

A new species of the genus *Calodorylaimus* (Nematoda, Dorylaimida) from highly mineralised rivers of the Elton Lake basin, Russia

Новый вид рода *Calodorylaimus* (Nematoda, Dorylaimida) из высокоминерализованных рек бассейна озера Эльтон, Россия

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A new species of free-living nematode (*Calodorylaimus salinus* sp. nov.), found in sediment of the highly mineralised rivers of the Elton lake basin (Russia), is described and illustrated. This species is close to *C. mongolicus* Andrassy, 1988, but differs from the latter in having a wider labial region, a stouter tail in females and a greater number of separate precloacal supplements in males. A dichotomic key for identification of valid species of the genus *Calodorylaimus* Andrassy, 1986 is given. *Calodorylaimus densus* Andrassy, 1988 is assigned to the genus *Laimydorus* Siddiqi, 1969.

Представлены описание и рисунки нового вида свободноживущих нематод (*Calodorylaimus salinus* sp. nov.), обнаруженного в осадках высокоминерализованных рек бассейна озера Эльтон, Россия. Этот вид морфологически близок к *C. mongolicus* Andrassy, 1988, но отличается от него более широкой областью губ, более толстым хвостом у самок и большим числом свободнолежащих преклоакальных супплекментов у самцов. Приведен дихотомический ключ для определения валидных видов рода *Calodorylaimus* Andrassy, 1986. *Calodorylaimus densus* Andrassy, 1988 отнесен к роду *Laimydorus* Siddiqi, 1966.

Key words: freshwater free-living nematodes, morphology, highly mineralised rivers, Dorylaimida, Dorylaimidae, *Calodorylaimus*, new species

Ключевые слова: пресноводные свободноживущие нематоды, морфология, высокоминерализованные реки, Dorylaimida, Dorylaimidae, *Calodorylaimus*, новый вид

INTRODUCTION

Continental water bodies with a high level of water mineralisation are widespread in arid regions. Their hydrofauna is being intensively studied. Unlike lentic water bodies, meso- and hyperhaline rivers are much less numerous. Therefore their inhabitants have not been sufficiently investigated yet (Zinchenko et al., 2011; Gusakov & Gagarin, 2012). Lake Elton, one of the largest European hyperhaline lakes, is situated in the northern part of Near-Caspian Lowland in Volgograd Province, Russia. The lake has seven small tributaries with length of about

3–40 km with a water salinity of 7–32 g l⁻¹. In summer 2009, the community of bottom meiofauna (meiobenthos) was explored in rivers of the Elton basin for the first time (Gusakov & Gagarin, 2012). Some species from different taxonomic groups were new for the fauna of Russia or the Volgograd region, and unknown species of free-living nematode from the genus *Calodorylaimus* Andrassy, 1986 were found. In the present paper, description and illustrations of a new nematode species and a key for identification of all valid species of *Calodorylaimus* are given.

MATERIAL AND METHODS

A detailed description of the research region and the rivers is given in a separate paper by Gusakov & Gagarin (2012). The nematode material was collected in August 18–21, 2009 by means of a microbenthometer S-1 with corer diameter 34 mm (about 9 cm²). Each sample included three sediment columns and was fixed in 4% formalin. In the laboratory, the samples were filtered through a sieve with a mesh size 82 × 82 µm. The sieving residues were examined using a Bogorov counting chamber under a stereomicroscope. Identification and measurements of the found nematodes were completed with glycerine mounts using a light microscope MBA-1A.

Calodorylaimus salinus sp. nov. was discovered in middle part of two rivers: Bol'shaya Smorogda (the habitat characteristics are given below in the holotype description) and Lantsug (49°13.557'N, 46°37.125'E, black silty sand with biofilm and hydrogen sulphide smell, depth 0.2 m, water mineralisation 6.8 gl⁻¹).

TAXONOMIC PART

Order **DORYLAIMIDA** Pearse, 1942

Family **DORYLAIMIDAE** de Man, 1876

Subfamily **LAIMYDORINAE**

Andrássy, 1969

Calodorylaimus Andrássy, 1969

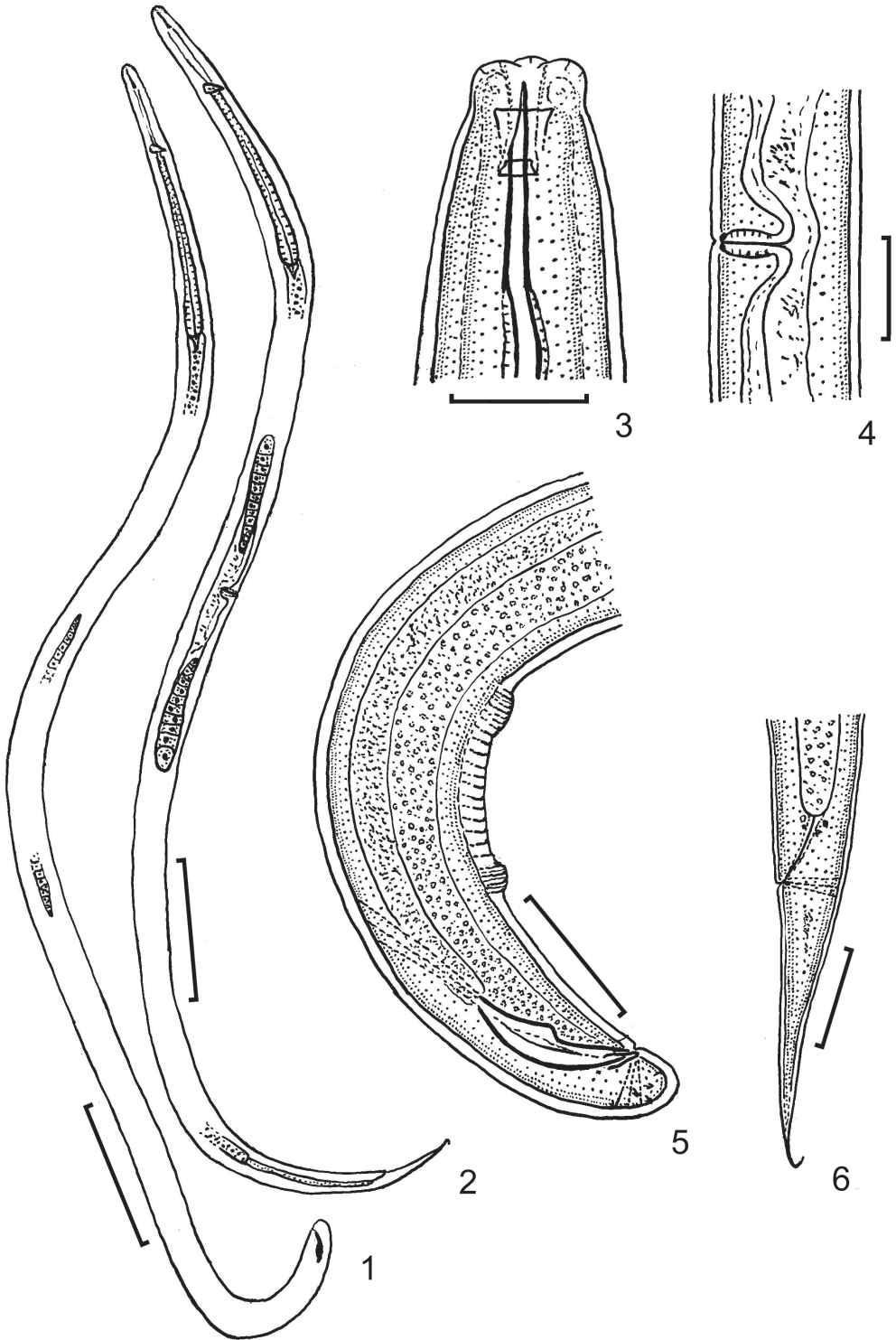
Calodorylaimus salinus sp. nov.
(Figs 1–6; Table 1: measurements)

Holotype. Male; **Russia**, *Volgograd Prov.*, El'ton Lake basin, Bol'shaya Smorogda River (49°07.328'N, 46°49.450'E), black sandy silt with hydrogen sulphide smell, depth 0.3 m, mineralization of water 10.3 gram/liter; 21 Aug. 2009; leg. V.A. Gusakov. Slide 100/20 deposited in the nematode collection of the Institute of Ecology and Evolution, Center of Parasitology, Russian Academy of Sciences, Moscow.

Paratypes. Two males, 6 females; same locality as for holotype. Two slides deposited in the same collection as holotype.

Description. *Male*. Body comparatively long and slender. Cuticle smooth, with 40–44 longitudinal ridges, without cuticular pores. Cuticle 4.5–5.0 µm thick at mid-body. Labial region offset from adjacent body. Labial papillae small, hardly visible. Amphidial fovea cup-like, wide, occupying 52% of the corresponding body diameter and situate at the base of lips. Odontostyle straight and slender, 2.0–2.1 times as long as the labial region diameter. Its aperture constituting 30–33% its length. Odontostyle width at its base more than cuticle thickness at the corresponding of body level. Odontophore rod-like, 0.5–0.6 times as long as the odontostyle length. Guiding ring double, thick. Pharynx muscular, expanding gradually along whole length. Pharyngeal gland nuclei indistinct. Nerve ring situated at 32–40% of the total pharynx length. Cardia conoid, muscular, surrounded with intestinal tissue. Testes paired, opposed. Spicules robust, bent ventrally, 1.4–1.5 times as long as the cloacal body diameter. Lateral guiding pieces spindle-shaped, 14–15 µm long. Precloacal ventromedian supplements in the shape of small papillae. One adcloacal supplement and a series of 26–27 contiguous supplements, disposed in two groups at 6–7 supplements in each group. Between both groups 12–13 single supplements. The series of ventromedian supplements 121–141 µm long. Prerectum long, well developed, 10.5–11.9 cloacal body diameters long. Intestine–prerectum junction located at 247–335 µm from the anteriormost supplement. Tail comparatively short, its terminus rounded. Its length less than cloacal body diameter. Caudal papillae in 4–5 pairs.

Female. General appearance similar to that of males. Structure of cuticle and anterior body end as in males. Odontostyle 2.0–2.1 times as long as labial region width. Guiding ring double. Pharynx muscular, expanding gradually along its length. Pharyngeal gland nuclei indistinct. Cardia large, elongate-conical. Prerectum 2.5–3.2 times as long as the anal body diameter. Rectum



Figs 1–6. *Calodorylaimus salinus* sp. nov.: 1, habitus male; 2, habitus female; 3, head male; 4, vulva area; 5, posterior body end of male; 6, female tail. Scale bars: 400 μm (1, 2), 70 μm (3–5), 25 μm (6).

Table 1. Morphometrics of *Calodorylaimus salinus* sp. nov. All absolute lengths are in μm .

Character	Holotype male	Paratypes		
		2 males	6 females	
			range	mean
L	3952	3553, 3979	3382–3877	3596
a	41	39, 43	34–42	38
b	5.7	5.0, 5.6	4.7–5.6	5.2
c	124	114, 117	15.9–19.6	17.5
c'	0.6	0.7, 0.6	4.1–4.7	4.4
V, %	–	–	40.8–45.8	43.4
Labial region width	20	20, 21	20–21	21
Odontostyle length	41	41, 42	41–43	42
Pharynx length	698	709, 716	635–776	695
Distance from pharynx end to vulva	–	–	747–983	851
Distance from pharynx end to cloaca	3222	2806, 3229	–	–
Distance from vulva to anus	–	–	1715–2001	1845
Tail length	32	38, 34	198–220	205
Prerectum length	581	547, 601	262–284	269
Spicules length	72	73, 74	–	–
Number of supplements	27	26, 27	–	–
Supplement row length	131	127, 142	–	–

1.1–1.2 times as long as the anal body diameter. Reproductive system didelphic, amphidelphic. Both ovaries situated at the left of intestine, reflexed and comparatively long. Vulva preaequatorial, in the shape of transverse slit. Vulva lips not sclerotized and not protruding outside the body counter. Oocytes numerous, first in two rows, then in a single row. Vagina with muscular walls, extending inwards to half of the corresponding body diameter. *Pars proximalis vaginae* 43–47 μm long, *pars refrigens vaginae* consisting of round, drop-like sclerotizations, *pars distalis vaginae* short. Uterus spacious, with spindle-shaped spermatozoa. Tail comparatively long, gradually narrowing. Its terminus hook-like bent dorsally.

Comparison. *Calodorylaimus salinus* sp. nov. is close to *C. mongolicus* Andrassy, 1988 in body size but differs from the latter in having a wider labial region (20–21 μm vs 17 μm), a thicker tail in females ($c' = 4.4$ – 4.7 vs $c' = 5.5$) and a greater number of single supplements (12–13 vs 7–8) (Tsalolikhin, 1985; Andrassy, 1988).

Etymology. The species name is originated from salinus (Lat.) – saline, as it belongs to a species from saline water bodies.

Note. The genus *Calodorylaimus* was proposed by Andrassy (1969). The genus differs from close genus *Laimydorus* Siddiqi, 1969 by the arrangement of the precloacal supplements in males. These supplements are located in males of the genus *Calodorylaimus* in three groups, and in males of the genus *Laimydorus* in one group. Some authors (Loof, 1969; Texas..., 2011) do not accept validity of the genus *Calodorylaimus*, synonymising this genus with the genus *Laimydorus*. We accept validity of the genus *Calodorylaimus*. It contains 14 valid species (Andrassy, 1988, 2009; Vinciguerra, 2005) that inhabit fresh and saline water bodies: *C. andrassyi* Baqri, Jana, 1983; *C. chassanicus* (Alekseev & Naumova, 1977) Andrassy, 1988; *C. gravidus* Andrassy, 1986; *C. indicus* Ahmad & Jarajpuri, 1982; *C. insignis* (Gagarin, 1981) Andrassy, 1988; *C. limnophilus* Gagarin, 2011; *C. macrostylus* (Ahmad & Ahmad, 2002) Andrassy, 2009; *C. mangalo-*

Table 2. Morphometrics of valid species of the genus *Catoloryctimus* Andrassy, 1969. All absolute lengths (except *L*) are in μm .

Species	Males							Females					
	<i>L</i> , mm	<i>a</i>	<i>b</i>	<i>c</i>	Labial region width	Odon-tostyle-length	Spicules length	Number of sup-plements	<i>c</i>	<i>c'</i>	V, %	Distance from vulva to anus/tail length	Prerectum length/anal body diameter
<i>octo</i>	2.2–2.6	30–36	5.0–5.6	100–130	15–16	32–35	56–60	17–20	5.0–5.5	20–27	36–37	2.0–2.4	6–10
<i>andrassyi</i>	2.6–3.1	58–61	4.8–5.6	131–260	13–15	26–29	50–59	16–18	8.0–11.0	12–15	44–46	3.7–4.1	8–10
<i>chassariticus</i>	2.1–2.9	26–50	3.9–4.1	74–76	14–15	39–42	78–84	28–32	–	–	–	–	–
<i>gravidus</i>	1.3	28	4.3	80	8.0	19	46	18	9–11	9–10	44–47	4.4	3.2
<i>indicus</i>	1.7–2.0	29–49	3.9–4.6	98–118	10–11	24–28	40–45	20–22	5–7	14–20	43–47	2.3–2.5	4–6
<i>insignis</i>	1.4–1.5	29–38	3.9–4.1	78–92	15	21–22	36	21–22	13.3–16.0	5.2–6.0	44–47	6.4–6.8	2.7–3.9
<i>limnophilus</i>	1.4–1.6	24–27	3.7–4.5	80–97	10–12	24–26	48–50	17–19	12.2–15.0	4.9–5.7	47–53	5.3–6.5	2.4–2.6
<i>macrostylus</i>	1.8–1.9	34–35	3.8–4.0	93–94	10–11	36	46–47	15–16	7.4–13.5	8–14.2	46–48	3.0–3.5	7.3–7.7
<i>mangalorensis</i>	2.1–2.3	42–46	4.0–4.4	92–105	14–15	28–30	43–46	18	7.7–9.9	9.8–14.0	43–44	3.5–4.8	5.0–7.0
<i>mongolicus</i>	3.3–3.6	31–36	4.4–5.1	71–110	17	40	70–80	23–27	15.6–18.7	5.5	42–43	8.6	?
<i>parthomalopapillatus</i>	3.6	43	3.5	91	?	?	71	29	12.7	5.5	31	7.6	?
<i>sachalinus</i>	2.2	30–33	4.5–4.7	96–98	12	23–24	51–52	25–27	–	–	–	–	–
<i>salinus</i>	3.6–4.0	39–43	5.0–5.7	114–124	20–21	41–42	72–74	26–27	15.9–19.6	4.1–4.7	41–46	8.7–9.1	2.5–3.2
<i>wasimi</i>	1.4	31–33	4.0–4.7	67–68	8.5	22–23	36–38	18–19	9.6–10.8	8.2–9.4	45–46	4.2–5.0	1.6–1.7

rensis (Ahmad & Ahmad, 2002) Andr ssy, 2009; *C. mongolicus* Andr ssy, 1988; *C. octo* Andr ssy, 1969; *C. parhomalopapillatus* (Sh. Stekhoven, 1944) Andr ssy, 1988; *C. sachalinus* Gagarin, 1993; *C. salinus* sp. nov.; *C. wasimi* Baqri & Bohra, 2003. Morphometrics of the valid species other than the new one are given in Table 2.

Calodorylaimus densus Andr ssy, 1988, described from freshwater bodies of India, is here assigned to the genus *Laimydorus*, *L. densus*, because the supplements in males of this species are localised in one group. Three species of the genus *Calodorylaimus* were described from water bodies of Russia: *Calodorylaimus chassanicus* was found in Khasan Lake in the Far East (Alekseev & Naumova, 1977); *C. sachalinus*, in Tym' River on the Sachalin Island (Gagarin, 1993); *C. salinus* sp. nov. is described from high-mineralized rivers of the El'ton Lake system.

Key to valid species of the genus *Calodorylaimus*

- 1. Cuticle with longitudinal ridges 2
 - Cuticle without longitudinal ridges 5
- 2. Cuticle with 30 longitudinal ridges; males *L* = 2.1–2.9 mm *C. chassanicus*
 - Cuticle with 40–44 longitudinal ridges; males *L* = 3 mm or more 3
- 3. Females *V* = 31%, *c* = 12.7 *C. parhomalopapillatus*
 - Females *V* more than 40%, *c* more 15 4
- 4. Labial region 17 µm wide; females *c'* = 5.5 *C. mongolicus*
 - Labial region 20–21 µm wide; females *c'* = 4.1–4.7 *C. salinus*
- 5. Males *L* 2.0 mm or less 6
 - Males *L* more 2.0 mm 11
- 6. Labial region 8.0–8.5 µm wide 7
 - Labial region 10 µm and more 8
- 7. Odontostyle 19 µm long, spicules 46 µm long *C. gravidus*
 - Odontostyle 20–23 µm long, spicules 36–38 µm long *C. wasimi*
- 8. Females prerectum 7.3–7.7 times as long as the anal body diameter; odontostyle 36 µm long *C. macrostylus*
 - Females prerectum 6 or less times as long as the anal body diameter; odontostyle less than 28 µm long 9

- 9. Females distance from vulva to anus 2.3–2.5 times as long as tail length; *c'* = 14–20 *C. indicus*
 - Females distance from vulva to anus 5 times or more as long as the tail length; *c'* = 6.0 or less 10
- 10. Females prerectum 2.7–3.9 times as long as the anal body diameter; spicules 36 µm long *C. insignis*
 - Females prerectum 2.4–2.6 times as long as anal body diameter; spicules 48–50 µm long *C. limnophilus*
- 11. Labial region 12 µm wide; odontostyle 23–24 µm long *C. sachalinus*
 - Labial region 13 µm wide or more; odontostyle 26 µm long or more 12
- 12. Males *b* = 4.0–4.4; odontostyle 43–46 µm long *C. mangalorensis*
 - Males *b* = 4.8 or more; odontostyle 26–35 µm long 13
- 13. Females *c'* = 12–15, *V* = 44–46%; odontostyle 26–29 µm long *C. andrassyi*
 - Females *c'* = 20–27, *V* = 36–37%; odontostyle 32–35 µm long *C. octo*

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