# VĚSTNÍK
## ČESKOSLOVENSKÉ SPOLEČNOSTI
# ZOOLOGICKÉ

XXXVI
1972
3

ACADEMIA PRAHA

**VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ**

Roč. Tom. 36 - Čís. No. 3 Srpen August 1972

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Bibliografická zkratka názvu časopisu — *Věst. Čs. spol. zool.*
Abbreviatio huius periodici bibliografica



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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 161—168

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# NEMATODES PARASITIZING HOSTS OF THE GENUS ELEUTHERODACTYLUS (AMPHIBIA) FROM CUBA

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Received November, 29, 1971

Abstract: First data are given for the nematode fauna of hosts of the genus *Eleutherodactylus* (Leptodactylidae) from Cuba. A total of 7 species was found: of these 4 (*Oswaldocruzia lenteixeirai, Aplectana cubana* sp. n., *Aplectana* sp., *Neyraplectana* sp.) were adult worms, 3 were larvae (*Porrocaecum sp.. Abbreviata sp.* and *Agamospirura sp.*). A description and drawings are given of the new species *A. cubana* sp. n. and a differential diagnosis is added. The paper contains also data on the morphology and measurements of 4 other nematode species.

The genus *Eleutherodactylus* Dumeril et Bibron (Fam. Leptodactylidae) is the most numerous and most variegated group of amphibians in Cuba. Buide (1967) recorded a total of 40 species and subspecies of this genus from Cuba, all of them Cuban endemites. The papers available on Cuban amphibians (Pérez Vigueras, 1938, 1942, 1955; Walton, 1940, 1941; Baruš and Moravec, 1967; Baruš 1972) are concerned only with the helminth fauna of hosts of the genera *Bufo* (Fam. Bufonidae) and *Hyla* (Fam. Hylidae). Therefore, we commenced a helminthological study on 6 species and subspecies of the genus *Eleutherodactylus*, resulting in a list of nematodes parasitizing members of this genus. This survey contains the first data on the helminth fauna of the genus *Eleutherodactylus* from the Caribean region.

## MATERIAL

In the years 1967 and 1968, we examined in post-mortem a total of 76 hosts of the genus *Eleutherodactylus* belonging to these species and subspecies: *E. planirostris planirostris* (6 specimens examined); *E. planirostris goini* (8); *E. planirostris ricordii* (2); *E. cuneatus* (46); *E. dimidiatus amelasma* (9); *E. eileenae* (3) and *E. zugi zugi* (2). Of these, 30 hosts, i.e. 39.4%, were infected with helminths of two classes only — Trematoda and Nematoda; members of the first class were found in 5 hosts, i.e. 6.5%, of the second class in 27 hosts, i.e. 35.6%.

We are grateful to Mr. R. Herrera Rodriguez and Mr. Jorge de la Cruz for their assistance in catching the hosts. Our thanks are due to Dr. Orlando H. Garrido from the Biological Institute of the Cuban Academy of Sciences in Havana for the exact identification of the hosts.

## SYSTEMATIC SURVEY

### Fam. Trichostrongylidae

### 1. *Oswaldocruzia lenteixeirai* Pérez Vigueras, 1938

**Hosts:** Eleutherodactylus zugi zugi Schwartz, 1958; E. dimidiatus amelasma **Schwartz, 1958;** E. cuneatus (Cope, 1862); E. planirostris planirostris (Cope, 1862) and **E. planirostris** goini Schwartz, 1960.

Location: small intestine
Localities. Soroa, Las Cañas, Loma del Cusco (province Pinar del Río), Marianao (province Havana)

Of the two *E. zugi zugi* examined, this species was found in one host (2 nematodes), of the 9 *E. dimidiatus amelasma* in 3 (1–4 nematodes per host), of the 6 *E. planirostris planirostris* in 2 (1 and 2 nematodes) and of the 8 *E. planirostris goini* in one (1 nematode).

This species is considered to be an endemite of Cuba and has been recovered from *Hyla insulsa* (viz. Pérez Vigueras, 1938; Baruš and Moravec, 1967) and *Bufo peltacephalus fustiger*, *B. longinasus dunni* and *B. taladai* (viz. Baruš, 1972) Our finding of *O. lenteixeirai* in hosts of the genus *Eleutherodactylus* is a first record. Interesting data were obtained from a comparative study of this species from the hosts under consideration. In spite of the fact that no morphological differences were observed in nematodes from different hosts, the body measurements of the nematodes in our material from hosts of the genus *Eleutherodactylus* were distinctly smaller. This was most marked in the spicule length which in nematodes from *H. insulsa* measured 0.144–0.179 mm, in those from *Bufo* 0.124–0.182 mm, but in nematodes from hosts of the genus *Eleutherodactylus* only 0.087–0.133 mm. We assume that the original hosts of *O. lenteixeirai* were species of the genus *Bufo* and *Hyla*, which had come to Cuba from North and Central America. The transition from these hosts to the new hosts of the genus *Eleutherodactylus* (Fam. Leptodactylidae) which are evidently of South and Central American origin, is accompanied by a decrease of body measurements (under the influence of the space factor). At present, however, we are unable to ascribe any taxonomic importance to these differences.

### Fam. Heterocheilidae

#### 2. *Porrocaecum* sp. — larvae

Hosts: *Eleutherodactylus dimidiatus amelasma* Schwartz, 1958; *E. cuneatus* (Cope, 1862).
Location: in cysts in the stomach wall
Localities: Soroa (province Pinar del Río); Marianao (province Havana).

Of the 9 *E. dimidiatus amelasma* examined, larvae were found in one host (3 nemathodes); of the 46 *E. cuneatus*, 2 were positive (one nematode per host).

The morphology and measurements of these larvae are consistent with those of larvae of the genus *Porrocaecum* from *Bufo taladai* (province Oriente, locality La Vuelta) recovered and described by Baruš (1972). The amphibians under consideration are the reservoir hosts of these larvae.

### Fam. Physalopteridae

#### 3. *Abbreviata* sp. – larvae (Fig. 1A, B)

Host: *Eleutherodactylus cuneatus* (Cope, 1862).
Location. in cysts in the stomach wall
Locality: Botanical garden in Havana (province Havana).

One of the 46 *E. cuneatus* examined one was positive (1 larva).

Baruš (1972) found nematode larvae of the family Physalopteridae in frogs of the genus *Bufo* in Cuba; Freitas and Ibañez (1965) in Brasil. The larva recovered from *E. cuneatus* differs from those found by these authors in the smaller body measurements. Since an exact determination of the larva was not possible, a description is added: Larva of reddish colour, cuticle with distinct transverse striation. Mouth with two rounded lips and a terminal tooth; a pair of papillae on each lip. Length of body 1.82 mm, width at oesophagus ending 0.12 mm. Muscular oesophagus 0.25 mm long, maximum width 0.022 mm. glandular oesophagus 0.73 mm long, width 0.073 mm. Nerve ring at 0.11 mm from anterior body end, excretory pore

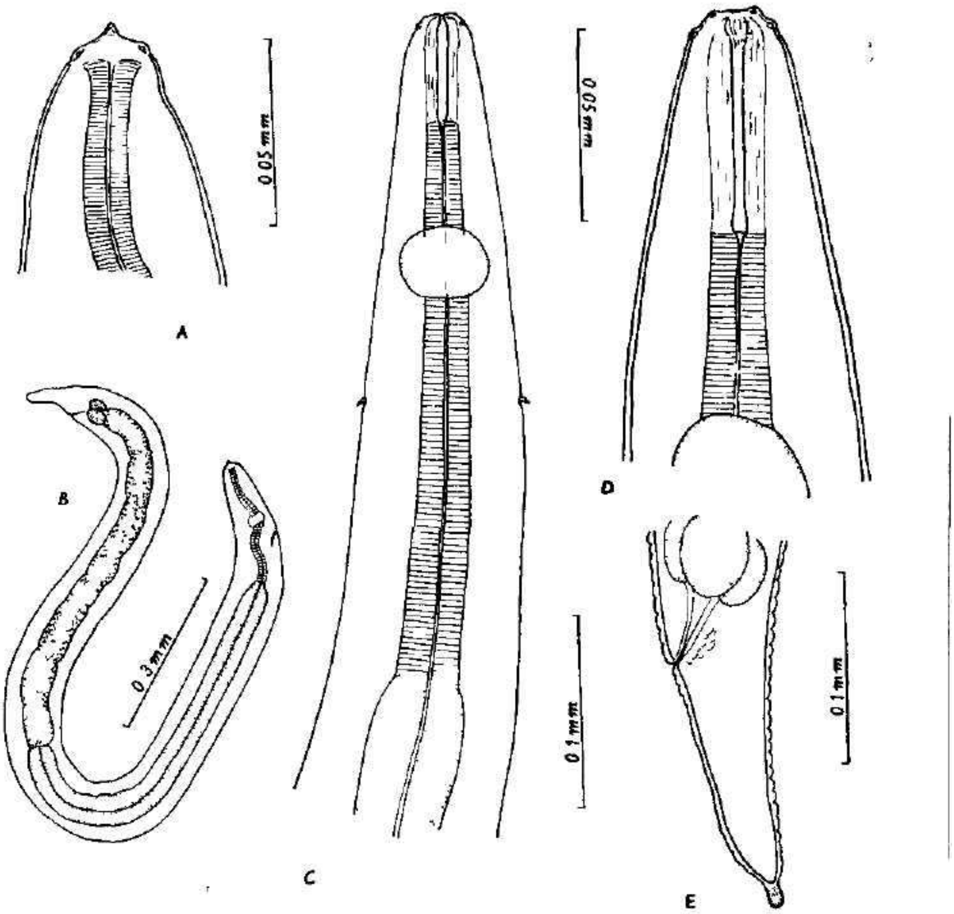


Fig. 1. *Abbreviata* sp. — larvae from *Eleutherodactylus cuneatus* (A, B); *Agamospirura* sp. — larvae from *E. planirostris ricordii* (C, D, E). A — anterior extremity (lateral view), B — larva (general view); C — anterior extremity (dorsal view); D — anterior extremity (lateral view); E — posterior extremity (lateral view).

at 0.15 mm. Intestine, a straight tube, terminates in the rectum. which contains a group of rectal cells. Posterior end rounded. Anus at 0.080 mm from posterior end of body.

### Fam. Spiruridae

#### 4. *Agamospirura* sp. — larvae (Fig 1C, D, E)

**Hosts:** *Eleutherodactylus planirostris ricordii* (Dumeril et Bibron, 1841), *E. cuneatus* (Cope, 1862).

**Location:** in cysts in the stomach wall
**Locality:** Soroa (province Pinar de Río).

One of the two *E. planirostris ricordii* was positive (2 larvae); two of the 46 *E. cuneatus* examined were positive (4—6 larvae).

Amphibians and reptiles are relatively frequent reservoir hosts of the infective larvae of nematodes of the suborder Spirurata (Moravec, 1963; Šarpilo, 1964). Larval stages of this suborder with an indistinct taxonomic position, are generally assigned to the genus *Agamospirura* Railliet et Henry, 1913. Also our larvae have been assigned to this genus and their description is added: Larval body yellowish, cuticle with fine transverse striation. Mouth terminal, lips indistinct. Six cephalic papillae present. Anterior oesophageal portion (length 0.058 mm) has a sclerotized inner lining. Overall length of muscular oesophagus 0.30—0.34 mm, of glandular oesophagus 0.80—0.87 mm. Nerve ring at 0.12—0.14 mm from the anterior body end, excretory pore at 0.18 mm, cervical papillae at 0.16—0.17 mm. Length of cervical papillae 0.003 mm. Overall length of larval body 2.48—2.70 mm, width at oesophageal termination 0.10—0.11 mm. Intestine tubular, straight, ending in the rectum, which contain a group of rectal cells. Anus at 0.13 to 0.15 mm from posterior end of body, terminating in a short rounded extension with small indistinct papillae.

## Fam. Cosmocercidae

### 5. *Aplectana cubana* sp. n. (Fig. 2)

**Hosts:** *Eleutherodactylus dimidiatus amelasma* Schwartz, 1958 (the **typical host**); *E. cuneatus* (Cope, 1862); *E. zugi zugi* Schwartz, 1958.
**Location:** large intestine
**Localities:** Soroa and Loma del Cusco (province Pinar del Río).

Of the 9 *E. dimidiatus amelasma* examined the nematode species was found in one host (3 females); of the 46 *E. cuneatus*, one was positive (1 female); it was present also in the two *E. zugi zugi* examined (one female in each host).

Description of females: Nematodes of white colour, cuticle with a feeble till indistinct transverse striation. Anterior end of body obtuse. Mouth with 3 small lips (one dorsal, two lateroventral), with 6 papillae on the inner circle. The base of the dorsal lip bears an additional pair of double papillae, each lateroventral lip one double papilla and one single papilla. Oesophagus divided into an anterior portion (pharynx), a corpus, the neck of the oesophagus and the bulb with the valvular apparatus. Anterior portion of pharynx terminating in three lobes with a pseūdochitinized support on each lobe. The peaks of these supports penetrate the oral cavity with their sharp points and appear like teeth. Lateral alae start at 0.25 to 0.30 mm below the bulb and terminate at the beginning of the proximal third of the body length. Width of their central portion 0.022 mm. Cervical papillae not visible.

Overall length of the body 5.14—7.02 mm, maximum width 0.37 to 0.46 mm. Overall oesophagus length 0.44—0.53 mm, width of bulb 0.11 to 0.13 mm. Nerve ring at 0.16—0.24 mm from anterior body end, excretory pore at 0.30—0.50 mm (situated at the level of either the anterior or posterior margin of the bulb). Vulva narrowly slit-shaped, with unelevated rounded margins, at 2.40—3.12 mm from anterior end of body. Genital apparatus of the females didelphic, prodelphic; eggs numerous with thin, smooth walls and a coiled larva inside. Size of eggs 0.109—0.118 mm × × 0.065—0.080 mm. The presence of free larvae in the posterior portion of the uterus indicates that this form is viviparous. Larvae 0.29—0.31 mm long, maximum width 0.046—0.048 mm. Anterior end of body obtuse. Oral pore terminal, surrounded by three small lips. Larval body filled with granules and nontranslucent. Posterior end conically attenuated terminating in

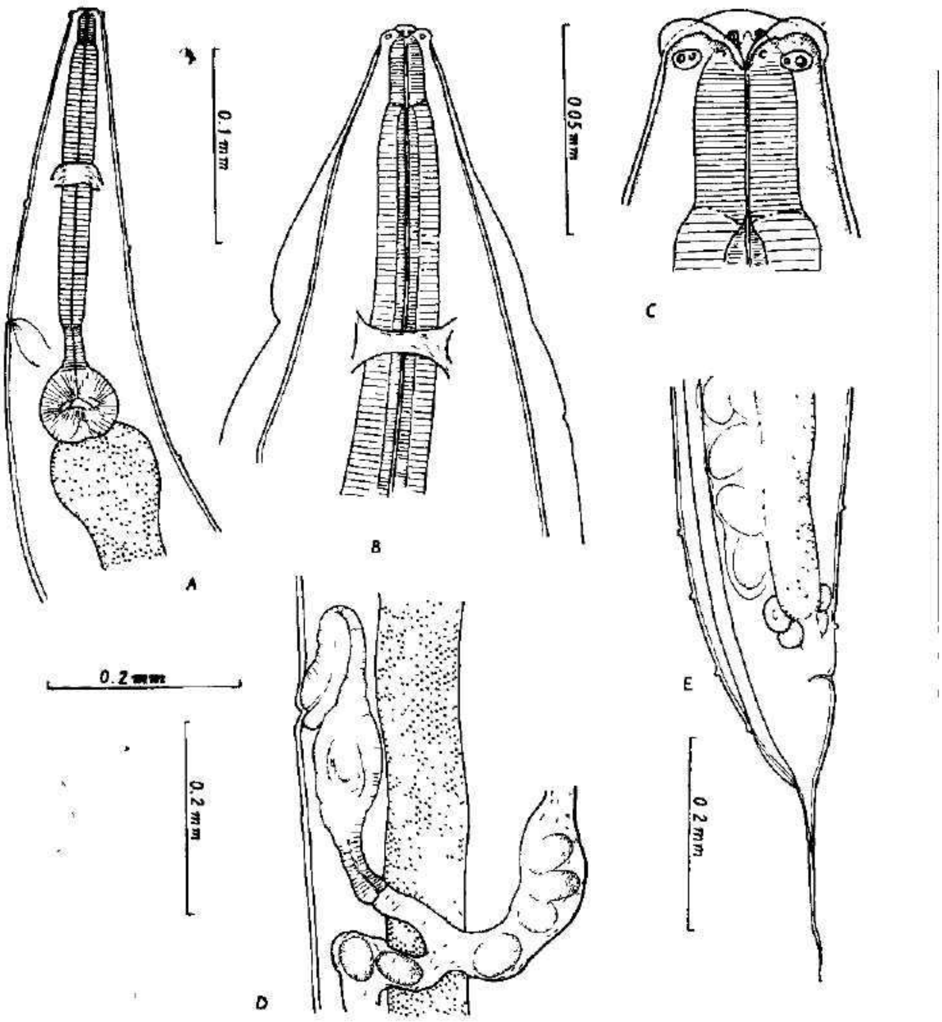


Fig. 2. *Aplectana cubana* sp. n. from *Eleutherodactylus dimidiatus amelasma*. A — anterior extremity of the female (lateral view); B — anterior extremity (apical view); C — anterior extremity (detailed view); D — larva; E — posterior extremity (lateral view); F — vulva area (lateral view).

a tail with a rounded peak. Anus of the adult females at 0.40—0.44 mm from posterior body end.

Discussion: As regards the fact that only female worms were found, the generic assignment is provisional. In morphology and measurements, however, *A. cubana* sp. n. differs distinctly from the remaining species of the genus *Cosmocerca* Diesing, 1861, *Aplectana* Railliet et Henry, 1916 and *Neyraplectana* Ballesteros Marques, 1945. Although several signs are similar to those of species of the family Oxyascarididae (genus *Pteroxyascaris* Freitas, 1958), the shape of the oesophagus justified the assignment of this species to the family Cosmocercidae.

The only similar species of the genus *Cosmocerca* is *C. parva* Travassos, 1925. *A. cubana* sp. n. differs from this species in the smaller distance of the anus from the end of the tail, in the shape of the tail and in the smaller size of the bulb. Closely related species of the genus *Aplectana* are these: *A. hoffmani* Bravo-Hollis, 1943; *A. longicaudata* Walton, 1929; *A. lopesi* Silva, 1954; *A. membranosa* (Schneider, 1866) and *A. mexicana* (Caballero, 1933). With the exception of the species *A. lopesi*, *A. cubana* sp. n. differs from the remaining species in the shape of the tail. In addition, it differs from *A. hoffmani* in the distance of the anus and vulva and in the length of the oesophagus; from *A. longicaudata* in the presence of teeth in the buccal cavity, in the location of the vulva and in that it is viviparous; from *A. lopesi* in the position and length of the lateral alae and in all body measurements; from *A. membranosa* and *A. mexicana* in the larger measurements of all morphological signs. From the species of the genus *Neyraplectana*, *A. cubana* sp. n. differs in the shape of the tail, in larger measurements of the eggs and in a different site of commencement and length of the lateral alae. Moreover, *A. cubana* sp. n. is the first recorded taxon of the family Cosmocercidae parasitizing hosts of the genus *Eleutherodactylus*.

The material of *A. cubana* sp. n. is deposited in the collection of the Institute of Parasitology, Czechoslovak Academy of Sciences, Prague (5 females) and in the collection of the Humboldt Museum in Berlin (one female)

### 6. *Aplectana* sp. (Fig. 3)

Hosts: *Eleutherodactylus dimidiatus amelasma* Schwartz, 1958; *E. cuneatus* (Cope, 1862) and *E. eileenae* Dunn, 1926.

Location: large intestine

Localities: Soroa (province Pinar del Río); Botanical garden in Havana and Marianao (province Havana).

The species was found in two of the 9 examined *E. dimidiatus amelasma* (1 and 9 females); in 6 of the 46 *E. cuneatus* (1—4 worms per host); in one of the 3 *E. eileenae* examined (1 female).

These nematodes are morphologically, and that particularly in the shape of the oral elements, close to the species *A. itzocanensis* Bravo-Hollis, 1943 and *A. hoffmani* Bravo-Hollis, 1943 and *A. longicaudata* Walton, 1929. This applies also to their measurements. In the absence of male worms it is, therefore, impossible to establish their exact taxonomic position. We are adding a description of the females in our material: Nematode of opaque colour, cuticle with fine transverse striation. Mouth surrounded by three lips (one dorsal, two lateroventral). The dorsal lip bears two double papillae which are noticeably elevated, each lateroventral lip one double papilla and one single papilla. The upper portion of the pharynx has a sclerotized support entering the buccal cavity with its rounded peaks as distinct teeth. The lateral alae separate from the anterior end of body at 0.10—0.12 mm and extend down to the base of the tail. Maximum width of the alae 0.020 to 0.025 mm. Length of body 2.82—3.90 mm, width at vulva level 0.24 to 0.36 mm. Overall length of oesophagus 0.40—0.50 mm, width of bulb 0.087 to 0.10 mm. The bulb contains the valvular apparatus. Pharynx 0.036 to 0.040 mm long. Nerve ring at 0.18—0.19 mm from anterior end of body, excretory pore at 0.24—0.35 mm. Vulva transversely slit-shaped with

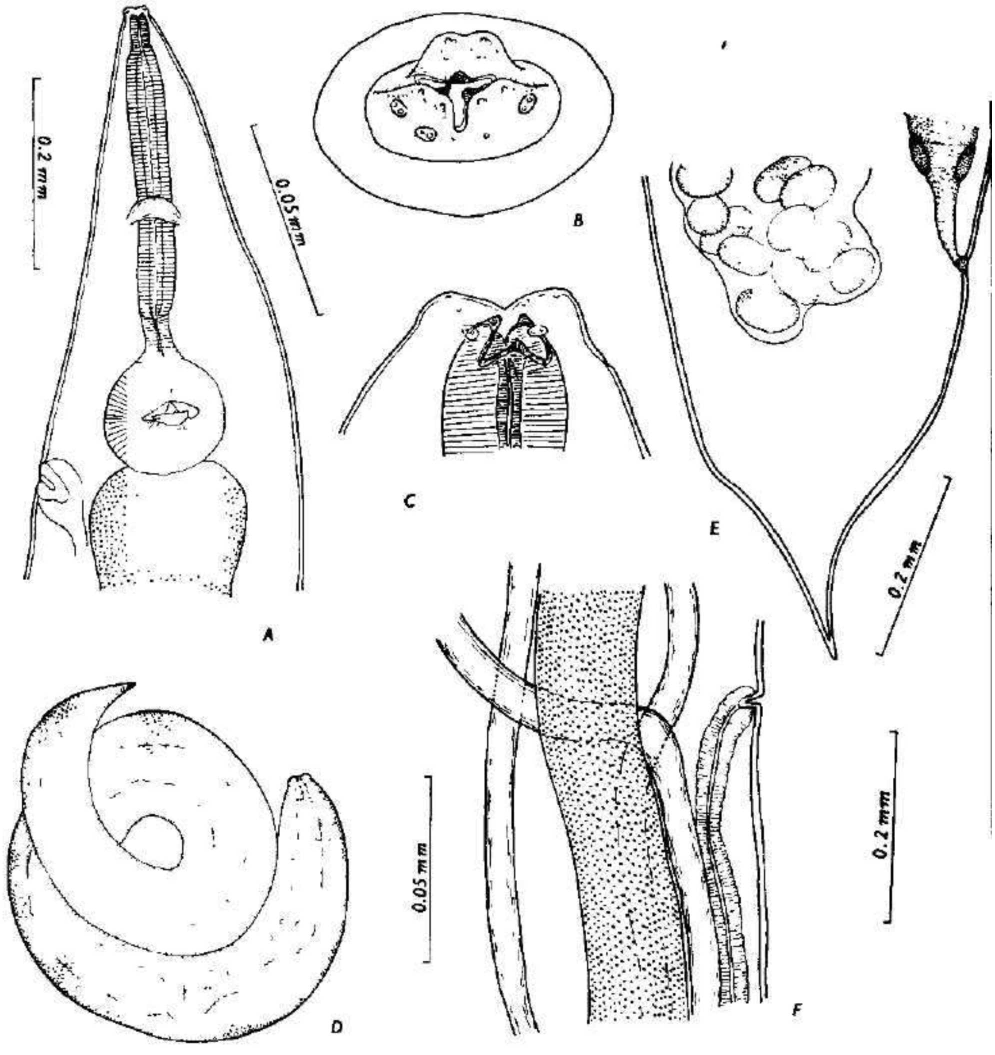


Fig. 3. *Aplectana* sp. from *Eleutherodactylus cuneatus.* A — anterior extremity of the female (lateral view); B — anterior extremity of the female (lateral view); C — anterior extremity (detailed view); D — vulva area (lateral view); E — posterior extremity (lateral view).

rounded, moderately elevated margins. Genital apparatus didelphic, prodelphic. Eggs 0.065—0.073 mm × 0.040—0.043 mm. Inside the mature eggs

**a coiled larva. Posterior** extremity **terminating in a sharply pointed tail. Anus at 0.24—0 33** mm from tip of tail.

### 7 *Neyraplectana* sp.

Hosts: ***Eleutherodactylus** cuneatus* (Cope, 1862); *E. dimidiatus amelasma* **Schwartz, 1958;** *E. eileenae* Dunn, 1926.
Location: large intestine
Localities: Soroa and Las Cañas (province Pinar de Río).

The nematode species was found in 3 of the 46 *E. cuneatus* examined (1—4 nematodes per host); in 1 of the 9 *E. dimidiatus amelasma* examined (4 nematodes); in 1 of the 3 *E. eileenae* examined (1 nematode).

Since we found only females it was impossible to determine their exact taxonomic position. Baruš (1972) found specimens of analogous morphology and measurements in hosts of the genus *Bufo* (*B. peltacephalus fustiger* and *B. longinasus* dunni) from the localities Las Cañas (province Pinar del Río) and La Mariposa (province Las Villas).

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 169—171

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# ON THE SYSTEMATICS OF THE RUDD, SCARDINIUS ERYTHROPHTHALMUS (LINNAEUS, 1758) (OSTEICHTHYES: CYPRINIDAE) FROM BOHEMIA

KARTHIGESU CHITRAVADIVELU

Received November 25, 1971

Abstract: Morphometric and meristic characters of *Scardinius erythrophthalmus* (L.) have been studied using 50 specimens from the Elbe river backwater, Velká Arazimova and the results have been compared with those of Vladykov (1931), Oliva (1952), Banarescu (1964) and Žukov (1965).

Although the rudd, *Scardinius erythrophthalmus* (L.) belongs to the most common fishes of Central Europe, the data concerning the systematics of the species are not sufficient. Vladykov (1931) had studied the specimens from the drainage of Tisza while Oliva (1952) had utilised the specimens from the drainage of Labe.

Author is thankful to Asst. Prof. Dr. O. Oliva for suggesting the problem for study and critical reading of the manuscript.

## MATERIALS AND METHODS

Fifty specimens of *Scardinius erythrophthalmus* (L.) collected in September, 1971 from the Elbe river backwater, Velká Arazimova near Čelákovice, in middle Bohemia, lying in the inundation area were used in this investigation. Measurements were made according to the schemes of Vladykov (1931), Berg (1949) and Oliva (1952), and the results are compared with the data available in literature.

## DESCRIPTION AND COMPARATIVE REMARKS

The morphometric and the meristic characters are given in the table 1. The shape of the fish and colouration are the same as those described by Vladykov (1931), Berg (1949) and Oliva (1952).

When the results of the present investigation are compared with the data of other authors (Vladykov, 1931; Oliva, 1952; Banarescu, 1964 and Žukov, 1965) it can be seen that the length of head, depth of dorsal fin and anal, fin and diameter of the eye have the highest values. The body depth, caudal peduncle length and number of scales in the lateral line are the lowest, except those given by Banarescu (l.c.). Banarescu had not given the averages. (See table.)

**Table 1. Morphometric and meristic**

| Authority | Author | | Vladykov, 1931 | | Žukov, 1965 | |
|---|---|---|---|---|---|---|
| Locality | Drainage of Labe | | Drainage of Tisza | | Drainage of Dniepr | |
| Number of specimens | 50 | | 36–38 | | 77–82 | |
| | ranges | ave. | ranges | ave. | ranges | ave. |
| Standard length in mm | 56–107 | 83.3 | — | — | 75–175 | 124.0 |
| As % of standard length: | | | | | | |
| Length of head | 25.9– 31.4 | 27.4 | 22.2– 25.0 | — | 20–26* | 23.0 |
| Diameter of eye | 6.9– 9.5 | 8.1 | 5.5– 7.6 | — | — | — |
| Body depth | 27.2– 33.6 | 30.2 | 31.2– 37.0 | — | 28.0–36.0 | 32.4 |
| Dorsal fin depth | 18.7– 23.4 | 21.1 | 18.9– 22.2 | — | 17.3–25.0 | 20.5 |
| Anal fin depth | 16.1– 19.9 | 17.9 | 15.4– 22.3 | — | 13.5–20.0 | 16.8 |
| Dorsal fin length | 10.3– 13.8 | 12.4 | 11.4– 15.0 | — | 10.0–15.0 | 12.4 |
| Anal fin length | 12.2– 16.2 | 14.1 | 15.0– 17.0 | — | 9.8–16.0 | 13.7 |
| Caudal peduncle length | 14.9– 19.8 | 17.4 | 18.2– 22.3 | — | 16.0–22.0 | 19.6 |
| As % of head length: | | | | | | |
| Preorbital distance | 24.0– 32.2 | 29.0 | 33.5– 45.5 | — | 24.0–33.0 | 28.0 |
| Diameter of eye | 27.0– 36.4 | 30.5 | 24.5– 30.5 | — | 23.0–33.0 | 26.9 |
| Eye diameter as % of preorbital distance | 89.0–125.0 | 104.9 | 77.0–100.0 | — | — | — |
| Eye diameter as % of interorbital distance | 70.0–100.0 | 83.3 | 52.3– 71.0 | — | — | — |
| Minimum body depth as % of body depth | 29.1– 37.5 | 33.4 | 28.6– 36.0 | — | — | — |
| Dorsal fin depth as % of dorsal fin length | 146.2–200.0 | 170.3 | 150–190 | — | — | — |
| Anal fin depth as % of anal fin length | 114.4–150.0 | 128.2 | — | — | — | — |
| Minimum body depth as % of caudal peduncle | 50.0– 68.8 | 58.5 | 50.0– 59.0 | — | — | — |
| Number of dorsal fin rays | (II–III)+7–9 | 2.5+8.1 | (II–III)+8–9 | 8.1 | 8–10 | 8.6 |
| Number of anal fin rays | III+(10–12) | III+10.9 | III+(10–12) | 10.8 | 9–13 | 11.7 |
| Number of lateral line scales | 37–42 | 38.7 | 40–42 | 41.7 | 37–44 | 40.6 |
| Number of scales above lateral line | 8 | 8 | 7– 8 | — | — | — |
| Number of scales below lateral line | 4 | 4 | 3– 4 | — | — | — |

* From Žukov, 1965

In the materials under investigation, there were no specimens with horizontal mouth resembling *Rutilus rutilus* which Vladykov (1931) had classified as a separate morpha *rutiloides*.

The differences in morphometric characters are certainly due to the small size of the specimens examined. Smaller specimens of Cyprinids have always larger eyes and longer heads. But in general the differences are very small and it can be said that contrary to roach, *Rutilus rutilus*, there is no such variability in form in rudd (Berg, 1949, Banarescu, 1960).

*Scardinius erythrophthalmus* shows an apparent stability of its morphometric and meristic characters.

characters of *Scardinius erythrophthalmus*

| Žukov, 1965 | | According to Penjaz* | | Oliva, 1952 | | Banarescu, 1964 | |
|---|---|---|---|---|---|---|---|
| Drainage of Neman | | Drainage of Western Dwina | | Drainage of Labe | | Romania | |
| 54–64 | | 49 | | 24 | | 30 | |
| ranges | ave. | ranges | ave. | ranges | ave. | ranges | ave. |
| 86.0– | 130.0 | 155–220 | 194 | 126–274 | 201 | 100–248 | — |
| 19.5–25.9 | 23.0 | 21.5–25.5 | 22.9 | 20–26 | 22.9 | 20.5–27.0 | — |
| — | — | — | — | — | — | 4.7–7.4 | — |
| 28.9–38.1 | 32.9 | 32.5–40.5 | 37.1 | 33–42 | 37.7 | 29.5–40.0 | — |
| 18.6–24.1 | 20.5 | 14.5–21.5 | 18.7 | 16–25 | 19.2 | — | — |
| 14.4–19.4 | 16.2 | 14.5–17.5 | 16.3 | 14–20 | 16.2 | — | — |
| 10.5–13.6 | 12.3 | 12.5–17.5 | 13.5 | 12–15 | 13.5 | — | — |
| 11.8–15.9 | 14.0 | 12.5–18.5 | 14.4 | 13–17 | 15.2 | — | — |
| 15.0–22.3 | 19.3 | 14.5–22.5 | 19.9 | 16–21 | 18.7 | 16.5–20.8 | — |
| 23.8–29.0 | 26.1 | 26.5–35.5 | 29.9 | 27–35 | 30.7 | — | — |
| — | 26.1 | 21.5–29.5 | 24.2 | 19–24 | 21.5 | 19.2–29.4 | — |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | 42–75 | — |
| — | — | — | — | — | — | 9.4–13.0 | — |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — |
| 8–11 | 8.47 | 8–10 | 8.6 | 8–9 | 8.3 | III 8 (9) | — |
| 9–13 | 10.87 | 9–13 | 11.7 | 10–12 | 11.2 | III 10–12 | — |
| 39–45 | 41.1 | 39–44 | 41.7 | 39–43 | 41.0 | 40–42 (39) | — |
| — | — | — | — | 8–9 | 8.3 | 7–8 | — |
| — | — | — | — | 3–4 | 3.8 | 3–4 | — |

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 172—178

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# GROWTH OF HUCHO TAIMEN (PALLAS, 1773) IN THE UPPER YENISEI RIVER OF MONGOLIA

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Received December 20, 1971

Abstract: Growth of *Hucho taimen* (Pallas, 1773) in the upper Yenisei river of Mongolia has been investigated using scales from 116 specimens and compared with the growth of *Hucho taimen* in the river Amur and in the mouth of the river Kurejka. Growth has also been compared with those of two related species, *Hucho hucho* (Linnaeus, 1758) and *Hucho perryi* (Brevoort, 1856).

## INTRODUCTION

*Hucho taimen* (Pallas, 1773) is a valuable Salmonoid fish closely related to *Hucho hucho* (Linnaeus, 1758) and differs from it only by the lesser number of gill rakers and the lesser deep vomerine bone. It lives in all rivers of Siberia; in the east direction up the river Indigirka (absent in the river Kolyma), in the water drainages of river Amur; in the west, in the river system of Kama and Wjatka, in the central part of Volga, also in the upper part of the river Ural, in tributaries of the river Amur, Ussuri and Sungari, rivers Tugar and Uda and tributaries of the Okhotsk Sea (Berg, 1948).

Except for the growth of *Hucho taimen* in the river Amur reported by Nikolskij (1956) and that in the mouth of the river Kurejka reported by Pollesnyj (1958), no other data appear to be available regarding the growth of this species.

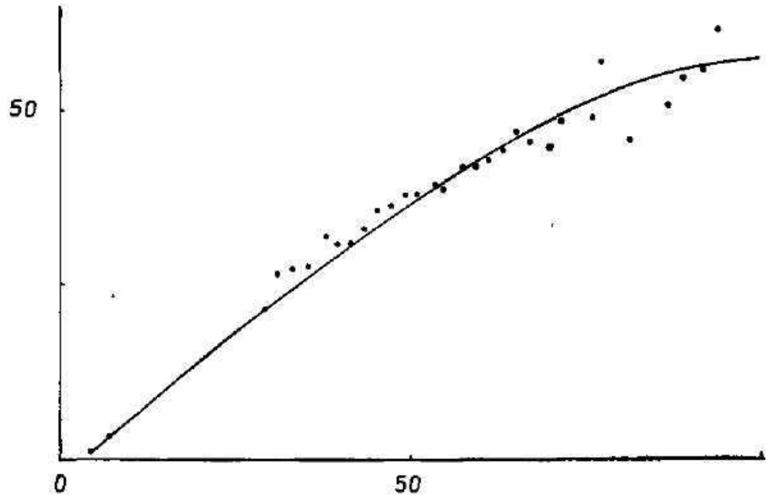
## MATERIALS AND METHODS

The scales and other data used in this investigation were obtained through the courtesy of Dr. K. Hensel*, Commenius University, Bratislava and Dr. K. Pivnička*, Charles University, Prague. The specimens were collected by them with *Thymallus arcticus* (Pallas, 1776) and other species in July, 1969 from the Šišchid river which is the Mongolian name for the upper Yenisei. The collection was made at a locality 20 Km from Dood-caagan nuur, (99°22′ EL, 51°31′ N Lat.) using a seine net of 7—8 mm mesh size. (For further details see Chitravadivelu, 1971.)

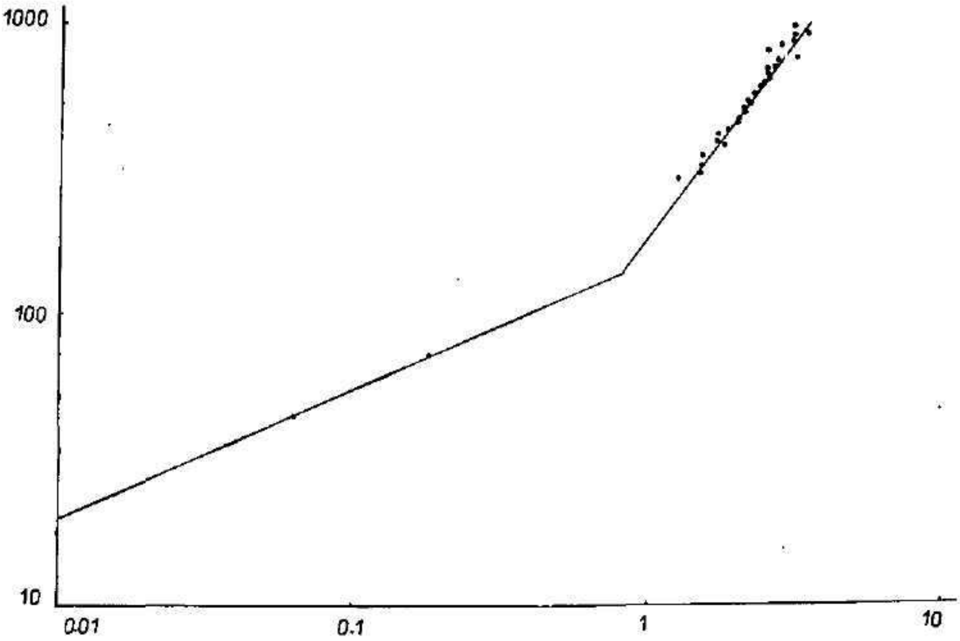
The age and growth of *Hucho taimen* were determined from the scales by examination in dry mounts, in a Carl Zeiss microprojector with 17.5 magnification. Age was assigned by counting the number of annuli. The oral radius and the distance of the different annuli from the focus along the oral radius were measured. The average fork lengths grouped into 20 mm intervals plotted against the corresponding average oral radius expressed a curvilinear relationship. (See graph 1.) The same data when represented logarithmically did not give a single straight line (see graph 2). Apparently, the relationship between the oral radius of scale and fork length is not a normal parabola and the method of Monastyrsky cannot be applied here. Therefore, the normal oral radius-fork length graph (graph 1) was used in the computation of the growth histories.

* Expedition to Mongolia was sponsored by the Mongolian State University, the Mongolian Academy of Sciences and the Ministry of Education, Czechoslovakia.

The growth of *Hucho taimen* in the Šišchid is shown in table 1. Two specimens of 0 age class of fork lengths 4.7 cm and 7.2 cm are not included

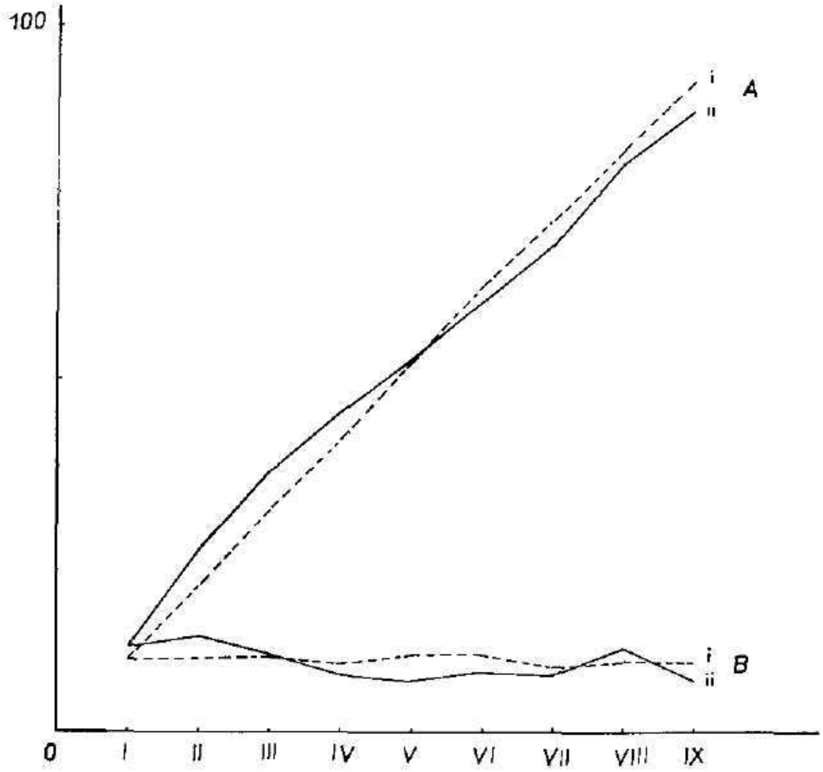



Graph 1. Relation between fork length and oral radius of scale of *Hucho taimen*. Abscissa, fork length in cm; ordinate, oral scale radius × 17.5, in mm. Fork length = Smitt's length.




Graph 2. Logarithmic graph showing the relation of fork length (in mm, ordinate) to oral radius of scale (in mm, abscissa).

in the tables. In the former the scales are without any circuli while in the scales of the latter, 5—6 circuli could be made out. The absence of specimens of fork lengths less than 30 cm (except the two already referred to) brought in difficulties as to the determination of the exact course of the graph. The author has choosen the course that the graph could possibly




Graph 3. Illustrates (A) the average yearly growth and (B) the yearly increments in successive years of life of *Hucho taimen* in (i) Amur (Nikolskij, 1956) and (ii) Šišchid (Author).

take, if the parameters from the two specimens were to be relied upon. According to graph 2, the theoretical fork length at which scales will start to develop appears to be 2.0 cm, which compares favourably with the length obtained for a related species *Hucho hucho* by Kirka (1963).

The annual increment during the second year is more than the length attained during the first year. Subsequent annual increments decrease up to the 5th year and further annual increments are nearly equal, except during the 8th year (see graph 3).

The tables 2 and 3 give the growth of males and females separately. The females grow faster than the males.

In the specimens of *Hucho taimen* which Nikolskij (1956) had investigated, the annual increments were more or less constant and equal to the length attained at the end of the first year, but the annual increments

Table 1. Growth of *Hucho taimen* (♂ + ♀) in the river Šišchid

| Age class | Year of hatching | No. | Ranges and average fork lengths in cm at the time of capture | | Mean computed fork lengths in cm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $l_1$ | $l_2$ | $l_3$ | $l_4$ | $l_5$ | $l_6$ | $l_7$ | $l_8$ | $l_9$ |
| II | 1967 | 7 | 29.0–32.2 | 30.3 | 13.7 | 27.4 | | | | | | | |
| III | 1966 | 29 | 30.5–47.5 | 39.6 | 12.5 | 27.0 | 39.0 | | | | | | |
| IV | 1965 | 27 | 41.5–52.5 | 47.4 | 12.0 | 26.5 | 39.0 | 48.2 | | | | | |
| V | 1964 | 11 | 50.5–56.5 | 54.0 | 12.4 | 24.0 | 33.4 | 43.0 | 51.3 | | | | |
| VI | 1963 | 14 | 52.5–62.5 | 59.1 | 11.6 | 23.1 | 33.8 | 42.7 | 50.3 | 58.5 | | | |
| VII | 1962 | 16 | 63.0–80.5 | 70.1 | 12.0 | 24.5 | 35.0 | 43.0 | 51.0 | 58.0 | 64.5 | | |
| VIII | 1961 | 10 | 65.0–94.0 | 85.6 | 12.0 | 25.8 | 38.2 | 47.5 | 55.0 | 63.7 | 71.2 | 82.0 | |
| IX | 1960 | 2 | 80.5–99.0 | 86.3 | 11.5 | 28.7 | 39.8 | 46.2 | 55.0 | 63.3 | 71.2 | 79.3 | 88.0 |
| | Total | 116 | Average | | 12.2 | 25.9 | 36.9 | 45.1 | 52.5 | 60.9 | 68.9 | 80.6 | 88.0 |

Table 2. Growth of female *Hucho taimen* in the river Šišchid

| Age class | Year of hatching | No. | Ranges and average fork lengths in cm at the time of capture | | Mean computed fork lengths in cm | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $l_1$ | $l_2$ | $l_3$ | $l_4$ | $l_5$ | $l_6$ | $l_7$ | $l_8$ | $l_9$ |
| I | 1967 | 1 | | 29.5 | 12.7 | 27.4 | | | | | | | |
| III | 1966 | 20 | 35.0–47.5 | 40.3 | 12.5 | 26.7 | 39.3 | | | | | | |
| IV | 1965 | 10 | 42.5–51.0 | 47.8 | 12.5 | 27.7 | 39.4 | 48.8 | | | | | |
| V | 1964 | 7 | 53.0–55.0 | 53.7 | 12.6 | 24.0 | 34.3 | 44.3 | 52.5 | | | | |
| VI | 1963 | 6 | 58.0–62.5 | 60.2 | 11.7 | 24.1 | 35.0 | 44.0 | 51.7 | 60.2 | | | |
| VII | 1962 | 7 | 63.0–72.0 | 69.1 | 12.4 | 26.6 | 37.4 | 45.7 | 53.0 | 58.7 | 66.0 | | |
| VIII | 1961 | 3 | 65.0–92.0 | 81.3 | 11.3 | 24.9 | 37.5 | 44.8 | 52.0 | 60.3 | 67.2 | 77.0 | |
| IX | 1960 | 2 | 88.5–99.0 | 93.7 | 11.5 | 28.7 | 39.8 | 46.2 | 55.0 | 63.3 | 71.2 | 79.3 | 88.0 |
| | Total | 56 | Average | | 12.1 | 26.3 | 37.5 | 45.6 | 52.8 | 60.6 | 68.1 | 78.1 | 88.0 |

Table 3. Growth of male *Hucho taimen* in the river Šišchid

| Age class | Year of hatching | No. | Ranges and average fork lengths in cm at the time of capture | | Mean computed fork lengths in cm $l_1$ | $l_2$ | $l_3$ | $l_4$ | $l_5$ | $l_6$ | $l_7$ | $l_8$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| II | 1967 | — | | | | | | | | | | |
| III | 1966 | 4 | 40.0 – 45.0 | 41.3 | 12.0 | 29.0 | 39.2 | | | | | |
| IV | 1965 | 17 | 41.5 – 52.5 | 47.2 | 11.6 | 25.8 | 38.9 | 48.0 | | | | |
| V | 1964 | 4 | 50.5 – 56.5 | 54.6 | 11.5 | 24.0 | 32.0 | 41.3 | 49.4 | | | |
| VI | 1963 | 8 | 52.5 – 62.0 | 58.4 | 11.6 | 22.4 | 32.6 | 42.0 | 49.5 | 57.5 | | |
| VII | 1962 | 7 | 64.0 – 70.0 | 66.4 | 12.4 | 22.4 | 32.6 | 40.0 | 49.4 | 57.0 | 64.4 | |
| VIII | 1961 | 3 | 82.0 – 92.0 | 86.8 | 11.5 | 24.9 | 37.0 | 48.0 | 55.0 | 63.3 | 69.9 | 79.3 |
| | Total | 43 | Average | | 11.8 | 24.7 | 35.4 | 43.9 | 50.8 | 59.3 | 67.1 | 79.3 |

Table 4. Comparison of the growth of *Hucho taimen*

| Locality and authority | Data | Years of life 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Average growth characteristics (1 – 9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Šišchid Author | l | 12.2 | 25.9 | 36.9 | 45.1 | 52.5 | 60.9 | 68.1 | 80.6 | 88.0 | |
| | i | | 13.7 | 11.0 | 8.2 | 7.4 | 8.4 | 8.0 | 11.7 | 7.4 | |
| | $C_{th}$ | | 9.18 | 9.17 | 7.41 | 6.85 | 7.78 | 7.52 | 10.80 | 7.09 | 8.22 |
| Amur Nikolskij, 1956 | l | 10.3 | 20.8 | 31.5 | 41.4 | 52.3 | 63.2 | 72.5 | 82.5 | 92.3 | |
| | i | | 10.5 | 10.7 | 9.9 | 10.9 | 10.9 | 9.3 | 10.0 | 9.8 | |
| | $C_{th}$* | | 7.24 | 8.63 | 8.61 | 9.67 | 9.89 | 8.67 | 9.38 | 9.25 | 8.92 |

l = fork length in cm
i = annual increment in cm
$C_{th}$ — growth characteristic
* Calculated from the data of Nikolskij (1956)

during the 2nd and 3rd year are *less than those attained* by *Hucho taimen* in the Šišchid (see table 4 and graph 3). On the whole, the growth of *Hucho taimen* in the Šišchid is slower than that in the river Amur. This is also evident from the values of average growth characteristics, $C_{th(1-9)}$ which are 8.22 for the former and 8.92 for the latter (see table 4).

*In the sample of Hucho taimen* from Šišchid, the oldest specimen recorded is *nine* years old, having a fork length of 99.0 cm. Nikolskij (l.c.) had recorded specimens of *Hucho taimen*, thirteen years old, of 128 cm fork length, while Pollesnyj (1958) had reported specimens as old as 21+ years with a fork length of 117 cm. Pollesnyj (l.c.) had also referred to a 55 years old *Hucho taimen* weighing 56 Kg, caught in the Yenisei, not far from Krasnoyarsk, in 1944 — *perhaps the oldest living Hucho taimen* ever recorded!

According to the growth data of Pollesnyj (1958) for *Hucho taimen* in the mouth of the river Kurejka, the fork length attained by 6+ is 62 cm, 7+ is 66 cm, 8+ is 70 cm and 9+ is 77 cm. Compared with this the growth of *Hucho taimen* in the Šišchid is faster.

The growth of *Hucho taimen* when compared with that of an allied species *Hucho hucho* in the Klíčava reservoir of

| | $l_1$ | $l_2$ | $l_3$ | $l_4$ | $l_5$ | $l_6$ | $l_7$ (in cm) |
|---|---|---|---|---|---|---|---|
| Klíčava reservoir (Holčík, 1970) | 13.6 | 28.2 | 35.4 | 40.6 | 44.4 | 48.6 | |
| Váh (Kirka, 1963) | 12.8 | 31.3 | 40.6 | 47.9 | 54.6 | | |
| Orava (Kirka, 1963) | 13.5 | 31.3 | 44.5 | 52.8 | 60.2 | 65.7 | 68.6 |

Czechoslovakia (Holčík, 1970) appears to be slower during the first two years and faster thereafter. However, *Hucho hucho from the* Váh and Orava rivers of Czechoslovakia (Kirka, 1963) grows faster than *Hucho taimen* in the river Šišchid, right from the first year.

Yamashiro (1965) had reported an average body length of 8.3 *cm* for I+, 11.6 cm for II+, 17.4 cm for III+, 27.2 cm for IV+, 32.0 cm for V+ and 40.0 *cm* for VI+ for *Hucho perryi* in northeastern Hokkaido, Japan. This data is not strictly comparable to the data of the present investigation because the lengths given are the body lengths at the time of capture. However, the faster growth of *Hucho taimen* in the Šišchid when compared with the above data is clearly evident.

## SUMMARY

1. Growth of *Hucho taimen* (Pallas, 1773) in the upper Yenisei river of *Mongolia (Šišchid) has been investigated* using scales from 116 specimens.
2. The relationship between the oral radius of scale and fork length is curvilinear
3 The oldest specimen recorded is 9 years old with a fork length of 99.0 cm. Females grow faster than males.
4. Growth has been compared with that of *Hucho taimen* in the Amur (Nikolskij, 1956) and with that in the *mouth of the river Kurejka* (Pollesnyj, 1958). Growth has also been compared with that of the Czechoslovak *Hucho hucho* in the Váh, Orava (Kirka, 1963) and the Klíčava reservoir (Holčík, 1970) and with that of another allied species, *Hucho perryi* in northeastern Hokkaido, Japan (Yamashiro, 1965).
5. *Hucho taimen* in the Šišchid grows faster than that in the Amur up to the 5th year. Subsequent growth is slower than that in the Amur.

6. The growth of *Hucho taimen* in the Šišchid is faster than that in the mouth of the river Kurejka.

7. Growth of *Hucho taimen* in the Šišchid is slower than those of *Hucho hucho* in the Váh and Orava right from the first year, but slower than that of *Hucho hucho* in the Klíčava reservoir during the first two years and faster thereafter.

8. *Hucho taimen* in the Šišchid grows faster than *Hucho perryi* in northeastern Hokkaido, Japan.

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 179—180

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# THE INCIDENCE OF THE NEMATODE HELIGMOSOMUM MIXTUM SCHULZ, 1954 IN CZECHOSLOVAKIA

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Received Februar 1, 1972

During ecological investigations of the incidence of helminths in small rodents, performed from 1963—1964, Dr. J. Prokopič collected a large material of nematodes of the genus *Heligmosomum* Railliet et Henry, 1909, sensu Durette-Desset, 1968 from the vicinity of Nový Bydžov (East Bohemia). The helminth material obtained from the bank vole [*Clethrionomys glareolus* (Schreber, 1780)] consisted of a large number of nematodes of the species *Heligmosomum mixtum* Schulz, 1954 — family Heligmosomatidae Cram, 1927 and of an occasional *Heligmosomum costellatum* (Dujardin, 1845), (4 times only).

Earlier findings of nematodes from the bank vole identified by various authors as *Heligmosomum costellatum* (Dujardin, 1845) appear to be incorrect and, in our opinion, most of the specimens concerned pertained to *H. mixtum* Schulz, 1954. The taxonomy of nematodes of the genus *Heligmosomum* parasitizing rodents of central Europe, has been discussed in detail by Tenora and Mészáros (1971a, b).

The morphological differences in the cuticular system of *H. mixtum* and *H. costellatum*, and also the ecological specifity of *H. mixtum* to the bank vole and that of *H. costellatum* to the field mouse [*Microtus arvalis* (Pallas, 1778)], are distinct enough for their differentiation.

*Heligmosomum mixtum* parasitizes in the small intestine of its host. Its body is slender, spindle-shaped, of rusty colour. After fixation, the body loses gradually its rusty colour, which changes into a whitish yellow. The cephalic portion is covered by a transversely striated vesicle. The cuticular pattern of the body surface is more pronounced on the dorsal side by the presence of transverse cuticular grooves and on the ventral side by longitudinal cuticular grooves.

## Description

Male — length 14.0—16.3 mm, width 0.17—0.26 mm. Structure of the copulatory burse with two lobes symmetrical, externodorsal ribs relatively short without a pyriform swelling on their base. Length of filamentous spicules 0.9—1.2 mm.

Female: 20.8—23.2 mm long, 0.22—0.30 mm wide. Vulva at 0.380 mm from anus. Eggs 0.043—0.058 × 0.073—0.087 mm. The body of the female terminates in a short terminal spine (length 0.004—0.008 mm) arising from the subcuticular layer.

**The number of nematodes** measured was 50 males **and 50 females.** Of the **218 bank voles examined, 124** were attacked by ***H. mixtum*, i.e.** 56.9%.

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Svazek XXXVI — Číslo 3 — 1972 — Str. 181—186

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# ACANTHORHODEUS ROBUSTUS SP. N. FROM CHINA AND ACANTHORHODEUS POLYSPINUS SP. N. FROM VIETNAM, TWO NEW SPECIES OF ACHEILOGNATHINAE FISHES (TELEOSTEI: CYPRINIDAE)

JURAJ HOLČÍK

Received September 16, 1971

Abstract: *Acanthorhodeus robustus* sp. n. found in China and *Acanthorhodeus polyspinus* sp. n. occurring in Vietnam are described. Phyletical relationships of both species are discussed.

List of species belonging to the genus *Acanthorhodeus* Bleeker, 1870 must be enlarged by two new species discovered now in the bitterling collection of the Muséum National d'Historie Naturelle in Paris, France. The description of these new species (each formerly labelled under other names) is as follows:

## 1. *Acanthorhodeus robustus* sp. n.

Fig. 1, 2, 3, 4

Diagnose: Stout bitterling with relatively few branched rays in dorsal and anal fins (12 and 9—10 respectively), medium number of gill-rakers on the first branchial arch (12—13) and barb of medium size at each angle of mouth.

Material: MNHN 34—88 (labelled formerly as *Acanthorhodeus tonkinensis* Vaillant) and MNHN 34—96 (determined formerly as *Acanthorhodeus taenianalis* Günther).

Holotype: MNHN 34—88 (Fig. 1, 2), male 91.7 mm in standard length, collected in Yi-Hing, basin of the Yangtse River, China. Gifted to Muséum National d'Histoire Naturelle in Paris by Pr Chi Ping.

Other material: MNHN 34—96 (Fig. 3, 4), male 75.4 mm in standard length taken at Nanking, China. No other data available.

Description (data for MNHN 34—96 in brackets): D II 12 (III 12), A III 10 (III 9), unbranched rays in both fins transformed into hard and stout spines. In lateral line 36 pored and 1 unpored scale (same in MNHN 34—96), above the lateral line 6 (7) and below 5 (4) scales. First branchial arch bears 13 (12) short and thick gill-rakers. Uniserial pharyngeal teeth 5—5 in formula (not complete in both fishes but the traces of lacking teeth clearly visible) are deeply plicated. Scales (taken at the centre of body just above the lateral line) are rather rhomboidal with marked projection on the caudal part. The latter displays zig-zag waved radii 68 (40) in number which

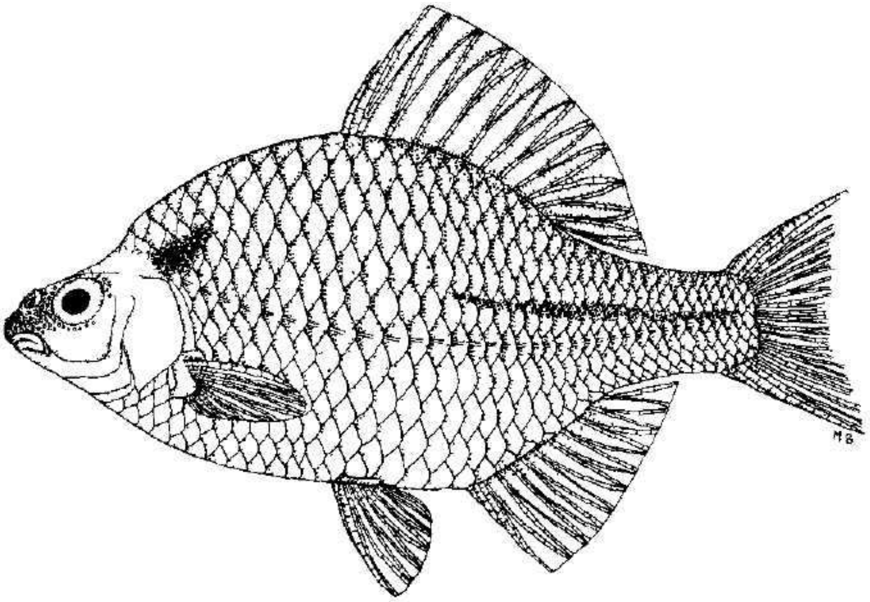


Fig. 1. Holotype of *Acanthorhodeus robustus* sp. n. Drawn by Miriam Baradlai.

are characteristic in shape and course as shown on figures 2 and 4. The relationship of the caudal and centrolateral part of scales to that of oral is 1.46 (1.52) and 1.83 (1.77) respectively. Mouth oblique, subterminal with distinct and relatively stout barb at each angle measuring 1.4 (2.4) per cent of the standard length. Head triangular, considerably broad mainly between eyes and the top of the head. Body distinctly deep and compressed. Pectoral fins do not reach the base of ventral fins but the latter reach the base of the anal fin. The base of pelvics just under the base of dorsal fin. Dorsal and anal fin edge convex as usual in males of this genus.

Measurements (in per cent of standard length): Head length 24.4 (24.5), snout length 7.4 (8.0), internasal distance 5.9 (5.3), horizontal diameter of eye 6.8 (6.9), distance between eyes 9.9 (10.7), postorbital distance 11.2 (11.3), head depth 20.2 (19.6), head width 13.5 (13.3), predorsal length 53.5 (55.9), preventral length 49.9 (47.2), preanal length 64.4 (66.2), maximal body depth 19.9 (19.2), caudal peduncle width 8.7 (5.7), minimal body depth 13.1 (13.3), P-V distance 24.9 (23.9), V-A distance 16.9 (17.2), length of D 33.6 (30.0), length of A 22.0 (20.4), length of P 19.0 (20.7), length of V 17.9 (17.0), depth of D 20.2 (22.3), depth of A 15.8 (18.2).

Colouration in alcohol: Light brown body and head, darker above the lateral line. Behind the head and above the lateral line there is distinctly marked cirkular dark spot continuing in the narrow dark "rhodeine" strip which suddenly grows thick at the area below the middle of dorsal fin. All fins pale without any sketch.

Derivation of the name: *Robustus* referring to the stout and strong body of this fish.

Remarks: Small number of fin rays in dorsal and anal fins characterizes this species as closely related to *Acanthorhodeus barbatus* (Nichols, 1926)

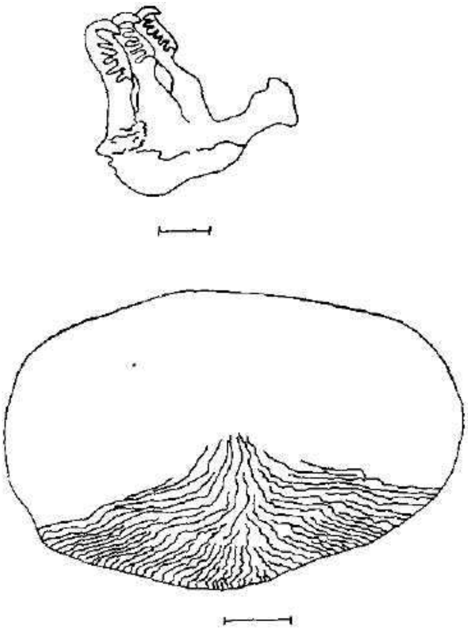


Fig. 2. Fragment of the left pharyngeal arch of the holotype of *Acanthorhodeus robustus* and its scale. Scales in mm.

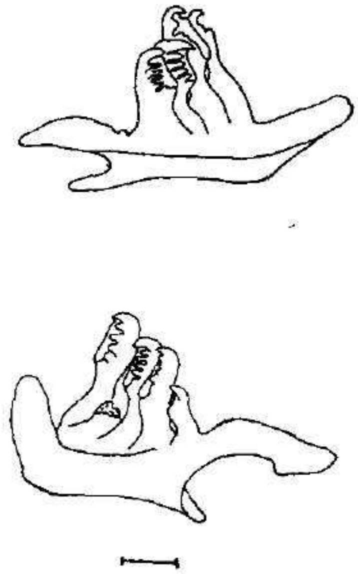


Fig. 3. Pharyngeal arches of *Acanthorhodeus robustus* no. coll. MNHN 34—96.

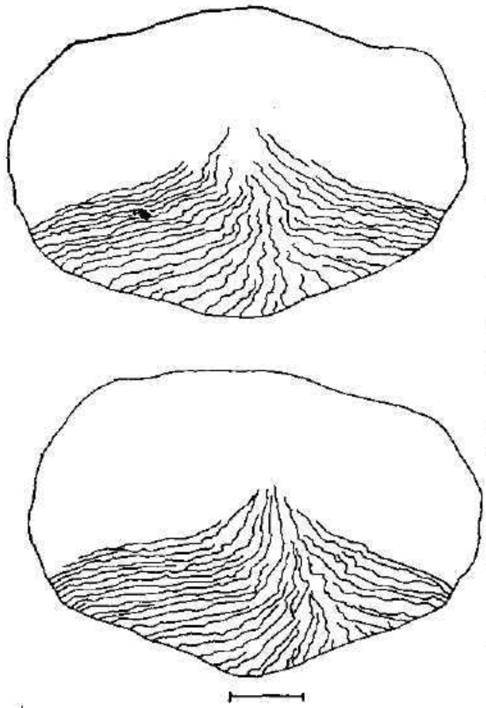
(D III 10—11, A III 8—10) and *Acanthorhodeus deignani* Smith, 1945 (D III 11—12, A III 10—11), resembling the mentioned species also in the number of pored scales in lateral line (32—38 in *barbatus* and 32—35 in *deignani**), but differing from them in the body shape, size attained (70 mm of standard length in *barbatus* and 52 mm in *deignani*), shorter barb (3—4 % of standard length in *barbatus* and 2.5—3.6 % in *deignani*), completely different and obviously more primitive structure of scales, structure of pharyngeal teeth (which are not so deeply plicated in both *barbatus* and *deignani*, and in some specimens of *deignani* plications are evenly lacking) and colouration too. Other related species seem to be *Acanthorhodeus argenteus* Wu, 1939 and *A. polylepis* Wu, 1964. However, these species display more rays in dorsal fin (13—14 in *argenteus* and 12—14 in *polylepis*), other number of pored scales in lateral line (31—35 in *argenteus* and 38—39 in *polylepis*), short barbs (0.7—1.0 in *argenteus* and very minute in *polylepis*), less number of branchial spines (9 and 10—11 respectively), other structure of scales and pharyngeal teeth too.

## 2. *Acanthorhodeus polyspinus* sp. n.

Fig. 5, 6

Diagnose: Bitterling of moderate size (up to 60 mm of standard length), high number of ramified rays in dorsal and anal fins (16—17 and 13—14

*) *A. barbatus* and *A. deignani* are probably only one species and *deignani* seems to be subspecies of *barbatus*.



respectively), few branchial spines (7—8) and barbless mouth. No dark spot behind the head and nearly invisible "rhodeine" strip at the centre of body.

Material: MNHN 34—205 and 34—206 (labelled originally as *Acanthorhodeus tonkinensis* Vaillant), and MNHN 07—287 and 07—288 (labelled formerly as *Acanthorhodeus taenianalis* Günther).

Holotype: MNHN 34—205 (Fig. 5, 6), male 60.1 mm of standard length, caught in the Red River (*Hong bo*) at the vicinity of Hanoi, Vietnam. To the fish collection of the Muséum National d'Histoire Naturelle in Paris presented by M. Busy. No other data available.

Paratype: MNHN 34—206, male of 49.9 mm in standard length, of the same origine and sample like the holotype.

Other material: Sample of two specimens cat. no MNHN 07—287 and 07—288 (*preserved in a very bad condition with damaged fins and of white colouration*) is composed of one male 60.0 mm and one female 58.3 mm in standard

Fig. 4. Two scales of the same specimen like on Fig. 3.

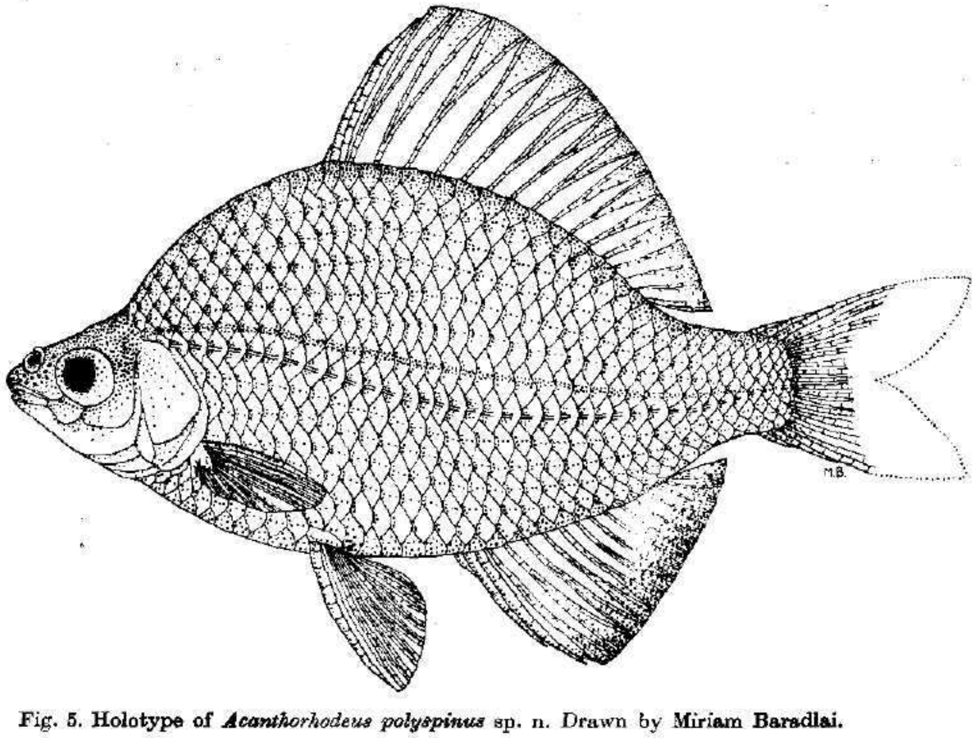



Fig. 5. **Holotype of *Acanthorhodeus polyspinus*** sp. n. Drawn by **Miriam Baradlai.**

Table 1. Counts and measurements of *Acanthorhodeus polyspinus* sp. n. No. 34-205 is holotype, and 34-206 paratype

| No. coll. (MNHN) | 34-205 | 34-206 | 07-287 | 07-288 |
|---|---|---|---|---|
| *Standard length* (mm) | 60.1 | 49.9 | 60.0 | 58.3 |
| Sex | ♂ | ♂ | ♀ | ♂ |
| Counts: | | | | |
| *Rays in D* | III 17 | III 17 | II 17 | ? 17 |
| Rays in A | III 14 | III 13 | II 13 | III 13 |
| Scales in lateral line (pored + unpored) | 33 + 3 | 33 + 2 | 33 + 2 | 33 + 2 |
| Scales above/below lateral line | 7/6 | 7/? | 6/5 | 6/5 |
| Gill-rakers | 7 | 7 | 8 | 8 |
| Measurements (*in % of standard length*): | | | | |
| Head length | 24.0 | 26.0 | 24.5 | 25.0 |
| Preorbital distance (snouth length) | 6.8 | 7.0 | 6.7 | 6.7 |
| Internasal distance | 4.2 | 5.6 | 5.3 | 4.5 |
| Diameter of eye | 8.0 | 10.0 | 8.5 | 7.7 |
| Distance between eyes | 9.7 | 10.0 | 10.0 | 9.1 |
| Postorbital distance | 10.5 | 11.8 | 10.5 | 10.3 |
| Head depth | 21.6 | 23.6 | 22.0 | 23.2 |
| Head width | 12.7 | 13.4 | 13.5 | 12.9 |
| Predorsal distance | 53.7 | 58.0 | 54.8 | 53.7 |
| Preventral distance | 45.3 | 47.0 | 46.0 | 42.5 |
| *Preanal distance* | 63.6 | 62.5 | 62.3 | 57.4 |
| Body depth | 50.7 | 49.5 | 49.6 | 49.4 |
| Body width | 10.8 | 10.6 | 13.0 | 12.5 |
| Caudal peduncle length | 19.1 | 18.6 | 16.7 | 19.5 |
| Caudal peduncle depth | 18.6 | 16.2 | 15.3 | 16.6 |
| Caudal peduncle width | 5.0 | 4.6 | 6.3 | 7.2 |
| Minimal body depth | 13.2 | 13.2 | 12.8 | 12.7 |
| P-V distance | 21.6 | 19.8 | 23.5 | 19.2 |
| V-A distance | 19.6 | 17.0 | 38.5 | 34.3 |
| Dorsal fin length | 39.3 | 40.0 | 38.5 | 34.3 |
| Anal fin length | 29.3 | 29.2 | 27.7 | 26.4 |
| *Caudal fin length* | ? | ? | ? | ? |
| Pectoral fin length | 21.5 | 19.2 | 16.7 | ? |
| Ventral fin length | 20.3 | 20.0 | 18.0 | 14.7 |
| Dorsal fin depth | 24.2 | 20.6 | 23.3 | ? |
| Anal fin depth | 18.6 | 21.0 | 21.7 | 19.2 |

length which were caught in Tonkin and presented to museum by the Permanent Mission in In dochine. No other data on locality and date of capture available.

**Description:** D II-III 16–17, A II-III 13–14, unbranched rays trans formed into the hard spines. Lateral line is composed of 33 pored and 2–3 un pored scales. Above the lateral line there is 6–7 and below it 5–6 scales Number of branchial spines varies from 7 to 8. These elements are short Pharyngeal teeth are deeply plicated, uniserial, 5–5 in formula. Scales oval the relationship of the caudal and centrolateral radiuses to that of oral range from 1.35 to 1.79 (1.60 *in average*) and from 1.77 to 2.26 (1.99 in average respectively. Number of scale radii 26–33 (30.8 in average). The shape and course of radii is shown on fig. 6. Body considerably high, discoidal, re

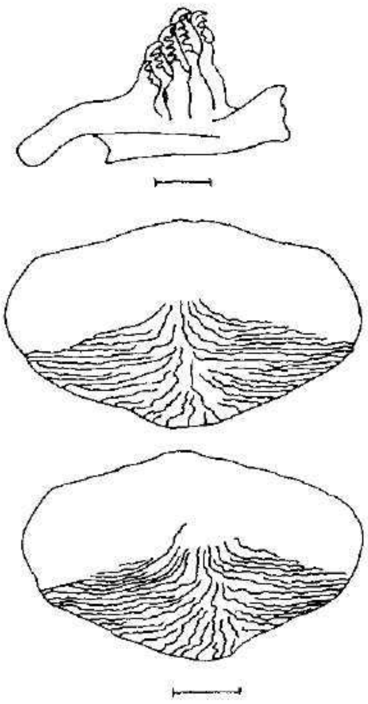


Fig. 6. Left pharyngeal arch of *Acanthorhodeus polyspinus* and its scales.

markably flattened. Head triangular, mouth subterminal and oblique without barbs.

All counts and measurements of the holotype, paratype and other two species respectively are shown on the Table 1.

Colouration in alcohol· Silvery greyish. In the body centre there is a wide light belt containing very thin dark "rhodeine" strip beginning just behind the head. Dorsal and anal fins bear two pale longitudinal stripes. The edge of the anal fin is dark. Other fins pale.

Derivation of the name: *Polyspinus* means "many spines" referring to the large number of rays in the dorsal and anal fins.

Remarks: Only two species of the genus *Acanthorhodeus* seem to be in some relationship to *A. polyspinus*. There are *A. hypselonotus* Bleeker, 1871 and *A. macropterus* Bleeker, 1871 (D III 14—15, A III 12—13 and D III 12—18, A III 9—14 respectively). However, both species considerably differ from *A. polyspinus: hypselonotus* has 15—18 gill-rakers instead 7—8 in *polyspinus*, and *macropterus* has small but conspicuous barb at the angle of mouth whilst *polyspinus* is barbless. Beside these features also the structure of scales in *polyspinus* is completely different just as the colouration. Nevertheless it is believed that here is a closer affinity between *polyspinus* and *macropterus* also with regard to fact that both species are sympatric — *A. macropterus tonkinensis* inhabits the same area like *A. polyspinus*. In this occasion it is interesting to note, that the discovery of *A. polyspinus* just as the occurrence of *A. deignani* and *Rhodeus spinalis* (Holčík, 1971) in the same geographical area for which only *A. macropterus tonkinensis* has been reported for a long period before, indicates that the *Acheilognathinae* fauna of Indo-China is certainly more rich as thought formerly. This fact together with the list of species considered has been already suggested (Holčík l.c.).

Acknowledgement

I wish to give my sincere thanks to Mme. Professor Dr. M. L. Bauchot, vice-director of the Muséum National d'Histoire Naturelle, Department Poissons et Reptiles, Paris, France, for possibility to work out the collection of *Acanthorhodeus* specimens from this institute as well as for her valuable information concerning the origin of species examined. Mrs. Miriam Baradlai is acknowledged for the drawings of both holotypes.

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 187—191

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# THE SYSTEMATIC STATUS OF BULLHEAD (ICTALURUS RAFINESQUE, 1820) (OSTEICHTHYES: ICTALURIDAE) IN CZECHOSLOVAKIA

JURAJ HOLČÍK

Received November 30, 1971

**Abstract:** The author studied the systematic status of bullhead imported from the USA at the end of last century which had spread over the whole teritory of Czechoslovakia and came to the conclusion that Czechoslovak populations belong to species *Ictalurus nebulosus* (Le Sueur, 1819). The wide range of anal fin rays observed in Czechoslovakia and Roumania is probably due to ecological adaptation to the new environmental factors, or due to hybridization between *I. nebulosus* and *I. melas*.

The following notes were stimulated by the paper Spillmann (1967 and Banarescu (1968) who had followed the systematic status of bullhead in France and Roumania. Both authors had found that the bullhead inhabiting the water-bodies of both countries was not *Ictalurus nebulosus* (Le Suer, 1819) but *Ictalurus melas* (Rafinesque, 1820). In Czechoslovakia the taxonomy of acclimatized bullhead had been studied by Frank (1956) for Bohemian populations and by Sedlár (1957) for populations inhabiting some Slovakian waters. Both authors had identified studied specimens with brown bullhead — *Ictalurus nebulosus*. However, they had not considered the possibility of change with other species despite the fact that some characters had not excluded this.

According to most American authors (e.g. Jordan and Evermann, 1896; Trautman, 1957; Slastenenko, 1958; Hubbs and Lagler, 1964; Scott and Crossman, 1969) the principal differences between *nebulosus* and *melas* (which are generally very similar) are as follows:

1) number of anal fin rays (including the rudimentary ones) in *nebulosus* varies from 21 to 24 (mostly 22—23). and in *melas* from 17 to 21 (mostly 18—19 Table 1)*),

2) the first ray of pectoral fins which is transformed into the strong spine showed distinct serrations (called also teeth or barbs) in *nebulosus*, but it is mostly smooth in *melas*. Only in juvenile *melas* the serrations may

* According to Dr. William R. Taylor, authority in taxonomy of catfishes, "The anal fin-ray count of both species in this country (i.e. USA — note of J. H.) overlaps broadly and varies geographically — highest in southern latitudes — and is not a satisfactory method of distinguishing species". (In letter of June 22, 1971.)

be developed which are, however, rather fine in comparison with those of *nebulosus*,

3) the coloration of nebulosus is usually yellow-, olive-, slaty- or light chocolate brown with vague darker mottlings. The sides are more pale and often blotched and mottled with dark brown. The belly is bright yellow or whitish. Fins are unicolor, of the same color as the body but lighter. In *melas* the back is greenish-, yellowish-, brownish-, or slaty olive, sides are lighter. The fins are usually jet-black. Adult fish possesses a whitish bar at the base of caudal fin.

Table 1. Number of anal fin rays in *Ictalurus nebulosus* and *Ictalurus melas* in North America according to some authors

| Authority | *Ictalurus nebulosus* | *Istalurus melas* |
|---|---|---|
| Jordan and Evermann 1896 | 21–22 | 17–19 |
| Slastenenko 1956 | 19–24 | 16–22 |
| Trautman 1957 | 21–24 | 16–22 |
| Sigler and Miller 1963 | – | 17–24 |
| Hubbs and Lagler 1964 | 21–24 | 17–21 |
| Scott and Crossman 1969 | 21–24 | 17–21 |

In Czechoslovakia Frank (l.c.) studied the bullhead populations from Bohemia and counted 18–25 rays in the anal fin (20.97 in average). The coloration of fish studied was greyish or greenish, more intensive on the back, pale on sides. The latter are distinctly mottled chiefly in adult specimens. Sedlár (l.c.) investigated 3 samples of bullhead from the Žitava and Danube rivers (Slovakia). He found only 18–19 rays in sample collected at Dolný Ohaj (middle course of the Žitava river) but 21–24 and 22–23 rays at the lower course of that river (locality Húl) and in the Danube river at Radvaň respectively. Sedlár did not state the coloration of fish. I have studied two samples of bullhead from the Danube river (19 specimens measuring 153–223 mm of standard length caught at Štúrovo and Iža, and 9 specimens measuring 115–130 mm in standard length taken in the lake Lyon at Medveďov) and one sample from East Slovakia (15 specimens measuring 92–117 mm in standard length collected in brook at Klokočov (Tisa river basin)]. The number of anal fin rays varied from 17 to 22 in fish from Danube near Štúrovo (19.95 in average), from 17 to 23 in sample from the Lyon lake (20.11 in average) and from 19 to 22 in bullheads taken at Klokočov (20.20, Tab. 2). All fish, regardless of locality, display the same coloration which is (in alcohol) dark greyish on back, more pale on sides. There is no whitish bar at the base of caudal fin. The banks demonstrate good visible mottlings ("marmoration") both in the adults and juveniles. The pectoral spine bears very distinct serrations (Fig. 1), the same in shape as pictured by Trautman (1957, Fig. 107a).

Summarizing the above mentioned results obtained from bullhead population in Czechoslovakia one can observe 1) big variability of number in anal fin rays which covers the values for both *I. nebulosus* and *I. melas* — the mean value however is closer to the latter than to the former species,

2) coloration typical for *nebulosus* and 3) presence of distinct serrations pectoral spine — character typical for *nebulosus*. Comparing these resul with the data from literature and with specimens of *I. nebulosus* and *I. mel* from USA (the Iroquis and Potawatomi rivers, Illinois) kindly loaned Dr. P. Banarescu from Bucarest I classify the bullhead populations fro

Table 2. Number of anal fin rays in some populations of *Ictalurus nebulosus* from Czechoslovak

| Locality | Author | Mean | Ranges | Number of specimens |
|---|---|---|---|---|
| Elbe region (Žehuň) | Frank 1956 | 20.97 | 18—25 | 60 |
| Nitra (Dolný Ohaj) | Sedlár 1957 | — | 18—19 | 6 |
| Nitra (Húl) | Sedlár 1957 | — | 22—23 | 6 |
| Danube (Radvaň) | Sedlár 1957 | — | 21—24 | 6 |
| Danube (Štúrova) | our data | 19.95 | 17—22 | 19 |
| Danube (Lyon lake) | our data | 20.11 | 17—23 | 9 |
| Tisa basin (Klokočov) | our data | 20.20 | 19—22 | 15 |

Czechoslovakia as *Ictalurus nebulosus* (Le Sueur, 1819). This conclusion wa verified also by Dr. K. Hensel (personal communication) who studied th skull of bullheads from the Elbe river region in Bohemia and found it ident ical with *Ictalurus nebulosus*.

Observed wide range of anal fin rays number in Czechoslovak population of brown bullhead is probably due to the adaptation to new environmenta conditions. Such adaptation expressed in remarkable change of meristic anc plastic features (and ecology too) is well known just in acclimatized fishes

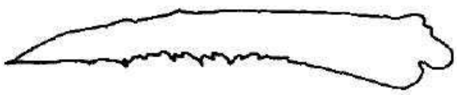

Fig. 1. Left pectoral spine of *Ictalurus nebulosus* from Danube at Štúrovo. Standard length of fish 153.4 mm, length of spine 21.1 mm.

I mention here only some examples. Luzhin (1953) found in *Salmo ischchan* population introduced to the lake Issyk-kul in Kirgizia from the lake Sevan in Armenia that 20 years afterwards the morphology as well as ecology of this species had changed so strongly that this form should be classified as a new species*). Burmakin (1956) stated that carp (*Cyprinus carpio*) from the Balkash lake into which it had been introduced from the Chu river in about 1913, had changed its counts and measurements. This author also mentions the forming of two forms evolved spontaneously during the past 50 years of carp existence in the Balkash lake. Serov (1959) observed the origin of the new form of *Abramis brama orientalis* living in the Balkash lake into which it had been introduced from the Aral Sea. Belyj (1964) also found deep changes in the taran (*Rutilus rutilus m. migratorius*)ac - climatized in the Crimean impoundments and originated from the Dnieper river. These changes include both morphology and ecology of this species.

* Later Luzhin described this form as a new subspecies *Salmo ischchan issykogegarkuni* [Luzhin B. P., 1956: Issyk-kulskaya forel (The trout from Issyk-kul). Izd. AN Kirg. SSR, 1956].

The Amurian sleeper (*Percottus glehni*) acclimatized in European Russia (below Moscow) displayed not only an increasing variation of its morphological characters but also their expressive change, because 8 from 18 measurements showed statistically significant difference in comparison with those of sleeper from the original habitat (Spanovskaja and others 1964).

These facts point to the possibility that also Czechoslovak populations of brown bullhead responded to the new environment by gradual change of number of its anal fin rays. Less probable seems the possibility of hybridization between *I. nebulosus* and *I. melas* (which is suspected but not certain — Taylor in his letter from June 22, 1971) or in their native country or here in Europe after acclimatization This possibility cannot be fully excluded, because *I. melas* was found also in Netherlands (Taylor, l.c.) and probably also on other places of Europe. According to Dr. S. Frank (pers. comm.) there are some data in old archives of the State Fishery at Třeboň, Bohemia, that several species of north-american catfishes were introduced into Czechoslovakia at the end of last century. From these only a sample of 7 specimens labelled as "*Ameiurus catus*" was saved in Ichthyological collection of National Museum at Prague. According to Frank (1956) the number of anal fin rays in these fishes ranged from 19 to 23 (with 22 in average) and all belong to *I. nebulosus*. This determination was now verified by Dr. J. Čihař, Curator of Fishes in National Museum in Prague, who found very distinct serrations on pectoral spines of these bullheads (pers. comm.).

The systematic status of bullhead in Roumania has to be reexamined. According to Banarescu (l.c.) all populations from Roumania belong to *I. melas*, but the sample taken in the river Timis showed distinct serrae on the pectoral fin spine regardless of a small size of the fish. The caudal fin base does not show the shitish bar present in *I. melas* from Iroquis river (in fish of the same length).


### Acknowledgement

I am greatly indebted to Dr. P. Banarescu, Institute of Biology "Traian Savulescu", Bucarest for sending me samples of bullhead from Roumania and USA and to Dr. W. R. Taylor, Curator of Fishes, US National Museum in Washington, for reidentification of bullhead from Czechoslovakia and for his valuable comments. Dr. S. Frank, Zoological Institute of Charles University in Prague is acknowledged for his valuable advice and information and Dr. J. Čihař, Department of Zoology, National Museum in Prague for kind reexamination of "*Ameiurus catus*" sample deposited here. Thanks are due also to my colleague Dr. K. Hensel, Department of Zoology, Comenius University, Bratislava for information on his *Ictalurus* skull studies as well as for fruitful discussion.


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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 192—195

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Forschungslaboratorium für Ultrastruktur der Zellen und Gewebe der Tschechoslowakischen Akademie der Wissenschaften, Praha

# DAS MORPHOLOGISCHE BLUTBILD BEIM NEUNAUGE LAMPETRA PLANERI (BLOCH, 1784) (CYCLOSTOMATA)

ZBYNĚK LIKOVSKÝ

Eingegangen am 4. September 1971

**Abstrakt:** Beim Neunauge *Lampetra planeri* (Bloch, 1784) wurde Verminderung der Werte von Erythrozyten, Leukozyten und Koagulozyten in der Laichzeit gefunden. Zwischen Männchen und Weibchen wurden keine Unterschiede festgelegt. Die Änderung der Leukozyten-Werte hängt von absoluten Zahlen der Lymphozyten ab. Die Werte der rundkernigen Granulozyten Vorkommen der Pelger-Huëtsche Kernanomalie bestätigen.

Die hämatologische Untersuchungen sind bei den Petromyzonten nur sehr selten durchgeführt worden. Über die Blutkörperchenzahlen wurden nur einzelne Angaben veröffentlicht — z. B. Wiedersheim (1909), Raunich (1947), Ivanova-Berg u. Sokolova (1959). Blutbild der *Lampetra planeri* ist bisher unbekannt — die Arbeit von Raunich (1947) behandelt wahrscheinlich über Blutzellen der *Lampetra zanandreai* Vladykov, 1955 (vgl. z. B. Zanandrea, 1958). Ergebnisse unserer Untersuchungen über Blutzellen der *Lampetra planeri* sind in dieser Arbeit angeführt[1].

## MATERIAL UND METHODIK

Untersucht wurden *Lampetra planeri* (Bloch, 1784): 32 Erwachsene (♂♀) in der Laichzeit (VI.), 1 Weibchen kurz nach Metamorphose (IX.), 2 Tiere in Metamorphose (X.) und 15 Larven 47 bis 136 mm lang (X.) von Bělečský potok bei Běleč n. Orlicí, von Bobřice bei Dolany und von Zdobnice und Nebenbächen bei Slatina n. Zdobnicí (O.- u. N. O.-Böhmen). Die Tiere in Metamorphose und Erwachsene bevor der Laichzeit kommen nur sehr spärlich vor.

Die Blutentnahme aus der *arteria caudalis* erfolgte unter MS-222 (Sandoz) Anästhesie. Die Zahlen der Blutzellen wurden nach Shaw bestimmt (in isoosmotischen Lösungen). Färbung der Blutausstriche: panoptische nach Pappenheim — Likovský u. Mitarb. (1972).

## ERGEBNISSE

Die zahlenmässigen Ergebnisse sind in der Tabelle 1 und 2 angeführt. Die absoluten Zahlen der verschiedenen Leukozytentypen bringt Abb. 1.

Die absoluten Zahlen der Blutzellen von Larven sind deutlich höher als bei erwachsenen Tieren. Von Tieren in Metamorphose bzw. von Erwachsenen

[1] Ich danke Herrn Dr. K. Lohniský vom Kreismuseum in Hradec Králové für die freundliche Überlassung des Tiermaterials and für faunistische, taxonomische und nomenklatorische Angaben; Frl. E. Rezková für die technische Mitarbeit.

vor der Laichzeit konnten wir nicht wegen zu kleiner Zahl der Untersuchungen die gefundenen Werte näher behandeln; sie sind hier nur für Information angeführt.

## DISKUSSION

Verminderung der Zahlen der Erythrozyten in Laichzeit, die von uns beobachtet wurde, wird von Raunich (1947) für *Lampetra* cf. *zanandreai* und von Ivanova-Berg u. Sokolova (1959) für *Lampetra fluviatilis* ange-

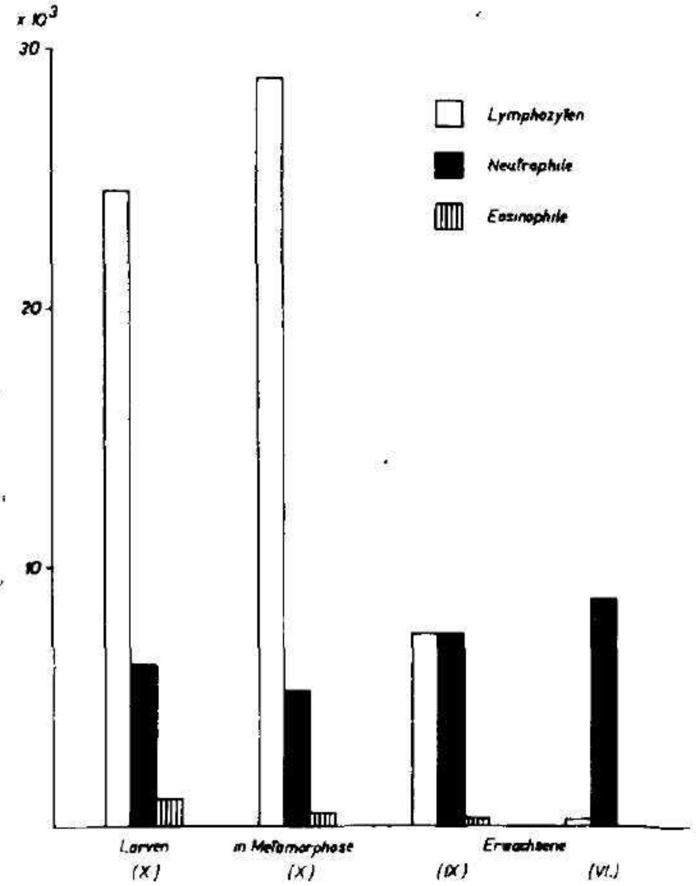


Abb. 1. Absolute Zahlen der verschiedenen Leukozytentypen.

führt. Bei Erwachsenen unseres Materials wurden keine Unterschiede zwischen Männchen und Weibchen in der Laichzeit gefunden — die Werte bei Männchen sind nur etwas niedriger. Dagegen Ivanova-Berg u. Sokolova (1959) fanden deutlich niedrigere Zahlen bei Weibchen *Lampetra fluviatilis* — deren Lebensweise aber ganz andere ist. In der Zahl der Erythrozyten wurden keine bedeutenden Unterschiede unter Larven verschiedenen Alters beobachtet; die Körperlänge (47 bis 136 mm bei von uns untersuchten Tieren) hängt vom Alter ab — Lohniský (1965).

Tab. 1. **Absolute Zahlen der Erythrozyten, Leukozyten und Koagulozyten**
(Mittelwerte und Schwankungsbreite)

| | | | Monat der Untersuchung | n | Erythrozyten | Leukozyten | Koagulozyten |
|---|---|---|---|---|---|---|---|
| Larven | | | X. | 15 | 1136700 (970000—1410000) | 31700 (15200—43700) | 9800 (5000—12800) |
| Tiere in Metamorphose | | | X. | 2 | 1245000 (1160000—1330000) | 34550 (31000—38100) | 12650 (10800—14500) |
| Erwachsene | vor Laichzeit | | IX. | 1 | 1510000 | 15100 | 3500 |
| | in der Laichzeit | ♂♀ | VI | 32 | 431200 (280000—650000) | 9100 (2100—17700) | 900 (240—2090) |
| | | ♂♂ | VI. | 19 | 394500 (280000—550000) | 9700 (3000—17700) | 1050 (240—2090) |
| | | ♀♀ | VI. | 13 | 485000 (390000—650000) | 9000 (2100—14000) | 890 (260—1370) |

Tab. 2. Leukozyten (**Mittelwerte** und Schwankungsbreite)

| | | Larven | In Metamorphose | Erwachsene | |
|---|---|---|---|---|---|
| Monat der Untersuchung | | X. | X. | IX. | VI. (Laichzeit) |
| n | | 15 | 2 | 1 | 32 |
| Lymphozyten | | 77,6% (69—90) | 84,0% (83—85) | 49,0% | 3,0% (0—8) |
| Myeloblasten | | 0 | 0 | 0 | 0 |
| Promyelozyten | | 0 | 0 | 0 | 0 |
| Neutrophile | Myelozyten | 5,5% (1—9) | 3,5% (3—4) | 10,0% | 38,8% (27—46) |
| | Metamyelozyten | 1,4% (0—3) | 1,0% (1) | 3,0% | 7,6% (1—20) |
| | Stabkernige | 2,8% (1—10) | 2,0% (1—3) | 9,0% | 11,6% (4—35) |
| | Segmentkernige | 9,4% (6—13) | 8,0% (5—11) | 27,0% | 39,0% (21—63) |
| Eosinophile Granulozyten | | 3,3% (2—5) | 1,5% (1—2) | 2,0% | 0 |
| Hynek's Index[2] | | 1,51 | 1,57 | 1,68 | 1,42 |
| Kernverschiebungsindex | | 1 : 0,97 | 1 : 1,23 | 1 : 1,12 | 1 : 0,67 |

[2] z. B. Netoušek (1951)

Die Schwankung unserer Ergebnisse über Leukozytenzahlen ist verhaltnismässig breiter als bei Erythrozyten. Trotzdem aber stellten wir fest, dass ihre Werte bei *Lampetra planeri* in der Laichzeit am niedrigsten sind; zwischen Männchen und Weibchen konnten wir keine Unterschiede finden. Zahlen der weissen Blutzellen, die von Raunich (1947) für *Lampetra* cf. *zanandreai* und von Ivanova-Berg u. Sokolova (1959) für *Lampetra fluviatilis* angeführt wurden sind erheblich höher, als unsere Funde. Die relativen Zahlen der verschiedenen Leukozytentypen bei *Lampetra planeri* mit denen bei *Lampetra* cf. *zanandreai* — Raunich (1947) — stimmen überein; von beiden Arten wurde relative Lymphozytose bei Larven und relative Neutrophilie bei Erwachsenen beobachtet. Die absoluten Werte bei unserem Material aber zeigen, dass die Zahl der Neutrophilen (und Eosinophilen mit Ausnahme der Laichzeit) relativ konstant ist; Änderung der Leukozyten-Werte im Laufe der Ontogenese ist nur von den Zahlen der Lymphozyten abhängig. Zwischen Verminderung der Lymphozyten-Werte und Rückbildung der Lymphopoese in Leber und Spiralklappe bei *Lampetra planeri* in Metamorphose — Likovský (1972) — möglicherweise ist eine Korrelation. Die hohen Werte der neutrophilen Myelozyten (zu welchen von uns alle rundkernigen Zellen eingereiht wurden) sowie die Hynek's Indexe und Kernverschiebungsindexe bestätigen, dass bei *Lampetra planeri* die Pelger-Huëtsche Kernanomalie vorkommt; Segmentierungsgrad der Granulozytenkerne hat phylogenetische Bedeutung — Undritz (1943), Fey (1966).

Zahl der Koagulozyten bei Larven der *Lampetra planeri* ist deutlich höher als bei Erwachsenen, namentlich in der Laichzeit. Zwischen Männchen und Weibchen wurden keine Unterschiede festgelegt. Die Koagulozyten wurden von weiteren Autoren wahrscheinlich für Leukozyten gehalten und zusammen mit diesen gezählt.

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 196—208

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# A REVISION OF AFRICAN SPECIES OF THE NEMATODE GENUS RHABDOCHONA RAILLIET, 1916

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Received June 25, 1971

Astract: This paper deals with a revision of the representatives of the genus *Rhabdochona* parasitic in fishes of Africa. *Rhabdochona gendrei* Campana-Rouget, 1961, *R. srivastavai* Chabaud, 1970, *R. paski* Baylis, 1928, *R. congolensis* Campana-Rouget, 1961, and *R. gambiana* Gendre, 1922 are considered to be the valid species of this region; all are redescribed and illustrated. The species *R. macrolaima* Gendre, 1922 is regarded as a *species inquirenda*. In addition to new findings concerning their morphology, the hosts and geographical distribution of the valid members of the genus are reviewed. The species *R. congolensis* is recorded from a new host. The paper is supplemented by a key for the identification of species of the genus parasitic in African fishes.

This paper, dealing with the African species, is another in the series concerned with the revision of the genus *Rhabdochona* (see Moravec, 1972; Moravec and Arai, 1971). At present six species of this genus are known from fish hosts in Africa; however, this review indicates that only five of them may be regarded as valid. Moreover the two species, *R. paski* and *R. congolensis*, are very similar and subsequent detailed studies might prove their conspecificity. The purpose of the author's present paper is to verify the original descriptions of the individual species and to complete and correct errors and inaccuracies. The author believes that such a revision may enable a more reliable species indentification and may help to form a basis for future work on the biology and zoogeography of these interesting nematodes. A key has been constructed to facilitate the determination of the individual species.

## MATERIALS

The specimens used to this study were borrowed from the collections of: Musée Royal de l'Afrique Centrale, Tervuren, Belgium; Museum National d'Histoire Naturelle, Paris, France; British Museum (Natural History), London, Great Britain; and Laboratoire de Parasitologie, Faculté de Médecine et de Pharmacie, Dijon, France. The methods used for the examination of the specimens have been described in an earlier paper (Moravec, 1972).

## SURVEY OF SPECIES

### 1. *Rhabdochona (Rhabdochona) gendrei* Campana-Rouget, 1961

Fig. 1

The following description is based on specimens from the host *Barbus duchesnii* from the Congo (Lake Kivu).

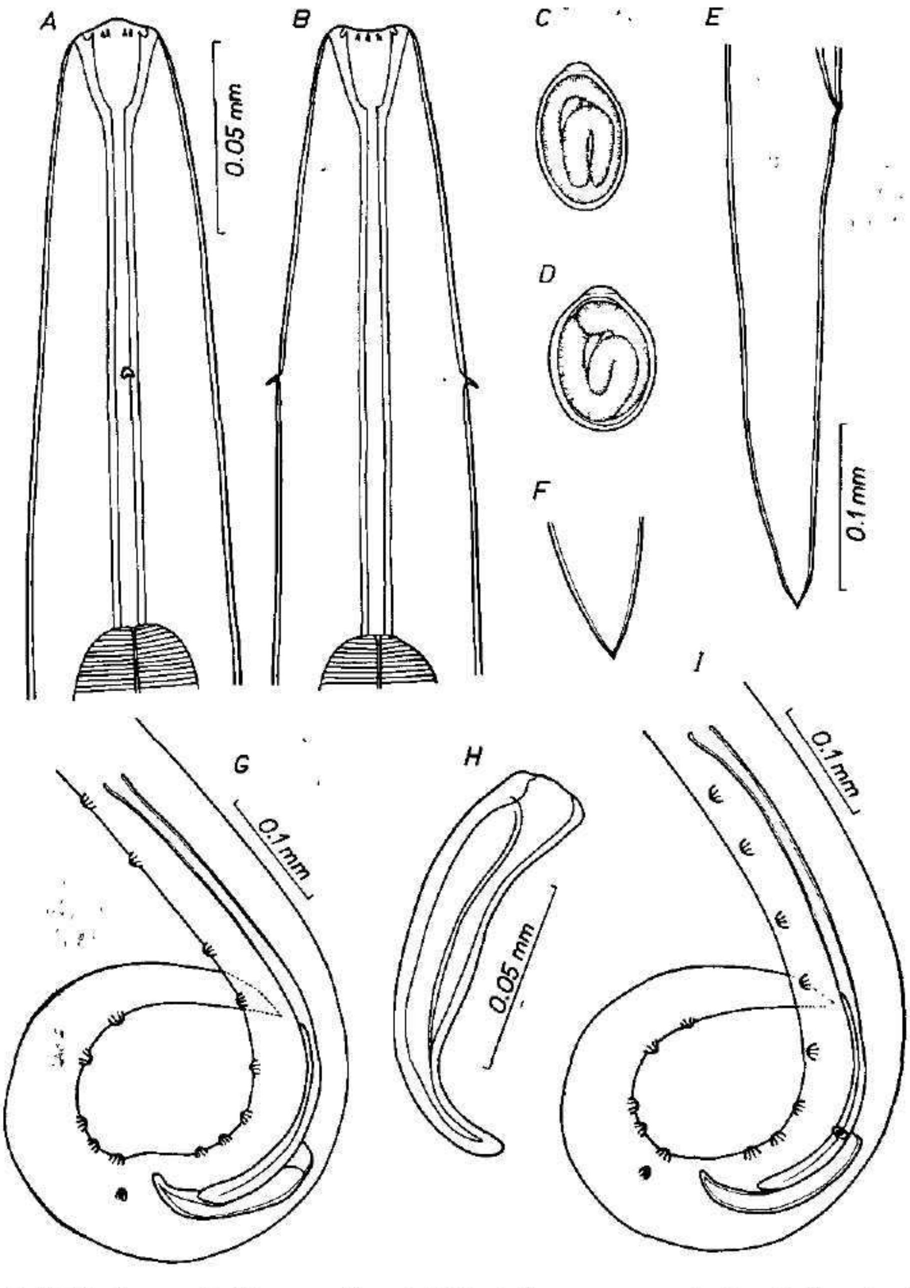


Fig. 1. *Rhabdochona gendrei* Campana-Rouget, **1961. A, B** — anterior end of female (lateral **and** dorsal view); C, D — egg; E — tail of fem**ale; F — female's** tail tip; G, I — posterior end of **male;** H — smaller spicule. Orig.

Male (2 specimens): Body 8.36—9.10 mm long with a maximum width of 0.122—0.136 mm. Prostom funnel-shaped, with basal teeth slightly developed, 0.021—0.024 mm long with a maximum width of 0.018 mm. Prostom lined internally with longitudinal ribs forming small, forwardly directed teeth at their anterior ends; their exact number could not be established. (According to Gendre (1922) and Campana-Rouget (1961) there are 14 teeth). Vestibule including prostom 0.147—0.153 mm long. Length of muscular oesophagus 0.270—0.300 mm, of glandular oesophagus 2.68—2.72 mm. Deirids medium sized, bifurcate, situated 0.078 mm from the anterior extremity. Nerve ring encircling muscular oesophagus 0.204—0.213 mm from the anterior end of the body; excretory pore lying at a distance of 0.276 mm from the anterior. Eight pairs of subventral and one pair of lateral preanal papillae present; the latter pair located approximately at the level of the third subventral pair (counted from the cloaca). Six pairs of postanal papillae present with the second pair lateral and the remaining pairs subventral. Larger spicule 0.480—0.498 mm long, with an indistinct distal tip. Small spicule (length 0.140—0,150 mm) tapering at its distal end, without the usual terminal barb. Length ratio of spicules 1 : 3.21—3.55. Tail conical, 0.393 to 0.429 mm long, with cuticular spike at tip.

Female (2 specimens): Body 10.35—10.96 mm long with a maximum width of 0.136—0.163 mm. Prostom 0.024 mm long and 0.018 mm wide, with distinct basal teeth. Length of vestibule including prostom 0.153 — 0.159 mm, of muscular oesophagus 0.345—0.360 mm, of glandular oesophagus 3.10 to 3.26 mm. Nerve ring 0.225 mm, excretory pore 0.312—0.315 mm, and deirids 0.090—0.093 mm from anterior extremity. Vulva slightly postequatorial, 4.43—5.03 mm from posterior extremity. Eggs oval, relatively wide; one pole of the egg provided with a distinct protuberance (operculum?). Size of mature eggs (containing larvae) 0.036—0.039 × 0.024—0.027 mm. Tail conical, 0.270—0.303 mm long, with a distinct cuticular spike at the end.
Location: intestine.

Hosts: *Barbus duchesnii*, *B. bynni*, *Barbus* sp. *(Cyprinidae)*. Campana-Rouget (1961) also listed *Barbus altinalis* (see p. 51), although the other species, *Rhabdochona congolensis*, is reported from this host on page 31 in the same paper. It seems probable that *R. gendrei* is a specific parasite of some members of the genus *Barbus*.

Distribution: Gendre (1922) found this species in Gambia, while Campana-Rouget (1961) recorded it from the Congo (Lakes Albert, Édouard and (?) Kivu).

Specimen: Prof. Campana-Rouget's collection, Laboratoire de Parasitologie, Faculté de Médecine et de Pharmacie, Dijon, France.

Comments: Gendre (1922) was the first to find these nematodes. He gave a description and drawings but he assigned them to the species *R. acuminata* (Molin, 1860). Recently Campana-Rouget (1961) found that the nematodes under consideration represented a new species and consequently she named it *R. gendrei**). In the specimens examined, contrary to the original description, I found basal teeth in the prostom, fewer preanal papillae in the male, and somewhat smaller spicules.

*) Campana-Rouget (1961) gave an incorrect designation "nom. nov." instead of "sp. nov."; the designation "nom. nov". should be used only when it applies to a new name for a homonym.

## 2. *Rhabdochona (Rhabdochona) srivastavai* Chabaud, 1970

Fig. 2

The following description is based on type specimens from the host *Sicyopterus fasciatus* from Madagascar.

Male (1 specimen): Body 7.62 mm long, with a maximum width of 0.150 mm. Prostom funnel-shaped (0.018 mm long, 0.015 mm wide), with basal teeth. Length of vestibule including prostom 0.102 mm, of muscular oesophagus 0.216 mm, of glandular oesophagus 1.29 mm. Deirids bifurcate, well developed, situated slightly anterior to the middle of the vestibule (0.039 mm from the anterior extremity). Nerve ring encircling muscular oesophagus 0.150 mm

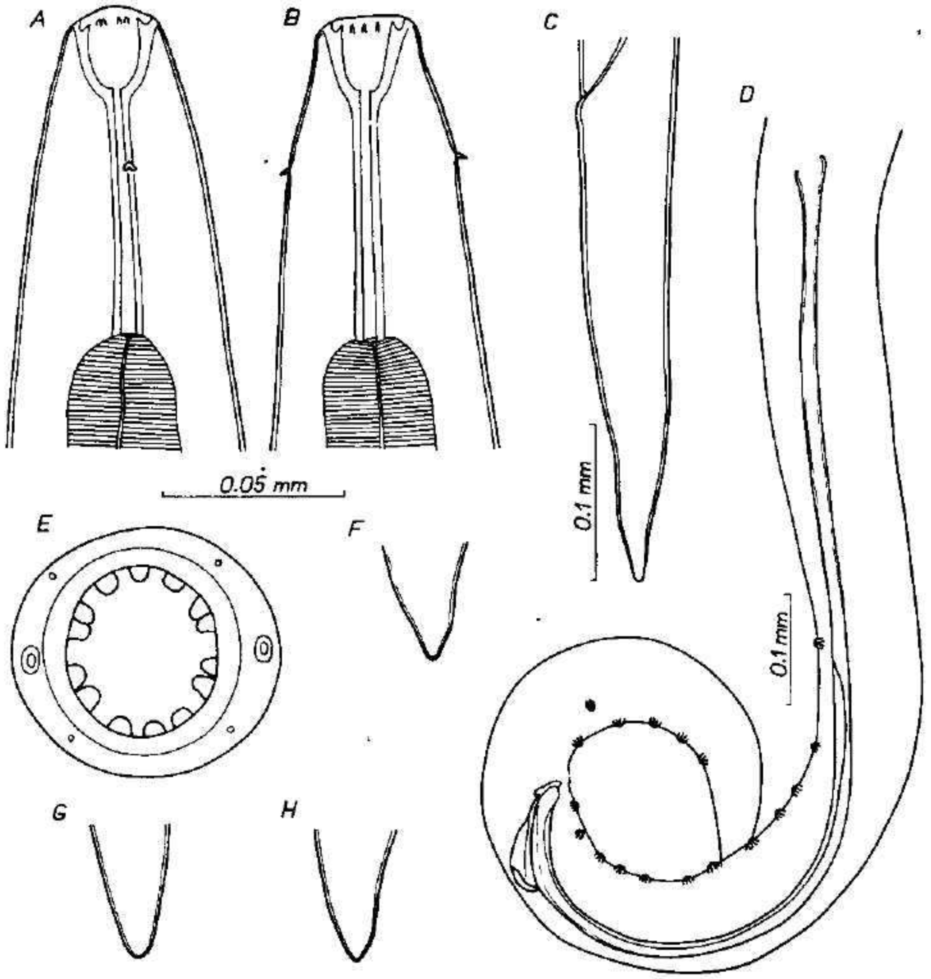


Fig. 2. *Rhabdochona srivastavai* Chabaud, 1970. A, B — anterior end of female (lateral and dorsal view); C — tail of female; D — posterior end of male; E — anterior end of female (apical view); F — male's tail tip; G, H — female's tail tips. Orig.

from the anterior end of body; excretory pore lying at a distance of 0 225 m from the anterior. Subventral preanal papillae asymmetrical (12 papil on one side and 13 papillae on the other), lateral preanal papillae not o served. Six pairs of postanal papillae present with the second pair late and the remaining pairs subventral. Larger spicule very long (0.999 mm with distal tip appearing to be provided with a cuticular membrane. Smal spicule 0.126 mm long, with a dorsally reflected barb at distal end. Leng ratio of spicules 1 : 7.93. Tail conical, 0.360 mm long, without a termi cuticular spike.

Female (2 specimens): The body of the females contained not fully mat eggs. Length 8.98—10.89 mm with a maximum width of 0.204—0.258 mm Prostom 0.024 mm long with a maximum width of 0.018 mm, provided wi distinct basal teeth. Prostom lined internally with 14 longitudinal rib forming small, forwardly directed teeth at their anterior ends; lateral tee arranged in pairs. Length of vestibule including prostom 0.096—0.099 m of muscular oesophagus 0.252—0 255 mm, of glandular oesophagus 1.50 t 1.57 mm. Nerve ring 0.165—0.168 mm, excretory pore 0.246 mm, and bifu cate deirids 0.042 to 0.054 mm from anterior extremity. Vulva situated ne the middle of the body, 4.08—5.32 mm from the posterior end. Uteri co tained only immature eggs. Tail conical, 0.312—0.318 mm long, witho cuticular spike at the tip.

Location: not given.

Host: Only in *Sicyopterus fasciatus* (Gobiidae).

Distribution: Hitherto recorded only from Madagascar (Beforara).

Specimen: Museum National d'Histoire Naturelle, Paris, France.

Comments: The description of the species given by Chabaud (1970) relatively good. I found the only difference was the number of teeth in th prostom. While Chabaud recorded 12 teeth, mentioning that one med tooth was duplicated, I observed 14 teeth as in the majority of species of th genus.

As the mature eggs of *R. srivastavai* have not been observed, the appurt nance of this species to the subgenus *Rhabdochona* is only provision Chabaud (1970) illustrated only the immature egg (without a larva d veloped inside).

### 3. *Rhabdochona (Rhabdochona) paski* Baylis, 1928

Fig. 3

The following description is based on paratype specimens collected fro „Tanganyika salmon", Lake Tanganyika.

Male (2 specimens): Body 21.76—22.41 mm long with a maximum widt of 0.286—0.354 mm. Prostom funnel-shaped, with the basal teeth distinctl developed; its length 0.042—0.045 mm and maximum width 0 027 mm Prostom lined internally with longitudinal ribs, forming forwardly directe teeth at their anterior end. The number of teeth could not be determined Baylis (1928) recorded 8 teeth. Length of vestibule including prosto 0.165—0.204 mm, of muscular oesophagus 0.450—0.525 mm, of glandula oesophagus 2.52—2.95 mm. Deirids large, simple, situated 0.123 mm fro the anterior extremity. Nerve ring located at 0.204—0.255 mm and excretor pore 0 345 mm from the anterior end. Preanal papillae variable in number —

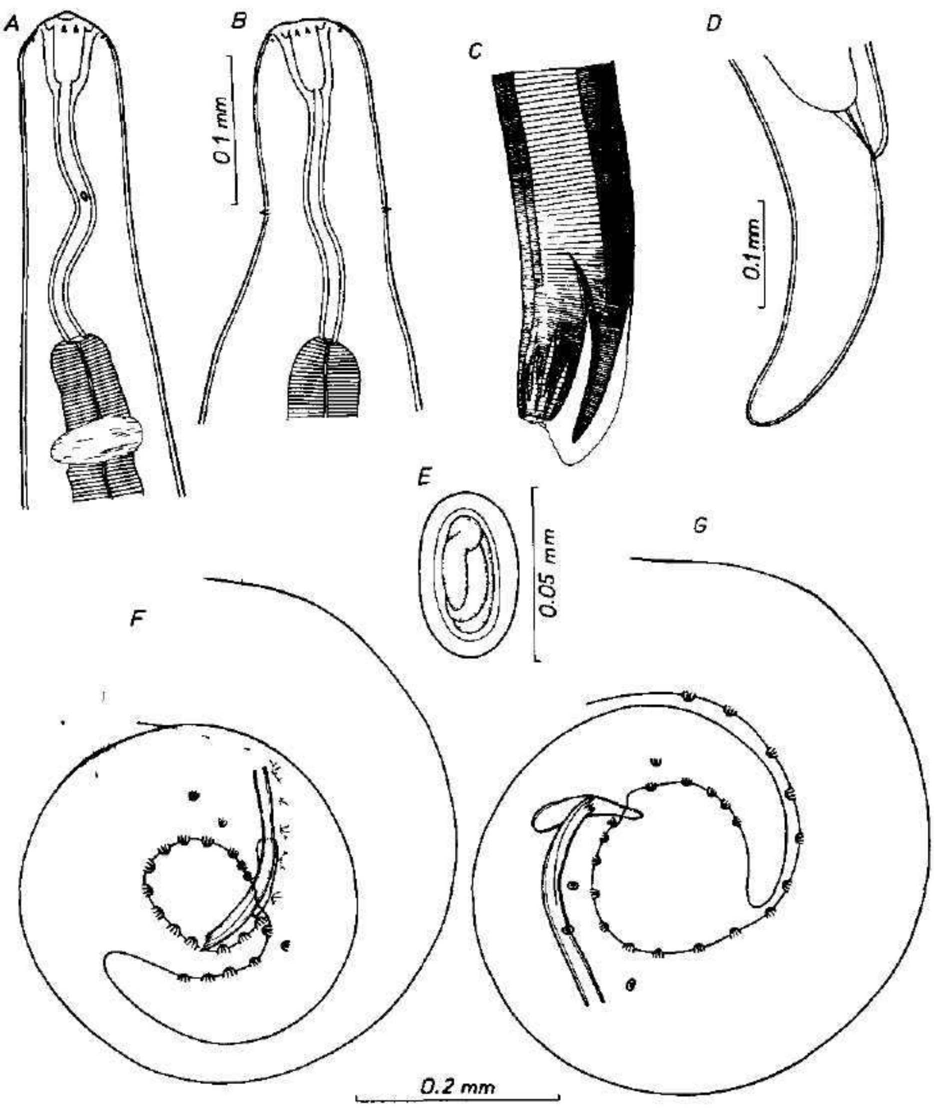


Fig. 3. *Rhabdochona paski* Baylis, 1928. A, B — anterior end of female (lateral and dorsal view); C — distal tip of larger spicule (lateral view); D — tail of female; E — egg; F, G — posterior end of male. Orig.

in one male 16 pairs of subventral and 3 pairs of lateral papillae were found, in the second 19 pairs of subventral and 2 pairs of lateral papillae were present. Six pairs of postanal papillae present with second pair lateral and remaining pairs subventral. Larger spicule 0.282—0.300 mm long, its distal tip appears to consist of several irregular prongs provided with a slight cuticular membrane. Smaller spicule simple, 108—0.140 mm long. Length ratio from the anterior end of body; excretory pore lying at a distance of 0 225 mm from the anterior. Subventral preanal papillae asymmetrical (12 papillae on one side and 13 papillae on the other), lateral preanal papillae not observed. Six pairs of postanal papillae present with the second pair lateral and the remaining pairs subventral. Larger spicule very long (0.999 mm), with distal tip appearing to be provided with a cuticular membrane. Smaller spicule 0 126 mm long, with a dorsally reflected barb at distal end. Length ratio of spicules 1 : 7.93. Tail conical, 0 360 mm long, without a terminal cuticular spike.

Female (2 specimens): The body of the females contained not fully mature eggs. Length 8.98—10.89 mm with a maximum width of 0.204—0.258 mm. Prostom 0.024 mm long with a maximum width of 0.018 mm, provided with distinct basal teeth. Prostom lined internally with 14 longitudinal ribs, forming small, forwardly directed teeth at their anterior ends; lateral teeth arranged in pairs. Length of vestibule including prostom 0.096—0.099 mm, of muscular oesophagus 0.252—0 255 mm, of glandular oesophagus 1.50 to 1.57 mm. Nerve ring 0.165—0.168 mm, excretory pore 0.246 mm, and bifurcate deirids 0.042 to 0.054 mm from anterior extremity. Vulva situated near the middle of the body, 4.08—5.32 mm from the posterior end. Uteri contained only immature eggs. Tail conical, 0.312—0.318 mm long, without cuticular spike at the tip.

Location: not given.

Host: Only in *Sicyopterus fasciatus* (Gobiidae).

Distribution: Hitherto recorded only from Madagascar (Beforara).

Specimen: Museum National d'Histoire Naturelle, Paris, France.

Comments: The description of the species given by Chabaud (1970) is relatively good. I found the only difference was the number of teeth in the prostom. While Chabaud recorded 12 teeth, mentioning that one medial tooth was duplicated, I observed 14 teeth as in the majority of species of this genus.

As the mature eggs of *R. srivastavai* have not been observed, the appurtenance of this species to the subgenus *Rhabdochona* is only provisional. Chabaud (1970) illustrated only the immature egg (without a larva developed inside).

### 3. *Rhabdochona (Rhabdochona) paski* Baylis, 1928

Fig. 3

The following description is based on paratype specimens collected from „Tanganyika salmon", Lake Tanganyika.

Male (2 specimens): Body 21.76—22.41 mm long with a maximum width of 0.286—0.354 mm. Prostom funnel-shaped, with the basal teeth distinctly developed; its length 0.042—0.045 mm and maximum width 0 027 mm. Prostom lined internally with longitudinal ribs, forming forwardly directed teeth at their anterior end. The number of teeth could not be determined; Baylis (1928) recorded 8 teeth. Length of vestibule including prostom 0.165—0.204 mm, of muscular oesophagus 0.450—0.525 mm, of glandular oesophagus 2.52—2.95 mm. Deirids large, simple, situated 0.123 mm from the anterior extremity. Nerve ring located at 0.204—0.255 mm and excretory pore 0.345 mm from the anterior end. Preanal papillae variable in number —

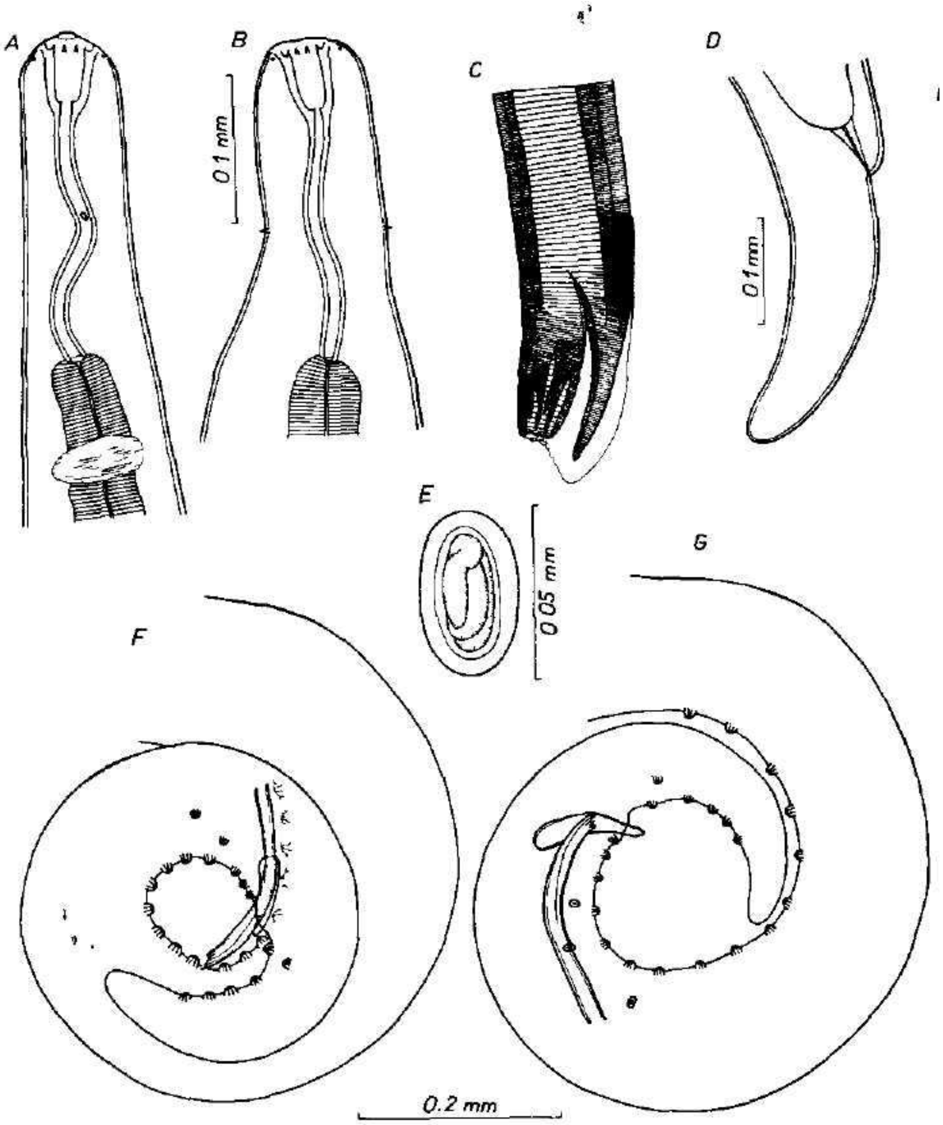


Fig. 3. *Rhabdochona paski* Baylis, 1928. A, B — anterior end of female (lateral and dorsal view); C — distal tip of larger spicule (lateral view); D — tail of female; E — egg; F, G — posterior end of male. Orig.

in one male 16 pairs of subventral and 3 pairs of lateral papillae were found, in the second 19 pairs of subventral and 2 pairs of lateral papillae were present. Six pairs of postanal papillae present with second pair lateral and remaining pairs subventral. Larger spicule 0.282—0.300 mm long, its distal tip appears to consist of several irregular prongs provided with a slight cuticular membrane. Smaller spicule simple, 108—0.140 mm long. Length ratio

of spicules 1 : 2.14—2.61. Tail (0.405—0.411 mm long) tapering posteriorly, with a rounded end.
Female (3 specimens): Body of females containing mature eggs 29.38 to 35.39 mm long with a maximum width of 0.408—0.422 mm. Length of prostom 0.045—0.048 mm, maximum width 0.027—0.033 mm. Vestibule including prostom measuring 0.198—0.237 mm, muscular oesophagus 0.468 to 0.600 mm, glandular oesophagus 4.35—4.90 mm. Distance of nerve ring from anterior extremity 0.276—0.300 mm, of excretory pore 0.345—0.375 mm, of deirids 0.126—0.153 mm. Vulva postequatorial, 13.36—17.14 mm from the posterior end of the body. The eggs were observed only within the cleared body of the nematodes — the mature eggs seemed to be smooth, without filaments or floats. Eggs thick-walled, size 0.042—0.048 × 0.027 to 0.030 mm. Tail (0.294—0.354 mm long) tapering posteriorly; rounded end without any processes.
Location: intestine and pyloric appendages.
Hosts: The type host "Tanganyika salmon" (probably *Alestes macrophthalmus-Characidae*); also in a "siluroid fish" and a "smal fish".
Distribution: Hitherto recorded only by Baylis (1928) in fishes from Lake Tanganyika.
Specimen: British Museum (Natural History), London, Great Britain.

### 4. *Rhabdochona (Rhabdochona) congolensis* Campana-Rouget, 1961

Fig. 4

I examined 3 specimens from the host *Chrysichthys nigrodigitatus* from Cameroon kindly lent by Dr. F. A. Puylaert.
Male (1 specimen): Body 12.24 mm long with a maximum width of 0.163 mm. Prostom large, funnel-shaped, with distinct basal teeth; its length 0.036 mm, maximum width 0.030 mm. Length of vestibule including prostom 0.180 mm, of muscular oesophagus 0.456 mm, of glandular oesophagus 2.90 mm. Deirids conspicuously large, simple (not bifurcate), approximately opposite to the midportion of the vestibule (0.096 mm from anterior extremity). Nerve ring encircling muscular oesophagus 0.216 mm from anterior end of body, excretory pore at a distance of 0.342 mm from the anterior. Subventral preanal papillae asymmetrical (14 papillae on one side and 13 papillae on the other); in addition to subventral papillae two pairs of lateral preanal papillae are present. Six pairs of postanal papillae are present with the second pair lateral and the remaining pairs subventral; the last pair is located more laterally, and is smaller than the other pairs. Large spicule 0.207 mm long with distal tip appearing cone-shaped in lateral view; in ventral view it seems to be divided into several prongs surrounded by a cuticular membrane. Short spicule simple, 0.087 mm long, without a dorsal barb. Length ratio of the spicules 1 : 2.37. Tail (0.237 mm long) tapering posteriorly, with a rounded end.
Female (2 specimens): Body of females (without eggs) 7.15—8.90 mm long with a maximum width of 0.122—0.177 mm. Length of prostom 0.033 to 0.036 mm, its maximum width 0.021—0.024 mm. Prostom lined internally with 8 longitudinal ribs, forming large, forwardly directed teeth at each end. Length of vestibule including prostom 0.129—0.168 mm, of muscular oesophagus 0.369—0.456 mm, of glandular oesophagus 2.18—3.06 mm. Distance

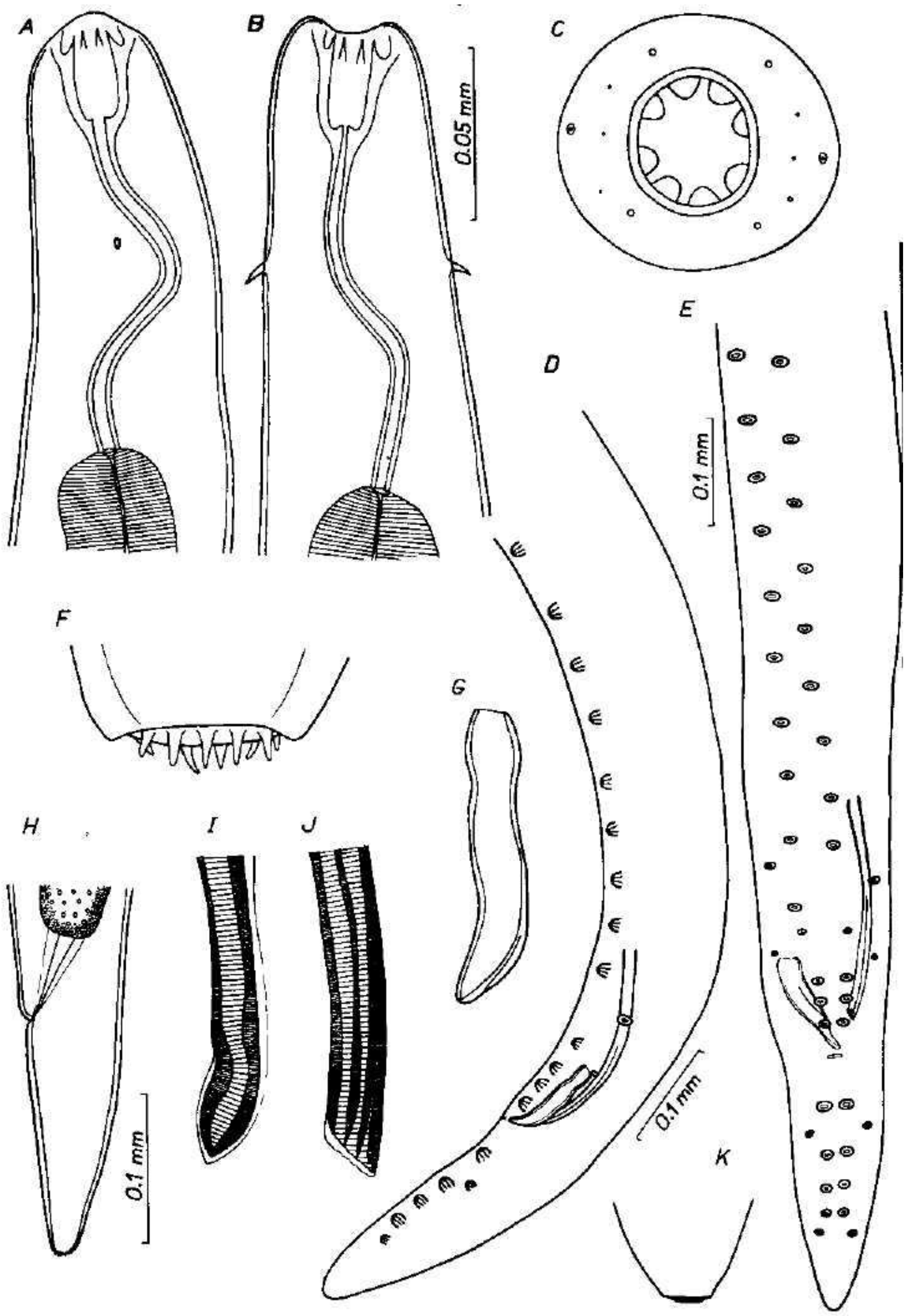


Fig. 4 *Rhabdochona congolensis* Campana-Rouget, 1961. A, B — anterior end of female (lateral and dorsal view); C — anterior end of female (apical view); D, E — posterior end of male (lateral and ventral view): F — female's tail tip; G — smaller spicule (lateral view); H — tail of female; I, J — distal tip of larger spicule (lateral and ventral view); K — male's tail tip. Orig.

of the nerve ring from anterior extremity 0.174—0.243 mm, of excretory pore 0.240 mm, of large deirids 0.069—0.084 mm. Vulva postequatorial, 2.38—3.47 mm from the posterior end of the body. Eggs were not present; according to Rasheed (1965) the egg is without filaments or floats. Tail 0.159—0.180 mm long, with truncate tip provided with about ten finger-shaped processes 0.003 mm long.

Location: not given; the specimens from *Ch. nigrodigitatus* were found in the stomach, this suggesting an atypical host.

Hosts: This species has been reported by Campana-Rouget (1961) from a variety of fish hosts belonging to the families Polypteridae, Characidae, Cyprinidae, Bagridae, Clariidae, Schilbeidae, Mochocidae and Cichlidae. Rasheed (1965) based her redescription of the species on nematodes from *Haplochromis wingati* (fam. Cichlidae).

Distribution: Hitherto recorded only by Campana-Rouget (1961) from the Congo (Lakes Albert, Édouard and Kivu) and by Rasheed (1965) from the Albert Nile; the specimens examined by me originated from Cameroon (Elang). In addition I was informed by Dr. S. Prudhoe that the collection of the British Museum (Natural History) contained several specimens of this species collected from *Haplochromis* sp. in Uganda.

Specimen: Musée Royal de l'Afrique Centrale, Tervuren, Belgium, No. 33.715.

Comments: In many important features *R. congolensis* seems to be very similar to the species *R. paski* and subsequent studies might prove that *R. congolensis* only represents younger specimens of *R. paski*. Regardless of metrical differences the two species should be also differentiated by the number of preanal papillae in the male, by the shape of the distal tip of the larger spicule, and by the presence or absence of finger-shaped processes on the tail tip of the female. However, as is obvious from Table 1 and drawings, the only difference which may be taken into account is the presence or absence of finger-shaped processes at the tail tip of the female. The number of preanal papillae may be considerably variable within the same species of the genus (polymorphism ?). Also the metrical differences and the differences in the shape of the tip of the larger spicule might be explained by age or host

Table 1. Comparison of some features of *Rhabdochona conglensis* and *R. paski*

| | *R. congolensis* | | | *R. paski* | |
|---|---|---|---|---|---|
| | after Campana-Rouget 1961 | after Rasheed 1965 | own data | own data | after Baylis 1928 |
| Length of male | 5—8 | 4.5—6.5 | 12.24 | 21.8—22.4 | 15—20 |
| Length of female | 9.5—18 | 6.6—6.8 | 7.2—8.9 | 29.4—35.4 | 18—35 |
| No. of subventral preanal papillae | 11—12 pairs | 14 pairs | 14 + 13 | 16—19 pairs | 17—18 pairs |
| No. of lateral preanal papillae | 2 pairs | 2 pairs | 2 pairs | 2—3 pairs | 3—4 pairs |
| Length of larger spicule | 0.140 | 0.150—0.170 | 0.207 | 0.282—0.300 | 0.250—0.260 |
| Length of smaller spicule | 0.062 | 0.065—0.068 | 0.087 | 0.108—0.140 | 0.120—0.140 |
| Finger-shaped processes on female's tail tip | present | present | present | absent | absent |

variability. However, until this problem is satisfactorily solved, I consider that both species are independent.

Campana-Rouget (1961) gave a list of the hosts of *R. congolensis*, including a total of 19 fish species belonging to 8 families. This fact seems very remarkable, as the majority of members of the genus *Rhabdochona* exhibit higher degrees of specificity and their hosts largely belong to the same family (see Moravec, 1972). Consequently it may be supposed that in some of the named hosts only accidental or secondary infections were recorded. Campana-Rouget (1961) did not designate the type host; on page 31 the author only gives the measurements of two specimens of *R. congolensis* from *Barbus altinalis*, however, in the list on page 51 the other species, *R. gendrei*, is reported from this host.

### 5. *Rhabdochona (Globochona) gambiana* Gendre, 1922

Fig. 5

Syn.: *Cystidicola minuta* Rodhain et Vuylsteke, 1934

The following description is based on specimens described as "*Cystidicola minuta*" from the host *Barbus eutaenia* from the Congo.

Male (1 specimen): Body 3.81 mm long with a maximum width of 0.095 mm. Prostom small, funnel-shaped, without distinct basal teeth; its length 0.015 mm, width 0.012 mm. Prostom lined internally with longitudinal thickenings forming small, forwardly directed teeth at their anterior ends; their number could not be established. According to Gendre (1922) and Campana-Rouget (1961) there are 12 teeth. Length of vestibule including prostom 0.078 mm, of muscular oesophagus 0.135 mm, of glandular oesophagus 1.14 mm. Deirids very small, simple (not bifurcate), lying slightly in front of the anterior margin of the muscular oesophagus (0.060 mm from the anterior extremity). Nerve ring encircling muscular oesophagus 0.114 mm from anterior end of body; excretory pore not located. Of the 10 pairs of preanal papillae, two pairs are lateral and the remaining pairs subventral; first lateral pair situated slightly anterior to the first subventral pair (counted from the cloaca), second lateral pair approximately at the level of second subventral pair. Five pairs of larger postanal papillae present with second pair lateral and the remaining pairs subventral. An additional pair of minute lateral papillae seem to be present behind the last subventral postanal pair. Larger spicule 0.345 mm long, with only a slightly distended distal tip, ending in a transparent membrane. Smaller spicule simple, 0.075 mm long. Length ratio of spicules 1 : 4.57. Tail conical, 0.132 mm long, with a rounded tip.

Female (1 specimen): Body of female containing only immature eggs 5.24 mm long with a maximum width of 0.136 mm. Prostom 0.015 mm long and 0.012 mm wide. Length of vestibule including prostom 0.060 mm, of muscular oesophagus 0.159 mm, of glandular oesophagus 1.97 mm. Nerve ring 0.117 mm from the anterior end of the body; excretory pore not located. Deirids very small, simple, lying approximately at the level of the anterior margin of the muscular oesophagus (0.048 mm from the anterior extremity). Vulva postequatorial, 1.82 mm from the posterior end of the body. Size of the immature eggs $0.021-0.027 \times 0.012-0.015$ mm. Gendre (1922), Rodhain and Vuylsteke (1934) and Campana-Rouget (1961) record that the eggs

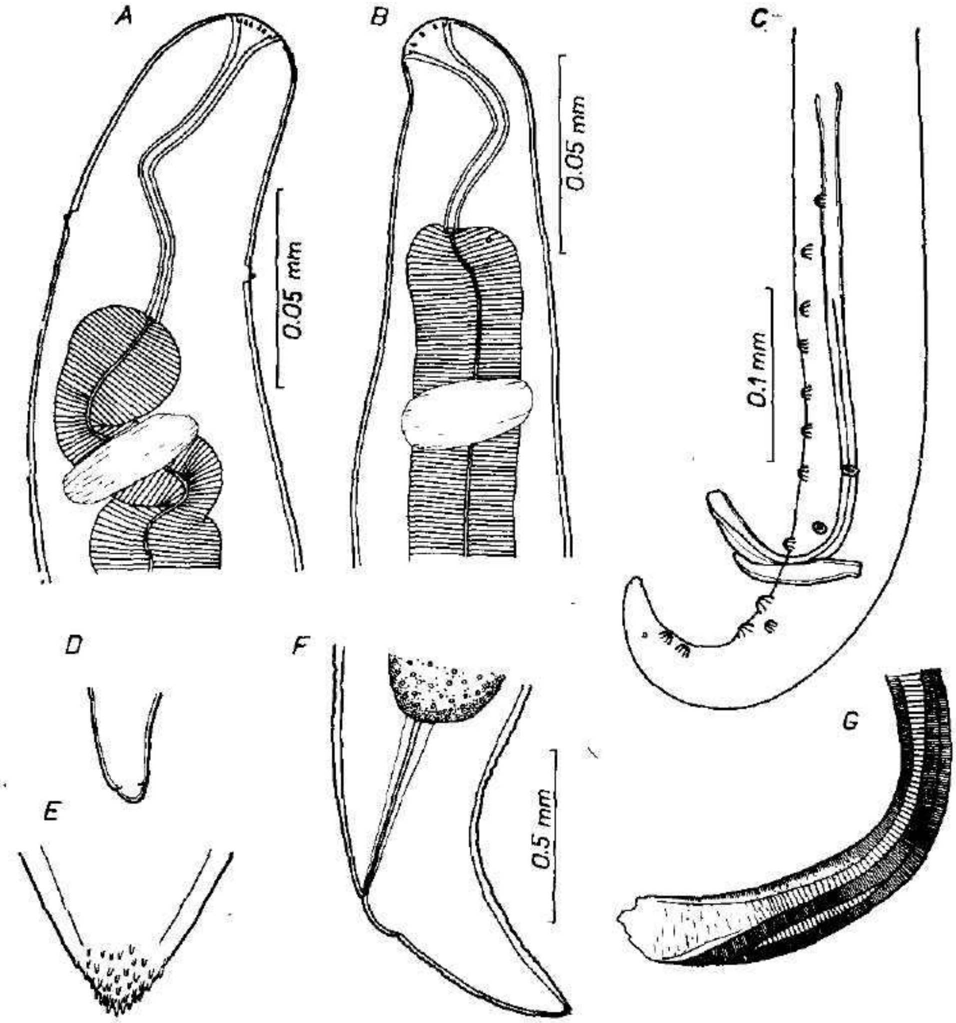


Fig. 5. *Rhabdochona gambiana* Gendre, 1922. A — anterior end of male (dorsal view); B — anterior end of female (lateral view); C — posterior end of male; D — male's tail tip; E — female's tail tip; F — tail of female; G — distal tip of larger spicule. Orig.

are provided with four lateral, hemispheric floats. Tail very short (0.084 mm), cone-shaped, with a rounded tip. Under higher magnification numerous minute points are seen to cover the tail tip.

Location: intenstine; Rodhain and Vuylsteke (1934) record specimens from the oesophagus.

Hosts: Members of the family Cyprinidae. Gendre (1922) described *R. gambiana* as nematodes of an unidentified fish. Rodhain and Vuylsteke (1964) reported *Barbus eutaenia* to be the host, while Campana-Rouget (1961) recorded it from *Barilius moori*. It may be assumed that this species is typically a parasite of fishes of the genus *Barilius*.

Distribution: Hitherto recorded only from the River Gambia, Gambia (Gendre, 1922), from the River Kalemie near Elizabethville, the Congo (Rodhain and Vuylsteke, 1934) and from Lake Kivu, the Congo (Campana-Rouget, 1961).
Specimen: Musée Royal de l'Afrique Centrale, Tervuren, Belgium, No. 17268—17269.
Comments: According to information given me by Prof. Chabaud and Prof. Campana-Rouget, Gendre's type specimens are not preserved. However, detailed original description of *R. gambiana* enables me to state that the nematodes described as *Cystidicola minuta* are conspecific with Gendre's specimens. At the same time I agree fully with Campana-Rouget (1961) who synonymised both species. The appurtenance of the nematodes "*Cystidicola minuta*" to the genus *Rhabdochona* has been also shown by Ko and Anderson (1969).

The presence of minute points on the tail tip of the female in the specimens I examined is a remarkable feature, showing affinities of this species to the Asiatic species *R. barusi*, *R. chodukini*, *R. coronocauda*, and *R. sarana*.

### 6. *Rhabdochona macrolaima* Gendre, 1922

This species was described by Gendre (1922) on the basis of one young female recovered from the intestine of an unidentified fish in Gambia. Prof. Chabaud and Prof. Campana-Rouget kindly informed me that Gendre's type specimen had been lost. The morphology and measurements of this species suggest its resemblance to *R. paski* and *R. congolensis*. But Gendre's drawings indicate that the prostom of *R. macrolaima* should be without basal teeth. These details might, however, have been overlooked by the author, as well as the presence of processes on the female's tail tip. For these reasons I suggest the consideration of *R. macrolaima* Gendre, 1922 as a *species inquirenda*.

#### Key to the African species of Rhabdochona

1 Mature eggs (containing larvae) provided with four lateral, hemispheric floats; male with 4 pairs of subventral postanal papillae . . . . . . . . . . . . . . . . . . . *R. gambiana*
— Mature eggs without floats; males with 5 pairs of subventral postanal papillae . . . . . 2
2 (1) Prostom with 8 teeth; deirids large, not bifurcate; larger spicule at most 0.3 mm long . . 3
— Prostom with 14 teeth; deirids of medium size, bifurcate; larger spicule longer than 0.4 mm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4
3 (2) Tail tip of female provided with about ten small, finger-shaped processes; body of male 4.5—12.3 mm long, that of female 6.6—18 mm; larger spicule 0.14—0.21 mm long . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *R. congolensis*
— Tail tip of female rounded, smooth, without any processes; length of male 15—22 mm, of female 28—35 mm; longer spicule 0.25—0.30 mm long . . . . . . . . . . . . *R. paski*
4 (2) Larger spicule longer than 0.9 mm, length ration of spicules 1 : 7.5—7.9; distal end of smaller spicule provided with a dorsal barb; tail tip of female without a terminal cuticular spike . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *R. srivastavai*
— Larger spicule shorter than 0.6 mm, length ratio of spicules 1 : 3.21—3.55; distal end of smaller spicule without a dorsal barb; tail tip of female ending in a sharp cuticular point . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . *R. gendrei*

#### Acknowledgments

I express my appreciation to the following who sent me specimens and thus made the present work possible: Dr. A. J. Petter and Prof. A. G. Chabaud, Museum National d'Histoire Naturelle, Paris, Prof. Y. Campana-Rouget, Laboratoire de Parasitologie, Faculté de Médecine et de Pharmacie, Dijon, France; Dr. F. A. Puylaert, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, and Dr. S. Prudhoe, British Museum (Natural History), London. For correcting the English translation of the manuscript thanks are due to my friend, Dr. Anita D. Thomas-Jeacock, Department of Zoology, University of Liverpool.

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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 209—213

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# ON THE SYSTEMATICS OF THE STERLET, ACIPENSER RUTHENUS LINNAEUS, 1758 (OSTEICHTHYES: ACIPENSERIDAE)

OTA OLIVA & KARTHIGESU CHITRAVADIVELU

Received on November 11, 1971

**Abstract**: Sixteen specimens of the sterlet from the Czechoslovak section of the river Danube were studied with regard to their morphometric (14) and meristic (6) characters. Results have been compared with the literary data. There are no differences between various European populations. Regarding the slight sexual dimorphism normally shown chiefly in the paired fin lengths of both sexes, it is interesting that the pectoral fins are somewhat shorter in males than in females.

## INTRODUCTION

With the exception of the data obtained by Vladykov (1931) who examined the sterlet ftom the Carpathian Ukraine (lower parts of riwers Tizsa, Borjava, Latorica and Ouge), we have no information concerning the systematic position of sterlets of the Czechoslovak part of the river Danube, where also this species occurs (See Oliva-Hrabě-Lác, 1968).

## MATERIALS AND METHODS

We have received a sample of 16 sterlets collected in the river Danube near the town Komárno, in 1951, through the kind courtesy of the Asst. Prof. Ing. Dr. František Volf, Fisheries Research Institute, Prague. The fish were preserved in 4% formalin and then transferred into 80% alcohol.

The scheme of measurements used was according to Pravdin (1931) Vladykov (1931) and partially that of Vladykov-Beaulieu (1946). The measurements were taken according to the following scheme:

The total length (absolute length), TL is measured from the tip of the snout to the vertical from the upper half of the caudal fin. With this length are compared all other lengths except those of the head (e.g. length of snout, eye diameter etc.) which are compared with the head length.

The length of caudal peduncle, Cl — the distance from the base of the last anal fin ray to the anterior margin of the caudal fin rays.

The maximum body depth (height), BH — the distance in the projection of the greatest body depth between the scutes.

The minimum body depth, MH is measured in the most narrow part of the body, generally at the begining of the caudal fin.

The head length, Tp — the distance from the tip of the snout to the posterior margin of the gill cover, following the central line of the head.

The postorbital distance (length), op — the distance from the posterior margin of the eye to the posterior margin of the gill cover.

Eye diameter, do — the longitudinal eye diameter, "the length of eye".

*The length of the snout, Td — the distance from the tip of the snout to the anterior eye margin.*

Dorsal fin length, Dl — the length of the dorsal fin base.

Dorsal fin depth, DDe — the maximum height of dorsal fin, the length of its longest ray.

Anal fin length, Al — the length of anal fin base.

Anal fin depth, Aa — the maximum height (depth) of the anal fin, the length of the longest ray.
Pectoral fin length, Pl — the length of its longest ray.
Ventral fin length, Vl — the length of its longest ray.

Furthermore, the number of all rays in the dorsal and anal fins, including the rudimentary ones were counted, with due attention to the difficulties referred to by Vladykov and Beaulieu (1946).

## DESCRIPTION

The body is cylindrical and elongated in shape, covered with 5 rows of bony scutes; the upper lobe of caudal fin with rhomboidal scales. The head is covered with closely adhering bony plates. The protractile mouth is lo-

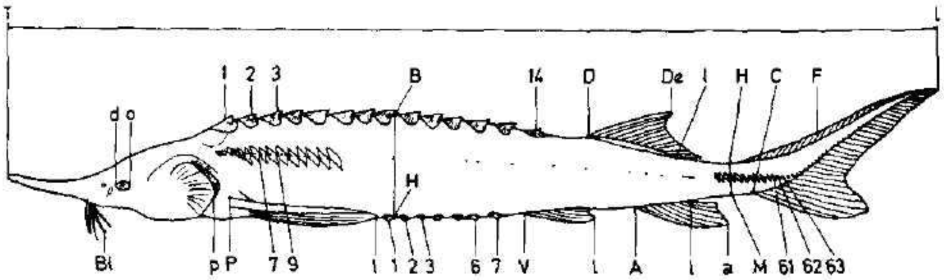


Fig. 1. Explanations to the table of measurements in *Acipenser ruthenus*. TL — total length; Cl — length of caudal peduncle; BH — maximum body depth (height); MH — minimum body depth (height); Tp — head length; op — postorbital distance; do — eye diameter; Td — length of snout; Dl — dorsal fin length; DDe — dorsal fin depth; Al — anal fin length; Aa — anal fin depth; Pl — pectoral fin length; Vl — ventral fin length; 1, 2, 3 — 14 dorsal scutes; 7, 8, 9 — 61, 62, 63 lateral scutes; 1, 2, 3 — 6, 7 ventral scutes; F — fulcral scales on the upper lobe of caudal fin; Bl — barbels.

cated on the lower side of the head and is bounded by thick lips. Branchiostegal rays as well as the interoperculum are lacking. The dorsal and anal fins are located very posteriorly. The eyes are comparatively small. The gill membranes are united to the isthmus not forming free fold. The lower lip is divided, but comparatively little. The barbels are fringed and reach to the anterior margin of the mouth. The body between scutes is covered with small crest-like grains (the scutes are not present here). Sometimes very small isolated plates, rarely occur below the dorsal scutes (Berg, 1911). We have found this in one specimen (No. 6250). The dorsal spines are with keels on the upper surface and these kells end posteriorly by spines directed caudally. The surface of the scutes are with radial lines which are not clearly granulated. The anterior scutes are higher than the posterior ones. The lateral scutes very closely adhere to one another and are prolonged in a transverse direction, somewhat obliquely, and are not less than 57 in number (Berg, 1911 cites the number as 57). Anterior to the anal fin there are always 3—5 unpaired scutes. The first spinal as well as the first ventral fulcral scales of the caudal fin are not magnified. The rostrum is triangular, prolonged, and pointed but the length is very variable, ranging from 20% to 60% of the head length (Berg, 1911). According to Berg (l.c.), there are generally three warts on the vomer, but the number of warts is variable from 0 to 6. We have found in average 3.8 (in 2 specimens 2; in 5 specimens 4; in 9 specimens 3 warts). The branchial spines (gill rakers) on the first arch ranges from 14—23 in our specimens (Berg, 1911; 15—23). There are 26—38 (32.8) fulcral scales on the upper margin of the dorsal lobe of the caudal fin.

## COMPARATIVE DATA

Only part of our data can be used in comparing with those of Berg (1911), Vladykov (1931), Šmidtov (1939), Chochlova (1955), Janković (1958) and Banarescu (1964). For example, the length of the snout is apparently longer in the material of Janković (l.c.). This character is very variable, and based on this, the short-nosed morpha *kamensis* Lovetzky, 1834 (= morpha *brevirostris* Antipa, 1909) has been recognised. According to Janković, 1958, this morpha does not exist.

It is evident from the table of measurements that our data are very similar to those of other authors who had studied the material of the Central European origin, river Kama and Yenisei. The specimens from Yenisei have apparently larger number of gill rakers and forms a separate natio *marsigli* Brandt, 1833 (for further details see Berg, 1948; p. 76). According to Chochlova (1955) this natio does not exist, but her own data show evident differences in the number of gill rakers between the sterlet populations from Yenisei, Irtysh and Angara (75 specimens from Yenisei has had 19—35 gill rakers, ave. 26.88 $\pm$ 0.54; 116 specimens from Irtysh had 17—24, ave. 20.95 $\pm$ 0.14; 113 specimens from Angara had in average 28.68 $\pm$ 0.68. ranges are not given). The specimens from Irtysh resemble the Central European ones in this character but not those from the river Angara.

## SEXUAL DIMORPHISM

Vladykov (1931) found the P length in males being 15.5—17.7% of the total length and 15.9—18.0% in females. Pectoral fin forms 44.4—58.7% of the P—V distance in males and 45.6—60.4% in females. Ventral fin forms 7.2—9.0% of the total length in males and 7.3—8.9% in females. The ventral fin also forms 53.7—59.2% (maximum 66.0%) of V—A distance in males and 50.0—60.6% (maximum 64.3%) in females. Similar results were found by us also (see the table). Janković (1958,) has not dealt with these characters.

It is interesting that the pectoral fins, generally longer in the males of Cyprinid and Cobitid fishes, are shorter in sterlet males. According to Janković (1958) and Banarescu (1964) the length of snout is somewhat longer in adult males (46.5—63.5%, ave. 56.25% of the head length), and in the adult females the average is 55.77%, but in the subadult (non ripe) males it is 57.12% compared with the 57.31% in the subadult females. It is also evident from our data that females have slightly longer head than the males and this is in conformity with the observation of Janković (1958).

## SUMMARY

The 16 sterlets (*Acipenser ruthenus* Linnaeus, 1758) from Czechoslovak part of the Danube has the following morphometric and meristic characters. Averages are given in the brackets. Total length 327—508 (428.4) mm; in % of total length: head 18—28 (21.9), body depth 5.9—9.8 (8.0), mini-

Table of morphometric and meristic

| Authority | Authors | | | | | |
|---|---|---|---|---|---|---|
| Number of specimens and sex | 8 males | | 8 females | | 16 males and females | |
| | ranges | ave. | ranges | ave. | ranges | ave. |
| Total length | 396–508 | 439.9 | 327–486 | 416.9 | 427–508 | 428.4 |
| As % of total length: | | | | | | |
| Head length | 18–24 | 21.4 | 20–28 | 22.5 | 18–28 | 21.9 |
| Body depth | 7.5– 8.8 | 8.0 | 5.9– 9.8 | 7.9 | 5.9– 9.8 | 8.0 |
| Minimum body depth | 2.3– 4.0 | 3.3 | 2.4– 4.6 | 3.4 | 2.4– 4.6 | 3.4 |
| Dorsal fin length | 9.0–12.0 | 10.5 | 11.0–14.0 | 11.9 | 9.0–14.0 | 11.2 |
| Dorsal fin depth | 5.5– 7.6 | 6.8 | 5.3–10.0 | 7.3 | 5.3–10.0 | 7.0 |
| Anal fin length | 5.5– 6.2 | 5.8 | 5.1– 8.0 | 6.1 | 5.1– 8.0 | 5.9 |
| Anal fin depth | 6.9– 8.2 | 7.5 | 7.3–11.0 | 8.3 | 6.9–11.0 | 7.9 |
| Pectoral fin length | 13.0–18.0 | 16.6 | 16.0–22.0 | 18.0 | 13.0–22.0 | 17.3 |
| Ventral fin length | 5.5– 7.2 | 7.5 | 5.8– 9.2 | 6.9 | 5.5– 9.2 | 6.8 |
| As % of head length: | | | | | | |
| Length of snout | 45–54 | 47.9 | 42–49 | 46.3 | 42–54 | 47.1 |
| Postorbital length | 38–48 | 45.1 | 43–51 | 45.5 | 38–51 | 45.3 |
| Length of anterior barbel | 17–23 | 21.0 | 21–24 | 22.4 | 17–24 | 21.7 |
| Eye diameter | 7.6– 9.4 | 8.4 | 8.3–10.0 | 9.1 | 7.6–10.0 | 8.8 |
| Number of rays in dorsal | 39–47 | 43.0 | 39–46 | 42.2 | 39–47 | 42.6 |
| Number of rays in anal | 26–30 | 27.7 | 23–39 | 28.6 | 23–39 | 28.2 |
| Number of dorsal scutes | 13–15 | 14.1 | 10–15 | 13.4 | 10–15 | 13.7 |
| Number of lateral scutes | 60–66 | 63.2 | 59–64 | 62.0 | 59–66 | 62.6 |
| Number of ventral scutes | 13–16 | 13.7 | 12–16 | 14.5 | 12–16 | 14.1 |
| Number of gill rakers in the first branchial arch | 14–23 | 19.9 | 15–23 | 18.5 | 14–23 | 19.2 |
| Number of fulcral scales | 28–37 | 33.5 | 26–38 | 32.0 | 26–38 | 32.8 |

* Cited after Berg, 1948.

mum body depth 2.3–4.6 (3.4), dorsal fin length 9.0–14.0 (11.2), dorsal fin depth 5.5–10.0 (7.0), anal fin length 5.1–8.0 (5.9), anal fin depth 6.9 to 11.0 (7.9), pectoral fin length 13.0–22.0 (17.3) and ventral fin length 5.5–9.2 (6.8).

In % of head length: snout 42–54 (47.1), postorbital length 38–51 (45.3), length of anterior barbel 17–24 (21.7), eye diameter 7.6–10.0 (8.8), D 39–47 (42 6), A 23–39 (28.2), dorsal scutes 10–15 (13.7), lateral scutes 59–66 (62.6), ventral scutes 12–16 (14.1), gill rakers 14–23 (19.2) and fulcral scales 26–38 (32.8).

The specimens under investigation do not differ from those from the Yugoslav part of the Danube and the Soviet Union but differ from those from the river Yenisei, which hase larger number of gill rakers described as a separate natio *marsigli* Brandt, 1833.

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characters of *Acipenser ruthenus*

| Vladykov, 1931 19 males and females ranges | ave. | Janković, 1958 300 males and females ranges | ave. | Šmidtova*, 1939 number of spec. unknown ranges | ave. | Chochlova, 1955 61 males and females ranges | ave. |
|---|---|---|---|---|---|---|---|
| 320–560 | — | — | — | — | — | — | — |
| 18–23 | — | 15.5–30.5 | 21.3 | 16.0–25.0 | 20.9 | 18.7–26.3 | 20.5 |
| — | — | — | — | — | — | 9.6–14.5 | 12.2 |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | 2.3– 3.7 | 3.2 |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — |
| — | — | — | — | — | — | — | — |
| — | — | 12–16 | 14.5 | — | — | 10.6–16.4 | 14.2 |
| — | — | — | — | — | — | 6.4– 9.1 | 7.9 |
| 47–57 | — | 46.5–63.5 | 56.0 | 31.0–53.0 | 42.6 | 34.6–50.5 | 43.0 |
| — | — | — | — | — | — | 36.0–59.0 | 48.2 |
| — | — | — | — | — | — | 14.3–21.8 | 18.8 |
| — | — | — | — | — | — | 4.2– 8.3 | 5.8 |
| 39–43 | — | 41–48 | — | — | — | 38–48 | 42.6 |
| 22–25 | — | 22–27 | — | — | — | 18–30 | 23.8 |
| 12–15 | 13.0 | 12–17 | 13.7 | 12–16 | 13.6 | 11–17 | 14.4 |
| 57–64 | 60.8 | 58–70 | 62.3 | 58–69 | 61.9 | 59–70 | 63.4 |
| 10–15 | 13.0 | 12–18 | — | 12–19 | 13.8 | 12–16 | 14.5 |
| 18–25 | — | 15–27 | 19.7 | — | — | 19–35 | 26.8 |
| — | — | — | — | — | — | — | — |


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VĚSTNÍK ČESKOSLOVENSKÉ SPOLEČNOSTI ZOOLOGICKÉ
Svazek XXXVI — Číslo 3 — 1972 — Str. 214—220

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# CESTODES SPECIES NEW FOR THE PARASITE FAUNA OF MICROMAMMALIANS FROM GEORGIA

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Received February 1, 1972

Abstract: A survey is presented of 23 cestode species, recorded for the first time from the territory of Georgia, or found in new hosts. A general survey of the cestode fauna of small mammals from Georgia is given in Table 1.

The first report on the finding of cestodes in micromammalians from Georgia was published by Gamtsemlidze (1941). The material examined in post-mortem by this author had been collected by members of the 115th Helminthological Soviet Expedition headed by K. I. Skrjabin in 1931. Among the 10 helminth species from rodents, the author found two cestode species, i.e. *Hymenolepis diminuta* and *H. straminea.* In the years 1939 to 1949, Kirschenblatt (1938, 1940, 1948, 1949) continued studies on the helminth fauna of small mammals and reported 18 cestode species from Georgian micromammalians (Table 1). Meladze (1960) found 4 larval cestode species and that *Cysticercus pissiformis, C.* sp., *Echinococcus granulosus* and *Diphyllobothrium* sp. in Altai squirrels from the reservation Taberdinsk. Rodonaja (1956) reported 7 cestode species (Table 1) in 1956 and 3 additional cestode species in 1959. Kurashvili (1966) found *Alveococcus multilocularis* in *Microtus socialis.* Matsaberidze (1961) reported the finding of *Vampirolepis skrjabiniana* from bats; in 1963, this author found 5 cestode species in rodents and, in 1966, his list of cestodes of small mammals contained a total of 22 species. We found another 23 cestode species during our helminthological examination of small mammals performed in Georgia in November 1970. Of these 6 species were recovered from new hoss.

## MATERIAL AND METHODS

Our cestode material was obtained from 26 small mammals belonging to 12 species: *Sorex araneus* (1), *S. raddei* (3), *S. minutus* (1), *Crocidura gueldenstaedti* (1), *Neomys fodiens* (12), *Talpa romana* (1), *T. transcaucasica* (1), *Apodemus sylvaticus* (2), *Rattus norvegicus* (1), *Mesocricetus brandti* (1), *Microtus socialis* (1), *Sciurus altaicus* (1). The animals had been caught in 7 localities: Kutaisi, Nardevani, Ordzhonikidze, Likhet Mts., Logodekhi, Gukhari, Khaturi.

## SURVEY OF THE CESTODE SPECIES RECOVERED

1. *Andrya montana* Kirschenblatt, 1941

Originally described by Kirschenblatt (1941) from *Microtus arvalis transcaucasicus* and *M. nivalis.* Erhardová-Kotrlá and Daniel

**Table 1. Survey of Cestodes found in Georgia**

| Cestode species | Authors: Gamtsemlidze (1941) | Kirshenblatt (1938—1949) | Meladze (1960) | Rodonaja (1956) | Rodonaja (1959) | Kurashvili (1961) | Matsaberidze (1961) | Matsaberidze (1963) | Matsaberidze (1966) | Prokopič, Matsaberidze (1971) | Prokopič, Matsaberidze (here) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Paranoplocephala dentata* | | + | | | | | | | + | | |
| *Paranoplocephala omphalodes* | | + | | | | | | | + | | |
| *Aprostatandrya macrocephala* | | + | | | | | | | + | | |
| *Andrya montana* | | + | | | | | | | | | + |
| *Mozgovogia pectinata* | | + | | | | | | | | | |
| *Mathevotaenia symetrica* | | | | | | | | + | + | | |
| *Catenotaenia cricetorum* | | + | | | | | | | | | |
| *Catenotaenia dendritica* | | | | | | | | | + | | |
| *Catenotaenia pusilla* | | + | | + | | | | + | + | | |
| *Skrjabinotaenia lobata* | | + | | | | | | | + | | |
| *Hymenolepis diminuta* | + | + | | + | | | | + | + | | |
| *Hymenolepis erinacei* | | | | + | | | | | + | | |
| *Hymenolepis fraterna* | | | | | | | | + | | | |
| *Hymenolepis mathevossianae* | | | | | | | | | | | + |
| *Armadolepis myoxi* | | + | | | | | | | | | |
| *Rodentolepis asymetrica* | | + | | | | | | | + | | |
| *Rodentolepis criceti* | | | | | | | | | | | + |
| *Rodentolepis microstoma* | | + | | | | | | | | | |
| *Rodentolepis straminea* | + | + | | | | | | | + | | |
| *Staphylocystis furcata* | | | | | | | | | + | | + |
| *Staphylocystis jacobsoni* | | | | | | | | | | | + |
| *Neoskrjabinolepis singularis* | | | | | | | | | + | | + |
| *Vigisolepis barbascolex* | | | | | + | | | | | | |
| *Pseudodiorchis prolifer* | | | | | | | | | | | + |
| *Passerilepis crenata* | | | | | | | | | | | + |
| *Myotolepis crimensis* | | | | + | + | | | | + | | |
| *Vampirolepis magnirostellata* | | | | | | | | | | | + |
| *Vampirolepis skrjabiniana* | | | | + | + | | + | | + | | |
| *Vampirolepis soltysi* | | | | | | | | | | | + |
| *Triodontolepis bifurcus* | | | | | | | | | | | + |
| *Triodontolepis hamanni* | | | | | | | | | | | + |
| *Triodontolepis kurashvilii* | | | | | | | | | | + | + |
| *Coronacanthus integrus* | | | | | | | | | | | + |
| *Coronacanthus omissus* | | | | | | | | | | | + |
| *Soricinia diaphana* | | | | | | | | | + | | + |
| *Soricinia soricis* | | | | | | | | | | | + |
| *Soricinia tripartita* | | | | | | | | | | | + |
| *Insectivorolepis globosa* | | | | | | | | | | | + |
| *Insectivorolepis globosides* | | | | | | | | | | | + |
| *Rodentotaenia crassiscolex* | | | | | | | | | + | | + |
| *Rodentotaenia filamentosa* | | | | | | | | | | | + |

| Cestode species | Authors | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gamtsemlidze (1941) | Kirshenblatt (1938—1949) | Meladze (1960) | Rodonaja (1956) | Rodonaja (1959) | Kurashvili (1961) | Matsaberidze (1961) | Matsaberidze (1963) | Matsaberidze (1966) | Prokopič, Matsaberidze (1971) | Prokopič, Matsaberidze (here) |
| *Dilepis undula* | | | | | | | | | + | | |
| *Cladotaenia cylindricaea* (larvae) | | + | | | | | | | | | |
| *Taenia crassiceps* (larvae) | | + | | | | | | | | | |
| *Taenia martis* (larvae) | | | | | | | | | | | + |
| *Taenia pisiformis* (larvae) | | | + | + | | | | | | | |
| *Taenia polyacantha* (larvae) | | | | | | | | | + | | |
| *Taenia tenuicollis* (larvae) | | + | | | | | | | | | |
| *Hydatigera taeniaeformis* (larvae) | | | | | | | | + | + | | |
| *Echinococcus granulosus* (larvae) | | | + | | | | | | | | |
| *Alveococcus multilocularis* (larvae) | | | | | | + | | | + | | |
| *Cysticercus* sp. | | | + | | | | | | | | |
| *Diphyllobothrium erinacei* (larvae) | | | | + | | | | | | | |
| *Diphyllobothrium* sp. (larvae) | | | + | | | | | | | | |
| *Mesocestoides lineatus* (larvae) | | + | | | | | | | + | | |

(1970) found this species in *Alticola argentata* (Severtzov, 1879) from Afghanistan; Andrejko (1970) in *M. arvalis* and *Clethrionomys glareolus* from Moldavia.

The cestode in our material was recovered from a new host, *Microtus socialis*, from the vicinity of Khaturi.

2. *Hymenolepis matevossianae* Akhumian, 1946
The author of this species described it from *Mesocricetus brandti* from Armenia.
Our species was recovered from the same host in Georgia near Nardevani.

3. *Soricinia diaphana* (Cholodkowsky, 1906)
This species is known to parasitize species of the genus *Sorex* from the Palaearctic region. Matsaberidze (1966) recovered the species from *Sorex araneus* in Georgia. Our species was found in the new host *Sorex raddei* in the vicinity of Ordzhonikidze.

4. *Soricinia soricis* (Baer, 1928)
Baer (1928) described the species from *Sorex alpinus* from Switzerland. Prokopič (1959) found it in Czechoslovakia. Andrejko (1970) recorded it from *Sorex araneus*, *S. minutus* and *Neomys fodiens* from the Moldavian S.S.R. We found this species for the first time in Georgia in

the vicinity of Ordzhonikidze and Gukhari in the hosts *Sorex araneu* and *S. raddei*, the later being a new host.

5. *Soricinia tripartita* Żarnowski, 1956
The author of this species described it from *Sorex araneus* from Poland Kisielewska and Prokopič (1963) found this species in Czechoslovakia, Vaucher and Hunkeler (1967) in Switzerland. In Georgia this species was reported for the first time from *Sorex raddei* from the vicinity of Ordzhonikidze.

6. *Pseudoriorchis prolifer* (Villot, 1890)
The species is known to parasitize shrews of the subfamily Soricinae from the Palaearctic region. In Georgia, we found this species for the first time in the new hosts *Sorex raddei* and *S. minutus* from the vicinity of Ordzhonikidze.

7. *Neoskrjabinolepis singularis* (Cholodkowsky, 1912)
Also a parasite of Soricidae from the Palaearctic region. Cholodkowsky (1912) described it from the U.S.S.R. (the vicinity of Leningrad) and so did Vasilev (1949). From various other areas including Georgia, the parasite was recorded under the name *Neoskrjabinolepis schaldybini* Spassky, 1947. We recovered it from *Sorex raddei* (Ordzhonikidze).

8. *Rodentolepis criceti* (Janicki, 1904)
The species is a typical parasite of hamsters. Baer (1932) placed this species in synonymy with *Rodentolepis straminea* (Goeze, 1782). This synonymy was accepted by various authors (e.g. Lopez-Neyra, 1942; Żarnowski, 1955; Baer and Tenora, 1970), while other authors (Skrjabin and Kalantarjan, 1942; Akhumjan, 1945; Skrjabin and Matevosjan, 1948; Spassky, 1954; Wahl, 1967) considered both to be independent species. Joyeux and Kobozieff (1928) maintained that the hooks of *R. criceti* (Janicki, 1904) were identical with those of *R. microstoma* (Dujardin, 1845), while Wahl (1967) considers *R. microstoma* to be in synonymy with *R. straminea*.
On the basis of our material we are inclined to agree with the authors Skrjabin and Kalantarjan (1942), Akhumjan (1945), Skrjabin and Matevossian (1968), Spassky (1954), Wahl (1967) in that the cestode *R. criceti* is an independent species parasitic mainly in hamsters
We found our species in the intestine of *Mesocricetus brandti* in the vicinity of Nardevani.

9. *Passerilepis crenata* (Goeze, 1782)
This cestode is a typical parasite of Passeriformes from the Palaearctic region. An occasional finding of this cestode species has been recorded from *Apodemus flavicollis* and other rodents under the name *Hymenolepis muris-sylvatici* (Rudolphi, 1819) by, e.g., Stammer (1955), Rybicka (1959), Sadovskaja (1952), Schmidt (1961), Chiriac and Hamar (1966), Vaucher and Hunkeler (1967), Prokopič and Mahnert (1970). Prokopič (1967) placed the species *H. muris-sylvatici* in synonymy with *Passerilepis crenata* (Goeze, 1782) on the basis of the results of the examination of his material and of the life cycle.

The cestode was recovered by the authors from *Apodemus sylvaticu* in the vicinity of Kutaisi and the Likhet Mts.

10. *Staphylocystis furcata* (Stieda, 1862)
This species is known to parasitize Soricidae from the Palaearctic and Ethiopian regions.
The authors found this cestode in the new hosts *Talpa transcaucasica*, *Sorex raddei* and *Sorex araneus* from the vicinity of Ordzhonikidze.

11. *Staphylocystis jacobsoni* (Linstow, 1907)
This cestode parasitizes members of the genus *Crocidura* from the Palaearctic region.
Our finding of *Staphylocystis jacobsoni* in a new host — *Crocidura gueldenstaedti* is the first finding of this species in Georgia. (Logodekhi.)

12. *Vampirolepis magnirostellata* (Baer, 1931)
This species is known to parasitize mainly members of the genus *Neomys* and other shrew species from the mountains of Europe.
We recorded the first finding of the species from Georgia in the vicinity of Nardevani and the Likhet Mts. It was recovered from *Neomys fodiens*.

13. *Vampirolepis soltysi* Prokopič, 1957
Soltys (1954) described *Vampirolepis soltysi* from *Neomys anomalus* and *Neomys fodiens* from Poland under the name *Hymenolepis magnirostellata* (Baer, 1931), forma 44. In 1957, Prokopič studied these cestodes from shrews of the genus *Neomys* from Czechoslovakia and, on the basis of his results, created the independent species *Vampirolepis soltysi* Prokopič, 1957. Shaldybin (1968) described the species from *Neomys fodiens* from the Gorki area as the new species *Vampirolepis heleni* Shaldybin, 1968. Our species from Georgia recovered from *Neomys fodiens* from the vicinity of Ordzhonikidze and the Likhet Mts. differs from the foregoing species mainly in the doubled number of its hooks.

14. *Triodontolepis bifurcus* (Hamann, 1899)
The species is known to parasitize *Neomys fodiens* from Switzerland, France, Czechoslovakia, Poland and Bulgaria. Our finding of the species in *Neomys fodiens* from Georgia (in the vicinity of Ordzhonikidze and the Likhet Mts.) is the first recorded finding from the territory of the U.S.S.R.

15. *Triodontolepis hamanni* (Mrázek, 1891)
The cestode is known to occur in France, Switzerland, Germany, Czechoslovakia and Bulgaria. Our finding in *Neomys fodiens* from the vicinity of Ordzhonikidze and the Likhet Mts. in Georgia is also the first finding of this species in the territory of the U.S.S.R.

16. *Triodontolepis kurashvilli* Prokopič and Matsaberidze, 1971
The species was found in *Neomys fodiens* (Georgia, Likhet Mts.) and described as a new species by Prokopič and Matsaberidze (1971).

17. *Coronacanthus integrus* (Hamann, 1891)
A parasite of shrews of the genus *Neomys* and other Soricidae in Europe. We found it in Georgia in *Neomys fodiens* (the vicinity of Ordzhonikidze and the Likhet Mts.).

18. *Coronacanthus omissus* (Baer et Joyeux, 1943)
The species was recorded from France, Switzerland, Czechoslovakia and

Bulgaria. In Georgia, we found it in *Neomys fodiens* from the vicinity of Ordzhonikidze and the Likhet Mts.

19. *Insectovorolepis globosa* (Baer, 1931)
A parasite of shrews in the mountain areas of Switzerland, Czechoslovakia and Bulgaria. We found it in *Neomys fodiens* in Georgia (Likhet Mts.).

20. *Insectivorolepis globosoides* (Soltys, 1954)
A parasite of shrews recorded from Poland, Czechoslovakia, Switzerland and Bulgaria. We found it in Georgia in *Sorex raddei* and *Neomys fodiens* (Likhet Mts.).

21. *Rodentotaenia filamentosa* (Goeze, 1782)
A parasite of members of the genus *Talpa* from the Palaearctic region. In Georgia, we recovered this species from *Talpa romana* (Likhet Mts.)

22. *Rodentotaenia crassiscolex* (Linstow, 1890)
The most common parasite of Soricidae in the Palaearctic region. In Georgia, we recovered the species from *Sorex raddei* in the vicinity of Ordzhonikidze.

23. *Taenia martis* (Zeder, 1803)
The adult cestode parasitizes Mustelidae. Its larval stages develop in the abdominal cavity of rodents. In Georgia, we found the species in *Sciurus altaica*, a host introduced to this area.

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Svazek XXXVI — Číslo 3 — 1972 — Str. 221—227

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# STUDIES ON THE LIFE HISTORY OF SOME CESTODES OF WATER BIRDS (HYMENOLEPIDIDAE: SOBOLEVICANTHUS (ZEDER, 1803))

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Received June 30, 1971

**Abstract**: The life cycles of the cestodes *Sobolevicanthus gracilis* and *S. octacantha* were studied under conditions of natural and experimental infection. The larval development was characterized by a complex of certain changes. Studies of the structure of the cysticercoid disclosed that its cyst wall consists of 5 layers. The larvae of *S. gracilis* were found to developed in nature in *Mesocyclops crassus* (a new intermediate host), in *Eucyclops serrulatus* and *Eudiaptomus vulgaris* (new intermediate hosts for Czechoslovakia) and, under experimental conditions, in *Dolerocypris fasciata* only. The larval development of *S. octacantha* was studied for the first time in the field, and that in the crustaceans *Eucyclops serrulatus* (a new intermediate host). In experimentally produced infection, the cysticercoids of this species developed in *Mesocyclops crassus* (a new intermediate host). All life cycles were terminated with feeding experiments.

Between 1963—1970, we studied the life cycle of cestodes of the genus *Sobolevicanthus* in various fishponds of southern Bohemia (near Lomnice n. L., Třeboň, Písek, Vodňany). The low incidence of *S. gracilis*, *S. krabbeella* and *S. octacantha* found in these localities induced us to extend our investigations to several fishponds in central Bohemia (near Louny and Benešov) and southern Moravia (near Lednice and Valtice).

Since *S. krabbeella* was discussed in an earlier paper (Neradová, 1969), the data in this paper will be concerned only with the two remaining species.

The larval development of *S. gracilis* has been studied by various authors. Linstow (1872) recorded the presence of cysticercoids in the digestive tube of *Perca fluviatilis* L. and (1892) in the body cavity of *Gammarus pulex* L. Mrázek (1891), Daday (1901), Lindner (1921) and Joyeux and Baer (1936) described cysticercoids from the body cavity of copepods and ostracods infected in the field. Jarecka (1958, 1960, 1961), Petročenko and Kotelnikov (1959), Ryšavý (1961) described, in addition to cysticercoids from naturally infected intermediate hosts, also those from an experimental infection; their reports are completed with data on several earlier larval stages.

The species *S. octacantha* was studied by Ryšavý (1960) in an experimentally produced infection.

## MATERIAL AND METHODS

The materials used and the techniques employed were essentially those described earlier (Neradová-Valkounová, 1971). We are completing these data by two remarks only:

1) Experimental infection occurred at a temperature of 18–20°C, **pH of the water 6.8–7;**
2) In feeding experiments we employed 4 week old ducklings (*Anas platyrhynchos* **dom.** L.); these were killed 4 weeks p.i. and examined in post mortem

RESULTS

The larval development of cestodes of the genus *Sobolevicanthus* is similar to that of other cestode genera of the family Hymenolepididae (*Dicranotaenia, Diorchis, Fimbriaria, Microsomacanthus*) which have been studied by

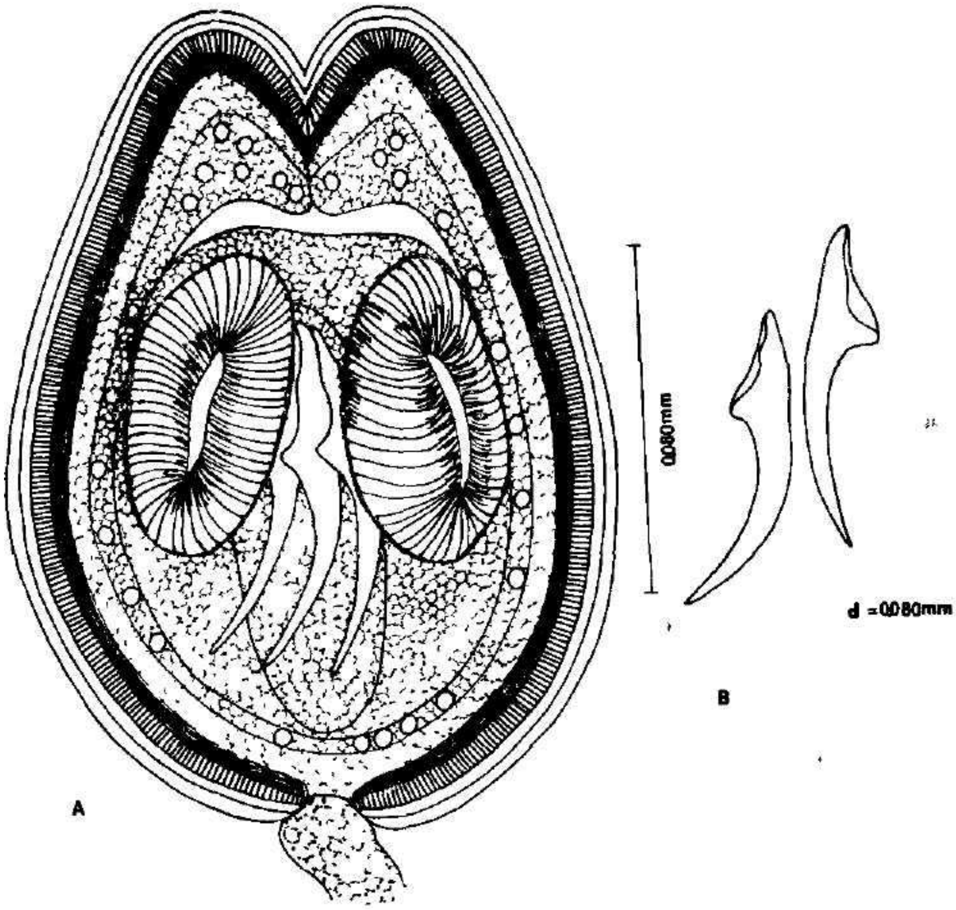


Fig. 1 — A Cysticercoid of *S. gracilis* from the body cavity of *Dolerocypris fasciata*; B rostellar hooks.

the author. For a better orientation, we divided larval development into seven stages: the mobile oncosphere, the growing oncosphere, the elongated larva, the differentiating larva, the differentiated larva before invagination, the invaginating larva and the cysticercoid. The wall of the cyst consists of 5 layers; the hyaline, the homogeneous, the basal, the outer fibrous and the intermediate parenchymatous layer. The individual larval stages and the individual layers of the cyst wall in a morphologically completely differentiated cysticercoid have been described in an earlier paper (Neradová-Valkounová, 1971).

We did not succeed in finding cysticercoids in the reservoir hosts because the walls of their cysts are too thin to pass undamaged through the diges

Table 1. Survey of crustaceans infected with cysticercoids of *S. gracilis*

| Locality | Date of collection | Intermediate host | Number of crustaceans examined | Number of infected crustaceans | Percentage of infected crustaceans | Intensity of infection |
|---|---|---|---|---|---|---|
| Village pond at Radošovice near Vlašim | September 23, 1963 | *Eudiaptomus vulgaris* | 3,600 | 900 | 25 | 2—3 |
| Fishpond Mlýnský near Lednice | October 20, 1964 | *Eucyclops serrulatus* | 3,200 | 3 | 0.09 | 2 |
| Fishpond Klec near Lomnice n. Lužnicí | June 30, 1965 | *Mesocyclops crassus* | 3,800 | 40 | 1.05 | 1 |
| Fishpond Sv. Vít near Třeboň | August 20, 1967 | *Eucyclops serrulatus* | 3,900 | 10 | 0.2 | 2—3 |
| Fishpond Klec near Lomnice n. Lužnicí | June 12, 1968 | *Mesocyclops crassus* | 2,800 | 15 | 0.5 | 1 |

tive tract of the snails. We confirmed in experiments, that the cysticercoids of *S. gracilis* are crushed and digested in the stomach of the snail.

### 1. *Sobolevicanthus gracilis* (Zeder, 1803) (Fig. 1, 2)

Findings of cysticercoids in nature: A survey of the findings is given in Table 1.

Experimental infection of intermediate hosts: Eggs are either moderately ovoid, or, more frequently, spherical; measurements 29—35 μm; oncosphere 15—20 μm, embryonic hooks 9 μm. The eggs were placed in vessels occupied by crustaceans of the species *Acanthocyclops viridis* (Jurine), *Cyclops strenuus* (Fischer), *C. vicinus* Uljanin, *Eucyclops serrulatus* Fischer *Macrocyclops albidus* (Jurine), *Mesocyclops crassus* (Fischer), *M. leuckarti* Claus, *Eudiaptomus vulgaris* (Schmeil), *Dolerocypris fasciata* (O. F. Muller), *Heterocypris incongruens* (Ramdohr), *Notodromas monacha* (O F. Müller) and *Daphnia pulex* Leydig. Mobile oncospheres were observed in body cavities of the crustaceans 4—6 hrs p.i. (experiment No. 1 — *Dolerocypris fasciata*; experiment No. 2 — *Dolerocypris fasciata*, *Eudiaptomus vulgaris*). Larval development continued in *D. fasciata* only. mobile oncosphere — on the first two days; growing oncosphere — from day 3 onwards, measurements 80—90 μm; elongated larva — from day 5 onwards, length 180—190 μm; differentiating larva — from day 7 onwards, length 340 to 420 μm; differentiated larva before invagination — from day 11 onwards; completely formed cysticercoids from day 13 — day 15 (Table 2)

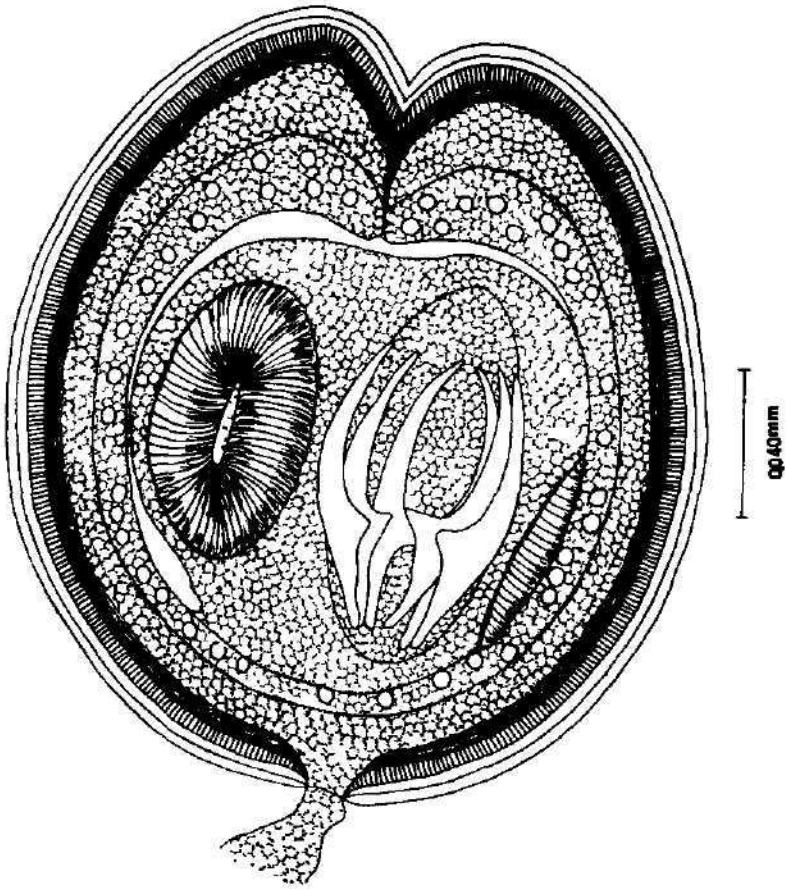


Fig. 2. Cysticercoid of *S. gracilis* from the body cavity of *Eudiaptomus vulgaris*.

Description of the cysticercoids: The cysticercoids show variation in shape in the different species of intermediate hosts. They are oval to pyriform in *Dolerocypris fasciata*, oval to broadly oval in *Eudiaptomus vulgaris*, oval in *Eucyclops serrulatus* and *Mesocyclops crassus* (measurements in Table 3).

Feeding experiments: Infection was produced with cysticercoids obtained from naturally and experimentally infected intermediate hosts. Adult cestodes of the species *S. gracilis* were found in post-mortem examination of 10 domestic ducks.

Table 2. The course of experimental infection with eggs of *S. gracilis* in the crustaceans

| Commencement of experiment | Intermediate host | Number of crustaceans in the experiment | Number of crustaceans infected with cysticercoids | % of crustaceans infected with cysticercoids | Intensity of infection | Duration of cysticercoid development (in days) |
|---|---|---|---|---|---|---|
| November 30, 1964 | *Dolerocypris fasciata* | 100 | 14 | 14 | 2 | 13–15 |
| October 23, 1965 | *Dolerocypris fasciata* | 100 | 32 | 32 | 1 | 13–15 |

## 2. *Sobolevicanthus octacantha* (Krabbe, 1869) (Fig. 3)

Findings of cysticercoids in nature Cysticercoids were found only once, on September 23, 1970 on the fishponds Propustové near Valtice. Of the 1,200 crustaceans of the species *Eucyclops serrulatus* examined two were infected with one cysticercoid each (i.e. 0.2%). This isolated finding of cysticercoids in the field was reflected in the low incidence of infection with this cestode species in domestic and wild ducks.

Table 3. Measurement (in μm) of the cysticercoids of *S. gracilis* in the individual intermediate hosts

| | | *Eucyclops serrulatus, Mesocyclops crassus* | *Dolerocypris fasciata* | *Eudiaptomus vulgaris* |
|---|---|---|---|---|
| Cysticercoid | l | 144–175 | 170–213 | 179–232 |
| | w | 147–156 | 140–184 | 157–200 |
| Hyaline layer | w | 2–3 | 1–3 | 2–4 |
| Homogeneous layer | w | 1–3 | 1–3 | 1–3 |
| Basal layer | w | 2–5 | 3–6 | 3–6 |
| Outer fibrous layer | w | 2–6 | 2–6 | 2–6 |
| Intermediate layer | $w_1$ | 2–3 | 5–10 | 10–20 |
| | $w_2$ | 3–5 | 4–7 | 6–10 |
| | $w_3$ | 2–6 | 4–10 | 6–10 |
| Neck | $w_1$ | 6–8 | 20–30 | 7–26 |
| | $w_2$ | 4–7 | 2–7 | 14–26 |
| | $w_3$ | 3–5 | 3–5 | 12–16 |
| Scolex | l | 120–150 | 115–145 | 120–150 |
| | w | 110–130 | 95–132 | 105–135 |
| Suckers | l | 50–75 | 54–75 | 50–85 |
| | w | 50–75 | 35–51 | 36–75 |
| Rostellum | l | 90–120 | 98–105 | 90–120 |
| | w | 30–40 | 30–40 | 30–60 |
| Hooks | l | 78–81 | 80–87 | 75–84 |
| Calcareous corpuscles | in ⌀ | 4–6 | 4–6 | 4–6 |
| Tail | l | 500–630 | 450–640 | 400–450 |

l = length, w = width
$w_1$ = width of the layer at the site of invagination
$w_2$ = width of the layer in the lateral portion
$w_3$ = width of the layer at the distal pole

Experimental infection of intermediate hosts: Eggs spherical, 70—75 × 75 to 80 μm, oncosphere spherical till moderately oval, 30—38 × 30—36 μm. Embryonic hooks u p to 11 μm. The eggs were placed into vessels containing the same crustacean species as those in the experiment with *S. gracilis*. Viable oncospheres were present in the body cavities of *Mesocyclops crassus*

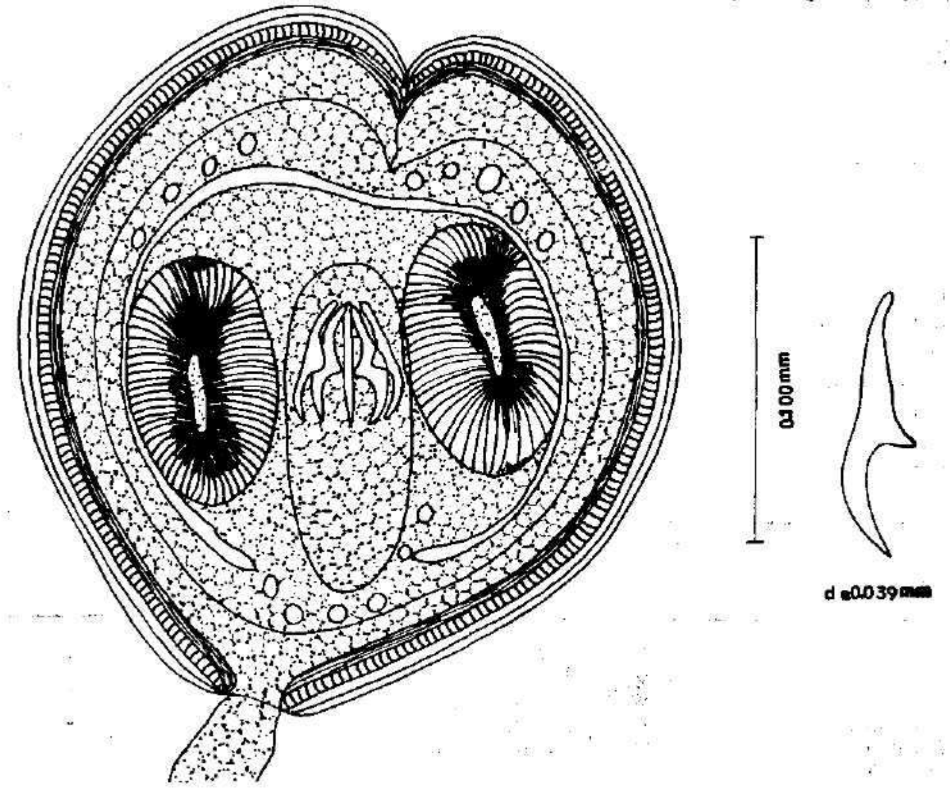


Fig. 3. Cysticercoid of *S. octacantha* from the body cavity of *Mesocyclops crassus*.

4 hrs p.i.; mobile oncosphere — on day 1 and 2 p.i.; growing oncosphere — from day 3 onwards, measurements 40—60 μm; elongated larva — from day 5 onwards, length 100—120 μm; differentiating larva — from day 7 onwards, length 400—500 μm; differentiated larva before invagination — from day 16 onwards. Cysticercoids were found on day 19 and 20 p.i.. The experiment was performed with 60 crustaceans; of these 50% were infected with cysticercoids. The copepods harboured only one cysticercoid each, although 4—8 oncospheres were present in the body cavities of *M. crassus* as late as day 3 p.i..

Description of the cysticercoids: Body almost spherical except for the pointed distal end which accounts for a slightly oval appearance. Measurements 119—218 × 178—204 μm, thickness of hyaline layer 2—4 μm, of homogeneous layer 1—2 μm, basal layer 3—6 μm. Width of outer fibrous layer 4—6 μm. Thickness of the intermediate parenchymatous laye at the site of invagination 15—20 μm, at both sides 7—15 μm, at th distal pole 6—20 μm. Neck 15—20 μm, scolex 120—136 × 121—140 μm suckers 68—90 × 45 — 60 μm, rostellum 84—106 × 38—48 μm, 8 hook 36—39 μm. Calcareous corpuscles 3—6 μm in diameter, tail up to 2 mm long

Feeding experiment: Infection of the two definitive hosts was pro duced with cysticercoids from an experimental infection. Post-mortem dis closed the presence of *S. octacantha*.

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Svazek XXXVI — Číslo 3 — 1972 — Str. 228—230

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# CLADOTHYRIDIUM SP. IN THE LIVER OF CIRCUS AERUGINOSUS L. (CESTODES)

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Received February 13, 1972

**Abstract:** In *Circus aeruginosus* L. shot in southern Bohemia, we found in post mortem in the liver a dense dissemination of miliary nodules similar to necrotic foci. Histological examination and parasitological identification disclosed an infection with *Cladothyridium* sp. Upon microscopical inspection the foci were found to consist of inflammatory granulomas originating around the freely distributed bodies of the parasites.

Post mortem examination of the predatory bird *Circus aeruginosus* L., shot at the age of approximately two years near the village Hluboká nad Vltavou in southern Bohemia, we observed greyish-white foci in the liver parenchyma mimicking necrosis. The material was fixed in 10% formol and embedded in paraffin. Slides of 6 microns thick were stained with haematoxylineosin and with van Gieson's method. We found scolices of cestodes inside these foci and identified them by their diagnostic signs to be larval stages of the genus *Cladotaenia* Cohn, 1901.

## *Cladothyridium* sp.

In histological slides of the liver parenchyma we found larval cysts of cestodes which were in accord with the diagnostic features given for *Cladothyridium* (Rybaltovskij, Ovchinnikova, 1960).

In 38 slides measuring 8 × 8 mm (64 mm² of liver parenchyma) we counted 6—11 foci containing sections through *Cladothyridium* of different morphological structure.

The size of the nodules in the sections ranged from 0.417 to 0.727 mm in length and 0.339 to 0.552 mm in width. We were unable to determine the size of the individual *Cladothyridium* — bodies. Our findings are compared with those of Freeman (1959) — (Table 1).

The hooks of the first row measured 0.026 to 0.030 mm in length, maximum width 0.0076 to 0.0095 mm, length of handle 0.0152 to 0.0192 mm. The morphology of these hooks was similar to that of *Cladotaenia globifera* (Batsch, 1786). The hooks of the second row attained the same measurements as these of the first row except that their handle was less developed. A similar observation was made by Freeman (1959) in experimentally infected mice. In some sections we found the canals of the excretory system (Fig. 4). Changes of the liver parenchyma attained a width of 0.0388 to 0.164 mm.

**Table 1. Measurements of *Cladothyridium* sp. (in mm)**

| | Our findings (Histological sections) | *Cladothyridium globifera* Freeman, 1959 |
|---|---|---|
| Scolex length | 0.407 (in section) | 0.225 – 0.335 |
| Scolex width | 0.196 – 0.213 | 0.150 – 0.200 |
| Rostellar sheath length | 0.036 – 0.048 | 0.042 – 0.056 |
| width | 0.067 – 0.072 | 0.067 – 0.090 |
| Suckers length | 0.072 – 0.079 | 0.069 – 0.104 |
| width | 0.034 – 0.049 | 0.049 – 0.067 |
| Hooks number | 26 – 36 (incomplete) | 44 – 54 |
| size | 0.026 – 0.030 | 0.026 – 0.034 |
| arrangement | 2 rows | 2 rows |
| Length of rostellar canal | 0.106 | — |
| Widh of rostellar canal | 0.009 | — |

## PATHOLOGICAL FINDINGS

The macroscopical picture was that of a dense dissemination of miliary foci (the size of a pin-head) in the parenchyma of the liver located mainly at the sharp edges of the liver and in the interlobar grooves. The shape of the nodules as seen on the cutting plane was regularly spherical, its colour was greyish and the nodules were sharply demarcated from the adjoining unchanged liver tissue. Under the Glisson sheath the lesions were moderately elevated.

Microscopical inspection disclosed that the nodules were inflammatory granulomas formed around the centrally located *Cladothyridium* — bodies. Most of the granulomas contained in its centre one larval cyst; two cysts were found only occasionally. The body of the parasite was lying freely in the cavity, the inner surface of which was covered with one, sometimes two, layers of cuboidal or flagstone-like flattened cells with a foamy plasma and lighty ovoid nuclei, which adhered to the thin lamellar encapsulating layer. The inner layers of the sheath formed an inflammatory proliferation marked mainly by the presence of light histocystes with pale oval nuclei placed in the loose network of colageneous fibres. At the periphery of the granuloma, there is a thicker layer of concentrically arranged connective tissue infiltrated with lymphocytes.

## DISCUSSION

Under European conditions, two cestode species of the genus *Cladotaenia* Cohn, 1901 are known to parasitize *Circus aeruginosus* L. These are *Cladotaenia globifera* (Batsch, 1786) Cohn, 1901 and *C. circi* Yamaguti, 1935. The intermediate hosts of both these species are small rodents and insectivores (Abuladze, 1964). Meggitt (1933) found *C. fania* Meggitt, 1933 in *Choriotis kori* in India; otherwise, cestodes of this genus parasitize only predatory birds.

Our findings is of interest in that it is the first recorded finding of larval cysts in the liver of the definitive host. It is difficult to explain the route of infection, but Markowski (1928) mentioned the considerable resistance of the oncospheres of *C. globifera* to desiccation and to the influence of external factors in general. The eggs may be disseminated by the wind from the dried-up faeces of predatory birds as this was confirmed in experiments on mice after their food had been mixed with the faeces of *Buteo lagopus*. In our case infection may have been acquired in the nest or after ingestion of mature segments by preying on another non predatory bird who had ingested mature segments of this cestode.

Development of *Cladothyridium* in the mice lasted from 14 days (Markowski, 1928) to 21 day (Freeman, 1959). Both authors agree in that *Cladothyridium* is surrounded by an oval, whitish cyst which has a wall consisting of two thick layers. A single cyst may harbour as many as three larvae. We found a maximum of 2 larvae in one focus. The normal site is the liver margin; when the incidence is high the larval cysts are smaller as recorded by various authors. Penner (1938) described proliferative inflammatory changes caused by the presence of *Cladothyridium* — bodies in the liver parenchyma, which are similar to our findings. By contrast to these descriptions, we did not observe sheaths which suggested the presence of cyst enclosing bodies of *Cladothyridium* in the tissue.

**Acknowledgements**

We should like to thank Doc. Dr. B. Ryšavý Dr. Sc. for his valuable help in determining the larval cysts.

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The plates will be found at the end of this issue.

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**Taschenlexikon der Biologie (1971) M. Abercrombie, C. J. Hickman, M. L. Johnson,** 258 pp., 10 Abb. Gustav Fischer Verlag, Stuttgart, Preis DM 12,80.

Fischer Verlag ve Stuttgartu zahrnul do svého edičního plánu na r. 1971 německý překlad velice úspěšného „Penguin Dictionary of Biology". Úspěšnost dokumentuje již 6. vydání v období necelých 20 let. Podle tohoto 6. anglického vydání byl pořízen J. Quernerem i německý překlad.
Lexikon zahrnuje přes 2000 hesel ze všech oborů biologie, která stručně a věcně informují o obsahu termínu. Najdeme tu vysvětlení jak obecných pojmů, tak i výklad různých vnějších i vnitřních orgánů, stejně jako stručné charakteristiky nejdůležitějších autotrofních i heterotrofních skupin organismů. Je samozřejmé, že při maximální snaze o úspornost jsou některá hesla jen vysloveně informativní, některé pojmy, namátkou vybráno např. anabiosa nebo metagenese, vůbec chybí. To ale přirozeně nesnižuje hodnotu a základní poslání tohoto dílka, míněného jako kapesní lexikon, který úměrně poučí velice širokou obec zájemců, pro niž byl také napsán a vydán.
Jako takový doporučujeme tento kapesní slovník biologických termínů (i rozměrem 12 × 19 mm) co nejširší obci nejen zoologické.

*K. Hůrka*

**Lellák J. (1971): Klíč k určení larev pakomárů čeledi Chironomidae (se zřetelem k fauně Československa).** Acta Universitatis Carolinae — Biologica 1970 : 1—109, 1971 (cena 10 Kčs).

Pakomáří larvy jsou nejen početnou, ale pokud jde o biomasu často silně převažující složkou fauny dna a hrají proto důležitou roli i v potravním jídelníčku ryb. Jsou přitom na druhy velmi bohatou skupinou. Autor klíče předpokládá, že u nás žije celkem asi 1.000 druhů. V klíči však rozlišuje jen kolem 550 taxonomických jednotek. Je to dáno tím, že v larválním stadiu nelze řadu druhů a někdy i rodů rozlišit, a proto určení se musí omezit na určování někdy jen do skupiny rodů, jindy do skupiny druhů a spíše výjimečně lze bezpečně stanovit druh. Je to situace velmi nepříznivá pro prohloubení ekologie benthické fauny, neboť různé druhy mohou mít pochopitelně různé ekologické nároky, různé doby výletu, resp. různý počet generací v roce. Dále pak různé zásahy včetně znečištění se projevují ochuzením, případně obohacením souboru druhů, tedy rozličnou druhovou bohatostí a o tom všem nelze získat dostatečné podklady jen morfologickým studiem larev.
Za takového stavu věcí nepřekvapí, že literatura, zabývající se druhovým určením larev, je velmi roztříštěná a že je mimořádně obtížné konfrontovat názory jednotlivých autorů na taxonomickou validitu jednotlivých popsaných forem, resp. jejich přidružení k druhům, popsaným podle dospělých jedinců. Je proto mimořádnou zásluhou doc. J. Lelláka, že shrnul své skoro 25leté zkušenosti s identifikací larev této skupiny do přehledného klíče a tím umožnil dalším pracovníkům podstatně zkrátit období zapracování se do studia této, pro pochopení produkčních procesů ve vodě tak důležité, skupiny. Je třeba rovněž přivítat publikování této práce v publikaci přírodovědecké fakulty Karlovy university, neboť kde jinde než na přírodovědeckých fakultách mohou být vychováni další odborníci pro studium této skupiny. Bez spolupráce a dělby práce řady pracovníků si nelze představit urychlení studia této obtížné skupiny vodních organismů.

*J. Hrbáček*

**Schwerdtfeger F. (1968): Ökologie der Tiere. Ein Lehr- und Handbuch in drei Teilen. Band II: Demökologie. Struktur und Dynamik tierischer Populationen.** 448 str., 252 obr., 55 tab. Paul Parey, Hamburg a Berlin. Cena DM 84.00.

Ve svém třídílném ekologickém kompendiu se profesor Schwerdtfeger pokouší předložit čtenáři syntézu ekologie jako celku, shrnutí vycházející z výsledků práce různých ekologických škol. Po dokončení se toto dílo bezpochyby stane jedním z nejobsáhlejších a nejlépe dokumentovaných svého druhu a zajisté nejdůležitější ekologickou příručkou v jiné než anglické literatuře. Zdá se, že největší autorova zásluha zatím tkví v sepsání druhého dílu kompendia, který je věnován ekologii populací. Ačkoli od jeho vydání již uplynul určitý čas, je jistě záhodno upozornit zde na knihu tak mimořádného významu, která by neměla ujít pozornosti žádného zoologa.
Svazek je — obdobně jako první díl — pojat jako vysvětlení základních principů a fakt na základě bohatého dokumentačního materiálu z nejrůznějších živočišných skupin včetně ekonomicky významných druhů. Jeho podstatou jsou dva základní oddíly. První z nich, zabývající se ekologickou strukturou populace (str. 21—173), představuje statický přístup k po-

znání. Objasňuje pojmy charakterizující populaci, jako je hustota, rozšíření, fenetická variabilita, věkové složení, poměr pohlaví, nemocnost, chování, fyziologický stav, plodnost a úmrtnost. Druhý hlavní oddíl knihy (str. 174–399) je věnován populační dynamice. Autor jej uvádí obecnou rozpravou o proměnlivosti populací a ukazuje, že jakákoliv jejich vlastnost či charakteristika může podléhat změnám. Poté se podrobně zabývá dynamikou rozšíření a hustoty populací.

Knihu činí přitažlivou zřejmá snaha překlenout rozdíly v myšlení a orientaci výzkumu mezi ekology kontinentální Evropy a zemí anglické jazykové oblasti. Dalšími klady, které zasluhují zvláštní zmínky, jsou přístupná forma výkladu, četné instruktivní grafy a tabulky a dále dosáhlé části textu věnované metodice výzkumu. Bohatý faktografický materiál, který doplňuje teoretické stati, je úspěšným shrnutím značné části demekologických publikací; opírá se o mimořádně rozsáhlý seznam literatury (asi 1500 položek), který z tohoto svazku činí i vítanou bibliografickou pomůcku.

Struktura textu není tradiční, ale je velmi logická, účelná a přehledná. Je potěšitelné, že autor odolal sklonu mnoha evropských specialistů, kteří ve snaze po logické klasifikaci ekologických poznatků vytvářejí nové a nové odborné termíny. Usiluje naopak o precizování zavedených, leč ne jednotně užívaných termínů (tak např. definuje oscilace jako změny ve velikosti populace během roku, fluktuace jako výkyvy ve velikosti v různých letech a cykly jako pravidelné změny s několikaletou periodicitou).

Matematika, která je pro demekologii důležitou pomůckou, je zde potlačena na minimum. Důvodem je zřejmě oprávněná obava z nesrozumitelnosti výkladu pro mnohé čtenáře, avšak do značné míry tím trpí úplnost některých kapitol. Je škoda, že autor opomíjí genetická hlediska populační ekologie, ač je nasnadě, že studium dynamiky populací nelze odloučit od poznatků ekologické genetiky.

Druhý svazek významného díla profesora Schwerdtfegera je bezesporu vydařenou knihou, která v mnohém směru předčí jiné srovnatelné příručky. Zásluhu na tom má nejen autor, ale i nakladatelství, které zajistilo pečlivou redakci a vzornou typografickou úpravu.

*J. Losos*

**Smirnov N. N. (1971): Chydoridae fauny mira (Chydoridae of the World's Fauna), Rakoobraznye 1.**, vyp. 2, Fauna SSSR, Izdatelstvo Nauk, Leningrad, 531 pp, 658 figs.

This is a magnificent monograph of the family Chydoridae which includes the largest number of species of Cladocera. More than one third of the book contains the general chapters and the rest is concerned with descriptions of 173 species belonging to 26 genera. More than half of the general part is devoted to morphology with special emphasis on its functional aspects. The main findings of the classical paper of Behning in 1915 on the morphology of Cladoceran appendages had been monotonously transfered from monograph to monograph until in the last decade Dr. Smirnov and Dr. Freyer revealed in Chydoridae that the differences in the morphology of the trunk limbs can be related to differences in feeding-habits. This concerns not only differences among genera but different feeding habits are found even in the same genus (e.g. *Allonella*). This discovery has contributed to the understanding of the mechanism of coexistence of several species of the same genus in the same habitat.

The taxonomical part is based on a rich material collected in the Palearctic region. The material from South Eastern Asia, Australia, Africa and South America was less numerous. From the descriptions of individual species it is apparent how rich material examined and where the slides examined are preserved. In the rarer cases when material was not available the descriptions and figures were based on literature.

Six new species and one new genus is described in the monograph. New generic combinations are introduced for 20 species and 30 taxa have been synonymified with already recognized ones. To those who, as the reviewer, are not intensively concerned with the taxonomy of this family two features are apparent from the monograph:

1) Fourthy five species of the total 173, i.e. nearly one quarter, belong to one genus, namely *Alonella*. Seven genera are monotypical, one of them based on fossil material.

2) Since many of the species of Cladocera show a wide distribution some of them are cosmopolitain, it is interesting to note that all 5 species of the genus *Kozhovia* G. L. Vasiljeva et N. N. Smirnov are restricted in ther distribution to the Lake Baikal.

The author is to be congratulated to this work which represents a reliable starting point for further studies in this family which in recent years has attracted interest of many authors from various points of view.

*J. Hrbáček*

Baruš V. 1972

Nematodes parasitizing hosts of the genus Eleutherodactylus (Amphibia) from Cuba.

*Věst. Čs. spol. zool* **36:** 161—168

Chitravadivelu K. 1972

On the systematics of the Rudd, Scardinius erythrophthalmus (Linnaeus, 1758) (Osteichthyes: Cyprinidae) from Bohemia.

*Věst. Čs. spol. zool.* **36:** 169—171

Chitravadivelu K. 1972

Growth of Hucho taimen (Pallas, 1773) in the Upper Yenisei river of Mongolia.

*Věst. Čs spol zool* 36: 172—178

Gabriel M 1972

The incidence of the nematode Heligmosomum mixtum Schulz, 1954 in Czechoslovakia.

*Věst. Čs. spol zool.* **36:** 179—180

Holčík J 1972

Acanthorhodeus robustus sp. n from China and Acanthorhodeus polyspinus sp n. from Viet nam, two new species of Acheilognathinae fishes (Teleostei Cyprinidae).

*Věst. Čs. spol. zool.* **36:** 181—186

Holčík J 1972

The systematic status of Bullhead (Ictalurus Rafinesque, 1820) (Osteichthyes: Ictaluridae) in Czechoslovakia.

*Věst. Čs. spol. zool.* 36 : 187—191

Likovský Z 1972

Das morphologische Blutbild beim Neunauge Lampetra planeri (Bloch, 1784) (Cyclostomata).

*Věst. Čs. spol. zool.* **36:** 192—195

Moravec F. 1972

A revision of African species of the nematode genus Rhabdochona Railliet, 1916.

*Věst. Čs. spol. zool.* **36:** 196—208

Oliva O., K. Chitravadivelu 1972

On the systematics of the Sterlet, Acipenser ruthenus Linnaeus, 1758 (Osteichthyes: Acipenseridae).

*Věst. Čs. spol. zool* **36:** 209—213

Prokopič J, G. Matsaberidze 1972

Cestodes species new for the parasite fauna of micromammalians from Georgia.

*Věst. Čs. spol. zool.* **36:** 214—220

Valkounová J. 1972

Studies on the life history of some cestodes of water birds (Hymenolepididae: Sobolevicanthus (Zeder, 1803))

*Věst. Čs. spol. zool.* **36:** 221—227

Zajíček D., J. Vítovec, L. Dvořáková 1972

Cladothyridium sp in the liver of Circus aeruginosus L. (Cestodes).

*Věst. Čs. spol. zool.* **36:** 228—230

Fig. 1. General view on location of *Cladothyridium* sp. in the liver parenchyma and reaction of surrounding tissue.
Fig. 2. Longitudinal section through scolex. Detailed view on the hooks.


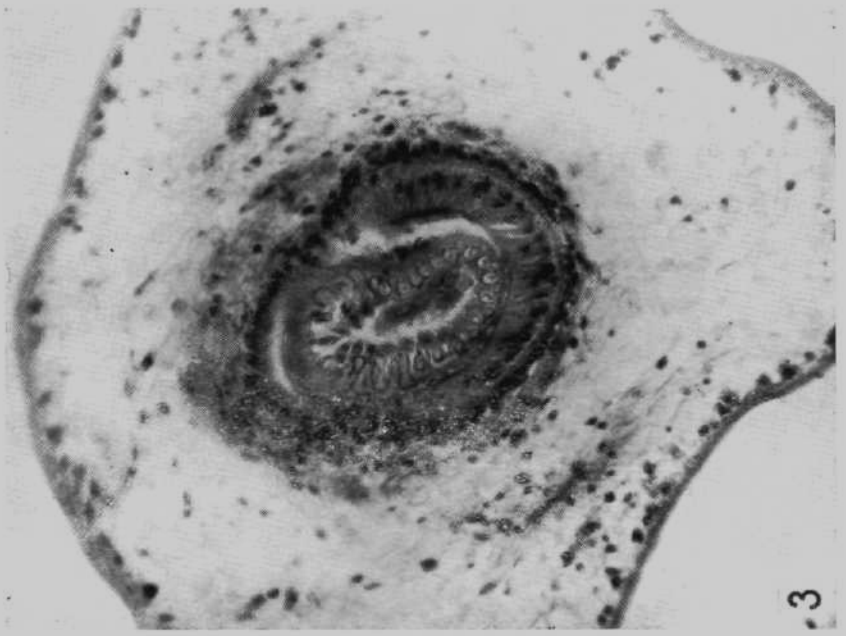


Fig. 3. Transverse section. Detailed view on the corona of hook on the rostellum.
Fig. 4. Transverse section through detailed on excretory canals.