



Taxonomic revision of the type specimens of Ethiopian Nippostrongylineae (Nematoda) deposited at the Natural History Museum of London

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Abstract

We studied the original material of several species of Nippostrongylineae (Nematoda: Heligmonellidae) described by H. A. Baylis in muroid rodents from Nigeria: *Heligmonina praomyos* Baylis, 1928, *Heligmonina oenomyos* Baylis, 1928, *Heligmonina cricetomyos* Baylis, 1928, *Neoheligionella affinis* (Baylis, 1928), *Neoheligionella intermedia* (Baylis, 1928), *Neoheligionella gracilis* (Baylis, 1928), *Neoheligionella impudica* (Baylis, 1928), *Neoheligionella moennigi* (Baylis, 1928), and *Heligmonoides murina* Baylis, 1928. The comparison of the material examined to the original descriptions, revealed the presence of at least seven other species mixed among the type and voucher material. For the nominal species of Baylis lectotypes and paralectotypes are designated. Due to the poor condition of the material, the other species found were only identifiable to generic level. Most of them were coparasitic with Baylis' species. The following species associations were found: *Heligmonina praomyos* + *Neoheligionella moennigi*, *Heligmonina oenomyos* + *Neoheligionella* sp. 1, *Heligmonina cricetomyos* + *Neoheligionella moennigi*, *Heligmonina* sp. 2 + *Neoheligionella* sp. 4. Tables with the identification of the specimens studied are provided. New morphometrical data and illustrations on this material are also provided, particularly on the anterior part of the body and genital apparatus in the females. The occurrence of coparasitism as a frequent phenomenon among the Trichostrongylinea is highlighted.

Key words: Trichostrongylinea; Heligmonellidae; coparasitism; rodents; Nigeria

Introduction

In an article dating from 1928, H. A. Baylis described a number of nematode parasites of mammals, mainly of rodents from Nigeria. Most of these nematodes belong to the family Heligmonellidae and particularly to the subfamily Nippostrongylineae. In the aforesaid article, Baylis erected two new genera: *Heligmonina* Baylis, 1928 (five species) with *Heligmonina praomyos* Baylis, 1928, parasitic in *Praomys tullbergi* Thomas, as type species, and *Heligmonoides* Baylis, 1928 with the type and unique species *Heligmonoides murina* Baylis, 1928, parasitic in *Mus (Nannomys) musculoides* (Temminck) (*Leggada musculoides* in Baylis' description) (type-host) and in *Mus musculus* Linnaeus. He also described seven new species in the genus *Heligionella* Mönnig, 1927.

Durette-Desset (1971) redefined the genera *Heligionella* and *Heligionoides* and reclassified Baylis' species, transferring most of the species treated by Baylis as *Heligionella* to the new genus *Neoheligionella* Durette-Desset, 1971 (Table 1). The three genera are distinguished as follows: *Heligionella* is characterised by a hypertrophied left ridge (left ala). In *Neoheligionella* a carene is present or absent; when present, it is made up of two left ridges. In both genera the number of ridges is between 9–16. *Heligionoides* possesses a carene made up of at least four left ridges better developed than the remaining ridges and a total number of ridges between 17 and 30 (Durette-Desset *et al.* 2007a). The caudal bursa is strongly asymmetrical with a left lobe much better developed in *Heligionella*, it is subsymmetrical with the dorsal ray divided in its distal half in *Neoheligionella* and subsymmetrical or slightly asymmetrical with the dorsal ray divided in its proximal half in *Heligionoides*.

To date, the fauna of Ethiopian nippostrongyline parasitic in the Murinae (about 56 species) is made up only of these three genera. It seemed therefore important to have access to the types of the species described by Baylis, and particularly the type species of *Heligmonina* and *Heligmonoides*, deposited in the Helminthological Collections of the Natural History Museum of London. However, during this process, several difficulties arose:

- No wet material was available and thus the synopse (main specific character utilized in the systematics of the Trichostrongyline) could not be studied, as it should be, in transverse body sections.
- Baylis often described species based on material from different hosts and/or localities and generally there is no precision in the text on the provenance of the data.
- Baylis normally nominated "co-types" without designating a specific holotype and the type series are frequently composites of several species.

The comparison of the material examined to the original descriptions, revealed the presence of at least seven other species mixed among the type and voucher material for the nominal species of Baylis. We attempted to identify as accurately as possible all this material and especially to separate the types from the voucher material, designating lectotypes and paralectotypes for the nominal species of Baylis and identifying as much as possible (usually at generic level) the other species found.

TABLE 1. Comparative classifications of Baylis (1928) and Durette-Desset (1971).

Baylis, 1928		Durette-Desset, 1971		
Heligmosomidae		Heligmonellidae		
Genus	species	species	Genus	Subfamily
	<i>Heligmonella spira</i> type-species	<i>Heligmonella spira</i>	<i>Heligmonella</i> Mönnig, 1927	Heligmonellinae n. subfam.
	<i>Heligmonella affinis</i> *	<i>Neoheligmonella affinis</i> *		
<i>Heligmonella</i> Mönnig, 1927	<i>Heligmonella gracilis</i> *	<i>Neoheligmonella gracilis</i> *	<i>Neoheligmonella</i> n. gen.	Nippostrongylineae n. subfam.
	<i>Heligmonella impudica</i> *	<i>Neoheligmonella impudica</i> *		
	<i>Heligmonella intermedia</i> *	<i>Neoheligmonella intermedia</i> *		
	<i>Heligmonella moennigi</i> *	<i>Neoheligmonella moennigi</i> *		
	<i>Heligmonella streptocerca</i>	<i>Paraheligmonina streptocerca</i>	<i>Paraheligmonina</i> n. gen.	Brevistriatinae n. subfam.
	<i>Heligmonella trifurcata</i>	<i>Paraheligmonina trifurcata</i>		
	<i>Heligmonina praomyos</i> * type species	<i>Heligmonina praomyos</i> *	<i>Heligmonina</i> Baylis, 1928	Nippostrongylineae n. subfam.
<i>Heligmonina</i> n. gen.	<i>Heligmonina aenomyos</i> *	<i>Heligmonina aenomyos</i> *		
	<i>Heligmonina cricetomyos</i> *	<i>Heligmonina cricetomyos</i> *		
	<i>Heligmonina magna</i>	<i>Paraheligmonina magna</i>	<i>Paraheligmonina</i> n. gen.	Brevistriatinae n. subfam.
<i>Heligmonoides</i> n. gen.	<i>Heligmonoides murina</i> * type species	<i>Heligmonoides murina</i> *	<i>Tenorastrongylus</i> n. gen. (= <i>Heligmonoides</i> Baylis, 1928) **	Nippostrongylineae n. subfam.

* species studied in this article

** the genus *Heligmonoides* Baylis, 1928 was revalidated by Durette-Desset (1983)

Abbreviations for Tables 2–12: *He*: *Heligmonella*; *Hi*: *Heligmonina*; *Ho*: *Heligmonoides*; *Ne*: *Neoheligmonella*.

* lectotype; ** paralectotype

Material and methods

The worms were deposited in the Helminthological Collections of the Natural History Museum of London. They were collected from rodents belonging to the Muroidea from five localities of Nigeria and from Tanganyika. These hosts were: six *Praomys tullbergi* from Adu, one *Oenomys hypoxanthus* (Pucheran) from Ife, five *Cricetomys emini* (Wroughton) from Adu and Ife and one *Cricetomys gambianus* Waterhouse from Kano, seven *Lemniscomys striatus* (Linnaeus) from Adu, Ibadan and Oyo, five *Mus (Nannomys) musculoides* from Ibadan, one *Mus (Mus) musculus* from Adu, four *Gerbilliscus (Taterona) kempi* (Wroughton) from Ibadan and Kano, three *Arvicanthis rufinus* Temminck from Ibadan and Kano, two *Malacomys edwardsi* Rochebrune from Adu, an unspecified number of *Mastomys erythroleucus* (Temminck) from Adu and Oyo (all Nigerian localities) and one *Grammomys dolichurus* Smuts from Tanganyika. The nomenclature of the hosts follows Wilson & Reeder (2005).

Seventy-three slides containing 126 mounted specimens were examined for identification. Most of the specimens were excessively cleared, even chitinized structures such as the spicules. The internal soft structures such as the intestine or the genital organs were destroyed to varying degrees. The uterus lengths here reported are therefore approximate since they were calculated based on the presence of the eggs. The measurements provided are in micrometers except where otherwise stated. Abbreviations: SpL/BL means the proportion (%) of the length of the spicules on the length of the body. UtL/BL means the proportion (%) of the length of the uterus on the length of the body.

Tables are provided with the data concerning the hosts, the identification of the material (Tables 2–12) and the differential diagnosis between the species found (Tables 13–16).

Results

I. Genus *Heligmonina* Baylis, 1928

Heligmonina praomyos Baylis, 1928

(Table 2)

The type material was made up of one male (slide 127) parasitic in the small intestine of one *Praomys tullbergi* n° 114 from Adu. It was in very poor condition. The left ala disappeared just anterior to the caudal bursa. The width of the body was 200 within the distal third, the left ala (120) included. From the same host Baylis described three males and one female of *Heligmonella moennigi* Baylis, 1928 (= *Neoheligmonella moennigi* (Baylis) Durette-Desset, 1971).

The voucher material came from three *Praomys tullbergi* (n° 139, n° 175, and n° 72) from Adu. In *P. tullbergi* n° 139, only one male out of three (slide 129) was identifiable. In this male, the spicules were 370 long with a SpL/BL of 14.8%, which corresponds to Baylis' data (spicules 330, 350 long and SpL/BL 13.4–15.7%). In *P. tullbergi* n° 175, four males out of five (slide 130) were identifiable. Two males had spicules 310, 350 long and a SpL/BL of 9.8, 12.5%, similar to that of *H. praomyos*, and we identified them as this species. In the two other males the spicules were 800, 905 long with a SpL/BL of 16.7% and 22%. In addition, in these males the left lateral ala was poorly developed or not visible. These males were identified as *Neoheligmonella moennigi* (Baylis, 1928), the length of the spicules and the ratio SpL/BL being similar. In *P. tullbergi* n° 72 we identified the single female (slide 125) as *H. praomyos*, the left ala being visible.

Species identified

1) *Heligmonina praomyos* Baylis, 1928

(Table 2, Figure 1)

Type material: lectotype male (slide 127) coparasite with *Neoheligmonella moennigi* (slides 66, 67).

Type host: *Praomys tullbergi* n° 114 (Table 2).

Site: Small intestine.

Type locality: Adu (Nigeria).

Voucher material: one male (slide 129), two males (slide 130) coparasites with *Neoheligionella moennigi*, one female (slide 125).

Hosts: *Praomys tullbergi* n° 72, n° 139, n° 175 (Table 2).

Site: Small intestine.

Locality: Adu (Nigeria).

TABLE 2. Parasites from *Praomys tullbergi*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Praomys tullbergi</i>	n° 127	Male 1*	<i>Hi. praomyos</i>	<i>Hi. praomyos</i>
N° 114 - Adu	n° 66	Male 1	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Female 1	<i>He. moennigi</i>	<i>Ne. moennigi</i>
Type host for	n° 67	Male 1	<i>He. moennigi</i>	<i>Ne. moennigi</i>
<i>Heligionina praomyos</i>	n° 68	Male 1	<i>He. moennigi</i>	unidentifiable
<i>Praomys tullbergi</i>	n° 125	Female 1	<i>Hi. praomyos</i>	<i>Hi. praomyos</i>
N° 72 - Adu				
<i>Praomys tullbergi</i>	n° 129	Male 1	<i>Hi. praomyos</i>	<i>Hi. praomyos</i>
N° 139 - Adu		Male 2	<i>Hi. praomyos</i>	unidentifiable
		Male 3	<i>Hi. praomyos</i>	unidentifiable
<i>Praomys tullbergi</i>	n° 130	Male 1	<i>Hi. praomyos</i>	<i>Ne. moennigi</i>
N° 175 - Adu		Male 2	<i>Hi. praomyos</i>	<i>Ne. moennigi</i>
		Male 3	<i>Hi. praomyos</i>	<i>Hi. praomyos</i>
		Male 4	<i>Hi. praomyos</i>	<i>Hi. praomyos</i>
		Male 5	<i>Hi. praomyos</i>	unidentifiable
<i>Praomys tullbergi</i>	n° 62	Male 1	<i>He. moennigi</i>	unidentifiable
N° 189 - Adu	n° 63	Male 1**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Male 2**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
Type host for		Male 3**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
<i>Heligionella moennigi</i>		Female 1**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
	n° 64	Male 1**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Male 2**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Male 3*	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Female 1**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
		Female 2**	<i>He. moennigi</i>	<i>Ne. moennigi</i>
<i>Praomys tullbergi</i>	n° 60	Female 1	<i>He. moennigi</i>	<i>Ne. moennigi</i>
N° 22 - Adu				

* the male chosen as lectotype of *Neoheligionella moennigi* (male 3 on slide n° 64) is the male 4.2 mm long, with spicules 850 long, and with two spiral turns in its anterior part.

Males: 2.25–3.15 mm long and 150–160 wide at mid-body, left ala included. Cephalic vesicle 40, - long and 40, - wide. Spicules thin, 310–370 long, ending in sharp tip (Figure 1). SpL/BL: 9.8, 14.8%.

Female: About 3.2 mm long. Cephalic vesicle 35 long and 20 wide. Oesophagus 210 long. Left ala visible in optical section.

2) *Neoheligionella moennigi* (Baylis, 1928)

(Table 2, Figure 2)

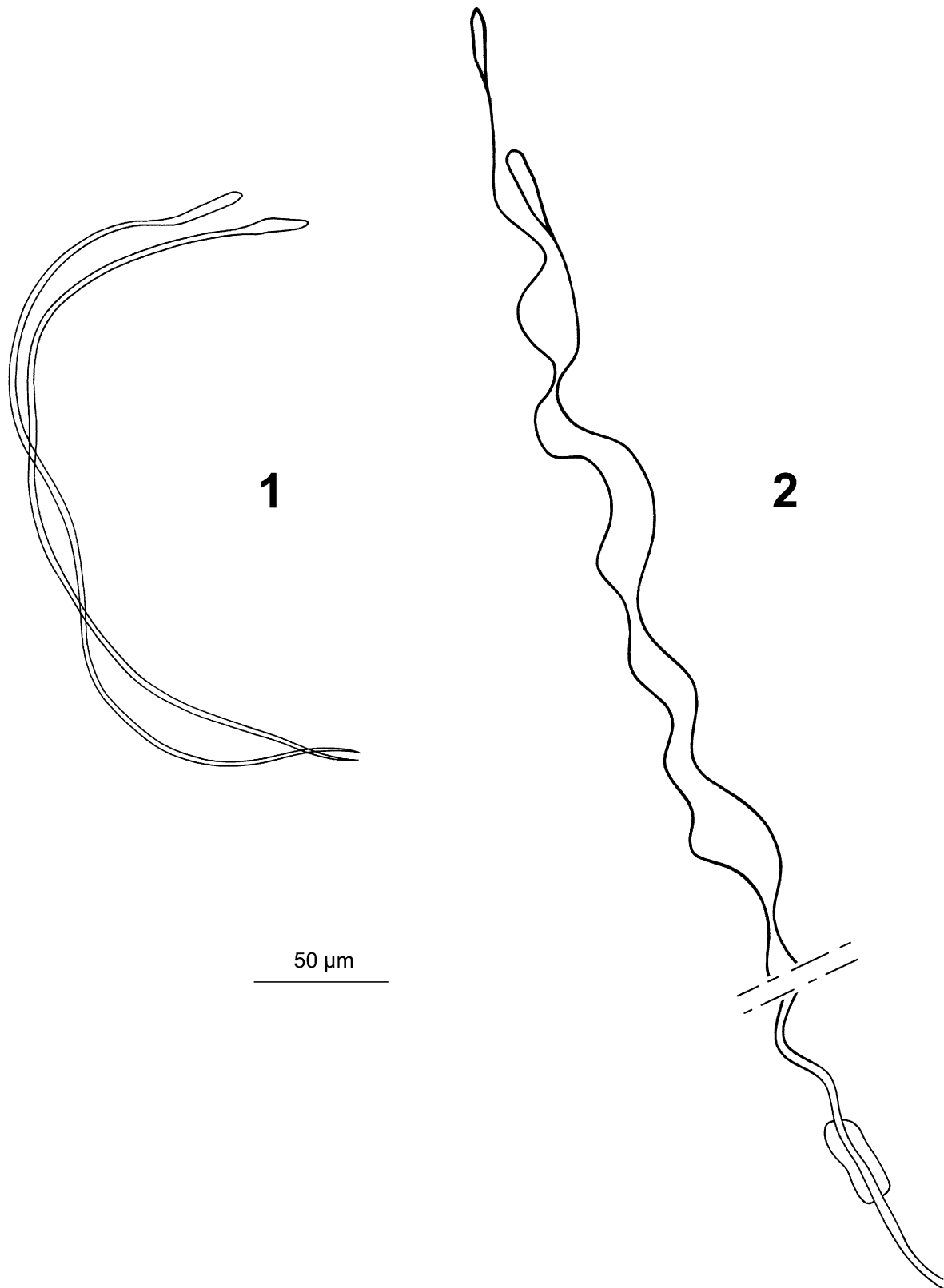
Material: two males (slide 130).

Host: *Praomys tullbergi* n° 175 (Table 2).

Site: Small intestine.

Locality: Adu (Nigeria).

Males: Body curved ventrally, 4.8, 4.1 mm long and 140, 200 wide at mid body, carene 50 included or not observed. Cephalic vesicle -, 40, long and -, 35 wide. Spicules 800, 905 long very thin and sinuous (Figure 2). SpL/BL: 16.7%, 22%. Gubernaculum -, 40 long and -, 15 wide.



FIGURES 1, 2. Figure 1. *Heligmonina praomyos* Baylis, 1928, spicules in situ, right lateral view. Figure 2. *Neohelgmonella moennigi* (Baylis, 1928), spicules in situ. Figures 1, 2, slide 130 from *Praomys tullbergi* n° 175.

Remarks

Given that a well developed left ala was not observed in these specimens, they cannot belong to the genus *Heligmonina*. They may be identified to *Neoheligmonella moennigi* described by Baylis (1928) as *Heligmonella moennigi*, the length of the spicules and the ratio SpL/BL being similar. The data provided above are included in the redescription of *Neoheligmonella moennigi* (see below and Table 9).

Heligmonina oenomyos Baylis, 1928

(Table 3)

The type-material was made up of three males and six females parasites from the small intestine of one *Oenomys hypoxanthus* n° 418, from Ife. Baylis' description was not illustrated but he revealed that there is a left ala about 80 µm wide in the male and 40–50 µm in the female plus 12 cuticular ridges. In the material examined, the left ala was visible in one male (slide 144) and three females (slides 147, 148). Therefore this is the material which must be considered as the type-material of *Heligmonina oenomyos*. In the male the SpL/BL is 19.9%. In the females the vulvar alae are absent and the vulva is situated at 170–200 µm from the caudal extremity. The left ala was not visible in the remaining males and females. In the two males (slide 142) the SpL/BL was 13, 13.1%. In the three females (slides 142, 143 and 147) two lateral vulvar alae, slightly displaced ventrally, were present and the vulva was situated more distally, at 120–150 µm from the caudal extremity. Therefore these specimens may belong to another species, coparasite with *H. oenomyos*, and probably belong to the genus *Neoheligmonella*.

Species identified

1) *Heligmonina oenomyos* Baylis, 1938

(Table 3, Figures 3–6)

Type material: lectotype male (slide 144), one paralectotype female (slide 147), coparasite with *Neoheligmonella* sp. 1, two paralectotype females (slide 148).

Type-host: *Oenomys hypoxanthus* n° 418 (Table 3).

Site: Small intestine.

Type locality: Ife (Nigeria).

General: Small nematodes slightly coiled sinistrally along ventral side. Deirids not observed. Left ala disappearing just anterior to caudal bursa in male (Figure 5), at level of proximal vestibule in female (Figure 4).

Male: 3.0 mm long and 120 wide at mid-body, left ala (45) included. Spicules ending in sharp tip, 580 long. SpL/BL 19.3%. Gubernaculum 70 long and 30 wide (Figure 5).

Females: 3.5–4.6 mm long, 90–105 wide, left ala 20, 25 included. Cephalic vesicle 50–52 long and 22–30 wide. Nerve ring and excretory pore situated 140–150 and 210–240 from apex, respectively. Oesophagus 310–320 long (Figure 3). Vulvar opening situated 170–200 from caudal extremity. Ovejector (n=2): vagina vera 38, 40 long, vestibule 70, 80 long, sphincter 30, 42 long and 40, 50 wide, infundibulum 105, 130 long (Figure 4). Uterus 760–1,500 long, with 16–32 eggs, 55–66 long and 35–40 wide. UtL/BL 20.5–32.6%. Tail conical with rounded extremity, 45–51 long (Figure 4).

Remarks

The presence of a well-developed left ala and a caudal bursa with a larger right lobe are characteristic of the genus *Heligmonina* as redefined by Durette-Desset (1971). In 1969, Durette-Desset studied the synlophe of *H. oenomyos* from some syntypes but provided no illustrations. This synlophe being similar to that of *Heligmonina chippauxi* (Desset, 1964) a parasite of the same host from the Central African Republic, Durette-Desset (1969) synonymized *H. chippauxi* and *Heligmonina spira* Mönnig, 1927 with *H. oenomyos*. In 1971,

Durette-Desset revalidated the species *H. spira* and kept the synonymy of *H. chippauxi* with *H. spira*. Durette-Desset *et al.* (2002) revalidated the species *H. chippauxi* but provided no differential diagnosis with *H. oenomyos*. The illustration of a female syntype of *H. oenomyos* unpublished in 1969 by Durette-Desset is now provided (Figure 6) and confirms that both species have a similar synlophe with 15 cuticular ridges in both sexes, a decreasing gradient of size from the right to the left on the dorsal side and from the left to the right on the ventral left quadrant. On the ventral right quadrant, the ridges are of similar size. However the two species can be differentiated by the SpL/BL, which is of 14.7% (data from Baylis) to 19.3% (new data) in *H. oenomyos* and 6.8–9.0% in *H. chippauxi*. In addition the spicule tips are sharp in *H. oenomyos* and curved in *H. chippauxi*. *Heligmonina oenomyos*, *H. chippauxi* and *H. spira* are parasites of the same host species but from different regions. This confirms that in the genus *Heligmonina*, the geographic distribution of the parasites may be of greater importance than the host spectrum (see Durette-Desset *et al.* 2007b) in the process of speciation.

2) *Neoheligionella* sp. 1

(Table 3, Figures 7–9)

Material: two males (slide 142), three females (slides 142, 143, 147) coparasites with *Heligmonina oenomyos* Baylis, 1928.

Host: *Oenomys hypoxanthus* n° 418 (Table 3).

Site: Small intestine.

Locality: Ife (Nigeria).

General: Small nematodes slightly curved along ventral side. Anterior part of males not observed. Left ala not observed.

Males: 3.7, 3.9 mm long and 75, 100 wide at mid-body. Thick spicules ending in sharp tip, 480, 510 long (Figure 8). SpL/BL: 13, 13.1%.

Females: 3.9–5.3 mm long and 110, 150 wide at mid-body. Oesophageal region (n=1): Cephalic vesicle 45 long and 30 wide. Nerve ring and excretory pore situated 160 and 270 from apex, respectively. Oesophagus 340 long (Figure 9). Monodelphic. Vulva situated 120–150 from caudal extremity (Figure 7). Presence of two developed lateral vulvar alae situated slightly ventrally (Figure 7). Right vulvar ala 120–150 long and 40–50 wide, left vulvar ala 110–130 long and 40–50 wide. Ovejector (n=2): vestibule, 200, 200 long, sphincter 30, 25 long and 50, 45 wide, infundibulum 200, 200 long. Uterus (n=2) 700, 1,000 long with 17, 25 eggs 68–70 long and 30–31 wide. UtL/BL 13.2, 20.8%. Rounded tail (n=2) 50, 65 long (Figure 7).

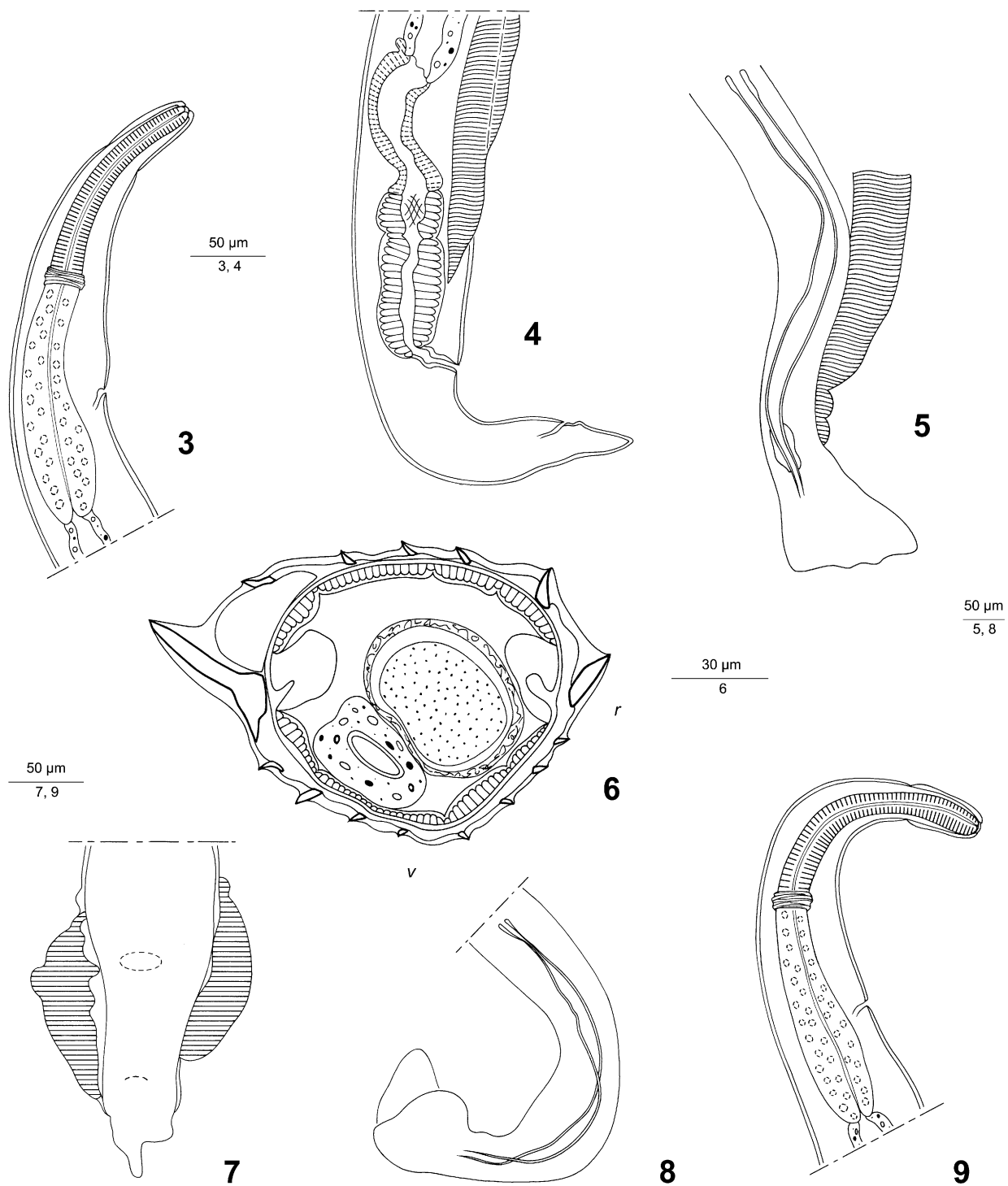
Remarks

The very well developed left ala not being observed in these specimens means that they do not belong to the genus *Heligmonina* and they are probably related to the genus *Neoheligionella*. The morphological data, particularly those concerning the synlophe are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Neoheligionella* see Table 14.

Heligmonina cricetomyos Baylis, 1928

(Table 4)

The type-material was made up of three males (slides 131, 132, 133) parasites from the small intestine of one *Cricetomys emini* n° 14, from Adu. Baylis (1928) identified this species in four other *Cricetomys emini*, three from Adu (n° 197, n° 359, n° 363) and the fourth from Ife (n° 439) and in one *Cricetomys gambianus* (*Cricetomys buchmanani* Thomas & Hinton on the label) (n° 481) from Kano, all from the small intestine. Baylis indicated that the synlophe was made up of a left ala of 80–150 µm (without specifying the sex) and 8–10 inconspicuous ridges. The metrical data provided by Baylis concern both sexes.



FIGURES 3–9. Figures 3–6. *Heligmonina oenomyos* Baylis, 1928. 3, 4, paralectotype female. 3, anterior extremity, right lateral view. 4, posterior extremity, right lateral view. 5, lectotype male, posterior extremity, ventral view. 6, female, transverse section at mid-body. Figures 7–9. *Neoheligmonella* sp. 2. 7, female, posterior extremity, dorsal view. 8, male, posterior extremity, left lateral view. 9, female, anterior extremity, right lateral view. Figures 3, 4, slide 148, Figure 5, slide 144, Figures 7, 9, slide 147. Figure 8, slide 142 from *Oenomyx hypoxanthus* n° 418. Figure 6, voucher material from *Oenomyx hypoxanthus* MNHN 755M. Abbreviations: v: ventral side, r: right lateral side.

For the males, the description was probably based only on the syntypes, since we obtained the same measurements from this material, even though unfortunately, on these slides, the spicules were not observable anymore.

With regard to the males from the voucher material, we identified as *H. cricetomyos* the male (slide 140) parasitic in *C. emini* n° 359 and the male (slide 141) parasitic in *C. gambianus* n° 481. In both cases, the spicule length (370, 370) and the ratio SpL/BL (7.2, 7.5%) correspond to the data provided by Baylis (spicule length 400–450, ratio SpL/BL 7.5–9%).

Regarding the females Baylis (1928) wrote «Vulva about 0.2 mm from posterior end; cuticle sometimes much inflated in front of vulva». The vulva was situated at about this level in the voucher females from *C. emini* n° 197 and n° 359. Therefore this is the material which must be identified as *Heligmonina cricetomyos*. In the voucher females from *C. emini* n° 363, it was not possible to observe the position of the vulva but they are differentiated from the females of *H. cricetomyos* by the position of the ventral prevulvar ala which is 110, 120 µm from the posterior end versus 280 µm in *H. cricetomyos*. In addition the shape of the prevulvar ala was different in both species. Therefore these specimens may belong to another species of *Heligmonina*. It was not possible to identify the male and the three females (slide 135) parasitic in *C. emini* n° 439 from Ife.

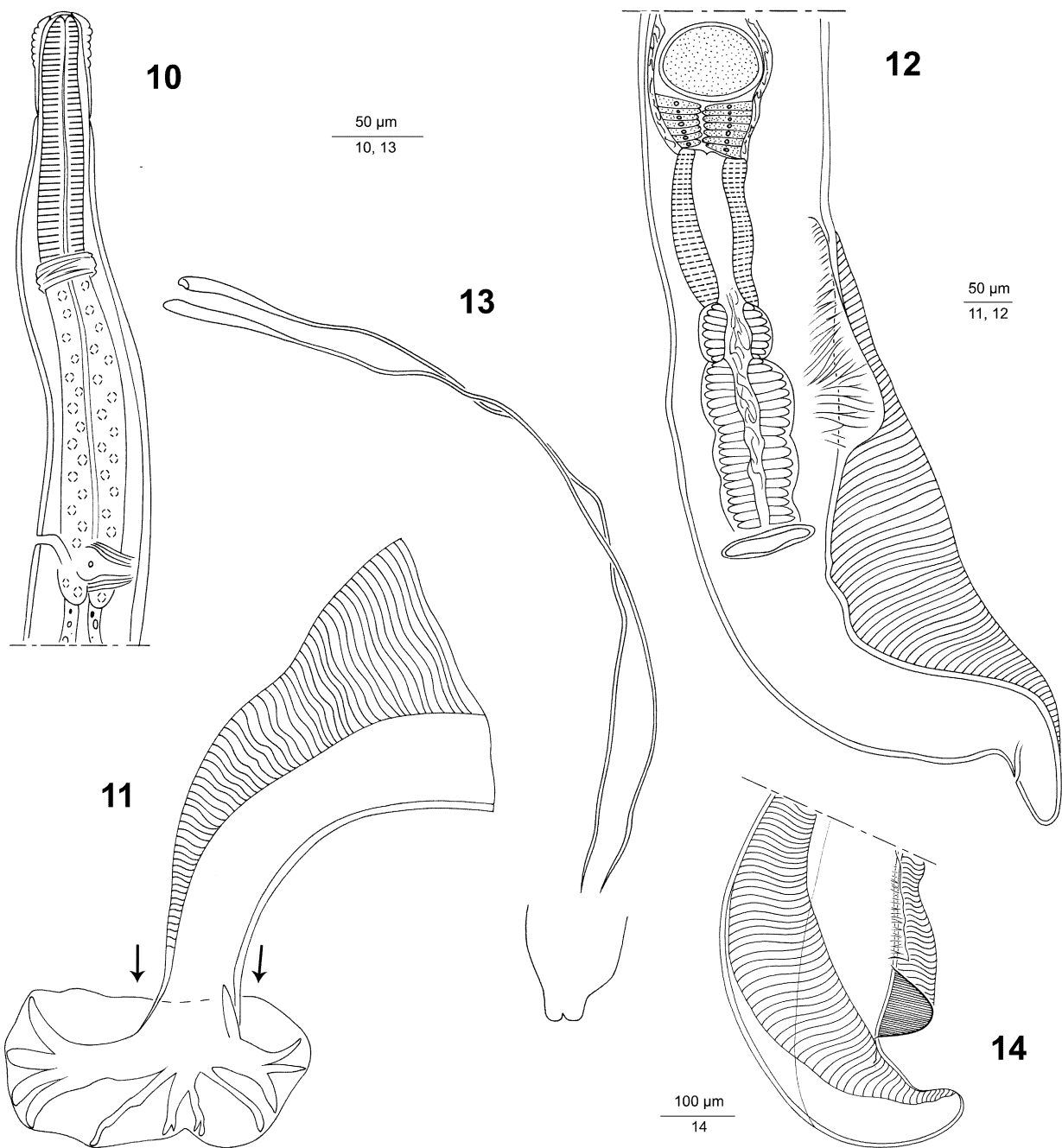
TABLE 3. Parasites from *Oenomys hypoxanthus*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Oenomys hypoxanthus</i> N° 418 - Ife	n° 142	Male 1	<i>Hi. oenomyos</i>	<i>Neoheligionella</i> sp.1
		Male 2	<i>Hi. oenomyos</i>	<i>Neoheligionella</i> sp.1
		Female 1	<i>Hi. oenomyos</i>	<i>Neoheligionella</i> sp.1
Type host for <i>Heligmonina oenomyos</i>	n° 143	Female 1	<i>Hi. oenomyos</i>	<i>Neoheligionella</i> sp.1
		Male 1*	<i>Hi. oenomyos</i>	<i>Hi. oenomyos</i>
	n° 147	Female 1	<i>Hi. oenomyos</i>	<i>Neoheligionella</i> sp.1
		Female 2**	<i>Hi. oenomyos</i>	<i>Hi. oenomyos</i>
	n° 148	Female 1**	<i>Hi. oenomyos</i>	<i>Hi. oenomyos</i>
	Female 2**	<i>Hi. oenomyos</i>	<i>Hi. oenomyos</i>	

** the female chosen as paralectotype of *Heligmonina oenomyos* (female 2 on slide n° 147) is 3.7 mm long and lacks vulvar alae.

TABLE 4. Parasites from *Cricetomys* spp.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Cricetomys emini</i> N° 14 - Adu	n° 131	Male 1*	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
		Male 1**	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
		Male 1**	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
Type host for <i>Heligmonina cricetomyos</i>	n° 133	Male 1**	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
<i>Cricetomys emini</i> N° 197 - Adu	n° 136	Female 1	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
		Female 2	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
		Male 1	<i>Hi. cricetomyos</i>	<i>Ne. moennigi</i>
<i>Cricetomys emini</i> N° 359 - Adu	n° 75	Male 1	<i>Hi. cricetomyos</i>	<i>Ne. moennigi</i>
		Female 1	<i>Hi. cricetomyos</i>	unidentifiable
		Male 1	<i>Hi. cricetomyos</i>	unidentifiable
		Female 1	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
		Male 1	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>
<i>Cricetomys emini</i> N° 363 - Adu	n° 134	Female 1	<i>Hi. cricetomyos</i>	<i>Heligmonina</i> sp.1
		Female 2	<i>Hi. cricetomyos</i>	<i>Heligmonina</i> sp.1
		Male 1		unidentifiable
<i>Cricetomys emini</i> N° 439 - Ife	n° 135	Male 1		unidentifiable
		Female 1		unidentifiable
		Female 2		unidentifiable
		Female 3		unidentifiable
<i>Cricetomys gambianus</i> (syn <i>C. buechanani</i>) N° 481 - Kano	n° 141	Male 1	<i>Hi. cricetomyos</i>	<i>Hi. cricetomyos</i>



FIGURES 10–14. Figures 10–13. *Heligmonina cricetomyos* Baylis, 1928. 10, 11, lectotype male. 10, anterior extremity, left lateral view. 11, caudal bursa, dorsal view. 12, female, posterior extremity, ventral view. 13, male, spicules and gubernaculum in situ, ventral view. Figure 14. *Heligmonina* sp. 1, female, posterior extremity (orientation unclear). Figures 10, 11, slide 131 from *Cricetomys emini* n° 14. Figure 12, slide 136 from *C. emini* n° 197. Figure 13, slide 140 from *C. emini* n° 359. Figure 14, slide 134 from *C. emini* n° 363. Arrows indicate the position of right ray 3 and left ray 2, not visible on the preparation.

Species identified

1) *Heligmonina cricetomyos* Baylis, 1928

(Table 4, Figures 10–13)

Type material: lectotype male (slide 131), two paralectotype males (slides 132, 133).

Type-host: Cricetomys emini n° 14 (Table 4).

Site: Small intestine.

Type locality: Adu (Nigeria).

Voucher material: One male (slide 140), one male (slide 141), three females (slides 136, 139).

Hosts: *Cricetomys emini* n° 359, n° 481, n° 197 [coparasites with *Neoheligmonella moennigi*, see below and Table 4], *Cricetomys gambianus* (syn *Cricetomys buchanani*) n° 481 (Table 4).

Site: Small intestine.

Localities: Adu, Kano (Nigeria).

General: Body strongly coiled sinistrally along ventral side in male either all along body or at different levels. Coiling less pronounced in female. Deirids situated at same level than excretory pore (Figure 10).

Synlophe: Left ala disappearing just anterior to caudal bursa in male (Figure 11), at level of anus in female (Figure 12). In female, presence of prevulvar ala situated at level of vestibule on left ventral side, 240 long and 80 wide maximum (Figure 12).

Type males: 5.1–5.5 mm long and 220–300 wide, including left ala 110–210. Cephalic vesicle (n=2) 60, 65 long and 35, 40 wide. Excretory pore and deirids (n=1) situated 290 and 300 from apex, respectively. Oesophagus (n=2) 320, 370 long (Figure 10) Caudal bursa strongly asymmetrical with right lobe larger (Figure 11). Spicules not observed.

Voucher males: 5.1, 4.9 mm long and 310, 200 wide at mid-body, left ala 200, 150 included. Cephalic vesicle 60, long and 30, - wide, oesophagus 300, - long (Figure 10). Thin spicules 370, 370 long, ending in one sharp tip (Figure 13). SpL/BL 7.2, 7.5%.

Voucher females: 6.1–7.7 mm long, 210–300 wide at mid-body, left ala (60–100) included. Cephalic vesicle (n=2) 60, 60 long and 30, 40 wide. Oesophagus (n=2) 320, 410 long. Vulva (n=2) situated 180, 240 from posterior end. Ovejector (n=2): *vagina vera* 40, 45, vestibule 80, 75, sphincter 40, 50 long and 40, 40 wide, infundibulum 120, 130 long (Figure 12). Uterus (n=3) 950–1,500 long. Number of eggs (n=2) 30, 38, size of eggs (n=2), 60–62 long and 39–42 wide in 2 rows. UtL/BL 15.6–16.2%. Tail (n=2) rounded and thick, 27, 35 long, twisted at 90° to the right (Figure 12).

Remarks

Heligmonina cricetomyos has the main characters of the genus *Heligmonina*: a well-developed left ala and a strongly asymmetrical caudal bursa with a left lobe «considerably larger than the right lobe».

2) *Heligmonina* sp. 1

(Table 4, Figure 14)

Material: two females (slide 134).

Host: *Cricetomys emini* n° 363 (Table 4).

Site: Small intestine.

Locality: Adu (Nigeria).

Female (only one measurable, except measurements of prevulvar ala): 7.0 mm long and 210 wide at mid-body, left ala included. Cephalic vesicle 55 long and 30 wide. Nerve ring 125 long. Excretory pore and deirids not observed. Oesophagus 340 long. Uterus 1.3 mm containing 51 eggs. UtL/BL 18.6%. Presence of a ventral left prevulvar ala, 75, 80 long and 70, 70 wide (Figure 14).

Remarks

This species can be placed in the genus *Heligmonina* by the presence of the left ala and be differentiated from *H. cricetomyos* by the shape and position of the prevulvar ala. The morphological data are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Heligmonina*, see Table 13.

***Heligmonina intermedia* (Baylis, 1928) Durette-Desset, 1971**

(Table 5)

The type-material was made up of two males (an entire one and a posterior fragment) and two females parasitic in the small intestine of one *Lemniscomys striatus* n° 397 from Ibadan. The species described as *Heligmonella intermedia* was transferred into the genus *Heligmonina* by Durette-Desset (1971) since Baylis (1928) provided a drawing of the posterior part of the male and described «an extremely broad left lateral ala» which corresponds to the redefinition of the genus *Heligmonina*. In the entire syntype male, the spicules were very thin and the SpL/BL was 12.2%. Baylis also identified as *H. intermedia* one male parasitic in another *L. striatus* n° 329 from Adu. In this male (slide 122) the left ala was present but the spicules were thick and the SpL/BL was 5.5%. Therefore this male may belong to another species of *Heligmonina*. Two other males (slides 83, 84) parasitic in the same *L. striatus* were identified by Baylis as *Heligmonella impudica* Baylis, 1928 (see below and Table 5).

Species identified

1) *Heligmonina intermedia* (Baylis, 1928)

(Table 5, Figures 15, 16)

Type-material: lectotype male (slide 123), one paralectotype male (a posterior part) (slide 125), two paralectotype females (slides 122a, 124).

Type host: *Lemniscomys striatus* n° 397 (Table 5).

Site: Small intestine.

Type locality: Ibadan (Nigeria).

General: Body slightly curved ventrally. Left ala disappearing at level of caudal bursa in male (Figure 15), not observed in females.

Male: 2.3 mm long, 150 wide at mid-body, left ala 75 included. Oesophagus 280 long. Caudal bursa sub-symmetrical (Figure 15). Spicules 280, 325 long, very thin, ending in sharp tip (Figure 15). SpL/BL: 12.2 %. Gubernaculum 21 long and 10 wide.

Females: 2.7, 3.2, mm long, 125, 125 wide at mid-body. Oesophagus 290, - long. Vulvar opening -, 140, from posterior extremity. Uterus 440, 500 long, containing 12, 14 eggs. UtL/BL 16.3, 15.6%. Tail narrow with rounded tip, 70 long (Figure 16).

2) *Heligmonina* sp. 2

(Table 5, Figures 17–19)

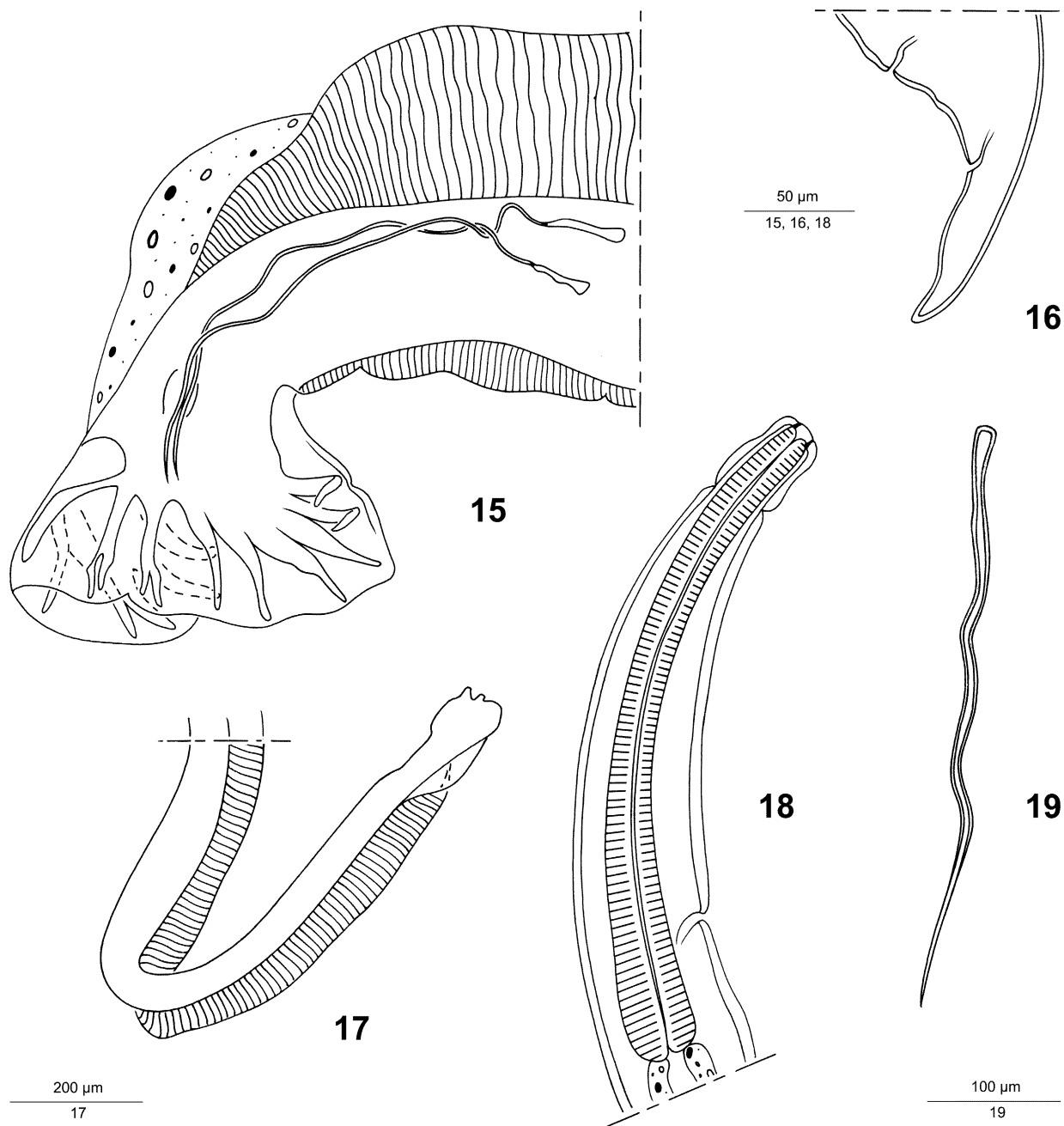
Material: one male (slide 122) coparasite with *Neoheligmonella* sp. 4 (see below).

Host: *Lemniscomys striatus* n° 329 (Table 5).

Site: Small intestine.

Locality: Adu (Nigeria).

Male: 3.8 mm long and 110 wide at mid-body, left ala (50) included (Figure 17). Cephalic vesicle 48 long and 25 wide. Excretory pore situated 220 from anterior end. Oesophagus 280 long (Figure 18). Spicules very thick, 210 long, ending in one sharp tip (Figure 19). SpL/BL: 5.5%. Left ala disappearing just anterior to caudal bursa (Figure 17).



FIGURES 15–19. Figures 15, 16. *Heligmonina intermedia* (Baylis, 1928). 15, lectotype male, caudal bursa, right latero-dorsal view. 16, paralectotype female, posterior extremity, left lateral view. Figures 17–19. *Heligmonina* sp. 2. 17, male, silhouette of posterior part of body showing the left ala, ventral then dorsal views. 18, anterior extremity, right lateral view. 19, one spicule in situ, dorsal view. Figure 15, slide 123, Figure 16, slide 124 from *Lemniscomys striatus* n° 397. Figures 17–19, slide 122 from *L. striatus* n° 329.

Remarks

This species can be placed in the genus *Heligmonina* by the presence of the left lateral ala and be differentiated from *H. intermedia* and the three other Nigerian *Heligmonina* with known males (*H. praomyos*, *H. oenomyos*, *H. cricetomyos*) by a lesser SpL/BL and by the thicker spicules. The morphometrical data are insufficient to identify it as a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Heligmonina* see Table 13.

II. Genus *Neoheligionella* Durette-Desset, 1971

Neoheligionella gracilis (Baylis, 1928)

(= *Heligionella gracilis*, Baylis, 1928)

The type-material is made up of four males and one female parasitic in one *Mus (Nannomys) musculoides* (*Leggada musculoides* on the label) n° 411 from Ibadan (Nigeria). In Baylis' description the spicules are 230–280 µm long. In the type-material, three males (slides 105, 106, 108) have spicules long of 280, 290, 285 µm long, respectively. Therefore we consider these specimens as belonging to *Neoheligionella gracilis*. The spicules of the fourth male (slide 107) are 710 µm long. This specimen is 2.7 mm long and 100 µm wide at mid-body, the ratio SpL/BL is 25.3% versus 9–10.7% in the type specimens. It belongs therefore to another species which is a coparasite with *N. gracilis* but the data concerning this specimen are insufficient to identify it at level of the genus. It is only possible to say that it is a member of the Nippostrongylineae.

TABLE 5. Parasites from *Lemniscomys striatus*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Lemniscomys striatus</i>	n°122a	Female 1**	<i>He. intermedia</i>	<i>Hi. intermedia</i>
N° 397 - Ibadan	n° 123	Male 1*	<i>He. intermedia</i>	<i>Hi. intermedia</i>
Type host for	n° 124	Female 1**	<i>He. intermedia</i>	<i>Hi. intermedia</i>
<i>Heligionella intermedia</i>	n° 125	Male 1**	<i>He. intermedia</i>	<i>Hi. intermedia</i>
<i>Lemniscomys striatus</i>	n° 122	Male 1	<i>He. intermedia</i>	<i>Heligionina</i> sp. 2
N° 329 - Adu	n° 83	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 4
	n° 84	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 4
<i>Lemniscomys striatus</i>	n° 86	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
N° 57 - Adu	n° 87	Female 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
		Female 2	<i>He. impudica</i>	unidentifiable
	n° 88	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
	n° 89	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
	n° 90	Female 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
<i>Lemniscomys striatus</i>	n° 91	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
N° 80 - not specified	n° 92	Female 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
	n° 93	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
	n° 94	Female 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
	n° 95	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
<i>Lemniscomys striatus</i>	n° 96	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
N° 286 - Adu				
<i>Lemniscomys striatus</i>	n° 85	Female 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 3
N° 477 - Oyo				
<i>Lemniscomys striatus</i>	n° 97	Male 1	<i>He. impudica</i>	unidentifiable
N° 258 - Adu				

Species identified

1) *Neoheligionella gracilis* (Baylis, 1928)

(Table 6, Figures 20, 21)

Type material: lectotype male (slide 105), two paralectotype males (slides, 106, 108), one paralectotype female (slide 104).

Type host: *Mus (Nannomys) musculoides* (syn *Leggada musculoides*) n° 411 (Table 6).

Site: Small intestine.

Locality: Ibadan (Nigeria).

TABLE 6. Parasites from *Mus (Nannomys) musculoides* (syn *Leggada musculoides*).

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>M. (N.) musculoides</i>	n° 104	Female 1**	<i>He. gracilis</i>	<i>Ne. gracilis</i>
N° 411 - Ibadan	n° 105	Male 1*	<i>He. gracilis</i>	<i>Ne. gracilis</i>
	n° 106	Male 1**	<i>He. gracilis</i>	<i>Ne. gracilis</i>
Type host for	n° 107	Male 1	<i>He. gracilis</i>	Nippostrongylinae
<i>Heligmonella gracilis</i>	n° 108	Male 1**	<i>He. gracilis</i>	<i>Ne. gracilis</i>
<i>M. (N.) musculoides</i>	n° 153	Male 1*	<i>Ho. murina</i>	<i>Ho. murina</i>
N° 385 - Ibadan	n° 154	Female 1**	<i>Ho. murina</i>	<i>Ho. murina</i>
		Female 2**	<i>Ho. murina</i>	<i>Ho. murina</i>
Type host for		Female 3**	<i>Ho. murina</i>	<i>Ho. murina</i>
<i>Heligmonoides murina</i>				
<i>M. (N.) musculoides</i>	n° 155	Male 1	<i>Ho. murina</i>	<i>Ho. murina</i>
N° 392 - Ibadan		Male 2	<i>Ho. murina</i>	<i>Ho. murina</i>
<i>M. (N.) musculoides</i>	n° 152	Female 1	<i>Ho. murina</i>	unidentifiable
N° 86 - Ibadan				
<i>M. (N.) musculoides</i>	n° 156	Female 1	<i>Ho. murina</i>	unidentifiable
N° 399 - Ibadan		Female 2	<i>Ho. murina</i>	unidentifiable
		Female 3	<i>Ho. murina</i>	unidentifiable

General: Body only curved on ventral side.

Males: 2.7–3.1 mm long and 100 wide at mid-body. Cephalic vesicle (n=2) 40, 40 long and 25, 33 wide. Nerve ring (n=3) situated 120–160 from apex, excretory pore and deirids (n=1) situated at same level, 200 from apex. Oesophagus (n=3) 240–340 long (Figure 20). Spicules (n=3) 280–290 long. SpL/ BL: 9–10.7%.

Female: 3.3 mm long and 100 wide at mid-body. Body abruptly decreasing posterior to vulva. Tail narrow with rounded extremity (Figure 21).

Neoheligmonella impudica (Baylis, 1928)

(= *Heligmonella impudica* Baylis, 1928)

(Tables 5, 7, 8, Figures 22–24)

The type material is made up of three males and one female parasitic in one *Gerbilliscus (Taterona) kempfi* (*Taterona kempfi* on the label) n° 404 from Ibadan, Nigeria. Baylis identified this species in three other *G. (T.) kempfi* (n° 387, n° 455, n° 467), two *Arvicanthis rufinus* (*Arvicanthis mordax* on the label) (n° 505 and n° 508) from Kano, one *Arvicanthis rufinus* (n° 445) from Ibadan and six *Lemniscomys striatus*, four (n° 57, n° 258, n° 286, n° 329) from Adu, one (n° 477) from Oyo and another one (n° 80) without indication of geographic origin. In his description, Baylis mixed the data concerning the type material and the voucher material. The spicules of the syntype males measure 300, 380 long with a ratio SpL/BL of 6.25, 9.7%. The single syntype female has a rounded and very thick tail. From these data we have attempted to identify the voucher material.

Species identified

1) *Neoheligmonella impudica* (Baylis, 1928).

(Tables 7, 8, Figures 23–24)

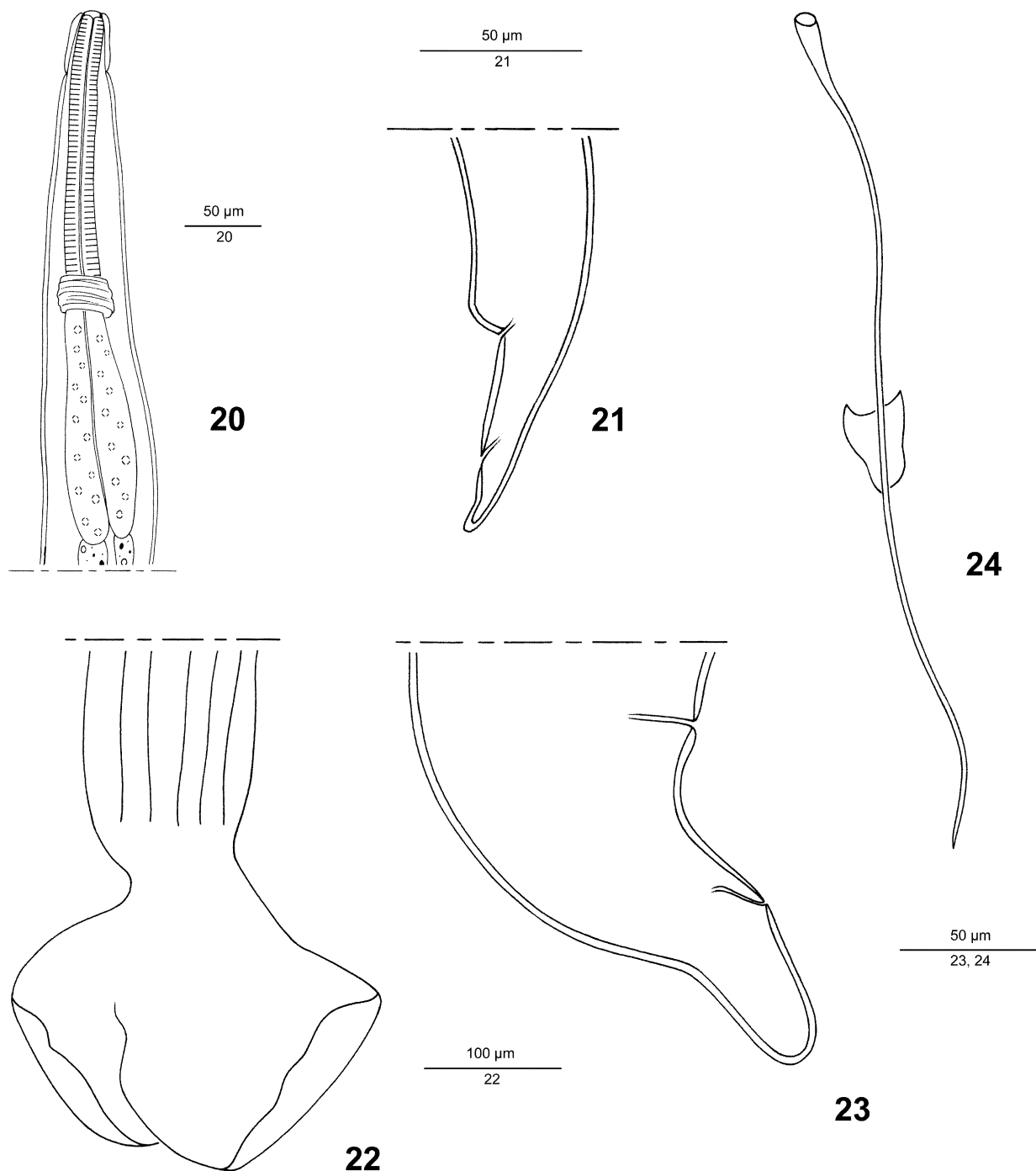
Type material: lectotype male, two paralectotype males, one paralectotype female (slide 77).

Type host: *Gerbilliscus (Taterona) kempfi* (Wroughton, 1906) (syn *Taterona kempfi*) n° 404 (Table 7).

Site: Small intestine.

Locality: Ibadan (Nigeria).

General: Body curved ventrally or coiled sinistrally following two spiral turns in male, one in female. In male, cuticular ridges disappearing just anterior to caudal bursa (Figure 22).



FIGURES 20–24. Figures 20–21. *Neoheligionella gracilis* (Baylis, 1928). 20, lectotype male, anterior extremity, orientation uncertain. 21, paralectotype female, posterior extremity, left lateral view. Figures 22–24. *Neoheligionella impudica* (Baylis, 1928). 22, male, silhouette of closed caudal bursa, disappearance of cuticular ridges. 23, paralectotype female, posterior extremity, right lateral view. 24, male, one spicule and gubernaculum in situ, ventral view. Figure 20, slide 105, Figure 21, slide 104 from *Mus (Nannomys) musculoides* n° 411. Figure 22, slide 78 from *Gerbilliscus (Taterona) kempi* n° 455. Figure 23, slide 77 from *G. (T.) kempi* n° 404. Figure 24, slide 98 from *Arvicanthis mordax* n° 505.

Males: 3.9–4.8 mm long and 140–150 wide at mid-body. Thin spicules 300–380 long, ending in one sharp tip. SpL/BL: 6.7–9.5%.

Female: 8.8 mm long and 200 wide at mid-body. Cephalic vesicle 60 long and 50 wide. Oesophagus 310 long. Vulvar opening situated 155 from caudal extremity. Vestibule 160 long, sphincter 38 long, infundibulum

130 long. Uterus 2.0 mm long with about 100 eggs, 60–65 long and 40–42 wide. UtL/BL 22.7%. Thick tail rounded at extremity, 60 long (Figure 23).

Voucher material: (A) four males (slide 78), seven females (slides 76, 79, 80).

Host: *Gerbilliscus (T.) kempfi* n° 387, n° 455, n° 467 (Table 7).

Site: Small intestine.

Locality: Kano (Nigeria).

Males: 4.4–4.9 mm long and 110–190 wide at mid-body, carene (50) included. Anterior part of body (n=1): Cephalic vesicle 50 long and 30 wide. Excretory pore and deirids situated 290 from apex, respectively. Oesophagus 480 long. Spicules thin, 240–340 long ending in one sharp tip. SpL/BL: 4.9–7.1%. Gubernaculum 38 long and 21 wide.

Females: 6.2–7.6 mm long and 150–200 wide. Cephalic vesicle 55 long and 40 wide. Excretory pore situated 240 from apex. Oesophagus 370 long. Genital apparatus (n =3): vulvar opening situated 185–215 from caudal extremity. Uterus 1.4–2.2 mm long with 72–107 eggs 70–72 long and 30–31 wide. UtL/BL 20.1–23.6%. Rounded tail, 50–60 long.

Voucher material: (B) five males (slides 98, 99), five females (slides 98, 99, 100).

Host: *Arvicanthus rufinus* (syn *Arvicanthus mordax* Thomas) n° 505, n° 508 (Table 8).

Site: Small intestine.

Locality: Kano (Nigeria).

Males: 3.2–4.6 mm long and 125–125 wide. Thin spicules 230–318 long, ending in one sharp tip (Figure 24). SpL/BL: 6.3–7.6 %. Gubernaculum 30–35 long and 20–22 wide.

Females: 6.1–9.9 mm long and 180–200 wide. Cephalic vesicle 65–100 long and 50–50 wide. Excretory pore (n=1) situated 470 from apex. Oesophagus (n=1) 480 long. Tail rounded, strongly curved ventrally at level of anus, 50, 65 long.

2) *Neoheligionella* sp. 2

(Table 8)

Material: two males (slide 101).

Host: *Arvicanthus rufinus* n° 445 (Table 8).

Site: Small intestine.

Locality: Ibadan (Nigeria).

Males: 2.3, 2.2 mm long. Thin spicules, 285, 360 long, ending in one sharp tip. SpL/BL: 12.4–16.4%.

Remarks

The specimens may be related to the genus *Neoheligionella* by the absence of a well developed left ala. They are differentiated from *N. impudica* by a smaller body length and a greater SpL/BL (12.4–16.4 % versus 6.3–9.5 %). The morphological data, particularly those concerning the synlophe are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Neoheligionella* see Table 14.

3) *Neoheligionella* sp. 3

(Table 5, Figures 25–27)

Material: seven males (slides 86, 88, 89, 91, 93, 95, 96), five females (slides 85, 87, 90, 92, 94).

Hosts: *Lemniscomys striatus* n° 57, n° 80, n° 286, n° 477 (Table 5).

Site: Small intestine.

Localities: Adu, Oyo (Nigeria).

TABLE 7. Parasites from *Gerbilliscus (Taterona) kempii*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>G. (T.) kempii</i> N° 387 - Kano	n° 76	Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
<i>G. (T.) kempii</i> N° 404 - Ibadan Type host for <i>Heligmonella impudica</i>	n° 77	Male 1**	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 2*	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 3**	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 1**	<i>He. impudica</i>	<i>Ne. impudica</i>
<i>G. (T.) kempii</i> N° 455 - Kano	n° 78	Male 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 2	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 3	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 4	<i>He. impudica</i>	<i>Ne. impudica</i>
	n° 79	Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 2	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 3	<i>He. impudica</i>	<i>Ne. impudica</i>
<i>G. (T.) kempii</i> N° 467 - Kano	n° 80	Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 2	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 3	<i>He. impudica</i>	<i>Ne. impudica</i>

TABLE 8. Parasites from *Arvicanthus rufinus*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Arvicanthus rufinus</i> N° 445 - Ibadan	n° 101	Male 1	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 2
		Male 2	<i>He. impudica</i>	<i>Neoheligionella</i> sp. 2
<i>Arvicanthus rufinus</i> (syn <i>A. mordax</i>) N° 505 - Kano	n° 98	Female 1	<i>He. impudica</i>	unidentifiable
		Male 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 2	<i>He. impudica</i>	<i>Ne. impudica</i>
<i>Arvicanthus rufinus</i> (syn <i>A. mordax</i>) N° 508 - Kano	n° 99	Male 3	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Male 2	<i>He. impudica</i>	<i>Ne. impudica</i>
<i>Arvicanthus rufinus</i> (syn <i>A. mordax</i>) N° 508 - Kano	n° 100	Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 1	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 2	<i>He. impudica</i>	<i>Ne. impudica</i>
		Female 3	<i>He. impudica</i>	<i>Ne. impudica</i>

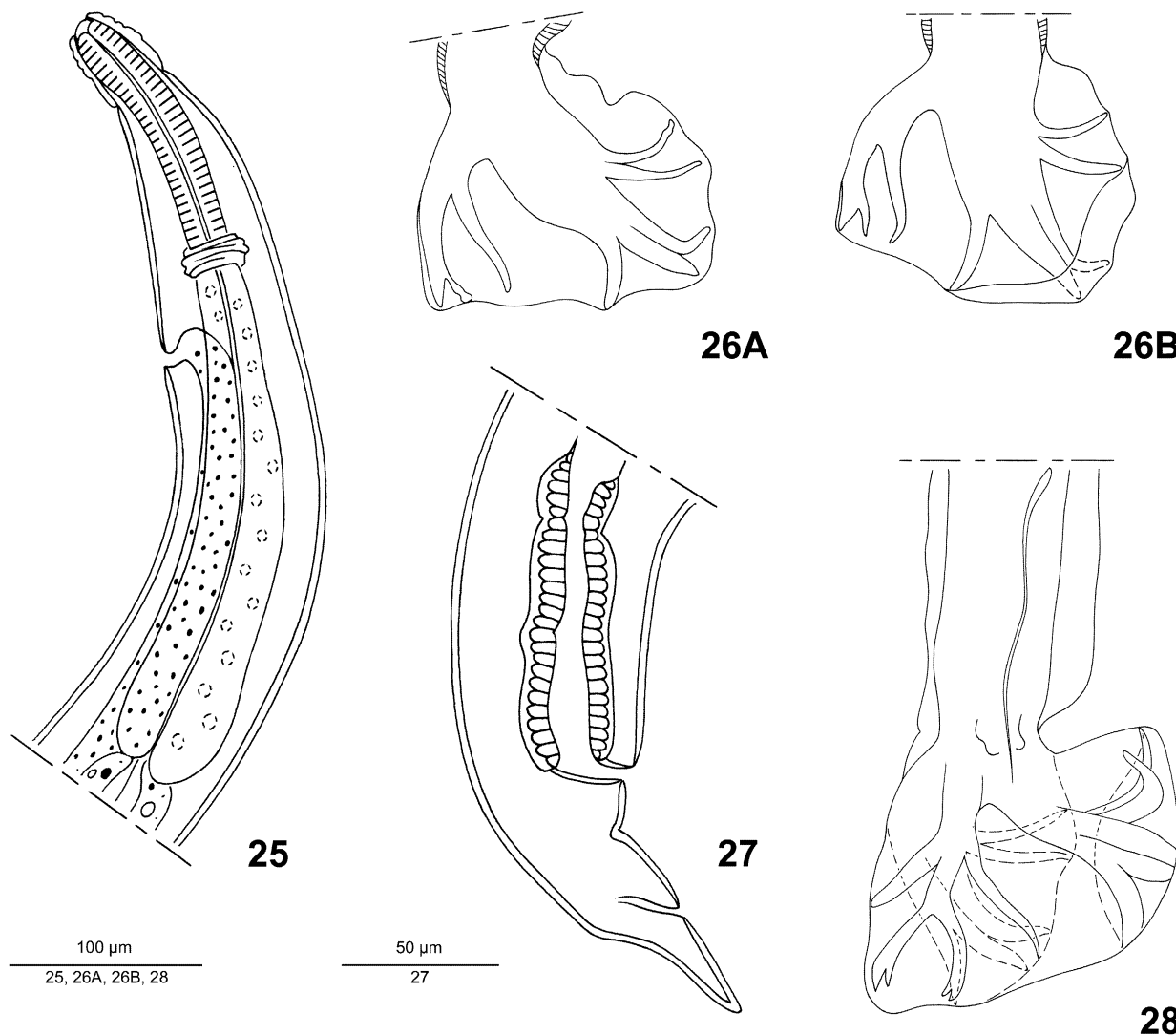
Males: 3.6–5.7 mm long and 75–110 wide at mid-body. Cephalic vesicle (n=5) 40–60 long and 30–35 wide. Nerve ring (n=5) and excretory pore (n= 2) situated 120–180 and 160, 190 from apex, respectively. Oesophagus 355–445 long (Figure 25). Caudal bursa sub-symmetrical of type 2-3 (Figure 26, A, B). Spicules (n=5) thin, 260–400 long, ending in one sharp tip. SpL/BL: 6.2–7.0%. Gubernaculum (n=1) 35 long and 23 wide.

Females: 4.6–9.4 mm long and 110–125 wide. Cephalic vesicle (n= 2) 70, 72 long and 50, 55 wide. Oesophagus (n=2) 350, 470 long. Vulvar opening (n=2) situated 160, 200 from posterior end. Vagina vera (n=1) 40 long, vestibule (n=1) 150 long, uterus 550–1,200 long with 15–32 eggs, 60–70 long and 35–50 wide. UtL/BL 12.8–18.5%. Tail (n=3) 60–75 long with sharp extremity (Figure 27).

Remarks

The absence of the left developed ala and also of numerous cuticular ridges enable us to place these specimens in the genus *Neoheligionella*. The males are differentiated from those of *N. impudica* by a sub-symmetrical caudal bursa. The females are easily differentiated by the shape of the tail, a smaller ratio UtL/BL and a smaller number of eggs. They are similar to *Neoheligionella lemniscomysi* (Durette-Desset, 1970), a parasite from the same host from the Central African Republic, by the short uterus and few eggs but they are

differentiated by a sub-symmetrical caudal bursa and a smaller SpL/BL. The morphological data are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Neoheligionella* see Table 14.



FIGURES 25–28. Figures 25–27. *Neoheligionella* sp. 3. 25, male, anterior extremity, left lateral view. 26, caudal bursa, A, right lobe, right laterodorsal view, B, left lobe, ventral view, through right lobe. Figure 28. *Neoheligionella* sp. 4. Male, caudal bursa, right laterodorsal view. Figure 25, slide 93, figure 26, slide 95, figure 27, slide 94 from *Lemniscomys striatus* n° 80. Figure 28, slide 83 from *L. striatus* n° 329.

4) *Neoheligionella* sp 4.

(Table 5, Figure 28)

Material: two males (slides 83, 84) coparasites with *Heligionina* sp. 2.

Host: *Lemniscomys striatus* n° 329 (Table 5).

Site: Small intestine.

Locality: Adu (Nigeria).

Males: 4.5, 3.6 mm long and 110, 90 wide. Cephalic vesicle 58, 55 long and 34, 35 wide. Nerve ring and excretory pore situated 140, 170 and -, 270 from apex, respectively. Oesophagus 360, 350 long. Spicules thin, 180, 210 long, ending in one sharp tip. Caudal bursa of type 2-3 (Figure 28). SpL/BL: 4.0, 5.8 %. Gubernaculum -, 28 long and 20 wide (Figure 28).

Remarks

The specimens are similar to *N. impudica* by the asymmetry of the caudal bursa with a left lobe better developed, but they are differentiated by smaller spicules for a similar body length. The morphological data, particularly those concerning the synlophe are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Neoheligionella* see Table 14.

Neoheligionella moennigi (Baylis, 1928)

(= *Heligionella moennigi* Baylis, 1928)

(Tables 2, 4, 9, Figures 2, 29–32)

The type material is made up of six males (slides 62, 63, 64) and three females (slides 63, 64) from the small intestine of one *Praomys tullbergi* n° 189 from Adu, Nigeria. The voucher material came from two *P. tullbergi* (n° 114, n° 22) from Adu and two *Malacomys edwardsi* (n° 45, n° 118) also from Adu. We also treat as voucher material two males from *Praomys tullbergi* n° 175 (slide 130) identified by Baylis as *Heligionina praomyos* and two males from *Cricetomys emini* n° 197 (slides 74, 75) identified by Baylis as *Heligionina cricetomyos*. These four males were found to correspond to *N. moennigi*.

Species identified

1) *Neoheligionella moennigi* (Baylis, 1928)

Type material: lectotype male, two paralectotype males, two paralectotype females (slide 64), three paralectotype males, one paralectotype female (slide 63).

Type-host: *Praomys tullbergi* (Thomas, 1894) n° 189 (Table 2).

Site: Small intestine.

Type-locality: Adu (Nigeria).

Males: 3.5–4.5 mm long and 110–150 wide. Spicules thin, sinuous, 850–950 long, ending in one sharp tip. SpL/BL: 20.2–24.7%. Gubernaculum (n=2) 35, 55 long and 22, 25 wide.

Females: 4.4–5.0 mm long and 110–190 wide. Cephalic vesicle (n=1) 60 long and 35 wide. Oesophagus (n=1) 250 long. Uterus (n=1) 900 long with 16 eggs 50–55 long and 30–30 wide. UtL/BL: 18%. Tail retractile (Figure 32).

Voucher material: (A) one female (slide 60), two males, one female (slides 66, 67) coparasites with *Heligionina praomyos*, two males (slide 130) coparasites with *Heligionina praomyos*.

Hosts: *Praomys tullbergi* n° 22, n° 114, n° 175 (Table 2).

Site: Stomach (n° 22) and small intestine.

Locality: Adu (Nigeria).

Males: 4.1–4.8 mm long and 90–200 wide at mid-body, carene (50) included or not observed. Cephalic vesicle (n=1) 40 long and 35 wide. Caudal bursa of type 2-2-1. Spicules (n=3) 800–950 long very thin and sinuous (Figure 2). SpL/BL: 16.7–22%. Gubernaculum (n=1) 40 long and 15 wide.

Females: 5.2, 6.4 mm long and 140, 150 wide at mid-body. Cephalic vesicle (n=1) 78 long and 35 wide. Oesophagus (n=1) 390 long. Uterus with 19 eggs. Tail retractile.

Voucher material: (B) 2 males, one female (slide 72).

Host: *Malacomys edwardsi* n° 45 (Table 9).

Site: Small intestine.

Locality: not specified.

Males: 4.0, 3.3 mm long and 125, 115 wide at mid-body. Spicules thin and sinuous -, 910 long, ending in one sharp tip (Figure 31). SpL/BL: 27.5%.

Female: 5.3 mm long and 200 wide at mid-body. Oesophagus 400 long. Tail retractile.

Voucher material: (C) 2 males (slides 74, 75) coparasites with *Heligmonina cricetomyos*.

Host: *Cricetomys emini* n° 197 (Table 4).

Site: Small intestine.

Locality: Adu (Nigeria).

Males: 4.0, 4.1 mm long and 150, 150 wide. Cephalic vesicle 50, 55 long and 30, 30 wide.

Nerve ring situated 150, - from apex. Oesophagus 400, 380 long (Figure 29). Right lobe of caudal bursa of type 2-2-1 (Figure 30). Spicules -, 1,000 long. SpL/BL: -, 24.4%.

TABLE 9. Parasites from *Malacomys edwardsi*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Malacomys edwardsi</i> N° 45 - not specified	n° 72	Male 1 Male 2 Female 1	<i>He. moennigi</i> <i>He. moennigi</i> <i>He. moennigi</i>	<i>Ne. moennigi</i> <i>Ne. moennigi</i> <i>Ne. moennigi</i>
<i>Malacomys edwardsi</i> N° 118 - Adu	n° 73	Male 1	<i>He. moennigi</i>	unidentifiable

***Neoheligmonella affinis* (Baylis, 1928)**

(= *Heligmonella affinis*, Baylis, 1928)

(Table 10, Figures 33–34)

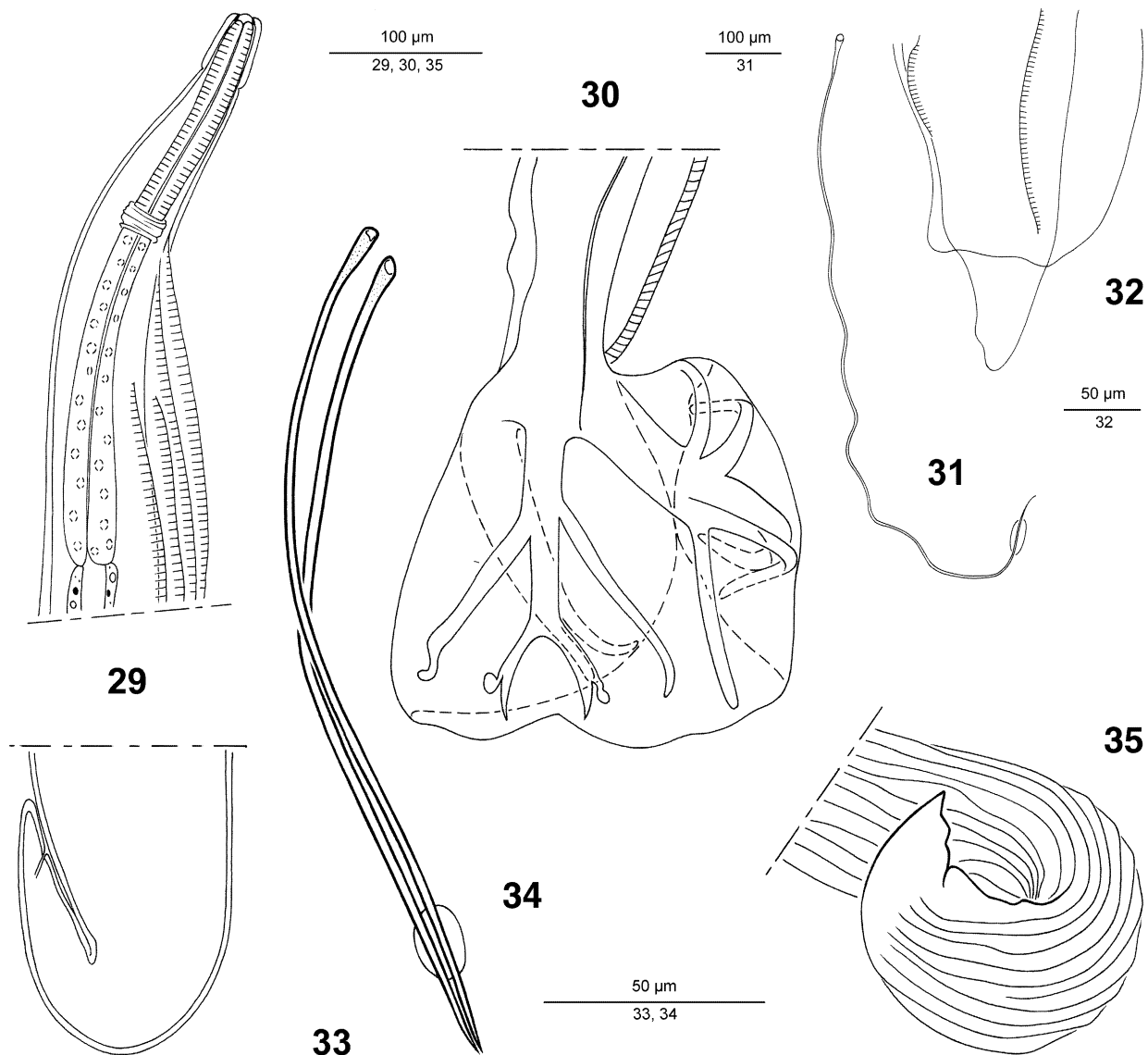
The type material is preserved in alcohol, but the specimens are flattened and included in a thin film of Canada balsam, indicating that they were originally mounted on slides, then unmounted. The material is made up of three males and three females, all with the label “cotypes” in two separate flasks. One of the flasks contained two vials and three labels. Label 1: “1929.1.24 102–103 *Heligmonella affinis* Ex *Mastomys erythroleucus*, Adu + Oyo, Nigeria, Co-types”. Label 2: “*Heligmonella affinis* Baylis, 1928-*Mastomys erythroleucus*-1 male, 2 females cotypes”. Label 3: “*Heligmonella affinis* Baylis, 1928-*Mastomys erythroleucus*-Oyo, Nigeria-single male (broken) cotype”. Since labels 2 and 3 corresponded with the content of both vials we considered these specimens (two males and two females) to be the type material. The other flask contained a vial and four labels: two labels referred to the hosts, sites and localities: “*Mastomys erythroleucus* n° 379-intestine-Adu-Nigeria” and “*M. erythroleucus* n° 470-intestine-Oyo-Nigeria”. The other two labels referred to the parasites: “*H. affinis* Baylis, 1928-male, females-1929.1.24.103” and “*H. affinis* Baylis, 1928-male-1929.1.24.102”. The references on the labels did not correspond with the content of the vial, which contained one male and one female, and therefore those specimens are not treated in this work.

Among the type material, only one male and one female corresponded well with the description of Baylis, which is not illustrated. In these specimens the left ala is absent. The male was 3.25 mm long and 90 wide with thick spicules 380 long (SpL/BL: 11.7%) (Figure 34). The female, 3.65 mm long and 80 wide, had “the caudal end hooked ventrally and the body slightly swollen in front of the vulva”. The body diameter abruptly decreases at level of the hook (Figure 33).

The second female had striking differences with the type female, mainly the tail shape and the number of eggs, which allow us to exclude it easily as *N. affinis*. The absence of a left ala excludes it from the genus *Heligmonina*. However, it is not possible to place it in a given genus and we prefer to treat this specimen as a member of the Nippostrongylineae.

In the second male, 1.90 mm long, the left ala was not observed and the spicules were 390 long. The SpL/BL is of 20.1%. However this ratio is uncertain because the specimen is broken; although there are no

fragments lacking, it is not possible to confirm the body length. Since we are not able to confirm or to exclude the attribution of this male to *N. affinis*, it is considered as *Neoheligionella* sp.



FIGURES 29–35. Figures 29–32. *Neoheligionella moennigi* (Baylis, 1928). 29, male, anterior extremity, ventral view. 30, 31, male, 30, caudal bursa, dorsolateral right view. 31, one spicule and gubernaculum in situ, right lateral view. 32, paralectotype female, posterior extremity, left lateral view. Figures 33–34. *Neoheligionella affinis* (Baylis, 1928). 33, paralectotype female, posterior extremity, left lateral view. 34, lectotype male, spicules and gubernaculum in situ, ventral view. Figure 35. *Heligionoides murina* Baylis, 1928. Female, posterior extremity, showing the disappearance of cuticular ridges, left lateral view.

Figure 29, slide 74, figure 30, slide 75 from *Cricetomys emini* n° 197. Figure 31, slide 72 from *Malacomys edwardsi* n° 45. Figure 32, slide 63 from *Praomys tullbergi* n° 189. Figure 33, Figure 34, from *Mastomys erythroleucus* (without number). Figure 35, slide 134 from *Mus (Nannomys) musculoides* n° 385.

Species identified

1) *Neoheligionella affinis* (Baylis, 1928) Durette-Desset, 1971
(Table 10, Figures 33, 34)

Type material: lectotype male, paralectotype female.

Type host: Mastomys erythroleucus, without number.

Site: Small intestine.

Locality: Adu (Nigeria).

General: Small nematodes slightly curved along ventral side. Left ala not observed.

Male: 3.25 mm long and 90 wide. Cephalic vesicle 35 long and 20 wide. Excretory pore situated 235 from apex. Thick spicules 380 long, ending in one sharp tip (Figure 34). SpL/BL: 11.7%. Gubernaculum symmetrical, 35 long and 20 wide.

Female: 3.65 long and 80 wide. Oesophagus 430 long. Ovejector: vestibule 60 long, sphincter 40 long and 55 wide. Uterus 720 long containing 18 eggs, 50–52 long and 30–45 wide. UtL/BL 19.7%. Posterior extremity curved ventrally. Body slightly swollen in front of the vulva, abruptly tapering at level of the hook. Tail conical, 40 long (Figure 33).

2) *Nippostrongylinae* sp.

Material: one female.

Host: Mastomys erythroleucus without number.

Site: Small intestine.

Locality: Adu (Nigeria).

Left ala not observed, body 2.35 long and 50 wide. Cephalic vesicle 35 long and 18 wide. Excretory pore and deirids situated 150, 180 from apex, respectively. Oesophagus 180 long. Vulva situated 120 from posterior end. Vestibule 50 long, sphincter 35 long and 33 wide. Uterus 350 long, containing 5 eggs, 60–62 long and 30–35 wide. UtL/BL 14.9%. Posterior extremity straight, body tapering gradually behind vulva. Tail conical, 35 long.

3) *Neoheligionella* sp.

Material: one broken male.

Host: Mastomys erythroleucus without number.

Site: Small intestine.

Locality: Adu (Nigeria).

Left ala not observed. 1.90 (?) mm long and 90 wide. Spicules 390 long, gubernaculum 50 long and 25 wide.

III. Genus *Heligmonoides* Baylis, 1928

Heligmonoides murina Baylis, 1928

(Tables 6, 11, Figure 35)

The type material is made up of one male and three females parasitic in one *Mus (Nannomys) musculoides* (*Leggada musculoides* on the label) n° 385 from Ibadan (Nigeria). Baylis also identified this species in three other *M. (N.) musculoides* (n° 86, n° 392 and n° 399), all from Ibadan and one *Mus (M.) musculus* (n° 164) from Adu. In the type material, the spicules of the males were 800 µm long with a SpL/BL of 25% and the females have a thick tail sharp at its extremity and 13–21 eggs. We identified the two males parasitic in *M. (N.) musculoides* (n° 392) as *Heligmonoides murina* since the spicules were 730, 750 long and the SpL/BL of 17.85% for the entire male. In *M. (N.) musculoides* n° 86 and n° 399 the four females were unidentifiable. In *M. (M.) musculus* n° 164, only four females out of six were identifiable. We identified them as *Heligmonoides murina* since the number of eggs was 18–26. Even if it is impossible to count the cuticular ridges, it is possible to observe in all specimens that they are numerous. In Baylis' description the number is about 30.

TABLE 10. Parasites from *Mastomys erythroleucus*.

Host - Locality	Vial / Slide	Specimens	Baylis' identification	Present identification
<i>Mastomys erythroleucus</i>	1929.1.24	Male 1*	<i>He. affinis</i>	<i>Ne. affinis</i>
- Adu, Oyo	102–103	Female 1**	<i>He. affinis</i>	<i>Ne. affinis</i>
w/o number		Female 2	<i>He. affinis</i>	<i>Nippostrongylinae</i>
<i>Mastomys erythroleucus</i>	1929.1.24	Male 1	<i>He. affinis</i>	<i>Neoheligionella sp.</i>
- Adu, Oyo	102–103			
w/o number				

** the female chosen as paralectotype of *Neoheligionella affinis* (female 1 in the vial containing two females) is 3.65 mm long and has a left ala.

TABLE 11. Parasites from *Mus (Mus) musculus*.

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Mus (Mus) musculus</i>	n° 157	Female 1	<i>Ho. murina</i>	<i>Ho. murina</i>
N° 164 - Adu		Female 2	<i>Ho. murina</i>	<i>Ho. murina</i>
	n° 159	Female 1	<i>Ho. murina</i>	<i>Ho. murina</i>
		Female 2	<i>Ho. murina</i>	unidentifiable
	n° 160	Female 1	<i>Ho. murina</i>	<i>Ho. murina</i>
		Female 2	<i>Ho. murina</i>	unidentifiable

TABLE 12. Parasites from *Grammomys dolichurus* (syn *G. surdaster*).

Host - Locality	Slide	Specimens	Baylis' identification	Present identification
<i>Grammomys dolichurus</i>	n° 101–120	Male 1	<i>Hi. oenomyos</i>	<i>Neoheligionella sp. 5</i>
w/o number - not specified	n° 101–120	Male 1	<i>Hi. cricetomyos</i>	<i>Neoheligionella sp. 5</i>

TABLE 13. Differential diagnosis between the species of *Heligionina* from Baylis (1928). Males.

Parasite	Host	Body length	Spicules	SpL/BL
<i>Heligionina praomyos</i>	<i>Praomys tullbergi</i>	2.8–3.15 mm	thin, 310–350 µm	9.8–14.8 %
<i>Heligionina oenomyos</i>	<i>Oenomys hypoxanthus</i>	3.0 mm	580 µm	19.3%
<i>Heligionina cricetomyos</i>	<i>Cricetomys emini</i>	5.1–5.5 mm	370 µm	7.2–7.5%
<i>Heligionina intermedia</i>	<i>Lemniscomys striatus</i>	2.3 mm	280–325 µm	12.2%
<i>Heligionina sp. 2</i>	<i>Lemniscomys striatus</i>	3.8 mm	thick, 210 µm	5.5%

TABLE 14. Differential diagnosis between the species of *Heligionina* from Baylis (1928). Females.

Parasite	Host	Body length	N° of eggs	Tail shape	Preulvar ala
<i>Heligionina praomyos</i>	<i>Praomys tullbergi</i>	4.4, 5.0 mm	16, 19	Sharp, retractile	Absent
<i>Heligionina oenomyos</i>	<i>Oenomys hypoxanthus</i>	3.9, 5.3 mm	68, 70	Rounded	Absent
<i>Heligionina cricetomyos</i>	<i>Cricetomys emini</i>	6.1–7.7 mm	30–38	Rounded, thick	280 µm from caudal end
<i>Heligionina intermedia</i>	<i>Lemniscomys striatus</i>	2.7, 3.2 mm	12, 14	Narrow	Absent
<i>Heligionina sp. 1</i>	<i>Cricetomys emini</i>	7 mm	51	Rounded, thick	110–120 µm from caudal end

TABLE 15. Differential diagnosis between the species of *Neoheligmonella* from Baylis (1928). Males.

Parasite	Host	Body length	Spicules	SpL/BL
<i>Neoheligmonella affinis</i>	<i>Mastomys erythroleucus</i>	3.25 mm	thick, 380 µm	11.7%
<i>Neoheligmonella moennigi</i>	<i>Praomys tullbergi</i>	3.5–4.8 mm	800–950 µm	16.7–24.7%
	<i>Cricetomys emini</i>	4.0, 4.1 mm	1 mm	24.4%
	<i>Malacomys edwardsi</i>	3.3–4.0 mm	910 µm	27.5%
<i>Neoheligmonella gracilis</i>	<i>Mus (Nannomys) musculoides</i>	2.7–3.1 mm	280–290 µm	9–10.7%
<i>Neoheligmonella impudica</i>	<i>Gerbilliscus (T.) kempfi</i>	3.9–4.9 mm	240–380 µm	4.9–9.5%
	<i>Arvicanthis rufinus</i>	3.2–4.6 mm	230–318 µm	6.3–7.6%
<i>Neoheligmonella</i> sp. 1	<i>Oenomys hypoxanthus</i>	3.7, 3.9 mm	480, 510 µm	13, 13.1%
<i>Neoheligmonella</i> sp. 2	<i>Arvicanthis rufinus</i>	2.2, 2.3 mm	285, 360 µm	12.4, 16.4 %
<i>Neoheligmonella</i> sp. 3	<i>Lemniscomys striatus</i>	3.6–5.7 mm	260–400 µm	6.2–7.0 %
<i>Neoheligmonella</i> sp. 4	<i>Lemniscomys striatus</i>	3.6, 4.5 mm	thin, 180, 210 µm	4.0, 5.8 %
<i>Neoheligmonella</i> sp. 5	<i>Grammomys dolichurus</i>	4.8, 5.1 mm	510 µm	10.0, 10.6%

TABLE 16. Differential diagnosis between the species of *Neoheligmonella* from Baylis (1928). Females.

Parasite	Host	Body length	N° of eggs	Tail shape
<i>Neoheligmonella affinis</i>	<i>Mastomys erythroleucus</i>	3.65 mm	18	Conical, narrow
<i>Neoheligmonella moennigi</i>	<i>Praomyos tullbergi</i>	4.4–6.4 mm	16, 19	Sharp, retractile Retractile
	<i>Malacomys edwardsi</i>	5.3 mm	No data	
<i>Neoheligmonella gracilis</i>	<i>Mus (Nannomys) musculoides</i>	3.3 mm	No data	Narrow
<i>Neoheligmonella impudica</i>	<i>Gerbilliscus (T.) kempfi</i>	6.2–8.8 mm	72–>100	Rounded, thick
	<i>Arvicanthis rufinus</i>	6.1–9.9 mm	No data	
<i>Neoheligmonella</i> sp. 1	<i>Oenomys hypoxanthus</i>	3.9, 5.3 mm	68, 70	Rounded
<i>Neoheligmonella</i> sp. 3	<i>Lemniscomys striatus</i>	4.6–9.4 mm	15–32	Sharp

Species identified

1) *Heligmonoides murina* Baylis, 1928

(Tables 6, 11, Fig. 35)

Type material: lectotype male (slide 153), three paralectotype females (slide 154).

Type host: *Mus (Nannomys) musculoides* (syn *Leggada musculoides*) n° 385 (Table 6).

Site: Small intestine.

Type locality: Ibadan on the slide, Adu in the publication.

General: Body coiled sinistrally on ventral side with one or two irregular spirals. Cuticular ridges numerous.

Male: 3.2 mm long and 75 wide at mid-body. Spicules 800 long, ending in one sharp tip. SpL/BL: 25%.

Females: 4.5–5.1 mm long and 95–125 wide. Cephalic vesicle 40, 48 long and 20, 20 wide. Excretory pore situated 215, 315 from apex. Oesophagus 290, 410 long. Uterus 1.1, 1.1 mm long with 13–21 eggs 55–60 long and 29–38 wide. UtL/BL 21.6–25%.

Voucher material: (A) two males (slide 155).

Host: *Mus (Nannomys) musculoides* (syn *Leggada musculoides*) n° 392 (Table 6).

Site: Small intestine.

Locality: Ibadan (Nigeria).

Male 1: only posterior part. Spicules 730 long.

Male 2: 4.2 mm long and 110 wide. Excretory pore situated 180 from apex. Oesophagus 270 long. Spicules 750 long, ending in one sharp tip. SpL/BL: 17.85%.

Voucher material: (B) four females (slides 157, 159, 160).

Host: *Mus musculus* n° 164 (Table 11).

Site: Small intestine.

Locality: Adu (Nigeria).

Females: 4.1–4.8 mm long and 70–100 wide. Cephalic vesicle (n=2) 50, 53 long and 30, 38 wide. Oesophagus (n=1) 420 long. Uterus with 18, 26 eggs, 53–55 long and 38–40 wide. UtL/BL 21.7–21.9%. Vulvar opening situated 80 from caudal extremity. Tail 25 long (Figure 35). Body with numerous cuticular ridges (16 on one side in female 2) disappearing at level of anus (Figure 35).

Remarks

It was not possible to observe the presence of a carene, which is present in the other species in the genus. However the high number of ridges (about 30) clearly distinguishes this genus from the two other Ethiopian genera, the number of ridges being 9–16 in *Heligmonina* and 10–16 in *Neoheligionella*.

Comments

Among Baylis' material, two slides were registered under the same number (n° 101–120). The indications concerning the host and locality were the same: *Grammomys surdaster* Thomas & Wroughton (a synonym of *G. dolichurus*), without host number, from Tanganyika (Table 12). On the first slide there was a single male identified by Baylis as *Heligmonina oenomyos*. In this male, 4.8 mm long, the spicules measured 510 µm, i.e a SpL/BL of 10.6%. On the second slide, there was a single male identified by Baylis as *Heligmonina cricetomyos*. In this male, 5.1 mm long, the spicules measured 510 µm, i.e a SpL/BL of 10.0%. The well developed left ala not being observed, they do not belong to *Heligmonina*, and the presence of few cuticular ridges excludes the genus *Heligmonoides*. Therefore, they probably belong to the genus *Neoheligionella* and to the same species since the SpL/BL is similar. We consider them as *Neoheligionella* sp. 5. The morphological data, particularly those concerning the synopse are insufficient to identify them to a known species or to describe a new species. For the differential diagnosis with the other Nigerian *Neoheligionella* see Table 14.

Discussion

The poor condition of most of the specimens prevented a complete study and an accurate identification of all the material examined. Despite this, we were able to arrive at the following conclusions:

- From the descriptive point of view, new morphometrical data are provided, particularly on the females, not illustrated by Baylis, but also on the spicule morphology and the oesophageal region.

- From the taxonomic point of view, the descriptions of the type and voucher material are differentiated and lectotypes and paralectotypes are designated, using essentially morphometrical data (spicules length, SpL/BL, shape of spicules and female tail, ratio uterus length/body length). This enables a better delimitation of the species concerned and stabilizes the nomenclature for the future. The inclusion of some species in the genera in which they had been placed by Durette-Desset (1971) is also confirmed (Table 1).

- From the biological point of view, the presence of coparasitic species is highlighted, either within the type material or within the voucher material. Coparasitic species may be congeneric or, as is the case here, belong to related genera (*Heligmonina praomyos* + *Neoheligmonella moennigi*, *H. oenomyos* + *Neoheligmonella* sp. 1, *Heligmonina cricetomyos* + *Neoheligmonella moennigi*, *Heligmonina* sp. 2 + *Neoheligmonella* sp. 4). Among the Trichostrongylina, the coparasitism is a frequent phenomenon, where the same individual host may harbour up to ten or more species congeneric or belonging to related genera (Chabaud & Durette-Desset 1978). Among the Nippostrongylinae, the number of congeneric or related species rarely exceeds two (concerning the Ethiopian Nippostrongylinae, see Diouf *et al.* 1997, Diouf & Durette-Desset 2002, Diouf *et al.* 2005). It seems therefore important to draw attention to the fact that during a necropsy all the worms present in the small intestine should be collected and identified.

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