

Three new free-living nematode species (Nematoda, Enoplida) from mangrove habitats of Nha Trang, Central Vietnam

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Summary. Three new nematode species of the order Enoplida were found in a degrading mangrove biotope in the Bay of Nha Trang, Central Vietnam. *Admirandus belogurovi* sp. n. (Oncholaimidae), a second species of the genus, differs from the only other species, *A. multicavus* Belogurov et Belogurova, 1979, in having shorter spicules (41-49 vs 71-110 μm) and some measurements, as well as presence of a small midventral preanal supplementary papilla. Diagnosis of the genus *Admirandus* Belogurov et Belogurova, 1979 is emended. *Tripyloides caudaensis* sp. n. (Tripyloididae) is close to a group of species *T. gracilis* (Ditlevsen, 1918), *T. marinus* (Bütschli, 1874) and *T. pallidus* Tchesunov, 1981 with partly overlapped measurements and differs from them in shape of the tail consisting of distinct proximal conical and distal slender cylindrical portions and from *T. pallidus* additionally by oviparity vs viviparity. An annotated list of eleven valid species and a pictorial key for identification of *Tripyloides* species are given. *Litinium subterraneum* sp. n. (Oxystominidae) is characterised by the position of the amphideal fovea closely behind the circle of twelve anterior setae and presence of two preanal supplementary papillae. *Litinium subterraneum* sp. n. differs from the related *L. aequale* Cobb, 1920, *Litinium* sp. 1 and *Litinium* sp. 2 (both latter unnamed species were found in mangroves of Vietnam, Quang Ngo Xuan *et al.*, 2008) in body length, relatively longer tail, position of the amphideal fovea, relative pharynx length, different distance from the cephalic apex to the ventral pore. Some data on microscale distribution of three species in mangrove intertidal zone are provided.

Key words: *Admirandus*, free-living nematodes, *Litinium*, mangroves, Oncholaimidae, Oxystominidae, pictorial key, taxonomy, *Tripyloides*, Tripyloididae.

The present communication is one of a series of the papers on free-living nematode diversity of mangrove habitats in the Nha Trang area, Khanh Hoa Province, Central Vietnam. The mangrove biotopes are disappearing there rapidly and the small remaining mangrove sites show various levels of degradation in this area. Our prospective goal is the understanding of diversity and communities of free-living nematodes under various conditions of normal, vanishing and restoring mangroves.

The bulk of nematode species found in the Nha Trang mangroves is new to science. Here we describe three new species belonging to the order Enoplida collected from the intertidal zone in the Be estuary at the south outskirts of the Nha Trang City, Vietnam.

MATERIAL AND METHODS

Samples of sediments were collected by a cylinder during the low tide and fixed with 4% formal diluted in sea water *in situ*. The meiofauna stained by Bengal rose was isolated by decantation and subsequent filtration through a sieve of 70 μm mesh size. The nematodes were extracted and put into watch glass with Seinhorst's solution (alcohol-glycerin-water mixture in proportion 29:1:70), and processed to glycerin by means of slow evaporation. Specimens were mounted in permanent glycerin slides with a paraffin ring, glass bead separators and glyceel seal. These slides were then studied with an Olympus BX51 light microscope equipped with Nomarski optics.

Table 1. Morphometrics of *Admirandus belogurovi* sp. n.

Character	Holotype male	Males (n=9)				Females (n=9)			
		min-max	mean	S.D.	C.V.	min-max	mean	S.D.	C.V.
L	1899	1551-2111	1894	180	9.52	1807-2286	2057	142.8	6.94
a	34.5	30.3-40.6	34.2	3.25	9.51	29-40.4	33.9	3.96	11.7
b	5.56	5.15-6.1	5.71	0.37	6.53	5.02-6.67	5.77	0.57	9.83
c	14.5	11.4-16.2	14.6	1.49	10.2	9.24-16.3	12.5	2.32	18.5
V	-	-	-	-	-	50.5-55.1	52.7	1.82	3.45
diam.c.s.	20.5	20-22	21.1	0.78	3.70	21-25	22.8	1.33	5.82
diam.am.	23	23-26.5	25.1	1.11	4.43	24-30	26.6	1.79	6.75
diam.n.r.	45.5	45-50.5	47.9	2.12	4.42	50-59	52.3	2.78	5.32
diam.ca.	51.5	48.5-57	53	2.80	5.27	53-72	58.8	5.74	9.77
diam.midb.	55	49-63	55.3	4.47	8.08	56-72	62.1	5.33	8.57
diam.ani	33	31-35	33.3	1.35	4.05	34-42	38.3	3.27	8.54
am.w.	9.5	8.5-10	9.11	0.49	5.33	7-9	7.94	0.58	7.34
am.w., %	39.1	34-39.6	36.5	2.31	6.34	27-35.4	30.0	2.43	8.10
dis.am.	14	13-17	14.8	1.27	8.59	14-18	16.6	1.49	8.99
st.w.	12.5	12.5-15	13.9	0.68	4.89	13-17	14.9	1.18	7.93
st.l.	32.5	30-34	32.5	1.32	4.07	32-39	35.6	2.05	5.77
d.onch	19	19-23	21.3	1.35	6.34	21-27	23.3	1.73	7.42
r.l-v.onch	24	24-28.5	26.6	1.53	5.76	25-34	29.4	2.32	7.88
l.l-v.onch	20	20-23	21.3	0.91	4.25	21.5-26	23.6	1.21	5.14
dis.v.pore	59	55-65	59.9	3.01	5.01	51-88	64.8	10.8	16.7
spic.ch.	49	41-49	44.1	2.63	5.96	-	-	-	-
spic.ar.	51	42-51.3	44.3	1.88	4.23	-	-	-	-
gub.l.	17	15-18	16.3	1.03	6.31	-	-	-	-
c'	4.1	3.79-4.38	4.07	0.16	4.56	4-5.64	4.75	0.51	10.8
d.tail p., %	75	71.4-76.7	74.0	1.72	2.32	67.6-78	72.1	3.08	4.27

a – body length divided by maximum body diameter; **am.l.** - length of amphideal fovea, in μm ; **am.w.** – width of amphideal fovea, in μm ; **am.w., %** - width of amphideal fovea, expressed as percentage of corresponding body diameter, in %; **ant.st.** – anterior stoma part in *Tripyloides*, see explanation in description of *T. caudaensis*; **b** – body length divided by pharyngeal length; **c** – body length divided by tail length; **c'** – tail length, expressed in anal diameters; **calc** (calculated) – morphometric value calculated from drawings of published species descriptions; **c.b.d.** – corresponding body diameter; **c.s.** – length of cephalic setae, in μm ; **C.V.** – coefficient of variation, in %; **diam.am.** – body diameter at level of amphids, in μm ; **diam.ani** - anal body diameter, in μm ; **diam.ca.** – body diameter at level of cardia, in μm ; **diam.c.s.** – body diameter at level of cephalic setae, in μm ; **diam.midb.** – mid-body diameter, in μm ; **diam.n.r.** – body diameter at level of nerve ring, in μm ; **dis.am.** – distance from cephalic apex to anterior rim of amphideal fovea, in μm ; **dis.c.s.** – distance from cephalic apex to circle of cephalic setae, in μm ; **d.scl.gub.l.** – length of distal sclerotised part of gubernaculum in *Tripyloides*, in μm ; **dis.v.pore** – distance from cephalic apex to ventral pore, in μm ; **d.onch** – length of dorsal onch in buccal cavity of *Admirandus*, in μm ; **dors.t.l.**, μm - length of dorsal tooth in *Tripyloides*, in μm ; **d.tail p., %** – length of posterior cylindrical tail portion, expressed as a percentage of entire tail, in %; **gub.l.** μm – length of gubernaculum along spiculum, in μm ; **L** – body length, in μm ; **l.l-v.onch** – length of left lateroventral onch in buccal cavity of *Admirandus*, in μm ; **mid.st.** – middle stoma part in *Tripyloides*, see explanation in description of *T. caudaensis*; **o.l.s.** – length of outer labial setae, in μm ; **o.l.s., %** - length of outer labial setae, expressed as percentage of corresponding body diameter, in %; **post.st.** – posterior stoma part in *Tripyloides*, see explanation in description of *T. caudaensis*; **r.l-v.onch** – length of right lateroventral onch in buccal cavity of *Admirandus*, in μm ; **S.D.** – standard deviation; **spic.ar.** – spicule's length along arc, in μm ; **spic.ch.** – spicule's length along chord, in μm ; **st.l.** – total stoma length, in μm ; **st.w.** – maximal stoma width, in μm ; **V** – distance of vulva from anterior end as percentage of body length, in %.

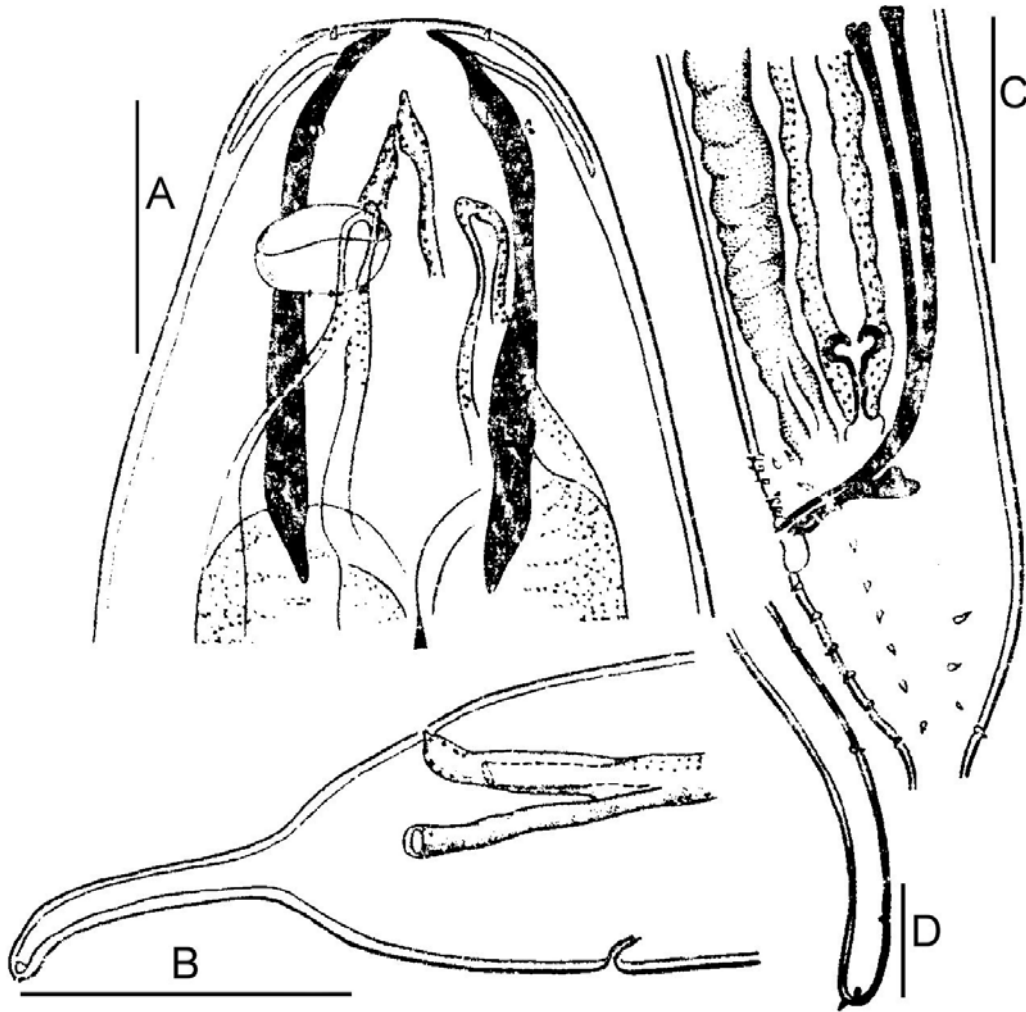


Fig. 1. *Admirandus multicavus* Belogurov et Belogurova 1979, original figures slightly modified. A: cephalic end of a male; B: female tail; C: posterior body of a male (distal part of the tail omitted); D: distal part of the same male tail. Scale bars: A – 30 μm ; B – 100 μm ; C, D – 50 μm (after Belogurov & Belogurova, 1979).

Slides with type specimens of these new species are deposited in the nematode collection of the Department of Nematology, Institute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Rd., Hanoi, Vietnam.

DESCRIPTION

Order Enoplida Filipjev, 1929
Family Oncholaimidae Filipjev, 1916
Genus *Admirandus* Belogurov et Belogurova, 1979

Since the description of the genus and its type species were published by Belogurov & Belogurova

(1979) in Russian in an edition that is not easily accessible, we give here the original figures of the type and hitherto the only species (Fig. 1).

Generic diagnosis: *Admirandus* Belogurov & Belogurova, 1979 (after Belogurov & Belogurova, 1979, 1989, 1992, emended).

Oncholaimidae. Outer labial and cephalic sensilla papilliform. Buccal capsule elongate, length to width ratio *ca* 2:1. Three onchs in the buccal cavity: the largest the right subventral, the other two lower ones equal. Ovaries paired. Demanian tube system generally of the *Adoncholaimus* type, but with postanal terminal canals and pores situated on the tail. The spicules curved, relatively long, slender, proximally cephalated, distally pointed, slightly

Table 2. Comparison of measurements of *Admirandus multicavus* and *A. belogurovi* sp. n., males/females.

Species	L	c.s.	st.l.	st.w.	c'	d.tail p., %	spic.ch.- spic.ar.
<i>multicavus</i>	2060-2280/2700-4010	5 ¹ /3-5	26-42/45-57	14-17/19-20	2.9/2.13 calc	59/51	71-110
<i>belogurovi</i>	1551-2111/1807-2286	1-2/1.5-2	31-34/32-39	12-15/13-17	3.8-4.4/4-5.6	71-77/67-74	41-49

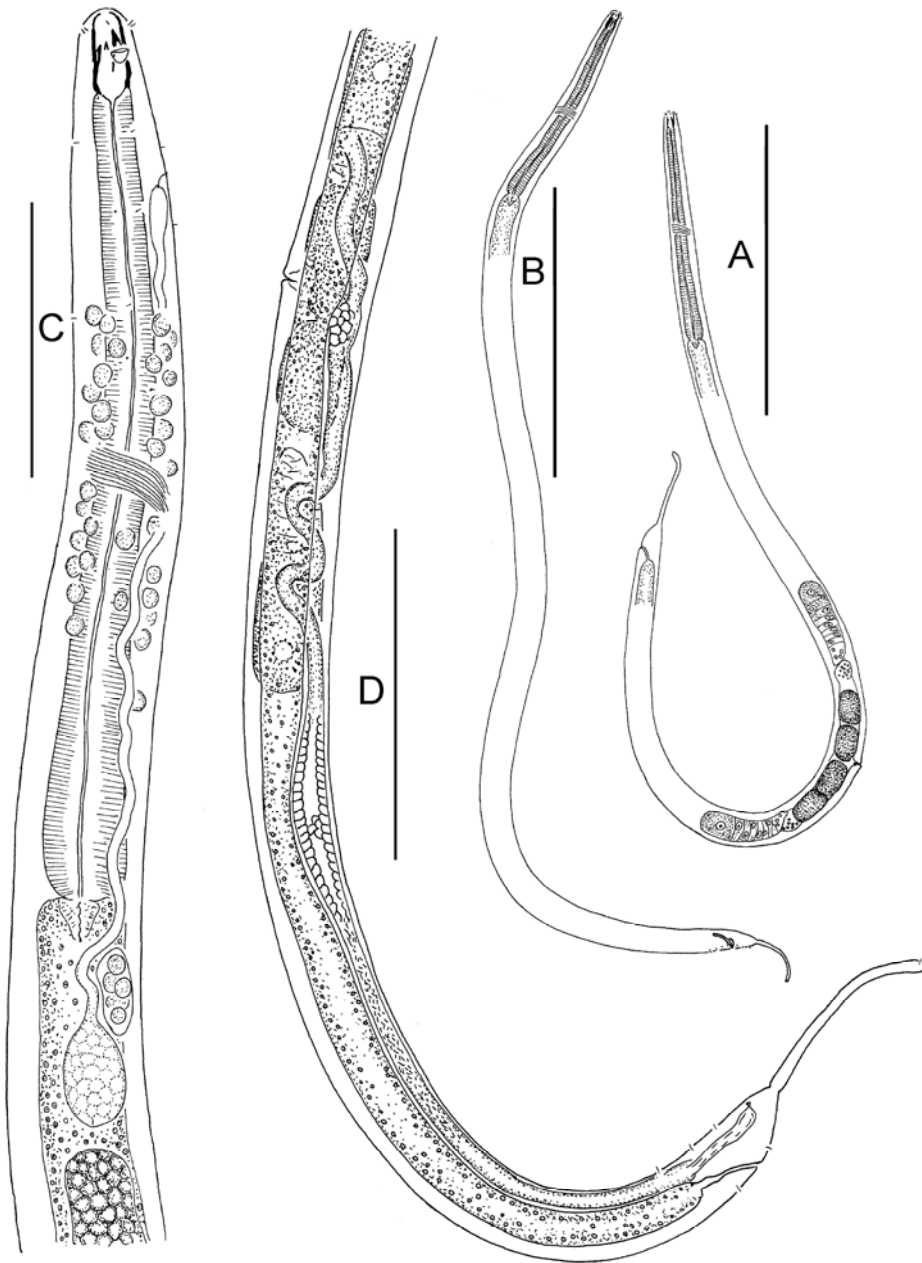


Fig. 2. *Admirandus belogurovi* sp.n. A: paratype male 2, entire worm; B: paratype female 2, entire worm; C: anterior body end, holotype male; D: posterior body end, paratype female 6. Scale bars: A, B – 50 μ m; C – 100 μ m; D – 200 μ m.

¹ The value in the original diagnosis may be a mistake: a calculation derived from the illustration (see fig. 11, Belogurov & Belogurova, 1979) gives length of cephalic setae less than 1 μ m.

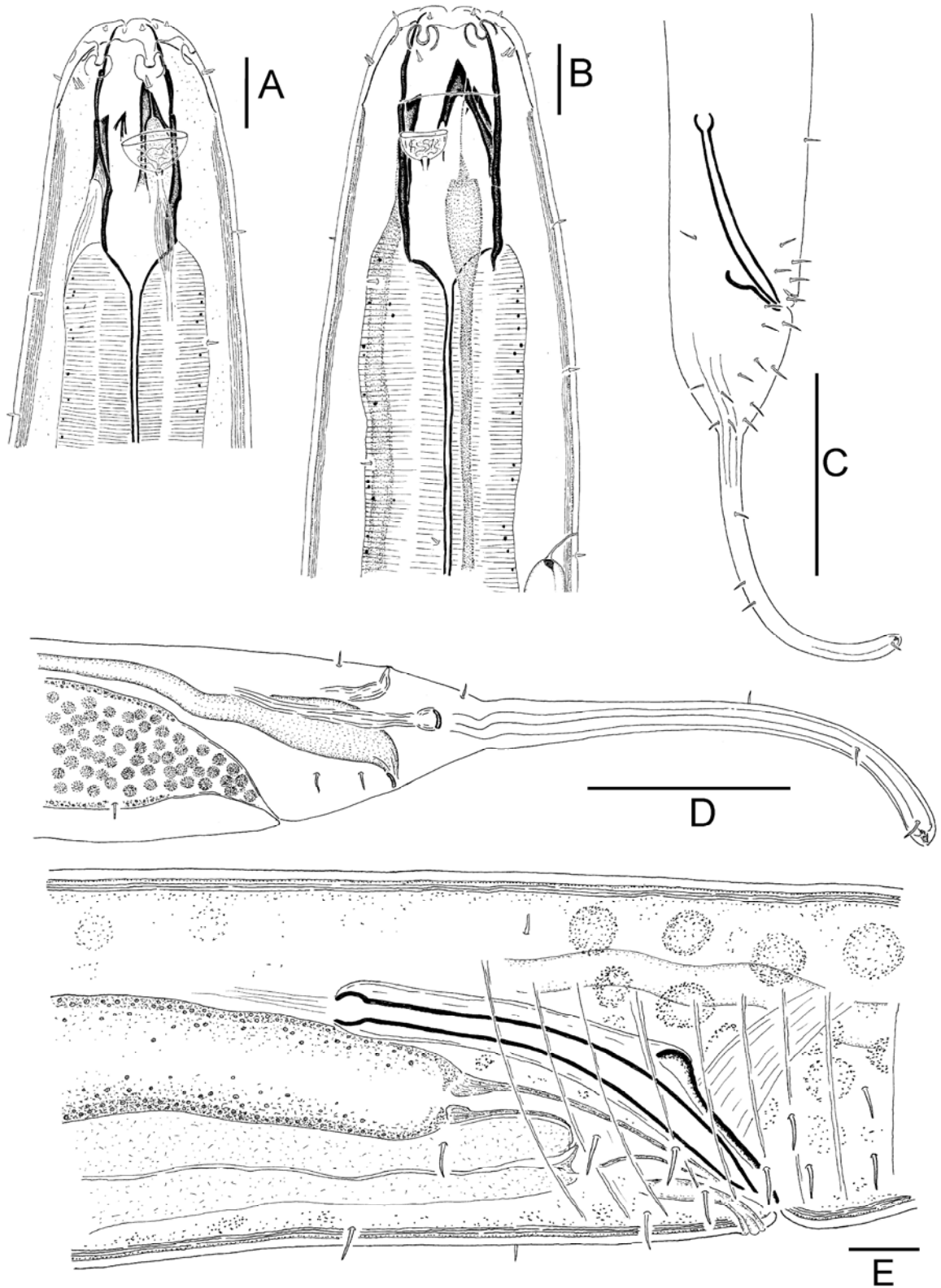


Fig. 3. *Admirandus belogurovi* sp. n., details. A: holotype male, cephalic end; B: paratype female 1, cephalic end; C: holotype male, tail; D: paratype female 3, tail; E: paratype male 1, spicular area. Scale bars: A, B, E – 10 μ m; C, D – 50 μ m.

broadening only in front of the distal end. Gubernaculum present. Midventral preanal supplementary organ present or not. Tail from anterior conical and posterior cylindrical portions.

Type species *Admirandus multicavus* Belogurov & Belogurova, 1979. Only other species: *A. belogurovi* sp.n.

Remark. *Admirandus* is similar to *Adoncholaimus* Filipjev, 1918 in general structure of demanian tubular system and other characters. However, all *Adoncholaimus* species have terminal ducts of the demanian system opening anterior to the anus, and the number of the terminal ducts is nearly constantly two. By contrast, *Admirandus* possess three terminal ducts and they open on the tail.

***Admirandus belogurovi* sp. n.**
(Figs. 2, 3; Table 1)

Material studied. Nine males (one holotype and eight paratypes) and nine females (paratypes). The type species are deposited in the Department of Nematology of the Institute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Rd., Hanoi, Vietnam.

Type locality and habitat. Central Vietnam, Bay of Nha Trang, estuary of Be River (Cua Be) at the south suburban of the Nha Trang City (12°12.033'N, 109°10.899'E), intertidal flat with *Avicennia* mangrove trees, upper oxygenated layer of sediment (silty sand); 16.03.2008.

Etymology. The species is named in honour of late Prof. Oleg I. Belogurov, author of the genus *Admirandus* and many other works on oncholaimid nematodes.

Description. Body elongate and nearly cylindrical. Cuticle smooth, lacking even fine striations. Cephalic end not off-set from the body.

Six inner labial sensilla as minute conical papillae. Six outer labial and four cephalic sensilla situated at same level forming circle of ten very short conical setae 1-2 μm long (males) and 1.5-2 μm (females). Three sparse rows of very minute conical somatic setae (1-2 μm long in both sexes) extended posteriorly from the anterior sensilla; behind the nerve ring somatic setae becoming scanty and diminishing in size. Metanemes indistinct.

Amphideal fovea delicate, transparent, semicircular, pocket-like, with transversal slit-like aperture. Male amphidial fovea slightly wider than that of females.

Anteriorly, somatic cuticle thickened from level of mid-stoma to apex due to thickening of median

layer; basal layer of thickened cuticle condensed and clearly visible. In labial area, sinusoidal intracuticular pattern forming horseshoe-like loops around inner labial papillae.

Buccal capsule voluminous, cylindroid. Stomatal walls consist of three sections joined with narrow regions. Buccal capsule with three unequal triangular onchs, dorsal and left subventral ones small with right one subventral noticeably larger. Necks of pharyngeal glands distinct, with granular content exuded through subapically placed onch pores

Ventral pore and ventral gland ampulla in about two stoma lengths posterior to apex. Ventral gland cell body small, oval, situated to left (three females, one male) or to right (one female) of intestine. Sinusoidal, coiled neck of ventral gland runs from cell body anteriorly and disappears out of sight in nerve ring region.

Pharynx evenly muscular and gradually widens to posterior end. Cardia large, triangular and embedded into intestinal tissue.

Inside buccal cavity, a lump of coarse particles and 'sausage' of condensed fine granular material with a touch of coarse particles and coal-black powder visible.

Ovaries paired, antidromously reflexed, both situated right to intestine. Four to seven fertilized eggs with coarse granulated cytoplasm in uteri. Eggs 60-100 μm long and 40-50 μm wide. Demanian system discernible as light string or duct running posteriorly from anterior uterus. Duct extends to anal region where branches out 3 short fibrous canals terminating with slit-like external pores on proximal part of tail.

Both anterior (outstretched) and posterior (reflexed) testes situated either right (seven males) or left to intestine (one male). Spicules equal, short, slightly curved, sword-shaped. Spicules distally pointed, with subterminal pores, proximally knobbed. Each spicule associated distally with gubernaculum shaped as slightly curved plate. Inconspicuous wart-shaped supplementary organ situated mid-ventrally just anterior to anus present. Lump of secretion on supplement occasionally present. Perianal setae 3.5-4.5 μm long arranged in two slightly arched lateroventral rows, seven to nine setae in each row.

Tail consists of distinct proximal conical portion and distal slender cylindrical one. Caudal gland cell bodies located closely to anus.

Diagnosis. Body length 1551-2286 μm . Outer labial and cephalic setae 1-2 μm long. Buccal cavity 31-39 μm long and 12-17 μm wide. Distal part of tail 67-74%; c' 3.8-4.6. Spicules 67-74 μm long.

Males with a small mid-ventral preanal supplementary papilla. About three copulatory pores on conical part of tail.

Differential diagnosis. *A. belogurovi* sp. n. is very close to *A. multicavus*, the only hitherto known species of *Admirandus*. However, the new species differs from the type species in some measurements (table 2), the most significant of which is the length of spicules. Furthermore, *A. belogurovi* is distinguished by the presence of a mid-ventral preanal supplementary organ. Belogurov and Belogurova (1979) have not mentioned and depicted any similar structure in males of *A. multicavus* – but this undistinguished organ could be overseen easily.

Ecological remark. *Admirandus belogurovi* is quite common in two sites in the middle intertidal zone, in the site with burrows of brachyuran crab *Uca* sp. (it is the second most numerous species there) and in the site of *Avicennia* sp. tree pneumatophores (where it is the third species by its numbers), and is much less abundant in the site of *Rhizophora* sp. support roots. *Admirandus belogurovi* prefers the upper 0-1 cm sediment layer but also occurs deeper in lesser amount.

Family Tripyloididae Filipjev, 1918

Genus *Tripyloides* de Man, 1886

Tripyloides species are frequently recovered worldwide in coastal as well as in brackish waters, less often in fresh waters and rarely in soil biotopes. Apart from description of new the species, we propose an annotated list of valid species and a pictorial key for species identification.

List of valid *Tripyloides* species

1) *Tripyloides acherusius* Gerlach, 1952. Gerlach, 1952: 328-329, Abb. 7 a-c (Kiel Bay, wet sand, upper littoral). Altherr, 1958: 46-67, fig. 1 a-b (as *Bathylaimus latisetosus* - opinion of Riemann, 1970: 399) (North Sea, Helgoland, fresh to brackish waters). Within the genus, this species is distinguished by the longest and basally thickest outer labial setae as well as large distinctly spiral amphideal fovea at the posterior ending of the stoma, and proximally narrowed spicules. Evidently, the species is not strictly marine, since it was found by Gerlach in upper intertidal zone and by Altherr in fresh water on Helgoland.

2) *Tripyloides amazonicus* (Gerlach, 1957) Riemann, 1970. Gerlach, 1957b: 451-453, Abb. 14 d-g (*Nannonchus a.*) (Brazil, Sao Paulo, littoral).

Gerlach, 1958: 364, fig. 13 a-b (*Nannonchus a.*) (Madagascar). Riemann, 1970: 398-399, fig. 48-50 (Caribbean coast of Colombia, estuary of Magdalena River). Pastor de Ward, 1993: 65, fig. 2 A-C (Argentina, River Deseado Estuary). All the specimens share position of the amphidial fovea well posterior to the stoma ending but they have no other prominent structural features in common. All descriptions differ more or less from one another in some dimensions, but the specimens of Riemann differ more notably from those of Gerlach and Pastor de Ward by longer jointed outer labial setae (13 μm vs 8-9 μm and 69% c.b.d. vs 40-50%). Specimens from Madagascar and Colombia were found in brackish and even fresh waters.

3) *Tripyloides brevis* Gerlach, 1958. Gerlach, 1958: 362-364, fig. 12 a-b (Madagascar, intertidal interstitial). Outer labial setae long, jointed, small amphideal fovea situated posterior to the stoma ending, stout, nearly cylindrical tail.

4) *Tripyloides caudaensis* Tchesunov, Mokievsky & Nguyen Vu Thanh. Present paper.

5) *Tripyloides gracilis* (Ditlevsen, 1918) Filipjev, 1927. Ditlevsen, 1918: 190, Pl. IX, fig. 3; Pl. X, fig. 4 (*Macrolaimus g.*) (Danish Belt Sea). De Coninck & Stekhoven, 1933: 123-124, figs 113-115 (*T. septentrionalis*) (North Sea, Zwyn, on *Enteromorpha*, sand and organic debris). Platt & Warwick, 1983: 278, fig. 128 (Great Britain). See a discussion below, under a title of *Tripyloides marinus*.

6) *Tripyloides granulatus* (Cobb, 1913) Wieser, 1956. Cobb, 1913: 442, fig. (*Nannonchus g.*) (Potomac River, Arlington, roots of aquatic plants). Gerlach, 1957a: 162, fig. 9 b-f (*Nannonchus g.*) (Brazil, mangrove). Mulvey, 1969: 380-381, fig. 30-32 (*Nannonchus g.*) (Canadian Arctic, Ellesmere Island, Hazen Lake area, soil). The original description is rather poor. All the descriptions agree more or less in measurements and reflect such common features as very short outer labial and cephalic setae, and position of amphideal foveas at the level of the posterior ending of the stoma. However, conspecificity of specimens denoted in the publications cited above may be doubtful on ecological grounds. Specimens of Cobb (1913) were found in a fresh water milieu, Virginia in USA. However, the original description is incomplete and hence the species may not be recognised easily if found again in the type locality. Specimens of Mulvey (1969) came from soil of the Canadian

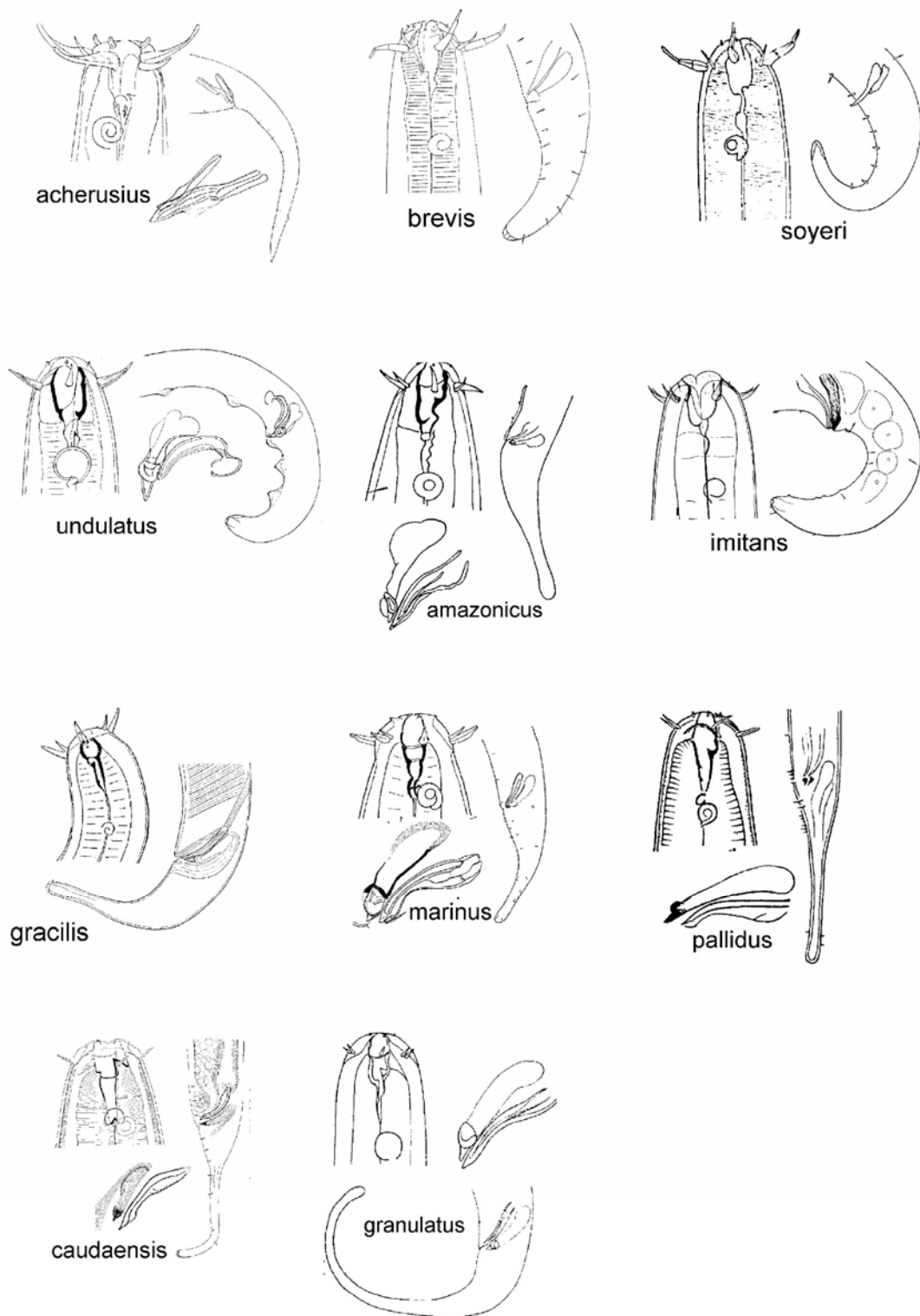


Fig. 4 Pictorial key to the species of *Tripyloides*. *acherusius* – Gerlach, 1952, Abb. 7 a-c; *amazonicus* – Gerlach, 1957, Abb. 14 d-g; *brevis* – Gerlach, 1958, fig. a-b; *gracilis* – de Coninck & Stekhoven, 1933, fig. 113-115; *granulatus* – Gerlach, 1957, Abb. 9 b, d, e; *imitans* – Wieser, 1959, fig. 81 a-b; *marinus* – Lorenzen, 1969, Abb. 8 a-b, d; *caudaensis* – present paper; *pallidus* – Tchesunov, 1981, fig. 2; *soyeri* – de Bovée, 1977, fig. 3 C, G; *undulatus* – Gerlach, 1962, Taf. 9, Fig. 1-n.

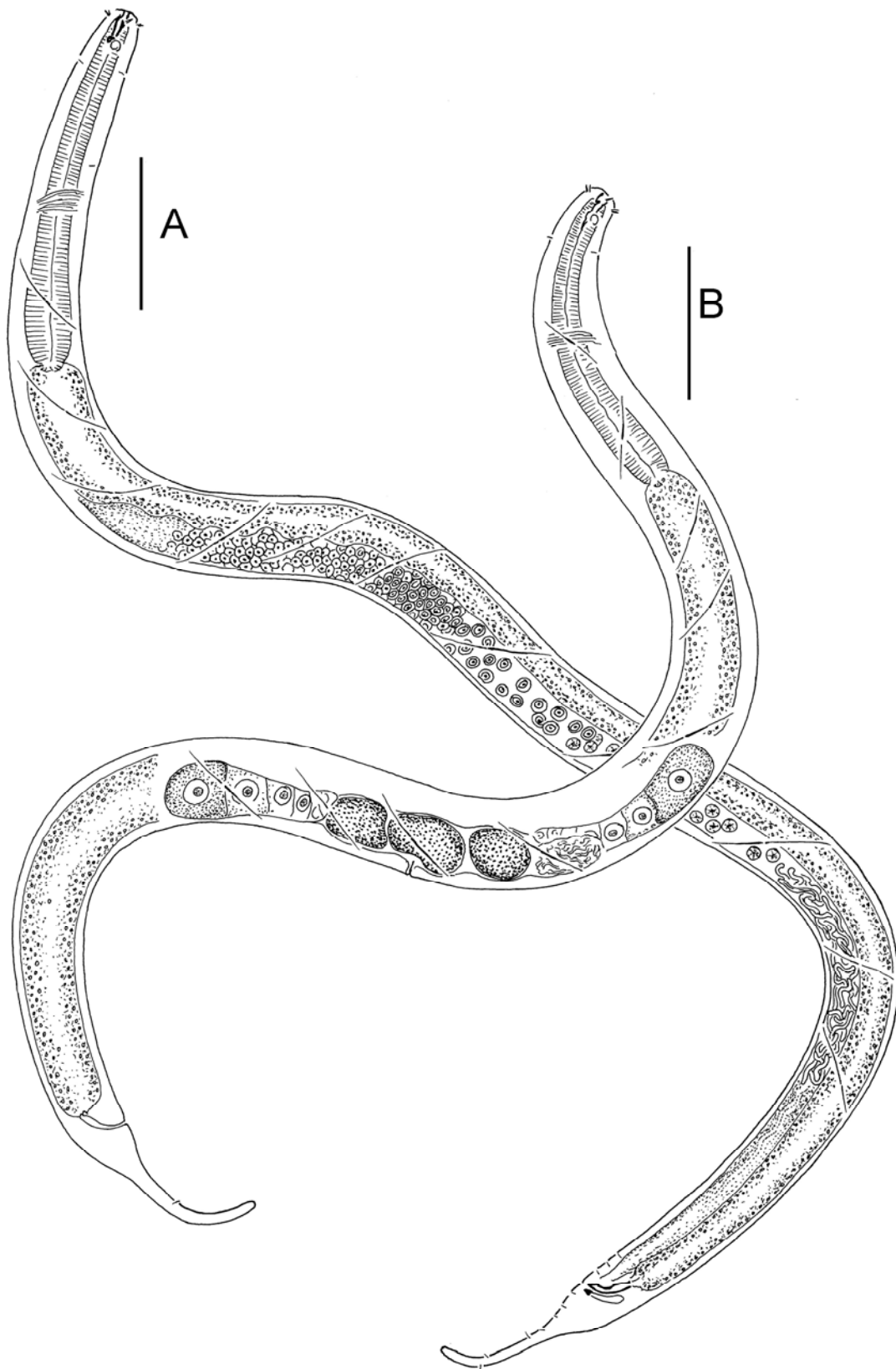


Fig. 5. *Tripilyoides caudaensis* sp. n., entire view. A: paratype male; B: paratype female. Scale bars 100 μ m.

Table 3. Some morphometric parameters of *Tripyloides* species, males.

Species	Characters						
	L	a	c	c'	o.l.s.	am.w.	am.w., %
<i>acherusius</i>	828-1109	23-24	8.2-9.2	6	20	8	30
<i>amazonicus</i>	1083	25	8.8	3.5	8.5	6.5	25
<i>brevis</i>	1736	32	23	2.2	17	7.5-8	30
<i>caudaensis</i>	1145-1377	19-26	9.6-12.7	2.9-3.9	4.5-6	5.5-6	18-19
<i>gracilis</i>	1500-2000	24-42	16	3.3-3.9	8-9	6-7	20-26
<i>granulatus</i>	1300	27.8	5.6	7.2	3-5	5-7.5	25
<i>imitans</i>	2620	52	21	3.8	9-12	7.5	23
<i>marinus</i>	1050-2257	29-45	12-19	2.9-4.3	3.5-8.5	5-6	20-28
<i>pallidus</i>	1650-1865	30-41	14-15	3.7	7.5-8.8	5	18
<i>soyeri</i>	1315-1371	33-39	11.4-11.9	3.6-4	16-17	5.5-7	20-25
<i>undulatus</i>	2135	47	16	3.2	11-12	10.5	40

Arctic what is also unusual for a predominantly marine genus *Tripyloides*. *Tripyloides granulatus* was found in a marine location in mangroves of Brazil (Gerlach, 1957a).

7) *Tripyloides imitans* Wieser, 1959. Wieser, 1959: 75, fig. 81 a-b (Puget Sound). The species is clearly distinguished by the greater body size (2620 μm in male) and plump tail with six ventral papillae.

8) *Tripyloides marinus* (Bütschli, 1874) de Man, 1886. Bütschli, 1874: 33-34, fig. 12 a-c, Taf. III (*Tripyla marina*) (Kiel Bay). De Coninck & Stekhoven, 1933: 121-123, fig. 110-112 (North Sea, Ostende). Lorenzen, 1969: 206-207, Abb.8 a-h, 'schlanke Form' (North Sea, salt marshes). Both *T. marinus* and *T. gracilis* are often recorded in European seas. According to Platt & Warwick (1983), these two species are easily separated by the number of chambers of the buccal cavity. In *T. marinus*, the buccal cavity consists of four separate chambers, instead of two or three sections in *T. gracilis*. However, the discrimination of these two species is not clear. Ditlevsen (1918) in the original diagnosis of *T. gracilis* indicated a presence of a four-chambered buccal cavity for this species. However, the observed shape of a buccal cavity depends, first, on the position of the cephalic end under a coverslip and, second, the anterior muscle contraction which reflects the degree of expansion or compression of the stoma. The sections in the buccal cavity are composed by irregularly shaped cuticular thickenings. These thickenings are not presented by full rings and not strictly transversal. The variability of stoma shape makes it difficult to use the character for discrimination of species. Some authors (Schneider, 1939) even did not see a necessity in discriminating these species. On the other hand, Riemann (1966) found in the Elbe estuary two close but different forms of *Tripyloides* that shared a four-chambered construction of the stoma. He denoted them as *T. marinus* 'plumpe

Form' [stout form] and *T. marinus* 'schlanke Form' [slim form]; the latter quite possible was *T. gracilis*. Though close, both forms differ in some measurements and show no transitional stoma shapes. In 'plumpen Form', the border between first (anteriormost) and second chambers is inconspicuous while the border between the second and third chambers is labelled by two subventral teeth. In 'schlanken Form', both borders between stoma chambers are composed from distinct cuticular rings. It is interesting that both forms occur in different biotopes, 'schlanke Form' in silt whereas 'plumpe Form' in fine sand with a touch of silt higher on the beach. Lorenzen (1969) also differentiated the same or similar 'schlanke' and 'plumpe' forms of *T. marinus* along the German coast of the North Sea. These forms also differed from each other by the body shape and four-chambered ('schlanke') or three-chambered ('plumpe') stoma. The Lorenzen's 'schlanke Form' was also found mostly in silt whereas 'plumpe Form' in fine sand of higher littoral horizon.

The two forms found by both authors might correspond to the formal species *T. marinus* and *T. gracilis*. However, the problem is still not resolved needing further studies on morphology, variability and barcoding to determine a position of these species/forms.

9) *Tripyloides pallidus* Tchesunov, 1981. Tchesunov, 1981: 53-54, fig. 2 (northern part of the Caspian Sea). The species is close to *T. marinus* and *T. gracilis*. The main diagnostic feature of *T. pallidus* is viviparity.

10) *Tripyloides soyeri* de Bovée, 1977. De Bovée, 1977: 300-302, fig. 3 (Kerguelen Island in the south Indian Ocean, mouth of a river). The species is well characterised with relatively long and stout three-jointed outer labial setae.

11) *Tripyloides undulatus* Gerlach 1962. Gerlach, 1962: 106-107, Taf. 9 l-n (Maldiv Islands). The species is distinguished by wide

amphideal fovea, large rounded knobs of the spicules and prominent conical pre- and postanal mid-ventral supplementary papillae.

Key for identification *Tripyloides* species

For identification of *Tripyloides* species, we propose the two-component pictorial key from a set of valid species caricatures (Fig. 4) and a table of their most important morphometric characteristics (Table 3). Such keys were introduced into marine nematology by Platt (1984).

As it was mentioned above, a variability in a stoma configuration caused by the angle of the examined specimen under microscope and the degree of stoma compression makes the use of this feature difficult for discrimination of *Tripyloides* species. The position of the amphideal fovea is also not stable within a species – it looks and is measured as a rectangular projection from a bent cephalic end. Thus, the absolute and relative length of anterior setae, absolute and relative body width and the position of the amphideal fovea are considered as the most valuable diagnostic features in *Tripyloides*.

Simplified images of valid species are arranged in a series with decreasing length of outer labial setae. Other characters suitable for species discrimination are associated with a posterior body end, especially males; it is a tail shape and the arrangement of preanal and postanal supplementary papillae.

Tripyloides caudaensis sp. n. (Figs. 5-7, Table 4)

Material studied. Holotype male, five paratype males, four paratype females. The type species are deposited in the Department of Nematology of the Institute of Ecology and Biological Resources (IEBR), Vietnamese Academy of Science and Technology, 18 Hoang Quoc Viet Rd., Hanoi, Vietnam.

Type locality and habitat. Central Vietnam, Bay of Nha Trang, the estuary of Be River (Cua Be) at the south suburban of the Nha Trang City (12°12.033'N, 109°10.899'E), the intertidal flat with mangrove trees, the upper oxygenated layer of sediment (silty sand); 16.03.2008.

Etymology. The species name is derived from Cau Da, a port settlement in the Nha Trang Bay at the Be estuary where *T. caudaensis* has been collected.

Description. Body cylindrical, stout. Cuticle smooth. Mouth opening wide, surrounded by three petaloid, distally thin lips. Inner labial sensilla as minute conical papillae about 1 μ m long. Six outer labial and four cephalic sensilla, all short, and stout conical setae

Table 4. Morphometrics of *Tripyloides caudaensis* sp. n.

Character	Holotype male	Males (n=6)	Females (n=4)
L	1333	1145-1377	1157-1372
a	22.2	19.4-25.5	17.8-30.5
b	5.50	5.5-6	5.51-5.9
c	12.7	9.62-12.7	9.06-11.3
V	-	-	50.6-52.6
diam.c.s.	21	20.5-23	22.5-23
diam.am.	30	30-32	29-35
diam.n.r.	49	44-53	43-49.5
diam.ca.	50	50-55.5	46.5-54
diam.midb.	60	54-62	45-65
diam.ani	32	31-35	28-35
o.l.s.	6	4.5-6.5	5.5-6
o.l.s., %	28	22-31	24-27
c.s.	5	3.5-5	4.5-5
am.w.	6	5.5-6	6-6
am.w. %	20	18-19	17-20.5
dis.am.	22	20-23	24-25
st.w.	9.5	8-10.5	9-9.5
st.l.	27	25-28	27.5-29.5
dors.t.l.	3.5	3.5-4.5	4-4
ant.st.	6	6-9	6-8.5
mid.st.	11	11-11	10-10
post.st.	5.5	5-6.5	7-7
spic.ch.	27	27-30	-
gub.l.	27	20-27	-
d.scl.gub.l.	5.5	5-7	-
c ^o .	3.65	2.98-3.91	3.57-4.67
d.tail p. %	68	58-72	61-78

arranged in one circle. Outer labial setae appearing as composed of two-joints, with tips truncate, slightly longer and thicker than cephalic setae with pointed tips. Short (1.5-2 μ m) and thin somatic setae sparsely distributed along the body. About eleven laterally placed loxometanemes distributed along body from level of posterior of pharynx to posterior of intestine.

Amphideal fovea rather small, rounded, as a comma-shaped loop, its inner margin more distinct than outer rim; situated at level of posterior lateral pockets of stegostoma.

Somatic cuticle sharply widening apically and again narrowing to lips. Buccal cavity with thin but distinctly sclerotised walls. According to de Ley *et al.* (1995), the nematode stoma consists of three principal compartments: cheilostoma made of labial, that is somatic, cuticle, gymnostoma formed by modified pharyngeal cuticle but free of muscular pharyngeal tissue, and stegostoma formed also by

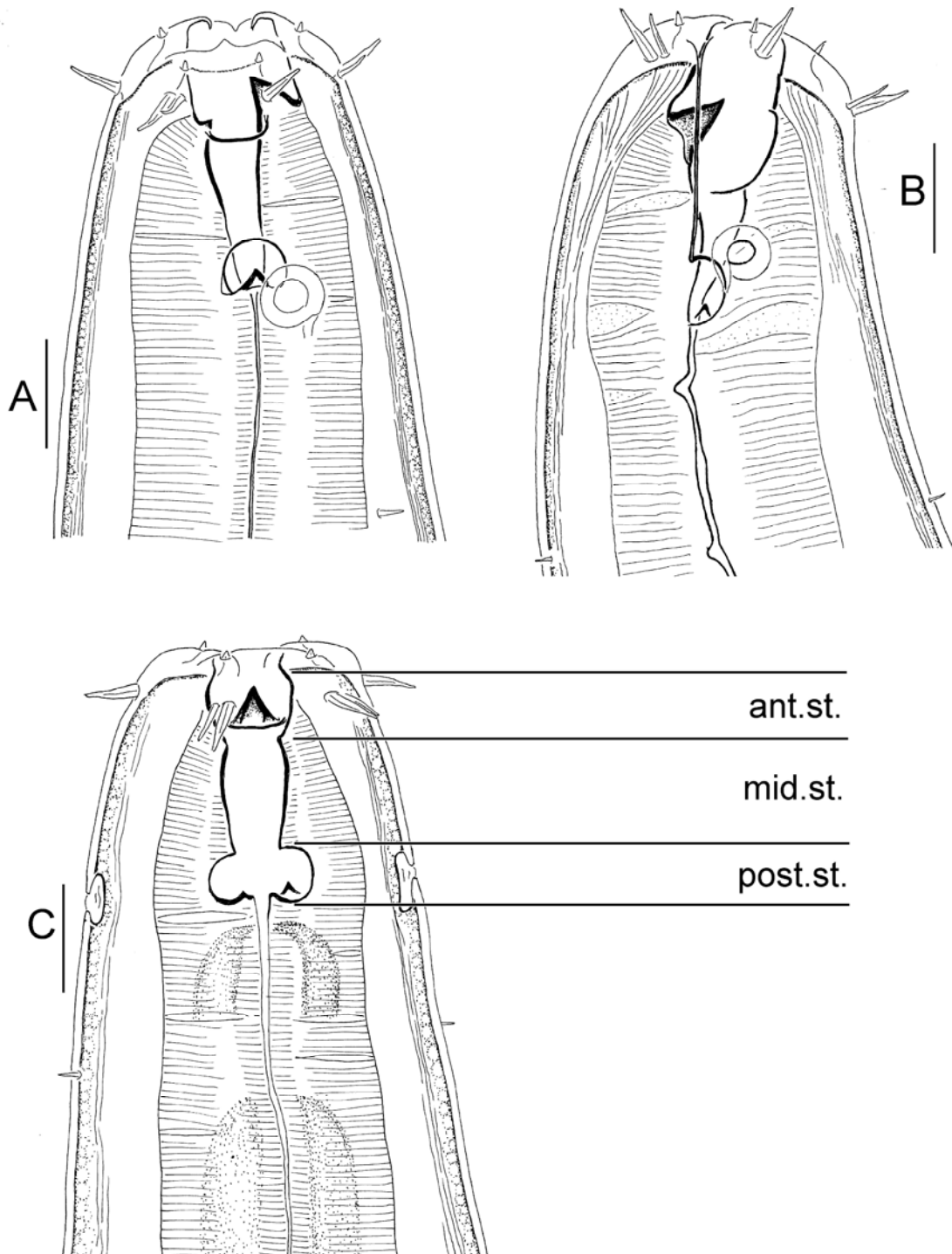


Fig. 6. *Tripylroides caudaensis* sp. n., cephalic ends. A: paratype male, lateral view; B: paratype female, lateral view; C: other paratype male, median view; horizontal bars mark borders between anterior, middle and posterior stoma parts (see explanations in the description). Scale bars 10 μ m.

pharyngeal cuticle but surrounded by pharyngeal tissue cuff. Buccal cavity of *Tripyloides* could be divided into three parts, which could be reliably measured and thus used for discrimination of species (Fig. 6). Anterior part of stoma (ant.st.) situated just posterior to cheilostoma, including gymnostoma and anterior portion of stegostoma. It irregularly cup-shaped and armed with a triangular, solid, dorsal tooth. Middle part of stoma separated from anterior stoma by nearly transversal cuticular ring (visible in lateral view) with a constriction visible in median view. Middle stoma (mid.st.) irregularly cylindroid-conoid, slightly narrowed posteriorly; in some specimens, it looks two-chambered. Posterior part of stoma (post.st.) forms two lateral hemispherical pouches with small

triangular basal denticle in each. Lateroventral pharyngeal glands presumably opened just behind these pockets; dorsal pharyngeal gland outlet presumably situated at same level but its position could not be reliably ascertained. Pharynx evenly muscular throughout its length, gradually widening posteriorly. Cardia small, surrounded with intestinal tissue. Intestinal cells with mustard-coloured drops. Intestine sometimes with a sausage-like condensed mass of coarse particles and debris in the lumen.

No renette cell present.

Ovaries paired and antidromously reflexed, arranged ventrally and laterally to intestine, anterior and posterior branches sometimes situated at opposite sides of intestine. Up to four mature eggs 50-57 μm long and 29-44 μm wide in uteri at a time.

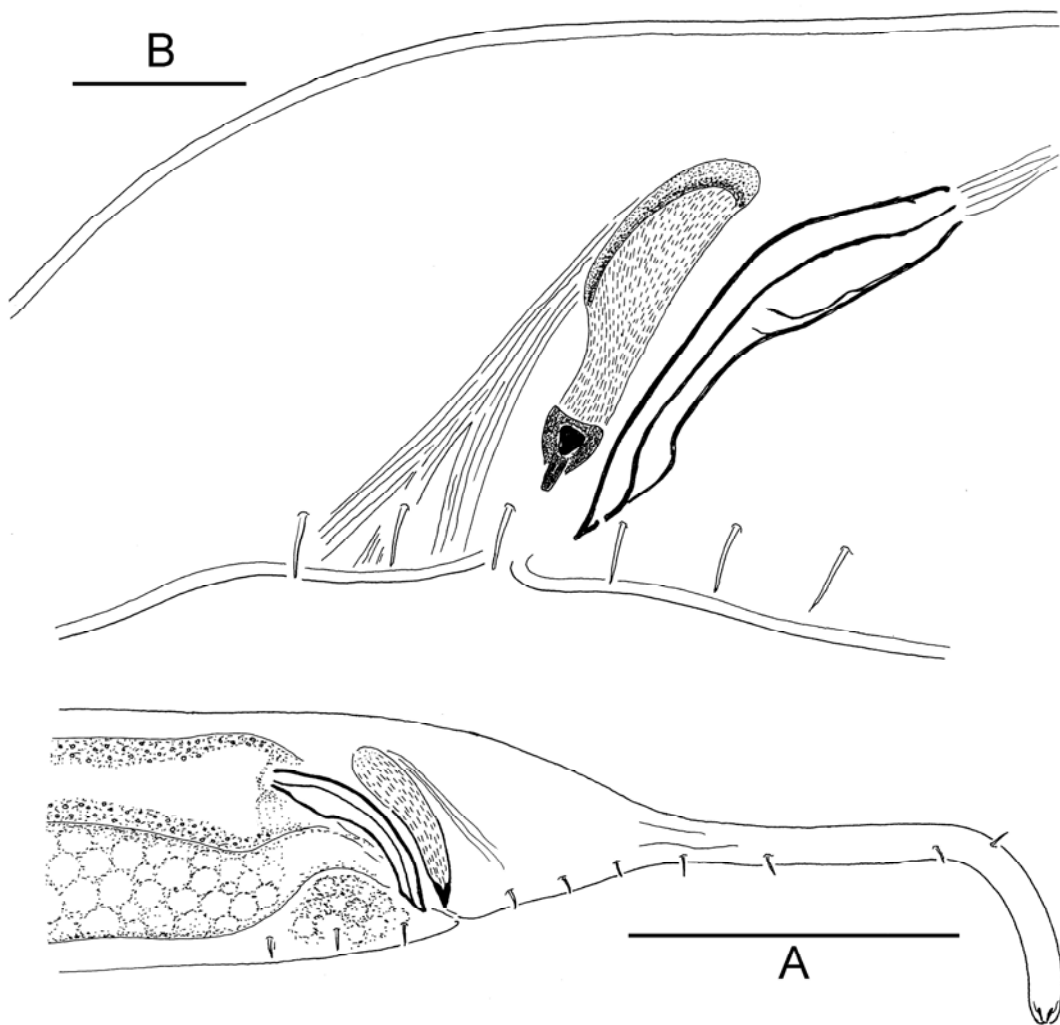


Fig. 7. *Tripyloides caudaensis* sp. n., posterior body structures in males. A: posterior body, holotype male; B: spicular area of paratype male. Scale bars: A 50 μm ; B – 10 μm .

Testis unpaired, outstretched, situated ventrally of intestine. Germinal zone very small. Major part of gonad filled anteriorly with compact rounded cells (spermatids) and posteriorly with vermiculated structures (spermatozoans or late spermatids) similar to those occurring in spermathecas of females. Spicules straight and short, nearly trapezium-shaped, with some longitudinal ribs, distally acute and proximally non-knobbed. Gubernaculum non-sclerotised, longitudinal body parallel to the spicule, with distal solid triangular structure.

Tail from proximal conical and distal slender cylindrical portions, not swollen terminally. Pre- and postanal rows of lateroventral setae, about three preanally and three postanal setae on conical portion of tail.

Diagnosis: Body length 1145-1377 μm , a 17.8-30.5. Outer labial and cephalic setae smooth, 4.5-6 μm and 3.5-5 μm long, respectively. Amphideal fovea 5.5-6 μm and 17-20.5% c.b.d. wide, situated at level of posterior lateral pouches of stegostoma. Tail from distinctly set-off proximal conical and distal cylindrical portions; c 9.06-12.7, c' 2.98-4.67. Spicules 27-30 μm long. Neither mid-ventral preanal nor postanal supplementary papillae present. Oviparous.

Differential diagnosis: In aspect of the anterior end, *T. caudaensis* is similar to the species with short and smooth anterior setae and relatively small amphideal fovea, found from *T. amazonicus* to *T. pallidus* on Fig. 4.

The new species differs from *T. amazonicus* in having slightly shorter outer labial setae (4.5-6 vs 6 μm) and principally by lacking minute preanal mid-ventral papillae in males and different tail shape; from *T. imitans* by much shorter and stout body with relatively longer tail (L = 1145-1377 vs 2620 μm , a = 19-26 vs 52, c = 2.9-3.9 vs 21), shorter outer labial setae (4.5-6 μm vs 9-12 μm) and quite different tail shape without postanal ventral papillae in males; from *T. granulatus* by a little longer outer labial setae (4.5-6 vs 3-5 μm) and shorter tail with distinctly set-off cylindrical portion (c = 9.6-12.7 vs 5.6, c' = 2.9-3.9 vs 7.2).

Tripyloides caudaensis sp. n. most resembles *T. gracilis*, *T. marinus* and *T. pallidus* with similar morphometric characteristics but differs from them by tail from distinct proximal conical and distal slender cylindrical portions and from *T. pallidus* additionally by oviparity vs viviparity. .

Morphometric differences of *T. caudaensis* sp. n. from related species are shown in Table 3.

Ecological remark. *T. caudaensis* sp. n. is most abundant in the biotope with burrows of brachyuran crab *Uca* sp. (the third species by numbers) and present also in sites with *Avicennia* and *Rhizophora* roots. It prefers upper sediment layer but few specimens can be found deeper.

Family Oxystominidae Chitwood 1935

Genus *Litinium* Cobb 1920

Recently, the genus *Litinium* has been reviewed by Quang Ngo Xuan *et al.* (2008). The authors diagnosed the genus, cited a list of species and provided a key for species identification. They also described two males from Vietnam mangroves, designating them as holotypes of *Litinium* sp. 1 and *Litinium* sp. 2 without formal scientific names. The authors further recorded *Litinium* species in a number of sites along the Vietnam coastline including Bay of Nha Trang. However, the species described below does not fit the description of any hitherto known *Litinium* species.

Litinium subterraneum sp. n. (Figs. 8, 9; Table 5)

Material. Holotype male, paratype male and five paratype females. The type species are deposited in the Department of Nematology of the Institute of Ecology and Biological Resources (IEBR), Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Rd., Hanoi, Vietnam.

Table 5. Morphometrics of *Litinium subterraneum* sp. n.

Character	Holotype male	Paratype male	Paratype females (n=5)
L	1855	1532	2058-2305
a	80.6	69.6	73.5-85.3
b	5.66	5.19	5.82-6.3
c	26.8	27.7	23.9-32.1
V, %	–	–	26.9-29.9
diam.c.s.	6	6	5.5-6.5
diam.am.	7	6.5	6.5-8
diam.n.r.	20	19	19-22
diam.ca.	24	24	25-27.5
diam.midb.	23	22	25-29
diam.ani	20	16,5	16-18
o.l.s.	2.5	3-4	2-2.5
c.s.	3	3-4	2-2.5
dis.c.s.	15	13	15-17
am.w.	4	4	3.5-4
am.w., %	57	61	50-62
am.l.	8	7	6.5-7
dis.am.	2	3	1.5-2.5
st.l.	5	6	5-6
dis.v.pore	95	80	92-117
spic.ch.	22	21,5	–
spic.ar.		23	–
gub.l.	7	6	–
dis.ant.suppl	34	63	–
dis.post.suppl	78	23	–
c'	3.48	3.47	4.03-5.7

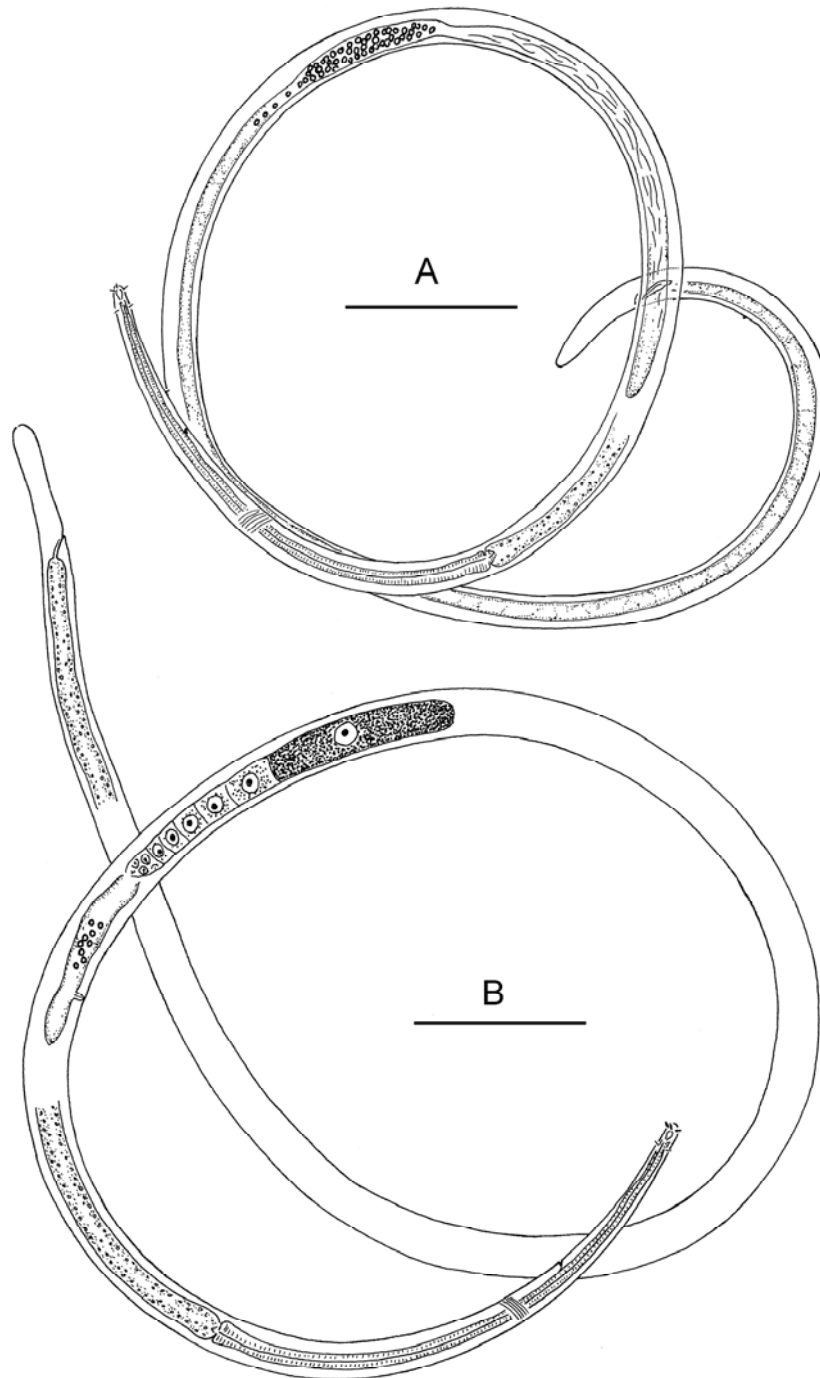


Fig. 8. *Litinium subterraneum* sp. n., entire. A: holotype male. B; paratype female. Scale bars 100 μ m.

Type locality and habitat. Central Vietnam, Bay of Nha Trang, the estuary of Be River (Cua Be) at the south suburban of Nha Trang City (12°12.033'N, 109°10.899'E), the intertidal flat with *Avicennia* mangrove trees, the subsurface layer of reduced sediment (silty sand); 16.03.2008.

Description. Body long, slim, thread-like, resilient. Cuticle smooth, cross-striation not discernible.

Cephalic end not set-off. Mouth opening very small. Six pairs of nearly equally long, elongate conical setae; setae situated very closely to one another in each pair (evidently, set is composed of six inner and six outer labial setae). Four posterior lateromedian setae nearly as long as anterior ones but thinner, distanced from circle of twelve anterior setae.

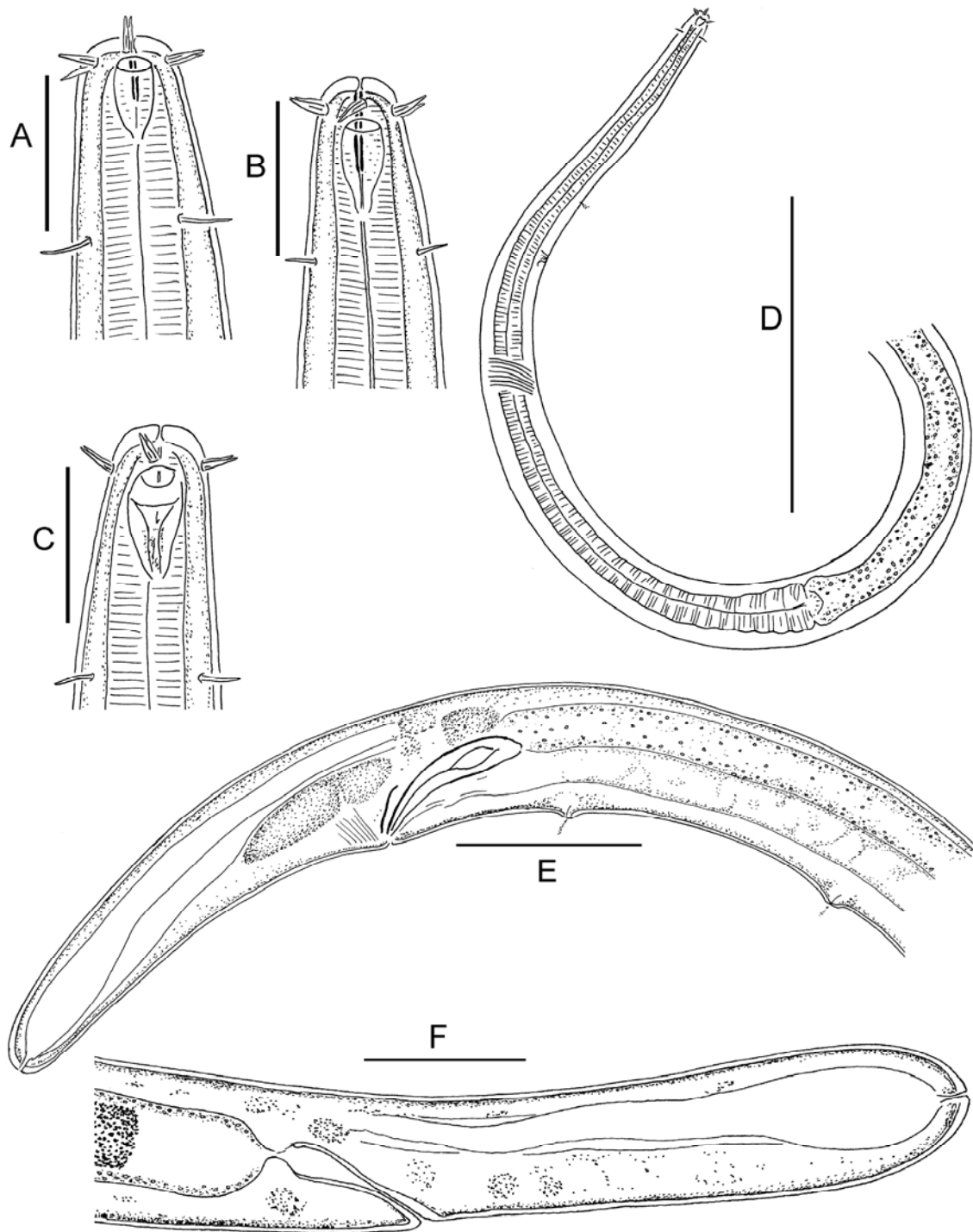


Fig. 9. *Litinium subterraneum* sp. n., details. A: cephalic end of paratype male; B: cephalic end of paratype female. C: cephalic end of holotype male; D: anterior body of paratype male; E: posterior body of holotype male; F: tail of paratype female. Scale bars: A-C – 10 μ m; D – 100 μ m; E-F – 20 μ m.

Amphideal fovea pocket-like, longitudinally oval to pear-like, with small, transversely-oval anterior aperture. Anterior margin of fovea (aperture) at level of crown of ten anterior setae.

In one male, one lateral seta situated in front of half distance from cephalic apex to nerve ring. In males, short (1.5-2 μm) mid-ventral seta situated just behind level of lateral setae, 62-75 μm from anterior end. Many setae with droplet of secret on tip. No setae present further posterad.

Somatic cuticle clearly widened around mouth. Buccal cavity vestigial, not differing in width from internal lumen of pharynx. Cuticular walls of stegostoma thickened which differentiates it from cuticular pharynx lining. Pharynx gradually widening to cardia; at posterior, outline of pharynx wavy. Muscular cross striation more evident in posterior part where muscular bands alternate with plasmatic lenses regularly.

Ventral pore located posterior to ventral somatic seta. Somatic cuticle thickened in area of ventral pore. Cell body of ventral gland not visible.

Ovary single, posterior, antidromously reflected; situated to left (two females) or to right (two females) of intestine. Small prevulvar sack as a rudiment of anterior ovary present. Ripe egg in uterus 135 \times 25 μm in size.

Anterior testis situated to left of intestine. Spindle-shaped bodies with fine longitudinal striation (spermatids?) in posterior part of gonad present. Posterior testis not found. Vagina short, perpendicular to body axis; two granular vulvar glands just anterior to vagina.

Spicules weakly sclerotised, broad, slightly curved, with beaked distal tip and knob-like narrowed proximal end. Gubernaculum as two small sclerotised bars along distal part of spicules.

Two preanal mid-ventral supplementary organs as small cuticular mounds with thin axial canals and apical pores.

Tail of moderate length, cylindrical, rounded at tip. Female tail club-like, thickened, no setae visible. Caudal glands protruded ahead anterior to anus.

Diagnosis. Body length 1532-2305 μm , $a = 69.6-85.3$, $c = 23.9-32.1$, $c' = 3.47-5.7$. Inner and outer labial setae equal, 2.5-4 μm , united in one circle of twelve setae. Four cephalic setae 2-4 μm long. Amphideal fovea longitudinally ovoid. Ventral pore at 80-117 μm from cephalic apex. Two mid-ventral preanal supplementary papillae in males.

Differential diagnosis. The new species is similar to *L. aequale* Cobb, 1920 (Cobb, 1920, Florida; Gerlach, 1958, Madagascar), *Litinium* sp. 1 and *Litinium* sp. 2. (Quang Ngo Xuan *et al.*, 2008,

both in Can Gio mangroves, South Vietnam) by having two mid-ventral preanal supplementary papillae. *Litinium subterraneum* sp. n. differs from *L. aequale* by relatively longer tail (in males, $c = 27-28$ vs 76 and $c' = 3.5$ vs 1) and position of the amphideal fovea just posterior to the circle of twelve anterior setae vs posterior to the cephalic setae; from *Litinium* sp. 1 by relatively shorter pharynx (in males, $b = 5-5.7$ vs 10) and longer tail (in males, $c = 27-28$ vs 47, $c' = 3.5$ vs 2); from *Litinium* sp. 2 by shorter body (in males, $L = 1500-1700$ vs 3400 μm) with relatively longer tail (in males, $c = 27-28$ vs 110, $c' = 3.5$ vs 0.9), greater distance from the cephalic apex to the ventral pore (in males, 80-117 vs 48 μm).

Etymology: Species name 'subterraneum' (underground) is given because this species dwells in the subsurface layer of the intertidal sediment, deeper than 0-1 cm layer.

Ecological remark. *Litinium subterraneum* sp. n. is relatively common in the site of *Rhizophora* roots where it occurs in the upper as well as in subsurface sediment layers.

ACKNOWLEDGEMENT

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А.В. Чесунов, В.О. Мокиевский, Нгуен Ву Тхань. Три новых вида свободноживущих нематод (Nematoda, Enoplida) из мангрового местообитания в заливе Нячанг, Центральный Вьетнам.

Резюме. Приводятся светомикроскопические описания трёх новых видов нематод отряда Enoplida, собранных в деградирующем мангровом биотопе на южной окраине г. Нячанг, Центральный Вьетнам. *Admirandus belogurovi* sp. n. (Oncholaimidae) является вторым видом рода, отличаясь от типового вида *A. multicavus* Belogurov et Belogurova, 1979 более короткими спикулами (41-49 против 71-110 μm) и другими размерами, а также наличием маленькой медиоventральной преанальной супплементарной папиллы. Предлагается исправленный диагноз рода *Admirandus* Belogurov et Belogurova, 1979. *Tripyloides caudaensis* sp. n. (Tripyloididae) близок к группе видов *T. gracilis* (Ditlevsen, 1918), *T. marinus* (Bütschli, 1874) и *T. pallidus* Tchesunov, 1981, чьи размеры частично перекрываются. *T. caudaensis* отличается от этих видов преимущественно формой хвоста, где чётко разделены проксимальная коническая и дистальная цилиндрическая части, а от *T. pallidus* дополнительно откладкой яиц вместо живорождения. Приводятся аннотированный список из 11 валидных видов рода и пикториальный ключ для их определения. *Litinium subterraneum* sp. n. (Oxystominidae) характеризуется положением амфидеальной фовеи сразу позади круга из шести пар щетинок (внутренние и внешние лабиальные щетинки); отличается от близких *L. aequale* Cobb, 1920, *Litinium* sp. 1 и *Litinium* sp. 2 (оба последних непоименованных вида обнаружены в мангровых биотопах Вьетнама Quang Ngo Xuan *et al.*, 2008) относительно более длинным хвостом, положением амфидеальной фовеи, относительной длиной фаринкса, положением вентральной поры. Приводятся данные о микромасштабном распределении этих трёх видов на мангровой литорали.
