

# Distribution Pattern and Injurious Status of *Raoiella indica* (Hirst) (Acari: Tenuipalpidae) on Arecanut Palms

Prabheena, P. and Ramani, N.

Division of Acarology, Department of Zoology, University of Calicut, Kerala, India-673635

**Abstract-** Areca palm (*Areca catechu* L.) of the family Arecaceae is an important commercial crop cultivated in the tropics like the Pacific, Asia and east Africa. Many insect and non insect pests induce serious damage to areca palms in different parts of the world. The Red Palm Mite, *Raoiella indica* heavily infests palms of nursery stage and young palms and induces damage by sucking sap from the frond leaves of young palms during hot dry weather. This polyphagous species of false spider mite rapidly spreads through the Neotropical region where the mite damages economically and ecologically important plants. The present study is focussed on incidence, distribution pattern and injurious status of *R.indica* on areca palms. Field sampling was conducted fortnightly for the period of March, 2013 to September, 2013 on areca palms cultivated in two districts viz. Malappuram and Wayanadu of North Kerala, South India. Results of the study revealed significantly high population densities of the mite on areca palms with peak population in March/April. High numbers of the mite could be observed on the bottom frond leaves than the middle and top leaves. The present study also indicated that the distribution pattern of the red palm mite was relatively high in the Thenhipalam region of the Malappuram district when compared to other regions surveyed.

**Index Terms-** *Raoiella indica* , *Areca catechu*, Red Palm Mite, False spider mite

## I. INTRODUCTION

The areca palm, *Areca catechu* L. is the source of arecanut commonly referred to as betel nut in India. Since time immemorial, it is being used in masticatory (chewing), religious and social ceremonies [1]. Arecanut is largely cultivated in the plains and foothills of Western Ghats and North Eastern regions of India. Karnataka, Kerala and Assam accounts for over 90% of area and production. Less labour intensive and good price in the last two decades forced the farmers to cultivate these crops with improved varieties in changed agro-climatic conditions. Although considerable crop losses from pest attack were encountered on areca palms in fields, dearth of knowledge among the farmers and cultivators on the identity, distribution pattern and bionomics of the important pests hinders the formulation of appropriate management practices to protect this commercial crop.

Areca palms are exposed to the attack of an array of insect and non- insect pests which infest various regions such as stem, leaves, inflorescence, roots and nuts in one or other stages of growth. As many as 102 insect and non-insect pests have been reported to be associated with arecanut palms [2]. Among these,

mites are the serious pests in young areca plantation on leaves which are active after the onset of hot weather [3]. Phytophagous mites of the family Tenuipalpidae comprise 35 genera and 900 species [4, 5] and most frequently, economic damage to a great variety of crops is reported by members of genera like

*Brevipalpus*, *Raoiella* and *Tenuipalpus* . Of these, the genus *Raoiella* gained economic importance in recent years and the species, *R. indica* was first reported in 1924 from Tamil Nadu, India. It 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 [6]. It was reported as a serious pest of economically important fruit-producing trees like the coconut, *Cocos nucifera* and banana, *Musa* spp. [7, 8] and it formed the first mite species in which feeding was observed through the stomata of its host plants [9] (Ochoa *et al.*, 2011). Through this specialized feeding habit, *R. indica* would probably interfere with the photosynthesis and respiration processes of its host plants. Mite infested palms displayed stunted growth and withering of leaves [10]. However, the damage caused by this species to most of its host plants has not yet been characterised in detail, till to date, and there is no report on the infestation of *R. indica* on arecanut palms of North Kerala. Hence this study was undertaken to depict the relative distribution pattern and injurious status of the mite on areca palms of Kerala.

## II. MATERIALS AND METHODS

Field sampling of the mite was carried out from areca plantations in two districts of North Kerala where palms belonging to six to seven years of age group were cultivated in separate gardens. The study was conducted covering two consecutive seasons, during March, 2013 and September, 2013. During the study period, field surveys were undertaken twice in a month in order to obtain temporal data for the study. In each garden, ten young palms, not taller than 3 metres were selected randomly and three fronds were sampled (bottom, middle and top). On each frond, five leaflets were removed from the region close to the rachis. Leaflets were transported to the laboratory for subsequent microscopic observation for recording the presence of various life stages of *R. indica*. The number of mites present on the leaflets was counted under a Stereo Zoom microscope at fortnightly intervals.

III. RESULTS

Areca palms are widely cultivated throughout Kerala and infestation by the red palm mite, *R.indica* was reported seasonally in the selected regions. Results of the present study revealed that *R. indica* initiated its population build up during the period of March to April at which the field experienced a rise in

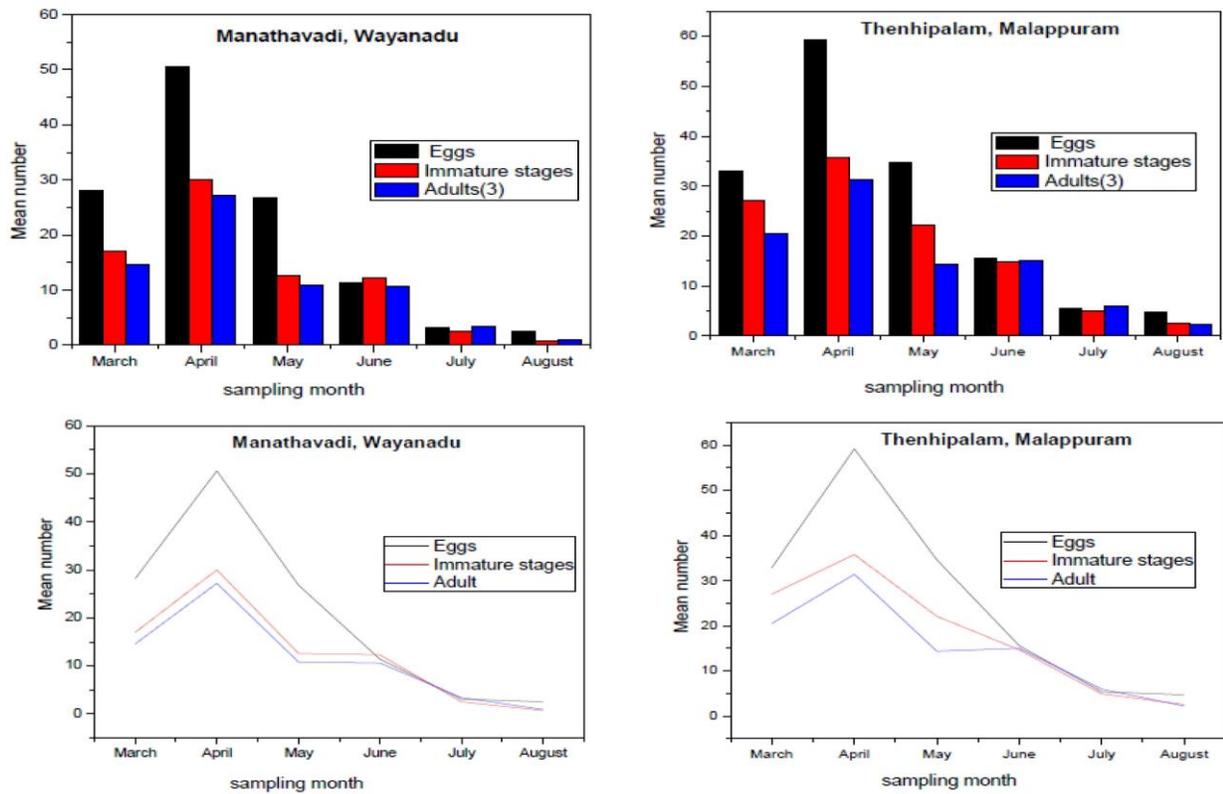
temperature (Table 1-2, Fig. 1). The mite population attained the peak level in April and subsequently showed a decline from last week of May onwards to August. The lowest population density of the mite could be recorded during period of July and August. Data on population density of the mite in each site distributed over the two districts are presented in Tables 1-2 & Fig.1.

Month of Sampling	Mean number of different life stages of <i>R. indica</i> mites/ leaflet								
	Bottom frond			Middle frond			Top frond		
	Egg	Immature stages	Adult	Egg	Immature stages	Adult	Egg	Immature stages	Adult
March	33	18.6	13.5	30	20.4	18.9	21.6	12	11.4
April	48	27	25.2	49.8	30	28.8	54	33	27.6
May	33	18	9	15.6	11.4	12	31.8	8.4	11.4
June	12.6	12	8.4	9.6	12	12.6	12	12.9	10.8
July	3	2.4	3	2.4	1.5	3	3.9	3.6	4.2
August	6	1.2	0.6	0.3	0.3	0.6	1.2	0.6	1.5

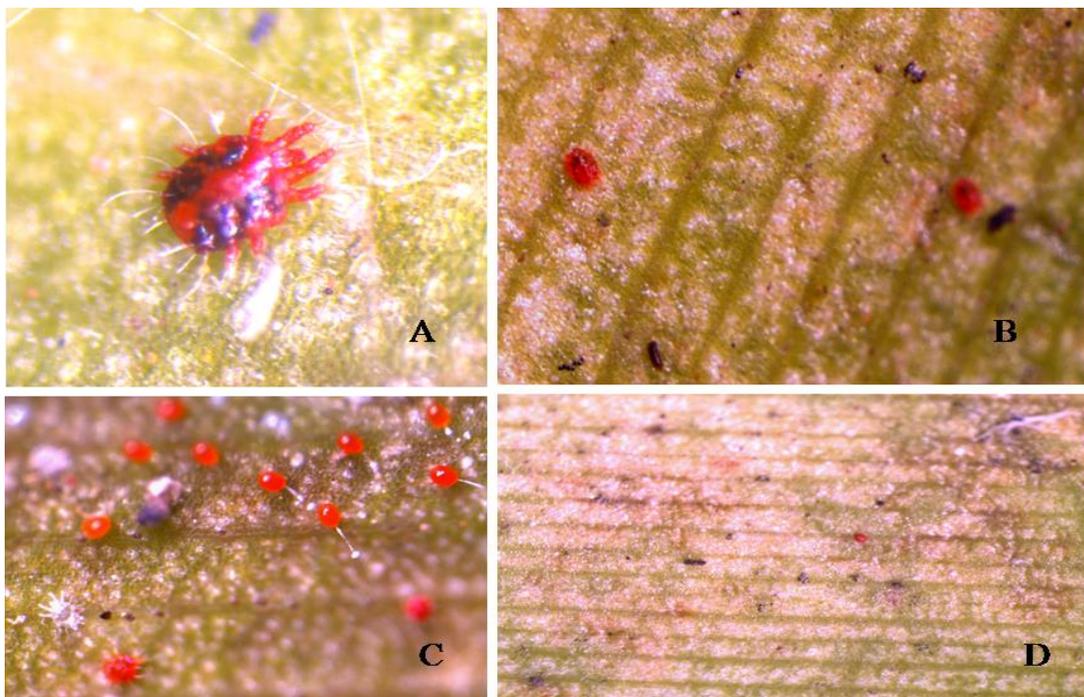
**Table 1. Seasonal incidence of *R. indica* on Areca palms in Mananthavadi, Wayanadu District.**

Month of Sampling	Mean number of different life stages of <i>R. indica</i> mites/ leaflet								
	Bottom frond			Middle frond			Top frond		
	Egg	Immature stages	Adult	Egg	Immature stages	Adult	Egg	Immature stages	Adult
March	37.8	24	20.4	30.3	28.5	23.4	30.6	28.5	17.7
April	58.8	39.9	29.1	57.9	34.2	32.4	60.9	33.3	32.7
May	36	22.5	12.6	33.3	24.6	15	34.5	19.2	15.6
June	16.5	15	14.7	15.9	13.5	17.1	14.4	15.6	13.2
July	5.1	3.6	5.4	6.3	4.5	8.1	4.8	6.6	4.5
August	2.7	3.3	2.1	3	2.1	2.4	8.4	2.4	2.1

**Table 2. Seasonal incidence of *R. indica* on Arecanut palms in Thenhipalam, Malappuram District.**



**Fig. 1.** Graph (Bar diagram and Line diagram) showing the Seasonal incidence and relative distribution of different life stages of *R. indica* on Areca palms in Wayanadu and Malappuram districts of Kerala.



**Fig. 2.** A- Adult female of *Raiella indica* on areca leaf, B- Infested leaf lamina with *R. indica*, C- Eggs & larva of *R. indica*, D – Heavily infested leaf

The mite incidence was highest on the bottom frond leaflet when compared to the top and middle frond leaflets. The highest population of the mite could be recorded on areca palms cultivated in the Thenjipalam area of Malappuram district in April (100-120 mites/ frond) when compared to Mananthavadi of Wayanadu (Fig.1). Lowest mite population was observed in the Mananthavadi region (Tables 1&2), which experienced a significant variation in the population density of *R. indica* in different geographical location, thereby indicating that the population build up of this mite was associated with the temperature and relative humidity conditions prevailing in the site. Very low population density of the mite could be accounted during the monsoon season (Table 1&2).

Infestation of the red palm mite was found confined to the lower surface of the leaflets in all examined cases, and often the number of mites recovered from a single leaflet ranged from 50 – 100, during April, which ensured easy detection of the mites even with unaided eyes in the field.. All the life stages the mite appeared predominantly red in colour, while the adult females often exhibited dark coloured areas on the body. Feeding activity of large numbers of the various life stages of the mite imparted the development of localised yellow colouration to the leaf lamina. On progressive feeding, these yellow patches coalesced and turned to bronze coloured, thereby leading to the withering of the leaves (Figs. 2 A - D).

#### IV. DISCUSSION

The present study forms the first report on the incidence of red palm mite on areca palms of North Kerala. The results of the study enabled to record infestation by *R. indica* as one of the major problems in the arecanut plantations of Kerala. Population density of the mite was relatively high in the Malappuram District than the Wayanadu district. Temperature is a main abiotic factor for poikilothermic insects [11]. The changes in surrounding temperature regimes certainly involve in development rates, voltinism and survival of insects and subsequently act upon size, density and genetic composition of populations their ability to exploit particular host plants, and their geographic distribution range [12]. Likewise in this study we have observed that the temperature and relative humidity of the habitat exerted a major role in determining the population size of the mite, *R. indica*.

The rainfall was found to affect the mite population drastically, as the number of mites encountered during monsoon season was comparatively low. Probably, the decrease in population density of the mite would be a reflection of the washing effect of rain on the various life stages of the mite. Many previous studies also pointed out the effects of rainfall to reduces the populations of important insects and mite pests of various crops through mechanical action [13, 14, 15, 16]. Pallini Filho *et al.* [17] observed that the period of lowest *O. ilicis* incidence coincided with the rainy season. The study conducted by Reis *et al.* [14] also observed a decrease in the phytoseiid predatory mite population in citrus trees in function of the rainfall.

#### REFERENCES

- [1] Murthy, K.N. (1968). Arecanut growing in north east India. Indian Farming, 18: 21.
- [2] Nair CPR, Daniel M (1982). Pests. In: The Arecanut palm. (Bavappa KVA, Nair MK, Prem Kumar T, eds). CPCRI. Kasaragod, pp. 151-184.
- [3] Patel, G.I., Rao, K.S.N. (1958). Important diseases and pests of arecanut and their control. Arecanut. J., 9: 89-96.
- [4] Mesa, N.C., Ochoa, R., Welbourn, W.C., Evans, G.A. and Moraes, G.J. (2009) A catalog of the Tenuipalpidae (Acari) of the World with a key to genera. Zootaxa 2098:1–185.
- [5] Beard, J.J., Ochoa, R., Bauchan, G., Trice, M., Redford, A., Walters, T. and Mitter, C. (2012) Flat mites of the world, <http://idtools.org/id/mites/flatmites/> (Accessed Apr 2012)
- [6] Flechtman, C.H.W. and Etienne, J. (2004). The red palm mite, *Raoiella indica* Hirst, a threat to palms in the Americas (Acari: Prostigmata: Tenuipalpidae). Systematic and Applied Acarology, 9: 109-10.
- [7] Nagesha-Chandra, B. K. N., and Channabasavanna, G. P. (1984). Development and ecology of *Raoiella indica* Hirst (Acari:Tenuipalpidae) on coconut, pp.785-798 In D. A. Griffiths and C. E. Bowman [eds.], *Acarology VI*, 2.
- [8] Welbourn, C. (2006). Red palm mite *Raoiella indica* (Acari:Tenuipalpidae). Pest Alert. DPI-FDACS. Available from <http://www.doacs.state.fl.us/pi/enpp/ento/r.indica.html>. (Accessed October 10, 2008).
- [9] Ochoa, R., Beard, J.J., Bauchan, G.R., Kane, E.C., Dowling, A.P.G and Erbe, E.F. (2011). Herbivore exploits chink in armor of Host. *Am Entomol* 57(1):26–29.
- [10] Puttarudraiah, M. and Channabasavanna, G. P. (1956), Some new insect and mite pests of areca palm. *Mysore Journal of Agricultural Sciences*, 7: 9-10.
- [11] Parmesan C. (2006), Ecological and evolutionary responses to recent climate change, *Annual Review of Ecology, Evolution, and Systematics* 37: 637-669.
- [12] Bale, J., Masters, G., Hodkinson, I., Awmack, C., Inbezemer, T.M., Brown, V.K. Butterfield, J., Buse, A., Coulson, J.C., Farrar, J. Good, J.G. Harrington, R. Hartley, S., Jones, T.H., Lindroth, L., Press, M., Mrioudis, L., Watt, A. and Whittaker, A. (2002). Herbivory in global climate change research: direct effects of rising temperature on insect herbivores. *J. Global Change Biol.*, 8: 1-16.
- [13] Franco, R. A., Reis, P. R., Zacarias, M. S., Altoé, B. F. and Pedro N. M. (2008) Dinâmica populacional de *Oligonychus ilicis* (McGregor, 1917) (Acari: Tetranychidae) em cafeeiro e de fitoseídeos associados a ele. *Coffee Science, Lavras*, 3: 38-46
- [14] Reis, P. R., Chiavegato, L. G., Alves, E. B., Sousa, E.O. (2000) Ácaros da família Phytoseiidae associados aos citros no município de Lavras, Sul de Minas Gerais. *Anais da Sociedade Entomológica do Brasil, Londrina*, 2: 95-105
- [15] Silva, R. A., Reis, P. R., Souza, B., Carvalho, C. F., Carvalho, G. A., Cosme, L. V. (2006). Flutuação populacional de adultos de *Chrysoperla externa* (Hagen, 1861) (Neuroptera: Chrysopidae) em cafeeiros conduzidos em sistema orgânico e convencional. *Manejo Integrado de Plagas y Agroecología, San José*, n. 77, p. 44-49.
- [16] Souza, B., Carvalho, C. F. (2002). Population dynamics and seasonal occurrence of adults of *Chrysoperla externa* (Hagen, 1861) (Neuroptera: Chrysopidae) in a citrus orchard in southern Brazil. *Acta Zoologica Academiae Scientiarum Hungaricae*, v. 2, n. 2, p. 301-310, Supplement.
- [17] Pallini F.A., Moraes, G. J. and Bueno, V. H. P. (1992), Ácaros associados ao cafeeiro (*Coffea arabica* L.) no Sul de Minas Gerais. *Ciência e Prática, Lavras*, 16: 303-307

#### AUTHORS

**First Author** – Prabheena P., Division of Acarology, Department of Zoology, University of Calicut, Kerala, India-673635, [p.prabheena@gmail.com](mailto:p.prabheena@gmail.com)

**Second Author** – Dr. Ramani N., Professor, Division of Acarology, Department of Zoology, University of Calicut, Kerala, India-673635, [drnramani@gmail.com](mailto:drnramani@gmail.com)

**Correspondence Author**– Dr. Ramani N.,  
drnramani@gmail.com and p.prabheena@gmail.com