{ab}	23.34 (4.88)^{c}	26.02 (5.15)^{b}	28.56 (5.39)^{a}	28.05 (5.33)^{bcd}	18.46
Vittal dwarf (VTLAH- 1)	3.34 (1.95)^{d}	4.87 (2.29)^{de}	5.42 (2.32)^{c}	7.42 (2.71)^{d}	12.38 (3.54)^{d}	18.64 (4.34)^{c}	20.36 (4.56)^{bc}	22.03 (4.66)^{d}	11.80
S. Em ±	0.20	0.18	0.20	0.26	0.23	0.24	0.30	0.34	
CD @5%	0.61	0.56	0.60	0.79	0.69	0.76	0.92	1.03	
CV (%)	13.46	11.12	10.04	10.32	8.01	8.02	9.58	10.30	

FN: Fortnight; # Figures in paranthesis are square root transformed values; In each column, means followed by the same alphabet are not statistically different from each other;

Table 3: Screening of different arecanut genotypes against *Raoiella indica* (Pooled)**

Genotypes	Mean number of mites / cm^2 of leaflet								Mean
	Jan I FN	**Jan II FN**	**Feb I FN**	**Feb II FN**	**Mar I FN**	**Mar II FN**	**Apr I FN**	**Apr II FN**	
Mangala	10.32 (3.27)^{a}	12.00 (3.53)^{b}	15.32 (3.97)^{b}	23.71 (4.91)^{b}	28.15 (5.35)^{b}	31.43 (5.64)^{ab}	35.03 (5.95)^{a}	37.36 (6.14)^{ab}	24.16
Sree mangala	5.81 (2.51)^{bc}	7.27 (2.78)^{d}	11.94 (3.52)^{cd}	20.93 (4.62)^{bc}	24.91 (5.03)^{cd}	26.76 (5.21)^{bc}	30.01 (5.50)^{bc}	33.98 (5.87)^{bc}	20.20
Sumangala	3.74 (2.05)^{de}	4.22 (2.15)^{e}	7.30 (2.79)^{e}	11.18 (3.41)^{d}	14.22 (3.83)^{f}	18.23 (4.31)^{d}	21.34 (4.66)^{d}	25.04 (5.04)^{de}	13.15
Mohith nagar	7.03 (2.74)^{b}	9.44 (3.15)^{c}	13.31 (3.71)^{bc}	22.90 (4.83)^{b}	26.99 (5.24)^{bc}	28.61 (5.39)^{bc}	33.90 (5.86)^{ab}	35.92 (6.02)^{b}	22.26
Thirthahalli local	12.73 (3.63)^{a}	16.29 (4.09)^{a}	19.23 (4.44)^{a}	27.90 (5.32)^{a}	34.40 (5.90)^{a}	36.58 (6.08)^{a}	38.86 (6.27)^{a}	42.92 (6.58)^{a}	28.61

Tarikere local	5.15 (2.35)cd	6.59 (2.66)d	11.76 (3.50)cd	19.12 (4.42)c	23.54 (4.90)de	26.98 (5.23)bc	30.00 (5.52)bc	31.50 (5.65)bc	19.33
Bheemsamudra	4.57 (2.24)cde	5.66 (2.47)de	10.97 (3.38)d	18.98 (4.41)c	22.34 (4.77)e	25.92 (5.13)c	28.06 (5.34)c	28.75 (5.40)cd	18.15
Vittal dwarf (VTLAH- 1)	3.44 (1.98)e	4.54 (2.23)e	6.12 (2.54)e	8.66 (3.00)e	13.24 (3.70)f	18.14 (4.30)d	20.96 (4.63)d	22.72 (4.79)e	12.22
S. Em ±	0.17	0.16	0.10	0.18	0.07	0.15	0.14	0.17	
CD@ 5%	0.35	0.32	0.31	0.36	0.22	0.48	0.42	0.54	
CV (%)	7.80	6.84	7.09	6.43	7.82	6.35	6.73	7.22	

FN: Fortnight; # Figures in paranthesis are square root transformed values; In each column, means followed by the same alphabet are not statistically different from each other, ** pooled data of 2017 and 2018

Table 4: Relationship between biochemical characters and incidence of *Raoiella indica* during April 2017

Genotypes	Number of mites/cm^2 leaflet	Biochemical constituents (%)						
		Nitrogen#	Phosphorus	Potassium	Crude fiber	Phenol	Crude protein	Moisture
Mangala	38.52	5.03	0.24	1.22	26.28	1.04	13.99	55.62
Sreemangala	34.40	4.22	0.32	1.60	30.16	2.57	11.64	51.04
Sumangala	25.77	2.68	0.45	2.35	33.15	4.50	9.10	45.68
Mohithnagar	36.42	4.98	0.27	1.43	27.14	2.02	13.52	53.16
Thirthahalli local	44.42	5.25	0.18	0.90	25.11	0.99	14.26	56.21
Tarikere local	32.43	4.09	0.40	1.92	31.53	3.16	10.62	49.22
Bheemsamudra	28.05	3.20	0.37	2.10	32.44	4.11	9.82	47.14
Vittal dwarf (VTLAH- 1)	22.03	2.16	0.49	2.69	34.61	5.62	8.06	42.19
S. Ed ±		1.16	0.11	0.60	3.49	1.66	0.60	4.92
Correlation coefficient (r)		0.968*	-0.967*	-0.998*	-0.963*	-0.981*	-0.998*	0.979*

** Significance at p= 0.01 level; * Significance at p=0.05 level

Table 5: Relationship between biochemical characters and incidence of *Raoiella indica* during April 2018

Genotypes	Number of mites/cm^2 leaflet	Biochemical constituents (%)						
		Nitrogen#	Phosphorus	Potassium	Crude fiber	Phenol	Crude protein	Moisture
Mangala	24.20	6.10	0.18	1.16	28.43	1.58	14.21	56.14
Sreemangala	20.25	4.85	0.28	1.52	33.81	2.73	12.85	52.29
Sumangala	13.19	2.92	0.41	2.24	37.20	4.81	10.10	45.90
Mohithnagar	22.20	5.14	0.21	1.31	29.10	2.30	13.60	54.20
Thirthahalli local	27.36	6.69	0.14	0.84	27.20	1.22	15.48	57.21
Tarikere local	19.23	4.83	0.36	1.85	34.22	3.48	11.31	50.10
Bheemsamudra	17.85	3.78	0.32	1.99	35.61	4.60	10.57	48.33
Vittal dwarf (VTLAH- 1)	12.65	2.93	0.44	2.47	37.80	6.07	9.94	44.52
S. Ed ±		1.38	0.11	0.56	4.13	1.70	2.07	4.67
Correlation coefficient (r)		0.986*	-0.961*	-0.986*	-0.956*	-0.935*	0.965*	0.981*

** Significance at p= 0.01 level; * Significance at p=0.05 level

Table 6: Relationship between biochemical characters and incidence of *Raoiella indica* (Pooled data of two years)

Genotypes	Number of mites/cm^2 leaflet	Biochemical constituents (%)						
		Nitrogen#	Phosphorus	Potassium	Crude fiber	Phenol	Crude protein	Moisture
Mangala	31.36	5.57	0.21	1.19	27.36	1.30	14.10	55.88
Sreemangala	27.33	4.54	0.30	1.56	31.99	2.65	12.25	51.67
Sumangala	19.48	2.80	0.43	2.30	35.18	4.65	9.60	45.79
Mohithnagar	29.31	5.06	0.24	1.37	28.12	2.16	13.56	53.68
Thirthahalli local	35.89	5.97	0.16	0.87	26.16	1.19	14.87	56.71
Tarikere local	25.83	4.46	0.38	1.89	32.88	3.29	10.97	49.66
Bheemsamudra	22.95	3.49	0.35	2.05	34.03	4.32	10.20	47.74
Vittal dwarf (VTLAH- 1)	17.34	2.55	0.47	2.58	36.21	5.84	9.00	43.36
S. Ed ±		1.26	0.11	0.58	3.80	1.66	2.20	4.79
Correlation coefficient (r)		0.985*	-0.973*	-0.997*	-0.961*	-0.956*	0.979*	0.986*

** Significance at p= 0.01 level; * Significance at p=0.05 level

References

1. Nair CPK, Daniel M. Pest on arecanut. CPCRI. Kasargud, Kerala. 1982, 151-184.
2. Patel GI, Rao KSN. Important diseases and pests of areca and their control. Arecanut Journal. 1958; 9:89-96.
3. Flechtmann CHW, Etienne J. The red palm mite, *Raoiella indica* Hirst, a threat to palms in the Americas (Acari: Prostigmata: Tenuipalpidae). Systematic and Applied Acarology. 2004; 9:109-110.
4. Nageshachandra BK, Channabasavanna GP. Development and ecology of *Raoiella indica* Hirst (Acari: Tenuipalpidae) on coconut. Griffiths, D. A. & Bowman, Proceedings of the 6th International Congress of Acarology. 1984; 6 (2):785-790.
5. Welbourn C. Red palm mite *Raoiella indica* (Acari: Tenuipalpidae). Pest Alert. DPI-FDACS. 2006, 4.
6. Ochoa R, Beard JJ, Bauchan GR, Kane EC, Dowling APG, Erbe EF. Herbivore exploits chink in armor of host. American Entomologist, 2011, 26-29.
7. Puttarudriah M, Channabasavanna GP. Some new insect and mite pests of areca in Mysore. Arecanut journal. 1956; 7:9-10.
8. Prasad Kumar Hegde NK. Population dynamics of red palm mite *Raoiella indica* Hirst (Acari: Tenuipalpidae) on arecanut. Pest Management in Horticultural Ecosystem. 2007; 13 (1):65-67.

9. Raghunatha, Manjunatha M, Latha M. Host preference of *Raoiella indica* Hirst to different areca cultivars. Journal of Eco-friendly Agriculture. 2015; 10(1):94-95.
10. Awmack CS, Leather SR. Host plant quality and fecundity in herbivorous insects. Annual Review of Entomology. 2002; 47:817-844.
11. Lardies MA, Carter MJ, Bozinovic F. Dietary effects on life history traits in a terrestrial Isopod: The importance of evaluating maternal effects and trade-offs. Oecologia. 2004; 138:387-395.
12. Balaza D, Vasquez C, Valeria R. Biological aspects of *Raoiella indica* Hirst (Acari: Tenuipalpidae) on cultivars. Entomotropica. 2015; 30 (18):181-192.
13. Sarkar PK, Somchoudhury AK. Interrelationship between plant characters and incidence of *Raoiella indica* Hirst on coconut. Indian Journal of Entomology. 1989; 51:45-50.