□ 보 문 □

韓應昆誌 31(4):416~426(1992)
Korean J. Appl. Entomol.

Nematodes Associated with Forest Trees in Korea Ⅲ. A New Species of *Xiphinemella* Loos, 1950, and Four Unrecorded Species of *Xiphinema* Cobb, 1913*

한국에 있어서 임목에 기생하는 선충조사 Ⅲ. *Xiphinemella* 속의 1신종 및 *Xiphinema* 속의 4미기록종에 관하여

Young Eoun Choi[1], Yeong Shick Choi[1], and Myoung Rae Cho[2]
최 영 연[1] · 최 영 식[1] · 조 명 래[2]

ABSTRACT A new species of *Xiphinemella* is described and illustrated from soil around the roots of larch in Korea. *Xiphinemella maiensis* n. sp. has stylet length of 63-68 ㎛, body length of 2.5-3.2 mm, and vulva position of 49-50%. It differs from *X. esseri* in more posteriorly positioned vulva (42-47% in *X. esseri*), shorter stylet (72-75 ㎛ in *X. esseri*), and more anteriorly located guide ring (25-27 vs. 35-38 ㎛). It also differs from *X. ornata* in having longer body (1.94-2.32 mm in *X. ornata*) and shorter stylet (82-92 ㎛ in *X. ornata*). A key to species of the genus is provided. *Xiphinema brevicolle*, *X. diffusum*, *X. chambersi*, and *X. insigne* are firstly recorded from Korea.

KEY WORDS Morphology, taxonomy, nematode

초 록 *Xiphinemella*屬의 1種을 마이산 낙엽송 뿌리주위에서 발견하여 形態的 特徵을 檢討한 結果 新種으로 記錄하였다. *Xiphinemella maiensis* n. sp.는 體長이 2.5~3.2 mm로 다른 種들에 비해 길어 쉽게 區別되며 口針의 길이는 63~68 ㎛, 陰門의 위치는 49~50%이다. 같은 屬의 *X. esseri*와 비교하면 陰門位置 42~47% 보다는 後部에 位置하고, 口針 길이 72~75 ㎛ 보다 짧은 것으로 區別되며 *X. ornata*와 比較하면 體長은 1.94~2.32 ㎛ 보다 길고 口針은 82~92 ㎛ 보다 짧은 것으로 區別된다. *Xiphinemella*屬의 各種들에 대한 分類學的 Key를 만들었다. *Xiphinema brevicolle*, *X. diffusum*, *X. chambersi*, *X. insigne*등 4種은 우리나라 未記錄種으로 밝혀졌다.

검 색 어 分類, 形態, 線蟲

In a survey on the nematodes associated with forest trees in Korea, many plant-parasitic nematodes were found. Among them an undescribed species of *Xiphinemella* Loos, 1950 and some species of genus *Xiphinema* Cobb, 1913 were collected. One of these yielded a new speicies of rarely found nematode genus *Xiphinemella* which is described here as

1 Department of Agricultural Biology, Kyungpook National University, Daegu, Korea(경북대학교 농과대학 농생물학과)
2 Floriculture Division Ⅱ, Horticultural Experiment Station, Suwon, Korea(원예시험장 화훼 2과)
* This paper was supported by NON-DIRECTED RESEARCH FUND, Korea Research Foundation 1990.

Table 1. Morphometric data of *Xiphinemella maiensis* n. sp.

Characters	Female (n=11)			Male (n=10)		
	Range	Mean	STD	Range	Mean	STD
Length (mm)	2.5-3.2	2.8	221.0	2.3-3.1	2.6	251.7
a	38.2-49.3	43.7	3.3	40.8-54.4	46.5	4.1
b	8.9-11.3	9.7	0.7	7.8-14.0	9.4	1.8
c	85.3-122.5	99.4	10.1	79.2-118.2	96.1	13.1
c'	0.5-0.7	0.6	0.1	0.6-0.8	0.7	0.1
V(%)	49.0-53.1	51.2	1.5	-	—	
Odontostyle(μm)	31-36	32.3	1.5	27-33	31.2	1.9
Odontophore(μm)	31-33	32.5	0.7	30-34	31.8	1.4
Stylet(μm)	63-68	64.7	1.6	60-66	63.0	2.3
Anterior end to guide ring(μm)	25-27	26.5	0.7	22-27	24.4	1.7
Esophagus length(μm)	267-317	290.9	12.7	203-325	285.5	39.4
Basal bulb length(μm)	67-85	75.2	5.1	45-87	71.2	13.1
Basal bulb width(μm)	17-27	23.1	2.6	20-30	23.5	3.1
Body width(μm)	57-79	65.0	6.3	48-62	56.2	4.1
Tail length(μm)	25-32	28.6	2.4	25-30	27.5	1.8
Anal body width(μm)	43-52	46.6	2.4	37-44	41.1	2.3
Hyaline body width(μm)	8-13	9.8	1.4	4-8	5.8	1.2
Hyaline width(μm)	27-33	30.1	2.1	18-25	21.1	2.3
Cloaca to PS*(μm)				14-19	16.9	1.5
PS-S1				63-91	77.9	10.1
S1-S2				10-21	13.3	3.1
S2-S3				12-24	15.1	3.9
S3-S4				13-23	17.3	2.6
S4-S5				12-54	21.9	12.2
S5-S6				13-27	18.2	4.1
S6-S7				15-33	20.9	5.3
S7-S8				13-31	20.6	6.0

*PS: Paired preanal supplements.

Xiphinemella maiensis n. sp. The genus name, *Xiphinemella* Loos, 1950, is a change of *Taprobanus* Loos, 1949 (Loos 1949 & 1950). A total of 9 species have been described in the genus (Ahmad et al. 1984., Chitwood 1957, Luc 1977, Siddiqi et al. 1968, Vinciguerra et al. 1983). Four unrecorded speices of *Xiphinema* from Korea are reported herein.

MATERIALS AND METHODS

Nematodes were extracted from soil by a sieving-Baermann funnel method. Specimens were fixed with 80℃ heated F.G: 4-1 fixative and processed to anhydrous glycerin by Seinhorst's rapid glycerin method. Photographs were taken with Olympus BH2 Nomarski Differential Interfence Contrast Attachment.

DESCRIPTIONS

Xiphinemella maiensis n. sp.

(Figs. 1, 2)

Holotype (female): L=3.0 mm; body width =44 μm; a=52.9; b=9.6; c=102.1; c'=0.7; V =50.6%; G1 = 12.2%; G2 = 12.8%; Odontostyle length=32 μm; Odontophore length =34 μm; total stylet length=66 μm; esophagus length=307 μm; tail length=29 μm.

Female (n=11): Morphmetrics in Table 1. Body forms open C shape when fixed. Outer cuticle smooth and inner cuticle transversely striated along the whole length of the body but not extending to the anterior end near the head and to the tail tip. Labial region 15-18 μm wide offset from the body by a deep constriction. Labial disc 9-10 μm wide and rounded. Six labial papillae prominent (Fig. 2-B, D). Amphids pocket like immediately postlabial (Fig. 2-D), 9-10 μm wide. Vestibule rod-like, weakly sclerotized. Odontostyle thin, 31-36 μm long. Odontophore 31-34 μm long, slender near the odontostyle/odontophore junction and getting thicker to the basal flanges measuring 6-8 μm wide (Fig. 2-A). Guide ring single, 4-6 μm long, 25-27 μm from the anterior end (Fig. 2-B). Anterior non-muscular part of esophagus almost similar in diameter throughout its length. Nerve ring at the anterior slender part of esophagus at 120-130 μm from the anterior end. Basal bulb 67-85 μm long and 25-27 μm wide with five esophageal glands. Cardia conical, 15-20 μm long (Fig. 2-F).

Vulva a transverse slit. Vagina thick-walled, 26-32 μm deep. Reproductive system didelphic with reflexed ovaries. Sphincter not distinct at oviduct uterus junction. Prerectum about four times anal body width long. Rectum about an anal body width long. Tail short, hemispherical with caudal gland in the middle (Fig. 2-E).

Male (n=10): Morphometrics in Table 1.

Body forms open J shape with the more pronounced curvature at the posterior end when fixed. Supplements an adanal pair and four to eight ventromedians (distances between supplements in Table 1). Spicule arcuate 50-65 μm long. Accessory piece 19-21 μm long. Tail dorsally convex, conical to hemispherical (Fig. 2-G, H).

Type locality and habitat: Found in soil around the roots of larch (*Larix lepitolepis* Gord) from Mt. Mai, Chinan-gun, Chollabuk-do, Korea, May, 1980.

Type specimens: Holotype female in slide 676-2 and rest of the paratype specimens in Collection of Department of Agricultural Biology, College of Agriculture, Kyungpook National University, Taegu, Korea. Paratype 2 females and 2 males in the USDANC, Beltsville, Maryland, U.S.A., and 2 females and 2 males in Loboratoires des vers, Museum, 61 rue de Buffon, Paris, France.

Diagnosis and relationships

Xiphinemella maiensis n. sp. can be distinguished from other species in the genus except *X. esseri* Chitwood, 1957 and *X. ornata* (Loos, 1949) Loos, 1950, in having longer body (2.5-3.2 vs. 1.2-1.85 mm). *X. maiensis* n. sp. comes most close to *X. esseri* and *X. ornata*. From *X. exxeri*, it differs in having more posteriorly positioned vulva (49-53 vs. 42-47%), shorter stylet (63-68 vs. 72-75 μm), and more anteriorly located guide ring (25-27 vs. 35-38 μm). From *X. ornata*, it differs in having longer body (2.5-3.2 vs. 1.94-2.32 mm), and shorter stylet (63-68 vs. 82-92 μm).

***Xiphinema brevicolle* Lordello & Da Costa, 1961**
(Fig. 3)

Measurements (n=24): Morphometrics in Table 2.

Female: Characteristics of the specimens correspond with the description given by Lamberti & Bleve-Zacheo (1979).

Locality and habitat: Soil around the roots

of pine tree (*Pinus densiflora* S. et Z.), Bulkuksa, Kyungsangbuk-do.

Key to species of *Xiphinemella*

1. Body length about 1.9 mm or longer ……2
   Body length less than 1.9 mm ……4
2. Anterior end to guide ring 25-27 μm ……
   ……*maiensis* n. sp.
   Anterior end to guide ring longer than 27 μm
   ……3
3. Total stylet length 72-75 μm ……
   ……*esseri* Chitwood, 1957
   Total stylet length 82-93 μm ……
   ……*ornata* (Loos, 1949) Loos, 1950
4. Tail length about 37 μm ……
   ……*caudata* Andrassy, 1970
   Tail length less than 37 μm ……5
5. Anterior end to guide ring 17 μm ……
   ……*eversa* (Heyns, 1963) Siddiqi, 1966
   Anterior end to guide ring longer than 17 μm
   ……6
6. Vulva position 44-47% ……
   …*andrassyi* Ahmad, Rahman & Jairajpuri,
   ……1983
   Vulva position more than 47% ……7
7. Odontostyle length 43~49 μm ……
   ……*fitulae* Luc, 1977
   Odontostyle length less than 43 μm ……8
8. Body length 1.03-1.43 mm ……
   globilabiata Vinciguerra & Giannetto, 1983
9. Total stylet length 52 μm ……
   ……*utahnemacea* Siddiqi & Husain, 1968
   Total stylet length 61-64 μm ……
   …*labiata* Ahmad, Rahman & Jairajpuri, 1983

Xiphinema diffusum Lamberti & Bleve-Zacheo, 1979 (Fig. 4)

Measurements (n=15): Morphometrics in Table 2.

Female: General characteristics of this species well correspond with the decription given by Lamberti & Bleve-Zacheo (1979).

Compared to the type population of *X. diffusum* (Lamberti et al. 1979), Korean populations have slightly shorter odontostylet (82.5-84.5 μm vs. 89-94 μm), shorter hyaline length (10.5-10.3 μm vs. 10-14 μm), and smaller hyaline width (14.0-14.9 μm vs 15-20 μm). *X. diffusum* is morphologically similar to *X. brevicolle*. However, Korean populations of *X. diffusum* can be distinguished from *X. brevicolle* described in this paper by following differences; *X. diffusum* has short body length (avg. 1.8 mm vs. 2.0 mm), and short stylet (134 μm vs. 153 μm). Lip region of *X. diffusum* is less depressed than that of *X. brevicolle* which is clearly separated by a constriction from the rest of the body. Tail hyaline width of *X. diffusum* is smaller than *X. brevicolle* (14.0-14.9 μm vs. 18.3 μm).

Locality and habitat: Soil around the roots of Japanese Zelkova tree(*Zelkova serrata* Makino), Bulkuksa, Kyungsangbuk-do, and pine treee(*Pinus densiflora* S. et Z.), Kyungpook National University, Taegu.

Xiphinema chambersi Thorne, 1939 (Fig. 4)

Measurements (n=4): Morphometrics in Table 3.

Female: Morphological characteristics correspond with the description given by Cohn & Sher (1972).

Cohn & Sher (1972) designated lectotype population of *X. chambersi*. When compared to the lectotype population, Korean populations have slightly shorter stylet (174-184 μm vs. 187-198 μm), and very close c' ratio (4.2-4.8 vs. 4.3-4.7).

Table 2. Morphometric data on females of *Xiphinema brevicolle* and *X. diffusum* from Korea.

Characters	*X. brevicolle* (n=24)			*X. diffusum* (n=15)		
	Range	Mean	STD	Range	Mean	STD
Length (mm)	1.9-2.2	2.0	92.4	1.7-2.0	1.8	70.7
a	37.8-48.4	42.4	2.5	41.8-48.0	44.5	1.4
b	5.8-8.2	6.4	0.5	5.4-7.4	6.5	0.6
c	59.3-78.2	69.7	5.1	62.4-84.6	69.9	6.6
c'	0.8-1.0	0.9	0.1	0.7-1.0	1.0	0.1
j'	0.5-0.7	.6	0.1	0.5-0.8	0.7	0.1
V (%)	48.5-53.3	50.6	1.0	49.0-53.4	51.2	1.2
Lip width (μm)	11-13	12.5	0.6	-	-	
Odontostyle (μm)	91-100	95.8	3.0	76-94	84.2	5.2
Odontophore (μm)	50-61	56.8	2.7	47-60	51.9	4.5
Stylet (μm)	144-159	152.6	4.1	126-146	136.1	7.1
Anterior end to guide ring (μm)	77-86	81.0	2.3	66-81	74.0	4.1
Tail length (μm)	27-36	29.4	2.2	21-29	26.3	2.4
Anal body width (μm)	29-38	32.6	2.1	24-31	27.8	2.0
Hyaline length (μm)	8-14	11.1	1.2	8-12	10.1	1.0
Hyaline width (μm)	15-21	18.3	1.4	12-19	15.3	1.8

Table 3. Morphometric data on females of *Xiphinema insigne* and *X. chambersi* from Korea

	X. insigne (n=10)			*X. chambersi* (n=4)		
	Range	Mean	STD	Range	Mean	STD
Length (mm)	2.3-2.6	2.5	123.2	1.8-2.5	2.1	238.6
a	57.8-63.4	60.7	1.8	46.2-52.1	48.7	2.2
b	6.2-7.9	7.2	0.6	5.3-6.0	5.6	0.3
c	17.2-21.0	19.1	1.0	17.2-21.1	18.8	1.5
c'	5.0-5.9	5.4	0.3	4.2-4.8	4.4	0.2
j'	2.1-4.1	2.8	0.5	4.1-4.9	4.4	0.3
V (%)	31.9-34.9	33.5	1.0	24.1-25.9	25.1	0.7
Odontostyle (μm)	101-105	102.4	1.3	108-116	112.5	2.9
Odontophore (μm)	62-68	64.6	1.7	66-71	68.0	1.9
Stylet (μm)	164-171	167.1	2.4	174-184	180.5	3.9
Anterior end to guide ring (μm)	87-99	94.0	3.9	90-106	98.3	5.8
Tail length (μm)	117-138	130.3	8.1	106-128	114.0	8.6
Anal body width (μm)	20-26	24.0	1.6	24-30	26.0	2.4
Hyaline length (μm)	17-29	20.2	3.6	39-55	45.0	6.2
Hyaline width (μm)	7-8	7.2	0.4	8-13	10.3	1.9

Locality and habitat: Soil around the roots of needle fir (*Abies holophylla* Max.), Bulkuksa, Kyungsangbuk-do.

Xiphinema insigne Loos, 1949

(Fig. 5)

Measurements (n=10): Morphometrics in Table 3.

Female: Morphological characteristics well correspond with the description given by Luc & Southey (1980).

X. insigne shows high degree of variability among worldwide populations. Luc & Southey (1980) compared 12 worldwide populations of

X. insigne. Korean populations of *X. insigne* are morphometrically most close to Japanese "Bonsai" population.

Locality and habitat: Soil around the roots of oriental Arbor-Vitae(*Thuja orientalis* Endl.), Sachun, Kyungsangnam-do.

DISCUSSION

Choi & Moon (1988) described *Xiphinema zulu* from Youngdok and Dasan, Kyungsangbuk-do. Reexamination on the specimens and morphometric data revealed that *X. insigne* was mistaken for *X. zulu*. A total of 11 *Xiphinema* species has been reported from Korea including 4 species in this paper. They are; *X. americanum*, *X. campinense*, *X. yapoense*, *X. radicicola*, *X. pini*, *X. setariae*, *X. bakeri*, *X. brevicolle*, *X. diffusum*, *X. chambersi*, and *X. insigne*.

ACKNOWLEDGEMENT

We thank Dr. R.T. Robbins, Department of Plant Pathology, University of Arkansas, Fayetteville, Arkansas, U.S.A., for his help in preparing this paper.

REFERENCES CITED

Ahmad, W., M.F. Rahman & M.S. Jairajpuri. 1983. Two new species of *Xiphinemella* Loos, 1950 (Nematoda: Dorylaimida) from India. Revue de Nematologie 6 : 217～222.

Cohn, E. & A. Sher. 1972. A contribution to the taxonomy of the genus *Xiphinema* Cobb, 1913. Journal of Nematology 4(1) : 36～65.

Chitwood, B.G. 1957. A new species of *Xiphinemella* Loos, 1950 (Nematoda) from Florida. Proceedings of the Helminthological Society of Washington 24 : 53～56.

Choi, Y.E. & Y.S. Moon. 1988. A taxonomical study on the family of Longidoridae (Nematoda) in Korea. 1. Three unrecorded species of Longidoridae. The Korean Journal of Applied Entomology 27(3) : 165～170

Lamberti, F. & T. Bleve-Zacheo. 1979. Studies on *Xiphinema americanum sensu lato* with description of fifteen new species (Nematoda: Longidoridae). Nematologia Mediterranea 7 : 51～106.

Loos, C.A. 1949. Notes on free living and plant parasitic nematodes of Ceylon. No.6. Journal of the zoological Society of India 1 : 30～36.

Loos, C.A. 1950. *Xiphinemella* nom. nov. A change of name for *Taprobanus* Loos, 1949 (Nematoda: Dorylaimidae). Journal of the Zoological Society of India 2 : 149.

Luc, M. 1977. *Xiphinemella fitulae* n. sp. (Nematoda: Leptonchidae). Bulletin du Museum National d'Histoire Naturelle, 3e serie, no 471 : 789～795.

Luc, M. & J.F. Southey 1980. Study of biometrical variability in *Xiphinema insigne* Loos, 1949, and *X. elongatum* Schuurmans Stekhoven & Teunissen, 1938; description of *X. savanicola* n. sp. (Nematoda: Longidoridae) and comments on thelytokous species. Revue de Nematologie 3(2) : 243～269.

Siddiqi, M.R. & Z. Husain. 1968. Observations on the genus *Xiphinemella* Loos, 1950, with descriptions of *X. utahnemacea* n. sp. and *Tylencholaimellus modulus* n. sp. (Nematoda: Leptonchidae) from India. Bulletin of Entomology 9 : 20～24.

Vinciguerra, M.T. & L. Giannetto. 1983. Three new species of Dorylaimida (Nematoda) from Italian terrestrial ecosystems. Animalia 10 : 283～289.

(Received July 9, 1992)

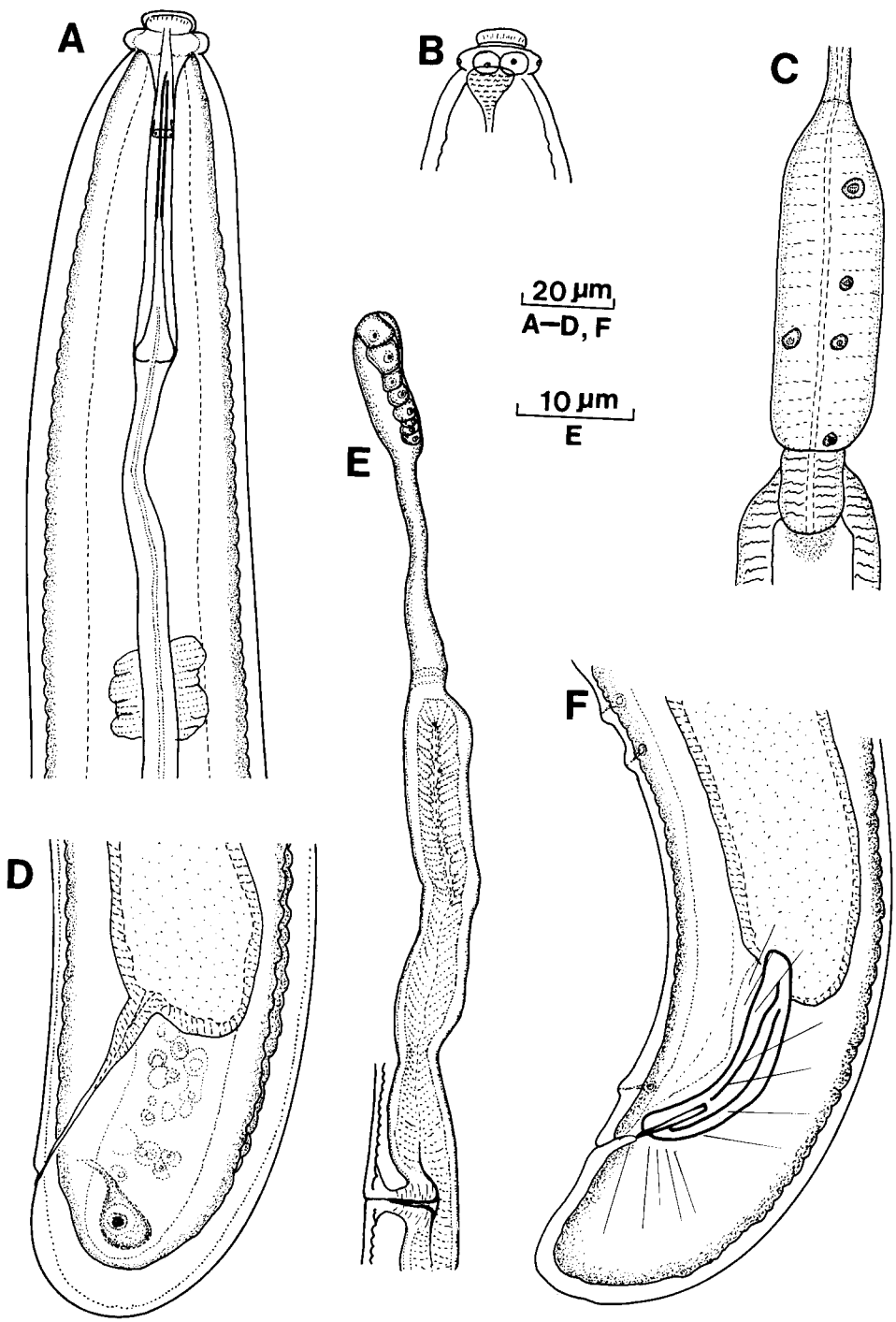

Fig. 1. *Xiphinemella maiensis* n. sp. A, B: anterior part of female, C: basal bulb of esophagus, D: tail of female, E: anterior genital branch of female, F: tail of male.

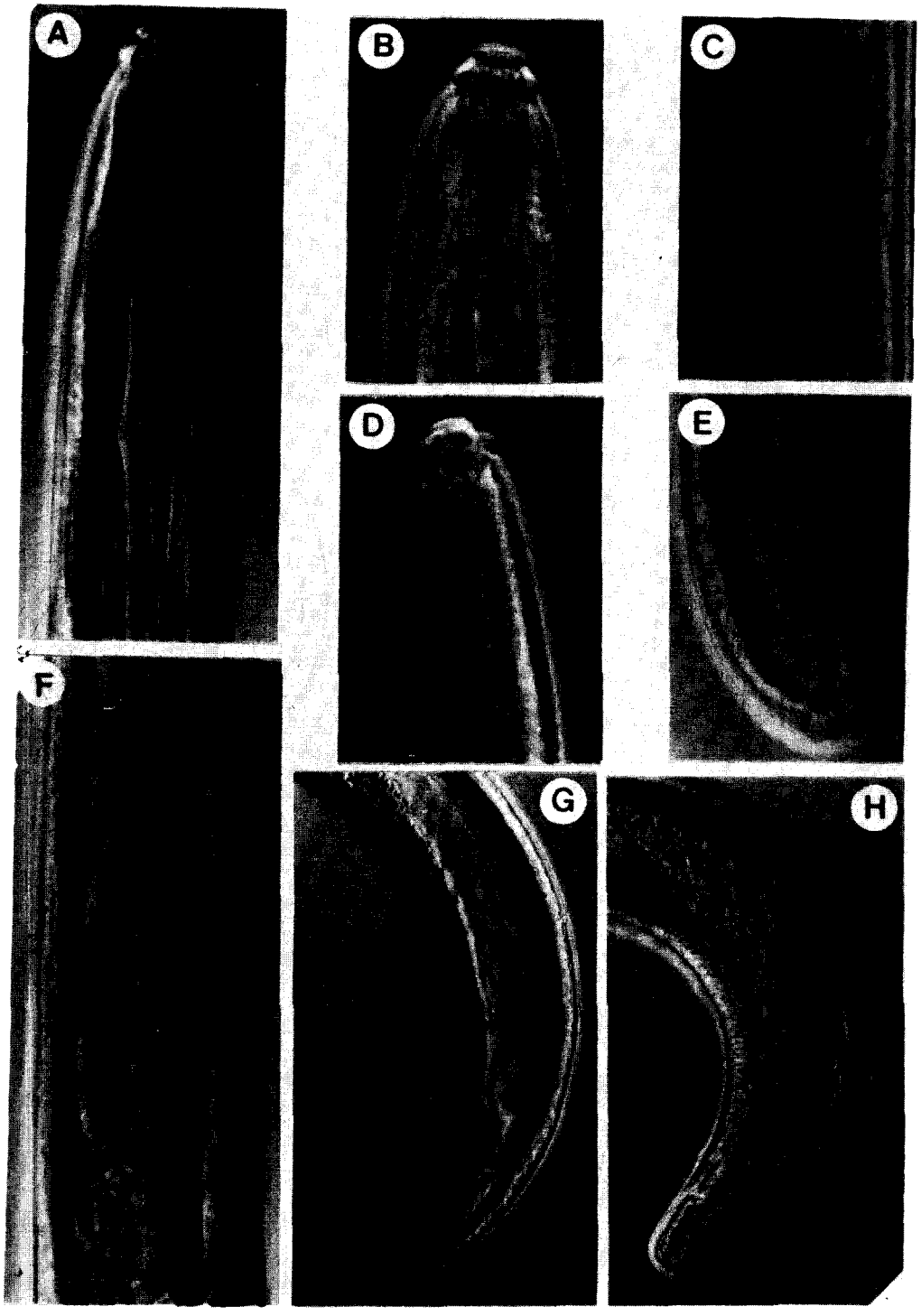

Fig. 2. *Xiphinemella maiensis* n. sp. A: anterior part of female, showing stylet, B: odontostylet and guide ring, C: spermatheca with sperms, D: amphid, E: female tail, F: esophageal bulb and cardia, G, H: male tail showing supplements, muscles and spicule.

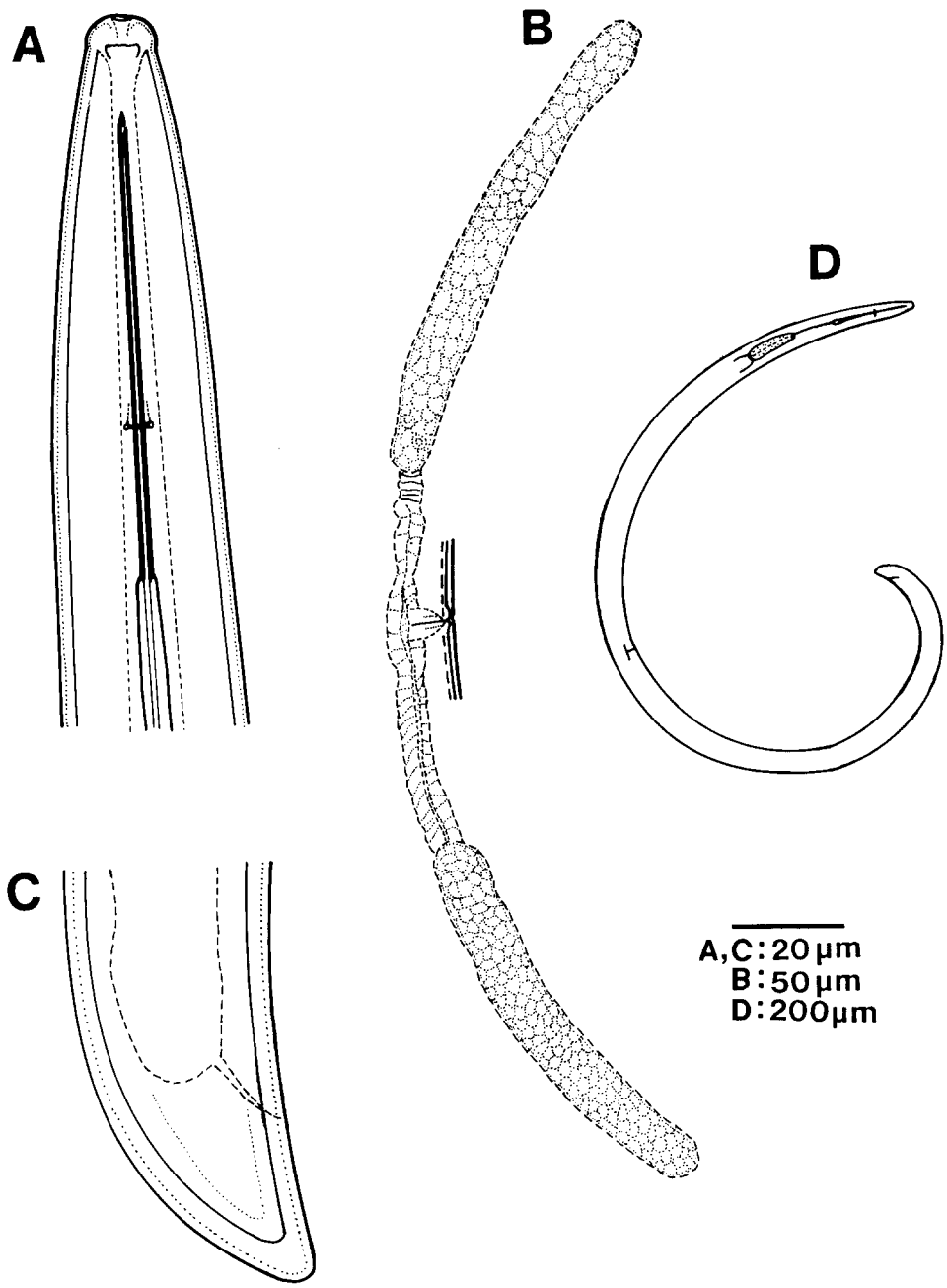

Fig. 3. *Xiphinema brevicolle* Lordello & Da Costa, 1961. A: anterior part of female, B: female genital tract, C: female tail, D: general shape.

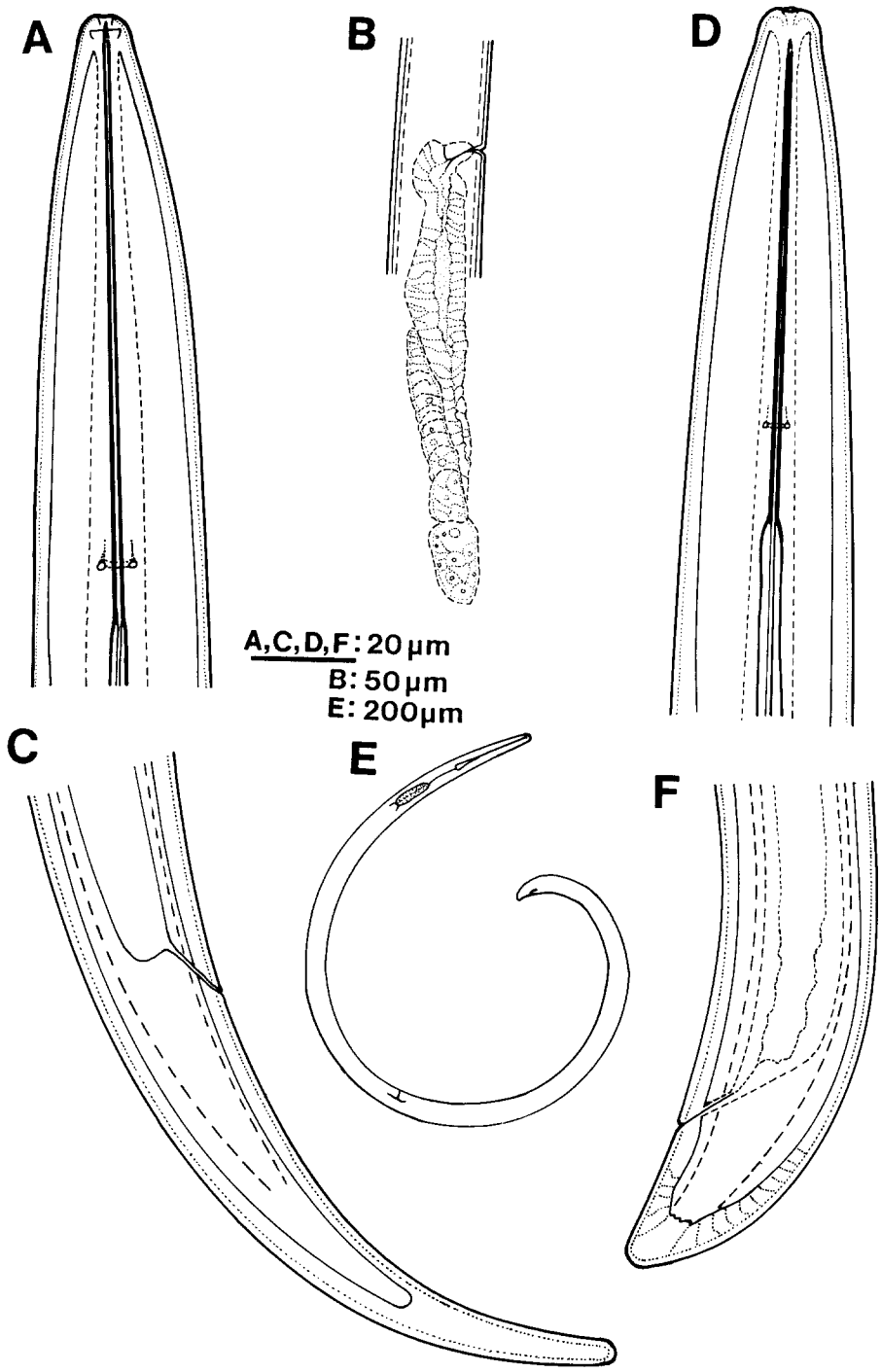

Fig. 4. A-C: *Xiphinema chambersi* Thorne, 1939, A: anterior part of female, B: female genital tract, C: female tail, D-F: *Xiphinema diffusum* Lamberti & Bleve-Zacheo, 1979, D: anterior part of female, E: general shape, F: female tail.

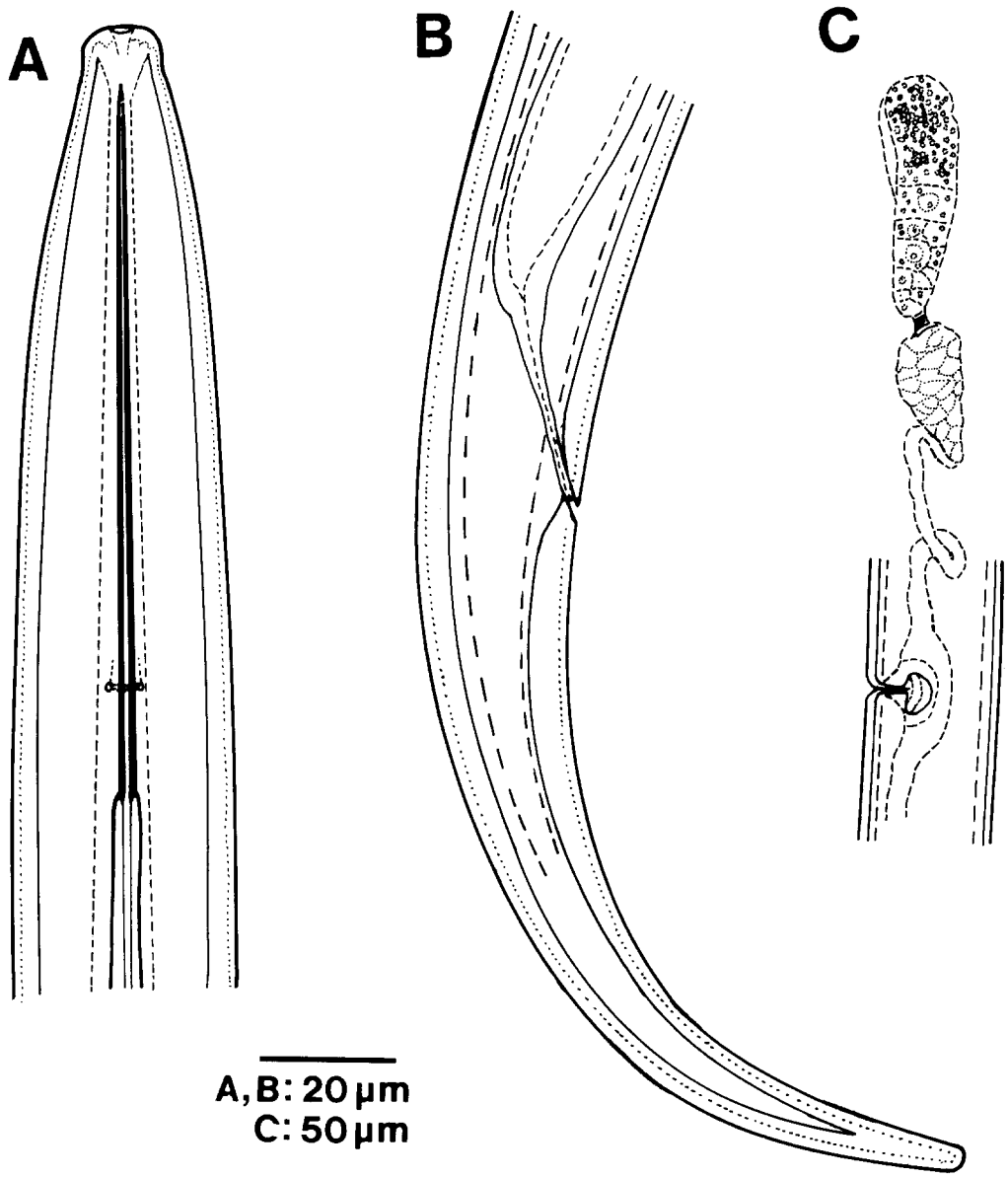

Fig. 5. *Xiphinema insigne* Loos, 1949. A: anterior part of female, B: female tail, C: anterior female genital tract.