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Systematic study of Criconematoidea from Korea*
3. Two new and one known species of Criconematoidea from Korea (Nematoda : Tylenchida)

韓國產 環線蟲上科의 系統分類學的 硏究
3. 環線蟲上科의 2新種 및 1未記錄種 報告

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ABSTRACT Among recent materials identified from Korea two species of Criconematoidea are different from described forms: *Criconemella hawangiensis* is larger and has a longer stylet than *C. paragoodeyi*, head and tail annuli also differ. *Hemicycliophora parajuglandis* has an outbulging lip area that sits like a hemicircle on the head and pushes the lateral head side inwards; morphology and measurements correspond to *H. juglandis* and also to *H. koreana*. *Hemicycliophora epichoroides* is newly recorded from Korea

KEY WORDS Criconematoidea, Taxonomy, Morphology, Host plant, Korea

초 록 環線蟲上科에 속하는 선충을 연구하던 중, 2新種을 발견하였다, *Criconemella hawangiensis*는 *C. paragoodeyi*보다 훨신 크고, 口針도 길고, 꼬리 주름 역시 다르다: *Hemicycliophora parajuglandis*는 외부로 부풀어오른 口脣部를 가지며 그것은 두부에 반원형으로 놓여 있다. 그리고 頭部側面은 안으로 밀렸다. 형태와 측정치는 *H. juglandis*나 *H. koreana*와 일치하였다. *H epichoroides*는 한국 未記錄種으로 보고된다.

검색어 환선충상과, 분류형태, 기주식물, 한국

Criconemella hawangiensis n.sp.
화왕산가는주름선충(신칭)
(Fig. 1 & 2 A-E)

Measurements: Holotype: L=6300μm, a=13.4; b=4.8, c=18.2; V=89.1%; Stylet=64μm; R=132, Rex=33; Rv=12; Ran=7, Rvan=5.

Paratype female n=16: L=591μm± 54.1(504-687); a=13.9± 1.2(11.5-16.1); b=4.7± 0.4(4.0-5.4); c=14.2± 2.3(10.5-18.2); Stylet=67μm± 3.3(59-73.4); R=137.8± 7 8(124-154); Rex=37.3± 3.4(33-44); Rv=13.5± 1 2(12-15); Rvan=4.3± 0 5(4-5); Ran=8.8± 1.2(7-11); V=88%± 2.4(80.1-90); G=51%± 10.5(38.6-65.9)

Head annuli almost not differentiated from body annuli, but head annuli usually not retrorse: the first annulus contains the frontal plate showing no additional structures, it is followed by one or two non retrorse annuli and two or one annuli similar to the body annuli. Annuli slightly consecutive crenated, showing a few anastomoses. Stylet and oesophagus of the usual structure Vulva closed, vagina elongated, anteriorly directed, spermatheca empty. Post vulval region regularly conical, last tail annuli bigger than preceeding ones and slightly irregular: top annulus usually very small.

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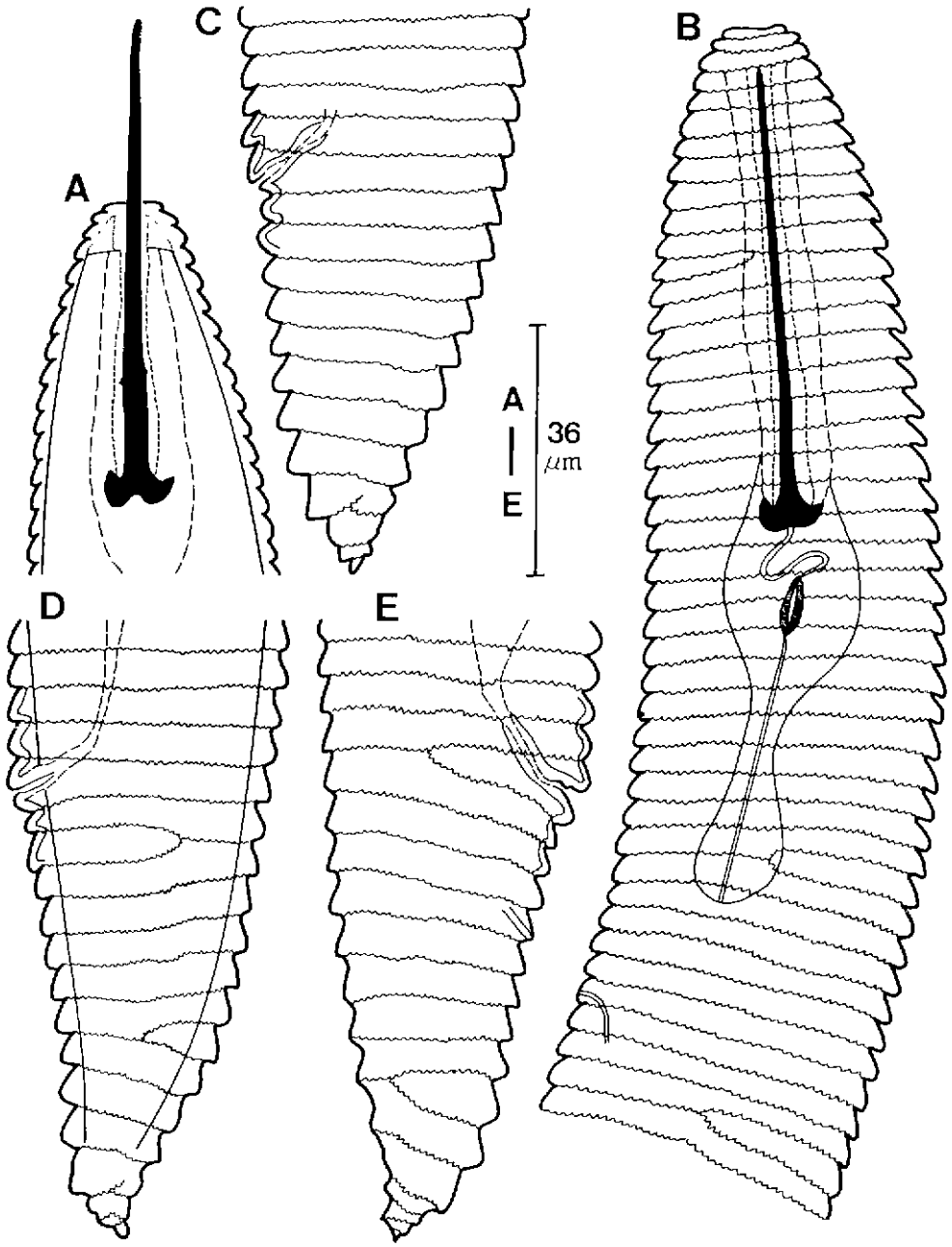

Figs. 1. *Criconemella hawangiensis* n.sp.: A-B=anterior part, C-E=various posterior parts of female

Comparison with related species

This new species is very much related to another Korean species *Criconemella paragoodeyi* Choi & Geraert, 1975, also showing almost not differentiated head annuli, crenated annuli, anastomoses, closed vulva, conical tail. The main differences are in the measurements, the new species being much bigger (L=504-687μm against L=375-460μm) with a much larger stylet(59-73μm against 46-47μm). Although the total number of annuli is similar(R=124-

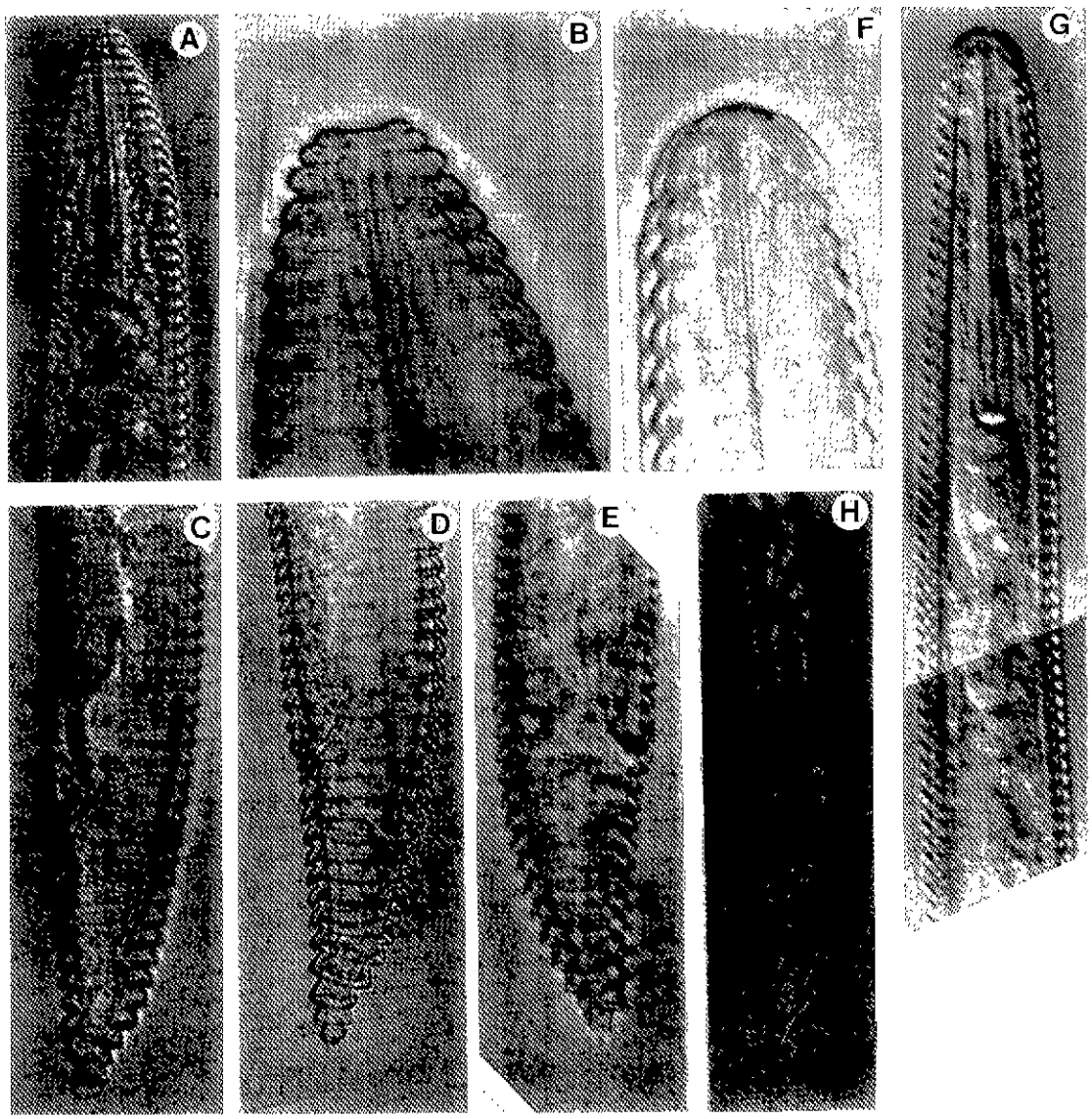

Fig. 2. Light microscopy *Criconemella hawangiensis* n.sp.. A-E: A=head region; B=anterior end, C-E=variation in female tail shape and vulva position; *Hemicycliophora epicharoides* F-H; F=head region: G=oesophagus, H=female posterior region

154 in the new species and 132-137 in *C. paragoodeyi*), Rv, Rvan and Ran are slightly different(in *C. hawangiensis* 12-15, 4-5, 7-11 and in *C. paragoodeyi* 15-20, 5-7, 11-13 respectively). These last differences correspond to the morphological differences between the two species. in *C. hawangiensis* the last tail annuli are bigger than the preceeding ones while in *C. paragoodeyi* they are smaller and more numerous. In *C. paragoodeyi* there are five head annuli, one more than in *C. hawangiensis*

Type specimens Holotype on slide Ring 99 in collection of Department of Agricultural Biology, College of Agriculture, Kyungpook National University, Taegu, Korea. Paratype females on slides Ring 99-16 same collection, slides 658 in collection of the Instituut voor Dierkunde, Ledeganckstraat 35, Gent,

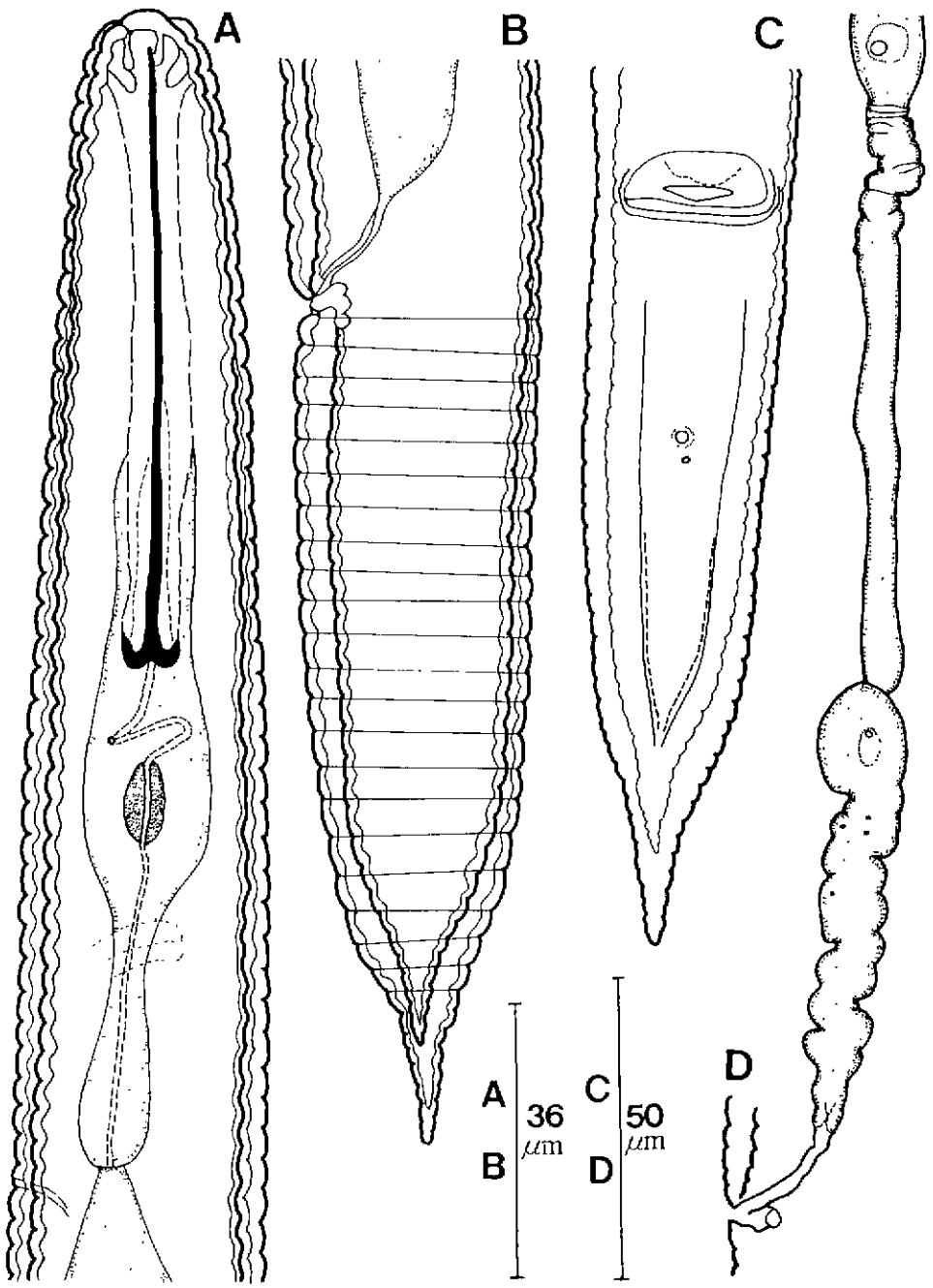

Fig. 3. *Hemicycliophora epicharoides*: A=anterior part; B=Posterior part; C=ventral view of vulva. D=female gonad

Belgium

Type locality and Host plant. Ch'angnyŏng Hawangsan(*Miscanthus nakaiana* var. *purpurascens* Rendle)

***Hemicycliophora epicharoides* Loof, 1968**
느티나무껍질선충(신칭)
(Fig. 2 F-H & 3)

Table 1. Morphometric comparison of *Hemicycliophora epicharoides* from different localities and hosts (Female)

	The Netherlands	Korean specimens			
	(Paratype)	A	B	C	D
	n=50	n=11	n=15	n=10	n=10
L(μm)	810(660-930)	797 3± 53 3(727-925)	831 6± 34 1(765-892)	868± 36 2(811-918)	774± 29.9(734-820)
a	24(21-27)	22.1± 1.3(19.0-24.4)	21.4± 1 2(19.1-24.2)	22.5± 1 5(20 4-24 8)	21.9± 1.2(20.4-24.4)
b	5.1(4.7-5.7)	5.4± 0 4(5 0-6.1)	5.3± 0.2(5 0-6.0)	5.8± 0 3(5.3-6.4)	5.4± 0 2(5 1-5 8)
c	11.6(10.1-13.6)	9.8± 1.3(8.1-12.8)	9.7± 0.5(9.1-10.5)	10.6± 0 9(9.2-12 6)	10 1± 0.5(9.2-10.7)
V(%)	86(84-87)	85± 1.5(83-88)	84± 0.9(83-86)	84± 1.3(82-86)	85± 0.6(83-85)
G(%)		41± 5.7(34-55)	46± 4.3(40-54)	47± 6 6(38-63)	42± 2.6(39-46)
Stylet(μm)	81(76-87)	77.7± 3.5(72-83)	83.4± 2 9(78-89)	85.9± 2.2(79-88)	80± 3.3(76-85)
R	183(165-202)	192.4± 6.4(181-200)	189 6± 5 1(180-197)	214.9± 6.2(203-225)	216± 3 9(211-223)
RV	37(31-42)	37.1± 3.8(30-42)	36.4± 1.3(34-38)	37.7± 1 2(35-40)	41 6± 2.7(38-47)
RVan	11(9-13)	12.5± 1.4(11-15)	11.7± 0.9(11-14)	13.2± 1 5(11-16)	13 6± 1.4(12-16)
Ran	24(20-30)	25.6± 2 5(20-29)	24.9± 1.2(22-27)	24 7± 1 5(22-27)	27.9± 1.9(26-32)
Rex	35(32-39)	39 8± 2 9(35-45)	38.2± 1.8(36-40)	43± 2 4(38-46)	42.6± 1.3(40-44)

A: Sangju(*Zelkova serrata* Makino), B: Okch'ŏn(*Cercis chinensis* Bunge),
C. Ch'ŏngju(*Zelkova serrata* Makino), D: Kerongsan(*Camellia japonica* Linne)

Measurements. see Table 1.

Lip region rounded, the labial disc slightly protruding with two distinct annules. Spear with rounded, backwardly directed knobs, in some specimens slightly directed forward(Fig. 2. F, G). Excretory pore located from 1-2 annules anterior and posterior to the base of esophagus. Vulva conspicuous. vulva lip short but distinct. Gonad single, anteriorly outstretched. with distinct round spermatheca but without sperm. Tail cylindroid, bluntly triangular distally.

Discussion. Comparing with the paratype, the Korean populations show some differences among the localities: Body length slightly shorter than the paratype at Kerongsan(*Camellia japonica*) 774μm (734-820) instead of 810μm(660-930). Number of body annuli higher than the paratype at Chŏngju (*Zelkova serrata*). 241.9(203-225) and Kerongsan (*Camella japonica*) 216(211-223) instead of 183 (165-202). Excretory pore located at 3-7 annules more posteriorly in Korean populations.

Locality and Host Plants. Sangju Wangsan(*Zelkova serrata*), Okch'ŏn(*Cercis chinensis*), Ch'ŏngju (*Zelkova serrata*), Kerongsan(*Camellia japonica*).

Hemicycliophora parajuglandis n.sp.
어리호두껍질선충(신칭)
(Figs. 4, 5 & 6)

Measurements. see Table 2.3

Female. body annuli with a few breaks suggesting here and there a lateral line; SEM shows that indeed a very fine line can be present. Head very peculiar with outbulging oral disc, amphidial plate and lateral plate, there is a distinct groove between all these structures and the dorsal and ventral head annuli; on the lateral side the head annuli are sometimes interrupted by the lateral plate; the lateral side of the head following the lateral plate can be variously excavated. Mostly three head annuli but the head is not always distinctly offset. Stylet and oesophagus are usual for the genus Vulva position obvious by the body constriction posterior to it: vulva lips slightly projecting, not modified; vagina anteriorly bent; spermatheca with sperm Post vulval region subcylindrical for about three quarters than showing a sudden constriction, ending in a sharply conical last quarter. On this conical part the annulation gradually disappears.

Male. Conical head, degenerated digestive system. Spicule semicircular; spicular sleeve moderately long. Bursa well developed. tail conical.

Comparison with related species

This species is very similar to the two species described from Korea: *H. koreana* Choi & Geraert,

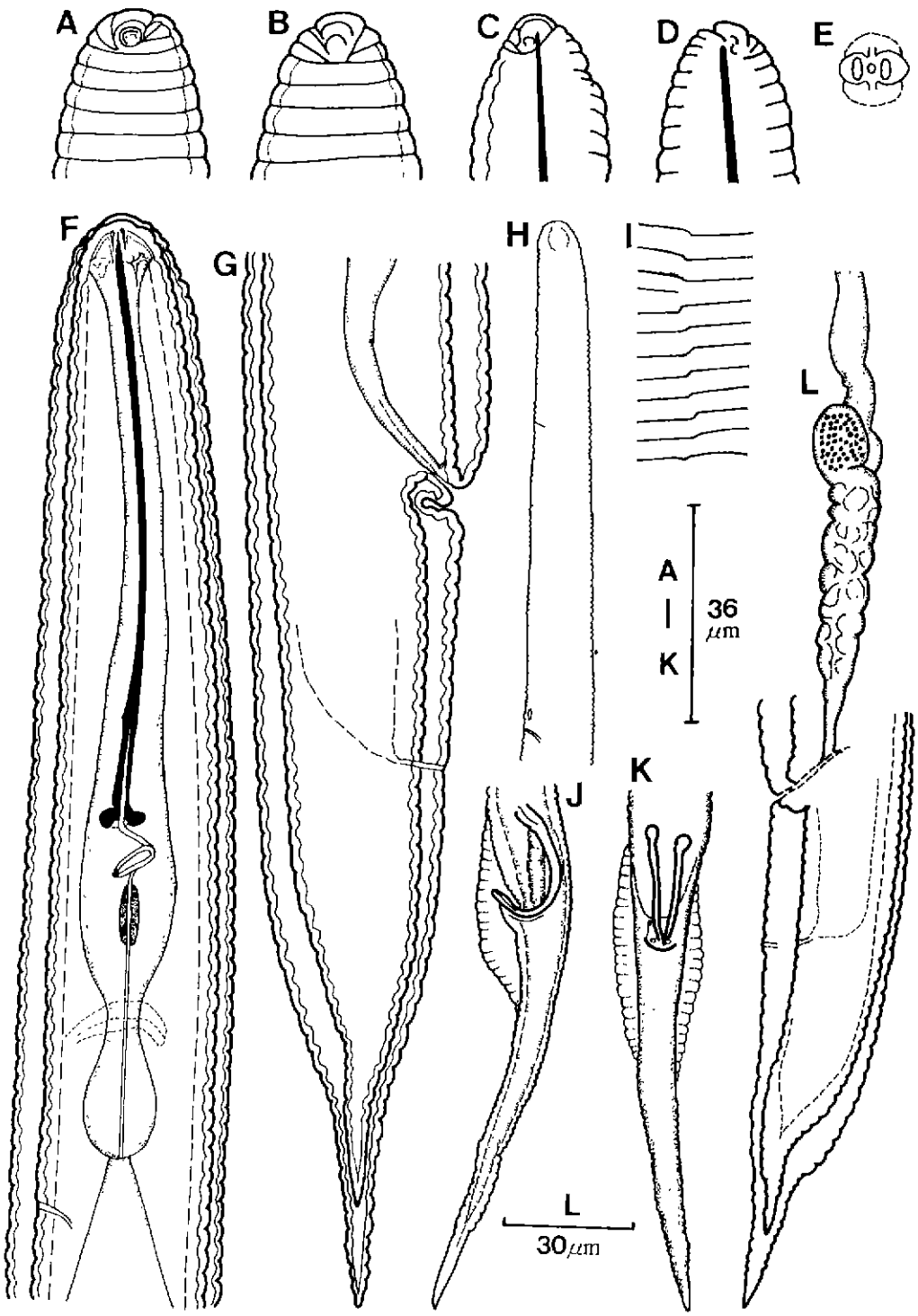

Fig. 4. *Hemicycliophora parajuglandis* n sp: A-D=various shape of head region; E=enface view, F=anterior part of female; G=posterior part of female; H=anterior part of male, I=lateral field; J-K=posterior part of males; L=female gonad.

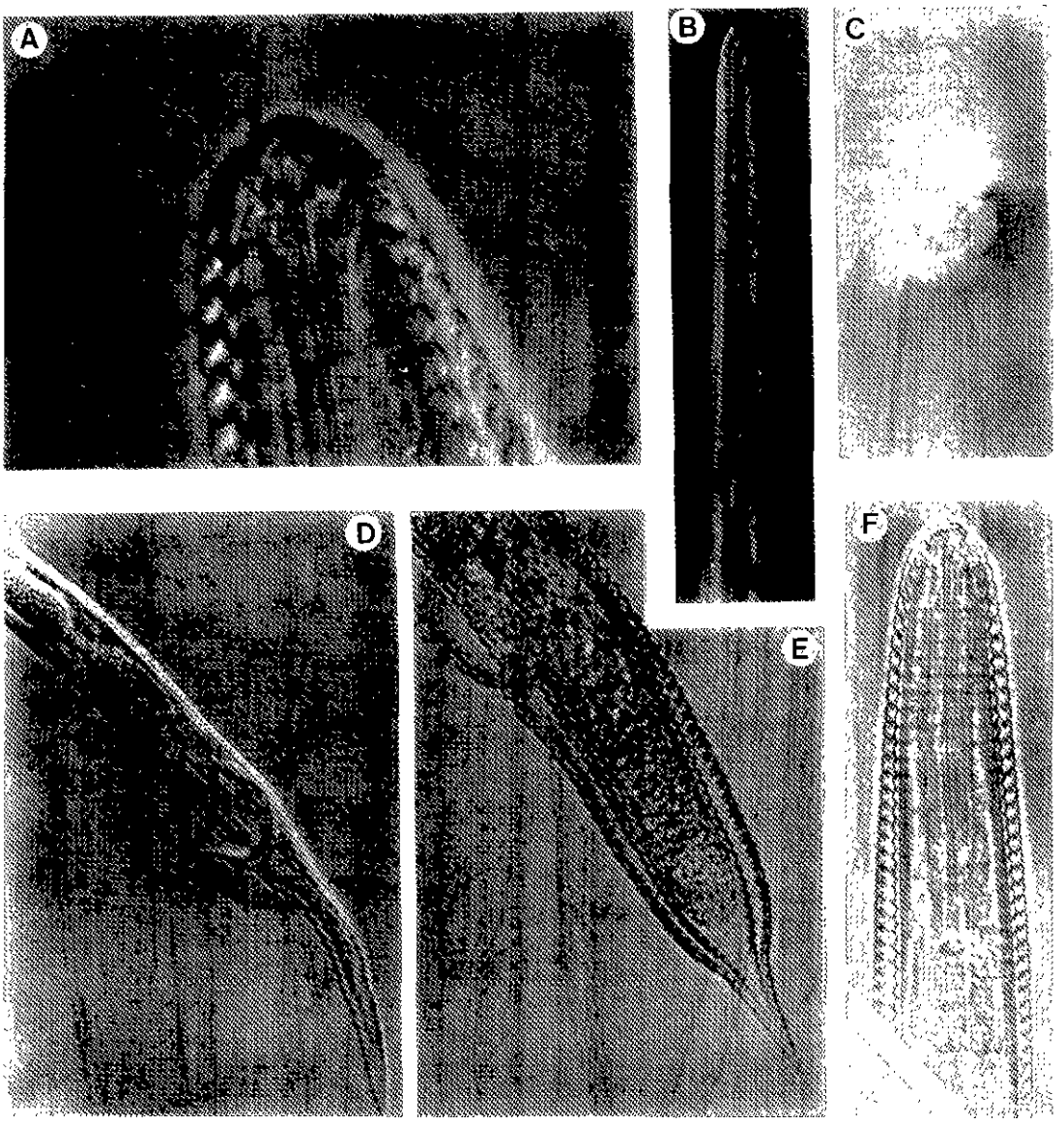

Fig. 5. *Hemicycliophora parajuglandis* n sp.: A-F: LM photographs, A=head region, showing the projecting labial region; B=male, anterior region; C=head, enface view showing the oral ring, the two amphids and the lateral dimples in the head, D=male, posterior end, E=female, post vulval region, F=female, oesophageal region.

1971 and *H. juglandis* Choi & Geraert, 1975.

Loof(1985), in his comparative study of the end-on views of *Hemicycliophora* females by SEM, concluded that *H. koreana* was an aberrant case; his Figs. 4 E & F show a similar structure to what is found in our new species with an oral ring and lateral plates; of *H juglandis* no SEM is available but Choi & Geraert's (1975) Figs 1 F & G show a similar lateral view as the one obtained for our new species. *H parajuglandis* n. sp. has, however, the outbulging lip region not found in the other two species, moreover *H. juglandis* has a more offset head while *H koreana* has less distinct head annuli. The morphology and the measurements of

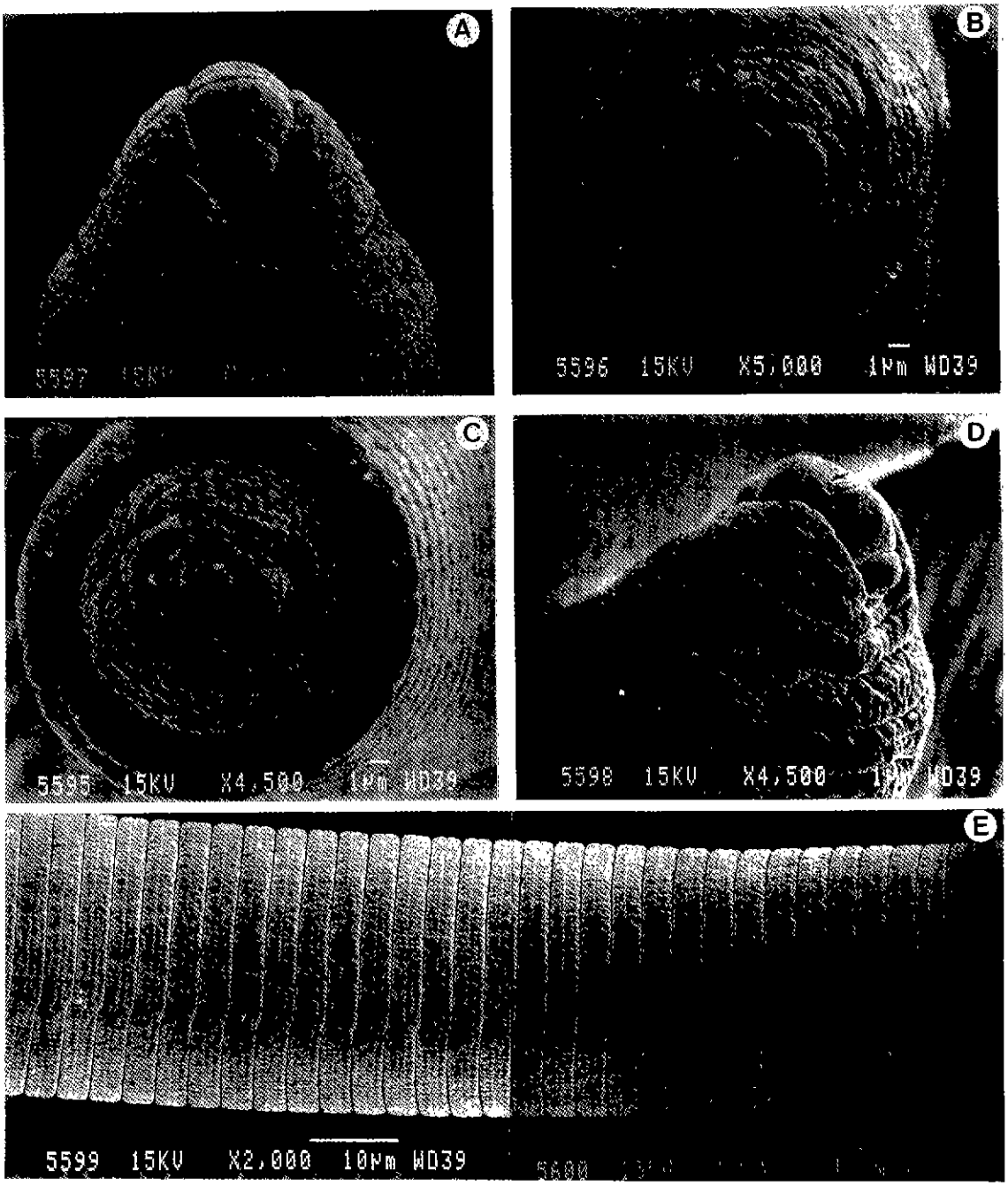

Fig. 6. *Hemicycliophora parajuglandis* n.sp.: SEM photographs· A-D=head in two females viewed from different angles showing the outbulging oral ring with the slit like prestoma aperture in the middle,the two large and outbulging amphidial plates, followed on both sides by two additional lateral plates; all these items form a laterally elongated shape that sits as a hemicircle on the head; dorsally and ventrally the head is normally developed but laterally the head shows dimples. E=33 body rings showing on some of them a very faint lateral line, occuring more or less together with some slight breaks in the annulations.

Table 2. Morphometric comparison of *Hemicycliophora parajuglandis* n.sp from different localities and host plants.(Female)

Characters	Holotype	Hamyang (*Pinus densiflora*)	Jinan (*Quercus acutissima*)	Yangsan (*Pinus densiflora*)
		n=25	n=26	n=26
L(μm)	845	830.4± 39.8(755-890)	843± 41.6(750-932)	874.7± 57.6(788-986)
a	25.7	22± 1.2(18 6-24.5)	23.7± 1.4(21.1-26.6)	21.8± 1.4(19.7-25.3)
b	5.3	5.1± 0.2(4.7-5.5)	5.4± 0 2(4.8-5.8)	5 2± 0.3(4.7-5.8)
c	9.1	13.1± 2.6(9.2-18.9)	8.8± 0.6(7.6-10)	10.7± 0.8(9.7-12.5)
V(%)	84.3	86.1± 1.1(83.7-89.8)	83± 1.2(79.2-85.9)	85± 1 1(82.6-87.1)
G(%)	49.4	59 1± 9.4(46.1-80.1)	45 7± 4.6(38.7-57)	43.0± 5.4(30.1-54.7)
Stylet(μm)	90	97.1± 3 7(89-103)	89.3± 2.7(84-96)	100.1± 3.0(93.6-108)
R	222	229.1± 6.4(218-240)	223± 6.9(213-240)	221± 11.9(200-246)
RV	48	41 8± 2.2(36-45)	44.2± 2.2(40-48)	41.0± 3.6(36-52)
RVan	12	12.3± 1.2(10-14)	11.8± 1.1(9-13)	12.5± 1.1(10.0-15.0)
Ran	31	29 6± 1.5(26-32)	33± 1.7(30-37)	28.3± 2 7(24-36)
Rex	43	48 1± 1.4(46-50)	44.4± 2(39-48)	46.9± 3.9(34-54)

Table 3. Morphometric comparison of *Hemicycliophora juglandis* n. sp from different localities and host plants.(Male)

Characters	Hamyang (*Pinus densiflora*)	Jinan (*Quercus acutissima*)	Yangsan (*Pinus densiflora*)
	n=16	n=21	n=4
L(μm)	683 3± 54 1(525-766)	667.1± 45.4(545-745)	643.3± 54.6(558-709)
a	34.6± 2.4(30.5-37.6)	34.3± 3(27.2-39 1)	29.8± 2.5(25 8-32.8)
b	6.4± 0.5(5.5-7.3)	6.3± 0.4(5.5-7.4)	5.9± 0.4(5 6-6 5)
c	7 5± 0.3(7-7.9)	7.3± 0.5(6 5-8.6)	7.7± 0 5(7-8.2)
T(%)	18.4± 2.8(12.2-23.1)	17.9± 1.9(13.3-20.7)	19.1± 1(17.6-20 5)
Spicule(μm)	45 3± 2.1(41.7-47.5)	43 0± 2.7(37-48)	47.3± 2.2(46-51)
Gubernaculum(μm)	8.2± 1(7.2-10 8)	7.7± 1.2(6-10)	8 8± 1(7 2-10)

the three species are very similar, with *H. juglandis* being slightly larger(L=930-1100μm against 755-985μm in *H. parajuglandis*) showing a slightly longer stylet(104-113μm against 84-108μm) than this new species. The several populations of *H. koreana* in Choi & Geraert(1975) fills the gaps among all these differences. The tail shape of this new species being more similar to *H. juglandis* than to *H. koreana*, therefore we prefer to use the name *H. parajuglandis*; males are known for *H. koreana* but not for *H. juglandis*.

Type specimens. Holotype on slide Forest 366 in collection of Department of Agricultural Biology, College of Agriculture, Kyungpook National University, Taegu, Korea. Paratype females on slides Forest 366, Forest 390, Forest 660. same collection; slides 659 in collection of the Instituut voor Dierkunde, Ledeganckstraat 35, Gent, Belgium.

Type locality and Host plant. Jinan(*Quercus acutissima*),

Other localities. Hamyang(*Pinus densiflora*) Yangsan(*Pinus densiflora*).

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