Raoiella indica **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Arachnida	Acariformes	Tenuipalpidae

Common name red palm mite (English), coconut red mite (English), coconut mite (English), red date mite (English), scarlet mite (English), frond crimson mite (English), leaflet false spider mite (English)

Synonym

Similar species *Tetranychus spp.*

Summary Raoiella indica (the red palm mite) is a parasitic mite invasive in the Caribbean region; it poses a serious threat to many plant industries. Its recent invasion is referred to as the biggest mite explosion in the Americas. Already taking serious tolls on coconut, ornamental palm and orchid crops, its infestation of new species and spread to new locations makes it one the most menacing pests to the Western tropics.

view this species on IUCN Red List

Species Description
Raoiella indica is a bright red mite that parasitizes many important plant species, principally palm and banana species. It can be found on the undersides of their leaves. *R. indica* resembles the common pests spider mites (Family:Tetranychidae) only with longer spatulate setae and lacking their web spinning ability. Adult females are about 0.32mm long and have dark patches on their abdomen. They are larger than males which have more triangular abdomens. Nymphal stages look similar only smaller with less pronounced setae. The mites are visible with the naked eye and usually congregate in clusters of 100-300, and are surrounded by their white exuvial remains (cast skins). (Kane, 2006; Welbourn, 2007).

Lifecycle Stages
Eggs are atteched to leaves by a stipe and hatch after an average of 6.5 days. The larvae are bright orange and develop into eight-legged protonymphs in 5-10 days and larger deutoronymphs in 5-7 days. Deutoronymphs then molt into adults after about 4-11 days. Immatures are smaller with shorter dorsal and lateral setae and lack protruding setal bases. Female pre-oviposition period ranges from three days in the summer to seven days in the winter. According to Pena, Nagesha-Chandra and Channabasavanna (1984) found longevity of females to be 50.9 days and males 21.6 days (Pena, 2006; CariPestNet, undated; Kane, undated).

Habitat Description
Red palm mites live on the abaxial, or underside, surfaces of leaves. They have been found to parasitize a wide range of plants located in tropical and subtropical climates, and typically inhabit USDA hardiness zones 9-11. Population growth is found to positively correlate with crude protein and nitrogen levels and leaf moisture, however, heavy rains result in a significant decline (Pena, 2006; APHIS 2007).

Reproduction
Oviparous. Sexual and Parthenogenetic. Fertilized eggs develop into females while unfertilized eggs become male. Fertilized females produce an average of 22 eggs while unfertilized females produce about 18, laying about 2 eggs a day. Sexual ratio ranges from 11.4 male to female from April to May, to 2.3 male to female from October to November. Males demonstrate pre-copulatory mate guarding by attaching to the rear of female deutonymphs and remaining in tandum. High temperature and daylength have a positive correlation with reproduction while rainfall and relative humidity have a negative correlation (APHIS, 2007; CariPestNet, undated; Kane, undated; Pena, 2006; Welbourn, 2007).

Nutrition
Raoiella indica is a phytophagus organism that feeds on the deep tissue layers of leaves, most likely the mesophyll. Indicated by the \"yellowing\" symptoms it inflicts rather than \"silvering,\" which is caused by the feeding on epidermal tissue. Mites have been observed extending their stylets into leaf stomata to access this inner tissue (Kane, undated).

General Impacts
Raoiella indica feeds on the deep tissue layers of leaves, most likely the mesophyll, which results in necrosis, cell death, and substantial chlorosis, leaf yellowing. Mites can number from 30-100 million per host plant (Pons & Bliss, 2007). Severly effected plants exhibit entirely dead leaves, especially on the lower third of the plant (EPPO, 2006). Symptoms are often confused with that of lethal yellowing, a prevalent disease of palms (Pena, 2006). *R. indica's* most signifcant damage has been on the coconut (*Cocos nucifera*), date palm (*Phoenix dactylifera*), areca palm (*Dypsis lutescens*), and banana (*Musa* spp.). It is considered a high risk invasive species (Pons & Bliss, 2007; APHIS, 2007). For example, a farmer in Trinidad expects a 50% reduction in coconut production (Pena, 2006).
Red palm mites parasitize a wide range of plants also including: Everglades palm (*Acoelorraphe wrightii*), Christmas palm (*Veitchia merrillii*), multiple crown palm (*Aiphanes* spp.) betel nut palm (*Areca catechu*), coco macaco (*Bactris plumeriana*), Bismark palm (*Bismarckia nobilis*), fishtail palm (*Caryota mitis*), chamaedorea palm (*Chamaedorea* spp.), princess palm (*Dictyosprema album*), triangle palm (*Dypsis decaryi*), African oil palm (*Elaeis guineensis*), Licuala palm (*Licuala grandis*), Chinese fan palm (*Livistona chinensis*), Canary Island date palm (*Phoenix canariensis*), Senegal date palm (*Phoenix reclinata*), pygmy date palm (*Phoenix roebelenii*), Fiji fan palm (*Pritchardia pacifica*), buccaneer palm (*Pseudophoenix sargentii*), Cacheo (*Pseudophoenix vinifera*), solitaire palm (*Ptychosperma elegans*), Macarthur palm (*Ptychosperma macarthurii*), lady palm (*Rhapis excelsa*), royal palm (*Roystonea borinquena*), queen palm (*Syagrus romanzoffiana*), arikury palm (*Syagrus schizophylla*), fan palm (*Washingtonia filifera*), Mexican fan palm (*Washington robusta*), parrot flower (*Heliconia psittacorum*), wild plantain (*Heliconia caribaea*), lobster claw heliconia (*Heliconia rostrata*), Macaw flower (*Heliconia bihai*), sweet basil (*Ocimum basilicum*), screw pine (*Pandanus utilis*), bird of paradise (*Strelitzia reginae*), traveler's tree (*Ravenala madagascariensis*), red torch ginger (*Eltingera elatior*), and red ginger (*Alpina purpurata*) (Welbourn, 2007; EPPO, 2006).

Management Info
Preventative measures: Surveys for potential infestation of *Raoiella indica* are being periodically performed in many coastal areas in Florida (Feiber, 2007). Intensive outreach of flyers and educational materials have been distributed throughout the Caribbean and Florida to the public indicating the threat of *Raoiella indica* (Feiber, 2007). Also, flowers, crafts made from palm leafs, and other potential vectors for the mite are prohibited from being brought into the U.S. unless first bleached, dyed, painted or shellacked (APHIS, 2007).
The European and Mediterranean Plant Protection Organitzation (EPPO) has included the mite on its Alert list (EPPO, 2007). The EPPO Secretariat felt that it could be added to the Alert List considering that it could be a threat to the palm nursery industry and date palm production in the EPPO region.
Chemical: Current knowledge of chemical control of *R. indica* is based on research performed in India or the Near East, and in most cases is not yet applicable to Western Hemisphere infestations. However, there have been several effective controls. The spraying of neem oil mixed with sulfur from above infested coconut palms 5-6 times a year resulted in a decrease of red palm mite populations and a 25% increase in yield. Several systemic insecticides have proven toxic to *R indica*. These include: Phosphamidon, which is most effective, monocroptophos, dimethoate, formothion, and dementon-methyl. Most of these products are not registered for use on coconuts or bananas in Florida and Puerto Rico. A full evaluation before use on commercial food crops is required. Additionally, petroleum oil, pyridaben, fentbutatin-oxide, dicofol, and high rates of sulfur have been successful in controlling other members of the family Tenuipalpidae (Pena, 2006).
Biological: Natural predators may provide a means of controlling red palm mite populations. However they have not been used in practice and more research is necessary. Those in India include the phytoseiid mite (*Amblyseius channabasavanni*), lady beetle (*Stethorus keralicus*), and (*Stethorus parcempunctatusi*. In Mauritius, *Amblyseius caudatus* preys on red palm mites in coconut palms. In the Western Hemisphere, *Neoseiulus longipinosus*, also native to the East, has been found to prey on *R. indica* in the Caribbean. Also, there are several conccinellid and phytoseiid potential, endemic predators that are found preying on similar species in the Western Hemisphere (Hoy, 2006). The USDA Bee Research Laboratory has searched for predators by looking for a sequenced portion of *R. indica* DNA in the guts of potential candidates. They have found lacewings (*Chrysopidae* spp.) to be good predators and intend to use a chemical isolated from catnip-oil to attract them to prey on *R. indica* populations (Pons & Bliss, 2007). Another possibility lies in predatory beetles of the Chrysomelidae family (Welbourn, 2007). Utilizing arachnid pathogens such as fungi may prove to be yet another means of controlling *R. indica*. A fungus, possibly, *Hirsutella* spp. has been observed infecting the red palm mite. Similarly, other members of Tenuipalpidae have been documented has being infected by fungi (Hoy, 2006).

Principal source: APHIS, Animal and Plant Health Inspection Service. United States Department of Agriculture. 2007. Red Palm Mite.
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[1] VIRGIN ISLANDS, U.S.

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