

To the fauna of free-living freshwater nematodes (Nematoda) of North Borneo

К фауне свободноживущих пресноводных нематод (Nematoda) Северного Борнео

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Free-living freshwater nematodes from Borneo Island (Kalimantan) have not been studied before. In the article, a brief list of nematodes found in shallow rivers and streams of the North Borneo (Malaysia, Sabah State) is given. The few samples with single specimens of nematodes suggest similarity of the nematode fauna of the entire Malay Archipelago.

Свободноживущие пресноводные нематоды о. Борнео (Калимантан) ранее не исследовались. В предлагаемой статье впервые приводится краткий список нематод, обнаруженных в мелких водоёмах и водотоках Северного Борнео (Малайзия, штат Сабах). Даже небольшое число проб с единичными экземплярами нематод позволяет говорить об общности нематофауны всего Малайского архипелага.

Key words: free-living nematodes, fauna, Malaysia, Borneo, Nematoda

Ключевые слова: свободноживущие нематоды, фауна, Малайзия, Борнео, Nematoda

INTRODUCTION

Among more than a hundred samples examined, the following six samples contained nematodes (all from Sabah State): **1** – Gorama River, depth 0.3 m, 5°21'05''N, 115°34'54''E, 10 June 2011; **2** – Sindumin farm, pond, 4°59'21''N, 115°31'31''E, 10 June 2011; **3** – pond, 5°21'08''N, 115°36'19''E, 10 June 2011; **4** – pond, 5°5'38''N, 116°17'49''E, 11 June 2011; **5** – small river, 4°58'51''N, 115°30'29''E, 12 June 2011; **6** – town of Kota-Kinabalu, sand beach, hollow with fresh water, 5°58'21''N, 116°3'26''E, 14 June 2011.

Brief descriptions of all the species found in North Borneo are given below (in Table 1); the most interesting of these have been illustrated and described in greater detail.

Order DESMODORIDA

Family DESMODORIDAE

Prodesmodora sp.

Material examined. One juvenile specimen from the sample **6**.

Description. Juv.: L = 736 µm, a = 22.3, b = 8.1, c = 16.3, c' = 2. Head 7 µm wide, amphid (diameter 4 µm) situated 14 µm from anterior end. Oesophagus 91 µm long, tail 45 µm long.

Note. Schneider (1937) described new species *P. minuta* from Java. This species is very diminutive: female (n = 2): L = 332–363 µm, a = 19.3–21.5, b = 5–5.6, c = 7.6–8.6, V = 46–47%. There are four diminutive species (L < 410 µm) and five large species (L > 500 µm) in fresh water of the world.

Table 1. A list of distribution of nematode species from Borneo and adjacent areas (in some cases, the close species are given: x, *P. minuta* Schneider, 1937; xx, *A. siddiqii* Andrassy, 1970; xxx, *M. szechenyii* Andrassy, 1961).

Species	Borneo	Sumatra, Java (Schneider, 1937)	Malacca, Singapore, Thailand (Tsalolikhin, 2009)
Order Desmodorida			
<i>Prodesmodora</i> sp.	+	x	–
Order Enoplida			
<i>Eurystomina whangae</i>	+	–	–
<i>Brevitobrilus stefanskii</i>	+	+	+
Order Mononchida			
<i>Mononchulus nodicaudatus</i>	+	+	+
<i>Mylonchulus lacustris</i>	+	+	+
Order Dorylaimida			
<i>Ironus longicollis</i>	+	+	+
<i>Alaimus similis</i>	+	–	xx
<i>Dorylaimus stagnalis</i>	+	+	+
<i>Mesodorylaimus hofmaenleri</i>	+	+	xxx
<i>Aporcelaimellus obtusicaudatus</i>	+	+	–
<i>Nygolaimus</i> sp.	+	–	–
<i>Meylis</i> sp.	+	–	–
<i>Mactinolaimus omercooperi</i>	+	+	+
Order Tylenchida			
<i>Neodolichodorus</i> sp.	+	–	–

All large species have long tail ($c < 8.6$) whereas our specimen has short tail ($c = 16.3$). This specimen most probably represents a new species.

Order ENOPLIDA

Suborder ONCHOLAIMINA

Family ENCHELIDIIDAE

Eurystomina whangae Yeates, 1967
(Figs 1–3)

Material examined. One male from the sample 6.

Description. Male: L = 3111 μm , a = 81.9, b = 4.4, c = 42.6, c' = 2, spic. 46 μm , gub. 16 μm . Head rounded and slightly offset from body contour; cephalic diameter 22 μm . Cephalic setae 11 μm long. Buccal cavity consist of two parts; in the middle of the anterior part, four rings of denticles

are present; in the posterior part, three large onchs are present. Amphid 9 μm diameter, situated on the level of denticles. Oesophagus 710 μm long. Tail 73 μm long. Length of spicules makes up 1.5% of the length of the body. Distance between supplements: cloaca I = 73 μm ; I–II = 40 μm .

Note. *Eurystomina whangae* was described by Yeates (1967a) from sand in 20 m inland from high tide level in Taylors Bay, near Christchurch, New Zealand.

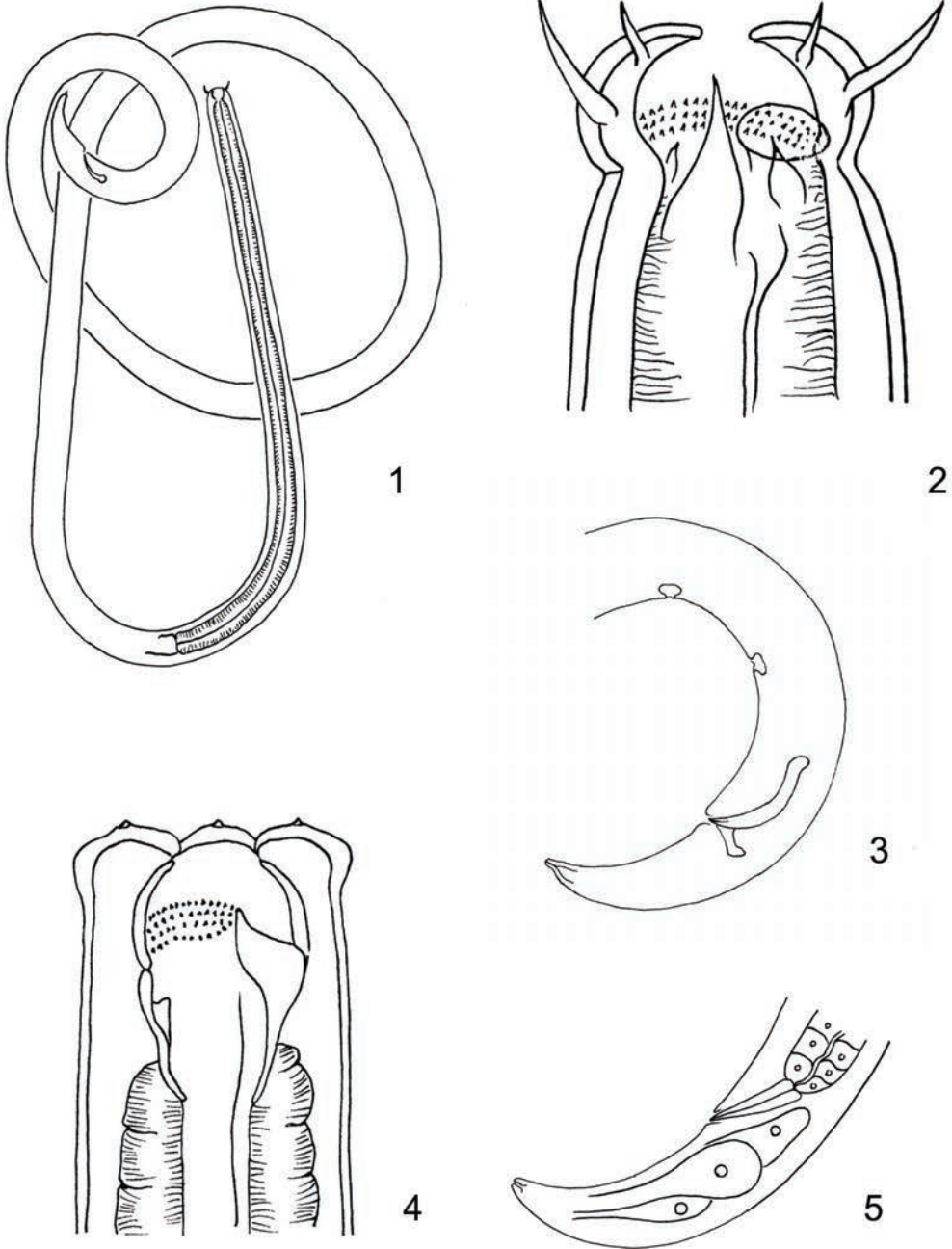
Suborder TOBRILINA

Family TOBRILIDAE

Brevitobrilus stefanskii
(Micoletzky, 1925)

Material examined. One juvenile specimen from the sample 4.

Note. *Brevitobrilus stefanskii* is a wide-spread polymorphic species. *Brevitobrilus*



Figs 1–5. *Eurystomina* and *Mylonchulus*. 1–3, *E. whangae*: 1, entire body of male; 2, head; 3, tail of male. 4–5, *M. lacustris*: 4, head; 5, tail of female.

malayanus (W. Schneider, 1938), *B. vibratus* (Sukul, 1967) and *B. montanus* Ocaña, Hernandez et Martin, 1996 are synonyms of *B. stefanskii* (Tsalolikhin, 2000). For the first time, this species was found in Malay Archipelago in 1937 (Schneider, 1937) and then in Thailand and Singapore (Tsalolikhin, 2009).

Order MONONCHIDA

Suborder MONONCHULINA

Family MONONCHULIDAE

Mononchulus nodicaudatus

(Daday, 1901)

Material examined. Nine females from the samples 1 and 6.

Description. Females (n = 9): L = 995–1293 (1111) μm ; a = 25.4–27.6 (26.4), b = 3.6–3.8 (3.7), c = 9.4–10.9 (10.3), c' = 3.6, V = 63–65 (64)%. Head diameter 13–14 μm , head 13–14 μm wide; width of buccal cavity 6 μm . Amphid aperture situated on the level 1/3 dorsal tooth. Oesophagus 271–343 μm long, NR = 30–33%. Sexual system monodelphic, prodelphic: Q = 76–127 μm without egg and 206–209 μm with egg. Vulva–anus/tail = 2.5–3. Tail 98–119 (108) μm long.

Notes. *Mononchulus nodicaudatus* was described by Daday (1899, 1901) from New Guinea as *Prismatolaimus nodicaudatus* with basic characteristics: L = 1190 μm , a = 23.8, b = 3.9, c = 9.9. Then this species was described in detail from Sumatra and Java (Schneider, 1937) as a *Mononchulus*. Females (n = 7): L = 875–1050 (970) μm , a = 20–28 (24), b = 3.3–4 (3.6), c = 9.2–10.4 (9.9), V = 63–65 (64)%. There are similar characteristics for *M. nudicaudatus* from Singapore (Tsalolikhin, 1988, 2002). Females (n = 10): L = 849–988 (933) μm , a = 22.5–27.6 (25.2), b = 3.5–4.1 (3.8), c = 8.7–10.2 (9.6), c' = 3.3, V = 62–66 (63)%. Besides, this species was found in South America (Surinam). Females (n = 9): L = 800–1210 μm , a = 24–31, b = 3.4–4.2, c = 8.5–9.5, V = 59–63% (Loof, 1973). Two

females were found in Africa (Tanganyika Lake): L = 749–823 μm , a = 27, b = 3.7, c = 8.6, V = 62% (Tsalolikhin, 1988). And fourteen females were collected from a rice field in Bangladesh: L = 1120–1290 μm , a = 33–37, b = 3.9–4.3, c = 10–11, V = 60–63% (Jairajpuri & Loof, 1965). Everywhere, males are very rare.

Mononchulus nodicaudatus is a typical holoandromorphic uniform species.

Suborder MONONCHINA

Family MYLONCHULIDAE

Mylonchulus lacustris (Cobb, 1915)

(Figs 4, 5)

Material examined. Two females from the sample 5.

Description. Female (n = 2): L = 1865–2027 μm , a = 26.7–28.3, b = 3.5–3.6, c = 22.7–23, c' = 2, V = 64–65%. Head 30–31 μm wide. Stoma 16–17 \times 31–32 μm , onch 81–84% from bottom of stoma, there are seven rows microonchs. Oesophagus 512–584 μm long, NR = 26–28%. Gonads not developed. Vulva–anus/tail = 7, rectum 39–42 μm long, tail 82–88 μm long.

Note. *Mylonchulus lacustris* is rare but widespread species: North America, Europe, Africa, South-East Asia, Australia (Mulvey, 1961; Zullini & Peneva, 2006; Tsalolikhin, 2009). Schneider (1937) mentioned eight females from Sumatra and Java: L = 1350–1438 μm , a = 22.7–26.6, b = 3.1–3.4, c = 16.6–19.2, V = 65–69%.

Order ALAIMIDA

Family ALAIMIDAE

Alaimus similis Thorne, 1939

Material examined. One female from the sample 6.

Measurement. Female: L = 1535 μm , a = 52.9, b = 7, c = 16.5, c' = 5, V = 38%.

Note. For the first time, this species was found in North America (Thorne, 1939) and then in Africa (Andrassy, 1965). A similar species, *A. siddiqii* Andrassy, 1970, was

found in a puddle in Vietnam (Andrassy, 1970) and in silt of a little river in Thailand (Tsalolikhin, 2009).

Order DORYLAIMIDA

Suborder IRONINA

Family IRONIDAE

Ironus longicollis Daday, 1899

= *Ironus ignavus paludicola* Schneider, 1937.

Material examined. Two females from the sample 5.

Description. Females (n=2): L = 1506–1509 μm , $a = 35.9\text{--}39.6$, $b = 4.2\text{--}4.3$, $c = 6.1\text{--}7.3$, $V = 50\%$. De Man index without tail: $L' = 1264\text{--}1300$ μm , $a' = 30\text{--}34$, $b' = 3.6$, $V' = 58\text{--}59\%$. Head 10 μm wide. Depth of stoma 68–70 μm (19% of oesophagus length). Oesophagus 350–360 μm long. Vulva–anus/tail = 2–2.7. Tail 206–245 μm long.

Note. For the first time, this species was described from Sumatra by Daday (1899) and then as *I. ignavus paludicola* by Schneider (1937).

Suborder DORYLAIMINA

Family DORYLAIMIDAE

Dorylaimus stagnalis Dujardin, 1845

Material examined. One female and one male from the sample 3.

Note. A hackneyed species, cosmopolite.

Mesodorylaimus hofmaenneri

(Menzel, 1914)

Material examined. One female and three males from the sample 1.

Description. Female: L = 1538 μm , $a = 35.7$, $b = 4.6$, $c = 11.2$, $c' = 6.5$, $V = 46\%$; males (n = 3): L = 1176–1520 μm , $a = 37\text{--}51$, $b = 3.1\text{--}4.4$, $c = 40\text{--}76$, $c' = 0.8\text{--}1.2$, suppl. 13–14, spic. 37–38 μm . Head 10 μm wide. Spear 13–14 μm long, aperture of spear 1/3 its lengths. Oesophagus 320–346 μm long, NR = 35–38%. Vulva–anus/tail = 6.5. Rec-

tum 36 μm long, prerectum 64 μm long. Tail 137 μm long (female) and 20–32 μm long (male).

Note. This species was found in Europe, North America (Andrassy, 1986) and Sumatra and Java (Schneider, 1937). Schneider (1937) indicated it as *Dorylaimus hofmaenneri*. Females (n = 5): L = 1038–1319 μm , $a = 31.3\text{--}38.4$, $b = 4.2\text{--}4.7$, $c = 5.3\text{--}10.6$, $V = 39\text{--}47\%$. Male: L = 1082 μm , $a = 29$, $b = 4.4$, $c = 57$, spic. 35–39 μm . Spear 12–15 μm long.

Family APORCELAIMIDAE

Aporcelaimellus obtusicaudatus

(Bastian, 1865)

Material examined. Three females from the sample 5.

Description. Females (n = 3): L = 2119–2373 μm , $a = 21.6\text{--}22.7$, $b = 3.5\text{--}3.7$, $c = 62.3\text{--}84.6$, $c' = 0.5\text{--}0.8$, $V = 49\text{--}54\%$. Head 18–19 μm wide. Spear 23 μm long, aperture of spear 61% its length. Oesophagus 602–636 μm long. Vulva–anus/tail = 29–38. Rectum 53–63 μm long, prerectum 80–90 μm long. Tail 26–34 μm long.

Note. A widespread species. Schneider (1937) recorded it from Java. Females (n = 2): L = 2188–2619 μm , $a = 28\text{--}32$, $b = 3.5\text{--}4.2$, $c = 70\text{--}78$, $V = 51\text{--}54\%$, rectum 63 μm long, prerectum 75–95 μm long.

Family NYGOLAIMIDAE

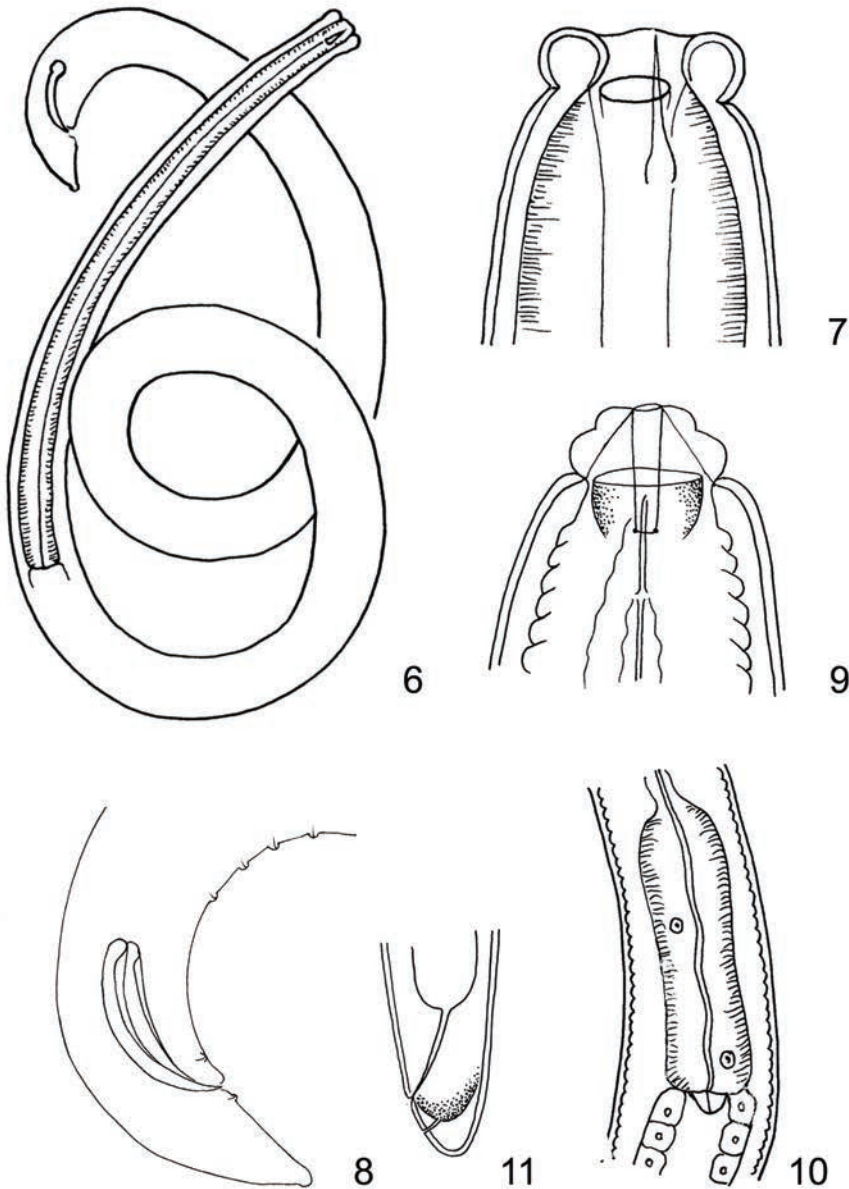
Nygolaimus sp.

(Figs 6–8)

Material examined. One male from the sample 6.

Description. Male: L = 1964 μm , $a = 41.8$, $b = 3.9$, $c = 41.8$, $c' = 1.5$, suppl. 4+1, spic. 53 μm . Head 15 μm wide. Spear 12 μm long. Oesophagus 500 μm long. Tail 47 μm long.

Note. *Nygolaimus thornei* Schneider, 1937 was described as *Aquatides thornei* from Sumatra and included in this genus by Heyns (1968). The specimen examined by us is most probably a new species of the genus *Nygolaimus*.



Figs 6–11. *Nygolaimus* and *Meylis*. 6–8, *Nygolaimus* sp.: 6, entire body of male; 7, head; 8, tail of male. 9–11, *M. multipapillatus*: 9, head; 10, “bulb”; 11, tail of female.

Family **LEPTONCHIDAE**

Meylis multipapillatus (Meyl, 1956)
(Figs 9–11)

Material examined. One female from the sample 6.

Description. Female: L = 1540 μ m, a = 39.5, b = 5.2, c = 64.2, c' = 1, V = 44%. Head 17 μ m wide, spear 15 μ m long. Oesophagus 294 μ m long, “bulb” 61 \times 15 μ m. Tail 21 μ m long.

Note. This species was known from moist sandy soil in Brasil as *Leptonchus multipapillatus* (Loof, 1963).

Family ACTINOLAIMIDAE

Mactinolaimus omercooperi (Filipjev, 1931)

Material examined. Four males from the samples 3 and 4.

Description. Males (n = 4): L = 2527–2627 µm, a = 56, b = 4.5–5, c = 112–133, c' = 0.6–0.7, spic. 50–56 µm. Head 15 µm wide. Spear 23–25 µm long, stoma diameter 9 µm. Oesophagus 517–561 µm long, NR = 29%. Tail 19–23 µm long. Supplements in two ventral series formed by 9 and 7–9 supplements respectively; distance between cloaca and first series 47 µm.

Note. *Mactinolaimus omercooperi*, described as *Actinolaimus omercooperi* by Filipjev (1931), is a rare African species (Tsalolikhin, 1995), but it found in Sumatra (Schneider, 1937). Males (n = 7): L = 2138–2982 µm, a = 41–71, b = 3.8–5.3, c = 90–144, spic. 50–58 µm.

Order TYLENCHIDA

Family DOLICHODORIDAE

Neodolichodorus sp.

Material examined. One juvenile (during molting) from the sample 6.

Description. Juvenile (molting): L = 1216 µm, a = 40.5, b = 6.9, c = 42, c' = 1. Cuticle strongly annulated, annules 4 µm wide. Lateral cuticle marked with four incisures. Lateral fields 10–12 µm wide. Head 11 µm wide, stylet 56 µm long. Oesophagus 177 µm long. Tail 29 µm long. Excretory pore and phasmid not seen.

Note. *Neodolichodorus arenarius* (Clark, 1963) was described from low sand dunes in New Zealand as *Dolichodorus arenarius* by Clark (1963) and included in this genus by Andrassy (1976). The specimen examined by us cannot be identified with certainty. Our specimen is possibly a new species.

DISCUSSION

Even a few samples with single specimens of nematodes suggest similarity of nematode fauna of entire Malay Archipelago where freshwater nematodes have been studied since 1899 (Daday, 1899; Schneider, 1937; Nicholas & Stewart, 1984; some others). Moreover, a similarity of free-living freshwater nematode fauna of the entire South-East Asia (Tsalolikhin, 2001; 2009) and partly of New Zealand (Clark, 1963; Yeates, 1967a, 1967b, 1967c) is observed. Most species found in this region are cosmopolites.

REFERENCES

- Andrassy I. 1965. Erd- und Süßwasser-Nematoden aus Ghana. *Opuscula Zoologica*, **5**: 127–151.
- Andrassy I. 1970. Freilebende Nematoden aus Vietnam. *Opuscula Zoologica*, **10**: 5–31.
- Andrassy I. 1986. The genus *Mesodorylaimus* and its relatives. *Acta Zoologica Hungarica*, **32**: 207–261.
- Clark W.C. 1963. A new species *Dolichodorus* from coastal dune sand. *New Zealand Journal of Science*, **6**: 531–534.
- Daday E. 1899. Uj-guineai szabadon élő nematodok. *Mathematika és Természettudományi Közlemények*, **17**: 557–572.
- Daday E. 1901. Mikroskopische süßwassertiere aus Deutsch-New-Guinea. *Természettudományi Füzetek*, **24**: 1–56.
- Jairajpuri S. & Loof P.A.A. 1965. The systematic position of *Mononchulus*. *Nematologica*, **14**: 496–500.
- Loof P.A.A. 1963. A review of the nematode genus *Leptonchus*. *Nematologica*, **9**: 507–520.
- Loof P.A.A. 1973. Freshwater nematodes from Surinam. *Zoologische Verhandlungen*, **129**: 3–46.
- Mulvey R.H. 1961. The Mononchidae. Genus *Mylonchulus*. *Canadian Journal of Zoology*, **39**: 665–696.
- Nicholas W.L. & Stewart A.C. 1984. *Oncholaimus balli* n.sp. from a volcanic crater lake in Papua New Guinea. *Nematologica*, **30**: 1–10.
- Schneider W. 1937. Freilebende Nematoden der Deutschen Limnologischen Sundaexpedition nach Sumatra, Java und Borneo. *Archiv für Hydrobiologie*. Suppl., **15**: 30–108.

- Thorne G.** 1939. A monograph of the nematodes of the superfamily Dorylaimoidea. *Capita Zoologica*, **8**: 5–256.
- Tsalolikhin S. Ya.** 1988. Tropical nematodes – new and rare species. *Trudy zoologicheskogo instituta Akademii nauk SSSR [Proceedings of the Zoological Institute of USSR Academy of Sciences]*, **180**: 59–67. (In Russian).
- Tsalolikhin S. Ya.** 1995. Review of the fauna of free-living nematodes from inland waters of Ethiopia. *Zoosystematica Rossica*, **4**: 205–218.
- Tsalolikhin S. Ya.** 2000. Notes on composition of the genus *Brevitobrilus*. *Zoosystematica Rossica*, **9**: 25–35.
- Tsalolikhin S. Ya.** 2001. Some species of freshwater nematodes from Singapore and Japan. *Zoosystematica Rossica*, **10**: 231–239.
- Tsalolikhin S. Ya.** 2009. To the fauna of free-living freshwater nematodes of South-East Asia. *Proceedings of the Zoological Institute of the Russian Academy of Sciences*, **313**: 427–434. (In Russian).
- Yeates G.W.** 1967a. Studies on nematodes from dune sand. *New Zealand Journal of Science*, **10**: 280–329.
- Yeates G.W.** 1967b. Studies on nematodes from dune sand. *New Zealand Journal of Science*, **10**: 527–547.
- Yeates G.W.** 1967c. Studies on nematodes from dune sand. *New Zealand Journal of Science*, **10**: 752–807.
- Zullini A. & Peneva A.** 2006. Order Mononchida. In: **Eyualem-Abebe et al.** (Ed.). *Freshwater nematodes*: 468–496. CABO Publishing.

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