

**A NEW NEMATODE SPECIES, *BRASILAIMUS LOMBARDOI* SP. N.
(ACTINOLAIMIDAE, DORYLAIMIDA) AND THE MALE OF *AMPHIDELUS BOA*
ANDRASSY, 1968 (ALAIMIDAE, ENOPLIDA) FROM ECUADOR**

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Summary. The new nematode species *Brasilaimus lombardoi* (Actinolaimidae, Dorylaimida) and the male of *Amphidelus boa* Andrassy, 1968 (Alaimidae, Enoplida), both from Ecuador, are described. *B. lombardoi* sp. n. is characterised by a cuticle with 14-18 prominent and broad longitudinal ridges among which there are secondary fine, irregularly arranged, longitudinal ridges; it has lip region truncate-conoid, high, slightly set off from the adjoining body; odontostyle 20-26 μm long; pharynx with glossa; female reproductive apparatus didelphic, vulva longitudinal, vagina lacking sclerotized pieces, with the refractive part large, thick-walled, conoid, and the proximal part smaller; male supplements in two fascicles of 7-9 and 8-11 respectively, and numerous pseudo-supplements; copulatory hump well developed; tail elongate conoid with pointed terminus in female and short and round in male. *Brasilaimus lombardoi* sp. n. differs from all the other species of the genus by having primary and secondary ridges in the cuticle and in the low number of primary longitudinal ridges. The male of *A. boa*, found for the first time, is similar to the female in most respects; it is monorchic, with straight, transversally directed, spicules 0.6 cloacal body widths long; it has two ventral precloacal papillae, sperms ovoid, 0.2-0.3 cloacal body widths long and convex-conoid, ventrally curved tail, with finely rounded pointed tip.

During a faunal expedition in Ecuador some researchers of the Dipartimento di Biologia Animale of the University of Catania collected soil and moss samples for a survey on the microfauna. Two of these samples yielded several specimens of a new species of the genus *Brasilaimus* Lordello *et* Zamith 1957; moreover, the male of *Amphidelus boa* Andrassy, 1968 was found for the first time. The two species are herein described and illustrated on the basis of a thorough light microscope and scanning electron microscope investigation.

MATERIALS AND METHODS

The samples, collected in March 1996 in different localities of Ecuador, were constituted respectively of a mixture of sieved tree bark, mosses and roots from a forest near the left side of Rio Hollin at Union Hollin (Napo) and of mosses, litter and soil from a forest near Rio Verde at Lita (Imbabura). For light microscope observations the specimens were fixed in 4% formaldehyde and mounted in dehydrated glycerin. For scanning electron microscope observations, some glycerin-embedded specimens were first washed with gradually added distilled water and then dehydrated in a graded series to 100% ethanol. The specimens were subsequently critical point dried with CO_2 , mounted on stubs and coated with gold. In Table I absolute values, average values and standard deviation are reported.

DESCRIPTIONS

***BRASILAIMUS LOMBARDOI* sp. n.**
(Figs 1-3; Table I)

Female. Body of medium size, rather slender, ventrally curved, tapering at both extremities; lip region width 15-25% of body width at pharynx base and at mid-body. At 25-30% of pharynx length body widens abruptly in the type population, more gradually in specimens from Lita. Cuticle 6-8 μm thick at mid-body, with 14-18 prominent longitudinal ridges 1.5-2.0 μm wide and 2.0 μm high; in between these conspicuous ridges further longitudinal ridges, much thinner and less prominent, with less regular arrangement, are also visible in light microscope; the latter ridges are more developed in males and are particularly evident in all the type specimens while they are rather weak in some specimens from Lita. The cuticle is also marked by fine transverse striae, also visible with the light microscope. The primary longitudinal ridges rise slightly posterior to the amphidial openings and extend in a rather irregular pattern until, at about 30% of pharynx length, they reach their definitive number and the secondary ridges appear. The ridges become irregular again in the tail. Numerous papillae, more conspicuous in males, are irregularly scattered all along the body; they start at level of odontostyle and are always located on the primary ridges. The lip region, only slightly set off from the adjoining body by a weak constriction at level of amphidial opening, is truncate-conical and rather high: its height about 60-70% of its width. Amphids wide, stirrup-shaped, their opening 55-70% of corresponding

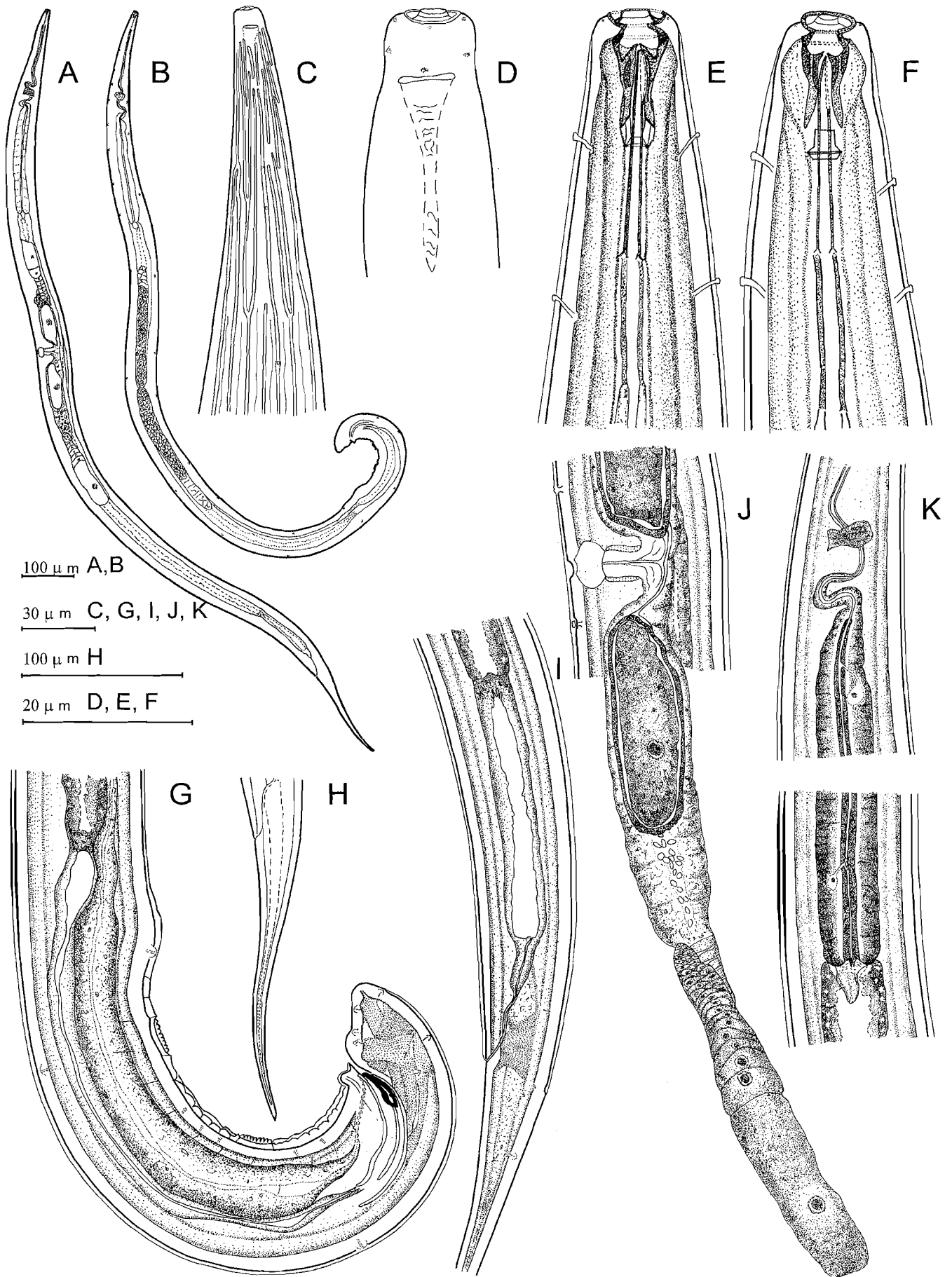


Fig. 1. *Brasilaimus lombardoi* sp. n.: A, female body; B, male body; C, D, E, F, anterior end (C, E, specimens from Union Hollin); G, male tail; H, female tail; I, pre-rectum and rectum; J, female reproductive apparatus; K, pharynx.

body width. Distance fusus-amphidial opening 1.3-2.2 times lip region width. Anterior end externally bearing the six labial inner papillae and, in the same circle, the four cephalic papillae; the six outer labial papillae are located just anterior to the amphidial opening. On the anterior peri-oral surface, inside the external anterior margin, there is a thin sclerotized circular ring, connected to a disc-like cuticular projection surrounding the mouth and slightly protruding. The pre-onchial mouth cavity is 0.5-1 times as long as wide. The four large onchia appear unevenly sclerotized and the sclerotization pattern differs in the various specimens; in some of them the onchia anterior margin appears discontinuous.

Just anterior to each onchium from the cheilostom walls four thick longitudinal sclerotizations rise, directing anteriorly, and connect to the peri-oral disk. The post-onchial mouth cavity, 6.5-7 μm long, is 0.7 times as long as lip region. The odontostyle is straight, 2-2.4 times as long as lip region, 0.5-1 times as wide as cuticle thickness at the same level; odontostyle opening 24-30% of its length; odontophore 1.4-1.7 times as long as lip region width. The pharynx, a non-muscular tube in 45-51% of its length, at 50-58% of its length attains its maximum width becoming cylindrical. The nuclei of the five pharyngeal glands are sometimes obscure; their location is as follows (n=9): DN = 56-63%; AS₁ = 52-58%;

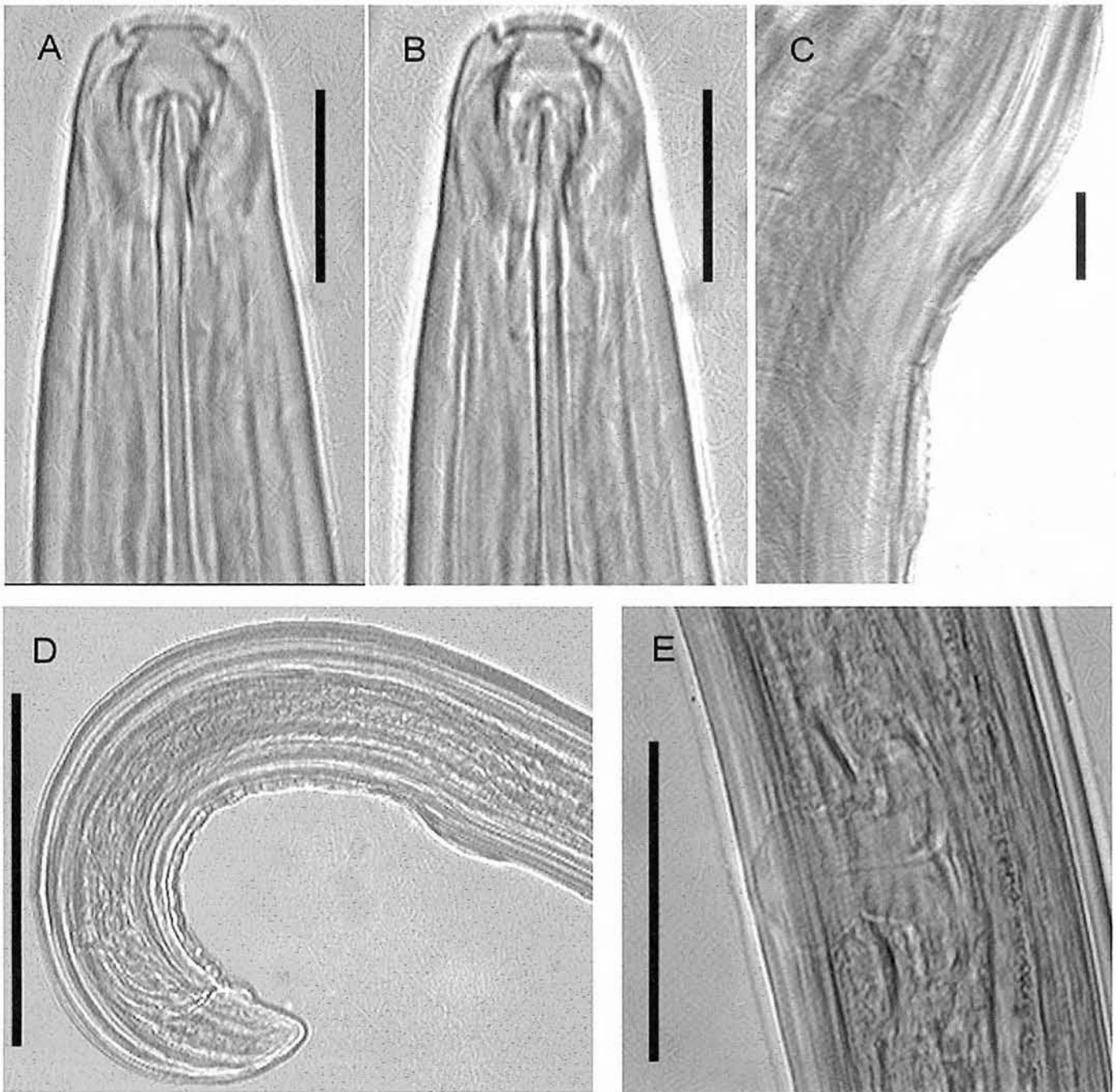


Fig. 2. *B. lombardoi* sp. n.: A, B, anterior end; C, detail of supplements and copulatory hump; D, male posterior end; E, vulval region. Scale bar 10 μm for A, B, C; 100 μm for D; 50 μm for E.

$AS_2 = 56-63\%$; $PS = 78-83\%$; $K = 90-95\%$. Excretory pore not seen. Nerve ring surrounding the non-muscular part of pharynx at 37-43% of pharynx length. At pharynx base a sclerotized cuticular thickening (glossa) is always present, but it is well developed in some speci-

mens and inconspicuous in others. Cardia conoid. Pre-rectum 3.5-4.5 anal body widths long; rectum 1.6-2 times anal body width long. Reproductive apparatus didelphic with reflexed ovaries. Vulva longitudinal, slightly sunken. Vagina without sclerotized pieces; its re-

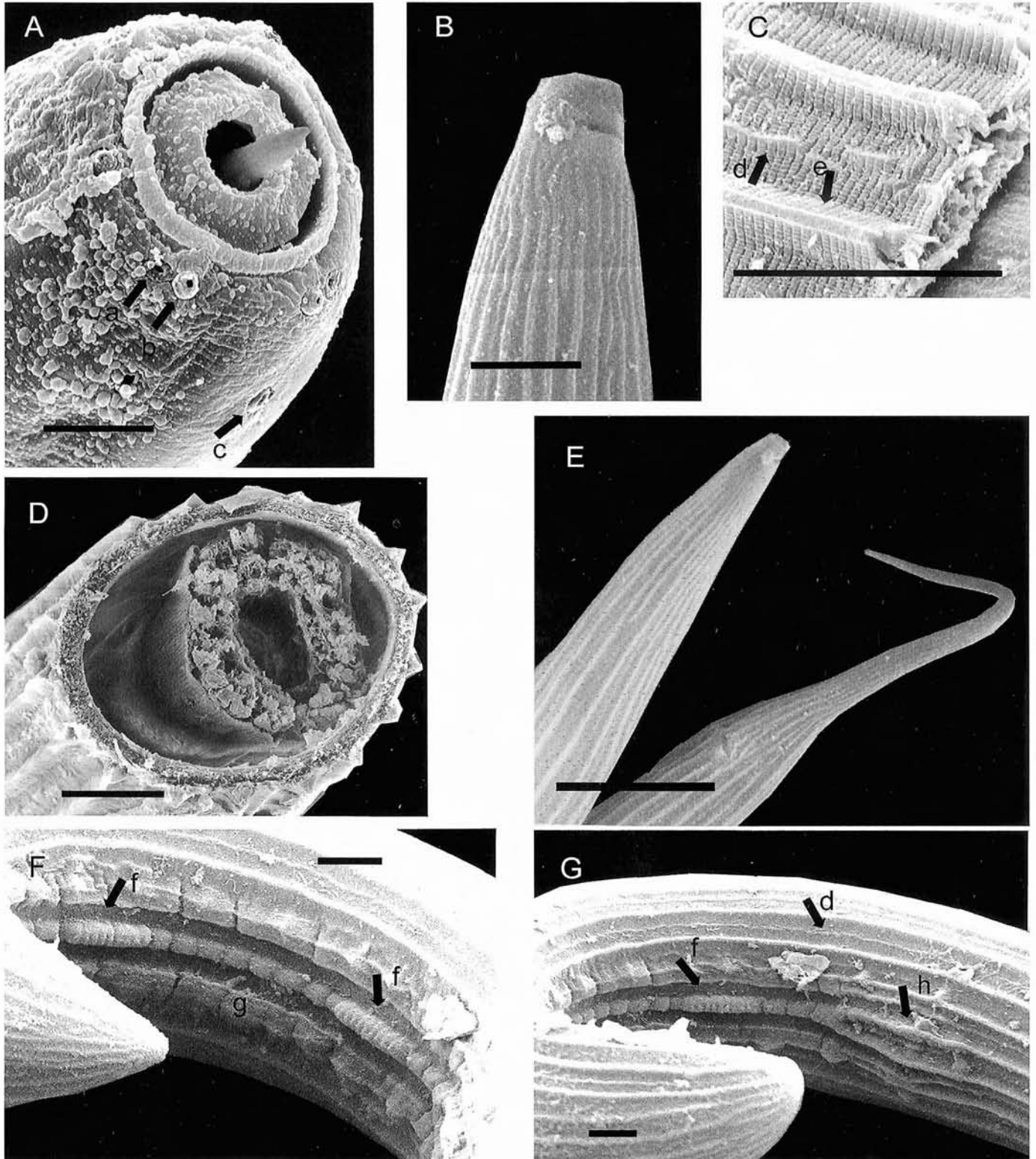


Fig. 3. *B. lombardoi* sp. n.: A, B, anterior end; C, D, detail of cuticle at mid-body; E, female anterior and posterior end; F, G, male posterior end (a: inner labial papillae; b: cephalic papillae; c: outer labial papillae; d: secondary longitudinal ridge; e: primary longitudinal ridge; f: supplements; g: pseudo-supplements; h: copulatory hump). Scale bar 2.5 μm for A; 10 μm for B, C, D, F, G; 50 μm for E.

Table I. Measurements of *Brasilaimus lombardoi* sp. n. (all absolute measures in μm , except L in mm).

Locality:	Union Hollin			Lita	
	Holotype 1 ♀	Holotype and 5 ♀ paratypes	Paratypes 3 ♂	7 ♀	3 ♂
n :					
L	1.61	1.80 ± 0.15 (1.61 - 2.00)	1.76 ± 0.14 (1.60 - 1.87)	1.90 ± 0.12 (1.7 - 2.0)	1.7 ± 0.03 (1.67 - 1.71)
A	35	30.4 ± 3.8 (26.0 - 35.0)	28.2 ± 3.7 (25.2 - 32.4)	28.4 ± 1.8 (26.5 - 31.5)	28.6 ± 0.7 (27.8 - 29.0)
B	3.4	4.0 ± 0.4 (3.4 - 4.5)	3.9 ± 0.2 (3.8 - 4.1)	4.1 ± 0.2 (3.9 - 4.5)	3.8 ± 0.1 (3.7 - 3.9)
C	10	10.0 ± 0.8 (8.9 - 11.3)	51.9 ± 12.7 (37.3 - 60.4)	8.30 ± 1.25 (7.3 - 10.7)	48.7 ± 1.1 (47.5 - 49.6)
C'	6.1	6.1 ± 0.47 (5.7 - 6.8)	0.9 ± 0.08 (0.8 - 1)	7.20 ± 0.85 (5.7 - 8.3)	0.95 ± 0.02 (0.93 - 0.97)
V/VD	44.7	43.4 ± 2.1 (40.3 - 46.2)	48.2 ± 1.1 (47.2 - 49.3)	41.6 ± 1.0 (39.8 - 42.5)	46.3 ± 1.5 (45.0 - 48.0)
G'	9.2	11.2 ± 4.3 (6.4 - 16.2)	13.5 ± 1.7 (12.5 - 15.4)	13.1 ± 2.8 (10.5 - 17.9)	16.7 ± 1.7 (15.0 - 18.5)
G''	8.9	14.8 ± 4.0 (8.9 - 17.8)	15.5 ± 2.2 (14.0 - 18.0)	16.5 ± 3.6 (12.0 - 21.5)	17.3 ± 0.6 (16.9 - 18.0)
Body width at mid-body	46	61.0 ± 11.3 (46.0 - 76.0)	63.0 ± 6.5 (56.0 - 69.0)	65.9 ± 5.3 (59.0 - 73.0)	59 ± 0.6 (59.0 - 60.0)
Pharynx	472	449 ± 20.3 (417 - 472)	449 ± 29.9 (415 - 472)	456.6 ± 27.0 (416 - 489)	445 ± 9.4 (434 - 452)
Body width at pharynx base	44	57.0 ± 10.6 (44.0 - 68.0)	58.0 ± 3.2 (54.0 - 60.0)	61.8 ± 3.5 (58.0 - 66.5)	58.0 ± 1.0 (57 - 59)
Tail	160	180 ± 11.8 (160 - 196)	35.0 ± 6.7 (30 - 42.5)	227.5 ± 34.4 (182 - 275)	35.0 ± 1.0 (34.0 - 36.0)
Anal body width	26	30.0 ± 3.2 (26.0 - 35.0)	37.2 ± 3.3 (35.0 - 41.0)	31.6 ± 2.4 (27.0 - 34.0)	36.5 ± 0.6 (36.0 - 37.0)
Lip region width	11	11.0 ± 0.6 (10.0 - 12.0)	11.0	10.9 ± 0.4 (10.0 - 11.0)	10.5 ± 0.6 (10.0 - 11.0)
Lip region height	6	8.0 ± 1.5 (6.0 - 10.0)	7.0 ± 0.8 (6.0 - 7.5)	8.0 ± 0.76 (7.0 - 9.0)	7.0 ± 1.0 (6.0 - 8.0)
Lip region height/ width	0.54	0.7 ± 0.1 (0.5 - 0.8)	0.5 ± 0.06 (0.5 - 0.6)	0.7 ± 0.05 (0.7 - 0.8)	0.7 ± 0.1 (0.6 - 0.8)
Fixed ring-anterior end	17	16.5 ± 0.5 (16.0 - 17.0)	16.0 ± 0.5 (15.5 - 16.5)	16.0 ± 0.9 (15.0 - 17.0)	15.5 ± 0.6 (15.0 - 16.0)
Odontostyle	20	24.0 ± 2.2 (20.0 - 25.0)	24.0 ± 1.1 (23.0 - 25.0)	24.0 ± 1.1 (23.0 - 26.0)	23.0 ± 1.1 (22.0 - 24.0)
Odontophore	16	16	15.5 ± 0.6 (15.0 - 16.0)	17.0 ± 1.2 (15.0 - 18.0)	18.0 ± 1.0 (17.0 - 19.0)
Cuticle width/odontostyle width	1.5	1.50 ± 0.2 (1.3 - 1.7)	1.7 ± 0.3 (1.4 - 2.0)	1.3 ± 0.2 (1.0 - 1.5)	1.47 ± 0.06 (1.4 - 1.5)
Amphidial opening width	7.0	7.0 ± 0.8 (6.0 - 8.0)	7.5 ± 0.6 (7.0 - 8.0)	6.9 ± 0.7 (6 - 8)	7
Fusus-amphidial opening	21	20.0 ± 3.2 (16.0 - 23.0)	21.0 ± 1.7 (20.0 - 23.0)	19.8 ± 1.47 (18.0 - 22.0)	21.0 ± 2.5 (18.0 - 23.0)
Nerve ring-anterior end	176	172 ± 7.8 (162 - 183)	187 ± 17.5 (169 - 204)	180 ± 11.4 (164 - 195)	179 ± 2.5 (177 - 182)
Nerve ring % pharynx	37	38.4 ± 1.1 (37.0 - 40.0)	41.9 ± 1.2 (41.0 - 43.3)	39.5 ± 1.0 (38.0 - 41.0)	40.3 ± 1.0 (39.2 - 41.2)
Basal bulb % pharynx	44	44.9 ± 2.4 (42.0 - 47.8)	43.0 ± 1.4 (42.0 - 44.0)	45.8 ± 2.5 (42.3 - 50.3)	46.4 ± 1.0 (45.7 - 47.6)
Muscular pharynx % pharynx	53.4	52.4 ± 2.3 (48.5 - 54.6)	48.7 ± 0.6 (48.0 - 49.0)	53.5 ± 1.8 (52.0 - 54.9)	52.4 ± 0.4 (52.0 - 52.8)
Vagina	26	30.0 ± 4.4 (25.0 - 35.0)		33.3 ± 2.27 (30.0 - 35.5)	
Spicules			59.0 ± 1.7 (58.0 - 61.0)		60.0 ± 2.6 (58.0 - 63.0)
Lateral guiding pieces			16.0 ± 1.0 (15.0 - 17.0)		16.3 ± 0.6 (16.0 - 17.0)
Prerectum	100	116 ± 14.7 (100 - 139)	199 ± 14.0 (189 - 209)	129.7 ± 12.5 (106 - 144)	213 ± 12.7 (203 - 227)
Prerectum/anal body width	3.8	3.9 ± 0.7 (3.3 - 4.8)	5.8 ± 0.3 (5.5 - 6.0)	4.1 ± 0.37 (3.5 - 4.5)	5.8 ± 0.4 (5.5 - 6.3)
Rectum	49	56.5 ± 6.6 (49.0 - 64.0)		57.3 ± 4.56 (53.0 - 64.0)	
Rectum/anal body width	1.9	1.9 ± 0.1 (1.7 - 2.0)		1.8 ± 0.12 (1.7 - 2.0)	

fractive part (*pars refringens* according to De Ley *et al.*, 1993) conoid and very thick-walled, larger than the thin proximal part; its length 45-60% of the corresponding body width. Some mature eggs, lined with a thick corion, are often present in uterus, sometimes two per gonad; their size 72-85 μm x 24-32 μm . Uterus distally widening to accommodate the small elongate-elliptical sperms 5-8 μm long; it connects to the oviduct usually without any visible sphincter; oocytes in a single row except than in the distal ovary tip. Tail elongate conoid, often dorsally concave, regularly tapering and with acute terminus.

Male. Similar to female in most characters. Prerectum 5.5-6.3 anal body widths long. Reproductive apparatus monorchic. Elongate-elliptical sperms 5-7 μm long. Spicules 0.8-1.1 cloacal body widths long. Copulatory hump (Kopulationshöcker) conspicuous. Supplements clustered in two fascicles: 7-9 in the anterior one, 8-11 in the posterior one. Three series of cuticular prominences lacking innervation (pseudo-supplements) are visible: 7-11 between the cloacal opening and the most posterior supplement, 5-9 between the two fascicles and 2-4 between the first fascicle and the copulatory hump. There are also numerous papillae: five pairs of medio-ventral and seven pairs of caudal papillae. Tail short and round.

Diagnosis and relationships. *Brasilaimus lombardoi* sp. n. is a medium sized species characterised by cuticle with fine transverse striae and with 14-18 prominent and broad longitudinal ridges among which there are secondary fine longitudinal ridges, irregularly arranged; lip region truncate-conoid, high, slightly set off from the adjoining body; four large onchia encircling the 20-26 μm long odontostyle; pharynx with glossa; female reproductive apparatus didelphic, vulva longitudinal, vagina lacking sclerotized pieces, with the refractive part large, thick-walled, conoid, and the proximal part smaller; male reproductive apparatus monorchic; supplements in two fascicles of 7-9 and 8-11 respectively; before the first fascicle, behind the second one and between them numerous pseudo-supplements; copulatory hump well developed; tail elongate conoid with pointed terminus in female and short and round in male, *B. lombardoi* sp. n., due to its massive, thick-walled refractive part of vagina and to the presence of a sclerotized glossa in the pharyngeal lumen, is a typical species of *Brasilaimus sensu stricto* (Vinciguerra and Clausi, 2001; Vinciguerra and Clausi 2002). It differs from all the other species of *Brasilaimus sensu stricto* (namely *B. subaquilus* Lordello *et* Zamith, 1957, *B. bryophilus* Hunt, 1978, *B. pachyderma* Andr ssy, 1968, *B. pilatus* Andr ssy, 1986, *B. spicatus* Thorne, 1967, *B. vinciguerrae* Loof *et* Zullini, 2000) by the peculiar structure of cuticle (no other species has minor secondary ridges in between the primary ones) and the low number of the main longitudinal ridges (14-18 vs. 30-40).

Type locality and habitat. Union Hollin (Napo, Ecuador): sieved tree bark, mosses and roots of a thin

forest with felled trees, near the left side of Rio Hollin, at 1100 m above sea level.

Other locality and habitat. Lita (Imbabura, Ecuador): mosses, litter and soil of a riparian forest near Rio Verde at 700 m above sea-level.

Type material. Holotype, one female paratype and one male paratype in the collection of the Dipartimento di Biologia Animale, University of Catania, Italy; one female and one male paratypes at the  llatszertani Int zet, University of Budapest, Hungary; one female paratype at the Instituut voor Dierkunde, University of Gent, Belgium.

Etymology. The new species is named in honour of Prof. Francesco Lombardo, of the Dipartimento di Biologia Animale of the University of Catania, who provided the samples.

AMPHIDELUS BOA Andr ssy, 1968

(Fig. 4; Table II)

Male. Body ventrally curved in a spiral after fixation, rather robust, slightly tapering at both extremities: body width at lip base 17% of body width at pharynx base

Table II. Measurements and diagnostic features of *Amphidelus boa* from Ecuador (all absolute measures in μm , except L in mm).

	1 σ
L	3.2
A	64
B	8.2
C	29.5
C'	2.8
VD	49.7
Pharynx	390
Tail	108
Stoma height	1
Lip region height	1
Lip region width	7.5
Inner labial pits-anterior end	2.5
Outer labial pits-anterior end	6.5
Cephalic pits-anterior end	12
Amphid-anterior end	9.5
Amphid-anterior end (%pharynx)	2.5
Fusus-amphidial opening	27
Fusus-amphidial opening (%pharynx)	6.9
Ductus length	13.5
Ductus length (% pharynx)	3.45
Nerve ring - anterior end	200
Nerve ring (% pharynx)	51.3
Excretory pore - anterior end	40
Excretory pore (% pharynx)	10.2
Body width at pharynx base	44
Body width at mid-body	50
Cloacal body width	39
Spicules	23
Sperms	10-13

and 15 % of body width at mid-body. Cuticle smooth, 4 μm thick. Lip region low, stoma longer than lip height. Anterior end rather conoid, its contour continuous with the adjoining body. Anterior sensilla consisting of a circle of six minute inner labial pits, a circle of six well developed outer labial pits and a circle of four barely visible cephalic pits. Amphids 1.3 lip widths from anterior end;

amphidial aperture slit-like, 4.5 μm wide, 34% of the corresponding body width; amphidial fovea very large, cup-like, shallow, with evident innervation. Pharynx pear-like, gradually enlarging at 75% of its length. Pharyngeal gland nuclei located as follows: DN = 86.5%; AS₁ = 21%; AS₂ = 40%; PS₁ = 64%; PS₂ = ?; K = 52%. Cardia consisting of an anterior, pharyngeal portion and

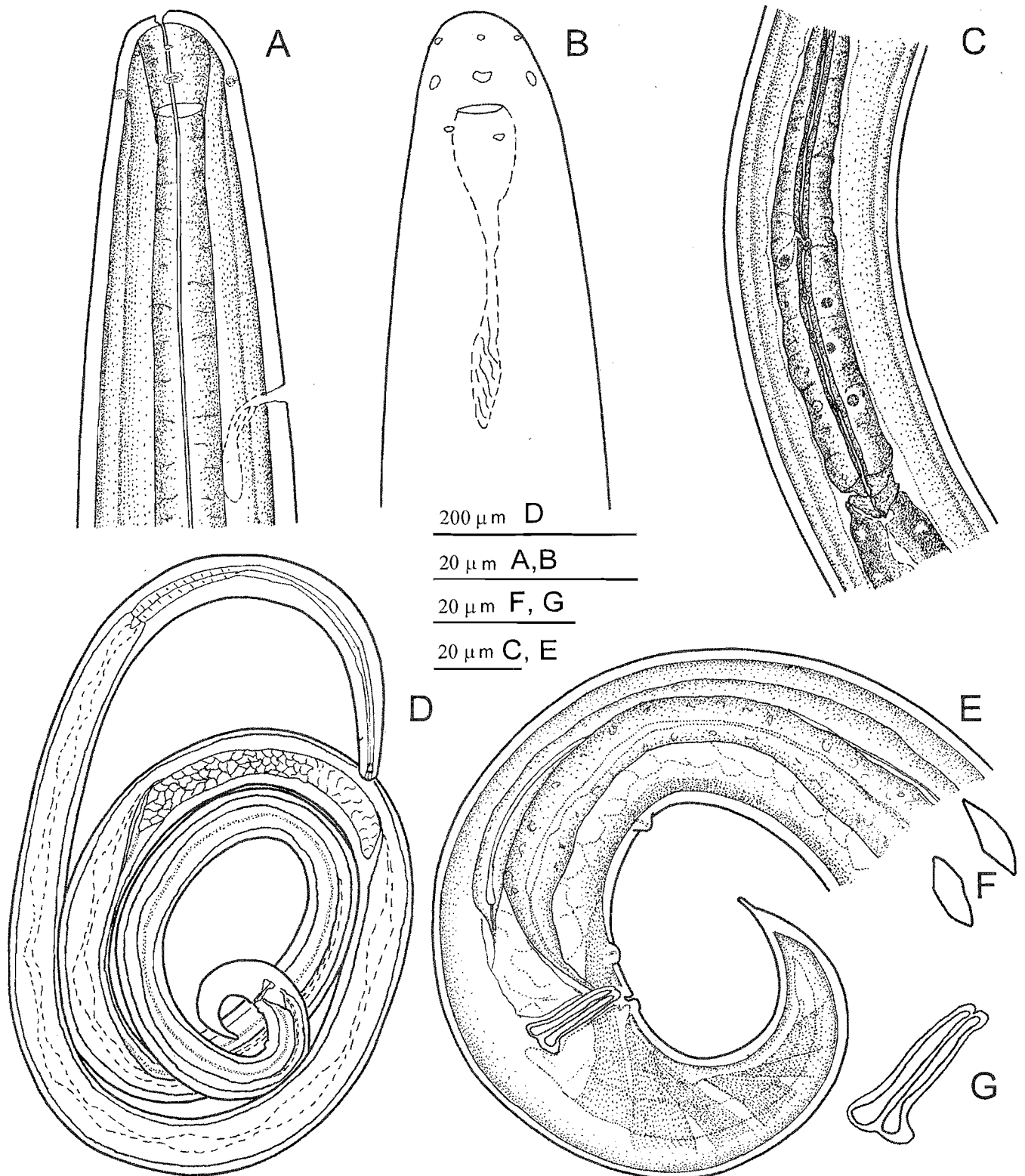


Fig. 4. *Amphidelus boa*: A, anterior end; B, amphid; C, pharynx; D, male body; E, male posterior end; F, sperm; G, spicule.

of a posterior, intestinal, portion. The excretory duct, just after originating from the excretory cell, splits into a pair of canaliculi which, near the cuticle, merge again into a single duct opening outside with a single pore.

Reproductive apparatus monorchic. Spicules straight, transversally directed, 0.6 cloacal body widths long. Two ventral precloacal papillae: the posterior one about 10 μm before the anus, the anterior one 43 μm before the anus. Sperms ovoid, 0.2-0.3 cloacal body widths long. Tail convex-conoid, ventrally curved, with finely rounded pointed tip.

Remarks. This is the first time the male of *A. boa* is reported and described. Our specimen greatly resembles in all respects the single female found in Paraguay and described by Andr assy (1968) and by Clausi and Vinciguerra (1998), especially in the very large size (which is distinctive for the species), the relatively short pharynx, low lip region, shape and location of amphids, location of excretory pore, structure of excretory gland and duct and tail shape. The apparently rather shorter body (3.2 mm vs. 4.2 mm) may be due to the very coiled body of the specimen from Ecuador.

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