

## DESCRIPTION OF TWO NEW SPECIES OF NIPPOSTRONGYLINAE (NEMATODA, TRICHOSTRONGYLINA, HELIGMOSOMOIDEA) COPARASITES IN *ARVICANTHIS ANSORGEI* (MURIDAE) FROM CAMEROON

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### Summary:

In the small intestine of a single *Arvicanthis ansorgei* from Cameroon, two new species of Nippostrongylinae were found: *Neoheligionella zera* n. sp. and *Heligionina camerounensis* n. sp. *N. zera* belongs to the *Neoheligionella* species in which the right dorsal ridge is poorly developed. Among these species, *N. bainaie* (Durette-Desset, 1970), a parasite of *Steatomys opinus* from Burkina Fasso, is a closely related species. It is differentiated by the presence of vulvar alae, the ratio uterus length/body length and the separation of rays 2 and 3 at two thirds of their length. *N. zera* is also closely related to *N. kenyae* (Yeh, 1958) a parasite of *Rattus rattus kijabius* from Kenya by the pattern of the caudal bursa and the ratio spicules length/body length. The synlophe of *N. kenyae* was not described in detail but it is differentiated from *N. zera* by the position of the excretory pore, situated just posteriorly to the nerve ring and in the female by the ratio ovejector length/body length which is smaller. *H. camerounensis* n. sp. is characterised by the ratio dorsal ridges/ventral ridges which is 4/7. It is differentiated from the species of which the synlophe has not been described by the pattern of the caudal bursa (type 1-4 with tendency 1-3-1). It is the first report of Nippostrongylinae species in Cameroon and the first record of a species of the genus *Heligionina* in an *Arvicanthis*.

**KEY WORDS :** Nematoda, Trichostrongylina, *Heligionina camerounensis* n. sp., *Neoheligionella zera* n. sp., Heligmosomoidea, Heligionellidae, Muridae, Cameroon, systematics.

**Résumé :** DESCRIPTION DE DEUX NOUVELLES ESPÈCES DE NIPPOSTRONGYLINAE (NEMATODA, TRICHOSTRONGYLINA, HELIGMOSOMOIDEA) COPARASITES D'*ARVICANTHIS ANSORGEI* (MURIDAE) AU CAMEROUN

Dans l'intestin grêle d'un *Arvicanthis ansorgei*, originaire de Zera I au Nord Cameroun, deux nouvelles espèces de Nippostrongylinae ont été trouvées : *Neoheligionella zera* n. sp. et *Heligionina camerounensis* n. sp. *N. zera* appartient aux espèces de *Neoheligionella* chez lesquelles la crête cuticulaire dorsale droite est peu développée. Parmi ces espèces, *N. bainaie* (Durette-Desset, 1970), parasite de *Steatomys opinus* au Burkina Fasso est proche de *N. zera*, mais s'en différencie par la présence d'ailes vulvaires, le rapport longueur de l'utérus/longueur du corps et la séparation des côtes 2 et 3 aux deux tiers de leur longueur. *N. zera* se rapproche également de *N. kenyae* (Yeh, 1958) parasite de *Rattus rattus kijabius* au Kenya par la disposition des côtes bursales et le rapport longueur des spicules/longueur du corps. Le synlophe de *N. kenyae* n'a pas été décrit, mais elle se différencie de *N. zera* par la position du pore excréteur situé juste en arrière de l'anneau nerveux, et chez la femelle par un rapport plus petit entre la longueur de l'ovéjecteur et la longueur du corps. *H. camerounensis* n. sp. est caractérisé par le rapport entre le nombre de crêtes dorsales et le nombre de crêtes ventrales qui est de 4/7. Elle se différencie des espèces dont le synlophe n'est pas connu par la disposition des côtes bursales (type 1-4 à tendance 1-3-1). C'est la première fois que des Nippostrongylinae sont signalés au Cameroun, et la première fois qu'une espèce du genre *Heligionina* est décrite chez un *Arvicanthis*.

**MOTS CLÉS :** Nematoda, Trichostrongylina, *Neoheligionella zera* n. sp., *Heligionina camerounensis* n. sp., Heligmosomoidea, Heligionellidae, Muridae, Cameroun, systématique.

## INTRODUCTION

Nippostrongylinae (Heligionellidae) in Muridae are spread all over the world today. In Africa, the sub-family is represented by three genera:

*Heligionoides* Baylis, 1928 only parasite of the genus *Mus*, *Heligionina* Baylis, 1928 and *Neoheligionella* Durette-Desset, 1970 which are closely related and parasite of Murinae. During a scientific expedition for research on borreliosis in Cameroon, some Trichostrongylina parasites of the small intestine of *Arvicanthis ansorgei* Voloboev *et al.*, 2002 were collected in Zera I locality. In this paper, two new coparasitic species are described, the first belonging to the genus *Neoheligionella*, and the second to the genus *Heligionina*. It is the first record of Nippostrongylinae species in Cameroon and the first record of a species of the genus *Heligionina* in an *Arvicanthis*. Five species of the genus *Neoheligionella* have been already described in the genus *Arvicanthis*.

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## MATERIAL AND METHODS

One *Arvicantbis ansorgei* (adult male) was caught in the village of Zera I (Cameroon). The nematodes were collected in the laboratory. To determine the location of the parasites, the small intestine was divided into three equivalent parts, numbered SI 1 to SI 3 from the duodenum to the caecum. The worms were fixed in boiling 70 % ethanol and stored in it. The nomenclature which is used above the family group is that of Durette-Desset & Chabaud (1993). The synopse was studied following the method of Durette-Desset (1985) and Durette-Desset & Digiani (2005). The nomenclature used for the study of the caudal bursa is that of Durette-Desset & Chabaud (1981). The measurements are given in micrometers, except where otherwise stated. Type specimens were deposited in the Collections of the Laboratoire de zoologie des invertébrés terrestres (ZIT) de l'Institut fondamental d'Afrique Noire C.A. Diop of Senegal (IFAN) and in the helminthological Collections of the Muséum national d'histoire naturelle de Paris (MNHN). The host nomenclature follows Musser & Carleton (1993).

## RESULTS

### *NEOHELIGMONELLA ZERA* N. SP. (Fig. 1)

Studied material: holotype male, allotype female, ZIT/IFAN 05I, eight male, seven female paratypes, ZIT/IFAN 06I, one male, one female paratypes MNHN 349 MQa, coparasites of *Heligmonina camerounensis* n. sp. Host: *Arvicantbis ansorgei* Voloboev *et al.*, 2002 (Muriidae, Murinae).

Site: small intestine (SI 1-SI 2)

Type locality: Zera I (8° 31' N; 13° 30' WW), Cameroon  
Collectors: J.M. Duplantier and K. Bâ, 12 February 2003.

#### Description

Small nematodes with body coiled sinistrally along ventral side. Position of excretory pore and deirids varying in relation to apex. Excretory pore situated in male within posterior third of oesophagus length, and in female within posterior quarter. Deirids usually posterior to excretory pore (Fig. 1A). Very short uterus less than 21 % of body length.

. Head: cephalic vesicle and small oesophageal tooth present. In apical view, triangular oral opening surrounded by two amphids, four externo labial papillae and four cephalic papillae (Fig. 1B).

. Synopse (studied in one male and one female paratype). In both sexes, body bearing longitudinal, uninterrupted ridges, appearing between cephalic vesicle and nerve-ring (Fig. 1C-F), and disappearing just anterior to caudal bursa in male. In female, ventral ridges

disappearing anterior to vulvar opening, dorsal ridges at different levels around vulvar region (Fig. 1K, L). Number of ridges: 13 (carene, five dorsal, six ventral) at mid-body (Fig. 1G, H), 6 (carene, four left dorsal, one left ventral) at level of vulvar opening (Fig. 1M). Carene poorly developed with dorsal ridge smaller than ventral ridge. Gradient of size decreasing from left to right on ventral side, dorsal ridges approximately same size. In both sexes, tips of ridges orientated from ventral right side to dorsal left. Double axis of orientation inclined at 60° to sagittal axis in male, 70° in female for right axis and 80° in both sexes for left axis. In vulvar region, dorsal ridges orientated from right to left on ventral side, perpendicularly to body on dorsal side (Fig. 1M).

. Holotype male: 5.0 mm long and 130 wide at mid-body. Cephalic vesicle 100 long and 60 wide. Nerve-ring, deirids and excretory pore situated at 210, 350, 380 from apex, respectively. Oesophagus 440 long, with muscular part 210 and glandular part 230. Symmetrical caudal bursa with pattern of type 2-2-1 (Fig. 1J). Prebursal papillae not observed. Rays 2 and 3 totally separated up to base forming a V. Extremities of rays 4 curved forwards. Thick rays 8 arising symmetrically at mid-length of dorsal ray. Thick dorsal ray divided at distal third into two branches, each branch giving rise to two small branches: rays 9 (external branches) slightly longer than rays 10 (internal branches). Filiform sub-equal alate spicules 310 long with sharp tips. Ratio spicule length/body length 6 %. Rectangular gubernaculum 30 long and 20 wide at base. Genital cone with papilla zero on ventral lip and small papillae 7 on dorsal lip (Fig. 1J).

. Main measurements of the nine paratypes (average and range): 4.7 (4.4-5.0) mm long and 140 (120-150) wide at mid-body; cephalic vesicle, 88.5 (75-100) long and 61 (50-70) wide; nerve ring, excretory pore and deirids situated at 193.5 (170-220), 291.5 (230-380), 383.5 (310-480) from apex, respectively; oesophagus, 451 (430-500) long; spicules 347 (320-370) long; ratio spicules length/body length 7 % (7-7).

. Allotype female: 7.55 mm long and 170 wide at mid-body. Cephalic vesicle 95 long and 80 wide. Nerve-ring, excretory pore and deirids situated at 200, 460 and 450 from apex, respectively. Oesophagus 550 long, with muscular part 250 and glandular part 300. Monodelphic (Fig. 1I): vulva situated at 200 from caudal extremity with *vagina vera* 30 long. Ovejector 440 long, with vestibule 200 long, sphincter 40 long and 80 wide and infundibulum 200 long. Uterus 1.1 mm long, with 44 eggs in two rows at morula stage, 75 long and 40 wide. Tail 45. Ratio uterus length/body length: 15 %.

. Measurements of the eight paratypes (average and range): 6.3 (5.8-7.0) mm long and 150 (130-170) wide at mid-body; cephalic vesicle 102.5 (90-110) long and

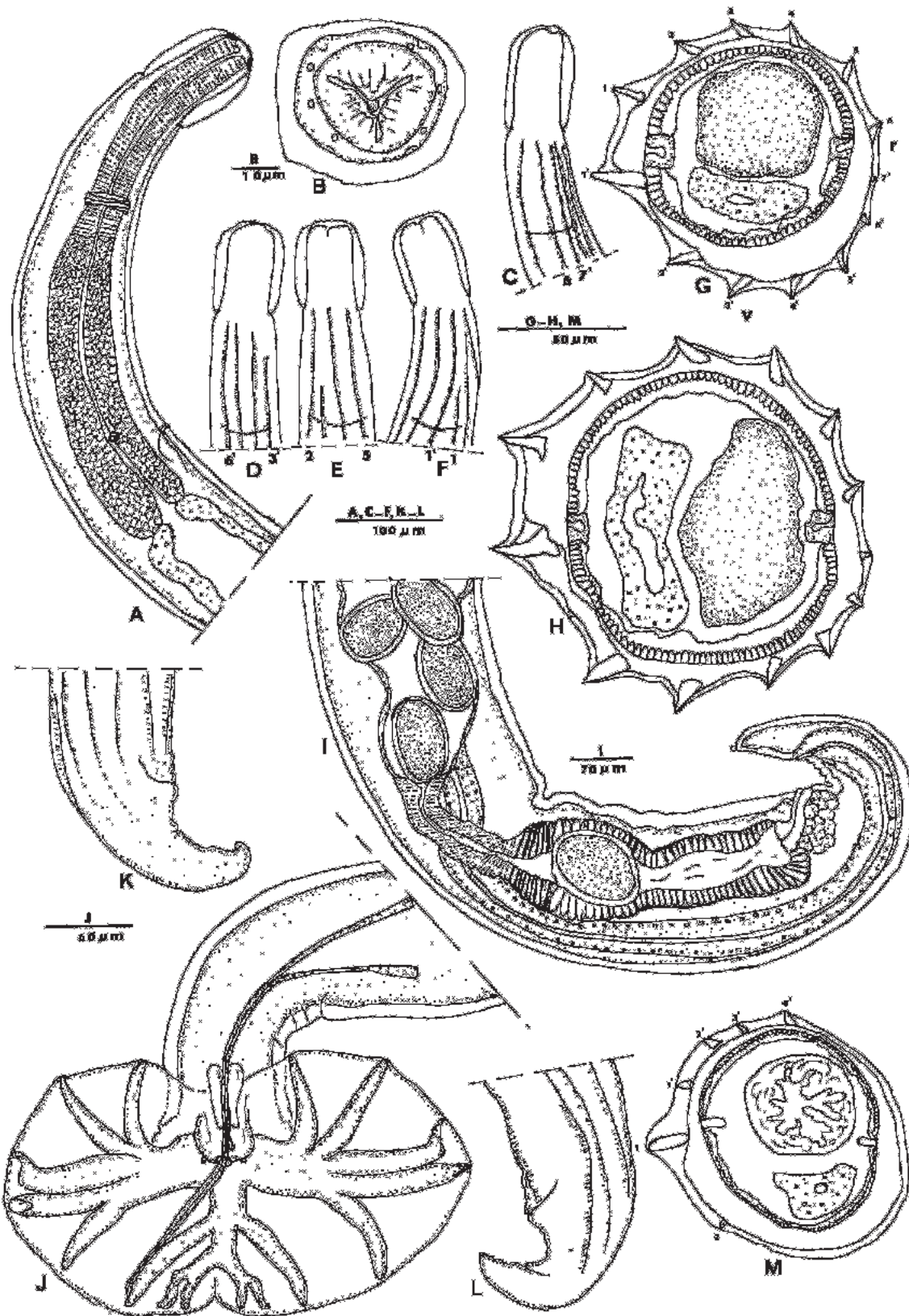


Fig. 1. – *Neobeligionella zera* n. sp. A: female, anterior extremity, right lateral view; B: female, head, apical view; C-F: female, anterior extremity, arising of the cuticular ridges, C, right lateral view, D, ventral view, E, dorsal view, F, left lateral view; G, H: synlophe at mid-body, G, male, H, female; I: female, posterior part, right lateral view; J: male, caudal bursa, ventral view; K, L: female, posterior part, right and left lateral view, respectively; M: female, synlophe, posterior to vulvar opening. All the sections are orientated as G. Abbreviations: v, ventral side; r, right side.



69 (60-80) wide; nerve ring, excretory pore and deirids situated at 212 (180-250), 424 (410-470), 432.5 (390-480) from apex, respectively; oesophagus 502 (420-520) long; vulva situated at 202 (180-220) from caudal extremity; ovejector 368 (340-420), vestibule 190 (180-220) long, sphincter 36.5 (30-40) long and 51.5 (40-70) wide, infundibulum 130 (120-150); uterus 1.3 (1.0-1.7) mm long; eggs 71 (70-75) long and 44.5 (40-50) wide; number of eggs: 42 (25-73); tail, 57.5 (40-70) long; ratio uterus length/body length: 21 % (15.4- 24.3).

#### Diagnosis

The specimens described above belong to the genus *Neobeligionella* Durette-Desset 1971 (Heligionellidae, Nippostrongylinae). The genus is mainly characterised by the pattern of the caudal bursa of type 2-3 (common trunk to rays 3 to 6) with tendency to type 2-2-1 (ray 6 arising the first from common trunk, rays 4 and 5 separated at their extremity). The features of the synopse are variable but, in all species, the left ventral ridge is the most developed, the axis of orientation is inclined between 70° and 90° to the sagittal axis and the number of the cuticular ridges comprises between 10 and 15. Apart from one species found in an arvicoline from Thailand, the other species are parasites of murines, one from Philippines and 20 from Africa.

Up to now, four species are parasites of *Arvicanthbis niloticus*: *N. bai* Diouf & Durette-Desset, 2002 and *N. dielmensis* Diouf, Bâ & Durette-Desset, 1997 both from Senegal, *N. bouini* (Durette-Desset, 1970) and *N. pseudospira* (Durette-Desset, 1970) both from Ethiopia. They are mainly differentiated from the specimens described above by the size of the right dorsal ridge (n° 6) being more developed than the other dorsal ridges.

Among the other species *N. bainaie* (Durette-Desset, 1970) a parasite of *Steatomys opinus* from Burkina Fasso, *N. lamaensis* Diouf, Daouda & Durette-Desset, 2005 a parasite of *Mastomys natalensis* from Benin and *N. skirringi* Diouf, Bâ & Durette-Desset, 1998 a parasite of *Mastomys erythroleucus* from Senegal share the following common features: presence of a carene, right ridge (n° 6) poorly developed. Decreasing gradient of size of the ridges from left to right sides, clearly visible on ventral side, absent or unclear on dorsal side. *N. skirringi* and *N. lamaensis* are both differentiated by the number of ventral ridges (8 *versus* 6), a well developed carene and a ratio spicules length/body length of 12.4 % in *N. lamaensis* and 15.9 % in *N. skirringi* *versus* 7 % on average in the specimens of *Arvicanthbis*. In this group, *N. bainaie* is the most closely related species with a small carene, the same number of cuticular ridges and a similar ratio spicules length/body length (6.8 %). It is distinguished by the length of the carene, the presence of vulvar alae and the ratio uterus

length/body length which is 9 % *versus* 14.6 % on average in the specimens of *Arvicanthbis*.

The synopse of five species belonging to the genus *Neobeligionella* has not been described, but it is possible to distinguish these species in relation to the parasites described above by other features. Four were described by Baylis (1928) from Nigeria: *N. affinis*, a parasite of *Mastomys erythroleucus*, is not illustrated but the ratio spicules length/body length is 13.3 %. The other three species have a caudal bursa pattern of 2-3 with tendency 2-2-1, with a great development of the lateral trident and the dorsal lobe. It concerns *N. gracilis*, a parasite of *Leggada musculoides*, *N. impudica*, a parasite of *Taterona kempi* and *N. moennigi*, a parasite of *Praomys tulbergi*. The last species *N. kenyaie* (Yeh, 1958), a parasite of *Rattus rattus kijabius* in Kenya, is very closely related to the specimens from *Arvicanthbis*, the pattern of the caudal bursa being similar, the number of the cuticular ridges being the same and the ratio spicules length/body length similar (7,5 %). *N. kenyaie* is differentiated from *N. zera* by the ratio ovejector length/body length which is smaller, and by the anterior position of the excretory pore. We consider the parasites from *Arvicanthbis* as a new species we have named *Neobeligionella zera* n. sp. after the name of the locality (Zera I) where the rodent was captured.

#### *HELIGMONINA CAMEROUNENSIS* N. SP. (Fig. 2)

Studied material: holotype male, allotype female, ZIT/IFAN 03I, five male, nine female paratypes, ZIT/IFAN 04I, one male, one female paratypes MNHN 349 MQB, coparasites of *Neobeligionella zera* n. sp.

Host: *Arvicanthbis ansorgei* Voloboev *et al.*, 2002 (Muridae, Murinae).

Site: small intestine (SI 1-SI 2)

Type locality: Zera I, (8° 31' N ; 13° 30' W), Cameroon. Collectors: J.M. Duplantier and K. Bâ, 12 February 2003.

#### Description

Small nematodes with body coiled sinistrally along ventral side. Excretory pore and deirids situated at about same level, within posterior quarter of oesophagus (Fig. 2A). Oesophagus less than 15 % of body length (11.8 % on average in male, 8.9 % in female). Very short uterus less than 14 % of body length.

. Head: cephalic vesicle present. In apical view, triangular buccal opening surrounded by two amphids, four externo labial papillae and four cephalic papillae (Fig. 2B).

. Synopse (studied in two males and two females): in both sexes, cuticle bearing, longitudinal, uninterrupted ridges, appearing posterior to cephalic vesicle except ridges n° 7' and 8' which appear posterior to nerve ring (Fig. 2C-F). Ridges disappearing anterior to caudal bursa in male. In female, ventral ridges disappearing anterior to vulva and dorsal ridges posterior to it (Fig. 2L-M). Number of ridges at mid-body: 12 (left hypertrophied ala,

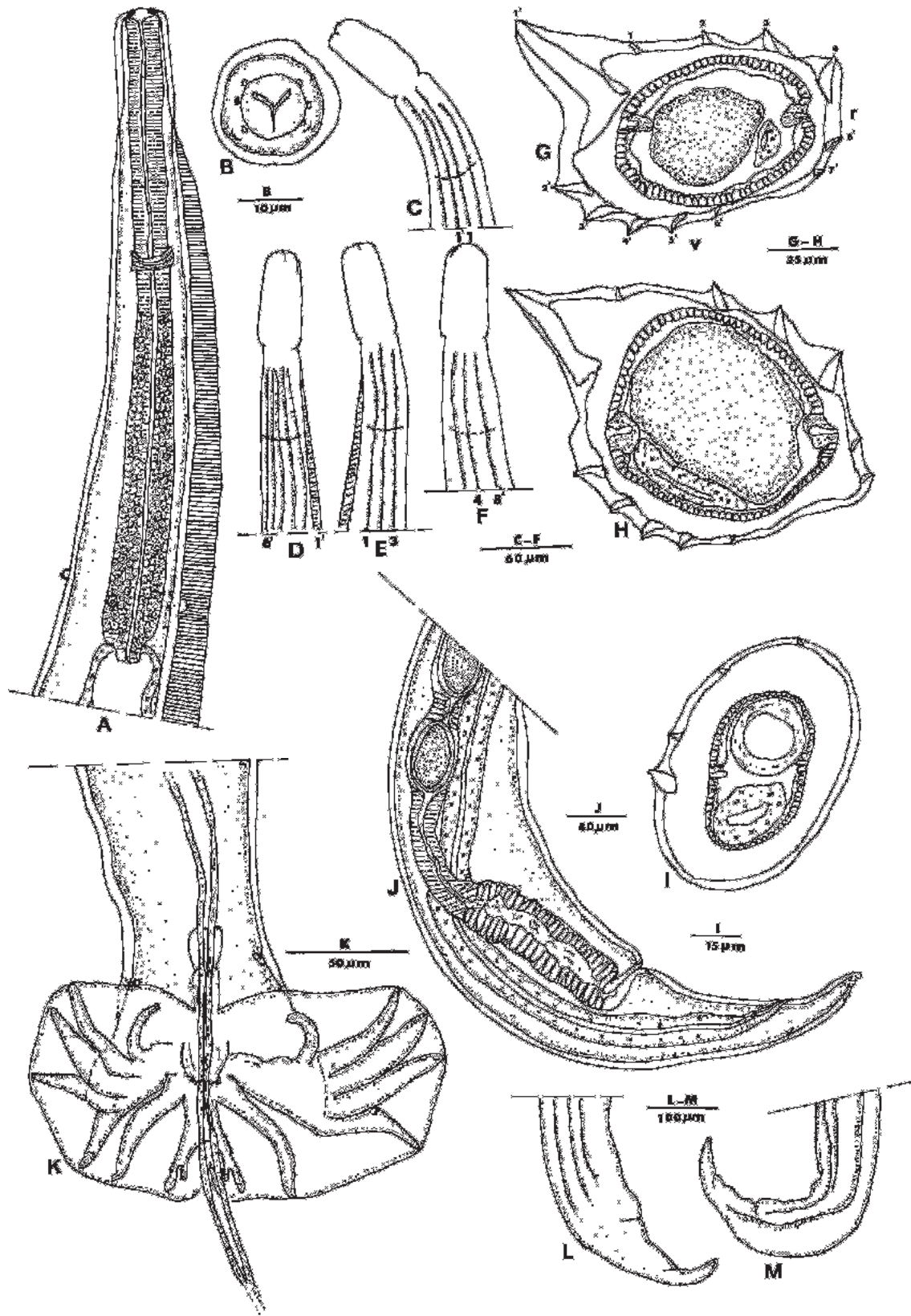


Fig. 2. – *Heligmonina camerounensis* n. sp. A : female, anterior extremity, ventral view; B: female, head, apical view; C-F: female, anterior extremity, arising of the cuticular ridges, C, left lateral view, D, ventral view, E, dorsal view, F, right lateral view; G, H: synlophe at mid-body, G, male, H, female; I: female, synlophe posterior to vulvar opening; J: female, posterior part, right lateral view; K: male, caudal bursa, ventral view; L-M: female, posterior part, right and left lateral view, respectively. All the sections are orientated as G. Abbreviations: v, ventral side; r, right side.

four dorsal, seven ventral) (Fig. 2G, H), four dorsal left posterior to vulvar opening (Fig. 2I). No ridges on right, ventral right side. Double gradient of size decreasing from left to dorsal on ventral side, from right to left on dorsal side. Tips of ridges orientated from right to left with axis of orientation inclined at about 45° to sagittal axis in male, 50° in female. In vulvar region, ridges orientated perpendicularly to body (Fig. 2D).

. Holotype male: 2.9 mm long and 130 wide. Cephalic vesicle 55 mm long and 30 wide. Nerve-ring, excretory pore and deirids situated at 90, 285 and 280 from apex, respectively. Oesophagus 370 long, with muscular part 170, and glandular part 200.

Asymmetrical caudal bursa with left lateral lobe most developed (Fig. 2K). Pattern of caudal bursa of type 1-4 (ray 2 arising the first from common trunk of rays 2 to 6), with tendency 1-3-1 (rays 6 separating first from common trunk to rays 3 to 6). Prebursal papillae observed only in one paratype specimen (Fig. 2K). Rays 2 and 3 totally separated up to base. Left lobe: rays 3, 4 and 5 separating at same level from common trunk to rays 3 to 5, with extremities equidistant. Right lobe: ray 5 separating first from common trunk to rays 3 to 5, with extremity of ray 5 nearer of that of ray 3 than that of ray 5. Rays 8 arising symmetrically at base of dorsal ray, left ray slightly longer than right ray. Thick dorsal ray divided into two branches within its middle third. Each branch divided into two unequal branches, rays 9 (external branches) longer than rays 10 (internal branches).

Filiform spicules 390 long, with sharp tips. Ratio spicules length/body length: 13 %. Rectangular gubernaculum 20 long and 15 wide at base. Genital cone, 20 long and 10 wide at base with papilla zero on ventral lip and papillae 7 on dorsal lip.

. Main measurements of the six paratypes (average and range): 2.5 (2.2-3.2) mm long and 135 (120-150) wide at mid-body; cephalic vesicle, 47.5 (40-60) long and 30 (30-30) wide; nerve ring, excretory pore and deirids situated at 105 (90-120), 270 (240-320), 275 (235-320) from apex, respectively; oesophagus, 322 (310-400) long; spicules 360 (340-400) long; ratio spicules length/body length, 14 % (11-15).

. Allotype female: 4.5 mm long and 125 wide. Cephalic vesicle 60 long and 30 wide. Nerve-ring, excretory pore and deirids situated at 130, 275 and 275 from apex, respectively. Oesophagus 385 long with muscular part 150 and glandular part 235 (Fig. 2A).

Monodelphic: vulva situated at 150 from caudal extremity with *vagina vera* 20 long. Ovejector 230 long with vestibule 80 long and 40 wide, sphincter 30 long and 35 wide and infundibulum 120 long and 20 wide. Uterus 650 long with 14 eggs 65 long and 35 wide. Tail: 50 long (Fig. 2J). Ratio uterus length/body length: 14 %.

. Measurements of the ten paratypes (average and range): 4.05 (3.5-4.8) mm long and 136 (100-170) wide at mid-body; cephalic vesicle 55 (50-60) long and 34, 5 (30-

45) wide; nerve ring, excretory pore and deirids situated at 136 (130-160), 281 (250-360), 285,5 (240-380) from apex, respectively; oesophagus 355 (300-480) long; vulva situated at 148,5 (130-180) from apex; ovejector 219 (205-240), vestibule 91 (70-100) long, sphincter 26 (30-40) long and 35,5 (30-40) wide, infundibulum 102 (90-120); uterus 577 (500-700) long; eggs 63,5 (55-80) long and 37 (30-50) wide; number of eggs: 8 (4-12); tail, 58 (50-65) long; ratio uterus length/body length: 14 % (11-16).

#### Diagnosis

The specimens described above possess the main features of the genus *Heligmonina* (Baylis 1928) redefined by Durette-Desset (1971) with a hypertrophied ala in particular. To date, 21 species have been described in this genus, all parasites of Muridae, 16 in Africa and five in Madagascar.

The parasites of the *Arvicanthis* are characterised by a caudal bursa pattern of type 1-4 with tendency 1-3-1. Only three species possess these two features: *Heligmonina chippauxi* (Desset, 1964), a parasite of *Oenomys hypoxanthus*, *Heligmonina dupuisi* (Desset, 1964) a parasite of *Praomys jacksoni*, both found from the Central African Republic and *Heligmonina kotoensis* Diouf, Daouda & Durette-Desset, 2005, a parasite of *Mastomys natalensis* from the Republic of Benin.

*H. chippauxi* is differentiated from the new species by the distance between the extremities of rays 3 to 6, the distance being equivalent in the left lobe, the extremity of ray 4 being nearer ray 5 than that of ray 3 in the right lobe; *H. dupuisi* is differentiated by the asymmetry of the branches of the dorsal ray and *H. kotoensis* by the deeper division of the dorsal ray.

On the other hand amongst the 16 species where the synopse is known, only the parasites of the *Arvicanthis* have, in addition to the left ala, 4 dorsal and 7 ventral ridges. We consider that the parasites of *Arvicanthis* belong to a new species that we have named *Heligmonina camerounensis* n. sp. after the name of the country where the rodent was captured.

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