

## Two new species of *Lauratonema* (Nematoda: Lauratonematidae) from the intertidal zone of the East China Sea

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Two new species of free-living marine nematodes of the genus *Lauratonema* Gerlach, 1953 from an intertidal sandy beach of the East China Sea are described and illustrated. *Lauratonema macrostoma* sp. nov. is characterized by a spacious buccal cavity, depth 2.1–2.3 times width; cup-shaped amphids; small blade-like spicules (14–16  $\mu\text{m}$  long, 0.55–0.65 anal or cloacal body diameter [a.b.d.]) and unequal length of outer labial setae and cephalic setae (13–17  $\mu\text{m}$  and 9–12  $\mu\text{m}$  respectively). *Lauratonema dongshanense* sp. nov. can be distinguished by the small buccal cavity with a strong cuticularized transverse strip structure; cup-shaped amphids; small blade-like spicules (14–15  $\mu\text{m}$  long, 0.58–0.67 a.b.d.), unequal length of outer labial setae and cephalic setae (8–10  $\mu\text{m}$  and 5–7  $\mu\text{m}$  respectively); the presence of a small precloacal papilla. A dichotomous key for the genus *Lauratonema* is given.

<http://zoobank.org/urn:lsid:zoobank.org:pub:B5BA6C15-E72A-4C62-97B4-1823E71A9355>

**Keywords:** free-living marine nematode; *Lauratonema macrostoma* sp. nov.; *Lauratonema dongshanense* sp. nov.; East China Sea; dichotomous key

### Introduction

Meiofauna from a sandy beach of Fujian province, East China Sea has been studied over the past few years, for biomonitoring assessment of water quality in intertidal ecosystems. Meiofaunal sediments were collected on Dongshan Island in Zhangzhou City, Fujian Province, East China Sea in July 2012 during this research. Average abundance of meiofauna was  $1272 \pm 519$  ind  $10\text{ cm}^{-2}$ , with 60% of the specimens being free-living nematodes. The nematode fauna of this investigated site is dominated by the families Lauratonematidae, Xyalidae, Thoracostomopsidae and Ironidae, of which the abundance of the genus *Lauratonema* Gerlach, 1953 accounts for 24.19%. The present paper describes two new species of free-living marine nematodes belonging to the genus *Lauratonema* Gerlach, 1953.

The genus *Lauratonema* was erected by Gerlach in 1953 with the type species *L. reductum*, for which he erected the family Lauratonematidae (Gerlach 1953; Gerlach and Riemann 1974). The most significant characteristic of *Lauratonema* is that the female genital duct is united with the rectum forming a cloaca (Gourbault and Vincx 1986; Keppner and Tarjan 1989). The taxonomy of Lauratonematidae is still in a state of flux and remains subject to debate (De Coninck 1965; Tchesunov 1984;

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Gourbault and Vincx 1986; Fadeeva 1989). Some authors (Clark 1961; De Coninck 1965; Andr ssy 1976; Tchesunov 1984; Gourbault and Vincx 1986; Fadeeva 1989) put it in the order Enoplida, while Lorenzen (1981) transferred it to the order Trefusiida. Species and genera in this family have been comprehensively revised by De Coninck (1965) and Tchesunov (1984). De Coninck (1965) moved *Lauratonema originale* to *Lauratonemoides*, Tchesunov (1984) transferred *Lauratonema minutum* to *Lauratonemoides* and established the genus *Lauratonemella* solely for *Lauratonema spiculifer* Gerlach, 1959 (De Coninck 1965; Tchesunov 1984).

## Materials and methods

Sediment samples were taken from an intertidal area on the coast of Dongshan Island in Zhangzhou City, Fujian Province, East China Sea, using a sawn-off syringe with a 2.9 cm inner diameter pushed into the sediment to a depth of 10 cm. Samples were taken at high, mid and low tide levels. Samples were fixed with 5% formalin in filtered seawater, then stained with 0.1% rose Bengal for more than 24 hours. The meiofauna were extracted from the sediment by decantation and/or Ludox centrifugation (Higgins and Thiel 1988). Each sample was washed into a lined Petri dish through two sieves (mesh sizes 500 and 31  $\mu\text{m}$ ) and the meiofauna was sorted to higher taxonomic levels under a stereoscopic microscope. Nematodes were transferred into a solution containing, by volume, 5% glycerol, 5% pure ethanol, and 90% freshwater in a cavity block to let the ethanol slowly evaporate and then mounted in glycerol on permanent slides (McIntyre and Warwick 1984). The descriptions were made from glycerine mounts using differential interference contrast microscopy (NIKON 80i, Tokyo, Japan). Drawings were made with a camera lucida. Types are deposited in the Institute of Oceanology, Chinese Academy of Sciences.

Measurements are in  $\mu\text{m}$ . Abbreviations are as follows: a, body length/maximum body diameter; b, body length/pharynx length; c, body length/tail length; a.b.d., anal or cloacal body diameter; c', tail length/a.b.d.; c.b.d., corresponding body diameter; Sc, spicule length as arc.

## Species descriptions

Family LAURATONEMATIDAE Gerlach, 1953

Genus *Lauratonema* Gerlach, 1953

*Lauratonema macrostoma* sp. nov.

(Figures 1, 2, Table 1)

### Type material

Five males and three females were collected from mid tide level of Station ZZDS in July 2012. Holotype: one male ( $\sigma^1$  on slide number ZZDS20120707 M1U124). Paratypes: four males and three females ( $\sigma^2$  on slide number ZZDS20120707 M1U104,  $\sigma^3$  on slide number ZZDS20120707 M1U110,  $\sigma^4$  on slide number ZZDS20120707 M1U118,  $\sigma^5$  on slide number ZZDS20120707 M1U122,  $\text{f}^1$  on slide number ZZDS20120707 M1U106,  $\text{f}^2$  on slide number ZZDS20120707

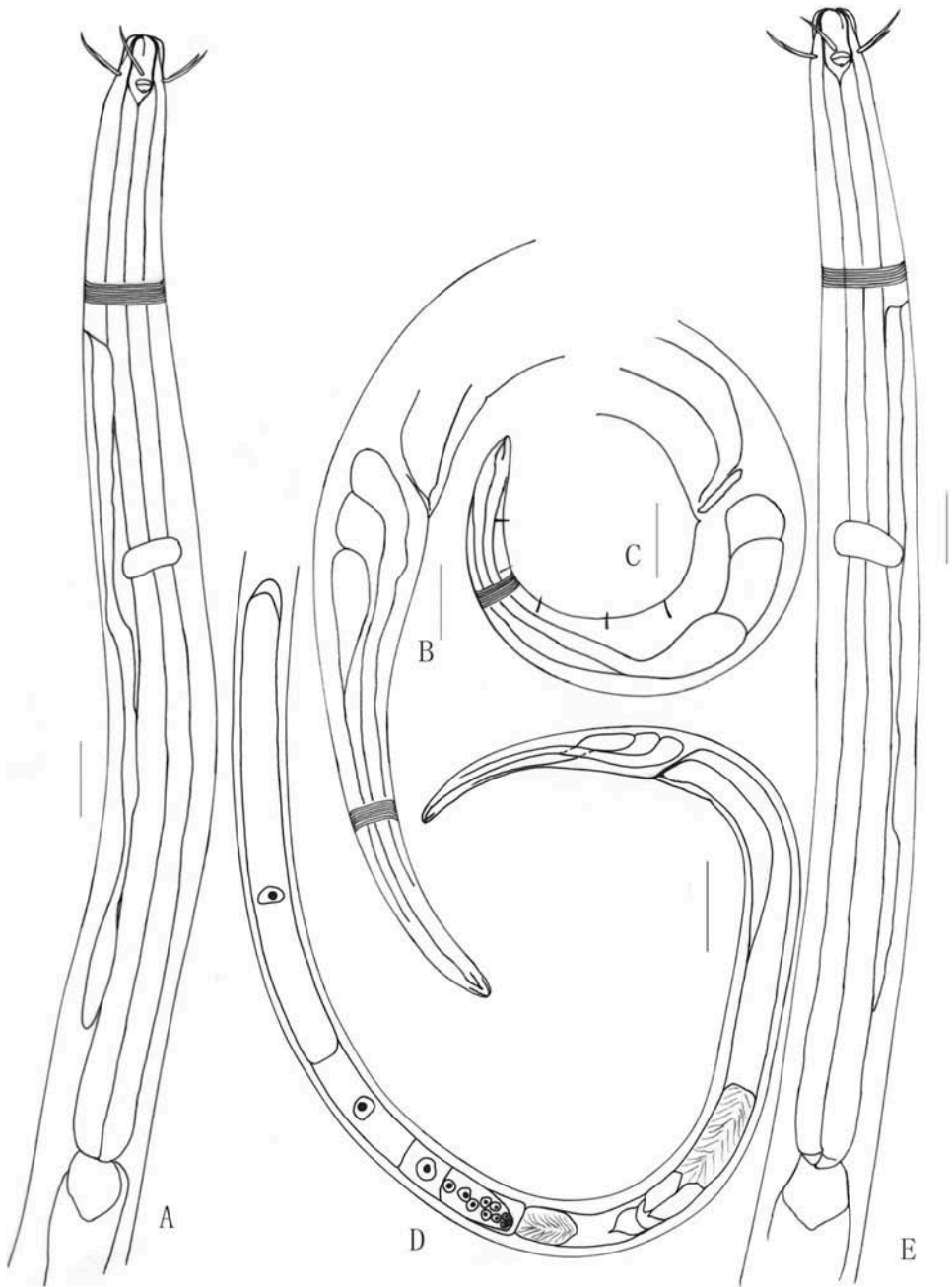


Figure 1. *Lauratonema macrostoma* sp. nov. (A) lateral view of male anterior part; (B) lateral view of female tail; (C) lateral view of male tail; (D) lateral view of female posterior part, showing reproductive system; (E) lateral view of female anterior part. Scale bar: A, B, C, E = 20  $\mu$ m; D = 50  $\mu$ m.

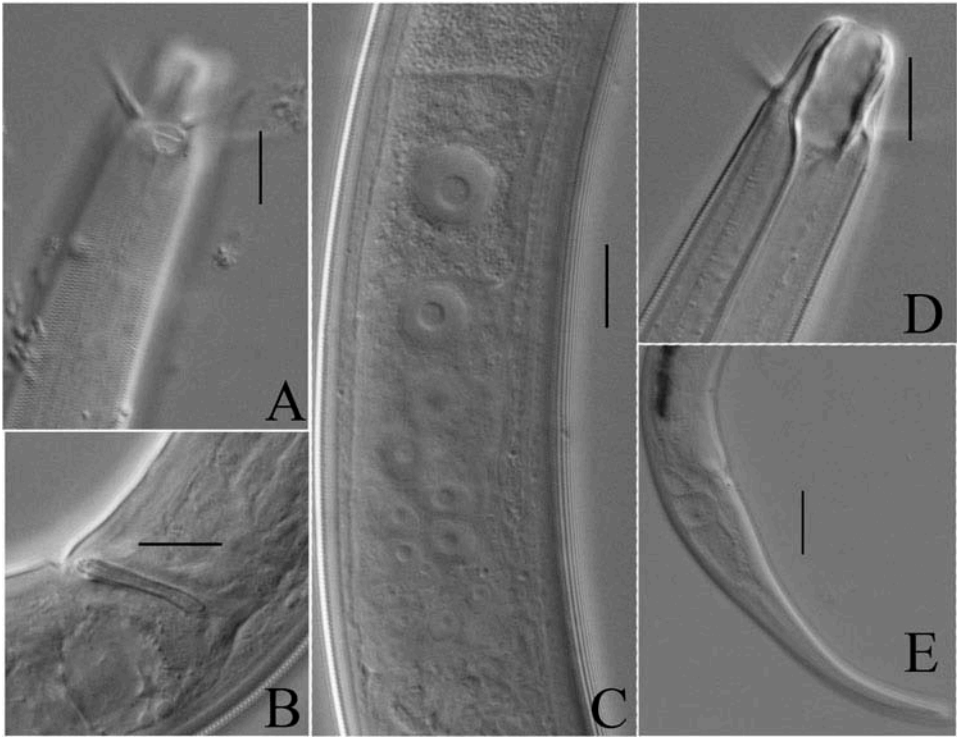


Figure 2. *Lauratonema macrostoma* sp. nov. (A) lateral view of male head end, showing amphids and bacteria; (B) lateral view of male body part, showing spicule; (C) lateral view of female body part, showing eggs; (D) lateral view of female head end, showing buccal cavity; (E) lateral view of female tail. Scale bar: A–D = 10 µm; E = 25 µm.

M1U101, ♀3 on slide number ZZDS20120707 M1U104). Types are deposited in the Institute of Oceanology, Chinese Academy of Sciences.

*Type locality and habitat*

Intertidal sandy sediment on the coast of Dongshan Island, Zhangzhou City. Silt+clay: 3.27%. Station ZZDS: 23.7081°N, 117.4836°E.

*Etymology*

This species is named for its large buccal cavity.

*Measurements* (Table 1)

Holotype ♂1:	<div><div><div>–297 W 1476</div><div>13 28 30 29</div></div></div>	1615 µm; a = 53.0, b = 5.4, c = 11.6, Sc = 16 µm
Paratype ♀1:	<div><div><div>–305 V 1454</div><div>13 27 31 28</div></div></div>	1592 µm; a = 51.6, b = 5.2, c = 11.5

Table 1. Individual measurements of *Lauratonema macrostoma* sp. nov. (in  $\mu\text{m}$ ).

Characters	Holotype	Paratypes						
	♂1	♂2	♂3	♂4	♂5	♀1	♀2	♀3
Total body length	1615	1760	1638	1541	1723	1592	1606	1643
Head diameter	13	13	13	14	14	13	13	13
Outer labial setae	13	14	15	16	15	14	15	17
Cephalic setae	10	10	10	12	11	11	10	9
Buccal cavity length	15	14	13	14	15	15	13	16
Buccal cavity diameter	6	6	6	7	7	6	6	7
Amphid from anterior end	11	11	12	11	12	11	11	13
Amphid diameter	5	5	5	6	5	5	5	5
Amphid c.b.d.	14	14	16	14	15	14	14	14
Excretory pore from anterior end	77	88	78	82	80	78	91	84
Excretory pore c.b.d.	22	22	22	22	22	23	22	25
Nerve ring from anterior end	135	137	138	141	146	138	125	131
Nerve ring c.b.d.	28	26	27	26	25	26	24	28
Pharynx length	297	295	302	300	319	305	297	301
Pharynx c.b.d.	28	26	29	27	26	27	26	30
Maximum body diameter a.b.d.	30	30	32	30	28	31	30	34
Tail length	139	138	147	131	144	138	138	141
c'	4.8	5.2	5.5	5.0	5.7	4.9	5.4	4.6
Spicule length as arc a	16	14	15	15	16	—	—	—
b	53.0	59.3	51.2	51.9	60.9	51.6	54.0	47.9
c	5.4	6.0	5.4	5.1	5.4	5.2	5.4	5.5
c	11.6	12.8	11.1	11.8	11.9	11.5	11.6	11.6

*Description*

Body cylindrical, slightly tapering towards both extremities. Cuticle marked with fine and conspicuous striations, which reach base of cephalic setae, and with rod-shaped bacteria more or less adhered. Inner labial sensilla not visible. Six outer labial setae and four cephalic setae in one ring, length 13–17  $\mu\text{m}$  and 9–12  $\mu\text{m}$  respectively, situated at the level of about two-thirds of the buccal cavity depth. Spacious barrel-shaped buccal cavity with strong cuticularized wall, depth 2.1–2.3 times width, slightly constricted at half its depth. Amphids unclear in some specimens, while obviously cup-shaped in others, located immediately posteriorly of the lateral outer labial setae, diameter about one-third of corresponding body diameter. Corresponding body diameter at posterior extremity of pharynx is 26–30  $\mu\text{m}$ . Cardia large, nearly heart-shaped, surrounded by intestinal tissue. Nerve ring encircled pharynx at about 42–47% of its length. Excretory pore opening ventrally 77–91  $\mu\text{m}$  from anterior end, 49–65  $\mu\text{m}$  in front of nerve ring. Ventral gland small, situated about 40  $\mu\text{m}$  anterior to end of pharynx. Tail elongate conoid, 4.6–5.7 a.b.d. long. Caudal glands well developed. Terminal seta absent. Spinneret small, terminal.

*Male.* Reproductive system diorchic with two testes arranged in tandem; anterior testis situated to right, posterior testis to left of the intestine. Spicules symmetrical and

straight, blade-like with distal proximal end closed, 0.55–0.65 a.b.d. long. No gubernaculum observed. Tail armed with two rows of ventrosublateral setae.

*Female.* Similar to male in general characteristics, but tail without ventrosublateral seta. Reproductive system monodelphic, reflexed, single ovary situated entirely to right of intestine. Genital zone of oogonia arranged in one or two rows; growth zone with a single row of gradually enlarging oocyte. Female genital duct united with rectum forming a cloaca.

#### *Diagnosis and discussion*

*Lauratonema macrostoma* sp. nov. is characterized by the size of the buccal cavity and spicules, the shape of the amphids and the length of the cephalic setae. It is close to *L. mentulatum* Wieser, 1959 and *L. reniamphidum* Hopper, 1961, which also have buccal cavity longer than wide. However, several differences can be seen. The new species differs from *L. mentulatum* Wieser, 1959 by its shorter body (1.54–1.76 mm versus 2.44 mm), the deeper buccal cavity (2.1–2.3 versus 1.6 times as long as width), the shorter outer labial setae (13–17  $\mu\text{m}$  versus 19  $\mu\text{m}$ ) and cephalic setae (9–12  $\mu\text{m}$  versus 14  $\mu\text{m}$ ) and spicules (14–16  $\mu\text{m}$  versus 26  $\mu\text{m}$ ), as well as the longer pharynx (b 5.1–6.0 versus 7.6) and tail (c 11.1–12.8 versus 15.2) (Wieser 1959). It can be distinguished from *L. reniamphidum* Hopper, 1961 by the size of body (length 1.54–1.76 mm versus 1.97–2.10 mm; a 47.9–60.9 versus 65.7–70.0), buccal cavity (6–7  $\mu\text{m}$  wide and 13–16  $\mu\text{m}$  long versus 5  $\mu\text{m}$  wide and 7  $\mu\text{m}$  long) and spicules (14–16  $\mu\text{m}$  versus 20  $\mu\text{m}$ ), and the shape and size of the amphids (cup-shaped and about one-third of c.b.d. versus reniform and about a quarter of c.b.d.) (Hopper 1961).

#### **Family LAURATONEMATIDAE Gerlach, 1953**

##### **Genus *Lauratonema* Gerlach, 1953**

##### ***Lauratonema dongshanense* sp. nov.**

(Figures 3, 4, Table 2)

#### *Type material*

Three males and two females were collected from mid tide level of Station ZZDS in July 2012. Holotype: one male ( $\sigma^1$  on slide number ZZDS20120707 M1U117). Paratypes: two males and two females ( $\sigma^2$  on slide number ZZDS20120707 M1U110,  $\sigma^3$  on slide number ZZDS20120707 M1U126,  $\text{♀}^1$  on slide number ZZDS20120707 M1U105,  $\text{♀}^2$  on slide number ZZDS20120707 M1U128). Types are deposited in the Institute of Oceanology, Chinese Academy of Sciences.

#### *Type locality and habitat*

Intertidal sandy sediment on the coast of Dongshan Island, Zhangzhou City. Silt+clay: 3.27%. Station ZZDS: 23.7081°N, 117.4836°E.

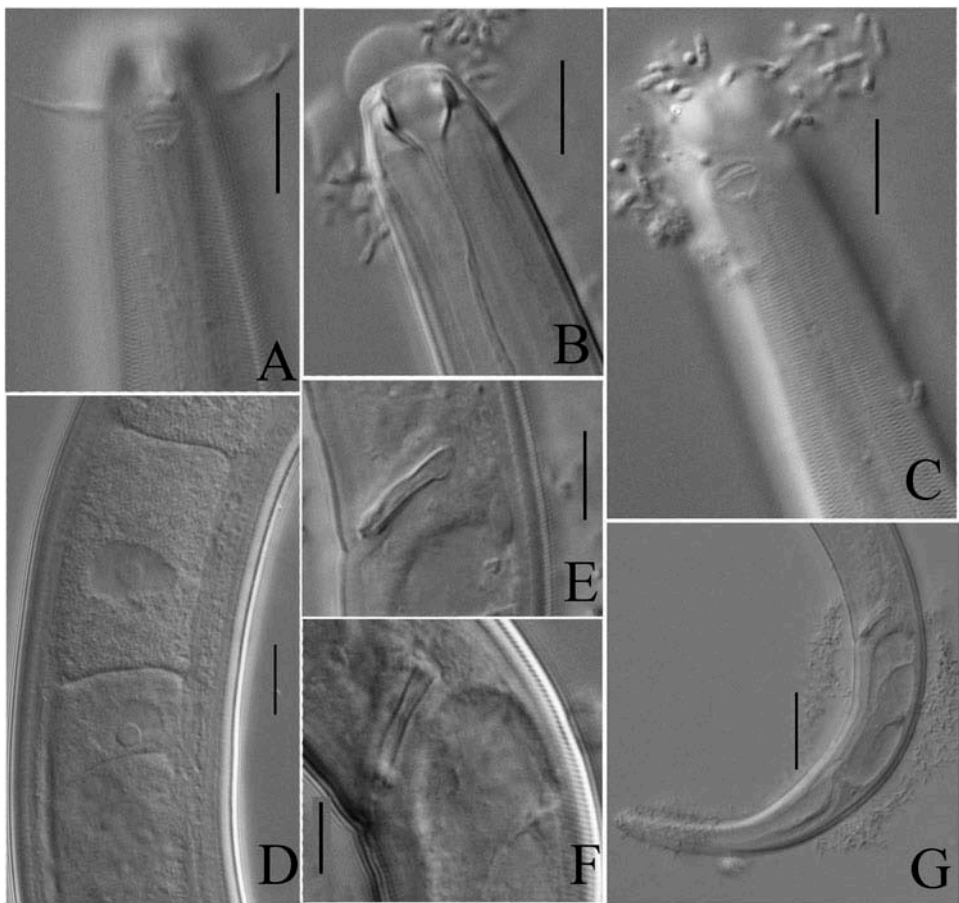


Figure 3. *Lauratonema dongshanense* sp. nov. (A) lateral view of male head end, showing amphid and cephalic setae; (B) lateral view of female head end, showing buccal cavity; (C) lateral view of female head end, showing amphid and bacteria; (D) lateral view of female body part, showing eggs; (E, F) lateral view of male body part, showing spicules; (G) lateral view of male tail. Scale bar: A–F = 10  $\mu\text{m}$ ; G = 25  $\mu\text{m}$ .

*Etymology*

This species is named for the type locality, intertidal sediment on Dongshan Island.

*Measurements* (Table 2)

Holotype ♂1:	–310 W 1421	1547 $\mu\text{m}$ ; a = 61.2, b = 5.0, c = 12.3, Sc = 14 $\mu\text{m}$
	14 24 25 24	
Paratype ♀1:	–323 V 1358	1495 $\mu\text{m}$ ; a = 44.7, b = 4.6, c = 10.9
	14 31 33 30	

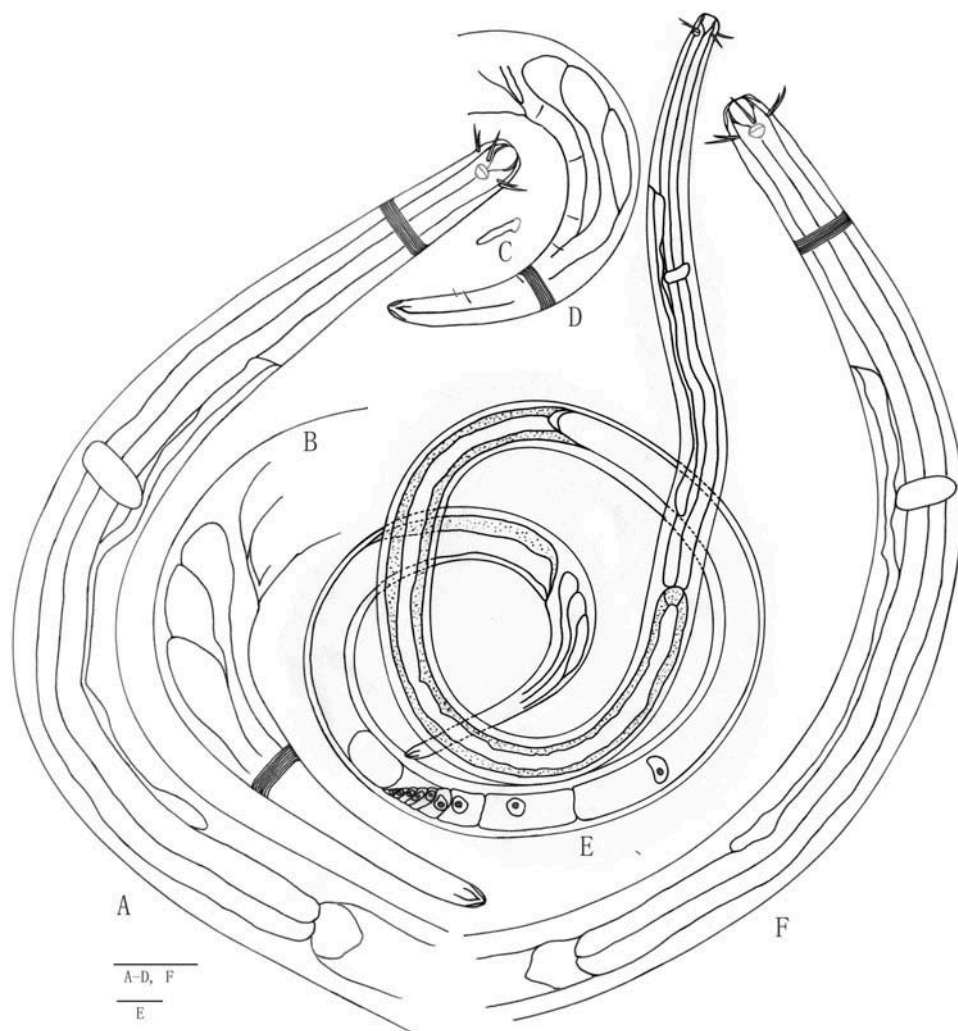


Figure 4. *Lauratonema dongshanense* sp. nov. (A) lateral view of female anterior part; (B) lateral view of female tail; (C) lateral view of spicule; (D) lateral view of male tail and spicule; (E) full view of female, showing reproductive system; (F) lateral view of male anterior part. Scale bar: 25  $\mu$ m.

### Description

Body elongated and attenuating towards the ends. Cuticle marked with fine and prominent transverse striations from posterior border of amphids to tip of tail and with rod-shaped bacteria more or less adhered. Inner labial sensilla not seen. Six outer labial setae and four cephalic setae in single crown, length 8–10  $\mu$ m and 5–7  $\mu$ m respectively, situated 8–10  $\mu$ m posterior to anterior end. Funnel-shaped buccal cavity with strong cuticularized transverse strip structure, depth almost equal to width. Amphids cup-shaped, situated just posterior to the lateral outer labial setae, with diameter 0.32–0.44 times of corresponding body diameter. Pharynx cylindrical and

Table 2. Individual measurements of *Lauratonema dongshanense* sp. nov. (in  $\mu\text{m}$ ).

Characters	Holotype	Paratypes			
	♂1	♂2	♂3	♀1	♀2
Total body length	1547	1542	1372	1495	1515
Head diameter	14	13	14	14	14
Outer labial setae	10	10	9	8	10
Cephalic setae	7	6	6	5	6
Buccal cavity length	7	6	6	6	6
Buccal cavity diameter	6	5	6	6	6
Amphid from anterior end	9	—	8	9	10
Amphid diameter	6	—	4	5	5
Amphid c.b.d.	15	—	14	15	14
Excretory pore from anterior end	83	88	87	92	99
Excretory pore c.b.d.	23	21	23	24	22
Nerve ring from anterior end	146	—	148	166	153
Nerve ring c.b.d.	24	—	24	27	24
Pharynx length	310	314	310	323	316
Pharynx c.b.d.	24	23	24	31	24
Maximum body diameter	25	25	25	33	27
a.b.d.	24	22	23	30	24
Tail length	126	123	125	137	141
c'	5.3	5.6	5.3	4.6	6.0
Spicule length as arc	14	15	14	—	—
a	61.2	61.3	54.4	44.7	56.1
b	5.0	4.9	4.4	4.6	4.8
c	12.3	12.5	11.0	10.9	10.7

muscular, with corresponding body diameter 23–31  $\mu\text{m}$  at posterior extremity. Cardia large, nearly heart-shaped, surrounded by intestinal tissue. Nerve ring surrounding pharynx situated at 47–51% of its length. Excretory duct very short, excretory pore situated 54–73  $\mu\text{m}$  anterior to nerve ring, ventral gland located at 40–50  $\mu\text{m}$  anterior to end of pharynx. Caudal glands well developed. Terminal seta absent.

*Male.* Tail elongate conoid, length 123–126  $\mu\text{m}$ , 5.3–5.6 a.b.d. long. Two rows of setae just located at ventrosublateral of tail. Reproductive system diorchic with two testes arranged in tandem; anterior testis situated to right, posterior testis to left of intestine. Spicules blade-like, short and straight, 0.58–0.67 times a.b.d. long. In three measured specimens, one with spicules with proximal end unclosed (Figure 3F), others with slightly cephalated proximal end (Figure 3E). No gubernaculum observed. A small papilla situated at about 15  $\mu\text{m}$  anterior to cloaca.

*Female.* Similar to male in general characteristics, but tail a little longer, length 137–141  $\mu\text{m}$ , without ventrosublateral seta. Reproductive system monodelphic, single ovary reflexed, situated entirely to right of intestine. Genital zone of oögonia arranged in one or two rows; growth zone with a single row of gradually enlarging oocytes. Female genital duct united with rectum forming a cloaca.

*Diagnosis and discussion*

*Lauratonema dongshanense* sp. nov. is morphologically close to *L. pugiunculus* Wieser, 1959, *L. reductum* Gerlach, 1953 and *L. hospitum* Gerlach, 1954 in several characteristics, such as their small buccal cavities, which are as short as or shorter than wide; outer labial setae and cephalic setae of unequal length; gubernaculum absent. However, the new species can be easily distinguished by the shape of buccal cavity (funnel-shaped with strong cuticularized transverse strip structure, depth almost equal to width versus small and conical) and spicules (blade-like, short and straight versus slender, more or less straight but with an S-like bend), the number and arrangement of male caudal papillae (one small precloacal ventral papilla versus three to four postcloacal ventral papillae), the tail length (c 10.7–12.5 versus 18; c' 4.6–6.0 versus 6.8), etc. It differs from *L. reductum* in the length of the body (1372–1547 µm versus 1601–1977 µm), pharynx (b 4.4–5.0 versus 5.3–7.6), spicules (14–15 µm versus 21–24 µm) and adult tail (c 10.7–12.5 versus 8.8–10.4), the presence of precloacal papilla, etc. (Gerlach 1953). From *L. hospitum* the new species differs by having small precloacal papilla, shorter spicules (14–15 µm and 0.58–0.67 a.b.d. versus 21 µm and about one a.b.d.) and tail (c' 4.6–6.0 versus 6.5–7.5), and plumper body form (a 44.7–61.3 versus 68–118) (Gerlach 1954).

**General discussion and key to *Lauratonema***

So far, a total of eight valid species in genus *Lauratonema* Gerlach, 1953 are known (Gerlach and Riemann 1974; <http://nemys.ugent.be>; <http://www.marinespecies.org/index.php>; <http://entomology.tamu.edu/>; <http://pipedev.tamu.edu/Biocat/Search/SearchTaxa.aspx>). A dichotomous key including eight species in this genus was provided by Hopper (1961), and three new species were described later: *L. obtusicaudatum* Murphy and Jensen, 1961, *L. minutum* Platonova, 1971 and *L. juncta* Fadeeva, 1989. However, *L. originale* was moved to *Lauratonemoides* by De Coninck (1965). Tchesunov (1984) gave a dichotomous key to the family Lauratonematidae, transferred *Lauratonema minutum*, the gonad of which is very similar to *L. originalis*, to *Lauratonemoides*, and established the genus *Lauratonemella* solely for *L. spiculifer* Gerlach, 1959 (De Coninck 1965; Tchesunov 1984; Gourbault and Vincx 1986; Fadeeva 1989). Therefore, this genus contains eight valid species. We revise the key base on Hopper (1961) and Tchesunov (1984) including all known eight valid species in this genus as well as the two newly described species, according to the size of buccal cavity, the shape and situation of the amphids, the length of the cephalic setae, the length and shape of spicules, the existence of ventral papillae, etc., as follows (Gerlach 1953, 1954; Wieser 1959; Hopper 1961; Murphy and Jensen 1961; Tchesunov 1984; Fadeeva 1989).

**Key to species of the genus *Lauratonema***

1. Stoma spacious, length more than width ..... 2  
 – Stoma small, length equal to, or less than, width ..... 4
2. Amphids anterior to lateral outer labial setae, at the level of buccal cavity .....  
 ..... *L. mentulatum* Wieser, 1959  
 – Amphids posterior to lateral outer labial setae, below buccal cavity ..... 3

3. Stoma length 1.5 times width. Amphids reniform ..... *L. reniamphidum* Hopper, 1961
- Stoma length 2.1–2.3 times width. Amphids cup-shaped (if visible) ..... *L. macrostoma* sp. nov.
4. Outer labial setae and cephalic setae of equal length ..... *L. adriaticum* Gerlach, 1953
- Outer labial setae and cephalic setae of unequal length ..... 5
5. Male caudal region with ventral papilla ..... 6
- Male caudal region without ventral papilla ..... 9
6. Stoma with dentate cuticularized ..... *L. juncta* Fadeeva, 1989
- Stoma without dentate cuticularized ..... 7
7. Cephalic region set off by a slight constriction. Male with one precloacal and two postcloacal ventral papillae ..... *L. obtusicaudatum* Murphy and Jensen, 1961
- Cephalic region not set off. Male with either precloacal or postcloacal ventral papillae ..... 8
8. Spicule slender, with a slight S-like bend. Gubernaculum small, thin. Male with three to four postcloacal ventral papillae ..... *L. pugiunculus* Wieser, 1959
- Spicules blade-like, short and straight. Gubernaculum absent. Male with one small precloacal ventral papilla ..... *L. dongshanense* sp. nov.
9. Body form slender, a more than 65; outer labial setae 8.5  $\mu\text{m}$  ..... *L. hospitum* Gerlach, 1954
- Body form plumper, a less than 50; outer labial setae 11 to 15  $\mu\text{m}$  ..... *L. reductum* Gerlach, 1953

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### Disclosure statement

No potential conflict of interest was reported by the authors.

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