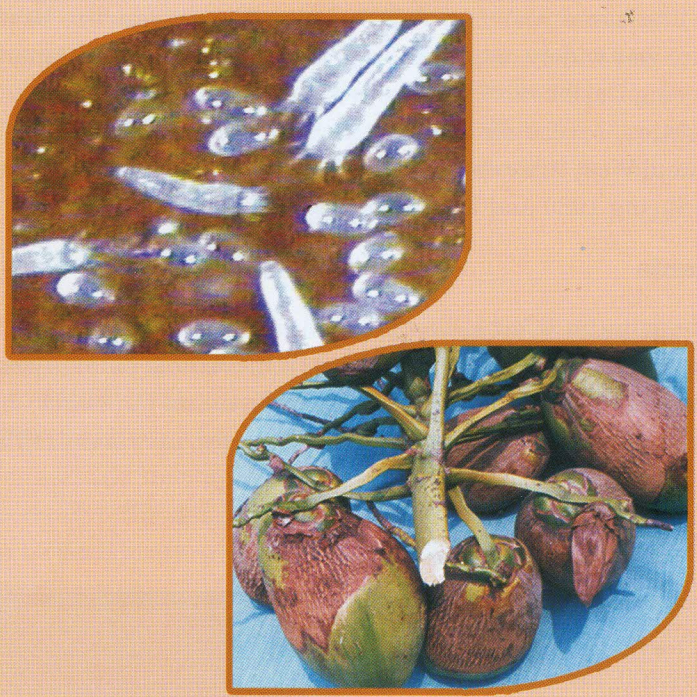
Coconut mite

(*Aceria guerreronis* Keifer)



- Common Fund for Commodities, The Netherlands
- Department For International Development, UK
- Asian and Pacific Coconut Community, Indonesia
- Food and Agriculture Organization, Italy
- Indian Council of Agricultural Research, India
- Central Plantation Crops Research Institute, India

Introduction

Coconut mite (*Aceria guerreronis* Keifer) is the most destructive pest among various species of eriophyid mites affecting coconut palm in 30 countries of Tropical America, Africa and Asia. In Asia, the coconut mite was first reported from Sri Lanka in late 1997 from Kalpitiya Peninsula of Puttalam district and from India during 1998 from Amballur Panchayat in Ernakulam district of Kerala. Within a short period of the first report, the coconut mite has spread rapidly to major coconut growing regions in both these countries. In India, the pest is reported currently from all the traditional coconut growing states in the west and east coast of the country.

Distribution of coconut mite

First report of *A. guerreronis* was from the Guerrero State in Mexico in 1965. The same year it was found near Rio de Janeiro, Brazil. Its occurrence was widely noticed in several countries in South America and neighbouring Caribbean Islands during 1968. During the seventies and early eighties, severe damage of the pest was reported from Central America and West African countries. Tanzania witnessed an outbreak of the pest during 1980 and USA (Florida) during 1984.

Host Plants

Coconut palm (*Cocos nucifera* Linnaeus) is the primary host of *A. guerreronis*. It has also been recorded from cocosoid palm (*Lytocaryum weddellianum*) in Brazil, palmyra palm (*Borassus flabellifer*) in India and queen palm (*Syagrus romanzoffiana [Arecastrum romanzoffianum]*) in USA.

Biology

The coconut mite is a microscopic creamy white vermiform organism measuring 200-250 microns in length and 36-52 microns in breadth (Fig. 1).

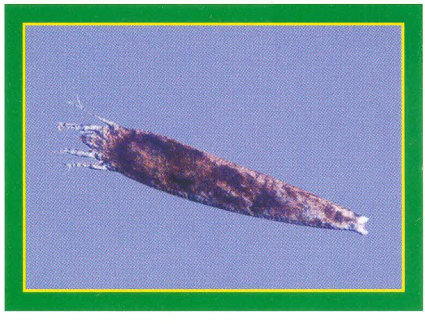


Fig. 1. *Aceria guerreronis*

The body is elongated, cylindrical, finely ringed and bears two pairs of legs at the anterior end. Mites attain sexual maturity within a week's time and start laying eggs. An adult mite lays about 50-100 eggs. The eggs hatch into protonymphs, deutonymphs and finally to adults. The total life cycle is completed in seven to ten days.

Nature of damage

In coconut, mites infest the developing young buttons and are seen in the floral bracts and the soft meristematic portion beneath the perianth. Mite infestation could be seen in developing buttons of 1-5 month old bunches and maximum mite population is observed in buttons of 3rd and

4th month old bunches. Unfertilized female flowers do not harbour any mite. Entry of the mite into the developing nuts takes place during the early phase of development immediately after the fertilization. The mites thus gaining entry into the nuts multiply and form active colonies containing various stages of development viz., eggs, nymphs and adults (Fig. 2). Usually in a developing nut, the coconut mite colonies are seen as two or three congregations on the meristematic region of the button below the perianth (Fig. 3). Under favourable conditions, the high reproductive potential and the shorter life cycle of the mite result in the enormous multiplication of the colonies. When colony size becomes substantially increased mites come out of the interspaces between the tepals of the developing nuts for dispersal. The dispersal of the pest is mainly through wind. Honey bees and other insects visiting inflorescence of coconut also act as agents for dispersal.

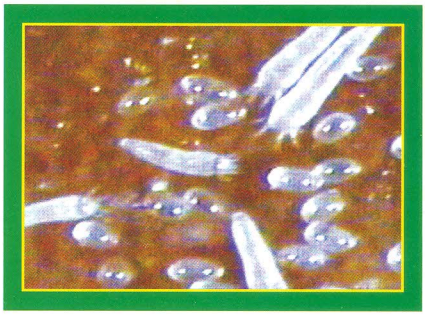


Fig. 2. Coconut mite colony with eggs and adults

Fig. 3. Coconut mite colony on perianth

The mite infestation symptoms are observed approximately one month after initial colonization of the nuts inside the fertilized button. Appearance of elongated white streaks below perianth is the first external manifestation of mite infestation on young buttons. In many cases, a small yellow halo develops around the perianth. Within a few days, this halo develops into yellow triangular patch pointing towards the distal end of the button. This can be clearly visible in 2-3 month old buttons (Fig. 4). In a short time, the yellow patch turns into brown and show necrotic patches on the periphery of the perianth (Fig. 5). As the affected nut grows, the injuries form warting and longitudinal fissures on the nut surface (Fig. 6).

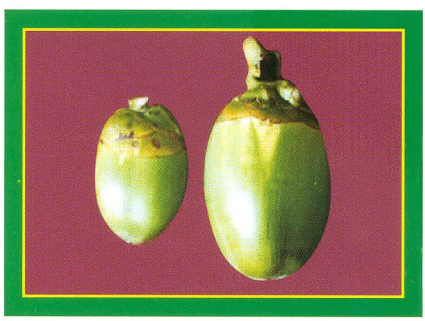


Fig. 4. Early symptoms of coconut mite attack showing yellow halo

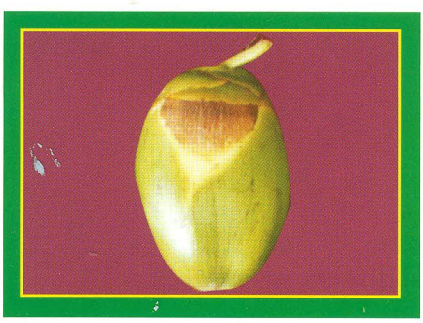


Fig. 5. Development of brown patch

The husk develops cracks, cuts and gummosis. Severe infestation causes shedding of buttons and young nuts or malformation of nuts as a result of retarded growth.

Fig. 6. Affected bunch with wartings

Crop loss

Feeding by few mites causes cosmetic damage to the husk without affecting the quality of copra or coconut water. Yield losses depend on cultivar, health and general maintenance of the crop, climate etc. Copra loss was 10 % in Benin, 16 % in Ivory Coast, 30 % in Mexico, 11-28 % in St. Lucia, 20-30% in Tanzania and about 16% in Sri Lanka.

In India invasion of coconut mite over large areas of coconut plantation in the initial years of occurrence has affected up to 70 % damage resulting in the production of undersized or malformed nuts. It has been observed that as the time advances, there is considerable reduction in the level of incidence resulting in reduction in economic loss. In Kerala, though pest damage has been reported initially ranging from 50-70 %, later surveys carried out in Alappuzha district have shown significant reduction in crop loss indicating an average loss of 30.94 % in terms of copra and 41.74 % in total husk production. Recent surveys by CPCRI in Kerala register still lower levels of pest incidence with comparatively less intensity of infestation. The loss in terms of copra in the present situation in southern districts of Kerala ranges from 8-12 percent compared to an average loss of 25 percent in the initial years.

Population dynamics

The coconut palm puts forth on an average one inflorescence a month. Thus, throughout the year the mite is able to find nuts of suitable age for initiating infestation and population build-up. However, the pest population reaches maximum during hot/dry months. In India, the population is very high during summer months from March-May. High temperature and relative humidity were found to favour mite build up. Rapid spread of mite occurs during humid warm weather during pre-monsoon season. Coconut palms with heavy nut setting and thickly arranged bunches are showing more incidence of the pest.

Varietal susceptibility

Coconut cultivars and Hybrids differ in their field tolerance to the mite. Malayan Yellow Dwarf in Costa Rica, Port-Bouet 121, Malayan Tall, Tahiti Tall, Cameroon Red Dwarf, and hybrid MYDXWAT in Benin performed better. Polynesian Tall , Malayan Red Dwarf , Rennel Tall , Cameroon Red Dwarf and Equatorial Green Dwarf showed more tolerance to mite attack in Tanzania. Coconut cultivars from Cambodia showed resistance to coconut mite in Africa. In India varieties like Kenthali, Cochin China, Andaman ordinary, Gangabondam, Chowghat Orange Dwarf, Malayan Green Dwarf, Laccadive Micro and Spicata recorded lower incidence of the pest. Chowghat Orange Dwarf showed maximum

level of tolerance to the mite in the field.

The shape of the nut (round shape) and tepal traits (tight perianth) are the important attributes for mite tolerance. Breeding for these characters may provide a long-term solution to coconut mite problem.

Management

Over five dozen systemic and contact insecticides have been evaluated world over and recommended from time to time. But none of them are presently recommended for mite control as they are not cost effective and cause serious residual problems in the coconut ecosystem. Even wettable sulphur recommended for mite management in the initial years was withdrawn due to deleterious effects on natural enemies of the mite particularly on the acaropathogenic fungus *Hirsutella thompsonii*. In Sri Lanka, monocrotophos application had deleterious effect on predatory mite (*Neoseiulus baraki*). In India, presently spraying of neem oil garlic soap mixture at 2% or commercial botanical pesticides containing azadirachtin at 0.004 % or root feeding with neem formulations containing azadirachtin 50,000 ppm at 7.5 ml or azadirachtin 10,000 ppm at 10 ml mixed with equal volume of water is recommended for managing the pest.

Preparation of spray solution

To prepare one litre of the 2% neem oil garlic soap emulsion, 20 ml pure neem oil, 20 g of cleared garlic pearls and 5 g washing soap are required. Dissolve the soap in 500 ml of water and add the neem oil to this solution and mix it well. Grind garlic pearls well, mix it well in 500 ml water and add this to the soap-neem oil mixture by sieving through a cloth to remove the debris of garlic pearls. The mixture is stirred well and can be used for spraying. The pesticide mixture shall be used on the day of preparation.

To prepare one litre of azadirachtin spray solution, take four ml of 10,000 ppm azadirachtin formulation and mix it well in one litre of water by stirring.

Method of spraying

Since the mite colonies are lodged on the inner soft tissues of the developing nuts covered by perianth, spray solution should be applied on the perianth region so as to provide its penetration into the perianth lobes and inner nut surface through capillary action. The spray solution should be applied as fine droplets on the perianth region and general surface of developing nuts of 1-6 month old bunches with a hand sprayer or rocker sprayer (Fig. 7). There is no need to spray the unpollinated and mature bunches in the crown.

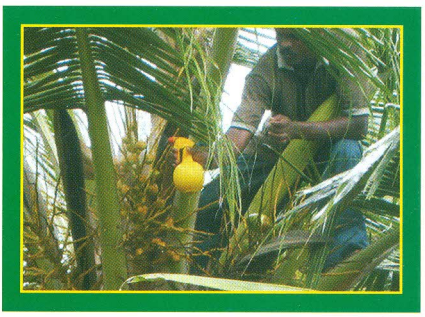


Fig. 7. Spraying coconut mite infested bunches

Root feeding method

Fig. 8. Root Feeding

Trace and select an active, semi hard, pencil thick and chocolate brown colored root at a distance of one meter away from the bole region of the palm. Make a slanting cut (45^0) at the tip portion of the root with a sharp knife. Take the well mixed botanical pesticide solution Azadirachtin 5% (7.5 ml mixed with 7.5 ml water) or Azadirachtin 1% (10 ml mixed with 10 ml water) in a small tubular polythene pouch. Fully immerse the cut end of the root in the pesticide solution up to the bottom of the pouch and tie the mouth of the pouch containing the root with a twine. Keep the root safely in slanting position without any injury for avoiding any spillage of the pesticide solution (Fig. 8). Cover the root gently with leaf mulch/loose soil.

Crop management as a component of IPM

The nutritional status of palm plays a significant role in the management of the pest. Adoption of an integrated nutrient management package consisting of balanced application of NPK fertilizers at the recommended dosage in 2 splits (Urea 1 kg, Rock Phosphate 1.5 kg, Muriate of Potash 2 kg); neem cake 5 kg; *in situ* growing of green manure crops like cowpea or sunhemp and its incorporation in the coconut basin and conservation of soil moisture has yielded promising results in reduction of coconut mite population.

Integrated mite management technology

In India adoption of integrated mite management approach with need based application of botanical pesticides either by spraying or root feeding and adequate nutrient management of the affected palms has given positive results in the field. The current recommendation for mite management includes phytosanitory measures like crown cleaning and plantation sanitation and spraying /root feeding of neem based pesticides containing azadirachtin thrice a year during December-January, April-May and September-October. For the nutritional care of affected palms recycling of organic biomass in coconut ecosystem using *in situ* vermi composting, raising of suitable green manure crops in the coconut basin, application of NPK fertilizers as per recommendation and soil moisture conservation measures suitable for the situation are recommended. These practices are presently popularized among farming communities in India, Sri Lanka and Tanzania through the Farmer Field School which is an innovative participatory extension programme for dissemination of the technology.

Biological control

World over several groups of insects, especially Diptera (Cecidomyiidae), Coleoptera, Neuroptera, Thysanoptera and Hemiptera

have been mentioned as predators of eriophyid mites. The predatory mites *Bdella distincta, Amblyseius channabasavannai, A. largoensis, Neoseiulus baraki, N. paspalivorus, N. mumai, Typhlodromus sp., Chelacaropsis moorei, Cheletogenes ornatus, Polyphagotarsonemus latus* and several others are able to check the population of the mite to some extent. In Sri Lanka, *N. baraki* is considered to cause significant reduction in pest population

Fig.9. *Neoseiulus baraki*

Entomopathogenic fungi belonging to nine genera and over a dozen species have been found to be pathogenic to mites. *Hirsutella thompsonii* was isolated from samples of coconut mites from tropical America, West Africa and Asia (India, Sri Lanka). In India 'Mycohit' an indigenous preparation based on a superior selected strain MF (Ag) 5 [IMI 385470] of *H. thompsonii* was evaluated. Even though under controlled conditions, up to 88% mortality has been achieved, field use against coconut mite had varied results. *Hirsutella nodulosa*, another species attacking the coconut mite, first found to be infecting mite population in Cuba in 1984, has also been isolated from the mite in India and Sri Lanka. So also *Sporothrix fungorum* has also been reported from India.

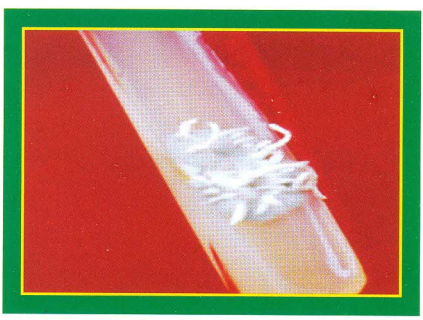


Fig.10. *Hirsutella thompsonii*

Investigations on the phytoseiid predatory mite *Neoseiulus baraki* (Fig. 9) and the acaropathogen *Hirsutella thompsonii* (Fig. 10) are currently in progress in India and Sri Lanka. The predator *N. baraki* is seen in abundance associated with mite colonies in the field. Attempts to culture the predator and its mass multiplication in laboratory have succeeded in Sri Lanka. It could be successfully mass multiplied on storage mite, *Tyrophagus putrescentiae* which in turn is multiplied on rice bran and wheat flour (1:1) in a closed arena without a water barrier. Currently, field studies on its efficacy are progressing. Similarly, new strains of the acaropathogenic fungus *H. thompsonii* could be collected from different locations in both the countries and the virulent isolates could be cultured and mass multiplied in the laboratory. Field efficacy studies of the fungus are currently investigated and formulations based on *H. thompsonii* are also evaluated in the field for assessing their acaropathogenic efficiency. In Sri Lanka, H/2 strain (IMI391722) of *H. thompsonii* was found to be more virulent and stable when applied to the nut bunches. Further investigations shall help in refinement of the Biointensive Integrated Pest Management (BIPM) technology for the management of coconut mite.

FOR ADDITIONAL INFORMATION

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