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Postembryonic development of the coconut mite, *Aceria guerreronis*, on coconut in Kerala, India*

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Abstract

The coconut mite, *Aceria guerreronis* Keifer (Eriophyidae), has invaded and caused significant problems to most of the coconut plantations in southern India. Several factors appear favorable for the invasion of the mite, especially continuous availability of young fruits suitable for attack and optimum temperature most of the year. This study was conducted to evaluate details of the morphology of the immature stages and the development of *A. guerreronis* on coconut. It was conducted in a laboratory at 28 ± 2°C and 80% RH. The eggs were small (66 ± 4 and 41 ± 2µm for long and short axes), and a single female laid an average of 66 ± 4 eggs during 15 days of oviposition period. Incubation period lasted 2.5–3.5 days. Hatching was completed in about 30 minutes. The larva emerged through a longitudinal slit on the surface of the egg. Almost transparent and sluggish and measuring 87 ± 12µm long, it started feeding soon after emergence. The active period of the larva lasted 1.5–2.5 days, being followed by a quiescent period that lasted about one day. The nymph measured 176 ± 11µm in length; the active and quiescent periods of this stage lasted 2 and 0.5–1.5 days, respectively. Adult females had an average length of 224 ± 9µm. Eight to ten days were necessary for immature development.

Key words: Biology, coconut, Eriophyidae.

Introduction

The coconut mite, *Aceria guerreronis* Keifer, has now earned the status of a dreadful international pest, damaging coconut plantations of many countries. After its first appearance as a minor pest in Guerrero, Mexico, in 1965, the mite extended its distribution to South America (Keifer, 1965; Robbs & Peracchi, 1965; Aquino *et al*., 1967; Doreste, 1968). A few years later, it was found in Africa (Mariau, 1969). Within a decade, the mite spread to parts of Central America and other African countries (Hall & Espinosa, 1981; Mariau, 1977). The arrival of this mite in Asia in the last decade marked the 'black era' for the coconut plantations of Peninsular India and Sri Lanka (Sathiamma *et al*., 1998; Haq, 1999). The quick spread of the mite to new areas could be related to its dispersal ability, but other aspects are likely to also contribute to it, as for example its biotic potential (Griffith, 1984; Ramarethinam & Marimuthu, 1998; Haq, 1999; Sumangala & Haq, 2005). The objective of this work was to study details of the morphology of the immature stages and the postembryonic development of *A. guerreronis* on coconut under laboratory conditions.

Materials and Methods

Coconut rachillae bearing nuts of 4–8 weeks of age were collected from Chavakkadan green variety of coconut plant and brought to the Acarology laboratory of Calicut University. Each of these was fixed in the central part of a beaker with plaster of Paris. After hardening, the plaster of Paris base

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was moistened daily with 100 mL of water to keep the rachillae fresh. Rearing units were prepared with these nuts. A glass ring (3.0, 4.5 and 2.5 cm in internal diameter, external diameter and height) was fixed on the surface of the nut after removing the tepals, in such a way as to encircle part of the meristematic tissue. Commercially available molding clay was used to fix the ring. A cover slip (1 mm thick, 4 cm in diameter) was used to close each rearing unit, to prevent mite from escaping.

A single adult female of *A. guerreronis* was transferred from the stock colony to each rearing unit. The units were checked every three hours, transferring each deposited egg to a similar rearing unit. The units containing the newly transferred eggs and all subsequent stages were checked every 2–3 h, until each mite reached adulthood, to determine duration of each stage (n= 10 for each stage). Observations were performed under a Wild M-420 stereomicroscope. Mites were transferred to new units when the units they occupied were considered physiologically unsuitable. The study was conducted in a laboratory at 28 ± 2°C and 80% RH. Specific observations on processes like hatching, moulting and quiescence were conducted other than regular culture examination. This was carried out with the help of a Leitz Aristoplan Research Microscope having light and dark, phase contrast and fluorescence facility. Measurements were taken for an average of five individuals of each stage with the aid of a micrometer.

Results

Eggs were usually oval (66 ± 4 and 41 ± 2μm for longer and shorter axes), almost transparent and glittering (Fig. 1). They were laid solitarily all over the meristematic area. A few hours before hatching, they became milky white. Immediately before hatching, a small projection appeared at the animal pole of the egg. Subsequently, this region extended into a longitudinal slit which slowly increased in length. Thrashing movements of the emerging larva against the longitudinal slit helped to widen the gap. After some time, the anterior region of the larva slowly wriggled out half way. With further wriggling, the remaining part of the body emerged. Hatching was accomplished in about 30 minutes. Incubation period lasted 2.5–3.5 days.

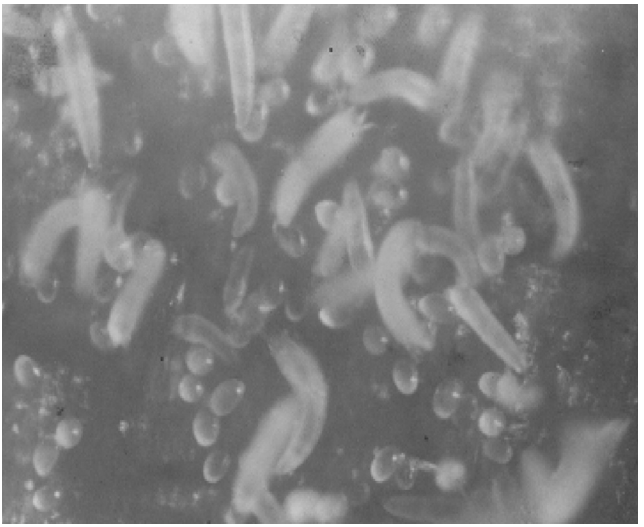

FIGURE 1. Developing colony of *Aceria guerreronis* showing egg and postembryonic stages.

The larva was very small, vermiform, almost transparent (Fig. 2) and on average 87 ± 12μm long and 38 ± 1μm wide. They started feeding soon after emergence. The active period of this stage lasted 1.5–2.5 days, being followed by a quiescent period that lasted about one day. The quiescent form was turgid and milky. At the end of the quiescent period, a dorso-longitudinal slit appeared at the anterior end of the body. Subsequently, gnathosoma and legs protruded. With the constant movements of the legs the slit widened up and the nymph emerged. The moulting process was completed within 15–20 minutes.

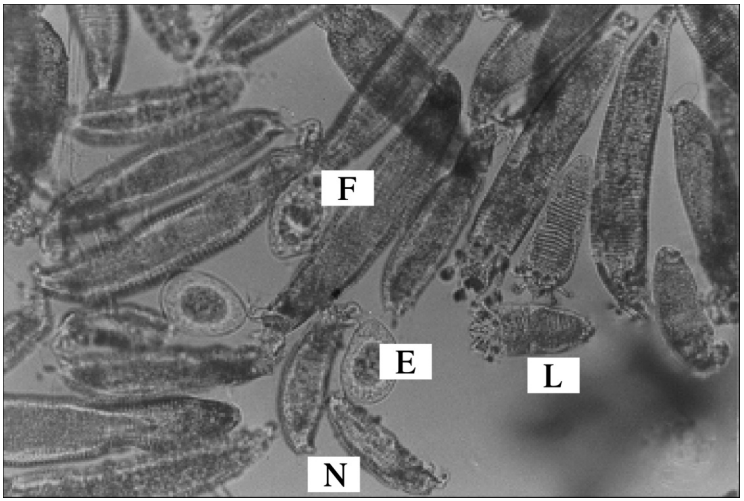

FIGURE 2. Different developmental stages of *Aceria guerreronis*: F—Female; E—Egg; L—Larva; N—Nymph.

The nymph was pale whitish, measuring 176 ± 11μm long and 41 ± 2μm wide. It actively fed for about two days and then became quiescent for 0.5–1.5 days. The quiescent form was also turgid and milky. Molting process to adult stage was similar to what was reported for the previous molting.

Oviposition started about three days after adult emergence; eggs were laid on the meristematic region of young nuts. Each female laid an average of 66 ± 4 eggs within an oviposition period of 15 days.

Adults were whitish and measured 224 ± 9μm long and 42 ± 3μm wide. Total development from egg to adult was completed in 8–10 days.

Discussion

The results reported in this study are in some aspects quite different from those reported by Ansaloni & Perring (2004), who studied the biology of this mite on *Syagrus romanzoffiana* (Cham.) Glassman at 15, 20, 25, 30 and 35°C. In that study, conducted at 27°C, the average oviposition rate was much lower (11.6 eggs per female), but the oviposition period was longer, 23 days. The oviposition rates of the present work and of Ansaloni & Perring (2004) are however much lower than reported by Singh & Singh (2003) and Chandrika Mohan & Nair (2000) on coconut, respectively 250 and 200 eggs per female.

While conducting field studies on crop loss due to invasion by *A. guerreronis* in Benin, Mariau (1977) reported a developmental cycle of 10 days for this mite, close to the duration reported by Haq (2001), 8 to 10.5 days. In their elaborate study on the impact of various temperatures on immature development and mortality of *A. guerreronis*, Ansaloni & Perring (2004) concluded that developmental time of all life stages decreased with increasing temperatures and that optimal temperature for development was 33.6°C. This can probably explain the high population build up of the mite in Kerala in the summer.

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