

***Paradraconema jejuense*, a New Species of  
Genus *Paradraconema* (Nematoda: Draconematidae)  
from Korea**

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**ABSTRACT**

A new species of draconematid nematode, *Paradraconema jejuense* n. sp., is described from the shallow sublittoral coarse sediments of Jeju Island, Korea. *Paradraconema jejuense* n. sp. is most similar to *P. antarcticum* Allen and Noffsinger, 1978 in having similar habitus (long slender body) and amphideal fovea (doubled elongate spiral in male and circular spiral in female), but is distinguished by the following characteristics: larger number of posterior sublateral adhesion tubes (10 in male and 11-12 in female) and subventral adhesion tubes (16 in male and 17-18 in female), fewer cephalic acathiform setae on rostrum (a pair of small cephalic acathiform setae in both sexes), the absence of eye-spots, and the presence of a differentiated lateral field in mid-body region. This is the first taxonomic report on *Paradraconema* species from Korea.

Key words: Nematoda, Draconematidae, *Paradraconema*, taxonomy, Korea

**INTRODUCTION**

The subfamily Draconematinae Filipjev, 1918 includes four genera (*Draconema* Cobb, 1913, *Dracograllus* Allen and Noffsinger, 1978, *Paradraconema* Allen and Noffsinger, 1978, and *Tenuidraconema* Decraemer, 1989) with 42 species (Decraemer, 1989; Decraemer et al., 1997;

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Rho and Kim, 2004a), and occurs from the various habitats, from the pole to the equator and from the exposed intertidal sands to subtidal sediments. They are also quite common in algal habitats (Allen and Noffsinger, 1978; Decraemer et al., 1997).

In Korea, only two draconematid nematodes have so far been reported. Rho and Kim (2004a) described the first draconematid species, *Tenuidraconema koreensis* Rho and Kim, 2004, which was collected from the washings of subtidal coarse sediments and various invertebrates (hermit crabs, sponges and bryozoans) from Namae in the eastern coast of Korea. Thereafter, Rho and Kim (2004b) also reported the second species, *Draconema japonicum* Kito, 1976, which was obtained from the washings of intertidal and subtidal sediments and various algae from the eastern, southern, and western coasts of Korea.

During a biodiversity survey on the free-living marine draconematid nematodes in Korea, a new draconematid species was collected from the washings of the shallow sublittoral coarse sediments of Jeju Island in Korea. The taxonomic study based on morphological characters using differential interference contrast microscope showed that this draconematid species is a new species of the genus *Paradraconema*.

Until now, only two *Paradraconema* species, *P. floridense* and *P. singaporense*, have been recorded in the Northwest Pacific (Allen and Noffsinger, 1978), but entirely unknown from Korea. In this report, we describe a new draconematid species, *P. jejuense* n. sp., with illustrations and differential interference contrast photomicrographs.

## MATERIALS AND METHODS

The nematodes were obtained from the washings of shallow sublittoral coarse sediments, which were collected from 25 to 35 m deep by SCUBA diving at the southern coast of Korea (Fig. 1). Samples were filtered through a sieve with 67  $\mu\text{m}$  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) equipped with Nomarski optics. All drawings were made with the aid of a camera lucida.

Terminology mostly follows Decraemer (1989). All measurements are in  $\mu\text{m}$ .

## SYSTEMATIC ACCOUNTS

Family Draconematidae Filipjev, 1918

Subfamily Draconematinae Filipjev, 1918

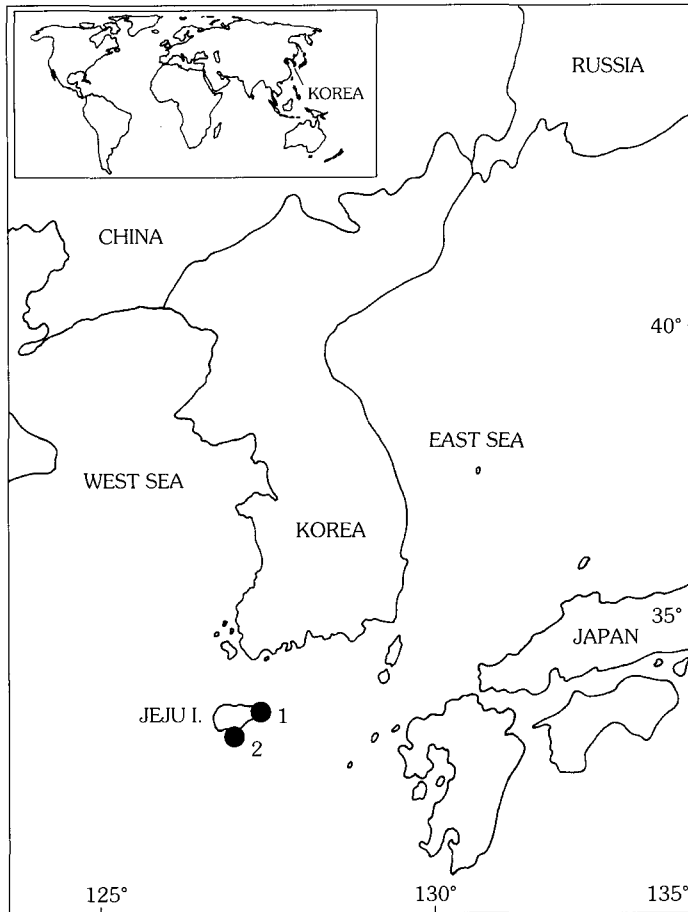
Genus \**Paradraconema* Allen and Noffsinger, 1978

\*\**Paradraconema jejuense* n. sp. (Figs. 2-5)

**Material examined.** Holotype, 1♂, Seongsanpo, Jeju Island (33° 27' 40" N, 126° 56' 33" E), 9

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**Fig. 1.** A map showing the localities. 1. Seongsanpo, 2. Munseom.

June 2002, shallow sublittoral coarse sediments from 25 to 35 m deep. Nine paratypes, 3♂♂, 6♀♀, collected with Holotype. Holotype and one paratype (1♀) will be deposited in the nematode collection of the Royal Belgian Institute of Natural Sciences, Brussels, Belgium. Another eight paratypes are kept in the authors' collection at the specimen room of the School of Biological Sciences, Seoul National University (SNU301-SNU308).

**Additional material examined.** Seven individuals (2♂♂, 2♀♀ and 3 juveniles), Munseom, Jeju Island (33° 13' 39" N, 126° 34' 03" E), 7 Nov 2000; sublittoral coarse sediments from 30 to 32 m deep.

**Measurements.**

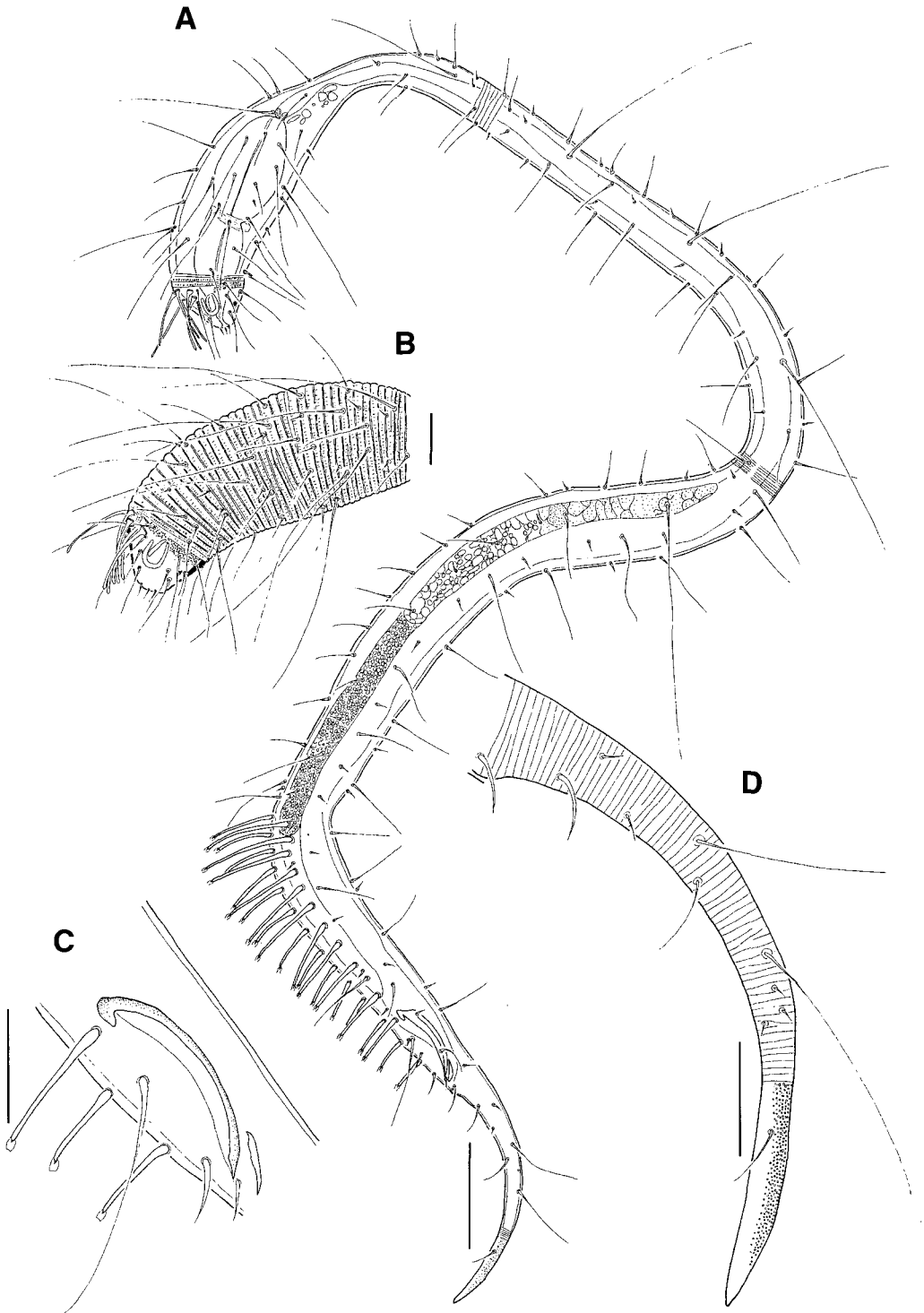
**Holotype male.** L = 1080, mbd = 40, (mbd) = 15, mbd Ph = 45, ph = 104, abd = 18, t = 135, tmr = 44, spic = 52, gub = 10, CAT = 12, SIATn = 10, SvATn = 16, a = 27, b = 10, c = 8, c' = 2.6.

**Allotype females.** L = 1040, mbd = 63, (mbd) = 16, mbd Ph = 51, ph = 117, abd = 15, t = 132, tmr = 41, CAT = 12, SIATn = 11-12, SvATn = 17-18, a = 16.5, b = 8.9, c = 7.9, c' = 8.8, V = 59.9.

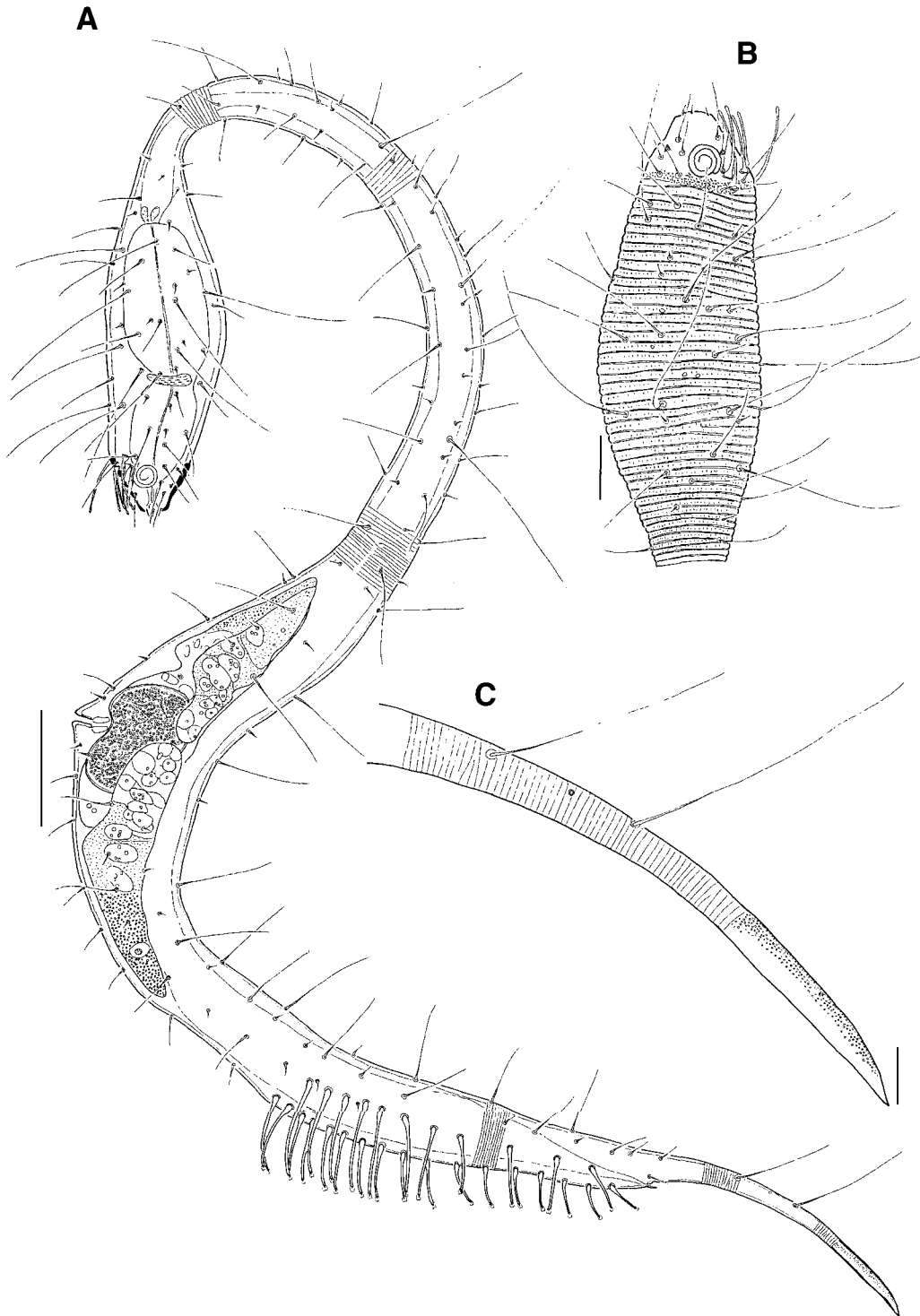
**Young male (molting specimen).** L = 760, mbd = 32, (mbd) = 15, mbd Ph = 44, ph = 91, abd = 18, t = 118, tmr = 37, spic = 47, gub = 12, CAT = 4, SIATn = 5, SvATn = 9, a = 23.8, b = 8.4, c = 6.4, c' = 6.5.

**Male (holotype).** Body slender and long (Fig. 2A). Pharyngeal region 13% of total body length; greatest body width at level of pharyngeal region. Tail narrow, cylindro-conoid (Fig. 2D). Cuticle striated; cuticular rings broader in anterior and posterior body region; laterally interrupted by well marked narrow lateral field (lateral differentiation) in mid-body region. Annules in anterior body region ornamented with fine vacuoles (Fig. 2B); annules smooth in mid-body region and anal region. Longest somatic setae (120  $\mu$ m) inserted on mid-body region. Somatic setae, hair-like with broadened base, more or less arranged in 10 longitudinal rows (2 subdorsal 6 sublateral, and 2 subventral) in pharyngeal region; 2 predominant length (67  $\mu$ m and 4  $\mu$ m). Rostrum with fine vacuolar ornamentation around posterior border. Amphideal fovea large, elongate doubled spiral, ventral arm longer than dorsal arm (Figs. 2B, 5A). Twelve CAT with widened base and blister-shaped tip, arranged in two transverse rows, adjacent to amphideal fovea on rostrum. Subcephalic setae in two transverse rows, one shortly behind cephalic setae and second row near posterior head end. One pair of small thorns, Ceph Acan-set, situated subventrally at nearly posterior one third of rostrum. Eye-spot absent. Four cephalic setae, 30  $\mu$ m long with marked insertion near anterior end of rostrum. Lip extruded, crown of six external labial setae, 4  $\mu$ m long. Stoma narrow, unarmed. Pharynx with enlarged corpus, separated by short isthmus from muscular posterior bulb; nerve ring at level of isthmus. Cardia short. Intestine narrow cylindrical, gradually widening posteriorly, and lying dorsal of genital system. Reproductive system typical of Draconematidae, with single anterior testis. Spicules 52  $\mu$ m long (Fig. 2C), slightly arcuate; corpus very slender, slightly wider at both extremities and ventrally with broad weakly sclerotized velum; capitulum offset, with ventral well-developed apophysis. Gubernaculum 10  $\mu$ m long, thin, parallel to spicules. Three pairs of anal setae, two preanally and one postanally, 15  $\mu$ m long. Anal flap not crenate. All posterior adhesion tubes with well marked bell-shaped end and situated precloacally. PAT arranged on 4 longitudinal rows: 2 sublateral rows each consisting of 10 (left side) and 10 (right side) adhesion tubes, and 2 intermingled somatic setae and 2 subventral rows each consisting of 16 (left side) and 16 (right side) adhesion tubes, without intermingled somatic setae. Posterior adhesion tubes becoming obviously shorter caudally. Tail gradually tapering to cylindrical smooth tip end, 18  $\mu$ m anal diameter long; with 9 pairs of somatic setae: 5 pairs of subdorsal setae and 4 pairs of subventral setae. Non-striated tail end finely vacuolated, 44  $\mu$ m long, 33% of total tail length. One pair of somatic setae laterally situated on non-striated tail region.

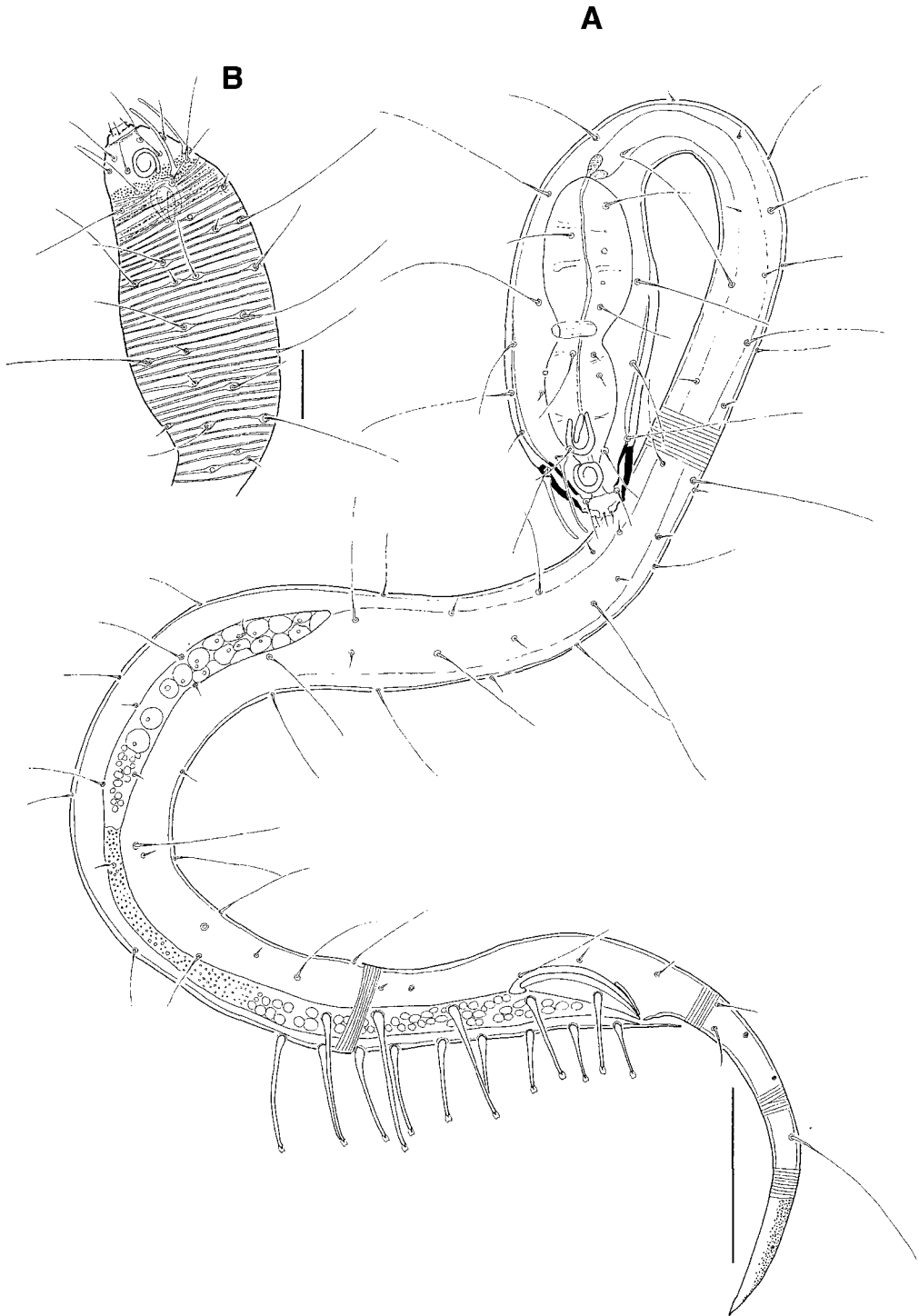
**Female.** Similar to male in most respects (Fig. 3A). Greatest body width at level of vulva. Swelling mid-body region pronounced, and protruding vulval lips. Amphideal fovea circular spiral (10  $\mu$ m), ventrally whirled, slightly over one coil (Figs. 3B, 5B). PAT arranged in 4 longitudinal rows as in male: 2 sublateral rows each consisting of 11 (left side) and 12 (right side) adhesion tubes and 2 subventral rows each consisting of 17 (left side) and 18 (right side) adhesion tubes. Intermingled somatic setae absent. Posterior adhesion tubes becoming obviously shorter caudally. 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. Two pairs of paravulval setae, 1 pair anterior and 1 pair posterior to the vulva (Fig. 3A). Anal flap present. Tail



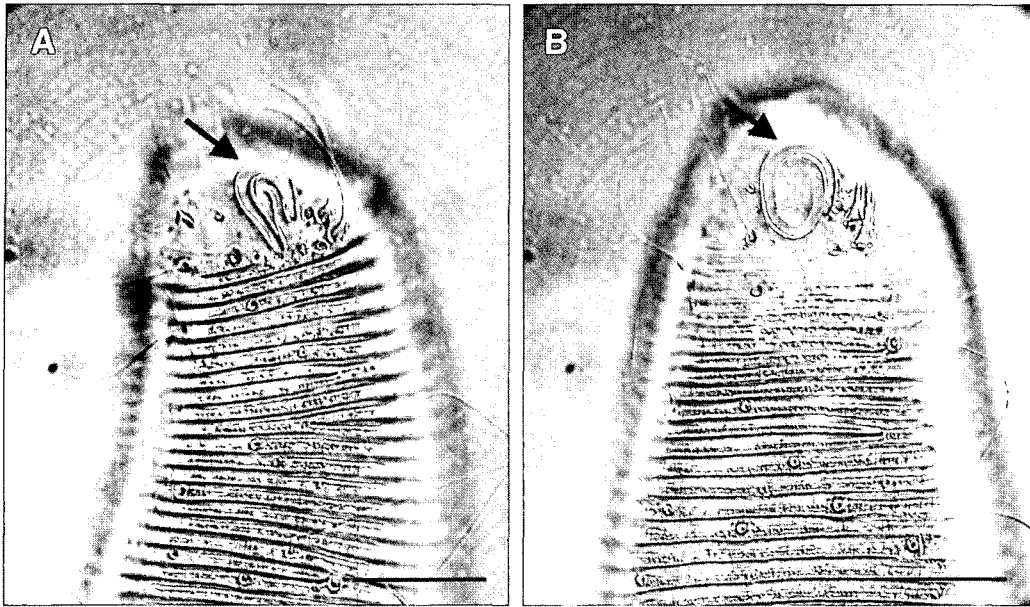
**Fig. 2.** *Paradraconema jejuense* n. sp., male (holotype). A, habitus, lateral view; B, head region, lateral view; C, spicule and gubernaculum, lateral view; D, tail region, lateral view. Scale bars = 50 μm (A), 20 μm (B-D).



**Fig. 3.** *Paradraconema jejuense* n. sp., female (allotype). A, habitus, lateral view; B, head region, lateral view; C, tail region, lateral view. Scale bars = 50  $\mu$ m (A), 20  $\mu$ m (B), 10  $\mu$ m (C).



**Fig. 4.** *Paradraconema jejuense* n. sp., young male (molting specimen). A, habitus, lateral view; B, head region, lateral view. Scale bars = 50  $\mu$ m (A), 20  $\mu$ m (B).



**Fig. 5.** *Paradraconema jejuense* n. sp. A, head region in male, lateral view. B, head region in female, lateral view. Arrow indicates a amphideal fovea. DIC micrographs. Scale bars = 20  $\mu$ m (A, B).

gradually tapering to cylindrical smooth tip end (Fig. 3C), with 5 pairs of somatic setae: 4 pairs of subdorsal setae and 1 pair of subventral setae. Non-striated tail end finely vacuolated, 41  $\mu$ m long, 31% of total tail length.

**Young male (molting specimen).** Similar to male in most respects (Fig. 4A). Body cuticle finely striated. Ceph Acan-set not observed. Four CAT with widened base and blister-shaped tip. Amphideal fovea circular spiral in surface and elongate doubled in internal (Fig. 4B). PAT arranged in 4 longitudinal rows as in male: 2 sublateral rows each consisting of 5 (left side) and 5 (right side) adhesion tubes and 2 subventral rows each consisting of 9 (left side) and 9 (right side) adhesion tubes. Intermingled somatic setae absent. Posterior adhesion tubes becoming obviously shorter caudally. Reproductive system well-developed. Tail gradually tapering to cylindrical smooth tip end (Fig. 4A), with 5 pairs of somatic setae: 4 pairs of subdorsal setae and 1 pair of subventral setae. Non-striated tail end finely vacuolated, 37  $\mu$ m long, 31% of total tail length.

**Differential diagnosis.** *Paradraconema jejuense* n. sp. is characterized by the following characteristics: (1) the shape of habitus with long length and short width in both sexes, (2) the presence of lateral differentiation in mid-body region in both sexes, (3) the absence of eye-spots in both sexes, (4) the presence of a pair of cephalic acanthiform setae on rostrum in both sexes, (5) the shape of amphideal fovea: doubled elongate spiral in male and circular spiral in female, (6) the number of posterior adhesion tubes: 10 sublateral and 16 subventral PAT in male and 11-12 sublateral and 17-18 subventral PAT in female, and (7) the absence of subventral preloacal copulatory thorn.

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



## DISCUSSION

The genus *Paradraconema* Allen and Noffsinger, 1978 is characterized by the three diagnostic characters, such as the presence of eye-spots, the presence of cephalic acanthiform setae, which separates it from all other genera in this family (except *Dracograllus stekhoveni* Allen and Noffsinger, 1978) and pre-anal acanthiform or coniform setae, and the position of sublateral adhesion tubes anterior to the cloacal opening (Allen and Noffsinger, 1978; Decraemer et al., 1997).

At present, nine species have been described in the genus *Paradraconema*: *P. antarcticum* Allen and Noffsinger, 1978, *P. californicum* Allen and Noffsinger, 1978, *P. floridense* Allen and Noffsinger, 1978, *P. hopperi* Allen and Noffsinger, 1978, *P. maggentii* Decraemer, 1989, *P. meridionale* (Kreis, 1937), *P. newelli* Allen and Noffsinger, 1978, *P. singaporense* Allen and Noffsinger, 1978 and *P. spinosum* (Southern, 1914). According to the key of Allen and Noffsinger (1978), the genus *Paradraconema* can be divided artificially into two groups on the basis of the shape of amphideal fovea in male. The first group is characterized by having elongate loop-shape amphideal fovea in male and comprises *P. californicum*, *P. floridense*, *P. hopperi*, *P. maggentii*, *P. meridionale*, *P. newelli*, *P. singaporense*, and *P. spinosum*. This group can be also subdivided into two subgroups based on the shape of annules on swollen pharyngeal region (the first subgroup has longitudinally areolated ornamentations, while another subgroup does not have longitudinally areolated ornamentations). The second group is characterized by the presence of doubled elongate spiral amphideal fovea in male and comprises *P. antarcticum* and the present new species.

*Paradraconema jejuense* n. sp. is easily distinguished from its congeners in having the following characteristics: (1) the absence of subventral precloacal copulatory thorn, (2) annules on swollen pharyngeal region with longitudinally areolated ornamentations, (3) mid-body annulations laterally interrupted by narrow lateral differentiation, and (4) PAT arranged on four longitudinal rows: two sublateral rows with 10 adhesion tubes in male and 11-12 adhesion tubes in female, and two subventral rows with 16 adhesion tubes in male and 17-18 adhesion tubes in female.

The present new species, *Paradraconema jejuense* n. sp., shows some resemblance with *P. antarcticum* in having the following characteristics: the doubled elongate spiral amphideal fovea in male and circular spiral one in female, and the absence of subventral precloacal copulatory thorn. However, *P. jejuense* n. sp. is discernable from *P. antarcticum* by the number of cephalic acanthiform setae on rostrum (a pair of Ceph Acan-set in the new species vs two pairs of Ceph Acan-set in *P. antarcticum*), the presence or absence of lateral differentiation on mid-body region (lateral differentiation present vs absent), the shape of anal flap (smooth anal flap vs faintly crenated anal flap), the presence or absence of eye-spots (absent vs prominent), and larger number of PAT (10 sublateral and 16 subventral PAT in male, and 11-12 and 17-18 in female vs 6-7 sublateral and 15 subventral PAT in male, and 9-10 and 16-17 in female).

The present new species is the most dominant draconematid nematode at Jeju Island of Korea.

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결도마뱀선충속 (선형동물문: 도마뱀선충과)의 해양 선충류 1신종

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요 약

제주도의 조하대 저질에서 채집한 해양 선충류 1신종 제주결도마뱀선충 (*Paradraconema jejuense*)을 기재하였다. 제주결도마뱀선충은 가늘고 긴 형태의 유사한 체형과 암수 모두 다 동일한 형태의 두부감각기관을 가지는 점에서 *P. antarcticum*과 유사하지만 몸 뒤쪽 부위의 측면 아래에 수컷은 9개에서 10개, 암컷은 11개에서 12개, 배면 아래에 수컷은 16개에서 17개, 암컷은 17개에서 18개의 후미흡착기관을 가지는 점, 1쌍의 두부 돌기를 가지는 점, 안점을 가지지 않는 점, 몸 중앙 측면의 표면이 구별되는 점과 같은 중요 형질에서 쉽게 구분되어 진다. 이 논문은 한국의 결도마뱀선충속 해양 선충류에 대한 첫 분류학적 보고이다.