ZOOLOGICAL SCIENCE **22**: 599–608 (2005)

A New Marine Nematode Species of the Genus *Dinetia* (Nematoda: Draconematidae) from South Korea

Hyun Soo Rho and Won Kim*

School of Biological Sciences, Seoul National University, Seoul 151-747, South Korea

ABSTRACT—A new draconematid nematode species of the genus *Dinetia* Decraemer and Gourbault, 1997 is described from the subtidal sediments and small logs from the eastern coast of South Korea. *Dinetia orientalis* n. sp. mainly differs from *D. nycterobia* Decraemer and Gourbault, 1997 by the following characters: large number of cephalic adhesion tubes (38–42 in male and 37–40 in female), number of posterior sublateral adhesion tubes (9–11 in male and 13–14 in female) and posterior subventral adhesion tubes (17–22 in male and 19–24 in female), the buccal cavity (narrow and armed with a dorsal and two weak ventrosublateral teeth), spicules (strongly arcuated and with a pair of strongly dilated gubernaculums around distal part of spicules), and higher "c" value (8.3–10.4 in male and 8.5–10.7 in female). This is the first report on free-living marine nematodes from South Korea, and the first record of the genus *Dinetia* in the Northwest Pacific.

Key words: taxonomy, Nematoda, Draconematidae, *Dinetia*, South Korea

INTRODUCTION

The draconematid nematofauna of the Northwest Pacific is poorly known. About eighty years ago, Steiner (1921) described the first draconematid species from this region as *Chaetosoma cephalatum* (Cobb, 1913) from the Yellow Sea; he considered it to be a senior synonym of *Draconema cephalatum* Cobb, 1913. Long after Steiner, Kito (1976) described the second species, *D. japonicum* Kito, 1976 which was collected by washing sea weeds of a *Sargasuum* community from Oshoro on the Japan Sea coast in Hokkaido. In addition, Allen and Noffsinger (1978) described and redescribed the following five species in the Northwest Pacific: *D. cephalatum* Cobb, 1913 from base of algae with sand from Japan and the Philippines, *Paradraconema floridense* Allen and Noffsinger, 1978 from a calcareous alga, *Halimeda* sp. from Japan, *P. singaporense* Allen and Noffsinger, 1978 from a alga, *Gracillaria* sp. and other one from Singapore, *Dracograllus filipjevi* Allen and Noffsinger, 1978 from holdfasts of kelp from Japan, and *D. gerlachi* Allen and Noffsinger, 1978 from brown algae growing on rocks from Japan. Recently, Kito (1983) described two new deep-sea draconematid species, *Cephalochaetosoma pacificum* Kito, 1983 and *Bathychaetosoma uchidai* (Kito, 1983), which were collected from 5507 to 5587 m deep among the fibrous coat of a broken coconut, off Mindanao Island, the Philippines. So far, Draconematidae are unknown from South Korea.

The genus *Dinetia* (family Draconematidae Filipjev, 1918) was established by Decraemer and Gourbault (1997) on the basis of a single species, *D. nycterobia* Decraemer and Gourbault, 1997, collected from 2600 m deep at a hydrothermal site of the East Pacific Rise. The monotypic genus *Dinetia* is differentiated from all other genera of the Prochaetosomatinae Allen and Noffsinger, 1978 by the absence of a cephalic helmet and the presence of a narrow and unarmed buccal cavity.

Present paper describes a new species of the genus *Dinetia* collected from subtidal sediments and small logs on the eastern coast of South Korea. This is the first discovery of the *Dinetia* outside the type locality, and the first taxonomic report on free-living marine nematodes from South Korea.

MATERIALS AND METHODS

The nematodes were obtained from the washings of subtidal sediments and small logs, which were collected from 250 to 300 m deep using a fishing net at Jangho and Guryongpo on the eastern coast of South Korea (Fig. 1). Samples were filtered through a sieve with 67 μm mesh in the field after freshwater rinsing for less than a minute for osmotic shock (Kristensen, 1989), and then fixed in 4% buffered formalin in sea water. Specimens were mounted in anhydrous glycerin between two coverslips on H-S slides (Shirayama *et al.*, 1993), and measured and photographed using a differential interference contrast (DIC) microscope (Olympus BX-60). All drawings were made with the aid of a camera lucida. Several specimens

* Corresponding author. Phone: +82-2-880-6695;
Fax : +82-2-872-1993;
E-mail: wonkim@plaza.snu.ac.kr

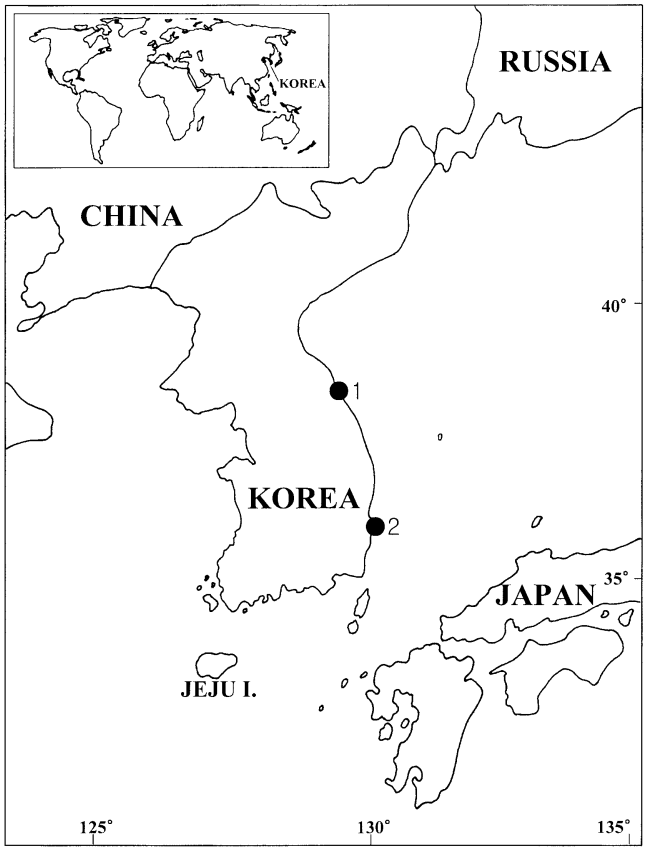

Fig. 1. A map showing the localities. 1. Jangho, 2. Guryongpo.

were examined using a scanning electron microscope (SEM, HITACHI S-520). Six males, seven females, and three juveniles were prefixed overnight at 4°C in a 2.5% phosphate buffered glutaraldehyde, followed by post fixation at 4°C with 1% phosphate buffered osmium tetraoxide. After dehydration through a graded series of ethanol (50%–100%, 10% intervals) for 30 min each, the materials were critical point dried and coated with gold-palladium in a high vacuum evaporator.

Terminology mostly follows Decraemer (1989). Abbreviations used in the text are as follows: abd=anal body diameter; CAT=cephalic adhesion tubes; gub=length of gubernaculum; L=body length; mbd Ph=maximum body diameter in pharyngeal region; (mbd)=minimum body diameter; mbd=maximum body diameter at mid body level; PAT=posterior adhesion tubes; ph=length of pharynx; spic=length of spicule measured along the median line; SlATl=length of sublateral adhesion tubes; SlATn=number of sublateral adhesion tubes; SvATl=length of subventral adhesion tubes; SvATn=number of subventral adhesion tubes; t=tail length; tmr=length of non-striated tail end; V=position of the vulva as a percentage of the total body length from anterior; a, b, c=proportions of de Man. All measurements are in μm; mean value in parentheses.

TAXONOMY

Family Draconematidae Filipjev, 1918

Subfamily Prochaetosomatinae Allen and Noffsinger, 1978

Genus *Dinetia* Decraemer and Gourbault, 1997

Diagnosis (emended): Prochaetosomatinae. Body cuticle with transverse striae surrounding spiral amphids, ornamented with scattered minute spines and lateral differentiation in narrow body region. Cuticle not thickened in head region, no cephalic helmet. Buccal cavity narrow, unarmed or armed with a small dorsal and two weak ventrosublateral teeth. Pharynx with terminal bulb provided with tripartite, thick, cuticularized lumen wall. Cephalic adhesion tubes without expanded base located in cervical region; posterior adhesion tubes with bell-shaped end.

Dinetia orientalis n. sp.

(Figs. 2–6)

Material examined: Holotype and four paratypes (one male, one female and two juveniles) are deposited in the nematode collection of the Royal Belgian Institute of Natural Sciences, Brussels, Belgium (RIT690-RIT694). Another thirty paratypes (eleven males, twelve females and seven juveniles) are kept in the author's collection at the specimen room of the School of Biological Sciences, Seoul National University (SNU400-SNU429).

Additional material examined: 10 individuals, four males, three females and three juveniles, from Guryongpo, Pohang.

Type locality and habitat: Jangho, Samchuk (37°16'44"N, 129°19'18"E), collected on 23 Nov 2002 by H. S. Rho and J. W. Choi. The nematodes were obtained from the washings of subtidal sediments and small logs collected from 250 to 300 m deep.

Other locality and habitat: Guryongpo, Pohang (35°59'37"N, 129°34'03"E), collected on 25 Aug 1998 by H. S. Rho. The nematodes were obtained from the washings of subtidal sediments and small logs collected from 250 to 300 m deep.

Diagnosis: Body cuticle with fine transverse striae not reaching to lip region, ornamented with minute scattered spines; at level of narrow body region, cuticle showing lateral differentiation. Dorsal somatic setae slender. Cephalic helmet absent, unispiral amphids surrounded by transverse striae of body cuticle. Buccal cavity narrow, armed with a small dorsal and two weak ventrosublateral teeth; pharynx with terminal bulb provided with tripartite, thick, cuticularized lumen wall. Adhesion tubes: cephalic adhesion tubes (38–42 in male and 37–40 in female) and posterior adhesion tubes (sublateral rows with 9-11 adhesion tubes in male and 13–14 adhesion tubes in female, and subventral rows with 17–22 adhesion tubes in male and 19-24 adhesion tubes in female); large spicules (45–55 μm) strongly arcuated with round knob-like capitulum and velum; a pair of gubernaculum strongly dilated around distal part of spicules. Tail cylindro-conical, short (ratio c: 8.3–10.4 in male and 8.5–10.7 in female).

Measurements:

Holotype male.

L=500, mbd=51, (mbd)=17, mbd Ph=36, ph=86, abd=22, t=58, tmr=18, spic=51, gub=13, CAT=42, SlATl=30, SlATn=9, SvATl=26, SvATn=21, a=9.8, b=5.8, c=8.6, c´=2.6.

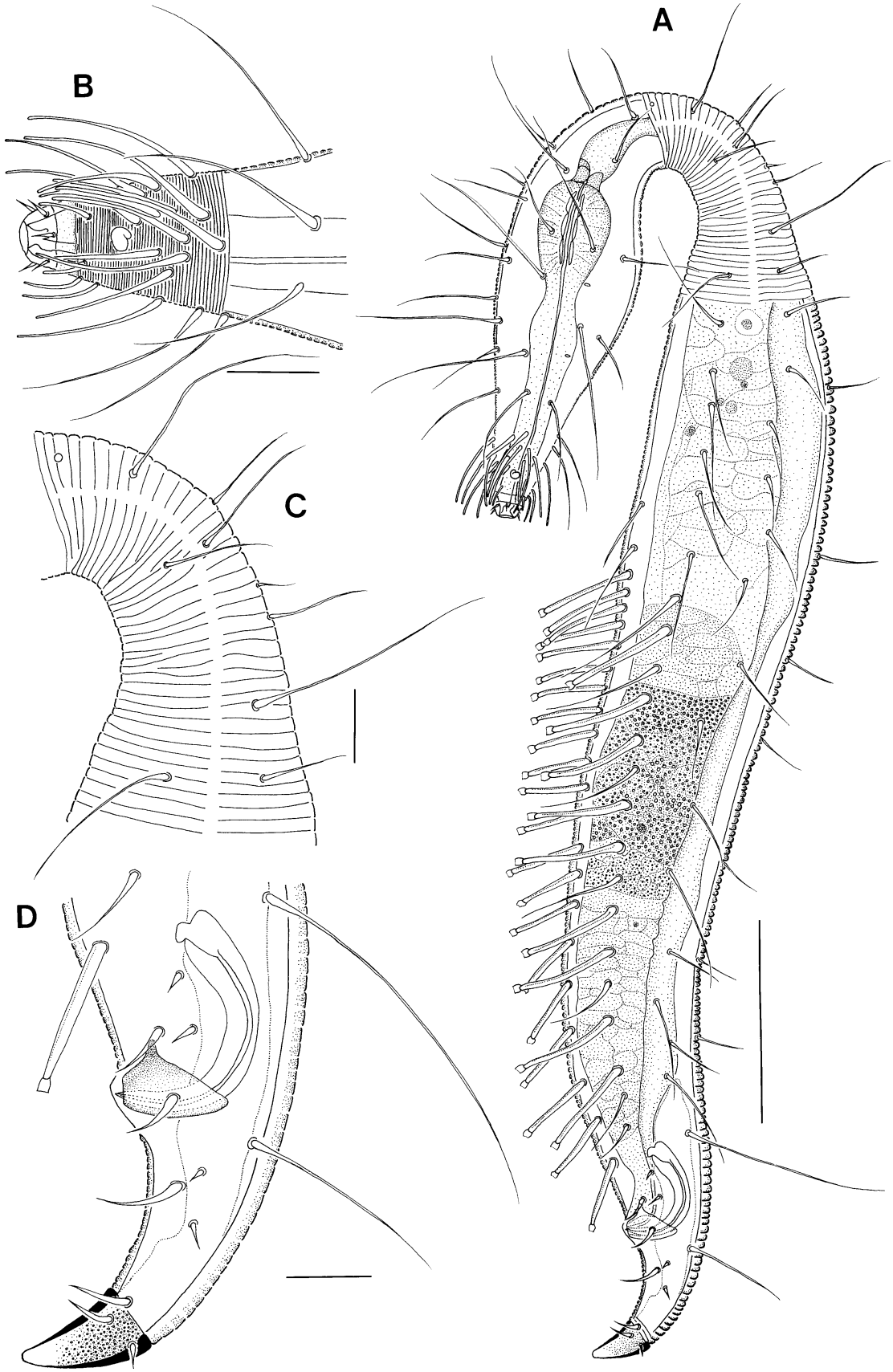

Fig. 2. *Dinetia orientalis* n. sp., male (holotype). A, habitus, lateral view; B, head region, some CAT not drawn, lateral view; C, lateral differentiation of the narrow body region; D, copulatory apparatus and tail region, lateral view. Scale bars: A=50 μm; B–D=10 μm.

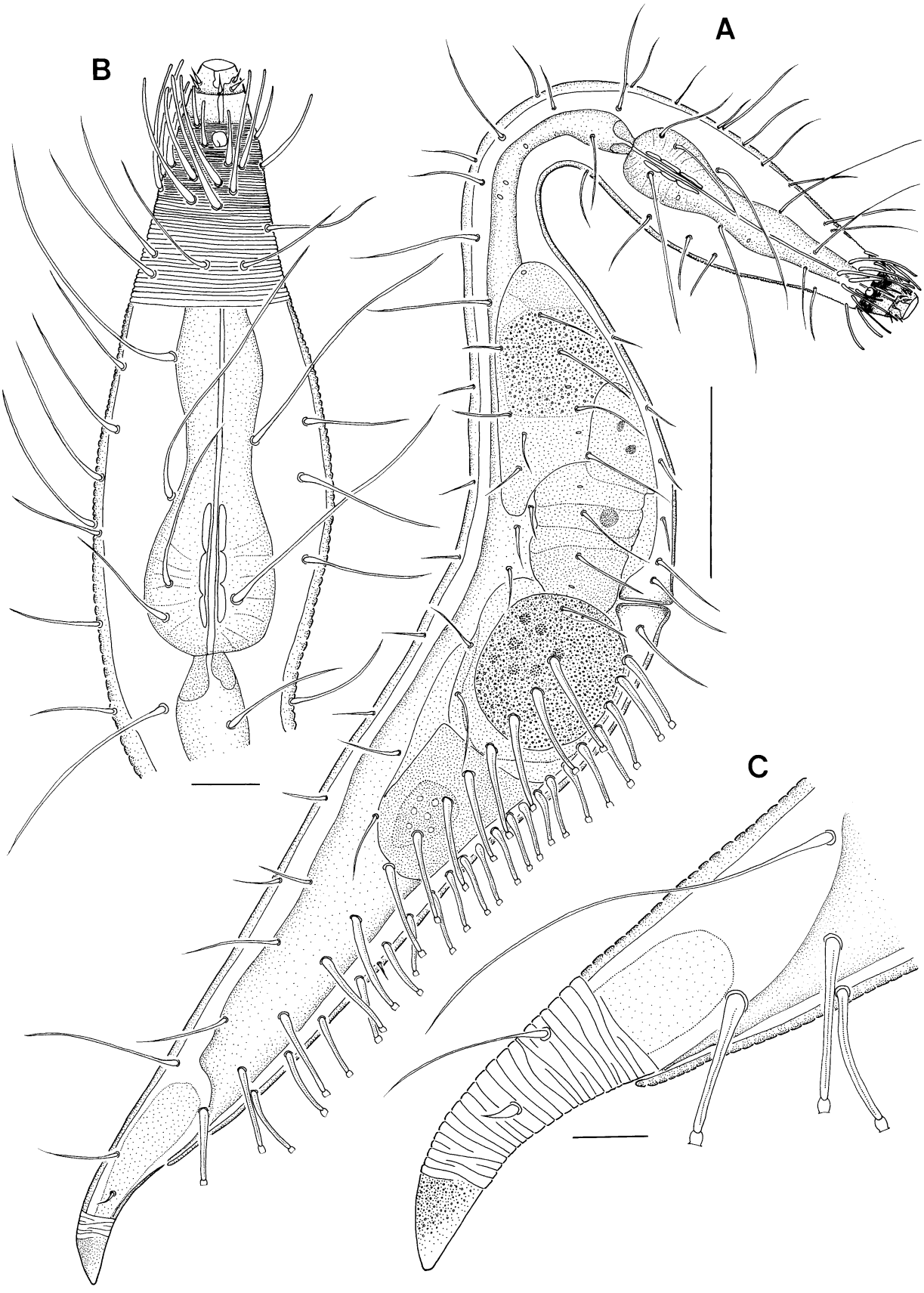

Fig. 3. *Dinetia orientalis* n. sp., female (paratype). A, habitus, lateral view; B, anterior body region, lateral view; C, tail region, lateral view. Scale bars: A=50 μm; B, C=10 μm.

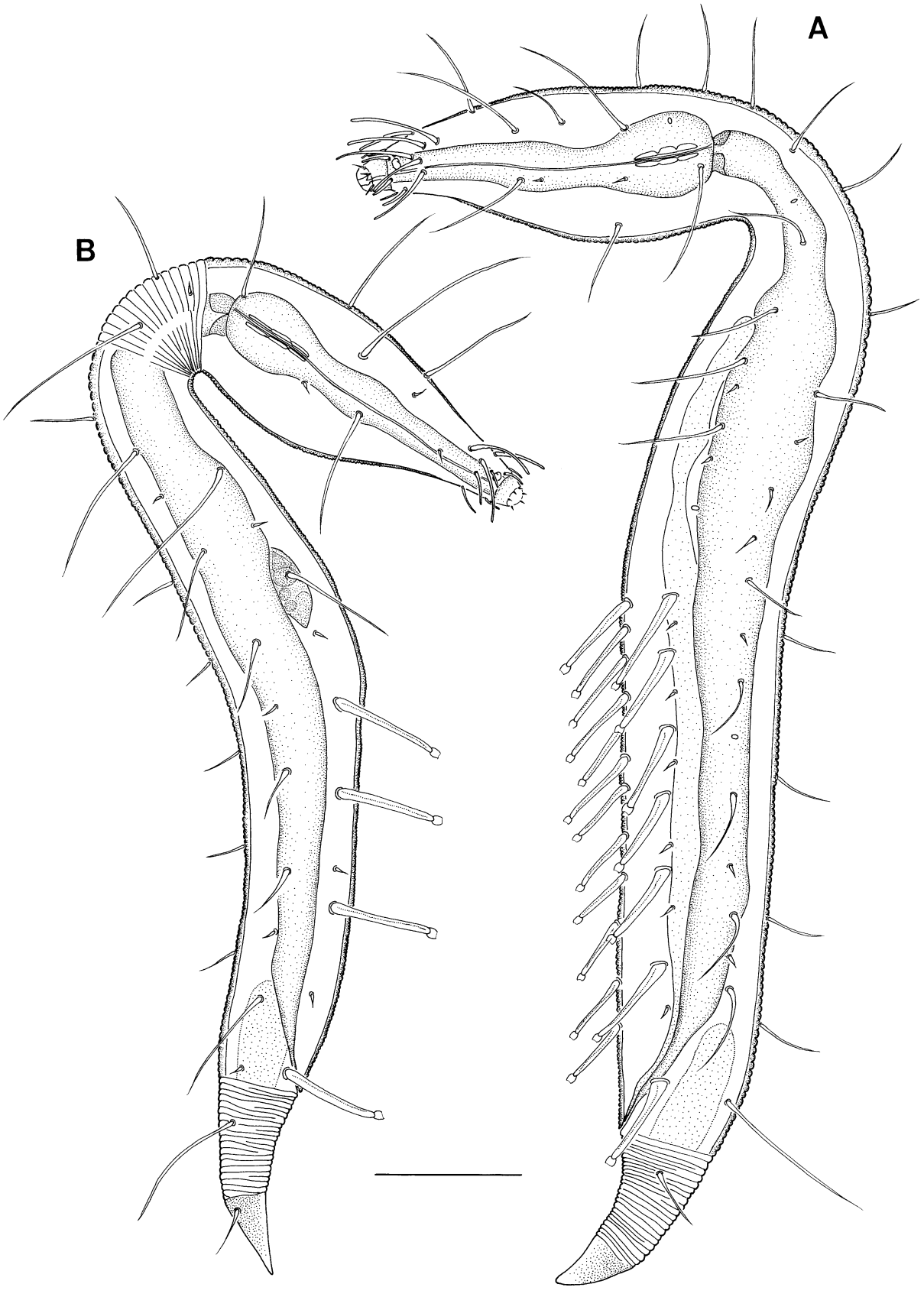

Fig. 4. *Dinetia orientalis* n. sp., juveniles (paratypes). A, habitus, fourth stage juvenile male (lateral view); B, habitus, second stage juvenile (lateral view). Scale bar=30 μm.

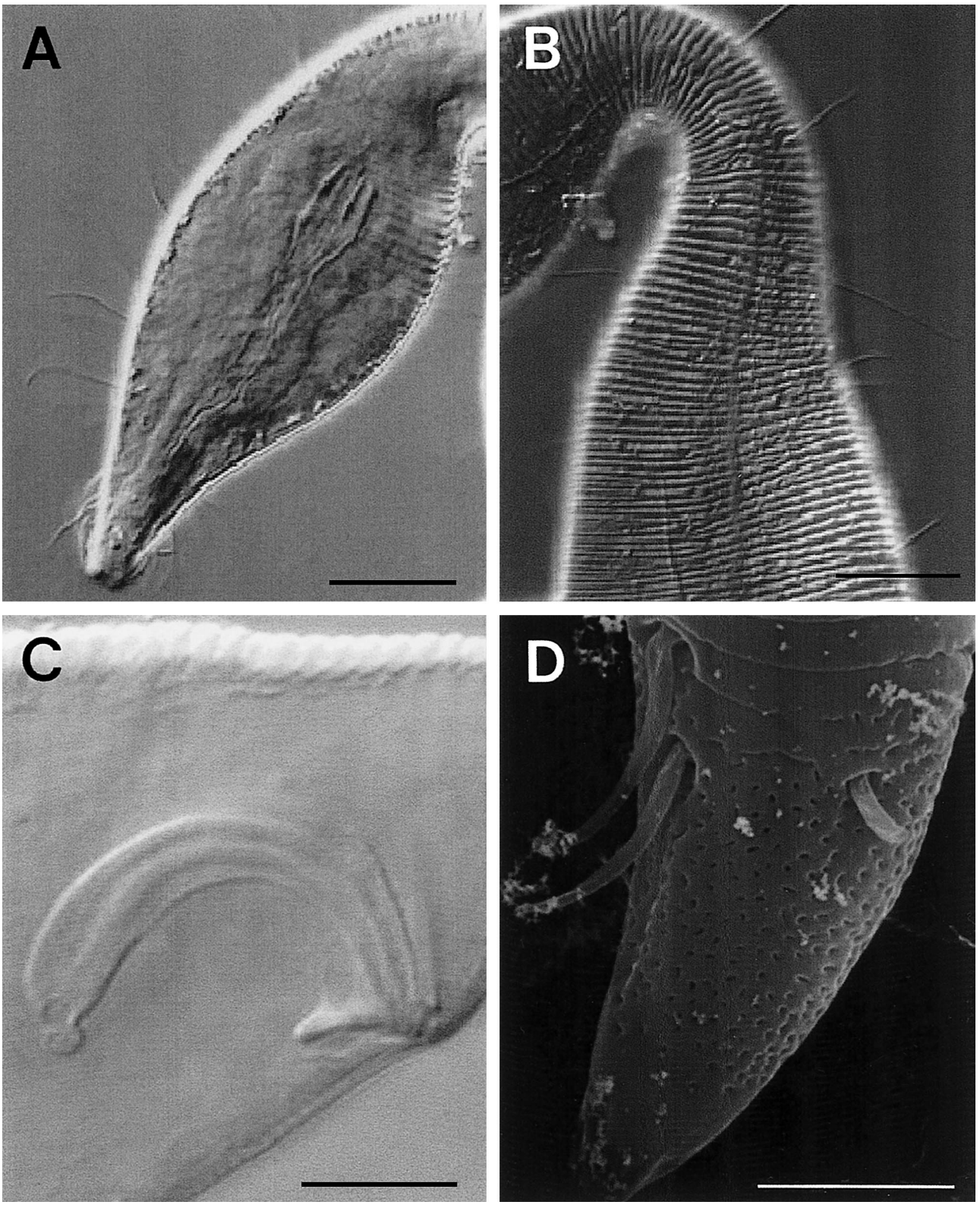

Fig. 5. *Dinetia orientalis* n. sp., male (paratype). A, pharyngeal region, lateral view; B, lateral differentiation of the narrow body region, lateral view; C, spicule and gubernaculum, lateral view; D, non-striated tail end, lateral view. A–C, DIC micrographs; D, SEM micrograph. Scale bars: A, B=20 μm; C=10 μm; D=5 μm.

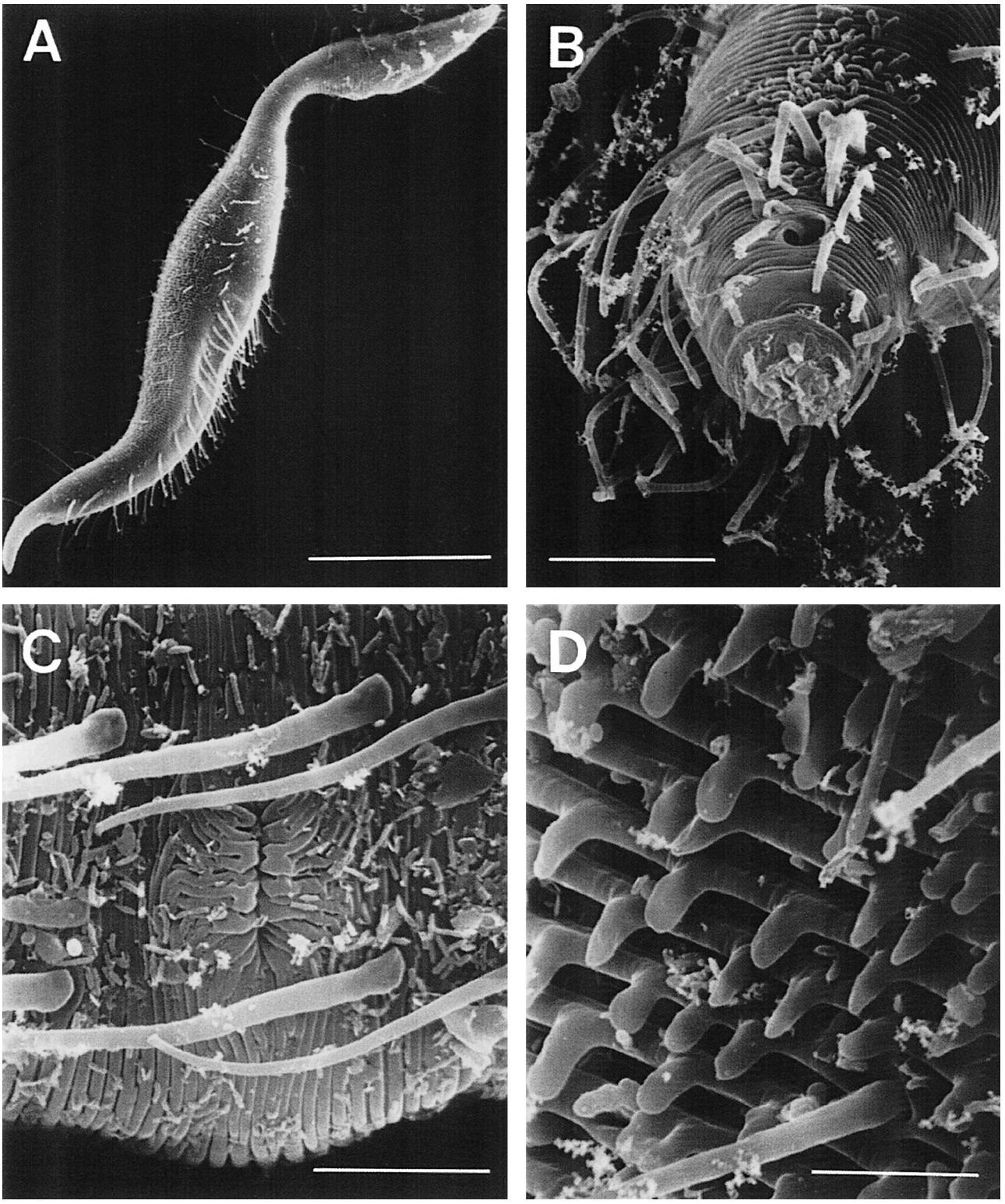

Fig. 6. *Dinetia orientalis* n. sp., female (paratype). A, habitus, lateral view; B, cephalic adhesion tubes and unispiral amphid, oblique enface view; C, vulva and paravulval setae, ventral view; D, detail of cuticle of the narrow body region with scattered minute spines, lateral view. SEM micrographs. Scale bars: A=100 μm; B=10 μm; C, D=5 μm.

Paratype males (n=9).

L=430–570 (488), mbd=41–57, (mbd)=18–21, mbd Ph=32–45, ph=82–94, abd=19–24, t=47-54, tmr=17–19, spic=45–55, gub=10–18, CAT=38–42, SlATl=27–29, SlATn=10–11, SvATl=22–28, SvATn=17–22, a=8.5–11.8, b=4.9–6.1, c=8.3–10.4, c´=2.1–2.6.

Paratype females (n=10).
L=450–520 (490), mbd=46–64, (mbd)=18–21, mbd Ph=33–45, ph=83–92, abd=16–19, t=44–61, tmr=17–21, CAT=37–40, SlATl=26–31, SlATn=13–14, SvATl=21–26, SvATn=19–24, a=7.4–9.4, b=5.2–6, c=8.5–10.7, c´=2.6–3.4, V=51.9–56.6.

Paratype juveniles.

Fourth stage juveniles (n=3).
L=385–420 (430), mbd=38–43, (mbd)=21–23, mbd Ph=34–40, ph=76–94, abd=19–22, t=47–52, tmr=17–19, CAT=20, SlATl=24–27, SlATn=7, SvATl=20–24, SvATn=11–12, a=10.1–11.3, b=5.1–5.5, c=7.5–9.3, c´=2.1–2.7.

Second stage juveniles (n=3).
L=290–350 (330), mbd=28–32, (mbd)=20–21, mbd Ph=30–33, ph=59–75, abd=17–18, t=42–47, tmr=17–20, CAT=14, SlATl=18–25, SlATn=4, a=10.2–12.4, b=4.6–5, c=6.9–7.9, c´=2.5–2.6.

Description:

Male (holotype): Body small, stout and sigmoid to epsilonematid, clearly tapered at both ends. Pharyngeal region 7.2% of total body length and swollen; mid-body basically cylindrical (Fig. 2A). Body cuticle with fine transverse striae, especially in anterior body region, and ornamented with scattered minute spines posterior to first curvature; lateral body cuticle differentiated in narrow body region (Figs. 2C, 5B), as in *D. nycterobia* (the present observation based on the paratype BN282). Head smooth, cuticle not thickened, no cephalic helmet (Fig. 2B). Somatic setae arranged in 8 longitudinal rows (2 subdorsal, 4 sublateral, and 2 subventral) in pharyngeal region, 2 predominant length (41 and 24 μm); longest somatic seta (51 μm) subdorsally just anterior to tail; dorsal somatic setae slender. Six short labial sensilla 2.5 μm long. Four cephalic setae (6 μm) located just in front of posterior head border. Amphideal fovea small (2.0–2.5 μm), unispiral, and shortly posterior to non-striated head region. Forty-two CAT without expanded base and with distal tip rounded, more or less arranged on 6 longitudinal rows on each side: 1 dorsal row (4 tubes), 1 laterodorsal (4), 2 lateral (6), 1 subventral (3), and 1 ventral (4). PAT with developed bell-shaped tip, all located anterior to anus and arranged on 4 longitudinal rows: 2 sublateral rows each consisting of 9 (left side) and 10 (right side) adhesion tubes, and 2 subventral rows each consisting of 21 (left side) and 17 (right side) tubes; sublateral rows each intermingling with 5 somatic setae. Buccal cavity narrow, armed with a small dorsal tooth and 2 weak ventrosublateral teeth; pharynx mostly cylindrical with slight mid-swelling and terminal bulb with tripartite, thick, cuticularized lumen wall (Figs. 2A, 5A). Intestine dorsal to reproductive system.

Male reproductive system typical of Draconematidae. Single testis outstretched, reaching first body curvature. Spicules short, strongly arcuated, with round knob-like capitulum and velum. Gubernaculum strongly dilated around distal part of spicules (Figs. 2D, 5C). Two pairs of cloacal setae present.

Tail with numerous fine transverse striae, tapering gradually; non-striated tail end finely vacuolated with 2 subventral and 1 subdorsal setae (Fig. 5D). Caudal glands extending anteriorly to cloacal opening.

Female: Similar to male in most respect (Figs. 3A, 6A). Body cuticle with fine transverse striae, ornamented with scattered minute spines posterior to first curvature (Fig. 6D). Greatest body width at level of vulva. Amphideal fovea unispiral (2 μm) with almost rounded outline (Figs. 3B, 6B). Forty CAT without expanded base and with distal tip rounded, more or less arranged on 6 longitudinal rows on each side: 1 dorsal row (4 tubes), 1 laterodorsal (5), 2 lateral (6), 1 subventral (1), and 1 ventral (4). PAT arranged in 4 longitudinal rows as in male: 13 sublateral and 21 subventral adhesion tubes. Alimentary system as in male (Fig. 3A).

Ovaries paired, opposed and reflexed. Vagina short, bipartite with sclerotized distal part; vulva near mid-body, not encircled by any projections, paravulval setae present (Fig. 6C). Anal flap present. Tail cylindro-conical, short, 1 pair of longest somatic setae (45 μm) on subdorsal side anterior to anus, and another pair of long setae (19 μm) subdorsally posterior to anus. Non-striated tail end without setae (Fig. 3C).

Juveniles (paratypes): First and third stage juveniles not found.

Fourth stage juvenile male: Habitus similar to adult (Fig. 4A). Body cuticle finely striated, scattered spines obvious. Amphids unispiral. Six short labial setae 2.5 μm long. Four cephalic setae located just in front of posterior head border. Twenty CAT without expanded base and with distal tip rounded, more or less arranged on 5 longitudinal rows on each side: 1 dorsal row (2 tubes), 1 laterodorsal (3), 1 lateral (2), 1 subventral (1), and 1 ventral (2). PAT arranged in 3 longitudinal rows anterior to anal opening: sublateral pair with 7 adhesion tubes with bell-shaped end and ventral row with 12 tubes. No intermingled somatic setae. Reproductive system largely formed, 169 μm long. Tail with 23 transverse striae at lateral line.

Second stage juvenile: Habitus similar to adult (Fig. 4B). Amphids unispiral. Scattered cuticular spines less obvious than in fourth stage juvenile male. Six short labial setae situated along anterior margin of head region. Fourteen CAT without expanded base and with distal tip rounded, more or less arranged on 5 longitudinal rows on each side: 1 dorsal row (2 tubes), 1 laterodorsal (1), 1 lateral (2), 1 subventral (1), and 1 ventral (1). PAT arranged in 2 sublateral rows anterior to anus, each row with 4 tubes. No intermingled somatic setae. Reproductive system with genital primordium, 18 μm long. Tail with 23 transverse striae. Non-striated tail end with 1 pair of subdorsal setae.

Etymology: The specific name *orientalis* alludes to the type locality of the new species.

DISCUSSION

Until now, only one species, *D. nycterobia* Decraemer and Gourbault, 1997, has been recorded in the genus *Dine-*

tia. The new species, *D. orientalis* n. sp., appears very close to *D. nycterobia* in sharing the following six characteristics: (1) absence of a cephalic helmet, (2) pharynx with terminal bulb provided with a thick cuticularized lumen wall, (3) body striation surrounding the spiral amphids and differentiated in the narrow body region, (4) narrow buccal cavity, (5) cephalic adhesion tubes without expanded base located in cervical region, and (6) posterior adhesion tubes with bell-shaped end (cf. Decraemer and Gourbault, 1997). As shown in Table 1, however, it differs from *D. nycterobia* in the body cuticle with transverse striae not reaching to the lip region vs striation reaching to the lip region in *D. nycterobia*, larger number of CAT (38–42 in male and 37–40 in female vs 19 in male and 15 in female), buccal cavity armed with a dorsal and two weak ventrosublateral teeth vs unarmed buccal cavity, larger number of PAT (9–11 sublateral and 17–22 subventral PAT in male, and 13–14 and 19–24 in female vs 4–5 sublateral and 14–19 subventral PAT in male, and 10–15 and 13–20 in female), higher "ratio c" value (8.3–10.4 in male and 8.5–10.7 in female vs 5.7–8.4 in male and 6.5–7.5 in female), and lower "ratio c´" value (2.1–2.6 in male and 2.6–3.4 in female vs 3.2–3.5 in male and 4.3–4.8 in female). *Dinetia orientalis* n. sp. has also strongly arcuated spicules (45–55 μm) and a pair of strongly dilated gubernaculum around distal part of spicules, while *D. nycterobia* has slightly curved spicules (31–37 μm) and paired plate-like gubernaculum. Moreover, the present new species, which was collected at a depth of 250 to 300 m from the eastern coast of South Korea, has slender dorsal somatic setae, while *D. nycterobia*, collected at a depth of 2600 m from a hydrothermal site of the East Pacific Rise, has stout dorsal somatic setae (the present observation based on the paratype BN282). The discovery of *Dinetia orientalis* n. sp. in subtidal benthic sediments and small logs on the eastern coast of South Korea expands the range of known habitats for the genus *Dinetia*, that is, from deep-sea to subtidal zone.

To unravel the phylogenetic relationships among the genera of the family Draconematidae, Decraemer *et al.* (1997) attempted the phylogenetic analysis for the fourteen genera of the family Draconematidae based on thirteen synapomorphic morphological characters. The results showed that the Draconematidae was divided into two monophyletic groups and six genera of the Prochaetosomatinae with unresolved position. The deep-sea genera, *Bathychaetosoma* Decraemer *et al*, 1997, *Cephalochaetosoma* Kito, 1983, and *Dinetia* Decraemer and Gourbault, 1997, and the genus *Prochaetosoma* Micoletzky, 1922 formed a monophyletic group. However, no resolution was proposed for the phylogenetic relationships of the four genera within this clade. According to the data in Decraemer *et al*. (1997), *Dinetia* appears to be most closely related to the other deep-sea genera, *Bathychaetosoma* and *Cephalochaetosoma*. The close relationship among these three genera is indicated by the following combination of shared character states: (1) the general body shape: slightly enlarged at the level of pharynx, (2) the body cuticle: thin, (3) the shape of cephalic adhesion tubes: a non-differentiated base and fine tip (modified type), (4) the number of cephalic adhesion tubes: more than thirteen, (5) the position of cephalic adhesion tubes: posterior to head region or helmet, extending up to more than one head diameter along the cervical region, (6) the shape of posterior adhesion tube: with bell-shaped tip, (7) the shape of amphideal fovea in male and female: spiral or loop-shaped, (8) the shape of pharynx: largely cylindrical with well-developed terminal bulb, (9) the lumen wall of terminal bulb in pharynx: moderately thicken, and (10) the number of "annules" (=transverse striae) on tail: more than ten to numerous. However, the *Dinetia* is easily differentiated from the *Bathychaetosoma* and *Cephalochaetosoma* on the basis of the structure of the head region (*Dinetia* without helmet vs helmet present in the other genera).

Table 1. Character comparisons of *Dinetia orientalis* n. sp. and *D. nycterobia*.

Characters	*D. orientalis* n. sp.	*D. nycterobia*
CAT	38–42 in male & 37–40 in female	19 in male & 15 in female
Transverse striae	Not reaching to the lip region	Reaching to the lip region
Buccal cavity	Armed with a small dorsal and two weak ventrolateral teeth	Unarmed
Dorsal somatic setae	Slender	Stout
SlATn	9–11 in male & 13–14 in female	4–5 in male & 10–15 in female
SvATn	17–22 in male & 19–24 in female	14–19 in male & 13–20 in female
Spicule	Strongly arcuated	Slightly curved
Spicule length	Long (45–55 μm)	Short (31–37 μm)
Gubernaculum	Strongly dilated	Plate-like
Ratio c	8.3–10.4 in male & 8.5–10.7 in female	5.7–8.4 in male & 6.5–7.5 in female
Ratio c´	2.1–2.6 in male & 2.6–3.4 in female	3.2–3.5 in male & 4.3–4.8 in female
Habitat	Subtidal sediments and small logs	Soft sediments of hydrothermal vents
Locality	Korea (Jangho & Guryongpo)	Hydrothermal site of the East Pacific Rise

ACKNOWLEDGMENTS

The authors thank Wilfrida Decraemer for her critical review of the manuscript. The authors also thank Wilfrida Decraemer and Kenji Kito for providing paratype specimens. We appreciate the anonymous reviewers for their helpful comments that greatly improved the manuscript. The authors are grateful to J. R. Lee, J. W. Choi and S. J. Huh for their assistance in collecting samples. This work was supported by the Korea Research Foundation Grant (KRF-2002-070-C00080).

REFERENCES

Allen MW, Noffsinger EM (1978) A revision of the marine nematodes of the superfamily Draconematoidea Filipjev, 1918 (Nematoda: Draconematina). Univ Calif Publs Zool 109: 1–133

Decraemer W (1989) Three new draconematid species from Papua New Guinea. Bull Inst r Sci nat Belg (Biologie) 59: 5–24

Decraemer W, Gourbault N (1997) Deep-sea nematodes (Nemata, Prochaetosomatinae): new taxa from hydrothermal vents and a polymetallic nodule formation of the Pacific (East Rise; North Fiji and Lau Basins; Clarion-Clipperton fracture zone). Zool Scr 26: 1–12

Decraemer W, Gourbault N, Backeljau T (1997) Marine nematodes of the family Draconematidae (Nemata): a synthesis with phylogenetic relationships. Hydrobiologia 357: 185–202

Kito K (1976) Studies on the free-living marine nematodes from Hokkaido, I. J Fac Sci Hokkaido Univ Ser VI Zool 20: 568–578

Kito K (1983) Deep-sea nematodes off Mindanao Island, the Philippines 1. Draconematidae. Annot Zool Japon 56: 27–41

Kristensen RM (1989) Marine Tardigrada from the southeastern United States coastal waters I. *Paradoxipus orzeliscoides* n. gen., n. sp. (Arthrotardigrada: Halechiniscidae). Trans Am Microsc Soc 108: 262–282

Shirayama Y, Kaku T, Higgins RP (1993) Double-slided microscopic observation of meiofauna using an HS-slide. Benth Res 44: 41–44

Steiner G (1921) Ostasiatische marine nematoden. Zool Jahrb Abt Syst Oekol Geogr Tiere 44: 195–226

(Received December 16, 2004 / Accepted March 17, 2005)