

Taxonomic Studies of Trichodoridae (Nematoda: Trichodoroidea) from Korea, with Descriptions of a New Species

韓國産 弓針線蟲科의 분류학적 연구 및 1 新種 기재

Hyun Sil Baek and Young Eoun Choi

백현실 · 최영언

ABSTRACT A new species, *Trichodorus jeonjuensis* n. sp., resembles *T. cedarus* Yokoo, 1964, *T. tricaulatus* Shishida, 1979, and *T. californicus* Allen, 1957, from which it differs by male with three ventromedian cervical pores anterior to excretory pore. The spicules are straited all over and first supplement is located on half of spicules and the female has kidney shape vagina. *T. tricaulatus* Shishida, 1979 is newly reported from Korea. *T. cedarus* Yokoo, 1964 and *Paratrachodorus porosus* (Allen, 1957) Siddiqi, 1974 were found at several localities and some morphological data were compared by localities

KEY WORDS Morphology, taxonomy, Trichodoridae, host plant

초 록 *Trichodorus jeonjuensis* n. sp는 *T. cedarus*, *T. tricaulatus*, *T. californicus*와 비슷하나 수컷에서는 3개의 腹中央 頸孔이 排泄孔에 대하여 전방에 있고 交接刺는 전체적으로 주름졌고, 첫째 보조돌기가 교집자 중앙부에 있으며 암컷의 膣 모양이 腎臟形이다. *T. tricaulatus*는 우리나라 未記錄種으로 밝혀졌으며, *T. cedarus*와 *Paratrachodorus porosus*가 여러 곳에서 새로이 채집되어 기주식물 및 지역별 차이를 검토하였다.

검색어 形態, 分類, 弓針線蟲科, 寄主植物

During a study on Trichodoridae from Korea, soil samples were taken around the roots of several plants. A new and an unrecorded species of Trichodoridae were identified. New host plants and comparative morphological characteristics of *Trichodorus cedarus* and *Paratrachodorus porosus* are reported herein.

MATERIALS and METHODS

Nematodes were extracted from soil by a modified sieving-Baermann funnel method and fixed in hot (80°C) F.G. 4-1 fixative. Then processed to pure glycerin according to Seinhorst's rapid glycerin method. Photographs were taken with Olympus Nomarski Differential Interference Contrast Attachment.

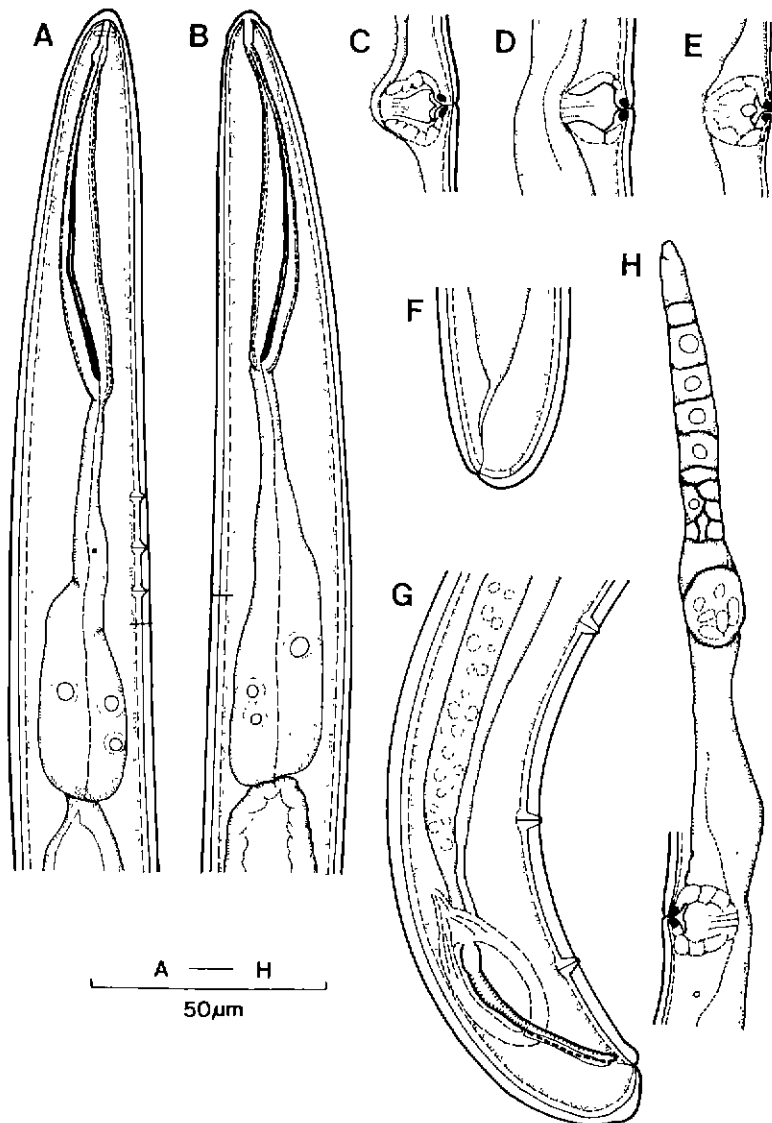
Trichodorus jeonjuensis n. sp.

해송궁침선충(신칭)

(Fig. 1, Plates 1-B, 2-D)

Measurements. Male(holotype): L=775.8µm; a=23.0; b=4.6; T=66.6%; Neck length=128.9µm; Anterior end to excretory pore=134.6µm; Body width=33.8µm; Stylet length=75.6µm; Anterior end to CP1=105.8µm; CP1 to CP2=11.6µm; CP2 to CP3=8.6µm; CP3 to excretory pore=8.6µm; Spicule length=42.5µm; Gubernaculum length=13.0µm; Cloaca to SP1=23.8µm; SP1 to SP2=32.4µm; SP2 to SP3=40.3µm.

Male(paratype, n=1): L=739.8µm; a=22.8; b=4.5; T=62.8%; Neck length=120.2µm; Anterior end to excretory pore=126.7µm; Body width=32.4µm;



Figs. 1. *Trichodoros jeonjuensis* n. sp.: A: Anterior part of male, B: Anterior part of female, C-E: Vulval region, F: Female tail, G: Male tail, H: Anterior reproductive system of female.

Stylet length=74.2 μ m; Anterior end to CP1=98.6 μ m; CP1 to CP2=13.0 μ m; CP2 to CP3=10.1 μ m; CP3 to excretory pore=5.0 μ m; Spicule length=43.2 μ m; Gubernaculum length=13.0 μ m; Cloaca to SP1=23.0 μ m; SP1 to SP2=20.9 μ m; SP2 to SP3=39.6 μ m.

Female(paratype, n=13): L=720.6 μ m \pm 44.9(658.8-804.6); a=22.5+2.4(17.7-25.1); b=4.4 \pm 0.3(3.9-5.1); V=58.2% \pm 1.7(55.7-61.2); G1=23.4% \pm 2.7

(19.0-28.7); G2=21.9% \pm 2.5(18.7-25.9), Anterior end to excretory pore=130.4 μ m \pm 9.2(111.6-144.7); Neck length=122.9 μ m \pm 7.9(110.2-141.1); Body width=32.3 μ m \pm 2.8(27.4-38.9), Stylet length=72.8 μ m \pm 4.3(63.4-78.5); Anterior ovary length=168.9 μ m \pm 25.3(135.0-225.0); Posterior ovary length=158.4 μ m \pm 24.0(127.8-201.6).

Description. Male; General appearance typical

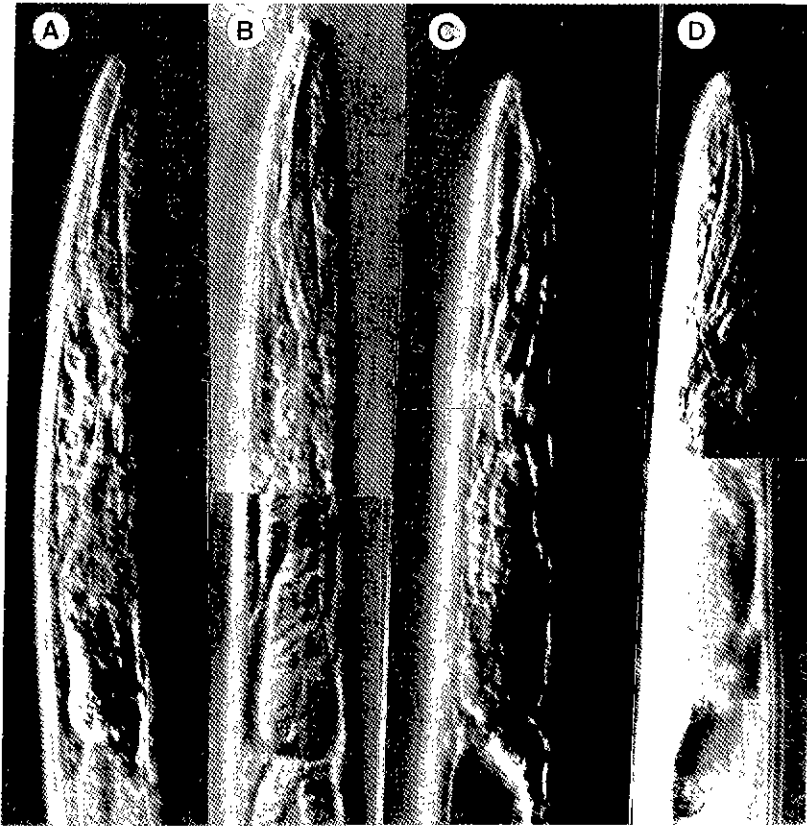


Plate 1. Anterior part of female A *Trichodorus cedarus*, B *T. jeonjuensis* n. sp. C: *T. tricaulatus*, D: *Paratrichodorus porosus*

of the genus. Body tapers rapidly to anterior end, and lip region width 1/8 of central body width(Fig 1, A). Tail curved ventrally after fixation with a rounded terminus(Fig. 1, G). Excretory pore located at anterior half of expanded part of the oesophagus from the anterior end of the body(Fig. 1, A). Three ventromedian cervical pores(CP) anterior to the excretory pore; the distance of CP1 to CP2 12.3 μ m, CP2 to CP3 9.3 μ m, and CP3 to excretory pore 6.8 μ m(Fig 1, A) Lateral pore located at the level of CP2 Three ventromedian supplements papillae(SP) found anterior to the cloaca(Fig. 1, G); the posterior one(SP1) located 23-23.8 μ m anterior to the cloaca or at the level of the middle of spicule. The distance between SP2 to SP3 extremely longer than that between SP1 and SP2 and also than that between SP1 and cloaca. Spicules curved ventrally and straight, gradually tapers, bluntly rounded(Fig. 1, G). Gu-

bemaculum rod shaped with thick terminus.

Female: Body cylindrical, a little curved ventrally by heat fixation. Excretory pore located slightly anterior to a half of the postcorpus, at 130.4 μ m(111.6-144.7) from the anterior end(Fig. 1, B). Basal bulb not-overlapping the intestine. Vagina about as wide as long. sclerotization of vagina in lateral view reniform to rounded(Fig. 1, C-E). Gonads paired, opposed outstretched, general appearance typical of the genus, and oval spermatheca with spermatozoa(Fig. 2, H). One lateral pore located at posterior to vulva. Anus subterminal, curved, transverse slit. Tail rounded with a caudal gland pore nearly terminus(Fig. 1, F).

Type locality and habitat. Soil around the roots of black pine(*Pinus thunbergii* Parl.) at Wansandong, Chŏnju-shi, Chollabuk-do. Korea, November,

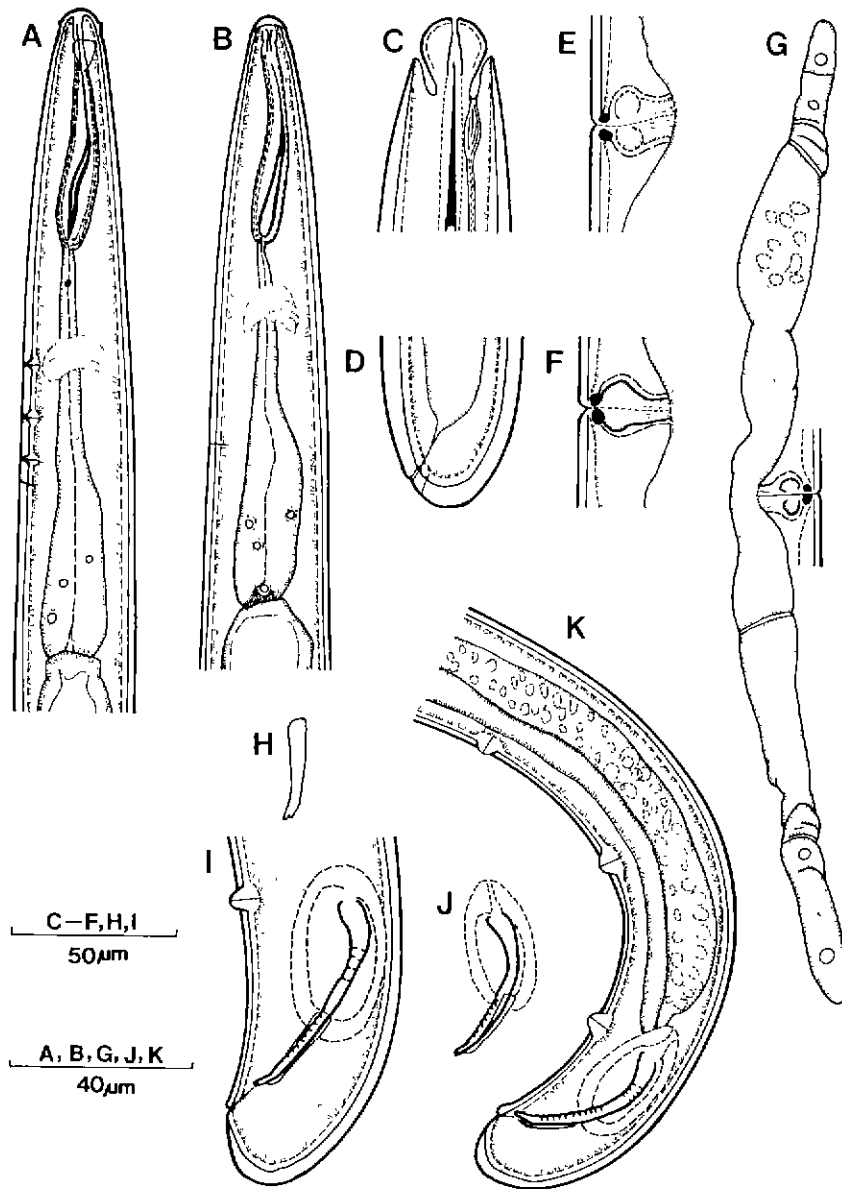


Fig. 2. *Trichodorus tricaulatus*: A: Anterior part of male, B: Anterior part of female, C: Amphids, D: Female tail, E, F: Vulval region, G: Female reproductive system, H: Gubernaculum, I, J: Spicule and gubernaculum, K: Male tail.

1990.

Type material. Holotype male (slide 277-2), one paratype male (slide 277-1), and 13 paratype females (slides 277-1, 277-2) in nematode collection of Department of Agricultural Biology, College of Agriculture, Kyungpook National University, Taegu, Korea.

Diagnosis and relationships. *Trichodorus jeonjuensis* n. sp. is characterized by oesophagus not overlapping intestine and well set off from intestine. Male with three ventromedian cervical pores anterior to excretory pore. First supplement located on half of spicules (23 μm from cloaca). The spicules are striated all over. Female with kidney shape vagina.

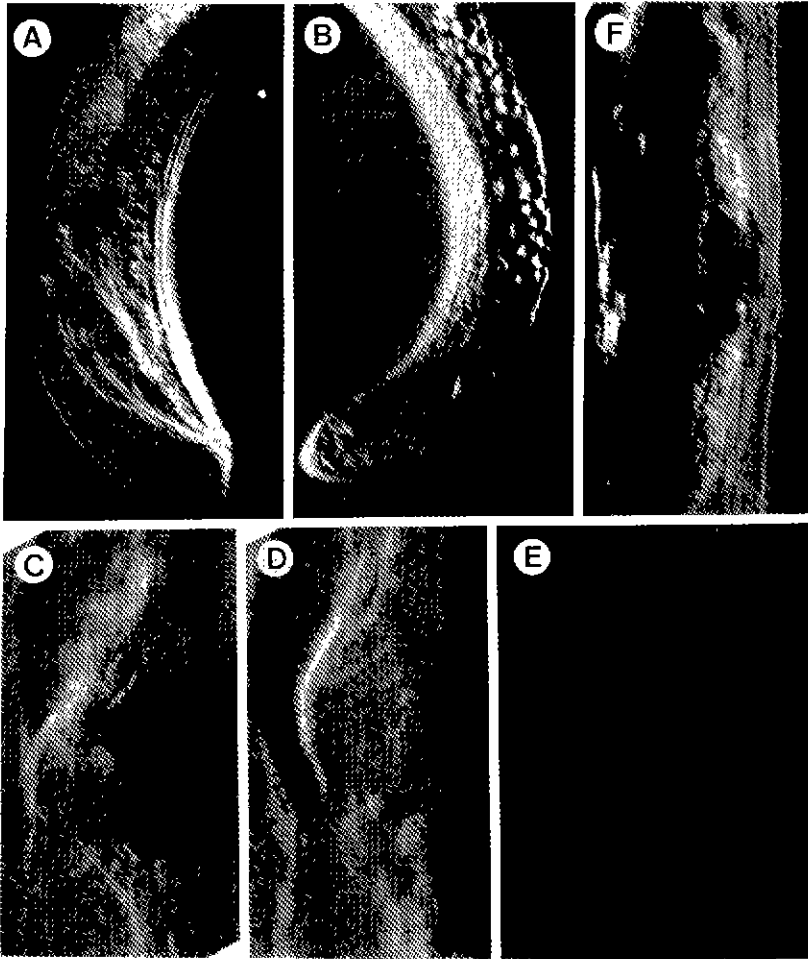


Plate 2. Posterior part of male: A. *Trichodorus cedarus*. B. *T. tricaulatus*, Vulval region, C. *T. cedarus*, D. *T. jeonjuensis* n. sp., E. *T. tricaulatus*. F. *Paratrichodorus porosus*.

The male of *T. jeonjuensis* n. sp. differs from *T. cedarus* Yokoo, 1964 and *T. tricaulatus* Shishida, 1979. *T. cedarus* spear length is shorter (74.2-75.6 μm vs. 41-63 μm) and the distance of excretory pore from head end is shorter (126.7-134.6 μm vs. 65-115 μm). *T. tricaulatus* spicules striated only at central shaft and with delicate scales, spear length shorter (74.2-75.6 μm vs. 38.5-51.0 μm), the distance of excretory pore from head end shorter (126.7-134.6 μm vs. 81-115 μm), and first supplement located at anterior manubrium (32-43 μm from cloaca).

The female of *T. jeonjuensis* n. sp. can be distinguished from the two species by vagina about as long as wide, reniform to round shape but long

square like shape in *T. cedarus* and fig shape in *T. tricaulatus*.

Trichodorus tricaulatus Shishida, 1979

제주궁침선충(신칭)

(Fig. 2, Plates 1-C, 2-B, E)

Measurements. see Table 1.

The species correspond to the description given by Shishida (1979).

This species is first recorded in Korea. Comparison of type collection of *T. tricaulatus*, the Korean collection from rice (*Oryza sativa* L.) have distinct

Table 1. Morphometric comparison of *Trichodorus tricaulatus* Shishida, 1979 by host plants

Characters (Measurements: μm)	<i>Oryza sativa</i>		<i>Abies holophylla</i>	
	Female(n=12)	Male(n=5)	Female(n=3)	Male(n=4)
	Mean(Range)	Mean(Range)	Mean(Range)	Mean(Range)
L	703.8(612.0-750.0)	723.0(675.0-785.0)	715.0(682.5-767.5)	698.4(653.4-739.8)
Body width	28.3(27.5-31.2)	27.5(26.2-28.7)	38.0(36.0-40.0)	36.4(35.3-37.4)
Neck length	131.8(117.0-142.0)	134.8(116.0-146.0)	114.0(108.0-124.0)	88.2(77.0-103.0)
Stylet length	42.8(35.0-50.0)	43.2(40.0-48.0)	53.0(48.0-61.0)	46.5(43.2-49.0)
Anterior end to excretory pore	92.5(83.0-98.0)	99.8(97.2-105.1)	112.0(104.0-126.0)	103.2(100.8-106.6)
Ratio-a	24.6(22.2-26.9)	26.3(23.6-28.5)	18.8(18.0-19.3)	19.2(18.3-20.3)
-b	5.3(5.0-5.5)	5.4(4.9-5.8)	6.0(4.8-7.7)	5.6(5.3-5.9)
-V(%)	54.0(52.3-55.5)		55.1(50.4-59.0)	
-T(%)		64.5(62.1-66.6)		65.1(61.3-67.2)
Anterior end to CP1		73.0(69.4-79.2)		77.6(76.3-79.2)
CP1 to CP2		12.1(11.2-13.7)		10.8(10.1-11.5)
CP2 to CP3		8.1(7.5-8.6)		9.0(5.8-14.4)
CP3 to excretory pore		5.3(4.0-7.09)		5.8(2.9-7.9)
Spicule length		36.2(33.0-39.0)		47.4(43.2-50.4)
Gubernaculum length		15.0(14.0-16.0)		10.6(9.4-12.2)
Cloaca to SP1		31.6(24.0-35.0)		36.7(33.8-39.6)
SP1 to SP2		40.6(28.0-53.0)		42.9(40.3-46.8)
SP2 to SP3		41.5(36.0-48.0)		45.4(36.0-52.5)

and smoothly triangle vaginal sclerotization. Male spicule with 4 wrinkles at both side of the beginning of shaft part, central shaft not-wrinkled, and 7-8 wrinkles at ventral from a half of it (Fig. 2, I-K). Especially gubernaculum with a cylindrical structure (Fig. 2, H). But, the population from fir tree (*Abies holophylla* Max.) are same as the original description

Locality and habitat. Soil around the roots of *Oryza sativa* L. at Pukcheju-gun, Cheju-do, and *Abies holophylla* Max. at Odaesan, P'yongch'ang-gun, Kangwon-do

Trichodorus cedarus Yokoo, 1964

= *Trichodorus kurumeensis* Yokoo, 1966

= *Trichodorus longistylus* Yokoo, 1964

삼나무궁침선충

(Fig. 3, Plates 1-A, 2-A, C)

Measurements. see Table 2-3.

Comparisons among collections; Female body length, 709-828 μm (Chinju) and 612-872 μm (Suwon)

much longer than 350-730 μm Yokoo(1964), 501-670 μm Shishida(1979) and 630-790 μm Lee(1976) Stylet length; 43.2-49 μm (Sangju), 44-47 μm (Andong) and 46-53 μm (Suwon) were much shorter than the other collections (Table 2).

Male body length; 691.2-797.4 μm (Odaesan), 669.6-808.2 μm (Sangju), 642-812 μm (Andong) and 697-812 μm (Suwon) much longer than 500-610 μm Yokoo(1964), 530-688 μm Shishida(1979) and 570-700 μm Lee(1976). Stylet length; 45.4-49.7 μm (Sangju), 46-49 μm (Andong) and 44-53 μm (Suwon) collections much shorter than other collections. Chinju collection (62.6-74.2 μm) most longer among collections. The distance from anterior end to CP1 were 77.7-83.3 μm at all localities, except Sangju collection of 69.8-79.2 μm (Table 3).

Locality and habitat. Soil around the roots of *Salix subopposita* Miq. at Kyesan-dong, Sangju-shi, *Abies holophylla* Max. at Hyuch'on-dong, Yöngju-shi. *Abies holophylla* Max. and *Abies nephrolepis* Max. at Kajwa-dong, Chinju-shi. *Liquidamber styraciflua* L. at Wansan-dong, Chönju-shi. *Acer palma-*

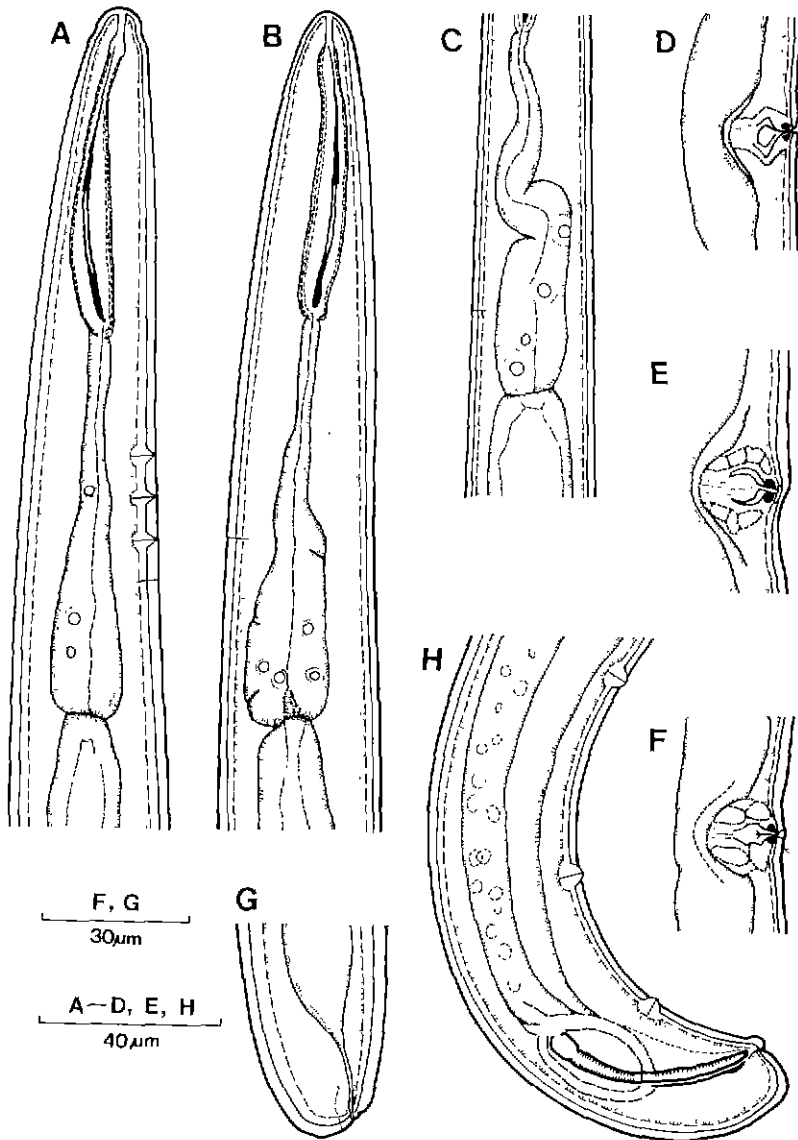


Fig. 3. *Trichodorus cedarus*. A: Anterior part of male, B: Anterior part of female, C: Oesophageal gland overlap of female, D-F: Vulval region, G: Female tail, H: Male tail.

tum var. *coreanum* Nak. at Odaesan, P'yŏngch'ang-gun. *Osetericum koreanum* Kitagawa at Namyang-myŏn, *Aralia continentalis* Kitagawa at Taech'i-myŏn. Ch'ŏngyang-gun. *Chrysanthemum morifolium* Ram. and *Liatris spicata* Wild at Imŏk-dong. Su-won-shi.

***Paratrichodorus porosus* (Allen, 1957)
Siddiqi, 1974**

= *Trichodorus bucrius* Lordello & Zamith, 1958

= *Trichodorus porosus* Allen, 1957

배추검궁침선충

(Fig. 4, Plates 1-D, 2-F)

Measurements. see Table 4.

Comparison between collections; Body length 621-801µm in Yusŏng collection, 662.4-874.8µm

Table 3. Morphometric comparison of *Trichodorius cedarus* male according to localities

Characters	Range	Shishida(1979)		Yongyu		Chuju		Chihju		Odaesan		Sangu		Andong		Sumon	
		n=23	Mean(Range)	n=19	Mean(Range)	n=11	Mean(Range)	n=9	Mean(Range)	n=5	Mean(Range)	n=7	Mean(Range)	n=8	Mean(Range)	n=16	
L(µm)	5000-6100	6030(5300-6880)	6000(5700-7000)	7053(6450-7520)	7293(5778-8424)	6452(5880-7650)	7352(6912-7974)	7138(6696-8082)	7404(6420-8120)	7701(6970-8120)							
Body width(µm)	-	34.0(31.0-42.0)	-	33.6(31.0-37.0)	37.4(32.4-43.9)	31.5(28.8-36.0)	36.9(33.8-41.0)	31.1(27.4-33.1)	27.9(26.0-30.0)	34.6(32.0-36.5)							
Neck length(µm)	-	137.0(121.0-160.0)	-	140.0(107.3-163.0)	114.7(93.6-128.2)	112.1(102.2-126.0)	102.9(92.9-108.7)	97.1(86.0-106.6)	149.0(142.0-157.0)	130.1(90.0-152.5)							
Stylet length(µm)	585-750	55.8(51.4-63.0)	60.3(59.4-63.0)	59.6(54.0-72.7)	68.5(62.6-74.2)	62.6(58.3-66.2)	56.7(52.6-58.3)	47.4(45.4-49.7)	47.3(46.0-49.0)	47.7(44.0-53.0)							
Anterior end to excretory pore(µm)	-	104.0(97.0-112.0)	-	119.2(103.0-177.0)	120.6(108.7-131.0)	117.5(105.8-128.2)	117.2(108.7-127.4)	104.8(101.5-110.9)	109.0(95.0-115.0)	114.9(103.0-142.0)							
Anterior end to CP1(µm)	-	78.9(77.7-83.3)	-	92.3(82.0-101.0)	94.6(70.6-107.3)	93.9(77.0-103.7)	93.6(87.1-98.6)	75.2(69.8-79.2)	83.9(75.0-91.0)	86.6(80.0-95.0)							
CP1 to CP2(µm)	-	10.2(5.6-14.7)	-	9.7(8.0-12.0)	11.7(8.6-28.8)	10.2(8.6-12.3)	9.8(9.3-11.6)	11.2(10.1-14.4)	9.9(7.0-19.0)	9.7(6.0-13.0)							
CP2 to CP3(µm)	-	7.5(4.9-9.1)	-	8.4(6.0-16.0)	8.1(0.7-15.8)	8.2(1.2-3.5)	8.8(6.8-11.5)	8.9(6.5-12.3)	7.5(7.0-11.0)	7.8(6.0-13.0)							
CP3 to excretory pore(µm)	-	7.4(3.2-10.5)	-	6.0(5.0-9.0)	6.7(2.9-15.8)	5.2(2.8-8.7)	5.0(0.7-10.1)	8.6(6.5-18.0)	8.5(6.0-12.0)	8.2(4.0-20.0)							
Spicule length(µm)	425-500	40.0(36.0-43.0)	43.4(41.5-45.6)	45.4(42.0-50.0)	47.6(43.9-50.4)	44.2(41.8-49.0)	41.9(40.3-43.2)	38.0(35.3-42.5)	41.6(39.0-43.0)	41.2(39.0-44.0)							
Gubernaculum length(µm)	130-225	200(180-210)	20.3(183-21.8)	19.2(10.8-23.0)	12.4(10.8-14.4)	12.3(10.8-14.4)	12.0(9.4-14.4)	12.4(10.1-14.4)	19.5(18.0-20.0)	17.4(15.0-20.0)							
Cloaca to SP1(µm)	-	23.0(22.0-26.0)	-	23.0(20.0-26.0)	23.1(20.2-24.5)	23.5(18.0-26.6)	24.2(21.6-26.6)	28.7(25.9-31.7)	22.6(21.0-26.0)	23.0(20.0-25.0)							
SP1 to SP2(µm)	-	30.0(23.0-34.0)	-	31.4(23.0-38.9)	31.1(24.5-35.3)	31.9(25.9-36.0)	34.4(27.3-41.1)	34.8(26.7-41.7)	30.0(22.0-35.0)	35.0(29.0-40.0)							
SP2 to SP3(µm)	-	36.0(18.0-45.0)	-	39.3(24.0-47.0)	39.7(31.7-46.8)	38.2(28.9-46.1)	39.8(36.0-43.9)	40.5(30.2-48.3)	37.0(26.0-59.0)	41.9(32.0-50.0)							
Tail length(µm)	-	-	-	8.6(5.8-10.0)	9.3(7.9-11.9)	8.4(7.2-10.1)	9.8(9.4-10.8)	10.1(8.6-11.5)	-	9.4(7.0-11.0)							
Ratio a	11.9-19.4	18.0(15.0-20.0)	17.1(16.7-18.3)	21.0(19.5-22.7)	19.6(16.9-22.1)	20.5(18.7-24.7)	20.0(19.4-21.4)	23.2(21.2-25.7)	26.5(23.7-29.0)	22.1(19.2-24.3)							
b	3.3-5.0	4.4(3.9-4.9)	4.5(4.1-5.8)	4.8(4.0-6.0)	4.7(3.6-5.8)	4.1(3.7-4.4)	5.5(4.9-6.5)	5.6(5.0-6.4)	5.0(4.5-5.4)	6.0(4.6-8.4)							
c	subterminal	-	subterminal	79.8(65.2-96.5)	79.2(63.4-101.6)	77.6(60.2-89.0)	75.0(73.5-77.0)	72.3(61.2-86.0)	-	73.0(57.2-81.6)							
-T(%)	-	65.0(51.0-74.0)	64.2(60.8-71.4)	66.3(62.1-71.6)	66.0(56.9-70.7)	65.9(62.0-70.4)	69.8(67.5-72.9)	65.3(60.9-71.1)	62.5(59.7-65.6)	68.8(62.0-81.2)							
-Anterior end to excretory pore/Neck length(%)	-	76.0(67.0-86.0)	-	84.0(69.5-110.6)	105.7(91.0-125.4)	105.1(95.5-120.7)	115.0(100.0-126.4)	108.5(102.1-121.2)	73.8(66.4-80.2)	88.9(75.4-130.0)							
-Stylet length/Neck length(%)	-	-	-	43.4(36.0-66.9)	60.0(53.9-73.1)	56.0(52.0-61.3)	55.5(53.6-57.0)	49.0(43.9-53.4)	31.7(30.1-33.8)	37.2(30.7-53.3)							

연
하
유
중
하
상
하
하
하

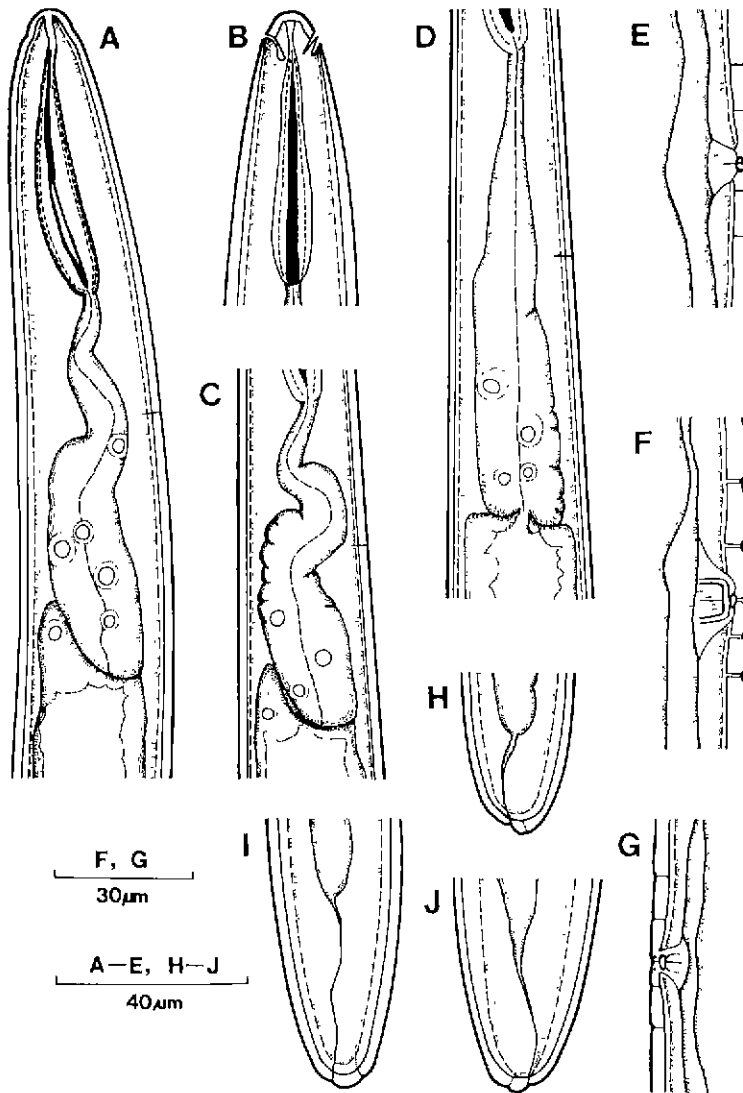


Fig. 4. *Paratrichodorus porosus*: A: Anterior part of female, B: Amphids, C,D. Oesophageal gland overlap of female, E-G: Vulval region, H-J: Female tail

in Chinju-1 collection, 648-889.2µm in Chinju-2 collection, 640.8-801µm in Chinju-3 collection longer than 460-770µm Allen(1957) and 400-720µm Lee (1976).

Locality and habitat. *Liriope platyphylla* Wang and *Angelica dahurica* Benth at Yaelim-ri, Sangnam-myōn, Milyang-gun. *Firmiana simplex* W. F. Wight, *Phellodendron molle* Nakai, *Quercus acuta* Thunb, *Nerium indicum* Mill and *Aucuba japonica*

for. *variegata* Rehder at Kajwa-dong, Chinju-shi. *Zizyphus jujube* var. *inermis* Rehder at Udu-dong, Ch'unchōn-shi, and *Acer buergerianum* Miq., *Magnolia kobus* A. P. Dc. at Tōkmyōn-dong, Yusōng-gu, Taejōn-jik'alshi

REFERENCES

Allen, M.W. 1957. A review of the nematode genus *Trichodorus* with descriptions of ten new species. *Ne-*

Table 4. Morphometric comparison of *Paratrichodoros porosus* according to sources

Characters	Allen(1957)		Lee(1976)		Yusong		Ch'unch'ön		Chinju-1		Chinju-2		Chinju-3	
	n=16	Range	n=10	Mean(Range)	n=14	Mean(Range)	n=3	Mean(Range)	n=12	Mean(Range)	n=19	Mean(Range)	n=25	Mean(Range)
L(µm)	460.0-770.0	510.0(400.0-720.0)	713.7(621.0-801.0)	698.4(680.4-716.4)	799.1(662.4-874.8)	755.0(648.0-889.2)	732.0(640.8-801.0)							
Body width(µm)	-	-	34.7(30.2-41.0)	36.7(33.8-38.2)	33.8(25.9-40.3)	33.7(31.7-36.0)	34.6(31.7-38.9)							
Neck length(µm)	-	-	87.5(67.0-103.7)	102.0(97.9-105.8)	96.1(74.2-108.7)	98.0(82.8-113.0)	96.5(80.6-103.7)							
Stylet length(µm)	43.0-50.0	46.0(40.8-48.2)	50.5(43.9-55.4)	51.6(50.4-54.0)	52.1(49.0-54.7)	51.4(49.7-55.4)	52.4(47.5-56.9)							
Anterior end to excretory pore(µm)	-	-	82.3(62.6-98.6)	86.6(77.0-91.4)	103.1(72.7-131.0)	95.9(73.4-123.8)	87.3(64.8-99.4)							
Ant ovary length(µm)	-	-	186.7(158.4-214.2)	169.8(144.0-192.6)	175.0(138.6-213.8)	157.3(113.4-271.8)	156.2(124.2-196.2)							
Post. ovary length(µm)	-	-	150.2(113.4-244.8)	142.2(124.2-158.4)	152.5(86.4-198.0)	149.7(109.8-198.0)	134.4(99.0-171.0)							
Ratio-a	15.0-25.0	21.0(16.3-27.0)	20.8(16.3-25.3)	19.1(17.8-20.7)	23.8(20.1-27.5)	22.5(19.6-26.9)	21.2(18.8-23.2)							
-b	4.1-5.5	4.6(4.0-5.3)	6.0(4.3-8.1)	5.2(4.6-5.8)	5.4(4.5-6.8)	5.3(4.0-7.4)	5.4(4.5-5.9)							
-V(%)	53.0-58.0	54.1(50.5-60.8)	55.6(53.4-57.1)	57.3(56.7-58.0)	58.2(54.7-63.7)	55.9(53.1-60.0)	57.3(55.6-59.8)							
-G1(%)	-	-	26.2(22.9-30.2)	24.3(21.2-27.6)	21.9(17.1-24.8)	20.7(16.1-30.6)	21.3(17.8-25.5)							
-G2(%)	-	-	21.0(16.4-33.5)	20.4(17.8-22.1)	19.0(13.0-22.8)	19.8(15.6-23.8)	18.3(13.3-23.2)							
-Anterior end to excretory pore/Neck length(%)	-	-	94.4(83.6-110.0)	84.8(78.7-89.4)	107.0(98.0-124.6)	98.0(78.5-122.0)	90.3(80.4-98.6)							
-Stylet length/Neck length(%)	-	-	58.3(50.7-69.8)	50.6(47.6-52.8)	54.6(49.7-66.0)	52.7(44.0-60.0)	54.4(49.3-67.0)							

*Yusong(Acer buergerianum), Ch'unch'ön(Zizyphus jujuba var. inermis), Chinju-1(Firmiana simplex), Chinju-2(Nerium indicum), Chinju-3(Aucuba japonica for variegata)

表 4. *Paratrichodoros porosus* による形態比較

- nematologica* 2: 32-62.
- Andrassy, I. 1976. Evolution as a basis for the systematization of nematodes. London, San Francisco & Melbourne, Pitman Publishing, 288pp
- Decraemer, W. 1980. Systematics of the Trichodoridae (nematoda) with keys their species. *Revue Nematol* 3(1): 81-99.
- Decraemer, W. & D. De Waele. 1981. Taxonomic value of the position of oesophageal gland nuclei and of oesophageal gland overlap in the Trichodoridae (Diphtherophorina). *Nematologica* 27: 82-94.
- Decraemer, W. 1989. Morphologic variability and value of the characters used for species identification in *Paratrichodorus* Siddiqi, 1974 (Nematoda:Trichodoridae). *Nematologica* 35: 37-61.
- Esser, R.P. 1971. A compendium of the Genus *Trichodorus* (Dorylaimoidea, Diphtherophoridae). Soil and Crop Science Society of Florida Proceedings. 31: 243-253.
- Farzana R., D. De Waele & A. Coomans. 1985. Trichodoridae (Nematoda) from Brazil. *Nematologica* 31: 289-320.
- Hooper, D.J. 1972. Two new species of *Trichodorus* (Nematoda :Dorylaimida) from England. *Nematologica* 18: 59-65.
- Hooper, D.J. 1974. Morphology of Trichodorid nematodes. NATO advanced study institutes serise 2: 91-101.
- Lee, Y.B. 1976. Two genera of Trichodoridae (Trichodoroidea:Nematoda) new to Korea. *Kor. J. Pl. Prot.* 15(2): 75-78.
- Loof, P.A.A. 1974. Taxonomy of Tricodoridae. NATO advanced study institutes serise 2: 103-127.
- Mamiya, Y. 1967. Descriptive notes on three species of *Trichodorus* (Dorylaimida :Trichodoridae) from forest nurseries in Japan. *App. Ent. Zool* 2: 61-68.
- 박중수. 1963. 우리나라 식물기생선충의 종류와 분포조사. 농사시험연구보고서. 6(1): 27-44.
- Rodriguez-MR. & A.H. Bell. 1978. Tree new species of Trichodoridae (Nematoda :Diphtherophorina) with observations on the vulva in *Paratrichodorus*. *J. Nematol.* 10(2): 132-141.
- Rodriguez-MR., Sher, S.A. & Siddiqi, M.R. 1978. Systematics of the monodelphic species of Trichodoridae (Nematoda :Diphtherophorina) with descriptions of a new genus and four new species. *J. Nematol.* 10: 141-152.
- Shishida, Y. 1979. Studies on nematodes parasitic on woody plants 1. Family Trichodoridae (Thome, 1935) Clark, 1961. *Japanese Journal of Nematology* 9: 28-44.
- Siddiqi, M.R. 1962. *Trichodorus pakistanensis* n. sp. (Nematoda :Trichodoridae) with observations on *T. porosus* Allen, 1957, *T. mirzai* Siddiqi, 1960 and *T. minor* Colbran, 1956 from India. *Nematologica* 8: 193-200.
- Siddiqi, M.R. 1973. Systematics of the genus *Tricodorus* Cobb, 1913 (Nematoda Dorylaimida), with descriptions of three new species. *Nematologica* 19: 259-278.
- Yokoo, T. 1966. On a new stubby root nematode *Trichodorus kurumeensis* n. sp. from Kyushu, Japan. *Agric. Bull. Saga Univ.* 23: 1-6.

(Received May 26, 1995)