

THE INFECTIVE LARVA OF *LITOMOSOIDES YUTAJENSIS* GUERRERO ET AL., 2003 (NEMATODA: ONCHOCERCIDAE), A *WOLBACHIA*-FREE FILARIA FROM BAT

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Summary:

The infective larva of *Litomosoides yutajensis* Guerrero et al., 2003, a parasite of the bat *Pteronotus parnellii*, is described; it is distinct from congeneric infective larvae by the absence of caudal lappets. The life cycles of five other species of *Litomosoides* are known; three are parasites of rodents, one of a marsupial and one of a bat. As with these species, the experimental vector of *L. yutajensis* used was the macronyssid mite *Ornithonyssus bacoti*. In nature, the main vectors are probably other macronyssids but transmission by *O. bacoti*, with its large host-range, could account for the characteristic host-switchings in the evolution of *Litomosoides*. Unlike the murine model *L. sigmodontis* Chandler, 1931, *L. yutajensis* is devoid of the endosymbiotic bacteria *Wolbachia* and may be of great interest.

KEY WORDS: Nematoda, Filarioidea, infective larva, *Litomosoides*, bat, mite, *Wolbachia*.

Résumé : LARVE INFECTANTE DE *LITOMOSOIDES YUTAJENSIS* GUERRERO ET AL., 2003 (NEMATODA: ONCHOCERCIDAE), FILAIRE DÉPOURVUE DE *WOLBACHIA*, PARASITE DE CHAUVES-SOURIS

Description de la larve infectante de *Litomosoides yutajensis* Guerrero et al., 2003, parasite de *Pteronotus parnellii*; elle est distincte des autres espèces du genre par l'absence de languettes caudales. Comme dans les cycles de *Litomosoides* élucidés, trois parasites de rongeurs, un de marsupial, et un de chauve-souris, le vecteur expérimental est *Ornithonyssus bacoti*. D'autres *Macronyssidae* sont probablement les principaux vecteurs naturels, mais *O. bacoti*, avec son large spectre d'hôtes, pourrait expliquer que les captures sont caractéristiques de l'évolution du genre *Litomosoides*. *L. yutajensis* est dépourvu de la bactérie endosymbiotique *Wolbachia*, contrairement au modèle murin *L. sigmodontis*, et pourrait avoir un grand intérêt.

MOTS CLÉS : Nematoda, Filarioidea, larve infectante, *Litomosoides*, chiroptère, acarien, *Wolbachia*.

INTRODUCTION

The species of *Litomosoides* Chandler, 1931 are parasites of neotropical bats and terrestrial mammals, including didelphid marsupials and murid rodents (Bain et al., 1980; Brant & Gardner, 1997; Guerrero et al., 2002; Bain et al., 2003; Notarnicola, 2005). Life-cycles have been elucidated for only five of the 31 described species, three from sigmodontines (Scott et al., 1951; Bain et al., 1980; Diagne et al., 1989), one from marsupials (Bain et al., 1980), and one from a bat (Bain et al., 2002). For all of them the experimental vector used was the same, the mite *Ornithonyssus bacoti* (Hirst, 1913) (Macronyssidae).

One of these species, *L. sigmodontis* Chandler, 1931 (incorrectly named *L. carinii* in the past; see Bain et al., 1989), has become a much used murine model for filarial immunological analyses (Bain & Philipp, 1991;

Martin et al., 2001; Bain, 2002; Allen et al., 2000; Hoerauf et al., 2005). Like the majority of human filariae and other onchocercids, most species of the genus *Litomosoides* are associated with the endosymbiotic bacterium *Wolbachia pipientis* Hertig, 1936. However *L. yutajensis* Guerrero et al., 2003 is free of this endosymbiont (Casiraghi et al., 2004). As in other filarial nematodes, there is evidence that this bacterium is required for the development and reproduction of its filarial host (Hoerauf et al., 1999; Casiraghi et al., 2002), knowledge of the life cycle of *L. yutajensis*, which parasites a bat (Guerrero et al., 2003), would be of particular interest.

MATERIALS AND METHODS

Bats were collected in Yutaje, Amazonas, Venezuela (5° 36' 30" N, 66° 06' 51" W) using three mist nets between 19:00 and 21:00 in October 2004 at the end of the rainy season. Nets were placed 1-3 metres above ground level, close to a small stream in an undisturbed area of tropical humid forest. Bats were collected alive and placed individually in cotton bags. Next morning, 2 µl of blood were taken by clipping a hind claw and immediately examined microscopically for living microfilariae.

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Ornithonyssus bacoti was used as experimental vector. The specimens, originating from a laboratory colony, were kept in 6 × 1.5 cm glass tubes, each containing 25 mites (Diagne *et al.*, 1990). Mites were released to feed on a microfilarial bat which had been immobilized in soft wire mesh and then placed overnight above a container filled with water in case any mites escaped. The next morning the fed mites were recovered, placed in tubes, and kept in an ice-box with wet cotton wool to maintain 80 % humidity and a temperature close to 25-27° C.

RESULTS

FILARIAL INFECTION

Many bats were collected and immediately released but seventeen *Pteronotus parnellii* (Gray) (Chiroptera: Mormoopidae), the type host of *L. yutajensis*, were collected and examined. Of these, three had only microfilariae and one had both adults and microfilariae, about 300/10 µl; this bat (number 39 YU) was used to feed the mites. A total of 420 fully engorged male and female *O. bacoti* were recovered and, after 15 days, two motile larvae were recovered from 191 surviving mites. One of these was a fully infective larva and the other was a late second stage.

MORPHOLOGY OF THE INFECTIVE LARVA

Body 750 µm long, 15 µm wide; tubular buccal capsule 19 µm long; nerve ring and excretory pore 65 µm and 85 µm from anterior extremity, respectively; oesophagus 290 µm long, with anterior muscular part of 160 µm; tail 52 µm long; tail extremity slightly distorted and attenuated; no lateral lappets (Fig. 1A-C).

DISCUSSION

The infective larva of *L. yutajensis* had the same morphology as those previously described in *Litomosoides* species: *L. sigmodontis* Chandler, 1931; *L. legerae* Bain *et al.*, 1980 and *L. galizai* Bain *et al.*, 1989, parasitic in sigmodontines; *L. petteri* Bain *et al.*, 1980; parasitic in didelphid marsupials; and *L. chandleri* Esslinger, 1973, parasitic in bats. The infective larvae of all these species have a long tubular buccal capsule nearly 20 µm long, a distinctive character of the genus (Bain & Chabaud, 1986). *L. yutajensis*, the only *Litomosoides* species without *Wolbachia*, is distinct from the other species in the absence of the two lateral small lappets at the caudal extremity.

Only two *L. yutajensis* larvae were found. The low density of blood microfilariae of the bat used to feed the

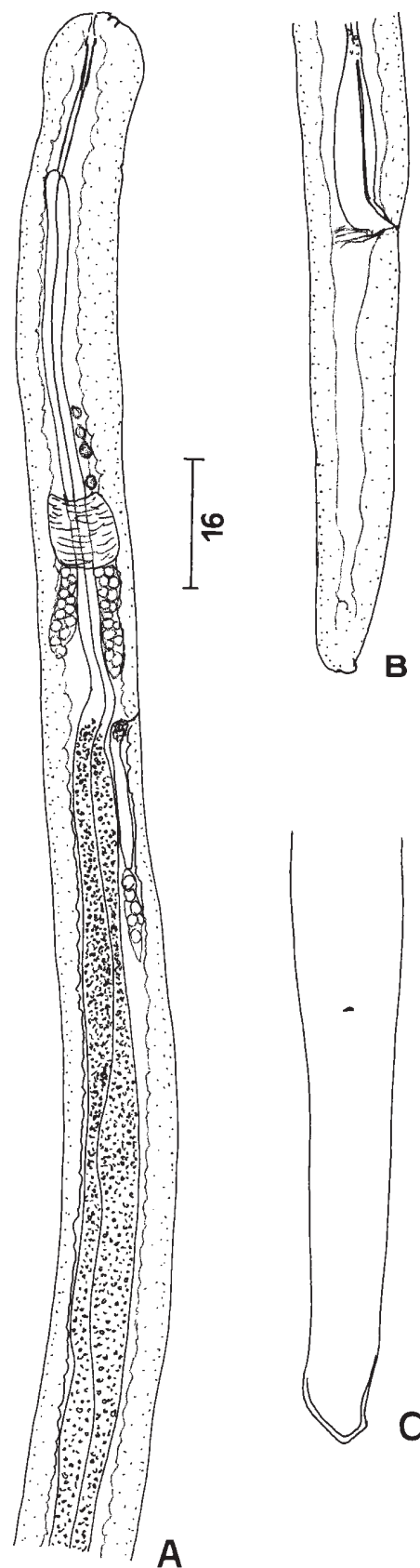


Fig. 1. – Infective larva of *Litomosoides yutajensis*. A: anterior part, right lateral view. B and C: caudal part, right lateral and ventral views, respectively. Scale bars: 16 µm.

mites was a restricting factor, since a high proportion of ingested microfilariae are destroyed by the teeth of the buccal armature (Diagne *et al.*, 1990). Moreover *O. bacoti* is probably not the natural vector, at least not the predominant one. *O. bacoti* is a widespread mite on birds and mammals (Micherdzinski, 1980; Guerrero, 1985) but it is found less commonly on bats than on terrestrial rodents and marsupials. Other macronyssids, such as *Radfordiella* spp. (Radovsky *et al.*, 1971), have been recorded on several species of bats including *Carollia perspicillata* (Linnaeus), *Anoura caudifer* (E. Geoffroy), *Glossophaga soricina* (Pallas) which also hosts *Litomosoides* species (Esslinger, 1973; Guerrero *et al.*, 2002; Bain *et al.*, 2003). An undescribed species of *Radfordiella* has been reported from *Pteronotus parnellii*, the type host of *L. yutajensis*, by Radovsky (1967), Saunders (1975) and Guerrero *et al.* (2003). Interestingly, Yunker & Chitwood (1972) reported a macronyssid, *Macronyssoides kochi* (Fonseca), containing two filarial larvae on the bat *Artibeus jamaicensis* Leach, in Mexico. The worms' size (742 µm long, 14 µm wide), the host and its geographical origin leave little doubt that they represent a species of *Litomosoides*, although the buccal capsule was not observed by these authors.

Several species of macronyssids naturally infecting bats are probably the natural vectors of *Litomosoides* species of these hosts. *O. bacoti*, although a less suitable vector, might play a role in favouring dispersion among the taxonomically unrelated mammals constituting the wide host-range of *Litomosoides*, and may be responsible for the host-switchings which seem to be a mark of the evolution of this filarial genus.

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