

*Nothocriconema* from Mt. Aso, with descriptions of two new species  
(Tylenchida: Criconematidae)

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In Mt. Aso region, Kumamoto Prefecture, four *Nothocriconema* species were collected and identified with *N. longulum* (Gunhold), *N. jaejuense* Choi & Geraert, and two new species, *N. palliatum* and *N. bellatulum*. *N. palliatum* n. sp. was detected from rhizosphere of *Clethra barbinervis*, *Aralia elata*, *Helwingia japonica*, *Cornus controversa*, *Elaeagnus pungens*, and *Acer Sieboldianum*. This new species is closely related to *N. loofi* having a thin cuticular sheath around tail-top annules, but differs from it by smaller body size, shorter stylet and smaller number of body annules. *N. bellatulum* n. sp. from *Weigela japonica* resembles *N. longulum* and *N. demani*, but differs from them by smaller body size and shorter stylet. Male- and female adults and larval stages of those four species were described and illustrated. *Jap. J. Nematol.* 10:16-26(1981)

The genus *Nothocriconema* was established by De Grisse & Loof from division of *Criconemoides* (s. l.)<sup>9)</sup>. This genus includes 37 nominal species and is characterized among subfamily Criconematinae by smooth annules of female, lacking submedian lobes, low and rounded lip region, etc. In Kyushu, a species of *Nothocriconema*, which is identified with *N. longulum* (Gunhold, 1953), was occasionally collected from herbaceous and woody plants and three other species were also obtained from woody plants around pastures in Mt. Aso region, Kumamoto Prefecture. Two of three are considered to be new species, which are named *N. palliatum* n. sp. and *N. bellatulum* n. sp. and described herein. The rest one is *N. jaejuense* Choi & Geraert, 1975, which was originally described from Korea. In this paper male- and female adults and larval stages of those four species are described and illustrated. All specimens in this study were fixed by T.A.F. and mounted in glycerine.

***Nothocriconema palliatum* n. sp.**  
(Fig. 1, A-V)

**Description and measurements.**

*Female.* Paratypes: n=25, L=270-460  $\mu$ m (374 $\pm$ 50; mean  $\pm$  standard deviation), a=6.3-11.6 (8.5 $\pm$ 1.4), b=3.0-4.1 (3.6 $\pm$ 0.4), c=15.3-32.4 (21.9 $\pm$ 4.4), V=83.2-88.0 (85.7 $\pm$

1.2), R=46-51 (49 $\pm$ 1.3), RV=9-11 (10 $\pm$ 0.6), Ran=4-5 (5 $\pm$ 0.5), RVan=4-5 (4 $\pm$ 0.4), Rex=14-17 (15 $\pm$ 0.9), stylet=63.2-72.6  $\mu$ m (67.8 $\pm$ 2.7), prorhabdion=50.5-61.6  $\mu$ m (56.2 $\pm$ 2.6). Holotype: L=351  $\mu$ m, a=8.2, b=3.4, c=22.2, V=85.6, R=47, RV=10, Ran=5, RVan=4, Rex=15, stylet=66.9  $\mu$ m, prorhabdion=54.5  $\mu$ m.

Body curved slightly ventrad after fixation. Head with two annules, not retrorse, usually subequal in diameter. Lip region elevated, round, with six pseudolips. Each head annule bears distinct notch in one of the lateral edges, and in some paratypes also first few body annules interrupted laterally. Stylet rather stout, knobs with forwardly directed processes, 7.9-9.5  $\mu$ m across, 3.2-4.7  $\mu$ m high. Excretory pore at 14th to 17th annule, 88.4-131.1  $\mu$ m (112.8 $\pm$ 11.8) from the anterior end. Vulva opens at 42.6-61.6  $\mu$ m (53.3 $\pm$ 6.8) from the posterior end, between vulval lips: in ventral view anterior lip with broad, flap-like structure, rectangular shape, some specimens with two bluntly pointed spines in front edges and knotted shallowly between them: posterior one round in outline. Anus prominent on fourth to fifth annule from terminus. Tail conoid to elongate-conoid, ended peg-like terminus, 11.1-26.8  $\mu$ m (17.6 $\pm$ 3.9) in length. A thin cuticular sheath around the tail-top annules. Ovary usually

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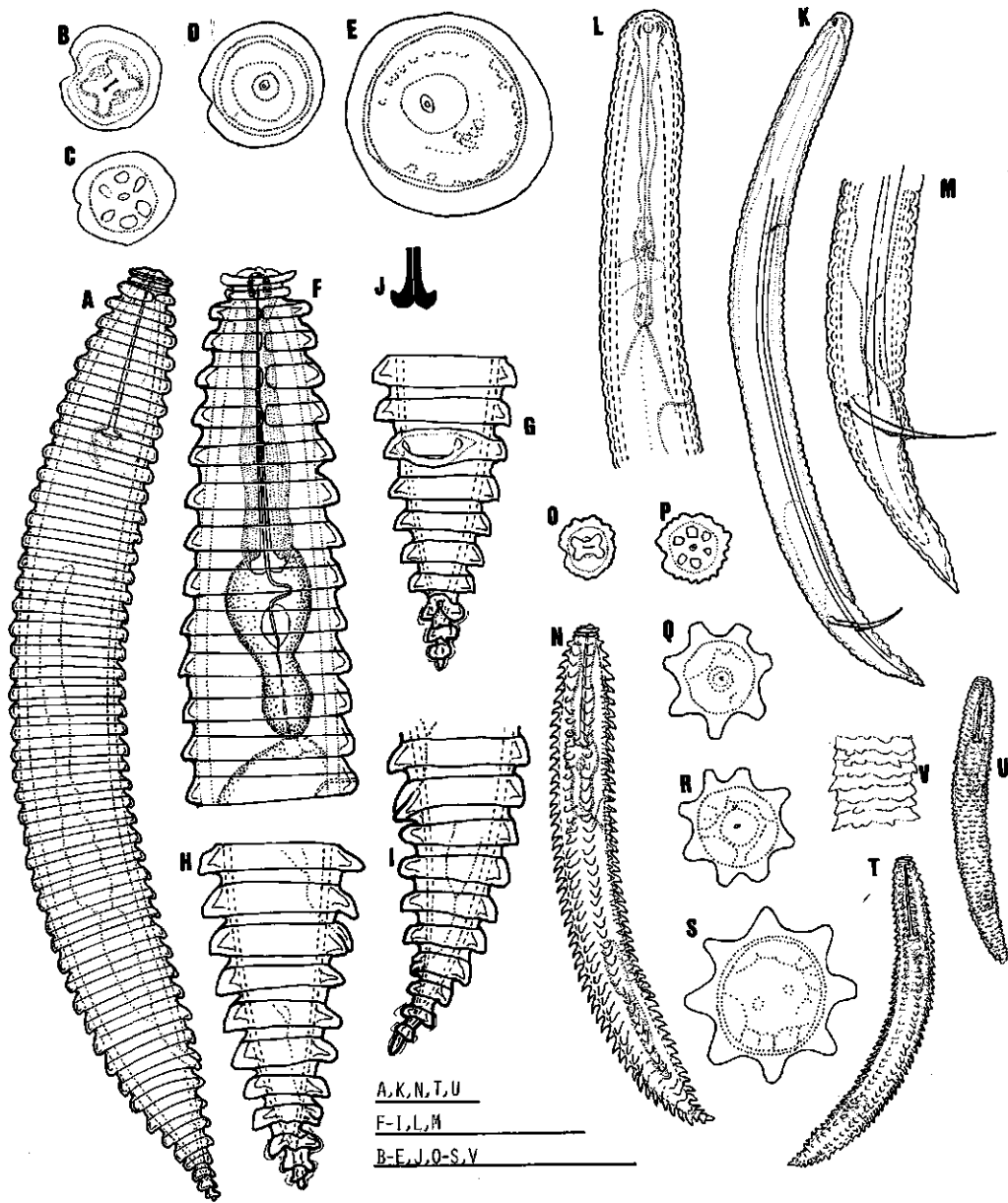


Fig. 1. *Nothocriconema palliatum* n. sp. Female: A. general view, B. en face view, C. cross-section at second head annule, D. cross-section at first body annule, E. cross-section at midbody, F. anterior part of body, G. posterior part of body; ventral view, H-I. ditto; lateral view, J. stylet knobs. Male: K. general view, L. anterior part of body, M. posterior part of body. Fourth-stage larva: N. general view, O. en face view, P. cross-section at second head annule, Q. cross-section at first body annule, R. cross-section at second body annule, S. cross-section at midbody. Third-stage larva: T. general view. Second-stage larva: U. general view, V. scales at midbody. Scales indicate 50  $\mu$ m.

outstretched, some with single or double flexures, the tip reaching around stylet knobs. Spermatheca round, filled with round sperms. Body annules smooth, notched in posterior margine in lateral or ventral portion throughout or a part of body with some paratypes, with or without anastomosis.

**Male.** Paratypes:  $n=25$ ,  $L=297-347 \mu\text{m}$  ( $318 \pm 13$ ),  $a=12.2-17.5$  ( $15.2 \pm 1.0$ ),  $b=3.8-5.1$  ( $4.5 \pm 0.3$ ),  $c=7.7-9.7$  ( $8.7 \pm 0.5$ ),  $c'=2.3-2.9$  ( $2.6 \pm 0.2$ ), spicules =  $32.3-37.9 \mu\text{m}$  ( $34.4 \pm 1.6$ ), gubernaculum =  $5.7-6.9 \mu\text{m}$  ( $6.3 \pm 0.3$ ).

Body curved ventrally after treatment by heat; narrows gradually to round head. Esophagus narrow. Excretory pore at  $78.9-96.6 \mu\text{m}$  ( $89.7 \pm 3.8$ ) from the anterior end of body. Spicules slender, slightly curved. Tail elongate-conoid,  $32.8-42.9 \mu\text{m}$  ( $36.7 \pm 2.4$ ) long, terminus acute. Lateral field  $3.8-5.7 \mu\text{m}$  wide, broadened around anus like a bursa; with three incisures, but inner one obscure with some paratypes.

**Fourth-stage larva.** Paratypes:  $n=18$ ,  $L=232-280 \mu\text{m}$  ( $253 \pm 15$ ),  $a=6.3-8.4$  ( $7.2 \pm 0.5$ ),  $a'=7.9-11.1$  ( $9.9 \pm 1.0$ ),  $b=2.7-3.4$  ( $3.0 \pm 0.2$ ),  $c=8.6-16.1$  ( $12.5 \pm 2.4$ ),  $R=50-54$  ( $52 \pm 1.3$ ),  $Ran=5-8$  ( $6 \pm 0.8$ ),  $Rex=16-22$  ( $19 \pm 1.7$ ), stylet =  $47.4-56.1 \mu\text{m}$  ( $51.0 \pm 2.6$ ), prorhabdion =  $37.1-45.0 \mu\text{m}$  ( $41.4 \pm 2.1$ ).

Body slightly curved ventrally after fixation. Head with two annules, not retrorse, smaller than body annules. Head annules saucer-shaped; first one smaller than the second, one of the lateral edges knotted. *En face* view shows six pseudolips. Stylet knobs anchor-shaped,  $2.4-3.2 \mu\text{m}$  high,  $6.3-8.7 \mu\text{m}$  across. Excretory pore at  $71.1-108.9 \mu\text{m}$  ( $90.0 \pm 9.4$ ) from anterior end. Tail  $17.4-33.3 \mu\text{m}$  ( $21.0 \pm 9.8$ ) in length, conoid to elongate-conoid. Genital primordium outstretched,  $36.8-86.6 \mu\text{m}$  long. Body annules retrorse, bear scale-like cuticles of rectangular shape and bluntly rounded tip, arranged in eight to eleven, mostly nine or ten, longitudinal rows at midbody.

**Third-stage larva.** Paratypes:  $n=10$ ,  $L=153.5-210 \mu\text{m}$  ( $186.2 \pm 18.7$ ),  $a=6.5-9.0$  ( $7.9 \pm 0.8$ ),  $a'=8.1-10.7$  ( $9.8 \pm 0.8$ ),  $b=2.3-2.9$  ( $2.7 \pm 0.2$ ),  $c=8.7-14.0$  ( $10.5 \pm 1.8$ ),  $R=55-60$  ( $57 \pm 1.8$ ),  $Ran=6-10$  ( $8 \pm 1.1$ ),  $Rex=18-22$  ( $20 \pm 1.3$ ), stylet =  $27.2-42.6 \mu\text{m}$  ( $38.8 \pm 4.6$ ), prorhabdion =  $20.8-34.7 \mu\text{m}$  ( $30.8 \pm 4.0$ ).

General view similar to fourth-stage larva. Head annules two, smaller than body annules; outer margine of them smooth. Longitudinal rows of body scales eight to ten at midbody. Excretory pore at

$54.9-74.6 \mu\text{m}$  ( $64.7 \pm 6.3$ ) from anterior end. Tail  $12.6-26.8 \mu\text{m}$  ( $18.3 \pm 4.5$ ) long, conoid, ended in acute terminus. Genital primordium  $11.1-20.5 \mu\text{m}$  in length.

**Second-stage larva.** Paratypes:  $n=9$ ,  $L=125.1-148.4 \mu\text{m}$  ( $139.1 \pm 7.5$ ),  $a=7.3-8.6$  ( $8.1 \pm 0.4$ ),  $a'=9.1-10.2$  ( $9.7 \pm 0.5$ ),  $b=2.1-3.0$  ( $2.6 \pm 0.3$ ),  $c=8.2-11.9$  ( $9.8 \pm 1.0$ ),  $R=58-62$  ( $59 \pm 1.3$ ),  $Ran=7-9$  ( $8 \pm 0.7$ ),  $Rex=22-27$  ( $23 \pm 1.6$ ), stylet =  $26.5-30.3 \mu\text{m}$  ( $28.2 \pm 1.8$ ), prorhabdion =  $21.5-24.0 \mu\text{m}$  ( $22.6 \pm 0.8$ ).

Body stout, curved slightly ventrad. Head truncate in front. Head annules two, not distinguished from body. Body annules with small scale-like cuticles, round in shape, eight or nine per annule, not arranged in longitudinal rows. Excretory pore at  $47.4-58.1 \mu\text{m}$  ( $52.3 \pm 3.0$ ) from anterior end of body. Tail conoid,  $11.4-16.4 \mu\text{m}$  ( $14.3 \pm 1.6$ ) in length. Genital primordium with two cells, oval,  $7.6-11.4 \mu\text{m}$  long.

#### Type specimens.

Holotype (female): type slide number 15. Paratypes: 132 females, 52 males and 71 larvae; type slide numbers 16-78. All slides deposited in the Kyushu National Agricultural Experiment Station, Nishigoshi, Kumamoto Prefecture.

#### Type habitat and locality.

Specimens were collected from rhizosphere of following plants on the somma of Mt. Aso (860 m alt.), Kumamoto Pref: *Clethra barbinervis* Sieb. & Zucc., *Aralia elata* (Miq.) Seemann, *Helwingia japonica* (Thunb.), *Cornus controversa* Hemsley, *Elaeagnus pungens* Thunb., and *Acar Sieboldianum* Miq.

#### Diagnosis.

This new species is most closely related to *N. loofi* De Grisse, 1967<sup>9</sup> having a thin cuticular sheath around tail-top annules, but differs from it by smaller body size ( $270-460 \mu\text{m}$  vs.  $507-640 \mu\text{m}$ ), shorter stylet ( $63.4-72.6 \mu\text{m}$  vs.  $89-99 \mu\text{m}$ ) and smaller number of body annules ( $46-51$  vs.  $68-75$ ) in female.

#### *Nothocriconema bellatulum* n. sp.

(Fig. 2, A-N)

#### Description and measurements.

**Female.** Paratypes:  $n=25$ ,  $L=257-358 \mu\text{m}$  ( $319 \pm 26$ ),  $a=7.6-11.3$  ( $9.9 \pm 0.9$ ),  $b=3.0-4.4$  ( $3.8 \pm 0.3$ ),  $c=8.4-15.9$  ( $11.7 \pm 1.8$ ),  $V=82.8-88.2$  ( $85.9 \pm 1.4$ ),  $R=77-84$  ( $81 \pm 1.9$ ),  $RV=12-15$  ( $14 \pm 1.1$ ),  $Ran=8-11$  ( $9 \pm 0.9$ ),  $RVan=2-4$  ( $3 \pm 0.6$ ),  $Rex=22-26$  ( $24 \pm 0.9$ ),

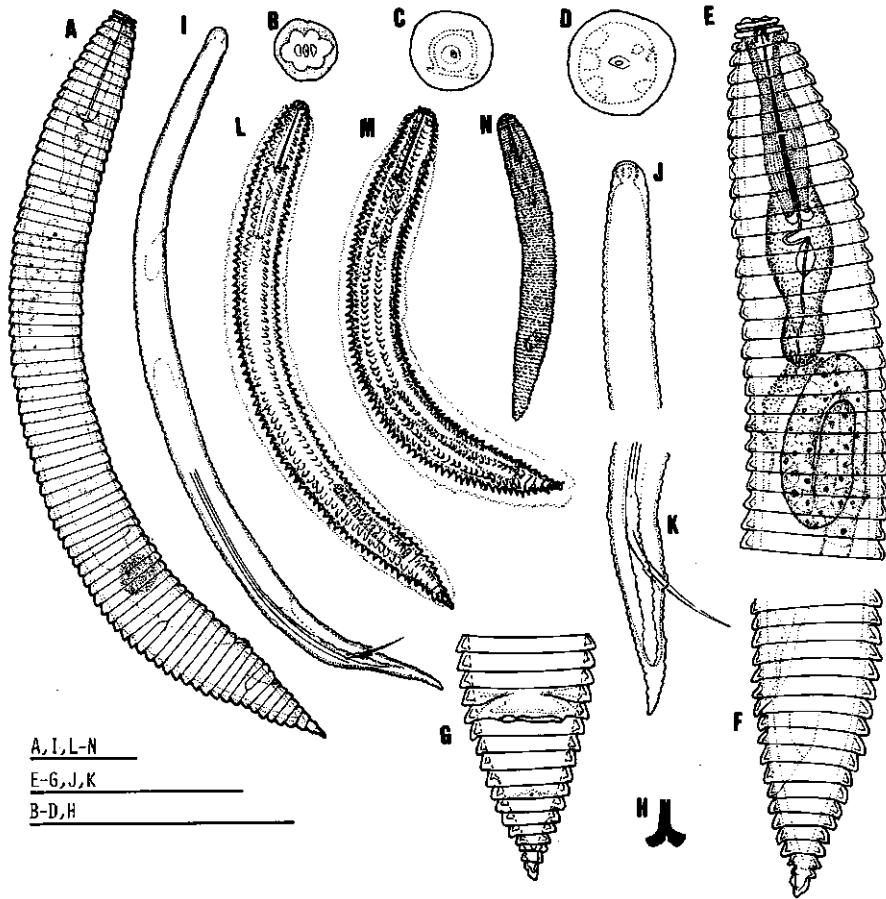


Fig. 2. *Nothocriconema bellatulum* n. sp. Female: A. general view, B. en face view, C. cross-section at second head annule, D. cross-section at midbody, E. anterior part of body, F. posterior part of body: lateral view, G. ditto; ventral view, H. stylet knobs. Male: I. general view, J. anterior part of body, K. posterior part of body. Larva: L. fourth-stage larva (male), M. ditto (female), N. second-stage larva. Scales indicate 50  $\mu\text{m}$ .

stylet=41.0–48.2  $\mu\text{m}$  ( $44.8 \pm 2.0$ ), prorhabdion=33.2–41.1  $\mu\text{m}$  ( $37.2 \pm 1.9$ ). Holotype: L=324  $\mu\text{m}$ , a=9.6, b=4.1, c=11.7, V=85.9, R=80, RV=14, Ran=9, RVan=4, Rex=23, stylet=45.8  $\mu\text{m}$ , prorhabdion=39.5  $\mu\text{m}$ .

Body cylindrical, regularly tapers to postvulvar part of body. Head with two annules: first annule discoid, with six pseudolips, smaller than the second ( $10.4 \pm 0.8 \mu\text{m}$  vs.  $11.7 \pm 0.7 \mu\text{m}$ ). Stylet slender, basal knobs somewhat anchor-like, with forwardly directed processes, 2.4–3.2  $\mu\text{m}$  high, 6.3–7.9  $\mu\text{m}$  across. Excretory pore at 75.9–107.4  $\mu\text{m}$  ( $92.9 \pm 8.0$ ) from anterior end, some posterior to the esophageal-intestinal junction. Vulva at 37.9–52.1

$\mu\text{m}$  ( $44.8 \pm 3.6$ ) from posterior end, opening simple narrow slit between vulval lips. Tail conoid to elongate-conoid, 20.2–34.7  $\mu\text{m}$  ( $27.8 \pm 3.9$ ) in length; last two to four annules fused, with bluntly pointed terminus. Spermatheca round, filled with sperms. Ovary with double flexures, the tip reaching near the base of esophagus. Body annules smooth, anastomoses occasionally occurred.

*Male.* Paratypes: n=3, L=282–341  $\mu\text{m}$  (313: mean), a=18.6–20.8 (19.6), b=3.7–4.4 (4.0), c=10.0–10.9 (10.5), c'=3.0–3.8 (3.5), spicules=32.3–34.1  $\mu\text{m}$  (33.3), gubernaculum=5.1–7.6  $\mu\text{m}$  (6.1).

Body slender, curved ventrally after fixation.

Esophagus obscure. Excretory pore at 87.8–98.5  $\mu\text{m}$  from anterior end, 2.3–25.9  $\mu\text{m}$  posterior to esophageal-intestinal junction. Spicules slender, slightly curved. Tail elongate-conoid, 25.9–32.2  $\mu\text{m}$  in length, ended bluntly pointed terminus. Lateral field 2.5–3.2  $\mu\text{m}$  wide, with three incisures.

*Fourth-stage larva (female)*. Paratypes:  $n=10$ ,  $L=234-268 \mu\text{m}$  ( $250 \pm 13$ ),  $a=8.0-10.7$  ( $9.4 \pm 1.0$ ),  $a'=9.2-14.9$  ( $11.7 \pm 1.8$ ),  $b=3.1-4.1$  ( $3.7 \pm 0.4$ ),  $c=9.0-15.0$  ( $10.8 \pm 2.2$ ),  $R=80-89$  ( $86. \pm 3.5$ ),  $Ran=7-11$  ( $9 \pm 1.3$ ),  $Rex=24-28$  ( $26 \pm 1.3$ ),  $stylet=33.2-34.7 \mu\text{m}$  ( $33.8 \pm 0.7$ ),  $prorhabdion=26.1-28.4 \mu\text{m}$  ( $27.4 \pm 0.9$ ).

Body curved in 'C'-shape, bears sheath of thin cuticle of third stage larva. Head with two annules, not retrorse. Body annules retrorse, with scales, arranged in ten to twelve longitudinal rows at midbody. Excretory pore at 67.0–80.5  $\mu\text{m}$  ( $74.3 \pm 4.2$ ) from the anterior end. Tail conoid, 15.8–30.0  $\mu\text{m}$  ( $23.8 \pm 4.3$ ) long. Genital primordium 52.1–85.3  $\mu\text{m}$  ( $71.8 \pm 13.9$ ) in length.

*Fourth-stage larva (male)*. Paratypes:  $n=6$ ,  $L=221-287 \mu\text{m}$  ( $256 \pm 24$ ),  $a=8.5-14.3$  ( $11.3 \pm 2.3$ ),  $a'=10.4-16.5$  ( $13.7 \pm 2.6$ ),  $b=3.3-4.2$  ( $3.8 \pm 0.3$ ),  $c=7.4-14.0$  ( $10.6 \pm 2.1$ ),  $R=84-91$  ( $86 \pm 2.7$ ),  $Ran=8-12$  ( $10 \pm 1.6$ ),  $Rex=24-30$  ( $26 \pm 2.3$ ),  $stylet=30.0-34.7 \mu\text{m}$  ( $31.5 \pm 2.0$ ),  $prorhabdion=23.4-28.4 \mu\text{m}$  ( $25.5 \pm 1.9$ ).

General view similar to fourth-stage female-larva, but body and stylet more slender. Longitudinal rows of scales eight to eleven at midbody. Genital primordium 48.9–90.3  $\mu\text{m}$  long.

*Third-stage larva*. Paratype:  $n=1$  (in cuticular sheath of second stage larva),  $L=170 \mu\text{m}$ ,  $a=8.4$ ,  $a'=9.3$ ,  $b=3.3$ ,  $c=20.7$ ,  $R=91$ ,  $Ran=7$ ,  $Rex=27$ ,  $stylet=24.6 \mu\text{m}$ ,  $prorhabdion=19.2 \mu\text{m}$ .

Similar to fourth-stage larva. Body scales arranged in twelve longitudinal rows at midbody. Genital primordium oval, 10.7  $\mu\text{m}$  in length.

*Second-stage larva*. Paratypes:  $n=6$ ,  $L=130-154 \mu\text{m}$  ( $141 \pm 9$ ),  $a=9.4-10.6$  ( $9.9 \pm 0.6$ ),  $a'=10.0-11.8$  ( $11.0 \pm 0.7$ ),  $b=2.7-3.9$  ( $3.1 \pm 0.5$ ),  $c=6.9-20.2$  ( $12.0 \pm 6.0$ ),  $R=88-92$  ( $89 \pm 1.6$ ),  $Ran=6-13$  ( $10 \pm 2.7$ ),  $Rex=27-31$  ( $29 \pm 1.7$ ),  $stylet=20.2-22.7 \mu\text{m}$  ( $21.2 \pm 1.2$ ),  $prorhabdion=15.8-17.7 \mu\text{m}$  ( $16.6 \pm 0.9$ ).

Body stout, tapers anteriorly in round head and posteriorly to conoid tail with pointed terminus. Small round scales on annules, not arranged in longitudinal rows. Excretory pore at 40.4–49.3  $\mu\text{m}$  ( $44.3 \pm 3.4$ ) from anterior end. Tail bluntly rounded, 7.6–19.1  $\mu\text{m}$  ( $14.0 \pm 5.4$ ) long. Genital

primordium oval, 7.2–9.5  $\mu\text{m}$  long.

#### Type specimens.

Holotype (female): type slide number 79. Paratypes: 125 females, 3 males, and 28 larvae; type slide numbers 80–121. All slides are deposited in the Kyushu National Agricultural Experiment Station.

#### Type habitat and locality.

Specimens were collected from rhizosphere of *Weigela japonica* Thunb. in the somma of Mt. Aso (940 m. alt.), Kumamoto Prefecture.

#### Diagnosis.

*N. bellatulum* n. sp. resembles *N. longulum* (Gunhold, 1953)<sup>24,7)</sup> with fused annules of tail terminus and also *N. demani* (Micoletzky, 1925)<sup>25)</sup> and *N. acriculum* Raski & Pinochet, 1975<sup>8)</sup> having conical tail, but this new species can be separated from by shorter stylet and smaller body size.

#### Nothocriconema longulum (Gunhold, 1953)

##### De Grisse & Loof, 1965

= *Criconema longula* Gunhold, 1953

= *Criconemoides longulum* (Gunhold, 1953)

Oostenbrink, 1960

Syn. *Criconema elegantula* Gunhold, 1953

= *Criconemoides elegantulum* (Gunhold, 1953) Oostenbrink, 1960

Syn. *Criconemoides quasidemani* Wu, 1965

= *Nothocriconema quasidemani* (Wu, 1965)

De Grisse & Loof, 1965

(Fig. 3, A-P)

#### Description and measurements.

*Female*. Body curved ventrad after fixation, tapering uniformly to distinctly conical posterior ending in rounded, button-shaped terminus. Head with two annules, round in front; first head annule slightly wider than second, outer margin of both annules smooth. Stylet slender; knobs anchor-shaped, 3.7  $\mu\text{m}$  high, 7.9–9.5  $\mu\text{m}$  across. Excretory pore at 101.1–150.0  $\mu\text{m}$  from anterior end. Vulva at 30.0–67.9  $\mu\text{m}$  from posterior end; in front view anterior lip simple, rounded. Tail length 22.1–39.5  $\mu\text{m}$  with two exceptions of 7.9  $\mu\text{m}$  and 15.8  $\mu\text{m}$ . Tail elongate-conoid; annules of caudal half very slender, terminal annules fused. Ovary reflected twice, the tip reaching near esophagus-end. Spermatheca round, with or without sperms. Body annules smooth, without notches in lateral portion of anterior body. Anastomoses of annules occasionally occurred. Measurements are shown in Table 1.

*Male* (The somma of Mt. Aso).  $N=1$  (in larval

Table 1. Comparison of measurements of females of *N. longulum* from various localities.

Locality	n	L ( $\mu$ m)	a	b	c	V(%)
The somma of Mt.Aso	12	321-445 (379 $\pm$ 38)	7.0-9.5 (8.2 $\pm$ 1.0)	3.3-5.2 (4.0 $\pm$ 0.5)	10.4-22.0 (14.1 $\pm$ 4.2)	82.4-90.5 (85.7 $\pm$ 2.4)
Kusasenri	25	325-447 (378 $\pm$ 30)	7.1-11.2 (9.0 $\pm$ 1.2)	3.3-4.0 (3.6 $\pm$ 0.2)	9.5-15.2 (11.7 $\pm$ 1.3)	81.7-86.9 (84.4 $\pm$ 1.3)
Nishigoshi	25	390-458 (443 $\pm$ 19)	8.6-10.9 (9.5 $\pm$ 0.6)	3.6-4.3 (3.9 $\pm$ 0.2)	10.2-18.3 (13.1 $\pm$ 1.9)	83.7-88.8 (85.5 $\pm$ 1.1)
Canada <sup>a)</sup>	15	380-485	9.7-12.9	3.9-5.0	7.6-10.8	82.1-86.0
California <sup>b)</sup>	11	470-570 (480)	9 -12 (10.7)	3.4-4.5 (3.9)	9 -13 (10.5)	81 -85 (84)
Hawaii <sup>b)</sup>	1	350		3.6	12	86
Austria 1 <sup>c)</sup>		430	9.2	3.4	10.2	85
Austria 2 <sup>c)</sup>		240-250	6.0-6.2	2.8-3	11.6-12	83

stylet ( $\mu$ m)	Prorhabdion ( $\mu$ m)	R	Rex	RV	Ran	RVan
65.5-78.9 (70.4 $\pm$ 4.7)	55.3-67.9 (59.9 $\pm$ 4.4)	59-71 (63 $\pm$ 3.8)	19-22 (20 $\pm$ 1.0)	10-15 (13 $\pm$ 1.5)	5-9 (8 $\pm$ 1.3)	2-5 (4 $\pm$ 0.9)
64.7-74.2 (70.7 $\pm$ 2.9)	55.3-66.3 (61.4 $\pm$ 2.7)	58-67 (63 $\pm$ 2.0)	18-22 (20 $\pm$ 1.0)	11-15 (13 $\pm$ 1.0)	6-10 (9 $\pm$ 0.9)	3-5 (4 $\pm$ 0.6)
63.2-74.2 (69.8 $\pm$ 2.5)	53.7-64.7 (60.4 $\pm$ 2.4)	57-66 (63 $\pm$ 2.0)	18-21 (20 $\pm$ 0.8)	11-14 (13 $\pm$ 0.9)	7-10 (8 $\pm$ 0.8)	2-5 (4 $\pm$ 0.6)
62 -70.2	55 -60	73-87	21-26	14-16	10-12	
78 -87 (84)	67 -76 (82)	67-77 (70)	19-22	13-16	8-11	
65	54	81				
76		88		13	8	4
70		90		13	8	4

Figures indicate minimum and maximum values, and mean  $\pm$  standard deviation in parentheses. a) after Wu, 1965, b) after Raski & Golden, 1965, c) after Meyl, 1961; Austria 1 for *Crimonemoides longulum*, and Austria 2 for *C. elegantulum*.

cuticle), L=363  $\mu$ m, a=15.5, b=5.6, c=10.3, c'=3.0, spicules=42.9  $\mu$ m, gubernaculum=6.9  $\mu$ m.

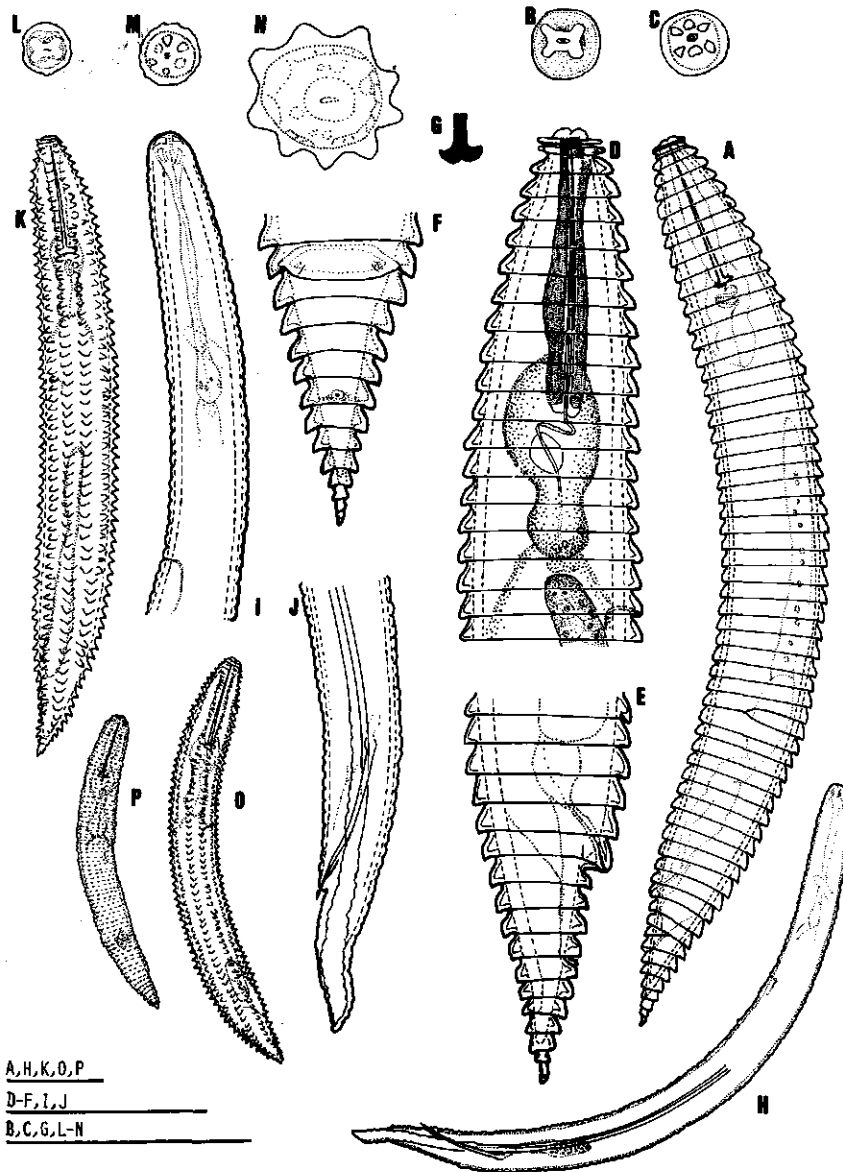
Body curved in open-'C' shape. Esophagus narrow. Excretory pore at 99.2  $\mu$ m from anterior end. Spicules slender, almost straight. Tail 35.4  $\mu$ m long, tapers gradually to terminus; the tip conoid, minutely rounded. Lateral field 3.8  $\mu$ m wide, with three incisures. Transverse striae 2.2  $\mu$ m apart at midbody.

*Fourth-stage larva* (Nishigoshi). N=10, L=286-349  $\mu$ m (308 $\pm$ 26), a=7.2-8.7 (7.8 $\pm$ 0.5), a'=8.4-10.1 (9.4 $\pm$ 0.6), b=2.9-4.0 (3.4 $\pm$ 0.3), c=8.9-12.3 (10.4 $\pm$ 1.2), R=65-69 (67 $\pm$ 1.3), Ran=9-11 (10 $\pm$ 0.7), Rex=21-24 (23 $\pm$ 0.9), stylet=52.1-56.8  $\mu$ m (55.0 $\pm$ 1.7), prorhabdion=42.6-48.9  $\mu$ m (46.0 $\pm$ 2.0).

Body straight or curved ventrally after

fixation. Head with two annules, not retrorse, smaller than body annules. First head annule bearing four pseudolips with very minute dentations which are only visible at high magnification. Outer margin of the annule notched laterally. Second annule nearly equal or slightly wider than the first, small denticles on outer margin. Stylet knobs anchor-shaped, 2.4-3.2  $\mu$ m high, 6.3-7.9  $\mu$ m across. Excretory pore at 90.0-118.4  $\mu$ m (104.4 $\pm$ 12.9) from anterior end. Tail 25.3-36.3  $\mu$ m (30.2 $\pm$ 4.2) long, tapers gradually to terminus. Genital primordium outstretched, 45.8-129.5  $\mu$ m long. Body annules retrorse, bear triangular scale-like cuticles arranged in nine to eleven longitudinal rows at midbody. Scale-like cuticles on tail region longer than those on the other parts of body.

*Third-stage larva* (Nishigoshi). N=10, L=186-237  $\mu$ m (216 $\pm$ 13), a=6.9-8.6 (7.6 $\pm$ 0.6),



A, H, K, O, P

D-F, I, J

B, C, G, L-N

Fig. 3. *Nothocriconema longulum* (Gunhold, 1953) Female: A. general view, B. *en face* view, C. cross-section at second head annule, D. anterior part of body, E. posterior part of body: lateral view, F. ditto; ventral view, G. stylet knobs. Male: H. general view, I. anterior part of body, J. posterior part of body. Fourth-stage larva: K. general view, L. *en face* view, M. cross-section at second head annule, N. cross-section at midbody. Third-stage larva: O. general view. Second-stage larva: P. general view. Scales indicate 50  $\mu$ m.

$a' = 8.0-10.2$  ( $8.8 \pm 0.7$ ),  $b = 2.5-3.1$  ( $2.8 \pm 0.2$ ),  $c = 9.1-11.7$  ( $9.8 \pm 1.3$ ),  $R = 66-72$  ( $69 \pm 1.8$ ),  $Ran = 8-11$  ( $10 \pm 1.0$ ),  $Rex = 23-26$  ( $25 \pm$

$1.4$ ), stylet =  $39.5-45.8 \mu$ m ( $42.0 \pm 1.8$ ), prorhabdion =  $33.2-37.9 \mu$ m ( $34.4 \pm 1.7$ ).

General view similar to fourth-stage larva, but

scales arranged in ten to twelve longitudinal rows and genital primordium shorter ( $12.8-28.4 \mu\text{m}$ ).

*Second-stage larva* (Nishigoshi).  $N=10$ ,  $L=138-163 \mu\text{m}$  ( $150 \pm 8$ ),  $a=7.5-9.0$  ( $8.4 \pm 0.4$ ),  $a'=8.3-10.1$  ( $9.3 \pm 0.6$ ),  $b=2.3-2.7$  ( $2.5 \pm 0.8$ ),  $c=8.1-13.1$  ( $9.4 \pm 1.6$ ),  $R=70-73$  ( $72 \pm 1.1$ ),  $Ran=9-11$  ( $10 \pm 0.6$ ),  $Rex=26-29$  ( $27 \pm 0.9$ ),  $stylet=29.7-32.2 \mu\text{m}$  ( $31.0 \pm 0.9$ ),  $prorhabdion=24.0-26.5 \mu\text{m}$  ( $25.1 \pm 0.9$ ).

As in other species of *Nothocriconema*, second-stage larva has rounded minute scales on annules, and they are not arranged in longitudinal rows. Tail  $11.4-20.2 \mu\text{m}$  ( $16.5 \pm 2.6$ ) long, ended in peg-like terminus. Genital primordium  $6.9-15.8 \mu\text{m}$  ( $9.6 \pm 2.6$ ) in length, oval-shaped.

#### Habitat and localities.

Soil around root of *Quercus serrata* Thunb., *Q. acutissima* Carruth., *Parabenzoin trilobum* Nakai, *Clethra barbinervis* Sieb. & Zucc., *Rhododendron nudipes* Nakai, *Viburnum plicatum* Thunb. f. *tomentosum* (Thunb.) Rehder and *Meliosma myriantha* Sieb. & Zucc., in the somma of Mt. Aso (860 m alt.); mixed stands of *Agrostis clavata* Trinius var. *Nukabo* Ohwi, *Paspalum Thunbergii* Kunth, *Arundinella hirta* Tanaka and *Zoysia japonica* Steud., at Kusasenri in Mt. Aso (1,130 m alt.); *Hydracotyle maritima* Honda and *Oplismenus undulatifolius* Roem & Schlt., in Nishigoshi, Kumamoto Prefecture.

#### Discussion.

Three Japanese populations are examined. In the somma of Mt. Aso, this species was collected from woody plants and from herbaceous plants in Kusasenri in Mt. Aso and Nishigoshi. The tail annules of the Somma population is rather slender than those of others, however, no differences are observed among respective measurements of females of all three populations. The morphology and demensions of Japanese collections agreed with Canadian population of *N. longulum*, which was described as *Criconemoides quasidemani*<sup>9)</sup>, excepting for the total numbers of body annules and location of anus from posterior end of body. Raski and Golden also reported *C. quasidemani* from California and Hawaii<sup>9)</sup>. The female adults in California are bigger in body size and longer in stylet compared with Japanese. In all other respects the Japanese collections are obviously related to the description of *N. longulum* and the differences are considered to represent the range of the species. The females from Kusasenri and Nishigoshi have empty spermathecae and no male adults were found,

but those from the somma of Mt. Aso have the spermathecae filled with round sperms, and one male was obtained. Male adults were only reported from California. compared with them, the Japanese male has a smaller body and shorter tail with rather round terminus instead of acute tail-top. The number of incisures in lateral field is also differed between them: two in Californian population and three in Japanese, however, basically there are three incisures in male of this genus. Inner one may be obscure in specimens from California and the same phenomenon was also observed in *N. palliatum* n. sp.

#### *Nothocriconema jaejuense* Choi & Geraert, 1975 (Fig. 4, A-O)

##### Description and measurements.

Female.  $N=25$ ,  $L=439-665 \mu\text{m}$  ( $556 \pm 59$ ),  $a=6.2-9.9$  ( $8.0 \pm 1.1$ ),  $b=2.5-5.2$  ( $4.2 \pm 0.6$ ),  $c=13.2-25.3$  ( $18.6 \pm 3.2$ ),  $V=80.5-86.3$  ( $83.6 \pm 1.7$ ),  $R=52-57$  ( $56 \pm 1.4$ ),  $RV=11-14$  ( $13 \pm 0.8$ ),  $Ran=6-9$  ( $7 \pm 0.9$ ),  $RVan=4-6$  ( $5 \pm 0.6$ ),  $Rex=15-18$  ( $16 \pm 0.8$ ),  $stylet=90.0-103.4 \mu\text{m}$  ( $97.0 \pm 3.9$ ),  $prorhabdion=77.4-86.8 \mu\text{m}$  ( $82.1 \pm 3.0$ ).

Body cylindrical, almost straight. Head annules two; the first discoid, with six pseudolips, slightly wider than the second ( $26.5 \pm 1.7 \mu\text{m}$  vs.  $24.1 \pm 1.9 \mu\text{m}$ ), the second head annule smooth in outer margin. Body annules with smooth-faced white-colored band on ridge, and the spaces between them are redish-brown to brown and sticky, bearing soil particles and plant debris as reported in original description.<sup>1)</sup> Stylet slender; knobs anchor-shaped,  $3.2-6.3 \mu\text{m}$  high,  $6.3-11.1 \mu\text{m}$  across. Excretory pore at  $126.3-205 \mu\text{m}$  ( $165.2 \pm 16.9$ ) from anterior end. Vulva at  $78.9-115.3 \mu\text{m}$  ( $92.5 \pm 8.2$ ) from posterior end. Vulval lips prominent, projecting outwards and overlapping procedure annule. Anterior lip triangular in outline, dentate in both sides, terminus bluntly tridentate; posterior lip triangular, the side of which smooth, with sharply pointed terminus. Anus at  $20.5-39.5 \mu\text{m}$  ( $31.3 \pm 5.6$ ) from posterior end. Tail variable in shape, usually conoid and rarely elongate-conoid, terminal annules fused. Anastomoses rare or absent.

Male.  $N=1$  (in larval cuticle),  $L=407 \mu\text{m}$ ,  $a=11.7$ ,  $b=4.2$ ,  $c=8.1$ ,  $c'=2.0$ , spicules= $36.6 \mu\text{m}$ , gubernaculum= $8.8 \mu\text{m}$ .

Body curved ventrad. Esophagus narrow,  $97.9 \mu\text{m}$  long. Excretory pore at  $109.9 \mu\text{m}$  from anterior



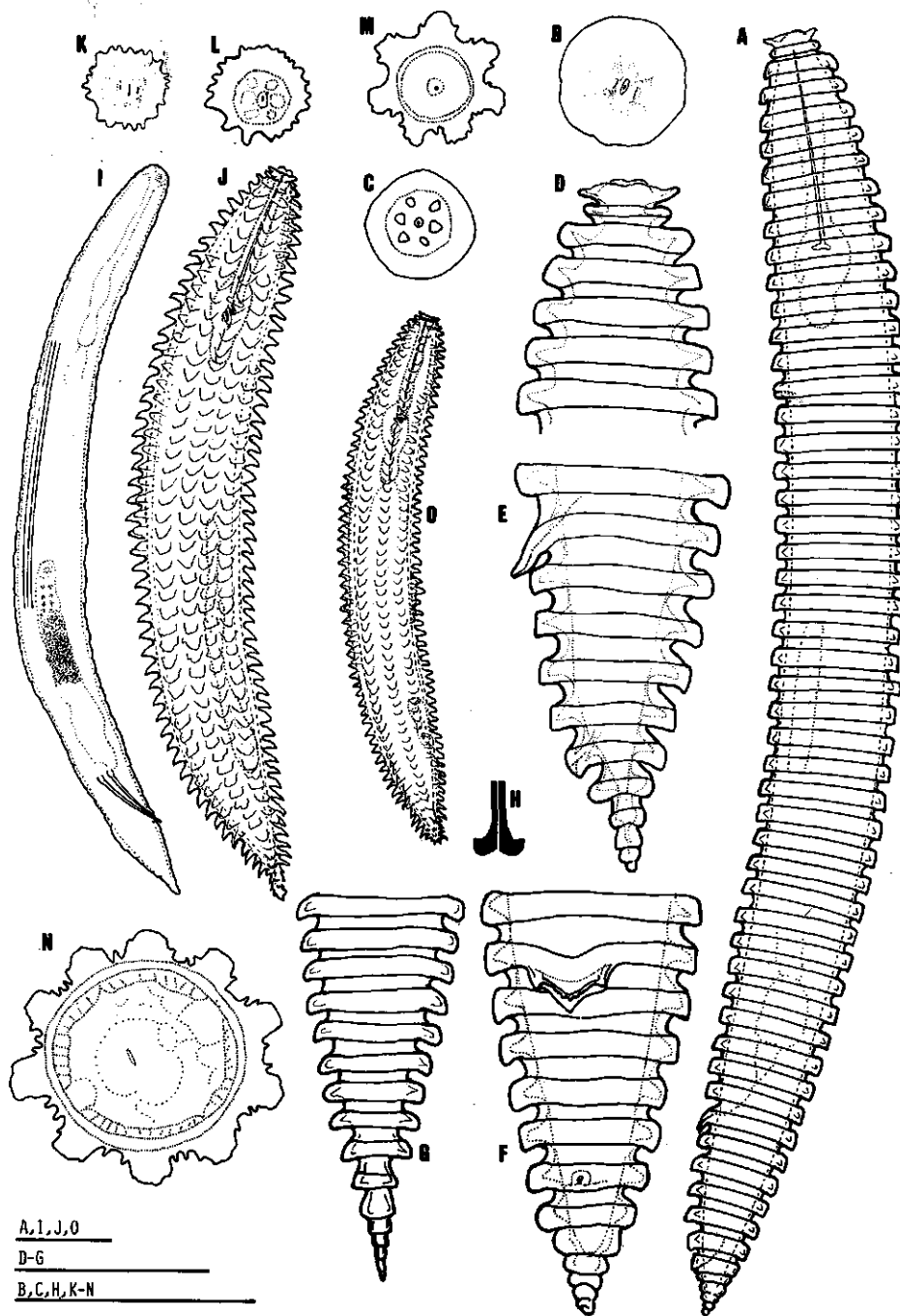


Fig. 4. *Nothocriconema jaejuense* Choi & Geraert, 1975 Female: A. general view, B. en face view, C. cross-section at second head annule, D. anterior part of body, E. posterior part of body, F. ditto: lateral view, G. ditto: ventral view, H. stylet knobs. Male: I. general view. Fourth-stage larva: J. general view, K. en face view, L. cross-section at second head annule, M. cross-section at first body annule, N. cross-section at midbody. Third-stage larva: O. general view. Scales indicate 50  $\mu$ m.

end. Spicules slender, almost straight. Tail conoid, 50.5  $\mu\text{m}$  long, ended in bluntly rounded terminus. Lateral field 5.1  $\mu\text{m}$  wide, with three incisures. Annules 3.9  $\mu\text{m}$  high, indistinct.

*Fourth-stage larva.* N=15, L=343–462  $\mu\text{m}$  (391 $\pm$ 32), a=5.7–7.2 (6.4 $\pm$ 0.5), a'=6.7–9.3 (8.1 $\pm$ 0.9), b=3.2–4.8 (3.7 $\pm$ 0.4), c=9.4–16.0 (12.4 $\pm$ 2.3), R=57–63 (60 $\pm$ 1.7), Ran=6–10 (9 $\pm$ 1.1), Rex=18–21 (19 $\pm$ 0.9), stylet=61.1–74.2  $\mu\text{m}$  (69.1 $\pm$ 4.2), prohabdion=53.7–63.2  $\mu\text{m}$  (57.5 $\pm$ 3.2).

Body curved ventrad after fixation, sometimes slightly twisted. Head with two annules, not retrorse, the second annule wider than the first; both head annules saucer-shaped, the denticles variable in shape and length: *en face* views show four median lips. Body annules retrorse, with scales, rectangular in shape, seven on the first, eight on the second annule, and ten to thirteen per annule at midbody, arranged in longitudinal rows. Base of and space between each scale bear small denticles, with minutely round top. Excretory pore 107.4–150.0  $\mu\text{m}$  (123.1 $\pm$ 12.8) from anterior end. Tail 23.7–44.2  $\mu\text{m}$  (32.8 $\pm$ 5.5) long, bears minute spines near tip. Genital primordium 47.4–102.6  $\mu\text{m}$  long.

*Third-stage larva* (?). N=27, L=201–287  $\mu\text{m}$  (242 $\pm$ 26), a=4.6–7.6 (6.4 $\pm$ 0.8), a'=5.2–10.9 (8.4 $\pm$ 1.3), b=2.5–3.3 (3.0 $\pm$ 0.2), c=7.5–17.5 (9.9 $\pm$ 2.3), R=59–66 (62 $\pm$ 2.6), Ran=7–10 (9 $\pm$ 1.0), Rex=19–23 (21 $\pm$ 1.3), stylet=44.2–56.8  $\mu\text{m}$  (51.3 $\pm$ 3.6), prohabdion=36.3–45.8  $\mu\text{m}$  (41.5 $\pm$ 2.8).

General view similar to fourth-stage larva. Head annules two, smaller than body ones, truncate in front, and saucer-shaped. Excretory pore at 71.1–97.9  $\mu\text{m}$  (82.5 $\pm$ 4.3) from anterior end. Tail conoid, with more slender scales than those at midbody. Genital primordium 11.1–18.9  $\mu\text{m}$  (15.3 $\pm$ 2.3) long. Body scales arranged in nine to thirteen longitudinal rows at midbody.

*Second-stage larva.* Unknown.

#### Habitat and locality.

Collected from the rhizosphere of following plants in the somma of Mt. Aso (860 m alt.): *Viburnum plicatum* Thunb. f. *tomentosum* (Thunb.) Rehder, *Styrax japonica* Sieb. & Zucc., *Clethra barvinervis* Sieb. & Zucc., *Aralia elata* (Miq.) Seeman, *Cornus controversa* Hemsley, *Elaeagnus*

*pungens* Thunb., *Euonymus Sieboldianus* Blume, *Acer Sieboldianum* Miq., *Quercus serrata* Thunb., *Buxus microphylla* Sieb. & Zucc. var. *japonica* (Muell Arg.) Rehd. & Wils. and *Meliosma myriantha* Sieb. & Zucc.

#### Discussion.

This species is unique among *Nothocriconema* in sticky body annules and triangular vulval lips, and has been known only from Korea. Compared with the original description of female, Japanese collection differs from it in the absence of the interruptions of head and body annules and significantly longer body and stylet. In other characters Japanese population agrees with the Korean one.

Second-stage larvae of this genus bear small rounded scales arranged irregularly as described in this paper. With this species fairly many specimens were examined, however, no such larvae were found. All specimens examined bore longitudinal rows of scales on body. It is not certain that the arrangement of scales with the second-stage larva of this species is similar to those of third- and / or fourth-stage larva.

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## 和文摘要

2新種を含む阿蘇山産  
*Nothocriconema* 属線虫 4種の記載

皆川 望

阿蘇山の主に外輪山上の牧野およびその周辺から採取された *Nothocriconema* 属線虫 4種について分類学的検討を行った。それらのうちの2種は *N. longlum* (Gunhold, 1953), *N. jaejuense* Choi & Geraert, 1975と同定した。他の2種は未記載の種と認め、*N. palliatum* n. sp. および *N. bellatulum* n. sp. と命名した。*N. palliatum* n. sp. はハナイカダ、リョウブ、ミズキ等の木本の根辺から分離された。本種は尾端部が薄いクチ

クラ様の膜に被われている事から *N. loofi* に近似の種と考えられるが、体長・口針長ともに短かく、体環数も少ない事からそれと区別される。*N. bellatulum* n. sp. はツクシヤブウツギの根辺から検出され、*N. longulum*, *N. demani* 等にやや似るが、体長、口針長ともにそれらの種より短い。上記2新種を含め、4種線虫について雌雄成虫、各令期の幼虫を記載・図示した。