

Two new free-living nematode species (Comesomatidae) from the mangrove wetlands in Fujian Province, China

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Abstract

Two new free-living marine nematode species from the mangrove wetlands of Fujian Province, China are identified and illustrated. *Sabatieria conicoseta* sp. nov. is characterized by its short conical somatic setae. There are 12–15 tubular pre-cloacal supplements and 12–15 μm long straight gubernacular apophyses. *Dorylaimopsis papilla* sp. nov. is characterized by spicules which are 1.5–1.8 a. b. d. long with media cuticularized strip along entire spicules, and have a cephalated proximal end with small hooked. There are 16–18 small papillate pre-cloacal supplements and 37–40 μm long dorso-caudal gubernacular apophyses.

Key words: free-living marine nematode, new species, *Sabatieria*, *Dorylaimopsis*, mangrove

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1 Introduction

The mangrove forest in China covers the area of 22 600 hm^2 , accounting for 0.13% of the world's total area of the mangroves. Mangrove forests in China are located in the northern edge of mangrove area in the world. Fujian is the northernmost province of mangrove natural distribution, and is also one of the earliest provinces in planted mangrove forests in China (Wang and Wang, 2007). The free-living marine nematode fauna from mangrove wetlands of Fujian Province has been studied in connection with the creation of a new database for the biomonitoring assessment of mangrove wetlands ecosystems. This work is part of the China national project for studying biodiversity of free-living nematodes of the coast of China mangrove wetlands.

Comesomatids typically have the following main characters: annulated cuticle with transverse rows of punctations, multi-spiral amphids, gubernaculum with paired dorsal apophyses and pre-cloacal supplements in the male. *Sabatieria* is a large genus in this family (Warwick et al., 1998). Platt (1985) revised *Sabatieria* and divides the species into five subgroups, according to differentiation characteristics including the type and distribution of pre-cloacal supplements, characteristics of the gubernaculum and apophyses, the number of turns of the amphideal fovea, and the cephalic setae (Platt, 1985). *Dorylaimopsis* is characterised by cylindrical buccal cavity with three teeth, cuticle with lateral differentiation of longitudinal rows of coarse dots. Spicules are usually elongated, arcuate or jointed. Gubernaculum has caudal or dorso-caudally apophyses, pre-cloacal supplements usually present (Jensen, 1979). The genus *Dorylaimopsis* was described by Ditlevsen in 1918. To date, 21 species in this genus have been recorded worldwide (<http://nemys.ugent.be/aphia.php?p=taxlist>) (Gagarin, 2013). *Sabatieria* and *Dorylaimopsis* species are typical inhabitants of muddy intertidal and subtidal sediments,

and are often the dominant members of the nematode fauna in such habitat (Muthumbi et al., 1997; Leduc, 2012).

2 Materials and methods

Undisturbed sediment samples were taken from four mangrove wetlands from the north to south of Fujian Province in July, October, 2012 and January, April, 2013; Zhangjiang Estuary mangrove wetland in Yunxiao County, Jiulong Estuary mangrove wetland in Longhai City, Fenglin mangrove wetland in Xiamen Tong'an Bay, Luoyang Estuary mangrove wetland in Quanzhou City (Table 1). In the four study region, a sampling transect was set within every area, and sampling was conducted at high, mid and low tidal levels along every transect. Samples were taken to a depth of 5 cm using remade-syringe tube with an inner 2.9 cm diameter and then fixed with 5% formalin. The nematodes were extracted by centrifugal-flotation technique and then transferred to anhydrous glycerine and finally made into slides. Drawings were made with the aid of a camera lucida attached to a Nikon Eclipse 80i microscope. Type specimens are deposited in the Third Institute of Oceanography, State Oceanic Administration, Xiamen, China.

Measurements are in μm . Abbreviations are as follows: *a*, body length divided by maximum body diameter; *b*, body length divided by pharyngeal length; *c*, body length divided by tail length; R3, cephalic setae length as percentage of head diameter; *A%*, amphid diameter divided by corresponding body diameter; *c'*, tail length divided by anal body diameter; h. d., head diameter; a. b. e., anterior body end; a. b. d., anal body diameter; c. b. d., corresponding body diameter; *V*, vulva distance from the anterior body end; *V%*, position of vulva as percentage of body length from anterior body end; and *Sc*, spicue length as arc.

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Table 1. The location of sampling region and some environment features (data in October, 2012)

Sampling region	North latitude	East longitude	Mangrove plants	Soil temperature/°C	Salinity	Total nitrogen/mg·g ⁻¹	Total phosphorus/mg·g ⁻¹	Organic carbon/%
Zhangjiang Estuary	23.96°	117.35°	<i>Kandelia obovata</i>	27.3	1.9	2.72	0.41	3.96
Jiulong Estuary	24.45°	117.82°	<i>Kandelia obovata</i>	28.6	1.6	1.56	0.58	2.04
Fenglin, Tong'an Bay	24.58°	118.10°	<i>Kandelia obovata</i>	27.4	22.9	2.28	0.46	3.17
Luoyang Estuary	24.94°	118.67°	<i>Aegiceras corniculatum</i>	28.1	15.9	1.31	0.40	1.72

3 Description of *Sabatieria conicoseta* sp. nov.

Family Comesomatidae Filipjev, 1918

Subfamily Sabatieriinae Filipjev, 1934

Genus *Sabatieria* Rouville, 1903*Sabatieria conicoseta* sp. nov.

(Figs 1, 2 and Table 2)

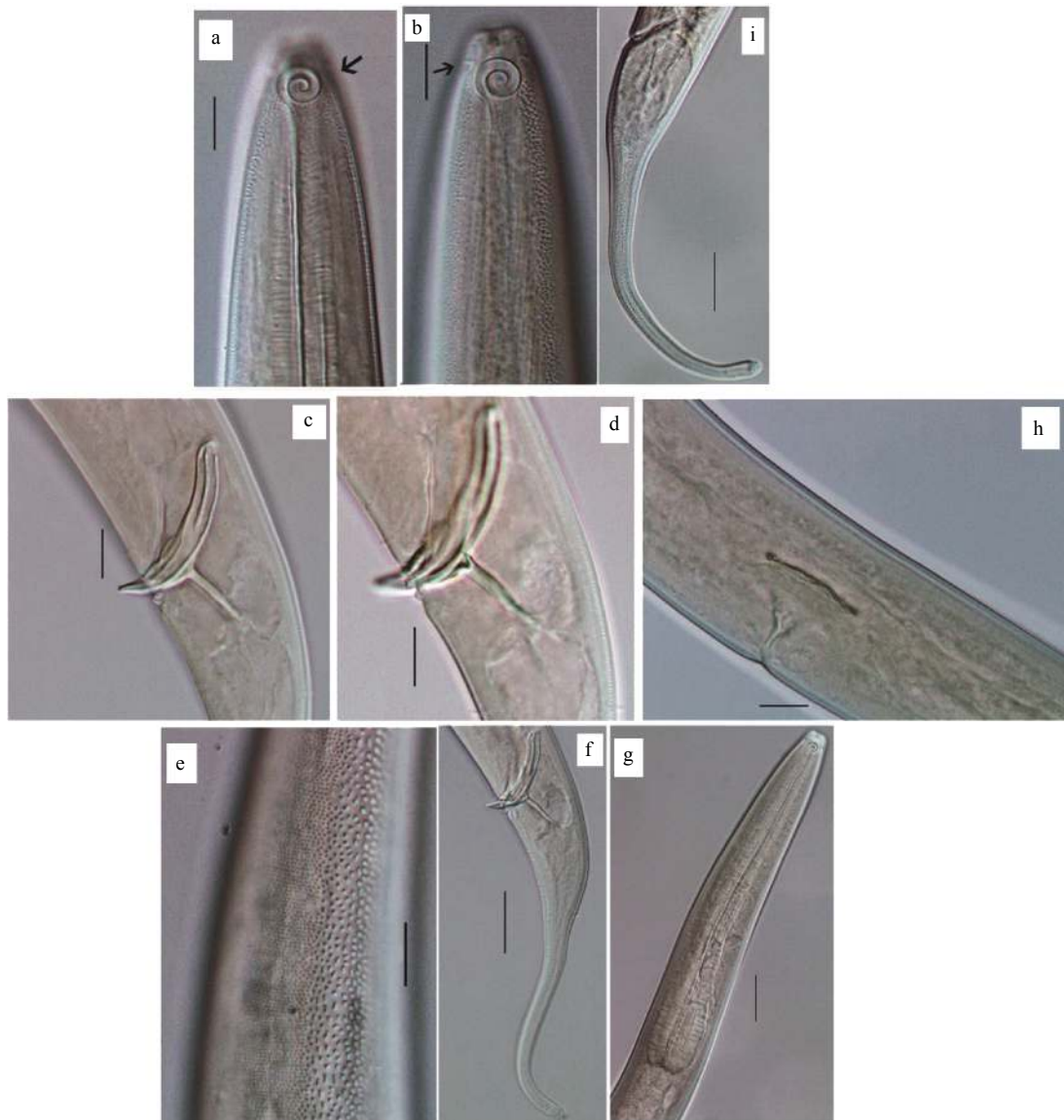
3.1 Type material

Five males and five females. Male holotype, slide number:

QZ20120713H203. Female allotype, slide number: YX20121021M202; four male paratypes, slides number: QZ20120713H210, QZ201210-12L207, QZ20121012H301 and LH20130105L107; four female paratype, slides number: YX20121021M203, YX20121021M207, YX20121021L201 and QZ20121012H406.

3.2 Type locality

♂1–♂4 were collected from the Luoyang Estuary, ♂1 and ♂2 in July, and ♂3 and ♂4 in October. ♀5 was collected from the Ji-

**Fig. 1.** *Sabatieria conicoseta* sp. nov. Male: lateral surface view of head region (amphid) (a), lateral surface view of head region (cephalic setae) (b), copulatory apparatus (c and d), lateral differentiation (mid body) (e), and copulatory apparatus and tail (f). Female: pharyngeal region (g), vulva region (h), and rectal region and tail (i). Bar scales: 10 μm (a, b, c, d, h) and 25 μm (e, f, g, i).

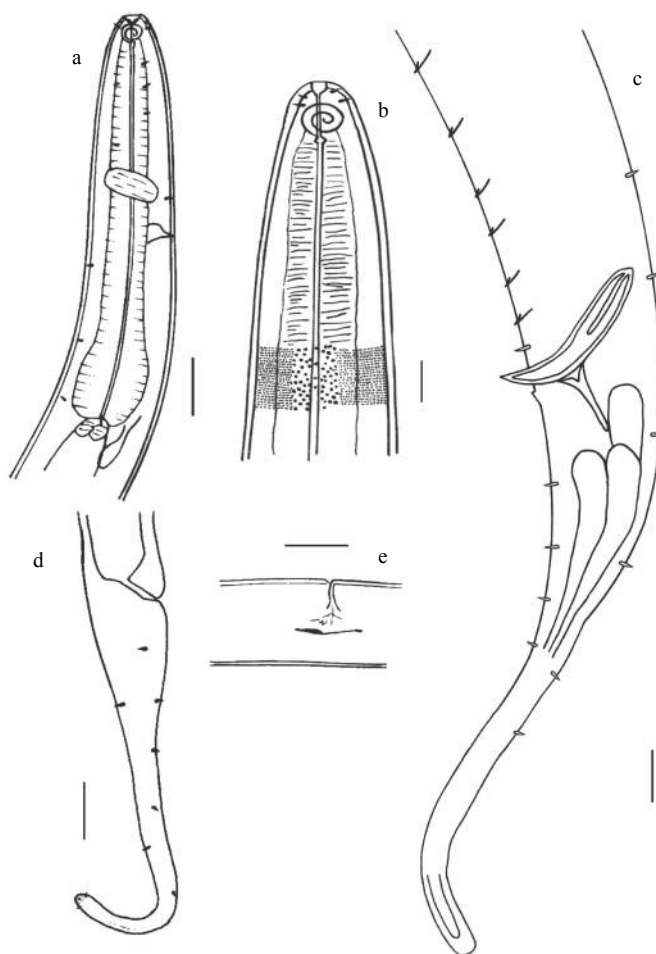


Fig. 2. *Sabatieria conicoseta* sp. nov. Male: pharyngeal region (a), anterior body end (b) and copulatory apparatus and tail (c). Female: rectal region and tail (d) and vulva region (e). Bar scales: 25 μm (a, d, e) and 10 μm (b, c).

along Estuary in January. ♀1–♀4 were collected from the Zhangjiang Estuary in October and ♀5 from the Luoyang Estuary in October. Environmental parameters are shown in Table 1.

3.3 Etymology

Sabatieria conicoseta is given with short conical cephalic and somatic setae.

3.4 Measurements

Holotype ♂1: $\frac{-181 \quad M \quad 1 \quad 396}{11 \quad 39 \quad 41 \quad 28}$ 1 536 μm ; $a=38$, $b=9$, $c=11$,
 $Sc=40$,

Allotype ♀1: $\frac{-202 \quad V \quad 1 \quad 535}{14 \quad 41 \quad 39 \quad 28}$ 1 710 μm ; $a=43$, $b=9$, $c=10$,
 $V\%=46\%$.

3.5 Descriptions

Body is cylindrical, attenuated at both ends. Cuticle marked by transverse rows of fine punctuation beginning at the level of middle of the amphid and terminating at the base of conical portion of the tail. Lateral differentiation in the form of larger and more widely spaced dots, irregularly arranged. Three crowns of anterior sensilla: inner labial sensilla invisible, six 1 μm short but distinct outer labial setae and four 1.4–2.1 μm long cephalic setae

(11%–18% of head diameter). Short conical somatic setae, distributed unevenly in the dorso- and ventro-lateral longitudinal rows. Amphids are spiral with 2.25 turns, 7–8 μm in diameter and 42%–64% of corresponding body diameter. Anterior border of amphids are 4–6 μm from the front end. Buccal cavity is cup-shaped, with conspicuous tooth-like structures at the base. The pharynx slightly broadens towards posterior end without forming a distinct bulb. Nerve ring 93–108 μm from anterior end of body, 49%–56% of the pharyngeal length. Excretory pore 107–133 μm from anterior end of body and the ventral gland extends well at the level of the cardia. Tail is 131–189 μm long or 4.8–6.3 times anal body diameter.

Males: Spicules paired, equal and curved, 1.4–1.7 a. b. d. long, with a swollen proximal end and central circularized strip extending a half of spicule length as arc from proximal end. Gubernaculum has 12–15 μm long straight apophyses. Twelve to fifteen tubular pre-cloacal supplements are gradually increased in distance apart anteriorly. There is one seta at anterior of the anal opening.

Females: The females are almost similar to the males, except for longer total body length (1 710–2 246 μm in female versus 1 429–1 656 μm in male) and tail length (173–189 μm in female versus 131–149 μm in male). Ovaries are opposite and outstretched. Vulva is located at 44%–46% of the body length.

Table 2. Measurements of *Sabatieria conicoseta* sp. nov. (in μm)

Characters	♂1	♂2	♂3	♂4	♂5	♀1	♀2	♀3	♀4	♀5
Body length	1 536	1 495	1 656	1 429	1 583	1 710	2 246	2 185	2 014	1 742
<i>a</i>	38	36	35	34	36	43	36	29	40	29
<i>b</i>	9	8	9	8	9	9	11	10	10	8
<i>c</i>	11	11	12	11	11	10	13	12	11	10
h.d.	11	12	12	13	12	14	14	15	15	14
Length of cephalic setae	2.0	1.4	1.6	1.6	1.9	1.9	1.8	1.9	2.1	1.5
Amphid distance from a. b. e.	5	5	4	5	5	5	5	6	5	6
Amphid diameter	8	8	7	8	8	8	7	7	8	7
A%	64%	52%	55%	52%	62%	49%	48%	43%	47%	42%
Nerve ring distance from a. b. e.	95	99	108	98	93	99	105	102	105	106
Nerve ring/pharyngeal length	52%	55%	55%	56%	52%	49%	50%	49%	54%	49%
Excretory pore distance from a. b. e.	118	122	119	112	107	122	130	126	133	128
Pharyngeal length	181	181	195	176	180	202	211	210	194	215
Pharyngeal end c. b. d.	39	37	44	41	40	41	50	55	46	51
Maximum body diameter	41	41	47	42	44	39	63	75	51	60
<i>V</i>	–	–	–	–	–	781	988	970	906	799
<i>V</i> %	–	–	–	–	–	46%	44%	44%	45%	46%
Spicule length as arc	40	43	42	42	40	–	–	–	–	–
Spicule length as chord	36	38	39	38	36	–	–	–	–	–
Gubernacular apophyses length	14	13	12	15	14	–	–	–	–	–
a. b. d.	28	28	29	27	24	28	34	36	32	31
Tail length	140	135	138	131	149	175	177	187	189	173
<i>c'</i>	5.0	4.8	4.8	4.9	6.2	6.3	5.2	5.2	5.9	5.6

3.6 Differential diagnosis

Sabatieria conicoseta sp. nov. belongs to *praedatrix* group because of the simple tubular supplements and straight gubernaculum apophysis. In this group, there are 45 valid species (Rosli et al., 2014). *Sabatieria conicoseta* sp. nov. resembles *Sabatieria fidelis* Botelho et al., 2009 in lateral differentiation and amphid turns, but can be distinguished from the known species especially by more shorter cephalic setae length (1.4–2.1 μm versus 3.0–3.7 μm), large “*c*” ratio (10–13 versus 14–21) and the type of pre-cloacal supplements (12–15 faint but visible tubular supplements versus invisible pore-like supplements). *Sabatieria conicoseta* sp. nov. is also close to *Sabatieria coomansi* Chen and Vincx, 1999 in having amphid turns (2.25), conspicuous tooth-like structures in the base of buccal cavity and relatively shorter cephalic setae (Chen and Vincx, 1999). The main differences between these two species are the total body length (1 429–2 246 μm versus 3 236–3 833 μm) and the number of tubular pre-cloacal supplements (12–15 versus 23–26) and *c'* (4.8–6.3 versus 2.9–3.6). *Sabatieria conicoseta* sp. nov. can be differentiated from *Sabatieria alata* Warwick, 1973 in the number of amphid turns (2.25 versus 2.8–3.2) and the total body length (1 429–2 246 μm versus 2 780–3 220 μm) (Warwick et al., 1998).

4 Description of *Dorylaimopsis papilla* sp. nov.

Family Comesomatidae Filipjev, 1918
 Subfamily Dorylaimopsinae De Coninck, 1965
 Genus *Dorylaimopsis* Ditlevsen, 1918
Dorylaimopsis papilla sp. nov.
 (Figs 3, 4 and Table 3)

4.1 Type material

Three males and one female. Male holotype, slide number: FL20120430L110; two male paratypes, slides number: FL20120430-L401 and FL20120430H404; female allotype, slide number: FL2013-

0930L115.

4.2 Type locality

♂1–♂3 were collected from Fenglin in the Tong'an Bay in April. ♀1 was collected from Fenglin in the Tong'an Bay in September. Environmental parameters are shown in Table 1.

4.3 Etymology

Dorylaimopsis papilla sp. nov. is given after papillate pre-cloacal supplements.

4.4 Measurements

Holotype ♂1: $\frac{-235}{16} \frac{M}{91} \frac{1}{98} \frac{803}{69}$ 2 019 μm ; *a*=21, *b*=9, *c*=9, *Sc*=101
 Allotype ♀1: $\frac{-249}{16} \frac{M}{79} \frac{1}{92} \frac{782}{55}$ 2 008 μm ; *a*=22, *b*=8, *c*=9,
V%=47%

4.5 Descriptions

Body is cylindrical, anteriorly with blunt end and with a conico-cylindrical tail. Punctuation begins at the level of the anterior border of the amphids. Cuticle marked by transverse rows of fine punctuation, with lateral differentiation in the form of longitudinal rows of enlarged dots, running from posterior to the amphids with 4–5 files, in the middle body with 2 files, then increases in four or more files in the spicule region. The lateral differentiation is about 8–10 μm wide in the middle of body, about 9%–10% of *c. b. d.*. Three rows of anterior sensilla, inner and outer labial sensilla are tiny but distinct and the cephalic ones are long (3.7–4.2 μm) setiform (22%–24% h. d.). The amphids are spiral with 2.5 turns and located immediately posterior of the cephalic sensilla. They are 10–11 μm in diameter (47%–55% *c. b. d.*). Stoma is tubular (18–21 μm) with three strong triangular teeth in the anterior part and sclerotized walls in the posterior

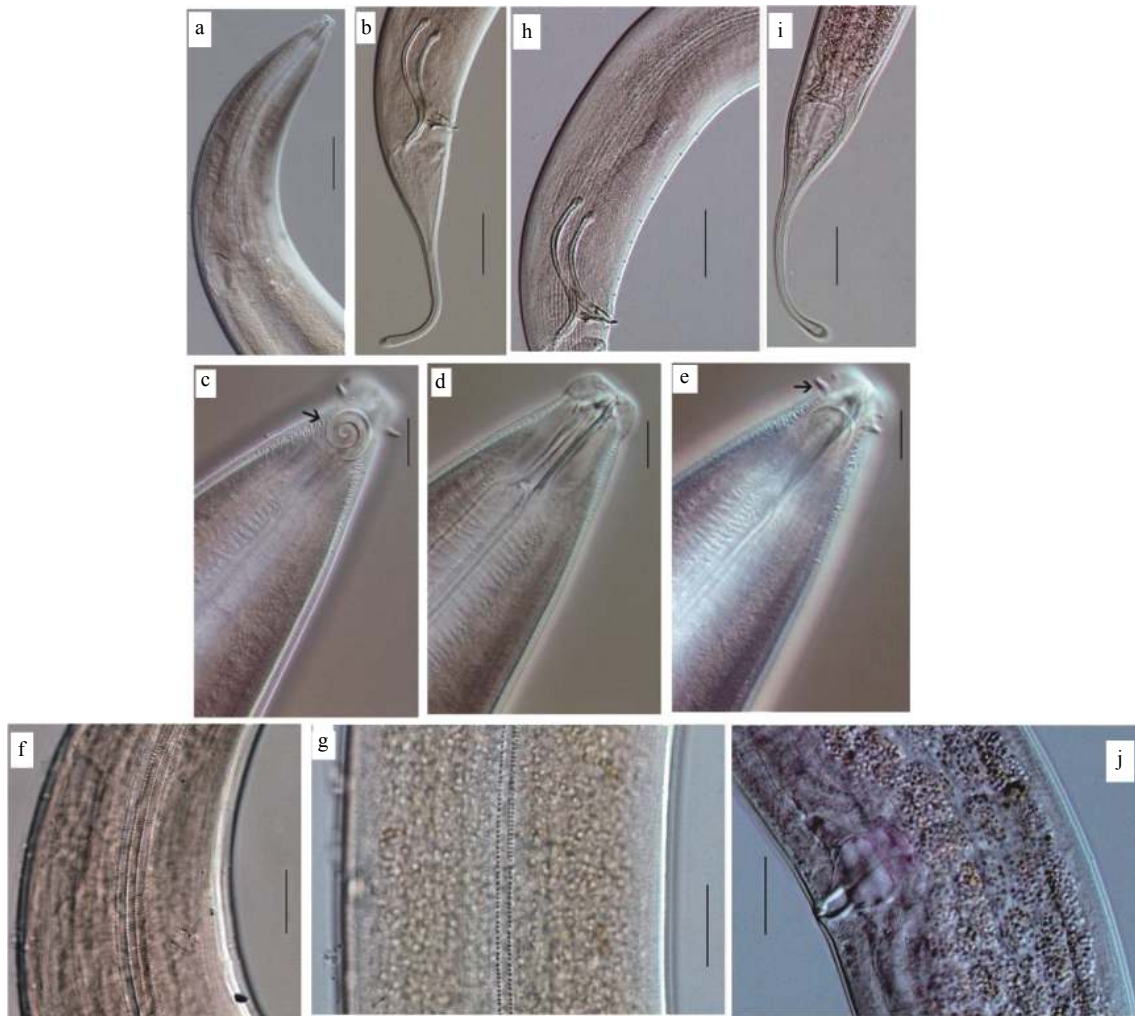


Fig. 3. *Dorylaimopsis papilla* sp. nov. Male: pharyngeal region (a), copulatory apparatus and tail (b), head region (amphid) (c), head region (stoma) (d), head region (cephalic setae) (e), lateral differentiation (pharyngeal region) (f), lateral differentiation (mid body) (g), and copulatory apparatus and precloacal supplements (h). Female: rectal region and tail (i), and vulva region (j). Bar scales: 50 μ m (a, b, h, i), 10 μ m (c, d, e) and 25 μ m (f, g, j).

part. The excretory pore is at 56% of pharynx length (52%–58%). The cardia is small.

Males: Two testes are opposite and outstretched. The curved spicules with media cuticularized strip along entire spicules are 1.5–1.8 a. b. d. long, and have a cephalated proximal end. 16–18 small but conspicuous papillate pre-cloacal supplements. The gubernaculum has long (37–40 μ m) dorso-caudal apophyses. The tail is 211–216 μ m long, and it is conical (1/2) anteriorly. There are numerous setae on the conical part of the tail and three setae (5 μ m long) at the tip.

Females: Similar to males in general characteristics, but c' is larger (4.1 in female versus 3.1–3.7 in male) and pharyngeal end body diameter shorter (79 μ m in female versus 90–93 μ m in male). Vulva is at 47% of body length. Two ovaries are opposite and outstretched.

4.6 Differential diagnosis

Dorylaimopsis papilla sp. nov. is characterized by short cephalic sensilla (3.7–4.2 μ m, 22%–24%). The amphids are spiral with 2.5 turns. There are 16–18 small papillate pre-cloacal supplements. Punctuated cuticle with lateral differentiation in the form

of longitudinal rows of enlarger dots, running from posterior to the amphids with 4–5 files, in the middle body 2 files, then increases in four or more files in the spicule region, on the dorsal and ventral sides, the punctuations are smaller and arranged in transverse rows. The tail is conico-cylindrical, half of the tail is conical portion.

Up to now, two species (*Dorylaimopsis rabalaisis* Zhang, 1992; *Dorylaimopsis turneri* Zhang, 1992) in this genus were recorded in China (Zhang, 1992). Our specimens are close to *D. rabalaisis* in amphid turns, however, *D. papilla* sp. nov. has longer body length (2 019–2 392 μ m versus 1 418–1 919 μ m) and shorter cephalic setae (7–10 μ m versus 4 μ m). *Dorylaimopsis papilla* sp. nov. has 16–18 small papillate pre-cloacal supplements while 14–21 fine but very indistinct ducts in *D. rabalaisis*. The ratio of conical portion to the tail is 1/2 in *D. papilla* sp. nov. while 2/3 in *D. rabalaisis*. Another difference lies in proximal end of spicule. The spicules are cephalated proximal end with small hooked in *D. papilla* sp. nov. while with ventral openings at proximal end in *D. rabalaisis*. And *D. rabalaisis* has spicules without median cuticularized strip.

Compared with three species found in 1997, including

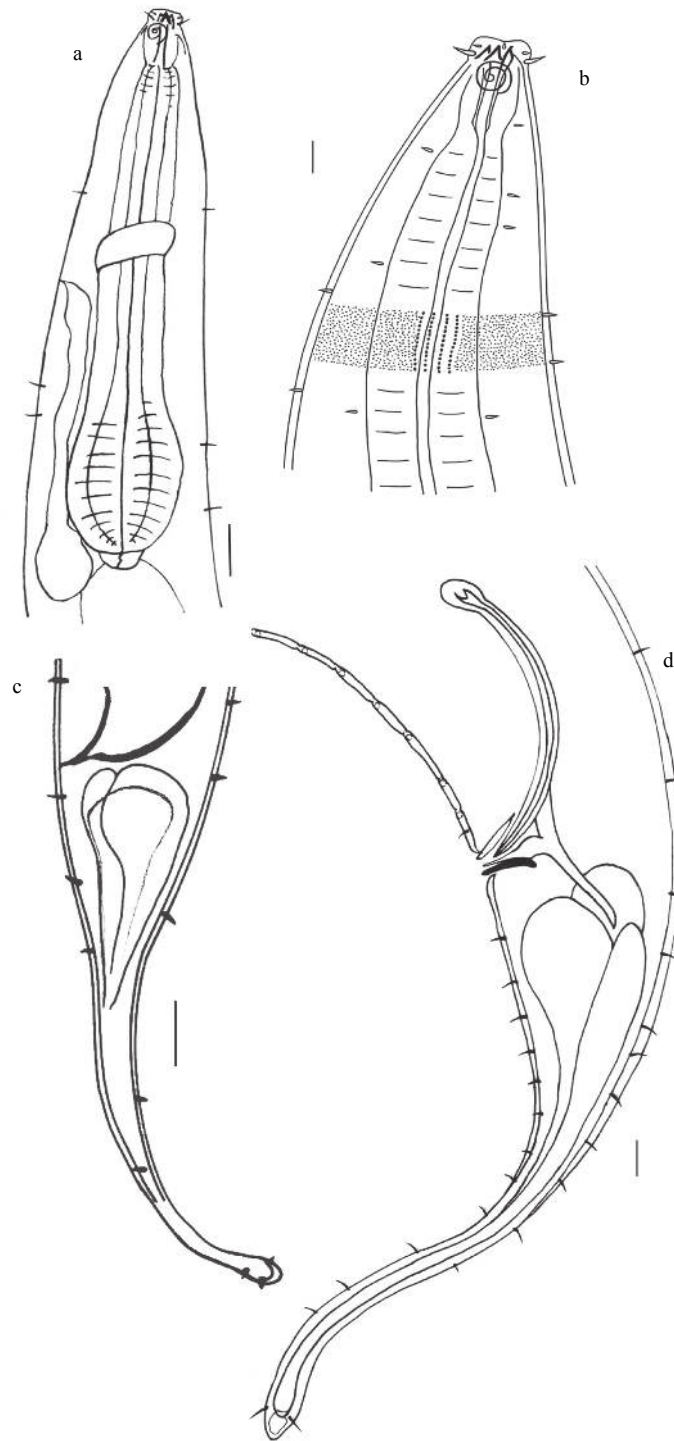


Fig. 4. *Dorylaimopsis papilla* sp. nov. Male: pharyngeal region (a), anterior body end (b) and copulatory apparatus and tail (d). Female: rectal region and tail (c). Bar scales: 25 μm (a, c) and 10 μm (b, d).

Dorylaimopsis coomansi, *Dorylaimopsis gerardi*, *Dorylaimopsis variabilis* from the India Ocean (Muthumbi et al., 1997), *D. papilla* sp. nov. is close to *D. coomansi* in amphid turns, however, R3 is 22%–24% in *D. papilla* sp. nov. while 67%–81% in *D. coomansi*. *Dorylaimopsis papilla* sp. nov. has punctuated cuticle with lateral differentiation of four or more regularly longitudinal rows on the pharyngeal and the tail region (including spicules level) while irregularly arranged punctuations in *D. coomansi*.

The latest record about this genus is described from New Zea-

land, southwest Pacific Ocean (350 m water depth) (Leduc, 2012). *Dorylaimopsis papilla* sp. nov. resembles *Dorylaimopsis nodderi* Leduc, 2012 in amphideal fovea, but can be distinguished from it by the absence of ventral projection at distal end of spicules. A total of 16–18 small papillate pre-cloacal supplements in *D. papilla* sp. nov., while 12–16 tubular pre-cloacal supplements in *D. nodderi*. Lateral differentiation consists of four or more longitudinal rows of larger dots in pharyngeal and caudal regions in *D. papilla* sp. nov. while three rows in *D. nodderi*.

Table 3. Measurements of *Dorylaimopsis papilla* sp. nov. (in μm)

Characters	♂1	♂2	♂3	♀1
Body length	2 019	2 252	2 392	2 008
<i>a</i>	21	22	21	22
<i>b</i>	9	8	10	8
<i>c</i>	9	8	11	9
h. d.	16	17	17	16
Length of cephalic setae	3.8	4.0	3.7	4.2
Amphid diameter	11	10	10	9
Amphid distance from a. b. e.	8	7	8	8
A%	55%	47%	48%	50%
Excretory pore distance from a. b. e.	134	140	144	133
Buccal cavity depth	18	18	21	21
Pharyngeal length	235	268	247	249
Pharyngeal end c. b. d.	91	93	90	79
Maximum body diameter	98	101	116	92
<i>V</i>	–	–	–	950
<i>V</i> %	–	–	–	47%
Spicule length as arc	101	104	107	–
Spicule length as chord	83	86	82	–
Gubernacular apophyses length	37	40	37	–
Lateral differentiation at mid body	8.8%	10.2%	9.9%	10.0%
a. b. d.	69	58	59	55
Tail length	216	216	211	226
<i>c'</i>	3.1	3.7	3.6	4.1

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