ABSTRACT: A new nematode species, Micropleura australiensis n. sp., is described on the basis of specimens found in the body cavity of Crocodylus johnsoni in Western Australia. The new species is mainly characterized by the length of spicules (0.360–0.366 mm) and gubernaculum (0.096–0.105 mm), the number and arrangement of male caudal papillae and 6 postanal pairs, and the postequatorial vulva. To date, it is the first species of Micropleura reported from Australia. Micropleura trionyx Arawal, 1960, and M. lissemystis Chattervati, 1985, are considered junior synonyms of M. indica Khera, 1951.

From June to October of 2002, 30 Australian freshwater crocodiles, Crocodylus johnsoni Kretfi, 1873, originating from the Ord River area, Western Australia, were examined by W. Kay as a part of a dichloro-diphenyl-trichloro-ethane study. While extracting liver and fat tissues, nematode specimens were opportunistically collected from the peritoneal cavity of these animals. A detailed study of their morphology shows that they represent a new species of the dracunculoid genus Micropleura Linstow, 1906, described below.

MATERIALS AND METHODS

A total of 30 specimens of C. johnsoni were examined: 10 animals from the lower Ord River, 10 from the Ord River Irrigation Area Drain 4, and 10 from the upper Ord River at the southern end of Lake Argyle. The nematodes were occasionally collected from their peritoneal cavity. They were fixed in 10% formaldehyde solution and cleared with glycerine for examination. Drawings were made with the aid of a Zeiss microscope drawing attachment. After examination, the specimens were briefly placed in 4% formaldehyde solution and then transferred to 70% ethanol, in which they were stored. For scanning electron microscopy (SEM), body fragments of 2 females were postfixed in 1% osmium tetroxide, dehydrated through a graded alcohol series, critical point dried, and sputter coated with gold. They were examined with a JSM-6300 scanning electron microscope at an accelerating voltage of 15 kV. All measurements are given in millimeters unless otherwise stated. The scientific names of reptiles are according to Uetz et al. (2002).

DESCRIPTION

Micropleura australiensis n. sp.

(Figs. 1–3)

General: Body white, elongate, tapering to both ends. Cuticle thin, with very fine transverse striations; body surface bearing numerous small, elongate cuticular inflations or bosses with minute papillalike formations on their upper side. Cephalic end rounded. Oral aperture small, circular, surrounded by a rather wide, slightly elevated ring of cuticle; inner margin of oral aperture appearing to be provided with numerous small papillalike formations. Cephalic papillae small, 14 in number, arranged in 2 circles: outer circle formed by 4 submedian pairs of papillae, inner circle by 4 single papillae forming 1 dorsal pair, 1 ventral pair, and a pair of larger lateral papillae; small lateral amphids posterior to lateral papillae. Small conical deirids located just anterior to level of excretory pore. Esophagus distinctly divided into short anterior muscular and much longer and wider, almost cylindrical glandular portion; approximately posterior half of muscular esophagus distinctly darker than anterior one; large cell nuclei of 3 esophageal glands usually distinct. Nerve ring encircling base of muscular esophagus. Excretory pore slightly posterior to anterior end of glandular esophagus; excretory cell large, spindled shaped, attached by its posterior part to glandular esophagus. Intestine straight, light colored, fairly narrow. Males distinctly smaller than females.

Male (2 specimens; measurements of holotype in parentheses): Length of body 7.167–7.385 (7.385), maximum width 0.272–0.354 (0.272). Cuticular inflations distinct, 0.006–0.009 (0.006) high, distributed throughout body length. Length of entire esophagus 1.463–1.673 (1.463), forming 20–23% (20%) of body length. Muscular esophagus 0.321–0.394 (0.321) long, maximum width 0.054–0.060 (0.060); glandular esophagus 1.142–1.292 (1.142) long, maximum width 0.109–0.114 (0.114); length ratio of both parts of esophagus 1:3.3–4.6 (1:4.6). Cell nucleus of dorsal esophageal gland 1.387 (not established) from anterior body end. Nerve ring and excretory pore 0.299–0.354 (0.299) and 0.456–0.530 (0.456), respectively, from anterior extremity. Deirids in holotype (0.450) from anterior end. Posterior end of body spirally coiled. Ventral precloacal surface with conspicuous elevations of striated cuticle, resembling caudal ala in lateral view. Caudal papillae: 4 pairs of preanal and 6 pairs of postanal subventral papillae present. Spicules slender, needlelike, almost equally long, with somewhat distended proximal ends and pointed distal ends; distal parts of spicules provided with narrow, ventral membranous ala; length of right spicule 0.360–0.366 (0.360), length of left spicule 0.354–0.357 (0.357). Gubernaculum large, well sclerotized, 0.096–0.105 (0.105) long. Tail conical, 0.222–0.435 (0.435) long, with smooth rounded tip.

Female (13 specimens; measurements of allotype in parentheses, those of 1 juvenile specimen in brackets): Length of body of specimens containing larvae 14.266–35.061 (23.338), maximum width 0.272–0.354 (0.272); glandular esophagus 1.356–1.673 (1.356), length of muscular esophagus 0.348–0.435 (0.435) long, maximum width 0.095–0.109 (0.109); length ratio of both parts of esophagus 1:3.3–4.6 (1:4.6). Cell nucleus of dorsal esophageal gland 1.387 (not established) from anterior body end. Nerve ring and excretory pore 0.299–0.354 (0.299) and 0.456–0.530 (0.456), respectively, from anterior extremity. Deirids in holotype (0.450) from anterior end. Posterior end of body spirally coiled. Ventral precloacal surface with conspicuous elevations of striated cuticle, resembling caudal ala in lateral view. Caudal papillae: 4 pairs of preanal and 6 pairs of postanal subventral papillae present. Spicules slender, needlelike, almost equally long, with somewhat distended proximal ends and pointed distal ends; distal parts of spicules provided with narrow, ventral membranous ala; length of right spicule 0.360–0.366 (0.360), length of left spicule 0.354–0.357 (0.357). Gubernaculum large, well sclerotized, 0.096–0.105 (0.105) long. Tail conical, 0.222–0.435 (0.435) long, with smooth rounded tip.
(0.612) [0.367] and 0.517–0.979 (0.789) [0.530], respectively, from anterior extremity. Deirids not located. Intestine narrow, light colored. Rectum considerably reduced, formed by thin hyaline tube; 3 unicellular rectal glands present. Tail of smaller specimens conical, with smooth, rounded tip; tail of larger specimens nearly rounded; 2 dorsolateral papillalike projections situated at about midlength of tail; length of tail 0.150–0.231 (0.177) [0.177]. Vulva slightly postequatorial, situated 7.698–12.022 (12.022) [4.978] in smaller specimens, at 52–54% (52%) [52%] of body length. Vagina considerably reduced, oriented posteriorly from vulva. Amphidelphic. Ovaries short. Uterus in larger females occupying almost whole space of body cavity, extending approximately from anterior end of glandular esophagus to intestinal end; uterus containing huge numbers of first-stage larvae. Body of larvae (n = 10) 0.453–0.480 long, 0.015–0.021 wide; esophageal part 0.129–0.153 long (17–20%...
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AB

FIGURE 3. Micropleura australiensis n. sp., SEM micrographs of gravid female. A. Cephalic end, apical view. Bar = 10 μm. B. Tail, ventral view. C. Oral aperture. D. Deirid. E. Cuticular inflation on body surface. a, amphid; b, subdorsal caudal projection; c, anus; i, submedian cephalic papilla of inner circle; l, lateral cephalic papilla of inner circle; p, submedian cephalic papilla of outer circle.

of body length); slender, sharply pointed tail 0.252–0.360 long (33–46% of body length).

Taxonomic summary

Type host: Crocodylus johnsoni Krefft (Crocodylidae, Crocodylia); total body length 92–135 cm.

Site of infection: Peritoneal cavity.

Type locality: Upper Ord River (southern end of Lake Argyle) (16°37’38”S, 128°41’19”E), Western Australia (collected 1 October 2002).

Other locality: Lower Ord River (downstream from Lake Kununurra) (15°34’46”S, 128°33’50”E), Western Australia.

Prevalence and intensity: Estimated prevalence in all localities 70–80%; intensity undetermined: 1–14 (mean 4) nematodes were collected from individual crocodiles, which may be proportional to the numbers in each crocodile (not every worm in each animal was collected).

Deposition of types: Holotype, allotype and 13 paratypes (1 male and 12 females) in the Western Australian Museum (catalog WAM V 4376, WAM V 4377, WAM V 4378) in Perth, Western Australia; 3 paratypes (females) in the helminthological collection of the Institute of Parasitology, Academy of Sciences of the Czech Republic (ASCR), in České Budějovice, Czech Republic (catalog N-804).

Etymology: The specific name of this nematode relates to the country of its origin.

Diagnosis: To date, 5 inadequately described species of Micropleura are known: M. vivipara Linstow, 1906 (type species), from Gavialis gangeticus (Gmelin) in India, M. vazi Travassos, 1933, from Caiman crocodilus (L.) in South America, and M. indica Khera, 1951, M. trionyxi Agrawal, 1966, and M. lissemyxis Chattervati, 1985, from freshwater turtles (Aspideretes gangeticus (Cuvier), Lissemys punctata (Lacépède), and Kachuga sylhetensis (Jerdon)) in India (Ivashkin et al., 1971; Baker, 1987; Sood, 1999). Of these, only M. vivipara somewhat resembles M. australiensis n. sp. in the length of spicules (0.30–0.33 mm) and gubernaculum (0.07 mm), but in contrast to the new species, its vulva is distinctly pre-equatorial, divid-
ing the body 5:6 (vs. slightly postequatorial), the male possesses 7 pairs (4 preanal and 3 postanal) (vs. 10 pairs) of caudal papillae, and the cephalic end is reported by Baylis (1939) to have 2 lateral cephalic papillae forming elevated conical structures. The remaining species can be easily separated from *M. australiensis* by the length of spicules (shorter than 0.29 mm) and the number (5–8 or 11 pairs) and arrangement of caudal papillae in the male, in addition to some other features. The new species also differs from congenerics in the geographical distribution (Australia vs. India or South America).

**DISCUSSION**

The morphology of all *Micropleura* spp. is inadequately known, including that of its type species *M. vivipara*. This was established by Linstow (1906) from specimens collected from the body cavity of *G. gangeticus* of the Zoological Gardens, Calcutta, India; however, his description is poor, and judging from the given body length (35 mm) of the male and the description and illustration of the male caudal end, e.g., presence of 2 lateral elevations on the tail, it is apparent that the author mistook a female for the male. The species was later redescribed by Baylis and Daubney (1922) and Baylis (1924).

According to Linstow (1906), the head end of *M. vivipara* bears 6 papillae, but Baylis (1939) reported 10 cephalic papillae in this species, of which 2 lateral papillae formed conical structures. Only 6 cephalic papillae were reported in the original descriptions also for *M. vazi*, *M. indica*, and *M. trionyxi* (Travassos, 1933; Khera, 1951; Agrawal, 1966), but Siddiqi and Jairajpuri (1963) mentioned 14 cephalic papillae in 2 circles and a pair of lateral amphids in *M. indica*; the number of cephalic papillae in *M. lissemysia* was not established. However, the cephalic papillae in this nematode group are poorly visible under the light microscope, and as mentioned by Moravec et al. (1998) for philometrids, the only reliable method of studying these papillae is SEM. Of *Micropleura* spp., this method has so far been used only in the South American species *M. vazi* and in *Micropleura* sp. from *Crocodylus moreletii* Duméril and Bibron in Mexico (Moravec, 2001; Moravec and Prouza, 2003), where 14 papillae were found; the same number and arrangement was observed in *M. australiensis* in this study. In all these cases, a pair of lateral papillae is somewhat larger than the remaining papillae; small pocketlike amphids are situated posterior to the lateral papillae.

The presence of deirids is characteristic of many dracunculoid genera, but these were not reported for any *Micropleura* species; only recently Moravec and Prouza (2003), using SEM, have discovered small deirids in *M. vazi*. The presence of deirids in *M. australiensis* suggests that these may be present in all congeneric species.

The male caudal end in *Micropleura* spp. is firmly spirally coiled and, therefore, it is rather difficult to study details in its structure. Some authors reported the presence of 1 or 2 caudal alae in these nematodes; this feature was sometimes used as a character of the family or for the separation of species, e.g., Ivashkin et al. (1971) and Sood (1999), but this study indicates that the “lateral caudal ala” is rather a modified, elevated ventral cuticle. It is highly desirable to study the male ventral caudal surface by SEM.

The situation of fairly large papillalike protrusions on the female tail of *M. australiensis* seems to be characteristic of this species (a similar situation of these formations was illustrated in *M. vivipara* by Baylis and Daubney [1922]); in contrast, these are located terminally in *M. vazi* and *Micropleura* sp. from *C. moreletii* (Moravec, 2001; Moravec and Prouza, 2003).

The species of *Micropleura* from crocodilians (*M. australiensis, M. vazi,* and *M. vivipara*) differ distinctly from each other in their morphology, host types, and geographical distributions. On the other hand, the 3 poorly described congeneric species from turtles are established on the basis of unreliable or doubtful features (their type specimens are lacking); they occur in the same host species in India, and apparently, they represent just a single species, *M. indica*, with *M. trionyxi* and *M. lissemysia* as its junior synonyms.

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