

Some species of freshwater nematodes from Singapore and Japan

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Information on free-living freshwater nematodes of East Asia is extremely scanty. In this paper, some species from a pond in the Botanical Garden of Singapore and from the Japanese lake Biwa are listed, with brief descriptions. A new species, *Daptonema timoshkini* sp. n. (Monhysterida: Xyalidae), is described from Biwa Lake. A new combination is established: *Aphanonchus longiceras* (Tsalolikhin, 1989) = *Paraphanolaimus longiceras* Tsalolikhin, 1989. Keys to the genera of the subfamily Aphanolaiminae and to species of the genus *Aphanonchus* are provided.

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Despite some recent publications (Wu et al., 1997; Tsalolikhin, 1999, 2000, 2001; Gagarin, 2000; Wu & Liang, 2000; Peng & Coomans, 2000), information on free-living freshwater nematodes of East Asia remains extremely scanty. The material considered in this paper originates from two countries and is listed for each of them separately.

Samples of bottom substrata from the littoral zone of Biwa Lake (silted sand) were collected 25.VII.1996 and 12.VIII.1996, and from a pond in the Botanical Garden of Singapore (silt), 9.VII.1998. The samples were fixed in 4% formalin; nematodes were cleared in glycerin and embedded in glycerin-gelatin.

NEMATODES FROM SINGAPORE

Cryptonchus abnormis (Allgen, 1933) (Figs 1-3)

Rather rare subtropical and tropical species. Solitary specimens (only females and larvae) were recorded from fresh waters and humid soil in Congo (Allgen, 1933; Schuurmans Stekhoven, 1951), Cote d'Ivoire (Andrássy, 1956), Suriname (Loof, 1973), Paraguay (Andrássy, 1968), Pakistan (Timm, 1957), India (Khera, 1976), New Zealand and Indonesia (Goodey, 1963). Females from Singapore are similar in morphology to those from other regions.

♀ (n = 2): L = 1141-1163 µm; a = 27-31; b = 4-5; c = 3-5; V = 42-52%; L' = 761-933 µm; b' = 3.2-3.3; V' = 63-65%. (Here and further: L', body length minus tail length; b' and V', accordingly).

Head 7-8 µm wide; stoma 3 µm wide. Amphid situated 7 µm from anterior end. Oesophagus 226-293 µm long. NR = 28-30%. Female reproductive system prodelphic, 140-150 µm long, with one egg (70 × 20 µm). Rectum 15-19 µm long. Tail length in females 380 and 230 µm, equal to 29 and 12 anal body widths, respectively. Similar data are given for specimens from Surinam: c = 3.4-5; tl/an = 11-20 (Loof, 1973). In this species, the tail is normally filiform, but it may be broken in the process of moult.

Ironus filicauda Daday, 1899 (Fig. 33)

Rather rare species described from New Guinea (Daday, 1901) and later recorded from fresh waters and humid soil in subtropical and tropical regions (Tsalolikhin, 1987).

Juv. (n = 2): L = 1175-1457 µm; a = 50-60; b = 5.8-5.9; c = 2.6-3; tl/an = 30.

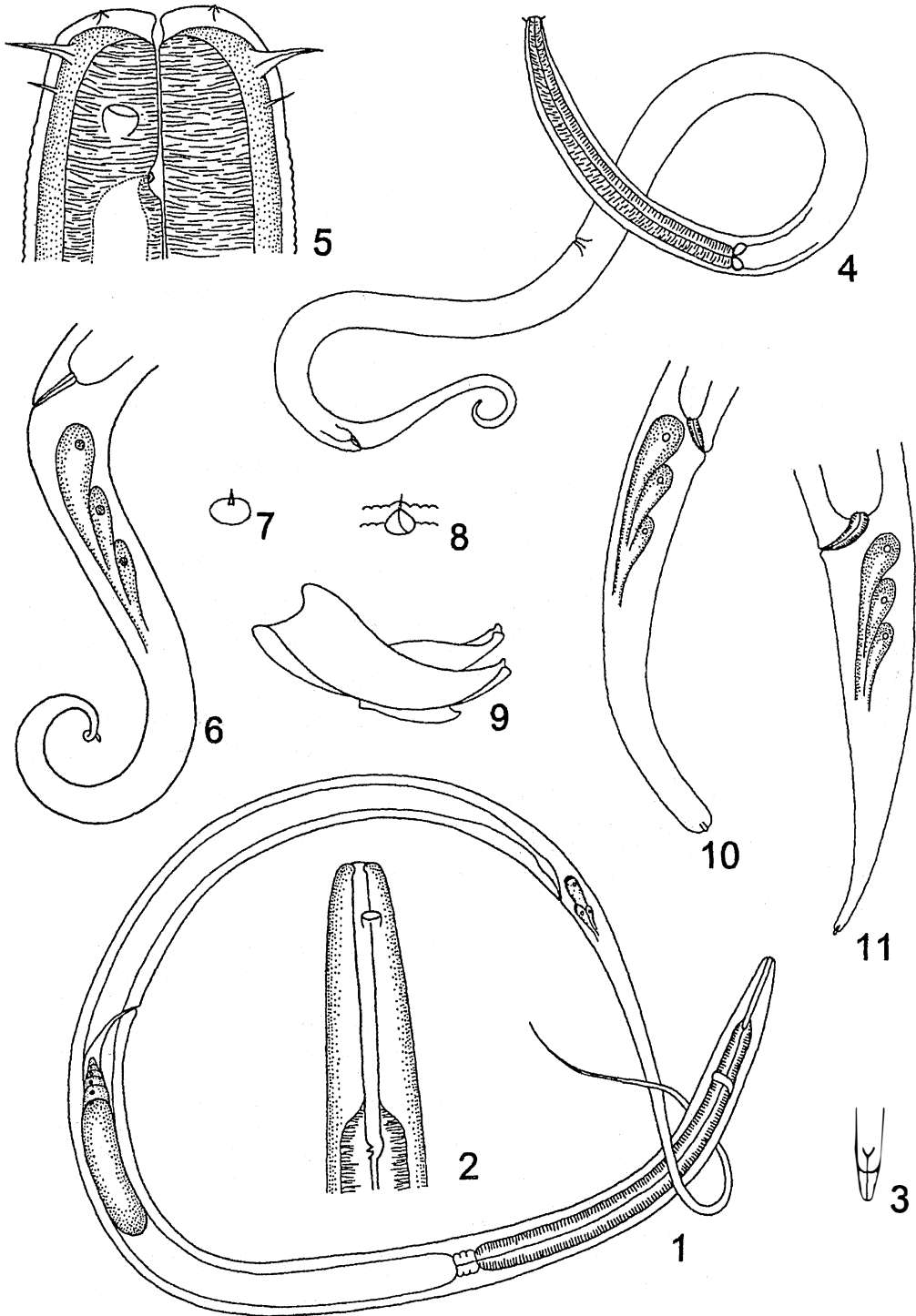
Head 10-11 µm wide; depth of stoma 78-87 µm (34-39% of oesophagus length); oesophagus 200-252 µm long; tail 450-490 µm long.

Brevitobrilus stefanskii (Micoletzki, 1925)

Widespread freshwater species. Its characteristics (taking into account also the material from Singapore) were published by Tsalolikhin (2000).

♀ (n = 2): L = 1086-1342 µm; a = 20.6-22.6; b = 4.9-5.9; c = 7.2; V = 41-46%.

♂ (n = 1): L = 1123 µm; a = 21.1; b = 5.4; c = 11.1; spic. 26 µm; gub. 13 µm; suppl. 6.



Figs 1-11. 1-3, *Cryptonchus abnormis* (Allgen): 1, entire body; 2, head; 3, tip of tail. 4-9, *Tripyla* sp.: 4, entire body; 5, head; 6, tail of female; 7, 8, supplements; 9, spicules. 10, *T. infia* Brzeski & Winiszewska-Ślipińska, tail of female. 11, *T. glomerans* Bastian, tail of female.

Head 19-20 μm wide; cephalic setae 4-6 μm long; total depth of stoma (buccal cavity and pockets combined) 24 μm ; distance between tops of teeth 8-10 μm . Oesophagus 220-230 μm long in females and 207 μm in male. Tail length 150-185 μm in females and 100 μm in male. Distance between supplements, in μm : cloaca-I: 23, I-II: 19, II-III: 16, III-IV: 19, IV-V: 16, V-VI: 24; total length of supplementary row 117 μm .

Monhystera sp. aff. **afromacramphis** Jacobs, 1987

♀ (n = 2): L = 880-989 μm ; a = 31-33; b = 5.8-6; c = 4.5-4.8; V = 60-61%; tl/an = 13; L' = 686-784 μm ; b' = 4.5-4.7; V' = 76-85%.

Head 19-20 μm wide; cephalic setae 5 μm long. Amphid (diameter 4 μm) situated at 7 μm from anterior end. Oesophagus 152-166 μm long. NR = 50%. Renette and excretory pore indistinguishable. Female reproductive system prodelphic, 295-320 μm long; egg 15-44 μm ; depth of vagina subequal to body width. Tail filiform, 295-320 μm long.

The length and shape of tail in these females are more typical for species of the genus *Eumonhystera* rather than of the genus *Monhystera*. However, the position of amphid (7 μm from anterior end) shows that the nematodes from Singapore belong to the genus *Monhystera*. Because of insufficient material and absence of males, the species could not be identified. It is most similar to *M. afromacramphis* Jacobs, 1987 from South Africa, which is characterized by the following characters of female (Joubert & Heyns, 1980; n = 10): L = 800-1060 (970) μm , a = 27.6-34.8 (30.6), b = 5.3-6.5 (6), c = 4.9-6.7 (5.6), V = 60-62 (61)%, tl/an = 7-10 (9); L' = 799 μm , b' = 4.9, V' = 74%; head 8-12 (11) μm wide; cephalic setae 3-4 μm long; amphid (diameter 3-4 μm) situated at 5-7 μm from anterior end; tail not filiform, 144-191 μm long.

Cobbonchus sp. aff. **charlesi** Coetzee, 1966 (Figs 12, 13)

♀ juv.: L = 2573 μm ; a = 54; b = 3.5; c = 51.5; tl/an = 0.9.

Head 29 μm wide; stoma 54 × 23 μm ; dorsal tooth situated at 29 μm (54%) and both subventral teeth, at 22 μm (41%) from bottom of stoma. Oesophagus 743 μm long. Tail 50 μm long; distal part of tail finger-like.

Dorylaimus afghanicus Andr ssy, 1960 (Figs 23-29)

Rather rare species described from Afghanistan and later recorded from South Africa, Europe and the Himalayas (Andr ssy, 1988). Males are rare. The material from Singapore comprises 6 males, 7 females and 4 larvae.

♀ (n = 6): L = 2835-4535 (3720 ± 323) μm ; a = 32-37 (34); b = 3.7-4.9 (4.2); c = 9.6-14.11 (12); V = 38-46 (42)%; tl/an = 5-7 (6).

♂ (n = 6): L = 2566-3190 (2937 ± 96) μm ; a = 22-36 (28); b = 3.2-3.6 (3.4); c = 33-50 (43); tl/an = 0.5-0.9 (0.6); spic. 90-108 (96 ± 3) μm ; suppl. 35-45.

Cuticle on head and tail 7-8 μm thick; on mid-body 28-32 longitudinal ridges. Head 19-23 (21) μm wide. Spear 40 μm long and 6-8 μm thick; aperture of spear 1/3 its length. Oesophagus 760-975 (864 ± 38) μm long in females and 760-900 (850 ± 19) μm in males. NR = 25%. Cardia elongated. Female reproductive system didelphic, amphidelphic: Q₁ = 570-660 μm , Q₂ = 715-760 μm ; eggs 70 × 30 μm ; depth of vagina 40-60 μm ; vulva semilunar. Prerectum 190-400 (310 ± 12) μm long; rectum 60-90 (70 ± 8) μm . Tail 250-380 (312 ± 18) μm long in females and 33-50 (43 ± 2) μm in males. Supplements of males very thin and closely spaced. Spermatozoa of irregular oval shape, 7-8 × 3-4 μm . The specimens from Singapore are most similar to those from Afghanistan, except for body length and position of vulva (37-39% vs. 38-45%).

Mononchulus nodicaudatus (Daday, 1899)

Rather rare subtropical and tropical species recorded from Indonesia (Daday, 1901; Schneider, 1937), Bangladesh (Jairajpuri & Loof, 1965), South America (Loof, 1973), Tanganyika Lake and the above-mentioned pond in Singapore (Tsalolikhin, 1988).

♀ (n = 10): L = 849-988 (933 ± 15) μm ; a = 22.5-27.6 (25.2); b = 3.5-4.1 (3.8); c = 8.7-10.2 (9.6); V = 62-66 (63)%; tl/an = 3.3.

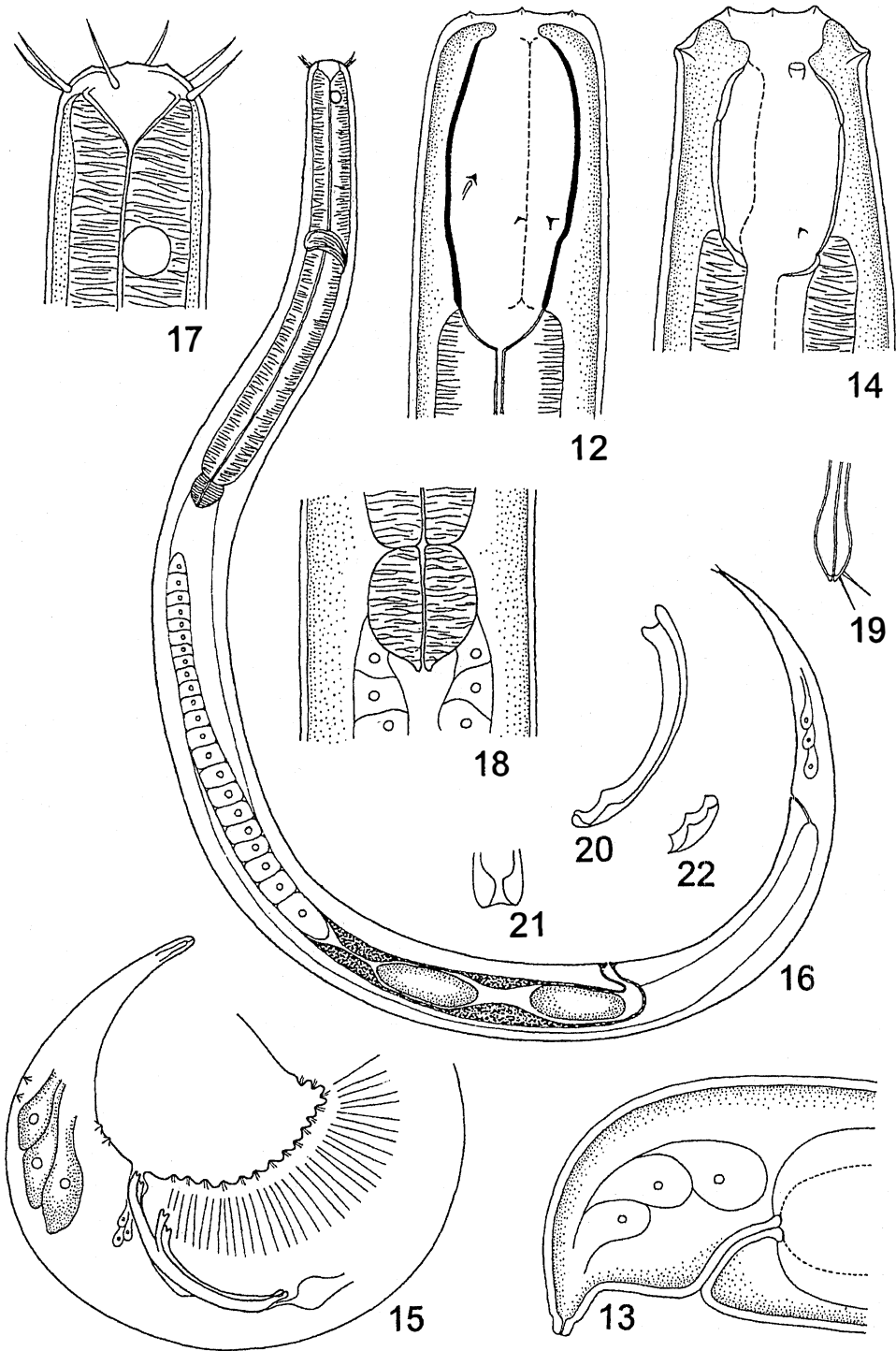
♂ (n = 1): L = 785 μm ; a = 22.4; b = 3.4; c = 11.5; tl/an = 2.2; spic. 30 μm ; suppl. 4.

NEMATODES FROM JAPAN

Tripyla sp. (Figs 4, 9)

♂ (n = 1): L = 2320 μm ; a = 29; b = 5; c = 5.9; tl/an = 7.8; spic. 48 μm .

♀ (n = 1): L = 2090 μm ; a = 38; b = 4.5; c = 6.7; tl/an = 7.6; V = 58%.



Figs 12-22. 12, 13, *Cobbonchus* sp.: 12, head; 13, tail of female. 14, 15, *Itonchus litoralis* Coetzee: 14, head; 15, posterior end of male. 16-22, *Daptonema timoshkini* sp. n.: 16, entire body of female; 17, head; 18, cardia; 19, tip of tail; 20, spicule; 21, tip of spicule; 22, gubernaculum.

Cuticle about 3 μm thick. Labial papillae distinct; outer labial sensillae (terminology by Brzeski & Winiszewska-Ślipińska, 1993) (or seta of first circle) 9-10 μm long; cephalic sensillae (or seta of second circle) fine, 4 μm long. Head rounded, 30-34 μm wide. Dorsal tooth small, triangular, situated at 24 μm from cephalic extremity. Amphid aperture 5 μm wide, situated at the level of cephalic sensillae. Oesophagus 460 μm long. NR = 35-37%. Female reproductive system underdeveloped. Rectum 26 μm long. Tail of female 270 μm long. Male reproductive system not seen; only 5 preloacal supplements clearly visible. Distance between cloaca and first supplement 52 μm , subequal to length of spicule. Spicules massive; gubernaculum without hook. Tail of male 390 μm long.

Tripyla glomerans Bastian, 1865
(Fig. 10)

σ (n = 4): L = 1860-1950 (1910) μm ; a = 16-20 (18.2); b = 4.9-5 (5); c = 6.7-8.4 (7.6); tl/an = 3-5 (3.5); spic. 63-68 (66) μm .

φ (n = 3): L = 1740-1920 (1833) μm ; a = 17-21 (19); b = 4.7-4.9 (4.8); c = 7.1-7.8 (7.5); tl/an = 4; V = 55-58 (56)%.

Head 29-35 μm wide; seta of first circle 4 μm long. Oesophagus 370-390 μm long. Rectum 40-46 μm long. Tail 220-285 μm long. Forepart of intestine contains fragments of thread colonial blue-green algae; prerectal part only with membranes of algae cells.

T. glomerans is a variable polymorphous species. Specimens from Biwa Lake (collected from muddy sand at a depth of 20 m) are most similar to those from Khanka Lake, Russian Far East (Aleksiev & Bestalannaya, 1990).

Tripyla infia Brzeski & Winiszewska-Ślipińska, 1993
(Fig. 11)

φ (n = 3): L = 1482-1878 (1673) μm ; a = 19-23 (21); b = 4.5-4.7; c = 6.3-7.1 (6.8); tl/an = 5.5-7(6.6); V = 53-57 (55)%.

Head 24-25 μm wide; seta of first circle 4 μm long. Oesophagus 315-400 μm long. Rectum 25-30 μm long. Tail 212-265 μm long.

The specimens were collected from sand and littoral periphyton at a depth of 9 m.

Daptonema timoshkini sp. n.
(Figs 16-22)

Holotype. φ , Japan, Biwa Lake, near Kita-Kamatsu, sand littoral, 12.VIII.1996 (O.A. Timoshkin), slide A-6718 (Zoological Institute, St.Petersburg).

Paratypes. 3 φ , 3 σ , same data as holotype, slides A-5489, A-5491, A-5505, A-5506, A-6127, A-6164 (Zoological Institute, St.Petersburg).

Description. Holotype: L = 1143 μm ; a = 23; b = 3.7; c = 6.8; tl/an = 5.3; V = 68%.

Paratype females (n = 3): L = 1051-1352 (1215) μm ; a = 22-31 (25); b = 3.7-4.5 (4); c = 6.6-6.9 (6.8); tl/an = 5-7 (6.5); V = 66-68 (67)%.

Paratype males (n = 3): L = 1084-1228 (1178) μm ; a = 22-32 (27); b = 4.1-4.5 (4.3); c = 6.5-8.4 (7.2); tl/an = 5-6.4 (5.5); spic. 29-30 μm .

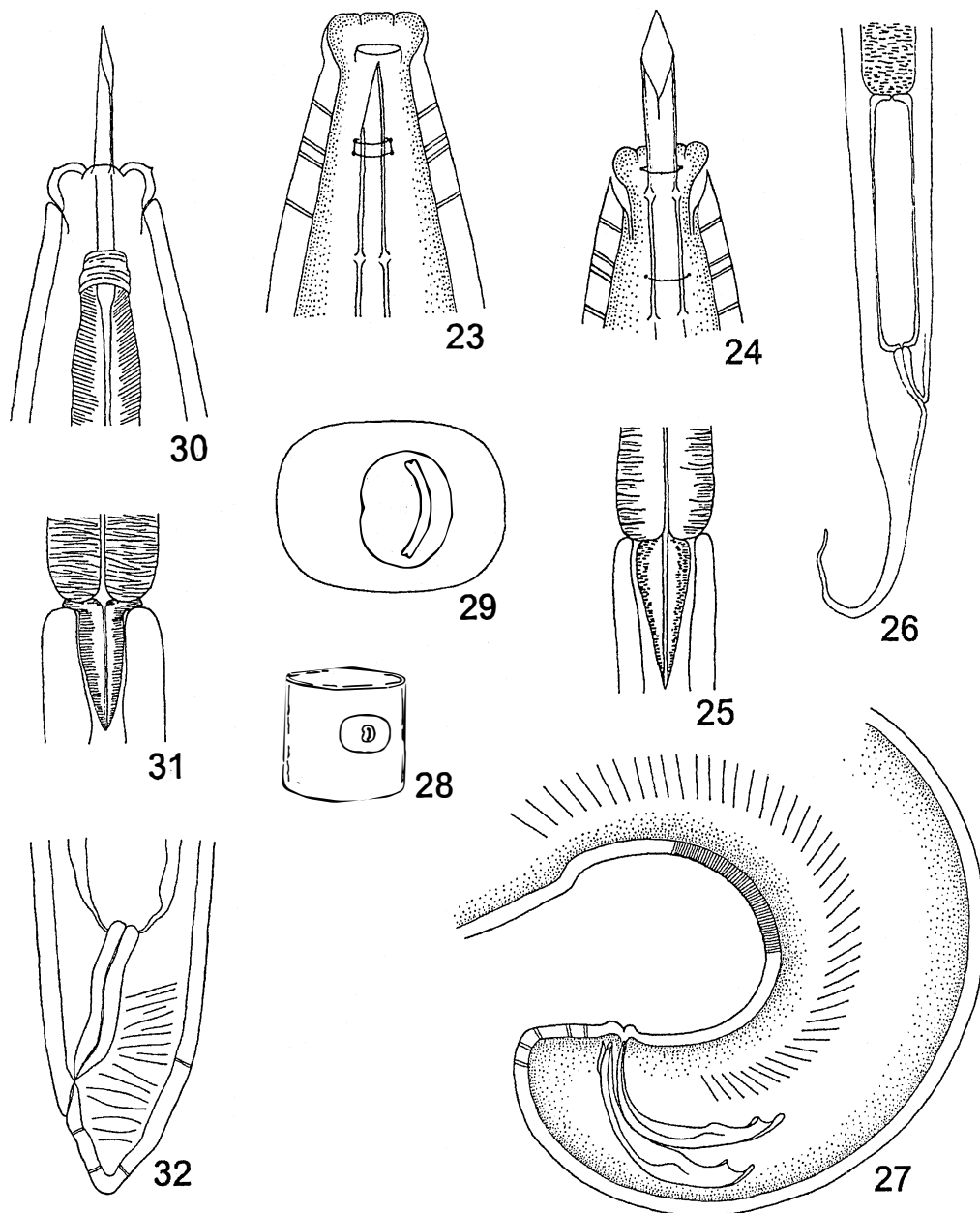
Cuticle thin and very faintly annulated. Head diameter 17-24 μm . Cephalic setae 10 (6 + 4); longer setae 8-10 μm long. Centre of amphid aperture located at 24 μm from cephalic end; diameter of amphid aperture 6-7 μm . Oesophagus muscular, 283-342 (307) μm long in females and 263-292 (275) μm long in males. NR = 40%. Cardia beet-shaped, muscular, 19-24 μm long. Rectum 26-34 (30) μm long. Tail with two subterminal setae about 6 μm long; length of tail 158-195 (179) μm in females and 146-178 (163) μm in males. Female reproductive system prodelphic-monodelphic, 415-512 (479) μm long; vulva with sclerotized pieces; depth of vagina 6 μm . Male reproductive system not visible; spicules with indentations on distal end. Gubernaculum poorly visible. Supplements absent.

Comparison. The new species belongs to the group of Asian brackish- and freshwater species of the genus: *D. karabugasense* (Tchesunov, 1980) from the Caspian Sea, *D. issykkulense* (Gagarin & Lemsina, 1980), *D. eximium* (Gagarin & Lemsina, 1981) and *D. gritsenkovi* (Gagarin & Lemsina, 1981) from Issyk-Kul Lake, Tien Shan, *D. rarum* Tsalolikhin, 1985 from brackish-water lakes of Mongolia, *D. inversum* Aleksiev, 1984 from freshwater lakes of the Kamchatka Peninsula, *D. aquaedulcis* Gagarin, 1984 from freshwater lakes of Vologda Prov., Russia, and *D. forte* Gagarin, 1993 from freshwater Taimyr Lake, Taimyr Peninsula. *D. timoshkini* sp. n. is most similar to *D. forte*, but differs in the shorter, faintly annulated body and the number of cephalic setae (10 vs. 12). The shorter species *D. aquaedulcis* and *D. inversum* differ from the new species and *D. forte* in the acute distal end of spicule.

Ironus ignavus Bastian, 1865

φ (n = 4): L = 2034-2376 (2183) μm ; a = 48.5-59.7 (53.2); b = 4.8-5.3 (4.9); c = 11.1-12.7 (11.8); tl/an = 8-9; V = 49-51%.

Head 11-12 μm wide; amphid aperture 4-5 μm ; cephalic setae 3-4 μm long; height of teeth 4 μm ; depth of stoma 80-85 μm (18-20% of oesopha-



Figs 23-32. 23-29, *Dorylaimus afghanicus* Andrassy: 23, head (lateral view); 24, head (dorsal view); 25, cardia; 26, posterior end of female; 27, posterior end of male; 28, 29, vulva. 30-32, *Aporcelaimellus obtusicaudatus* (Bastian): 30, head; 31, cardia; 32, tail of female.

gus length). Oesophagus 413-463 (432) μm long. NR = 35%. Q_1 = 340-546 μm , Q_2 = 390-460 μm ; eggs 150-160 \times 25-35 μm ; depth of vagina 15-24 (19) μm . Rectum 21-31 (27) μm long. Tail

160-195 (178) μm long.

Holarctic species. In specimens from Biva Lake, the tail and oesophagus are slightly shorter than in the typical ones.

Aporcelainellus obtusicaudatus (Bastian, 1865)
(Figs 30-32)

♀ (n = 2): L = 4748-4816 µm; a = 37-39.6; b = 4.9-5; c = 116-120; V = 51-52%; tl/an = 0.7.

Cuticle 5 µm thick on head and 11 µm thick on tail. Head 31-34 µm wide. Spear 47-48 µm long and 7 µm thick; aperture of spear 47-53% of spear length. Oesophagus 952-975 µm long; cardia 60 µm long. Q₁ = 660-700 µm, Q₂ = 570-720 µm; depth of vagina 47 µm. Prerectum 190-300 µm long; rectum 84-95 µm long. Tail 53-57 µm long.

The species is distributed worldwide. Specimens from Biwa Lake are slightly larger as compared to the typical ones.

Iotonchus litoralis Coetzee, 1967
(Figs 14-15)

♂ (n = 1): L = 2910 µm; a = 30.3; b = 4.1; c = 16.5; tl/an = 2; spic. 120 µm (cord); suppl. 14.

Head 55 µm wide. Stoma 62-38 µm; onch situated at the level of 23% from bottom of stoma. Oesophagus 714 µm long. NR = 27%. Tail 176 µm long.

The species was known from South Africa only (Coetzee, 1967).

Aphanonchus multipapillatus (Daday, 1905)
(Figs 34-41)

♀ (n = 5): L = 1231-1855 (1492) µm; a = 26.5-39.5 (33.2); b = 6.2-8.1 (6.8); c = 7-9.9 (8.9); c' = 6.5-7.5 (7); V = 46-51 (48)%.

Cuticle annulated, about 2 µm thick; number of annuli about 1000 or slightly more; first annulus located distinctly behind stoma base. Lateral field begins at the level of 55-65th annulus from anterior end, ends at the level of 25-35th annulus from terminus; lateral field at the level of vulva 1 µm wide and narrowed to head and to tail. Head and claviform terminus of tail smooth. Head 7-10 (8) µm wide, with four very thin setae 5-7 µm long. Stoma slightly elongated (3-4 × 4-5 µm), with sclerotized walls. Amphids spiral, located at the level of lower half of stoma, 4-5 µm wide. Oesophagus 200-240 (218) µm long. NR = 54%. Oesophago-intestinal junction poorly visible because of large renette. Four pairs of hypodermal glands located at the level of oesophagus. Vagina muscular, bulb-like, straight or slightly S-shaped, not sclerotized, its depth 18-

20 µm. All females with developed larvae (1-2 in anterior and posterior genital tubes) and with 1-2 eggs on different stages of cleavage (ovoviviparity is observed in *A. multipapillatus* for the first time). Distance from end of oesophagus to vulva 390-675 (508) µm; distance from vulva to anus 470-760 (595) µm, 3-4 times the length of tail. Tail 146-190 (171) µm long, with claviform terminus 10 µm long.

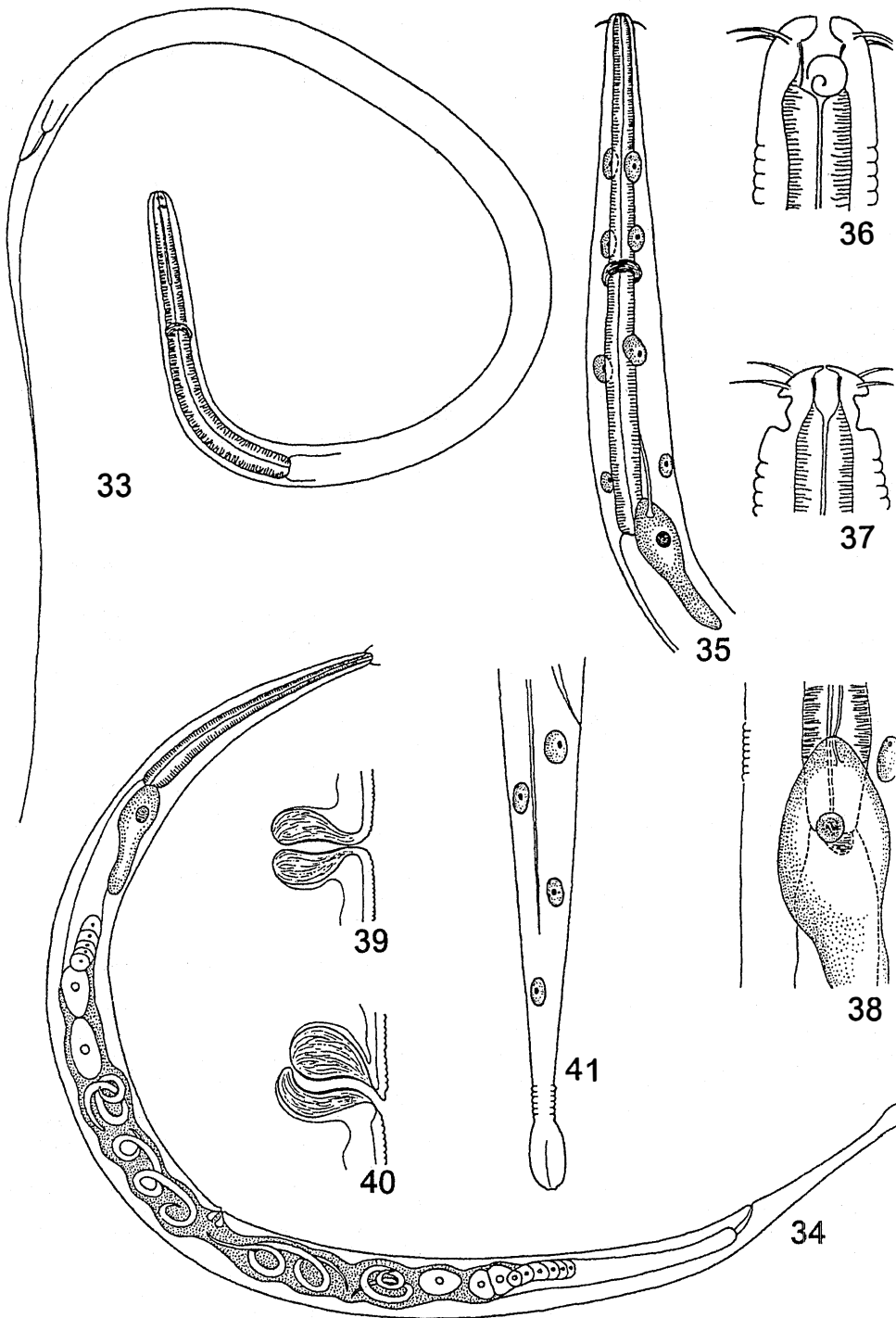
Note. The subfamily Aphanolaiminae Chitwood, 1936 (family Leptolaimidae Orley, 1880, s. str.) comprises 3 genera: *Aphanolaimus* de Man, 1880, *Paraphanolaimus* Micoletzky, 1923 and *Aphanonchus* Coomans & Raski, 1991. All these genera are very similar in morphology; the generic characters are not clearly expressed, especially in *Paraphanolaimus* and *Aphanonchus*. Keys for identification of the genera of Aphanolaiminae Chitwood, 1936 and species of *Aphanonchus* are given below.

Key to genera of the subfamily Aphanolaiminae

- 1(2). Total number of cuticle annuli no more than 1000 (as a rule, 300-500); tail terminus not claviform **Aphanolaimus**
Fourteen species from all continents, except for Australia and Antarctica.
- 2(1). Total number of cuticle annuli about 1000 or more; tail terminus claviform.
- 3(4). Stoma slightly sclerotized, cylindrical; vagina not sclerotized; spicules with blunt end (males known not in all species) **Paraphanolaimus**
Six species from Europe, Asia, Africa, and S America.
- 4(3). Stoma with thick walls, not cylindrical; vagina as a rule sclerotized; spicules with acute end **Aphanonchus**
Four species.

Key to species of the genus *Aphanonchus*

- 1(2). Amphids located below the level of stoma **A. longiceras** (Tsalolikhin, 1989), **comb. n.** (pro *Paraphanolaimus longiceras*)
Africa, Tanganyika Lake (Tsalolikhin, 1989).
- 2(1). Amphids located at the level of stoma.
- 3(4). Females with 10-17 alveolar supplements located from neck to vulva (males with 80 and more alveolar supplements) **A. intermedius** Coomans & Raski, 1991 (type species)
USA, Canada (Coomans & Raski, 1991).
- 4(3). Females without alveolar supplements (males with 30-60 alveolar supplements).
- 5(6). Males with 16-20 tubular supplements **A. multipapillatus** (Daday, 1905)
S America (Daday, 1905; Gerlach, 1957; Andrassy, 1968; Riemann, 1970; Loof, 1973), Austria (Schiemer, 1978), Japan (new record).
- 6(5). Males with 10-11 tubular supplements **A. orientalis** Wu & Liang, 2000
China (Wu & Liang, 2000).



Figs 33-41. 33, *Ironus filicauda* Daday, entire body of larva. 34-40, *Aphanonchus multipapillatus* (Daday): 34, entire body of female; 35, pharyngeal region; 36, head (lateral view); 37, head (dorsal view); 38, renette; 39, 40, vagina; 41, tail.

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