

Bitylenchus iphilus sp. n. and *Tylenchorhynchus kegasawai* sp. n. (Nematoda: Tylenchida) from Japan

Nozomu Minagawa

Laboratory of Nematology and Soil Zoology, National Institute of Agro-Environmental Sciences
Kannondai, Tsukuba, Ibaraki, 305 Japan

Abstract. Two new species of the stunt nematodes with clavate tails are described and illustrated from Japan. *Bitylenchus iphilus* sp. n. from the rhizosphere of *Juncus effusus* var. *utilis* in Hiroshima is characterized with 5 or 6 lip annules, thin stylet 16.7-20.2 μm long and female tail being clavate and with 24-41 annules and a rounded and annulated terminus. *Tylenchorhynchus kegasawai* sp. n. from the rhizosphere of an unidentified woody plant in Kagawa is characterized by 2 or 3 lip annules, a moderate 19.7-22.2 μm long stylet and a clavate tail with 15-21 annules and a rounded and smooth terminus. SEM of various morphological structures of the two new species have been provided and their taxonomic relationships discussed. *Bitylenchus* is considered as a valid genus.

Keywords: *Bitylenchus iphilus*, Japan, new species, SEM, taxonomy, *Tylenchorhynchus kegasawai*.

INTRODUCTION

Two new species of the stunt nematodes with clavate tails were detected in Japan. One was extracted from a paddy field cultivated with rushes used for making "Tatami" mats in Hiroshima and the other was isolated from the rhizosphere of a woody plant in Kagawa. They are described here as *Bitylenchus iphilus* sp. n. and *Tylenchorhynchus kegasawai* sp. n., respectively, and their line and SEM illustrations have been provided.

MATERIALS AND METHODS

Nematodes were extracted from the soil samples by using the double-layer centrifugal-flotation method (Takagi, 1970), treated by gentle heat, fixed in TAF, dehydrated and transferred to pure glycerol by a modified slow method (Minagawa and Mizukubo, 1994) and mounted in glycerol. For SEM observation, nematodes fixed in TAF were dehydrated by a gradient series of ethanol, dried from absolute ethanol in CO_2 by critical point drying, coated by 20 nm platinum-vanadium and examined under Hitachi S-2460N SEM at 20 kV.

DESCRIPTIONS

Bitylenchus iphilus sp. n. (Figs 1 & 2, Table 1)

Measurements. See Table 1.

Female. Body slender, arched to closed C-shape after treatment by gentle heat (Fig. 1A); slightly tapering from oesophageal base to a rounded lip region and posteriorly to a clavate tail; no longitudinal striae or ridges. Body annules fine in midbody, wider in oesophageal and tail regions. Lateral fields with areolae throughout (Fig. 2D); originating from the

level of stylet base (Fig. 2A) and occupying a quarter to one-third of the body width; with four incisures which become three on the tail posterior to the phasmids (Fig. 1D-I); usually the inner band is wider than the outer ones.

Lip region hemispherical, slightly set off from body contour (Fig. 1B, 2AB); divided by shallow hexaradial grooves as seen by SEM (Fig. 2C); with 5 or 6 fine annules (Fig. 2B), first annule convex and higher than others which are of equal height. Cephalic framework weakly sclerotized. In face view (Fig. 2C), labial cap elliptical; lateral lips semicircular; subdorsal and subventral lips also semicircular, larger than the lateral ones; amphidial apertures at the lateral sides of the labial cap.

Stylet thin, anterior part needle-like, about half of the total stylet length (Fig. 1B); knobs minute, rounded, extending laterally or inclined slightly posteriorly. Dorsal oesophageal gland orifice about twice stylet knob height behind stylet base. Median oesophageal bulb oblong; basal bulb elongate-pyriform, its base not extending over intestine, terminating at 106-128 μm from lip region. Cardia moderately developed. Excretory pore at level of isthmus base. Hemizonid just anterior to excretory pore, 1-4 annules wide; hemizonion inconspicuous.

Vulva slightly depressed from body contour, slit-like (Fig. 1J); epiptygma weakly developed or absent (Fig. 2E). Reproductive system amphidelphic; anterior and posterior ovaries equally developed but sometimes anterior one is longer (3 out of 21 paratype females) or shorter (4 out of 21 paratype females) than the posterior one. Spermathecae of both branches rounded to oval, filled with elongate spermatozoa in a quarter of the females (Fig. 1K). Distance between vulva and anus 5.0-7.5 times the tail length. Tail straight or slightly curved ventrally, clavate (Fig. 2F), 2.7-6.3 times the body

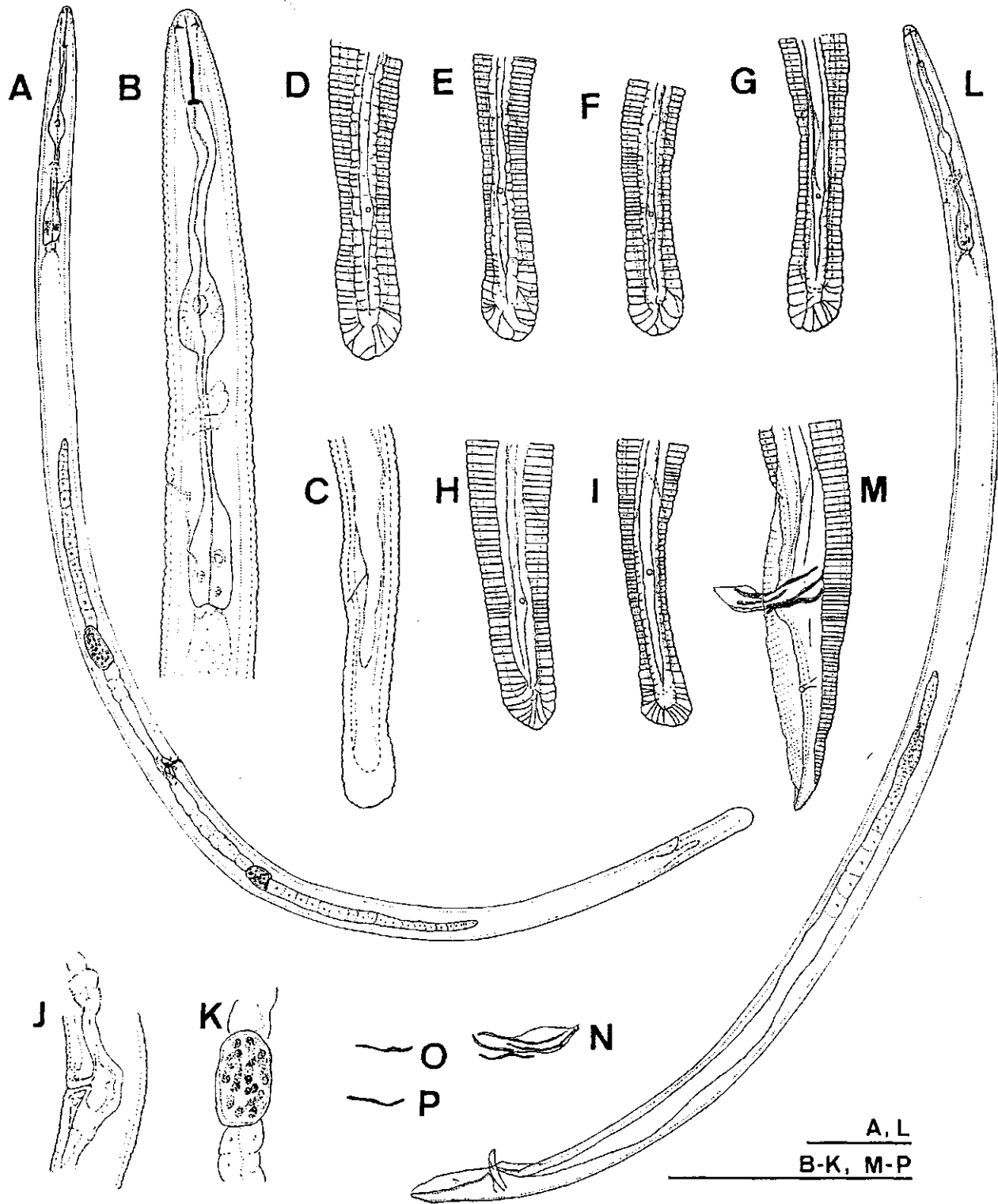


Fig. 1. *Bitylenchus iphilus* sp. n. Female: A. General view, B. Anterior body, C. Tail and postrectal intestinal sac. D-I. Tail. J. Vulva. K. Spermatheca. Male: L. General view. M. Tail. N. Spicule and gubernaculum. O-P. Gubernaculum. Scale bars indicate 50 μ m.

Table 1. Measurements and dimensions of *Bitylenchus iphilus* sp. n.

	Female		Male
	Holotype	Paratypes	Paratypes
n		20	20
L (μm)	686	554-799 (687+55.1)	581-773 (681+56.4)
W (μm)	20.2	16.2-26.3 (19.9+2.39)	15.2-22.7 (19.3+2.4)
a	34.0	29.5-43.5 (34.7+3.20)	31.1-41.8 (35.6+3.00)
b	5.7	5.3-6.4 (5.9+0.33)	5.2-6.6 (5.8+0.40)
c	16.2	13.7-18.4 (16.2+1.20)	14.0-19.1 (16.0+1.32)
c	4.0	2.7-6.3 (3.7+0.80)	2.4-3.3 (2.9+0.24)
V	57.8	53.0-59.7 (57.2+1.69)	
Stylet (μm)	19.2	16.7-20.2 (18.5+0.81)	16.7-19.2 (18.0+0.68)
Stylet cone (μm)	11.1	8.6-11.1 (9.8+0.68)	8.1-10.6 (9.5+0.66)
m	57.8	50.0-58.7 (53.2+2.56)	48.5-59.7 (52.9+2.66)
Stylet knobs H. (μm)	1.5	1.2-1.5 (1.4+0.14)	1.2-1.5 (1.3+0.13)
Stylet knobs W. (μm)	2.8	2.5-3.5 (2.9+0.28)	2.5-3.5 (2.8+0.33)
DGO (μm)	2.8	2.0-4.5 (2.9+0.56)	2.0-3.0 (2.6+0.36)
G1	28.0	16.5-26.5 (22.1+2.73)	
G2	23.4	16.0-26.3 (21.5+2.88)	
T			43.5-58.4 (42.4+2.92)
Body annule (μm)	1.3	0.9-1.3 (1.1+0.10)	0.8-1.6 (1.2+0.23)
Lateral incisures	4	4	4
Lateral field W. (μm)	6.1	5.6-7.6 (6.4+0.50)	5.1-7.1 (6.3+0.65)
Lateral field/W (%)	30.2	27.0-37.6 (32.5+2.47)	24.1-37.7 (33.1+3.71)
Lip annules	7	5-6 (5.4+0.47)	5-6 (5.6+0.50)
Lip H. (μm)	4.5	3.5-4.5 (3.9+0.29)	3.0-4.0 (3.6+0.36)
Lip W. (μm)	6.8	6.1-8.1 (6.9+0.52)	5.6-7.1 (6.4+0.34)
Metacarpus-Lip (μm)	62.6	52.5-65.7 (59.4+3.43)	54.5-63.6 (58.8+2.53)
Metacarpus L. (μm)	14.1	12.1-13.2 (13.7+1.37)	12.1-14.2 (13.0+0.52)
Metacarpus W. (μm)	9.1	8.1-9.6 (8.8+0.44)	7.6-10.1 (8.5+0.58)
Esoph. term.-Lip (μm)	120.1	103-128 (117+6.9)	110-125 (116+4.0)
Hemizonid-Lip (μm)	88.9	80.8-101 (90.1+4.26)	81.8-101 (89.6+5.28)
Excretory Pore (μm)	90.9	81.8-106 (93.0+5.34)	83.8-104 (92.2+5.61)
Excretory Pore/L (%)	13.2	12.4-15.7 (13.6+0.77)	12.4-15.0 (13.6+0.73)
Vulva-Lip (μm)	397	331-452 (393+26.6)	
Anterior gonad (μm)	192	109-197 (152+24.4)	
Posterior gonad (μm)	161	104-200 (148+24.0)	
Ant. spermatheca L. (μm)	14.1	16.2-21.2 (18.7+1.80, n=5)	
Ditto W. (μm)	10.1	10.1-13.2 (12.1+2.59)	
Ditto L/W	1.4	1.0-1.9 (1.6+0.36)	
Post. spermatheca L. (μm)	17.2	15.2-22.2 (18.0+3.06, n=6)	
Ditto W. (μm)	12.6	10.1-13.2 (13.1+4.00)	
Ditto L/W	1.4	0.8-2.1 (1.5+0.58)	
V-an. distance (μm)	248	183-317 (252+30.6)	
V-an./Tail	5.8	4.5-7.5 (5.9+0.69)	
Tail (μm)	42.4	37.4-51.0 (42.6+3.24)	37.4-48.5 (42.6+2.92)
ABW (μm)	10.6	8.1-16.2 (11.7+1.97)	12.6-16.2 (14.9+0.89)
Tail annules	29	24-41 (31.2+4.22)	
Hyaline part of tail (μm)	7.1	6.6-10.6 (8.0+1.10)	
Phasmid-Tail Term. (μm)	29.8	21.2-33.3 (27.3+3.06)	19.2-27.8 (24.0+2.57)
Ditto/Tail (%)	70.3	52.5-75.6 (64.2+6.38)	45.5-62.9 (56.2+4.18)
Postrect. intest. sac (μm)	26.3	8.1-32.3 (19.4+7.21)	
Ditto/Tail (%)	62.0	21.1-86.4 (45.9+17.97)	
Ditto/ABW	2.5	0.6-2.9 (1.7+0.65)	
Testis (μm)			286-404 (350+35.3)
Spicules (μm)			20.2-25.7 (23.8+1.34)
Gubernaculum (μm)			12.1-13.6 (12.6+0.53)

Figures indicate minimum and maximum values, and mean ± s.d. in parentheses.

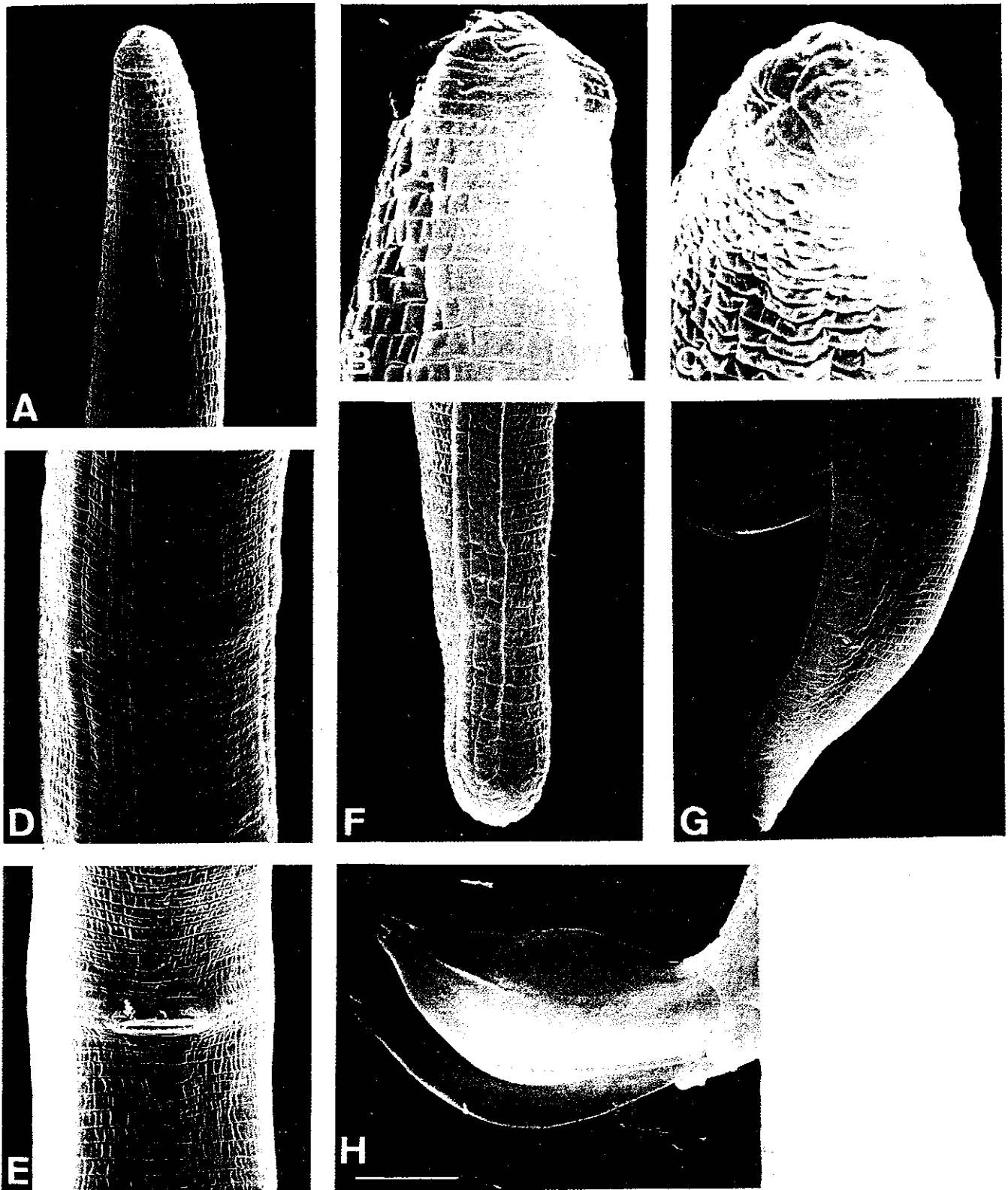


Fig. 2. *Bitylenchus iphilus* sp. n. Female: A. Anterior body. B. Head. C. Face view. D. Lateral field. E. Vulva. F. Tail. Male: G. Tail. H. Spicule. Scale bar indicates 2.5 μm for B-C, 3.1 μm for H, 8.3 μm for A, D-F and 10 μm for G.

width at anus, with 24-41 annules; terminus irregularly striated, usually rounded in profile, occasionally bluntly pointed or slightly truncate (Fig. 1D-I); hyaline part of tail terminus 6.6-10.6 μm in thickness. Phasmids in the anterior half of tail, at 8-21 annules posterior to anus. Postrectal intestinal sac 8.1-32.3 μm long, 0.6-2.9 times anal body width or 21.1-86.4% of tail length (Fig. 1C).

Male. Morphology and dimensions are almost corresponding with those of the female except for sexual characters (Fig. 1L). Testis single, outstretched. Spicules robust and arched, terminus minutely bifurcate (Fig. 2H). Gubernaculum half of the spicule length or slightly longer, thin, usually with proximal part curved and directed anteriorly or occasionally arched throughout or bent near middle portion (Fig. 10-P); cloacal aperture prominent. Tail terminus pointed with minute mucros as seen by SEM (Fig. 1G). Bursa well developed, reaching to tail end; phasmids on bursa, near middle of tail (Fig. 1M, 2G).

Type habitat and locality: Soil in a paddy field cultivated with rushes (*Juncus effusus* L. var. *utilis* Makino) used for "Tatami" mats in Fukuyama, Hiroshima, Japan.

Type specimens: Holotype female and 14 female and 14 male paratypes are deposited in the Herbarium and Insect Museum of the National Institute of Agro-Environmental Sciences (NIAES) at Tsukuba, Japan. Two female and two male paratypes are at each of the following centres: International Institute of Parasitology (IIP), St. Albans, UK; USDA Nematode Collection, Beltsville, Maryland, USA (USDANC); Department of Nematology, Agricultural University, Wageningen, The Netherlands (DNAUW).

Diagnosis and relationship: *Bitylenchus iphilus* sp. n. is a bisexual species characterized by slender body 554-799 μm in length, hemispherical lip region being continuous with body contour and bearing 5 or 6 fine annules, thin stylet 16.7-20.2 μm in length and clavate tail with 24-41 annules and rounded and annulated terminus in the female, and spicules 20.2-25.7 μm long and gubernaculum 12.1-13.6 μm long in the male.

Bitylenchus iphilus sp. n. resembles *B. natalensis* (Kleynhans, 1984) Siddiqi, 1986 by the tail shape, number of lip annules, stylet length etc., but differs from it in its shorter body, smaller number of tail annules, thinner stylet and the presence of males (body 787-964 μm long and tail annules 52-66 in *B. natalensis*).

Etymology: The species name is after the Japanese name of the supposable host plant "I".

Tylenchorhynchus kegasawai sp. n.

(Figs 3 & 4, Table 2)

Measurements. See Table 2.

Female. Body slender, arched after treatment by gentle heat

(Fig. 3A); slightly tapering from oesophageal base to lip region and posteriorly behind anus to a clavate tail terminus; no longitudinal striae or ridges. Body annules distinct 1.5-1.9 μm wide around midbody, wider in oesophageal and tail regions. Lateral fields originating from the level of stylet base (Fig. 4A) and occupying quarter to one-third of the body width; with four incisures of which the inner ones are fused to one posterior to the phasmids (Fig. 3D-E, 2F); outer incisures crenate; usually the inner band is wider than the outer ones but occasionally equally spaced.

Lip region low, flattened to rounded, almost continuous to body contour; outline smooth, not divided into sectors (Fig. 4B); with 2 or 3 annules. Cephalic framework moderately sclerotized. Labial cap large, separated from fused lips by parallel striae or by curved outside ones on dorsal and ventral sides, amalgamated to lips on lateral sides; lateral, subdorsal and subventral lips fused to form one structure; amphidial apertures on lateral sides of labial cap.

Stylet moderately strong, anterior part needle-like, about half of the total stylet length or slightly longer (Fig. 3B); knobs well developed, rounded, extending laterally or inclined slightly posteriorly. Dorsal oesophageal gland orifice about stylet knob height behind stylet base. Median oesophageal bulb oblong; basal bulb pyriform, slightly overlapping intestine. Cardia well developed. Excretory pore at about the middle of isthmus. Hemizonid usually just anterior to excretory pore, occasionally just posterior to it (2 out of 21 paratype females), 1-2 annules wide; hemizonion minute, about 10 annules posterior to hemizonid.

Vulva, slit-like, at slightly posterior to the middle of the body, more or less depressed from body contour (Fig. 3C); epiptygma absent (Fig. 4E). Reproductive system amphidelphic; anterior and posterior ovaries equally developed but sometimes anterior one is longer (2 out of 21 paratype females) or shorter (ditto) than the posterior one. Spermathecae of both branches rounded to elongate oval, filled with rounded spermatozoa in about three-quarters of the females (Fig. 4C). Distance between vulva and anus 4.3-5.2 times the tail length. Tail clavate (Fig. 3F) with 15-21 annules; terminus rounded in outline and smooth (Fig. 3D-E); hyaline part of tail terminus 5.6-8.1 μm in thickness. Phasmids in the anterior part of tail, 1-7 annules posterior to anus. Postrectal intestinal sac absent.

Male. Morphology and dimensions almost correspond with those of the female except for sexual characters and the slightly shorter body size (Fig. 3F). Testis outstretched, occasionally (1 in 20 paratypes) with one flexure. Spicules robust and arched, terminus minutely bifurcate (Fig. 4H). Gubernaculum half of the spicule length or slightly longer, thin, proximal part directed anteriorly or occasionally bent around middle portion (Fig. 3I-J); cloacal aperture prominent.

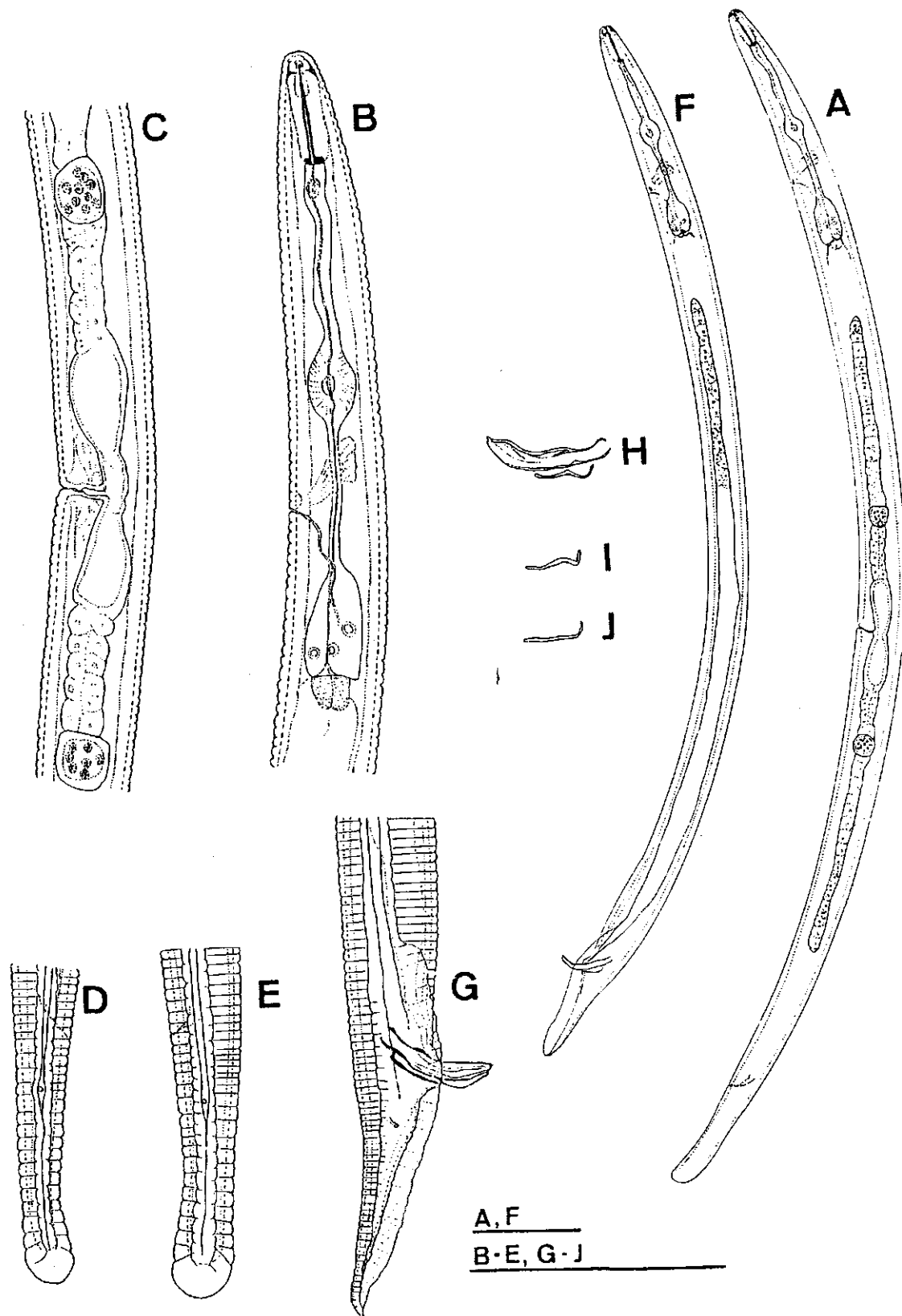


Fig. 3. *Tylenchorhynchus kegasawai* sp. n. Female: A. General view. B. Anterior body. C. Vulva and spermatheca. D-E. Tail. Male: F. General view. G. Tail. H. Spicule and gubernaculum. I-J. Gubernaculum. Scale bars indicate 50 μ m.

Table 2. Measurements and dimensions of *Tylenchorhynchus kegasawai* sp. n.

	Female		Male
	Holotype	Paratypes	Paratypes
n		20	20
L (μm)	596	523-631 (570+28.4)	485-591 (547+28.7)
W (μm)	21.2	19.2-24.2 (21.2+1.48)	18.2-21.2 (19.8+0.91)
a	28.1	25.0-30.1 (27.0+1.20)	25.5-29.6 (27.6+1.03)
b	5.0	4.7-5.5 (5.0+0.21)	4.7-5.5 (5.1+0.22)
c	11.8	11.3-13.0 (12.3+0.48)	11.2-14.6 (12.2+0.80)
c	3.7	3.0-4.0 (3.5+0.26)	2.6-3.7 (3.1+0.24)
V	52.5	51.8-55.5 (53.4+1.08)	
Stylet (μm)	21.2	19.2-22.2 (20.8+0.66)	19.2-21.2 (20.2+0.58)
Stylet cone (μm)	11.1	10.6-12.1 (11.0+0.36)	10.1-12.1 (11.0+0.40)
m	52.4	50.0-57.1 (52.7+1.73)	52.3-57.8 (54.3+1.50)
Stylet knobs H. (μm)	2.0	1.8-2.5 (2.1+0.17)	1.5-2.0 (1.8+0.21)
Stylet knobs W. (μm)	4.5	4.0-5.6 (4.7+0.51)	3.8-5.1 (4.4+0.38)
DGO (μm)	2.0	1.5-3.5 (2.2+0.48)	1.5-3.0 (2.3+0.47)
G1	25.8	16.5-28.0 (22.4+3.05)	
G2	25.0	16.0-26.3 (21.6+2.90)	
T			43.5-58.4 (42.4+2.92)
Body annule (μm)	1.7	1.5-1.9 (1.7+0.11)	1.3-1.9 (1.6+0.13)
Lateral incisures	4	4	4
Lateral field W. (μm)	6.1	5.1-7.1 (6.0+0.49)	5.1-6.6 (5.7+0.48)
Lateral field/W (%)	28.8	22.4-34.4 (28.4+2.88)	24.6-33.5 (28.9+2.34)
Lip annules	3	2-3 (2.6+0.50)	2-3 (2.4+0.49)
Lip H. (μm)	4.5	3.0-5.1 (4.0+0.46)	3.0-4.3 (3.6+0.39)
Lip W. (μm)	7.6	6.6-8.1 (7.2+0.47)	6.1-7.6 (6.9+0.41)
Metacarpus-Lip (μm)	64.5	54.5-64.6 (58.9+2.93)	52.5-60.6 (56.3+1.90)
Metacarpus L. (μm)	14.1	11.6-15.2 (13.2+1.02)	11.1-13.6 (12.5+0.71)
Metacarpus W. (μm)	9.6	9.1-11.1 (9.7+0.59)	8.6-10.1 (9.2+0.71)
Esoph. term.-Lip (μm)	119	104-122 (114+5.2)	103-116 (109+4.3)
Hemizonid-Lip (μm)	87.9	73.9-90.9 (82.0+3.97)	77.8-87.9 (83.0+3.01)
Excretory pore (μm)	89.9	75.8-92.4 (83.2+3.51)	78.9-89.9 (85.2+2.90)
Excretory pore/L (%)	15.1	13.4-16.0 (14.6+0.59)	14.7-16.8 (15.6+0.62)
Vulva-Lip (μm)	313	279-328 (304+14.2)	
Anterior gonad (μm)	154	111-179 (145+21.1)	
Posterior gonad (μm)	149	106-184 (139+21.1)	
Ant. spermatheca L. (μm)	17.2	8.1-26.3 (17.3+5.66, n=14)	
Ditto W. (μm)	10.6	9.1-15.2 (12.3+2.08)	
Ditto L/W	1.6	0.9-2.17 (1.4+0.34)	
Post. spermatheca L. (μm)	11.1	12.1-23.2 (17.1+3.87, n=15)	
Ditto W. (μm)	10.1	8.1-16.2 (12.1+2.49)	
Ditto L/W	1.1	1.0-2.0 (1.4+0.25)	
V-an. distance (μm)	232	196-249 (219+14.3)	
V-an./Tail	4.6	4.3-5.2 (4.7+0.23)	
Tail (μm)	50.5	41.9-53.5 (46.5+3.00)	35.5-51.5 (44.9+3.70)
ABW (μm)	13.6	12.1-15.2 (13.4+0.98)	13.1-16.2 (14.7+0.86)
Tail annules	18	15-21 (17.8+1.47)	
Hyaline part of tail (μm)	6.1	5.6-8.1 (6.7+0.72)	
Phasmid-Tail Term. (μm)	43.4	32.3-48.5 (38.9+3.52)	27.3-38.4 (34.2+2.50)
Ditto/Tail (%)	85.9	76.0-93.1 (83.7+5.46)	67.6-99.7 (76.6+6.71)
Testis (μm)			232-334 (292+27.5)
Spicules (μm)			21.2-26.3 (23.8+1.39)
Gubernaculum (μm)			10.1-12.6 (11.9+0.62)

Figures indicate minimum and maximum values, and mean ± s.d. in parentheses.

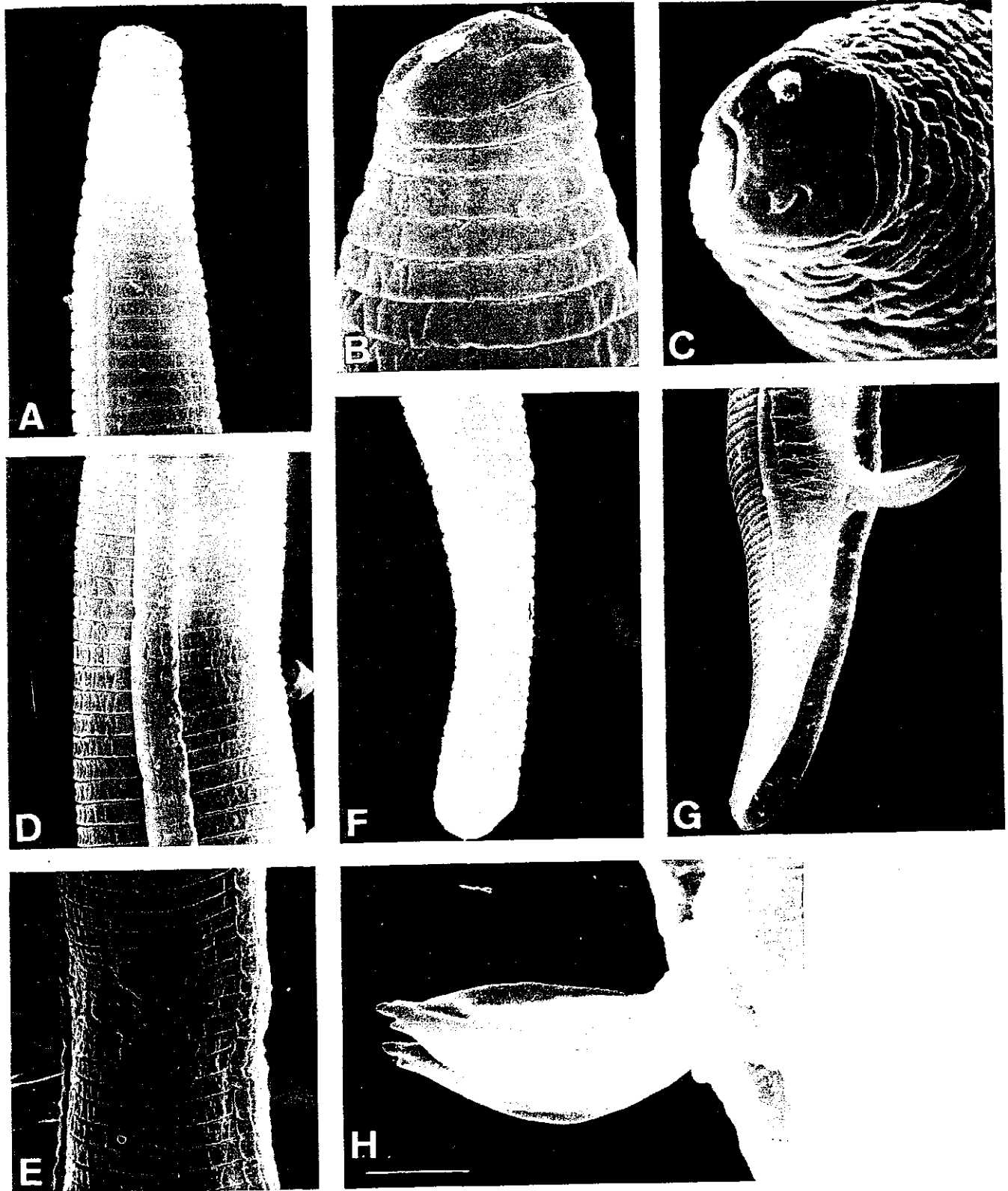


Fig. 4. *Tylenchorhynchus kegasawai* sp. n. Female: A. Anterior body. B. Head. C. Face view. D. Lateral field. E. Vulva. F. Tail. Male: G. Tail. H. Spicule. Scale bar indicates $2.5 \mu\text{m}$ for B-C, $3.1 \mu\text{m}$ for H, $8.3 \mu\text{m}$ for A, D-F and $10 \mu\text{m}$ for G.

Tail terminus pointed. Bursa well developed, reaching to tail end; phasmids on bursa, in anterior half of tail. (Fig. 3G, 4G).

Type habitat and locality: Soil round the roots of an unidentified woody plant in Zentsuji, Kagawa, Japan. This species was also detected from the rhizosphere of *Cinnamomus camphora* (L.) in the type locality, and from *Crataeva religiosa* G. Forster in Sata, Kagoshima, Japan.

Type specimens: Holotype female and 14 female and 14 male paratypes are deposited at NIAES. Two female and two male paratypes are at each of these centres: IIP, USDANC and DNAUW.

Diagnosis and relationship: *Tylenchorhynchus kegasawai* sp. n. is a bisexual species characterized by moderately robust body which is 523-631 μm long, hemispherical lip region being continuous with body contour and bearing 2 or 3 annules, stylet 19.7-22.2 μm in length and clavate tail with 15-21 annules and rounded and smooth terminus in the female, and spicules 21.2-26.3 μm long and gubernaculum 10.1-12.6 μm long in the male.

Tylenchorhynchus kegasawai sp. n. is similar to *T. crassicaudatus* Williams, 1960; *T. punensis* Khan & Darekar, 1979; *T. neoclavicaudatus* Mathur, Sanwal & Lal, 1979; *T. leviterminalis* Siddiqi, Mukherjee & Dasgupta, 1982 and *T. elegans* Siddiqi, 1961 by the tail and lip region shape and stylet length. It differs from *T. crassicaudatus* by the shape of the proximal end of the gubernaculum (anteriorly directed vs. curled); from *T. punensis* in the more robust stylet knobs (1.8-2.5 \times 4.0-5.6 μm vs. 1 \times 3 μm); from *T. neoclavicaudatus* in the lesser number of tail annules (15-21 vs. 32-50); from *T. leviterminalis* in the annulation of the lip region (2-3 annules vs. usually none, rarely two annules); and from *T. elegans* in the lesser number of lip annules (2-3 vs. 3-4).

Etymology: The species name is proposed in the honour of the Japanese nematologist, Kazuo Kegasawa.

DISCUSSION

Bitylenchus was established as a subgenus of the genus *Tylenchus* Bastian, 1865 by Filipjev in 1934 (see Jairajpuri, 1982), and later synonymised with *Tylenchorhynchus* by Golden *et al.* in 1978. According to recent revisional studies of the suborder Tylenchina, *Bitylenchus* was referred to as a distinct genus of the family Dolichodoridae (Siddiqi, 1986) or a junior synonym of *Tylenchorhynchus* in the family Belonolaimidae (Fortuner & Luc, 1987). Gomez-Barcina *et al.* (1992) described two new and two known species of *Bitylenchus* from Spain and showed SEM photographs of three of them. They discussed the relationship between *Bitylenchus* and *Tylenchorhynchus* concluding that these two genera can be separated from each other by several characters particularly the structure of the gubernaculum and the presence/absence of

a postrectal intestinal sac.

The two species from Japan described here can be assigned to these two different genera. *Bitylenchus iphilus* shows typical *Bitylenchus* characters, e.g., the six separated labial sectors, hexaradial lip annules, areolated lateral fields and presence of a postrectal intestinal sac, whereas *Tylenchorhynchus kegasawai* has typical *Tylenchorhynchus* characters, e.g., an unsectored lip region with smooth lip annules, absence of lateral field areolations and of a postrectal intestinal sac. By these characteristics I agree with the conclusion of Gomez-Barcina *et al.* (1992) that *Bitylenchus* and *Tylenchorhynchus* are separate genera.

Acknowledgement. I wish to express my hearty thanks to Drs Kei Shimizu, National Agricultural Research Centre and Kazuo Kegasawa, formerly of Shikoku National Agricultural Experiment Station, who provided me the soil samples for this study.

LITERATURE CITED

- Fortuner, R. and M. Luc 1987. A reappraisal of Tylenchina (Nemata). 6. The family Belonolaimidae Whitehead, 1960. *Revue de Nématologie* 10, 183-202.
- Golden, A. M., M. A. Maqbool and Z. A. Handoo 1987. Descriptions of two new species of *Tylenchorhynchus* Cobb, 1913 (Nematoda: Tylenchida), with details on morphology and variation of *T. claytoni*. *Journal of Nematology* 19, 58-68.
- Gomez-Barcina, A., M. R. Siddiqi and P. Castillo 1992. The genus *Bitylenchus* Filipjev, 1934 (Nematoda: Tylenchida) with descriptions of two new species from Spain. *Journal of the Helminthological Society of Washington* 39, 96-110.
- Jairajpuri, M. S. 1982. Some studies on Tylenchorhynchinae: the subgenus *Bitylenchus* Filipjev, 1934, with description of *Tylenchorhynchus (Bitylenchus) depressus* n. sp. and a key to species of *Bitylenchus*. *Mededelingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent* 47, 765-770.
- Kleynhans, K. P. N. 1984. *Tylenchorhynchus natalensis* sp. nov. from South Africa (Nematoda: Tylenchorhynchinae). *Phytophylactica* 16, 71-72.
- Khan, E. and K. S. Darekar 1979. Soil and plant-parasitic nematodes from Maharashtra, India. V. *Tylenchorhynchus punensis* n. sp. and *Mertinius macrophasmidus* n. sp. (Nematoda: Tylenchida). *Indian Journal of Nematology* 8, 43-48.
- Mathur, V. K., K. C. Sanwal and A. Lal 1979. *Tylenchorhynchus neoclavicaudatus* n. sp. in soil washings from imported potato tubers. *Indian Journal of Nematology* 8, 148-150.
- Minagawa, N. and T. Mizukubo 1994. A simplified procedure to transfer nematodes to pure glycerol for permanent mounts. *Japanese Journal of Nematology* 24, 79.

- Siddiqi, M. R. 1961. Studies on *Tylenchorhynchus* spp. (Nematoda: Tylenchida) from India. *Zeitschrift für Parasitenkunde* 21, 46-64.
- Siddiqi, M. R. 1985. Nematodes from Colombian rain forest. 2. *Tylenchorhynchus (Bitylenchus) botrys* n. sp. and *T. (B.) colombianus* n.sp. *Fitopatologia Colombiana* 11 (2), 29-31.
- Siddiqi, M. R. 1986. *Tylenchida parasites of plants and insects*. Wallingford, UK: CAB International, pp.ix + 645.
- Siddiqi, M. R., B. Mukherjee and M. K. Dasgupta 1982. *Tylenchorhynchus microconus* n. sp., *T. crassicaudatus levi-terminalis* n. subsp. and *T. coffeae* Siddiqi & Basir, 1959 (Nematoda: Tylenchida). *Systematic Parasitology* 4, 257-262.
- Takagi, K. 1970. Double layers centrifugal-flotation method for the separation of nematodes. *Japanese Journal of Applied Entomology and Zoology* 14, 108-110 (in Japanese).
- Williams, J. R. 1960. Studies on the nematode soil fauna of sugar cane fields in Mauritius. 4. Tylenchoidea (partim). *Mauritius Sugar Industry Research Institute, Occasional Paper* 4, 30 pp.