FOLIA PARASITOLOGICA (PRAHA) 30: 357–361, 1983.

THE LIFE CYCLE OF ORNITHODOROS TADARIDAE ČERNÝ ET DUSBÁBEK (ARGASIDAE) UNDER LABORATORY CONDITIONS

E. HONZÁKOVÁ, V. ČERNÝ and M. DANIEL

Institute of Parasitology, Czechoslovak Academy of Sciences, Prague

Abstract. The life cycle of *O. tadaridae* was successfully completed under laboratory conditions with dark-coloured laboratory mouse as the host of all developmental stages. Data are given for periods of feeding, moulting, oviposition and hatching.

The species *Ornithodors tadaridae* was described by Černý and Dusbábek (1967) after three larval specimens originating from two localities in the northern coast of central Cuba (the former provinces Las Villas and Camagüey, now Sancti Spiritus and Las Tunas). All stages were later described by de la Cruz (1974) from a third locality in the same area. The larvae of this species are very similar to *O. boliviensis* Kohls et Clifford, 1964 and differ mainly in the measurements of some morphological structures (dorsal plate, palps, dorsal setae). The adults may be easily distinguished according to the form of body and hypostome. *O. tadaridae* is distinctly elongated in all stages.

The known hosts of this tick are bats of two species: *Mormopterus minutus* (Miller, 1899) (syn. *Tadarida minuta*) and *Tadarida laticaudata yucatanica* (Miller, 1902) (Molossidae). The first host species is a Cuban endemite, the second host subspecies is distributed apart from Cuba in southern parts of Mexico and Central America. Both these forms are very rare in Cuba. *M. minutus* has been known from 9 localities, *T. l. yucatanica* from four localities (Silva Taboada 1979). Under these conditions it is not surprising that *O. tadaridae* may be considered (together with *O. natalinus* Černý et Dusbábek, 1967) as an endemic *Ornithodoros* species (de la Cruz 1974).

The habitat of *O. tadaridae* is quite strange. They are the leaves of *Copernicia vespertilionum* León, 1931 (local name palma jata de los murciélagos). This palm tree may be 12–14 m high and its trunk reaches the diameter of 30–40 cm. The upper half of the ball-shaped crown is composed of upright green leaves, while the lower half, where the bats are taking shelter, is formed by a dense compact cluster of dry and solid leaves. The distribution of this palm tree in Cuba is limited to the former provinces Las Villas, Camagüey and Oriente. The palms serve as a daily refuge for the bats of the two above mentioned species and may harbour several hundreds of specimens. There are only seven findings of these bats inside the human dwellings. Both species are often found together in the same palm tree, sometimes accompanied by the third molossid species, *Eumops glaucinus* (Wagner, 1943). These hosts are exclusively insectivorous (Silva Taboada 1979).

MATERIAL AND METHODS

Figs. 1, 2

Six females represented the parental generation in our laboratory colonies. They were collected as fresh engorged by V. Černý, M. Daniel and J. de la Cruz in the leaves of *Copernicia vespertilionum* in Estero Real, Mayajigua, Sancti Spíritus on April 26, 1980. From the above mentioned tree additional 530 imagoes and nymphs of argasids belonging to the same species were collected and submitted to virological tests. Seven infectious agents were isolated from them.

The ticks were kept in a box with constant temperature 28 °C and a relative humidity 75—80 %, within a short-day photoperiod (8 hours light and 16 hours darkness). The individual specimens were kept separately in tubes with gauze tampons.

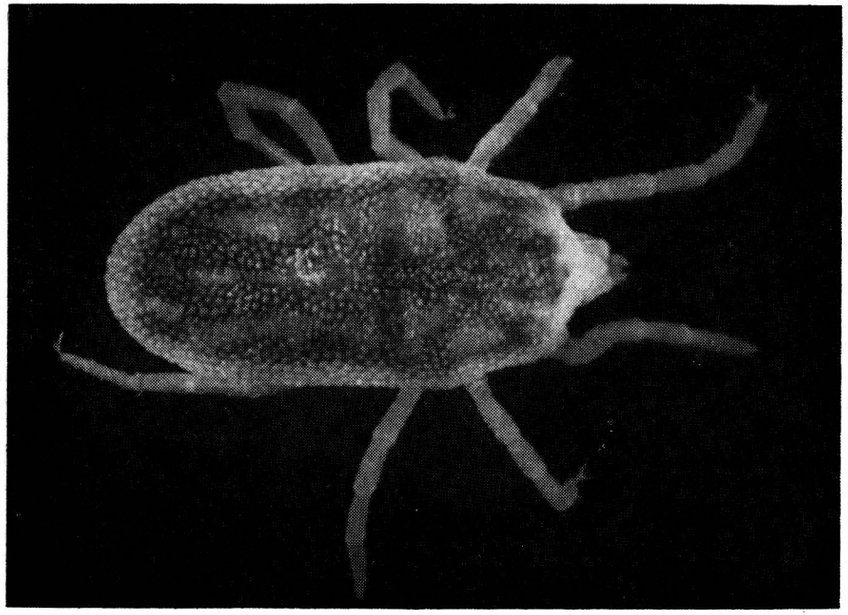

Fig. 1. *Ornithodoros tadaridae*, nymph II.

As no natural hosts for the argasid ticks were available in laboratory, three types of substitutes were tested. White laboratory mice and guinea pigs were rejected by the ticks, but the dark-coloured laboratory mouse proved finally to be the most suitable host for them. For the feeding of all developmental stages always a new mouse was used. The ticks were feeding in darkness at box temperature and humidity. Larvae were placed in a plastic cap 20 mm in diameter and fixed to the mouse's back. The cap was covered with a transparent silon fibre. The mouse with the fixed cap was placed in a wire box suspended in a container filled with water. If the cap was damaged the engorged larvae could drop off into the water and collected. Likewise, nymphs and imagoes were allowed to feed under the cap, but due to a shorter period of feeding their manipulation was easier. Males were allowed to feed together with females and after engorgement they were distributed into test tubes, always one pair per test tube.

RESULTS

Adults. The imagoes under study engorged within 10 hours after they had been planted on the host. At five-hour controls unattached imagoes were still found, but finally they fed to repletion. Females engorged within 14 days after moulting, did not feed readily. Some of them engorged after all, but mostly did not oviposit. Successful feeding and oviposition took place as late as two months after moulting. In some females the spermatofore attached to the genital orifice was found immediately after they dropped off, in others only several days after they finished feeding. The imagoes survived as many as 285 days without feeding.

Preoviposition period. The period between the engorgement and the beginning of oviposition ranged from 28 to 135 days, with an average of 76 days. This great range was observed both in the parental generation and the first filial generation. In two out of four females from Cuba, which still survived, repeated feeding and subsequent

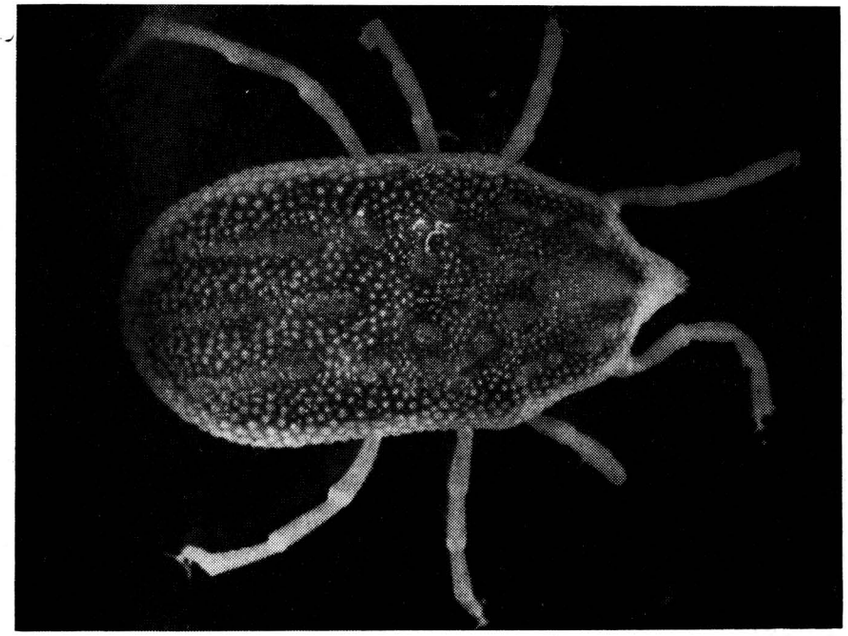

Fig. 2. *Ornithodoros tadaridae*, female.

oviposition were observed. In these cases the pre-oviposition period of females ovipositing for the second time was shorter (120 against 28, 52 against 46 days). More than two batches of eggs were never observed.

Egg production. The number of eggs oviposited by females which had engorged in Cuba on their natural host, was relatively small. It varied between 20 and 36 eggs with an average of 27 eggs, and after they repeatedly fed in laboratory they laid approximately the same number of eggs. The females of the first filial generation oviposited a much larger number of eggs (70—169) for the first and second time, with an average of 105 eggs.

Egg incubation period. This period ranged from 10 to 25 days, with an average of 18 days in all batches of eggs. The percentage of hatching larvae varied between 70 and 100 %, with an average of 97 %.

Larvae. Unfed larvae survived as many as 53 days, 41 days on the average. Out of the hungry larvae planted on the host only 8—67 % were found alive, 25 % on the average. Both the engorged larvae and the engorged nymphs of the lst stage dropped off the host. The development between the engorged larva and nymph I. was very

short in this species. The engorged larva frequently moulted directly on the host and the unfed nymph was able to attach itself immediately. The engorged larvae dropped off the mice after 6—13 days, mostly after 9 days, the engorged nymphs I. did so after 12—13 days. The engorged larvae metamorphosed into nymphs I after 5—10 days.

Nymphs. The nymphs I which had dropped off and fed to repletion on the host directly after larval feeding, rapidly metamorphosed into nymphs II (after 6—17 days). The nymphs I, which had moulted from the engorged larvae outside the host, fed on mice for 2—3 hours. Unfed nymphs II survived 30—123 days. They fed for 2—3 hours. The metamorphosis into nymphs III took 21—35 days. Unfed nymphs III survived 75—178 days. They fed for 1—2 hours. Imagoes appeared after 29—42 days. Succesful feeding of both the nymphs II and nymphs III accounted for 66 %. No subsequent nymphal stages of this species developing under laboratory conditions were observed. The sex ratio in moulted imagoes was 1 : 1.

The first moulted female of the filial generation appeared on 20 March 1982. The entire development of the engorged imago till the imago of the next generation under laboratory conditions took about 11 months. It is summed up in Table 1. Out of the initial number of 147 larvae planted on mice five females and five males were obtained (total outcome 6.8 %).

Table 1. The life cycle of *Ornithodoros tadaridae* under laboratory conditions (28 °C, 75—80 % RH)

Larval feeding	6—13 days	Adult feeding	10 hours
Larval moulting	5—10 days	Preoviposition period	28—135 days
First nymphal feeding	2—3 hours	Egg number after 1st feeding	70—169
First nymphal moulting	6—17 days	Egg incubation period	10—25 days
Second nymphal feeding	2—3 hours	Larval survival	till 53 days
Second nymphal moulting	21—35 days	Nymphal II survival	30—123 days
Third nymphal feeding	1—2 hours	Nymphal III survival	75—178 days
Third nymphal moulting	29—42 days	Adult survival	till 285 days

DISCUSSION

O. tadaridae is the first member of *Ornithodoros* species from Cuba whose life cycle could be observed under laboratory conditions. Although the ticks were fed on unnatural hosts — dark-coloured laboratory mice — with respect to the results of rearing experiments of Sonenshine and Anastos (1960), we may suppose, that our data reflect adequately the general aspects of the biology of the species. Of course, some minor differences can exist in the rates of feeding or various developmental times.

The life cycle of *O. tadaridae* was found to consist of egg, larva, nymphs I—III and adults. Two findings in our laboratory rearing experiments can be commented here. Firstly, the long period between exposure on and dropping off the host — 10 hours. A substantial part of this time was devoted to search of the appropriate site of attachement (at least 5 hours) and the feeding proper took the normal feeding time of about one hour. Secondly, the big difference between the numbers of eggs laid by the same female specimens of parental (fed on bats under normal conditions) and F_1 generation (fed on mice in the laboratory) during the first and second oviposition (average values 27 against 105 eggs). The lower number in both ovipositions of the parental females may be probably attributed to the influence of stress factors (before all, different conditions of temperature and relative humidity) during the transport of the specimens to a remote place.

We may compare our results with those obtained by Sonenshine and Anastos (1960) with laboratory rearing of another bat-infesting tick species, *Ornithodoros kelleyi* Cooley et Kohls, 1941. Some important differences were observed. In *O. kelleyi* the nymph I did not feed and moulted into the 2nd nymphal stage following a short resting period, in *O. tadaridae* the nymph I always fed. In *O. kelleyi* 2—4 nymphal stages occurred while in *O. tadaridae* only nymphs I—III were observed. In *O. tadaridae* one feeding for moulting of each nymphal stage was sufficient, but in *O. kelleyi* in several cases the nymphs III reared from larvae fed on rats required a second feeding before moulting. Although Davis (1942) reported that *O. kelleyi* would feed readily on small laboratory animals, especially in the nymphal and adult stages, Sonenshine and Anastos (1960) found that the larvae of the same species would feed successfully on bats and white rats but less satisfactorily on guinea pigs. The nymphal stages and the adults, however, would feed only on bats. In our experiments, *O. tadaridae* refused to feed on white laboratory mice and guinea pigs, but fed successfully on dark-coloured laboratory mice.

Several periods in the life cycle of the two tick species were more or less similar under experimental conditions. But the period of larval and nymphal II feeding was shorter and the period of larval and nymphal II moulting longer in *O. tadaridae* than in *O. kelleyi*. Interesting is the analogous increase of the time interval required for moulting between successive developmental stages and a high percentage of hatching larvae in both species.

ЖИЗНЕННЫЙ ЦИКЛ АРГАСОВОГО КЛЕЩА *ORNITHODOROS TADARIDAE* ČERNÝ ET DUSBÁBEK (ARGASIDAE) В ЛАБОРАТОРНЫХ УСЛОВИЯХ

Е. Гонзакова, В. Черны и М. Даниел

Резюме. В лабораторных условиях удалось завершить полный жизненный цикл аргасового клеща *O. tadaridae* в опытах на серой лабораторной мыши в качестве хозяина всех стадий развития клеща. Приведены данные о периодах кормления, линьки, яйцекладки и вылупления.

REFERENCES

ČERNÝ V., DUSBÁBEK F., The argasid ticks (Ixodoidea) of Cuban bats. Folia parasit. (Praha) 14: 161—170, 1967.

CRUZ J. de la, Notas adicionales a la fauna de garrapatas (Ixodoidea) de Cuba. III. Redescripción de *Ornithodoros tadaridae* Cerny y Dusbábek, 1967, Poeyana no 138: 1—5, 1974.

—, Composición zoogeográfica de la fauna de garrapatas (Acarina: Ixodoidea) de Cuba. Poeyana no 185: 1—5, 1978.

DAVIS G. E., Tick vectors and life cycles of ticks. Am. Ass. Adv. Sci., Publ. 18: 66—76, 1942.

SILVA TABOADA G., Los murciélagos de Cuba. Editorial Academia, La Habana, 423 pp., 1979.

SONENSHINE D. E., ANASTOS G., Observations on the life cycle history of the bat ticks *Ornithodoros kelleyi* (Acarina: Argasidae). J. Parasitol. 46: 449—454, 1960.

Received 7 December 1982.
Translated by: E. Bělyjová

E. H., Parasitologický ústav ČSAV,
Flemingovo n. 2, 166 32 Praha 6,
ČSSR