Biological Studies of Coconut Infesting Mite- *Dolichotertranychus COCOS*

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**ABSTRACT**

Breeding behaviour, embryonic and post embryonic development of the tenupalpid mite *Dolichotertranychus cocos*, H.W. Flechtmann and L.C.P. Fernando, 2000 were studied in detail by successfully rearing the mite on nuts kept in a desiccator under laboratory conditions. Mating, oviposition, hatching, the various developmental stages and total duration in days from egg to adult are described in the present paper. Sketches showing ontological development and life history are also given.

**Key words**: *Dolichotertranychus cocos*, Mating, oviposition, hatching, larva, moultling, protonymph, deutonymph and adult.

**Introduction**

Members of the family tenupalpidae are usually associated with agricultural and horticultural crops. Very little work has been done on the breeding biology of Tenuiupalpid mite. The different life stage of mite fauna associated with cause severe damaged to host plant coconut [15]. Different species of the mite were reported and described [11,14] from Perianth of coconut. The duration of the different stages was more strongly affected by the temperature than by the species of the plant [9,2,13]. Lazarova [10] recorded 70-75% RH as the most suitable one for embryonic development of the species *B. obovatus* (Tenupalpidae) in laboratory conditions. While studying the developmental process of Tenuiupalpus oudeman, Dosse [4] observed that the period incubation ranged from 18-23 days. Flechtmann and Fernando [5] described the morphology and post embryonic developmental stages of *D. cocos* from Sri Lanka. The present study is undertaken to investigate the breeding behaviour, the embryonic and post embryonic development of *D. cocos* under constant temperature and relative humidity.

**Materials and methods**

*D. cocos* infested nuts were collected from various coconut plantations of Kerala state, India. In the laboratory the tepals of the infested nut were separated and were care fully examined under the microscope for describing the presence of mite. Developmental studies of *D. cocos* were carried out in the laboratory by successfully rearing the mite on nuts kept in a desicator maintained at a temperature of 25 ± 1°C and RH of 88%. Mites from the infested nuts were isolated with the help of a camel hair brush and released into fresh tepals. Such tepals were placed over water soaked cotton in a petridish and kept covered by another tepal over them so as to provide a concealed habitate to the developing mite. The entire set up was placed in a desicator and sealed with grease. Regular observations were made to collect data on various aspects of breeding viz., mating, oviposition, incubation of egg, hatching process, larval and nymphal development and so on. The eggs laid by gravid females were immediately transferred to fresh tepals using camel hair brush and kept in desiccator for tracing subsequent development. Studies on embryonic development
were conducted by preparing slides of the eggs at different hours of incubation. In the present studies at zero hour, after 11th hour, 23rd hour, 35th hour, 47th hour and 59th hour. Data were also collected on the pre-oviposition period, oviposition period, morphological features of the active and inactive developmental stages; adult longevity etc. permanent sites of the various life stages were prepared. Mounted studies (Hoyer’s medium) were then examined under an Olympus Research Microscope (BH2) and figures were drawn using a camera lucida attached to Meopta Research Microscope. Measurements of all stages were taken with the help of an ocular micrometer. Necessary photo graphs were taken with the help of a Pentax camera. Details regarding the duration of development from egg to adult including the duration of each individual stages were worked out.

Results and discussion

Mating

Males and females were sexually mature at the time of emergence. Immediately after moulting of the deutonymphal stage, the males were found actively wandering on the surface of the tepals in search of females or quiescent female deutonymphs. (When it found a female deutonymph in the quiescent stage it settled very close to it and waited for its moulting and also helping to cast off the moulting skin. If the male, on locating an achievable female, the male was found gradually climbing over the back of the female by clasping around the female hysterosoma with its first and second pair of legs, so that both pairing individuals were facing the same direction. After a short time, the male raised its aedeagus upward and then actively pushed its narrow forked tip in to the genitalia of the female for 10 to 15 minutes. The process of mating lasted for maximum of 35 minutes. A single male was found mating with several females but a female usually mated only once. Occasionally the males were found copulating with female quiescent deutonymphs also by removing the molting skin of the latter with the aid of the first pair of legs.

Oviposition

Result of field and laboratory observations indicated that D. cocos usually oviposited with the feeding sites. During oviposition process, the adult female remained stationary for some time and then lowered the posterior region of the hysterosoma for laying eggs. The eggs laid were usually found distributed at specific feeding area and fluid to the surface by an adhermy fluid. Generally the process of oviposition initiated 4-5 days after adult emergence and single female was found laying an average of two eggs per day. The oviposition period lasted for 3-6 days. Thus fecundity of individual female ranged from 6-12 eggs under laboratory conditions.

Incubation and Embryonic Development

The result of the studies on the embryonic developmental period of eggs were traced in different stages of incubation such as zero hour, 11 hours, 23 hours, 47 hours and 55 hours.

At Zero hour (length 180 mm-width 80 mm)

The freshly, laid eggs appeared smooth, transparent, light yellowish in colour and centroleathel. Yolk spherules and central cytoplasm and diromic membrane (Fig. 1 A) outer to these two membranes, an egg membrane could be detected.

After 11 hours: (length 224mm and width 112 mm)

The egg which were incubated for 11 hours showed distinct evidences of cleavage, especially superficial cleavage, resulting in the formation of uniform monocular blastoderm layer. The process of balstoderm formation was followed by total cleavage (Fig. 1 B).

After 23 hours (length 248mm- width 120 mm)

The egg at this period of development showed intensive cell division with the utilization of remaining yolk mass. Ectoderm and extra embryonic area could clearly demarked. Meanwhile, the germinal disc bilateral symmetry. The embryo showed embryonic ectoderm and endoderm, it now had reached the gastrula stage. A gastric lip was also formed at the anterior end of the developing embryo (Fig. 1 C).

After 35 hours (length 256 mm and width 140 mm).

The egg at the 35th hour of incubation showed the development of embryonic metameres which were anteriorly formed an acron, primary buds for pedipalp and chelicerae and also first pair of legs. Posteriorly, the metameres formed opisthosomal segments and limb buds for the 2nd and 3rd pair of legs. This stage was also caracterized by the appearance of the body setae (Fig. 1 D).

After 47 hours (Length 256 mm and width 140 mm)

A rapid progress in morphogenesis and organ formation was noticed during this stage. Interior metameres together with the acron formed the
The new ly emer ged lar va was more or less oval white coloured and easily distinguishable from other life stages by the possession of three pairs of legs (Fig. 2 A). The larva appeared smaller with an average length of 183 mm and width of 93 mm. Larva showed feeding activity for a period of 1.23 to 2.22 days and during this period a change in colour from white to pale yellow was noticed. At the end of the active period, the larva entered in to the first quiescent phase which lasted for 1.25 to 2.35 days. On subsequent moulting, the protonymph emerged out.

Protonymph

The average length of protonymph was 226 mm and its average width was 102 mm. It was pale yellowish in colour and characterized by its larger size and presence of four pairs of legs. Body striations and setae were prominent (Fig. 2 B). The feeding activity of protonymph was similar to that of the larva and active period lasted for 1.85 to 2.24 days. Later, it entered in to the second quiescent period which lasted for an average of 2.14 days, on moulting the protonymph emerged out as deutonymph.

Deutonymph

The mean length of the deutonymph was 304 mm and the mean width was 105 mm. The deutonymph was slightly larger than the protonymph, pale yellow in colour and well ornamented with striations and setae. Sexual dimorphism was evident at the deutonymphal stage. The male deutonymph possessed a more or less pointed posterior end (Fig. 2 C) while the posterior end of the female deutonymph was rounded with under developed genitalia (Fig. 2 D). The active deutonymphal period of male was 2.10 to 2.52 days. The quiescent phase of male deutonymph was 1.75 to 2.10 days while that of the female deutonymph as 1.75 to 3.1 days. Subsequent moulting of the quiescent deutonymph resulted in the emergence of adults.

Male

Newly emerged males were pale yellow in colour which gradually turned into creamy yellow during successive days. Sexually matured males were distinctly smaller than the females, measuring 228 mm in length and 101 mm in width (Fig. 2 E). The posterior end of the male hysterosoma appeared conical due to the forked nature of aedeagus. Males were comparatively more active and fast moving than the females. Longitudinal striations were seen on the propodosomal region of the male and horizontal striations could be detected at the posterior hysterosomal region.

Female

Adult female was much larger in size, measuring 348 mm in length and 120 mm in width. The female on emergence was light red in colour and gradually turned into dark red. Horizontal striations were detected at the anterior propodosomal region while longitudinal striations were noticed at the hysterosomal region of the female (Fig. 2 F). The rear end of the female hysterosoma was rounded bearing genital plate on the ventral side.
Fig. 1: Embryonic development of *Dolichotertranychus cocos* at different hours of incubation. A. At 0 hour; B. After 11 hour; C. After 23 hour; D. After 35 hour; E. After 47 hour; F. After 59 hour.

Fig. 2: Life stages of *Dolichotertranychus cocos*. A. Larva; B. Portonymph; C. Deutonymph male; D. Deutonymph female; E. Adul male; F. Adul female.

**Moulting**

The development of *D. cocos* involved in three distinct moulting periods subsequent to each of the quiescent periods. In the laboratory, the moulting process took about 15-20 minutes for completion. During this process, the outer cuticle turned silvery white in colour and horizontal slit or streak appeared at the mid dorsal region of the body, between the second and third pair of legs. The slit after its appearance extended further, continuing to the ventral region of the cuticle also. As a result of this, the
cuticle got divided into anterior and posterior halves. However, the anterior half of the cuticle remained intact from which the individual emerged out by making slow backward movement. Occasionally, remnants of moulting such were also found attached to the body of the emerging individuals.

Duration of Development

The duration of development from egg to adult in *D. cocos* took an average of 15.42 days. Here, the male required an average of 13.93 days while the female generation was completed with an average of 15.92 days. The females initiated oviposition after 4-5 days of emergence. Hence the total duration of *F*1 generation required 20.42 days at a temperature of 25 ± 1°C and 88% RH. A similar variation was observed in the longevity of the male and female individuals also as evidenced in the laboratory condition. It was observed that the female had an average longevity of 15.03 days and that of the male was 7.2 days.

Discussion

Tenuipalpid mites are known to inflict different degree of damage to their respective host plant as illustrated by various authors [6,7]. The feeding activity of the mite showed great resemblance to that of another species of the genus viz., *D. vandergootti* reported by Sathiamma [14]. The mating time recorded in this species appeared to the other members of the family like *Raoiella indica* as reported by Nagesh Chandra and Channa Basavanna [13]. However, the mating pattern in both the species showed much resemblance, despite the variation observed in the duration. Similar variations could also be recorded in the duration of pre-oviposition period also, which lasted for an average of 4.5 days in *D. cocos* unlike that of *B. phoenicus* which required 2.34 days [3]. The rate of oviposition in *D. cocos* resembled that of *R. indica* as reported by Moutia [12]. The duration of development of *D. cocos* when traced under laboratory condition of 25 ± 1°C and 88% RH showed great variation from that of other tenuipalpid members. Species like *B. obovatus, B. californicus* and *B. phoenicus* required 29.9, 27.8, 26.5 days respectively for the completion of their development from egg to adult at 27 ± 1°C [17]. However, developmental time of *D. cocos* from egg to adult was 15.45 days at the temperature of 25± 1°C. This difference in the duration of the development can be accounted for the variation in temperature and RH. The current study also helped to acquire knowledge on the embryonic development of *D. cocos*. Only very little is known about acarine embryology, with exception of a few [16,8,1].

References
