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SEM observations on *Leidynema portentosae* Van Waerebeke, 1978 (Nematoda, Oxyurida) from *Gromphadorhina portentosa* (Insecta, Blattodea)

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Abstract

Adult males and females of the thelastomatid nematode *Leidynema portentosae* Van Waerebeke, 1978, parasites of the cockroach *Gromphadorhina portentosa* (Schaum), were examined by light and scanning electron microscopy. Broad lateral alae were present on the male. They were interrupted in two regions, forming three separate parts. Numerous small cuticular protuberances covered the posterior two thirds of the male. The male tail had four sets of genital papillae including two large pairs and two smaller, postanal pairs. Phasmids were observed in both males and females. The female cephalic region contained eight symmetrically arranged labiopapillae. Amphids were also observed, but no other cephalic papillae could be seen. The female lateral alae terminated in sharp projections in the tail region. These observations were compared to both the original description of *L. portentosae* and to a subsequent additional study of its morphology, and they reveal more details that are difficult to observe by light microscopy alone.

Key words

Leidynema portentosae, Nematoda, morphology, SEM, *Gromphadorhina portentosa*, Insecta

Introduction

The cockroach *Gromphadorhina portentosa* (Schaum) is widespread in zoo collections, teaching, and research institutions throughout North America. This species harbors several species of oxyurid nematodes, including *Leidynema portentosae* Van Waerebeke, 1978, *Cephalobellus ovumglutinosus* Van Waerebeke, 1978, and *Hammerschmidtiella diesingi* (Hammerschmidt, 1838) Chitwood, 1932 (Van Waerebeke 1978, Yu 1987, Adamson and Van Waerebeke 1992). The export of the cockroaches from their native Madagascar has led to the concurrent spread of their parasite fauna, as can be seen from the presence in North American collections of *G. portentosa* that harbor *L. portentosae*, which was originally described from Madagascar.

The small sizes of thelastomatid nematodes, particularly the males, make it difficult to discern morphological characters accurately by light microscopy. Apart from the original description of *L. portentosae* (Van Waerebeke 1978), only one study has provided additional morphological characters using scanning electron microscopy (Yu 1987).

We studied the morphology of *L. portentosae* specimens recovered from our own colony of *G. portentosa* using light microscopy as well as scanning electron microscopy (SEM). Several features of the species, including the stoma, male tail, and female tail that were examined by SEM revealed several characters that were not included in two previous descriptions. We describe here several characteristics of *L. portentosae* that complement the descriptions provided by Van Waerebeke (1978) and Yu (1987).

Materials and methods

Specimens of *L. portentosae* were recovered from the hindgut of the cockroach *G. portentosa* from a colony that has been maintained at Ohio Wesleyan University for several years. Additional parasites found in these cockroaches included *H. die-*

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singi and the eugregarine parasite *Leidyana migrator* Clopton, 1995 (Phylum Apicomplexa). Specimens for light microscopy were cleared in Berlese's medium (Pritchard and Kruse 1982) and observed by means of a Nikon E600 microscope using both bright field and differential interference contrast microscopy. Specimens for SEM were fixed in 5% formalin, dehydrated in a graded ethanol series, and critical point dried using an Autosamdri 795 Supercritical Point Dryer (Tousimis, Rockville, Maryland). Specimens were mounted on aluminum stubs, sputter coated with gold using an SPI-Module Sputter

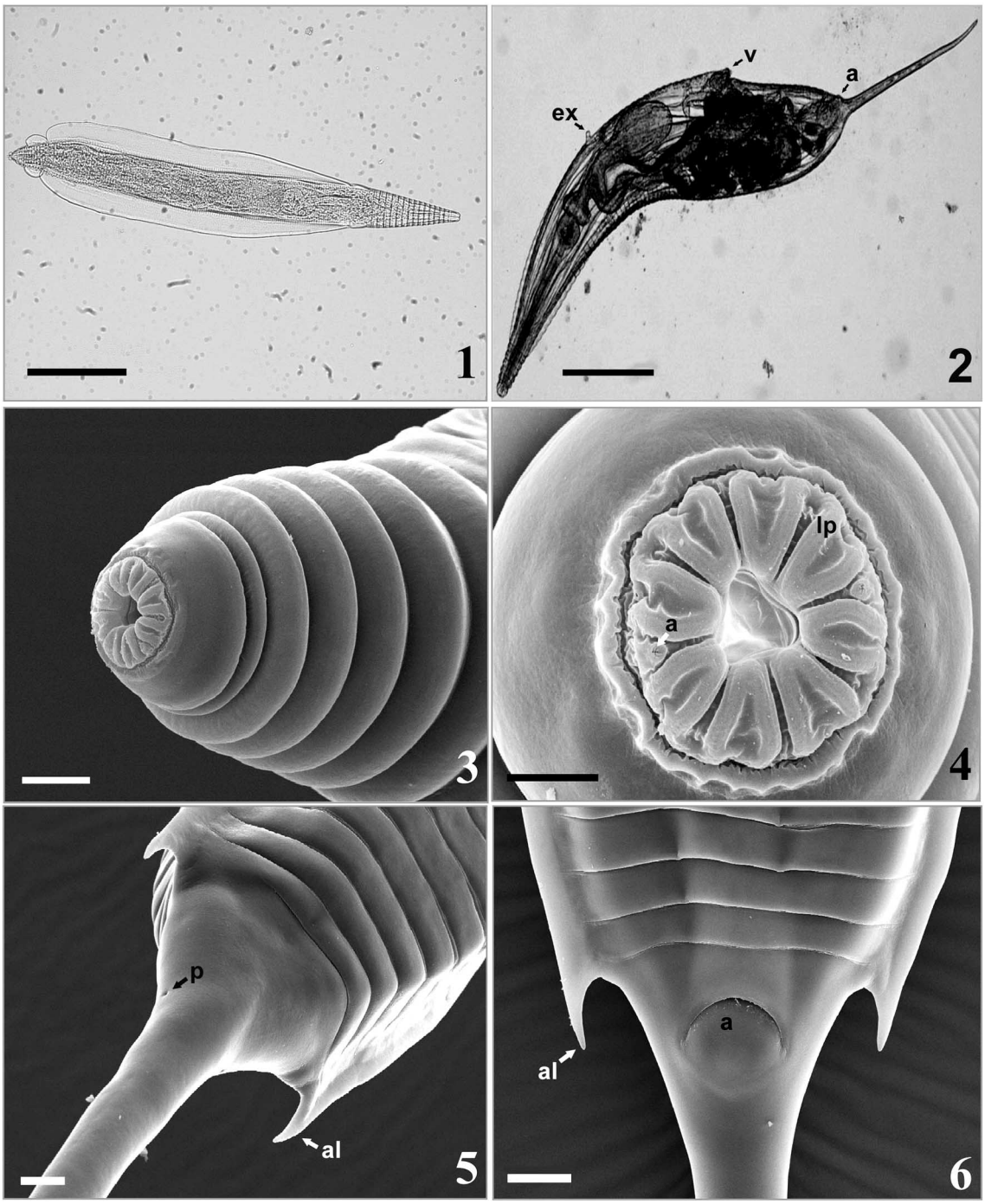

Fig. 1. *Leidynema portentosae*, adult male. Scale bar = 300 µm. **Fig. 2.** Adult female; excretory pore (ex), vulva (v), and anus (a) are shown. Scale bar = 400 µm. **Fig. 3.** Adult female, lateral view of anterior end. Scale bar = 20 µm. **Fig 4.** Adult female, en face view of stoma showing amphids (a) and labiopapillae (lp). Scale bar = 10 µm. **Fig. 5.** Adult female, dorsal view of tail region showing phasmids (p) and termination of alae (al). Scale bar = 35 µm. **Fig. 6.** Adult female, ventral view of tail region showing alae (al) and anus (a). Scale bar = 40 µm

Coater (SPI Supplies, West Chester, Pennsylvania), and observed using a LEO 435 VP scanning electron microscope (Carl Zeiss SMT, Thornwood, New York, U.S.A.) at an average accelerating voltage of 20 kV.

Results

Both males and females are covered by annules (Figs 1 and 2). In females, the pattern consists of a thin annule immediately posterior to the cephalic region followed by evenly spaced annules along the remainder of the body (Figs 2 and 3). The excretory pore of females extends from the body as a small protuberance (Fig. 2). The stoma is triangular and surrounded by eight large, labiopapillae (Figs 3 and 4). Each labiopapilla has a groove that produces a V-shaped structure with the groove gradually widening away from the stoma. Circular amphids are present (Fig. 4). Lateral alae arise on the body at the same point as the vulva, ending in sharp, pointed extensions in the tail region (Figs 5 and 6). Phasmids are visible on the tail of the female posterior to the alae (Fig. 5).

Adult males have prominent lateral alae consisting of three separate extensions of cuticle, the first arising at the region of the nerve ring, the second prominently extending also from the region of the nerve ring, spanning most of the body and terminating near the tail, and the third arising in the tail region (Figs 1 and 7). Annules on the cuticle are most prominent at the anterior end. Approximately 15–17 annules are present between the cephalic extremity and first extension of lateral alae (Fig. 7). The body is covered with cuticular protuberances across its posterior two thirds both dorsally and ventrally (Fig. 7). Two pairs of large papillae are present in the tail region, one larger precloacal pair ventrolaterally and one smaller distal pair dorsally situated postcloacally (Figs 8 and 9). Each papilla consists of a large base holding an arrangement of cuticular projections or papillae that surround the larger papilla. Two additional, smaller pairs of postcloacal papillae are present distally, one pair ventrally (Fig. 8), and one pair dor-

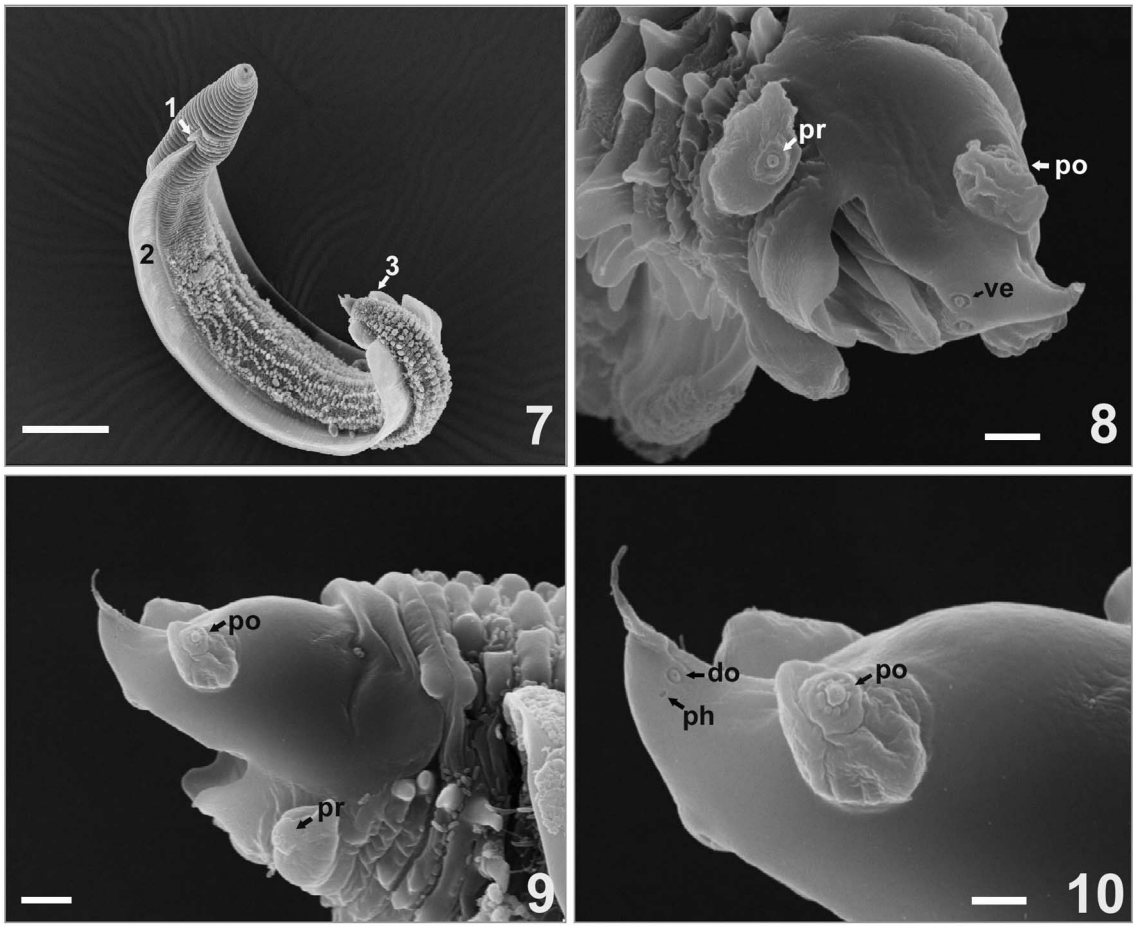

Fig. 7. Adult male, ventral view. Three separate lateral extensions of the cuticle (numbered) are seen. Scale bar = 200 μm. **Fig. 8.** Adult male, ventrolateral view of tail. Large precloacal (pr) and postcloacal (po) papillae are shown. Ventral (ve) papillae are also visible. Scale bar = 4 μm. **Fig. 9.** Adult male, lateral view of tail. Large precloacal and postcloacal papillae are shown. Scale bar = 4 μm. **Fig. 10.** Adult male, dorsolateral view of tail. Large postcloacal and small dorsal papillae (do) are shown. Phasmids (ph) are also visible. Scale bar = 2 μm

sally (Fig. 10). Phasmids are located anterior to last pair of postcloacal papillae, and the tail ends in a sharp cuticular projection (Fig. 10).

Discussion

Our microscopical observations of *L. portentosae* provide information that complements the original description by Van Waerebeke (1978) and a subsequent study by Yu (1987). The original description of *L. portentosae* excluded detailed illustrations of the broad lateral alae of the males. The alae are distinct in this species and are not as broad in other species of the genus. We have also provided a more accurate documentation of the cuticular protuberances that occur both ventrally and dorsally on the male body rather than only being present on one side. This pattern has not been described in other species in the genus. The lateral alae of the females including their pointed end-points were also not previously illustrated. Together, these characters may be difficult to observe by light microscopy alone.

The papillae in the cloacal region of the male are also considerably difficult to observe by light microscopy. The posterior male papillae were described by Van Waerebeke (1978) in the diagnosis of *L. portentosae* as consisting of three pairs with two of these being ventrally located. A fourth pair was referred to in the description, but only one pair was described to be situated posterior to the anus. We were able to verify the presence of a dorsally located pair of small postcloacal papillae as well as one ventrally located pair, in addition to the two larger precloacal pairs.

The small, dorsally situated papillae were not described by Yu (1987), and phasmids were not observed in males in that study. The small pores that we assume to be phasmids thus constitute the first description of their presence in males of this species. Our observations tentatively provide information on the location of phasmids in thelastomatids, information that is lacking for this family in general (Kiontke and Sudhaus 2000). Although there is little information on the location of genital papillae relative to the phasmids in thelastomatid nematodes as observed by SEM (e.g. Kiontke and Sudhaus 2000), we identified one pair of papillae posterior to the phasmids in male *L. portentosae*.

Our observations on the organization of labiopapillae and the location of the amphids are generally consistent with those of Van Waerebeke (1978). The cephalic region of *L. portentosae* was also examined by Yu (1987), who described the presence of four cephalic papillae in addition to the amphids and labiopapillae in adult females. We did not find these cephalic papillae from en face observation or from lateral views of the cephalic region. Cephalic papillae similar to those reported by Yu (1987) have not been reported in other thelastomatids based on light microscopical observations, and were not observed in *H. diesingi* using SEM (Yu and Crites 1986).

The observations reported here have clarified morphological details of *L. portentosae* that were difficult to observe by light microscopy alone, particularly in adult males. These observations indicate that SEM will be necessary to further document the morphology of other thelastomatid nematodes for which few details have been provided. Knowledge of morphological characters such as the organization of genital papillae and the cephalic region may be important in hypothesizing phylogenetic relationships among the Thelastomatidae.

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