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A Complete Overview of Eriophyid Mites: From Identification to Management

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Eriophyid mites are highly specialized phytophagous arthropods with significant economic importance due to their ability to rapidly establish in new environments, cause diverse plant damage, and, in some cases, transmit plant viruses. These obligate plant parasites exhibit unique morphological forms (vermiform and fusiform) and a simple life cycle comprising egg, larval, nymphal and adult stages with reproduction and development closely influenced by environmental conditions. Their feeding activity induces a range of characteristic symptoms, including gall formation, leaf rolling, erineum development and blistering, which alter plant physiology and reduce productivity; include sterility mosaic disease in redgram caused by *Aceria cajani* and severe nut damage in coconut caused by *Aceria guerreronis*. Integrated Pest Management (IPM) combines these strategies, emphasizing monitoring, threshold-based interventions, and judicious use of chemicals to achieve sustainable and effective control.

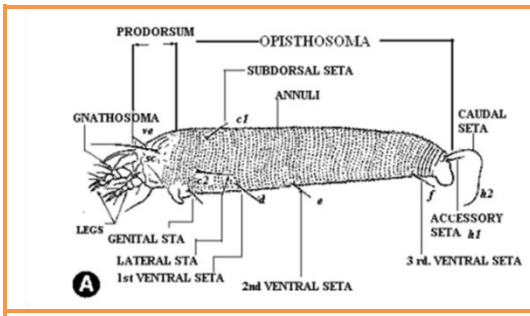
Key words: Eriophyid mites, Plant damage symptoms, Integrated Pest Management (IPM)

Introduction

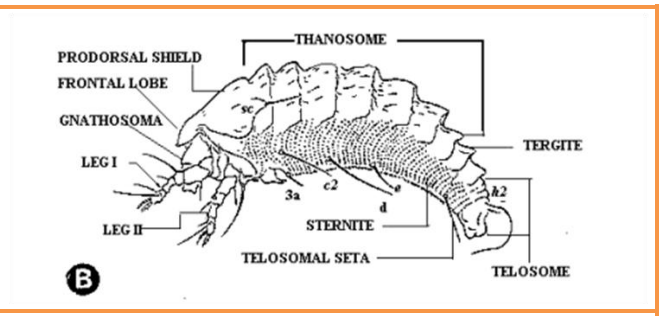
Phytophagous mites represent an important group of plant-feeding arthropods, among which eriophyoid mites possess a high potential as adventive species due to their ability to rapidly establish in new environments. These mites are obligate plant parasites that infest a wide range of plant organs, often inducing symptoms that closely resemble those caused by viral infections, nutrient deficiencies or physiological disorders. Furthermore, certain eriophyoid species function as vectors of plant viruses, thereby significantly reducing crop productivity and posing serious quarantine concerns worldwide (Oldfield and Proeseler, 1996). Their extremely small size and concealed mode of life, commonly within buds or inside specialized plant structures such as galls, erinea and blisters, make it difficult to accurately assess their population density and the extent of yield losses they cause. Despite their limited active movement, eriophyoid mites disperse efficiently through passive means such as wind currents, rain splash and human-mediated activities, particularly global trade, enabling their rapid spread across regions. Their economic importance varies considerably depending on environmental conditions, agricultural practices, host plant characteristics and market demands, which complicates broad generalizations of their impact. Some species intensify their damage by transmitting plant viruses (de Lillo *et al*., 2016), whereas others have shown potential as biological control agents against invasive weed species (Smith *et al*., 2010). Nearly one-third of the species within the families Eriophyidae and Phytoptidae are gall-forming or refuge-seeking, leading to significant alterations in plant physiology and ultimately affecting crop productivity.

Morphology of eriophyid mite

The eriophyid mite has two forms *i.e.*, vermiform and fusiform. In Vermiform mites, body is divided to gnathosoma, prodorsum and opisthosoma. Gnathosoma contains the mouthparts and sensory structures. Prodorsum is the anterior dorsal portion of the body covers the gnathosoma. Opisthosoma is the posterior elongated body with ring-like segments called annuli. In Fusiform mites, body is divided to gnathosoma and idiosoma. Gnathosoma contains mouthparts. Idiosoma comprises two regions *i.e.*, Thanosome (anterior portion of the body that contains legs, prodorsal shield, portions of the digestive system) and Telosome (terminal part of the body, posterior to the thanosome that contains reproductive organs and anal opening).



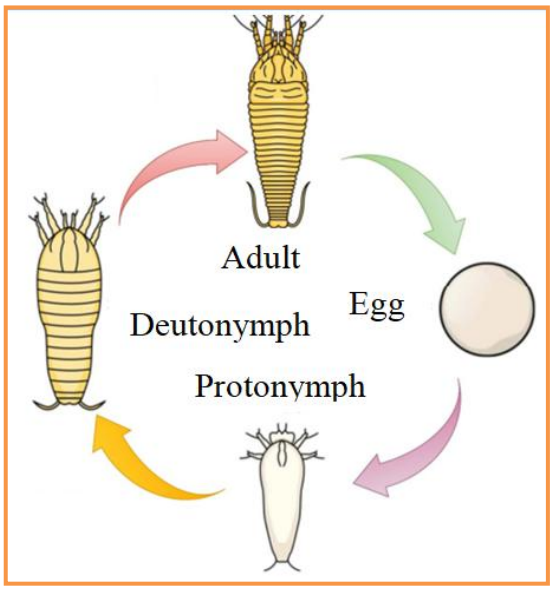
Vermiform type of eriophyid mite



Fusiform type of eriophyid mite

Biology of Eriophyid mites

The life cycle of eriophyid mites begins with oviposition on host plant tissues, with the timing and site of egg deposition influenced by factors such as host suitability and environmental conditions, particularly temperature. The eggs are minute, oval to spherical in shape and translucent to whitish in colour and are typically laid on young leaves, buds or other tender plant parts. Upon hatching, the mites emerge as larvae possessing three pairs of legs, representing the only hexapod stage in their development. During this stage, larvae are relatively active and feed on plant cells using specialized piercing-sucking mouthparts. Following the larval stage, eriophyid mites undergo two nymphal stages, namely the protonymph and deutonymph (often referred to as tritonymph in earlier literature), during which they develop the characteristic four pairs of legs. The final stage is the adult, which is morphologically distinguished by its vermiform body and two pairs of legs located anteriorly. Adult mites are responsible for feeding, reproduction, and population establishment, thereby ensuring continuity of the species. Female mites typically lay between 20 and 50 eggs over their lifespan (Mahmood *et al.*, 2024).



Life cycle of Eriophyid mites

Eriophyid mite damage symptoms

Eriophyid mite infestations produce a range of characteristic symptoms in host plants, which can be broadly classified based on the type of damage induced. Gall-forming species stimulate abnormal growths on leaves, stems, buds, or floral parts, resulting in structures that may be spherical, spindle-shaped, or irregular, serving both as feeding sites and protective habitats for the mites. Leaf-rolling species cause curling, folding, or rolling of leaves along the margins or midrib, leading to a reduction in eff Egg hotosynthetic area and consequent impairment of plant growth. Erenium-forming mites induce the development of dense, felt-like patches of trichomes, usually on the abaxial leaf surface, due to hypertrophy and

hyperplasia of epidermal tissues. In contrast, blister mites cause localized swellings or raised areas on leaves, formed by the separation of epidermal layers, often appearing as translucent or discolored blisters. In specific crops, eriophyid mite damage is associated with distinct symptomatology. In redgram, infestation by eriophyid mites is closely linked with sterility mosaic disease (SMD), characterized by mosaic patterns, chlorotic ring spots, reduced leaf size, severe stunting, and in advanced cases, complete sterility. In coconut, the eriophyid mite *Aceria guerreronis* infests developing nuts, causing necrotic lesions, longitudinal fissures, suberization and exudation of gummy substances, which result in deformation of nuts and significant reductions in yield and quality. Such damage is of considerable economic importance, particularly in major coconut-growing regions.

Gall formers

Leaf rollers

Erineum formers

Blister mites

Symptoms of SMD of redgram (A,B) Mosaic patterns (C,D) Chlorotic ring spots (E) Stunted growth with little leaf symptoms (F) Complete sterility

Coconut eriophyid mite

Control Strategies

Integrated Pest Management (IPM)

It is a holistic and sustainable approach for managing eriophyid mite infestations by integrating cultural, physical, biological and chemical control methods to maintain populations below economic damage thresholds (Mahmood *et al*., 2024).

Cultural control: It provide sustainable and environmentally sound approaches for managing eriophyid mite infestations. Crop rotation with non-host species disrupts the mite life cycle by limiting access to suitable hosts, thereby reducing population buildup. Sanitation practices, including the removal and destruction of infested plant material, particularly during dormant periods, help eliminate overwintering sites and lower subsequent infestations. Effective weed management is also essential, as weeds can serve as alternative hosts (Mahmood *et al*., 2024).

Physical control: It measures further contribute to mite suppression. Mechanical removal of infested plant parts and the use of high-pressure water sprays can effectively reduce mite populations and limit their spread (Chong, 2022). Environmental manipulation, such as optimizing planting density, irrigation, and plant health, can create unfavorable conditions for mite development. Additionally, physical barriers like fine mesh netting or row covers can prevent mite colonization.

Biological control: Biological control offers an eco-friendly and sustainable approach for managing eriophyid mite infestations by utilizing natural enemies to regulate their populations. Predatory mites, particularly those belonging to the family Phytoseiidae, are among the most effective biological control agents, feeding on eriophyid mite eggs, immatures, and adults. Species such as *Phytoseiulus persimilis* and *Neoseiulus californicus* are widely used, with their efficacy influenced by environmental conditions, especially moderate temperatures (20–30 °C), high humidity (60–80%) and prey availability. In addition, lady bird beetles (e.g., *Stethorus* spp.) contribute to mite suppression by feeding on eggs and nymphs and their conservation can be enhanced through habitat management and reduced use of broad-spectrum insecticides (Kalile *et al.*, 2023). Other biological agents include entomopathogenic nematodes such as *Steinernema feltiae*, which infect and kill mite

stages in soil or plant debris, with their effectiveness dependent on soil moisture and temperature (Shahid *et al*., 2023). Predatory insects, including lacewings (Chrysopidae) and minute pirate bugs (Anthocoridae), act as generalist predators that feed on eriophyid mites and other small arthropods. Furthermore, entomopathogenic fungi such as *Beauveria bassiana* and *Metarhizium anisopliae* can infect and eliminate mites upon contact, although their field efficacy is influenced by environmental conditions and application methods.

Chemical control: Chemical control using acaricides for managing eriophyid mite infestations in agricultural systems. The effectiveness of acaricides depends on factors such as the chemical class, mite species, developmental stage, and application practices. Commonly used acaricides include organophosphates, pyrethroids, and neonicotinoids, although their selection is influenced by regulatory guidelines and resistance status. The efficacy of these compounds varies, with eggs and immature stages often being more susceptible than adults and is further affected by dosage, timing and frequency of application. However, the widespread and repeated use of acaricides has led to the development of resistance in eriophyid mite populations, reducing their long-term effectiveness.

Conclusion

Eriophyid mites are important pests that cause significant damage to crops. They produce symptoms such as galls, leaf rolling, erineum and blisters. Some species also transmit plant viruses and reduce crop productivity. Integrated Pest Management (IPM) is essential for their sustainable control. Combining cultural, physical, biological and chemical methods provides effective management.

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