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OBSERVATIONS ON SOME NEMATODES PARASITIC IN JAPANESE FRESHWATER FISHES

F. MORAVEC and K. NAGASAWA

Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Czechoslovakia, and Hokkaido Fisheries Experimental Station, Hakodate, Japan

Abstract. In the years 1976–1986, samples of some freshwater fishes collected from different localities in Japan were examined for helminths. This material comprised several species of parasitic nematodes, six of them being represented by adults (*Camallanus cotti, Rhabdochona denudata, Rh. zacconis, Ezonema bicornis, Cucullanus truttae* and *Pseudocapillaria tomentosa*) and two by larvae (*Raphidascaris biwakoensis* and *Anisakis simplex*). *C. truttae* and *Rh. denudata* are reported from Japan for the first time. The latter species is represented here by a separate subspecies, *Rh. d. honshuensis* subsp. n. (type host pale chub, *Zacco platypus*); the new subspecies is characterized mainly by the shape of the distal tip of the left spicule (without a ventral tooth-like process), small body measurements, and small size of nonfilamented eggs. Some of the nematodes have been recorded from new species of fish hosts and from new regions in Japan. Most of these parasites are briefly described and illustrated and some problems concerning their taxonomy and geographical distribution are discussed.

Although the fauna of Japan is of particular interest from the viewpoint of zoogeography, the nematode fauna of freshwater fishes remains still inadequately known in this country. In the years 1976–1986, the junior author (K. N.) had an opportunity to examine helminthologically several species of freshwater fishes collected from different parts of Japan. Since the nematodes recovered have represented interesting findings, mainly from the viewpoint of taxonomy and zoogeography, the results of their systematic evaluation are presented in this paper. One species of this material (*Philometroides masu*) has not been included as it has been dealt with in a separate publication (Moravec and Nagasawa 1989).

MATERIALS AND METHODS

The nematodes were collected by one of us (K. N.) from fishes of several rivers and one lake (Lake Biwa) from Hokkaido and Honshu in 1976–1986. The nematodes were fixed in hot 70% ethanol and for examination they were cleared with glycerine. *En face* views were prepared according to Anderson's (1958) method. Drawings were made with the aid of a Zeiss microscope drawing attachment. The specimens have been deposited in the Meguro Parasitological Museum, Tokyo, and partly in the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice. The scientific names of fishes are those recommended in Nakamura (1975). All measurements are in millimetres.

REVIEW OF SPECIES

1. ***Camallanus cotti*** Fujita, 1927 Fig. 1
(Syn.: *Camallanus zacconis* Li, 1941; *C. fotedari* Raina et Dhar, 1972)

Description: Medium sized, whitish nematodes with slightly transversely striated cuticle and large, orange-brown capsule typical of genus. Mouth opening slit-shaped, surrounded by four oral papillae and four sclerotized plates. Valves of buccal capsule roughly pentagonal upon lateral view, supported inside by smooth longitudinal ribs, some of them being incomplete. Narrow, sclerotized ring present at bottom of capsule. Tridents large, only moderately surpassing posterior border of buccal capsule. Deirids not observed.

Male (10 specimens): Length of body 2.77—4.05, maximum width 0.136—0.190. Length of buccal capsule including basal ring 0.099×0.105, maximum width 0.090 to 0.096; size of basal ring 0.060×0.009—0.012. Each valve of buccal capsule strengthened internally by 15—18 longitudinal ribs, some of them being incomplete. Length of tridents 0.060—0.066. Muscular oesophagus measuring 0.285—0.313, glandular oesophagus 0.330—0.422. Nerve ring and excretory pore 0.180—0.186 and 0.270 to 0.273, respectively, from anterior extremity. Posterior end of body provided with caudal alae. Papillae pedunculated: 7 pairs preanal and 6 postanal. Postanal papillae of first three pairs close together. Cloacal opening surrounded by two transverse mounds, appearing upon lateral view as two pairs of small sessile papillae. Spicules unequal, simple; length of larger spicule 0.144—0.171, of smaller, less sclerotized spicule 0.099—0.105. Length of tail 0.108—0.123.

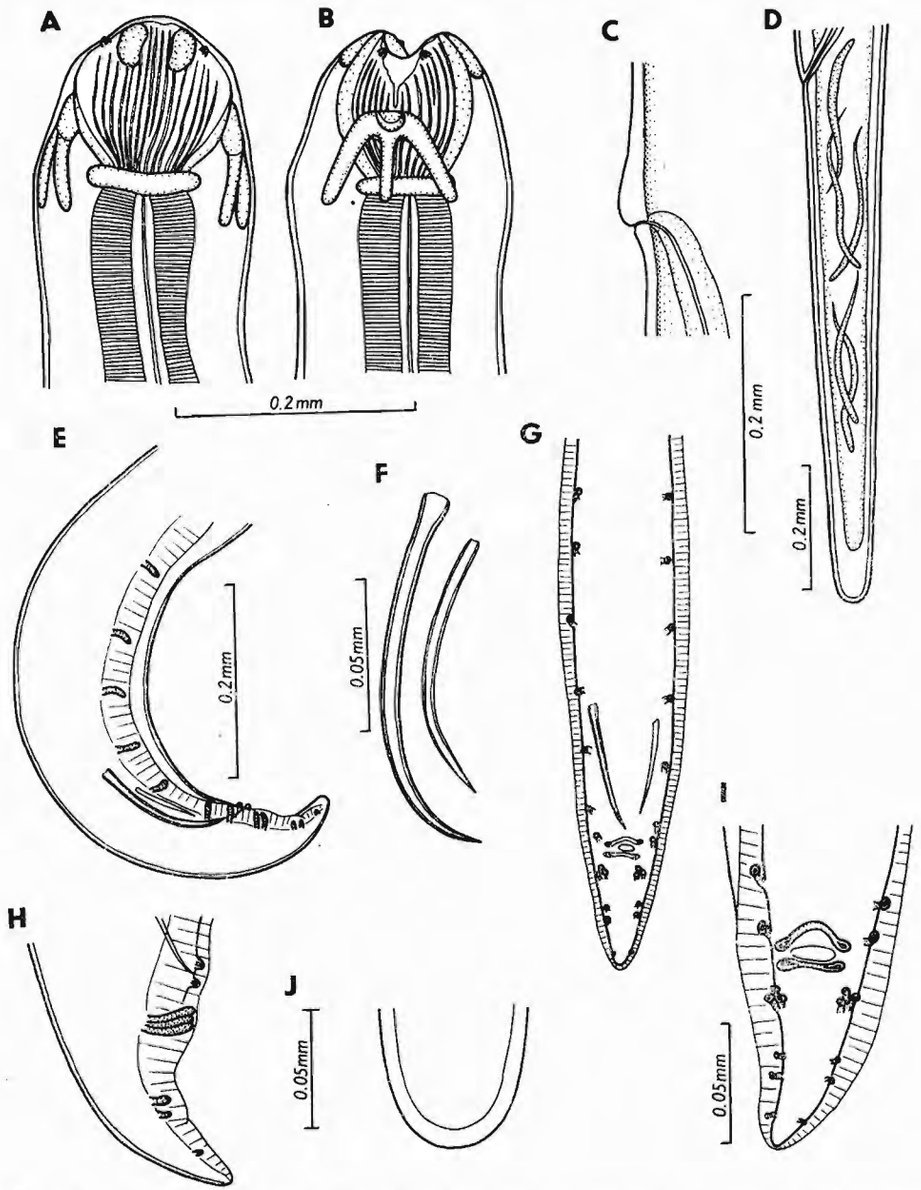

Fig. 1. *Camallanus cotti* Fujita, 1927. A, B — head end of female; C — vulva; D — tail of gravid female; E — posterior end of male, lateral view; F — spicules; G — posterior end of male, ventral view, H, I — tail tip of male, lateral and ventral views; J — tail tip of gravid female.

Female (10 specimens): Body length of females with larvae in uterus 5.11—7.30, maximum width 0.231—0.313. Length of buccal capsule including basal ring 0.159 to 0.165, maximum width 0.144—0.150; size of basal ring 0.090—0.175×0.015. Each valve bearing 17—20 longitudinal ribs. Length of tridents 0.075—0.111. Muscular oesophagus 0.449—0.462, glandular oesophagus 0.530—0.612 long. Nerve ring 0.258—0.272 and excretory pore 0.299—0.367, respectively, from anterior extremity. Tail very elongate, 0.816—0.966 long, representing 13—16% of whole body length; its tip rounded, without any processes. Vulva postequatorial, 2.27—3.06 from posterior end of body, dividing body length in ratio 2.25—2.39 : 1; vulvar lips elevated. Vagina muscular, directed posteriorly. Uterus extending posteriorly nearly to end of tail, filled with numerous larvae.

Host: freshwater sculpin, *Cottus reinii* Hilgendorf (fam. Cottidae, Scorpaeniformes).
Localization: rectum.
Locality: Lake Biwa, Shiga Prefecture, Honshu (5 February 1980).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. No. 19533). 1 ♂ + 1 ♀ in Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (Coll. No. N — 11).

Comments: — This species was originally described by Fujita (1927a, b) from fishes of Lake Biwa and Lake Tazawa from Japan; later Yamaguti (1935, 1941) redescribed it from the specimens newly collected from different Japanese fishes. The nematode specimens of the present material, originating from the type locality, correspond morphologically to the species *C. cotti*, as it has been redescribed by Yamaguti (1941). The only difference is the number of postanal papillae in the male; there are 7 pairs present according to Yamaguti (1941), but the last but one is lacking in some individuals; in males of the present material as well as in the conspecific males from northern Vietnam (Moravec and Sey 1988) only 6 pairs of postanal papillae were found. In addition, the vulva of the present specimens is shifted a little more posteriorly than found by Yamaguti (1941), dividing the body length in ratio 2.25—2.39 : 1 instead of 1.2—1.45 : 1 as given by Yamaguti (1941); this may be taken for an intraspecific variability.

This parasite has been reported from a number of fish species belonging to various families and orders (largely Cypriniformes) from the region of eastern, south-eastern and southern Asia, namely from Japan (Fujita 1927a, b, Yamaguti 1935, 1941), the R. Amur basin in the USSR (Dogiel and Akhmerov 1959, Roytman 1963), China (Chen 1973, Wang et al. 1979, Wu 1984) and Vietnam (Moravec and Sey 1988); under the synonyms *C. zacconis* and *C. fotedari* it has been reported from Korea (Li 1941), China (Wang et al. 1979) and India (Raina and Dhar 1972). It occurs as well in the breedings of aquarium fishes in Europe where it was probably brought in along with exotic fishes imported from Singapore (see Campana—Rouget et al. 1976).

2. ***Rhabdochona denudata honshuensis*** subsp. n. Fig. 2

Description: Small nematodes with smooth cuticle. Mouth roughly hexagonal. Two lateral amphids and four small submedian cephalic papillae present. Prostom elongate, funnel-shaped, without basal teeth; anterior margin of prostom armed with 14 forwardly directed teeth, lateral teeth arranged in pairs. Vestibule relatively long, straight. Deirids small, bifurcate, anterior to mid-length of vestibule. Tail of both sexes with sharp terminal cuticular spike.

Male (10 specimens; measurements of holotype in parentheses): Length of body 3.70—4.35 (4.35), maximum width 0.068—0.082 (0.068). Prostom 0.018 (0.018) long

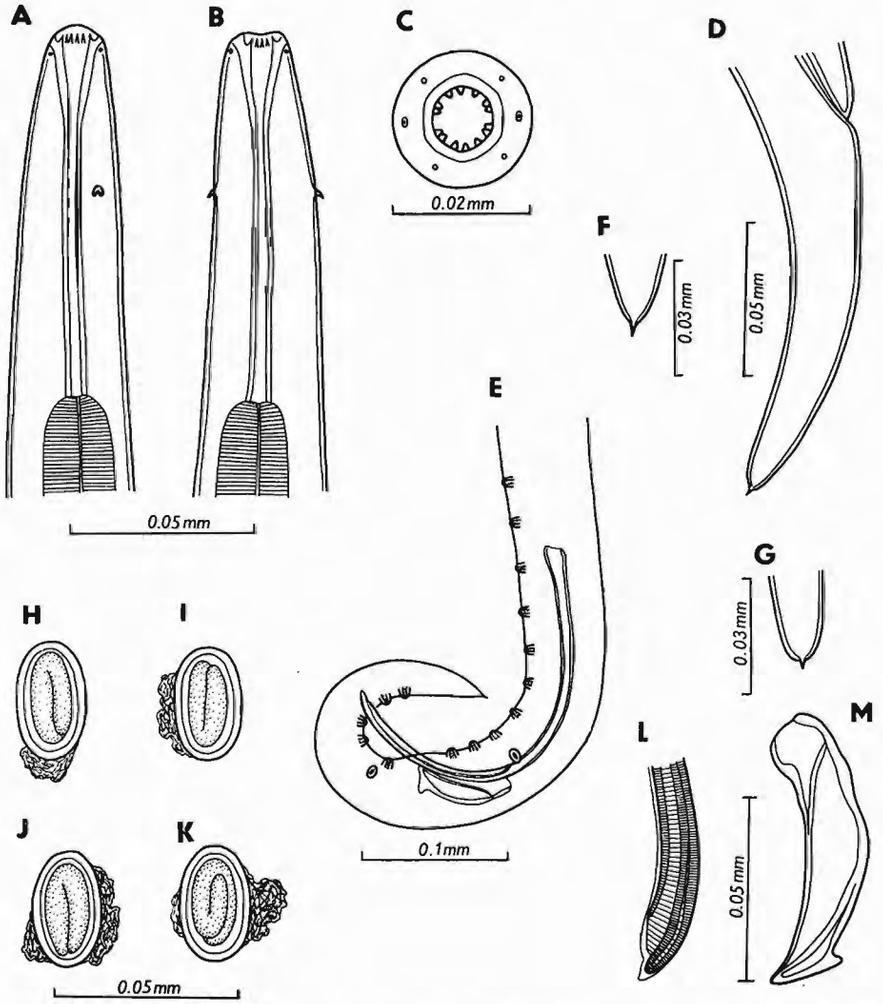

Fig. 2. *Rhabdochona denudata honshuensis* subsp. n. A, B — head end of female, lateral and dorsal views; C — same, apical view; D — female tail; E — posterior end of male; F, G — tail tip of female and male; H—K — mature egg; L — distal end of left spicule; M — right spicule.

and 0.009—0.012 (0.012) wide. Length of vestibule including prostom 0.090—0.096 (0.090), of muscular oesophagus 0.186—0.240 (0.195), of glandular oesophagus 1.56—1.92 (1.91). Nerve ring encircling muscular oesophagus 0.114—0.129 (0.114) from anterior end of body, distance of excretory pore 0.180—0.195 (0.180), of deirids 0.033—0.039 (0.036). Subventral preanal papillae occurred in following combinations: 7 + 8, 8 + 9, 8 + 10, and 10 + 11 (8 + 9). Additional pair of lateral preanal papillae present approximately at level of third subventral pair (counted from cloacal opening). Postanal papillae: 6 pairs present, second pair lateral, remaining subventral. Area rugosa absent. Larger (left) spicule 0.306—0.330 (0.321) long, length of its shaft 0.165—0.180 (0.174), representing 53—59 % of whole spicule length; distal tip of this spicule slightly expanded, provided with cuticular cover, without tooth-like ventral process. Smaller (right) spicule 0.075—0.090 (0.078), with distinct dorsal barb at its distal end. Length ratio of spicules 1 : 3.4—4.4 (1 : 4.1). Tail conical, 0.156—0.207 (0.207) long, with sharp cuticular spike at tip.

Female (10 specimens; measurements of allotype in parentheses): Length of body of gravid females 4.09—6.80 (6.80), width 0.068—0.122 (0.122). Prostom 0.018—0.024 (0.024) long and 0.012 (0.012) wide. Length of vestibule including prostom 0.084—0.108 (0.108), of muscular oesophagus 0.186—0.240 (0.240), of glandular oesophagus 1.40 to 1.92 (1.92). Distance of nerve ring 0.117—0.159 (0.159), of excretory pore 0.165—0.180 (—), of deirids 0.039—0.048 (0.048). Tail conical, 0.132—0.150 (0.150) long, with sharp terminal cuticular spike. Vulva postequatorial, 1.78—2.95 (2.95) from posterior end of body. Muscular vagina directed posteriorly. Eggs oval, size 0.033—0.036 × 0.021—0.024 (0.033—0.036 × 0.021—0.024); surface of mature (larvated) eggs provided with fine, irregular, almost transparent flock-like coating.

Host: pale chub, *Zacco platypus* (Temminck et Schlegel) (fam. Cyprinidae, Cypriniformes).
Localization: intestine.
Locality: Fuji River, Yamanashi Prefecture, Honshu (10 August 1977).
Specimens: holotype (♂), allotype (♀) and paratypes (♂♂ + ♀♀) in Meguro Parasitological Museum, Tokyo (M. P. M. Coll. No. 19511); two paratypes (♂ + ♀) in Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (Coll. No. N-358).
Etymology: The subspecific name of these nematodes relates to the region of their occurrence (Honshu).

Differential diagnosis: *Rh. denudata honshuensis* subsp. n. differs from the nominate subspecies *Rh. denudata denudata* (Dujardin, 1845) mainly in the shape of the distal tip of the left spicule (ventral tooth-like process typical of the nominate subspecies is absent), smaller measurements of the body and organs (body length 3.7—4.4 mm and 4.1—6.8 mm in males and gravid females, respectively, versus 4.9—6.5 mm and 7.2—14.2 mm in *Rh. d. denudata*), smaller size of mature eggs (0.033—0.036 × 0.021—0.024 mm versus 0.039—0.048 × 0.024—0.027 mm), and in the absence of ventral cuticular ridges (area rugosa) in the male. From *Rh. denudata dzhalilovi* Moravec et Amin, 1978, a subspecies described from cyprinids of the subfamily Schizothoracinae in Afghanistan and Soviet Central Asia (Tajikistan), it differs principally in the structure of the distal tip of the left spicule (nonbifurcated versus somewhat bifurcated in *Rh. d. dzhalilovi*), shape of the prostom (more elongate), and smaller size of mature eggs (0.033—0.036 × 0.021—0.024 mm versus 0.042—0.045 × × 0.021—0.024 mm). By its morphology and measurements, *Rh. d. honshuensis* subsp. n. also resembles *Rh. phoxini* Moravec, 1968 parasitizing European brook minnows, *Phoxinus phoxinus*, differing from it, however, by the presence of a dorsal barb on the right spicule (it is lacking in *Rh. phoxini*), smaller body measurements, smaller mature eggs, and by some other features.

Comments: — The morphology of nematodes of the present material corresponds, on the whole, to the description of *Rh. denudata* (Dujardin, 1845), a widely distributed parasite of many cyprinids and some other fishes of the palearctic region (see Moravec 1975). However, because of certain morphological differences, which are considered to be within the limits of intraspecific variability, the nematodes are described here as a new subspecies, *Rh. denudata honshuensis* subsp. n. This subspecies may represent *Rh. denudata* populations near the eastern border of the area of distribution of this species. Although *Rh. denudata* was previously reported from the Far East from the R. Amur system in the USSR (see Moravec 1975), it has not so far been recorded from Japan.

From Japan, another *Rhabdochona* species, *Rh. zacconis* was described from *Zacco platypus* and *Liobagrus reini* by Yamaguti (1935). Later Moravec (1975) and Moravec et al. (1981) redescribed *Rh. zacconis* from the type specimens from *Z. platypus* and newly collected Japanese materials from *Tribolodon hakonensis* and *Z. platypus* and established a new species, *Rh. japonica*, for Yamaguti's type specimens of *Rh. zacconis* from *L. reini*. While redescribing *Rh. zacconis* by Moravec et al. (1981), the character of eggs of this species could be studied only in the specimens from *T. hakonensis*, but not those from *Z. platypus*; the only available female type specimen from *Z. platypus* was mounted as a permanent slide and, therefore, the eggs could not be dissected out of its body for more detailed examination, whereas the newly collected specimens from the same host species were not fully mature. Nevertheless, all other features of the specimens from both *T. hakonensis* and *Z. platypus* were identical and, accordingly, they were considered to be conspecific. But in spite of the presence or absence of egg filaments, the nematodes of the present material differ considerably from the type specimens of *Rh. zacconis:* the ventral tooth-like process on the distal tip of the left spicule, typical of *Rh. zacconis*, is absent, length of the body is considerably smaller (3.7—4.4 mm and 4.1—6.8 mm in males and gravid females, respectively, versus 9.7—9.8 mm and 17.6 mm in *Rh. zacconis*), and the length of the left spicule is only 0.306—0.330 mm (0.513—0.522 mm in *Rh. zacconis*). Consequently, they cannot be considered conspecific with *Rh. zacconis* and they are described as *Rh. denudata honshuensis.*

Apparently, pale chub, *Zacco platypus*, may be parasitized by both *Rhabdochona denudata honshuensis* and *Rh. zacconis*, but the principle host of the latter is probably dace, *Tribolodon hakonensis.*

3. ***Rhabdochona zacconis*** Yamaguti, 1935
(Syn.: *Rhabdochona marinum* Roytman, 1963)

Host: dace, *Tribolodon hakonensis* (Günther) (fam. Cyprinidae, Cypriniformes).
Localization: intestine.
Localities: Amano River, Hokkaido (20 April 1980); Honshu: Kanita River, Aomori Prefecture (16 August 1976 and 5 August 1978), Chikuma River, Nagano Prefecture (10 June 1977 and 2 June 1978) and Tama River, Tokyo (8 September 1976).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. Nos. 19512, 19513, 19514, 19515, 19516, 19517); two specimens (♂ + ♀) in Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (Coll. No. N-38).

Comments: — The morphology of nematodes from the present material fully corresponds to the description of this species as given in the publications by Moravec (1975) and Moravec et al. (1981); since the redescription of *Rh. zacconis* by the latter authors was based on specimens from Japan, we refrained from describing this species again in this paper. The present material of *Rh. zacconis* comprised many adult and

juvenile specimens; gravid females containing mature eggs were found in June and August.

Rh. zacconis was originally described from *Zacco platypus* from Japan (Nagano Pref.) by Yamaguti (1935) who incorrectly included in this species also specimens

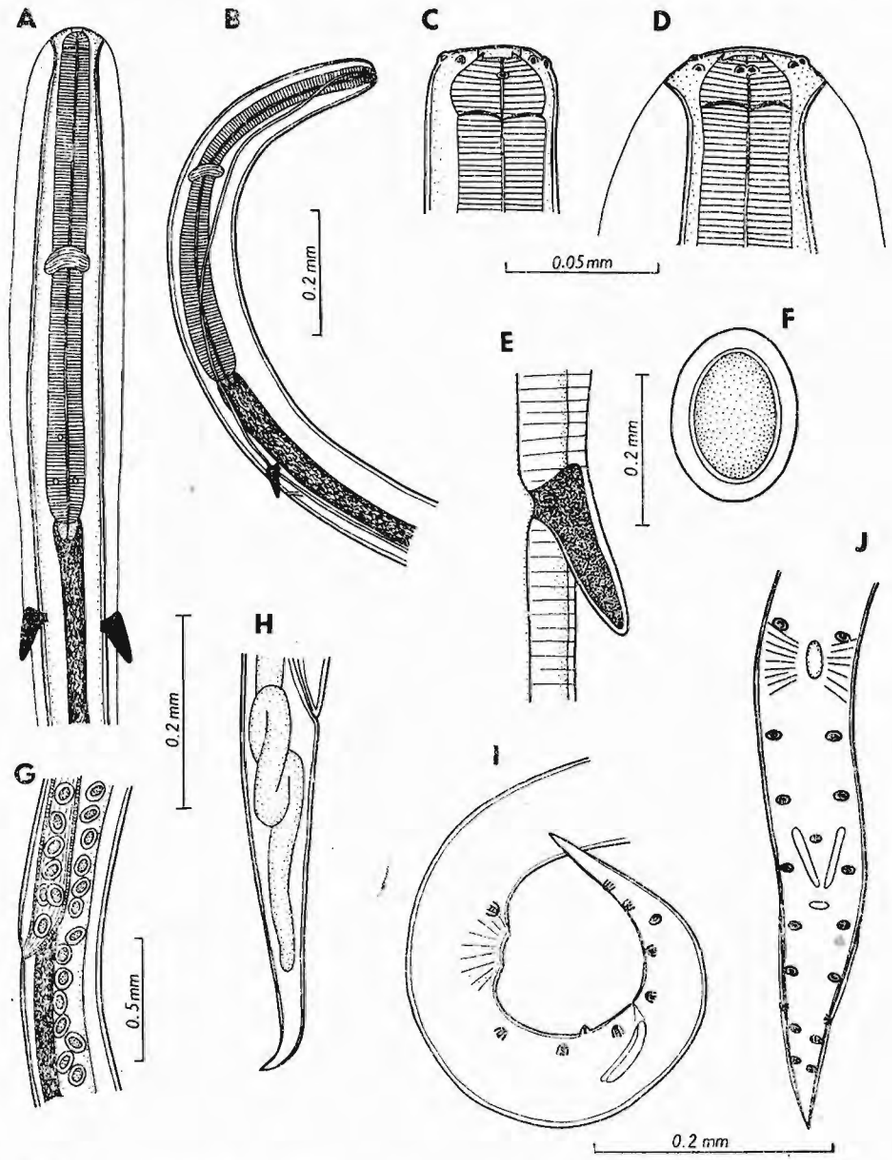

Fig. 3. *Ezonema bicornis* Boyce, 1971. A, B — anterior end of female, ventral and lateral views; C, D — head end of female, lateral and dorsal views; E — deirid, ventral view; *F* — egg; G — vulva egion of female; H — female tail; I, J — posterior end of male, lateral and ventral views.

from *Liobagrus reini*; the latter were described by Moravec (1975) as an independent species *Rh. japonica*. *Rh. zacconis* was later redescribed by Moravec et al. (1981) on the basis of specimens newly collected from *Tribolodon hakonensis* and *Z. platypus* from Japan. Outside Japan it occurs in the Far-Eastern part of the USSR (see Moravec 1975) and in western Canada (Arai and Mudry 1983).

4. ***Ezonema bicornis*** Boyce, 1971 Fig. 3

Description: Medium sized nematodes with smooth cuticle. Body elongate, anterior end dorsally bent in fixed specimens. Head end rounded; one pair of lateral amphids and four submedian doubled papillae present. Head end forming two large lateral lobes; from them, lateral alae extending posteriorly along almost whole body; alaee broadest in oesophagus region. Deirids forming very large, horn-like projections directed posteriorly and situated slightly subventrally in front of excretory pore. One dorsal and two subventral, almost indistinct tooth-like structures projecting forward from anterior end of oesophagus. Oesophagus long, its posterior end slightly expanded; separation of pharynx distinct; anterior part of oesophagus up to nerve ring muscular, its posterior part muscular-glandular. Tail of both sexes slender, terminating in sharp cuticular point.

Male (10 specimens): Length of body 4.95—8.08, maximum width 0.068—0.109. Length of entire oesophagus 0.465—0.571, length of pharynx 0.012—0.018. Nerve ring 0.210—0.282, excretory pore 0.522—0.721, and deirids 0.480—0.680 from anterior extremity. Caudal alae extending from cloacal opening level to end of tail poorly developed, almost absent. Four pairs of preanal papillae present. Ventral muscular sucker present in space between first and second pairs of preanal papillae; median, unpaired papilla present between third and fourth pairs of subventral preanal papillae. Postanal papillae: 5 pairs present, third of them being lateral, remaining subventral. Two moderately sclerotized, ill-visible spicules 0.075—0.084 long present. Tail conical, 0.165—0.207 long, ending in sharp point.

Female (10 specimens): Posterior half of body somewhat broader than anterior one. Length of body of gravid females 8.34—19.45, maximum width 0.136—0.204. Length of entire oesophagus 0.555—0.734, length of pharynx 0.021—0.024. Nerve ring 0.267—0.366, excretory pore 0.690—0.966, and deirids 0.648—0.898 from anterior extremity. Vulva situated in posterior half of body, 2.54—6.39 from posterior end; vulvar lips not elevated. Vagina short, thin-walled, directed anteriorly. Uterus amphidelphic. Coils of anterior ovary by far not reaching end of oesophagus; posterior ovary extending into tail. Eggs oval, thick-walled, size 0.060—0.075×0.048—0.054, nonembryonated. Tail slender, conical, length 0.249—0.414, ending in sharp point.

Hosts: freshwater sculpins, *Cottus nozawae* Snyder and *C. pollux* Günther (both fam. Cottidae, Scorpaeniformes).
Localization: intestine.
Localities: Hassabu River, Sapporo, Hokkaido (21 July 1980 — *C. nozawae*) and Yasu River, Shiga Prefecture, Honshu (6 February 1980 — *C. pollux*).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. Nos. 19507, 19510); two specimens (♂+♀) in Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (Coll. No. N-284).

Comments: — The morphology of the present nematodes fully agrees with the original description of this species given by Boyce (1971). However, we found a considerably broader biometrical variability in our specimens, concerning both males and females.

E. bicornis, the only species of the monotypic genus *Ezonema* Boyce, 1971, was described from the intestine of *Cottus pollux* and *Salvelinus leucomaenis* from several

rivers in Hokkaido; in addition to the intestine, the author (Boyce 1971) also mentions the swimbladder as the site of localization in the second fish host species. Later this interesting parasite was found only by Seki (1975a) in *Salvelinus leucomaenis* in Lake Shizunai in Hokkaido (see also Nagasawa et al. 1987). Accordingly, our finds of *E. bicornis* in Honshu represent the first record of this parasite outside Hokkaido and *Cottus nozawae* is a new host record for this nematode. It seems probable that freshwater sculpins are the principle definitive hosts of this nematode species.

5. ***Cucullanus (Truttaedacnitis) truttae*** Fabricius, 1794 Fig. 4
(Syn.: *Cucullanus globosus* Zeder, 1800; *Dacnitis stelmioides* Vessichelli, 1910; *Dacnitis laevis* Heitz, 1914; *Bulbodacnitis occidentalis* Smedley, 1933; *B. scotti* Simon, 1935; *B. ampullastoma* Maggenti, 1971; *B. alpinus* Mudry et McCart, 1974)

Description: Whitish, medium sized nematodes with smooth cuticle. Anterior end of body somewhat bent dorsally. Oral opening dorsoventrally elongate, inclined dorsally, surrounded by raised narrow membraneous ala (collarette) forming small dorsal lobe in lateral view. Inner side of this ala provided with numerous minute tooth-like structures. Small, two-lobed dorsal ridge (tuberculate in lateral view) transversing subdorsal sectors present. Oesophagus muscular, expanded at anterior

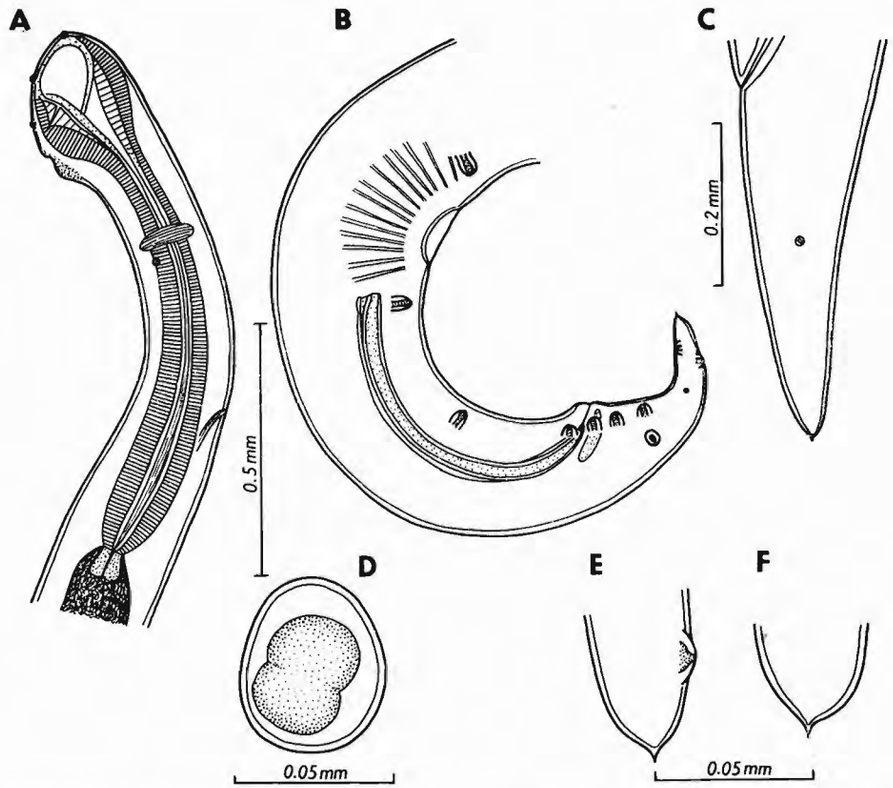

Fig. 4. *Cucullanus truttae* Fabricius, 1794. A — head end of female; B — posterior end of male; C — tail of female; D — egg; E, F — tail tip of male and female.

end to form pseudobuccal capsule (oesophastome); posterior part of oesophagus also somewhat expanded. Oesophastome with thick cuticular lining, consisting of a complex set of thickened cuticularized pieces separated by sutures. Oesophagus opening into intestine through distinct valves. Deirids slightly below nerve ring level, excretory pore situated approximately at mid-length between nerve ring and oesophagus end. Tail of both sexes conical, ending in sharp cuticular point.

Male (10 specimens): Length of body 7.68—14.48, maximum width 0.258—0.408. Length of entire oesophagus 1.17—1.61, length of oesophastome 0.286—0.313, its width 0.218—0.272; oesophagus representing 11—15 % of whole body length. Nerve ring 0.530—0.660, excretory pore 0.930—1.070, and deirids 0.530—0.639 from anterior extremity. Length of spicules 0.555—0.720, gubernaculum 0.105—0.120 long. Caudal papillae: 4 pairs of preanal, 1 pair of adanal and 6 pairs of postanal papillae present. First, third and sixth postanal pairs subventral, second and fourth pairs lateral; small papillae of fourth pair being in fact outlets of phasmids. Ventral sucker present in space between first and second pairs of preanal papillae. Length of tail 0.245—0.367.

Female (10 specimens): Length of body of gravid females 9.94—13.02, maximum width 0.299—0.381 (smallest nongravid female 7.90 long and 0.218 wide). Length of entire oesophagus 1.33—1.56, length of oesophastome 0.299—0.340, its width 0.245 to 0.286; oesophagus representing 12—13 % of whole body length. Nerve ring 0.503 to 0.625, excretory pore 0.950—1.210, and deirids 0.748—0.952 from anterior extremity. Tail conical, 0.340—0.394 long; pair of small lateral papillae (outlets of phasmids) present approximately at mid-length of tail. Vulva in posterior half of body, 3.99—4.83 from posterior extremity (at 33—40 % of body length), vagina directed anteriorly. Eggs oval, thin-walled, size 0.054—0.066×0.045—0.051, their content cleaved at most into four blastomeres.

Host: huchen, *Hucho perryi* (Brevoort) (fam. Salmonidae, Salmoniformes).
Localization: intestine.
Locality: Sarobetsu River, Hokkaido (27 September 1980).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. No. 19519); two specimens in Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (Coll. No. N-66).

Comments: — The present specimens of *C. truttae* from Japan are in a full accordance with the existing descriptions of this parasite.

C. truttae is a widespread holarctic species parasitizing many species of salmonids in Europe, Asia and North America. Until now it has not been reported from Japan, although there are frequent records of *C. truttae* from the nearby Far-Eastern region of the USSR (e.g. Spasskiy et al. 1961, Trofimenko 1962, Makhovenko 1972, Butorina 1975, 1980, Butorina et al. 1980). It is probable that the nematodes reported as *Cucullanus* sp. from salmonids in Japan (Hokkaido) by Seki (1975a, b) and Awakura et al. (1984) (see also Nagasawa et al. 1987) belonged, in the fact, to this species. *Hucho perryi* is a new host record for this nematode.

6. ***Raphidascaris biwakoensis*** Fujita, 1928 — larvae Fig. 5
(Syn.: *Raphidascaris gigi* Fujita, 1928; *R. plecoglossi* Fujita, 1928)

Description of fourth-stage larva (2 specimens): Body whitish, cuticle with fine transverse striation. Length of body 5.71—7.71, maximum width 0.204—0.286. Anlagen of lips 0.027—0.041 long, interlabia absent. Lateral cervical alae missing. Oesophagus including ventriculus 0.558—0.603 long, its posterior part somewhat expanded. Size of ventriculus 0.057—0.060×0.081, length of posterior ventricular appendix 0.299—0.503, its width 0.027—0.030. Nerve ring encircling oesophagus

0.210—0.258 from anterior extremity; excretory pore 0.312—0.367 from anterior end. Tubular anlagen of sexual glands forming numerous coils in region near mid-body, reaching anteriorly up to posterior end of vestibular appendix in largest female larva. Tail short, conical, ending in sharp point; length of tail of smaller male larva 0.177, that of larger female larva 0.111.

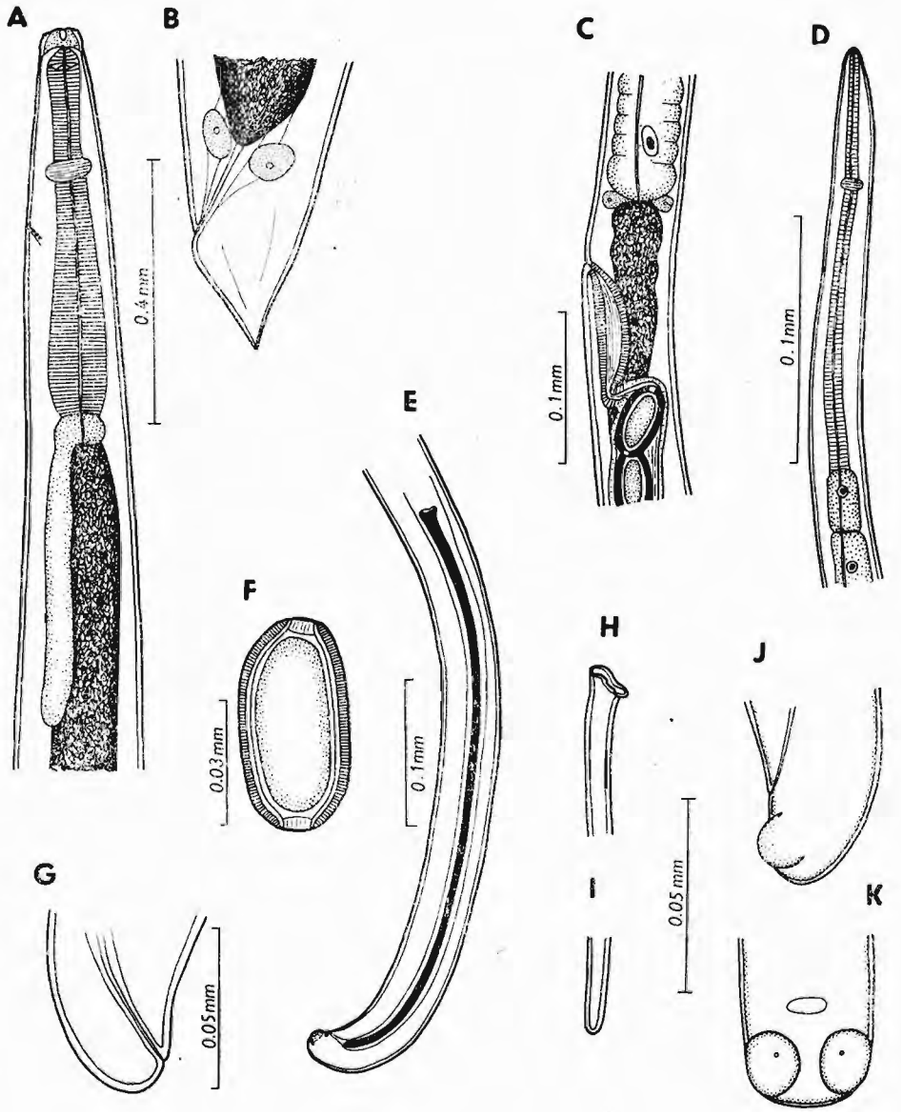

Fig. 5. A—B — *Raphidascaris biwakoensis* Fujita, 1928 — larva. (A — anterior end of body; B — tail). C—K — *Pseudocapillaria tomentosa* (Dujardin, 1843) (C — vulva region of female; D — head end of female; E — posterior end of male; F — mature egg; G — posterior end of female; H, I — proximal and distal ends of spicule; J, K — tail of male, lateral and ventral views).

Third-stage larva (1 specimen): Length of body 4.2, width 0,150. Anlagen of lips weakly developed; ventral boring tooth present. Oesophagus 0.530 long, size of ventriculus 0.045×0.069; length of ventricular appendix 0.345, width 0.033. Nerve ring and excretory pore 0.210 and 0.291, respectively, from anterior extremity. Length of tail 0.136.

Host: freshwater sculpin, *Cottus reinii* Hilgendorf (fam. Cottidae, Scorpaeniformes).
Localization: stomach and intestine
Locality: Lake Biwa, Shiga Prefecture, Honshu (5 February 1980).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. Nos. 19508, 19533).

Comments: — Regarding the revisional paper of Smith (1984), *R. biwakoensis* is the only valid freshwater *Raphidascaris* species occurring in Japan. Since larvae of the present material were collected from the type locality of *R. biwakoensis* from where it had previously been reported from various fish hosts (Fujita 1928, Kataoka and Momma 1934), we consider them identical with this species.

According to Smith (1984), there are only two valid *Raphidascaris* species parasitizing freshwater fishes, *R. acus* (Bloch, 1779) and *R. biwakoensis* Fujita, 1928. The present material of *R. biwakoensis* fourth-stage larvae shows that these are noted, in contrast to those of *R. acus* (see e.g. Moravec 1970), for the absence of lateral cuticular alae; this feature may be useful for identifying *Raphidascaris* fourth-stage larvae.

The hosts of adult *R. biwakoensis* are some piscivorous fishes (*Pelteobagrus nudiceps*, *Salmo gairdneri*) (Fujita 1928, Yamaguti 1935), small forage fishes serving probably as intermediate or paratenic hosts only. Adult *R. biwakoensis* was also found in the salmonoid fish *Plecoglossus altivelis* (see Kataoka and Momma 1934). *Cottus reinii* represents a new host record for this nematode species.

7. ***Anisakis simplex*** (Rudolphi, 1809) — larvae
(Syn.: *Ascaris angulivalvis* Creplin, 1851; *A. bicolor* Baird in Murie, 1868; *A. kuekenthalii* Cobb, 1889; *A. rosmari* Baylis, 1916; *A. similis* Baird, 1853; *Anisakis alata* Hsü, 1933; *A. catodontis* Baylis, 1929; *A. kogiae* Johnston et Mawson, 1939; *A. pegreffii* Campana-Rouget et Biocca, 1955; *A. tridentata* Kreis, 1938)

Host: huchen, *Hucho perryi* (Brevoort) (fam. Salmonidae, Salmoniformes).
Localization: liver, stomach wall.
Locality: Sarufutsu River, Hokkaido (1 August 1986).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. No. 19521).

Comments: — The morphology of the larvae recorded corresponds on the whole to the description of *A. simplex* larvae given in a previous paper (Moravec et al. 1985). In Japan, larvae of this species have been reported from many fish species including salmonids (see Nagasawa et al. 1987). *Hucho perryi* represents a new host record for this parasite species.

8. ***Pseudocapillaria tomentosa*** (Dujardin, 1843) Fig. 5
(Syn.: *Trichosomum cyprini* Diesing, 1851; *Trichosoma brevispiculum* Linstow, 1873; *Capillaria leucisci* Hesse, 1923; *C. catostomi* Pearse, 1924; *Hepaticola bakeri* Mueller et Van Cleave, 1932, partim, *Capillaria lewaschoffi* Heinze, 1933; *C. rutili* Zakhvatkin et Azheganova, 1940; *C. ugui* Yamaguti, 1941; *C. amurensis* Finogenova, 1967; *C. gobionina* Lomakin, 1971; *C. pseudorasborae* Wang, Zhao et Chen, 1978; *Skrjabinocapillaria elopichthydis* Wang, 1982)

Description: Small, thread-like nematodes. Two lateral bacillary bands extending along almost whole body. Head end narrowed, mouth surrounded by minute oral papillae. Stichosome consisting of single row of 35—38 stichocytes with large nuclei; stichocytes subdivided into several transverse annuli; 1—2 lighter-coloured stichocytes alternating with 1—2 darker (more granulated) ones.
Male (2 specimens): Length of body 4.49—4.76, maximum width 0.054. Width of bacillary bands 0.024. Length of entire oesophagus 2.79—3.05 (59—68% of body length), of muscular oesophagus 0.156—0.204; distance of nerve ring from anterior extremity 0.060—0.084. Spicule well sclerotized, 0.396—0.417 long and 0.006 wide; its proximal end distinctly expanded, with lobular rim, distal end rounded; spicule surface smooth. Spicular sheath nonspiny. Tail short (length 0.015), rounded, provided with two large, round ventrolateral lobes; each lobe seemingly with minute papilla. Membraneous bursa absent.
Female (body fragments of 2 specimens): Body length of one almost complete specimen (head end lacking) 6.62; maximum width of body of gravid females 0.068—0.082. Width of lateral bacillary bands 0.030. Length of stichosome 3.14. Vulva situated 0.024 below oesophagus end level, vulvar lips not elevating. Uterus containing eggs arranged in one row near vulva. Mature eggs oval, without protruding polar plugs. Egg wall two-layered; inner layer hyaline, outer layer with distinct irregular, rather rough sculpture on surface. Contents of eggs uncleaved. Size of eggs 0.057—0.063× ×0.030—0.033; egg wall 0.003 thick, height of polar plugs 0.003—0.004, their width 0.006. Posterior end of body rounded, anus subterminal; length of tail 0.006—0.009.

Host: dace, *Tribolodon hakonensis* (Günther) (fam. Cyprinidae, Cypriniformes).
Localization: intestine.
Locality: Tama River, Tokyo, Honshu (8 September 1976).
Specimens: Meguro Parasitological Museum, Tokyo (M. P. M. Coll. No. 19534).

Comments: — In 1941, Yamaguti described a new species, *Capillaria ugui*, on the basis of females found in the intestine of *Leuciscus* (= *Tribolodon*) *hakonensis* from Japan (Obama, Hukui Pref.) and it has not been recorded since. Recently Moravec (1987) has synonymized it with *Pseudocapillaria tomentosa* (Dujardin, 1843). The present examination of the specimens, originating from the same host species as those of Yamaguti's material and comprising also males, has showed that the proposed synonymy was fully justified. The morphology of these Japanese specimens is in a full agreement with the description of this species given by e.g. Moravec (1987), the only difference being a slightly longer spicule. But this is considered to be within the limits of intraspecific variability of this species. A similar length of spicule was observed in *P. brevispicula* (= *P. tomentosa*) specimens found in aquarium-reared fishes in Czechoslovakia (Moravec et al. 1984).

P. tomentosa is a widely distributed holarctic species parasitizing mainly various freshwater cypriniform fishes (see Moravec 1987). It can be expected that in Japan it will be found in some other suitable fish hosts too.

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К ПОЗНАНИЮ НЕКОТОРЫХ НЕМАТОД ПАРАЗИТИРУЮЩИХ У ПРЕСНОВОДНЫХ РЫБ ЯПОНИИ

Ф. Моравец и К. Нагасава

Резюме. В годах 1976—1986 проводились гельминтологические вскрытия пресноводных рыб из различных мест Японии. Собранный материал заключал в себе восемь видов паразитических нематод, в том числе шесть видов половозрелых нематод (*Camallanus cotti, Rhabdochona denudata, Rh. zacconis, Ezonema bicornis, Cucullanus truttae* и *Pseudocapillaria tomentosa*) и два вида личинок (*Raphidascaris biwakoensis* и *Anisakis simplex*). *C. truttae* и *Rh. denudata* приводятся из Японии в первый раз. Второй вид представлен здесь отдельным подвидом *Rh. d. honshuensis* subsp. n. (типовой хозяин *Zacco platypus*); характеристическими признаками нового подвида являются главным образом форма дистального конца левой спикулы (без зубовидного отростка), небольшие размеры тела и маленькие яйца без филаментов. Некоторые нематоды были найдены в новых видах хозяев и в новых областях Японии. Работа содержит короткие описания и изображения почти всех обнаруженных видов паразитов и дискуссии к проблематике их таксономии и географического распространения.

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F. M., Parazitologický ústav ČSAV,
Branišovská 31,
370 05 České Budějovice, ČSSR