

THE LIFE CYCLE OF *CHARLETONIA TAIWANENSIS* TSAI AND CHOW (ACARINA: ERYTHRAEIDAE)¹

CHERN-FENG YEN, RU-SHIOW TSAI
and YIEN-SHING CHOW²

Institute of Zoology, Academia Sinica,
Taipei, Taiwan 11529,
Republic of China

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Chern-Feng Yen, Ru-Show Tsai and Yien-Shing Chow (1991) The life cycle of *Charletonia taiwanensis* Tsai and Chow (Acarina: Erythraeidae). *Bull. Inst. Zool., Academia Sinica* 30(2): 99-106. The larval mite, *Charletonia taiwanensis* is frequently found as an ectoparasite on the grasshopper, *Condracris rosea* Degeer in the mountainous areas of Taiwan. There are six different stages in the life cycle of *C. taiwanensis* which include egg, larva, proto-, deuto-, tritonymph and adult. The eggs are orange in color and elliptical in shape. The six-legged larva position themselves as parasites on the posterior wings of the grasshopper, *Condracris rosea* feeds on the hemolymph. After hemolymph feeding is complete, the larvae become immobile protonymphs with membranous exuvia. No feeding occurs during this period as the free living eight-legged deutonymphs emerge from protonymphs, they are active and feed on the eggs of Lepidoptera, Homoptera and small insects of Homoptera. They then become immobile tritonymphs as the adults emerge from tritonymphs, they feed on the eggs of *Notolophus australis posticus* Walker until they lay their eggs.

Key words: *Charletonia taiwanensis*, Ectoparasites, Life cycle, Free living.

The rearing of erythraeid mites has been studied all over the world. However, few species have been successfully reared in the laboratory. Some of these mites are predacious during larva, nymph and adult stages, e.g. *Balaustium putmani* (Cadogan and Laing, 1977; Putman, 1970) and *Leptus* sp. (Treat, 1979). Some mites are parasitic larvae but are predacious during deutonymph and adult stages. For example the deutonymph and the adult of *Callidosoma metzi* Drooz and Treat are predacious on lepidopteran eggs. In

Lasioerythraeus johnstoni deutonymph and the adult are predacious on tarnished plant bug nymphs (Sharma *et al.*, 1982; Young and Welbourn, 1987). Many species belong to the erythraeid *Charletonia* genus of which the larvae are parasitic in form. Although deutonymphs of several species of this genus were reared successfully from larvae (Rosa and Flechtmann, 1980; Treat, 1980), studies on postlarval stages were not found. In an earlier report, a local species, *C. taiwanensis*, which has the parasitic larva, was described (Tsai and Chow, 1989). In this paper, we will add

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2. To whom reprint request should be sent.

more details on the prey of the other postlarval stages and describe the entire life cycle of this species which survived in our laboratory for the first time.

MATERIALS AND METHODS

Ectoparasitic larvae *C. taiwanensis* were collected and kept on the posterior wings of grasshopper, *Condracris rosea* during the late summer until they became immobile. After the emergence of the protonymphs, the deutonymphs were individually kept in a covered petri dish (I. D. 5 cm). Different foods were tested including honey water (2%), pollen grains (*Portulaca* sp.), one species of toad, eggs of many species of insects and other small insects (Table 1) to feed the deutonymphs until they became tritonymphs. After the emergence of the tritonymphs, eggs of *Notolophus australis posticus* which is one of the kinds of prey that are able to survive the deutonymphs and are easily obtained from our laboratory, were used to feed the adults. Groups of 10 to 15 adult mites were gathered in a covered petri dish (I. D. 9 cm) until they laid eggs in large quantities.

Different stages of these mites were kept in the laboratory ($25 \pm 1^\circ\text{C}$, $80 \pm 5\%$ RH) to record their life cycle. During the spring because this is not the season for the grasshopper, *Condracris rosea*, the larvae were reared on the posterior wings of another grasshopper, *Catantops splendens* (Thund.) (collected from orange orchards in Nankang). Nymphs of *Coccus hesperidum* and eggs of *Notolophus australis posticus* were used to feed the deutonymphs. Distinctions between different stages were observed under a binocular microscope. Some of the deutonymphs were immersed in lactophenol fluid to clear and observe the details of the mouthpart under a light microscope.

RESULTS

Rearing

Food that can survive the deutonymphs of *C. taiwanensis* are shown in Table 1 and Fig. 1. After the deutonymphs feed on eggs of *Notolophus australis posticus*, *Spodoptera exigua*, *Papilio memnon heronus*, *Nisia serrata*, *Rhynchocoris humeralis*, spiders and small insects such as nymphs of *Aleurocanthus spiniferus* and *Coccus hesperidum*, they can survive and develop into the tritonymph stage. Honey water (2%) was also supplied to the deutonymphs. This kept the deutonymph alive for a short time, but it couldn't sustain the mite to reach tritonymph stage. Deutonymph couldn't survive on pollen grains (*Portulaca* sp.), eggs of *Dacus dorsalis*, *Plutella xylostella*, larvae of *Drosophila melanogaster*, *Plutella xylostella*, nymphs of *Planococcus citri*, *Nisia serrata*, *Uroleucon formosanus* or toads.

Life cycle

After the larvae of *C. taiwanensis* hatched from the eggs, larvae climbed up the body of the grasshopper, *Catantops splendens* (Thund.) The developmental duration of all stages were observed in the laboratory ($25 \pm 1^\circ\text{C}$, $80 \pm 5\%$ RH) and are shown in Table 2.

Larva (Fig. 2a)—Red colored, $500\text{--}1,186\mu$ in length, and $250\text{--}668\mu$ in width, parasitizing on the posterior wings of the grasshopper, *Condracris rosea* or *Catantops splendens* (Thund.). After the larvae feeding on the hemolymph, they detached from the grasshopper and became protonymphs.

Protonymph (Fig. 2b)—If there is a membranous exuvium around the body of the larva, the immobile protonymph stage forms the size with a length of $1,750\text{--}1,958\mu$ and a width of $1,063\text{--}1,183\mu$. There was no feeding during this period.

Deutonymph (Fig. 2c)—The eight-legged deutonymph, $1,333\text{--}2,180\mu$ in length

Table 1
Different kinds of food tested for the rearing of the deutonymphs
of *Charletonia taiwanensis*

Order	Food	Deutonymph survived*
	Honey water (2%)	—
	Pollen grains (<i>Portulaca</i> sp.)	—
Diptera	<i>Dacus dorsalis</i> (egg)	—
	<i>Drosophila melanogaster</i> (larva)	—
Lepidoptera	<i>Notolophus australis posticus</i> (egg)	+
	<i>Spodoptera exigua</i> (egg)	+
	<i>Plutella xylostella</i> (egg)	—
	(larva)	—
	<i>Papilio memnon heronus</i> (egg)	+
Homoptera	<i>Aleurocanthus spiniferus</i> (nymph)	+
	<i>Coccus hesperidum</i> (nymph)	+
	<i>Nisia serrata</i> (egg)	+
	(nymph)	—
	<i>Uroleucon formosanus</i> (nymph)	—
	<i>Planococcus citri</i> (nymph)	—
Hemiptera	<i>Rhynchocoris humeralis</i> (egg)	+
Araneina	Spider (egg)	+
Anura	Toad	—

* —: no, +: yes

and 667–1,090 μ in width emerged from the quiescent protonymph several days later. The newly emerged deutonymph was small. After it fed on some eggs through the styliform chelicerae (Fig. 4a), it grew and developed into the tritonymph.

Tritonymph (Fig. 2d)—The tritonymph, similar to the protonymph with a length of 2,000–2,700 μ and a width of 1,150–1,600 μ , was immobile and had membranous exuvium. No feeding was observed during this period.

Adult (Fig. 2e)—After a few days, the adults emerged from the tritonymph. With a length of 2,100–3,250 μ and a width of 1,250–1,600 μ the adults were similar to the deutonymph and fed on the eggs of *Notolophus australis posticus* through the styliform chelicerae (Fig. 4b). The adults had apparent reproductive organs on the venter which made them distinguishable from the deutonymph (Fig. 3). They

Table 2
The developmental time of all stages
of *Charletonia taiwanensis*
(25 \pm 1°C, 80 \pm 5% RH)

Stage	Developmental time (days)
Egg	68.3 \pm 7.4*
Larva	12.0 \pm 1.5
Protonymph	14.6 \pm 2.1
Deutonymph	23.4 \pm 5.3
Tritonymph	14.6 \pm 1.7
Adult	35.0 \pm 11.2

* Mean \pm standard error

usually aggregated in the dark areas of the container and mating occurred when there was nothing around to disturb them.

Egg (Fig. 2f)—The adults which gathered in a covered petri dish laid about three hundred eggs. The eggs were orange in color and elliptical with a size of 348 \times 248 μ .

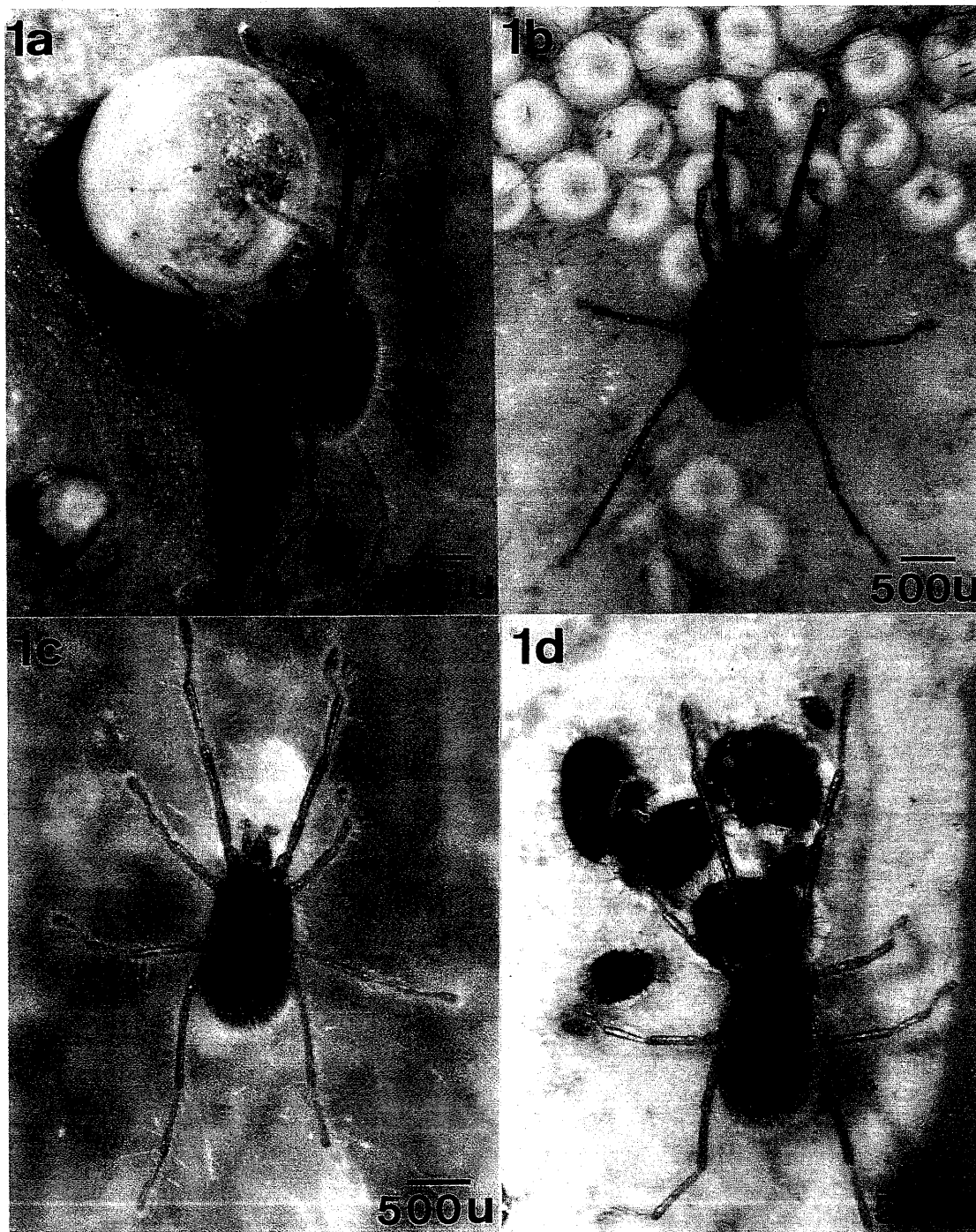


Fig. 1. Photographs of *Charletonia taiwanensis* showing a deutonymph feeds on some insects.

- a. on egg of *Papilio memnon heronus*
- b. on egg of *Notolophus australis posticus*
- c. on egg of *Nisia serrata*
- d. on nymph of *Aleurocanthus spiniferus*



Fig. 2. The developmental stages of *Chaletonia taiwanensis*.
a. larvae on the posterior wings of the grasshopper
b. protonymph c. deutonymph d. tritonymph
e. adult f. egg mass

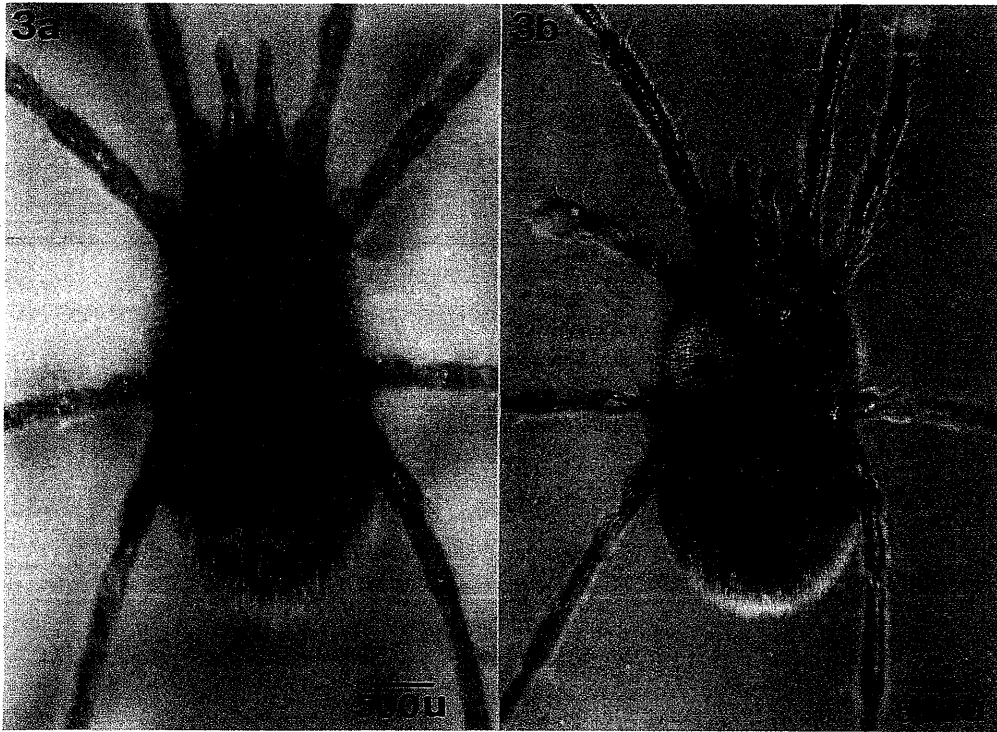


Fig. 3. Ventral side of *Charletonia taiwanensis* showing the reproductive organ (R).
a. deutonymph b. adult

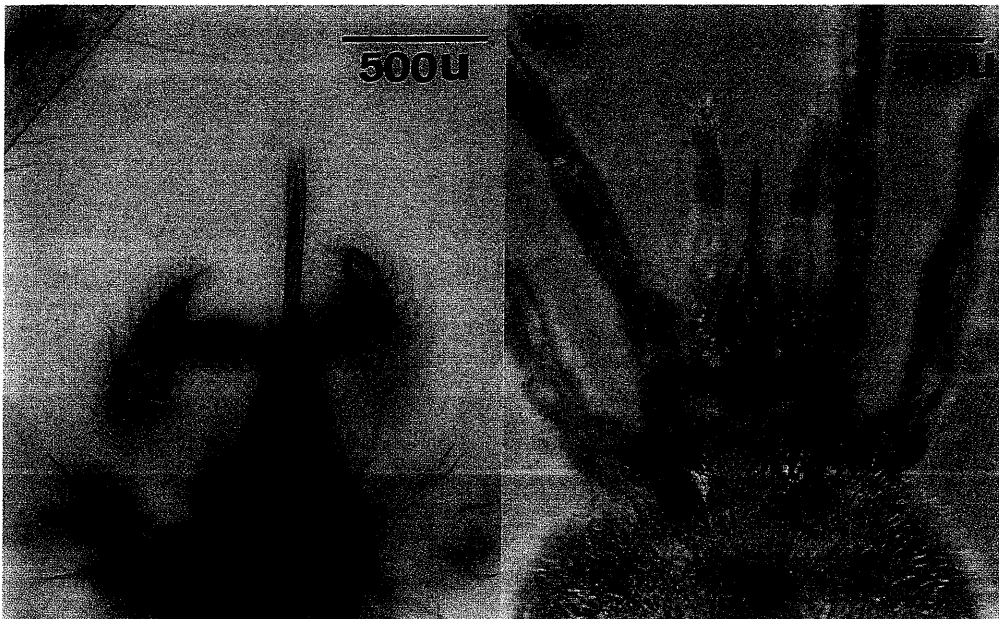


Fig. 4. Photomicrographs of the mouthparts of *Charletonia taiwanensis* showing the styliform chelicerae. a. deutonymph b. adult

DISCUSSION

The erythraeid mite—*C. taiwanensis* is different from other species of Erythraeidae, such as *Balaustium putmani*, where the larvae, the nymph and adult are free-living predators of small soft-bodied arthropods (Putman, 1970). Yet the erythraeid mite is similar to *Callidosoma metzi* and *Lasioerythraeus johnstoni* where the larvae assume a parasitic form and the deutonymph and adult assume a predacious form. The larval form of *Callidosoma metzi* is a parasite on adult *Anacamptodes vellivolata* (Lepidoptera: Geometridae). There are thirteen insect species from three orders (Hemiptera, Homoptera and Diptera) recorded which serve as hosts of the larval *Lasioerythraeus johnstoni*. However, *C. taiwanensis* is a parasite on the grasshopper, but is not able to be a parasite on bugs in its larval form. It is clear that the parasitism of the mite causes some harm to the grasshopper, but before the mite can be used as a controlling agent for the grasshopper, more experimentation needs to be conducted.

The adult has an apparent reproductive organ located on the mid-venter site. The external appearance of the genital organ between the male and female is so similar that no distinction can be made from external observation at this time. For a detailed understanding of the species, more internal anatomical work is needed in the future.

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臺灣地蠨生活史之研究

顏辰鳳 蔡如秀 周延鑫

以幼蠨外寄生在臺灣大蝗 (*Condracris rosea* Degeer) 的 *Charletonia taiwanensis* Tsai and Chow, 其生活史尚未完全明瞭。本文乃為初次在實驗室以鱗翅目、同翅目、半翅目的卵及同翅目的刺粉蝨 (*Aleurocanthus spiniferus* (Quaintance)) 成功的將幼蠨飼育至成蠨並產卵之報告, 其發育期則包括卵期 (68.3 ± 7.4 日)、幼蠨期 (12.0 ± 1.5 日)、第一若蠨期 (14.6 ± 2.1 日)、第二若蠨期 (23.4 ± 5.3 日)、第三若蠨期 (14.6 ± 1.7 日) 及成蠨期 (35.0 ± 11.2 日)。