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TWO NEW SPECIES OF THE GENUS *LAIMYDORUS* SIDDIQI, 1969 (NEMATODA, DORYLAIMIDA) FROM SMALL FRESHWATER BODIES OF VIETNAM

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[Гагарин В.Г., Гусаков В.А. Два новых вида рода *Laimydorus* Siddiqi, 1969 (Nematoda, Dorylaimida) из мелких пресноводных водоемов во Вьетнаме]
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Key words: *free-living nematodes, small freshwaters bodies, Nematoda, Dorylaimida, Laimydorus, new species, Vietnam*

Ключевые слова: *свободноживущие нематоды, мелкие пресноводные водоемы, Nematoda, Dorylaimida, Laimydorus, новые виды, Вьетнам*

Summary: Two new species of free-living nematodes of the genus *Laimydorus (L. gigas* **sp. nov**. and *L. tenuis* **sp. nov**.), found in the sediments of small freshwater bodies in Vietnam, are described and illustrated. *Laimydorus gigas* **sp. nov**. is similar to *L. distinctus* Dey, Baqri, 1986 and *L. elephas* Andrassy, 1988. From the former species it differs in the longer tail in females, the shorter spicules and greater number of supplements in males. From *L. elephas* it differs in the thinner cuticle, thinner body, comparatively longer odontostyle and comparatively longer prerectum in females. *Laimydorus tenuis* sp. nov. is similar to *L. merogaster* (Steiner, 1916) and *L. pinguis* Andrassy, 1988. From the former species it differs in the thinner cuticle, thinner body, shorter odontostyle, shorter spicules and smaller number of supplements in males. From *L. pinguis* it differs in the thinner body, shorter tail in females, another position of vulva and comparatively longer prerectum in females.

Резюме: Представлены описания и рисунки двух новых видов свободноживущих нематод рода Laimydorus (*L. gigas* **sp. nov.** and *L. tenuis* **sp. nov**.), обнаруженных в осадках мелких пресноводных водоемов во Вьетнаме. *Laimydorus gigas* **sp. nov.** подобен *L. distinctus* Dey, Baqri, 1968 и *L. elephas* Andrassy, 1988. От первого отличается более длинным хвостом у самок, более короткими спикулами и меньшим числом супплементов у самцов. От *L. elephas* отличается более тонкой кутикулой, более тонким телом, сравнительно более длинным копьем и сравнительно более длинным преректумом у самок. *Laimydorus tenuis* sp. nov. подобен *L. merogaster* (Steiner, 1916) и *L. pinguis* Andrassy, 1988. От первого отличается более тонкой кутикулой, более тонким телом, более коротким копьем, более короткими спикулами и меньшим числом супплементов у самцов. От *L. pinguis* отличается более тонким телом, более коротким хвостом у самок, иным положением вульвы и сравнительно более длинным преректумом у самок.

INTRODUCTION

During a study of the meiobenthos in various freshwater bodies of Central and South Vietnam in 2010 and 2012, several new species of free-living nematodes have been found [Gagarin, Gusakov, 2012; 2013a, 2013b]. In the present paper two new species of the genus *Laimydorus (L. gigas* sp. nov. and *L. tenuis* sp. nov.) from the order Dorylaimida are described and illustrated. Both of these species were discovered as in the temporarily inundated, so in the permanent small, shallow silvan lakes located in Cat Tien National Park (South Vietnam, basin of Dong Nai River). The fauna of the freshwater free-living nematodes of the country is still insufficiently studied, especially that from the water bodies located in sparsely populated territories. The detailed description of the sites in which the new species were recorded is given below.

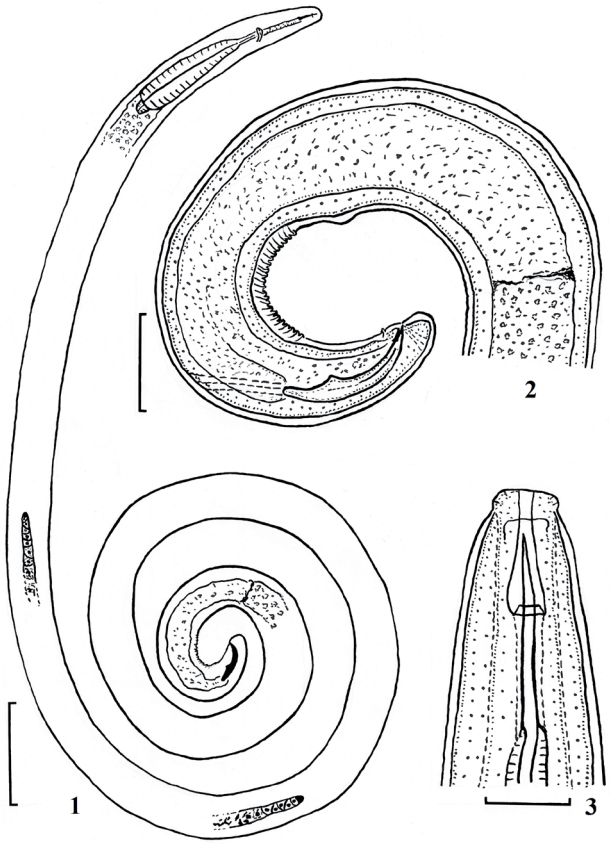
MATERIAL AND METHODS

The meiobenthos samples were collected in September, 2010 and May, 2012 using a Microbenthometer S-1 with a corer diameter of 34 mm (about 9 cm^2). Each sample included three 5-10 cm columns of sediment and near-bottom water; it was fixed in 4% formalin. In the laboratory the samples were filtered through a sieve with a mesh size of 82×82 μm and stained with Rose Bengal by a standard method [Williams, Williams, 1974]. The sieving residues were examined using a Bogorov counting chamber under a stereoscopic microscope. The worms were picked out of the chamber manually using a pipette and mounted in glycerol on slides. Observations, measurements and photographing were made using a Nikon Eclipse 80i light microscope equipped with Nomarski DIC accessories, Nikon DS-Fi1 digital camera and PC with NIS-Elements D 3.2 software for imaging and analysis.

SYSTEMATIC PART

Order DORYLAIMIDA Pearse, 1942
Family DORYLAIMIDAE de Man, 1876
Subfamily Laimydorinae Andrássy, 1969
Genus *Laimydorus* Siddiqi, 1969
***Laimydorus gigas* sp. nov.**
(Figs 1-12, tabl.1)

Type material. Holotype male, slide 102/20 de-



Figs 1-3. *Laimydorus gigas* sp. nov., holotype male: ***1*** – general view; ***2*** – posterior body end; ***3*** – head. lateral view. Scale bars: 300 μm (*1*), 70 μm (*2*), 30 μm (*3*)

posited in the Helminthological Museum of the Center of Parasitology RAS, Institute of Ecology and Evolution, Russian Academy of Sciences (Moscow, Russia).

Paratypes. Five females. One slide deposited in the same collection with the holotype male.

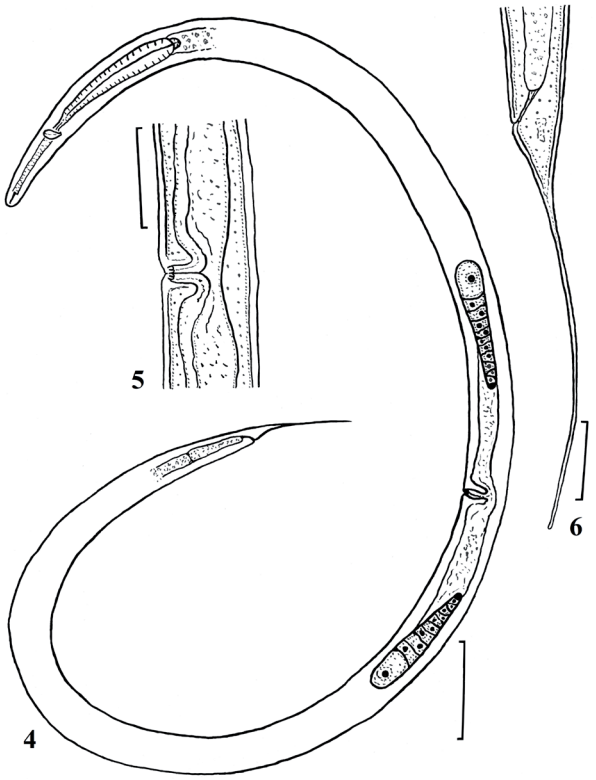
Type locality. Vietnam, Dong Nai (Đồng Nai) Prov., Cat Tien (Cát Tiển) National Park, small shallow silvan lake Dau Cha (Đâu Châ) (11°27.291' N, 107°20.410' E), altitude 134 m a.s.l., clay with plant residues, depth 0.3 m, water temperature 28.9 °C, pH 6.2, conductivity 51 μS/cm; 10 Sept. 2010; leg. V.A. Gusakov.

Description. Male. Body long and slender. Cuticle smooth, without longitudinal ridges and cuticular pores, 6.5-8.0 μm thick at mid-body. Labial region slightly offset from adjacent body. Labial papillae small, hardly visible. Amphidial fovea cup-like, occupying 55 % of the corresponding body diameter and situating at the base of lips. Odontostyle long and robust, 2.7 times as long as the labial region diameter. Its aperture consisting 29 % of its length. Testes paired, opposed, situated to the left of intestine. Spicules long, slender, bent ventrally, 2.5 times as long as cloacal body diameter. Lateral guiding pieces spindle-shaped, 19 μm long. Precloacal ventromedian supplements small, papilla-shaped. One adcloacal supplement and a series of 28 contiguous supplements, disposed in one group. The length of supplementary field 114 μm. Prerectum long, well developed, 11.9 times as long as cloacal body diameter. Tail comparatively short, its terminus rounded.

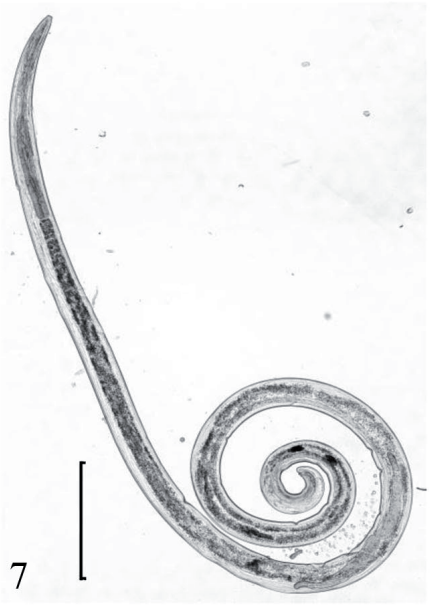
Tail length is 0.6 times less than cloacal body diameter.

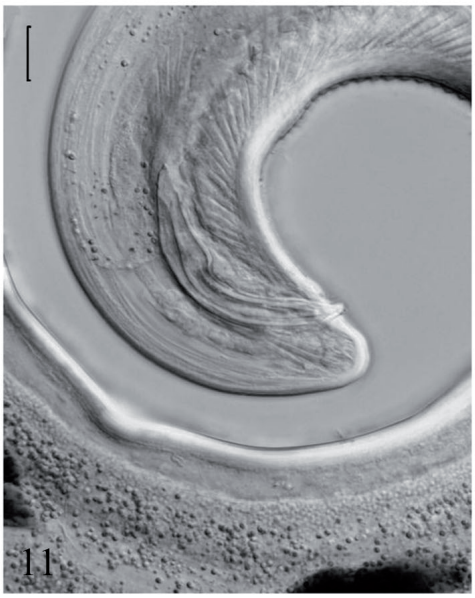
Female. General appearance similar to that of male. Structure of cuticle and anterior body end as in male. Odontostyle 3.0-3.1 times as long as labial region width. Guiding ring double. Pharynx muscular, expanding at 48-55 % of its length. Cardia elongated, conical. Prerectum 8.6-10.7 as long as the anal body diameter. Reproductive system didelphic, amphidelphic. Both ovaries situated at the left of intestine, reflexed and comparatively long. Vulva preequatorial, in the shape of longitudinal slit. Vulva lips not sclerotized, not protruding outside the body contour. Oocytes numerous, distally in two rows, then in a single row. Vagina with muscular walls, extending inwards to 45-50 % of corresponding body diameter. *Pars proximalis vaginae* 37-40 μm long, *pars refrigens vaginae* consisting of elongate, drop-like sclerotization, *pars distalis vaginae* short. Uterus spacious, with spindle-shaped spermatozoa. Tail comparatively long, with rather broad basal conical portion followed by rather narrow cylindrical posterior portion. Tail length is 17.4-20.8 times more than anal body diameter. Caudal papillae not observed.

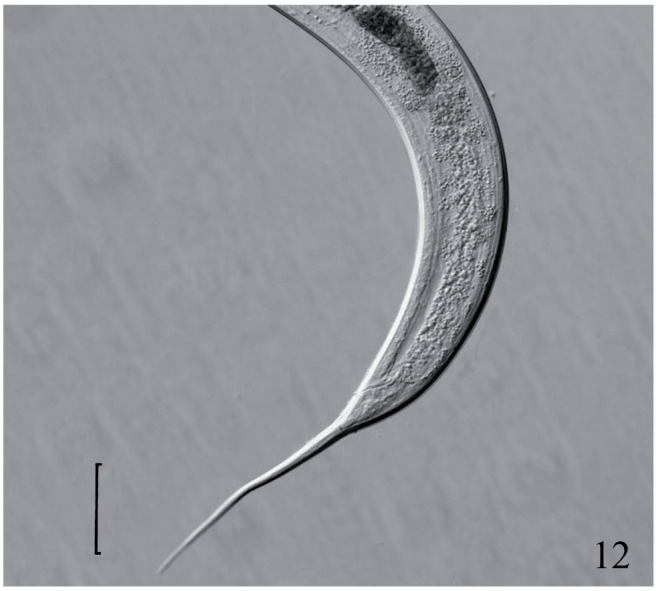
Diagnosis. *Laimydorus gigas* **sp. n.** is characterized by long and thin body (*L* = 5885-6882 μm, *a* = 41-50), slightly separated from the rest of body labial region, long and robust odontostyle, comparatively



Figs 4-6. *Laimydorus gigas* sp. nov., paratype female: ***4*** – general view; ***5*** – vulva region; ***6*** – posterior body end. Scale bars: 300 μm (*4*), 150 μm (*5*), 70 μm (*6*)







Figs 7-12. Light micrograph of *Laimydorus gigas* sp. nov.: ***7, 8, 11*** – holotype male; ***9, 10, 12*** – paratype female. ***7*** – general view; ***8, 9*** – head, lateral view: ***10*** – vulva region; ***11, 12*** – posterior body end. Scale bars: 500 µm (*7*), 100 µm (*12*), 20 µm (*8-11*)

Table 1

Morphometrics of *Laimydorus gigas* sp. nov. (mean ±standard deviation, with range in parentheses). All absolute length are in µm

Character	Holotype	Paratypes
	male	5 females
L	6246	6264±662 (5885-6882)
a	50	44±3 (41-49)
b	7.7	7.1±0.4 (6.7-7.8)
c	272	18.5±1.2 (17.4-20.8)
c'	0.6	8.5±0.3 (8.1-9.0)
V, %	–	45.4±2.1 (43.3-49.2)
Labial region width	22	21±1 (20-22)
Odontostyle length	60	62±1 (61-63)
Odontostyle length divided to labial region width	2.7	3.0±0.1 (2.8-3.2)
Odontophore length	58	57±2 (55-59)
Pharynx length	812	875±28 (824-911)
Distance from posterior end of pharynx to vulva	–	1933±321 (1575-2363)
Distance from posterior end of pharynx to cloaca	5411	–
Distance from vulva to anus	–	3118±158 (2936-3400)
Mid-body diameter	124	142±7 (135-153)
Anal or cloacal body diameter	38	39±1 (38-41)
Prerectum length	451	347±14 (325-360)
Prerectum length divided to anal or cloacal body diameter	11.9	8.9±0.5 (8.3-9.5)
Number of supplements	28	–
Spicules length	95	–
Supplement row length	114	–
Distance from cloaca to supplement row	61	–
Tail length	23	338±14 (326-365)

long odontophore, double guiding ring, long prerectum (in male intestine-prerectum junction is located far before the series of supplements), long female tail (*c* = 17.4-20.8, *c'* = 8.1-9.0), short male tail (*c* = 272, *c'* = 0.6), presence of the one adcloacal supplement and series of 28 contiguous ventromedial supplements in male, comparatively long spicules (95 µm long, 2.5 cloacal body diameter).

Differential diagnosis. *Laimydorus gigas* sp. nov. is one of largest species in the genus. It is similar to *L. distinctus* Dey et Baqri, 1986 and *L. elephas* Andrássy, 1988 in body size. From the former species it differs in the longer tail in females (*c* = 17.4-20.8, *c'* = 8.1-9.0 *vs c* = 24.6, *c'* = 6.6), shorter spicules (95 µm *vs* 110 µm) and greater number of supplements in males (28 *vs* 26) (Dey, Baqri, 1986). From *L. elephas* it differs in the thinner cuticle (6.5-8.0 µm *vs* 12 µm), thinner body (*a* = 41-50 *vs a* = 28), comparatively longer odontostyle (2.8-3.0 diameter of labial region *vs* 2.0 diameter of labial region) and comparatively longer prerectum in females (8.2-10.0 anal body diameter *vs* 4.0 anal body diameter) [Andrássy, 1988].

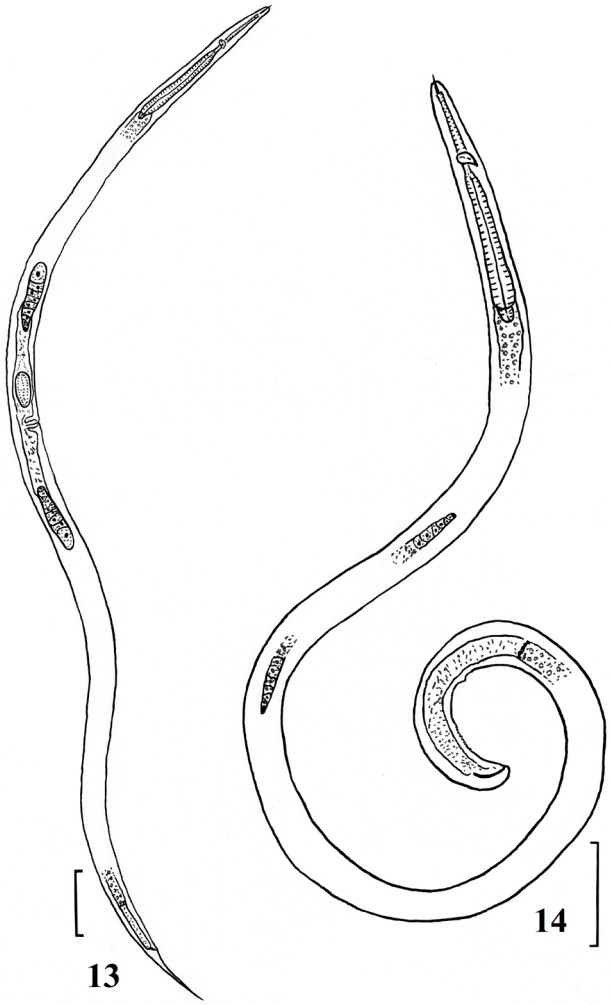
Laimydorus tenuis sp. nov.

(Figs 13-24, tabl. 2)

Type material. Holotype male, slide 102/21, deposited in the Helminthological Museum of the Center of Parasitology RAS, Institute of Ecology and Evolution, Russian Academy of Sciences (Moscow, Russia)

Paratypes. One male and six females. Two females located at the same slide with holotype. One male and four females located at separate slides and deposited in nematode collection in the Institute for Biology of Inland Waters, RAS (Borok, Russia).

Type locality. Vietnam, Dong Nai (Đồng Nai) Prov., Cat Tien (Cát Tiển) National Park, small, shallow, silvan lake Dau Cha (Đâu Châ) (11°27.291' N, 107°20.410' E), altitude 134 m a.s.l., clay with plant residues, depth 0.3 m, water temperature 28.9 °C, pH 6.2, conductivity 51 µS/cm; 10 Sept. 2010; leg. V.A. Gusakov. One males and two females are found with holotype. One female is found in: Dong Nai (Đồng Nai) Prov., Cat Tien (Cát Tiển) National Park, temporary flood-plain lake Bau Chim (Bàu Chim) (11°28.826' N, 107°22.641' E), altitude 132 m a.s.l., clay with plant residues and roots, depth 0.1 m, water temperature 31.3 °C, pH 6.3, conductivity 105 µS/cm; 09 Sept. 2010; leg. V.A. Gusakov. Two females are found in: Dong Nai (Đồng Nai) Prov., Cat Tien (Cát Tiển) National Park, nameless small shallow silvan lake (11°27.311' N, 107°20.121' E), altitude 131 m a.s.l., clay with plant residues, depth 0.25 m, water temperature 27.0 °C, dissolved oxygen 2.0 mg/l, pH 6.2, conductivity 40 µS/cm; 12 May 2012; leg. V.A. Gusakov. One more female is found in: *D*ong Nai (Đồng Nai) Prov., Cat Tien (Cát Tiển) National

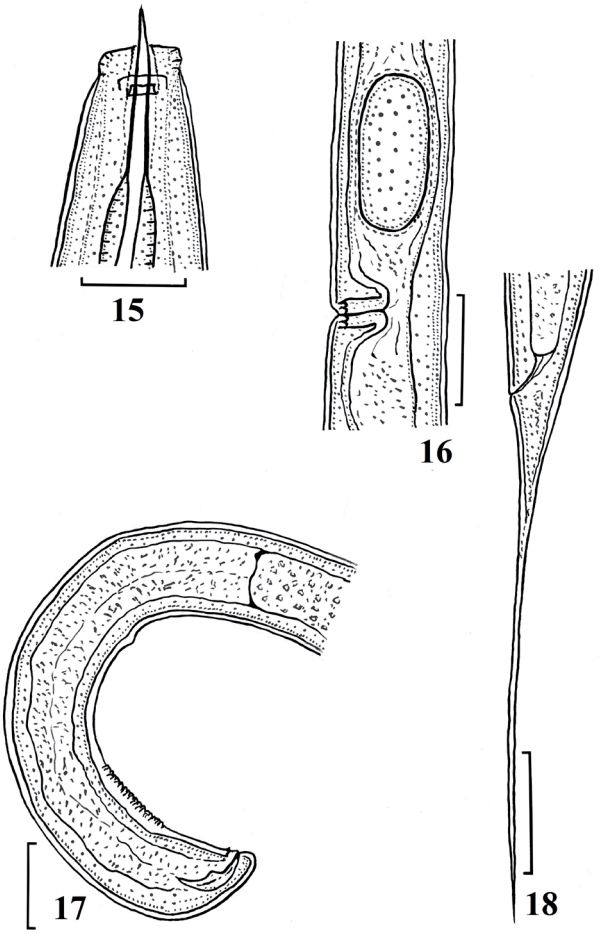


Figs 13, 14. *Laimydorus tenuis* sp. n.**:** ***13*** – holotype male; ***14*** – paratype female. ***13, 14*** – general view. Scale bars: 300 μm (13, 14)

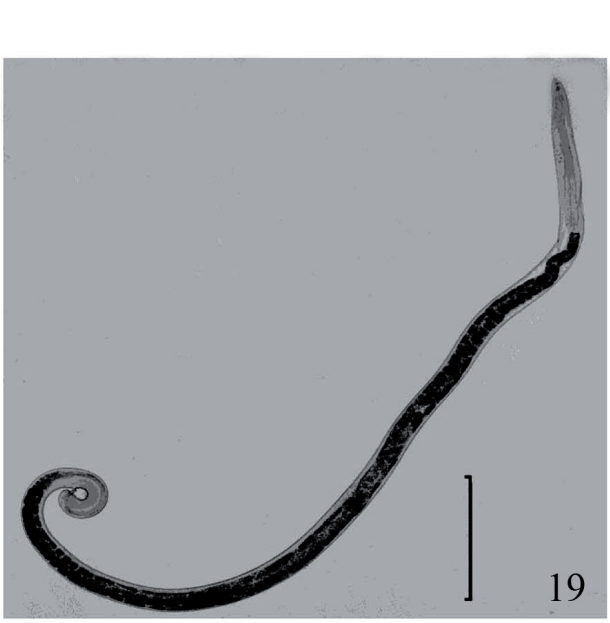
Park, small shallow silvan lake Nai Cap (Nai Cạp) (11°27.354' N, 107°20.072' E), altitude 136 m a.s.l., clay with plant residues, depth 0.2 m, water temperature 27.0 °C, dissolved oxygen 1.6 mg/l, pH 6.1, conductivity 42 μS/cm; 12 May 2012; leg. V.A. Gusakov.

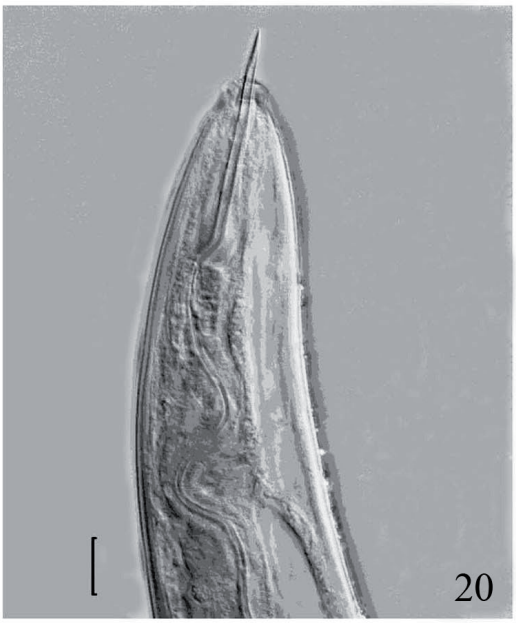
Description. Male. Body long and slender. Cuticle smooth, without longitudinal ridges and cuticular pores. Cuticle thin, about 4.0 μm thick at mid-body. Labial region slightly offset from adjacent body. Labial papillae small, hardly visible. Amphidial fovea cup-like, occupying 50-55 % of the corresponding body diameter and situate at the base of lips. Odontostyle long and robust, 2.1 times as long as the labial region diameter. Its aperture comprising 30-32 % of odontostyle length. Odontostyle at its base thicker than cuticle at the corresponding body level. Odontophore rod-like, slightly more than odontostyle length. Guiding ring double. Pharynx muscular, expanding at 55-57 % of its length. Pharyngeal gland nuclei indistinct. Cardia conoid, muscular, surrounded with intestinal tissue. Testes paired, opposed, situated to the left of intestine. Spicules long, slender, ventrally bent, 2.4-2.5 times as long as the cloacal body diameter. Lateral guiding pieces spindle-shaped, 18-20 μm long. Precloacal ventromedian supplements in the shape of small papillae. One adcloacal supplement and a series of 27-28 contiguous supplements disposed in one group. The length of ventromedian supplement row 83–92 μm. Prerectum long, well developed, 8.3-11.0 times as long as cloacal body diameter. Tail comparatively short, its terminus rounded. Its length is 0.4 times less than cloacal body diameter.

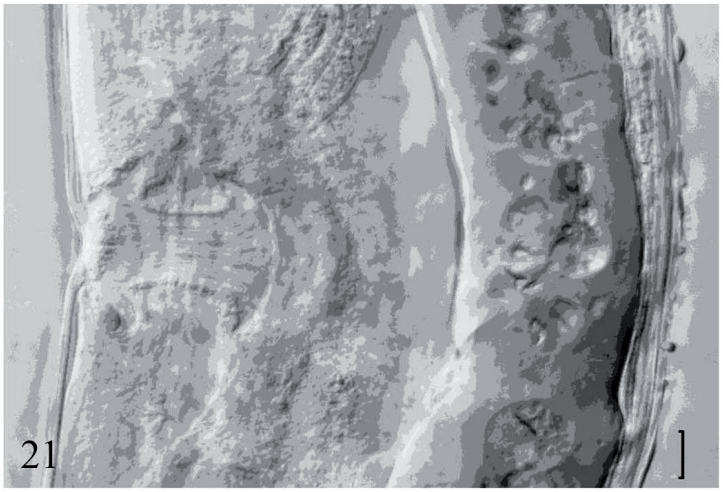
Female. General appearance similar to that of male. Structure of cuticle and anterior body end as in male. Odontostyle 2.1-2.2 times as long as the labial region width. Guiding ring double. Pharynx muscular, expanding at 50-56 % of its length. Prerectum 7.8-8.7 anal body diameters. Rectum 1.0-1.2 times the anal body diameter. Reproductive system didelphic, amphidelphic. Both ovaries situated to the left of intestine, reflexed and comparatively long. Vulva pre-equatorial, longitudinal, slit-shaped. Vulva lips not sclerotized and not protruding outside the body contour. Oocytes numerous, distally in two rows, then in a single row. Vagina with muscular walls, extending inwards to 43–48 % of corresponding body diam-

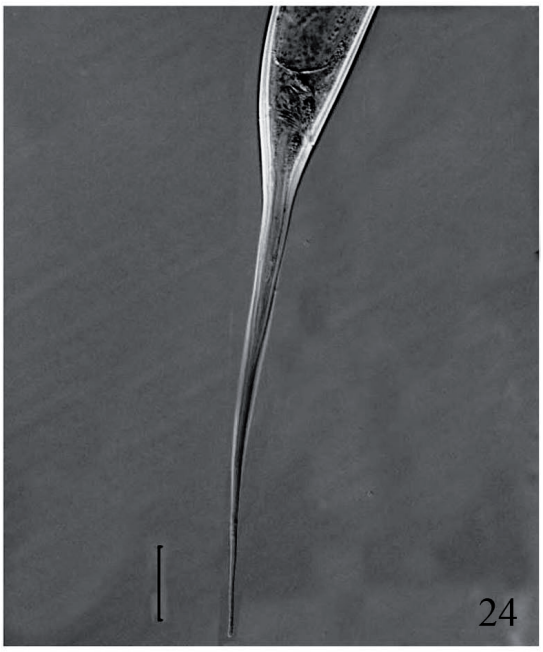


Figs 15-18. *Laimydorus tenuis* sp. n.**: 15, 17** – holotype male; **16, 18** – paratype female. **15** – head; **16** – vulva region; **17, 18** – posterior body end. Scale bars: 100 μm (*16, 17*), 70 μm (*18*), 25 μm (*15*)









Figs 19-24. Light micrograph of *Laimydorus tenuis* sp. n.: ***19, 20, 22, 23*** – holotype male; ***21, 24*** – paratype female. ***19*** – general view; ***20*** – head; ***21*** – vulva region; ***22, 23*** – posterior body end; ***24*** – tail. Scale bars: 500 µm (*19*), 50 µm (*23, 24*), 20 µm (*20, 22*), 10 µm (*21*).

Table 2

Morphometrics of *Laimydorus tenuis* sp. nov. (mean ± standard deviation, with range in parentheses). All absolute lengths are in µm

Character	Holotype	Paratypes	
	male	1 male	6 females
L	4175	4382	5221±234 (4768-5511)
a	41	35	50±3 (45-53)
b	6.6	6.8	8.0±5 (7.2-8.7)
c	182	191	17.9±0.9 (16.3-18.8)
c'	0.4	0.4	8.7±0.3 (8.3-9.3)
V, %	–	–	42.1±1.7 (39.7-45.2)
Labial region width	18	18	17±1 (16-18)
Odontostyle length	38	38	37±2 (35-40)
Odontostyle length divided to labial region width	2.1	2.1	2.3±0.1 (2.1-2.3)
Odontophore length	40	39	41±1 (38-42)
Pharynx length	637	646	680±50 (610-745)
Distance from posterior end of pharynx to vulva	–	–	1579±173 (1283-1805)
Distance from posterior end of pharynx to cloaca	3515	3713	–
Distance from vulva to anus	–	–	2696±83 (2580-2790)
Mid-body diameter	101	124	106±8 (95-119)
Anal or cloacal body diameter	59	59	35±1 (33-36)
Prerectum length	651	493	267±42 (198-335)
Prerectum length divided to anal or cloacal body diameter	11.0	8.4	7.8±1.0 (6.3-9.3)
Number of supplements	27	28	–
Spicules length	74	72	–
Supplement row length	92	83	–
Distance from cloaca to supplements row	102	100	–
Tail length	23	23	293±7 (284-304)

eter. *Pars proximalis vaginae* 42-45 µm long, *pars refrigens vaginae* consisting of very small oval, drop-like sclerotization, *pars distalis vaginae* short. Uterus spacious, with spindle-shaped spermatozoa and one-two intrauterine eggs, measuring 135-142 × 54-59 µm. Tail comparatively long, with rather broad basal conical portion followed by rather narrow cylindrical posterior portion.

Diagnosis. *Laimydorus tenuis* **sp. nov.** is characterized by long and thin body (*L* = 4175–5511 µm, *a* = 35–55), labial region slightly set off, long and robust odontostyle, comparatively long odontophore, double guiding ring, long prerectum (in males the intestine–prerectum junction is located far before the series of supplements), short male tail (*c* = 182-191, *c'* = 0.4), presence of one adcloacal supplement and series of 27-28 contiguous ventromedian supplements in males, comparatively long spicules (72-74 µm long or 1.2-1.3 cloacal body diameter).

Differential diagnosis. *Laimydorus tenuis* sp. nov. is similar to *L. merogaster* (Steiner, 1916) and *L. pinguis* Andrássy, 1988 in body size. From the former species it differs in the thinner cuticle (4.0 µm *vs* 7.0 µm), thinner body (*a* = 35-55 *vs a* = 30), shorter odontostyle (36-40 µm *vs* 70 µm), shorter spicules (72-74 µm *vs* 140 µm) and smaller number of supplements in males (27-28 *vs* 30) [Steiner, 1916; Andrássy, 1988]. From *L. pinguis* it differs in the thinner body (*a* = 35-55 *vs a* = 25), shorter and slenderer tail in females (*c* = 17.5-18.6, *c'* = 8.4-8.8 *vs c* = 13.5, *c'* = 5), other position of vulva (*V* = 41.4-41.8 % *vs V* = 46 %) and comparatively longer prerectum in females (7.8-8.7 anal body diameter *vs* 3.0 anal body diameter) [Andrássy, 1988].

Note. The genus *Laimydorus* was proposed by Siddiqi [1969]. According to different opinions the worldwide fauna of the genus *Laimydorus* includes approximately 40-50 valid species and undoubtedly the genus is in need of a revision [Vinciguerra, 2006; Pena-Santiago, 2007; Andrássy, 2009]. The species of the genus inhabit fresh and less often saline water bodies and crude soil. In Vietnam only four species belonging to this genus were recorded: *L. oxurus* Gagarin et Nguyen Vu Thanh, 2005; *L. pseudostagnalis* (Micolenzky, 1927); *L. gigas* **sp. nov.** and *L. tenuis* **sp. nov**. *L. pseudostagnalis* is widespread in fresh water bodies of the World (Vinciguerra, 2006; Andrassy, 2009). In Vietnam, it was found in the soil among the roots of rice (*Oryza sativa* L.), tea (*Camellia sinensis* L.) and maize (*Zea mays* L.) [Nguyen, 2007], and in the sediments of some fresh water bodies [Gagarin & Nguyen Vu Thanh, 2005]. *L. oxurus* was discovered in Vietnam for the first time [Gagarin, Nguyen Vu Thanh, 2005]. Hitherto, it was registered in the sediments of Day River [Gagarin, Nguyen Vu Thanh, 2005], Red River Delta [Gagarin, Nguyen,

2008a], Vhu River [Gagarin, Nguyen, 2008b] and Cai River [Gusakov at al., 2011]. *L. gigas* sp. nov. and *L. tenuis* sp. nov. were found in the sediments of small forest fresh water bodies of Vietnam (present article). Morphological characters of the four listed species are given in Table 3.

Dichotomous key to species of the genus *Laimydorus* found in Vietnam

1. Body length from 2.0 mm to 4.0 mm ….....… 2
– body length more than 4.0 mm 3
2. Odontostyle 31-40 μm long, spicules 62-68 μm long …..... *L. pseudostagnalis*
– odontostyle 22-24 μm long, spicules 45 μm long …. .....…. *L. oxyurus*
3. Odontostyle 60-63 μm long, spicules 95 μm long …..... *L. gigas* sp. nov.
– odontostyle 36-41 μm long, spicules 72-74 μm long ……..... *L. tenuis* sp. nov.

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