GUIDE TO MONOGENOIDEA OF FRESHWATER FISH OF PALAEARTIC AND AMUR REGIONS

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Front cover: /Dactylogyrus extensus,/ three dimensional image by G. Strona and P. Galli.

INTRODUCTION

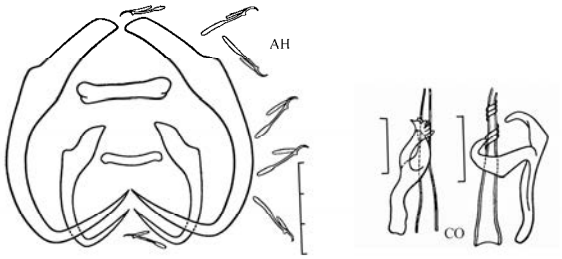
The first key to parasites of freshwater fish of the USSR was published in Russian in 1962 and was translated into English in 1964. It was a one volume book that included keys for all parasite groups to the species level. Its translation is only one available internationally to present day. The second edition, also in Russian, was published between 1984 and 1987 and consists of three volumes (editor-in-chief O.N. Bauer). The second volume deals mostly with monogenenans (editor A.V. Gussev) and includes 24 keys and 16 supplements. In this volume, the Dactylogyridae (*sensu* Bychowsky et Nagibina, 1978) includes seven genera, and two separate keys can be used to identify over 200 nominal *Dactylogyrus* species. Three keys identify about 50 species in two subfamilies of the Ancyrocephalidae (*sensu* Bychowsky, 1937), and the Tetraonchidae includes 20 species. Keys for four genera in the Gyrodactylidae identify about 150 nominal species. For the polyopisthcotyleans, several keys can be used to identify more than 30 species from 10 genera. Overall, about 500 species of monogeneans can be identified to species level using the keys and supplements in this book. Thus, this volume became popular among ichthyoparasitologists, despite it being written in Russian. Currently, it is a rare book.

More than 20 years have passed since the second edition was published, and many new monogenan species have been described. New data from different countries exists, and some revisions to different monogenean taxa have been published. Therefore, preparation of a second edition English language "Guide to the Monogenoidea of Freshwater Fish of the Palaearctic and Amur Regions" seems to be of current importance.

Because fish parasites, especially monogeneans, follow their host's distribution, in general fish zoogeography reflects monogenean distribution. The terms "Palaearctic" and "Nearctic" are not zoogeographical units but can be used for notational convenience (Banarescu, 1992).Palaearctic defines the Eurasian part of the Holarctic that includes the Euro-Mediterranean, Circumpolar (the Asian part) (Berg, 1949), Baikal, and western Mongolian subregions. The Sahara marks a sharp southern border between northwestern Africa which belongs to Palaearctic and contains mainly European aquatic fauna, and tropical African and Ethiopian regions. In contrast, vague borders exist in western Asia: Southern Anatolia, the entire Near East, central and southern Iran, and parts of Afghanistan must be considered as transitional areas between the Euro-Mediterranean subregion and the South Asian subregion of the Sino-Indian region (Banarescu, 1992). The same is true for the Amur River, which is transitional area between the Circumpolar subregion and the Sino-Indian region. Considering that a number of fish species from the Amur River were introduced into European aquaculture, a separate key for *Dactylogyrus* species of Amur River fishes is included in this edition, in contrast to species from other transitional areas which are inserted to a common keys. Some precise data on monogenean distribution can be found in Pugachev's (2002) "Checklist of the Freshwater Fish Parasites of the Northern Asia" and Moravec's (2001) "Checklist of the Metazoan Parasites of Fishes of the Czech Republic and Slovak Republic (1873–2000)."

When adding newly described species and species from new geographic regions to the keys from the 1985 publication, it seemed prudent to retain the structure of the keys. This provides continuity between the previous and current editions of the book that would have been lacking if the keys were completely revised. Moreover there is no modern accepted monogenean classification. Although the more conservative monogenean classification was used in this edition, it does not greatly influence the identification process. Therefore, some monogenean groups maintain their systematic status (e.g., order Tetraonchidea, family Ancyrocephalidae, etc.). However, some groups obviously need revision (e.g., genera *Dactylogyrus* and *Gyrodactylus*).

Many changes were made in this edition of the book. For simplicity, the small theoretical chapters (e.g., infection pathways of monogeneans and marine monogenean species) from the second edition were excluded from this one. A new family—Bothitrematidae, with the genus *Bothitrema*—was added to the common key of families. The key for *Dactylogyrus* now includes 62 additional species, and the key for *Gyrodactylus* now includes 25 new species. The key for the



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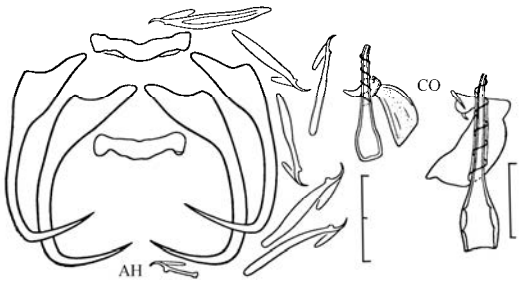

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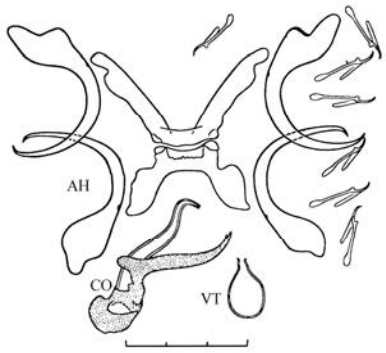

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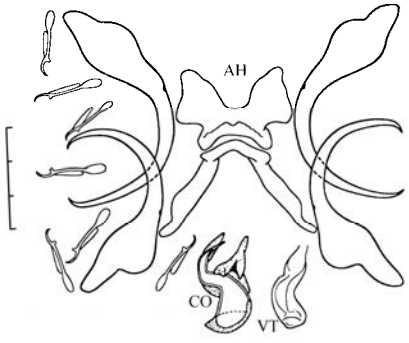

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Fig. 381 – 384.

381 - *Haplocleidus dispar* (CO – right - after Lambert, 1977a; left – after Ergens et Lom, 1970). **382 -** *Urocleidus similis* (after Lambert, 1977a; right CO – after Ergens et Lom, 1970). **383 -** *Actinocleidus oculatus* (after Lambert, 1977a). **384 -** *Actinocleidus recurvatus* (after Lambert, 1977a).

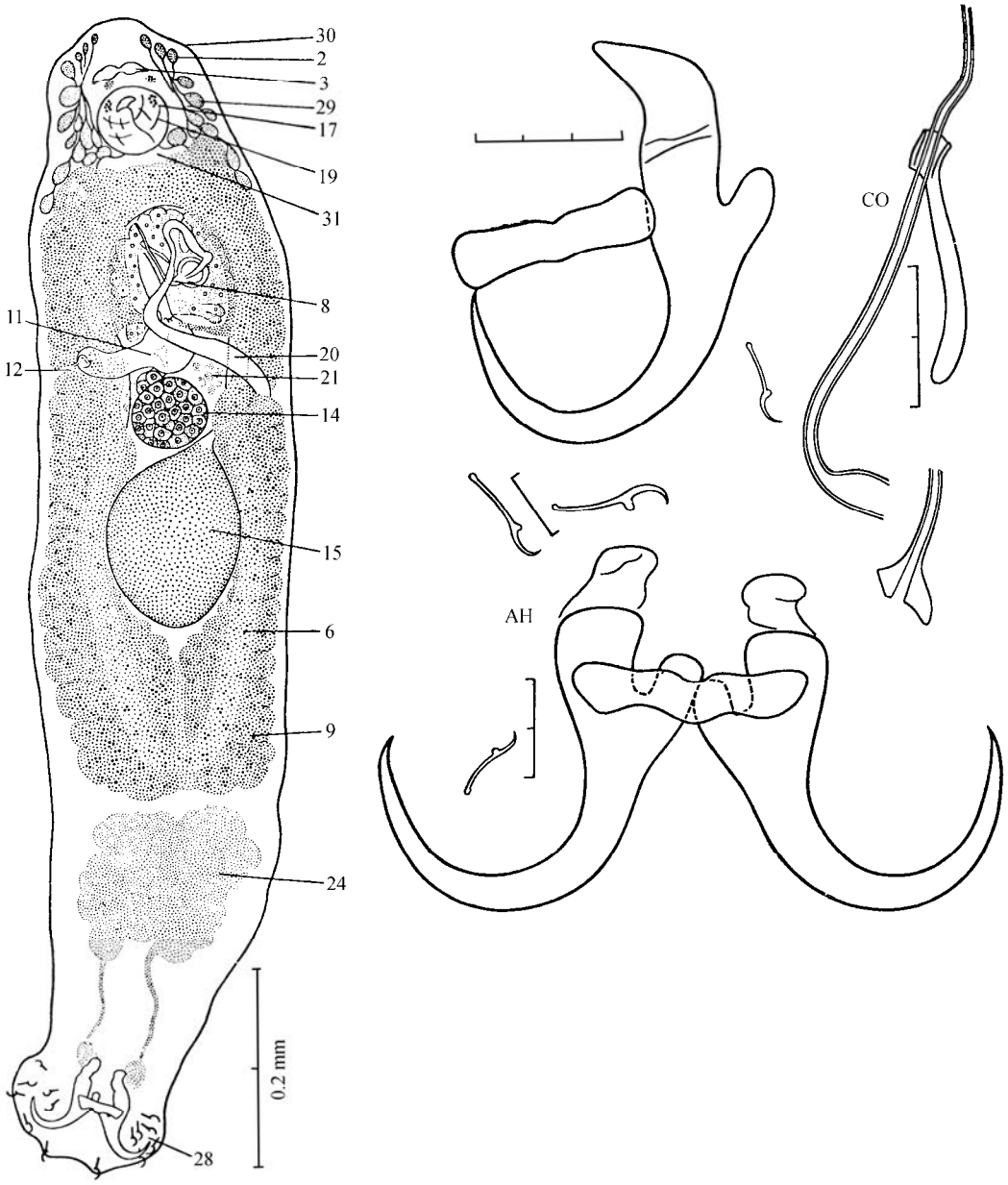


Fig. 385 - *Pseudodactylogyrus bini*, total drawing from ventral view (after Gussev, 1965). Designations are the same as on Fig. 1.

IV. Representatives of a peculiar genus, *Pseudodactylogyrus* Gussev, 1965, can be found on gills of *Anguilla anguilla* in Palaearctic natural waters. Species of this genus have been formerly described as belonging to *Dactylogyrus* and *Neodactylogyrus*, but this designation is incorrect. Three species of this genus are known at present: *Pseudodactylogyrus bini* (Kikuchi, 1929), *P. anguillae* (Yin et Sproston, 1948), and *P. microrchis* Ogawa et Egusa, 1976. They are found on the

gills of *A. japonica, A. anguilla* in the rivers and fish farms of Japan and China and *A. reinchardti* in Australia (Kikuchi, 1929; Yin and Sproston, 1948; Gussev, 1965; Ogawa and Egusa, 1976).

Pseudodactylogyrus differs from other Dactylogyridae and many of the Ancyrocephalidae in having only one reservoir of the prostatic gland. The main difference is the armament of the haptor, which contains seven pairs of marginal hooks of the larval type, one pair of peculiar anchors directed with the point toward the ventral side of the haptor, and only one bar, which is ventral. No traces of the needle-shaped structures found in Dactylogyridae and in *Anaconthorus* (Ancyrocephalinae) have been noted. These peculiarities, and the fact that it parasitizes fishes that are very far geographically from the common hosts of Dactylogyridae, indicate that *Pseudodactylogyrus* is phylogenetically nearer to the Ancyrocephalinae than to the Dactylogyridae. It seems that their ancestors, which would have had two pairs of anchors, lost a pair, unlike other ancyrocephalid genus *Trianchoratus*, which has rudiments of it.

Table 3. Measures of species of *Pseudodactylogyrus* (in Ogawa et Eguza (1976) with corrections from other publications) (in mm).

Character	*P. bini*	*P. anguillae*	*P. microrchis*
Length:			
body	0.639–1.626	0.582–1.168	0.347–1.259
marginal hooks	0.015–0.018	0.014–0.016	0.014–0.017
anchor			
with straighten inner root	0.063–0.081	0.103–0.121	0.100–0.125
with bent inner root	0.053–0.070	0.091–0.105	0.086–0.102
main part	0.038–0.058	0.067–0.084	0.060–0.080
point	0.022–0.027	0.031–0.034	0.028–0.032
ventral bar	0.035–0.047	0.048–0.064	0.040–0.059
accessory piece	0.029–0.050	0.032–0.047	0.028–0.038
Ovary			
length	0.030–0.114	0.036–0.092	0.038–0.143
width	0.032–0.108	0.043–0.104	0.035–0.086
Testis			
length	0.067–0.265	0.100–0.154	0.022–0.084
width	0.052–0.184	0.068–0.132	0.017–0.070
Prostatic reservoir			
diameter	0.013–0.037	0.031–0.047	0.012–0.023

All three species of *Pseudodactylogyrus* (Table 3, Figs. 385–387) are large; the largest is *P. bini*. *P. anguillae* and *P. microrchis* differ from *P. bini* in having larger anchors; they differ from another other by the correlation of the ovary and testis dimensions: in *P. anguillae* the ovary is 2–2.5 times smaller than the testis (as in *P. bini*); in *P. microrchis* this correlation is opposite. The prostatic reservoir is two times smaller in *P. microrchis* than in *P. anguillae*; in *P. bini* its size is intermediate. The glands of the posterior part of the body are more developed in *P. bini* than in the other two species (compensation for small anchors?). Other features differ faintly.

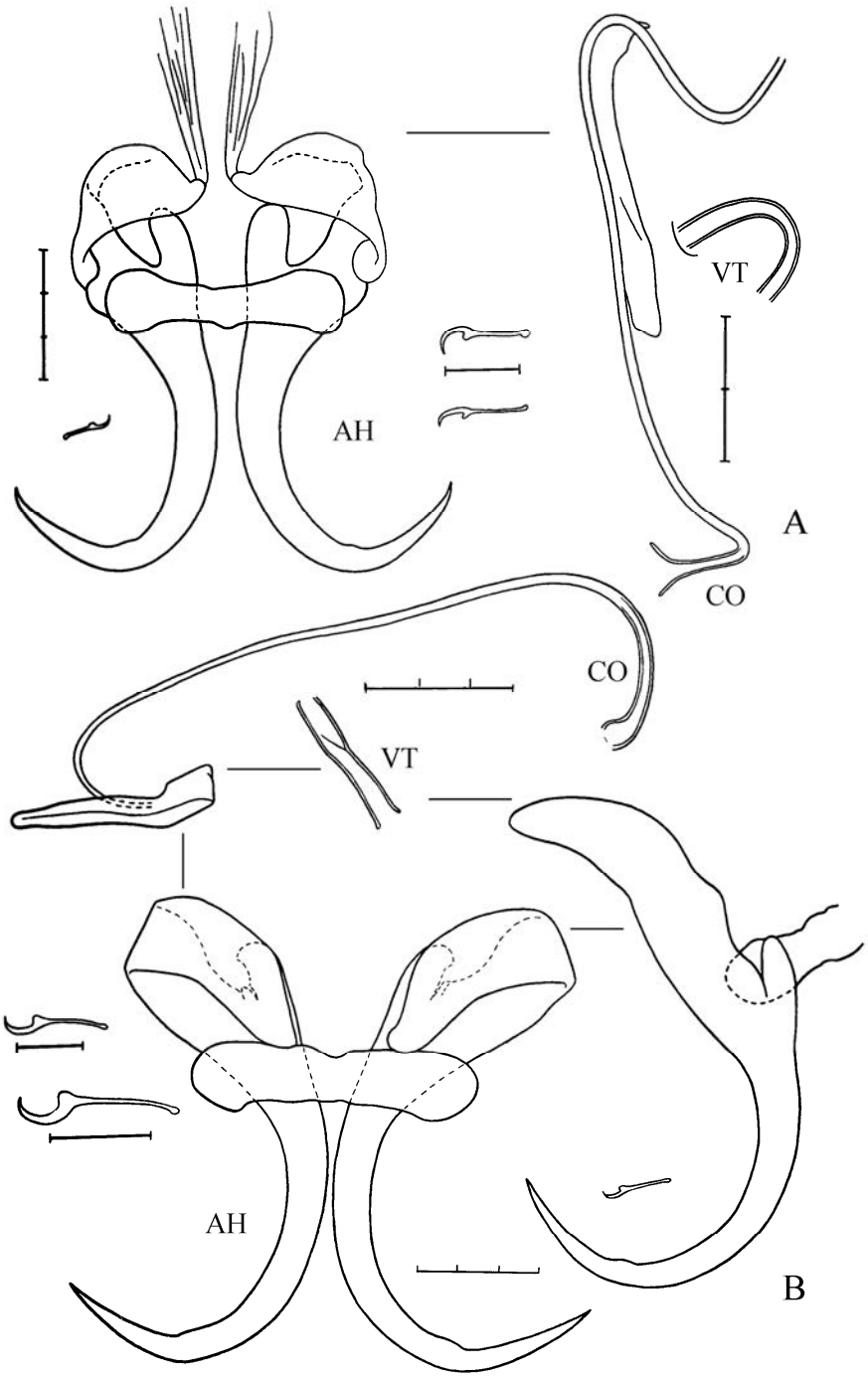


Fig. 386 - *Pseudodactylogyrus anguillae* (after Gussev, 1965).
A – from *Anguilla reinchardii* (Australia), B – from *A. japonica* (Far East, Russia).

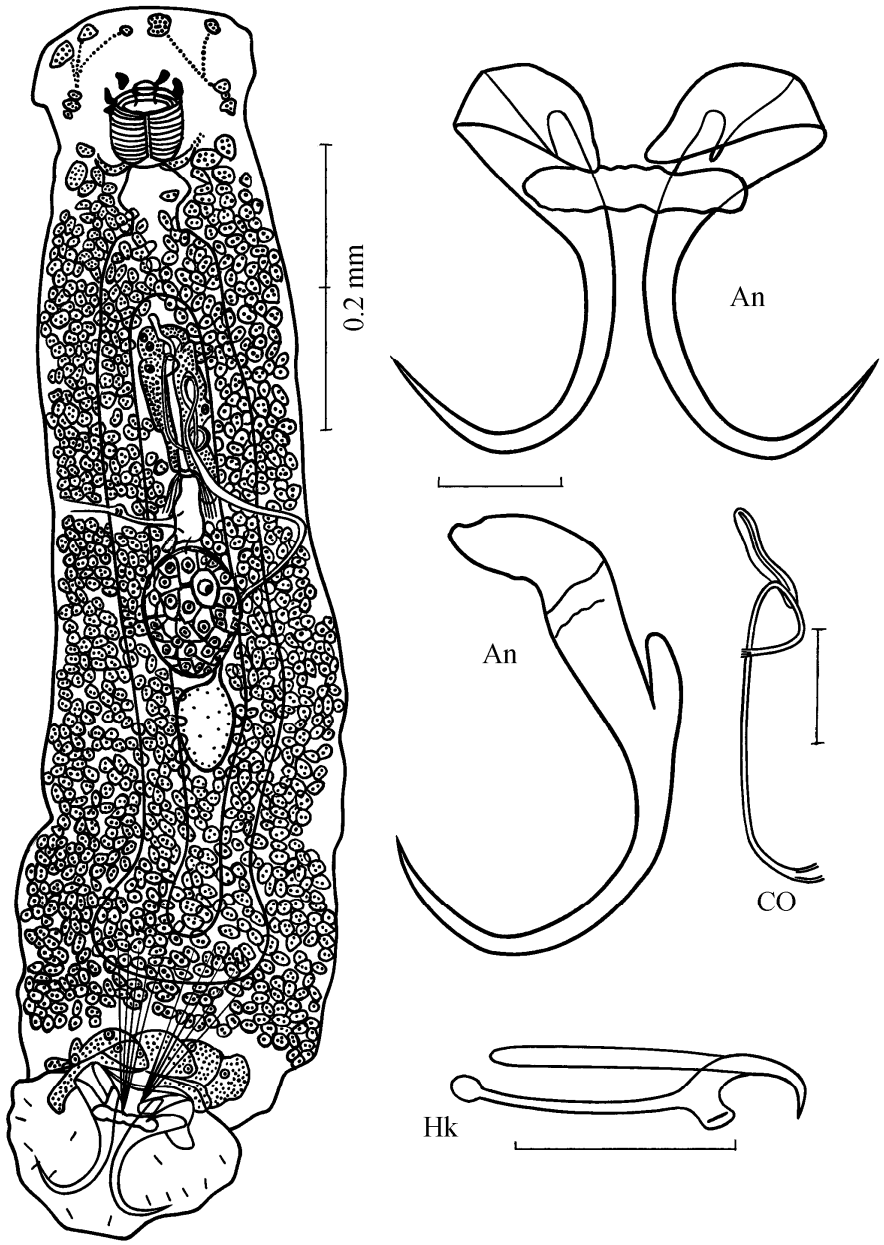


Fig. 387 - *Pseudodactylogyrus microrchis*, ventral view (after Ogawa et Egusa, 1976).

Subfamily Ancylodiscoidinae Gussev, 1961[71]

The body of Ancylodiscoidinae is elongate, and the anterior region is narrow with three pairs of head organs. Four eye spots are present in the anterior dorsal region, sometimes present as scattered pigment granules. The pharynx is muscular. The intestine is bifurcate and the caeca unite posterior to the gonads to form a cyclocoel or they end blindly. The haptor may or may not be set off from the body, and in some case it is bilobed. Two pairs of anchors are present: the ventral anchors are developed or occasionally vestigial. Two connecting bars are present: the dorsal bar usually is undivided, whereas the ventral bar may or may not be separated into two parts. Fourteen marginal hooks are present; they all may be of the larval type, or there may be a combination of larval and modified adult types. Sometimes additional sclerite(s) (onchium or onchia) are present between two marginal hooks. Patches may be present on the dorsal anchors; sometimes they occur on both dorsal and ventral anchors. Gonads are between caeca and may overlap. The testis lies posterior and dorsal to the ovary. The vas deferens loops around the left intestinal caecum to the ventral side, where it dilates once to form a dactylogyrid-type or blind sac-like seminal vesicle or twice to form two seminal vesicles (either both of the dactylogyrid-type or one of each type). The copulatory organ consists of a straight, curved, or coiled tube, with or without an accessory piece. The ovary lies mid-body, ventral to the testis; the oviduct is short and arises from the anterior part of the ovary. The uterus extends from the oviduct to open via a uterine pore or common genital pore near the copulatory organ. The vagina is dextrally submedian, dextral or sinistral, and may or may not be sclerotised. The seminal receptacle usually is prominent and medial. The vitellarium is follicular and coextensive with the intestinal caeca (after Lim et al., 2001).

These are parasites of gill filaments of Siluriformes. Nineteen genera are known from freshwaters of Eurasia, Africa, and South America. The current status of the nominal genera recorded from the Siluriformes of the Old World can be found in Lim et al. (2001). Four genera are found in the Palaearctic and Amur regions.

Key to genera of Ancylodiscoidinae

1 (6). All marginal hooks are of the larval type and are identical; the ventral bar can be unpaired or paired and is not connected to the dorsal bar.

2 (3). The dorsal anchors lack patches that are short and broad; they are small as well as the whole haptor in comparison with the body's size. The rounded haptor is set off from the body; in mature worms the haptor is embedded in the host's gill tissue. The ventral bar is separated into two parts.
Ancylodiscoides

3 (2). The dorsal anchors have patches that are long and narrow; they are largish as well as the whole haptor in comparison with the body's size. The haptor is elongated and not well set off from the body and it is not embedded in the host's gill tissue. The ventral bar may or may not be separated into two parts.

4 (5). The ventral bar is not separated into two parts but is divided into two symmetrical halves by a bend and constriction in the middle.
Thaparocleidus

5 (4). The ventral bar is separated into two parts. These are parasites of Bagridae.
Pseudancylodiscoides

[71] Lim et al. (2001) raised this subfamily to full family status.

6 (1). Four pairs of marginal hooks are small, whereas the others are large and have a well-developed handle of the *Dactylogyrus* type. The ventral bar is separated into two parts, both of which are articulated with the dorsal bar.
Bychowskyella

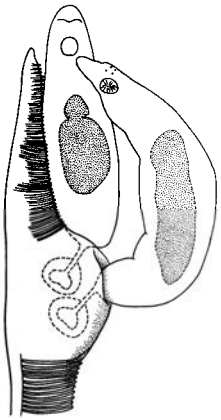
Genus *Ancylodiscoides* Yamaguti, 1937
Syn.: *Indocotylus* Kulkarni, 1969

These relatively large worms are greater than 1.2 mm in length and have four compact eye spots. The intestinal caeca unite posterior to the testis. The haptor is small and well set off from the body by a peduncle, and it usually is embedded in the host's gill tissue. The anchors are comparatively small; the dorsal anchors have a wide base without patches, and the ventral anchors are similar to the dorsal anchors. The dorsal connecting bar is **V**-shaped; the ventral bar is split into two parts. The marginal hooks are of the larval type. The copulatory tube has an accessory piece. The seminal vesicle is blind and sac-like. The vagina is sinistral. These are parasites of freshwater silurids and bagrids (after Lim et al., 2001).

The type species, and the only one found in the Amur region, is *A. parasiluri* Yamaguti, 1937. The genus consists of three species.

Ancylodiscoides parasiluri Yamaguti, 1937 (Fig. 388, 389)

These are very large worms; body length can be up to 7.0 mm and width to 1.0 mm. The haptor is sharply set off from the body by a muscular peduncle. Length of marginal hooks is 0.014–0.017 mm. Total length of ventral anchors is 0.034–0.036 mm. The ratio between the length of their main part and the width at the bifurcation of the roots is about 1.5. Size of bar of ventral anchors is 0.004–0.006 x 0.025–0.031 mm.



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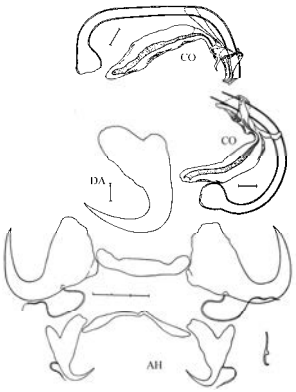

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Fig. 388 – 389.
388 - *Ancylodiscoides parasiluri* (after Gussev et Strelkov, 1960). Attachment on gills. **389 -** *Ancylodiscoides parasiluri* (after Gussev et Strelkov, 1960).

Total length of dorsal anchors is 0.050–0.060 mm, larger width of the main part about 0.030 mm. Size of bar between the dorsal anchors is 0.004–0.006 x 0.047–0.054 mm. The K coefficient is 1.4–1.7.[72] Total length of copulatory organ is 0.070–0.095 mm, diameter of tube about 0.005 mm. A long esophagus is present. The testis is very large (seven times larger than the ovary). The vitellaria begin as an unpaired strip in front of the esophagus, then divide into two thin lateral strips that are confluent behind the testis. The posterior intestinal caecum has no diverticulum.

Found on gill filaments of *Silurus soldatovi* and *S. asotus*; Amur River Basin (Russia); described from Lake Suwa (Japan).

Genus *Thaparocleidus* Jain, 1952

Syn.: *Jainius* Akhmerov, 1964; *Neomurraytrema* Tripathi, 1959; *Parancylodiscoides* Akhmerov, 1964 nec. Caballero et Bravo Hollis, 1960; *Silurodiscoides* Gussev, 1976; *Wallagotrema* Tripathi, 1959 (after Lim et al., 2001)

The body is elongate and the worm has four eye spots. The caeca unite posterior to the testis. The haptor may or may not be well demarcated from the body; sometimes it is bilobed. Patches are present on the dorsal anchors. The dorsal anchors usually are larger than the ventral anchors. The dorsal and the ventral anchors have roots of variable length. The dorsal bar is straight to **V**-shaped; the ventral bar usually is **V**-shaped or divided into two parts. The marginal hooks are variable in shape and size. The seminal vesicle is single, blind, and sacciform. The copulatory organ usually consists of a coiled copulatory tube and an accessory piece. The vaginal opening normally is sinistral.

These are parasites of gills of Siluriformis, especially of Siluridae.

The type species is *T. wallagonis* Jain, 1952 from *Wallago attu* (India). About 77 other species are known from Europe and eastern and southern Asia. Twenty-two species have been found in the Palaearctic and Amur regions: 3 in the Palaearctic and 19 in the Amur River Basin. The Sino-Indian and Palaearctic regions have no species in common, which is why we divided our Key into two parts.

Key to species of *Thaparocleidus* of the Palaearctic

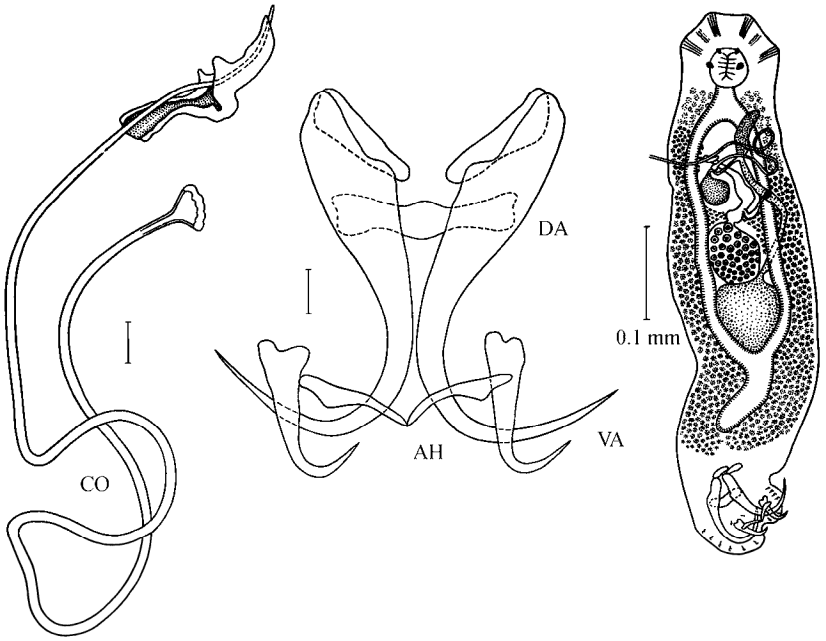
1 (2). The copulatory tube is rather wide (diameter 0.003–0.004 mm) and short (length about 0.40 mm, forming 2–3 spires in the middle), with a funnel-shaped initial part. Vaginal armament is absent.
T. siluri (Zandt, 1924) (Fig. 390)

Syn.: *Ancyrocephalus siluri* Zandt, 1924; *Urocleidus siluri*: Mizelle et Hughes, 1938; *Ancylodiscoides siluri*: Yamaguti, 1937; *Parancylodiscoides siluri*: Akhmerov, 1964; *Silurodiscoides siluri*: Gussev, 1976

These medium size worms have a body length up to 0.8 mm and width to 0.22 mm. Length of marginal hooks is about 0.017 mm. Ventral anchors are narrow and long; total length is 0.033–0.037 mm; the ratio of the length of its main part to its width near the beginning of the roots is about 2.6; the ratio of the length of its main part to the length of the point is about 2:1. Total length of dorsal anchors is 0.080–0.090 mm. Size of patches is 0.007–0.009 x 0.026–0.030 mm. The K coefficient is 2.4. Size of bars: at ventral anchors (half of bar) about 0.004 x 0.027 mm, at dorsal anchors 0.008 x 0.044 mm. A long blind projection protrudes backward from the posterior intestinal arch. Total length of copulatory organ is 0.084–0.16 mm, length of tube 0.39–0.42 mm, diameter 0.003–0.004 mm, accessory piece 0.029–0.047 mm. The vaginal pore opens ventrally, slightly to the left of the body midline. Short vaginal tube goes over to a large **J**-shaped seminal receptacle.

Found on gill filaments of *Silurus glanis*; Baltic, Black, Caspian, and Aral Sea Basins.

[72] The K ratio is the ratio of the total length of the dorsal anchors to that of ventral ones; also called the "anchor coefficient" (Akhmerov, 1952).



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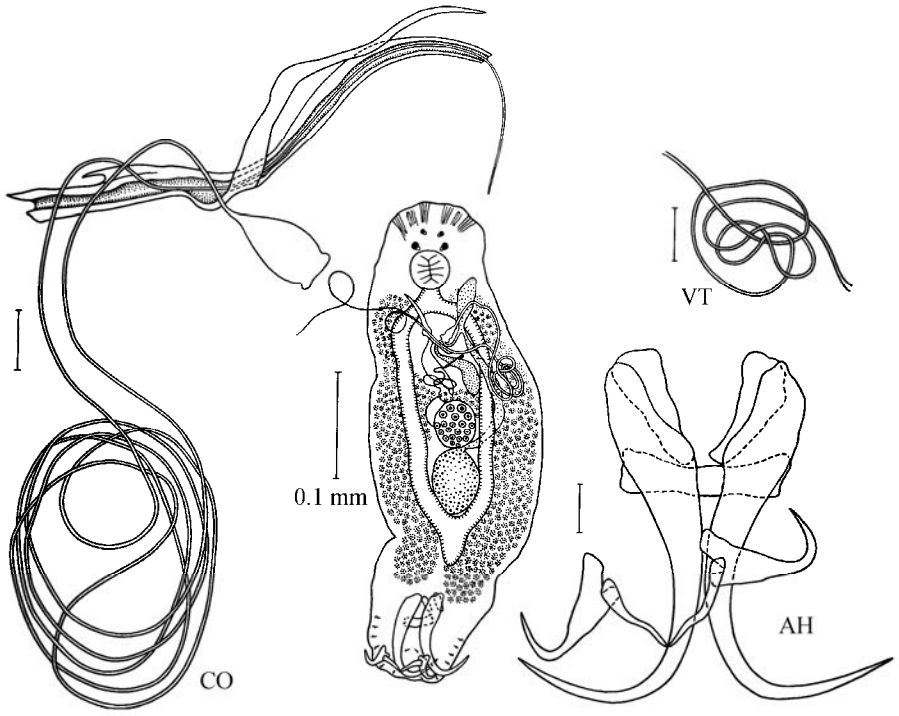

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Fig. 390 – 391.
390 - ***Thaparocleidus siluri,*** ventral view (after Bychowsky et Nagibina, 1957). **391 -** ***Thaparocleidus vistulensis,*** ventral view (after Bychowsky et Nagibina, 1957).

2 (1). The copulatory tube is thin (diameter about 0.001 mm), long, and makes at least four loops in the middle, with a scyphiform initial part. A chitinoid armament of the vaginal tube usually is present.

3 (4). The dorsal anchors are thin, with a narrow and slightly bent main part. Total length of the copulatory organ is about 0.15 mm.
T. vistulensis (Siwak, 1932) (Fig. 391)
Syn.: *Ancyrocephalus vistulensis* Siwak, 1932; *Urocleidus vistulensis*: Mizelle et Hughes, 1938; *Ancylodiscoides vistulensis*: Yamaguti, 1963; *Silurodiscoides vistulensis*: Gussev, 1985

These medium size worms have a body length up to 0.75 mm and width to 0.27 mm. Length of marginal hooks is about 0.016 mm. Ventral anchors are rather short and broad; total length is 0.025–0.028 mm; the ratio of the length of its main part to its width near the beginning of the roots is about 2.4; the ratio of the length of its main part to the length of the point is about 1.4. Total length of dorsal anchors is 0.070–0.077 mm. Size of patches is 0.007–0.008 x 0.024–0.028 mm. The K coefficient is 2.7–2.8. Size of bars: at ventral anchors (half of bar) about 0.003 x 0.025 mm, at dorsal anchors 0.005 x 0.034–0.040 mm. A short blind projection protrudes backward from the posterior intestinal arch. Total length of the copulatory organ is about 0.15 mm, length of tube 0.64–0.93 mm, diameter less than 0.001 mm, accessory piece 0.068–0.111 mm. Length along the curve of the vaginal tube that forms several loops is about 0.20 mm. The vaginal pore opens ventrally, near the body midline.

Found on gill filaments of *Silurus glanis*; Baltic, Black, Caspian, and Aral Sea Basins; Vakhsh (Tajikistan) and Chu (Kazakhstan) Rivers. *T. vistulensis* is a pathogen for *Silurus glanis* in fish farms (Molnar, 1968).

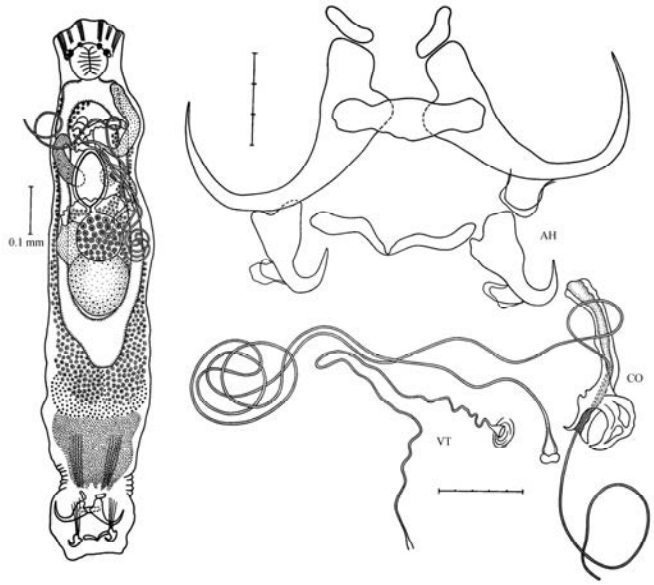
4 (3). The dorsal anchors are massive, with a broad and very bent main part. The total length of the copulatory organ is about 0.34 mm.
T. magnus (Bychowsky et Nagibina, 1957) (Fig. 392)
Syn.: *Ancylodiscoides magnus* Bychowsky et Nagibina, 1957; *Silurodiscoides magnus*: Gussev, 1985

These large worms have a body length up to 1.6 mm and width to 0.27 mm. Length of marginal hooks is about 0.017 mm. Ventral anchors are massive, short, and broad; their total length is 0.033–0.035 mm; the ratio of the length of its main part to its width at the beginning of its roots is 1.8–2.0 mm; the ratio of the length of its main part to the length of the point is 1.8–2.0 mm. Total length of dorsal anchors is 0.068–0.077 mm. Size of patches is 0.005 x 0.017–0.023 mm. The K coefficient is 2.0–2.2. Size of bars: at ventral anchors (half of bar) about 0.006 x 0.030 mm, at dorsal anchors 0.014 x 0.050 mm. The posterior intestinal arch has only a slight swelling. Well-developed glands in the prehaptor part of the body are present. Total length of copulatory organ is about 0.34 mm, length of tube 1.4–1.6 mm, diameter about 0.002 mm. Length of the curved vaginal tube is 0.30–0.40 mm. The vaginal pore opens ventrally near the left edge of the body between the ovary and copulatory organ.

Found on gill filaments of *Silurus glanis*; Black, Caspian, and Aral Sea Basins.

Key to species of *Thaparocleidus* of the Amur region

1 (2). The copulatory tube stretches from the edge of the anterior quarter of the body up to the posterior edge of the testis, where it makes a loop and reaches the anterior intestinal arch; its length can be up to 1.5 mm. The ratio of the length of the main part of the ventral anchors to the length of the point is less than 1.5.
T. longitubus (Gussev et Strelkov, 1960) (Fig. 393)
Syn.: *Ancylodiscoides longitubus* Gussev et Strelkov, 1960; *Silurodiscoides longitubus*: Gussev, 1985



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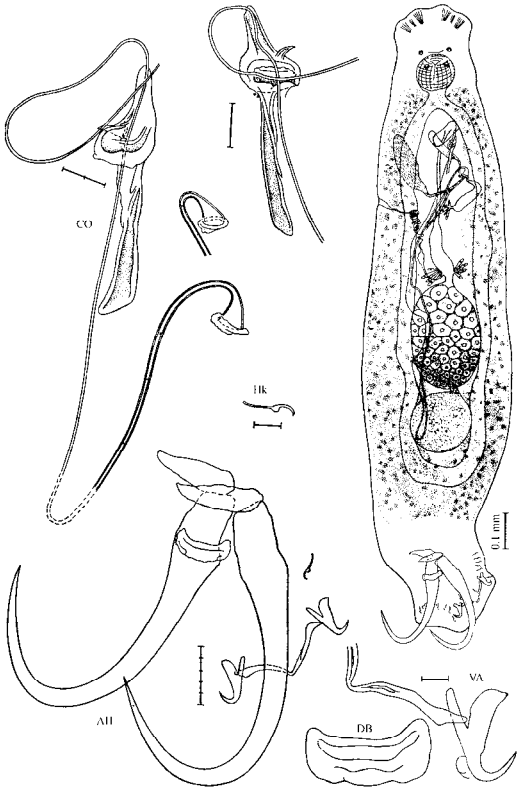

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Fig. 392 – 393.
392 - ***Thaparocleidus magnus***, ventral view (after Bychowsky et Nagibina, 1957). **393 -** ***Thaparocleidus longitubus***, dorsal view (after Gussev et Strelkov, 1960).

These are large worms; body length can be up to 2.0 mm and width to 0.3 mm. Length of marginal hooks is 0.016–0.017 mm. Ventral anchors have well-developed roots; their total length is 0.033–0.042 mm. Length of dorsal anchors is 0.210–0.235 mm. Size of patches is 0.070–0.089 x 0.019–0.021 mm. Size of bars: ventral (half of bar) 0.006–0.008 x 0.038–0.049 mm, dorsal bar 0.015–0.019 x 0.044–0.048 mm. The K coefficient is 5.3–7.1. Copulatory tube length is 1.5–1.9 mm, diameter at the beginning 0.003 mm, at posterior end less than 0.001 mm. Length of accessory piece is 0.103–0.113 mm. The vaginal tube can be seen only in living specimens; it is a thin, very coiled tube about 0.45 mm long. The vaginal pore is sinistral.

Found on gill filaments of *Silurus soldatovi*; Amur River.

2 (1). The copulatory organ is in front of the ovary; the tube is rather short (less than 0.20 mm). The ratio of the length of the main part of the ventral anchors to the length of the point is greater than 1.5.

3 (16). The ventral anchors are short and have a broad main part (the ratio of its length to width near the beginning of the roots is less than 2.5), with a relatively long point (ratio of the length of the main part to the length the point is less than 1.9). The accessory piece of the copulatory organ lacks lateral projections.

4 (9). The length of the dorsal anchors is less than 0.080 mm. The K coefficient is 2.6–3.6.

5 (8). The dorsal anchors have a slightly and smoothly bent main part; the outer root is absent. The length of the copulatory tube is less than 0.060 mm.

6 (7). The copulatory tube is slightly bent and about 0.040 mm long; its diameter is less than 0.001 mm.

T. infundibulovagina (Yamaguti, 1942) (Fig. 394)

Syn.: *Ancylodiscoides infundibulovagina* Yamaguti, 1942; *Silurodiscoides infundibulovagina*: Gussev, 1985

These are large worms; body length can be up to 1.0 mm and width to 0.27 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.022–0.025 mm, dorsal anchors 0.064–0.074 mm. Size of patches is 0.010–0.014 x 0.021–0.027 mm. Size of bars: ventral bar (half) 0.004 x 0.023–0.027 mm, dorsal bar 0.006–0.010 x 0.039–0.045 mm. The K coefficient is 2.6–3.3. The testis is very large (its diameter is three times greater than that of the ovary); a longitudinal reservoir of the prostatic gland with thick walls is present; the seminal vesicle is a narrow duct that reaches the pharynx. Length of copulatory tube is 0.029–0.043 mm, diameter less than 0.001 mm, length of accessory piece 0.035–0.044 mm. Vaginal armament is retort shaped and 0.034–0.043 mm long.

Found on gill filaments of *Silurus asotus* and rarely of *Silurus soldatovi*; Amur River Basin; Liao He and Yangtze (China) Rivers; water bodies of Japan (Lake Biwa near Kyoto).

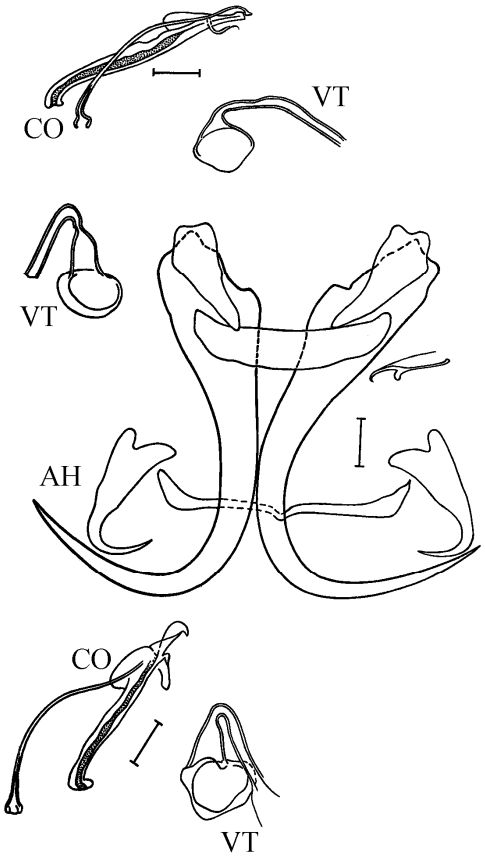
7 (6). The copulatory tube is arched or **S**-shaped with a length of 0.060 mm and diameter of 0.002 mm.

T. rarissimus (Gussev et Strelkov, 1960) (Fig. 395)

Syn.: *Ancylodiscoides rarissimus* Gussev et Strelkov, 1960; *Silurodiscoides rarissimus*: Gussev, 1985

These small worms have a body length up to 0.45 mm and width to 0.15 mm. Length of marginal hooks is 0.015–0.016 mm. Total length of ventral anchors is about 0.029 mm, dorsal anchors 0.090 mm. Size of patches is 0.013 x 0.032 mm. Size of bars: ventral bar (half) 0.004 x 0.037 mm, dorsal bar 0.008 x 0.050 mm. The K coefficient is 3.1. Length of copulatory tube is about 0.060 mm, diameter 0.002 mm, length of accessory piece about 0.050 mm. Vaginal armament is a broad funnel.

Found on gill filaments of *Silurus soldatovi*; Amur River.



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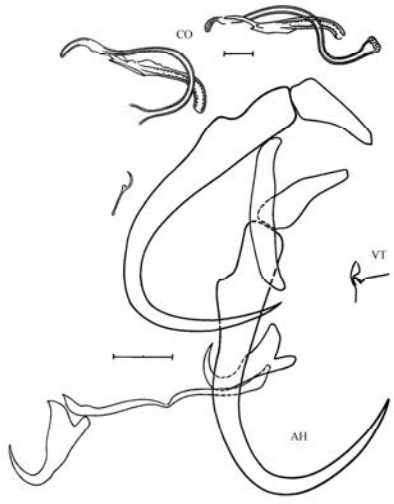


395

Fig. 394- 395.
394 - ***Thaparocleidus infundibulovagina*** (after Gussev et Strelkov, 1960). **395 -** ***Thaparocleidus rarissimus*** (after Gussev et Strelkov, 1960).

8 (5). The dorsal anchors have a sharply bent main part and a short outer root. The length of the copulatory tube is greater than 0.020 mm.
T. asoti (Yamaguti, 1937) (Fig. 396)
Syn.: *Ancylodiscoides asoti* Yamaguti, 1937; *Silurodiscoides asoti*: Gussev, 1985

These are large worms; body length can be up to 1.5 mm and width to 0.32 mm. Length of marginal hooks is about 0.016 mm. Total length of ventral anchors is 0.026–0.033 mm, dorsal anchors 0.088–0.100 mm. Size of patches is 0.009–0.010 x 0.027–0.030 mm. Size of bars: ventral bar (half) about 0.008 x 0.020 mm, dorsal anchors 0.014–0.020 x 0.048–0.054 mm. The K coefficient is 2.8–3.6. Length of sickle-shaped copulatory tube is 0.25–0.28 mm, diameter about 0.003 mm, length of accessory piece 0.13–0.16 mm. Vaginal armament is a short tube that passes over to a broad sacciform seminal receptacle.

Found on gill filaments of *Silurus asotus*; Amur River Basin; water bodies of China and Japan.

9 (4). The length of the dorsal anchors usually is greater than 0.095 mm. The K coefficient is 4.0–9.1.

10 (15). The length of the dorsal anchors is less than 0.140 mm. The K coefficient is 4.0–6.1. The length of the copulatory tube is less than 0.15 mm.

11 (14). The accessory piece of the copulatory organ is narrow, lacks projections, and is slightly broad at the end; its length usually is less than 0.075 mm.

12 (13). The vaginal armament has a short chitinoid funnel with a broad end that passes over to the seminal receptacle near the ovary; it also has a narrow end to the vaginal duct opening at the left side of the body.
T. mediacanthus (Akhmerov, 1952) (Fig. 397)[73]
Syn.: *Ancylodiscoides mediacanthus* Akhmerov, 1952; *Parancylodiscoides mediacanthus*: Akhmerov, 1964; *Silurodiscoides mediacanthus*: Gussev, 1985

These are large worms; body length can be up to 1.11 mm and width to 0.24 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.021–0.026 mm, dorsal anchors 0.097–0.134 mm. Size of patches is 0.008–0.012 x 0.031–0.045 mm. Size of bars: ventral bar (half) 0.003–0.004 x 0.020–0.027 mm, dorsal bar 0.006–0.012 x 0.029–0.039 mm. The K coefficient is 4.0–6.1. Length of copulatory tube is 0.093–0.130 mm, diameter slightly more than 0.001 mm. Length of accessory piece is variable in different regions: in Amur River mostly 0.060–0.070 mm. Vaginal armament is funnel shaped and 0.008–0.013 mm long. Two prostatic reservoirs are present.

Found on gill filaments of *Silurus asotus* and *S. soldatovi*; Amur River Basin (Russia); Liao He and Yangtze Rivers (China).

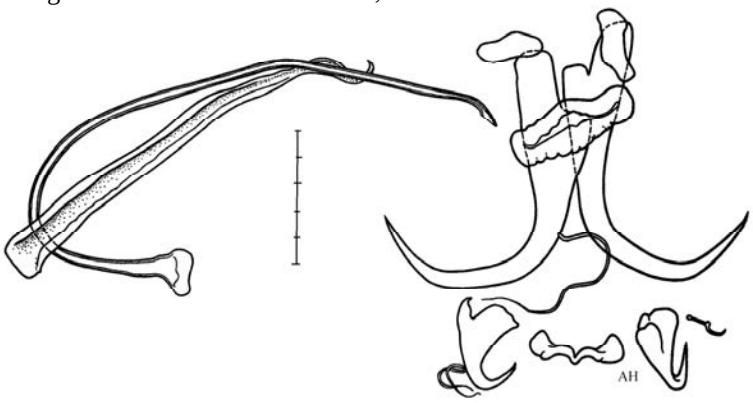
13 (12). The vaginal armament has a narrow, long, and straight tube with a scyphiform distal end that opens on the ventral side at the left intestinal caecum; the inner end opens to a rounded muscular seminal receptacle (everything is visible only on well-pressed specimens).
T. markewitschi (Gussev et Gerasev, 1982) (Fig. 398, 399)
Syn.: *Silurodiscoides markewitschi* Gussev et Gerasev, 1982: Gussev, 1985

These medium size worms have a body length up to 0.8 mm and width to 0.15 mm. Length of marginal hooks is 0.016 mm. Total length of ventral anchors is 0.022–0.024, dorsal anchors 0.123–0.132 mm. Size of patches is 0.010–0.014 x 0.040–0.050 mm. Size of bars: ventral bar (half) 0.003 x 0.020–0.024 mm, dorsal anchors 0.010–0.012 x 0.032–0.040 mm. The K coefficient is 5.5–5.6 mm. Length of copulatory tube is 0.125–0.150 mm, diameter in the middle 0.001–0.002 mm,

[73] Similar to this species is *T. hamatovagina* (Yamaguti, 1942) (see Supplement). It differs from *T. mediacanthus* by structure and larger size of the copulatory organ.

length of accessory piece 0.062–0.075 mm. Length of vaginal armament is 0.052–0.080 mm, size of its scyphiform part 0.007–0.010 x 0.012–0.020 mm, diameter of narrow tube 0.001 mm. A single reservoir of the prostatic glands is present.

Found on gill filaments of *Silurus asotus*; Amur River.



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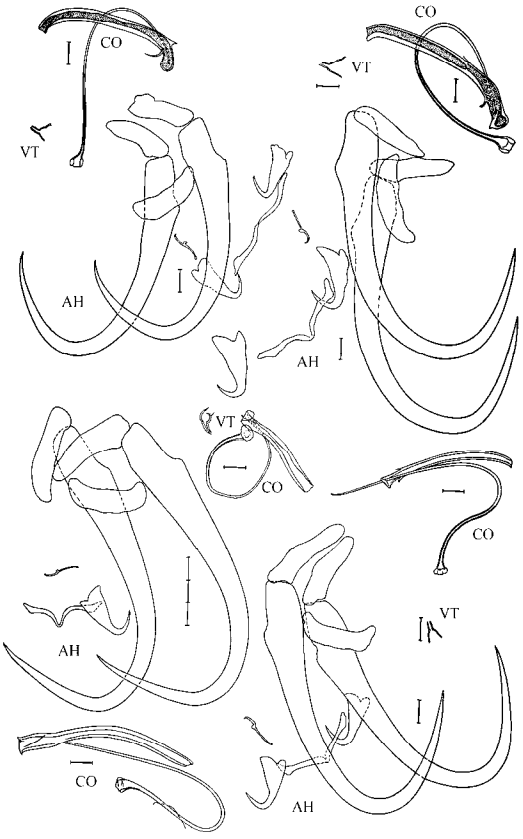
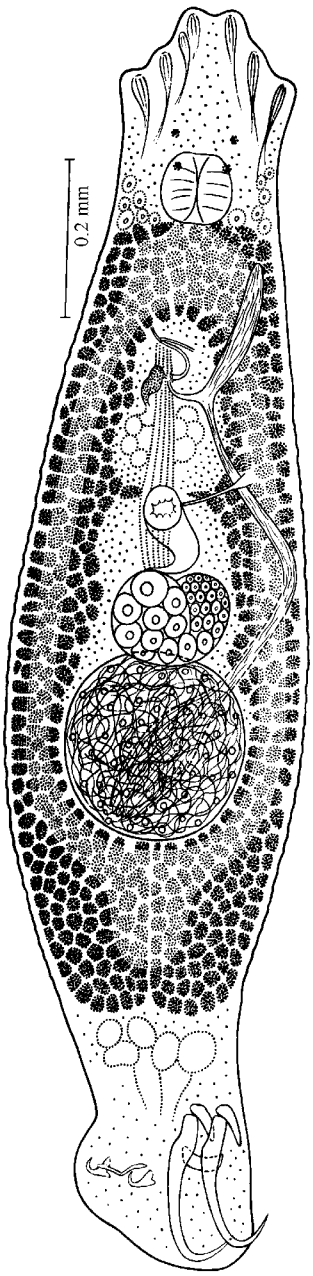
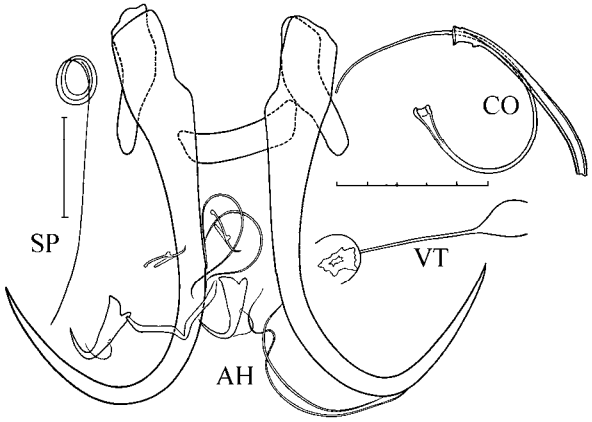


397

Fig. 396 – 397.
396 - *Thaparocleidus asoti* (after Gussev et Strelkov, 1960). **397 -** *Thaparocleidus mediacanthus* (after Gussev et Strelkov, 1960).





398 **399**

Fig.398- 399.
398 - *Thaparocleidus markewitschi*, ventral view (after Gussev et Gerasev, 1982). Designations are the same as on **399 -** *Thaparocleidus markewitschi* (after Gussev et Gerasev, 1982), sp – spermatozoon.

14 (11). The accessory piece of the copulatory organ becomes broader at its end and forms three finger-shaped projections; its length usually is greater than 0.090 mm.
T. magnicirrus (Gussev et Strelkov, 1960) (Fig. 400)
Syn.: *Ancylodiscoides magnicirrus* Gussev et Strelkov, 1960; *Silurodiscoides magnicirrus*: Gussev, 1985

These large worms can be up to 1.0 mm long and 0.3 mm wide. Length of marginal hooks is 0.015–0.016 mm. Total length of ventral anchors is 0.022–0.027 mm, dorsal anchors 0.093–0.127 mm. Size of patches is 0.009–0.012 x 0.031–0.039 mm. Size of bars: ventral bar (half) 0.003–0.004 x 0.020–0.029 mm, dorsal bar 0.008–0.010 x 0.033–0.041 mm. The K coefficient is 4.6–5.1 mm. Length of copulatory tube is 0.11–0.14 mm, diameter about 0.002 mm, length of accessory piece 0.090–0.127 mm. Length of funnel-shaped vaginal tube is 0.010–0.016 mm.

Found on gill filaments of *Silurus asotus* and *S. soldatovi*; Ussuri River, Lake Khanka (Russia); Liao He River (China).

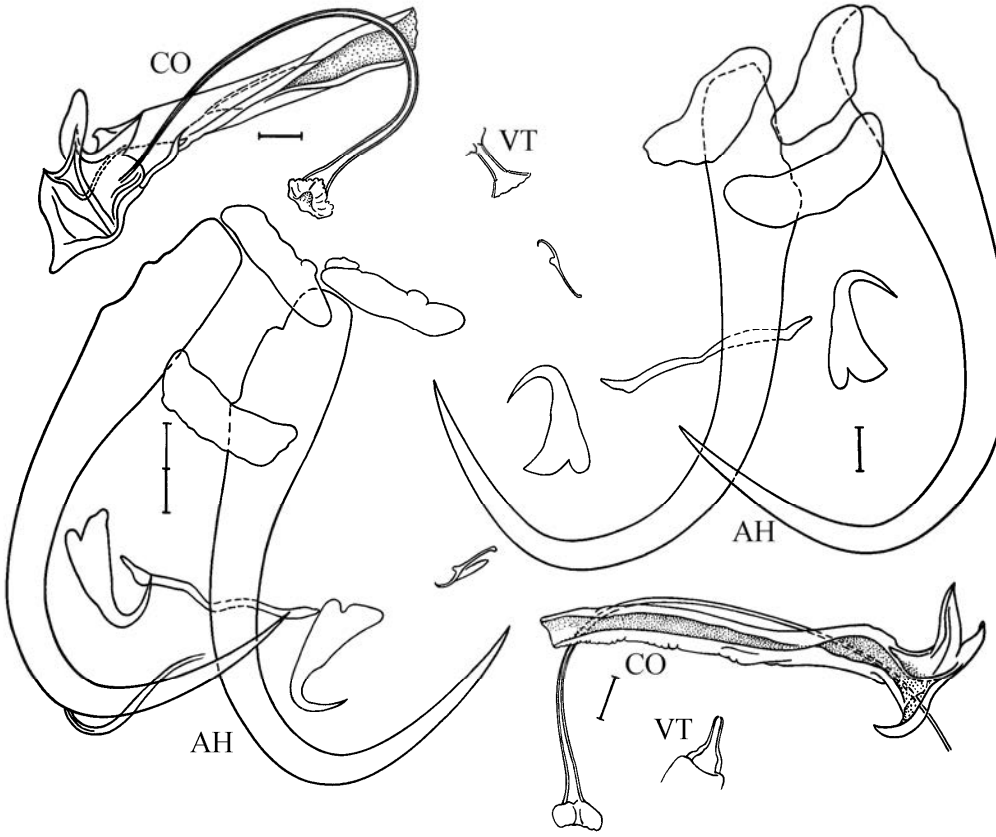


Fig. 400 - *Thaparocleidus magnicirrus* (after Gussev et Strelkov, 1960).

15 (10). The length of the dorsal anchors is greater than 0.20 mm. The K coefficient is 7.2–9.1. Length of copulatory tube is greater than 0.17 mm.
T. macracanthus (Akhmerov, 1952) (Fig. 401)
Syn.: *Ancylodiscoides macracanthus* Akhmerov, 1952; *Silurodiscoides macracanthus*: Gussev, 1985

These large worms have a body that can be up to 1.0 mm long and 0.20 mm wide. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.031–0.035 mm, dorsal anchors 0.23–0.28 mm. Size of patches is 0.016–0.023 x 0.080–0.093 mm. Size of bars: ventral bar (half) 0.006–0.008 x 0.035–0.045 mm, dorsal bar 0.020–0.027 x 0.050–0.063 mm. The K coeffi-

cient is 7.2–9.1. Length of copulatory tube is 0.17–0.24 mm, diameter about 0.003 mm. Length of accessory piece is 0.12–0.16 mm. Vaginal armament is a tube with a buble-shaped end; length of the narrow part is 0.041–0.049 mm.

Found on gill filaments of *Silurus soldatovi*; Amur River Basin.

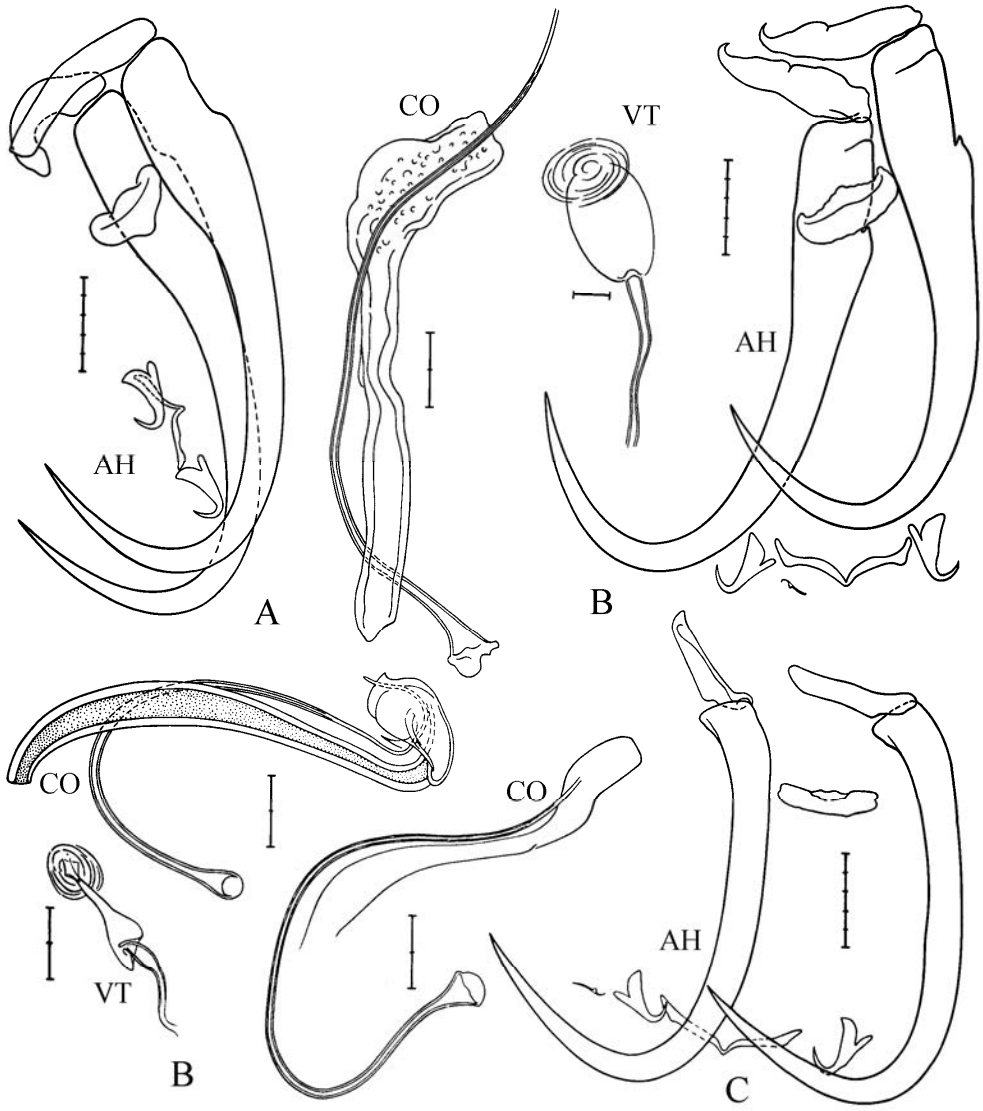


Fig. 401 - *Thaparocleidus macracanthus*:

A, B – adult specimens; C – young specimen (after Gussev et Strelkov, 1960).

16 (3). The ventral anchors are relatively long with a narrow main part; the ratio of its length to its width at the beginning of the roots (which sometimes are weakly developed or lacking) is greater than 3.0; the point is relatively short; the ratio of the length of its main part to the length of its point is greater than 2.5. The accessory piece of the copulatory organ has lateral projections.

17 (36). The ventral anchors have small roots; the outer one is finger shaped and 2–3 times thinner than the inner one; the latter one sometimes is not developed; the bar of the ventral anchors is rela-

tively thin with a poorly developed hillock.

18 (35). The vaginal armament is present.

19 (20). The vaginal armament is a thin-walled bubble-shaped structure (seminal receptacle) with a thick-walled retort-shaped “tip” (real vaginal tube). These are parasites of ***Silurus soldatovi*** only.
T. soldatovi (Gussev et Strelkov, 1960) (Fig. 402)
Syn.: ***Ancylodiscoides soldatovi*** Gussev et Strelkov, 1960; ***Silurodiscoides soldatovi***: Gussev, 1985

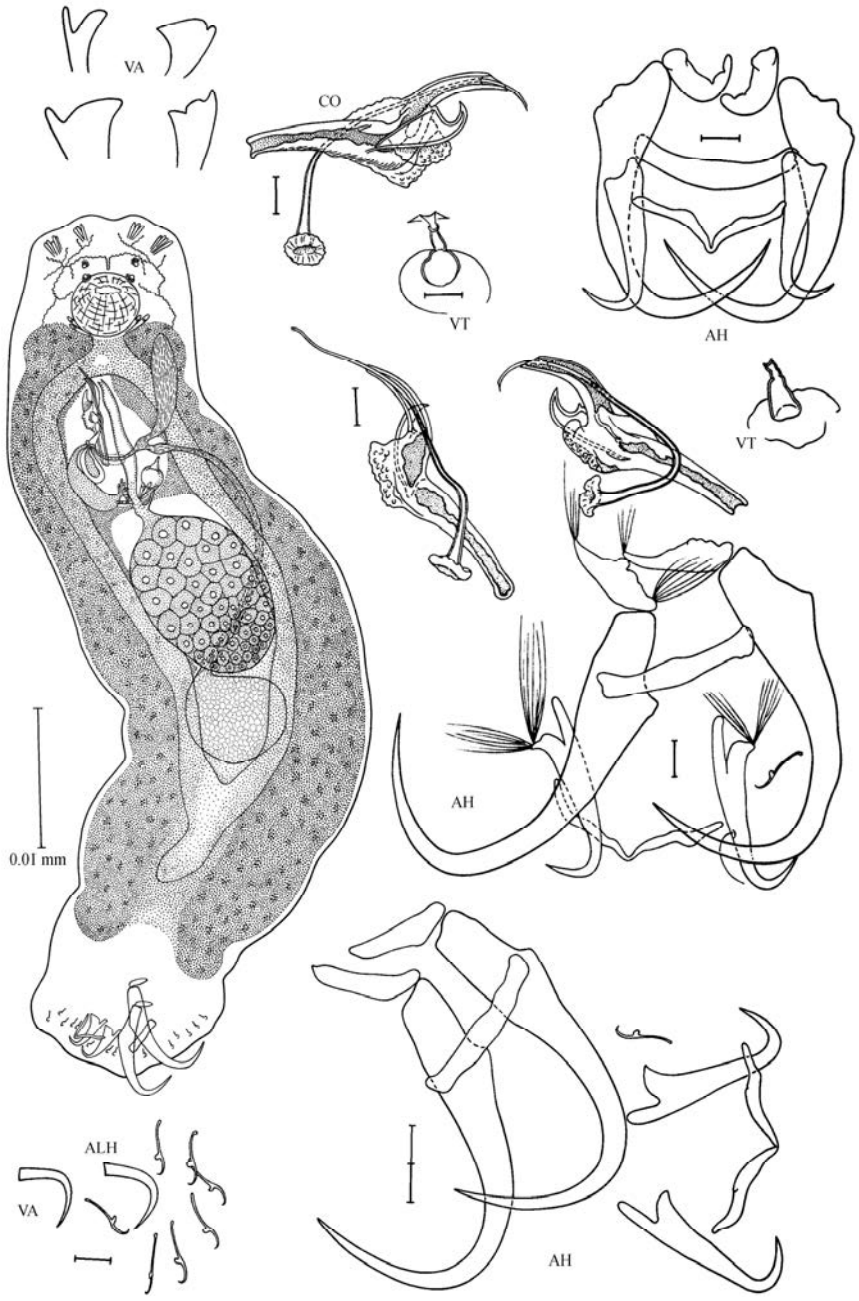


Fig. 402 - *Thaparocleidus soldatovi*,
ventral view, ALH - armament of larvae haptor (after Gussev et Strelkov, 1960).

These medium size worms have a body length up to 0.70 mm and width to 0.25 mm. Length of marginal hooks is 0.014–0.017 mm. Total length of ventral anchors is 0.034–0.043 mm (highly variable in shape), dorsal anchors 0.066–0.085 mm. Size of patches is 0.007–0.009 x 0.025-0.030 mm. Size of bars: ventral bar (half) 0.002-0.004 x 0.026-0.030, dorsal bar 0.006–0.009 x 0.041–0.047 mm. The K coefficient is 1.8–2.4 (usually 2.0). Length of copulatory tube is 0.080–0.095 mm, diameter less than 0.002 mm. Length of claw-shaped accessory piece is 0.070–0.078 mm. Diameter of bubble-shaped seminal receptacle is 0.020–0.028 mm, length of funnel-shaped or retort-shaped "tip" 0.012–0.016 mm.

Found on gill filaments of *Silurus soldatovi*; Amur and Ussuri Rivers (Russia); Liao He River (China).

20 (19). The vaginal armament is in the shape of a broad tube (seminal receptacle) with a cylindrical "tip". These are parasites of *Silurus asotus* only.

21 (34). A "tip" is at the end of the vaginal tube.

22 (27). The vaginal armament looks like a spiral or sinusoidal (**Ω**-shaped) tube.

23 (26). The vaginal tube is spiral.

24 (25). The accessory piece of the copulatory organ has a claw-shaped projection in the middle.
T. sigmoidovagina (Yamaguti, 1942) (Fig. 403)
Syn.: *Ancylodiscoides sigmoidovagina* Yamaguti, 1942; *Silurodiscoides sigmoidovagina*: Gussev, 1985

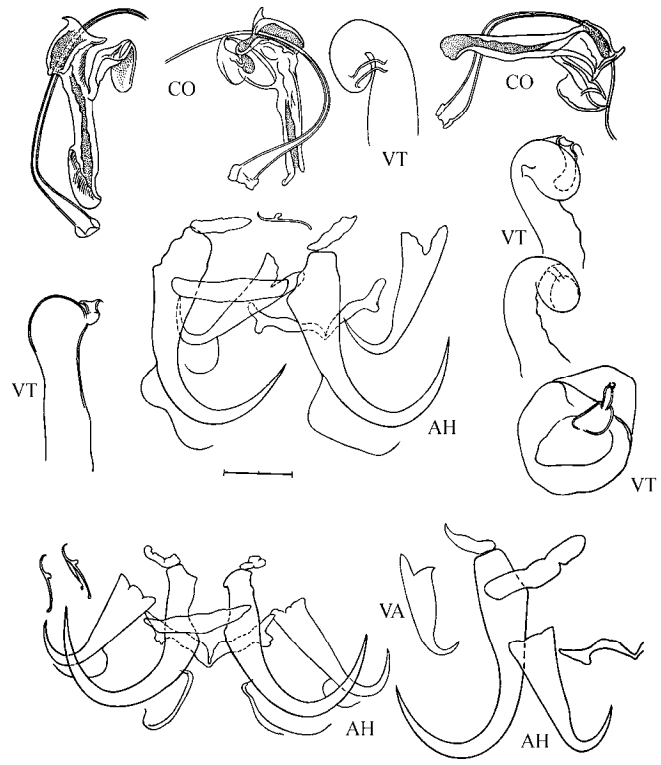
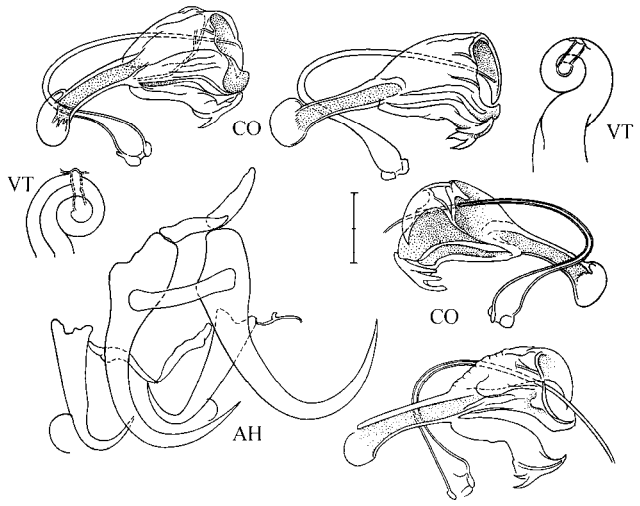


Fig. 403 - *Thaparocleidus sigmoidovagina* (after Gussev et Strelkov, 1960).



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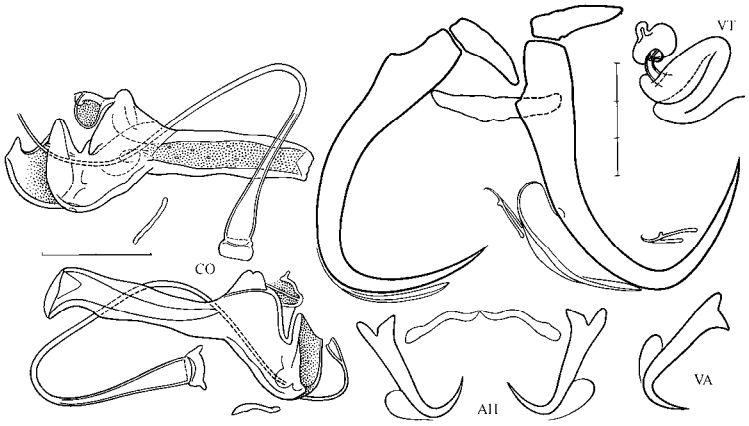

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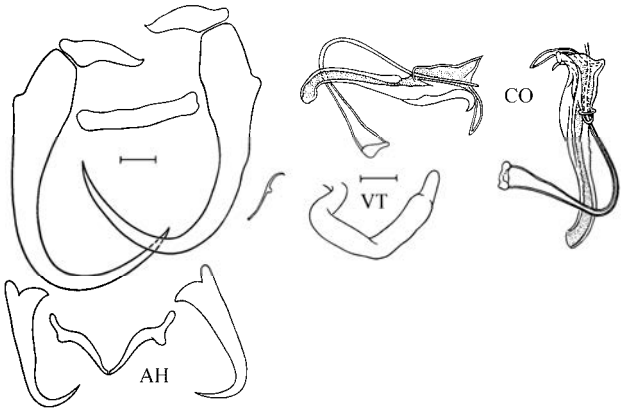


406

Fig. 404 – 406.
404 - *Thaparocleidus cochleavagina* (after Gussev et Strelkov, 1960). **405 -** *Thaparocleidus omegavagina*. **406 -** *Thaparocleidus botulovagina* (after Gussev et Strelkov, 1960).

These medium size worms have a body length up to 0.75 mm and width to 0.16 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.033–0.036 mm, dorsal anchors 0.049–0.061 mm. Size of patches is 0.004–0.006 x 0.010–0.017 mm. Size of bars: ventral bar (half) 0.003–0.006 x 0.020–0.027 mm, dorsal bar 0.005–0.006 x 0.031–0.035 mm. The K coefficient is 1.5–1.8. Length of copulatory tube is 0.080–0.097 mm, diameter less than 0.002 mm. Length of accessory piece is 0.043–0.056 mm. Length of comma-shaped or straightened spiral-shaped seminal receptacle is 0.040–0.068, "tip" length 0.010–0.015 mm.

Found on gill filaments of *Silurus asotus*; Ussuri River (Russia); Liao He and Yangtze River (China); water bodies of Japan.

25 (24). The accessory piece of the copulatory organ has a broad folded leaf-shaped distal half and a claw-shaped projection with a jagged outer edge.

T. cochleavagina (Gussev et Strelkov, 1960) (Fig. 404)

Syn.: *Ancylodiscoides cochleavagina* Gussev, Strelkov, 1960; *Silurodiscoides cochleavagina*: Gussev, 1985

These are small worms; body can be up to 0.50 mm long and 0.14 mm wide. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.033–0.037 mm, dorsal anchors 0.057–0.064 mm. Size of patches is 0.005–0.006 x 0.017–0.023 mm. Size of bars: ventral bar (half) 0.003–0.006 x 0.022–0.027 mm, dorsal bar 0.004–0.006 x 0.027–0.039 mm. The K coefficient is 1.6–1.9. Length of copulatory tube is 0.089–0.101 mm, diameter about 0.002 mm. Length of accessory piece is 0.051–0.072 mm. Length of vaginal tube along the curve is 0.040–0.052 mm, length of "tip" about 0.010 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Liao He River (China).

26 (23). The vaginal tube is bent in a sinusoidal shape (**Ω**-shaped).

T. omegavagina (Hwang, 1964) (Fig. 405)

Syn.: *Ancylodiscoides omegavagina* Hwang, 1964; *Silurodiscoides omegavagina*: Gussev, 1985

These medium size worms have a body length up to 0.75 mm and width to 0.12 mm. Length of marginal hooks is 0.014–0.016 mm. Total length of ventral anchors is 0.026–0.033 mm, dorsal anchors 0.070–0.080 mm, root 0.018–0.026 mm, point 0.035–0.042 mm. Size of patches is 0.008–0.012 x 0.024–0.028 mm. Size of bars: ventral bar (half) 0.002–0.004 x 0.019–0.022 mm, dorsal bar 0.007–0.009 x 0.032–0.036 (according to original description 0.040–0.047) mm. The K coefficient is 2.3–2.4. Length of copulatory tube is 0.080–0.100 mm, diameter 0.001 mm in the middle, length of accessory piece 0.055–0.060 mm. An isolated chitinoid stick lies near the broadened part of the accessory piece. Length of vaginal tube along the curve is about 0.70 mm, "tip" about 0.010 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Yangtze River (China).

27 (22). The vaginal armament is of another shape.

28 (29). The vaginal armament is sausage-shaped and straightened seminal receptacle with a short "tip".

T. botulovagina (Gussev et Strelkov, 1960) (Fig. 406)

Syn.: *Ancylodiscoides botulovagina* Gussev et Strelkov, 1960; *Silurodiscoides botulovagina*: Gussev, 1985

These are small worms; body can be up to 0.50 mm long and 0.16 mm wide. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.030–0.036 mm, dorsal anchors 0.060–0.073 mm. Size of patches is 0.005–0.008 x 0.021–0.028 mm. Size of bars: ventral bar (half) 0.004–0.005 x 0.021–0.025 mm, dorsal bar 0.005–0.007 x 0.030–0.036 mm. The K coefficient is 1.9–2.1. Length of copulatory tube is 0.075–0.081 mm, diameter slightly more than 0.001 mm. Length of accessory piece is 0.051–0.063 mm. Total length of vaginal armament is 0.060–0.080 mm.

Found on gill filaments of *Silurus asotus*; Lake Khanka (Russia).

29 (28). The vaginal armament looks like an **S**-shaped sacciform seminal receptacle.

30 (31). The lateral projection of the accessory piece is linguiform with a massive square end; its surface is uneven.

T. varicus (Akhmerov, 1952) (Fig. 407)

Syn.: *Ancylodiscoides varicus* Akhmerov, 1952; *Parancylodiscoides varicus*: Akhmerov, 1964; *Silurodiscoides varicus*: Gussev, 1976; *Ancylodiscoides exima* Ling in Chen et al., 1973 (Fig. 408)[74]; *Silurodiscoides exima*: Gussev, 1985

These are small worms; body can be up to 0.44 mm long and 0.16 mm wide. Length of marginal hooks is 0.014–0.016 mm. Total length of ventral anchors is 0.030–0.035 mm, dorsal anchors 0.071–0.082 mm. Size of patches is 0.006–0.008 x 0.023–0.025 mm. Size of bars: ventral bar (half) 0.003–0.004 x 0.023–0.025 mm, dorsal bar 0.005–0.008 x 0.032–0.037 mm. The K coefficient is 2.0–2.3. Length of copulatory tube is 0.082–0.110 mm, diameter less than 0.002 mm. Length of accessory piece is 0.054–0.066 mm. Length of sacciform seminal receptacle is 0.060–0.070 mm, "tip" 0.010–0.017 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Liao He and Yangtze Rivers (China).

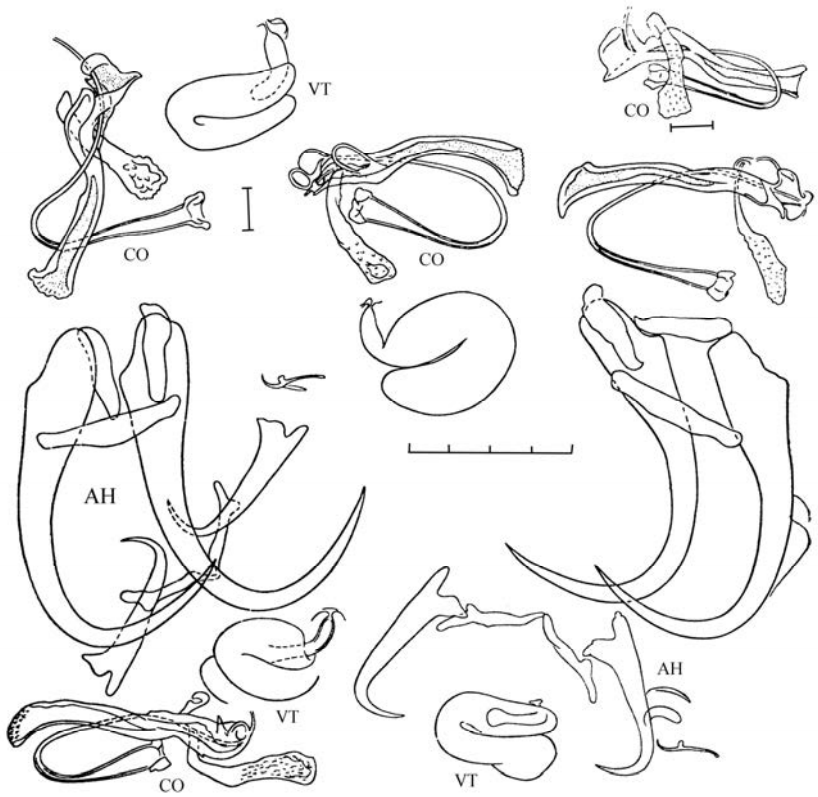
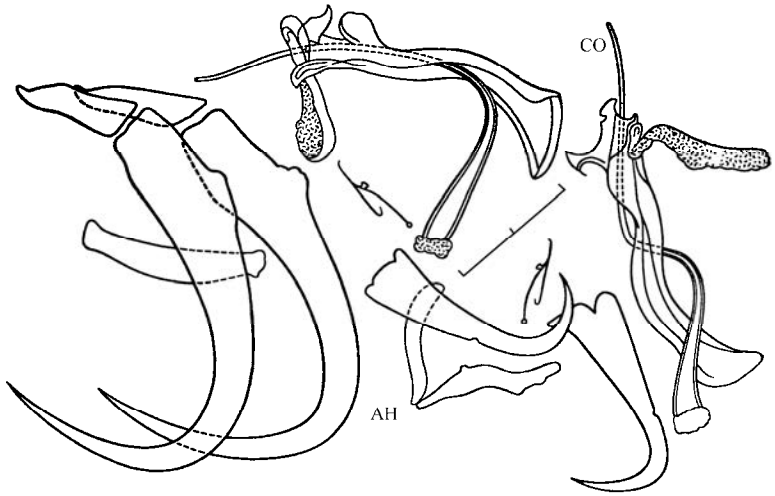


Fig. 407 - *Thaparocleidus varicus* (after Gussev et Strelkov, 1960).

[74] Originally described by Ling in an unpublished thesis. Sometimes erroneously attributed to Gussev et Strelkov (1960) as *Silurodiscoides*.



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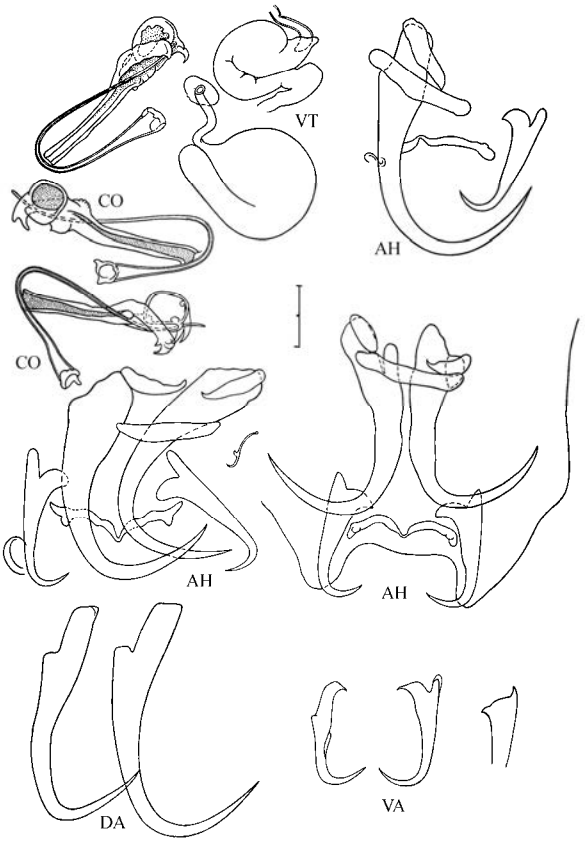

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Fig. 408 – 409.
408 - *Ancylodiscoides exima* (after Ling in Chen et al., 1973). **409 -** *Thaparocleidus curvilamellis* (after Gussev et Strelkov, 1960).

31 (30). The projection of the accessory piece is not broadened to its end.

32 (33). The projection of the accessory piece is rectangular shaped, slightly bent, and lies obliquely at the anterior part of the accessory piece; the accessory piece is rounded with a thick edge and two short claw-shaped projections.
T. curvilamellis (Akhmerov, 1952) (Fig. 409)
Syn.: *Ancylodiscoides curvilamellis* Akhmerov, 1952; *Ancylodiscoides curvilamellis* f. typica: Gussev et Strelkov, 1960; *Parancylodiscoides curvilamellis*: Akhmerov, 1964; *Silurodiscoides curvilamellis*: Gussev, 1985

These medium-size worms have a body length up to 0.64 mm and width to 0.16 mm. Length of marginal hooks is 0.014–0.016 mm. Total length of ventral anchors is 0.031–0.034 mm, dorsal anchors 0.064–0.075 mm. Size of patches is 0.004–0.008 x 0.021–0.024 mm. Size of bars: ventral bar (half) 0.004–0.005 x 0.022–0.025 mm, dorsal bar 0.003–0.006 x 0.030–0.033 mm. The K coefficient is 1.8–2.2. Length of copulatory tube is 0.081–0.101 mm, diameter less than 0.002 mm. Length of accessory piece is 0.051–0.061 mm. Length of sacciform seminal receptacle about 0.080 mm, vaginal tube 0.010–0.013 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Liao He and Yangtze Rivers (China).

33 (32). The projection of the accessory piece of the copulatory organ is turned aside; it is rather thin and tapers to its end; the distal part of the piece is fungiform.
T. obscurus (Gussev et Strelkov, 1960) (Fig. 410)
Syn.: *Ancylodiscoides curvilamellis* f. obscura Gussev et Strelkov, 1960; *Silurodiscoides obscurus*: Gussev, 1985

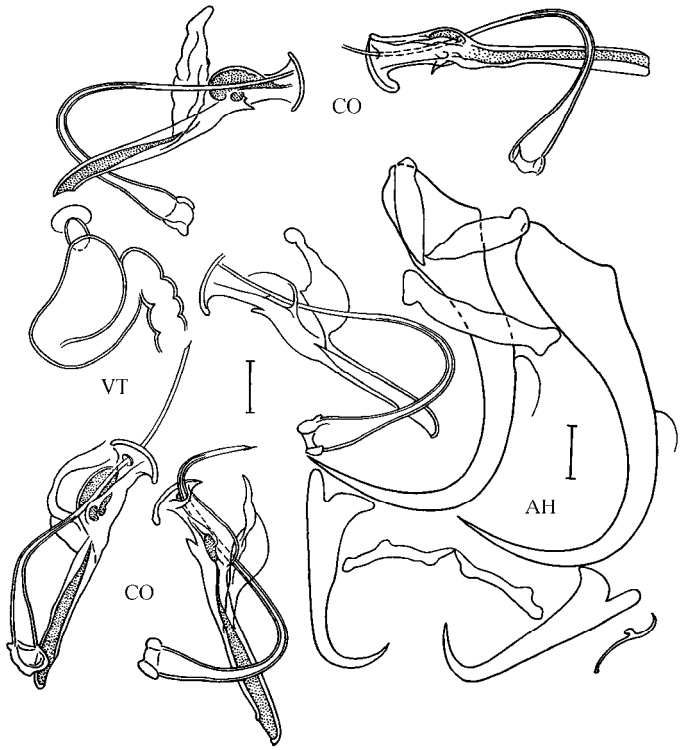


Fig. 410 - *Thaparocleidus obscurus* (after Gussev et Strelkov, 1960).

These medium size worms have a body length up to 0.62 mm and width to 0.18 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.031–0.035 mm, dorsal anchors 0.058–0.069 mm. Size of patches is 0.005–0.008 x 0.020–0.025 mm. Size of bars; ventral bar (half) 0.003–0.006 x 0.019–0.023 mm, dorsal bar 0.004–0.006 x 0.032–0.035 mm. The K coefficient is 1.8–2.1. Length of copulatory tube is 0.074–0.080 mm, diameter slightly greater than 0.001 mm. Length of accessory piece is 0.047–0.054 mm. Length of vaginal armament is 0.052–0.076 mm.

Found on gill filaments of *Silurus asotus*; Amur River Basin (Russia); Liao He and Yangtze Rivers (China).

34 (21). The "tip" begins approximately at the middle of the first bend of the sacciform seminal receptacle, the anterior end of which forms a “pocket.”

T. lingmoeni (Gussev et Strelkov, 1960) (Fig. 411)[75]

Syn.: *Ancylodiscoides lingmoeni* Gussev et Strelkov, 1960 f. typica; *Silurodiscoides lingmoeni*: Gussev, 1985; *Thaparocleidus japonicus* (Yamaguti, 1963)

These medium size worms have a body length up to 0.68 mm and width to 0.22 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.030–0.037 mm, dorsal anchors 0.078–0.083 mm. Size of patches is 0.006–0.008 x 0.023–0.031 mm. Size of bars: ventral bar (half) 0.003–0.004 x 0.020–0.023 mm, dorsal bar 0.004–0.006 x 0.031–0.037 mm. The K coefficient is 2.1–2.6. Length of copulatory tube is 0.072–0.086 mm, diameter about 0.0015 mm. Length of accessory piece is 0.041–0.049 mm. Length of bent seminal receptacle is 0.08–0.12, of "tip" about 0.010 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Liao He and Yangtze Rivers (China).

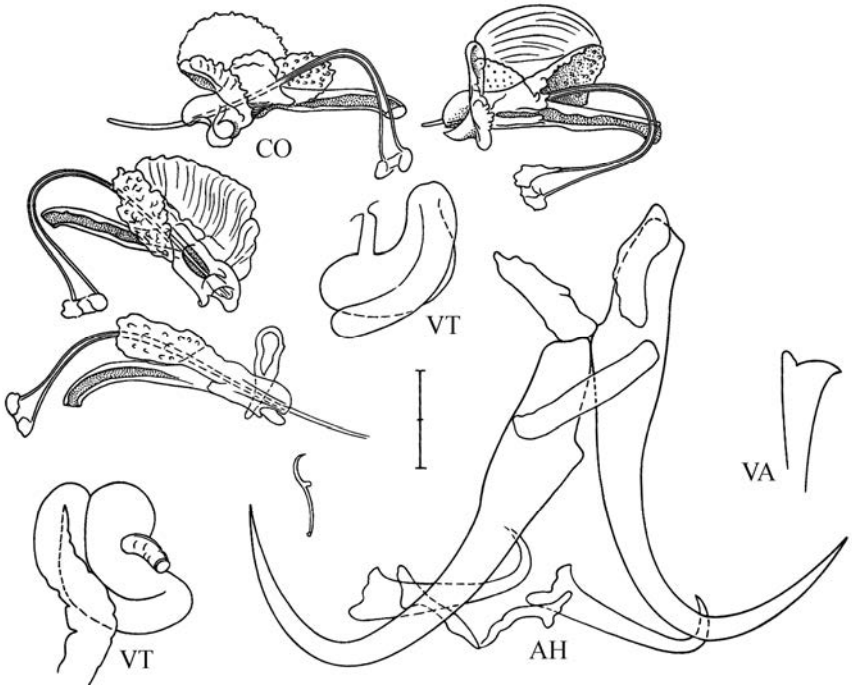


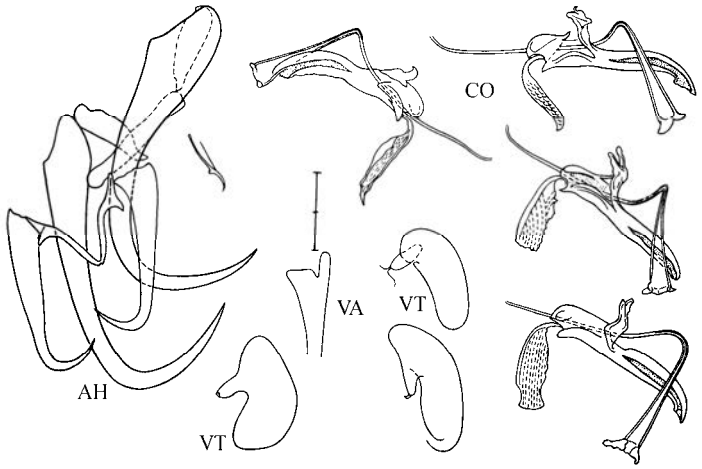
Fig. 411 - *Thaparocleidus lingmoeni* (after Gussev et Strelkov, 1960).

[75] There is another form *Ancylodiscoides lingmoeni* f. japonica described from Japan; it differs from typical one by details of accessory piece of copulatory organ (see Supplement and Fig. 412).

35 (18). The vaginal armament is absent; a broad curved vaginal duct can be seen on living specimens only.

T. mutabilis (Gussev et Strelkov, 1960) (Figs. 413–415)

Syn.: *Ancylodiscoides mutabilis* Gussev et Strelkov, 1960; *Silurodiscoides mutabilis*: Gussev, 1985



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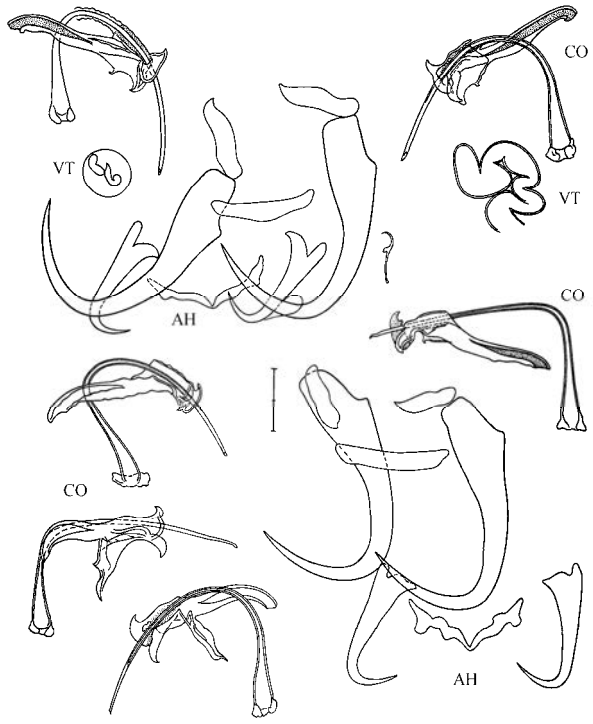
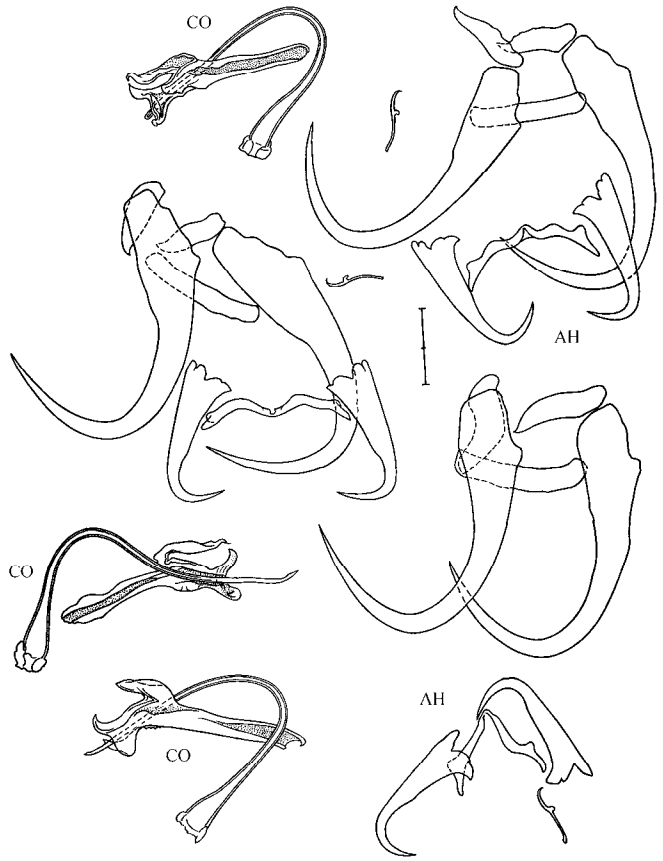


413

Fig. 412 – 413.

412 - *Thaparocleidus japonicus* (after Gussev et Strelkov, 1960). **413 -** *Thaparocleidus mutabilis*, typical form (after Gussev et Strelkov, 1960).



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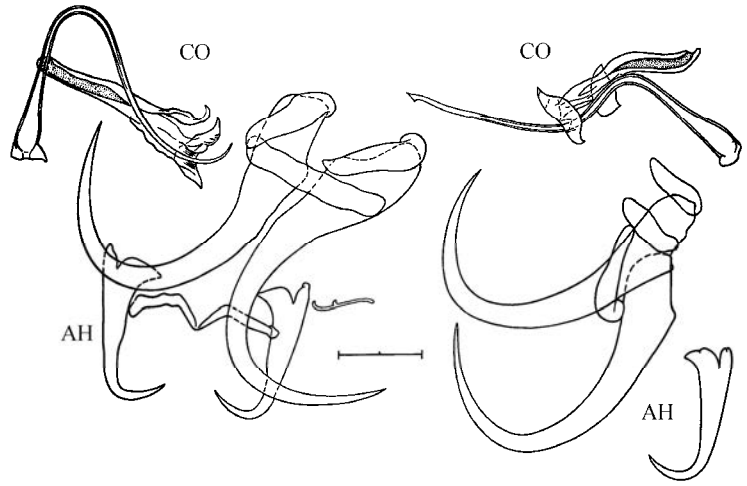


415

Fig. 414 – 415.
414 - ***Thaparocleidus mutabilis***, one of a number of atypical forms (after Gussev et Strelkov, 1960).
415 - ***Thaparocleidus mutabilis***, another atypical form (after Gussev et Strelkov, 1960).

These medium size worms have a body length up to 0.53 mm and width to 0.23 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.029–0.034 mm, dorsal anchors 0.060–0.069 mm. Size of patches is 0.005–0.007 x 0.021–0.026 mm. Size of bars: ventral bar (half) 0.003–0.004 x 0.022–0.025 mm, dorsal bar 0.004–0.006 x 0.030–0.035 mm. The K coefficient is 2.0–2.2. Length of copulatory tube is 0.086–0.100 mm, diameter about 0.002 mm. Length of accessory piece is 0.043–0.052 mm.

Two forms of this species have been described; they differ in the details of the accessory piece of the copulatory organ. Found on gill filaments of *Silurus asotus*; Liao He and Yangtze Rivers (China); can be found in the Amur River.

36 (17). The ventral anchors lack roots and have a broad wavy edge; their bar is very massive with bifurcated ends.

T. disjunctus (Gussev et Strelkov, 1960) (Fig. 416)

Syn.: *Ancylodiscoides disjunctus* Gussev et Strelkov, 1960; *Silurodiscoides disjunctus*: Gussev, 1985

These medium size worms have a body length up to 0.66 mm and width to 0.22 mm. Length of marginal hooks is 0.015–0.017 mm. Total length of ventral anchors is 0.041–0.045 mm, dorsal anchors 0.074–0.084 mm. Size of patches is 0.004–0.008 x 0.035–0.040 mm. Size of bars: ventral bar (half) 0.003–0.008 x 0.012–0.024 mm, dorsal bar 0.005–0.007 x 0.033–0.036 mm. The K coefficient is 1.7–2.0. Length of copulatory tube is 0.080–0.097 mm, diameter less than 0.002 mm. Length of accessory piece is 0.051–0.060 mm. Length of **S**-shaped sacciform seminal receptacle is 0.054–0.074 mm, "tip" about 0.012 mm.

Found on gill filaments of *Silurus asotus*; Amur River (Russia); Liao He and Yangtze Rivers (China).

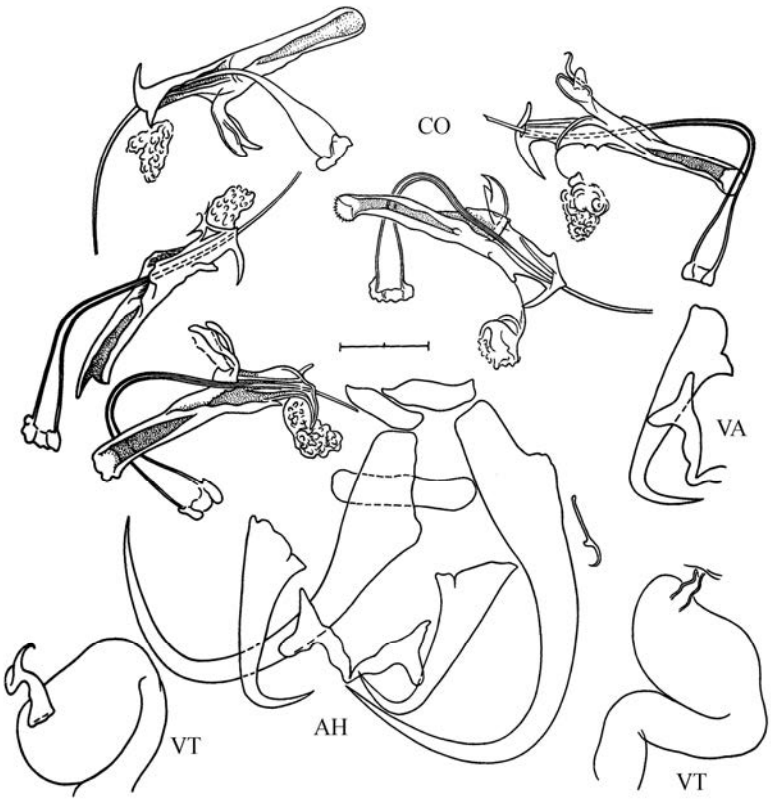


Fig. 416 - *Thaparocleidus disjunctus* (after Gussev et Strelkov, 1960).

Genus *Pseudancylodiscoides* Yamaguti, 1963
Syn.: *Subancylodiscoides* Akhmerov, 1964 (after Lim et al., 2001)

Body is elongate, fusiform, and up to 0.75 mm long, and four compact eye spots are present. The haptor is poorly demarcated from the body. The intestinal caeca unite posterior to the testis. The dorsal anchors are larger than the ventral anchors. Patches are present on the dorsal anchors and absent on the ventral anchors. The dorsal bar is straight. The ventral bar is divided into two well-separated parts. Marginal hooks are similar and of the larval type. The seminal vesicle is a blind sac. The copulatory organ consists of a slightly curved tube and an accessory piece. The vagina is sinistral, and a seminal receptacle is present.

These are parasites of freshwater Bagridae. The genus consists of 10 species.

The type species is *P. gigi* (Yamaguti, 1942) from *Pseudobagrus undiceps*, Japan.

Key to species of the genus *Pseudancylodiscoides*

1 (4). The ventral anchors are short; their main part and point form a semicircle. The K coefficient is greater than 2.5. Patches are relatively short and conical.

2 (3). The K coefficient is 2.8–3.2; length of the dorsal anchors is less than 0.050 mm, inner root about 0.010 mm; the bar of the dorsal anchors is thin.
P. strelkowi (Akhmerov, 1952) (Fig. 417)
Syn.: *Ancylodiscoides strelkowi* Akhmerov, 1952; *Subancylodiscoides strelkowi*: Akhmerov, 1964; *Thaparocleidus strelkovi*: Lim, 1996

These are minute worms; body can be up to 0.30 mm long and 0.07 mm wide. Length of marginal hooks is 0.013–0.016 mm. Total length of ventral anchors is 0.013–0.016 mm, dorsal anchors 0.041–0.046 mm. Size of patches is 0.013–0.016 x 0.005–0.006 mm. Size of ventral bars is 0.002–0.003 x 0.025–0.030 mm, dorsal bar 0.003–0.004 x 0.033–0.037 mm. Length of copulatory tube is 0.062–0.070 mm, diameter 0.002 mm. Length of accessory piece is 0.033–0.058 mm. The vaginal armament is a bubble-shaped seminal receptacle, diameter about 0.022 mm, and it has a retort-shaped "tip".

Found on gill filaments of *Pelteobagrus fulvidraco* and *Pelteobagrus brashnikowi*; Amur River (Russia); Liao He and Yangtze Rivers (China).

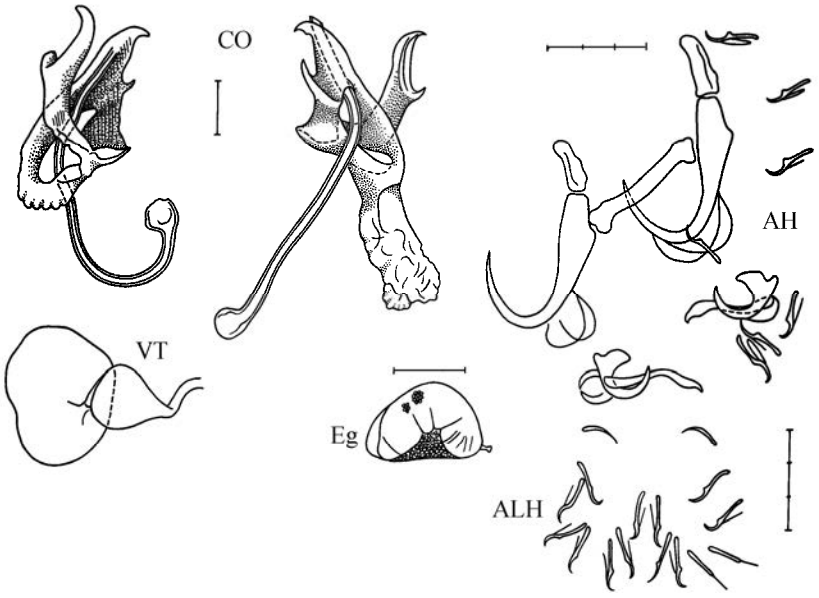


Fig. 417 - *Pseudancylodiscoides strelkowi* (after Gussev et Strelkov, 1960).

3 (2). The K coefficient is 3.9–4.2; length of dorsal anchors is greater than 0.060 mm; length of its inner root is about 0.025 mm; the dorsal bar is thick.
P. rimskykorsakowi (Akhmerov, 1952) (Fig. 418)
Syn.: *Ancylodiscoides rimskykorsakowi* Akhmerov, 1952; *Subancylodiscoides rimskykorsakowi*: Akhmerov, 1964; *Thaparocleidus rimskykorsakowi*: Lim, 1996

These medium size worms have a body length up to 0.75 mm and width to 0.16 mm. Length of marginal hooks is 0.013–0.015 mm. Total length of ventral anchors is 0.016–0.019 mm, dorsal anchors 0.068–0.075 mm. Size of patches is 0.022–0.025 x 0.009–0.010 mm. Size of bars: ventral bars 0.002–0.003 x 0.030–0.032 mm, dorsal bar 0.007–0.010 x 0.030–0.037 mm. Length of copulatory tube is 0.10–0.11 mm, diameter about 0.002 mm. Length of accessory piece is 0.040–0.057 mm. Length of vaginal armament is 0.08–0.09 mm, diameter of seminal receptacle 0.030–0.035 mm.

Found on gill filaments of *Pseudobagrus ussuriensis*; Amur River.

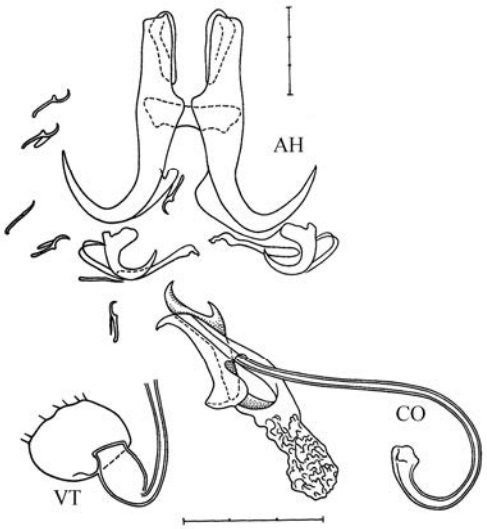


Fig. 418 - *Pseudancylodiscoides rimskykorsakowi* (after Gussev et Strelkov, 1960).

4 (1). The ventral anchors are long with a straight main part. The K coefficient is 1.5. Patches are relatively long and ribbon like.
P. gigi (Yamaguti, 1942) (Fig. 419, 420)
Syn.: *Ancylodiscoides gigi* Yamaguti, 1942; *Subancylodiscoides gigi:* Akhmerov, 1964; *Ancylodiscoides poljanskyi* Gussev, 1955; *Thaparocleidus poljanskyi*: Lim, 1996

These are small worms; body can be up to 0.40 mm long and 0.13 mm wide. Length of marginal hooks is 0.013–0.016 mm. Total length of ventral anchors is 0.024–0.026 mm, dorsal anchors 0.037–0.040 mm. Size of patches is 0.025–0.029 x 0.004–0.007 mm. Size of bars: ventral bars 0.002 x 0.029–0.039 mm, dorsal bar 0.003–0.004 x 0.041–0.043 mm. Length of copulatory tube, accessory piece, and vaginal armament are the same as for *P. strelkowi.*

Found on gill filaments of *Pelteobagrus fulvidraco*; Amur River; Liao He River (China).

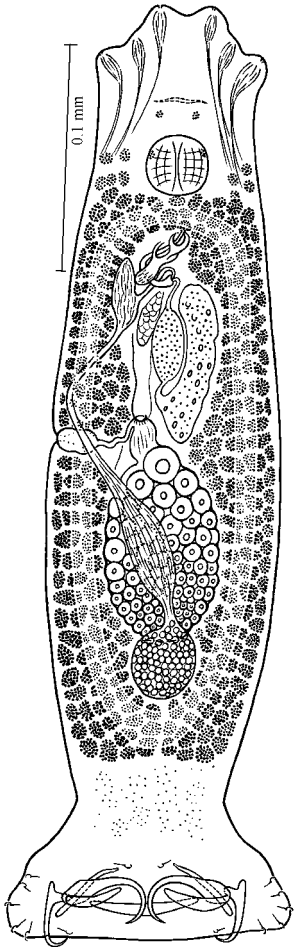
Genus *Bychowskyella* Akhmerov, 1952
Syn.: *Silonditrema* Tripathi, 1959; *Sprostonia* Jain, 1959; *Neosprostonia* Jain, 1959; *Clariotrema* Long, 1981; *Neobychowskyella* Ma, Wang, Li, 1983 (after Lim et al., 2001)

Body length is up to 0.55 mm and has a well-demarcated haptor. Four eye spots, sometimes in the form of dispersed granules, are present. The intestinal caeca unite posterior to the testis.

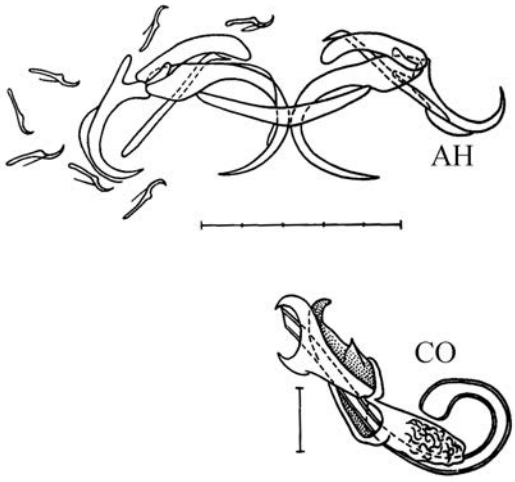
The dorsal anchors lack roots and have long recurved patches; the ventral anchors are smaller and lack roots and patches. The dorsal connecting bar is wide, **V**-shaped, and fenestrated; the ventral connecting bar usually is divided into two parts. Two additional rod-like sclerites, one on either side of the dorsal anchors, are present. The onchium may be absent or present as one dorsal onchium or two (dorsal and ventral) onchia. The marginal hooks are of different sizes: three pairs have dilated proximal handles and the others are of the larval type. The two seminal vesicles are of the dactylogyrid-type. The copulatory organ consists of a short curved or coiled tube and an accessory piece. The vagina is sinistrally submedian. A seminal receptacle is present.

Found on gill filaments of Siluriformes (Siluridae, Clariidae, Schilbeidae, and Sisoridae) of the Sino-Indian region; 24 species are considered valid.

The typical and only species known for the Amur region is *B. pseudobagri* Akhmerov, 1952.



419



420

Fig. 419 – 420.
419 - *Pseudancylodiscoides gigi*, dorsal view (after Gussev et Gerasev, 1986). **420** - *Pseudancylodiscoides gigi* (after Gussev et Strelkov, 1960).

B. pseudobagri Akhmerov, 1952 (Fig. 421, 422, 423)

These are small worms; body can be up to 0.55 mm long and 0.13 mm wide. In mature specimens, eyes are scattered pigment grains. Length of small marginal hooks is 0.011–0.016 mm, large 0.025–0.048 mm. Total length of ventral anchors is 0.023–0.035 mm, dorsal anchors 0.039–0.062 mm. Size of the paired bar of ventral anchors is 0.009–0.015 x 0.040–0.062 mm, unpaired dorsal bar 0.011–0.018 x 0.047–0.057 mm. Total length of copulatory organ is 0.038–0.047 mm. Diameter of bubble-shaped vaginal armament is about 0.012 mm.

Found on gill filaments of *Pelteobagrus fulvidraco* and *P. brashnikowi*; Amur River (Russia); Liao He and Yangtze Rivers (China).

Fig. 421- *Bychowskyella pseudobagri*, dorsal view (after Gussev et Gerasev, 1986).

Supplement to Ancylodiscoidinae

I. An atypical form of *Ancylodiscoides lingmoeni* was described from *Silurus asotus* (Lake Biwa and suburbs of Tokyo, Japan). We revised this description and came to the conclusion that these two forms differ from each other in the structure of the accessory piece of the copulatory organ and of the vaginal armament; thus, they should be considered to be separate species. Here we give a description of the Japanese species, but it is not included in this Key.

Thaparocleidus japonicus Gussev, 1985 (Fig. 412)
Syn.: *Ancylodiscoides lingmoeni* f. japonica Gussev et Strelkov, 1960.

These small worms have a body length up to 0.44 mm and width to 0.12 mm. Length of marginal hooks is 0.015–0.017 mm. Ventral anchors (*T. siluri* type) usually lack roots, length 0.037–0.041 mm, point 0.011–0.013 mm. Length of dorsal anchors is 0.073–0.077 mm, main part 0.062–0.066 mm, inner root 0.012–0.014 mm, point 0.030–0.034 mm. Size of patches is 0.007 x 0.023 mm. Size of bars: ventral bar (half) 0.003–0.005 x 0.022–0.024 mm, dorsal bar 0.004–0.005 x 0.032–0.033 mm. The K coefficient is 1.9–2.0. Length of copulatory tube is 0.080–0.082 mm, diameter of its initial part 0.004–0.006 mm, in the middle 0.001 mm, length of accessory piece 0.040–0.045 mm. Unlike *T. lingmoeni*, the posterior projection of the accessory piece is linguiform. The vaginal armament is a sacciform structure with a short tube; its size is 0.028–0.035 x 0.010–0.012 mm.

II. Two new species of *Thaparocleidus* from *Silurus asotus* of the Yangtze River (China) were described in Chen et al. (1973). Below are descriptions of these species.[76]

[76] These species can't be dated by 1965 as it is shown in Chen et al. (1973) because there is only the manuscript of Ling Mo-en in References. There was no such publication in 1965.

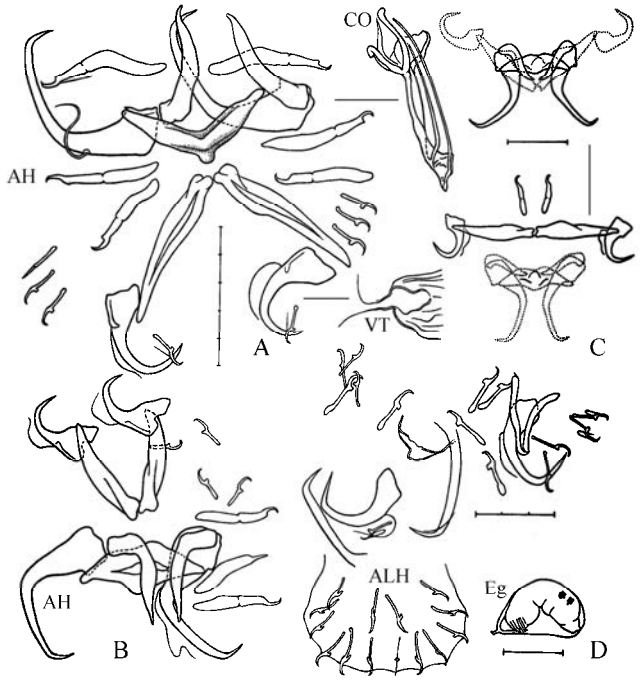


Fig. 422 - *Bychowskyella pseudobagri* – from Lake Khanka.
A – typical form, B – specimen with ventral anchors of atypical form (after Gussev, 1955a).

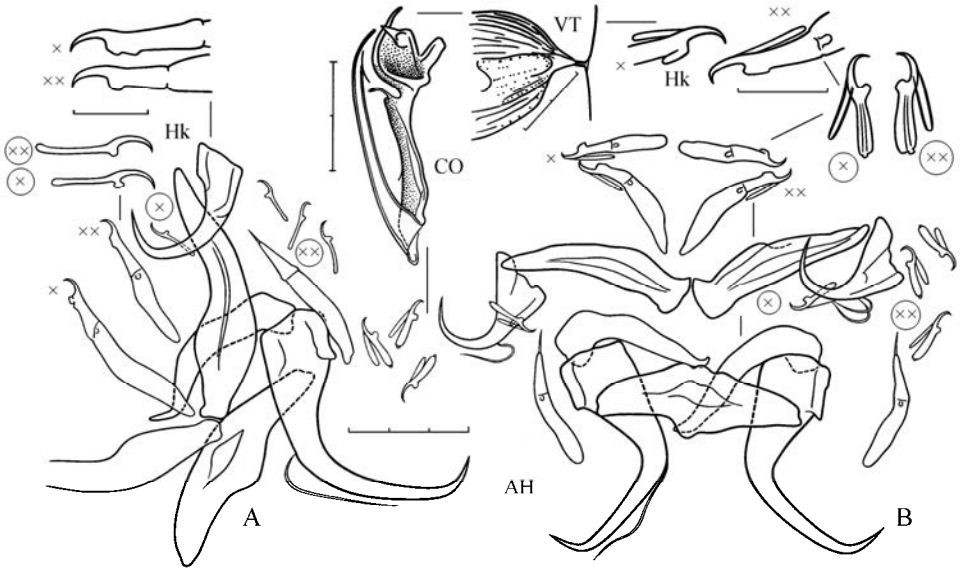


Fig. 423 - *Bychowskyella pseudobagri* – from Amur River, A – typical form, B – specimen with ventral anchors of atypical form, C – anchors disposition from ventral (beneth) and dorsal view, D – young specimen with underdeveloped anchors and bars. Symbol «X» and "XX" marks enlarged drawings of marginal hooks.

Thaparocleidus dorsocirrus (Ling in Chen et al., 1973) (Fig. 424)
Syn.: *Ancylodiscoides dorsocirrus* Ling in Chen et al., 1973; *Silurodiscoides dorsocirrus*: Gussev, 1985

These large worms have a body length up to 0.94 mm and width to 0.1 mm. Length of marginal hooks is 0.013–0.016 mm. Length of ventral anchors is 0.022 mm, inner root 0.002 mm, outer root 0.003 mm, point 0.011 mm. Length of dorsal anchors is 0.123 mm, inner root 0.030 mm, point 0.056 mm. Size of patches is 0.043 x 0.009 mm. Size of bars: ventral bar (half) 0.003 x 0.018 mm, dorsal bar 0.011 x 0.032 mm. Length of copulatory tube is 0.134 mm, accessory piece 0.062 mm.

All of these data do not coincide with data from the figures (those values are lower). It is difficult to say which data are correct. The true values likely are those mentioned in the survey, and the scale given in the drawings likely is erroneous. Nevertheless, *T. dorsocirrus* is very similar to *T. hamatovagina*. If these are identical, *T. dorsocirrus* should be considered as a synonym of *T. hamatovagina*.

Thaparocleidus cornucirrus (Ling in Chen et al., 1973) (Fig. 425)
Syn.: *Ancylodiscoides cornucirrus* Ling in Chen et al., 1973; *Silurodiscoides cornucirrus*: Gussev, 1985

These are large worms; body length can be up to 0.87 mm and width to 0.18 mm. Length of marginal hooks is 0.014–0.016 mm. Length of ventral anchors is 0.029–0.031 mm, inner root 0.004–0.005 mm, outer root 0.005–0.006 mm, point 0.008–0.011 mm. Length of dorsal anchors is 0.060–0.063 mm, inner root 0.014–0.016 mm, point 0.029–0.033 mm. Size of patches is 0.019–0.021 x 0.004–0.005 mm. Size of bars: ventral bar (half) 0.002–0.004 x 0.021–0.024 mm, dorsal bar 0.005 x 0.033–0.038 mm. Length of copulatory tube is 0.089–0.097 mm, accessory piece 0.032–0.062 mm.

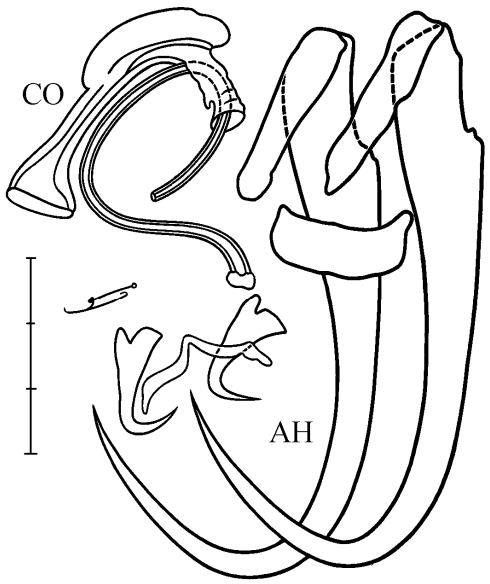


Fig. 424 - *Thaparocleidus dorsocirrus* (after Chen et al., 1973).

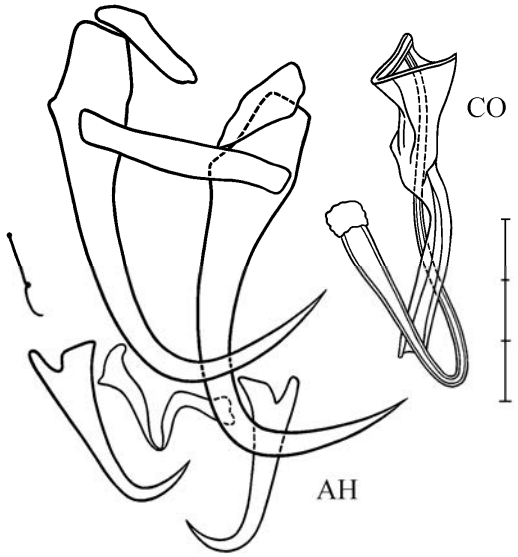


Fig. 425 - *Thaparocleidus cornucirrus* (after Chen et al., 1973).

Order Capsalidea Lebedev, 1988[77]

Syn.: Monopisthocotylinea (Odhner, 1912) sensu Bychowsky, 1937; Monopisthocotylidea (Odhner, 1912) sensu Gussev, 1977

The larvae of these Polyonchoinea have 14 (or 16?) marginal hooks. Mature specimens have armament consisting of 14 marginal hooks and 1–3 pairs of anchors. Bars are absent. In rare cases, the chitinoid armament is absent (Microbothriidae). In most cases, the haptor is in the form of a saucer-shaped sucker, and it is the main mechanism of attachment in mature specimens. Sometimes during individual development, the haptor loses this sucker and attachment is performed by a secondary pseudodisc that develops in front of the haptor (Acanthocotylidae). The intestine has two caeca that may or may not be confluent posteriorly. In many cases, lateral diverticula and anastomoses are present.

These are parasites of marine and freshwater Chondrichthyes and teleosts. The order contains five families. A separate order has been established for the family Microbothriidae (Lebedev, 1988). Only one family of Capsalidea is found in brackish waters of the Palaearctic.

Family Capsalidae Baird, 1858

These worms are of medium or large size in the adult state. The attachment apparatus consists of a sucker-shaped disc divided by muscular septa into a number of peripheral and one central pit and a chitinoid armament. In some cases, the septa can be weakly expressed or completely absent. Disc armament consists of 14 marginal hooks and 2–6 anchors, which can disappear secondarily. The anterior end of the body has two glandular rollers or suckers. Four eyes are present. The intestinal caeca have inner and outer diverticula, in rare cases they are absent. The intestinal caeca in most cases are not confluent posteriorly; in rare cases they are confluent. The male genital pore and the female vagina open laterally at the level of the pharynx or slightly lower; in some cases they open at the midline of the ventral side. The copulatory organ has no chitinoid armament. Two or more testes are present. The ovary is round or lobed. The vaginal duct is unpaired, and in most cases it is very long and opens ventrally at the body's side near the genital pore; rarely it is short and opens ventrally between the intestinal caeca.

The Capsalidae are parasites of marine fishes and rarely or anadromous ones. The family contains nine subfamilies. Only one genus, *Nitzschia*, of the subfamily Nitzschiinae Johnston, 1931 is found in the Palaearctic.

Genus *Nitzschia* Baer, 1827

In members of this genus, the anterior adhesive areas are shallow, weakly muscular grooves into which cephalic glands open. The haptor is aseptate, muscular, and has 3 pairs of anchors[78] and 14 marginal hooks. The pharynx lacks constriction; the caeca have diverticula and do not merge posteriorly. Testes are numerous, median, and confined to the intercaecal area. The genital pore is submedian and postbifurcal. Ovary is round, pretesticular. Vagina has a median opening and lies posterior to the genital pore.

Nitzschia are parasites of Acipenseridae.

The type species and single representative of this genus in the Palaearctic is *N. sturionis* (Abildgaard, 1794).

[77] The order is paraphyletic and includes taxa of different origin.

[78] Kearn (1963) and others treat the third pair of anchors as modified marginal hooks. New materials on development of *Nitzschia* have shown that this is wrong. These hooks have nothing to do with marginal hooks (Fig. 426).

N. sturionis (Abildgaard, 1794) (Fig. 426)

The body is elongate, broadly lanceolate, and has a cup-shaped attachment disc. Two glandular attachment pits are situated obliquely at the anterior end of the body. Body length is 10–25 mm.

Found on gill filaments and mouth cavity of Acipenseridae. Area of distribution coincides with that of the hosts. Infection with this parasite damages the tissue of the gill filaments, resulting in acute anemia. There is a known case of mass mortality of *Acipenser nudiventris* in the Aral Sea. This parasite was absent there before the 1930s but was brought there with several specimens of *A. stellatus* transferred from the Caspian Sea. It was established on *A. nudiventris*, which had no immunity to it, which resulted in high density of the parasite (Bauer et al., 2002, a review).

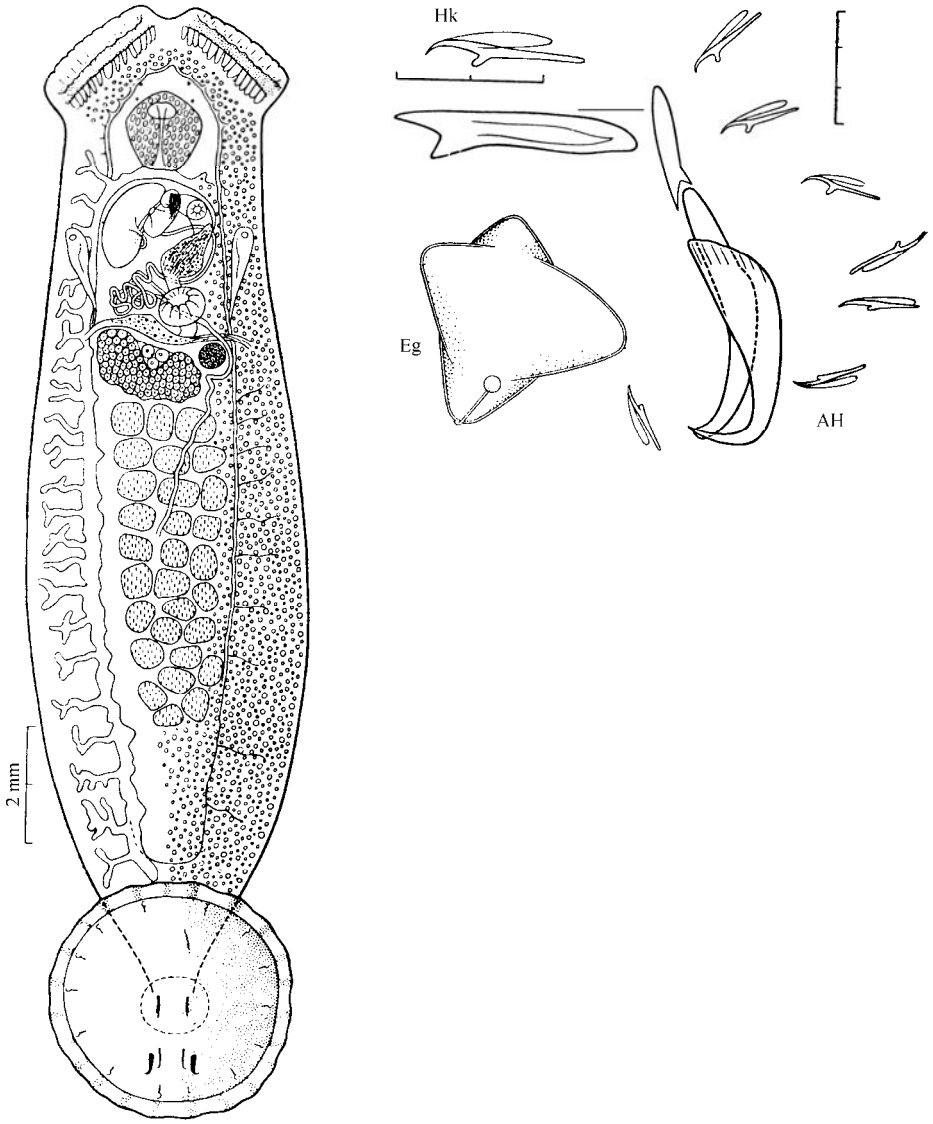


Fig. 426 - *Nitzschia sturionis*,
ventral view, egg, half of the larvae haptor armament with enlarged drawings of marginal hook and third anchor. Egg diameter about 0.25 mm.

Order Tetraonchidea Bychowsky, 1957

According to Bychowsky (1957a) the order consists of four families: Tetraonchidae, Tetraonchoididae, Amphibdellatidae, and Bothitrematidae. Two families were added later: Neotetraonchidae and Sundanonchidae. Boeger et Kritsky (2001) considered the Tetraonchidea as a suborder of the Dactylogyridea that consists of only three families: Tetraonchidae, Neotetraonchidae, and Sundanonchidae. Thus the compound of the order Tetraonchidea remains controversial. Only the Tetraonchidae and Bothitrematidae have representatives in the Palearctic and Amur regions.

Mature speciemens of these Polyonchoinea have 16 marginal hooks (mostly of the larval type), two pairs (or only ventral one) of anchors, and one bar, which is absent sometimes. In rare cases, anchors are absent. Sometimes supplemental armament is present in the form of bars of different shapes or small suckers. The copulatory organ has a chitinoid tube and an accessory piece. Two pairs of eyes may be present or absent. The anterior end of the body is of the *Dactylogyrus* type or is without a differentiated edge, and sometimes it has two glandular shafts, two pairs of small lobes, or sometimes suckers. The intestine has only one caecum without lateral diverticula (although the Anoplodiscidae have them); in rare cases two blind caeca are present. The ovary is situated to the right of the body midline and lies above the intestine. If the intestine has two caeca, the ovarium can turn around the right caecum. A single testis is situated behind the ovarium. The spermaduct turns around the left side of the intestine. There is a single vaginal duct, and its pore is dextral or is moved to the midline on the ventral side; sometimes it has a chitinoid covering. The vitellaria consist of two lateral strips of large follicules that are separated or partly separated from each other. One or two prostatic reservoirs are present. The seminal vesicle is a widening of the spermaduct.

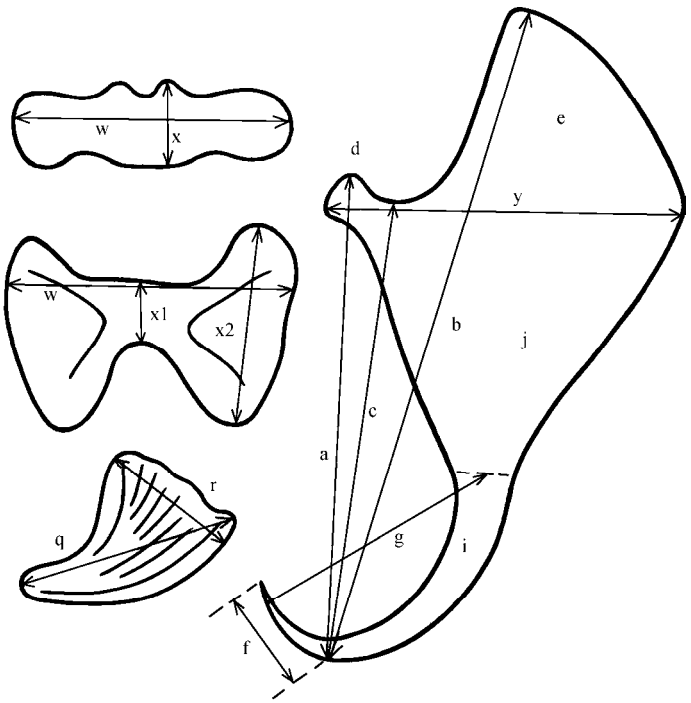


Fig. 427 -Tetraonchidae chitinoid structures and their parts with measurement schemes.
a – inner anchor length, b – outer anchor length, c – main part length, d – length of inner root, e – length of outer root, f – point length, g – blade length, i – pivot, j – anchor base, q – r – length and width of fan-shaped bar, w – connecting bar length, x – connecting bar width, x1- width of most narrow part of butterfly-like connecting bar, x2 - “wing” length of butterfly-like connecting bar, y – anchor width (width of anchor main part).

Family Tetraonchidae Bychowsky, 1937

The body of mature worms is medium or large in size (length up to 3.0 mm). The haptor has 16 marginal hooks (larval type), two pairs of anchors, one connective bar, and two fan-shaped bars situated behind the connective bar. The anterior end is glandular with small smoothed lobes. Two pairs of eyes are present. The intestine has only one caecum without lateral diverticula. The vitellaria consist of two lateral strips of large follicules that are partly separated from each other.

These are gill parasites of freshwater and anadromous Esociformes and Salmoniformes. The family consists of two genera.

For members of this family, another scheme of measuring must be used because of the peculiarities of the anchors (i.e., the absence of a sharp border between the point and the main part, as in the Dactylogyridae and Ancyrocephalidae with an open point): inner length and outer length of the anchor (the distance between the end of the inner or outer root and the most distant point of the blade); length of the main part (distance from the last point of the blade up to the beginning of the roots); length of the blade from its point up to the place where the ligament (wing) attaches to the anchors. Sometimes it is necessary to use correlation of the blade length and length of the base with the roots and width of the main part. If the bar has is shaped like a butterfly, it is necessary to measure not only the length and width of the most narrow part of the bar but also the length of the "wings" (Fig. 427). The anatomical structure of most species in this family has been studied insufficiently.

Member of this family exhibit variability in the shape and size of the anchors, bar, copulatory organ, and handles of the marginal hooks. For example, different pairs of marginal hooks of *Tetraonchus borealis* differ from one another due to different shaped handles, heals, and blades. The handles of the marginal hooks of different specimens of *Salmonchus lenoki* also are dissimilar. The anchors of *S. grumosus*, *T. borealis* (perhaps three forms will be described in the future as valid species), *S. spasskyi*, *S. roytmani*, and others exhibit extreme variability. The bar of *S. variabilis* is highly variable (this is the reason for its name), as it is in *S. grumosus* and *S. alaskensis*. Variability in the length of the copulatory tube and accessory piece also has been noted (e.g., *S. roytmani*).

Key to genera of Tetraonchidae

1 (2). The bar of the haptor is butterfly shaped; the fan-shaped bars look like small narrow loops. The accessory piece of the copulatory organ winds around the tube and then embraces the tube by annular circumference.
Tetraonchus Diesing, 1858

2 (1). The bar of the haptor is of another shape; the fan-shaped bars are large and wide. The accessory piece does not wind around the copulatory tube and then embraces the tube by annular circumference.
Salmonchus Spassky et Roytman, 1958

Genus *Tetraonchus* Diesing, 1858
Syn.: *Monocoelium* Wegener, 1909

Diagnosis corresponds to the diagnosis of the family. The genus now consists of two species. Representatives of the genus infect Thymallidae and Esocidae. *Tetraonchus* is widespread in northern and temperate zones of Eurasia and North America.

The type species is *T. monenteron* (Wagener, 1857), parasite of *Esox*.

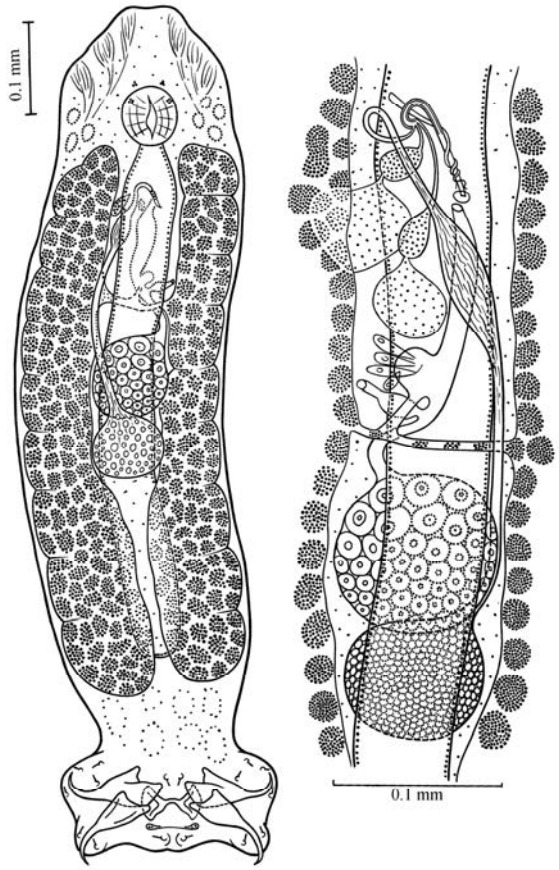


Fig. 428- Scheme of *Tetraonchus monenteron* morphological structure and reproductive system. Left – dorsal view, right – ventral view (after Alarotu, 1944).

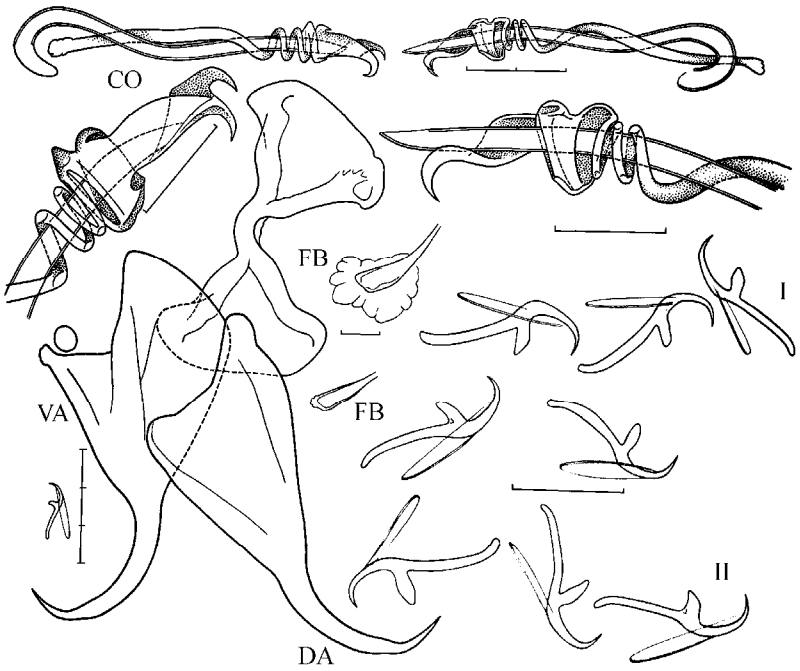


Fig. 429 - ***Tetraonchus monenteron*** from Lithuania; Tisa River; Lake Vrevo, Anadyr River: in the centre of figure – extreme variations of fan-shaped bars, to the right – half of marginal hooks set of specimen from Lithuania (I–II – numeration of marginal hooks).

Key to species of the genus *Tetraonchus*

1 (2). The accessory piece of the copulatory organ forms one stretched spire around the tube and then 2.5–3 pressed spires before the annular circumference of the tube. It is a parasite of Esocidae.
T. monenteron (Wagener, 1857) (Fig. 428, 429)
Syn.: *Gyrodactylus cochlea* Weld, 1857

These are large worms; body size can be up to 1.17 mm long and up to 0.2 mm wide. Length of marginal hooks is 0.012–0.015 mm. Dorsal anchors: inner length 0.086–0.120 mm, outer length 0.076–0.108 mm (specimens from one-summer-old pikes 0.072 and 0.065 mm, respectively), main part 0.077–0.090 (0.063) mm, blade 0.035–0.040 (0.032) mm. Ventral anchors: inner length 0.066–0.081 (0.056) mm, outer length 0.088–0.118 (0.071) mm, main part 0.062–0.085 (0.053) mm, blade 0.030–0.035 (0.030) mm. Connecting bar is 0.006–0.010 x 0.063–0.090 mm, length of "wings" is 0.038–0.060 mm, fan-shaped bars 0.004–0.008 x 0.012–0.015 mm. Length of copulatory tube along the curve is 0.070–0.081 mm, accessory piece 0.065–0.075 mm.

Found on gill filaments of *Esox lucius* and *E. reicherti*; widespread within its hosts' area (including North America).

2 (1). The accessory piece of the copulatory tube forms one to two stretched spires around the tube before annular circumference. These are parasites of *Thymallus*.

3 (6). The main part of the anchors with their longest root is more than twice as long as the length of the blade; inner length of the anchors greater than 0.070 mm.

4 (5). The main part of the anchors with the root is less than 2.5 times longer than blade.
T. borealis (Olsson, 1893)[79] f. typica (Fig. 430)

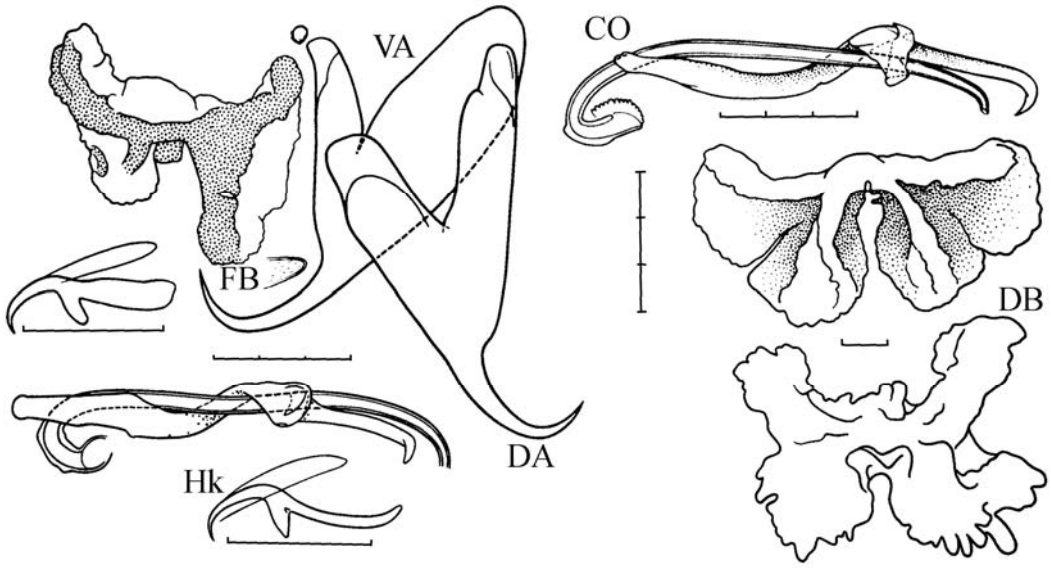


Fig. 430 - *Tetraonchus borealis* f. typica from Danube River Basin, variations of marginal hook from one specimen and bar variations.

[79] Area of *T. borealis* corresponds to the area of fishes of the genus *Thymallus*.

Length of marginal hooks is 0.012–0.014 mm. Dorsal anchors: inner length 0.080–0.110 mm, outer root 0.071–0.090 mm, main part 0.051–0.080 mm, blade 0.025–0.030 mm. Ventral anchors: inner length 0.068–0.090 mm, outer length 0.090–0.110 mm, main part 0.050–0.075 mm, blade 0.030–0.035 mm. Size of bar is 0.009–0.018 x 0.047–0.080 mm, length of "wings" 0.040–0.050 (Fig. 427), fan-shaped bars 0.004–0.007 x 0.010–0.015 mm. Length of copulatory tube is 0.106–0.126 mm, accessory piece 0.090–0.102 mm.

Found on gills of *Thymallus thymallus*, *T. arcticus*, and *T. brevirostris*; water bodies of Europe, Siberia, the Amur region, and Mongolia.

5 (4). The main part of the anchors has a root length that is greater than 2.5 times that of the blade.
T. borealis (Olsson, 1893) f. rauschi Mizelle et Webb, 1953 (Fig. 431)
Syn.: *T. rauschi* Mizelle et Webb, 1953

Length of marginal hooks is 0.013–0.015. Dorsal anchors: inner length 0.097–0.130 mm, outer length 0.080–0.111 mm, main part 0.060–0.082 mm, blade 0.025–0.030 mm. Ventral anchors: inner length 0.078–0.095 mm, outer length 0.100–0.130 mm, main part 0.050–0.075 mm, blade 0.025–0.035 mm. Size of highly variable connecting bar is 0.011–0.026 x 0.072–0.125, length of "wings" 0.045–0.050 mm (Fig. 427), fan-shaped bars 0.002–0.004 x 0.010–0.013 mm. Length of copulatory tube is 0.102–0.150 mm, accessory piece 0.088–0.135 mm.

Found on gills of *Thymallus arcticus*; Okhota, Anadyr', Kolyma, and Kamchatka Rivers; water bodies of Alaska.

6 (3). The main part of the anchors has a root length that is less than twice that of the blade; the inner length of the anchors is less than 0.070 mm.
T. borealis (Olsson, 1893) f. minor Pugachev, 1983 (Fig. 432)

Length of marginal hooks is 0.012–0.013 mm. Dorsal anchors: inner length 0.065–0.067 mm, outer length 0.060–0.063 mm, main part 0.040–0.051 mm, blade 0.026–0.030 mm. Ventral anchors: inner length 0.059–0.062 mm, outer length 0.072–0.080 mm, main part 0.040–0.058 mm, blade 0.030–0.035 mm. Size of bar is 0.009–0.011 x 0.040–0.050 mm, length of "wings" 0.038–0.045 mm (Fig. 427), fan-shaped bars 0.003–0.005 x 0.010 mm. Length of copulatory tube is 0.102–0.139 mm, accessory piece 0.068–0.125 mm.

Found on gills of *Thymallus thymallus* and *T. arcticus*; Pinega River (Arkhangelsk District), Amur River.

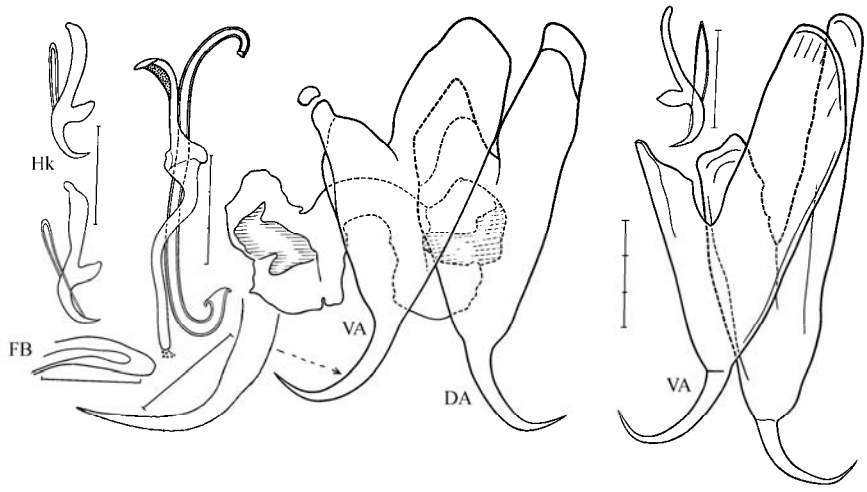
Genus *Salmonchus* Spassky et Roytman, 1958

The type species is *S. skrjabini* Spassky et Roytman, 1958 (Fig. 437). These are parasites of Salmonidae and Coregonidae.

Key to species of the genus *Salmonchus*

1(7). The supporting projection at the initial part of the copulatory tube is absent. The fan-shaped bars are sclerotized weakly and not easily visible.

2 (3). The copulatory tube is straight.
S. variabilis (Mizelle et Webb, 1953) (Fig. 433)
Syn.: *T. variabilis* Mizelle et Webb, 1953; *T. cylindraceus* Pronin, 1966



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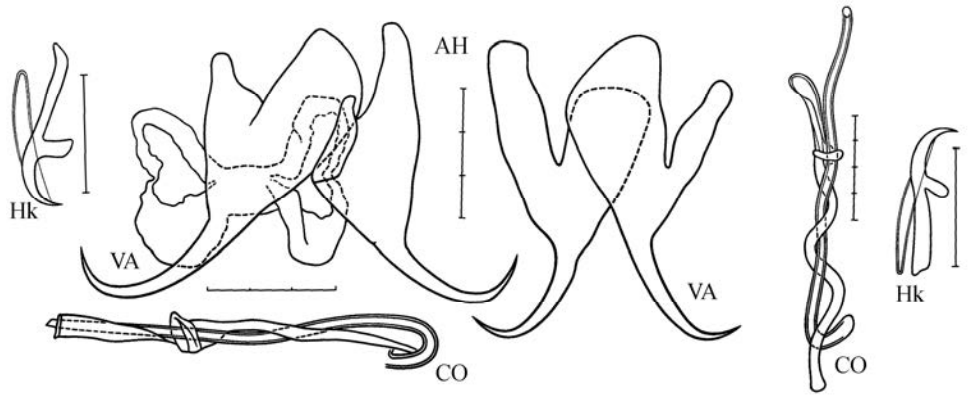

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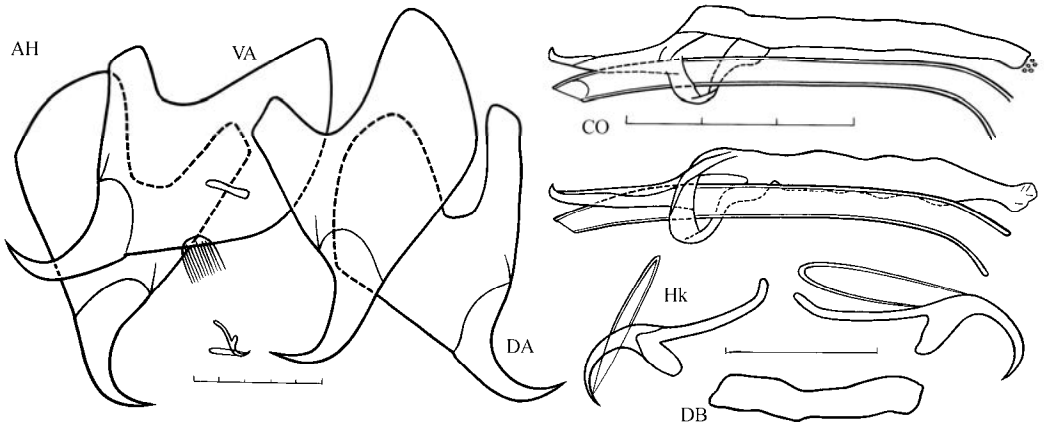

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Fig. 431 – 433.
431 - *Tetraonchus borealis* f. rauschi. **432 -** *Tetraonchus borealis* f. minor. **433 -** *Salmonchus variabilis.*

Body can be up to 2.6 mm long and up to 0.45 mm wide. Length of marginal hooks is 0.013–0.016 mm. Dorsal anchors: inner length 0.090–0.120 mm, outer length 0.090–0.135 mm, main part 0.052–0.066 mm, blade 0.028–0.040 mm. Ventral anchors: inner length 0.060–0.100 mm, outer length 0.100–0.145 mm, main part 0.050–0.086 mm, blade 0.029–0.040 mm. Size of highly variable bar is 0.002–0.034 x 0.012– 0.068 mm (sometimes absent), size of fan-shaped bars is 0.015 x 0.018 mm (in some cases is difficult to see). Length of the copulatory tube is 0.044–0.068 mm, accessory piece 0.036–0.063 mm.

Found on gills of *Prosopium cylindraceum*; Anadyr, Kolyma, and Lena Rivers (Russia); water bodies of Alaska and Canada.

3 (2). The initial part of the copulatory tube is bent.

4 (5). Main part of anchors has slightly longitudinal lines, often with sculpture such as hillocks and ridges that are highly variable in shape; roots are sometimes weakly developed. The initial part of the copulatory tube is bent more than 90°.

S. grumosus (Pugachev, 1984) (Fig. 434)

Syn.: *T. arcticus* Bychowsky n.nud. in Bauer, 1948, in part.; *T. alaskensis* : many authors; *T. grumosus* Pugachev, 1984

Length can be up to 3.5 mm, width up to 1 mm. Length of marginal hooks is 0.018–0.022 mm. The anchors are broad and highly variable in shape; roots of ventral anchors are absent sometimes. Dorsal anchors: inner length 0.084–0.141 mm, outer length 0.064–0.123 mm, main part 0.056–0.100 mm, blade 0.030–0.042 mm. Ventral anchors: inner length 0.064–0.097 mm, outer length 0.098–0.140 mm, main part 0.053–0.090 mm, blade 0.030–0.046 mm. Size of bar is 0.010–0.043 x 0.022–0.060 mm, fan-shaped bars 0.023 x 0.030 mm. Length of copulatory tube is 0.074–0.112 mm, accessory piece 0.067–0.092 mm.

Found on gill filaments of *Coregonus peled*, *C. nasus*, *C. autumnalis*, and *C. sardinella*; rivers flowing to the Arctic Ocean from the Pechora to Kolyma Rivers; found also in the Anadyr River (Russia).

Rasmaschkin and Kaschkovsky (1977) described a very high infection of coregonids in northern tributaries of the Ob' River in 1973. Heavy infection resulted in mortality. In several rivers, prevalence was up to 44% and intensity up to 2500 parasites per fish. This is one of the rare cases of disease observed in natural waters. The authors also described infection of *Stenodus leucichthys nelma* and *Coregonus lavaretus pidschian*, but this has never been reported since.

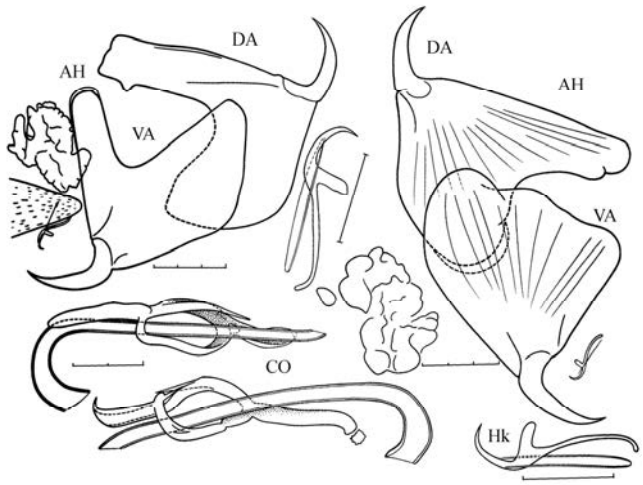


Fig. 434 - *Salmonchus grumosus*, anchor variations.

5 (6). The main part of the anchors has sculpture, such as hillocks and ridges that are highly variable in shape, and developed roots; length of the anchor blade is less than 0.030 mm; length of marginal hooks is less than 0.015 mm. The initial part of the copulatory tube is bent to form a right angle.
S. gussevi (Kakacheva-Avramova et al., 1986) (Fig. 435)

Body length can be up to 1.48 mm, width 0.57 mm. Length of marginal hooks is 0.012–0.015 mm. Dorsal anchors: inner length 0.060–0.068 mm, outer length 0.065–0.080 mm, main part 0.037–0.044 mm, blade 0.025–0.027 mm. Ventral anchors: inner length 0.057–0.066 mm, outer one 0.065–0.078 mm, main part 0.038–0.048 mm, blade 0.028–0.030 mm. Size of bar is 0.010–0.015 x 0.037–0.040 mm, fan-shaped bars 0.008 x 0.012 mm. Total length of copulatory organ is 0.075 mm, tube along the curve 0.080–0.090 mm, accessory piece 0.070–0.078 mm.

Found on gills of *Salmo trutta* (fario) in Bulgaria and Spain.

6 (4). The main part of the anchors has a smooth edge without hillocks that is covered with easily visible longitudinal lines and developed roots; length of anchors blade is greater than 0.030 mm; length of marginal hooks is greater than 0.015 mm. The initial part of the copulatory tube is bent to form a right angle.
S. alaskensis (Price, 1937) (Fig. 436)
Syn.: *T. arcticus* Bychowsky n.nud. in Bauer, 1948, part.; *T. alaskensis* : many authors

Body length can be up to 2.8 mm, width 0.7 mm. Length of marginal hooks 0.015–0.021 mm. The anchors are very wide with well-separated roots. Dorsal anchors: inner length 0.084–0.095 mm, outer length 0.092–0.101 mm, main part 0.053–0.063 mm, blade 0.039–0.046 mm. Ventral anchors: inner length 0.084–0.099 mm, outer length 0.088–0.107 mm, main part 0.055–0.066 mm, blade 0.040–0.046 mm. Size of bar is 0.004–0.025 x 0.023–0.040 mm, fan-shaped bars 0.018–0.025 mm. Length of copulatory tube is 0.073–0.119, accessory piece 0.060–0.120 mm.

Found on gills of *Parasalmo mykiss*, *Oncorhynchus keta*, *O. kisutch*, *Salvelinus albus*, *S. leucomaenis*, *S malma*, *Salmo salar* (?), *Thymallus arcticus* (?), *Salvelinus alpinus* (?), *Coregonus autumnalis* (?), and *C. nasus* (?); rivers flowing to Arctic and Pacific Seas.

7 (1). The supporting projection at the initial part of the copulatory tube may be present or absent; if absent, then the fan-shaped bars are highly sclerotized and well developed.

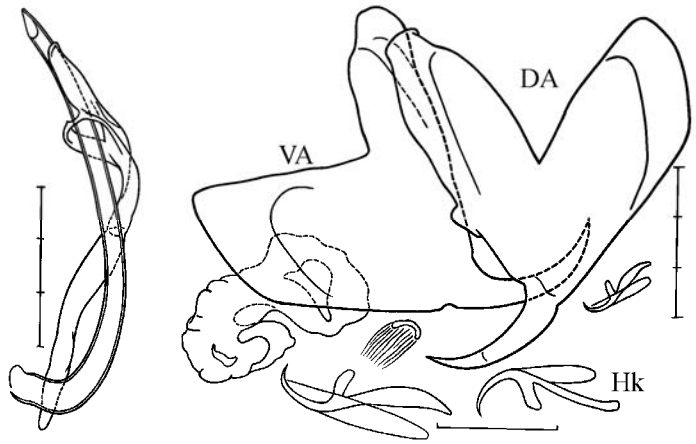
8 (19). The ventral and dorsal anchors greatly differ from one another in shape and size.

9 (18). The supporting projection at the initial part of the copulatory tube is present. The marginal hook handle is not wider than the blade.

10 (11). The copulatory tube is wide and bent; its diameter is 0.006–0.008 mm in the middle part of the tube. It is a parasite of *Hucho taimen*.
S. skrjabini Spassky et Roytman, 1958 (Fig. 437)

Body length is 2.9 mm, width up to 0.7 mm. Length of marginal hooks is 0.009–0.015 mm. Dorsal anchors: inner length 0.111–0.161 mm, outer length 0.122–0.185 mm, main part 0.108–0.146 mm, blade 0.073–0.077 mm. Ventral anchors: inner length 0.100–0.127 mm, outer length 0.108–0.163 mm, main part 0.088–0.119 mm, blade 0.060–0.062 mm. Size of bar is 0.021–0.028 x 0.097–0.103 mm, fan-shaped bars 0.027–0.030 x 0.036–0.050 mm. Length of copulatory tube is 0.107–0.182 mm, accessory piece 0.069–0.130 mm.

Found on gills of *Hucho taimen* and *Brachymystax lenok*; Yenisey and Lena Rivers (Russia); water bodies of Mongolia.



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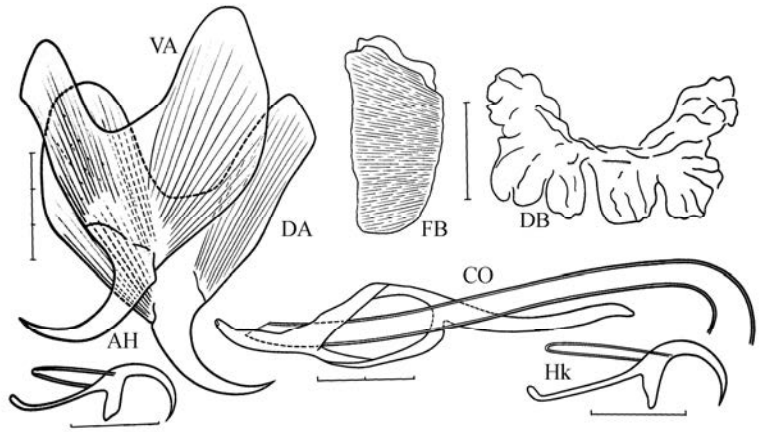

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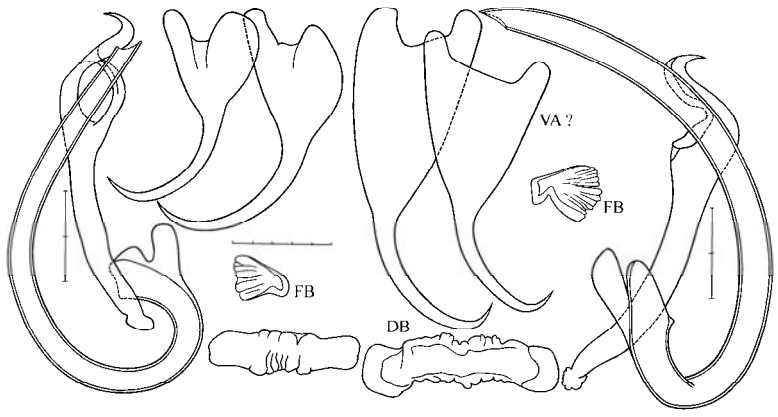

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Fig. 435 – 437.
435 - *Salmonchus gussevi* (after Kakacheva-Avramova et al., 1986). **436-** *Salmonchus alaskensis.* **437 -** *Salmonchus skrjabini* (after Ergens, 1971). Left – from *Hucho taimen* (Mongolia), to the right – syntype.

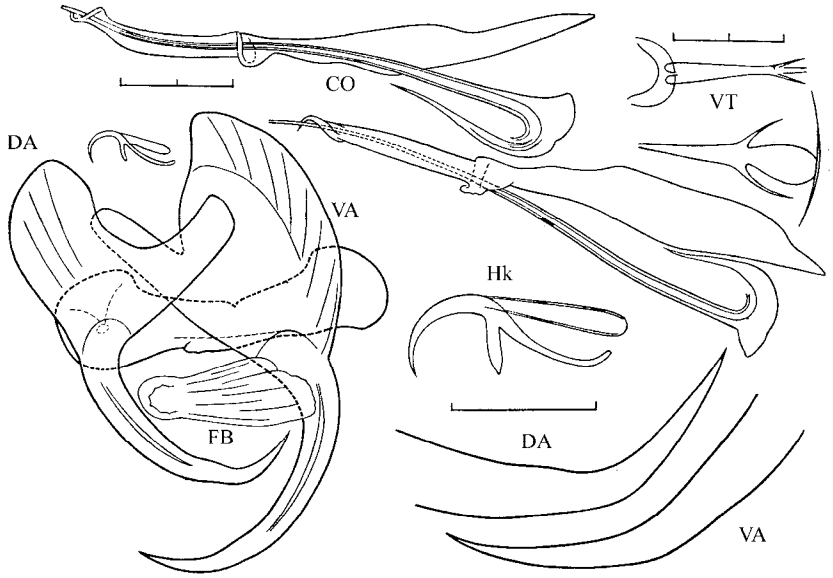


Fig. 438 - *Salmonchus kifai* (after Yukhimenko et Yukhimenko, 1986).

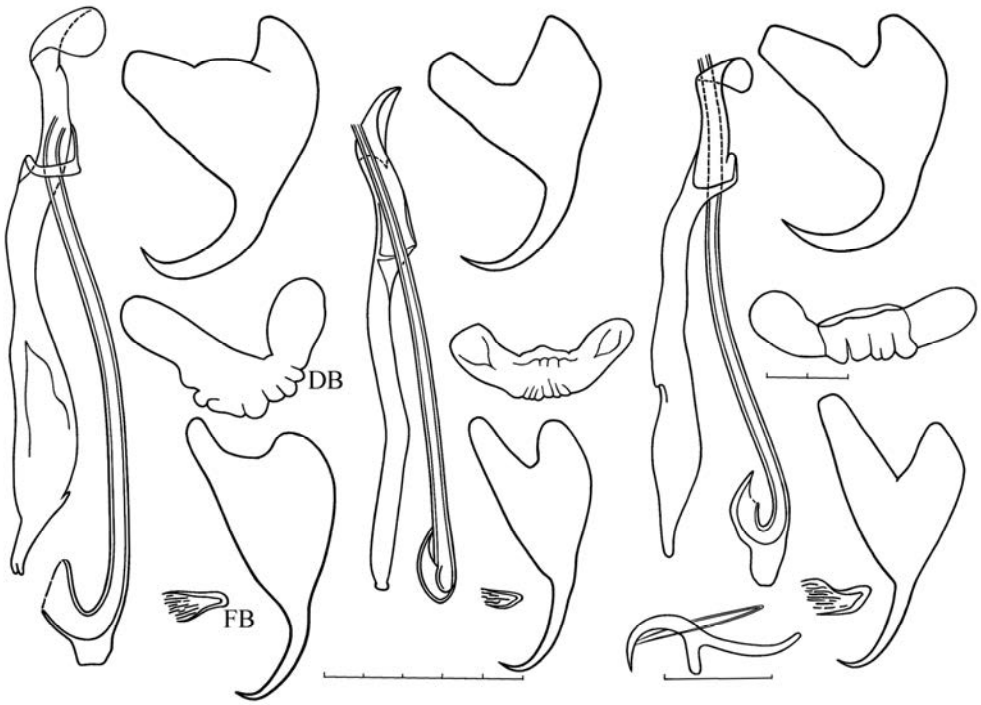


Fig. 439 - *Salmonchus rogersi* (after Ergens, 1971),
left – holotype, in the middle – young specimen, right – specimen identified by Spassky et Roytman (1960) as *Tetraonchus lenoki* (lower anchors – dorsal, upper one – ventral, in original description – vice versa).

11 (10). Diameter of the copulatory tube is less than 0.005 in its middle part; the tube is bent only in its initial part.

12 (13). The anchors have an easily visible bend at the blade, which has a longitudinal gutter in its middle.

S. kifai S. Yukhimenko et G. Yukhimenko, 1986 (Fig. 438)

They are large worms, with a body length up to 2.14 mm and width up to 0.26 mm. Length of marginal hooks is 0.013–0.017 mm. The anchors are rather thin and long and have an easily visible bend at the blade, as in *T. monenteron* and *T. borealis*. The blade has a longitudinal gutter in its middle. Inner length of dorsal anchors is 0.053–0.063 mm, outer length 0.068–0.080 mm, main part 0.049–0.060 mm, blade 0.045–0.050 mm. The ventral anchors are larger than the dorsal anchors; their inner length is 0.070–0.080 mm, outer length 0.081–0.092 mm, main part 0.060–0.078 mm, blade 0.049–0.054 mm. The ventral bar is almost straight and has widened ends (0.009–0.017 x 0.058–0.069 mm). The fan-shaped bar is like an elongated plate (0.012–0.015 x 0.026–0.033 mm). The copulatory organ has a comb on the bounded initial part of the tube; its total length is 0.100–0.124 mm. The vaginal armament is located on the right side of the body; it is like a tube with a funnel, and its length is about 0.030 mm.

Found on gills of *Oncorhynchus gorbuscha*, seldom on *Coregonus chadary*; basin of the Amgun' River (Amur River Basin) (Russia).

13 (12). The anchors do not have a break at the blade, and the blade does not have a gutter in its middle.

14 (15). The accessory piece embraces the copulatory tube and then widens like a spoon; the supporting projection of the copulatory tube is only slightly longer than the tube's diameter at its initial part.

S. rogersi (Ergens, 1971) (Fig. 439)

Syn.: *T. rogersi* Ergens, 1971; *T. lenoki* in Spassky et Roytman, 1960

Body length can be up to 2.0 mm, width up to 0.8 mm. Length of marginal hooks is 0.014–0.018 mm. Dorsal anchors: inner length 0.070–0.095 mm, outer length 0.070–0.084 mm, main part 0.061 mm, blade 0.018–0.029 mm. Ventral anchors: inner length 0.062–0.068 mm, outer length 0.059–0.072 mm, main part 0.062 mm, blade 0.026–0.037 mm. Size of bar is 0.010–0.017 x 0.048–0.065 mm, fan-shaped bars 0.013–0.015 x 0.018–0.022 mm. Length of copulatory tube is 0.120–0.128 mm, accessory piece 0.132–0.141 mm.

Found on gills of *Brachymystax lenok*; Yenisey, Lena, and Amur Rivers; Lake Baikal (Russia); water bodies of Mongolia.

15 (16). The accessory piece of the copulatory organ widens after embracing the copulatory tube; the supporting projection of the tube at its initial part is considerably longer than its diameter.

16 (17). The length of the copulatory tube is less than 0.2 mm; the length of the supporting projection is less than 0.030 mm.

S. roytmani Strelkov, 1963 (Fig. 440)

Body length can be up to 2.6 mm, width up to 0.7 mm. Length of marginal hooks is 0.015–0.018 mm. Dorsal anchors: inner length 0.067–0.105 mm, outer length 0.062–0.082 mm, main part 0.052–0.072 mm, blade 0.025–0.034 mm. Ventral anchors: inner length 0.057–0.080 mm, outer length 0.065–0.097 mm, main part 0.052–0.087 mm; blade 0.032–0.052 mm. Size of bar is 0.010–0.025 x 0.05–0.09 mm, fan-shaped plates 0.005–0.017 x 0.007–0.012 mm. Length of copulatory tube is 0.10–0.155 mm, accessory piece 0.130–0.162 mm, supporting projection 0.015–0.025 mm.

Found on gills of *Brachymystax lenok* and *Hucho taimen*; Yenisey, Selenga, Lena, Kolyma, and Amur Rivers and Lake Baikal (Russia); water bodies of Mongolia.

17 (15). The length of the copulatory tube is greater than 0.2 mm; the length of the supporting pro-

jection is greater than 0.030 mm.

S. strelkowi Pugachev et Rusinek, 2003 (Fig. 441)

Syn.: *T. pseudoroytmani* nomen nudum; *T. roytmani* forms B, C: Ergens, 1971

Body length can be up to 2.9 mm, width up to 0.7 mm. Length of marginal hooks is 0.018–0.020 mm. Dorsal anchors: inner length 0.087–0.1 mm, outer length 0.08–0.09 mm, main part 0.065–0.08 mm, blade 0.030–0.035 mm. Ventral anchors: inner length 0.070–0.087 mm, outer length 0.092–0.1 mm, main part 0.067–0.082 mm; blade 0.045–0.052 mm. Size of bar 0.017–0.025 x 0.06–0.095 mm, fan-shaped plates 0.007–0.015 x 0.02–0.03 mm. Length of copulatory tube is 0.228–0.306 mm, accessory piece 0.258–0.318 mm, supporting projection 0.03–0.042 mm.

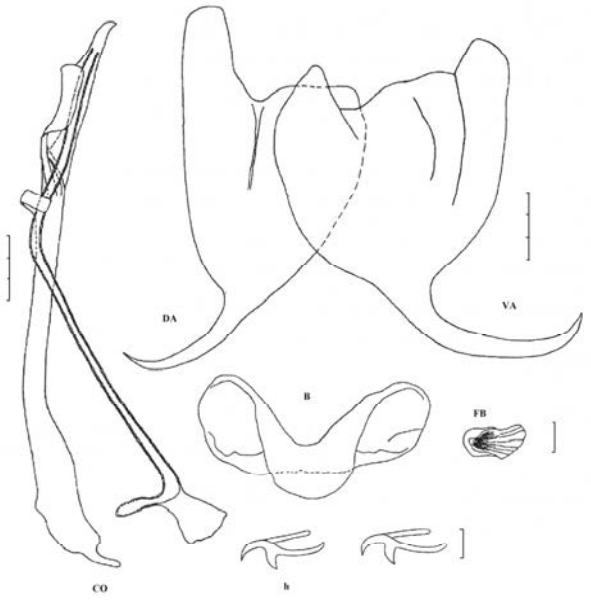
Found on gills of *Brachymystax lenok*; Selenga River (Mongolia).

Fig. 440 - *Salmonchus roytmani* (after Ergens, 1971): A – C - from Mongolia, D – syntype from Amur River.

18 (9). The supporting projections of the initial part of the copulatory tube are absent. The handle of the marginal hooks is widened and broader than the blade.

S. spasskyi (Strelkov, 1963) (Fig. 442)

Syn.: *T. spasskyi* Strelkov, 1963



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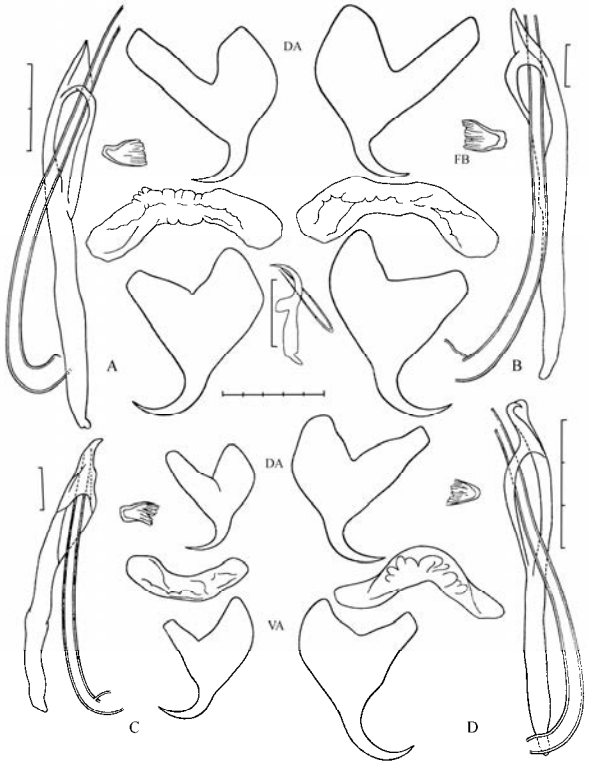


442

Fig. 441 – 442.
441 - *Salmonchus strelkowi* (after Pugachev et Rusinek, 2003). **442 -** *Salmonchus spasskyi* (after Ergens, 1971): A – syntype from Amur River; B – from *Hucho taimen* (Mongolia); C, D – from *Brachymystax lenok* (Mongolia).

Body length can be up to 3.7 mm, width up to 0.9 mm. Length of marginal hooks is 0.014–0.017 mm. Dorsal anchors: inner length 0.054–0.090 mm, outer length 0.054–0.086 mm, main part 0.035–0.054 mm, blade 0.021–0.032 mm. Ventral anchors: inner length 0.050–0.086 mm, outer length 0.064–0.096 mm, main part 0.039–0.068 mm, blade 0.031–0.036 mm. Size of bar is 0.015–0.020 x 0.064–0.103 mm, fan-shaped bars 0.014–0.015 x 0.023–0.029 mm. Length of copulatory tube is 0.062–0.098 mm, accessory piece 0.063–0.094 mm.

Found on gills of *Brachymystax lenok* and *Hucho taimen*; Yenisey, Lena, Selenga, and Amur Rivers (Russia), water bodies of Mongolia.

19 (8). The ventral and dorsal anchors are similar in shape and size; if there is a difference it is slight.

20 (25). The supporting projection of the initial part of the copulatory tube is present.

21 (24). The initial part of the copulatory tube is bent up to 180°.

22 (23). The blade of the anchors is the same length or slightly longer than the main part together with the roots.

S. lenoki (Akhmerov, 1952) (Fig. 443)

Syn.: *T. lenoki* Akhmerov, 1952

Body length can be up to 2.0 mm, width up to 0.5 mm. Length of marginal hooks is 0.012–0.017 mm. Dorsal anchors: inner length 0.074–0.107 mm, outer length 0.075–0.109 mm, main part 0.068–0.105 mm, blade 0.038–0.063 mm. Ventral anchors: inner length 0.064–0.095 mm, outer length 0.065–0.097 mm, main part 0.054–0.083 mm, blade 0.034–0.050 mm. Size of bar is 0.009–0.017 x 0.037–0.057 mm, fan-shaped bars 0.012–0.014 x 0.018–0.020 mm. Length of copulatory tube is 0.036–0.069 mm, accessory piece 0.042–0.064 mm. Vaginal armament is in the shape of a short chitinoid tube.

Found on gills of *Brachymystax lenok*; Yenisey, Lena, Kolyma, Selenga, and Amur Rivers and Lake Baikal (Russia); water bodies of Mongolia.

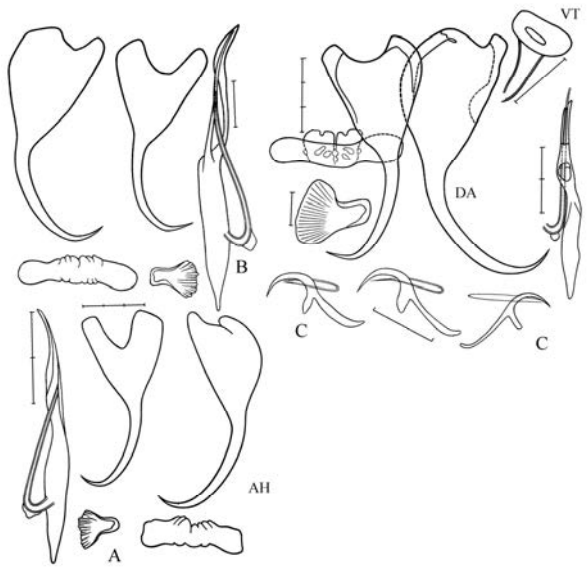


Fig. 443 - *Salmonchus lenoki* (after Ergens, 1971), A, B – from Onon and Kherulen Rivers (Mongolia), C – from Kolyma River (Russia).

23 (22). The main part of the anchors together with the roots is 1.5–2 times longer than the blade.
S. pseudolenoki (Strelkov, 1969) (Fig. 444)
Syn.: *T. pseudolenoki* Strelkov, 1969

Body length can be up to 2.0 mm, width up to 0.5 mm. Length of marginal hooks is 0.013–0.016 mm. Dorsal anchors: inner length 0.098–0.117 mm, outer length 0.120 mm, main part 0.090 mm, blade 0.040 mm. Ventral anchors: inner length 0.100–0.110 mm, outer length 0.112 mm, main part 0.090 mm, blade 0.040 mm. Size of bar is 0.017 x 0.062–0.089 mm, fan-shaped bars 0.016–0.027 x 0.017–0.032 mm. Length of copulatory tube is 0.086–0.094 mm, accessory piece 0.062–0.094 mm.

Found on gills of *Brachymystax lenok* and *Hucho taimen*; Lena and Amur Rivers (Russia).

24 (21). The copulatory tube at its initial part has a ring-shaped bend (a single spire).
S. huchonis (Bauer, 1948) (Fig. 445)
Syn.: *T. huchonis* Bauer, 1948

Body length can be up to 2.3 mm, width up to 0.6 mm. Length of marginal hooks is 0.006–0.012 mm. Dorsal anchors: inner length 0.145 mm, outer length 0.145–0.157 mm, main part 0.110 mm, blade 0.068 mm. Ventral anchors: inner length 0.148 mm, outer length 0.158–0.166 mm, main part 0.126 mm, blade 0.065 mm. Size of bar is 0.016–0.032 x 0.066–0.081 mm, fan-shaped bars 0.026–0.031 x 0.036–0.043 mm. Length of copulatory tube is 0.15–0.29 mm, accessory piece 0.113–0.190 mm.

Found on gills of *Hucho taimen*; Yenisey, Lena, Pjasina (Taimyr peninsular) Rivers and Amur River (Russia), water bodies of Mongolia.

25 (20). The supporting projection at the initial part of the copulatory tube is absent.

26 (29). The copulatory tube is bent at its initial part.

27 (28). The length of the copulatory tube is less than 0.060 mm.
S. oncorhynchi (Ogawa et Egusa, 1978) (Fig. 446)
Syn.: *T. oncorhynchi* Ogawa et Egusa, 1978

Body length can be up to 0.71–1.53 mm, width up to 0.24–0.30 mm. Length of marginal hooks is 0.014–0.016 mm. Dorsal anchors: inner length 0.075–0.088 mm, outer length 0.081–0.088 mm, main part 0.053–0.069 mm, blade 0.031–0.038 mm. Ventral anchors: inner length 0.064–0.086 mm, outer length 0.081–0.088 mm, main part 0.056–0.069 mm, blade 0.031–0.038 mm. Size of bar is 0.008–0.012 x 0.048–0.069 mm, fan-shaped bars 0.018–0.024 x 0.024–0.028 mm. Length of copulatory tube is 0.054–0.058 mm, accessory piece 0.060–0.069 mm.

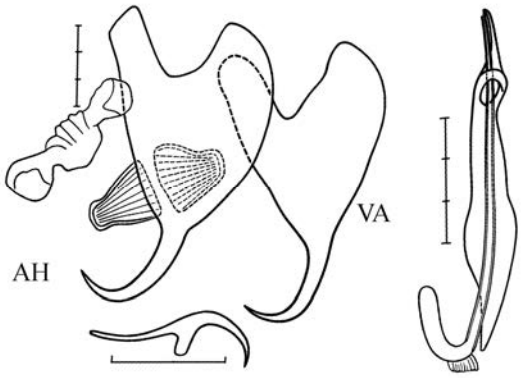
Found on gills of fingerlings of *Oncorhynchus masou*; water bodies of Japan; can be found in the Amur region.

28 (27). The length of the copulatory tube is greater than 0.090 mm.
S. gvosdevi Spassky et Roytman, 1960 (Fig. 447)

Body length can be up to 2.2 mm, width up to 0.5 mm. Length of marginal hooks is 0.012 mm. Dorsal anchors: inner length 0.077 mm, outer length 0.072–0.097 mm, main part 0.063 mm, blade 0.037 mm. Ventral anchors: inner length 0.083 mm, outer length 0.072–0.097 mm, main part 0.070 mm, blade 0.040 mm. Size of bar is 0.013–0.015 x 0.047–0.057 mm, fan-shaped bars 0.010–0.027 x 0.011–0.033 mm. Length of copulatory tube is 0.096–0.103, accessory piece 0.065–0.087 mm.

Found on gills of *Brachymystax lenok* and *Hucho taimen*; Yenisey and Lena Rivers (Russia), water bodies of Mongolia.

29 (26). The copulatory tube is straight.



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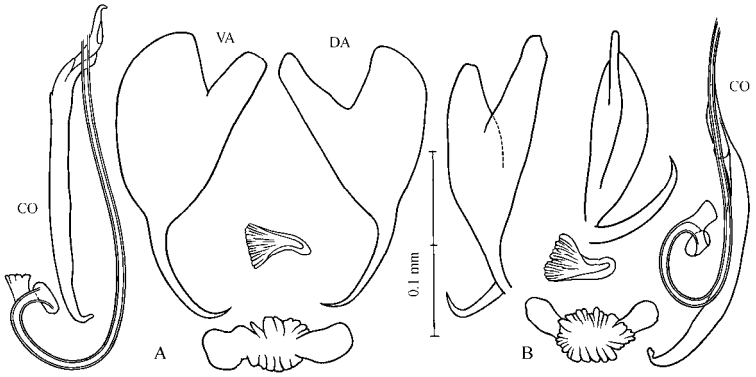

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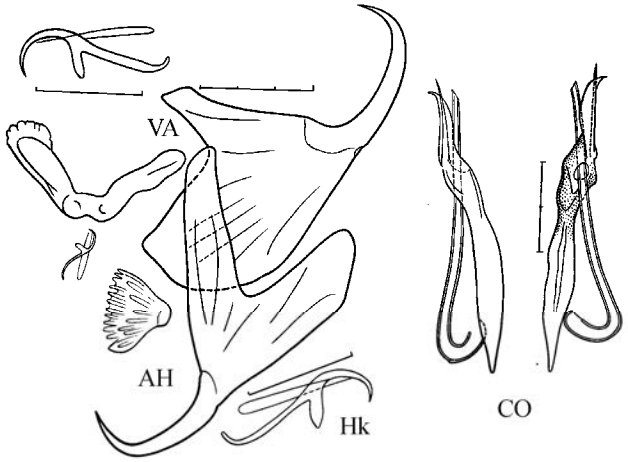
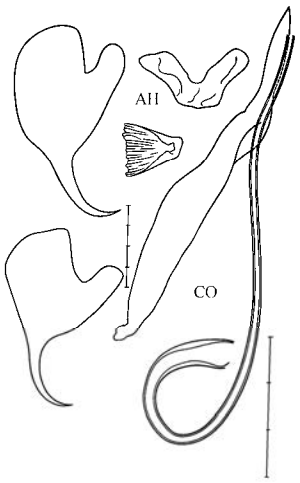


446

Fig. 444-446.
444 - *Salmonchus pseudolenoki*, syntype from Amur River. **445 -** *Salmonchus huchonis* (after Ergens, 1971): A – from Mongolia, B – syntype from Yenisey River. **446 -** *Salmonchus oncorhynchi* (from K. Ogawa's slide).



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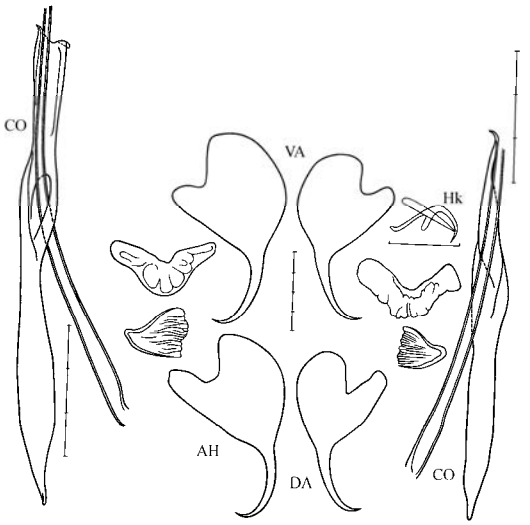

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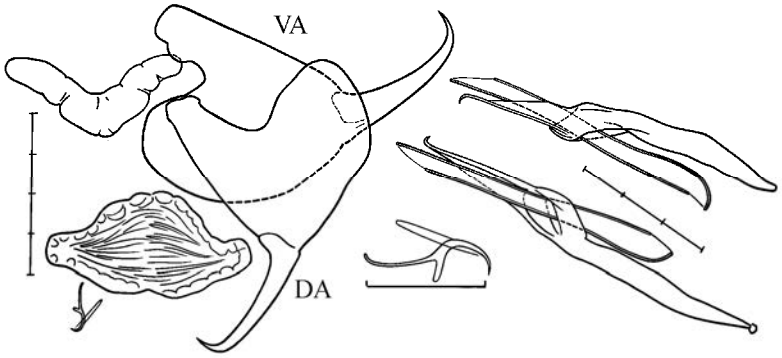


449

Fig. 447 – 449.
447 - *Salmonchus gvosdevi* (after Ergens, 1971). **448** - *Salmonchus ergensi* (after Ergens, 1971). Marginal hook is slightly deformed. **449** - *Salmonchus awakurai* (from K. Ogawa's slide).

30 (31). The length of the copulatory tube is greater than 0.070 mm.
S. ergensi (Ogawa et Egusa, 1978) (Fig. 448)
Syn.: *Tetraonchus* sp. I Ergens, 1971; *T. ergensi* Ogawa et Egusa, 1978

Length of marginal hooks is 0.011 mm, and only its points are easily visible. Dorsal anchors: inner lengh 0.071–0.086 mm, outer length 0.085–0.095 mm, main part 0.061–0.074 mm, blade 0.032–0.043 mm. Ventral anchors: inner length 0.071–0.089 mm, outer length 0.080–0.103 mm, main part 0.070–0.086 mm, blade 0.039–0.043 mm. Size of bar is 0.012–0.023 x 0.052–0.068 mm, fan-shaped bars 0.012–0.028 x 0.014–0.029 mm. Length of copulatory tube is 0.078–0.097 mm, accessory piece 0.088–0.112 mm.

Found on gills of *Brachymystax lenok*; Kolyma, Lena, and Selenga Rivers and rivers of the Maritime Territory (Russia); water bodies of Mongolia.

31 (30). The length of the copulatory tube is less than 0.065 mm.
S. awakurai (Ogawa et Egusa, 1978) (Fig. 449)
Syn.: *T. awakurai* Ogawa et Egusa, 1978

Body length is 0.66–1.08 mm, width 0.205–0.415 mm. Length of the very thin marginal hooks is 0.012 mm. Dorsal anchors: inner length 0.064–0.069 mm, outer length 0.069–0.076 mm, main part 0.050–0.054 mm, blade 0.030 mm. Ventral anchors: inner length 0.070–0.072 mm, outer length 0.073–0.082 mm, main part 0.060–0.063 mm, blade 0.030–0.033 mm. Size of bar is 0.009–0.014 x 0.045–0.056 mm, fan-shaped bars 0.023–0.026 x 0.022–0.032 mm. Length of copulatory tube is 0.052–0.062, accessory piece 0.058–0.075 mm.

Found on gills of *Brachymystax tumensis*; rivers of the Maritime Territory (Russia); on fingerlings of *Oncorhynchus masou* and *Parasalmo gairdneri*; water bodies of Japan.

Supplement to Tetraonchidae

Tetraonchus sp. II Ergens, 1971 (Fig. 450)

Inner length of smaller (dorsal?) anchors is 0.097 mm, outer length 0.115 mm, main part 0.078 mm, blade 0.040 mm. Inner length of larger (ventral?) anchors is 0.116 mm, outer length 0.127 mm, main part 0.090 mm, blade 0.045 mm. Size of bar is 0.029 x 0.086 mm, fan-shaped bars 0.017 x 0.029 mm. Length of copulatory tube is 0.35 mm (in original description 0.29 mm), accessory piece 0.35 mm.

Found on gills of *Brachymystax lenok* from water bodies of Mongolia. It probably is a new species.

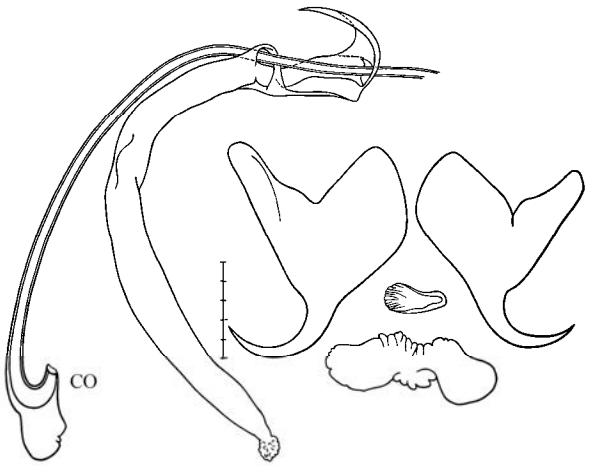


Fig. 450 - *Tetraonchus* sp. II Ergens, 1971 (after Ergens, 1971).

Family Bothitrematidae Bychowsky, 1957

These Tetraonchidae have anchors of medium size in the adult state. The attachment apparatus consists of a sucker-shaped disc, and its chitinous armature consists of 16 marginal hooks; two large anchors with a connecting plate; and of a ring of pipe-shaped, flattened plates lying with their longitudinal axes along the radii, tightly against or almost adjacent to each other at a certain distance from the exterior edge of the disc. This ring of plates is interrupted on the anterior edge and at this place, but closer to the center of the disc, is located a special coarse supporting plate. Four pairs of head organs and two pairs of eyes present. The single intestine is tubular. The testis is compact and pre-equatorial. A distinct ejaculatory bulb made of meridional muscle fibres is present behind the cirrus. The cirrus is hook shaped and has an accessory piece. The genital pore is median and lies a short distance posterior to the pharynx. The ovary is compact and pretesticular. The bulbous vagina opens ventrally near the left body margin at the level of the ovary, where the two body margins may be distinctly notched. Vitellaria are coextensive with the intestine. The type genus is ***Bothitrema*** Price, 1936.

Genus *Bothitrema* Price, 1936

Diagnosis corresponds to the diagnosis of the family. The genus currently consists of two species. Representatives of the genus infect Pleuronectiformes and Cottidae. Only one species is found in freshwaters. The type species is *B. bothi* MacCallum, 1913.

Bothitrema cotti Ermolenko et Lukjantschenko, 1988 (Fig. 451)

Body length with haptor is 0.19–1.44 mm, width 0.128–0.3 mm. The haptor is saucer shaped (0.17–0.363 x 0.16–0.4 mm) and has 16 marginal hooks and one pair of anchors. The marginal hooks are of the gyrodactyloid type and are situated more or less evenly on the haptor edge. Total length of marginal hooks is 0.025–0.028 mm, hooklet 0.006–0.008 mm, handle 0.015–0.02 mm. The anchors are directed to the ventral side. Total length of anchors is 0.086–0.21 mm, main part 0.072–0.14 mm, inner root 0.019–0.076 mm, point 0.017–0.032 mm. Two bars are present. One bar is closely related to the ring of plates and is situated near the anterior end of the haptor and has a **U**-like form. It size is 0.01–0.024 x 0.039–0.059 mm, length of ear-like projections 0.066–0.145 mm. The second bar is associated with the anchors and its size is 0.021–0.03 x 0.068–0.093 mm. Its membrane is 0.012–0.016 mm long. The ring of plates consists of 21–22 plates. Plate size increase anteriorally from 0.021 x 0.004 mm up to 0.050 x 0.006 mm. Length of the accessory piece of the cirrus is 0.09–0.194 mm. Size of vagina is 0.047–0.055 x 0.025–0.04 mm, egg 0.13–0.175 x 0.05–0.063 mm.

Found on gills and fins of *Cottus poecilopus* (spotted sculpin); Edinka and Frolovka Rivers, Maritime Territory (Russia).

Order Gyrodactylidea Bychowsky, 1937

These small, elongated worms are viviparous (or very rarely oviparous - Oogyrodactylidae). The anterior end of the body is bilobed, and each lobe has a head organ. The well-developed haptor bears one pair of anchors (sometimes absent) with dorsal and ventral supporting bars and 16 marginal hooks. The intestine bifurcates and lacks diverticula, and the two caeca do not unite posteriorly. Eye spots are absent. The copulatory organ is armed with a row of minute spines. The excretory system consists of three parts: protonephridia, ducts, and a posterior part that opens to the environment. The ovary is anterior to the testis.

Found on Crustacea, Cephalopoda, marine and freshwater fishes, and Amphibia. The order consists of two families. Only one family (Gyrodactylidae) is found in all parts of the world.

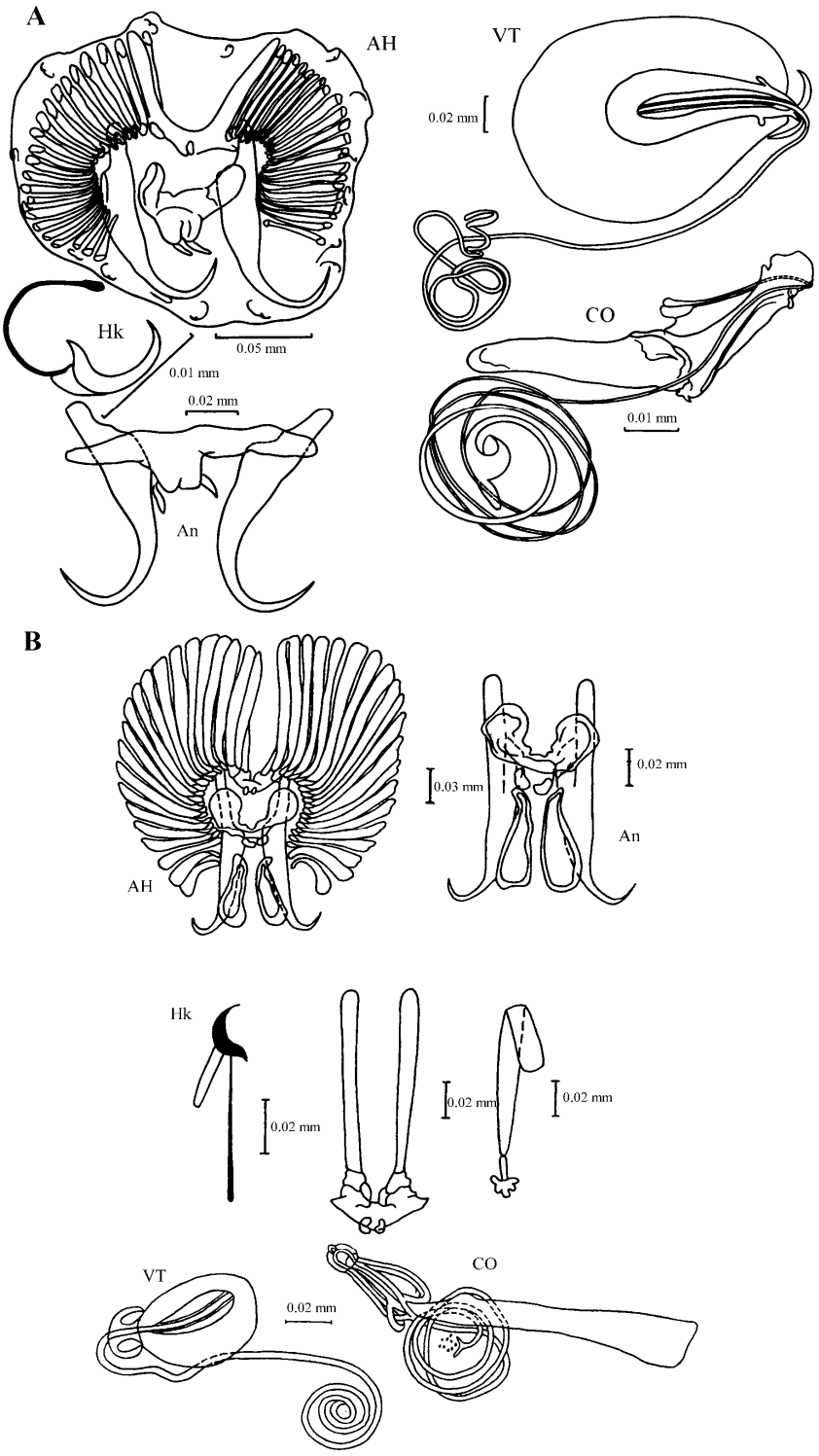


Fig. 451. - *Bothitrema cotti*: A – after Ermolenko et Lukjantschenko, 1988, B – after Butorina et Mikhailov, 1998.

Family Gyrodactylidae Van Beneden et Hesse, 1863

Features of Gyrodactylidae are the same as of the order. The family consists of four subfamilies: Gyrodactylinae, Polyclithrinae, Isancistrinae, and Gyrdicotylinae. Only one (Gyrodactylinae) has been found on freshwater fishes of the Palaearctic and Amur regions.

Subfamily Gyrodactylinae Van Beneden et Hesse, 1863

These are relatively small Gyrodactylidae (up to 1–1.5 mm long). Haptor armament consists of 16 marginal hooks, 2 anchors directed to the ventral side, and connective structures. Additional chitinoid structures that support the haptor in the open position sometimes are present. Other features of the subfamily coincide with those of the family (Fig. 452).

Of the 15 genera described for this subfamily, only two (*Gyrodactylus* and *Paragyrodactylus)* are parasites of freshwater fishes of the Palaearctic and Amur regions. Two more genera of marine origin (*Gyrodactyloides* and *Laminiscus*) can be found on anadromous salmonids.

Two or three scales of measurement usually are shown in drawings of Gyrodactylinae. When two are shown, the left is for anchors, marginal hooks, and the cirrus and the right one is for the hooklet of marginal hooks. When three scales are shown, the left is for anchors, the middle for marginal hooks and the cirrus, and the right for the hooklet of marginal hooks. The scale often is not divided into parts, but when it is each part of the divided scale corresponds to 0.01 mm.

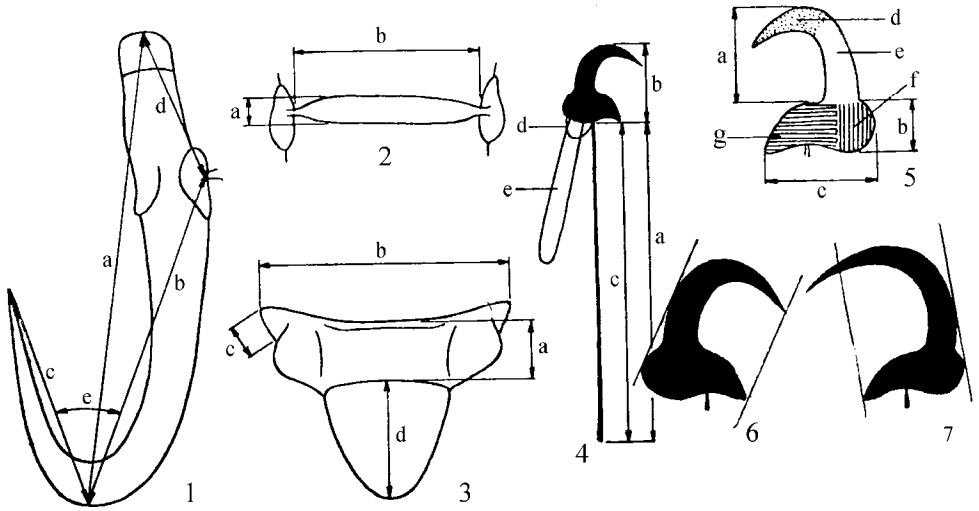


Fig. 452. - Parts of haptor armament and scheme of its measurements for subfamily Gyrodactylinae (after Ergens, 1985).

1 – anchor: a – total length, b – main part length, c – point length, d – inner root length, e – angle between main part and point; 2 – dorsal bar: a – length, b – width; 3 – ventral bar: a – length, b – width, c – ear-like projection length, d – membrane length; 4 – marginal hook: a – total length, b – hooklet (sickle) length, c – handle length, d – membrane, e – loop; 5 – hooklet (sickle): a – blade length, b – base length, c – base width, d – point, e – stalk, f – base external part, g – base inner part; 6 – hooklet point does not reach level of its base; 7 – hooklet point exceeds level of its base.

Key to genera of subfamily Gyrodactylinae

1 (4). The anchors lack an outer root and have only an inner one. Two bars (ventral and dorsal) are present. The haptor may or may not have additional chitinoid structures.

2 (3). The haptor lacks any additional structures.
Gyrodactylus

3 (2). The haptor has additional chitinoid structures (an arch with membranoid projections that are not connected posteriorly).
Paragyrodactylus

4 (1). Usually the anchors have an inner and outer root. Only a ventral bar is present. An additional chitinoid ring-shaped structure is present in the haptor.

5 (6). The additional chitinoid structure is in the form of an arch with a saddle-shaped thickening in its anterior part and threads projecting outward from it circularly.
Gyrodactyloides

6 (5). The additional chitinoid armament is shield shaped.
Laminiscus

Genus *Gyrodactylus* Nordmann, 1832

In the Gyrodactylinae, the haptor armament consists of 16 marginal hooks and two anchors without outer roots but with two bars: a ventral bar with a membrane[80] and a dorsal bar. Other features of the genus coincide with those of the subfamily (Fig. 453).

The type species is *G. elegans* Nordmann, 1832.

All species of this genus may be divided into several subgenera (Malmberg, 1964, 1970) or even genera (Glaeser, 1978). It would be of great

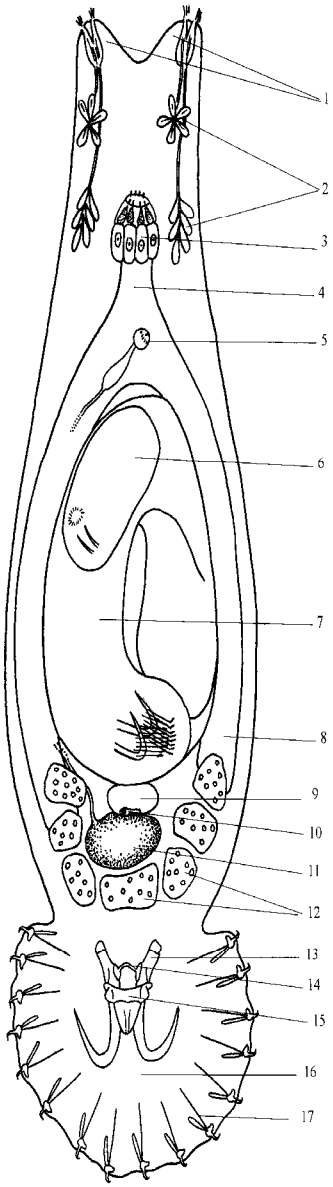


Fig. 453. Scheme of the genus *Gyrodactylus* monogenean morphological structure (after Ergens, 1985).
1 – head lobes, 2 – groups of cephalic glands, 3 – pharynx, 4 – esophagus, 5 – cirrus (copulatory organ), 6 – second embryo, 7 – first embryo, 8 – intestine, 9 – ootype, 10 – ovary, 11 – testis, 12 – follicular glands, 13 – anchors, 14 – dorsal bar, 15 – ventral bar with membrane, 16 – haptor, 17 – marginal hooks.

[80] This structure previously was called the membranoid posterior projection or membranoid continuation.

interest to revise all species, but not enough data are available for most of them. Because of the difficulty in studying the excretory system during faunistic investigations, the structure of this system is not considered in this Key.

The details of the morphology of the chitinoid armament and its parts are necessary to identify species. Parts of the haptor armament and the scheme used to measure them for the subfamily Gyrodactylinae according to Ergens (1985) are shown in Fig. 452. Another measurement scheme was proposed by Shinn et al. (2004). More information can be found on www.gyrodb.net.

Malmberg (1957, 1970), Ergens (1965a, 1965b), and others have shown that the most stable features are: shape of marginal hooks, correlation of its parts, type of blade bending, and shape of its base and its back and heel. The main types of marginal hooks (hooklets) used in identification to species are shown in Fig. 454. Size and correlation of anchors, type of bending, angles between axes of blade and main part and root, thickness of anchors, shape of root and bars, and shape of ear-like projections and the membrane of the ventral bar are also of great importance. Types of chitinoid structures most often observed are shown in Figs. 454-456 (Ergens, 1985).

The shape of the marginal hooks and identification of species can be performed easily only for well squeesed worms and when good and exact drawings are made using a magnified microscope. The anchors may be damaged in such slides, thus it is necessary to prepare slides with parasites pressed in a different manner. An scanning electron microscope (SEM) study of the haptoral sclerites after use of digestion or sonication techniques was proposed by Shinn et al. (1993).

Identification can be difficult because some species are highly variable. For example, in the same species larger structures are observed in cold water and smaller ones in warm water. Such variability also has been observed in water of different salinity (e.g., Ergens, 1991; Ergens et Gelnar, 1985; Mo, 1991; Shinn et al., 1996; Shinn et al., 2001; Prikrylova et al., 2008).

Some members of the Gyrodactylinae have practical significance. Several species have been described as pathogens that can cause mortality of one-summer and one-year-old carps. Mortalities have been observed in southern and temperate zones of carp culture. The main pathogens are *Gyrodactylus kathariner*i, *G. cyprini*, *G. medius* (identification of this species may be incorrect), and *G. sprostonae*. Cases of gyrodactylosis of young eels have been described in Japan due to infection with *G. anguillae*. Mortality of young *Salmo salar* in Norwegian rivers due to *G. salaris* infection has been described. Interest in the Gyrodactylidae has been raised during recent years, but many issues with systematics, morphology, and biology of this group remain to be solved. Due to the *G. salaris* problem, many investigations on *Gyrodactylus* biology and control were conducted during the last decade (e.g., Bychowsky, 1957a; Malmberg, 1970; Ergens, 1976; Golovin, 1977; Solomatova and Luzin, 1977; Kulemina, 1977; Bauer et al., 1981; Bakke and MacKenzie, 1993; Harris et al., 1994; Harris, 1998; Bakke et al., 1999; Soleng and Bakke, 2001; Cable et al., 2000, 2002a, 2002b).

Key to species of the genus *Gyrodactylus*

1 (262). The ventral bar has ear-like projections.

2 (19). The ear-like projections of the ventral bar are longer than the bar.

3 (6). The inner root of the anchors is lamellar and turned to the midline as if folded in two (see Fig. 455, 456).

4 (5). The inner roots have additional patches.
G. malmbergi Ergens, 1961 (Fig. 457)

Body length is about 0.45 mm. Total length of marginal hooks is 0.028–0.032 mm, hooklet 0.006–0.008 mm. Length of main part of anchors is 0.038–0.043 mm, point 0.027–0.029 mm. Size of ventral bar is 0.007–0.009 x 0.045–0.046 mm, length of membrane 0.014–0.015 mm. Size of dorsal bar is 0.002–0.003 x 0.026–0.033 mm.

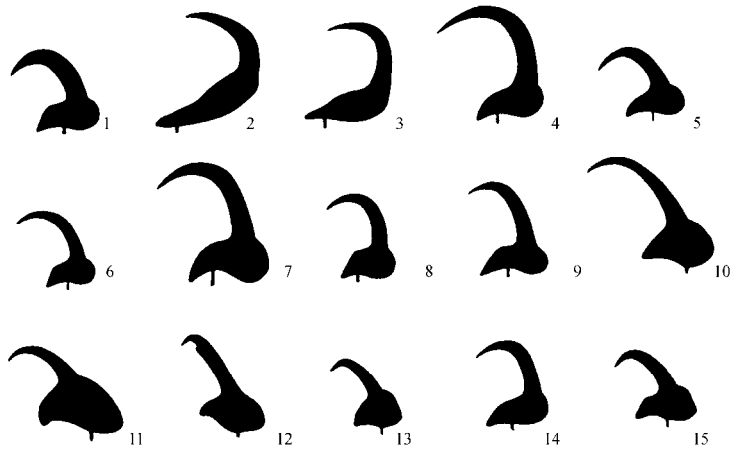


Fig. 454. - Hooklet types of some representatives of the genus *Gyrodactylus*: 1 – *G. gobii*, 2 – *G. rarus*, 3 – *G. cotti*, 4 – *G. lucii*, 5 – *G. stankovici*, 6 – *G. rhodei*, 7 – *G. thymalli*, 8 – *G. vimbi*, 9 – *G. barbi*, 10 – *G. marjami*, 11 – *G. barbatuli*, 12 – *G. markakulensis*, 13 – *G. minimus*, 14 – *G. cernuae*, 15 – *G. malmbergensis* (after Ergens, 1985).

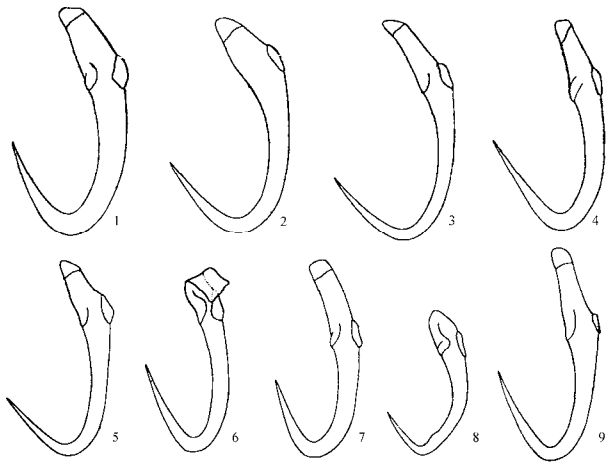


Fig. 455. - Anchor types of some representatives of the genus *Gyrodactylus*: 1 – *G. bliccensis*, 2 – *G. dulmaae*, 3 – *G. sprostonae*, 4 – *G. fairporti*, 5 – *G. medius*, 6 – *G. nemachili*, 7 – *G. osoblahensis*, 8 – *G. narzikulovi*, 9 – *G. limneus*.

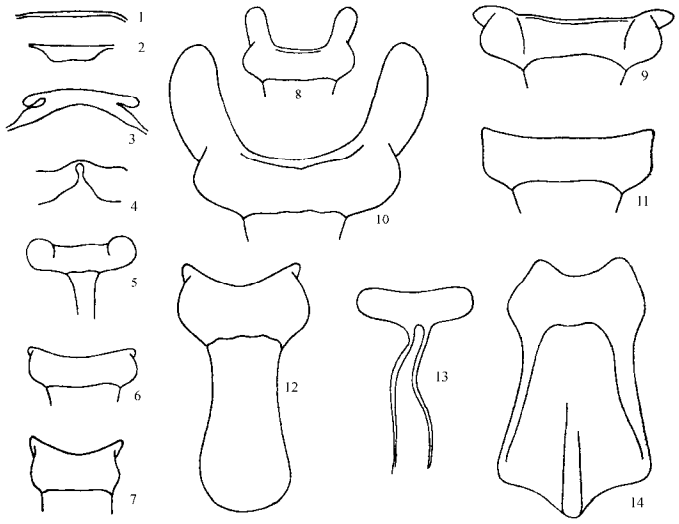


Fig. 456. - Bar main types of some representatives of the genus *Gyrodactylus* (1–4 – dorsal bar, 5–13 – ventral bar): 1 – *G. nemachili*, 2 – *G. prostae*; 3, 10 – *G. katharineri*, 4, 14 – *G. cyprini*, 5 – *G. elegans*, 6 – *G. misgurni*, 7 – *G. latus*, 8 – *G. proterorhini*; 9 – *G. luciopercae*; 11 – *G. curiosus*; 12 – *G. magnificus*; 13 – *G. tibetanus*.

Found on skin and fins of *Barbus barbus* and *B. petenyi*; rivers of East Slovakia, Hungary, and Bulgaria; may be found in Russia.

5 (4). The inner roots lack additional patches.
G. karabekovi Gvozdev, Baimagambetov, 1993 (Fig. 458)

Body length is 0.28–0.50 mm. Total length of marginal hooks is 0.028–0.032 mm, hooklet 0.004–0.006 mm. Length of main part of anchors is 0.042–0.046 mm, point 0.028–0.032 mm. Size of ventral bar is 0.006–0.007 x 0.036–0.050 mm. Size of dorsal bar is 0.002–0.004 x 0.024–0.028 mm. Scale-bar is absent in the original description.

Found on skin, fins, and gills of *Gymnodiptychus dybowskii*; basin of the Ili River (Kazakhstan).

6 (3). The inner root of the anchors is rather thick and straight.

7 (12). Total length of the anchors is less than 0.055 mm.

8 (11). The ventral bar membrane narrows at the end.

9 (10). The point of the hooklet of the marginal hook is shorter than its stalk.
G. arcuatus Bychowsky, 1933 (Fig. 459)
Syn.: *G. aculeati* Malmberg, 1957; *G. bychowskyi* Sproston, 1946

Body length is 0.26–0.46 mm. Total length of marginal hooks is 0.020–0.024 mm, hooklet 0.004–0.005 mm. Total length of the anchor is 0.031–0.046 mm, inner root 0.007–0.014 mm, main part 0.024–0.033 mm, point 0.015–0.020 mm. Size of ventral bar 0.003–0.005 x 0.012–0.024 mm, membrane 0.010–0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.012–0.021 mm.

Found on skin, fins, and gills of *Gasterosteus aculeatus*, *Pungitius pungitius*, and *Proterorhinus marmoratus*; it seems to follow its hosts through Europe and Asia.

10 (9) The point of the marginal hooks hooklet is longer than its stalk.
G. proterorhini Ergens, 1967 (Fig. 460)
Syn.: *G. najdenovae* Malmberg, 1970

Body length is about 0.3 mm. Total length of marginal hooks is 0.023–0.024 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.036–0.044 mm, inner root 0.009–0.014 mm, main part 0.028–0.035 mm, point 0.019–0.022 mm. Size of ventral bar is 0.004–0.006 x 0.014–0.019 mm, membrane 0.010–0.012 mm. Size of dorsal bar is 0.001–0.002 x 0.014–0.020 mm.

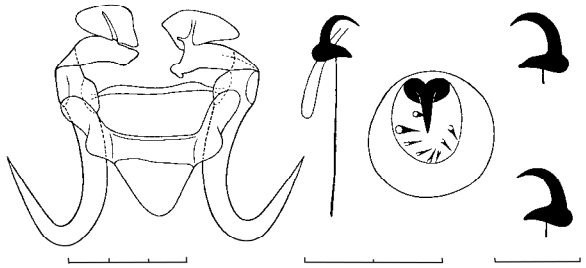
Found on skin, fins, and gills and in nasal cavities of *Proterorhinus marmoratus*, *Zosterisessor ophiocephalus*, and several other Gobiidae; basins of the Black and Caspian Seas.

11 (8). The ventral bar membrane does not narrow at the end.
G. colemanensis Mizelle et Kritsky, 1967 (Fig. 461)

Total length of marginal hooks is 0.026–0.029 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.043–0.051 mm, main part 0.032–0.040 mm, point 0.019–0.022 mm, inner root 0.009–0.014 mm. Size of ventral bar is 0.004–0.006 x 0.022–0.026 mm, membrane 0.010–0.012 mm. Width of dorsal bar is 0.015–0.020 mm.

Found on skin of *Parasalmo gairdneri* and *Salvelinus fontinalis*; Newfoundlend, Nova Scotia (Canada); can be found in the Far East territories of Russia.

12 (7). Total length of the anchors is greater than 0.060 mm.



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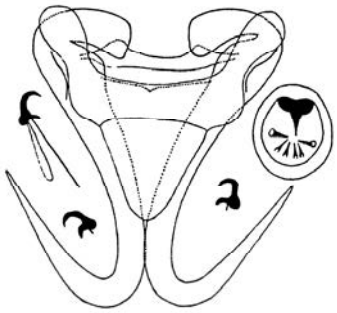

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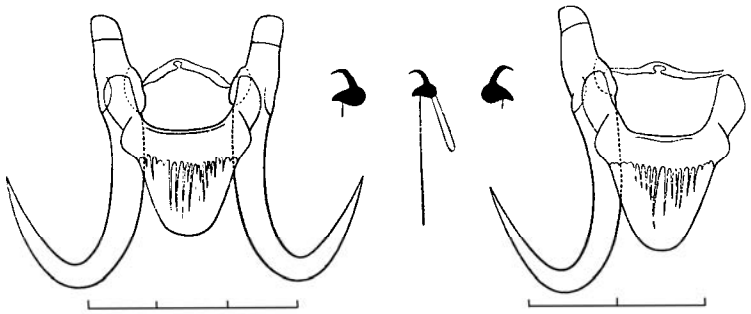

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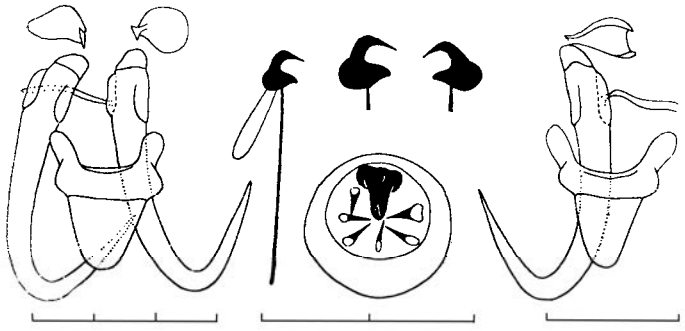


460

Fig. 457 – 460.
457 - *Gyrodactylus malmbergi*. **458** - *Gyrodactylus karabekovi* (after Gvozdev et Baimagambetov, 1993). Scale-bar is absent in original description. **459** - *Gyrodactylus arcuatus.* **460** - *Gyrodactylus proterorhini.*

13 (16). Total length of the marginal hooks is less than 0.032 mm.

14 (15). The point of the marginal hooks hooklet extends beyond the level of its base (see Fig. 452, 7).
G. ophiocephali Gussev, 1955 (Fig. 462)

Body length can be up to 0.5 mm. Total length of marginal hooks is 0.027–0.030 mm, hooklet 0.007–0.009 mm. Total length of anchor is 0.061–0.068 mm, main part 0.045–0.047 mm, point 0.027–0.032 mm, inner root about 0.022 mm. Size of ventral bar is 0.006–0.007 x 0.025–0.026 mm, membrane 0.014–0.016 mm. Size of dorsal bar is 0.003 x 0.018–0.020 mm.

Found on fins of *Channa argus* and fingerlings of *Cyprinus carpio rubrofuscus*; Lake Khanka, Amur region (Russia).

15 (14). The point of the hooklet does not reach the level of its base (see Fig. 452, 6).
G. tokobaevi Ergens et Karabekova, 1980 (Fig. 463)

Body length is about 0.5 mm. Total length of marginal hooks is 0.029–0.031 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.062–0.065 mm, main part 0.042–0.044 mm, point 0.028–0.029 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.006–0.007 x 0.027–0.030 mm, membrane 0.017–0.020 mm. Size of dorsal bar is 0.003–0.004 x 0.020–0.022 mm.

Found on skin of *Gymnodiptychus dybowskii*; Aksu River (Kyrgyzstan).

16 (13). Total length of the marginal hooks is greater than 0.038 mm.

17 (18). The membrane of the ventral bar tapers at its anterior part.
G. spathulatus Mueller, 1936 (Fig. 464)

Body length is about 0.6 mm. Total length of marginal hooks is 0.044–0.045, hooklet 0.007 mm. Total length of anchors is 0.11–0.13 mm, main part 0.079–0.088 mm, point 0.042–0.044 mm, inner root 0.037–0.046 mm. Size of ventral bar is 0.011–0.012 x 0.045–0.050 mm, membrane 0.057–0.072 mm. Size of dorsal bar is 0.005 x 0.023–0.029 mm.

Found on skin of *Catostomus catostomus*; Kolyma River (Russia).

18 (17). The membrane of the ventral bar tapers posteriorly.

19 (20). The anterior edge of the ventral bar membrane almost coincides with the posterior edge of the bar.
G. hrabei Ergens, 1957 (Fig. 465)

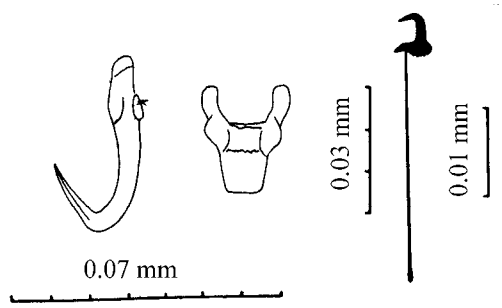
Body length can be up to 0.6 mm. Total length of marginal hooks is 0.038–0.042 mm, hooklet 0.008 mm. Total length of anchors is 0.061–0.074, main part 0.047–0.055 mm, point 0.031–0.035 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.008–0.009 x 0.026–0.029 mm, membrane 0.019–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.019–0.024 mm.

Found on fins of *Cottus gobio* and *C. poecilopus*; probably is spread throughout the area of the hosts.

20 (19). The anterior edge of the ventral bar membrane occupies about half of the posterior edge of the bar.
G. katharineri Malmberg, 1964 (Fig. 466)
Syn.: *G. cyprini* sensu Kollmann, 1968

Body length can be up to 0.9 mm. Total length of marginal hooks is 0.038–0.058 mm, hooklets 0.008–0.010 mm. Total length of anchors is 0.071–0.112 mm, main part 0.051–0.084 mm, point 0.027–0.052 mm, inner root 0.016–0.035 mm. Size of ventral bar is 0.008–0.014 x 0.033–0.050 mm, membrane 0.018–0.040 mm. Size of dorsal bar is 0.002–0.005 x 0.020–0.048 mm.

Found on skin, fins, and gills of *Cyprinus carpio*, *Carassius carassius*, *C. auratus gibelio*, *Barbus barbus*, *Alburnus alburnus*, *Scardinius erythrophthalmus*, *Gobio gobio*, and some other cyprinids; found throughout Europe and Asia in the area of its main hosts.



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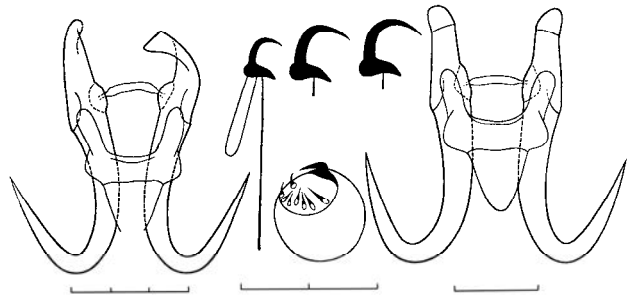

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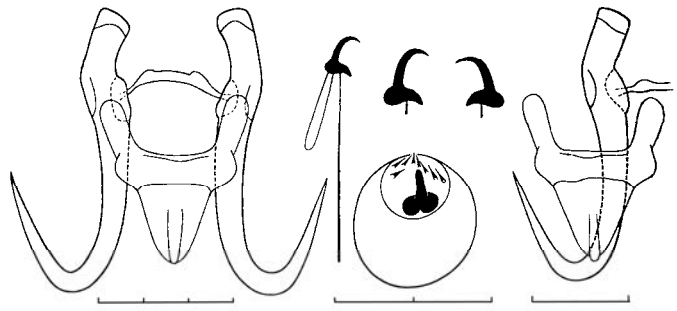

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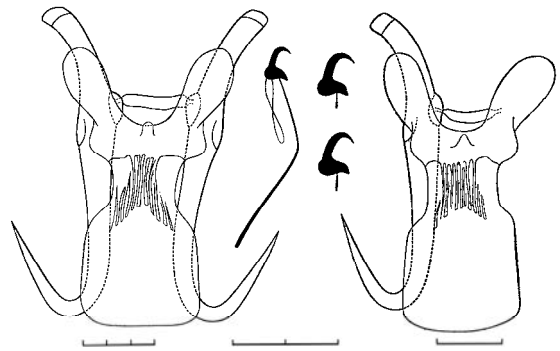


464

Fig. 461 – 464.
461 - *Gyrodactylus colemanensis* (after Mizelle et Kritsky, 1967). **462** - *Gyrodactylus ophiocephali*. **463** - *Gyrodactylus tokobaevi*. **464** - *Gyrodactylus spathulatus*.

G. katharineri is common in fish farms, sometimes in numerous quantities and causing disease and even mortality of one-summer-old and one-year-old carps. The main hosts of this species are *Cyprinus carpio* (both wild and domesticated) and both species of *Carassius*. All other host species can be considered as occasional or provisional. This species previously was identified as *G. elegans* Nordmann, 1832.

21 (2). The ear-like projections of the ventral bar are not longer than the bar itself.

22 (43). The inner root of the anchors is plate shaped, bent to the midline of the body, and folded (see Fig. 455, 6).

23 (26). The length of the main part of the anchors is less than 0.025 mm.

24 (25). The hooklet of the marginal hooks is massive, of the *G. gobii* type (see Fig. 454, 1).
G. aksuensis Ergens et Karabekova, 1980 (Fig. 467)

Body length is about 0.25 mm. Total length of marginal hooks is 0.021–0.022 mm, hooklet 0.005 mm. Length of anchor main part is 0.022–0.023 mm, point 0.013–0.014 mm. Size of ventral bar is 0.003–0.004 x 0.015–0.016 mm, membrane 0.008–0.009 mm. Size of dorsal bar is 0.001 x 0.012–0.013 mm.

Found on skin of *Gymnodiptychus dybowskii*; Aksu River (Kyrgyzstan).

25 (24). The hooklet is of another type.
G. lefua Gussev, 1955 (Fig. 468).

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.019–0.020 mm, hooklet 0.004–0.005 mm. Length of main part of anchor is 0.016–0.018 mm, point 0.010–0.012 mm. Size of ventral bar is 0.003–0.004 x 0.014–0.018 mm, membrane 0.006–0.009 mm. Size of dorsal bar is 0.001–0.002 x 0.010–0.013 mm.

Found on skin, fins, and gills of *Lefua pleskei*; Lake Khanka (Amur region, Russia).

26 (23). Length of the main part of the anchors is greater than 0.027 mm.

27 (32). The hooklet's blade has two more or less sharp bends.

28 (29). The length of the main part of the anchors main part is greater than 0.05 mm.
G. incognitus Ergens et Gussev, 1980 (Fig. 469)

Body length is about 0.5 mm. Total length of marginal hooks is 0.031–0.032 mm, hooklet 0.007–0.008 mm. Length of anchors main part is 0.053–0.057 mm, point 0.034–0.037 mm. Size of ventral bar is 0.008–0.011 x 0.035–0.041 mm, membrane about 0.035 mm. Size of dorsal bar is 0.002–0.003 x 0.030–0.033 mm.

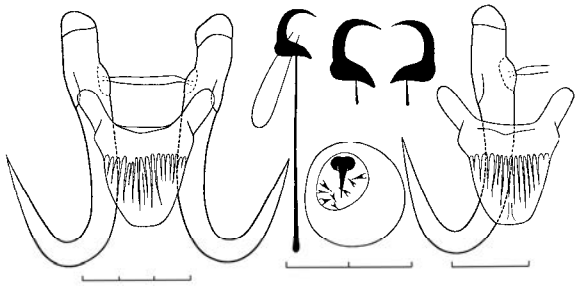
Found on gills of *Triplophysa strauchi*; Tardzhi River (Uzbekistan).

29 (28). The length of the main part of the anchors is less than 0.05 mm.

30 (31). The ratio between width and length of the hooklet base is 1:2.
G. pavlovskyi Ergens et Bychowsky, 1967 (Fig. 470)

Body length can be up to 0.35 mm. Total length of marginal hooks is 0.028–0.031 mm, hooklet 0.008–0.009 mm. Length of main part of anchors is 0.027–0.033 mm, point 0.023–0.025 mm. Size of ventral bar is 0.004–0.007 x 0.018–0.021 mm, membrane 0.011–0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.016–0.021 mm.

Found on fins of *Barbatula barbatula*; water bodies of Britain, Czechia, and Slovakia; surely will be found in Russia and other countries of the Palaearctic.



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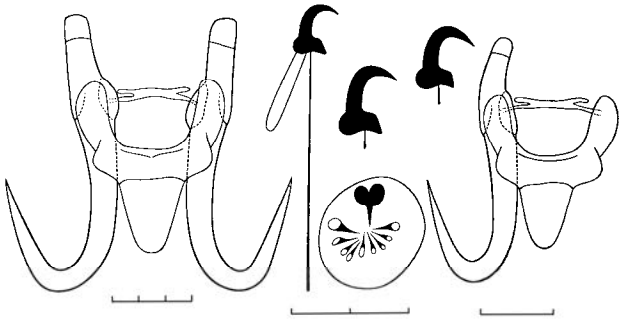

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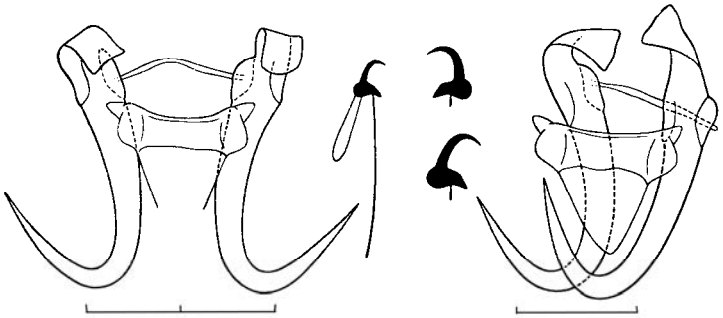

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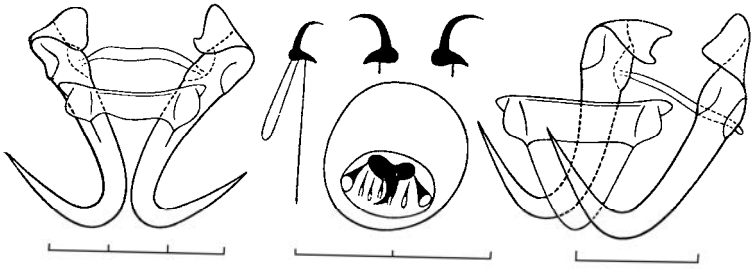
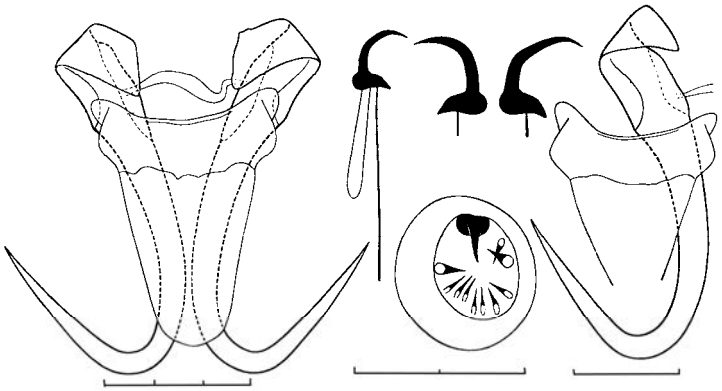


468

Fig. 465 – 468.
465 – *Gyrodactylus hrabei*. **466 –** *Gyrodactylus katharineri.* **467 –** *Gyrodactylus aksuensis.* **468 –** *Gyrodactylus lefua.*



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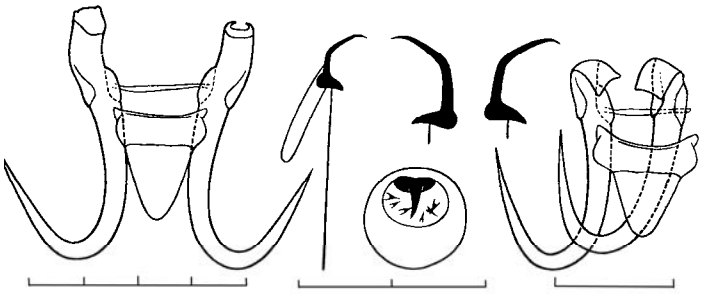

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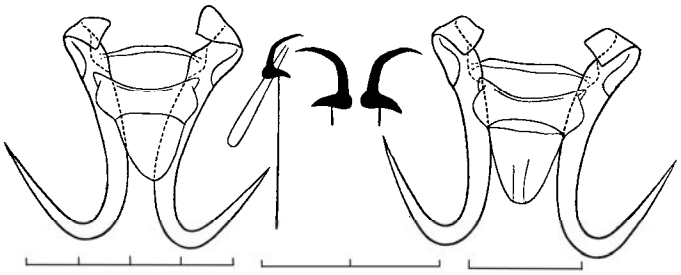

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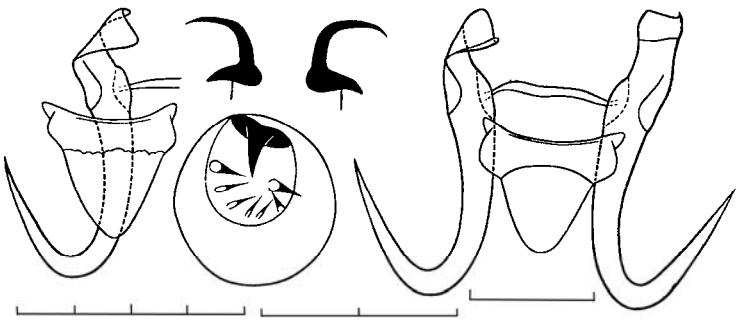


472

Fig. 469 – 472.
469 - *Gyrodactylus incognitus.* **470** - *Gyrodactylus pavlovskyi.* **471, 472** - *Gyrodactylus jiroveci.*

31 (30). The ratio between width and length of the hooklet base is 1:1.2–1.5.
G. jiroveci Ergens et Bychowsky, 1967 (Fig.471, 472)
Syn.: *G. papernai* Ergens et Bychowsky, 1967

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.022–0.033 mm, hooklets 0.005–0.008 mm. Length of main part of anchors is 0.033–0.044 mm, point 0.024–0.032 mm. Size of ventral bar is 0.005–0.011 x 0.022–0.031 mm, membrane 0.010–0.019 mm. Size of dorsal bar is 0.001–0.003 x 0.019–0.029 mm.

Found on gills, skin, and fins of *Barbatula barbatula* and *B. toni*; widespread in the area of its hosts.

32 (27). The hooklet blades lack sharp bends.

33 (38). The total length of the marginal hooks is greater than 0.030 mm.

34 (35). The ratio between the marginal hooks length and the length of the main part of the anchors is 1:1.
G. karatagensis Ergens et Allamuratov, 1972 (Fig. 473)

Body length is about 0.3 mm. Total length of marginal hooks is 0.031–0.033 mm, hooklets 0.006–0.007 mm. Length of main part of anchors is 0.032–0.034 mm, point 0.019–0.021 mm. Size of ventral bar is 0.005–0.007 x 0.021–0.025 mm, membrane 0.011–0.013 mm. Size of dorsal bar is 0.002 x 0.017–0.022 mm.

Found on fins of *Triplophysa stoliczkai*; Karatag River (Tajikistan).

35 (34). The ratio between the marginal hooks length and the length of the main part of the anchors is 1:1.25–1.5.

36 (37). The hooklet point does not exceed the level of its base.
G. mongolicus Ergens et Dulmaa, 1970 (Fig. 474)

Body length is about 0.45 mm. Total length of marginal hooks is 0.033–0.034 mm, hooklet 0.007–0.008 mm. Length of main part of anchors is 0.044–0.050 mm, point 0.025–0.033 mm. Size of ventral bar is 0.009–0.011 x 0.030–0.034 mm, membrane 0.017–0.022 mm. Size of dorsal bar is 0.003-0.004 x 0.022–0.027 mm.

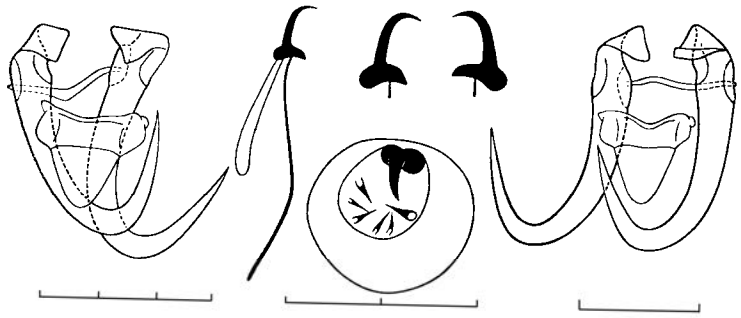
Found on fins and gills of *Oreoleuciscus potanini* and *O. humilis*; lakes and rivers of West Mongolia.

37 (36). The hooklet point exceeds the level of its base.
G. gvozdevi Ergens, Kartunova, 1991 (Fig. 475)

Total length of marginal hooks is 0.034–0.036 mm, hooklet 0.009 mm. Length of main part of anchors is 0.044–0.045 mm, point 0.030–0.031 mm. Size of ventral bar is 0.006 x 0.026 mm, membrane 0.013–0.015 mm. Size of dorsal bar is 0.002 x 0.021–0.022 mm.

Found on skin of *Triplophysa dorsalis*; Almaatinka River near Alma-Ata (Kazakhstan).

38 (33). The total length of the marginal hooks is less than 0.030 mm.



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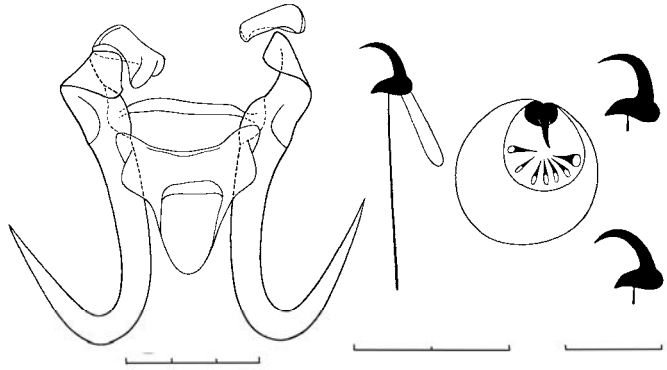

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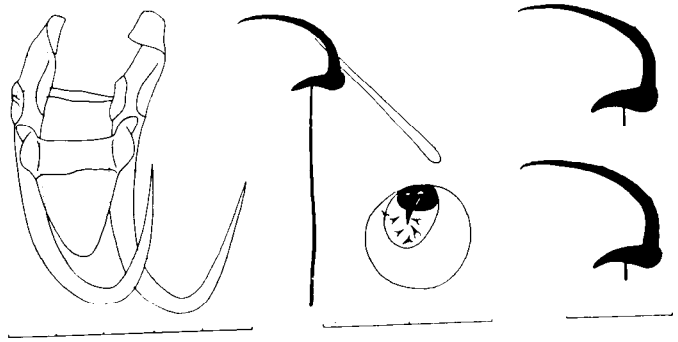

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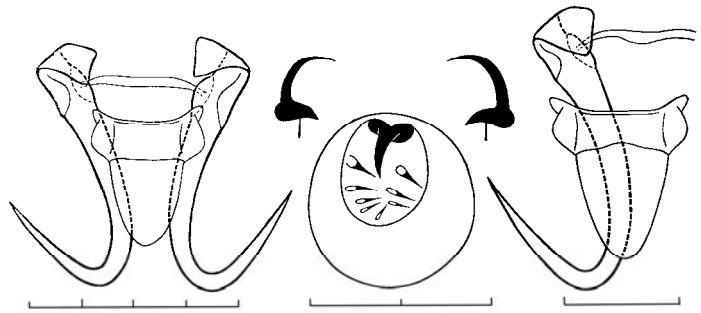


476

Fig. 473- 476.
473 - *Gyrodactylus karatagensis.* **474 -** *Gyrodactylus mongolicus.* **475 -** *Gyrodactylus gvozdevi* (after Ergens et Kartunova, 1991). **476 -** *Gyrodactylus pseudonemachili.*

39 (40). The stalk of the hooklet is less than 1.5 times longer than its point.
G. pseudonemachili Ergens et Bychowsky, 1967 (Fig. 476)

Body length is 0.35–0.45 mm. Total length of marginal hooks is 0.024–0.029 mm, 0.005–0.007 mm. Length of main part of anchors is 0.036–0.044 mm, point 0.023–0.028 mm. Size of ventral bar is 0.006–0.008 x 0.023–0.028 mm, membrane 0.017–0.023 mm. Size of dorsal bar is 0.002–0.003 x 0.019–0.026 mm.

Found on gills, fins, and skin and in nasal cavities of *Triplophysa dorsalis, T. strauchi, Barbatula toni*, and *Oreoleuciscus humilis*; Chu River (Kazakhstan), water bodies of Mongolia.

40 (39). The stalk of the hooklet is two times longer than its point.

41 (42). The total length of the marginal hooks is less than 0.020 mm.
G. paranemachili Ergens et Bychowsky, 1967 (Fig. 477)

Body length can be up to 0.35 mm. Total length of marginal hooks is 0.017–0.018 mm, hooklet 0.005 mm. Length of main part of anchors is 0.029–0.035 mm, point 0.015–0.022 mm. Size of ventral bar is 0.004–0.005 x 0.018–0.022 mm; dorsal bar 0.001 x 0.011–0.016 mm.

Found on gills of *Triplophysa dorsalis, T. stoliczkai, T. strauchi,* and *Barbatula toni*; Chu River (Kazakhstan), Selenga River (Mongolia).

42 (41). The total length of the marginal hooks is more than 0.020 mm.
G. nemachili Bychowsky, 1936 (Fig. 478)

Body length is about 0.30 mm. Total length of marginal hooks is 0.020–0.026 mm, hooklet 0.005–0.007 mm. Length of main part of anchors is 0.029–0.036 mm, point 0.018–0.024 mm. Size of ventral bar is 0.004–0.008 x 0.020–0.023 mm; membrane 0.010–0.014 mm. Size of dorsal bar is 0.001–0.003 x 0.015–0.024 mm.

Found on gills, fins, and skin and in nasal cavities of *Triplophysa dorsalis, T. stoliczkai, T. strauchi,* and *Barbatula toni*; Lake Onega, Ob' River (Russia), water bodies of Central Asia and Mongolia; it probably is widespread in the Palaearctic.

43 (22). The inner root of the anchors is rather thick and more or less straight.

44 (45). The membrane of the ventral bar is stick shaped with narrow lateral wings.
G. anudarini Ergens et Dulmaa, 1968 (Fig. 479)

Body length is 0.35–0.040 mm. Total length of marginal hooks is 0.028–0.030 mm, hooklet about 0.007 mm. Total length of anchors is 0.040–0.044 mm, main part 0.030–0.033 mm, point 0.024–0.026 mm, inner root 0.013–0.018 mm. Size of ventral bar is 0.005–0.006 x 0.022–0.024 mm, membrane 0.018–0.022 mm. Size of dorsal bar is 0.002–0.003 x 0.014–0.018 mm.

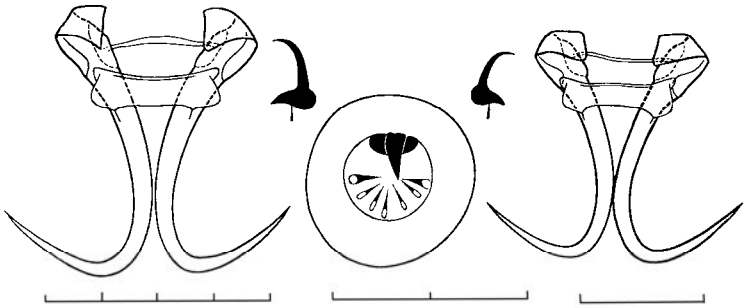
Found on fins and skin of *Cobitis melanoleuca*; Selenga River and Lake Khubsugul (Mongolia); may be found in Russia.

45 (44). The membrane of the ventral bar is membranoid.

46 (61). The membrane of the ventral bar has longitudinal ribs.

47 (52). The width of the hooklet base is longer than its length.

48 (49). The total length of the marginal hooks is more than 0.030 mm.
G. lotae Gussev, 1953 (Fig. 480)



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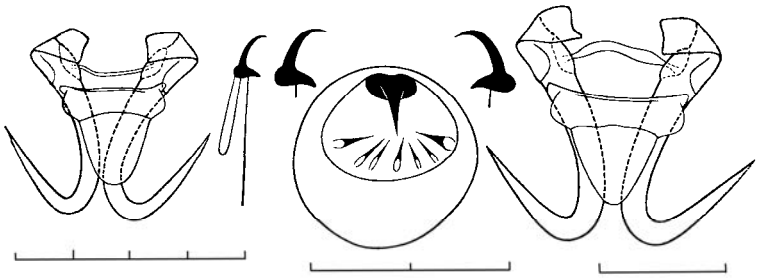

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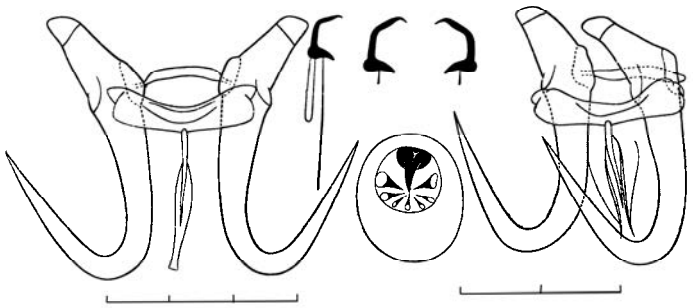

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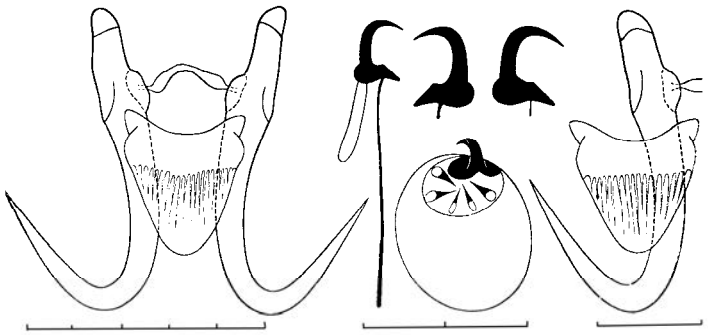


480

Fig. 477 – 480.
477 - *Gyrodactylus paranemachili.* **478** - *Gyrodactylus nemachili.***479** - *Gyrodactylus anudarini.***480** - *Gyrodactylus lotae.*

Body length can be up to 0.5 mm. Total length of marginal hooks is 0.036–0.043 mm, hooklet 0.008–0.011 mm. Total length of anchors is 0.061–0.083 mm, main part 0.045–0.058 mm, point 0.032–0.041 mm, inner root 0.015–0.028 mm. Size of ventral bar is 0.007–0.011 x 0.020–0.032 mm, membrane 0.016–0.022 mm. Size of dorsal bar is 0.003 x 0.018–0.024 mm.

Found on gills, skin, and fins of *Lota lota*; it is spread through its host's area.

49 (48). The total length of the marginal hooks is less than 0.030 mm.

50 (51). The external part of the hooklet base is rounded.

G. szanagai Ergens, 1971 (Fig. 481)

Body length is about 0.3 mm. Total length of marginal hooks is 0.025–0.026 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.057, main part 0.042 mm, point 0.024 mm, inner root 0.018 mm. Size of ventral bar is 0.006–0.007 x 0.021 mm, membrane 0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.018 mm.

Found on fins of *Cottus szanaga*; Onon River (Mongolia); can be found in East Russia.

51 (50). The external part of the hooklet base is obliquely cut.

G. haiteji Ergens, Yukhimenko, 1986 (Fig. 482).

Total length of marginal hooks is 0.023–0.027 mm, hooklet 0.005 mm. Total length of anchors is 0.045–0.057 mm, main part 0.039–0.044 mm, point 0.022–0.024 mm, inner root 0.014–0.016 mm. Size of ventral bar is 0.006 x 0.019–0.020 mm. Size of dorsal bar is 0.001 x 0.008–0.014 mm.

Found on fins of *Mesocottus haitej*; Somna River (Amur River Basin, Russia).

52 (47). The length of the hooklet's base is greater than its width.

53 (56). The shape of the hooklet base is triangular.

54 (55). The blade of the hooklet is massive; the ratio between the length of the anchor inner root and the length of its point is 1:1.4–1.5.

G. latus Bychowsky, 1933 (Fig. 483)

Body length is 0.30–0.40 mm. Total length of marginal hooks is 0.019–0.021 mm, hooklet about 0.007 mm. Total length of anchors is 0.050–0.057 mm, main part 0.040–0.044 mm, point 0.022–0.028 mm, inner root 0.015–0.019 mm. Size of ventral bar is 0.006–0.007 x 0.013–0.019 mm; membrane 0.012–0.014 mm. Size of dorsal bar is 0.001–0.002 x 0.009–0.014 mm.

Found on skin, fins, and gills of *Cobitis taenia*; estuaries of Volga, Danube, Oder, and Elbe Rivers.

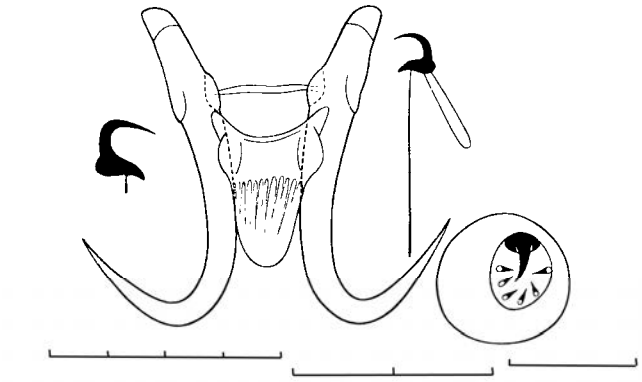
55 (54). The blade of the hooklet is thin; the ratio of the anchor inner root and the length of its point is 1:1.

G. misgurni Ling, 1962 (Fig. 484)

Body length can be up to 0.61 mm. Total length of marginal hooks is 0.017–0.019 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.042–0.051 mm, main part 0.033–0.041 mm, point 0.017–0.019 mm, inner root 0.013–0.018 mm. Size of ventral bar is 0.005–0.006 x 0.013–0.018 mm, membrane about 0.012 mm. Size of dorsal bar is 0.001 x 0.011–0.012 mm.

Found on gills of *Misgurnus fossilis, M. mohoity,* and *Cobitis melanoleuca*; basins of the Black, Caspian, and Baltic Seas, Amur River, Selenga River (Mongolia).

56 (53). The base of the hooklet is trapeziform.



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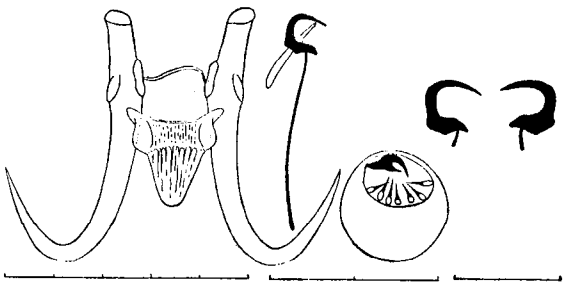

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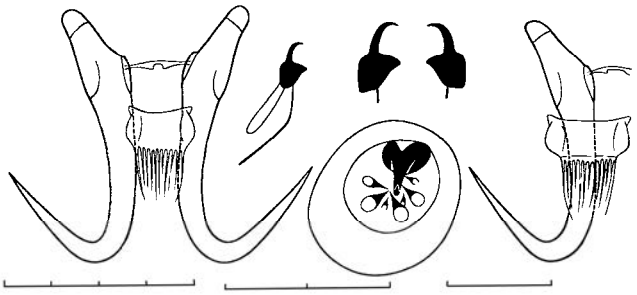

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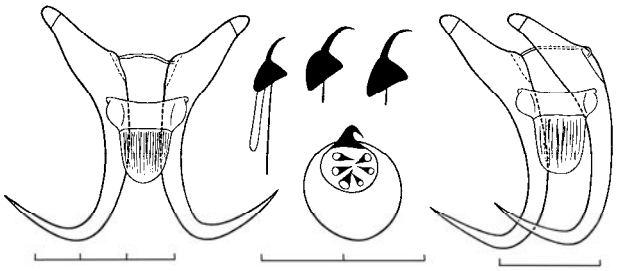


484

Fig. 481 – 484.
481 - *Gyrodactylus szanagai*. **482 -** *Gyrodactylus haiteji* (after Ergens et Yukhimenko, 1986). **483 -** *Gyrodactylus latus.* **484 -** *Gyrodactylus misgurni.*

57 (58). The total length of the anchors is more than 0.060 mm.
G. molnari Ergens, 1978 (Fig. 485)

Body length is about 0.40 mm. Total length of marginal hooks is 0.020–0.021 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.063–0.065 mm, main part 0.046–0.049 mm, point 0.027–0.030 mm, inner root 0.021–0.023 mm. Size of ventral bar is 0.007–0.009 x 0.020–0.022 mm, membrane 0.014–0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.015–0.018 mm.

Found on gills of *Cobitis taenia*; Tapio River (Hungary); can be found in other countries of the Palaearctic.

58 (57). The total length of the anchors is less than 0.060 mm.

59 (60). The ear-like projections of the ventral bar are three times shorter than the bar length.
G. yukhimenkoi Ergens, 1978 (Fig. 486)

Body length is 0.30–0.40 mm. Total length of marginal hooks is 0.021–0.023 mm, hooklet 0.008 mm. Total length of anchors is 0.053–0.057 mm, main part 0.044–0.045 mm, point 0.025–0.029 mm, inner root 0.015–0.020 mm. Size of ventral bar is 0.007–0.008 x 0.018–0.020 mm, membrane 0.011–0.015 mm. Size of dorsal bar is 0.001–0.002 x 0.012–0.015 mm.

Found on gills and skin of *Cobitis melanoleuca*; Selenga River (Mongolia), Amur River, Maritime Territory (Russia).

60 (59). The ear-like projections of the ventral bar are 6–8 times shorter than its length.
G. macracanthus Hukuda, 1940 (Fig. 487)
Syn.: *G. paralatus* Gussev, 1955, part.

Body length is about 0.5 mm. Total length of marginal hooks is 0.018–0.020 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.041–0.047 mm, main part 0.033–0.035 mm, point 0.019–0.025 mm, inner root 0.010–0.015 mm. Size of ventral bar is 0.005–0.007 x 0.012–0.017 mm, membrane 0.008–0.011 mm. Size of dorsal bar is 0.001–0.002 x 0.007–0.014 mm.

Found on fins, skin, and gills of Misgurnus mohoity; Khanka Lake (Amur region, Russia).

61 (46). The surface of the ventral bar membrane is smooth.

62 (73). The hooklet blade of the marginal hooks has two sharp bends.

63 (68). The total length of the anchors is less than 0.085 mm.

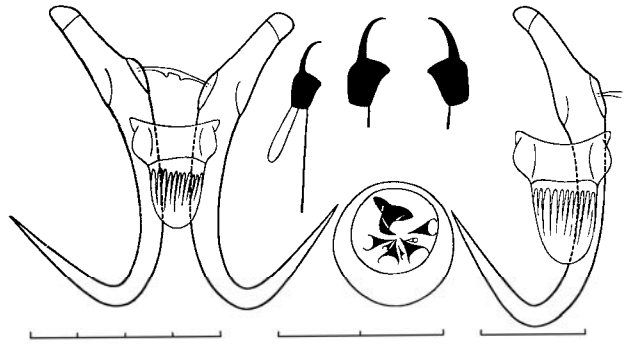
64 (69). The ventral bar width is less than 0.030 mm.

65 (68). The length of the hooklet can be up to 0.008 mm.

66 (67). The length of the anchor point is greater than 0.027 mm.
G. tincae Malmberg, 1957 (Fig. 488)

Body length is about 0.5 mm. Total length of marginal hooks is 0.030–0.033 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.056–0.070 mm, main part 0.042–0.051 mm, point 0.028–0.038 mm, inner root 0.016–0.024 mm. Size of ventral bar is 0.005–0.009 x 0.023–0.030 mm, membrane 0.013–0.018 mm. Size of dorsal bar is 0.001–0.003 x 0.016–0.028 mm.

Found on fins, skin, and gills of *Tinca tinca*; widely distributed species following the area of its host.



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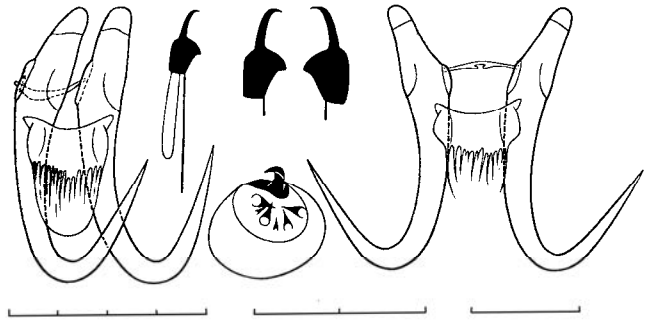

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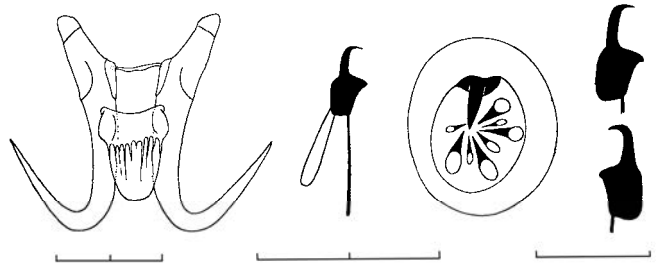

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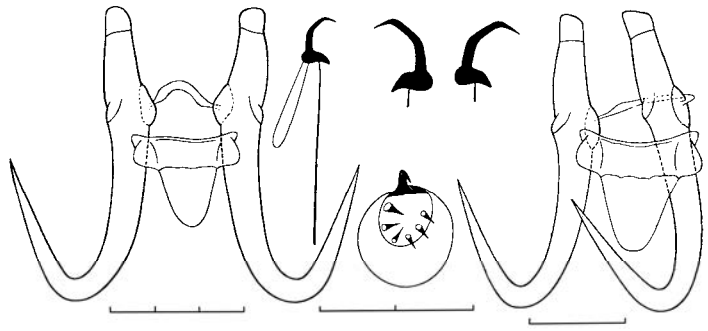


488

Fig. 485 – 488.
485 - *Gyrodactylus molnari.* **486** - *Gyrodactylus yukhimenkoi.* **487** - *Gyrodactylus macracanthus.* **488** - *Gyrodactylus tincae.*

67 (66). Length of anchor point is less than 0.027 mm.

G. dzhalilovi Ergens et Ashurova, 1984 (Fig. 489, B)

Body length is 0.4–0.6 mm. Total length of marginal hooks is 0.028–0.032 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.060–0.065 mm, main part 0.046–0.051 mm, point 0.022–0.025 mm, inner root 0.020–0.023 mm. Size of ventral bar is 0.005–0.006 x 0.021–0.026 mm, membrane 0.010–0.015 mm. Size of dorsal bar is 0.001 x 0.020 mm.

Found on fins of *Schizopygopsis stoliczkai*; Murgab River (Tajikistan).

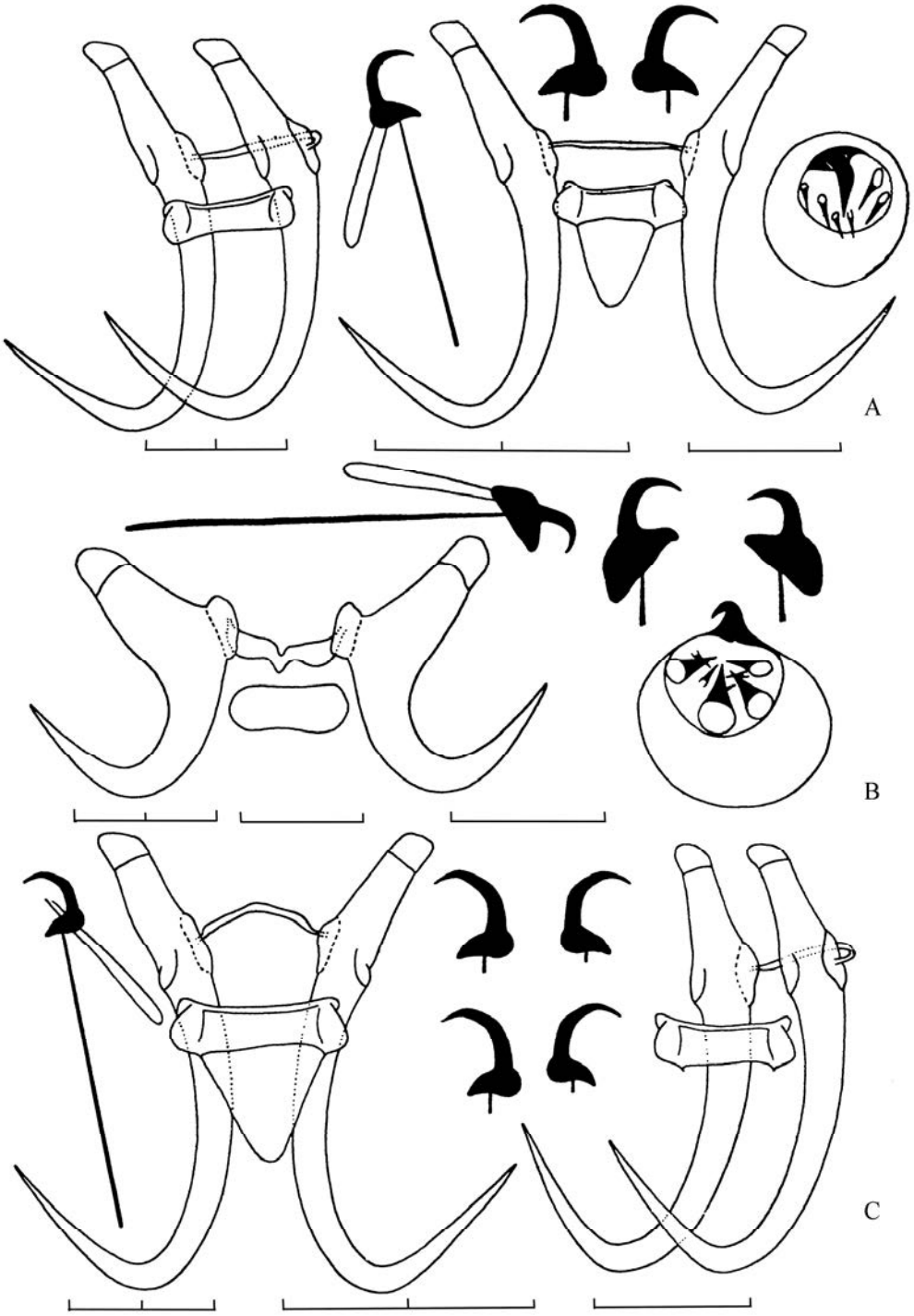


Fig. 489. - A – *Gyrodactylus seravshani*, B – *G. strelkovi*, C – G. *dzhalilovi.*

68 (65). The length of the hooklet is greater than 0.009 mm.
G. mantschuricus Ergens et Yukhimenko, 1977 (Fig. 490)

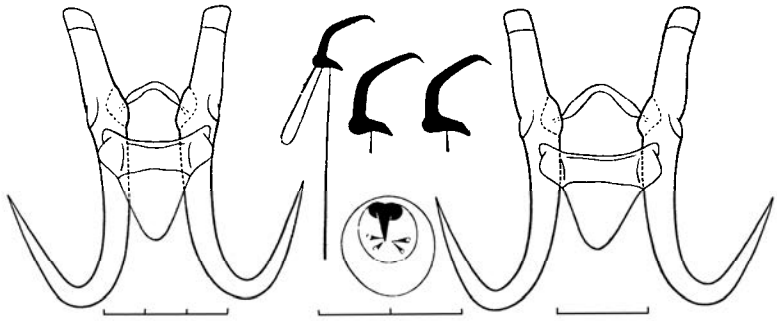
Body length can be up to 0.75 mm. Total length of marginal hooks is 0.035–0.037 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.068–0.071 mm, main part 0.047–0.049 mm, point 0.030–0.032 mm, inner root 0.024–0.026 mm. Size of ventral bar is 0.007–0.008 x 0.026–0.029, membrane 0.014–0.016 mm. Size of dorsal bar is 0.003–0.004 x 0.020–0.024 mm.

Found on skin and fins of *Phoxinus percnurus mantschuricus*; Ussuri River (Amur River Basin, Russia).

69 (64).Ventral bar width is greater than 0.030 mm.
G. alexanderi Mizelle et Kritsky, 1967 (Fig. 491)

Body length is 0.6–0.84 mm and width 0.097–0.2 mm. Total length of marginal hooks is 0.038–0.044 mm, hooklet 0.008–0.012 mm. Total length of anchors is 0.072–0.082 mm, main part 0.055 mm, point 0.031–0.033 mm, inner root 0.027–0.028 mm. Size of ventral bar is 0.008 x 0.037–0.044 mm. Width of dorsal bar is 0.014–0.027 mm.

Found on skin and fins of *Gasterosteus aculeatus*; Western Kamchatka (Russia), described from California (USA) and Canada.



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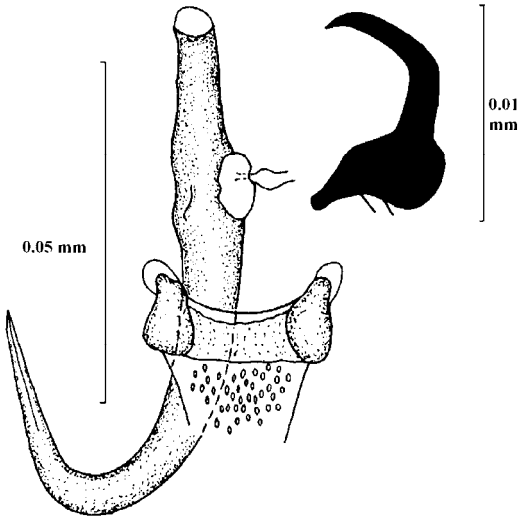


491

Fig. 490 – 491.

490 - *Gyrodactylus mantschuricus.* **491** - *Gyrodactylus alexanderi* (after Sokolov, 2002).

70 (63). The total length of the anchors is greater than 0.090 mm.

71 (72). The total length of the marginal hooks is greater than 0.042 mm; length of the hooklet is greater than 0.010 mm.
G. asiaticus Ergens, 1978 (Fig. 492)

Body length is about 0.5 mm. Total length of marginal hooks is 0.042–0.044 mm, hooklet 0.010–0.011 mm. Total length of anchors is 0.099–0.101 mm, main part 0.071–0.073 mm, point 0.043–0.044 mm, inner root 0.035–0.036 mm. Size of ventral bar is 0.011–0.012 x 0.028–0.030 mm, membrane 0.023–0.027 mm. Size of dorsal bar is 0.002 x 0.021–0.023 mm.

Found on fins and gills of *Brachymystax lenok*; Tula River, Lake Terkhiin-Tsagan (Mongolia).

72 (71). The total length of the marginal hooks is less than 0.036 mm; length of the hooklet is less than 0.010 mm.
G. pewzowi Ergens, 1980 (Fig. 493).

Body length can be up to 0.70 mm. Total length of marginal hooks is 0.033–0.036 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.091–0.097 mm, main part 0.064–0.068 mm, point 0.033–0.034 mm, inner root 0.033–0.034 mm. Size of ventral bar is 0.008–0.009 x 0.035–0.037 mm, membrane 0.019–0.021 mm. Size of dorsal bar is 0.002–0.003 x 0.025–0.032 mm.

Found on fins and gills of *Oreoleuciscus potanini* and *O. humilis*; water bodies of Mongolia.

73 (62). The blade of the hooklet lacks sharp bends.

74 (83). The hooklet is of the *G. rarus* or *G. cotti* type (see Fig. 454, 2, 3).

75 (76). The total length of the anchors is greater than 0.070 mm.
G. bychowskianus Bogolepova, 1950 (Fig. 494)

Body length can be up to 0.5 mm. Total length of marginal hooks is 0.035–0.037 mm, hooklet 0.008 mm. Total length of anchors is 0.079–0.089 mm, main part about 0.076 mm, point 0.023–0.028 mm. Size of ventral bar is 0.005–0.007 x 0.034–0.037 mm, membrane 0.027–0.028 mm. Size of dorsal bar is 0.002–0.003 x 0.017–0.022 mm.

Found on gills of *Cottocomephorus grewingkii* and *C. inermis*; Lake Baikal.

76 (75). The total length of the anchors is less than 0.065 mm.

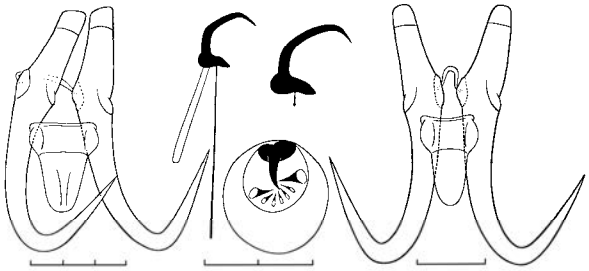
77 (80). The membrane of the ventral bar is triangular; the ratio between the length of the ear-like projection of the ventral bar and the ventral bar length is 1:1.2–1.4.

78 (79). The total length of the marginal hooks is less than 0.030 mm.
G. cotti Roman, 1956 (Fig. 495)

Body length is 0.3–0.4 mm. Total length of marginal hooks is 0.026–0.028 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.048–0.060 mm, main part 0.046–0.050 mm, point 0.020–0.025 mm, inner root 0.019–0.022 mm. Size of ventral bar is 0.005–0.007 x 0.023–0.025 mm, membrane 0.014–0.016 mm. Size of dorsal bar is 0.002 x 0.014–0.017 mm.

Found on gills of *Cottus gobio* s.l., *C. poecilopus*, and *C. cognatus*; widespread species in area of its hosts.

79 (78). The total length of the marginal hooks is greater than 0.031 mm.
G. comephori Bogolepova, 1950 (Fig. 496)



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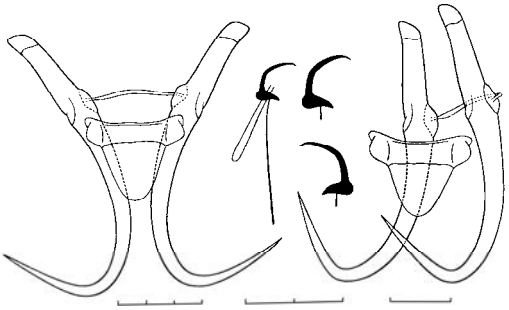

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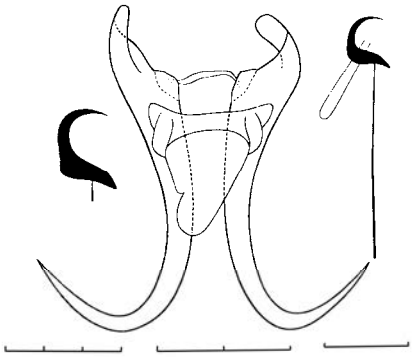

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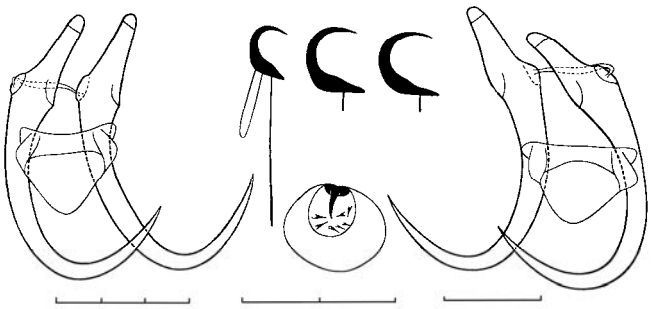


495

Fig. 492 – 495.
492 - *Gyrodactylus asiaticus.* **493** - *Gyrodactylus pewzowi.* **494** - *Gyrodactylus bychowskianus.* **495** - *Gyrodactylus cotti.*

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.033–0.034 mm, hooklet 0.007 mm. Total length of anchors is 0.052–0.056 mm, main part 0.042–0.043 mm, point 0.020–0.023 mm. Size of ventral bar is 0.007–0.009 x 0.023 mm, membrane 0.022 mm. Size of dorsal bar is 0.001 x 0.015–0.016 mm.

Found on fins and gills of *Comephorus dybowskii*; Lake Baikal.

80 (77). The posterior edge of the ventral bar membrane is gently rounded; the ratio between the length of the ear-like projection of the ventral bar and the ventral bar length is 1:3.

81 (82). The length of the hooklet is greater than 0.008 mm.

G. rarus Wegener, 1909 (Fig. 497)

Body length is 0.4–0.6 mm. Total length of marginal hooks is 0.029–0.035 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.040–0.056 mm, main part 0.035–0.046 mm, point 0.014–0.020 mm, inner root 0.014–0.023 mm. Size of ventral bar is 0.006–0.008 x 0.018–0.026 mm, membrane 0.011–0.013 mm. Size of dorsal bar is 0.001 x 0.017–0.025 mm.

Found on gills, and single specimens on skin and fins, of *Pungitius pungitius, P. sinensis,* and *Gasterosteus aculeatus* (?); widespread species in the area of its hosts.

G. rarus and *G. branchicus* (next entry) have been identified erroneously as *G. bychowskyi* Sproston, 1946 in many publications.

82 (81). The length of the hooklet is less than 0.007 mm.

G. branchicus Malmberg, 1964 (Fig. 498)

Body length is 0.38–0.68 mm. Total length of marginal hooks is 0.028–0.034 mm, hooklets 0.006–0.007 mm. Total length of anchors is 0.044–0.054 mm, main part 0.036–0.043 mm, point 0.014–0.020 mm, inner root 0.014–0.021 mm. Size of ventral bar is 0.004-0.005 x 0.018–0.022 mm, membrane 0.012–0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.015–0.025 mm.

Found on gills of *Gasterosteus aculeatus*; Sweden, Maritime Territory (Russia); surely it will be found in other countries of the Palaearctic.

83 (74). The hooklet is of another type.

84 (127). The point of the hooklet extends beyond the level of its base.

85 (92). The length of the handle of the marginal hooks is less than 2.9 times longer than that of the hooklet.

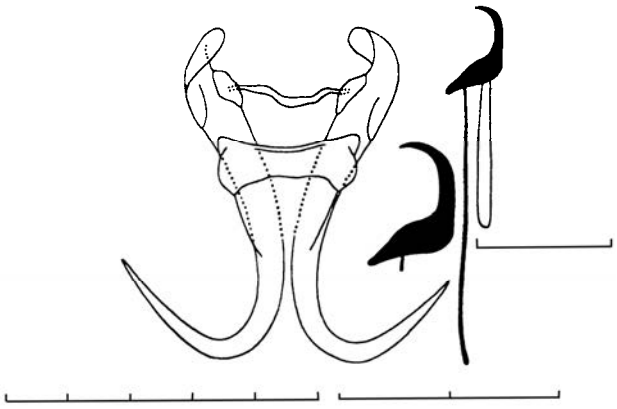
86 (89). The total length of the anchors is greater than 0.065 mm. The length of the marginal hooks is greater than 0.032 mm.

87 (88). The hooklet point extends beyond the level of its base for a distance equal to or greater than the width of the base.

G. macronychus Malmberg, 1957 (Fig. 499)

Body length is 0.3–0.45 mm. Total length of marginal hooks is 0.031–0.043 mm, hooklet 0.008–0.012 mm. Total length of anchors is 0.068–0.096 mm, main part 0.040–0.062 mm, point 0.026–0.040 mm, inner root 0.022–0.033 mm. Size of ventral bar is 0.006-0.012 x 0.026–0.045 mm, membrane 0.013–0.025 mm. Size of dorsal bar is 0.002–0.005 x 0.022–0.033 mm.

Found on fins, skin, and gills and in nasal cavities of *Phoxinus phoxinus, P. percnurus*, and *Rutilus rutilus lacustris*; widespread in the area of its host.



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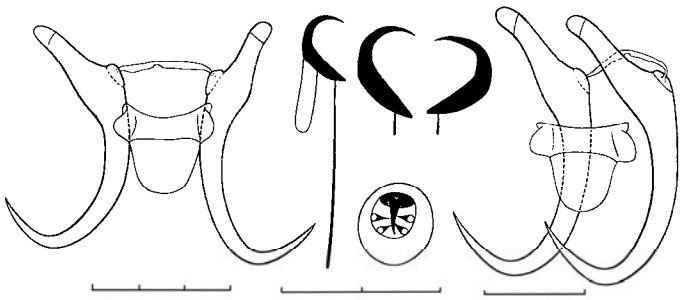

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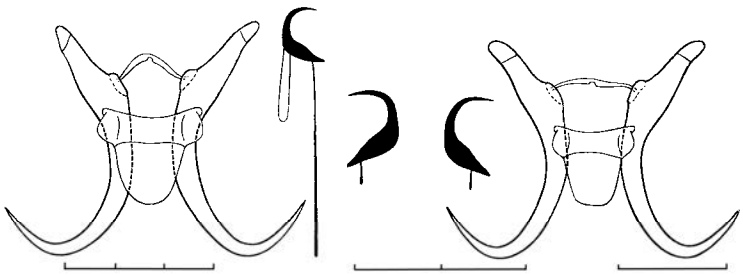

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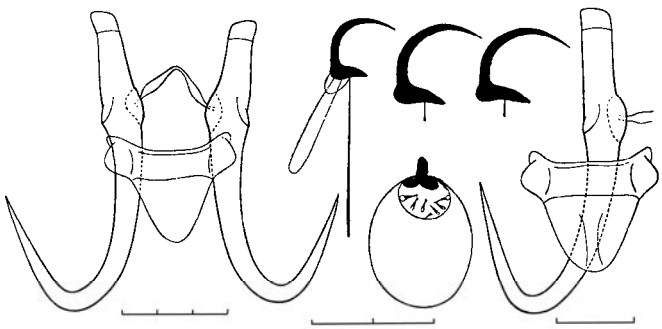
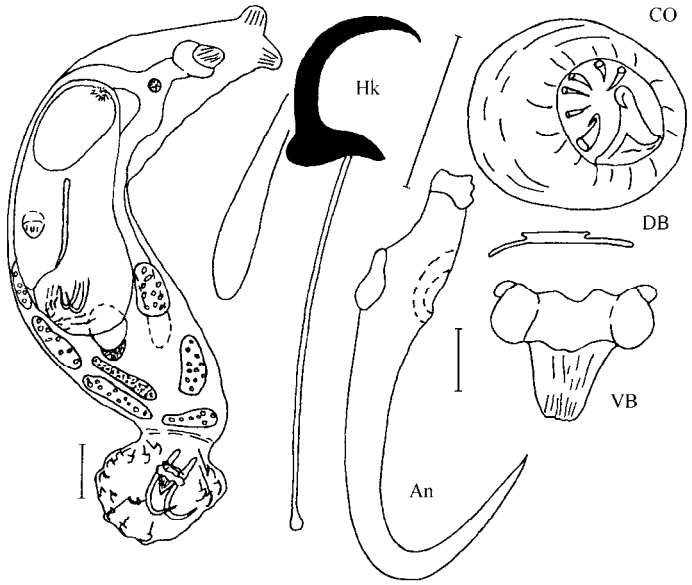


499

Fig. 496 – 499.
496 - *Gyrodactylus comephori.* **497 -** *Gyrodactylus rarus.* **498 -** *Gyrodactylus branchicus.* **499 -** *Gyrodactylus macronychus.*



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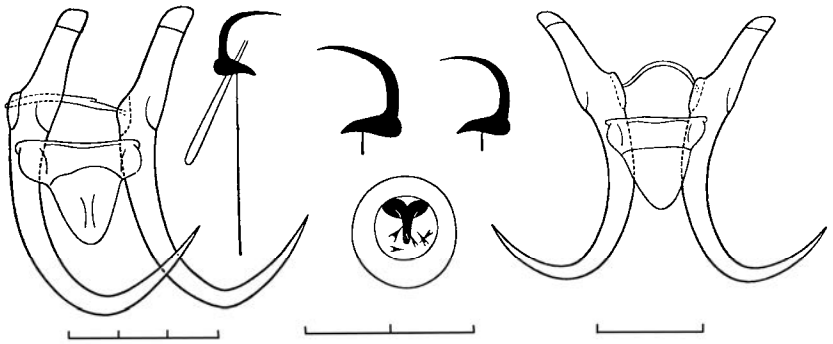

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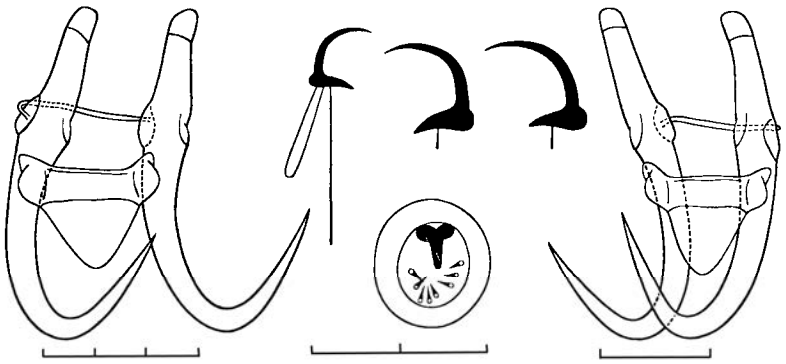


502

Fig. 500 – 502.
500 - *Gyrodactylus moldovicus* (after Gerasev et al., 2005). **501** - *Gyrodactylus nordmanni.*
502 - *Gyrodactylus slovacicus.*

88 (87). The hooklet point extends beyond the level of its base for a distance less than the width of the base.

G. moldovicus Gerasev, Dmitrieva, Moshu, 2005 (Fig. 500)

Body length is 0.50–0.72 mm and width is 0.13–0.16 mm. Total length of marginal hooks is 0.033–0.035 mm, hooklet 0.009–0.010 mm, handle 0.023–0.025 mm. Total length of anchors is 0.065–0.070 mm, main part 0.046–0.049 mm, point 0.028–0.030 mm, inner root 0.022–0.023 mm. Size of ventral bar is 0.007–0.009 x 0.027–0.033 mm, membrane 0.015–0.018 mm. Size of dorsal bar is 0.001–0.002 x 0.020–0.028 mm. Diameter of copulatory organ is 0.011–0.015 mm.

Found on skin and in nasal cavities of *Umbra krameri*; Dniester River (Moldova).

89 (86). The total length of the anchors is less than 0.065 mm. Length of the marginal hooks is less than 0.032 mm.

90 (91). The ear-like projections of the ventral bar are rounded; the ratio between their length and the length of the bar is 1:4–4.5.

G. nordmanni Ergens et Dulmaa, 1970 (Fig. 501)

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.028–0.030 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.056–0.065 mm, main part 0.042–0.047 mm, point 0.019–0.025 mm, inner root 0.023–0.026 mm. Size of ventral bar is 0.005–0.007 x 0.021–0.026 mm, membrane 0.013–0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.016–0.022 mm.

Found on gills of *Oreoleuciscus humilis* and *O. potanini*; lakes of West Mongolia.

91 (90). The ear-like projections of the ventral bar are triangular; the ratio between their length to the length of the bar is 1:2–2.5 mm.

G. slovacicus Ergens, 1963 (Fig. 502)

Syn.: *G. hungaricus* Molnar, 1964

Body length is 0.45–0.55 mm. Total length of marginal hooks is 0.025–0.030 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.061–0.065 mm, main part 0.040–0.044 mm, point 0.024–0.028 mm, inner root 0.020–0.025 mm. Size of ventral bar is 0.005–0.008 x 0.024–0.028 mm, membrane 0.012–0.015 mm. Size of dorsal bar is 0.001–0.002 x 0.021–0.026 mm.

Found on gills, skin, and fins of *Umbra krameri*; basin of the Danube River (Slovakia, Hungary).

92 (85). The length of the marginal hook handle is more than 3.1 times greater than that of the hooklet.

93 (94) The total length of the anchors is less than 0.055 mm.

G. umbrae Aioanei, 1994 (Fig. 503)

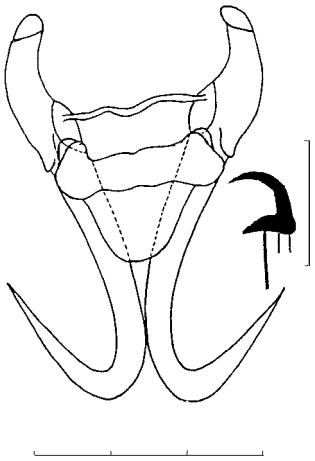
Total length of marginal hooks is 0.024–0.029 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.052–0.055 mm, main part 0.035–0.038 mm, point 0.020–0.021 mm, inner root 0.013–0.014 mm. Size of ventral bar is 0.007–0.008 x 0.020–0.022 mm, membrane 0.009–0.010 mm. Size of dorsal bar is 0.001–0.002 x 0.022–0.023 mm.

Found on fins and skin of *Umbra krameri*; Comana Pool southeast of the Romanian Plain, Romania.

94 (93). The total length of the anchors is greater than 0.055 mm.

95 (96). The total length of the anchors is 0.082–0.097 mm. The length of the marginal hook hooklet is greater than twice the width of its base.

G. lenoki Gussev, 1953 (Fig. 504)



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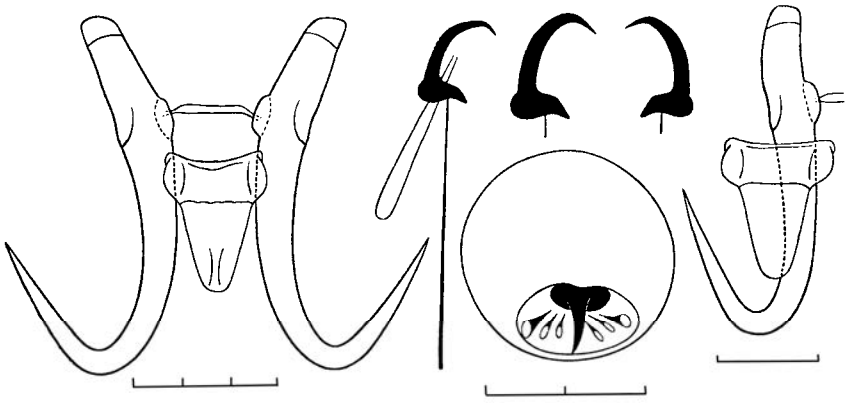

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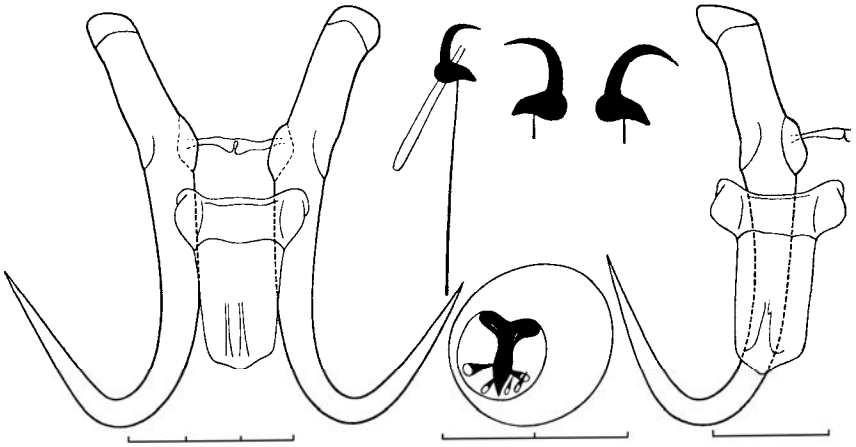


505

Fig. 503 – 505.
503 - *Gyrodactylus umbrae* (after Aioanei, 1994). **504 -** *Gyrodactylus lenoki.* **505 -** *Gyrodactylus kherulensis.*

Body length is about 0.4 mm. Total length of marginal hooks is 0.043–0.045 mm, 0.010–0.011 mm. Total length of anchors is 0.082–0.097 mm, main part 0.065–0.073 mm, point 0.041–0.045 mm, inner root 0.026–0.033 mm. Size of ventral bar is 0.009–0.014 x 0.026–0.033 mm, membrane 0.023–0.026 mm. Size of dorsal bar is 0.002–0.003 x 0.017–0.023 mm.

Found on gills and fins of ***Brachymystax lenok***; many water bodies of the Amur region (Russia) and the Selenga River (Mongolia).

96 (95). The total length of the anchors is 0.061–0.078 mm. The length of the hooklet is less than 1.6 times the width of its base.

97 (98). The posterior edge of the dorsal bar has a deep groove.
G. kherulensis Ergens, 1974 (Fig. 505)

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.026–0.031 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.061–0.078 mm, main part 0.045–0.057 mm, point 0.029–0.033 mm, inner root 0.019–0.030 mm. Size of ventral bar is 0.007–0.009 x 0.020–0.026 mm, membrane 0.019–0.026 mm. Size of dorsal bar is 0.003 x 0.010–0.017 mm.

Found on gills, skin, fins, and in nasal cavities of *Cyprinus carpio* and *C. c. rubrofuscus*; probably spread throughout all area of its hosts.

98 (97). The posterior edge of the dorsal bar lacks a groove.

99 (104). The total length of the anchors is less than 0.060 mm.

100 (101). The total length of the marginal hooks is less than 0.025 mm.
G. capoetai Ergens et Ibragimov, 1976 (Fig. 506)

Body length is about 0.25 mm. Total length of marginal hooks is 0.023–0.024 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.047–0.052 mm, main part 0.037–0.041 mm, point 0.022–0.026 mm, inner root 0.012–0.014 mm. Size of ventral bar is 0.005 x 0.015–0.022 mm, membrane 0.011–0.012 mm. Size of dorsal bar is 0.001–0.002 x 0.015–0.016 mm.

Found on fins and skin of *Capoeta capoeta gracilis*; Lenkoranka River (Azerbaijan).

101 (100). The total length of the marginal hooks is greater than 0.026 mm.

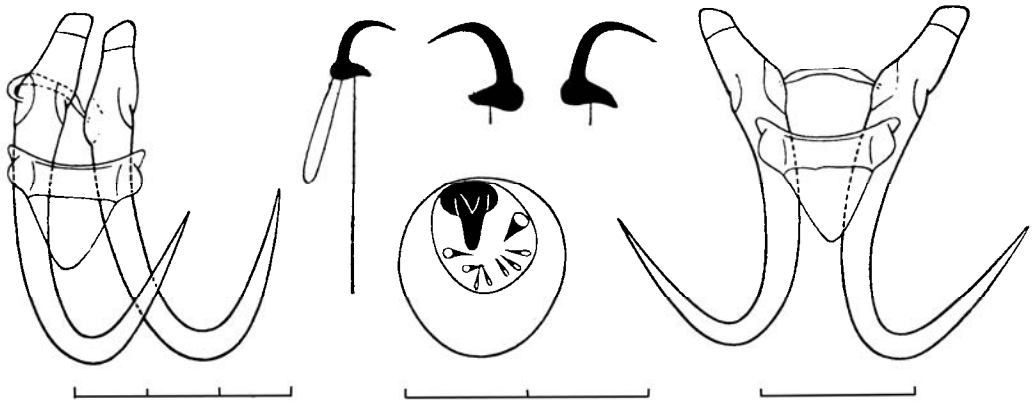


Fig. 506 - *Gyrodactylus capoetai.*

102 (103). The length of the main part of the anchors is more than 2.5 times greater than the length of the inner root.
G. ibragimovi Ergens, 1980 (Fig. 507)

Body length can be up to 0.3 mm. Total length of marginal hooks is 0.027–0.029, length of hooklet 0.006–0.007 mm. Total length of anchors 0.058–0.060, length of main part 0.047–0.049, point 0.022–0.027, inner root 0.015–0.016 mm. Size of ventral bar 0.006–0.007 x 0.019–0.025, membrane 0.012–0.013 mm. Size of dorsal bar 0.001–0.002 x 0.018–0.020 mm.

Found on gills of *Capoeta capoeta gracilis*; Lenkoranka River (Azerbaijan).

103 (102). The length of the main part of the anchors exceeds the length of the inner root, but not more than 2.1 times.
G. markewitschi Kulakowskaja, 1951 (Fig. 508)
Syn.: *G. albaniensis* Ergens, 1960

Body length is about 0.3 mm. Total length of marginal hooks is 0.026–0.029 mm, 0.005–0.006 mm. Total length of anchors is 0.056–0.058 mm, main part 0.038–0.042 mm, point 0.023–0.026 mm, inner root 0.021–0.023 mm. Size of ventral bar is 0.005–0.006 x 0.022–0.025 mm, membrane about 0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.018–0.020 mm.

Found on of *Barbus barbus*, *B. tauricus*, *B. petenyi*, and *Luciobarbus brachycephalus*; Danube River Basin (Czechia, Slovakia), rivers of Crimea (Ukraine); Albania.

104 (99). The total length of the anchors is greater than 0.065 mm.

105 (110). The inner root of the anchors exceeds the width of the ventral bar.

106 (107). The total length of the anchors is up to 0.070 mm.
G. matovi Ergens et Kakacheva-Avramova, 1966 (Fig. 509)

Body length can be up to 0.35 mm. Total length of marginal hooks is 0.032–0.033 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.065–0.067 mm, main part 0.046–0.054 mm, point 0.029–0.033 mm, inner root 0.023–0.024 mm. Size of ventral bar is 0.006–0.007 x 0.024–0.027 mm, membrane about 0.013 mm. Size of dorsal bar is 0.002 x 0.025–0.027 mm.

Found on fins of *Cobitis taenia*; Vrbnishka River (Bulgaria); also can be found in other countries of the Palaearctic.

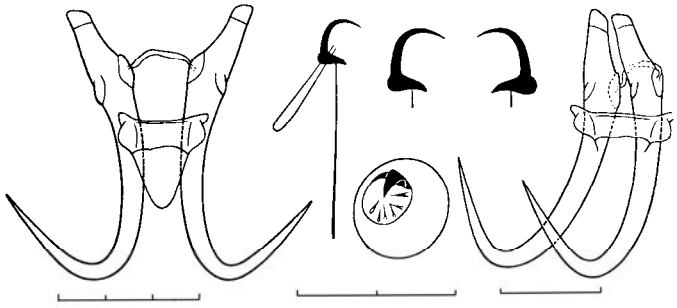
107 (106). The total length of the anchors is greater than 0.075 mm.

108 (109). The length of the main part of the anchors is greater than twice the length of the inner root.
G. brachymystacis Ergens, 1978 (Fig. 510)

Body length is about 0.4 mm. Total length of marginal hooks is 0.042–0.046 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.090–0.096 mm, main part 0.066–0.069 mm, point 0.042–0.046 mm, inner root 0.031–0.036 mm. Size of ventral bar is 0.010–0.012 x 0.031–0.034 mm, membrane 0.022–0.024 mm. Size of dorsal bar is 0.002–0.003 x 0.017–0.021 mm.

Found on fins of *Brachymystax lenok* and *Thymallus arcticus*; Tula River (Selenga River Basin, Mongolia); can be found in the Amur region and Eastern Siberia.

109 (108). The length of the main part of the anchors exceeds the length of the inner root, but not more than 1.8 times.
G. longiradix Malmberg, 1957 (Fig. 511)



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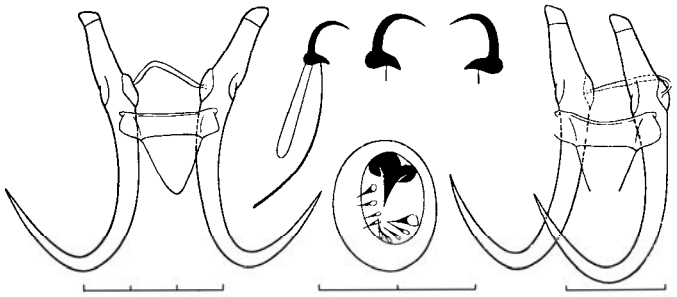

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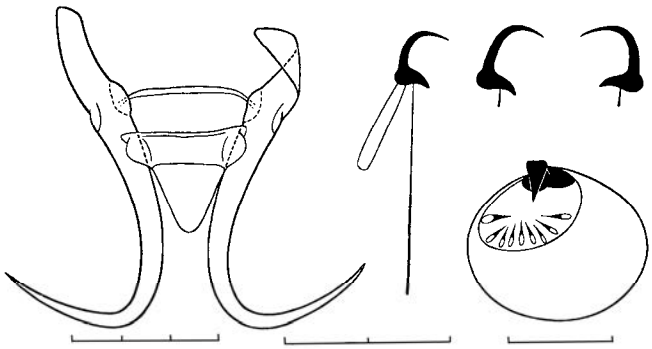

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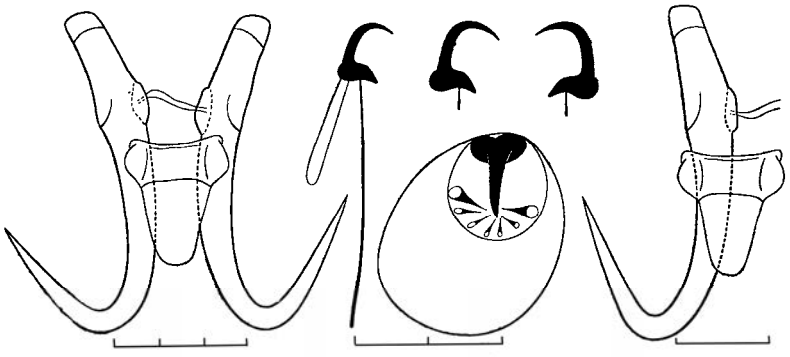


510

Fig. 507 – 510.
507 - *Gyrodactylus ibragimovi.* **508** - *Gyrodactylus markewitschi.* **509** - *Gyrodactylus matovi.* **510** - *Gyrodactylus brachymystacis.*

Body length is 0.8–1.2 mm. Total length of marginal hooks is 0.033–0.042 mm, hooklet 0.006–0.008 mm. Total length of anchors is 0.077–0.096 mm, main part 0.053–0.058 mm, point 0.030–0.040 mm, inner root 0.029–0.038 mm. Size of ventral bar is 0.007–0.012 x 0.030–0.038 mm, membrane 0.015–0.022 mm. Size of dorsal bar is 0.001–0.003 x 0.022–0.039 mm.

Found on fins and skin of *Gobio gobio, Rutilus rutilus lacustris, Gimnocephalus cernuus, Perca fluviatilis*, and *Sander lucioperca*; widespread species in the Palaearctic.

110 (105). The inner root of the anchors is not longer than the width of the ventral bar.

111 (114). The hooklet of the marginal hooks is of the *G. lucii* type (see Fig. 454, 4).

112 (113). The total length of the marginal hooks exceeds the width of the ventral bar.
G. lucii Kulakowskaja, 1951 (Fig. 512)

Body length can be up to 0.8 mm. Total length of marginal hooks is 0.032–0.040 mm, hooklet 0.007–0.009 mm. Total length of anchors is 0.065–0.081 mm; main part 0.047–0.055 mm, point 0.026–0.039 mm, inner root 0.020-0.026 mm. Size of ventral bar is 0.006–0.013 x 0.025–0.031 mm, membrane 0.014–0.021 mm. Size of dorsal bar is 0.001–0.003 x 0.017–0.035 mm.

Found on skin, fins, and gills of *Esox lucius* (main host), *Perca fluviatilis*, and *Sander lucioperca*; widespread species in the Palaearctic.

113 (112). The width of the ventral bar exceeds the total length of the marginal hooks.
G. mikailovi Ergens et Ibragimov, 1976 (Fig. 513)

Body length is 0.4 mm. Total length of marginal hooks is 0.031 mm, hooklet 0.008 mm. Total length of anchors is 0.085 mm, main part 0.059 mm, point 0.038 mm, inner root 0.029 mm. Size of ventral bar is 0.009 x 0.036 mm, membrane 0.022 mm. Size of dorsal bar is 0.004 x 0.026 mm.

Found on gills of *Capoeta capoeta gracilis*; Lenkoranka River (Azerbaijan).

114 (111). The hooklet is of another type.

115 (120). The length of the hooklet is greater than 0.009 mm.

116 (117). The membrane of the ventral bar is rectangular.
G. magnus Konovalov, 1967 (Fig. 514)

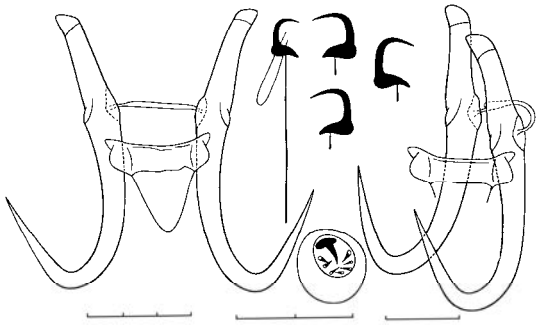
Body length is 0.55–0.65 mm. Total length of marginal hooks is 0.044–0.054 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.096–0.107 mm, main part 0.069–0.076 mm, point 0.039–0.043 mm, inner root 0.027–0.033 mm. Size of ventral bar is 0.012–0.014 x 0.038–0.043 mm, membrane 0.020–0.021 mm. Size of dorsal bar is 0.003–0.004 x 0.025–0.036 mm.

Found on fins of *Thymallus arcticus*; Penzhina River, rivers of the Maritime Territory (Russia), Selenga River (Mongolia).

117 (116). The membrane of the ventral bar is triangular.

118 (119). The base of the hooklets of the marginal hooks is concave in the place where the handle joins with it.
G. konovalovi Ergens, 1976 (Fig. 515)

Body length is up to 0.5 mm. Total length of marginal hooks is 0.036–0.040 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.079–0.086 mm, main part 0.058–0.063 mm, point 0.036–0.040 mm, inner root 0.025–0.029 mm. Size of ventral bar is 0.008–0.010 x 0.034–0.036 mm, membrane 0.018–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.023–0.027 mm.



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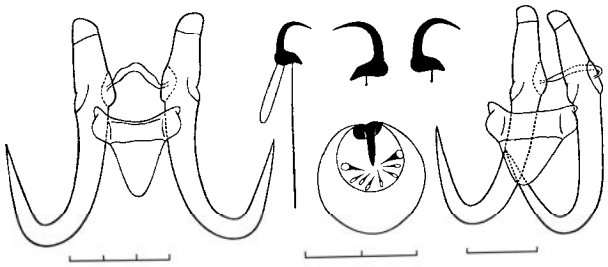

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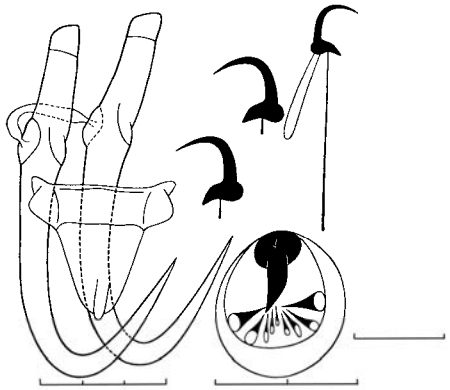

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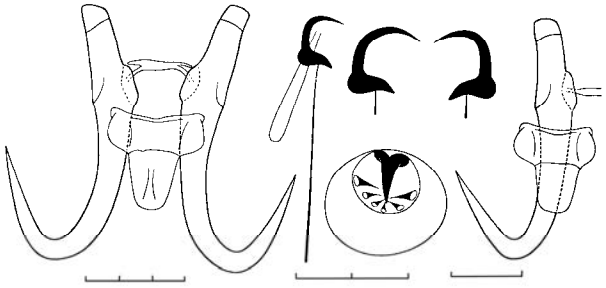
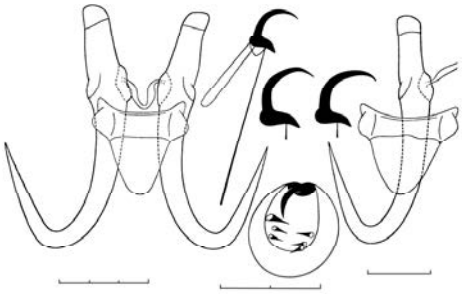


514

Fig. 511 – 514.
511 - *Gyrodactylus longiradix.* **512 -** *Gyrodactylus lucii.* **513 -** *Gyrodactylus mikailovi.* **514 -** *Gyrodactylus magnus.*



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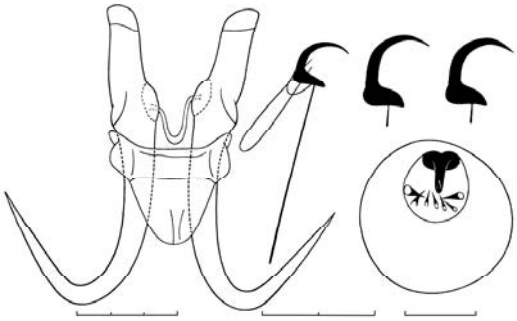

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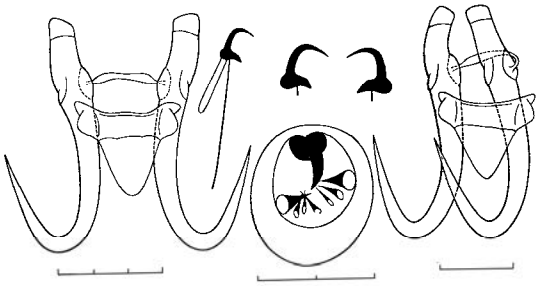

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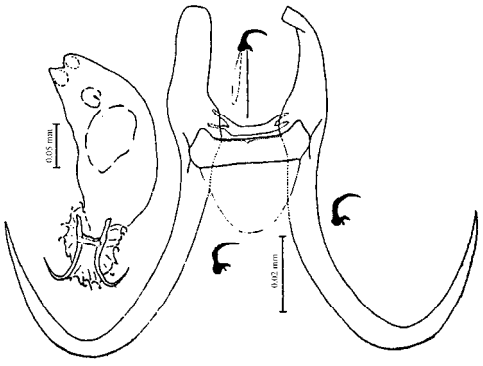


518

Fig. 515 – 518.
515 - *Gyrodactylus konovalovi.* **516** - *Gyrodactylus lagowskii.* **517** - *Gyrodactylus varicorhini.* **518** - *Gyrodactylus longihamus* (after Gvozdev et Baimagambetov, 1993).

Found on fins, skin, and gills of *Phoxinus phoxinus*, *P. lagowskii*, *P. oxycephalus*, and *Cottus czerskii*; rivers of the Maritime Territory (Russia), Selenga River (Mongolia).

119 (118). The base of the hooklet is straight in the place where the handle joins with it.
G. lagowskii Ergens, 1980 (Fig. 516)

Body length is about 0.4 mm. Total length of marginal hooks is 0.043–0.045 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.090–0.095 mm, main part 0.066–0.070 mm, point 0.042–0.043 mm, inner root 0.030–0.031 mm. Size of ventral bar is 0.010–0.011 x 0.038–0.041 mm, membrane 0.018–0.019 mm. Size of dorsal bar is 0.003 x 0.030–0.032 mm.

Found on fins of *Phoxinus lagowskii*; Selenga River (Mongolia); can be found in the Amur region.

120 (115). The length of the hooklet is less than 0.008 mm.

121 (124). The length of the main part of the anchors is greater than 2.5 times the length of the inner root.

122 (123). The hooklet point does not exceed the level of its base. The dorsal bar lacks bifurcated ends.
G. varicorhini Ergens et Ibragimov, 1976 (Fig. 517)

Body length can be up to 0.35 mm. Total length of marginal hooks is 0.027–0.030 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.063–0.071 mm, main part 0.047–0.053 mm, point 0.030–0.035 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.006–0.008 x 0.027–0.033 mm, membrane 0.014–0.019 mm. Size of dorsal bar is 0.002–0.003 x 0.021–0.022 mm.

Found on fins, gills and in nasal cavities of *Capoeta capoeta gracilis*; Lenkoranka River (Azerbaijan).

123 (122). The hooklet point exceeds the level of its base. The dorsal bar has bifurcated ends.
G. longihamus Gvozdev, Baimagambetov, 1993 (Fig. 518)

Body length is 0.252–0.256 mm and width I s0.072–0.080 mm. Total length of marginal hooks is 0.030–0.032 mm, hooklet 0.006 mm. Total length of anchors is 0.072–0.080 mm, main part 0.052–0.060 mm, point 0.034–0.036 mm. Size of ventral bar is 0.004–0.006 x 0.024–0.026 mm. Size of dorsal bar is 0.002 x 0.022–0.024 mm.

Found on fins and gills of *Gymnodiptychus dybowskii*; Charyn River (southeast Kazakhstan).

124 (121). The length of the main part of the anchors exceeds the length of the inner root, but not more than 2.2 times.

125 (126). The total length of the anchors is less than 0.080 mm.
G. vicinus Bychowsky, 1957 (Fig. 519)

Body length is about 0.4 mm. Total length of marginal hooks is 0.029–0.032 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.074–0.076 mm, main part 0.051–0.054 mm, point 0.033–0.035 mm, inner root 0.023–0.025 mm. Size of ventral bar is 0.007–0.008 x 0.030–0.035 mm, membrane 0.015–0.019 mm. Size of dorsal bar is 0.003 x 0.021–0.024 mm.

Found on gills of *Schizothorax intermedius*; Kafirnihan and Varzob Rivers (Tajikistan).

126 (125). The total length of the anchors is greater than 0.080 mm.
G. vicinoides Ergens et Karimov, 1988 (Fig. 520)

Total length of marginal hooks is 0.034–0.035 mm, hooklet 0.0077–0.008 mm. Total length of anchors is 0.086–0.091 mm, main part 0.058–0.059 mm, point 0.037–0.040 mm, inner root 0.032–0.036 mm. Size of ventral bar is 0.009–0.011 x 0.035–0.037 mm, membrane 0.009–0.011 mm. Size of dorsal bar is 0.004–0.005 x 0.029–0.035 mm.

Found on skin of *Schizothorax intermedius*; the Degmay hot spring (Tajikistan).

127 (84). The point of the hooklet of the marginal hooks does not reach the level of its base.

128 (134). The hooklet of the marginal hooks is of the *G. stankovici* type (see Fig. 454, 5).

129 (130). The membrane of the ventral bar is broadened posteriorly.
G. nagibinae Gussev, 1962 (Fig. 521)

Body length can be up to 0.35 mm. Total length of marginal hooks is 0.030–0.031 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.059–0.065 mm, main part 0.043 mm, point 0.030 mm, inner root 0.020 mm. Size of ventral bar is 0.007–0.008 x 0.024–0.025 mm, membrane 0.024 mm. Size of dorsal bar is 0.002 x 0.011–0.018 mm.

Found on gills of *Cyprinus carpio rubrofuscus*; ponds of the Valday fish farm; Novgorod District (Russia).

130 (131). The membrane of the ventral bar is not broadened or tapered posteriorly.
G. procerus Lux, 1990 (Fig. 522)

Body length is 0.44–0.73 and width is 0.11–0.18 mm. Total length of marginal hooks is 0.030–0.034 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.064–0.073 mm, main part 0.048–0.055 mm, point 0.035–0.038 mm, inner root 0.020–0.026 mm. Size of ventral barv is 0.005–0.007 x 0.023–0.027 mm, membrane 0.016–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.027 mm.

Found on fins of *Cyprinus carpio*; ponds of East Germany fish farms.

131 (129). The membrane of the ventral bar is tapered posteriorly.

132 (133). The posterior end of the ventral bar membrane is concave along the edges.
G. stankovici Ergens, 1970 (Fig. 523)

Body length is 0.3–0.4 mm. Total length of marginal hooks is 0.023–0.031, hooklet 0.005–0.006 mm. Total length of anchors is 0.050–0.063 mm, main part 0.035–0.046 mm, point 0.023–0.033 mm, inner root 0.016–0.023 mm. Size of ventral bar is 0.006–0.008 x 0.020–0.025 mm, membrane 0.012–0.018 mm. Size of dorsal bar is 0.002 x 0.013–0.019 mm.

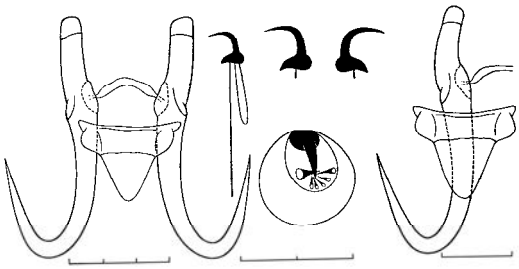
Found on fins, gills, and skin and in nasal cavities of *Cyprinus carpio* (both wild and domesticated) and *Carasius auratus gibelio* (?); widespread in the area of its host.

133 (132). The membrane of the ventral bar is triangular.
G. gobioninum Gussev, 1955 (Fig. 524)

Body length up can be to 0.3 mm. Total length of the marginal hooks is 0.024 mm, hooklet 0.005 mm. Total length of anchors is 0.051 mm, main part 0.037 mm, point 0.026 mm, inner root 0.016 mm. Size of ventral bar is 0.006 x 0.017 mm, membrane 0.012 mm. Size of dorsal bar is 0.002 x 0.017 mm.

Found on fins of *Gobio gobio, Romanogobio albipinnatus*, and *Abbottina rivularis*; Danube, Elbe, and Oder Rivers (Czechia and Slovakia), Lake Khanka (Amur region, Russia).

134 (128). The hooklet is of another type.



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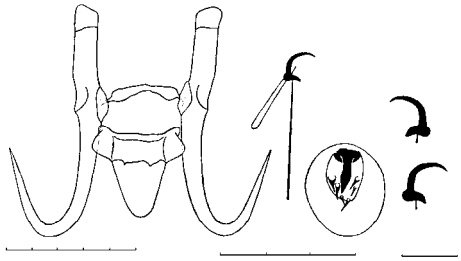

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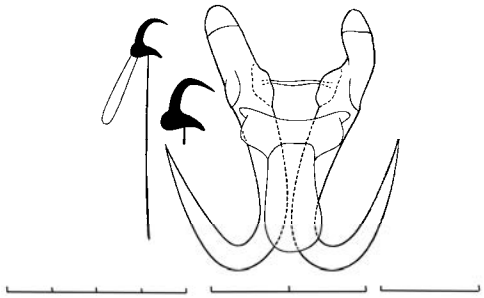

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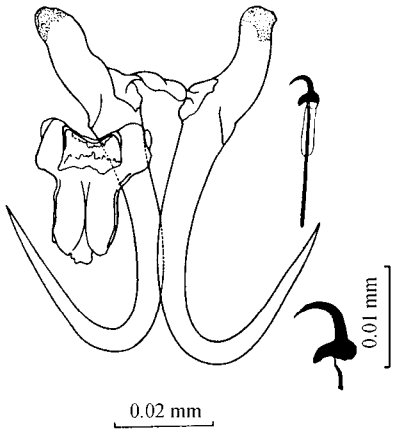
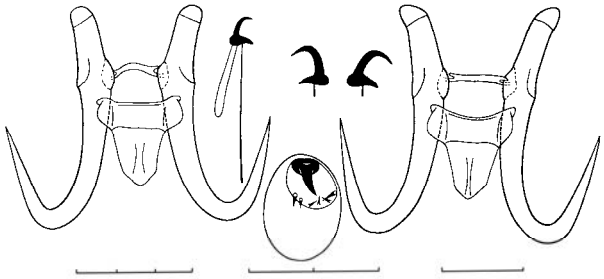


522

Fig. 519 – 522.
519 - *Gyrodactylus vicinus.* **520 -** *Gyrodactylus vicinoides* (after Ergens et Karimov, 1988).
521 - *Gyrodactylus nagibinae.* **522 -** *Gyrodactylus procerus* (after Lux, 1990).



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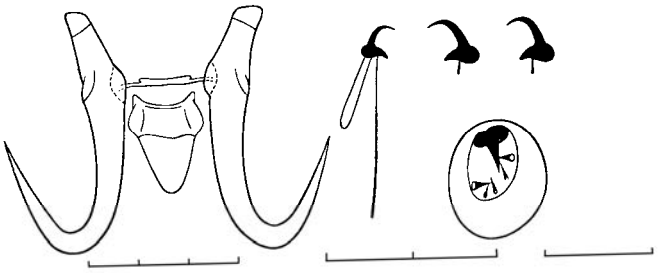

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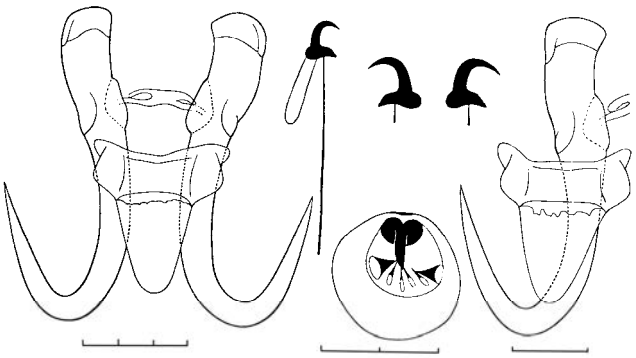

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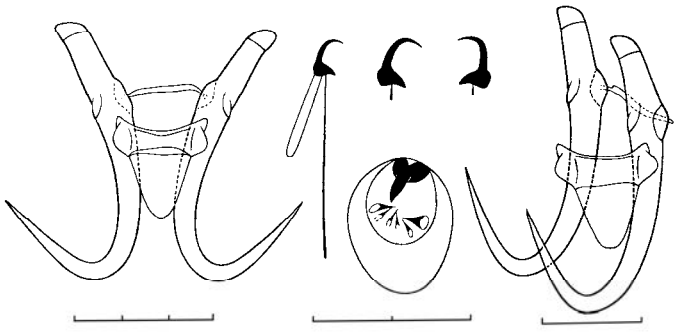


526

Fig. 523 – 526.
523 - *Gyrodactylus stankovici.* **524 -** *Gyrodactylus gobioninum.* **525 -** *Gyrodactylus montanus.* **526 -** *Gyrodactylus kobayashii.*

135 (136). The inner root of the anchors is broadened to the end.
G. montanus Bychowsky, 1957 (Fig. 525)
Syn.: *G. chadzikenti* Osmanov, 1964

Body length is 0.8–1.0 mm. Total length of marginal hooks is 0.037–0.048 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.088–0.100 mm, main part 0.063–0.078 mm, point 0.040–0.053 mm, inner root 0.021–0.033 mm. Size of ventral bar is 0.009–0.015 x 0.033–0.045 mm, membrane 0.022–0.035 mm. Size of dorsal bar is 0.003–0.006 x 0.022–0.044 mm.

Found on fins of *Schizothorax intermedius*; water bodies of Central Asia.

136 (135). The inner root of the anchors is not broadened to the end.

137 (140). The external part of the hooklet base is obliquely cut.

138 (139). The total length of the anchors is greater than 0.050 mm.
G. kobayashii Hukuda, 1940 (Fig. 526)
Syn.: *G. baueri* Ergens et Yukhimenko, 1975

Body length is about 0.3 mm. Total length of marginal hooks is 0.025–0.028 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.051–0.069 mm, main part 0.039–0.052 mm, point 0.025–0.032 mm, inner root 0.013–0.023 mm. Size of ventral bar is 0.006–0.007 x 0.021–0.025 mm, membrane 0.014–0.017 mm. Size of dorsal bar is 0.001–0.003 x 0.014–0.019 mm.

Found on skin and fins of *Carassius auratus gibelio*; water bodies of Czechia and Slovakia, water bodies of the Amur region (Russia).

139 (138). The total length of the anchors is less than 0.040 mm.
G. bolonensis Ergens et Yukhgimenko, 1975 (Fig. 527)

Body length is about 0.2 mm. Total length of marginal hooks is 0.023–0.024 mm, hooklet 0.004 mm. Total length of anchors is 0.033 mm, main part 0.025 mm, point 0.013 mm, inner root 0.011 mm. Size of ventral bar is 0.004–0.005 x 0.014 mm, membrane 0.008 mm. Size of dorsal bar is 0.001–0.002 x 0.010 mm.

Found on gills of *Hypomesus olidus*; Lake Bolon' (Amur River Basin, Russia).

140 (137). The external part of the hooklet base is rounded.

141 (249). The membrane of the ventral bar is tapered posteriorly.

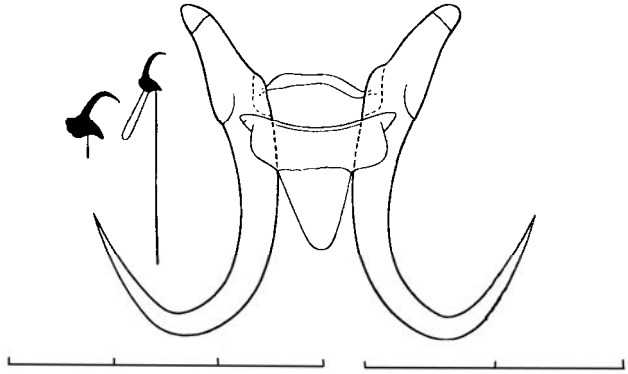
142 (143). The length of the hooklet of the marginal hooks is greater than 0.011 mm.
G. perccotti Ergens et Yukhimenko, 1973 (Fig. 528)

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.032–0.035 mm, hooklet 0.011–0.012 mm. Total length of anchors is 0.078–0.081 mm, main part 0.057–0.059 mm, point 0.030–0.033 mm, inner root 0.032–0.035 mm. Size of ventral bar is 0.010–0.012 x 0.023–0.028 mm, membrane 0.016–0.019 mm. Size of dorsal bar is 0.002 x 0.015–0.018 mm.

Found on gills of *Perccottus glenii*; Amur region.

143 (142). The length of the hooklet is less than 0.010 mm.

144 (147). The length of the handle of the marginal hooks is greater than six times the length of the hooklet.



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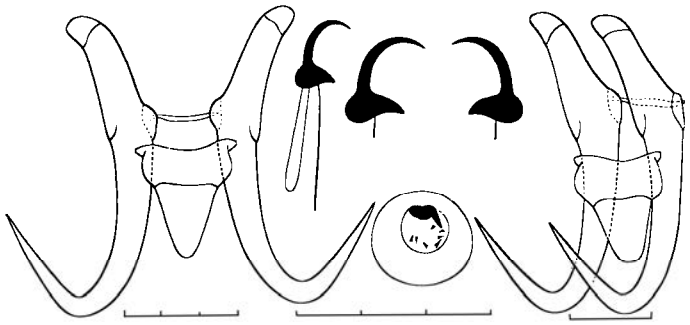

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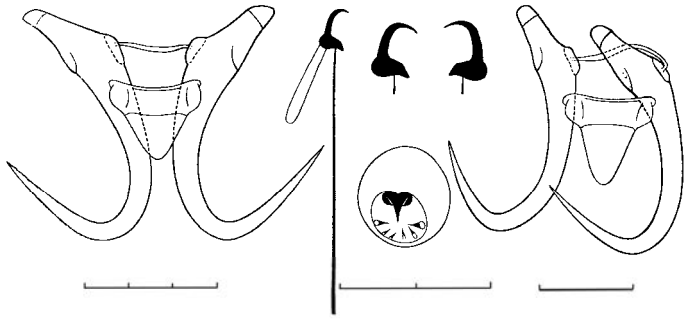

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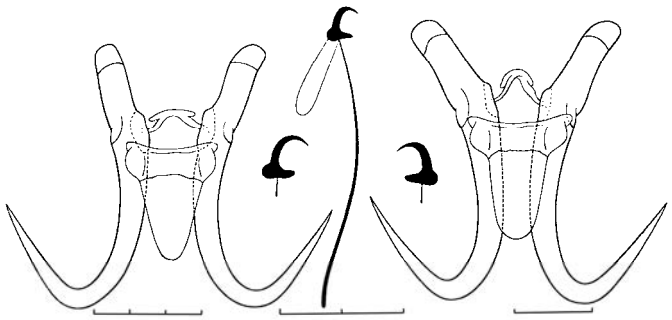


530

Fig. 527 – 530.
527 - *Gyrodactylus bolonensis.* **528** - *Gyrodactylus perccotti.* **529** - *Gyrodactylus llewellyni.* **530** - *Gyrodactylus editus.*

145 (146). The total length of the anchors is less than 0.065 mm.
G. llewellyni Ergens et Dulmaa, 1967 (Fig. 529)

Body length is about 0.35 mm. Total length of marginal hooks is 0.034–0.043 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.053–0.059 mm, main part 0.042–0.045 mm, point 0.025–0.030 mm, inner root 0.016–0.021 mm. Size of ventral bar is 0.005–0.006 x 0.020–0.022 mm, membrane 0.011–0.014 mm. Size of dorsal bar is 0.001–0.002 x 0.014–0.018 mm.

Found on fins and gills and in nasal cavities of ***Phoxinus phoxinus***, ***P. czekanowskii***, and ***Oreoleuciscus potanini***; basins of Kolyma and Suifun Rivers (Russia); upper stream of the Yenisey and Selenga Rivers, West Mongolian lakes (Mongolia).

146 (145). The total length of the anchors is greater than 0.070 mm.
G. editus Djalilov et Ashurova, 1980 (Fig. 530)

Body length is about 0.4 mm. Total length of marginal hooks is 0.047–0.053 mm, hooklet 0.006 mm. Total length of anchors is 0.073–0.077 mm, main part 0.051–0.054 mm, point 0.034–0.035 mm, inner root 0.026–0.031 mm. Size of ventral bar is 0.008–0.009 x 0.025–0.030 mm, membrane 0.023–0.024 mm. Size of dorsal bar is 0.003 x 0.018–0.021 mm.

Found on fins and gills of *Schizopigopsis stoliczkai*; Lake Yashilkul', Murgab River (Turkmenistan).

147 (144). The length of the handle of the marginal hooks exceeds the length of the hooklet, but not more than 5.5 times.

148 (153). The hooklet of the marginal hooks is of the *G. rhodei* type (see Fig. 454, 6); its length is less than 0.006 mm.

149 (150). The length of the main part of the anchors is greater than 0.040 mm.
G. rhodei Zitnan, 1964 (Fig. 531)

Body length is 0.35–0.55 mm. Total length of marginal hooks is 0.022–0.028 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.053–0.059 mm, main part 0.042–0.046 mm, point 0.023–0.030 mm, inner root 0.016–0.018 mm. Size of ventral bar is 0.005–0.009 x 0.023–0.026 mm, membrane 0.015–0.019 mm. Size of dorsal bar is 0.002–0.003 x 0.019–0.022 mm.

Found on fins and skin of ***Rhodeus amarus*** and ***R. sericeus***; Danube and Elbe Rivers; Maritime Territory (Russia).

150 (149). The length of the main part of the anchors is less than 0.040 mm.

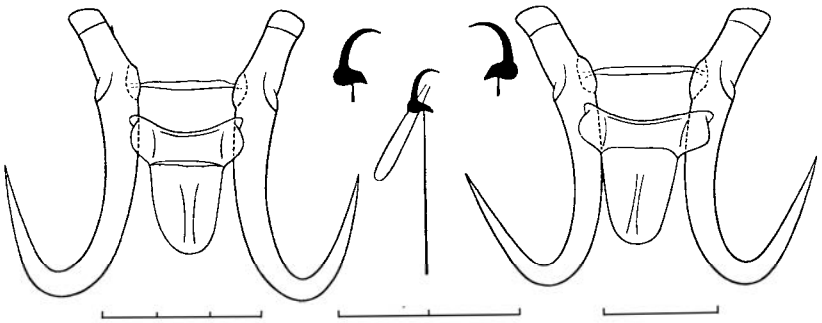
151 (152). The posterior edge of the ventral bar membrane is oval.
G. acanthorhodei Ergens et Yukhimenko, 1975 (Fig. 532)

Body length is about 0.3 mm. Total length of marginal hooks is 0.020–0.021 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.045–0.047 mm, main part 0.034–0.036 mm, point 0.018–0.021 mm, inner root 0.013–0.015 mm. Size of ventral bar is 0.004–0.005 x 0.018–0.022 mm, membrane 0.013–0.014 mm. Size of dorsal bar is 0.002 x 0.013–0.019 mm.

Found on fins of *Acanthorhodeus asmussi*; Amur region (Russia).

152 (151). The membrane of the ventral bar is triangular.
G. hemivicinus Ergens et Daniyarov, 1976 (Fig. 533)
Body length is 0.25 mm. Total length of marginal hooks is 0.023–0.025 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.045–0.047 mm, main part 0.034 mm, point 0.022 mm, inner root 0.013–0.014 mm. Size of ventral bar is 0.005 x 0.022 mm, membrane 0.010 mm. Size of dorsal bar is 0.002 x 0.017–0.019 mm.

Found on fins and in nasal cavities of ***Schizothorax intermedius***; Kafirnihan River (Tajikistan).



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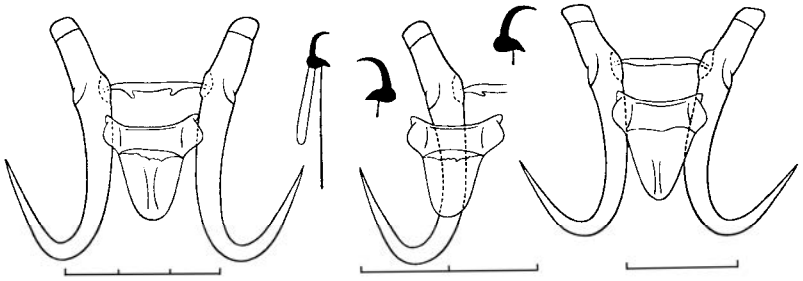

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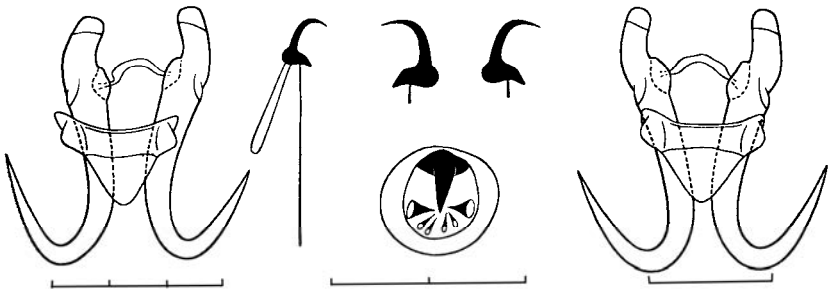

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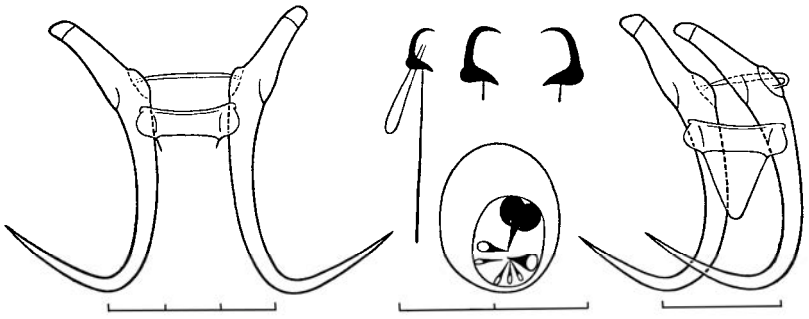


534

Fig. 531 – 534.
531 - *Gyrodactylus rhodei.* **532** - *Gyrodactylus acanthorhodei.* **533** - *Gyrodactylus hemivicinus.* **534** - *Gyrodactylus sprostonae.*

153 (148). The hooklet of the marginal hooks is of another type or another length.

154 (157). The anchors are of the *G. sprostonae* type (see Fig. 455, 3).

155 (156). The point of the hooklet does not reach the level of its base.
G. sprostonae Ling, 1962 (Fig. 534)

Body length is 0.2–0.4 mm. Total length of marginal hooks is 0.019–0.028 mm, hooklet 0.004–0.006 mm. Total length of anchors is 0.041–0.062 mm, main part 0.035–0.045 mm, point 0.017–0.025 mm, inner root 0.013–0.024 mm. Size of ventral bar is 0.004–0.007 x 0.013–0.026 mm, membrane 0.015–0.018 mm. Size of dorsal bar is 0.001–0.002 x 0.009–0.020 mm.

Found on gills of *Carassius carassius, C. auratus gibelio, Cyprinus carpio, C. c. rubrofuscus, Pseudaspius leptocephalus*, and some other cyprinids; parasite of the first three species mainly; widespread species in host's area.

156 (155). The point of the hooklet reaches the level of its base.
G. seravshani Osmanov, 1965 (Fig. 489, A)

Body length is about 0.4 mm. Total length of marginal hooks is 0.023–0.025 mm, hooklet 0.006 mm. Total length of anchors is 0.056–0.060 mm, main part 0.040–0.043 mm, point 0.023–0.026 mm, inner root 0.022–0.024 mm. Size of ventral bar is 0.004–0.005 x 0.019–0.021 mm, membrane 0.012–0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.014–0.019 mm.

Found on gills of *Schizothorax intermedius*; Zeravshan and Aksu Rivers (Uzbekistan).

157 (154). The anchors are of another type.

158 (159). The base and blade of the hooklet are almost the same length.
G. costatae Ergens et Gussev, 1976 (Fig. 535)

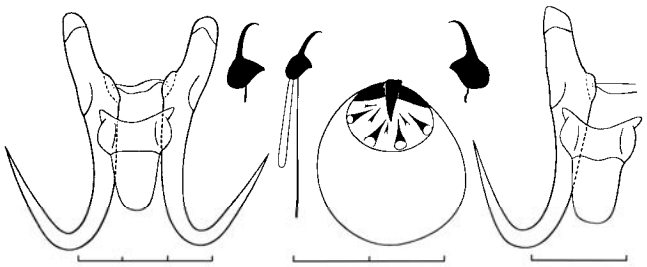
Body length is about 0.35 mm. Total length of marginal hooks is 0.024–0.025 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.052–0.053 mm, main part 0.039–0.040 mm, point 0.025–0.026 mm, inner root 0.018–0.019 mm. Size of ventral bar is 0.008–0.009 x 0.018 mm, membrane 0.015–0.016 mm. Size of dorsal bar is 0.002 x 0.011 mm.

Found on fins of *Lefua pleskei*; Lake Khanka (Amur region), rivers of the southern Maritime Territory (Russia).

159 (158). The base of the hooklet is not less than 1.5 time shorter than the hooklet blade.

160 (167). The hooklet of the marginal hooks is of the *G. cernuae* type (see Fig. 454, 14).

161 (162). The point of the anchors is unbent from the main part, forming a 60º angle.
G. cernuae Malmberg, 1957 (Fig. 536)
Syn.: *G. raabei* Prost, 1957
Body length is 0.5–0.9 mm. Total length of marginal hooks is 0.026–0.035 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.051–0.070 mm, main part 0.039–0.053 mm, point 0.021–0.030 mm, inner root 0.017–0.028 mm. Size of ventral bar is 0.005–0.008 x 0.023–0.028 mm, membrane 0.012–0.017 mm. Size of dorsal bar is 0.001–0.003 x 0.020–0.024 mm.



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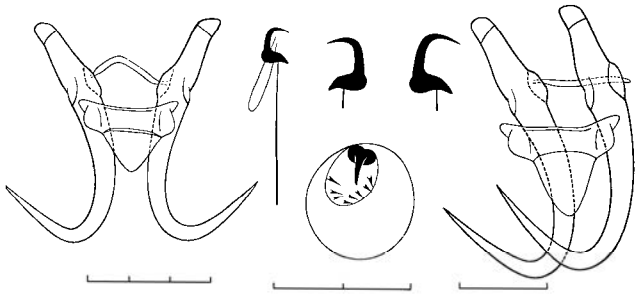

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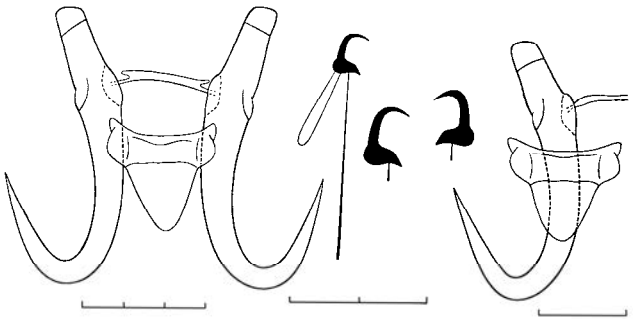

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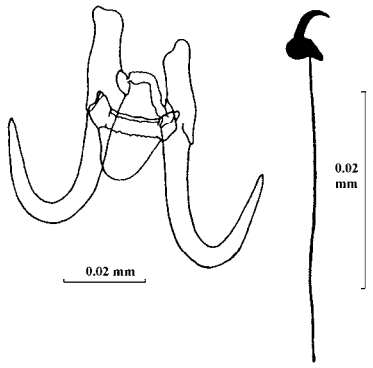


538

Fig. 535 – 538.
535 - *Gyrodactylus costatae.* **536** - *Gyrodactylus cernuae.* **537** - *Gyrodactylus gasterostei.* **538** - *Gyrodactylus rogatensis* (after Harriss, 1985).

Found on fins, skin, and gills of *Gymnocephalus cernuus* and *Perca fluviatilis* (?); widespread within the area of its host.

162 (161). The point of the anchors is unbent from the main part, forming a 45º angle.

163 (166). The anchors are massive.

164 (165). The ventral bar width is greater than 0.023 mm.
G. gasterostei Glaeser, 1974 (Fig. 537)

Body length is 0.55–0.95 mm. Total length of marginal hooks is 0.027–0.037 mm, hooklet 0.006–0.008 mm. Total length of anchors is 0.053–0.070 mm, main part 0.040–0.052 mm, point 0.026–0.035 mm, inner root 0.015–0.023 mm. Size of ventral bar is 0.005–0.008 x 0.028–0.031 mm, membrane 0.011–0.019 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.030 mm.

Found on fins, skin, and gills of *Gasterosteus aculeatus*, rarely on *Pungitius pungitius*, *Perca fluviatilis* (?), *Rutilus rutilus* (?), and other fishes; Britain, basins of Baltic and Black Seas; Maritime Territory (Russia).

165 (164). Ventral bar width is less than 0.023 mm.
G. rogatensis Harris, 1985 (Fig. 538).

Body length is 0.35–0.39 mm. Total length of marginal hooks is 0.033–0.038 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.057–0.063 mm, main part 0.037–0.046 mm, point 0.028–0.034 mm, inner root 0.017–0.023 mm. Width of ventral bar is 0.019–0.023 mm, membrane 0.011–0.014 mm. Length of dorsal bar is 0.018–0.024 mm.

Found on skin and fins of *Cottus gobio*; Britain.

166 (163). The anchors are relatively thin.
G. luciopercae Gussev, 1962 (Fig. 539)

Body length is 0.4–0.6 mm. Total length of marginal hooks is 0.031–0.036 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.064–0.080 mm, main part 0.045–0.051 mm, point 0.027–0.031 mm, inner root 0.022–0.028 mm. Size of ventral bar is 0.005–0.008 x 0.026–0.033 mm, membrane 0.014–0.019 mm. Size of dorsal bar is 0.001–0.003 x 0.021–0.029 mm.

Found on fins, skin, and gills of *Sander lucioperca*, rarely *Gymnocephalus cernuus* and *Perca fluviatilis*; basins of the Caspian, Black, and Baltic Seas.

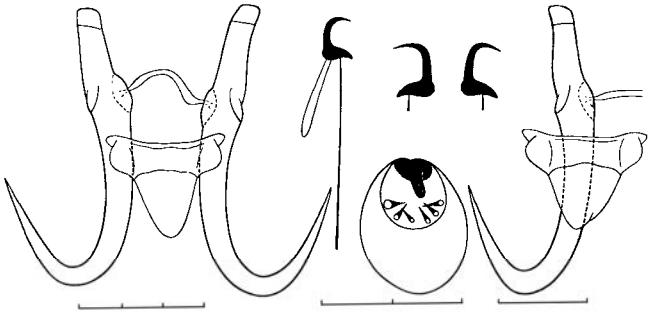
167 (160). The hooklets are of other types.

168 (169). The anchors are of the *G. osoblahensis* type (see Fig. 455, 7).
G. osoblahensis Ergens, 1963 (Fig. 540)

Body length can be up to 0.85 mm. Total length of marginal hooks is 0.031–0.039 mm, hooklet is 0.006–0.007 mm. Total length of anchors is 0.080–0.088 mm, main part 0.054–0.060 mm, point 0.033–0.036 mm, inner root 0.031–0.038 mm. Size of ventral bar is 0.007–0.014 x 0.029–0.033 mm, membrane 0.022–0.026 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.025 mm.

Found on fins of *Leuciscus leuciscus* and *Squalius cephalus*; Danube and Oder Rivers (Czechia), probably will be found in other countries of the Palaearctic.

169 (168). The anchors are of another type.



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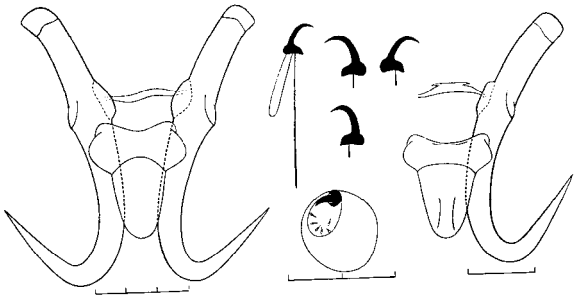

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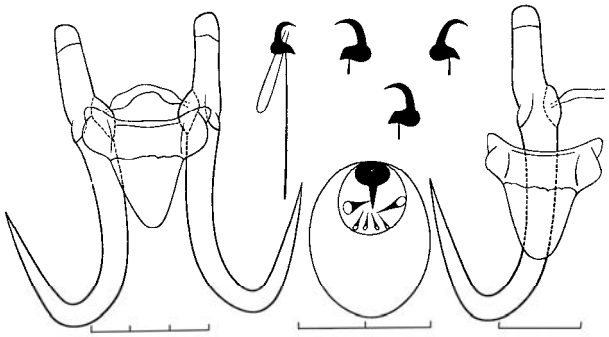

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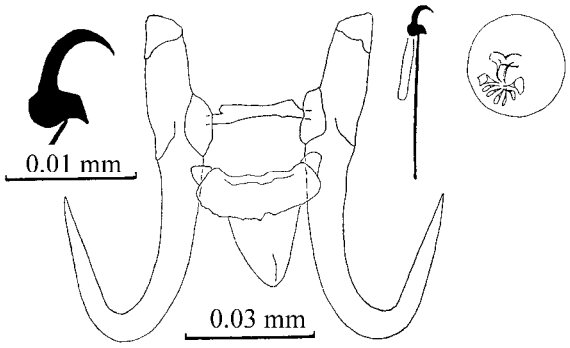


542

Fig. 539 – 542.
539 - *Gyrodactylus luciopercae*. **540** - *Gyrodactylus osoblahensis.* **541** - *Gyrodactylus macrocornis.* **542 -** *Gyrodactylus masu* (after Ogawa, 1986).

170 (179). The hooklet of the marginal hooks is massive; *G. gobii* type (Fig. 454, 1).

171 (174). The total length of the anchors is greater than 0.070 mm.

172 (173). The total length of the marginal hooks is greater than 0.036 mm.
G. macrocornis Ergens, 1963 (Fig. 541)
Syn.: *G. chondrostomatis* Zitnan, 1964

Body length is about 0.35 mm. Total length of marginal hooks is 0.025–0.035, hooklet 0.005–0.007 mm. Total length of anchors is 0.074-0.085 mm, main part 0.054–0.060 mm, point 0.030–0.048 mm, inner root 0.023–0.029 mm. Size of ventral bar is 0.007–0.011 x 0.029–0.036 mm, membrane 0.018–0.025 mm. Size of dorsal bar is 0.002–0.004 x 0.020–0.028 mm.

Found on fins of *Chondrostoma nasus*; Danube and Oder Rivers (Czechia and Slovakia); can be found in other countries of the Palaearctic.

173 (172). The total length of the marginal hooks is greater than 0.036 mm.
G. masu Ogawa, 1986 (Fig. 542)

Body length is 0.7–1.0 mm. Total length of marginal hooks is 0.037–0.044 mm, hooklet 0.007–0.009 mm. Total length of anchors is 0.071–0.077 mm, main part 0.053–0.057 mm, point 0.034–0.039 mm, inner root 0.022–0.027 mm. Size of ventral bar is 0.005–0.009 x 0.027–0.034 mm, membrane 0.015–0.021 mm. Size of dorsal bar is 0.002–0.0035 x 0.029–0.037 mm. Diameter of copulatory organ is 0.019–0.030 mm.

Found on fins, skin, and gills of *Oncorhynchus masou* and *Parasalmo gairdneri*; fish farms in various localities of Japan; it also can be found in the Far Eastern territories of the Palaearctic.

174 (171). The total length of the anchors is less than 0.070 mm.

175 (176). The total length of the marginal hooks is less than 0.030 mm.
G. gobii Schulman, 1953 (Fig. 543)

Body length can be up to 0.55 mm. Total length of marginal hooks is 0.024–0.028 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.047–0.060 mm, main part 0.034–0.044 mm, point 0.022–0.028 mm, inner root 0.013–0.019 mm. Size of ventral bar is 0.005–0.007 x 0.021–0.027 mm, membrane 0.011–0.015 mm. Size of dorsal bar is 0.002–0.003 x 0.015–0.020 mm.

Found on fins, skin, and gills and in nasal cavities of *Gobio gobio*; widespread in the area of its host.

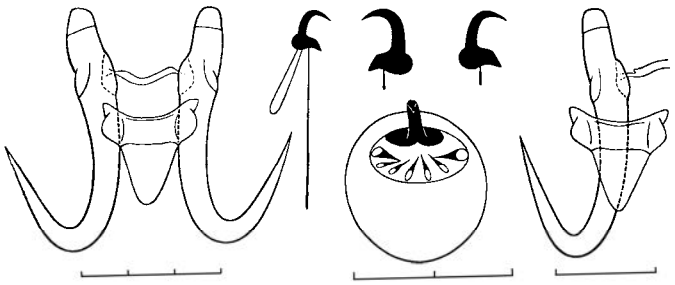
176 (175). The total length of the marginal hooks is greater than 0.030 mm.

177 (178). The total length of the anchors is less than 0.064 mm.
G. derjavini Mikailov, 1975 (Fig. 544)

Body length is 0.5–0.6 mm. Total length of marginal hooks is 0.031–0.034 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.061–0.064 mm, main part 0.044–0.047 mm, point 0.029–0.032 mm, inner root 0.018–0.021 mm. Size of ventral bar is 0.007–0.008 x 0.025–0.030 mm, membrane 0.012–0.015 mm. Size of dorsal bar is 0.002–0.003 x 0.018–0.025 mm.

Found on gills and fins of *Salmo trutta caspius*, *S. trutta* (lacustris), *Chondrostoma oxyrhynchum*, and *Cyprinus carpio*; Kura River Basin (Transcaucasus).

178 (177). The total length of the anchors is greater than 0.065 mm.
G. dykovae Ergens, 1991 (Fig. 545)



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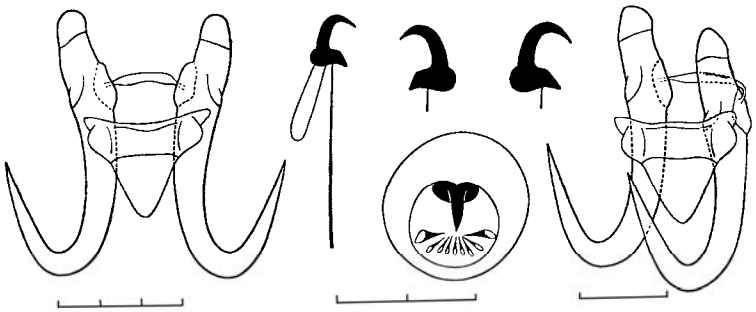

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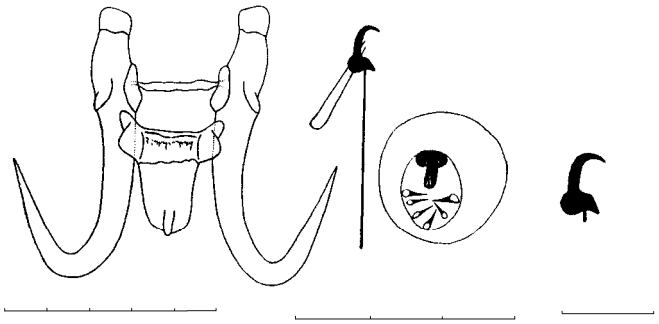

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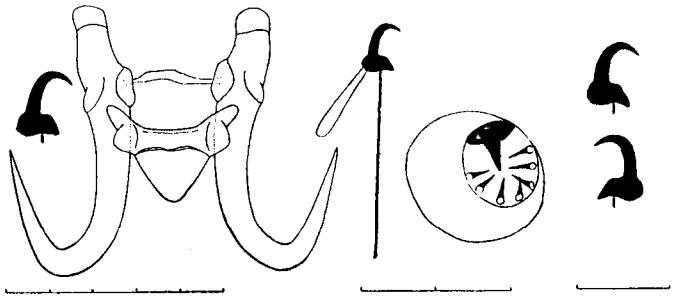
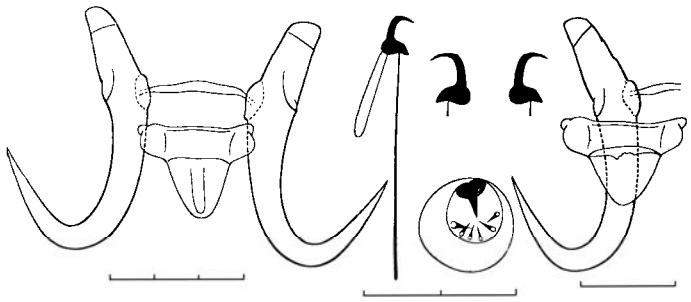


546

Fig. 543 – 546.
543 - *Gyrodactylus gobii.* **544** - *Gyrodactylus derjavini.* **545** - *Gyrodactylus dykovae* (after Ergens, 1991a). **546** - *Gyrodactylus lamberti* (after Ergens, 1990).



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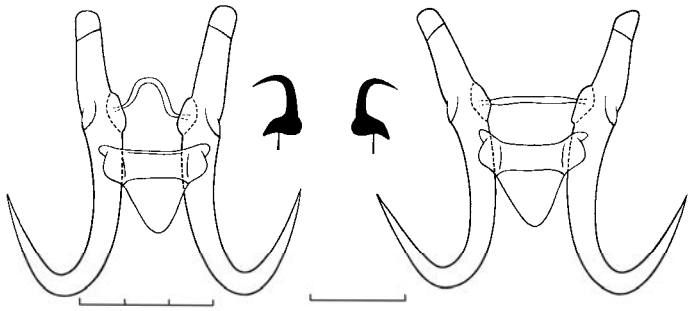

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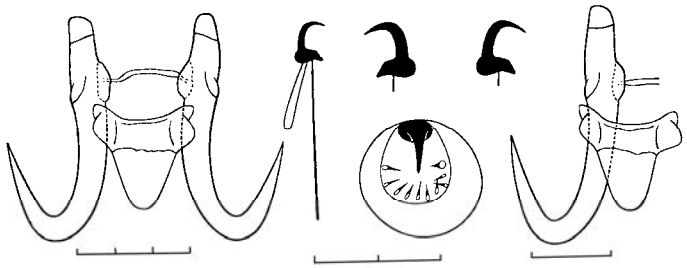

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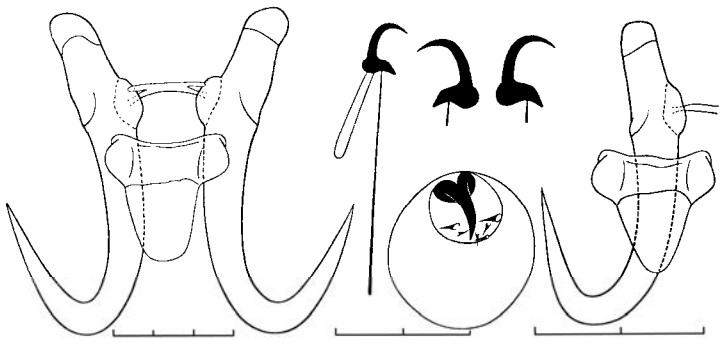

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Fig. 547 – 550.
547 - *Gyrodactylus bliccensis.* **548** - *Gyrodactylus pungitii.* **549** - *Gyrodactylus truttae.* **550** - *Gyrodactylus thymalli.*

Total length of marginal hooks is 0.030–0.033 mm, hooklet 0.007 mm. Total length of anchors is 0.065–0.068 mm, main part 0.048–0.055 mm, point 0.032–0.034 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.007–0.008 x 0.026–0.032 mm, membrane 0.014–0.018 mm. Size of dorsal bar is 0.002–0.003 x 0.018–0.022 mm.

Found on fins of *Gobio gobio*; Danube River, Czechia.

179 (170). The hooklet of the marginal hooks is of another type.

180 (183). The anchors are of the *G. bliccensis* type (see Fig. 455, 1).

181 (182). The ear-like projections are elongated and triangular in form.
G. lamberti Ergens, 1990 (Fig. 546)

Total length of marginal hooks is 0.031–0.033, hooklet 0.0065–0.0072 mm. Total length of anchors is 0.062–0.068 mm, main part 0.045–0.049 mm, point 0.031–0.034 mm, inner root 0.018–0.022 mm. Size of ventral bar is 0.005–0.008 x 0.029–0.033 mm, membrane 0.012–0.014 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.024 mm. Cirrus is about 0.018 mm in diameter.

Found on fins of *Squalius cephalus*; Danube River (Czechia).

182 (181). The ear-like projections are short and rounded.
G. bliccensis Glaeser, 1974 (Fig. 547)

Body length is about 0.6 mm. Total length of marginal hooks is 0.027–0.035 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.054–0.060 mm, main part 0.039–0.045 mm, point 0.024–0.028 mm, inner root 0.020–0.023 mm. Size of ventral bar is 0.006–0.009 x 0.024–0.029 mm, membrane 0.012–0.015 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.031 mm.

Found on gills and fins of *Blicca bjoerkna* and *Rutilus rutilus*; water bodies of Germany, Czechia, Slovakia; probably will be found in other water bodies of the Palaearctic.

183 (180). The anchors are of another type.

184 (185). The inner root of the anchors is relatively long, but it is shorter not more than 1.5 times than the main part of the anchors.
G. pungitii Malmberg, 1964 (Fig. 548)

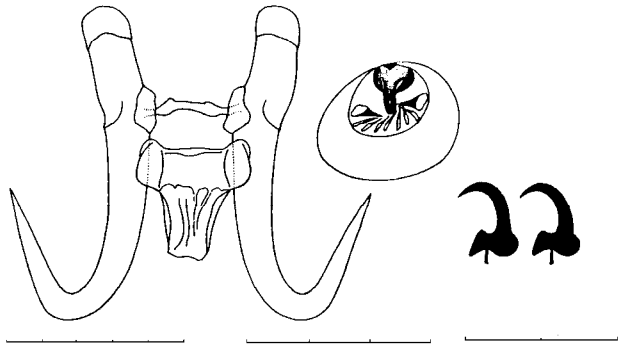
Body length is 0.65–0.9 mm. Total length of marginal hooks is 0.030–0.038 mm, hooklet 0.006 mm. Total length of anchors is 0.056–0.067 mm, main part 0.040–0.046 mm, point 0.023–0.028 mm, inner root 0.020–0.027 mm. Size of ventral bar is 0.006–0.010 x 0.023–0.028 mm, membrane 0.012–0.015 mm. Size of dorsal bar is 0.001–0.002 x 0.022–0.031 mm.

Found on skin and fins of *Pungitius pungitius* and *P. sinensis*; Britain, basin of the Baltic Sea, water bodies of the Amur region. *G. pungitii* has been identified erroneously as *G. rarus* Wegener, 1909 in many publications.

185 (184). The inner root of the anchors is shorter not less than twice than the main part of the anchors.

186 (200). The hooklet of the marginal hooks is of the *G. thymalli* type (see Fig. 454, 7).

187 (188). The total length of the marginal hooks is less than 0.035 mm.
G. truttae Glaeser, 1974 (Fig. 549)



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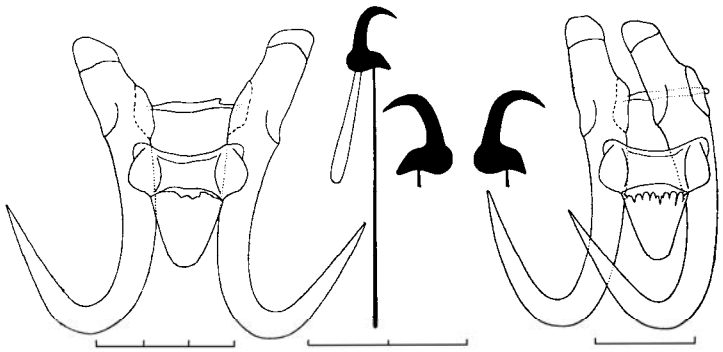

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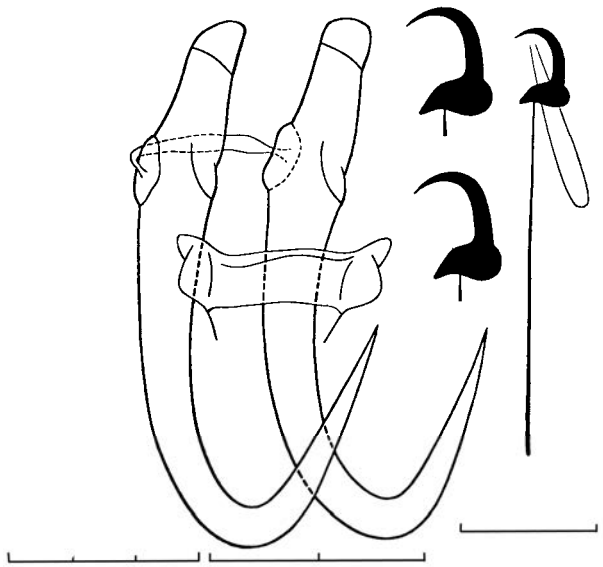


553

Fig. 551 – 553.
551 - *Gyrodactylus bohemicus* (after Ergens, 1992). **552** - *Gyrodactylus salaris.* **553** - *Gyrodactylus lavareti.*

Body length is 0.6–0.85 mm. Total length of marginal hooks is 0.029–0.034 mm, hooklet 0.006–0.008 mm. Total length of anchors is 0.054–0.065 mm, main part 0.040–0.049 mm, point 0.029–0.034 mm, inner root 0.016–0.021 mm. Size of ventral bar is 0.007–0.009 x 0.024–0.032 mm, membrane 0.010–0.017 mm. Size of dorsal bar is 0.001–0.002 x 0.017–0.030 mm.

Found on fins and skin of *Salmo trutta* (fario), *S. trutta* (lacustris), *Salvelinus fontinalis*, *Thymallus thymallus*, and *Parasalmo mykiss* (?); widespread in the area of *Salmo trutta*.

188 (187). The total length of the marginal hooks is greater than 0.037 mm.

189 (194). The ear-like projections of the ventral bar oval are poorly developed.

190 (193). The total length of the anchors is greater than 0.070 mm.

191 (192). The total length of the anchors is less than 0.085 mm.
G. thymalli Zitnan, 1960 (Fig. 550)

Body length is 0.35–0.50 mm. Total length of marginal hooks is 0.037–0.044 mm, hooklet 0.007–0.009 mm. Total length of anchors is 0.075–0.084 mm, main part 0.057–0.065 mm, point 0.033–0.039 mm, inner root 0.023–0.030 mm. Size of ventral bar is 0.009–0.012 x 0.029–0.034 mm, membrane 0.018–0.021 mm. Size of dorsal bar is 0.002–0.004 x 0.020–0.024 mm.

Found on fins of *Tymallus thymallus*, *T. arcticus*, and *T. brevirostris*; species widespread in the area of its hosts.

192 (191). The total length of the anchors is greater than 0.085 mm.
G. bohemicus Ergens, 1992 (Fig. 551)

Body length is 0.696–0.852 mm. Total length of marginal hooks is 0.043–0.045 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.087–0.091 mm, main part 0.063–0.066 mm, point 0.042–0.043 mm, inner root 0.030–0.032 mm. Size of ventral bar is 0.010–0.011 x 0.032–0.036 mm, membrane 0.020–0.022 mm. Size of dorsal bar is 0.003–0.004 x 0.023–0.025 mm.

Found on fins, skin, and gills of *Parasalmo mykiss* and *Salvelinus fontinalis*; trout farm (Czechia).

193 (190). The total length of the anchors is less than 0.070 mm.
G. salaris Malmberg, 1957 (Fig. 552)

Body length is 0.41 mm, width is 0.15 mm. Total length of marginal hooks is 0.034–0.041 mm, hooklet 0.008–0.009 mm. Length of anchors is 0.061–0.069 mm, main part 0.048–0.049 mm, point 0.030–0.037 mm, inner root 0.020–0.021 mm. Size of ventral bar with an ear-shaped projection is 0.007–0.013 x 0.022-0.027 mm, membrane 0.015–0.016 mm. Size of dorsal bar is 0.002 x 0.013–0.018 mm.

Found on skin and fins of *Salmo salar* (main host) and (accidentally?) some other fish species (list of all hosts see www.gyrodb.net). *G. salaris* seems to be spread throughout all freshwater bodies of the Baltic Sea Basin on *Salmo salar*. During recent years, it was found in the Keret' River (White Sea Basin). It was brought from Sweden to Norway with smolt and became a pathogen in fish farms.

194 (189). The ear-like projections of the ventral bar are well developed and triangular.

195 (196). The total length of the anchors is greater than 0.075 mm.
G. lavareti Malmberg, 1957 (Fig. 553)

Body length is about 0.35 mm. Total length of marginal hooks is 0.040–0.041 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.082–0.084 mm, main part 0.064 mm, point 0.037–0.038 mm, inner root 0.021–0.024 mm. Size of ventral bar is 0.007–0.013 x 0.035 mm, membrane 0.012 mm. Size of dorsal bar is 0.003 x 0.020–0.030 mm.

Found on gills, skin, and fins of *Coregonus lavaretus* and *C. nasus*. To date it has been found in Sweden; Lakes Onega, Ladoga, and Pyaozero (Karelia); and the Penzhina River (Kam-

chatka) (Russia).

196 (195). The total length of the anchors is less than 0.070 mm.

198 (199). The hooklet of the marginal hooks has a slender blade.
G. nerkae Cone et al., 1983 (Fig. 554)

Body length is 0.25–0.39 mm and width is 0.056–0.120 mm. Total length of marginal hooks is 0.040–0.045 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.057–0.067 mm, main part 0.044–0.049 mm, point 0.031–0.034 mm, inner root 0.018–0.023 mm. Size of ventral bar is 0.004–0.007 x 0.019–0.026 mm, membrane 0.010–0.013 mm. Width of dorsal bar is 0.020–0.028 mm.

Found on skin of *Oncorhynchus nerka*; British Columbia (Canada); can be found in the Far East Territories of Russia.

199 (198). The hooklet of the marginal hooks has a broad blade.
G. salmonis (Yin et Sproston, 1948) (Fig. 555)

Body length is 0.42–0.54 mm and width is 0.112–0.180 mm. Total length of marginal hooks is 0.041–0.045 mm; hooklet 0.008–0.009 mm. Total length of anchors is 0.058–0.062 mm, main part 0.044–0.053 mm, point 0.033–0.035 mm, inner root 0.017–0.021 mm. Size of ventral bar is 0.005–0.007 x 0.022–0.028 mm, membrane 0.008–0.014 mm. Width of dorsal bar can be up to 0.028 mm (after Cone et al., 1983).

Found on skin of *Oncorhynchus kisutch, Parasalmo clarki, P. gairdneri, Salmo salar,* and *Salvelinus fontinalis*; British Columbia, Nova Scotia (Canada); can be found in the Far East Territories of Russia.

200 (186). The hooklet of the marginal hooks is of other types.

201 (202). The length of the hooklet is greater than 0.009 mm.
G. mutabilitas Bychowsky, 1957 (Fig. 556)

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.041–0.042 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.053–0.068 mm, main part 0.043–0.052 mm, point 0.026–0.032 mm, inner root 0.014–0.020 mm. Size of ventral bar is 0.008–0.009 x 0.023–0.037 mm, membrane 0.017–0.018 mm. Size of dorsal bar is 0.002–0.004 x 0.016–0.025 mm.

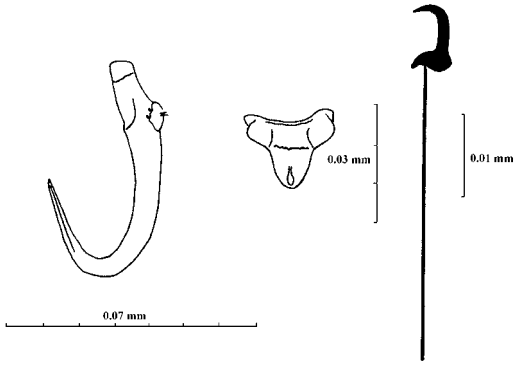
Found on gills and fins of *Capoeta capoeta steindachneri*; Varzob and Kafirnihan Rivers (Tajikistan).

202 (201). The length of the hooklet is less than 0.008 mm.

203 (204). The hooklet has a slightly straightened point.
G. rutilensis Glaeser, 1974 (Fig. 557)

Body length is 0.39–0.60 mm. Total length of marginal hooks is 0.025–0.029 mm, hooklet 0.0055–0.0065 mm. Total length of anchors is 0.050–0.057 mm, main part 0.037–0.044 mm, point 0.021–0.026 mm, inner root 0.014–0.018 mm. Size of ventral bar is 0.006–0.009 x 0.019–0.026 mm, membrane 0.011–0.014 mm. Size of dorsal bar is 0.001–0.002 x 0.025–0.029 mm.

Found on fins of *Rutilus rutilus*; Danube and Elbe Rivers (Germany, Czechia, Slovakia); can be found in other countries of the Palaearctic.



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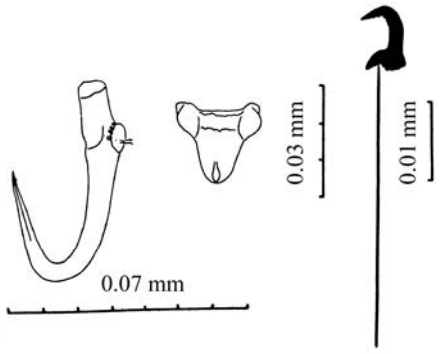

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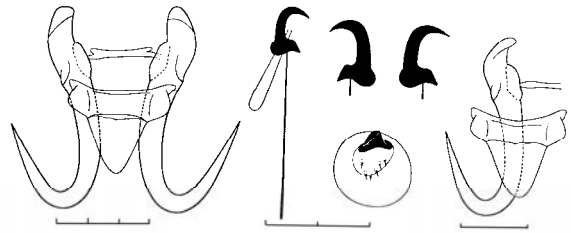

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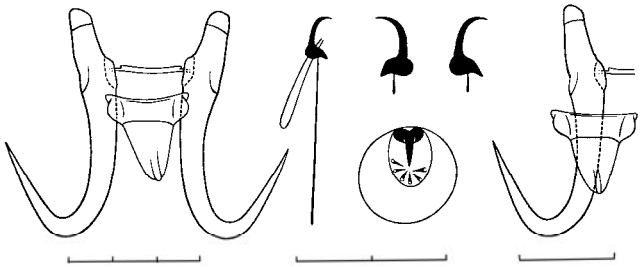
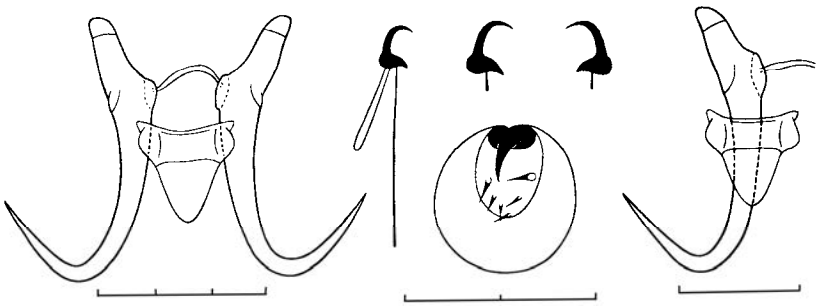


557

Fig. 554 -557.
554 - *Gyrodactylus nerkae* (after Cone et al., 1983)*.* **555 -** *Gyrodactylus salmonis* (after Cone et al., 1983).**556 -** *Gyrodactylus mutabilitas.* **557 -** *Gyrodactylus rutilensis.*



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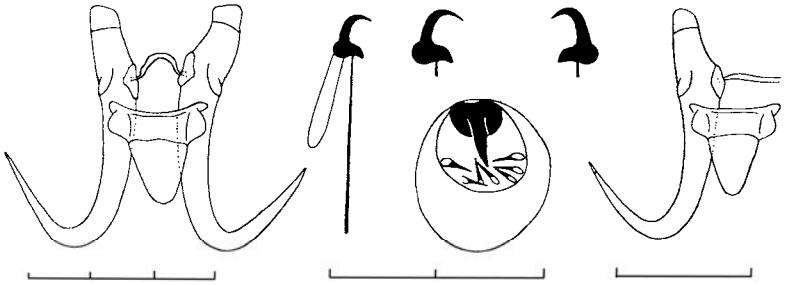

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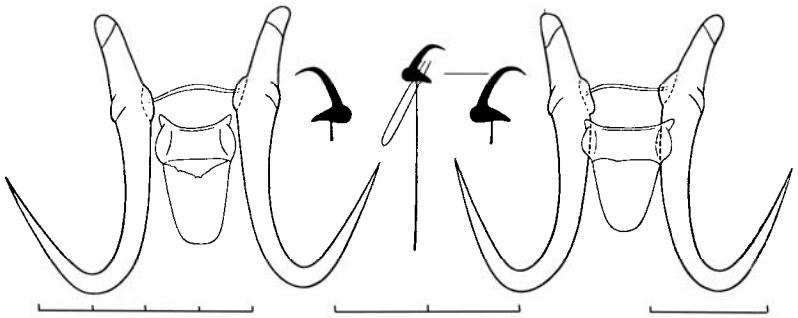

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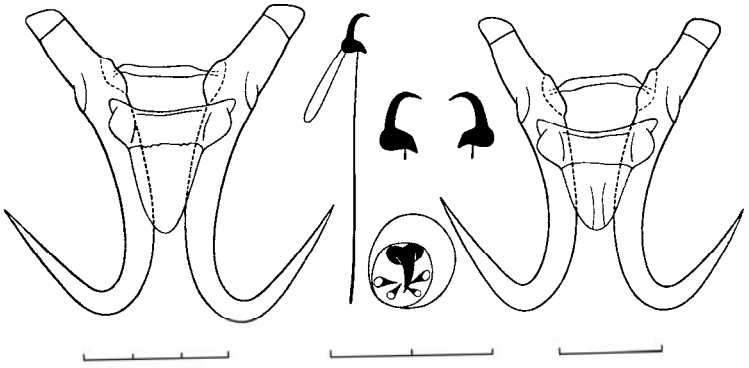


561

Fig. 558 – 561.
558 - *Gyrodactylus medius.* **559** - *Gyrodactylus schulmani***560** - *Gyrodactylus fairporti.* **561** - *Gyrodactylus scardiniensis.*

204 (203). The hooklet has a bent point.

205 (206). The anchors are of the *G. medius* type (see Fig. 455, 5).
G. medius Kathariner, 1893 (Fig. 558)

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.022–0.026 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.045–0.051 mm, main part 0.034–0.039 mm, point 0.018–0.020 mm, inner root 0.012–0.019 mm. Size of ventral bar is 0.005–0.007 x 0.018–0.021 mm, membrane 0.012–0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.012–0.018 mm.

Found on gills and rarely in nasal cavities of *Cyprinus carpio*, both wild and domesticated. Many authors have described this species from other fishes as well, but *G. medius* is a species specific to *C. carpio*. Finds on other species are viewed as misidentifications or accidental finds.

206 (205). The anchors are of another type.

207 (208). The length of the anchor point is less than 0.020 mm.
G. schulmani Ling, 1962 (Fig. 559)

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.019–0.024 mm, hooklet 0.004 mm. Total length of anchors is 0.034–0.044 mm, main part 0.024–0.033 mm, point 0.013–0.019 mm, inner root 0.009–0.013 mm. Size of ventral bar is 0.003–0.006 x 0.010–0.018 mm, membrane 0.007–0.011 mm. Size of dorsal bar is 0.001–0.002 x 0.009–0.015 mm.

Found on gills of *Carassius carassius*, *C. auratus gibelio*, *Cyprinus carpio*, and *C. c. rubrofuscus*; widespread, probably throughout the area of its hosts.

208 (207). The length of the anchor point is greater than 0.022 mm.

209 (210). The anchors are of the *G. fairporti* type (see Fig. 455, 4).
G. fairporti Van Cleave, 1921 (Fig. 560)

Body length can be up to 0.45 mm. Total length of marginal hooks is 0.023–0.024 mm, hooklets 0.005–0.006 mm. Total length of anchors is 0.051–0.053 mm, main part 0.038–0.040 mm, point 0.024–0.026 mm, inner root 0.016–0.019 mm. Size of ventral bar is 0.005–0.008 x 0.015–0.018 mm, membrane 0.012–0.017 mm. Size of dorsal bar is 0.001 x 0.013–0.014 mm.

Found on gills and in nasal cavities of *Ameiurus nebulosus*; Tisa River (Danube River Basin). It was introduced to the Palaearctic with its host from North America.

210 (209). The anchors are of other types.

211 (224). The hooklets are of the *G. vimbi* type (see Fig. 454, 8).

212 (213). The handle length of the marginal hook is at least five times greater than the hooklet length.
G. scardiniensis Glaeser, 1974 (Fig. 561)

Body length is 0.5–0.8 mm. Total length of marginal hooks is 0.032–0.038 mm, hooklet 0.0055–0.006 mm. Total length of anchors is 0.060–0.070 mm, main part 0.047–0.054 mm, point 0.028–0.035 mm, inner root 0.016–0.023 mm. Size of ventral bar is 0.005–0.008 x 0.024–0.030 mm, membrane 0.014–0.017 mm. Size of dorsal bar is 0.002–0.003 x 0.022–0.035 mm.

Found on fins of *Scardinius erythrophthalmus* and *Squalius cephalus*; Danube River Basin (Czechia), Germany; can be found in other countries of the Palaearctic.

213 (212). The handle length of the marginal hook exceeds the hooklet length, but not more than 4.5 times.

214 (219). The hooklet length is greater than 0.006 mm.

215 (216). The total length of the marginal hooks is greater than 0.032 mm.

G. sommervillae Turgut et al., 1999 (Fig. 562)

Total length of marginal hooks is 0.032–0.036 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.067–0.077 mm, main part 0.045–0.060 mm, point 0.032–0.040 mm, inner root 0.016–0.022 mm. Size of ventral bar is 0.003 x 0.030 mm, membrane 0.015–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.025 mm. Cirrus is 0.012–0.015 mm in diameter.

Found on skin, fins and gills of ***Abramis brama*** and ***Rutilus rutilus***; Blanheim Palace Lake, Woodstock, Oxfordshire, England.

216 (215). The total length of the marginal hooks is less than 0.032 mm.

217 (218). The ear-like projections are elongated and triangular in form.
G. leucisci Zitnan, 1964 (Fig. 563)

Body length is about 0.45 mm. Total length of marginal hooks is 0.030–0.031 mm, hooklet 0.007 mm. Total length of anchors is 0.063–0.073 mm, main part 0.044–0.051 mm, point 0.031–0.033 mm, inner root 0.021–0.024 mm. Size of ventral bar is 0.007–0.008 x 0.028–0.032 mm, membrane 0.017–0.019 mm. Size of dorsal bar is 0.002–0.003 x 0.019–0.021 mm.

Found on fins of ***Leuciscus leuciscus*** and ***Squalius cephalus***; Elbe and Danube Rivers (Czechia and Slovakia); can be found in other countries of the Palaearctic.

218 (217). The ear-like projections are short and rounded.
G. kearni Ergens, 1990 (Fig. 564)

Total length of marginal hooks is 0.031–0.032 mm, hooklet 0.0062–0.0066 mm. Total length of massive anchors is 0.066–0.073 mm, main part 0.049–0.053 mm, point 0.032–0.034 mm, inner root 0.021–0.025 mm. Size of ventral bar is 0.006–0.009 x 0.027–0.032 mm, membrane 0.006–0.009 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.023 mm. Cirrus is about 0.020 mm in diameter.

Found on fins of ***Squalius cephalus***; Danube River (Czechia).

219 (214). The hooklet length is less than 0.006 mm.

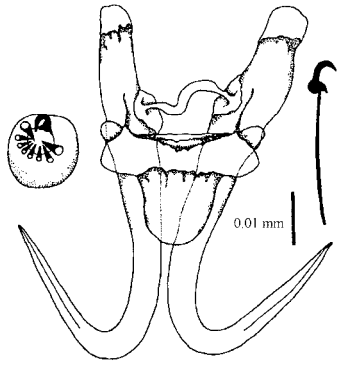
220 (223). The inner root is slightly turned up from the axis of the main part of the anchor.

221 (222). The total length of the marginal hooks is greater than 0.026 mm.
G. glaeseri Ergens, 1980 (Fig. 565).

Body length is about 0.35 mm. Total length of marginal hooks is 0.027–0.029 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.051–0.057 mm, main part 0.036–0.041 mm, point 0.022–0.025 mm, inner root 0.017–0.021 mm. Size of ventral bar is 0.005–0.006 x 0.020–0.024 mm, membrane 0.011–0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.019–0.022 mm.

Found on fins of ***Alburnus alburnus***; Elbe River (Czechia); probably will be found in other countries of the Palaearctic.

222 (221). The total length of the marginal hooks is less than 0.026 mm.
G. lomi Ergens et Gelnar 1988 (Fig. 566)



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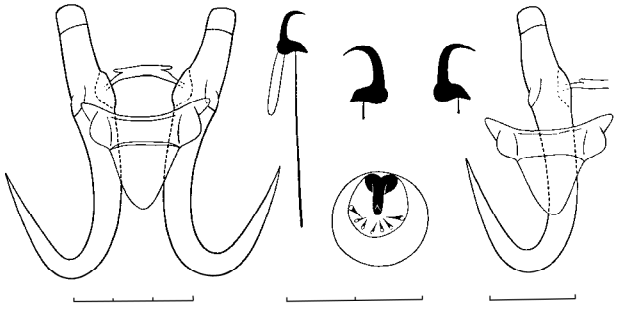

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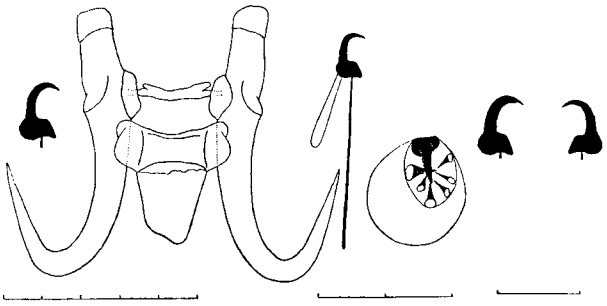

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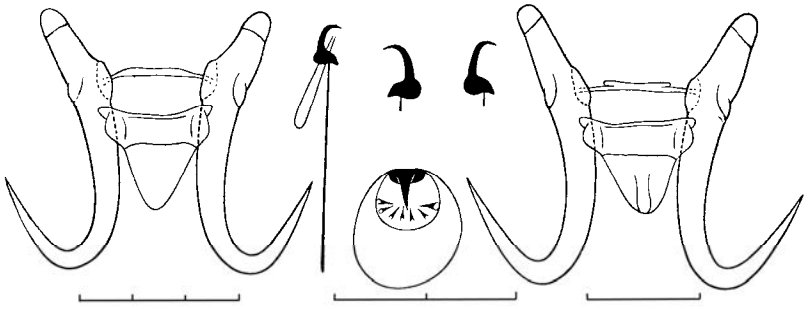
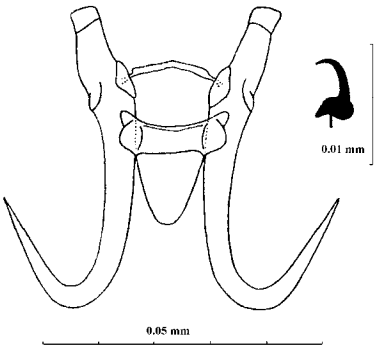


565

Fig. 562 – 565.
562 - *Gyrodactylus sommervillae* (after Turgut et al., 1999). **563** - *Gyrodactylus leucisci.*
564 - *Gyrodactylus kearni* (after Ergens, 1990). **565** - *Gyrodactylus glaeseri.*



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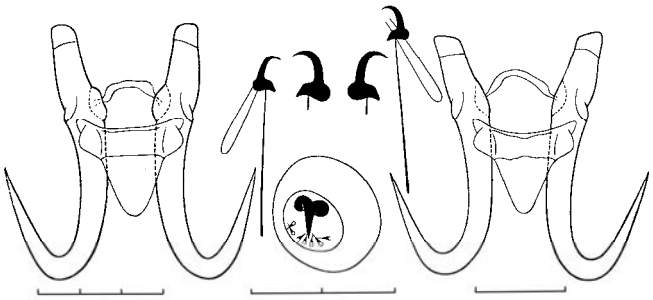

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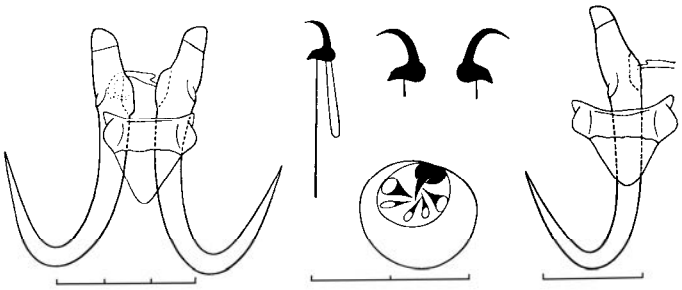

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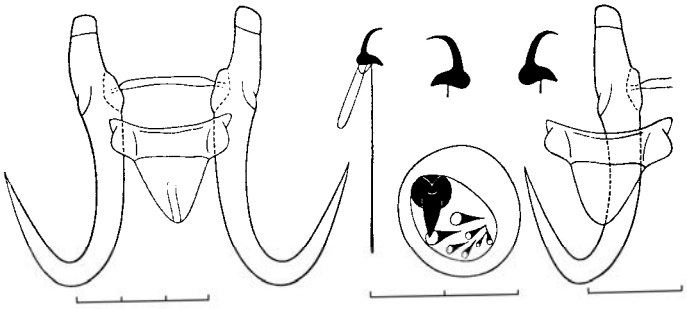


569

Fig. 566 – 569.
566 - *Gyrodactylus lomi* (after Ergens et Gelnar, 1988). **567 -** *Gyrodactylus vimbi.*
568 - *Gyrodactylus kafirniganensis.* **569 -** *Gyrodactylus barbi.*

Total length of marginal hooks is 0.024, hooklet 0.005 mm. Total length of anchors is 0.055–0.056 mm, main part 0.041–0.042 mm, point 0.025 mm, inner root 0.015-0.026 mm. Size of ventral bar is 0.005 x 0.020–0.021 mm, membrane 0.010–0.012 mm. Size of dorsal bar is 0.001 x 0.017–0.018 mm.

Found on fins of ***Squalius cephalus***; Elbe and Danube Rivers (Czechia); probably will be found in other countries of the Palaearctic.

223 (220). The inner root of the anchors lies approximately along the axis of the main part of the anchor.

G. vimbi Schulman, 1953 (Fig. 567)

Syn.: ***G. scardinii*** Malmberg, 1957

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.026–0.032 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.056–0.067 mm, main part 0.041–0.051 mm, point 0.024–0.031 mm, inner root 0.018–0.021 mm. Size of ventral bar is 0.006–0.008 x 0.024–0.028 mm, membrane 0.012–0.016 mm. Size of dorsal bar is 0.001–0.003 x 0.018–0.023 mm.

Found on fins and skin and in nasal cavities, and rarely on gills, of ***Vimba vimba***, ***Scardinius erythrophthalmus***, ***Rutilus rutilus***, ***R. r. lacustris***, rarely of ***Blicca bjoerkna***, ***Leuciscus leuciscus***, ***Squalius cephalus***, ***Gobio gobio***, and others (see host–parasite list); basins of the Black, Caspian, and Baltic Seas; Ob' River (Russia).

224 (211). The hooklets are of another type.

225 (226). The total length of the marginal hooks is less than 0.024 mm.

G. kafirniganensis Ergens et Daniyarov, 1976 (Fig. 568)

Body length can be up to 0.3 mm. Total length of marginal hooks is 0.020–0.024 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.052–0.058 mm, main part 0.040–0.044 mm, point 0.024–0.028 mm, inner root 0.015–0.019 mm. Size of ventral bar is 0.005–0.006 x 0.021–0.023 mm, membrane about 0.012 mm. Size of dorsal bar is 0.002–0.003 x 0.019–0.020 mm.

Found on fins of ***Schizothorax intermedius***; Kafirnihan River (Tajikistan).

226 (225). The total length of the marginal hooks is greater than 0.025 mm.

227 (228). The hooklet of the marginal hooks is of the ***G. barbi*** type (see Fig. 454, 9).

G. barbi Ergens, 1976 (Fig. 569)

Body length is 0.35–0.60 mm. Total length of marginal hooks is 0.028–0.033 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.064–0.071 mm, main part 0.045–0.053 mm, point 0.030–0.034 mm, inner root 0.020–0.024 mm. Size of ventral bar is 0.006–0.008 x 0.026–0.035 mm, membrane 0.013–0.017 mm. Size of dorsal bar is 0.002–0.004 x 0.019–0.023 mm.

Found on fins of ***Barbus barbus***, ***B. petenyi***, and ***B. lacerta cyri***; basins of the Black and Caspian Seas.

228 (227). The hooklet is of another type.

229 (238). The point and stalk of the hooklet are almost the same length.

230 (231). The length of the marginal hook handle is at least five times greater than the hooklet length.

G. aphyae Malmberg, 1957 (Fig. 570)

Body length is 0.35–0.60 mm. Total length of marginal hooks is 0.030–0.041 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.053–0.070 mm, main part 0.037–0.052 mm, point 0.024–0.034 mm, inner root 0.015–0.023 mm. Size of ventral bar is 0.005–0.009 x 0.022–0.033 mm, membrane 0.011–0.018 mm. Size of dorsal bar is 0.002–0.003 x 0.016–0.028 mm.

Found on fins, skin, and rarely on gills and in nasal cavities of ***Phoxinus phoxinus*** and ***P. czekanowskii***; widespread within the area of its host.

231 (230). The handle length of the marginal hooks exceeds the hooklet length, but not more than 4.8 times.

232 (233). The total length of the anchors is less than 0.055 mm.

G. longoacuminatus Zitnan, 1964 f. minor (Fig. 571)

Body length is about 0.25 mm. Total length of marginal hooks is 0.023–0.027 mm, hooklet 0.0045–0.005 mm. Total length of anchors is 0.045–0.055 mm, main part 0.035–0.041 mm, point 0.023–0.027 mm, inner root 0.014–0.019 mm. Size of ventral bar is 0.005–0.006 x 0.019–0.023 mm, membrane 0.010–0.012 mm. Size of dorsal bar is 0.001–0.002 x 0.012–0.019 mm.

Found on fins and skin of *Carassius auratus gibelio*, *Cyprinus carpio rubrofuscus*, and other cyprinids of the Amur region; on fins of *Phoxinus phoxinus* (Selenga River, Mongolia).

233 (232). The total length of the anchors is greater than 0.058 mm.

234 (235). The handle length of the marginal hooks exceeds the hooklet length, but not more than 3.5 times.

G. oreoleucisci Ergens et Dulmaa, 1970 (Fig. 572)

Body length is 0.35–0.8 mm. Total length of marginal hooks is 0.029–0.036 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.065–0.088 mm, main part 0.045–0.063 mm, point 0.026–0.036 mm, inner root 0.023–0.031 mm. Size of ventral bar is 0.007–0.009 x 0.027–0.038 mm, membrane 0.013–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.020–0.024 mm.

Found on fins and gills of *Oreoleuciscus potanini* and *O. humilis*; water bodies of West Mongolia.

235 (234). The handle length of the marginal hook is at least four times greater than the hooklet length.

236 (237). The ratio between the length of the cirrus sac and the total length of the marginal hooks is nearly 1:1.

G. longoacuminatus Zitnan, 1964 f. typica (Fig. 573)

Body length is 0.35–0.60 mm. Total length of marginal hooks is 0.029–0.036 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.058–0.071 mm, main part 0.045–0.054 mm, point 0.029–0.036 mm, inner root 0.018–0.024 mm. Size of ventral bar is 0.006–0.008 x 0.023–0.029 mm, membrane 0.014–0.017 mm. Size of dorsal bar is 0.002–0.004 x 0.015–0.024 mm.

Found on fins and skin of *Carassius carassius*, *C. auratus gibelio*, and *Cyprinus carpio* (?); widespread within the area of its hosts.

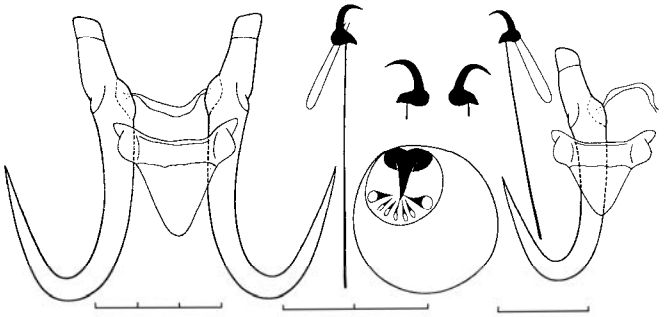
237 (236). The ratio between the length of the cirrus sac and the total length of the marginal hook is nearly 1:2.

G. baikalensis Bogolepova, 1950 (Fig. 574)

Body length can be up to 0.5 mm. Total length of marginal hooks is 0.030–0.031 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.066 mm, main part 0.047 mm, point 0.032 mm. Size of ventral bar is 0.007–0.008 x 0.027–0.028 mm, dorsal bar 0.002 x 0.017–0.018 mm.

Found on fins and gills of *Asprocottus herzensteini*, *Batrachocottus multiradiatus*, *B. nikolskii*, *Paracottus knerii*, *Limnocottus godlewskii*, *Cyphocottus megalops*, and *Leocottus kesslerii*; Lake Baikal.

238 (229). The point of the hooklet is shorter than the stalk.



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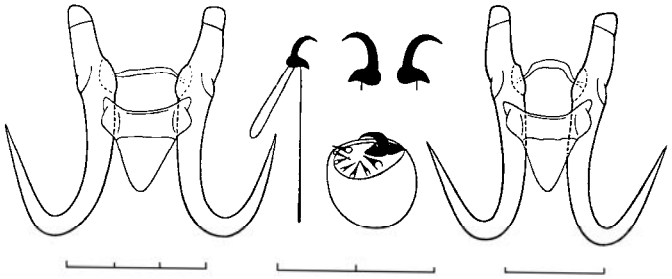

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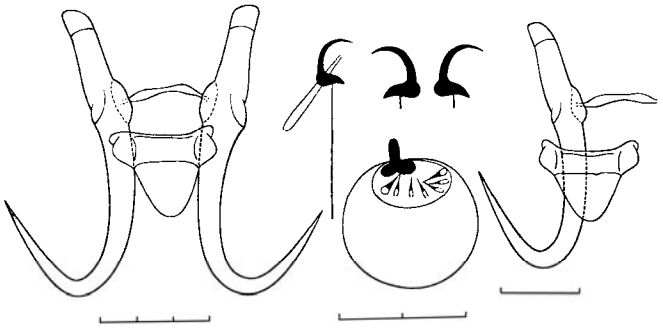

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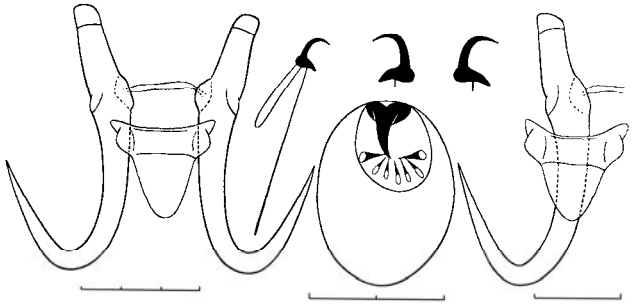
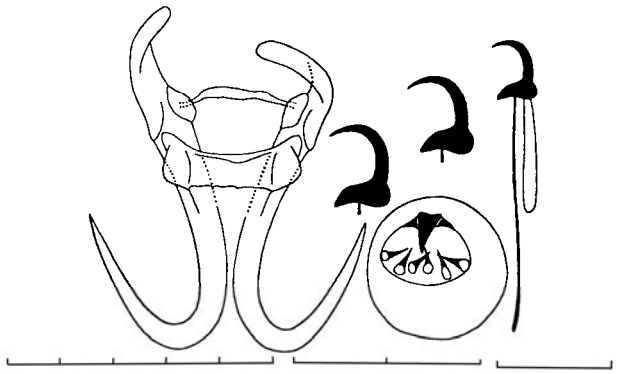


573

Fig. 570 – 573.
570 - *Gyrodactylus aphyae.* **571 -** *Gyrodactylus longoacuminatus* f. minor.**572 -** *Gyrodactylus oreoleucisci.* **573 -** *Gyrodactylus longoacuminatus* f. typica.



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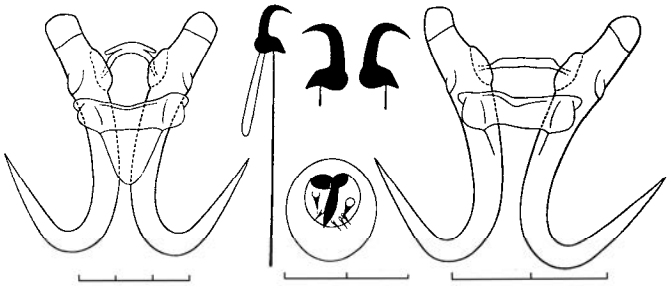

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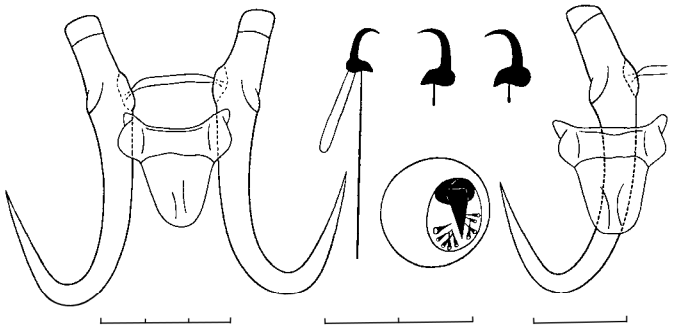

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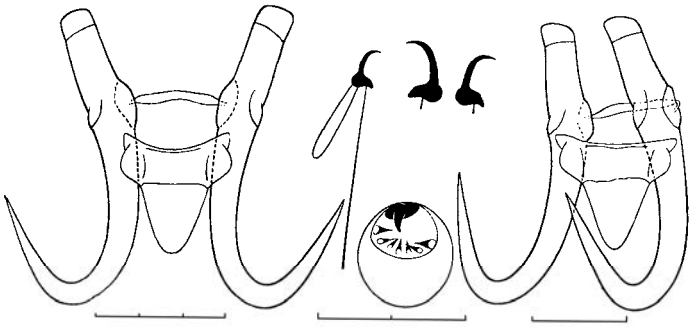


577

Fig. 574 – 577.
574 - *Gyrodactylus baikalensis.* **575** - *Gyrodactylus birmani.* **576** - *Gyrodactylus macrorhodei.* **577** - *Gyrodactylus gracilihamatus.*

239 (240). The total length of the marginal hooks is greater than 0.040 mm.
G. birmani Konovalov, 1967 (Fig. 575)

Body length is 0.35–0.65 mm. Total length of marginal hooks is 0.041–0.045 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.068–0.076 mm, main part 0.052–0.059 mm, point 0.033–0.040 mm, inner root 0.020–0.023 mm. Size of ventral bar is 0.007–0.010 x 0.028–0.034 mm, membrane 0.014–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.015–0.024 mm.

Found on fins of *Salvelinus malma* and *S. leucomaenis*; Lake Azabach'ye (Kamchatka), rivers of the Maritime Territory (Russia).

240 (239). The total length of the marginal hooks is less than 0.035 mm.

241 (244). The inner part of the hooklet base is stepped.

242 (243). The length of the main part of the anchors is greater than 0.053 mm.
G. macrorhodei Ergens et Yukhimenko, 1975 (Fig. 576)

Body length is about 0.35 mm. Total length of marginal hooks is 0.028–0.033 mm, hooklet 0.0055–0.007 mm. Total length of anchors is 0.066–0.070 mm, main part 0.053–0.056 mm, point 0.024–0.031 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.006–0.007 x 0.027–0.028 mm, membrane 0.019–0.021 mm. Size of dorsal bar is 0.002–0.003 x 0.018–0.021 mm.

Found on fins of *Rhodeus sericeus*; Amur River and rivers of the Maritime Territory (Russia). Ermolenko (1992) considered this species to be a synonym of *G. rhodei.*

243 (242). The length of the main part of the anchors is less than 0.050 mm.
G. gracilihamatus Malmberg, 1964 (Fig. 577)

Body length is 0.45–0.8 mm. Total length of marginal hooks is 0.025–0.032 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.057–0.080, main part 0.043–0.049 mm, point 0.024–0.031 mm, inner root 0.018–0.026 mm. Size of ventral part is 0.006–0.008 x 0.023–0.029 mm, membrane 0.013–0.018 mm. Size of dorsal bar is 0.001–0.002 x 0.017–0.025 mm.

Found on fins and skin of *Alburnus alburnus, Alburnoides bipunctatus, Rutilus rutilus, Squalius cephalus*, and *Blicca bjoerkna*; basins of the Black, Baltic, and Caspian Seas.

244 (241). The inner part of the hooklet base is smoothly tapered.

245 (246). The length of the main part of the anchors is less than 0.040 mm.
G. pannonicus Molnar, 1968 (Fig. 578)

Body length is 0.12–0.40 mm. Total length of marginal hooks is 0.025–0.029 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.045–0.054 mm, main part 0.033–0.038 mm, point 0.023–0.027 mm, inner root 0.012–0.018 mm. Size of ventral bar is 0.005–0.007 x 0.013–0.018 mm, membrane 0.008–0.010 mm. Size of dorsal bar is 0.001–0.002 x 0.013–0.020 mm.

Found on fins, skin, and rarely in nasal cavities of *Phoxinus phoxinus*; basins of the Baltic and Black seas, Skadar Lake (former Yugoslavia), Kola peninsular, Kolyma River (Russia), Selenga River (Mongolia).

246 (245). The length of the main part of the anchors is greater than 0.042 mm.

247 (248). The length of the anchor point is greater than 0.030 mm.
G. gobiensis Glaeser, 1974 (Fig. 579)

Body length is 0.4–0.75 mm. Total length of marginal hooks is 0.027–0.035 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.059–0.079 mm, main part 0.042–0.056 mm, point 0.030–0.037 mm, inner root 0.015–0.026 mm. Size of ventral bar is 0.006–0.007 x 0.026–0.031 mm, membrane 0.015–0.019 mm. Size of dorsal bar is 0.002–0.003 x 0.025–0.035 mm.

Found on fins, skin, and rarely gills of *Gobio gobio* and *Romanogobio kesslerii*; basins of the Baltic and Black Seas.

248 (247). The length of the anchor point is less than 0.029 mm.
G. hemibarbi Ergens, 1980 (Fig. 580)

Body length is about 0.35 mm. Total length of marginal hooks is 0.025–0.028 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.057–0.061 mm, main part 0.043–0.045 mm, point 0.026–0.029 mm, inner root 0.015–0.019 mm. Size of ventral bar is 0.005–0.007 x 0.023–0.028 mm, membrane 0.013–0.015 mm. Size of dorsal bar is 0.002 x 0.019–0.020 mm.

Found on fins and skin of *Barbus barbus*, *B. lacerta cyri*, and *Squalius cephalus*; Danube and Oder Rivers (Czechia), Lenkoranka River (Azerbaijan).

249 (141). The membrane of the ventral bar is widened posteriorly.

250 (251). The hooklet is of the *G. marjami* type (see Fig. 454, 10).
G. marjami Allamuratov et Gussev, 1969 (Fig. 581)

Body length is 0.3–0.4 mm. Total length of marginal hooks is 0.025–0.032 mm, hooklets 0.008–0.009 mm. Total length of anchors is 0.078–0.088 mm, main part 0.060–0.062 mm, point 0.026–0.032 mm, inner root 0.029–0.032 mm. Size of ventral bar is 0.008–0.010 x 0.018–0.023 mm, membrane 0.025–0.027 mm. Size of dorsal bar is 0.002–0.003 x 0.012–0.015 mm.

Found on gills and in nasal cavities of *Schizothorax intermedius*; basins of the Syrdar'ya and Kafirnihan Rivers (Tajikistan).

251 (250). The hooklet is of another type.

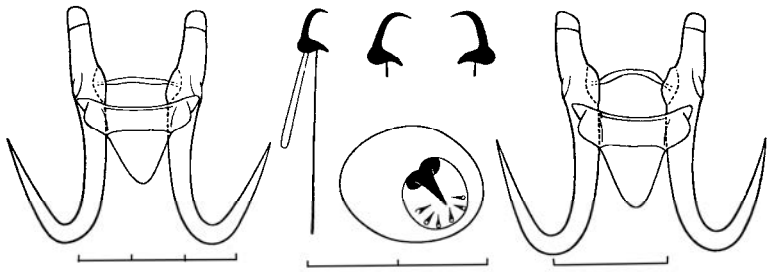
252 (253). The anchors are of the *G. limneus* type (see Fig. 455, 9).
G. limneus Malmberg, 1964 (Fig. 582)

Body length is 0.25–0.4 mm. Total length of marginal hooks is 0.019–0.022 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.048–0.057 mm, main part 0.033–0.041 mm, point 0.021–0.024 mm, inner root 0.018–0.019 mm. Size of ventral bar is 0.005–0.009 x 0.013–0.018 mm, membrane 0.014–0.018 mm. Size of dorsal bar is 0.001–0.003 x 0.008–0.011 mm.

Found on fins, skin, and rarely gills and in nasal cavities of *Phoxinus phoxinus, P. oxycephalus, P. percnurus, P. p. mantschuricus*, and *Oreoleuciscus humilis*; widely distributed in the area of its hosts. *G. limneus* has been confused with *G. phoxini* Malmberg, 1957 by many authors. *G. phoxini* lives on *Phoxinus phoxinus* in brackish waters (Malmberg, 1964, 1970); *G. limneus* (Fig. 583, 584) is found on the same fish but only in freshwater. The validity of these species seems to be doubtful, as data on variability of structures connected with water salinity exist for many species; resolution of this issue requires further study.

253 (252). The anchors are of another type.

254 (257). The external part of the hooklet base is enlarged and elongated (*G. barbatuli* type, Fig. 454, 11).



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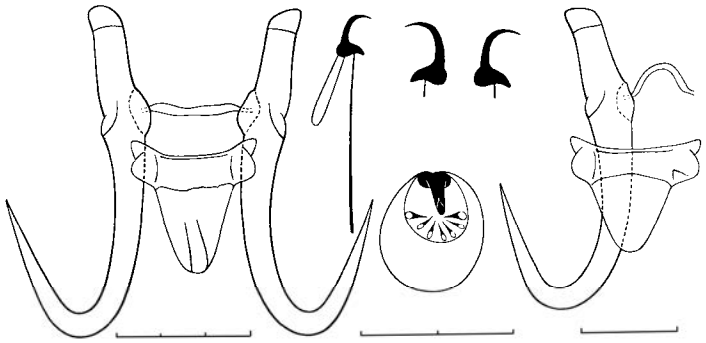

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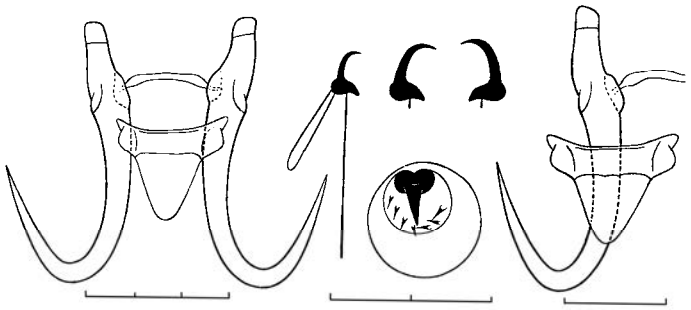

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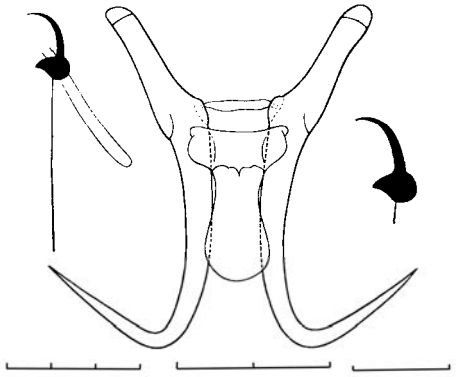
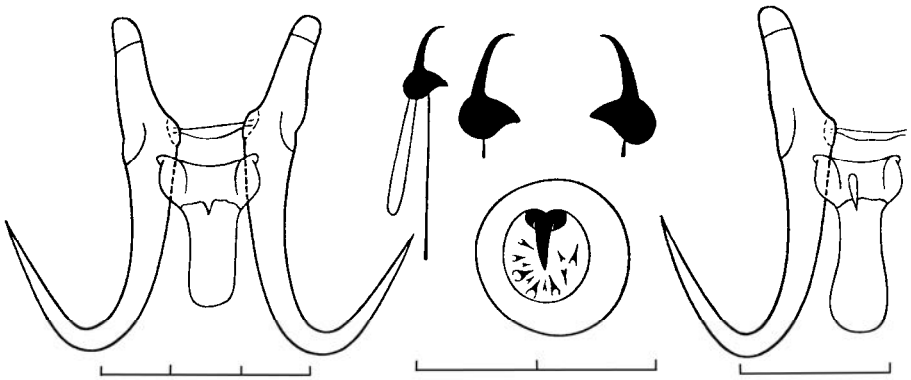


581

Fig. 578- 581.
578 - *Gyrodactylus pannonicus.* **579** - *Gyrodactylus gobiensis.* **580** - *Gyrodactylus hemibarbi.* **581** - *Gyrodactylus marjami.*



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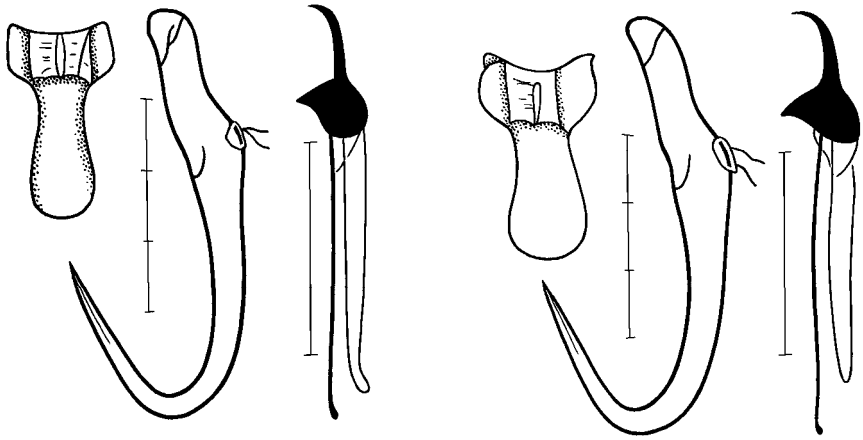
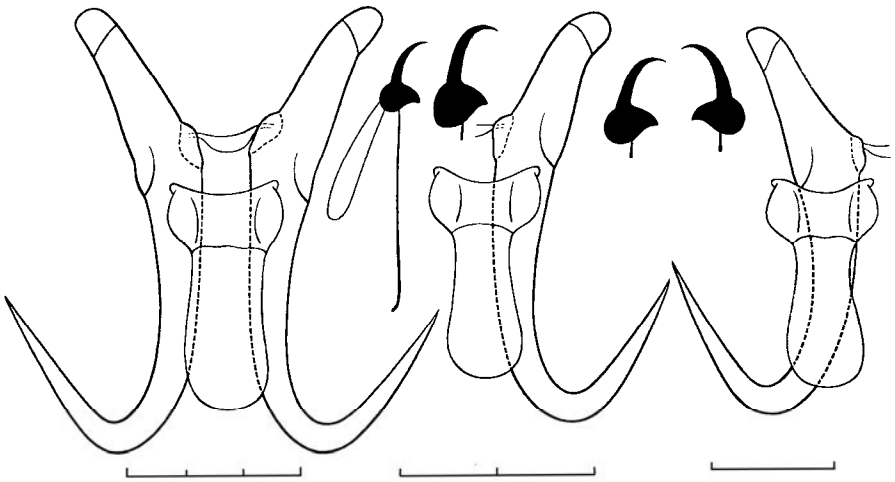


583 584



585

Fig. 582 – 585.
582 - *Gyrodactylus limneus.* **583 -** *Gyrodactylus phoxini* (after Malmberg, 1970). **584 -** *Gyrodactylus limneus* (after Malmberg, 1970). **585 -** *Gyrodactylus carassii* from *Carassius carassius.*

255 (256). The width of the hooklet base is shorter than the length of the blade.
G. carassii Malmberg, 1957 (Fig. 585, 586)

Body length is 0.4–1.0 mm. Total length of marginal hooks is 0.021–0.029 mm, hooklet 0.006–0.009 mm. Total length of anchors is 0.055–0.089 mm, main part 0.042–0.063 mm, point 0.023–0.039 mm, inner root 0.019–0.034 mm. Size of ventral bar is 0.006–0.014 x 0.014–0.028 mm, membrane 0.018–0.035 mm. Size of dorsal bar is 0.002–0.004 x 0.013–0.023 mm.

Found on fins, skin, and gills and in nasal cavities of *Carassius carassius*, *C. auratus gibelio*, *Scardinius erythrophthalmus*, *Alburnus alburnus*, *Rutilus rutilus*, *R. r. lacustris*, *Squalius cephalus*, and other cyprinids; widespread within the area of its hosts (see host–parasite list).

256 (255). The hooklet blade is shorter than the width of its base.
G. magnificus Malmberg, 1957 (Fig. 587)

Body length is 0.3–0.6 mm. Total length of marginal hooks is 0.026–0.029 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.073–0.089 mm, main part 0.052–0.064 mm, point 0.031–0.034 mm, inner root 0.023–0.029 mm. Size of ventral bar is 0.009–0.014 x 0.021–0.024 mm, membrane 0.026–0.031 mm. Size of dorsal bar is 0.003–0.004 x 0.013–0.017 mm.

Found on fins, skin, and gills and in nasal cavities of *Phoxinus phoxinus*, *P. czekanowskii*, *P. percnurus*, *Oreoleuciscus humilis*, *O. potanini*, *Rutilus rutilus* (?), and *R. r. lacustris* (?); widely distributed in the Palaearctic.

257 (254). The hooklet base is of another form.

258 (259). The hooklet blade is unbent.
G. sergeji Ergens, 1988 (Fig. 588)

Total length of marginal hooks is 0.025–0.026 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.060–0.064 mm, main part 0.044–0.046 mm, point 0.022–0.024 mm, inner root 0.024–0.026 mm. Size of ventral bar is 0.006–0.008 x 0.015–0.017 mm, membrane 0.018–0.021 mm. Size of dorsal bar is 0.002 x 0.009–0.010 mm.

Found on skin and fins of *Leuciscus waleckii*; Lake Golovino (Amur River Basin, Russia).

259 (258). The hooklet blade is declinate.

260 (261). The hooklet base width is greater than the blade length.
G. decorus Malmberg, 1957 (Fig. 589)

Total length of marginal hooks is 0.021–0.027 mm, hooklet 0.006–0.008 mm. Total length of anchors is 0.055–0.073 mm, main part 0.037–0.053 mm, point 0.022–0.030 mm, inner root 0.019–0.031 mm. Size of ventral bar is 0.006–0.009 x 0.013–0.020 mm, membrane 0.019–0.023 mm. Size of dorsal bar is 0.002–0.003 x 0.006–0.011 mm.

Found on skin and fins, and in the case of high infection on gills and in nasal cavities as well, of *Scardinius erythrophthalmus*, *Alburnus alburnus*, and *Rutilus rutilus*, and accidentally on *Gobio gobio*, *Leucaspius delineatus*, *Leuciscus leuciscus*, and *Squalius cephalus*; Czechia, Slovakia, Hungary, former Yugoslavia, and European part of Russia.

261 (260). The hooklet base width is less than the blade length.
G. tulensis Ergens, 1988 (Fig. 590)

Total length of the marginal hooks is 0.025–0.030 mm, hooklet 0.007–0.009 mm. Total length of anchors is 0.065–0.089 mm, main part 0.049–0.066 mm, point 0.02–0.036 mm, inner root 0.025–0.035 mm. Size of ventral bar is 0.008–0.013 x 0.017–0.025 mm, membrane 0.020–0.027 mm. Size of dorsal bar is 0.002–0.004 x 0.008–0.014 mm.

Found on fins, skin, and gills of *Leuciscus leuciscus baicalensis* and *L. idus*; Lakes Vrevo (Pskov region) and Pijaozero (Karelia), Rybinsk Reservoir (Volga River) (Russia); Tula River (Mongolia).

262 (1). The ventral bar lacks ear-like projections.

263 (270). The point and main part of the anchors are approximately the same length.

264 (269). The hooklets blade lacks sharp bends.

265 (266). The total length of the marginal hooks is less than 0.020 mm.
G. angorae Ergens et Ibragimov, 1979 (Fig. 591)

Body length is about 0.35 mm. Total length of marginal hooks is 0.018–0.019 mm, hooklet 0.004 mm. Total length of anchors is 0.035–0.038 mm, main part 0.021–0.023 mm, point 0.022–0.024 mm, inner root 0.015–0.016 mm. Size of ventral bar is 0.003–0.004 x 0.013–0.015 mm, membrane 0.005–0.008 mm. Size of dorsal bar is 0.001–0.004 x 0.011–0.013 mm.

Found on fins and skin of *Barbatula bergiana*; Lenkoranka River (Azebaijan).

266 (265). The total length of the marginal hooks is greater than 0.023 mm.

267 (268). The total length of the anchors is less than 0.050 mm.
G. fossilis Lupu et Roman, 1956 (Fig. 592)

Body length is about 0.4 mm. Total length of marginal hooks is 0.025–0.027 mm, hooklet 0.005–0.008 mm. Total length of anchors is 0.041–0.048 mm, main part 0.026–0.031 mm, point 0.019–0.031 mm, inner root 0.019–0.021 mm. Size of ventral bar is 0.004–0.006 x 0.016–0.021 mm, membrane 0.008–0.012 mm. Size of dorsal bar is 0.002–0.003 x 0.014–0.017 mm.

Found on skin and gills of *Misgurnus fossilis*; basin of the Black Sea.

268 (267). The total length of the anchors is greater than 0.050 mm.
G. strelkovi Ergens et Danilov, 1983 (Fig. 489, B)

Body length is 0.8–0.9 mm. Total length of marginal hooks is 0.035–0.036 mm, hooklet 0.006 mm. Total length of anchors is 0.036–0.039 mm, main part 0.028–0.031 mm, point 0.019 mm, inner root 0.017–0.019 mm. Size of ventral bar is 0.006 x 0.018mm. Size of dorsal bar is 0.002 x 0.014–0.016 mm.

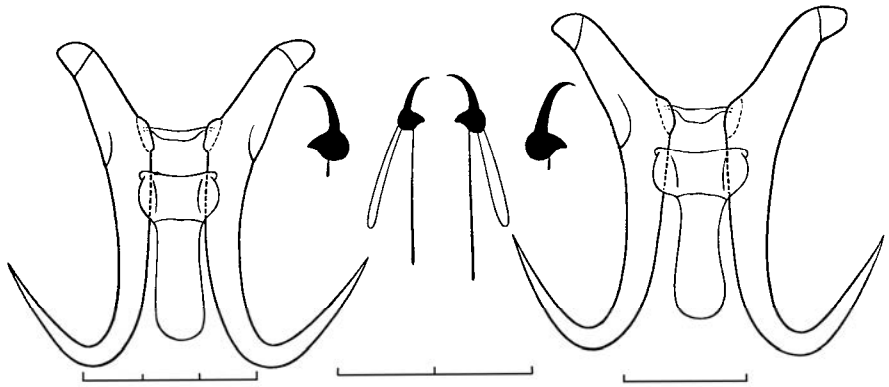
Found on fins of *Misgurnus mohoity*; Amur River Basin (Russia).

269 (264). The hooklet blade has two more or less sharp bends.
G. cobitis Bychowsky, 1933 (Fig. 593).

Body length is 0.3–0.5 mm. Total length of marginal hooks is 0.024–0.026 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.041–0.046 mm, main part 0.026–0.031 mm, point 0.024–0.026 mm, inner root 0.016–0.020 mm. Size of ventral bar is 0.004–0.005 x 0.019–0.023 mm, membrane 0.009–0.013 mm. Size of dorsal bar is 0.002–0.006 x 0.013–0.017 mm.

Found on gills, fins, and skin of *Cobitis taenia*, *C. melanoleuca*, and *Misgurnus fossilis*; Black Sea Basin, Ob' River (Russia).

270 (263). The anchor point is shorter than the main part.



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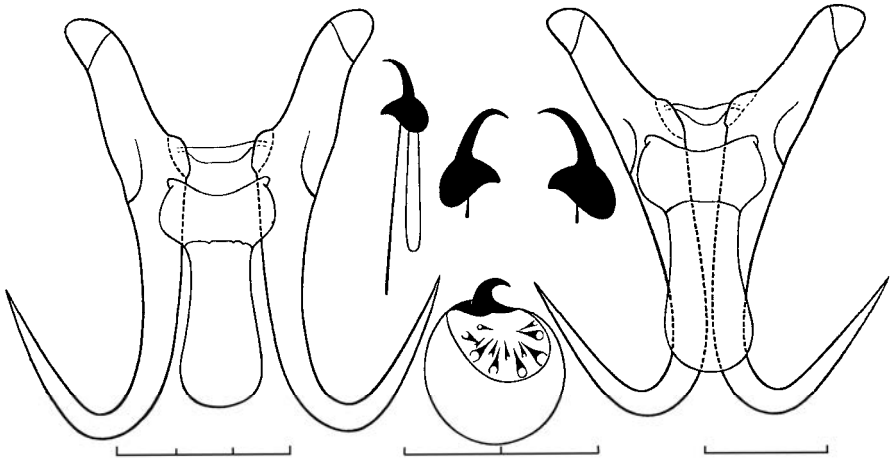
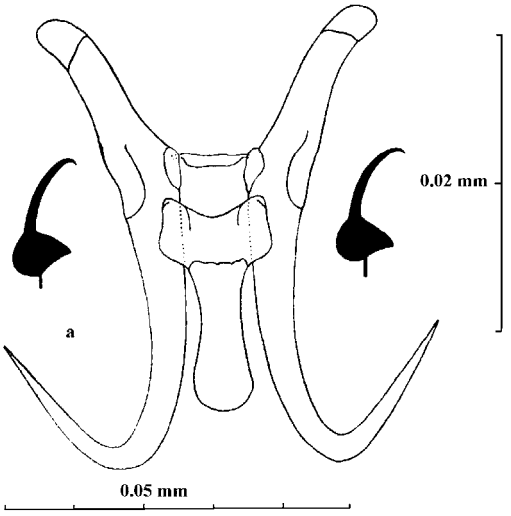


587

Fig. 586 – 587
586 - *Gyrodactylus carassii* from *Scardinius erythrophthalmus*. **587** - *Gyrodactylus magnificus.*



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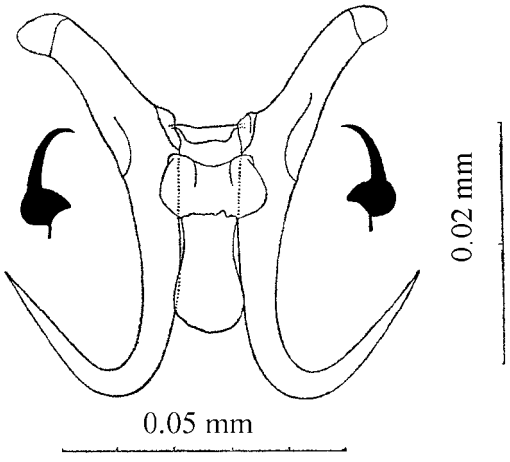
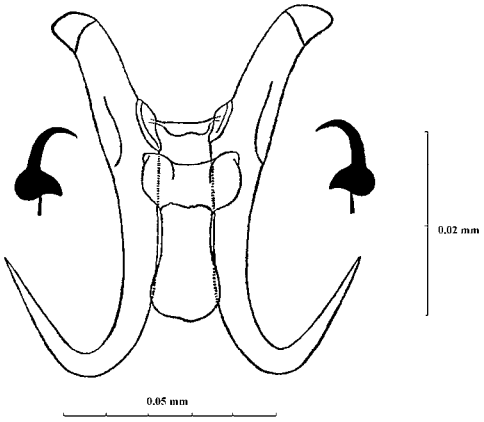


589

Fig. 588-589.
588 - *Gyrodactylus sergeji* (after Ergens, 1988). **589 -** *Gyrodactylus decorus* (after Ergens, 1988).



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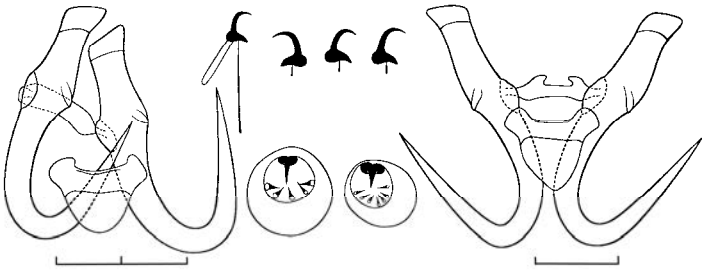

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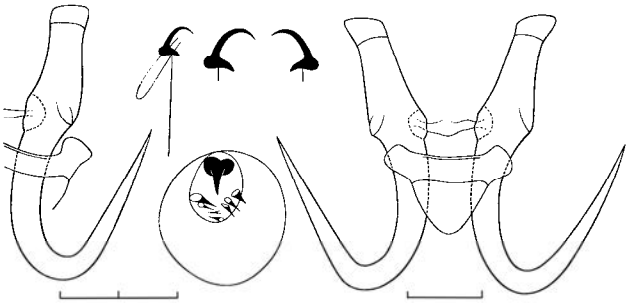

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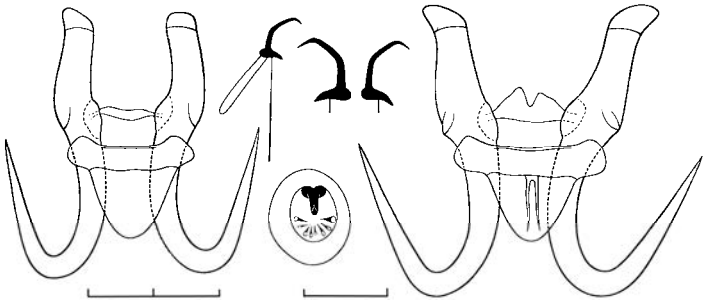


593

Fig. 590 – 593.
590 - *Gyrodactylus tulensis* (after Ergens, 1988). **591** - *Gyrodactylus angorae*. **592** - *Gyrodactylus fossilis.* **593** - *Gyrodactylus cobitis.*

271 (276). The hooklet point exceeds the level of its base.

272 (273). The total length of the anchors is less than 0.040 mm.
G. anguillae Ergens, 1960 (Fig. 594)

Body length is 0.4–0.65 mm. Total length of marginal hooks is 0.023–0.025 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.031–0.037 mm, main part 0.026–0.033 mm, point 0.013–0.017 mm, inner root 0.009–0.013 mm. Size of ventral bar is 0.004–0.005 x 0.010–0.015 mm, membrane 0.005–0.010 mm. Size of dorsal bar is 0.001–0.002 x 0.009–0.016 mm.

Found on gills and skin of *Anguilla anguilla* and *A. japonica*; found on eels cultured in the fish farm of Konakovo (Tver province, upper Volga, Russia).

273 (272). The total length of the anchors is greater than 0.060 mm.

274 (275). The total length of the anchors is less than 0.080 mm.
G. taimeni Ergens, 1971 (Fig. 595)

Body length is about 0.4 mm. Total length of marginal hooks is 0.033–0.034 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.067–0.072 mm, main part 0.051–0.055 mm, point 0.032–0.033 mm, inner root 0.025–0.028 mm. Size of ventral bar is 0.008–0.009 x 0.026–0.029 mm, membrane 0.015–0.017 mm. Size of dorsal bar is 0.002 x 0.020–0.022 mm.

Found on gills of *Hucho taimen* and *Brachymystax lenok*; water bodies of Mongolia (Yenisey and Selenga Rivers); probably will be found in Siberia and the Amur region.

275 (274). The total length of the anchors is greater than 0.080 mm.
G. somnaensis Ergens et Yukhimenko, 1990 (Fig. 596)

Total length of marginal hooks is 0.032–0.033 mm, hooklet 0.009–0.010 mm. Total length of anchors is 0.096–0.106 mm, main part 0.065–0.069 mm, point 0.039–0.044 mm, inner root 0.043–0.055 mm. Size of ventral bar is 0.015–0.017 x 0.024–0.026 mm, membrane 0.044–0.047 mm. Size of dorsal bar is 0.005–0.006 x 0.007–0.010 mm.

Found on fins and skin of *Phoxinus phoxinus* and young *Oncorhynchus keta* (temporary host); Somna River (Amur River Basin, Russia).

276 (271). The hooklet point does not reach the level of its base.

277 (278). The inner root of the anchors broadens to the end.
G. sedelnikowi Gvosdev, 1950 (Fig. 597)
Syn.: *G. amurensis* Akhmerov, 1952; *G. dubius* Roman, 1956

Body length is 0.3–0.45 mm. Total length of marginal hooks is 0.018–0.022 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.030–0.041 mm, main part 0.024–0.033 mm, point 0.012–0.020 mm, inner root 0.007–0.011 mm. Size of ventral bar is 0.005–0.007 x 0.013–0.015 mm, membrane 0.009–0.012 mm. Size of dorsal bar is 0.002 x 0.006–0.010 mm.

Found on gills of *Barbatula barbatula*, *B. toni*, and *B. t. markakulensis*; widespread, possibly in whole area of its hosts.

278 (277). The inner root of the anchors does not broaden to the end.

279 (280). The main part of the anchors turns into a point with a sharp-stepped narrowing from the inner side of the anchor.
G. curiosus Gussev, 1955 (Fig. 598)

Body length is about 0.45 mm. Total length of marginal hooks is 0.018–0.022 mm, hooklet 0.005 mm. Total length of anchors is 0.074–0.078 mm, main part 0.057–0.060 mm, point 0.028–0.034 mm, inner root 0.029–0.031 mm. Size of ventral bar is 0.007–0.008 x 0.026–0.030 mm, membrane 0.016–0.022 mm. Size of dorsal bar is 0.001–0.002 x 0.021–0.025 mm.

Found on gills of *Lefua pleskei*; Lake Khanka (Amur region), Maritime Territory (Russia).

280 (279). The main part of the anchors gradually narrows and turns into a point .

281 (288). The anchor point is shorter than the inner root.

282 (283). The total length of the anchors is greater than 0.08 mm.
G. cyprini Diarova, 1964 (Fig. 599)
Syn. and hom.: *G. cyprini* Osmanov, 1964; nec. *G. cyprini* Kollman, 1968

Body length is 0.5–0.9 mm. Total length of marginal hooks is 0.025–0.037 mm, hooklet 0.005–0.007 mm. Total length of anchors is 0.088–0.140 mm, main part 0.068–0.084 mm, point 0.034–0.053 mm, inner root 0.056–0.060 mm. Size of ventral bar is 0.008–0.017 x 0.029–0.038 mm, membrane 0.028–0.044 mm. Size of dorsal bar is 0.004–0.007 x 0.013–0.021 mm.

Found on skin, gills, and fins of *Cyprinus carpio*; widely distributed in the Palaearctic.

283 (282). The total length of the anchors is less than 0.070 mm.

284 (285). The total length of the anchors is greater than 0.050 mm.
G. hypophthalmichthysi Ling, 1962 (Fig. 600)

Body length is 0.3–0.55 mm. Total length of marginal hooks is 0.019–0.025 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.057–0.065 mm, main part 0.039–0.044 mm, point 0.019–0.027 mm, inner root 0.025–0.036 mm. Size of ventral bar is 0.004–0.007 x 0.017–0.019 mm, membrane 0.018–0.021 mm. Size of dorsal bar is 0.002 x 0.011–0.017 mm.

Found on gills and fins of *Hypophthalmichthys molitrix*; Liao He River (China); found in Russia and Central Asia on cultured fishes.

285 (284). The total length of the anchors is less than 0.050 mm.

286 (287). The inner root of the anchors and the axis of the main part of the anchor form an angle of almost 90º.
G. monstruosus Gussev, 1955 (Fig. 601)

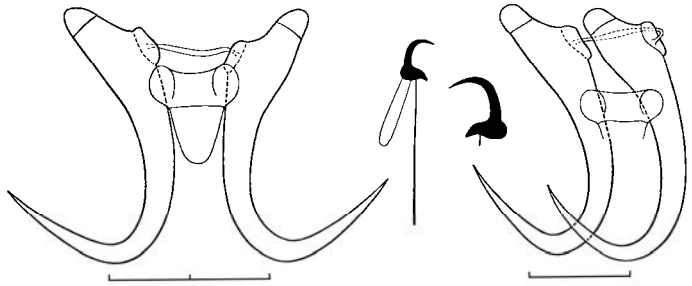
Body length is about 0.5 mm. Total length of marginal hooks is 0.016–0.018 mm, hooklet 0.004–0.006 mm. Total length of anchors is 0.040–0.044 mm, main part 0.034–0.037 mm, point 0.017–0.020 mm, inner root 0.024–0.027 mm. Size of ventral bar is 0.003–0.005 x 0.014–0.017 mm, membrane 0.009–0.012 mm. Size of dorsal bar is 0.001 x 0.010–0.013 mm.

Found on skin, fins, and gills of *Misgurnus mohoity*, *Lefua pleskei*, and *Cobitis lutheri* (?); Lake Khanka (Amur region, Russia), Suifun River (Maritime Territory, Russia).

287 (286). The inner root of the anchors and the axis of the main part of the anchor form an acute angle.
G. sibiricus Ergens, 1980 (Fig. 602)

Body length is 0.3–0.4 mm. Total length of marginal hooks is about 0.015 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.044–0.046 mm, main part 0.034–0.036 mm, point 0.017–0.019 mm, inner root 0.019–0.022 mm. Size of ventral bar is 0.005–0.006 x 0.014–0.015 mm, membrane 0.010–0.011 mm. Size of dorsal bar is 0.001 x 0.011–0.012 mm.

Found on fins of *Cobitis melanoleuca*; described from Mongolia, probably will be found in water bodies of Siberia.



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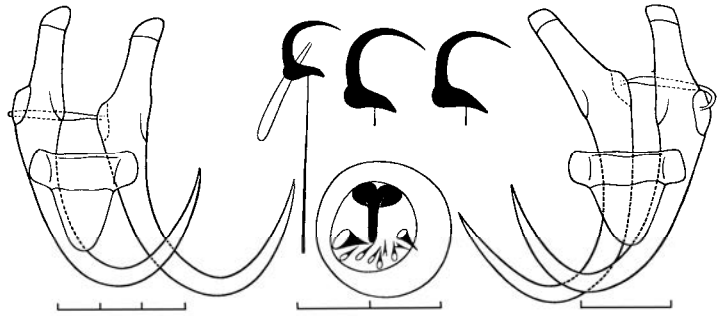

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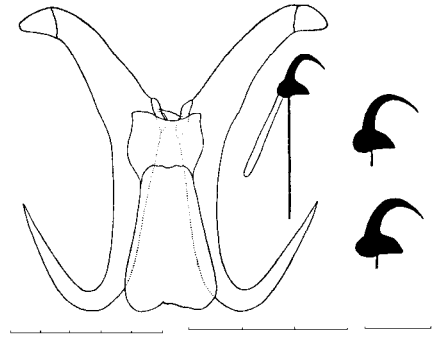

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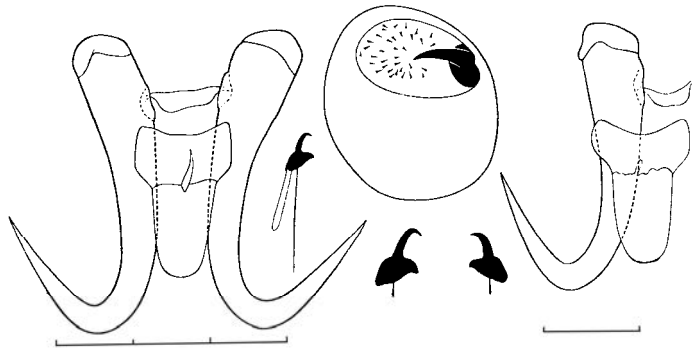

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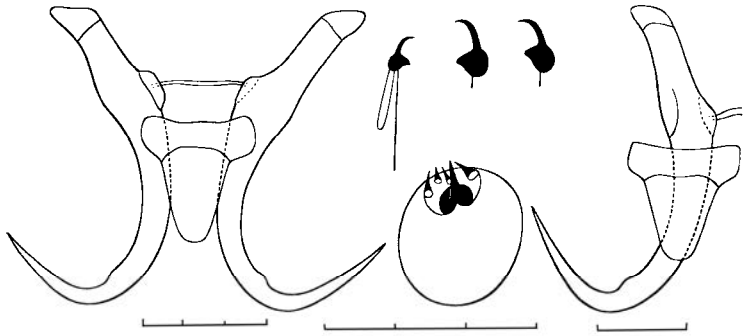
Fig. 594 – 597.
594 - *Gyrodactylus anguillae.* **595 -** *Gyrodactylus taimeni.* **596 -** *Gyrodactylus somnaensis* (after Ergens et Yukhimenko, 1990). **597 -** *Gyrodactylus sedelnikowi*



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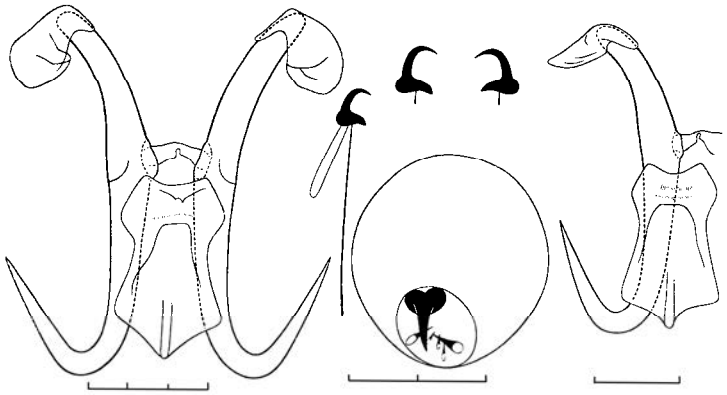

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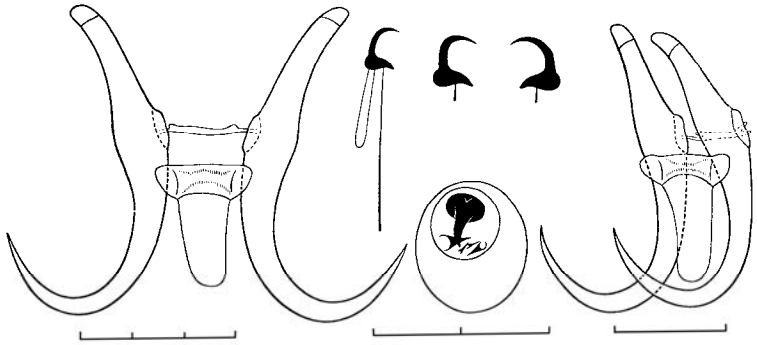

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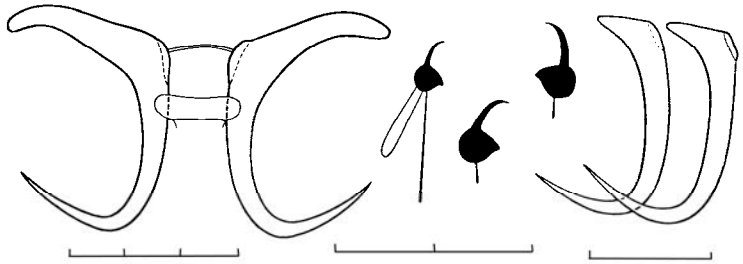

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Fig. 598 – 601.
598 - *Gyrodactylus curiosus.* **599** - *Gyrodactylus cyprini.* **600** - *Gyrodactylus hypophthalmichthysi.* **601** - *Gyrodactylus monstruosus.*

288 (281). The inner root of the anchors is shorter than the point.

289 (290). The anchors are of the *G. narzikulovi* type (see Fig. 455, 8).
G. narzikulovi Ergens et Djalilov, 1979 (Fig. 603)

Body length is about 0.25 mm. Total length of marginal hooks is 0.015–0.016 mm, hooklet 0.004 mm. Length of anchors is 0.033–0.034 mm, main part 0.026–0.029 mm, point 0.012–0.014 mm, inner root 0.010–0.011 mm. Size of ventral bar is 0.005–0.006 x 0.011–0.012 mm. Size of dorsal bar is 0.001 x 0.006–0.007 mm.

Found on gills and fins of *Schizopygopsis stoliczkai* and *Schizothorax intermedius*; Vanch and Gunt Rivers (Tajikistan, Pamir).

290 (289). The anchors are of another type.

291 (292). The anchor point turns into a main part by a sharp visible bend.
G. menschikowi Gvosdev, 1950 (Fig. 604).

Body length is about 0.3 mm. Total length of marginal hooks is 0.013–0.017 mm, hooklet 0.004–0.006 mm. Total length of anchors is 0.042–0.053 mm, main part 0.035–0.046 mm, point 0.017–0.020 mm, inner root 0.014–0.020 mm. Size of ventral bar is 0.005–0.008 x 0.012–0.018 mm, membrane 0.010–0.021 mm. Size of dorsal bar is 0.001–0.002 x 0.008–0.013 mm.

Found on gills of *Barbatula barbatula*, *B. toni*, and *B. t. markakulensis*; widespread in the area of its hosts.

292 (291). The anchor point turns into a main part smoothly without a bend.

293 (298). The membrane of the ventral bar is in the form of two ribbon projections.

294 (295). The total length of the anchors is less than 0.045 mm.
G. parvus Bychowsky, 1936 (Fig. 605)

Body length can be up to 0.25 mm. Total length of marginal hooks is 0.013–0.016 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.038–0.042 mm, main part 0.030–0.034 mm, point 0.018–0.019 mm, inner root 0.012–0.015 mm. Size of ventral bar is 0.004–0.005 x 0.011–0.015 mm, membrane about 0.010 mm. Size of dorsal bar is 0.001 x 0.007–0.011 mm.

Found on gills of *Triplophysa stoliczkai* and *T. strauchi*; several water bodies of Central Asia.

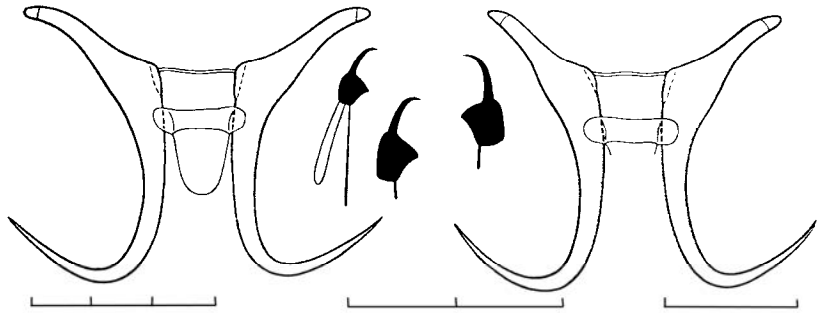
295 (294). The total length of the anchors is greater than 0.050 mm.

296 (297). The length of the hooklet is less than 0.0055 mm.
G. luckyi Ergens, 1970 (Fig. 606)

Body length is about 0.35 mm. Total length of marginal hooks is 0.015–0.017 mm, hooklet 0.005–0.0055 mm. Total length of anchors is 0.057–0.064 mm, main part 0.047–0.052 mm, point 0.023–0.027 mm, inner root 0.017–0.020 mm. Size of ventral bar is 0.007–0.008 x 0.021–0.023 mm, membrane 0.017–0.023 mm. Size of dorsal bar is 0.001–0.002 x 0.014–0.017 mm.

Found on gills of *Triplophysa strauchi*; Tesiyn River (Mongolia), probably will be found in Central Asia.

297 (296). The length of the hooklet is greater than 0.0066 mm.
G. tibetanus Djalilov, 1980 (Fig. 607)



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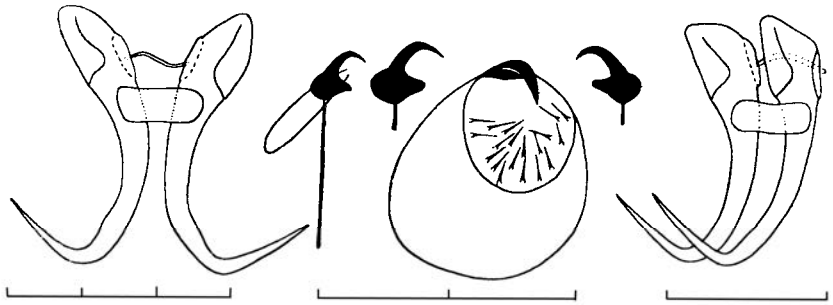

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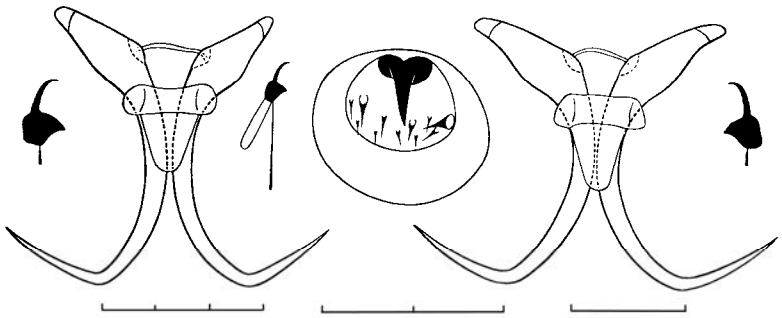

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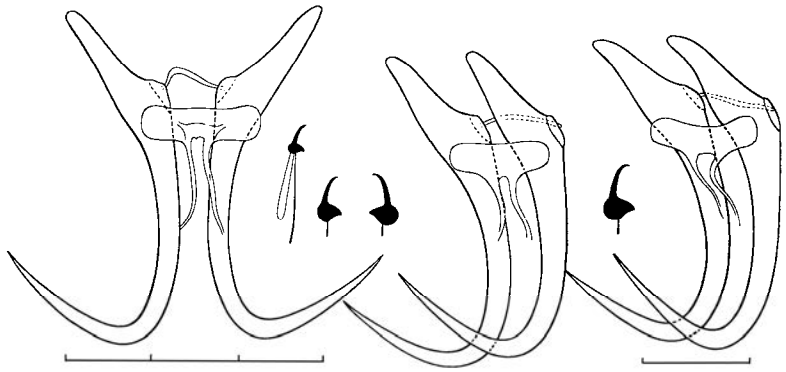

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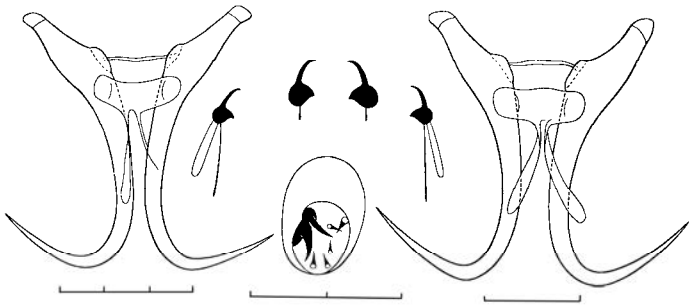
Fig. 602 – 605.
602 - *Gyrodactylus sibiricus.* **603** - *Gyrodactylus narzikulovi.* **604** - *Gyrodactylus menschikowi.* **605** - *Gyrodactylus parvus.*



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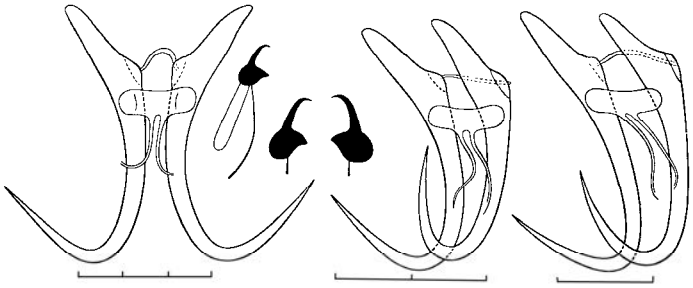

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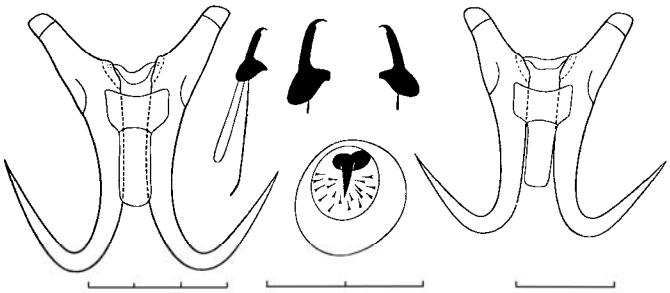

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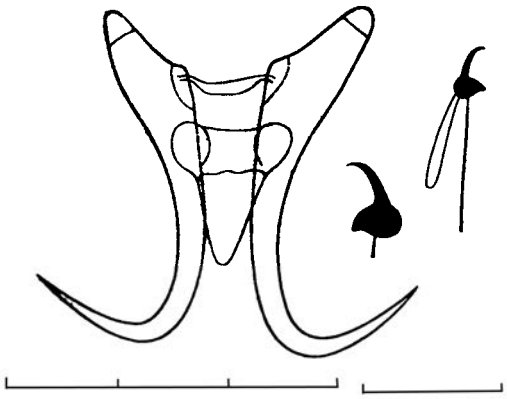

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Fig. 606 – 609.
606 - *Gyrodactylus luckyi.* **607** - *Gyrodactylus tibetanus.* **608** - *Gyrodactylus markakulensis.* **609** - *Gyrodactylus paraminimus.*

Body length can be up to 0.4 mm. Total length of marginal hooks is 0.020–0.021 mm, hooklet 0.0066–0.007 mm. Total length of anchors is 0.059–0.064 mm, main part 0.045–0.048 mm, point 0.027–0.029 mm, inner root 0.020–0.022 mm. Size of ventral bar is 0.005–0.006 x 0.017–0.018 mm, membrane 0.018–0.019 mm. Size of dorsal bar is 0.001–0.002 x 0.015–0.017 mm.

Found on gills of *Triplophysa stoliczkai*; Lake Bulyun-Kul' (Tajikistan).

298 (293). The membrane of the ventral bar is linguiform.

299 (300). The hooklet is of the *G. markakulensis* type (see Fig. 454, 12).
G. markakulensis Gvosdev, 1950 (Fig. 608)

Body length is 0.35–0.6 mm. Total length of marginal hooks is 0.018–0.026 mm, hooklet is 0.006–0.009 mm. Total length of anchors is 0.046–0.065 mm, main part 0.037–0.049 mm, point 0.022–0.030 mm, inner root 0.012–0.022 mm. Size of ventral bar is 0.007–0.011 x 0.013–0.017 mm, membrane 0.010–0.020 mm. Size of dorsal bar is 0.002–0.004 x 0.006–0.011 mm.

Found on gills, skin, and fins and rarely in nasal cavities of *Gobio gobio*, *G. acutipinnatus*, *G. carpathicus*, *G. lepidolaemus*, *Romanogobio albipinnatus*, and *R. tenuicorpus*; widespread within the area of its hosts.

300 (299). The hooklet is of another type.

301(304). The anchors are of the *G. dulmaae* type (see Fig. 455, 2).

302 (303). The width of the ventral bar exceeds the length of its membrane.
G. paraminimus Ergens, 1966 (Fig. 609)

Body length is 0.22 mm. Total length of marginal hooks is 0.018–0.019 mm, hooklet 0.005 mm. Total length of anchors is 0.031 mm, main part 0.024 mm, point 0.012 mm, inner root 0.009 mm. Size of ventral bar is 0.004 x 0.011 mm, membrane 0.009 mm. Size of dorsal bar is 0.001 x 0.009 mm.

Found on gills of *Chondrostoma nasus*; Latoriza River (Danube River Basin, Slovakia); probably will be found in other countries of the Palaearctic.

303 (302). The width of the ventral bar is less than the length of its membrane.
G. dulmaae Ergens, 1970 (Fig. 610)

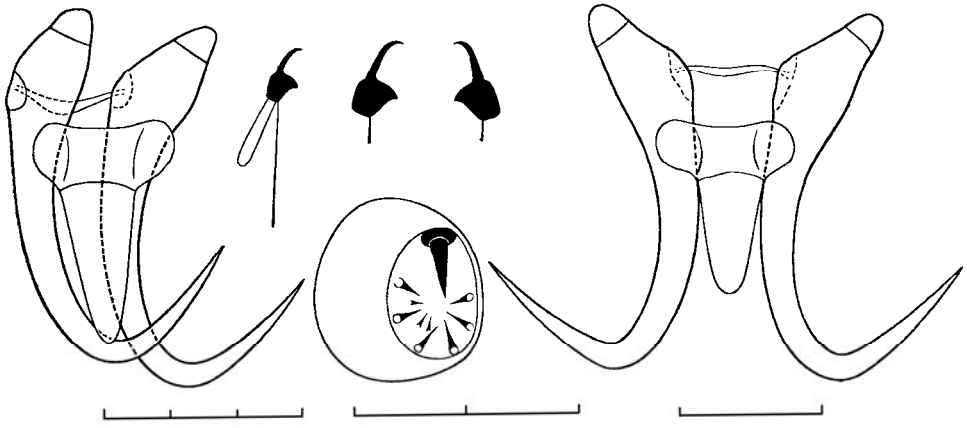
Body length is about 0.25 mm. Total length of marginal hooks is 0.016–0.018, hooklet 0.005 mm. Total length of anchors is 0.031–0.034 mm, main part 0.026–0.030 mm, point 0.013–0.014 mm, inner root 0.009–0.010 mm. Size of ventral bar is 0.004–0.006 x 0.011–0.013 mm, membrane 0.012–0.015 mm. Size of dorsal bar is 0.001 x 0.008–0.010 mm.

Found on gills of *Barbatula toni* and *Phoxinus phoxinus*; water bodies of Mongolia and the Maritime Territory (Russia).

304 (301). The anchors are of another type.

305 (306). The hooklet is of the *G. barbatuli* type (see Fig. 454, 11).
G. barbatuli Akhmerov, 1952 f. typica (Fig. 611, 612)

Body length is 0.35–0.65 mm. Total length of marginal hooks is 0.023–0.025 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.068–0.079 mm, main part 0.055–0.061 mm, point 0.030–0.034 mm, inner root 0.019–0.025 mm. Size of ventral bar is 0.010–0.012 x 0.023–0.028 mm, membrane 0.020–0.025 mm. Size of dorsal bar is 0.002–0.003 x 0.018–0.021 mm.



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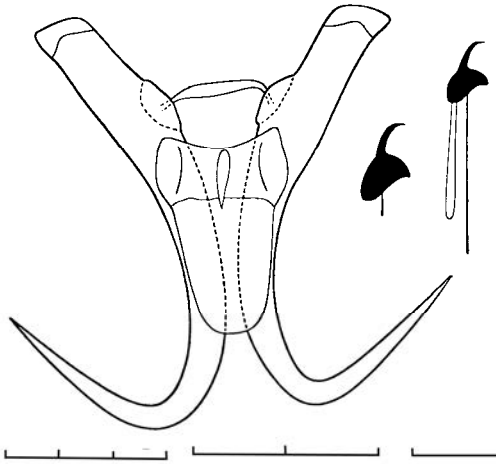

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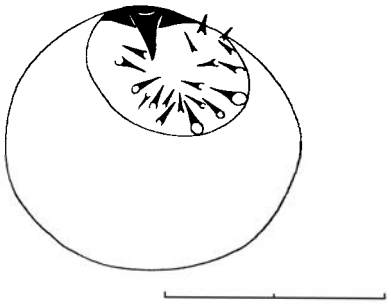

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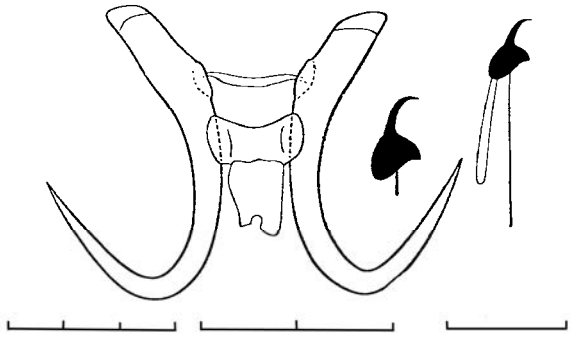

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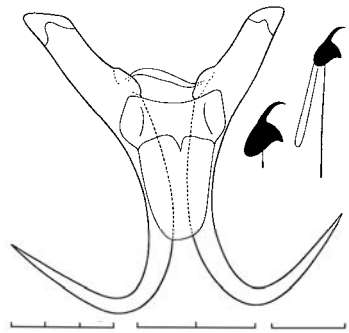
Fig. 610 – 613.
610 - *Gyrodactylus dulmaae.* **611 -** *Gyrodactylus barbatuli* f. typica. **612 -** Cirrus of *Gyrodactylus barbatuli* f. typica. **613 -** *Gyrodactylus barbatuli* f. "A".



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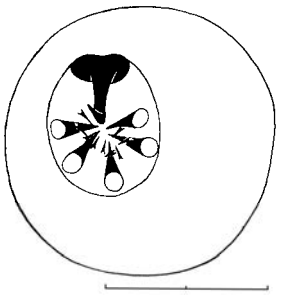

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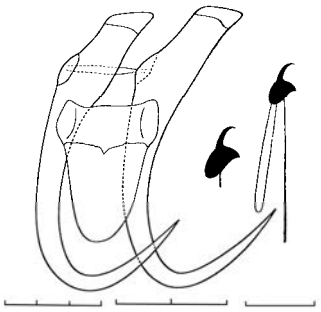

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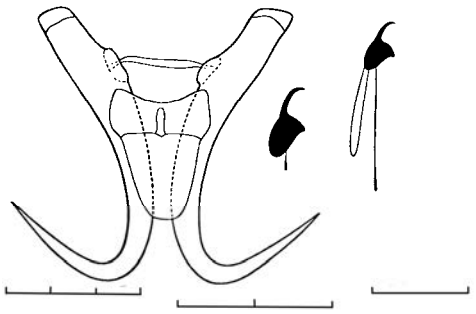

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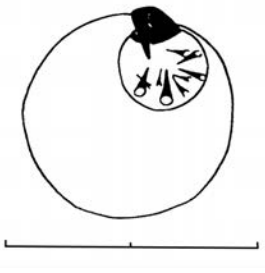

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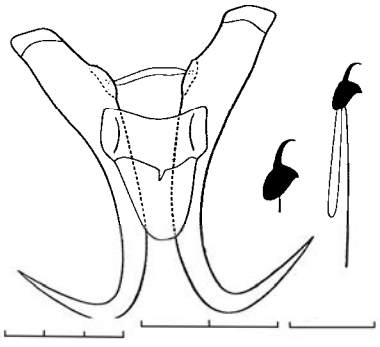


619

Fig. 614 – 619.
614 - *Gyrodactylus barbatuli* f. "B". **615 -** Cirrus of *Gyrodactylus barbatuli* f. "B". **616 -** *Gyrodactylus barbatuli* f. "C". **617 -** *Gyrodactylus barbatuli* f. "D". **618 -** Cirrus of *Gyrodactylus barbatuli* f. "D". **619 -** *Gyrodactylus barbatuli* f. "E".

Found on fins and gills of *Barbatula toni*; Lake Bolon' (Amur River Basin) and the Maritime Territory (Russia).

Other forms of *G. barbatuli* have been found by Ergens (1969). They differ one from another by size of some of the haptor structures.

G. barbatuli f. "A" (Fig. 613)

Total length of marginal hooks is 0.022–0.023 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.053–0.060 mm, main part 0.043–0.047 mm, point 0.024–0.031 mm, inner root 0.018–0.021 mm. Size of ventral bar is 0.008–0.012 x 0.018–0.023 mm, membrane 0.013–0.016 mm. Size of dorsal bar is 0.002 x 0.015–0.018 mm.

Found on fins of *Barbatula toni*; Kerulen River (Mongolia). It differs from the typical form by smaller anchor sizes and a longer membrane of the ventral bar.

G. barbatuli f. "B" (Fig. 614, 615)

Total length of marginal hooks is 0.027–0.029 mm, hooklet 0.007–0.009 mm. Total length of anchors is 0.088–0.099 mm, main part 0.069–0.079 mm, point 0.037–0.040 mm, inner root 0.028–0.034 mm. Size of ventral bar is 0.014–0.015 x 0.031–0.034 mm, membrane 0.028–0.033 mm. Size of dorsal bar is 0.003 x 0.019–0.027 mm.

Found on fins and gills of *Barbatula toni*; Selbe and Tula Rivers (Mongolia). This form differs from the typical one in terms of anchors size (larger), ventral bar, membrane, and a larger length of marginal hooks, especially their handle.

G. barbatuli f. "C" (Fig. 616).

Total length of marginal hooks is 0.033–0.034 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.092–0.094 mm, main part 0.072–0.074 mm, point 0.039–0.040 mm, inner root 0.027–0.030 mm. Size of ventral bar is 0.013–0.015 x 0.032–0.033 mm, membrane 0.029–0.030 mm. Size of dorsal bar is 0.003 x 0.024–0.025 mm.

Found on fins of *Barbatula toni*; Tula River (Mongolia). The anchors and bars are nearly identical to those of *G. barbatuli* f. "B," but the marginal hooks are larger than those of form "B."

G. barbatuli f. "D" (Fig. 617, 618)

Total length of marginal hooks is 0.024–0.025, hooklets 0.006–0.007 mm. Total length of anchors is 0.062–0.067 mm, main part 0.048–0.052 mm, point 0.026–0.032 mm, inner root 0.019–0.024 mm. Size of ventral bar is 0.008–0.011 x 0.023–0.025 mm, membrane 0.015–0.020 mm. Size of dorsal bar is 0.002–0.003 x 0.018–0.022 mm.

Found on fins and gills of *Barbatula barbatula*; several water bodies of Czechia and Hungary; probably will be found in other countries of the Palaearctic.

This form is between *G. barbatuli* f. typica and *G. barbatuli* f."A" when comparing the size of the chitinoid structures of the haptor.

G. barbatuli f. "E" (Fig. 619)

Total length of marginal hooks is 0.028–0.030 mm, hooklet 0.008 mm. Total length of anchors is 0.068–0.078 mm, main part 0.055–0.062 mm, point 0.027–0.029 mm, inner root 0.021–0.024 mm. Size of ventral bar is 0.011–0.012 x 0.022–0.024 mm. Size of dorsal bar is 0.002–0.003 x 0.015–0.022 mm.

Found on skin (?) of *Barbatula toni markakulensis*; Lake Markakol' (Kazakhstan). This form is between *G. barbatuli* f. typica and *G. barbatuli* f. "B". It is nearer to the first when comparing anchors and the ventral bar but nearer to the second when comparing massiveness of these structures and length of the marginal hooks.

306 (305). The hooklet is of another type.

307 (308). The total length of the marginal hooks is greater than 0.035 mm.
G. tonii Ergens, 1970 (Fig. 620)

Body length is about 0.5 mm. Total length of marginal hooks is 0.035–0.046 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.058–0.068 mm, main part 0.046–0.055 mm, point 0.030–0.032 mm, inner root 0.019–0.025 mm. Size of ventral bar is 0.010–0.011 x 0.018–0.023 mm, membrane 0.012–0.020 mm. Size of dorsal bar is 0.001–0.002 x 0.014–0.020 mm.

Found on fins and gills of Barbatula toni; Khubsugul Lake (Mongolia), Maritime Territory (Russia).

308 (307). The total length of the marginal hooks is less than 0.030 mm.

309 (310). The length of the hooklet of the marginal hooks is less than 0.003 mm.
G. gnathopogonis Ergens et Gussev, 1975 (Fig. 621)

Body length is 0.2–0.3 mm. Total length of marginal hooks is 0.015–0.016 mm, hooklet 0.003 mm. Total length of anchors is 0.027–0.030 mm, main part 0.022–0.024 mm, point 0.009–0.010 mm, inner root 0.008–0.010 mm. Size of ventral bar is 0.003–0.004 x 0.007–0.008 mm. Size of dorsal bar is 0.001 x 0.005–0.006 mm.

Found on fins of *Squalidus chankaensis*; Mo River (basin of Lake Khanka, Amur region, Russia).

310 (309). The length of the hooklet of the marginal hooks is greater than 0.004 mm.

311 (312). The length of the hooklet blade is less than the length of its base.
G. micracanthus Hukuda, 1940 (Fig. 622)
Syn.: *G. paralatus* Gussev, 1955, part.

Body length is 0.25–0.5 mm. Total length of marginal hooks is 0.018–0.022 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.036–0.042 mm, main part 0.028–0.034 mm, point 0.015–0.023 mm, inner root 0.009–0.012 mm. Size of ventral bar is 0.005–0.008 x 0.012–0.016 mm, membrane 0.009–0.013 mm. Size of dorsal bar is 0.001 x 0.009–0.012 mm.

Found on fins and gills of *Cobitis melanoleuca* and *Misgurnus mohoity*; Lake Khanka (Amur region, Russia), Suifun River (Maritime Territory, Russia), water bodies of Mongolia and Japan.

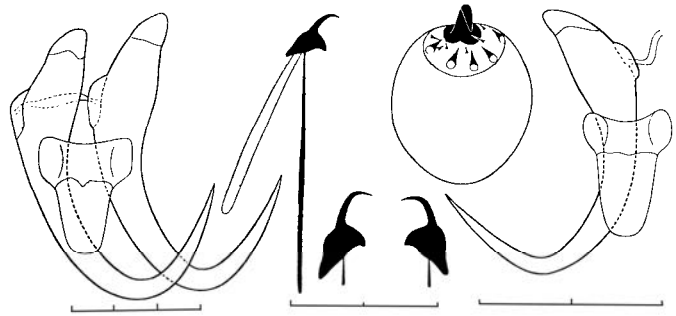
312 (311). The length of the hooklet base is less than the length of its blade.

313 (314). The hooklet is of the *G. minimus* type (see Fig. 454, 13).
G. minimus Malmberg, 1957 (Fig. 623)

Body length is about 0.3 mm. Total length of marginal hooks is 0.015–0.019 mm, hooklet 0.004–0.006 mm. Total length of anchors is 0.028–0.032 mm, main part 0.027–0.029 mm, point 0.013–0.017 mm, inner root 0.010–0.011 mm. Size of ventral bar is 0.005–0.006 x 0.009–0.012 mm. Size of dorsal bar is 0.001 x 0.006–0.007 mm.

Found on gills of *Phoxinus phoxinus*, *P. percnurus*, *Oreoleuciscus humilis*, and *O. potanini*; England, basins of the Baltic and Black Seas, water bodies of Mongolia, Lena River (Russia).

314 (313). The hooklet of the marginal hooks is of another type.



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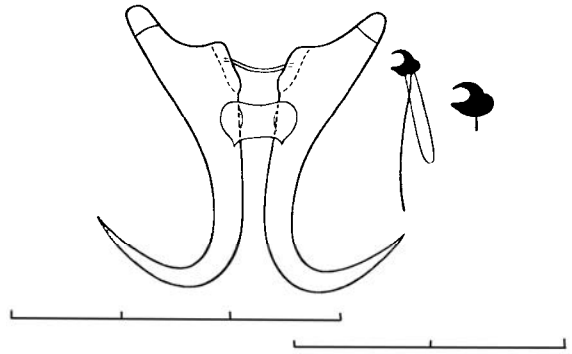

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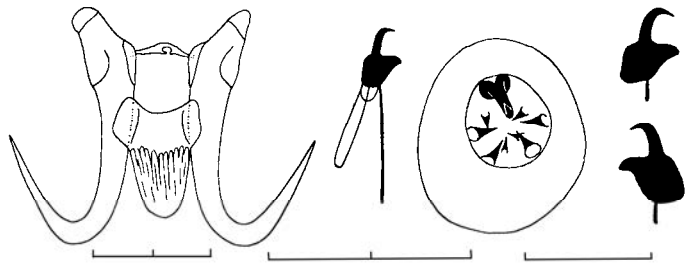

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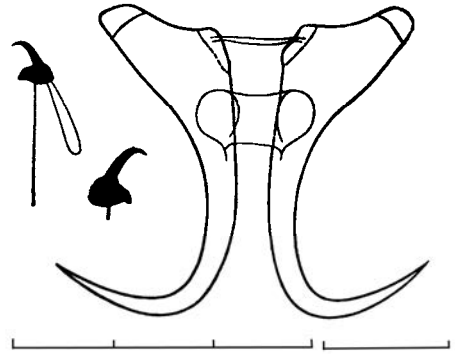
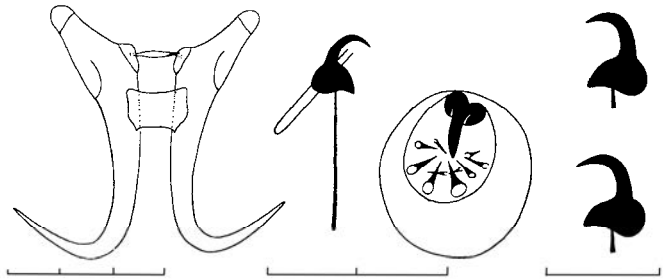


623

Fig. 620 – 623.
620 - *Gyrodactylus tonii.* **621** - *Gyrodactylus gnathopogonis.* **622** - *Gyrodactylus micracanthus.* **623** - *Gyrodactylus minimus.*



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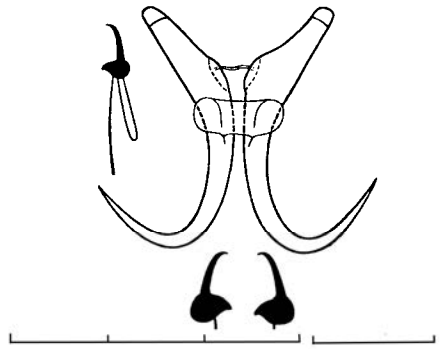

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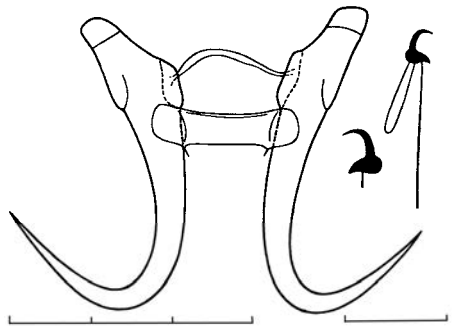

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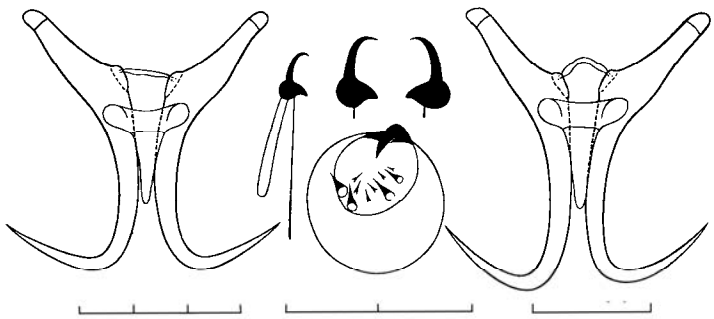


627

Fig. 624 – 627.
624 - *Gyrodactylus glehnii.* **625** - *Gyrodactylus hemiculteris.* **626** - *Gyrodactylus chondrostomi.* **627** - *Gyrodactylus elegans.*

315 (316). The point and stalk of the hooklet are the same length.
G. glehnii Ergens et Yukhimenko, 1973 (Fig. 624)

Body length is about 0.35 mm. Total length of marginal hooks is 0.022–0.024 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.042–0.047 mm, main part 0.035–0.039 mm, point 0.014–0.018 mm, inner root 0.012–0.017 mm. Size of ventral bar is 0.005–0.007 x 0.011–0.012 mm. Size of dorsal bar is 0.001 x 0.006–0.007 mm.

Found on gills of *Perccottus glehni*; Lake Khanka (Amur region, Russia).

316 (315). The hooklet point is shorter than the stalk.

317 (318). The total length of the anchors is less than 0.029 mm.
G. hemiculteris Ergens et Gussev, 1975 (Fig. 625)

Body length is about 0.2 mm. Total length of marginal hooks is 0.015–0.017 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.025–0.026 mm, main part 0.019–0.020 mm, point about 0.010 mm, inner root 0.009–0.010 mm. Size of ventral bar is 0.004–0.005 x 0.010–0.011 mm, dorsal bar 0.001 x 0.005–0.006 mm.

Found on gills of *Hemiculter lucidus*; Lake Khanka (Amur region, Russia).

318 (317). The total length of the anchors is greater than 0.031 mm.

319 (320). The hooklet is of the *G. cernuae* type (see Fig. 454, 14).
G. chondrostomi Ergens, 1967 (Fig. 626)

Body length is 0.2–0.3 mm. Total length of marginal hooks is 0.22–0.23 mm, hooklet 0.004–0.005 mm. Total length of anchors is 0.038–0.040 mm, main part 0.028–0.030 mm, point 0.019–0.020 mm, inner root 0.012–0.013 mm. Size of ventral bar is 0.004–0.005 x 0.018–0.019 mm. Size of dorsal bar is 0.001 x 0.015–0.017 mm.

Found on gills of *Chondrostoma nasus*; described from Hungary; probably will be found in other countries of the Palaearctic.

320 (319). The hooklet is of another type.

321 (322). The inner root and the point of the anchors are of the same length, or the point is shorter than the inner root.
G. elegans Nordmann, 1832 (Fig. 627)
Syn.: *G. parvicopula* Bychowsky, 1933

Body length is 0.45–0.6 mm. Total length of marginal hooks is 0.020–0.029 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.049–0.064 mm, main part 0.035–0.049 mm, point 0.018–0.023 mm, inner root 0.018–0.024 mm. Size of ventral bar is 0.004–0.007 x 0.015–0.019 mm, membrane 0.009–0.019 mm. Size of dorsal bar is 0.001–0.003 x 0.009–0.012 mm.

Found on gills of *Abramis brama*, *A. b. orientalis*, and *Ballerus sapa*; widespread within the area of its hosts. Many authors used this name for *G. katharineri* from *Cyprinus carpio* or for other species from different fishes. Malmberg (1964) ascertained that the type species for the genus *Gyrodactylus* has to be a species from *Abramis brama* (erroneously described by Bychowsky (1933b) as *G. parvicopula*). It is difficult to know which species were in the hands of researchers who used the name *G. elegans* before 1964; it is possible only to state that in cases in which parasites were not from *Abramis brama*, *Ballerus sapa*, or *Cyprinus carpio*, then they were neither *G. elegans* nor *G. katharineri*. Such doubtful data are to be used only with reservation.

322 (321). The inner root of the anchors is shorter than the point.

323 (324). The hooklet is of the *G. malmbergensis* type (see Fig. 454, 15).
G. malmbergensis Prost, 1974 (Fig. 628)

Body length is 0.3–0.55 mm. Total length of marginal hooks is 0.018–0.020 mm, hooklet

0.005–0.006 mm. Total length of anchors is 0.036–0.043 mm, main part 0.032–0.039 mm, point 0.015–0.020 mm, inner root 0.008–0.015 mm. Size of ventral bar is 0.005–0.007 x 0.012–0.017 mm, membrane 0.011–0.015 mm. Size of dorsal bar is 0.001–0.002 x 0.009–0.014 mm.

Found on fins and in nasal cavities of ***Phoxinus phoxinus, P. percnurus,*** and ***Oreoleuciscus humilis***; water bodies of Poland and Mongolia; Lena River (Russia); probably will be found in other countries of the Palaearctic.

324 (323). The hooklet is of another type.

325 (326). The total length of the marginal hooks is greater than 0.023 mm.
G. prostae Ergens, 1963 (Fig. 629)

Body length is 0.3–0.6 mm. Total length of marginal hooks is 0.024–0.030 mm, hooklet 0.007–0.008 mm. Total length of anchors is 0.044–0.060 mm, main part 0.034–0.044 mm, point 0.020–0.030 mm, inner root 0.016–0.022 mm. Size of ventral bar is 0.004–0.007 x 0.015–0.019 mm, membrane 0.012–0.016 mm. Size of dorsal bar is 0.002–0.003 x 0.009–0.011 mm.

Found on fins and skin and rarely on gills of ***Rutilus rutilus, R. r. lacustris, Blicca bjoerkna, Leuciscus leuciscus, L. l. baicalensis, L. idus, Phoxinus phoxinus, Abramis brama, Gobio gobio,*** and other cyprinids (see host–parasite list); widespread in the Palaearctic.

326 (325). The total length of the marginal hooks is less than 0.020 mm.
G. laevis Malmberg, 1957 (Fig. 630)
Syn.: ***G. pusanovi*** Osmanov, 1965; ***G. paralaevis*** Ergens, 1966; ***G. alburnensis*** Prost, 1972

Body length is about 0.35 mm. Total length of marginal hooks is 0.015–0.020 mm, hooklet 0.005–0.006 mm. Total length of anchors is 0.033–0.043 mm, main part 0.027–0.034 mm, point 0.015–0.018 mm, inner root 0.010–0.016 mm. Size of ventral bar is 0.004–0.006 x 0.009–0.015 mm, membrane 0.009–0.016 mm. Size of dorsal bar is 0.001 x 0.007–0.009 mm.

Found on gills of ***Phoxinus phoxinus, P. lagowskii, P. percnurus,*** and other cyprinids (see host−parasite list); widespread in the Palaearctic. Worms very similar to ***G. laevis*** are found on several species of Cyprinidae, and whether or not they represent ***G. laevis*** populations or several independent species is unknown. Solving this question will require studying numerous materials and data to determine the limits of morphological and metrical variability as well as specificity of ***G. laevis***.

Supplement to genus *Gyrodactylus*

Species inquirenda

1. ***G. hronosus*** Zitnan, 1964 (Fig. 631)

Body length is 0.43–0.45 mm. Total length of marginal hooks is 0.031–0.035 mm, hooklet 0.006–0.007 mm. Total length of anchors is 0.070–0.072 mm, main part 0.052–0.054 mm, point about 0.034 mm, inner root 0.020–0.023 mm. Size of ventral bar is 0.007–0.008 x 0.030–0.036 mm, membrane 0.013–0.016 mm. Size of dorsal bar is 0.002 x 0.024–0.030 mm.

Described from fins of ***Alburnus alburnus*** and ***Alburnoides bipunctatus*** from Slovakia.

2. ***G. alburnoidesi*** Chiriac, 1969 (Fig. 632)

Body length is 0.23–0.43 mm. Total length of marginal hooks is 0.016–0.023 mm. Total length of anchors is 0.048–0.056 mm, main part 0.037–0.044 mm, point 0.018–0.023 mm, inner root 0.011–0.023 mm. Size of ventral bar is 0.004–0.007 x 0.021–0.027 mm, membrane 0.006–0.013 mm. Size of dorsal bar is 0.001–0.002 x 0.008–0.011 mm.

Described from gills of ***Alburnus alburnus*** from Romania.

3. ***G. ctenopharingodonis*** in Gussev, 1962 (Fig. 633, A)

Body length can be up to 0.57 mm. Total length of marginal hooks is 0.025–0.030 mm. To-

tal length of anchors is 0.051–0.067 mm. Size of ventral bar is 0.006–0.008 x 0.025–0.028 mm, membrane about 0.018 mm. Size of dorsal bar is 0.003–0.004 x 0.020 mm.

Found on skin of *Ctenopharingodon idella* in Lake Tong Hu (China). *G. ctenopharingodonis* is a pathogen that causes mortality of grass carp fingerlings.

4. *G. gussevi* Ling Mo-en, 1962 (Fig. 633, B)

Body length is 0.2–0.7 mm. Total length of marginal hooks is 0.021–0.023 mm. Total length of anchors is 0.045–0.056 mm, main part 0.036–0.040 mm, point 0.026–0.028 mm, inner root 0.009–0.010 mm. Size of ventral bar is 0.006–0.009 x 0.015. Width of dorsal bar is 0.008–0.013 mm.

Described from gills and fins of *Silurus soldatovi* and *S. asotus* of the Liao He River (China).

5. *G. squaliobarbi* Ling Mo-en, 1962 (Fig. 633, C)

Body length is 0.41–0.44 mm. Total length of marginal hooks is 0.026–0.027 mm. Total length of anchors is 0.036–0.037 mm, main part 0.026–0.030 mm, point 0.012–0.014 mm, inner root 0.011–0.015 mm. Width of the ventral bar is 0.012–0.014 mm. Width of the dorsal bar is 0.007–0.010 mm.

Described from gills of *Squaliobarbus curriculus* of the Liao He River (China).

6. *G. alexgusevi* Zietara et Lumme, 2003

The first description does not include measurements, except for the hooklet, and the drawings are bad. The species was established based on molecular data from worms from fins of *Lota lota*. It is similar to *G. lotae.*

7. *G. jussii* Zietara et Lumme, 2003

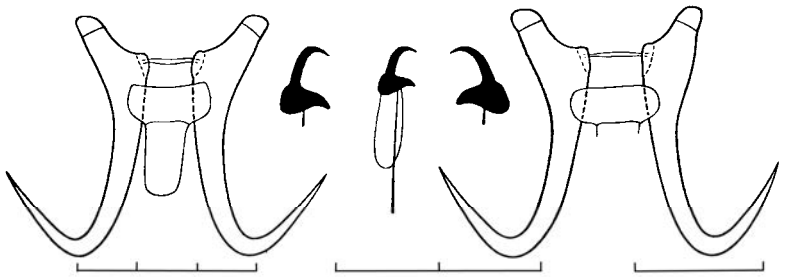
The first description does not include measurements, except for the hooklet, and the drawings are bad. The species was established based on molecular data from worms from fins of *Phoxinus phoxinus*. It is similar to *G. macronychus.*

8. *G. onegensis* Rumyantsev, 2000 (Fig. 634)

Body length is 0.2–0.3 mm. Total length of marginal hooks is 0.021–0.022, hooklet 0.004 mm. Total length of anchors is 0.036–0.042 mm, main part 0.027–0.029 mm, point 0.017–0.018 mm, inner root 0.010–0.011 mm. Size of ventral bar with ear-like projections is 0.004–0.005 x 0.016–0.017 mm, membrane 0.009–0.010 mm. Size of dorsal bar is 0.001 x 0.015 mm. Scale-bar is absent. Species needs re-examination.

Found on gills of *Cottus gobio*; Lakes Onega and Ladoga (Russia).

9. *G. osmeri* Rumyantsev et al., 1998 (Fig. 635)



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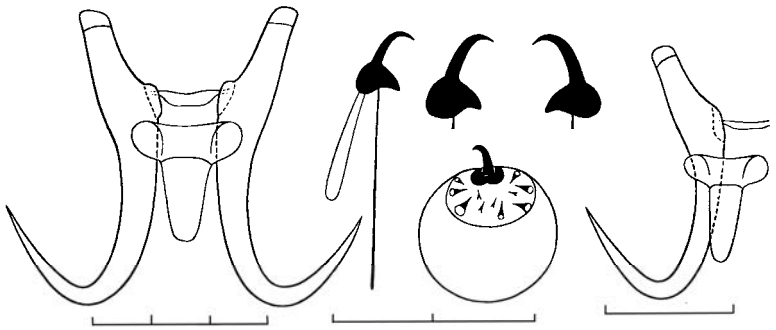
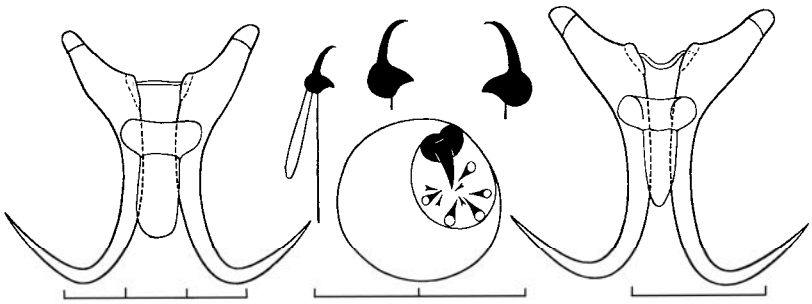


629

Fig. 628-629
628 - *Gyrodactylus malmbergensis.* **629** - *Gyrodactylus prostae.*



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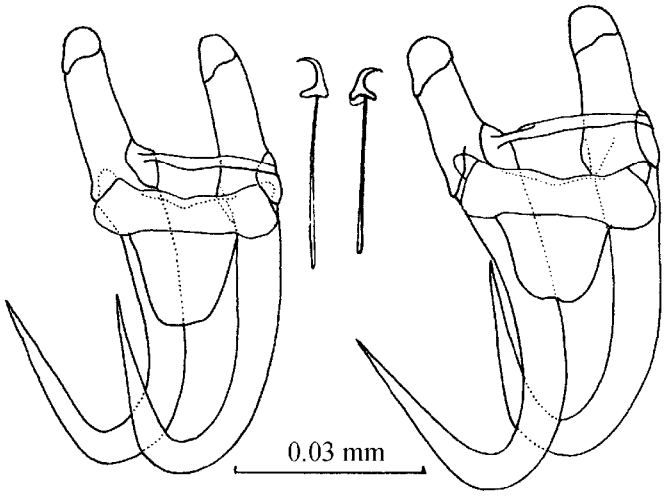
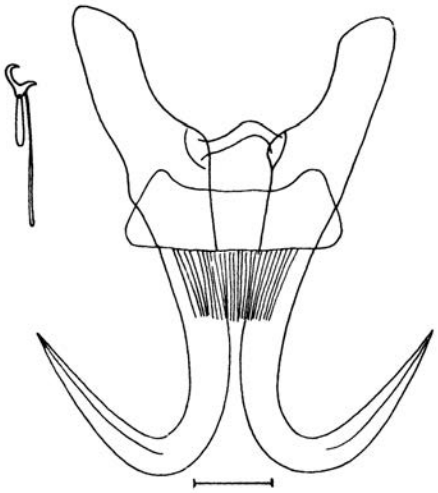


631

Fig. 630-631
630 - *Gyrodactylus laevis.* **631** - *Gyrodactylus hronosus* (after Zitnan, 1964).



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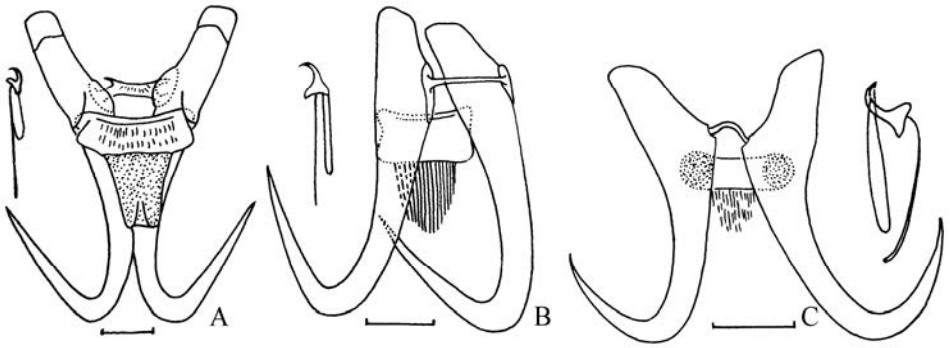
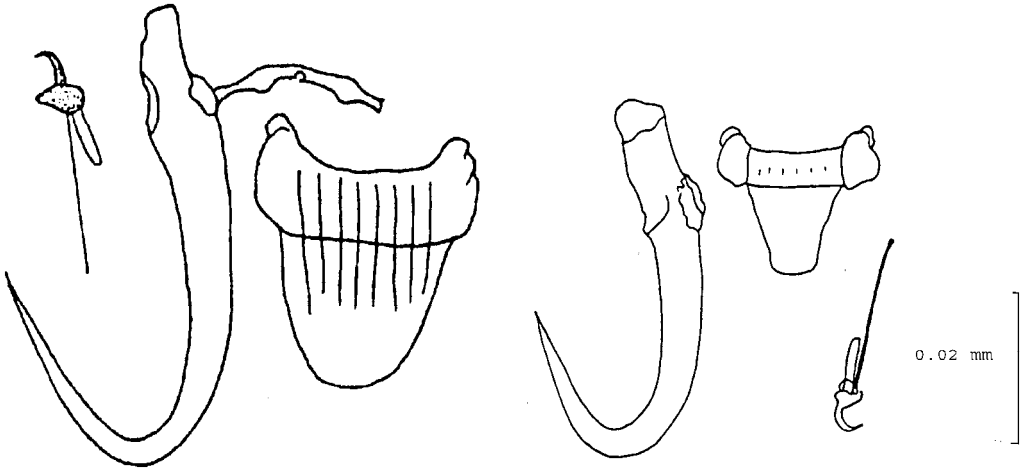


633

Fig. 632-633
632 - *Gyrodactylus alburnoidesi* (after Chiriac, 1969). **633 -** A – *Gyrodactylus ctenopharingodonis*, B – *G. gussevi*, C – G. *squaliobarbi* (after Ling Mo-en, 1962).



634 **635**

Fig. 634 – 635.
634 - *Gyrodactylus onegensis* (after Rumyantsev, 2000).**635 -** *Gyrodactylus osmeri* (after Rumyantsev et al., 1998).

Body length is 0.4–0.6 mm. Total length of marginal hooks is 0.027–0.028 mm, hooklet 0.006 mm. Total length of anchors is 0.050–0.057 mm, main part 0.037–0.040 mm, point 0.022–0.027 mm, inner root 0.013–0.016 mm. Size of ventral bar with ear-like projections is 0.005–0.006 x 0.023–0.025 mm. Size of dorsal bar is 0.002 x 0.020 mm. Species needs re-examination.

Found on gills of *Osmerus eperlanus*; Ladoga Lake (Russia).

10. *G. gracilis* Kathariner, 1894 and *G. luehei* Roman, 1960

The first descriptions and drawings of these species show that it is quite impossible to identify these species. We agree with G. Malmberg (1970), who proposed to leave them as species inquirenda.

Genus *Paragyrodactylus* Gvosdev et Martechov, 1953

These Gyrodactylinae have 16 marginal hooks and a pair of anchors that lack an outer root. Two bars—a ventral bar with a membrane and a dorsal bar—lie between the anchors. Moreover, the haptor has an additional chitinoid armament in the form of an arch with two membranoid processes. Other features are the same as in the subfamily.

To date, this genus has two species. The type species is *P. iliensis* Gvosdev et Martechov, 1953.

Key to species of the genus *Paragyrodactylus*

1 (2). The total length of the anchors is less than 0.045 mm.
P. iliensis Gvosdev et Martechov, 1953 (Fig. 636)
Syn.*: P. dogieli* Osmanov, 1965

Body length is about 0.4 mm. Total length of marginal hooks is 0.015–0.017 mm, hooklet 0.003–0.004 mm. Total length of anchors is 0.031–0.040 mm, main part 0.026–0.033 mm, point 0.017–0.022 mm, inner root 0.008–0.011 mm. Size of ventral bar is 0.006–0.008 x 0.013–0.015 mm. Size of dorsal bar is 0.002 x 0.008–0.010 mm.

Found on gills of *Triplophysa strauchi*, *T. stoliczkai*, and *T. dorsalis*; many water bodies of Central Asia, Ili, Chu, and Syrdar'ya Rivers.

2 (1). The total length of the anchors is greater than 0.060 mm.
P. barbatuli Ergens, 1970 (Fig. 637)

Body length is 0.45–0.7 mm. Total length of marginal hooks is 0.034–0.038 mm, hooklet 0.008–0.009 mm. Total length of anchors is 0.063–0.067 mm, main part 0.048–0.052 mm, point 0.031–0.033 mm, inner root 0.016–0.019 mm. Size of ventral bar is 0.011–0.012 x 0.031–0.036 mm, membrane 0.022–0.025 mm. Size of dorsal bar is 0.003–0.004 x 0.020–0.033 mm.

Found on gills of *Barbatula toni*; Selenga River (Mongolia) and the Maritime Territory (Russia).

Genus *Gyrodactyloides* Bychowsky, 1947

These Gyrodactylinae have a pair of anchors with inner and outer roots. The marginal hooks have an elongate handle more or less distinctly flexed near the middle, and they are distributed in three groups on the periphery of haptor: two anteriolaterally with four hooks each and one posteriorly with eight. One ventral bar is present. Additional chitinoid armament consists of a plate and lateral threads. The plate, which has a thickened anterior edge, is situated across the haptor at the level of the inner roots of the anchors. Other features are the same as in the subfamily.

These are parasites of marine fishes (herrings and others); rarely are they found on anadromous fishes (*Salmo salar*, *Oncorhynchus gorbuscha*). Five species have been described to date, one of which can be found in freshwaters of the Palaearctic.

The type species is *G. petruschewskii* Bychowsky, 1947.

G. bychowskii Albova, 1948 (Fig. 638)

Body length can be up to 0.6 mm, width 0.16 mm. Length of marginal hooks is 0.050–0.065 mm, anchors 0.075–0.100 mm. Size of ventral bar is 0.009–0.011 x 0.020–0.026 mm.

Found on gill filaments of *Salmo salar* and *Oncorhynchus gorbuscha* (introduced species) of the White Sea (Russia).

Genus *Laminiscus* Palsson et Beverley-Burton, 1983

These Gyrodactylinae have the following features: anchors with well-developed roots, only one ventral bar, and an additional shield-shaped armament similar to that of *Archigyrodactylus* Mizelle et Kritsky, 1967. The marginal hooks have a relatively short, straight handle and are distributed in three groups on the periphery of the haptor: two anterolateral groups of four hooks each and one posterior group of eight, which are more widely distributed. Other features are the same as in the subfamily.

These are parasites of marine and anadromous fishes (*Oncorhynchus gorbuscha*).

The type species is *L. gussevi* (Bychowsky et Poljansky, 1953). Two more species have been described.

L. strelkowi (Bychowsky et Poljansky, 1953) (Fig. 639)

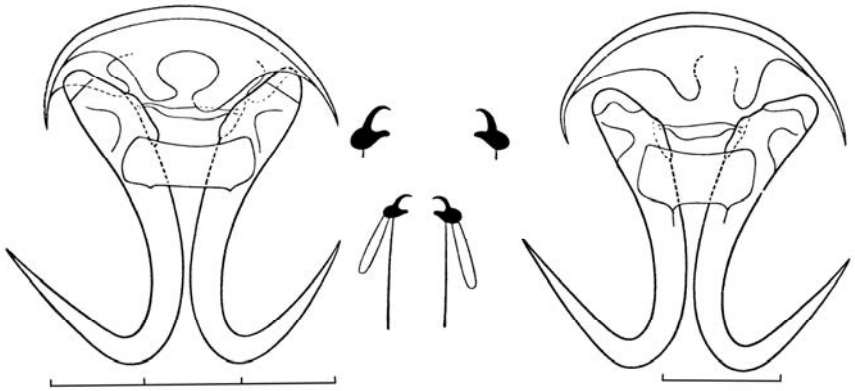
Body length can be up to 0.5 mm, width 0.1 mm. Length of marginal hooks is 0.032–0.040 mm, anchors 0.052–0.065 mm. Size of ventral bar is about 0.006 x 0.013–0.018 mm. The additional shield-shaped plate is about 0.030 x 0.030 mm.

Found on gill filaments of *Oncorhynchus gorbuscha, O. kisutch,* and *O. keta*; Okhotsk Sea (Russia), it probably will be found in freshwaters of the Palaearctic.

Subclass Oligonchoinea Bychowsky, 1937

The larvae of these Mongenoidea usually are armed with 10 marginal hooks, although the Chimaericolidea have 16 or 14 and some groups have fewer or lack them altogether. Larvae have also 1–2 pairs of anchors and often one pair of clamps. Most larvae have one doubled eye; rarely two are present and sometimes the eye is absent. The attachment structure of mature specimens is represented by modificated suckers (clamps). In the most complicated cases, the suckers are represented by a system of chitinoid sclerites that form two hard jaws composed of pinching clamps. The larval armament can remain partly intact in mature worms or it can disappear completely by resorption or by releasing from them. The anterior end of body has three groups of glands. The subterminal mouth has a well-developed perioral sucker, or two special suckers may be present inside the buccal cavity. In most cases the intestine has two caeca with lateral diverticula; in rare cases only one caecum is present. Eyes usually are absent in mature specimens, but in rare cases they are present. Testes are numerous; very rarely is a single testis present. In most cases they are situated behind the ovary; in rare they lie before it. The copulatory organ in most cases is muscular, and sometimes is armed with small hooklets. One or two vaginal ducts may be present; in rare cases it is absent. A uterus is present, sometimes full of eggs.

Found on fish, mostly marine Teleostomi, Elasmobranchii, and Holocephali. Representatives of two of the four known orders can be found in freshwater.



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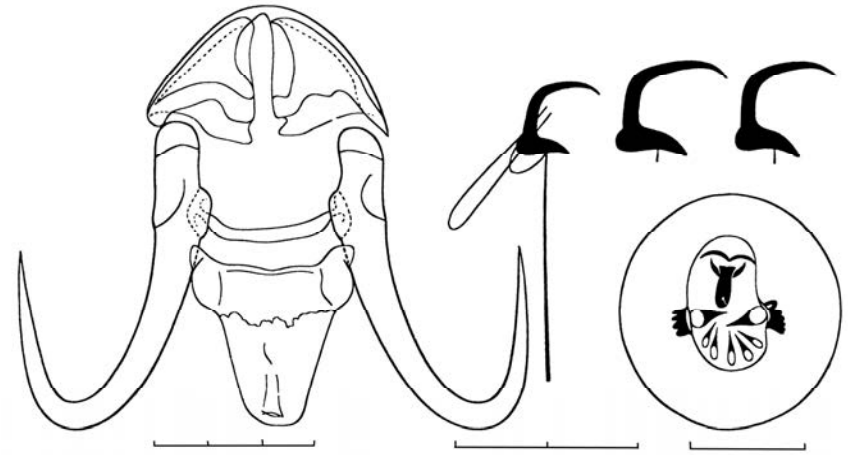

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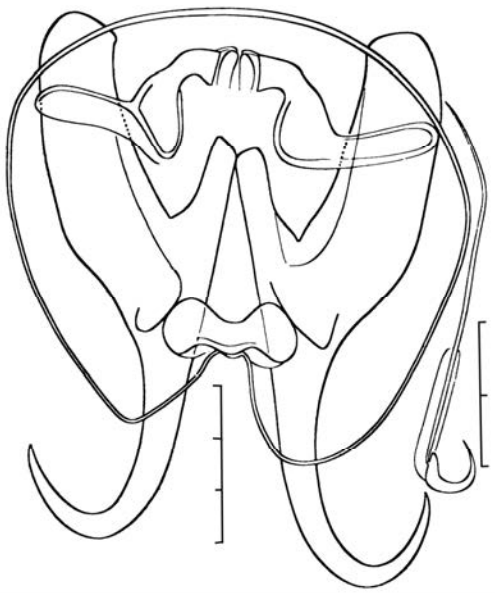
Fig. 636-637
636 - *Paragyrodactylus iliensis.* **637** - *Paragyrodactylus barbatuli.*



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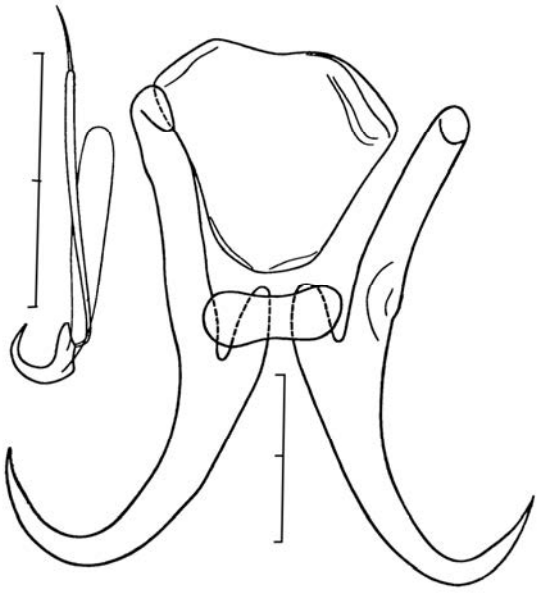


639

Fig. 638 – 639.
638 - *Gyrodactyloides bychowskii.* **639** - *Laminiscus strelkowi.*

Order Diclybothriidea Bychowsky, 1957

The larvae of these Oligonchoinea have 10 marginal hooks, 2–4 anchors, and 4 eyes. The attachment armament of mature worms consists of six large clamp-shaped suckers, each of which has one powerful arched sclerite and a pair of suckers that are situated on a special finger-shaped (or claw-shaped) posterior part of the haptor; 1–2 pairs of marginal hooks; and 1–2 pairs of anchors. The anterior end of the body has two lateral sucker-shaped pits that are not connected to the mouth or a mouth with a more-or-less developed perioral sucker. The intestine has two caeca that are confluent posteriorly. Mature specimens may have four eyes or no eyes. Testes are numerous and are situated behind the ovary. The copulatory organ may or may not have chitinoid hooklets. Two vaginal ducts are present.

Found on Acipenseriformes and Elasmobranchii. The order consists of two families: Diclybothriidae and Hexabothriidae. Only the first occurs in freshwaters of the Palaeacrctic.

Family Diclybothriidae Bychowsky et Gussev, 1950

The larvae of these Diclybothriidea have 10 marginal hooks and 4 anchors. The anterior end of mature worms has two lateral sucker-shaped pits (bothridium) that are not connected to the mouth. Two pairs of small eyes are present. A pair of difficult to see suckers in the little mouth funnel may or may not be present. The intestine consists of two caeca with lateral inner and outer diverticula. The caeca are confluent posteriorly. The unpaired caecum (sometimes with lateral diverticula) reachs up to the middle of the haptor or even to the posterior end of the haptor (but it never reachs the narrow posterior part of the haptor). The haptor has three pairs of suckers or clamps, each of which has a large arched sclerite with a hamiform end. The sclerite is very similar to the second pair of anchors. The posterior part of the haptor is in the form of a tapering projection with three pairs of large anchors (one pair is like a sclerite found in the clamps and two pairs are larval anchors) and one pair of very small larval-type hooks (i.e., the first pair of marginal hooks); in some cases a pair of rudimentary suckers also is present. Such hooks and suckers can be seen only on living specimens, on very flattened specimens, and in microscopic sections. The vaginal duct is unpaired at the beginning but then becomes double. Eggs lack peduncles or filaments.

Found on Acipenseridae and Polyodontidae. The family has two genera, both of which are found in the Palaearctic.

Key to genera of the family Diclybothriidae

1 (2). The posterior tapering part of the haptor is well-developed; two pairs of its large anchors are the same size as the clamp sclerites.
Diclybothrium

2 (1). The posterior tapering part of the haptor is rudimentary; large anchors are less than 2/3 of the length of the sucker sclerites.
Paradiclybothrium

Genus *Diclybothrium* Leuckart, 1835

The well-developed posterior tapering part of the haptor of these Diclybothriidae shoots out from the edge of haptor and has three pairs of large anchors; two of them are almost the same length as the clamp sclerites. Rudimentary suckers also are present on this part of the haptor. Two small suckers lie in the funnel of the mouth cavity. The unpaired posterior part of the intestine reaches the middle or posterior edge of the haptor. A single spermaduct lies on the dorsal side of the body between the intestinal caeca near the midline. The copulatory organ is of the everting cirrus type.

Found on Acipenseridae and Polyodontidae. Two species have been described. The type species, ***D. armatum*** Leuckart, 1835, has been found in the Palaearctic and the Amur region.

D. armatum Leuckart, 1835 (Figs. 640–643)

Body length of mature specimens is variable (4.0–23.0 mm long and 0.32–1.2 mm wide). Size of haptor is 0.43–0.95 x 0.55–1.35 mm, with the length of the posterior tapering part 0.2–0.33 mm. Size of clamps is 0.26–0.42 x 0.25–0.50 mm, and the length of their sclerites is 0.40–0.63 mm. Length of sclerites of the rudimentary suckers is 0.20–0.36 mm, first pair of anchors 0.08–0.10 mm, second pair of anchors 0.26–0.44 mm, first[81] pair of marginal hooks (larval) 0.016 mm. Size of pharynx is 0.076–0.166 x 0.066–0.16 mm. The copulatory organ is covered with many rows of minute spines. Length of the cirrus bursa is 0.17–0.38 mm, and the cirrus length is about 0.09 mm. Up to 200 testes may be present. Eggs are elliptical (0.13–0.20 x 0.07–0.10 mm). Vitellaria spread from the lateral vaginal ducts up to the posterior confluence of the intestinal caeca.

Found on gills of Acipenseridae; basins of the Black and Caspian Seas, Arctic Ocean, Amur River, and Lake Baikal. It has been also found on *Acipenser flavescens* in North America. A second species, *D. hamulatum* (Simer, 1929), which is very similar to *D. armatum*, has been described from *Polyodon spathula* and *Acipenser flavescens* in North America.

Heavy infection with *D. armatum* can cause mortality in young sturgeons, as described from an Ob' River fish hatchery (West Siberia) where infection reached about 600 specimens per fish.

Genus *Paradiclybothrium* Bychowsky et Gussev, 1950

The posterior tapering part of the haptor in these Diclybothriidae is rudimentary. It does not shoot out from the posterior edge of the haptor, and it has three pairs of large anchors. These anchors are less than 2/3 the length of the sucker sclerites. Rudimentary suckers on the posterior tapering part of the haptor are absent. Small suckers in the mouth funnel are absent. The unpaired posterior projection of the intestine reaches the haptor but does not enter into it. Two spermaducts lie parallel to the intestinal caeca and then become confluent at the level of the anterior intestinal arch. The copulatory organ is the penis type (without spines).

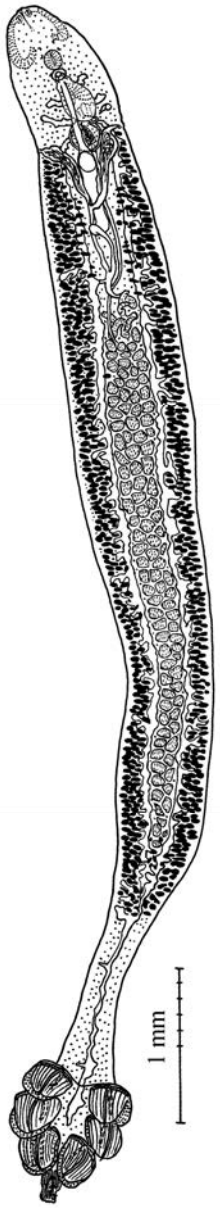
Found on *Acipenser medirostris*. It is the single species within this genus.

P. pacificum Bychowsky et Gussev, 1950 (Figs. 644–646)

Body length is 8.5–13.0 mm and width is 1.3–1.5 mm. Size of haptor is 1.0–1.3 x 1.3–1.9 mm. Its attachment structures are more similar to suckers than to clamps because of their type and structure. Their size is 0.38–0.47 x 0.59–0.67 mm. Length of the sucker sclerites is about 0.40, length of sclerites of rudimentary suckers 0.08–0.13 mm, first pair of anchors about 0.06 mm, second pair of anchors 0.21 mm. Marginal hooks on thick slides are not seen. Size of pharynx is about 0.20 x 0.10 mm. About 75 testes are present. The copulatory organ lacks spines. Eggs are bean shaped (0.16–0.19 x 0.08–0.15 mm). Vitellaria spread from the level of the genital atrium up to the middle of the unpaired posterior projection of the intestine.

Found on gills of *Acipenser medirostris*; Okhotsk Sea, Tatarskyi Proliv, estuary of the Amur River.

[81] Numeration of larvae marginal hooks, clamps, and sclerites of mature specimens begins from behind (see Fig. 2, I from the right). The same numeration is used for Mazocraeidea.



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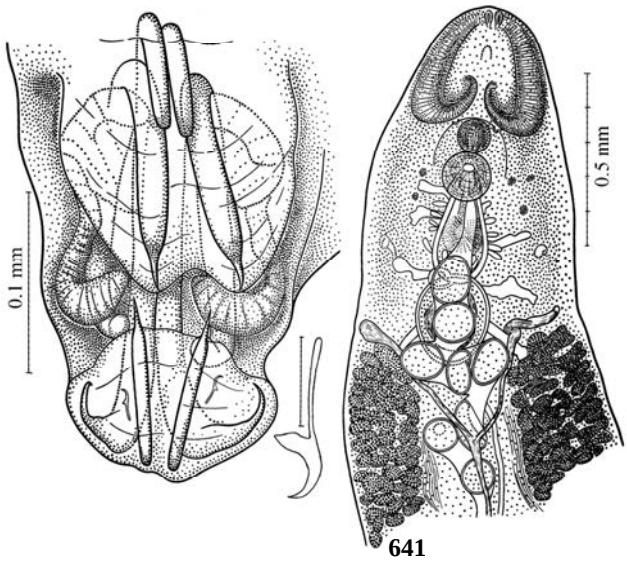

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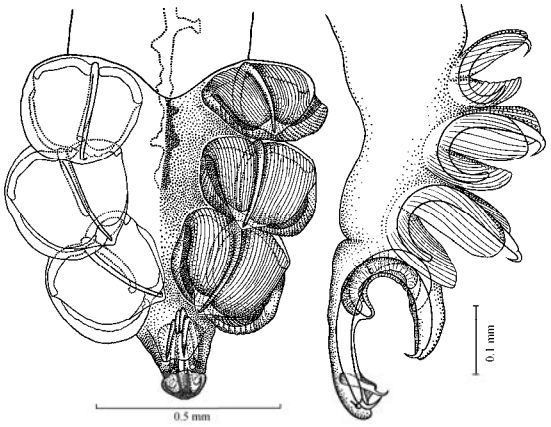
Fig. 640 – 641.

640 - *Diclybothrium armatum*, total view (after Bychowsky et Gussev, 1950). **641 -** *Diclybothrium armatum*, anterior end (in front of large bothridia is the pair of small suckers of buccal cavity) and posterior part of haptor with two pairs of anchors, with one pair of marginal hooks and with sclerites of rudimentary suckers (fourth pair) (after Bychowsky et Gussev, 1950).



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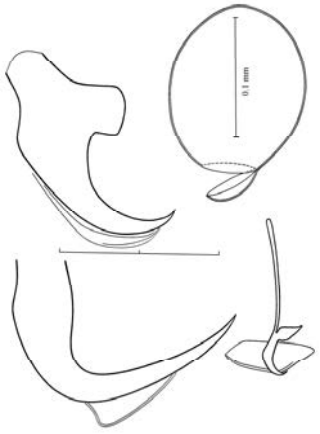

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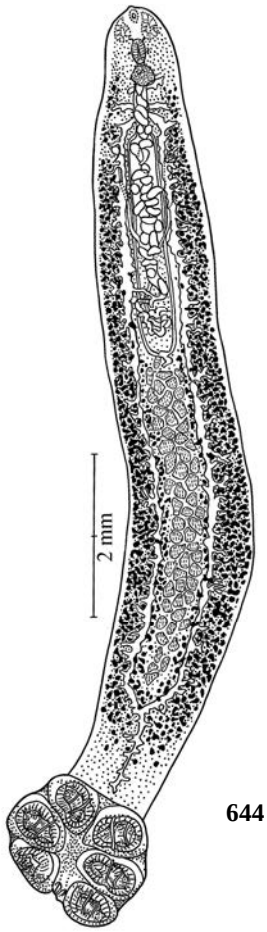
Fig. 642 – 643.

642 - *Diclybothrium armatum*, haptor of adult specimen and haptor of young specimen (view from one side). Second pair of marginal hooks are seen in the middle of rudimentary sucker (after Bychowsky et Gussev, 1950). **643 -** *Diclybothrium armatum*, egg, marginal hook and anchors of larvae. Only point and ligament of second anchor are represented below (after Bychowsky et Gussev, 1950).



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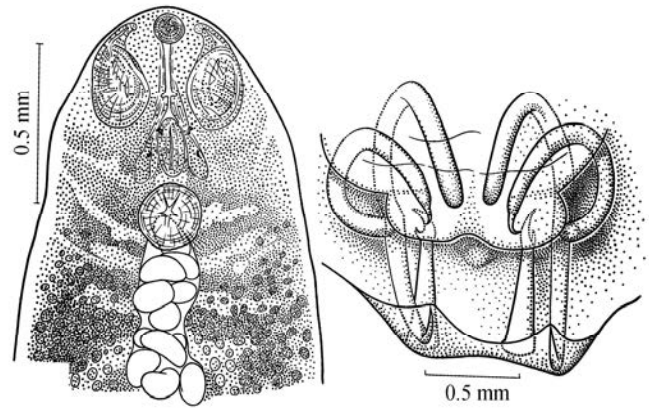

645

Fig. 644 – 645.
644 - *Paradiclybothrium pacificum,* total view (after Bychowsky et Gussev, 1950). **645** - *Paradiclybothrium pacificum,* anterior end and rudiment of haptor posterior part with anchors and sclerites of vanished suckers (after Bychowsky et Gussev, 1950).

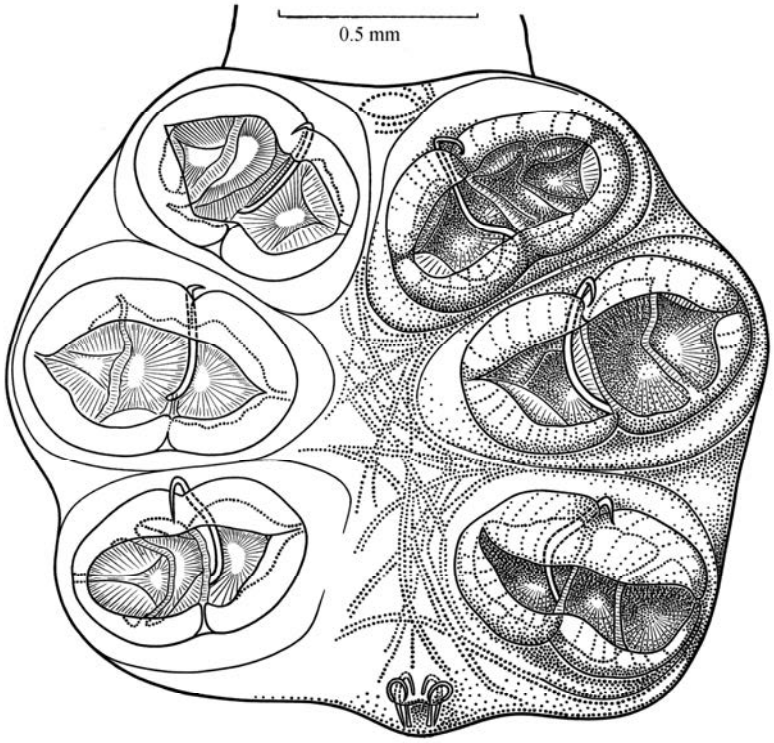

Fig. 646. - *Paradiclybothrium pacificum*, haptor (after Bychowsky et Gussev, 1950).

Order Mazocraeidea Bychowsky, 1957

The larval haptor of these Oligonchoinea usually has 10 marginal hooks and 4 anchors. As an exception, which is a feature of freshwater Discocotylinea, the number of marginal hooks and anchors may be fewer; a pair of clamps can appear instead of marginal hooks during the embryonic period. Armament of mature specimens consists of more or less typical clamps in four (rarely less) up to several dozen pairs, which in most cases are situated symmetrically or rarely asymmetrically. The anterior end of the body contains three groups of glands. The mouth is terminal or subterminal. Two muscular suckers lie within the mouth cavity. Eyes are absent in mature specimens. The intestine has two caeca that are blind or confluent posteriorly, with many diverticula that sometimes form anastomoses, resulting in an intestine that resembles a net. Rarely, the intestine has only one caecum. In most cases, a genital atrium armed with genital spines is present. The copulatory organ, armed or not, opens into the atrium. Testes in many cases are numerous, although sometimes only one is situated behind the ovary. The ovary mostly sharply bent. The vaginal duct can be double or single, or in rare cases absent; the duct(s) opens by two outlets, which sometimes are armed with chitinous hooks. The uterus is well developed and sometimes bag shaped. Vitellaria are well developed and situated on each side of the body.

These organisms are parasites of marine (rarely freshwater) Teleostei. In some cases they infect parasitic Isopoda. The order is divided into four suborders: Mazocraeinea Bychowsky, 1957; Discocotylinea Bychowsky, 1957; Gastrocotylinea Lebedev, 1972, and Microcotylinea Lebedev, 1972.[82]

Representatives of one family from first suborder and of three families of the second suborder have been found in freshwater fishes of the Palaearctic.

[82] Boeger and Kritsky (2001) raised the family Hexostomatidae to suborder rank. Khotenovsky (1985b) proposed new suborder, Octomacrinea, for the Octomacridae and Diplozoidae.

Suborder Mazocraeinea Bychowsky, 1957

Family Mazocraeidae Price, 1936

The Mazocraeidea (Mazocraeinae) have an average or large sized body. The haptor is poorly isolated from the body itself. The haptor of mature worms has one pair of marginal hooks, two pairs of anchors, and eight clamps that lie in two rows on each side of the haptor. The clamps have a chitinoid capsule containing five movable parts that are jointed one to another. The head glands are poorly developed. Eyes are absent in mature specimens. Two suckers lie within the mouth cavity. The intestine has two blind caeca that may or may not enter the haptor; each has many diverticula. The genital atrium lies in the middle of the body. The copulatory organ is armed with hooklets. Testes are numerous. The elongated ovary is retort shaped and bent like a V. Vaginal ducts are paired.

The Mazocraeidae are parasites of marine and anadromous Clupeidae and Scombridae fishes. Only one genus has been found in freshwaters.

Genus *Mazocraes* Hermann, 1782

The genus has the same features as the family.

In freshwaters of the Palaearctic, this genus can be found on anadromous Clupeidae, which carry the parasites rather far from estuaries. The type species is *M. alosae.*

M. alosae Hermann, 1782 (Fig. 647)

The body is lanceolate and tapers to the anterior end. Its length is 5.0–12.0 mm and its width is 1.5–1.7 mm. The haptor is rhombic in form and has four pairs of clamps. Testes are numerous, and the vaginal ducts are paired. Eggs are spindle-shaped with a long pedicle and filament.

Found on gills of different Clupeidae; in freshwaters of basins of the Black, Caspian, and Baltic Sea.

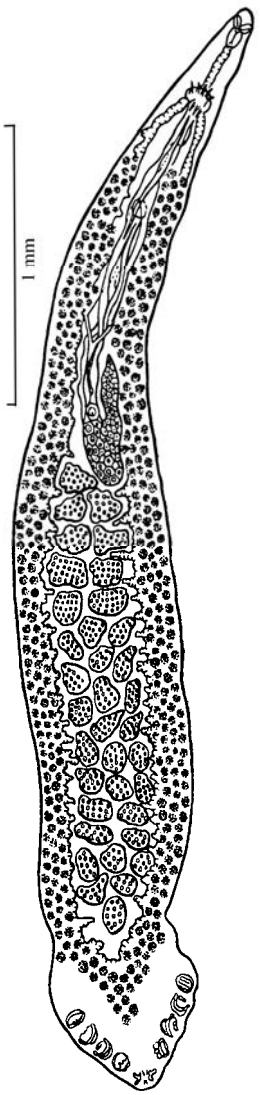

Fig. 647.- *Mazocraes alosae* (after Bychowsky, 1957a).

Suborder Discocotylinea Bychowsky, 1957

These Mazocraeidae have an average or large size body. The armament of mature specimens consists of four or more pairs of clamps, one pair of marginal hooks (although these are absent in some groups), and 1–2 pairs of anchors. Plate-shaped sclerites connected together form the base of the clamps. The intestine has one or two caeca with diverticula.

The suborder consists of six families: Diplozoidae, Discocotylidae, Anchorophoridae, Diclidophoridae, Macrovalvitrematidae, and Octomacridae.

Representatives of the Diplozoidae, Discocotylidae, and Octomacridae are parasites of freshwater and anadromous fishes. Members of the Anchorophoridae, Diclidophoridae, and Macrovalvitrematidae are parasites of marine fishes.

Family Diplozoidae Palombi, 1949

Discocotylinea two mature specimens of which coalesce into a single whole (Figs. 648–650), forming a cross. The body has different sizes and is divided into an anterior part, which lies before the cross, and a posterior part, which lies behind it. The posterior part can have folds and dilatations of dif-

ferent shapes. In most cases four pairs of clamps are present; in rare cases there are more. Two anchors are present, but marginal hooks are absent in mature specimens. Two suckers with or without a partition lie along the edges of the mouth funnel. A pharynx and bucco-esophagial duct are present. The esophagus can be of variable length. The intestine is not divided into caeca, and it becomes tubulate in the posterior part of the body. Sometimes it has lateral diverticula of different types. The intestine in the anterior part of the body has many diverticula without anastomoses. Testes are smooth-edged, lobulose, or ribbon-shaped and coiled. In most cases they are solitary, sometimes consisting of several rounded structures. A copulatory organ, seminal receptacle, and genital atrium are absent. Vitellaria are solitary in the anterior part of the body. Eggs usually have a filament, but sometimes do not. In some cases, a sharp projection exists at the egg pole where there is no filament.

The family consists of two subfamilies, one of which is found on freshwater fishes of the Palaearctic (Diplozoinae). Some species are pathogens. Data on biology and development, the morphology of the adhesive structures, and taxonomy and phylogeny of the Diplozoidae were published by Khotenovsky (1985 b).

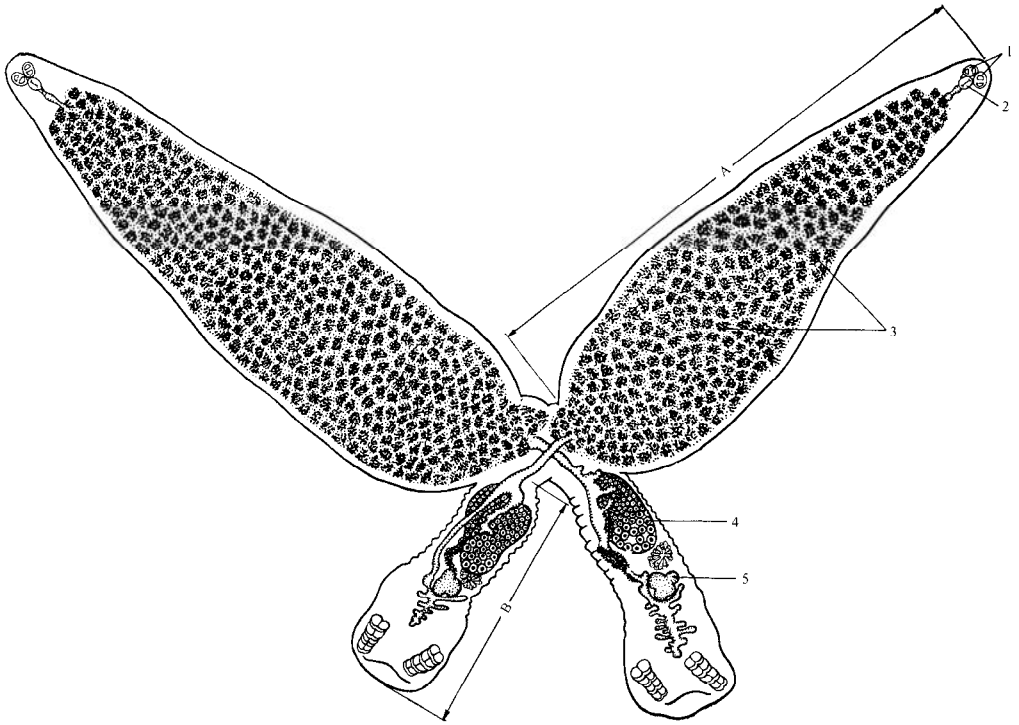

Fig. 648. - *Paradiplozoon bliccae.* Total view: A – anterior part of the body, B – posterior part, 1 – suckers, 2 – pharynx, 3 – vitellaria, 4 – testis, 5 – ovary (after Khotenovsky, 1985a).

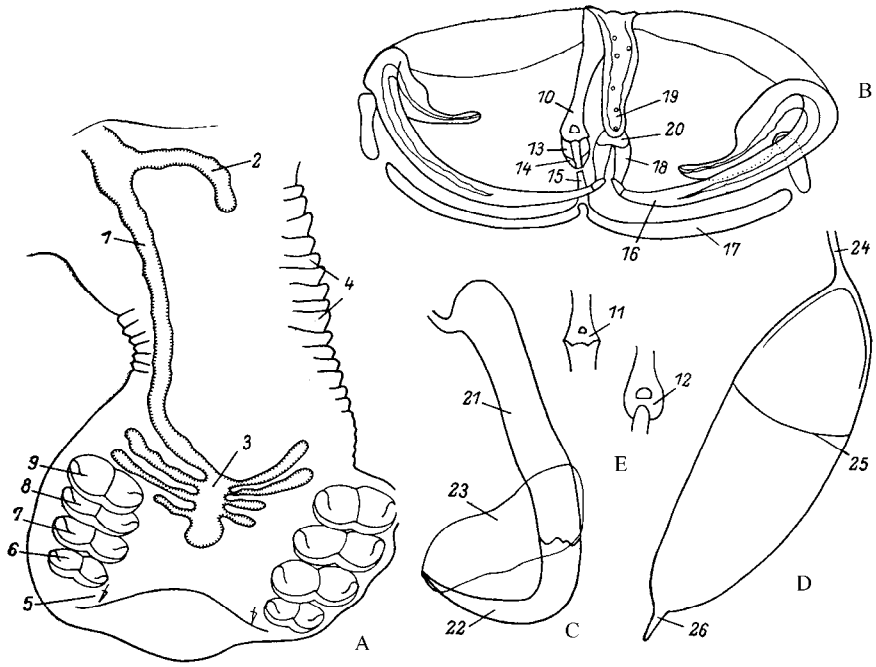

Fig. 649. - Details of diplozoids morphological structure (after Khotenovsky, 1985b).
A – posterior body end, B – clamp, C - hook, D – egg, E – posterior end of median sclerite.
1 – intestine, 2 – rudimentary second intestine caecum, 3 – intestine posterior part, 4 – folds on ventral posterior body part, 5 – anchor (hook), 6 – I clamp, 7 – II clamp, 8 – III clamp, 9 – IV clamp, 10 - posterior end of median sclerite, 11 - posterior end of median sclerite with edge cut off on-the-miter, 12 - posterior end of median sclerite with rounded edge, 13 – anterior additional sclerite, 14 - lateral bulges of anterior additional sclerite, 15 – posterior additional sclerite, 16 – anterior clamp jaw, 17 – posterior clamp jaw, 18 – sclerites connected anterior end of median sclerit with clamp jaws, 19 – anterior end of median sclerite, 20 - trapezoid outgrowth on anterior end of medial sclerite, 21 – anchor, 22 – point, 23 – wing, 24 – egg filament, 25 – suture line of egg cap, 26 – pointed outgrowth of egg shell.

Fig. 650. - Measurement scheme for diplozoids (after Khotenovsky, 1985a).
1 – body length, 2 – length of anterior end, 3 – length of posterior end, 4 – sucker length, 5 – sucker width, 6 – pharynx length, 7 – pharynx width, 8 – clamp length, 9 – clamp width, 10 – anchor length, 11 – handle length.

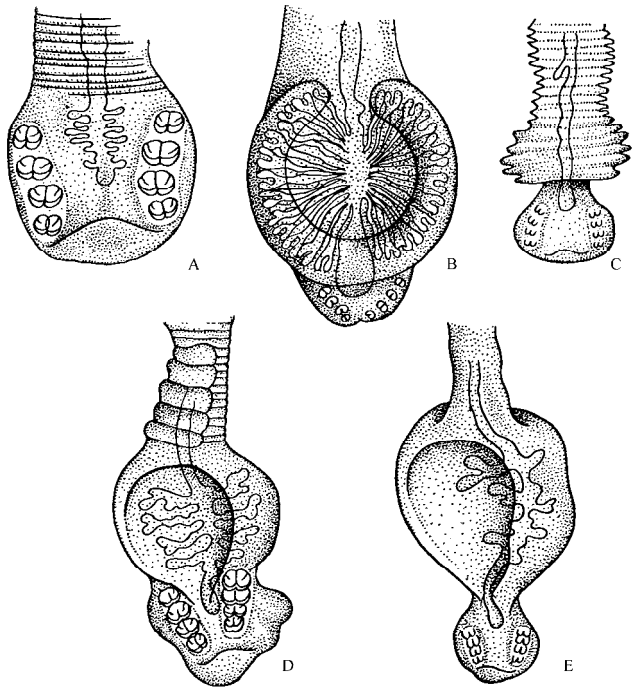

Fig. 651. - Posterior body ends of different genera. A – *Paradiplozoon,* B – *Inustiatus,* C – *Eudiplozoon,* D – *Diplozoon,* E – *Sindiplozoon* (after Khotenovsky, 1985a).

Subfamily Diplozoinae Palombi, 1949

Mature specimens of these Diplozoidae have four pairs of adhesive clamps. Other features are the same as for the family. The subfamily contains five genera, and representatives of all of them have been found in fish from the Palaearctic and Amur regions.

Key to genera of subfamily Diplozoinae

1 (2). There are no dilatations of the middle part of the posterior end of the body.
Paradiplozoon (Fig. 651A)

2 (1). The middle part of the posterior end of the body has dilatations of different shapes.

3 (4). The opening of the uterus is in the middle third of the anterior part of the body. The intestinal caeca form a dense net in the dilatation of the body.
Inustiatus (Fig. 651B)

4 (3). The opening of the uterus lies at the border of the anterior and posterior parts of the body. The intestinal caeca do not form a net in the dilatation of the body.

5 (6). There are two large glandular structures before the suckers. Dilatations have large folds.
Eudiplozoon (Fig. 651C; 703B)

6 (5). No glandular structures are present before the suckers. Dilatations are without folds.

7 (8). The anterior part of the posterior end of the body lacks folds.
Sindiplozoon (Fig. 651E)

8 (7). The anterior part of the posterior end of the body has folds.
Diplozoon (Fig. 651D)

Genus *Paradiplozoon* Akhmerov, 1974

The posterior part of the body is divided into two sections. The anterior section may or may not have folds of different shapes. The posterior section has adhesive clamps and anchors. Suckers may be larger or smaller than the pharynx. The intestine in the posterior part of the body can be tubulate and form small projections or diverticula. Gonads lie in the first half of posterior section. The one testis can be lobed or smooth edged. The uterus opening lies at the border of the anterior and posterior parts of the body. Eggs have a cover with a filament on its top.

The type species is *P. megan* (Bychowsky et Nagibina, 1959).

The genus consists of about 42 species; 25 have been found in the Palaearctic and Amur region.

Key to species of the genus *Paradiplozoon*

1 (12). The posterior part of the body lacks folds.

2 (7). The clamp sclerites are coarse.

3 (4). The posterior arch of the clamps has a well-marked cross striation.
P. parabramisi (Ling, 1973) (Fig. 652, 653)

Syn.: *Diplozoon (Paradiplozoon) parabramidis* Akhmerov, 1974

Body length is 2.5–2.9 mm, anterior part 1.3–1.4 mm, posterior part 0.7–1.0 mm; latter lacks folds. Size of clamps: I: 0.07–0.08 x 0.12–0.14; II: 0.07–0.08 x 0.15–0.16; III: 0.08–0.09 x 0.16–0.18; IV: 0.08–0.10 x 0.16–0.17 mm. Length of anchors is 0.016–0.017 mm, handles 0.035–0.038 mm. Diameter of suckers is 0.06–0.07 mm, pharynx 0.04 mm. The intestine in the posterior part of the body is tabulate and can have little diverticula. The testis is smooth edged.

Found on gills of *Parabramis pekinensis* and *Chanodichthys mongolicus*; Amur River Basin, Lakes Khanka and Bolon' (Russia); China.

4 (3). The posterior arch of the clamps lacks a cross striation.

5 (6). The intestinal caeca in the anterior part of the body are easily visible against a background of vitellaria. The intestine in the posterior part of the body is tubulate without projections. Parasite of *Schizotorax* spp.

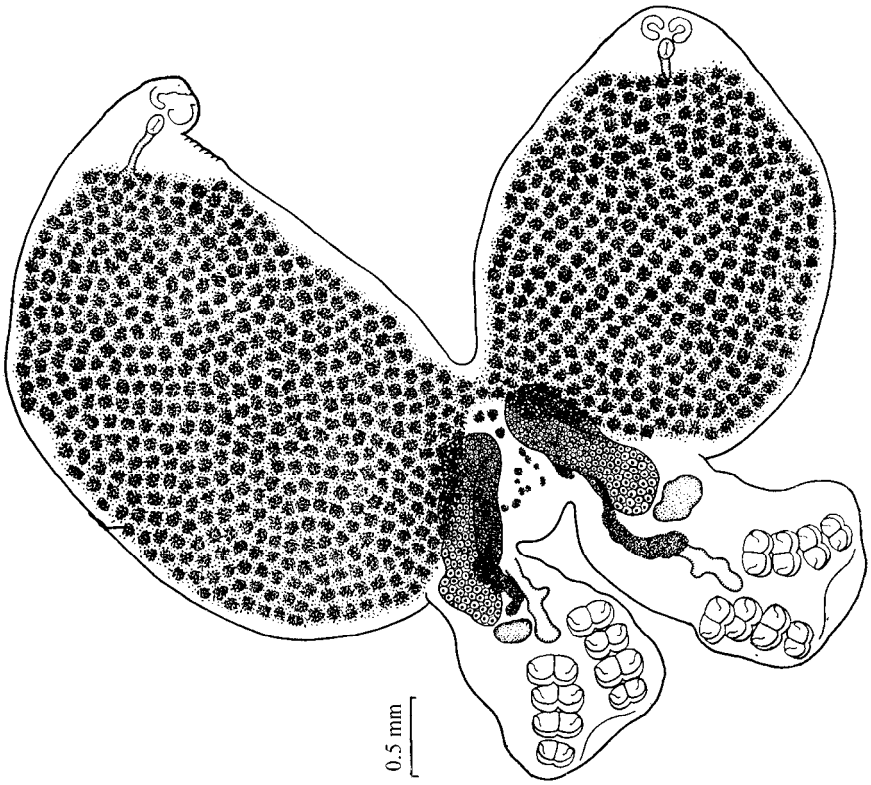

Fig. 652. - *Paradiplozoon parabramisi*, total view (after Khotenovsky, 1985b).

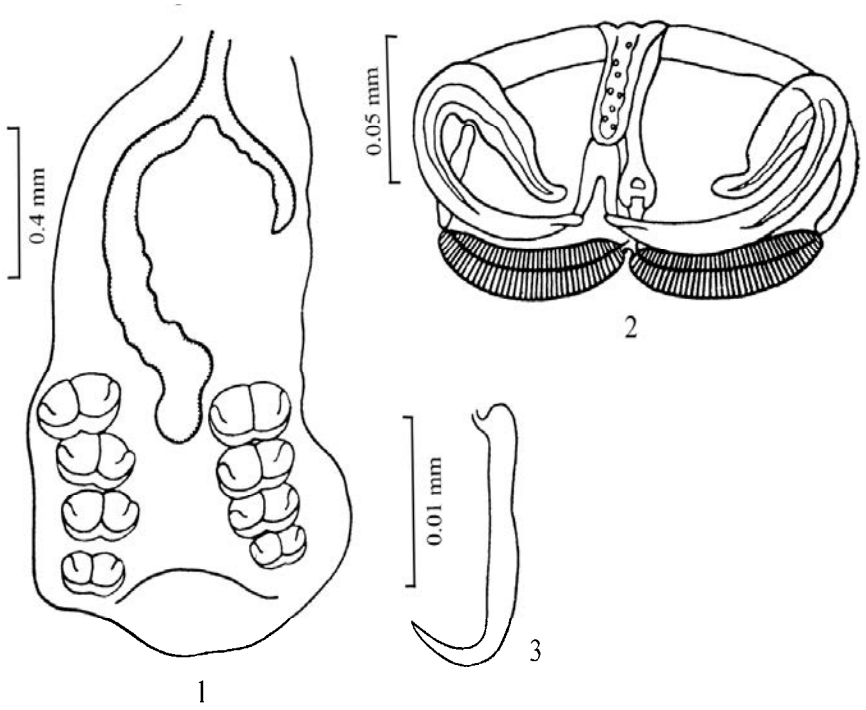

Fig. 653. - *Paradiplozoon parabramisi*, 1– posterior end, 2 – clamp, 3 – anchor (after Khotenovsky, 1985a).

P. schizotorazi (Iksanov, 1965) (Fig. 654, 655)
Syn.: *Diplozoon schizothorazi* Iksanov, 1965

Body length is 4.1–6.1 mm, anterior part 1.0-1.8 mm, posterior part 2.1–3.8 mm; latter lacks folds. Size of clamps: I: 0.12–0.17 x 0.17–0.20; II: 0.12–0.16 x 0.21–0.24; III: 0.13–0.16 x 0.21–0.26; IV: 0.13–0.18 x 0.22–0.26 mm. Clamps are coarse with well-developed sclerites. The anterior end of the median sclerite is jointed to the connivent ends of the anterior arches of the clamp by one broad and short sclerite. Length of anchors is 0.019–0.022 mm, handles 0.042–0.049 mm. Diameter of suckers is 0.11–0.16 mm, pharynx 0.06–0.09 mm. The intestinal caeca in the anterior part of the body are easily visible; the intestine in the posterior part is tubulate without lateral projections. The testis is smooth edged. Size of eggs is 0.13–0.33 x 0.15–0.24 mm.

Found on gills of *Schizothorax intermedius* and *S. pseudaksaiensis*; Issyk-Kul Lake (Kyrgyzstan) and Murgab River (Tajikistan).

6 (5). The intestinal caeca in the anterior part of the body are not visible against a background of vitellaria. The intestine forms diverticula in the posterior part of the body. These are parasites of *Leuciscus idus* and *Squalius cephalus.*

P. megan (Bychowsky et Nagibina, 1959) (Fig. 656, 657)
Syn.: *Diplozoon megan* Bychowsky et Nagibina, 1959

Body length is 4.2–8.2 mm, anterior part 2.5–5.2 mm, posterior part 0.8–1.7 mm; latter lacks folds. Size of clamps: I: 0.08–0.13 x 0.12–0.27; II: 0.11–0.20 x 0.23–0.36; III: 0.11–0.19 x 0.22–0.39; IV: 0.13–0.20 x 0.23–0.34 mm. The median sclerite is very massive; it widens at the anterior end in the form of a fish tail and is connected to the arch ends of the clamp by two short sclerites. Length of anchors is 0.022–0.027 mm, handles 0.050–0.058 mm. Diameter of suckers is 0.11–0.19 mm, pharynx 0.08–0.11 mm. The intestine behind the testis forms small lateral projections. The testis has many lobes. Size of eggs is 0.24–0.34 x 0.10–0.16 mm.

Found on gills of *Leuciscus idus* and *Squalius cephalus*; many rivers of the Baltic, Black, and Caspian Seas Basin; Ob' River (Russia).

7 (2). The sclerites of clamps are very delicate.

8 (9). The suckers are equal to or larger than the pharynx. These are parasites of *Megalobrama skolkovii.*

P. megalobramae Khotenovsky, 1982 (Fig. 658, 659)

Body length is 1.8–4.1 mm, anterior part 1.1–1.2 mm, posterior part 0.5–1.3 mm; latter lacks folds. Size of clamps: I: 0.07–0.09 x 0.10–0.14, II: 0.06–0.10 x 0.12–0.19, III: 0.06–0.10 x 0.13–0.18; IV: 0.07–0.10 x 0.12–0.17 mm. The anterior end of the median sclerite is connected to the ends of the clamp arches by two sclerites. Length of anchors is 0.015–0.017 mm, handles 0.035–0.038 mm. Diameter of suckers is 0.05–0.06 mm, pharynx 0.04–0.07 mm. The intestine in the posterior part of the body lacks diverticula. The testis is smooth edged. There are no data on size of eggs.

Found on gills of *Megalobrama skolkovii*; Amur River Basin.

9 (8). The suckers are smaller than the pharynx.

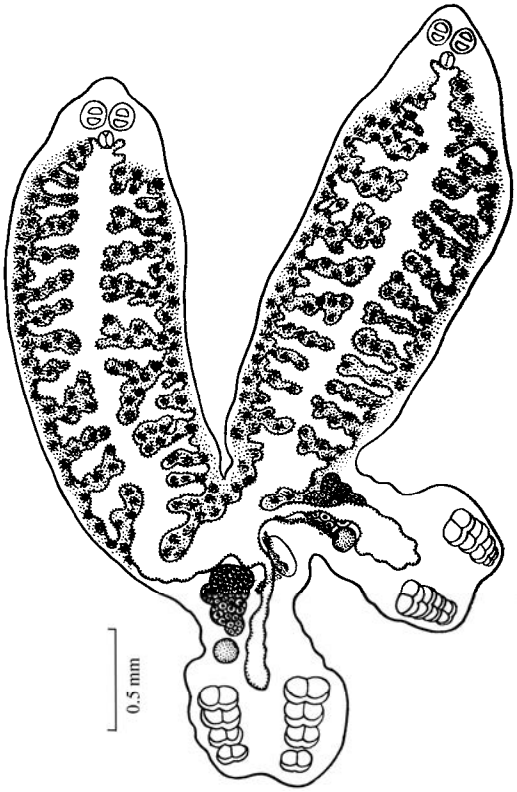

Fig. 654. - *Paradiplozoon schizotorazi*, total view (after Khotenovsky, 1985b).

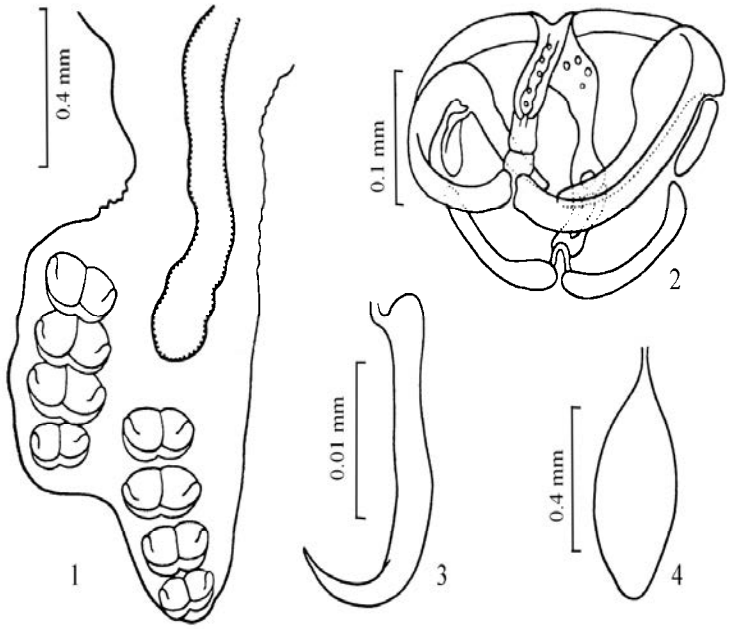

Fig. 655. - *Paradiplozoon schizotorazi.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

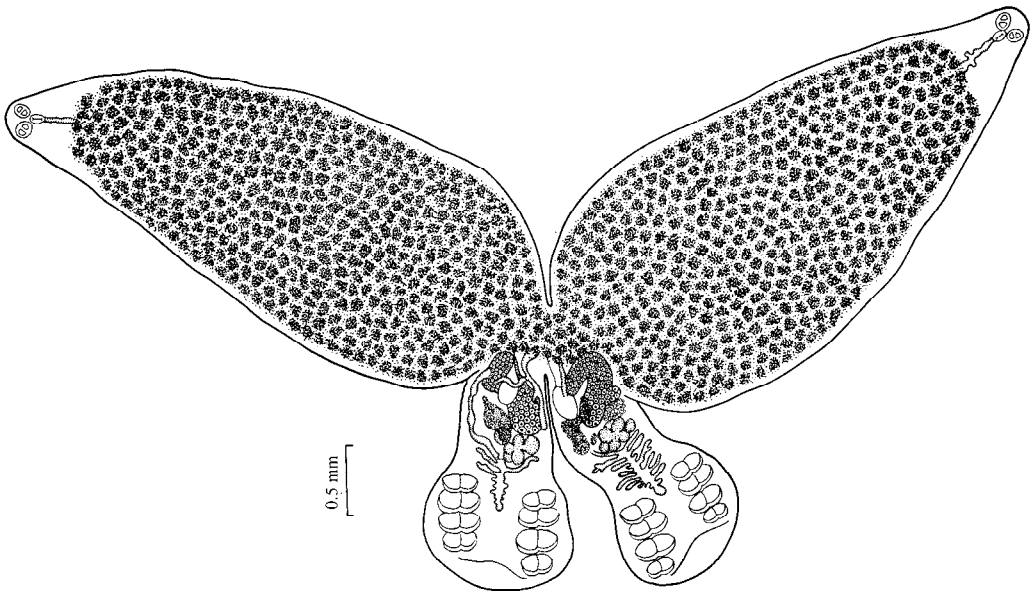

Fig. 656. - *Paradiplozoon megan*, total view (after Khotenovsky, 1985b).

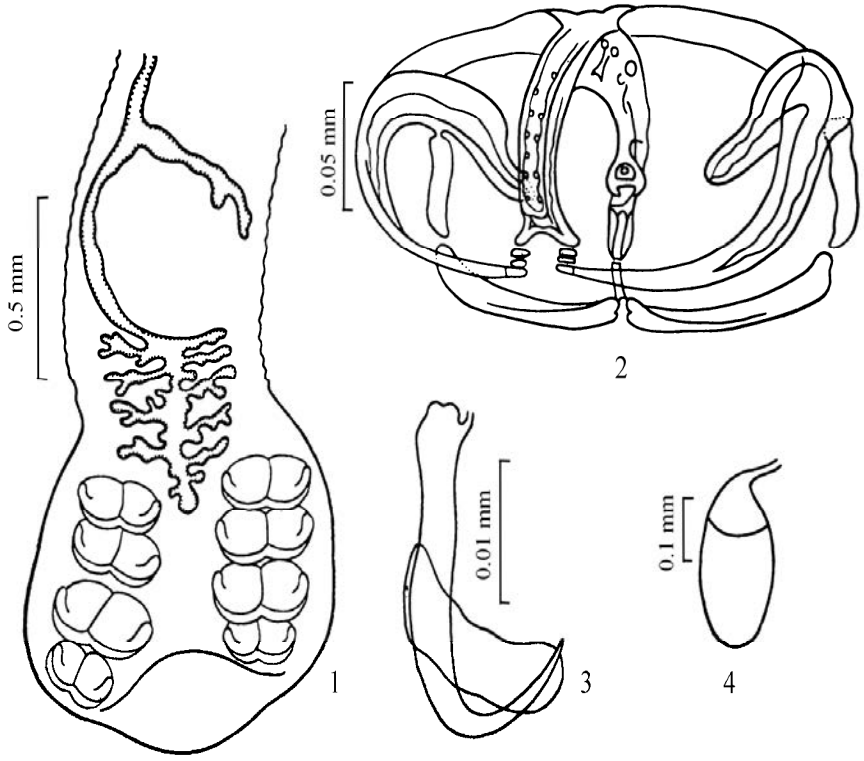

Fig. 657. - *Paradiplozoon megan.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

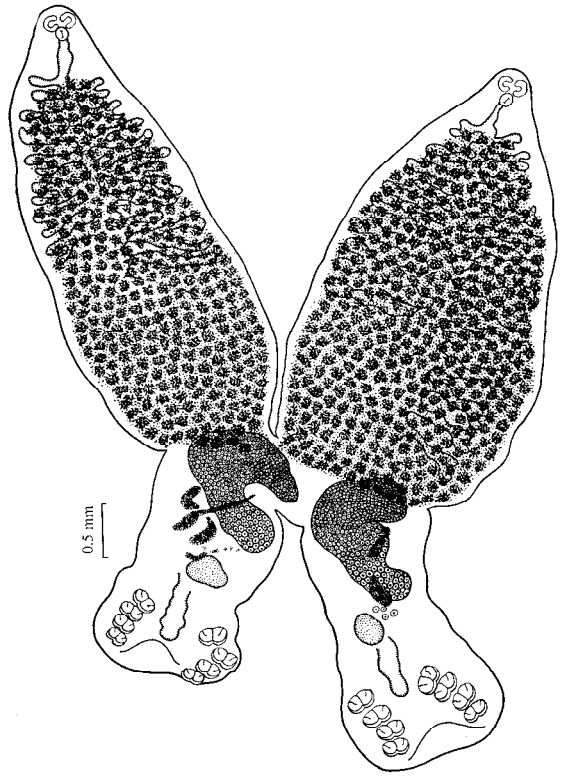

Fig. 658. - *Paradiplozoon megalobramae*, total view (after Khotenovsky, 1985b).

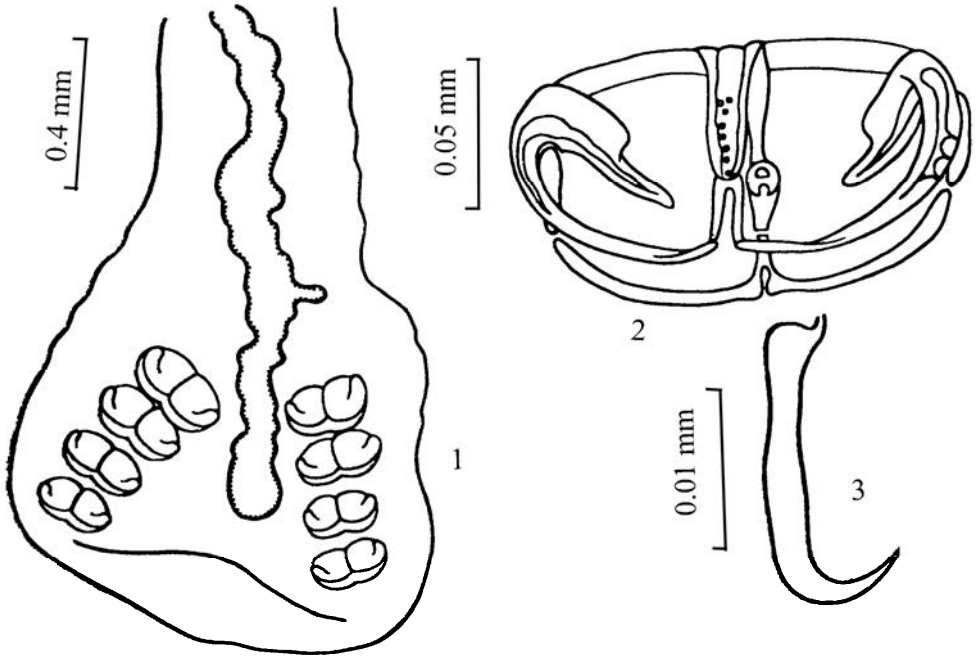

Fig. 659. - *Paradiplozoon megalobramae*. 1– posterior end, 2 – clamp, 3 – anchor (after Khotenovsky, 1985a).

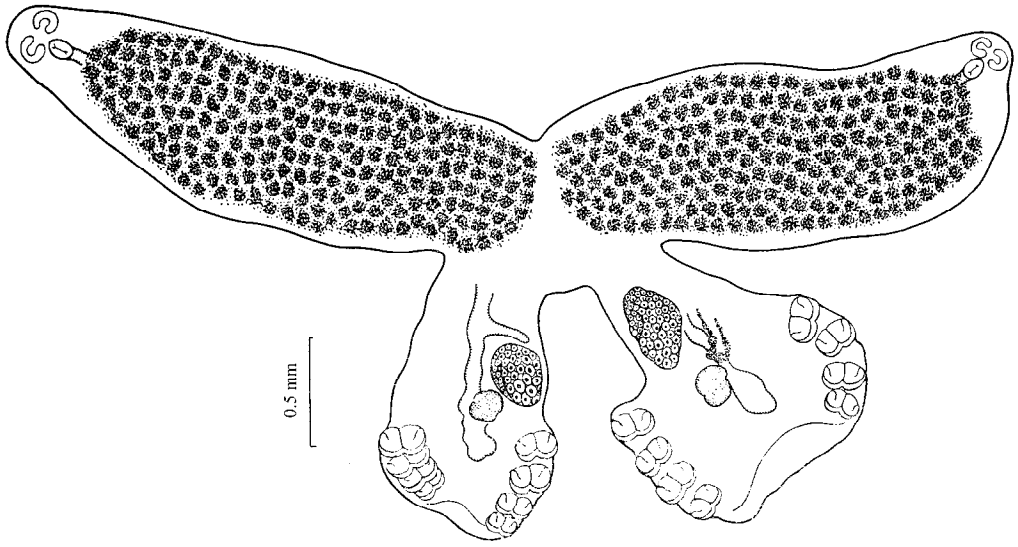

Fig. 660. - *Paradiplozoon marinae*, total view (after Khotenovsky, 1985b).

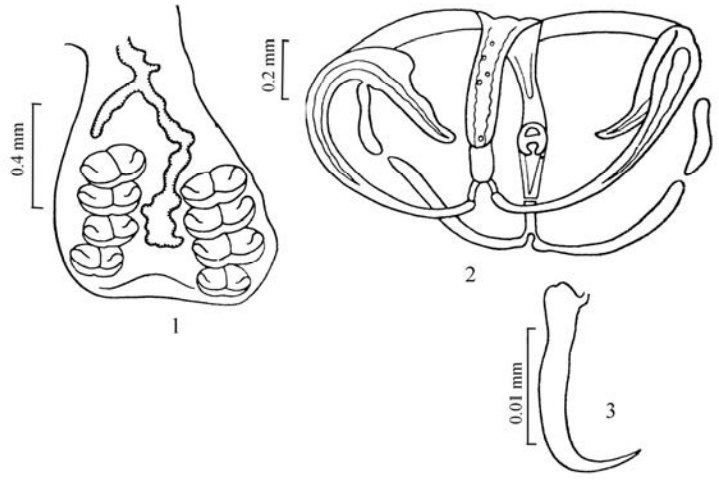

Fig. 661. - *Paradiplozoon marinae*. 1– posterior end, 2 – clamp, 3 – anchor (after Khotenovsky, 1985a).

10 (11). The anterior end of the median sclerite forms an additional projection that is connected to the clamp arches by two short sclerites.

P. marinae (Akhmerov, 1974) (Fig. 660, 661)

Syn.: *Diplozoon (Paradiplozoon) marinae* Akhmerov, 1974

Body length is 0.9–3.0 mm; anterior part 0.4–1.7, posterior part 0.3–0.9 mm; latter lacks folds. Size of clamps: I: 0.05–0.08 x 0.07–0.13; II: 0.06–0.10 x 0.08–0.15; III: 0.05–0.11 x 0.08–0.13; IV: 0.04–0.10 x 0.08–0.16 mm. The anterior end of the median sclerite is connected to the ends of the anterior arches by two sclerites that begin near the edges of the median sclerite's anterior end. Length of anchors is 0.015–0.017 mm, handles 0.030–0.037 mm. Diameter of suckers is 0.03–0.06 mm, pharynx 0.03–0.05 mm. The intestine forms small protrusions in the posterior part of the body. The testis is smooth edged. There are no data on size of eggs.

Found on gills of *Ctenopharyngodon idella*, *Xenocypris macrolepis*, *Culter alburnus*, and *Hypophthalmichthys molitrix*; Amur River Basin.

11 (10). The anterior end of the median sclerite lacks an additional projection. It is connected to the clamp arches by two elongated sclerites.
P. hemiculteri (Ling, 1973) (Fig. 662, 663)
Syn.: *Diplozoon hemiculteri* Ling, 1973

Body length is 1.2–3.1 mm; anterior part 0.7–2.0 mm, posterior part 0.3–0.6 mm; latter lacks folds. Size of clamps: I: 0.04–0.07 x 0.06–0.13; II: 0.05–0.07 x 0.08v0.13; III: 0.05–0.07 x 0.08–0.13; IV: 0.04–0.08 x 0.07–0.13 mm. The anterior end of the median sclerite is connected to the clamp arches by two elongated sclerites that begin at the middle of the median sclerite's anterior end. Length of anchors is 0.015–0.018 mm, handles 0.032–0.035 mm. Diameter of suckers is 0.03–0.06 mm, pharynx 0.03–0.05 mm. The intestine in the posterior part of the body is tube shaped, sometimes with 2–3 small projections. The testis is smooth edged or with poorly developed lobes. There are no data on size of eggs.

Found on gills of *Opsariichthys bidens* and *Hemiculter leucisculus*; Amur River Basin (China).

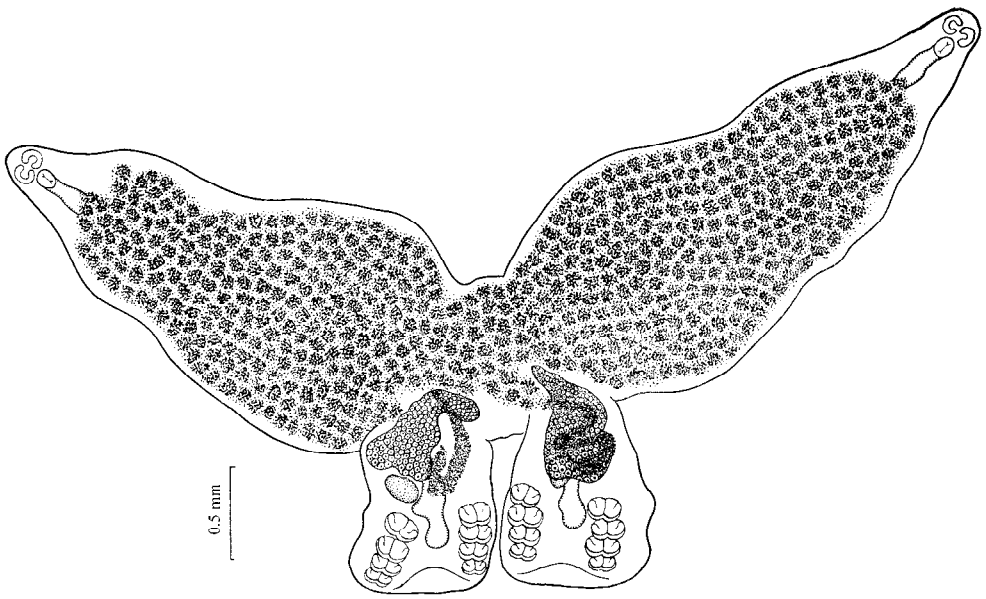

Fig. 662. - *Paradiplozoon hemiculteri*, total view (after Khotenovsky, 1985b).

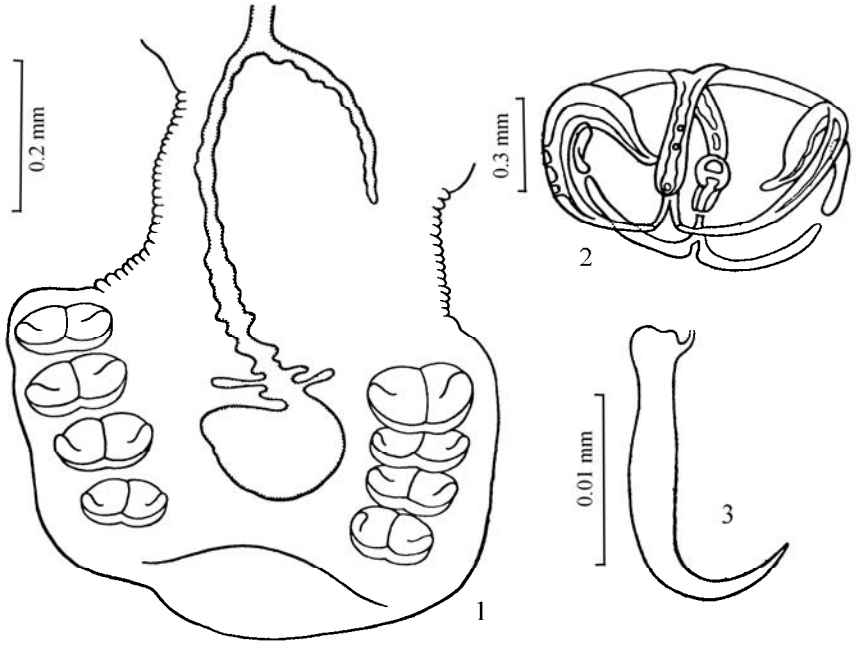

Fig. 663. - *Paradiplozoon hemiculteri.* 1– posterior end, 2 – clamp, 3 – anchor (after Khotenovsky, 1985a).

12 (1). The posterior part of the body has folds.

13 (16). The folds are minute; their width in the middle of the posterior part of the body is less than 0.15 mm.

14 (15). The anterior edge of the median sclerite is connected to the connivent clamp jaws by one short sclerite. The intestine in the posterior part of the body is without easily visible diverticula. Length of anchors is 0.022–0.024 mm. These are parasites of *Cyprinus carpio rubrofuscus.*
P. cyprini Khotenovsky, 1982 (Fig. 664, 665)

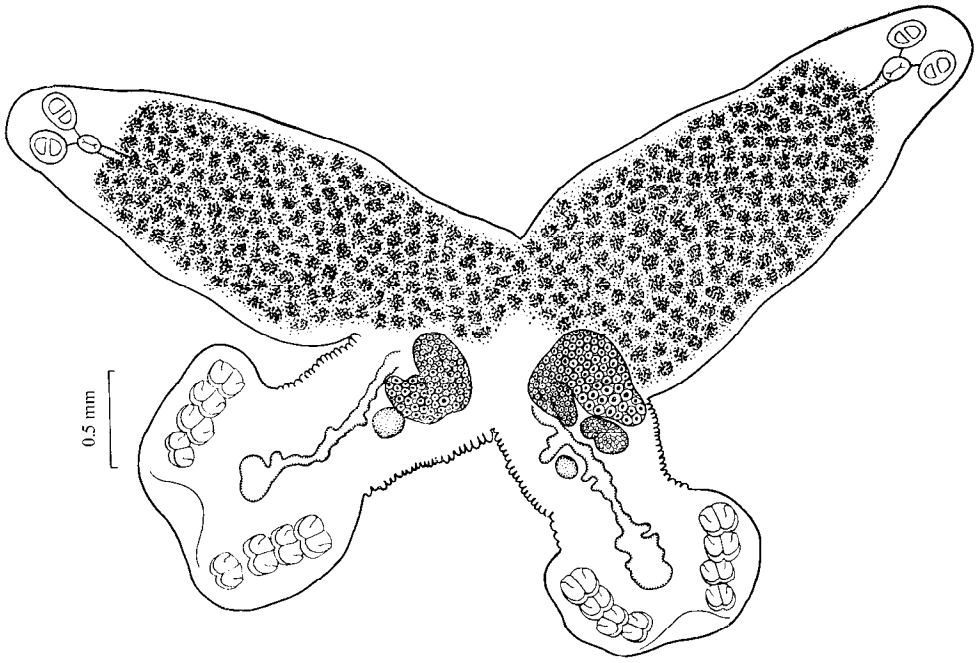

Fig. 664. - *Paradiplozoon cyprini*, total view (after Khotenovsky, 1985b).

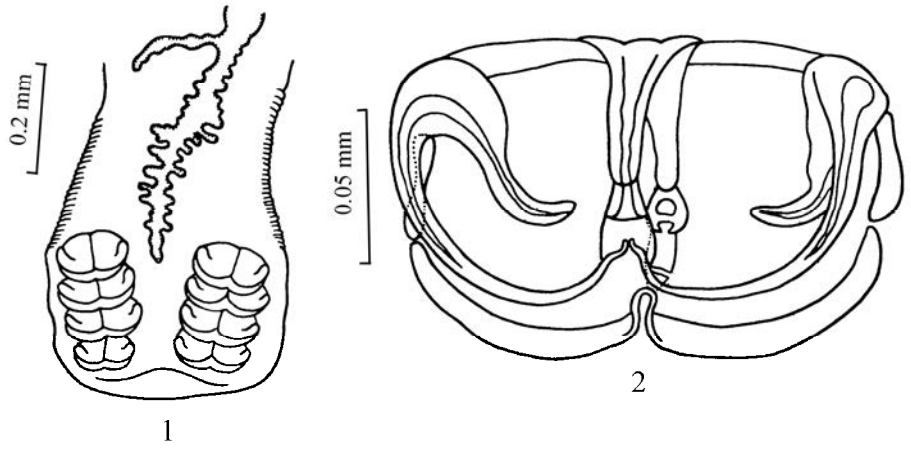

Fig. 665. - *Paradiplozoon cyprini.* 1– posterior end, 2 – clamp, (after Khotenovsky, 1985a).

Body length is 1.7–2.4 mm, anterior part 1.0–1.3 mm, posterior part 0.6–0.9 mm; latter has many small folds in its anterior part. Size of clamps: I: 0.07–0.08 x 0.10–0.12, II: 0.07–0.09 x 0.11–0.14; III: 0.07–0.09 x 0.12–0.14; IV: 0.08–0.10 x 0.10–0.13 mm. The anterior end of the median sclerite is connected by one short sclerite to the connivent anterior clamp jaws. Length of anchors is 0.022–0.024 mm, handles 0.044–0.049 mm. Diameter of suckers is 0.08–0.10 mm, pharynx 0.05 mm. The intestine in the posterior part of the body has small lateral projections. The testis is rounded or has little lobes. There are no data on size of eggs.

Found on gills of *Cyprinus carpio rubrofuscus*; Amur River Basin, Liao He River (China).

15 (14). The anterior end of the median sclerite is connected by two short sclerites to the clamp jaws. The intestine in the posterior part of the body has easily visible diverticula. Length of anchors is 0.027–0.030 mm.
P. rutili (Glaeser, 1967) (Fig. 666, 667)
Syn.: *Diplozoon rutili* Glaeser, 1967

Body length is 3.2–8.1 mm, anterior part 1.6–6.7 mm, posterior part 1.0–2.6 mm; latter has 40–50 small folds. Clamps are large. Size of clamps: I: 0.10–0.18 x 0.13–0.27; II: 0.10–0.20 x 0.17–0.36; III: 0.10–0.23 x 0.19–0.38; IV: 0.10–0.21 x 0.16–0.35 mm. The anterior part of the median sclerite is fish tail shaped and connected to the clamps jaws by two short sclerites. Length of anchors is 0.027–0.030 mm, handles 0.055–0.066 mm. Diameter of suckers is 0.06–0.15 mm, pharynx 0.06–0.10 mm. The intestine has few projections in the posterior part of the body. The testis is lobed. Size of eggs is 0.25–0.37 x 0.14–0.18 mm.

Found on gills of *Rutilus rutilus* (main host) and *Squalius cephalus*; Baltic Sea Basin and Danube River (Czechia).

16 (13). The folds are large; their width exceeds 0.2 mm in the middle of the posterior part of the body.

17 (22). The intestine is tube shaped and without diverticula in the posterior part of the body.

18 (21). The anterior end of the median sclerite is connected to the clamp jaws by two sclerites.

19 (20). The number of folds is 9–10.
P. minutum (Paperna, 1964) (Fig. 668)

These are small worms; body length is 0.8–1.6 mm, anterior part 0.5–1.2, posterior part 0.3–0.4 mm with 9–10 big folds. Clamps small: I: 0.02–0.043 x 0.032–0.074; II: 0.020–0.041 x 0.050–0.080; III: 0.020–0.041 x 0.050–0.080; IV: 0.025–0.050 x 0.042–0.090 mm. Sclerites are delicate. The anterior end of the median sclerite has two ear-like projections and is connected to the clamp jaws by two sclerites. Two additional sclerites at the posterior end of the median sclerite have the same width, and the anterior one has lateral bulges. Length of anchors is 0.019–0.020 mm, handles 0.037–0.041 mm, point 0.007–0.008 mm. Sucker length is 0.031–0.050 mm and width 0.025–0.034 mm; pharynx length is 0.035–0.046 mm and width 0.040–0.043 mm. The posterior part of the intestine lacks diverticula. The testis has little lobes. Size of eggs is 0.030 x 0.012 mm.

Found on gills of *Pseudophoxinus kervillei* and *Tylognathus steinitziorum*; Tiberias Lake (Israel).

20 (19). The number of folds is greater than 40.
P. pavlovskii (Bychowsky et Nagibina, 1959) (Fig. 669, 670)
Syn.: *Diplozoon pavlovskii* Bychowsky et Nagibina, 1959

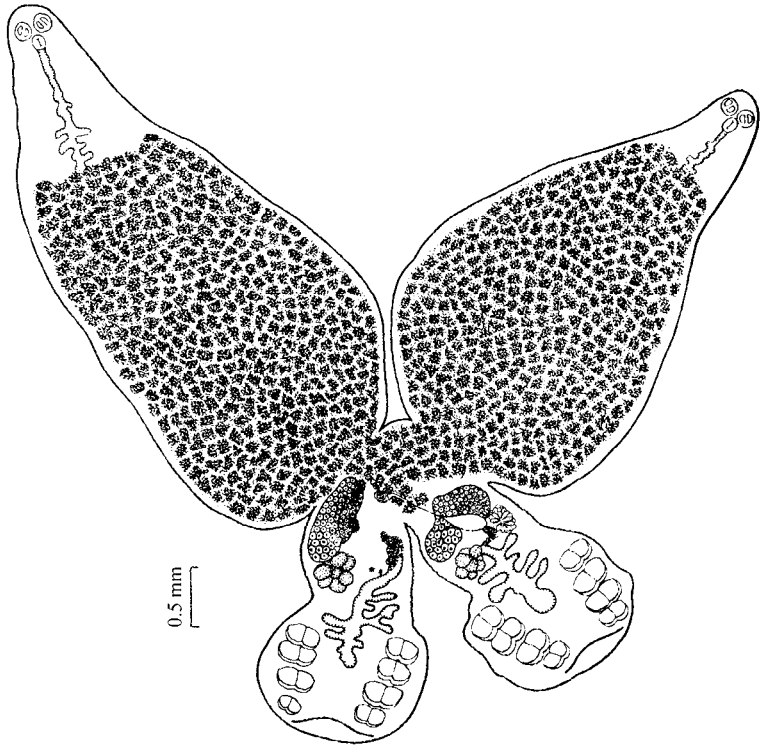

Fig. 666. - *Paradiplozoon rutili*, total view (after Khotenovsky, 1985b).

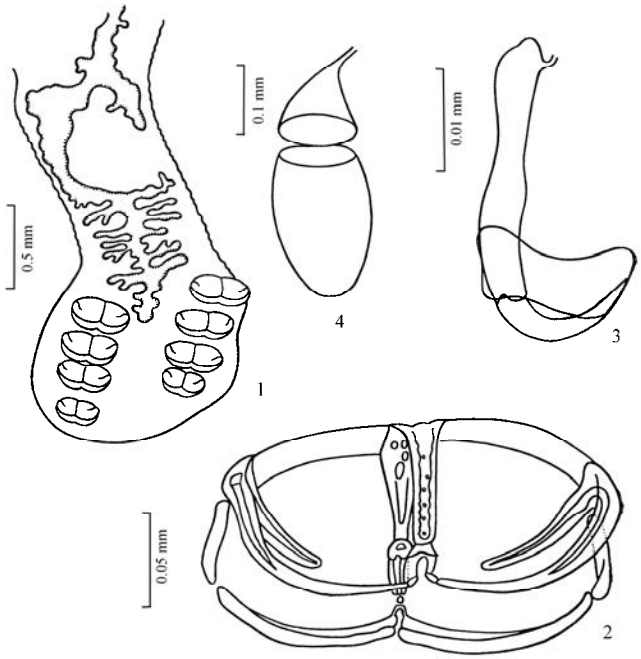

Fig. 667. - *Paradiplozoon rutili.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

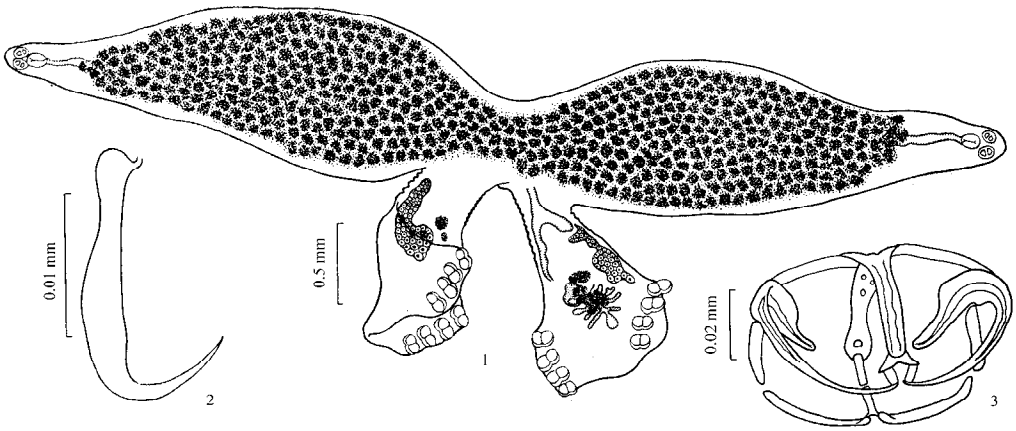

Fig. 668. - *Paradiplozoon minutum* (after Khotenovsky, 1985b).

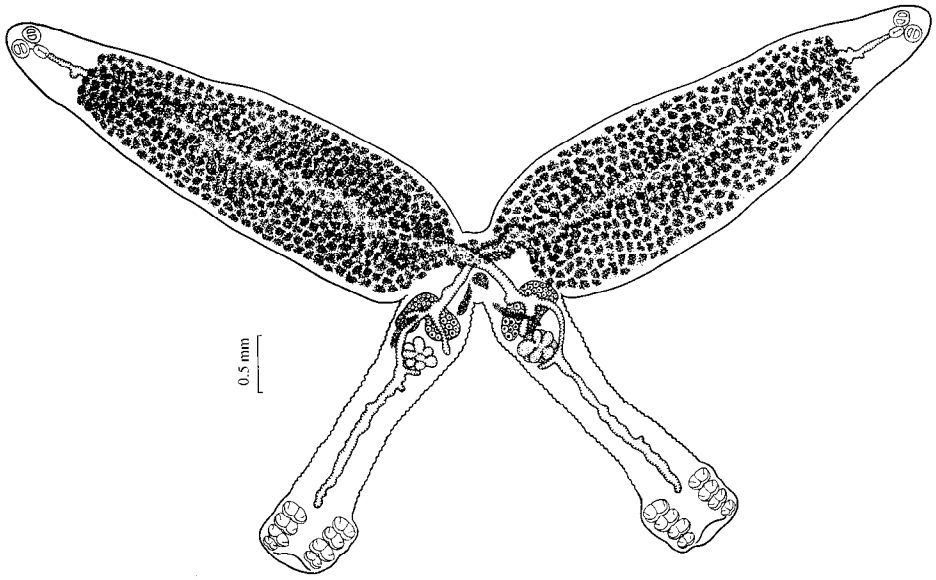

Fig. 669. - *Paradiplozoon pavlovskii*, total view (after Khotenovsky, 1985b).

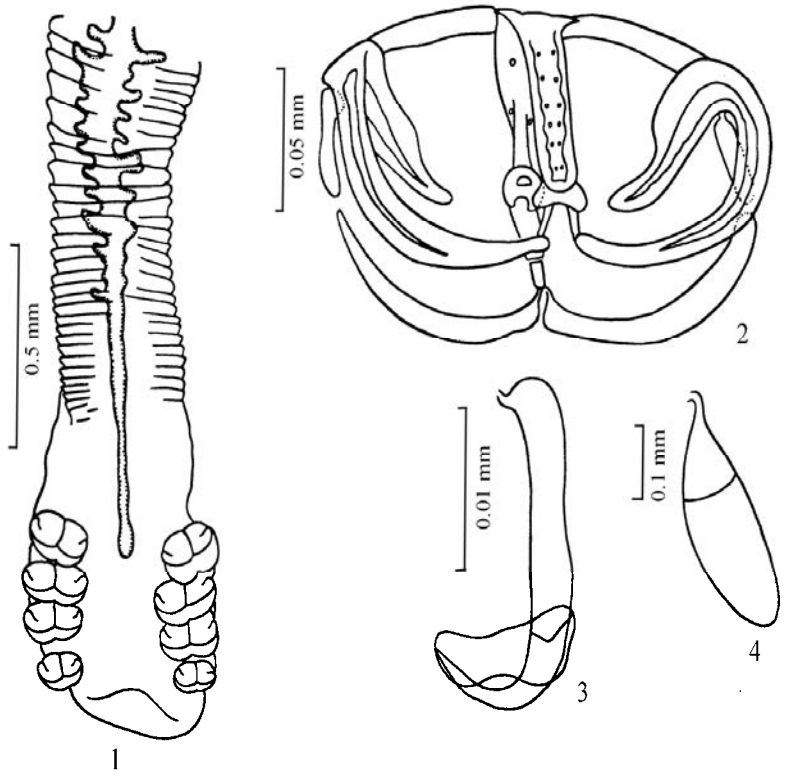

Fig. 670. - *Paradiplozoon pavlovskii.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

Body length is 2.6–7.7 mm, anterior part 1.3–4.5 mm, posterior part 0.7–2.2 mm; latter has 40–56 folds. Size of clamps: I: 0.06–0.10 x 0.09–0.15; II: 0.07–0.11 x 0.11–0.20; III: 0.07–0.12 x 0.12–0.21; IV: 0.08–0.14 x 0.11–0.23 mm. The anterior end of the median sclerite is widened, fish tail shaped, and connected to the clamp jaws by two sclerites. Length of anchors is 0.020–0.021 mm, handles 0.038–0.047 mm. Diameter of suckers is 0.06–0.10 mm, pharynx 0.05–0.10 mm. The intestine is tube shaped in the posterior part of the body and lacks diverticula. Size of eggs is 0.25–0.29 x 0.11–0.15 mm.

Found on gills of *Aspius aspius* and *Alburnus chalcoides*; rivers of the Baltic, Black, Caspian, and Aral Seas.

21 (18). The anterior end of the median sclerite is connected to the clamp jaws by one sclerite. The number of folds is less than 30.

P. tadjikistanicum (Gavrilova et Djalilov, 1965) (Fig. 671, 672)

Syn.: *Diplozoon tadjikistanicum* Gavrilova et Djalilov, 1965; *D. kovali* Kolesnikova, 1965; *D. kurensis* Mikailov, 1973; *D. mingetschauricum* Mikailov, 1973; *D. varicorhini* Mikailov, 1973

Body length is 3.4–4.4, anterior part 1.6–2.6, posterior part 1.0–1.4 mm; latter has 16–22 folds. Size of clamps: I: 0.07–0.09 x 0.09–0.10; II: 0.08–0.09 x 0.10–0.12; III: 0.07–0.09 x 0.10–0.12; IV: 0.07–0.09 x 0.10–0.12 mm. The anterior end of the median sclerite is trapezoid shaped and connected to the ends of the clamp jaws by one broad sclerite. Length of anchors is 0.023–0.026 mm, handles 0.05–0.06 mm. Diameter of suckers is 0.06–0.09 mm, pharynx 0.06–0.08 mm. The intestine lacks lateral projections in the posterior part of the body. The testis is lobed. Size of eggs is 0.37–0.40 x 0.14 mm.

Found on gills of *Capoeta capoeta sevangi*, *C. c. heratensis*, *Barbus lacerta cyri*, *Luciobarbus capito conocephalus*, and *L. brachycephalus*; rivers of the south Caspian and Aral Seas.

22 (17). The posterior part of the intestine has diverticula.

23 (24). The first clamp is 2–2.5 times smaller than the other clamps.

P. nagibinae (Glaeser, 1965) (Fig. 673, 674)

Syn.: *Diplozoon nagibinae* Glaeser, 1965

Body length is 1.6–5.4 mm, anterior part 0.7–3.4 mm, posterior part 0.8–1.6 mm; latter has 13–16 easily visible folds. Clamps are large and consist of thin sclerites. Size of clamps: I: 0.07–0.1 x 0.07–0.14; II: 0.09–0.20 x 0.14–0.26; III: 0.09–0.21 x 0.17–0.30; IV: 0.08–0.23 x 0.14–0.26 mm. Clamp I is 2–2.5 times smaller than the others. The median sclerite at the anterior end is fish tail shaped and connected to the clamps jaws by short sclerites. Length of anchors is 0.020–0.023 mm, handles 0.045–0.050 mm. Diameter of suckers is 0.05–0.08 mm, pharynx 0.06–0.09 mm. The intestine in the posterior part of the body has few diverticula. The testis is lobed. Size of eggs is 0.25–0.27 x 0.11–0.12 mm.

Found on gills of *Ballerus ballerus*; rivers of the Baltic, Black, and Caspian Seas.

24 (23). The first clamp is less than two times smaller than the other clamps.

25 (26). The anterior end of the median sclerite accretes to the ends of the clamp jaws (II–IV pairs) forming a ⊥ -shaped figure.

P. bliccae (Reichenbach-Klinke, 1961) (Fig. 675, 676)

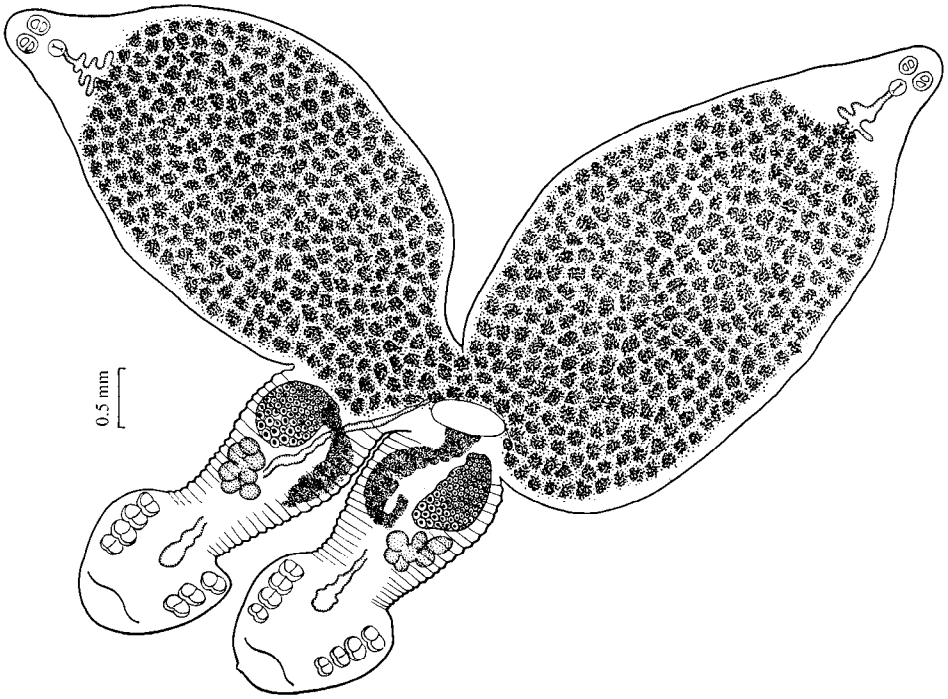

Fig. 671. - *Paradiplozoon tadjikistanicum*, total view (after Khotenovsky, 1985b).

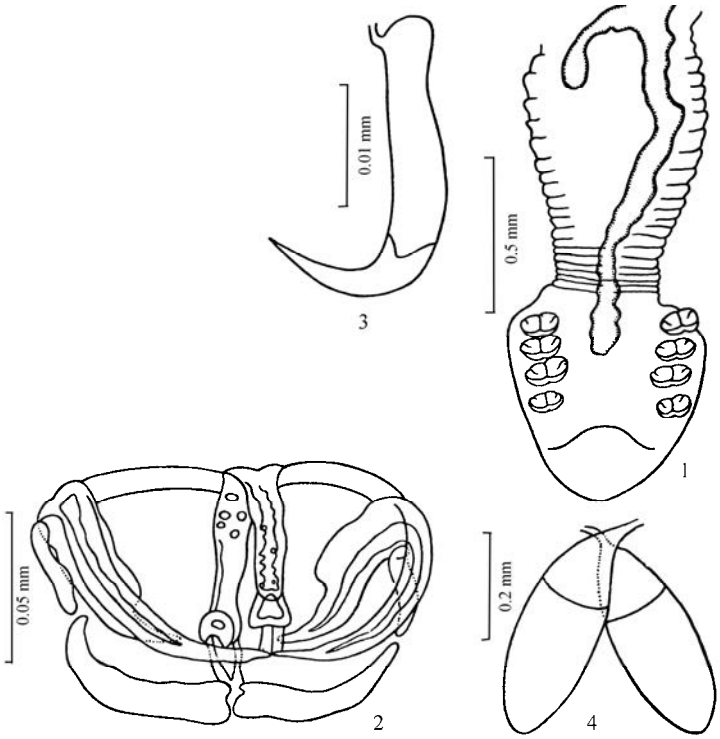

Fig. 672. - *Paradiplozoon tadjikistanicum.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

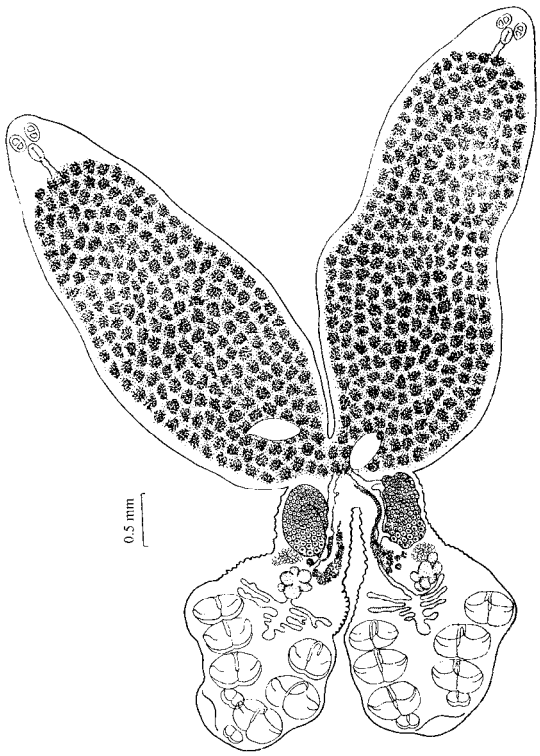

Fig. 673. - *Paradiplozoon nagibinae*, total view (after Khotenovsky, 1985b).

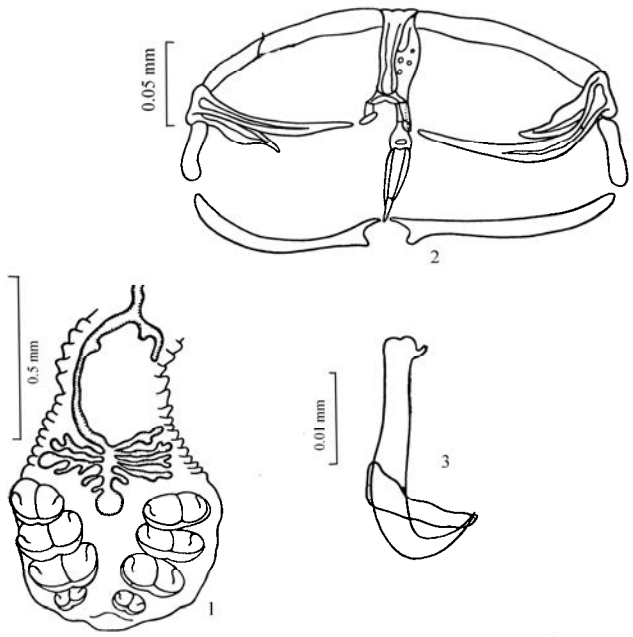

Fig. 674. - *Paradiplozoon nagibinae.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

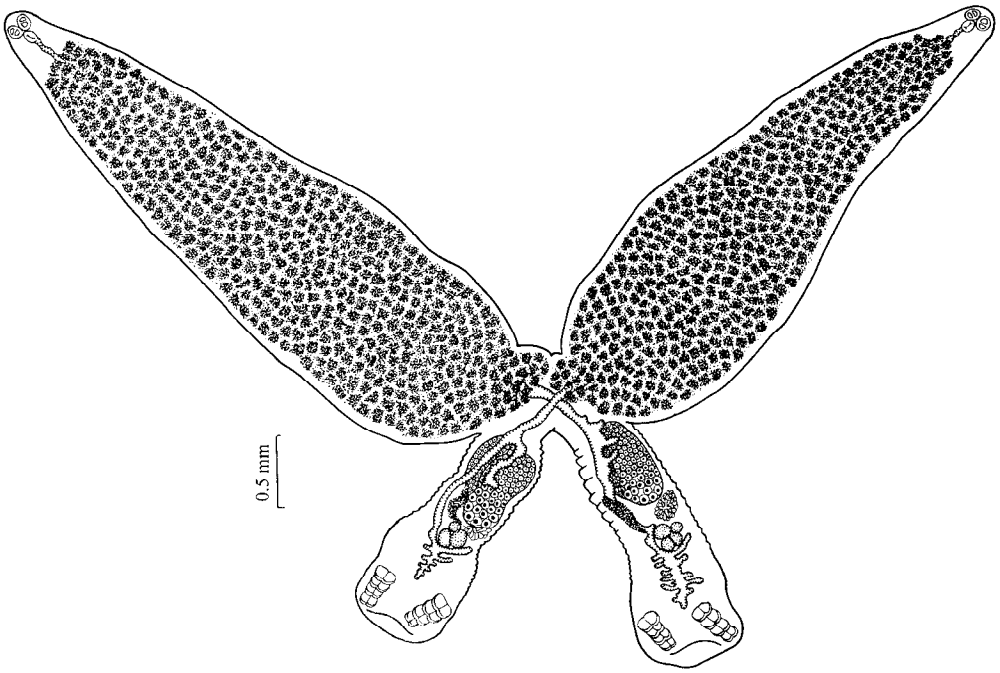

Fig. 675. - *Paradiplozoon bliccae*, total view (after Khotenovsky, 1985b).

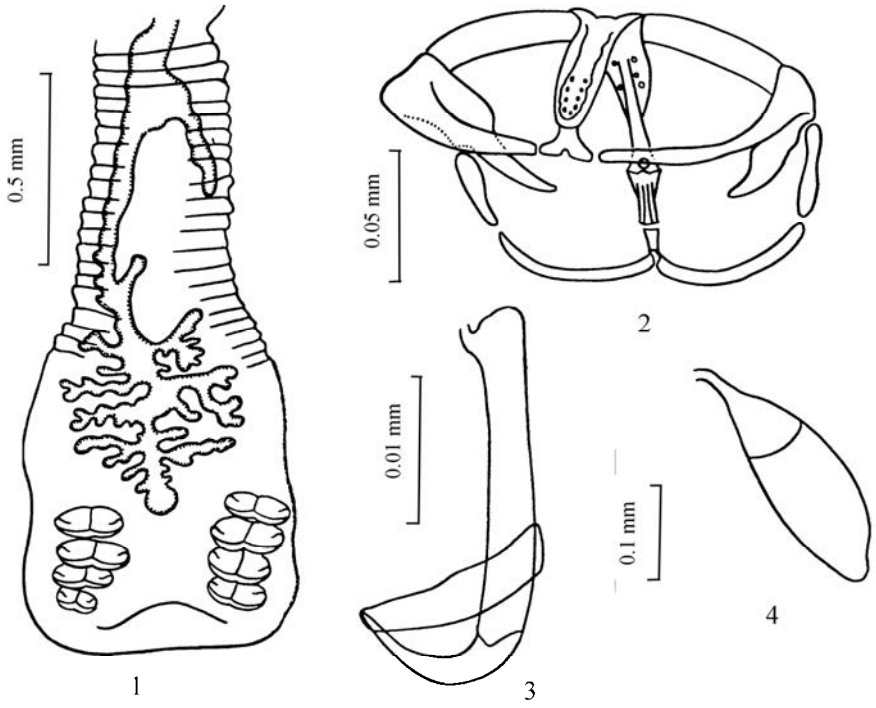

Fig. 676. - *Paradiplozoon bliccae.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

Syn.: *Diplozoon paradoxum bliccae* Reichenbach-Klinke, 1961; *D. gussevi* Glaeser, 1964; *D. markewitschi* Bychowsky, Gyntovt et Koval, 1964; *D. persicum* Mikailov, 1973

Body length is 1.7–5.9 mm, anterior part 0.9–3.6 mm, posterior part 0.6–2.0 mm; latter has 11–18 folds. Size of clamps: I: 0.05–0.09 x 0.08–0.15; II: 0.05–0.11 x 0.10–0.16; III: 0.05–0.11 x 0.11–0.17; IV: 0.06–0.11 x 0.11–0.21 mm. The anterior end of the median sclerite accretes to the ends of the clamp jaws forming a ⊥-shaped figure. Length of anchors is 0.022–0.025 mm, handles 0.05–0.06 mm. The intestine in the fore-part of the posterior section of the body is tube shaped and then forms diverticules nearer to the end. The testis is lobed. Size of eggs is 0.20–0.35 x 0.09–0.13 mm.

Found on gills of *Blicca bjoerkna, Scardinius erythrophthalmus, Abramis brama, Vimba vimba, V. v. persa,* and *V. v. tenella;* many rivers of the Baltic, Black, and Caspian Seas.

26 (25). The anterior end of the median sclerite does not accrete to the ends of the clamp jaws.

27 (28). The anterior end of the median sclerite is connected to the ends of the clamp jaws by one broad sclerite.

P. capoetobrama (Gavrilova, 1964) (Fig. 677, 678)

Syn.: *Diplozoon capoetobrame* Gavrilova, 1964

Body length is 2.3–4.5 mm, anterior part 1.3–2.9 mm, posterior part 0.8–1.4 mm; latter has 11–18 folds. Size of clamps: I: 0.05–0.07 x 0.08–0.09, II: 0.05–0.07 x 0.09–0.11; III: 0.05–0.07 x 0.10–0.12; IV: 0.06–0.07 x 0.09–0.13 mm. The anterior end of the median sclerite is rounded and connected by one broad sclerite to the clamp jaws. Length of anchors is 0.020–0.023 mm, handles 0.0440.05 mm. Diameter of suckers is 0.04–0.07 mm, pharynx 0.05–0.08 mm. The intestine has small projections in the posterior part of the body. The testis is lobed. Size of eggs is 0.23–0.26 x 0.08–0.11 mm.

Found on gills of *Capoetobrama kuschakewitschi*; Syrdar'ya River Basin (Tajikistan).

28 (27). The anterior end of the median sclerite is connected to the ends of the clamp jaws by two sclerites.

29 (36). The edges of the anterior end of the median sclerite are cut on the mitre.

30 (31). The pharynx is larger than the suckers.

P. alburni Khotenovsky, 1982 (Fig. 679, 680)

Body length is 1.4–3.6 mm, anterior part 0.8–2.1 mm, posterior part 0.4–1.2 mm; latter has 16–23 folds. Size of clamps: I: 0.04–0.07 x 0.07–0.12; II: 0.04–0.08 x 0.08–0.15; III: 0.04–0.08 x 0.09–0.16; IV: 0.05–0.08 x 0.09–0.16 mm. The anterior end of the median sclerite is almost square shaped and is connected to the clamp jaws by two short sclerites. The lateral edges of the posterior end of the median sclerites is cut on the mitre. Length of anchors is 0.020–0.022 mm, handles 0.040–0.045 mm. Diameter of suckers is 0.03–0.06 mm, pharynx 0.04–0.07 mm. The intestine has few lateral projections in the posterior part of the body. The testis is lobed. Size of eggs is 0.21–0.25 x 0.07–0.10 mm.

Found on gills of *Alburnus alburnus*, *Rutilus rutilus*, *Leuciscus idus*, *Scardinius erythrophthalmus*, *Ctenopharyngodon idella*, *Alburnoides bipunctatus*, and *Cyprinus carpio*; rivers of the Baltic, Black, and Caspian Seas.

31 (30). The pharynx is smaller than the suckers.

32 (35). The anterior end of the median sclerite has lateral projections.

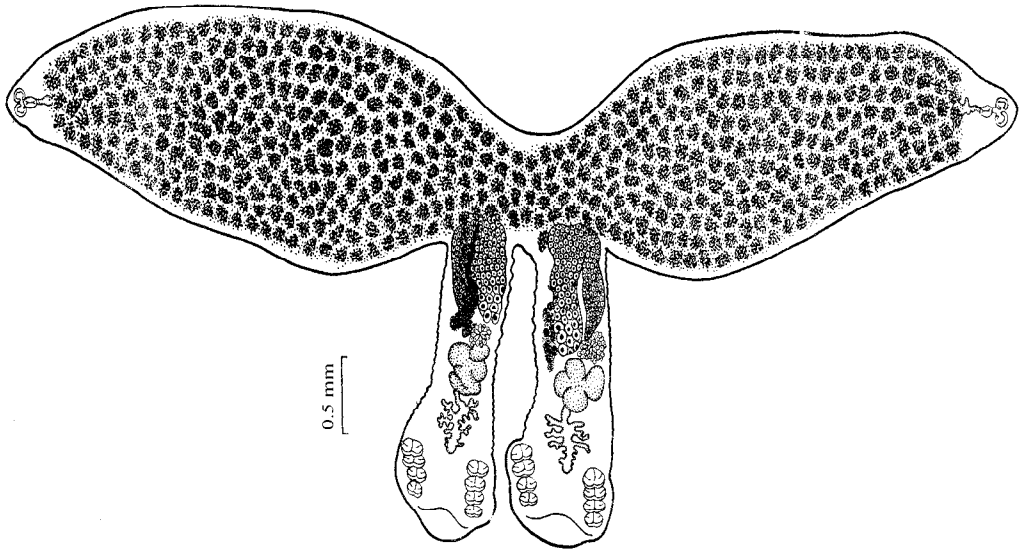

Fig. 677. - *Paradiplozoon capoetobrama*, total view (after Khotenovsky, 1985b).

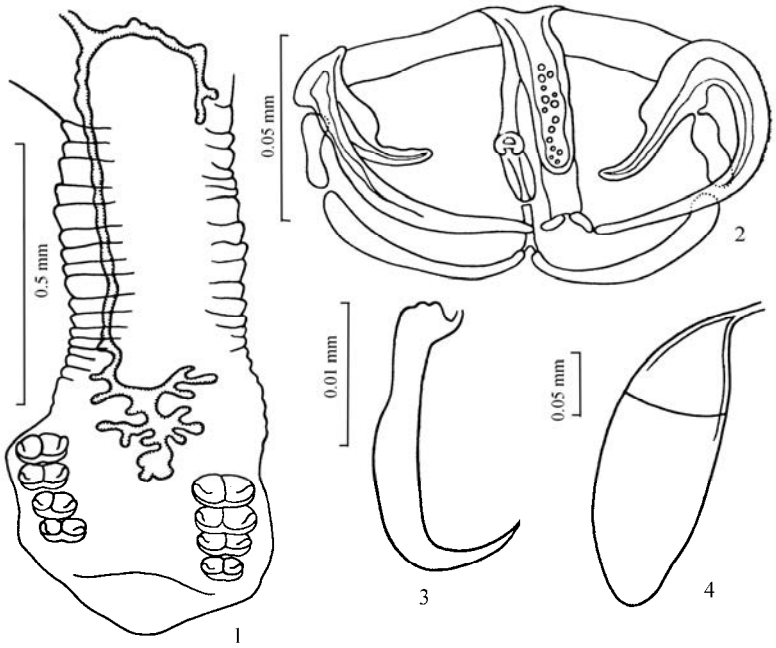

Fig. 678. - *Paradiplozoon capoetobrama*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

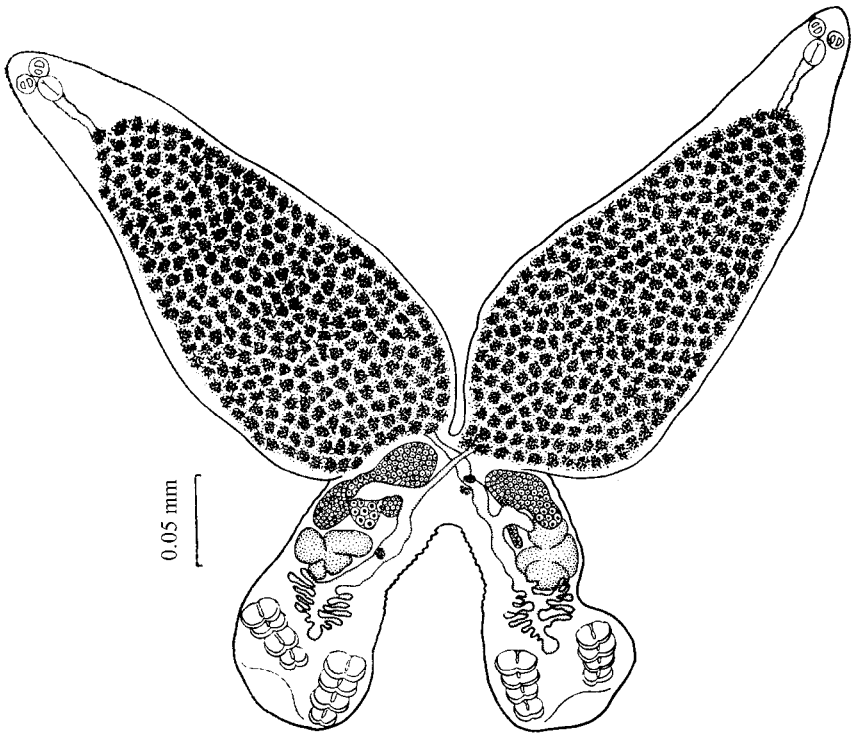

Fig. 679. – *Paradiplozoon alburni*, total view (after Khotenovsky, 1985b).

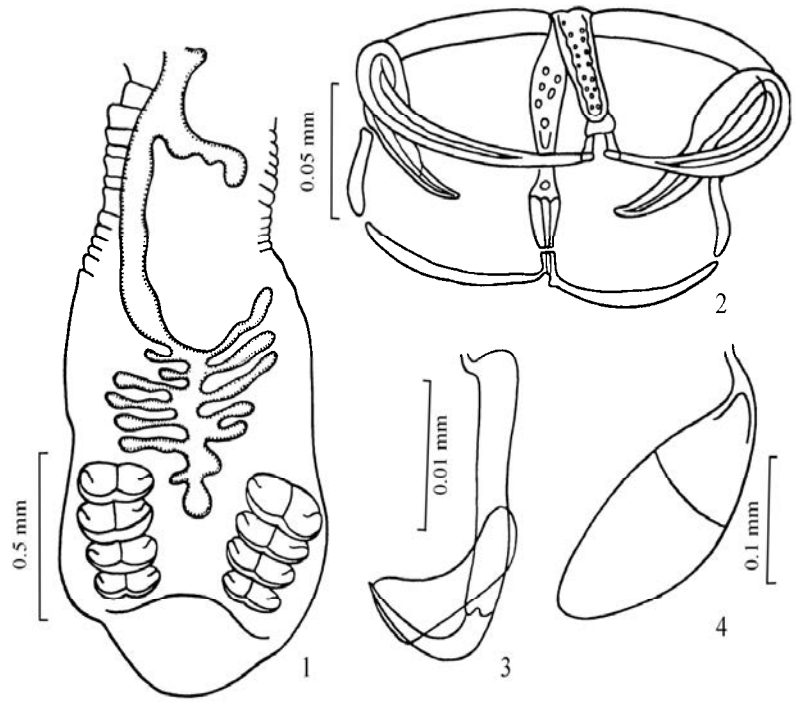

Fig. 680. - *Paradiplozoon alburni.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

33 (34). The testis has large lobes. Parasite of ***Pseudaspius leptocephalus***.
P. amurense (Akhmerov, 1974) (Fig. 681, 682)
Syn.: ***Diplozoon (Paradiplozoon) amurensis*** Akhmerov, 1974

Body length is 2.3–5.6 mm, anterior part 1.2–3.5 mm, posterior part 0.8–1.9 mm; latter hash 11–16 folds. Size of clamps: I: 0.06–0.08 x 0.08–0.14; II: 0.07–0.08 x 0.13–0.17; III: 0.07–0.09 x 0.12–0.18; IV: 0.07–0.10 x 0.12–0.19 mm. The anterior end of the median sclerite has two lateral projections that are connected to the clamp jaws by two sclerites. Length of anchors is 0.018–0.021 mm, handles 0.040–0.045 mm. Diameter of suckers is 0.06– 0.08 mm, pharynx 0.06–0.07 mm. The intestine in the posterior part of the body has short lateral projections. The testis is lobed. Size of eggs is 0.23–0.30 x 0.08–0.14 mm.

Found on gills of ***Pseudaspius leptocephalus***; Amur River.

34 (33). The testis is smooth edged. Parasite of ***Leuciscus waleckii***.
P. skrjabini (Akhmerov, 1974) (Fig. 683, 684)
Syn.: ***Diplozoon (Paradiplozoon) skrjabini*** Akhmerov, 1974

Body length is 1.1–4.0 mm, anterior part 0.6–2.5 mm, posterior part 0.4–1.4 mm; latter has 10–13 folds. Size of clamps: I: 0.04–0.07 x 0.06–0.12; II: 0.03–0.08 x 0.08–0.15; III: 0.04–0.08 x 0.08–0.15; IV: 0.04–0.09 x 0.07–0.16 mm. The anterior end of the median sclerite is trapezoid shaped and connected to the clamp jaws by two sclerites. Length of anchors is 0.018–0.022 mm; handles 0.033–0.042 mm. Diameter of the suckers is 0.03–0.09 mm, pharynx 0.03–0.07 mm. The intestine near its posterior end has little diverticula. The testis has smooth edges. Size of eggs is 0.25–0.27 x 0.08–0.1 mm.

Found on gills of ***Leuciscus waleckii***; Amur region.

35 (32). The anterior end of the median sclerite lacks lateral projections.
P. tisae Khotenovsky, 1982 (Fig. 685, 686)

Body length is 2.4–4.7 mm; anterior part 1.3–2.8 mm, posterior part 0.7–1.4 mm; latter has 11–16 folds. Size of clamps: I: 0.06–0.08 x 0.09–0.12; II: 0.05–0.08 x 0.10–0.15; III: 0.06–0.09 x 0.11–0.16; IV: 0.06–0.09 x 0.09–0.11 mm. The anterior end of the median sclerite is connected to the ends of the clamp jaws by an arcuate sclerite. The lateral edges of the posterior end of the median sclerite are cut on the mitre. Length of anchors is 0.019–0.021 mm, handles 0.039–0.048 mm. Diameter of suckers is 0.05–0.08 mm, pharynx 0.05–0.07 mm. The intestine in the posterior part of the body has few diverticula. The testis is lobed. Size of eggs is 0.18–0.26 x 0.07–0.11 mm.

Found on gills of ***Barbus barbus*** and ***B. petenyi***; Oder, Elbe, and Tisa Rivers (Danube Basin).

36 (29). The edges of the posterior end of the median sclerite are rounded.

37 (38.) The length of the anchors is greater than 0.025 mm. The posterior end of the median sclerite has a rectangular projection.
P. ergensi (Pejcoch, 1968) (Fig. 687, 688)
Syn.: ***Diplozoon ergensi*** Pejcoch, 1968

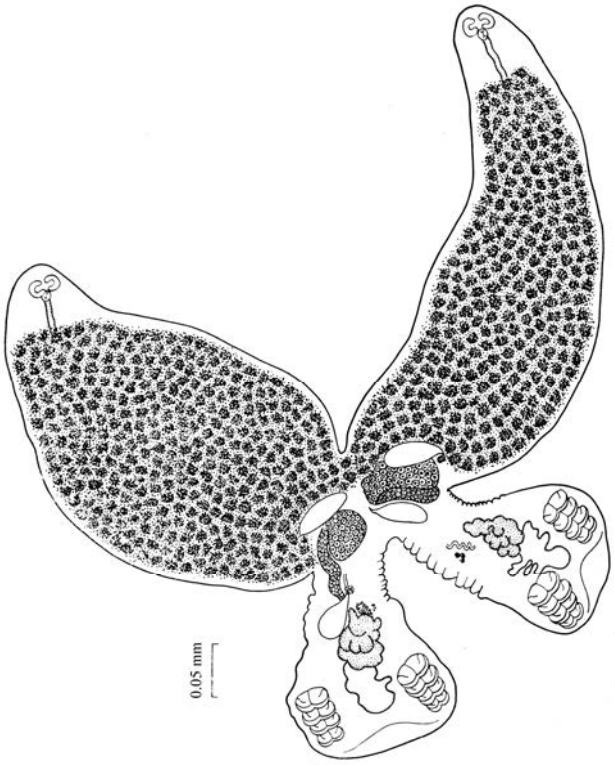

Fig. 681. - *Paradiplozoon amurense*, total view (after Khotenovsky, 1985b).

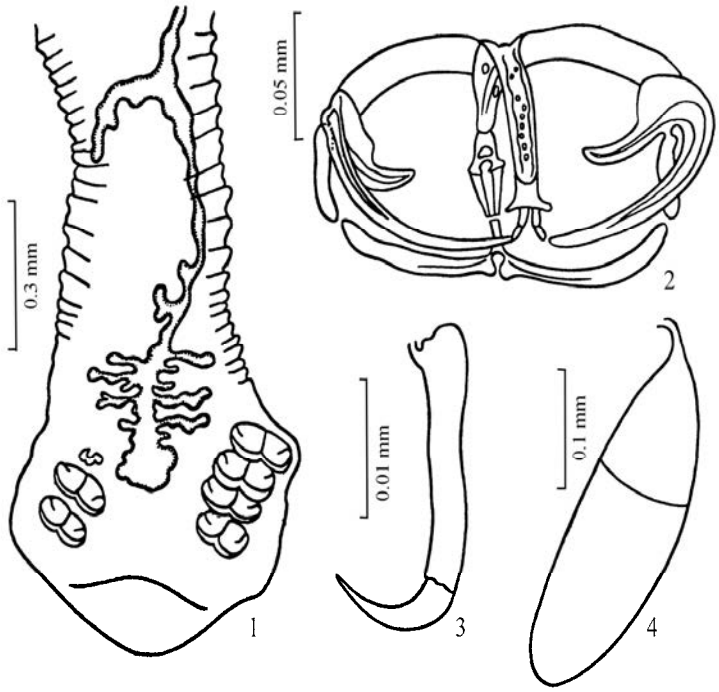

Fig. 682. - *Paradiplozoon amurense*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

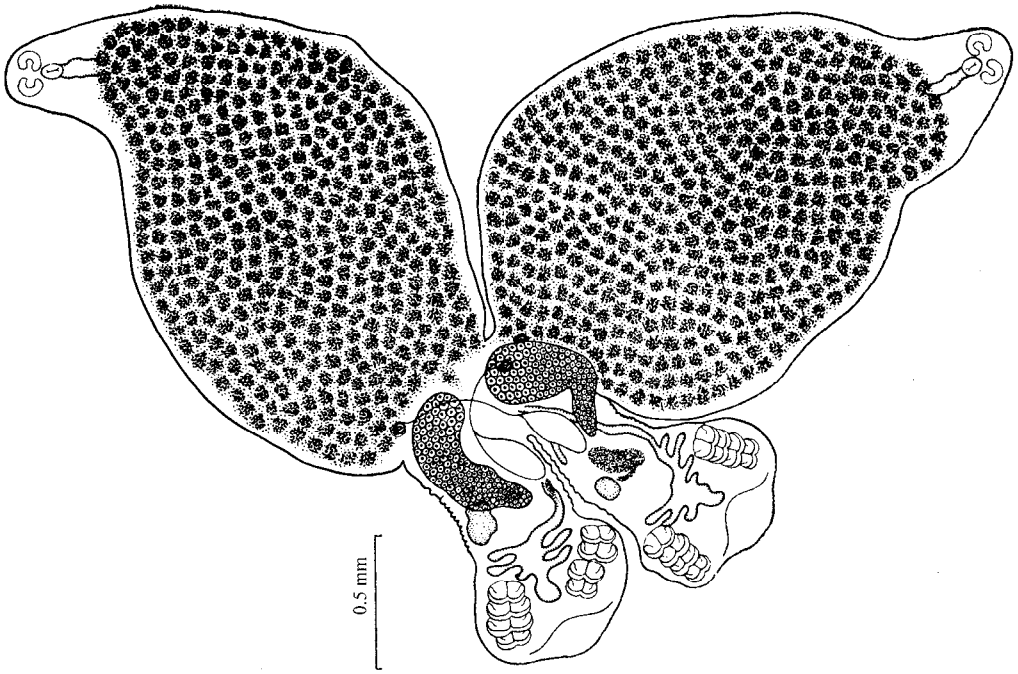

Fig. 683. - *Paradiplozoon skrjabini*, total view (after Khotenovsky, 1985b).

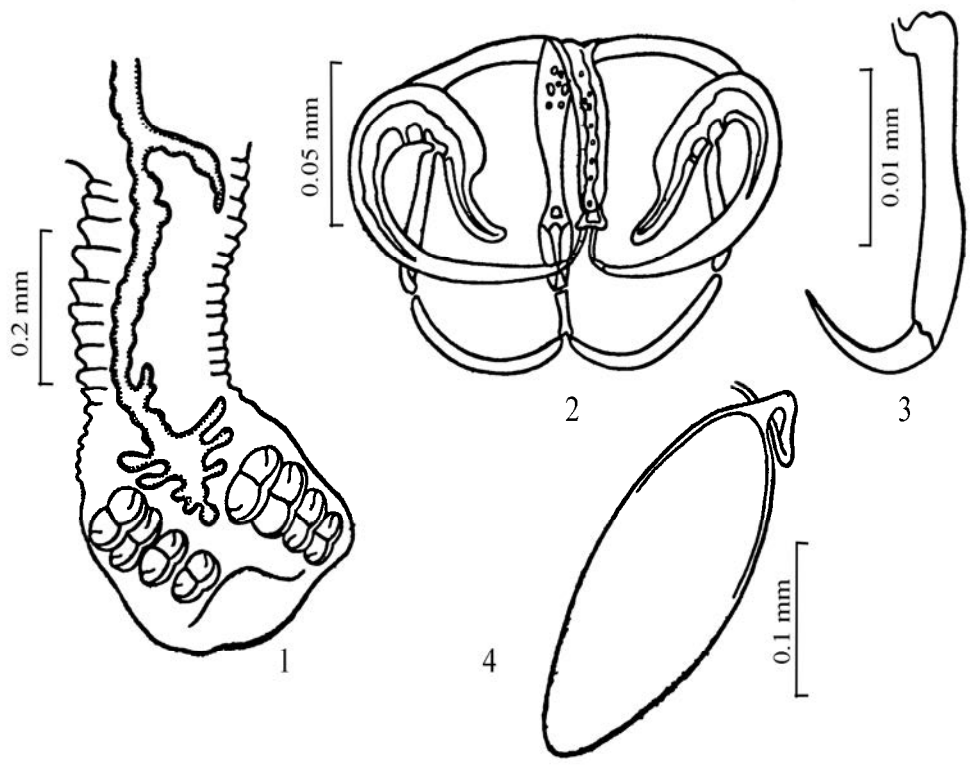

Fig. 684. - *Paradiplozoon skrjabini.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

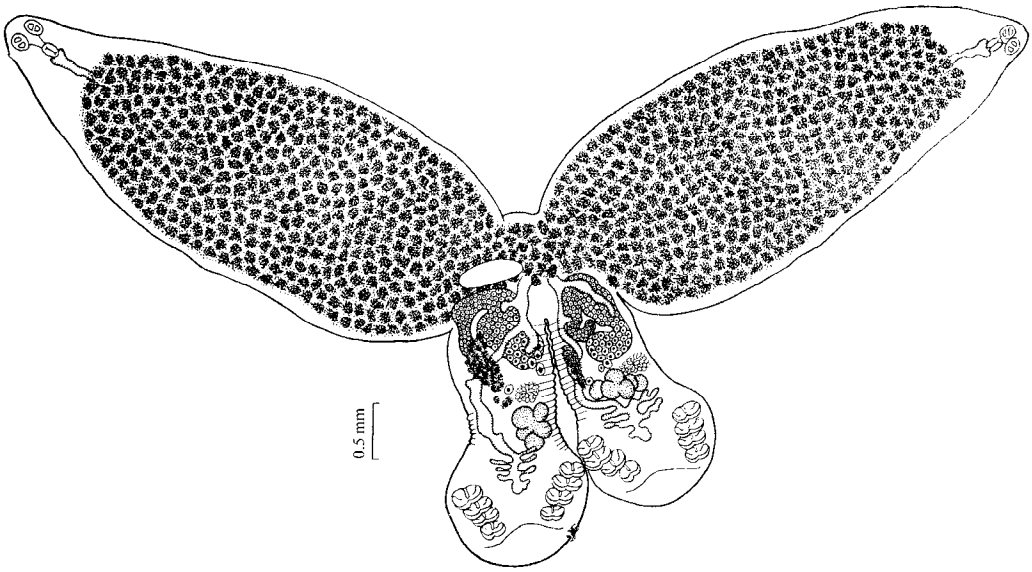

Fig. 685. - *Paradiplozoon tisae*, total view (after Khotenovsky, 1985b).

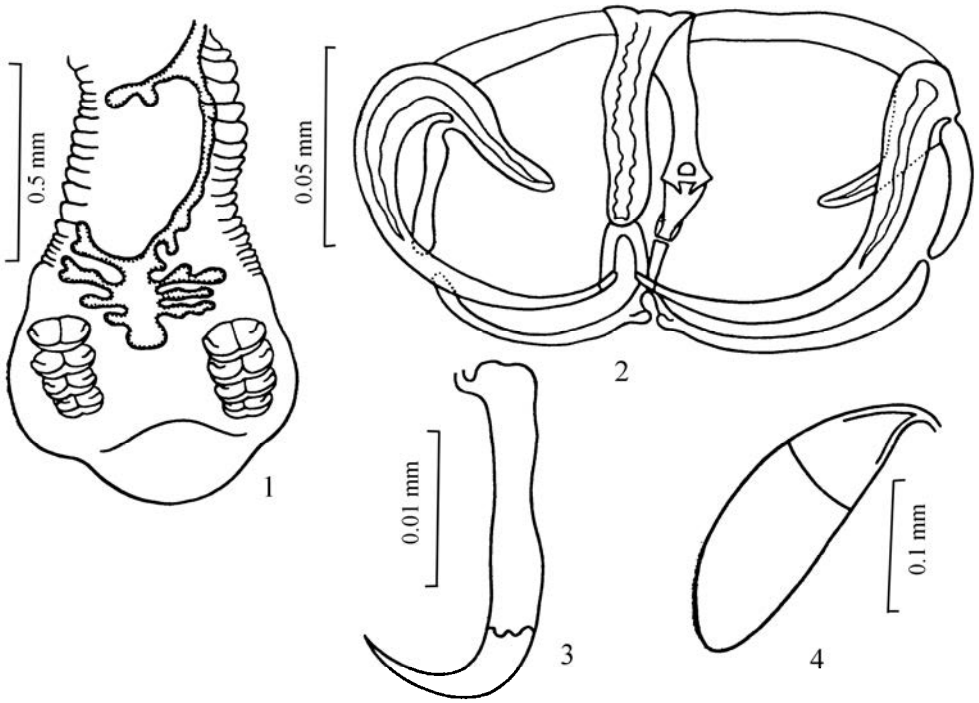

Fig. 686. - *Paradiplozoon tisae*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

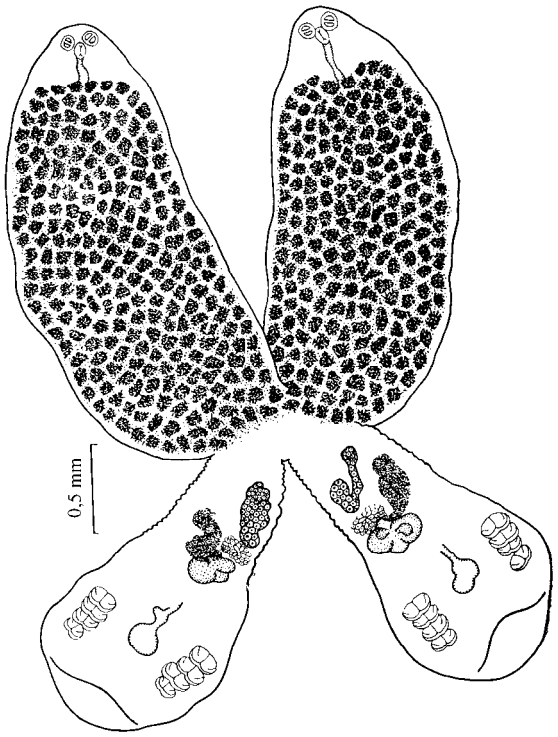

Fig. 687. - *Paradiplozoon ergensi*, total view (after Khotenovsky, 1985b).

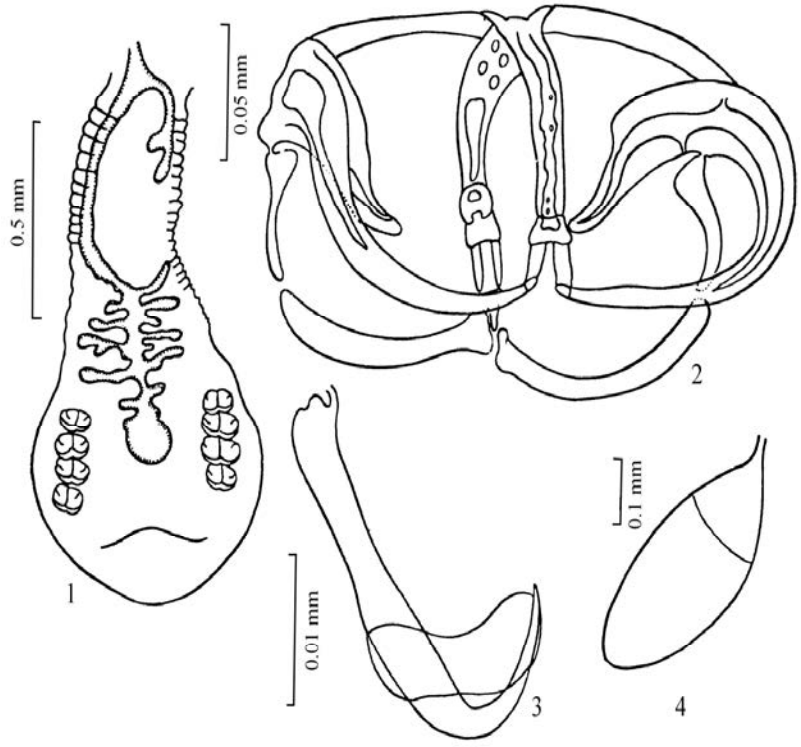

Fig. 688. - *Paradiplozoon ergensi.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

Body length is 3.0–7.5 mm; anterior part 1.5–4.8 mm, posterior part 1.3–2.7 mm. The anterior end of the posterior part of the body has minute folds, which disappear near the haptor. Size of clamps: I: 0.07–0.08 x 0.10–0.15; II: 0.07–0.09 x 0.11–0.18; III: 0.06–0.10 x 0.12–0.18; IV: 0.06–0.10 x 0.09–0.18 mm. The anterior end of the median sclerite is widened and connected to the clamp jaws by two sclerites. The posterior end of the median sclerite has a rectangular projection. Length of anchors is 0.027 mm, handles 0.050–0.057 mm. Diameter of suckers is 0.05–0.09 mm, pharynx 0.05–0.09 mm. The intestine has few lateral projections in the posterior part of the body. The testis is lobed. Size of eggs is 0.4 x 0.199 mm.

Found on gills of ***Squalius cephalus***; basins of the Oder, Elbe, and Danube Rivers.

38 (37). The length of the anchors is less than 0.025 mm. The posterior part of the median sclerite lacks a rectangular projection.

39 (40). The anterior end of the median sclerite has an additional arcuate projection connected to the clamp jaws.

P. leucisci Khotenovsky, 1982 (Fig. 689, 690)

Body length is 2.1–6.0 mm, anterior part 1.3–3.8 mm, posterior part 0.81.8 mm; the latter has 12–18 folds. Size of clamps: I: 0.05–0.07 x 0.08–0.13; II: 0.05–0.08 x 0.11–0.16, III: 0.05–0.08 x 0.12–0.17; IV: 0.05–0.08 x 0.12–0.18 mm. The median sclerite is rather coarse, and its anterior end is connected to the clamp jaws by two thin sclerites. The anterior end of the median sclerite has an additional arcuate projection that also is connected to the clamp jaws. The lateral edges of the posterior end of the median sclerite are rounded. Length of anchors is 0.020–0.023 mm, handles 0.041–0.048 mm. Diameter of suckers is 0.05–0.07 mm, pharynx 0.06–0.08 mm. The intestine has few lateral diverticula in the posterior part of the body. The testis is lobed. Size of eggs is 0.24–0.25 x 0.09–0.10 mm.

Found on gills of ***Leuciscus leuciscus*** and ***Squalius cephalus***; Tisa River Basin; Ladoga Lake; Sukhona and Volga Rivers (Russia).

40 (39). The anterior end of the median sclerite lacks an additional arcuate projection.

41 (42). The folds on the ventral side of the body in the posterior part of the body reach the level of the clamps.

P. sapae (Reichenbach-Klinke, 1961) (Fig. 691, 692)

Syn.: ***Diplozoon paradoxum sapae*** Reichenbach-Klinke, 1961; ***D. ballerus*** Komarova, 1964; ***D. bergi*** Gavrilova, 1964; ***D. balleri*** Nagibina, Ergens et Paschkevitchute, 1970; ***D. sapa*** Mikailov, 1973

Body length is 1.9–5.4 mm, anterior part 1.0–2.8 mm, posterior part 0.6–2.0 mm; latter has 18–28 folds and also covers the anterior part of the haptor. Size of clamps: I: 0.05–0.10 x 0.07–0.16; II: 0.05–0.10 x 0.10–0.17; III: 0.05–10 x 0.09–0.19; IV: 0.05–0.11 x 0.08–0.18 mm. The anterior end of the median sclerite is nearly rectangular shaped and connected to the clamp jaws by two short sclerites. Length of anchors is 0.020–0.023 mm, handles 0.037–0.05 mm. Diameter of suckers is 0.05–0.08 mm, pharynx 0.04–0.09 mm. The intestine near its end has few diverticula. The testis is lobed. Size of eggs is 0.22–0.24 x 0.09–0.12 mm.

Found on gills of ***Abramis brama***, ***Ballerus ballerus***, ***B. sapa***, and ***B. s. bergi***; rivers of the Baltic, Black, Caspian, and Aral Seas.

42 (41). The folds on the ventral side of the posterior part of the body do not reach the level of the clamps.

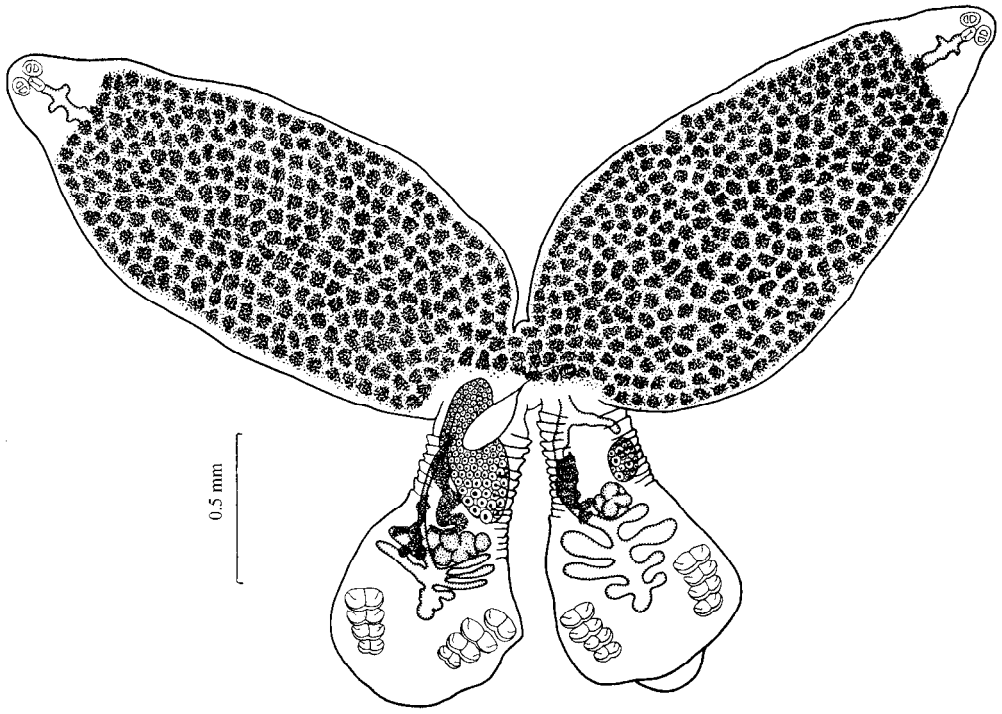

Fig. 689. - *Paradiplozoon leucisci*, total view (after Khotenovsky, 1985b).

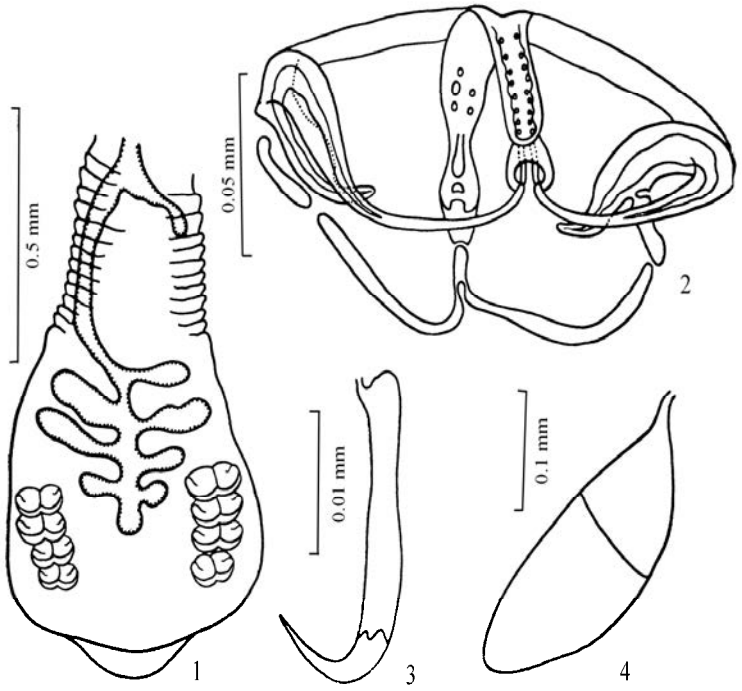

Fig. 690. - *Paradiplozoon leucisci.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

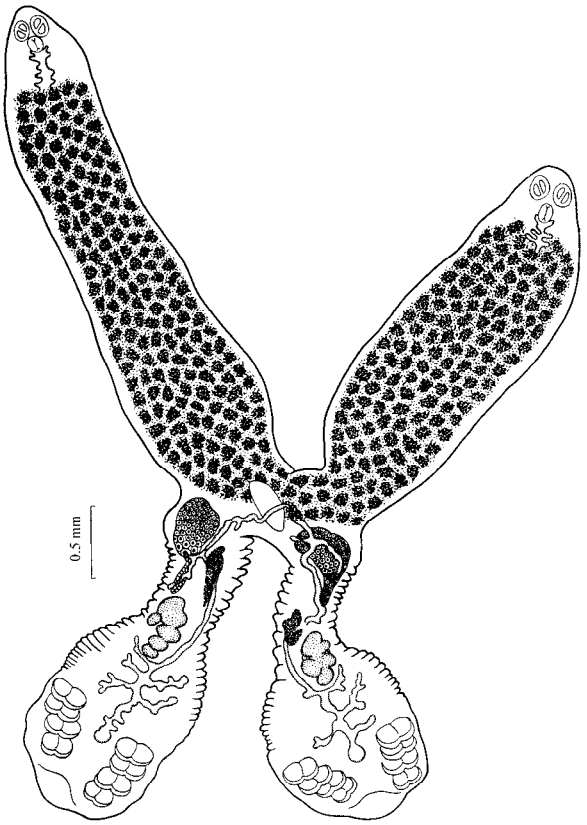

Fig. 691. - *Paradiplozoon sapae*, total view (after Khotenovsky, 1985b).

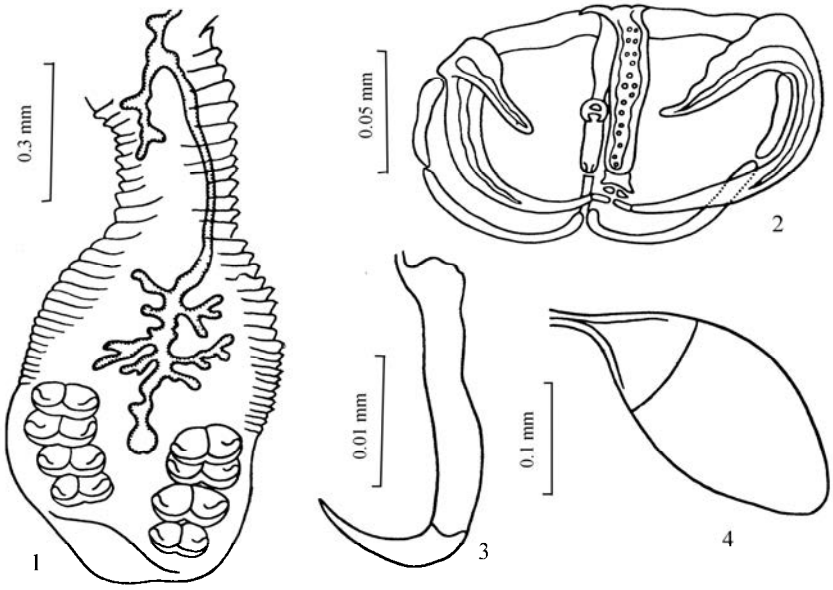

Fig. 692. - *Paradiplozoon sapae.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

43 (44). The number of folds is less than 15.
P. zeller (Gyntovt, 1967) (Fig. 693, 694)
Syn.: *Diplozoon zeller* Gyntovt, 1967

Body length is 1.2–2.9 mm, anterior part 0.6–1.9 mm, posterior part 0.4–0.9 mm; latter has 10–14 folds. Size of clamps: I: 0.04–0.07 x 0.04–0.11; II: 0.04–0.07 x 0.08–0.14; III: 0.04–0.07 x 0.08–0.12; IV: 0.04–0.07 x 0.08–0.15 mm. The anterior end of the median sclerite is broadened, fish tail shaped, and connected to the clamp jaws by two short sclerites. The lateral edges of the posterior end of the median sclerite are rounded. Length of anchors is 0.019–0.020 mm, handles 0.036–0.047 mm. Diameter of suckers is 0.04–0.05 mm, pharynx 0.04–0.07 mm. The intestine in the posterior part of the body has few lateral diverticula. The testis is lobed. Size of eggs is 0.21–0.22 x 0.08–0.09 mm.

Found on gills of *Phoxinus phoxinus*, *Rutilus rutilus*, *Scardinius erythrophthalmus*, *Gobio gobio*, *Barbus barbus*, *Rhodeus amarus*, and *Cyprinus carpio*; rivers of the Baltic, Black, and Caspian Seas.

44 (43). The number of folds is greater than 15.

45 (46). The median sclerite is rough. Its posterior end broadens laterally. The median sclerites of the anterior jaw are situated at right angles to the jaw.
P. vojteki (Pejcoch, 1968) (Fig. 695, 696)
Syn.: *Diplozoon vojteki* Pejcoch, 1968

Body length is 2.4–6.8 mm; anterior part 1.3–4.0 mm, posterior part 1.0–2.3 mm; latter has 18–22 folds. Size of clamps: I: 0.07–0.10 x 0.11–0.16; II: 0.09–0.14 x 0.15–0.22; III: 0.10–0.15 x 0.17–0.24; IV: 0.10–0.14 x 0.17–0.22 mm. The anterior end of the median sclerite is broadened, fish tail shaped, and connected to the clamp jaws by two sclerites that lie far apart from each other. Length of anchors is 0.020–0.021 mm, handles 0.034–0.040 mm. Diameter of suckers is 0.07–0.10 mm, pharynx 0.07–0.08 mm. The intestine in the posterior part of the body has few lateral diverticula. The testis is elongated and lobed. Size of eggs is 0.26 x 0.12–0.14 mm.

Found on gills of *Aspius aspius* and *Pelecus cultratus*; Danube River Basin.

46 (45). The median sclerite is delicate. Its posterior end lacks lateral broadenings. The median sclerites of the anterior jaw are situated in line with it.

47 (48). The vitellaria in the anterior part of the body form a dense mass. Length of eggs is greater than 0.26 mm.
P. homoion homoion (Bychowsky et Nagibina, 1959) (Fig. 697, 698)
Syn.: *Diplozoon homoion* Bychowsky et Nagibina, 1959

Body length is 1.8–5.2; anterior part 0.8–3.0 mm, of posterior part 0.5–2.0 mm; latter has 19–25 minute folds. Size of clamps: I: 0.05–0.09 x 0.09–0.16; II: 0.05–0.09 x 0.11–0.18; III: 0.05–0.09 x 0.11–0.20; IV: 0.07–0.09 x 0.11–0.21 mm. The anterior end of the median sclerite is slightly broadened, fish tail shaped, and connected to the clamp jaws by two sclerites. The lateral edges of the posterior end of the median sclerite are rounded. Length of anchors is 0.018–0.022 mm, handles 0.038–0.047 mm. Diameter of suckers is 0.05–0.08 mm, pharynx 0.04–0.07 mm. The intestine near its posterior end has few lateral diverticula. The testis is lobed. Size of eggs is 0.26–0.30 x 0.08–0.12 mm.

Found on gills of *Rutilus rutilus*, *R. caspicus*, *R. r. lacustris*, *Leuciscus leuciscus*, *L. l. baicalensis*, *L. idus*, *Squalius cephalus*, *Scardinius erythrophthalmus*, *Aspius aspius*, *Gobio gobio*, *Barbus barbus*, *Blicca bjoerkna*, *Abramis brama*, *Ballerus ballerus*, *Vimba vimba*, *Carassius carassius*, and *Cyprinus carpio*; rivers of the White, Baltic, Black, Caspian, and Aral Seas; Ob', Lena, and Selenga Rivers (Russia).

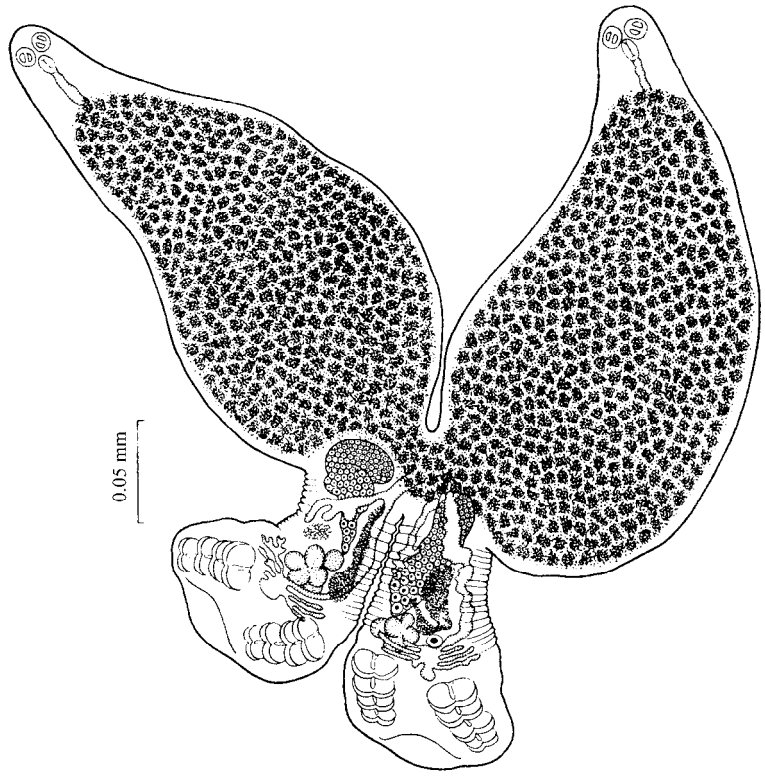

Fig. 693. - *Paradiplozoon zeller*, total view (after Khotenovsky, 1985b).

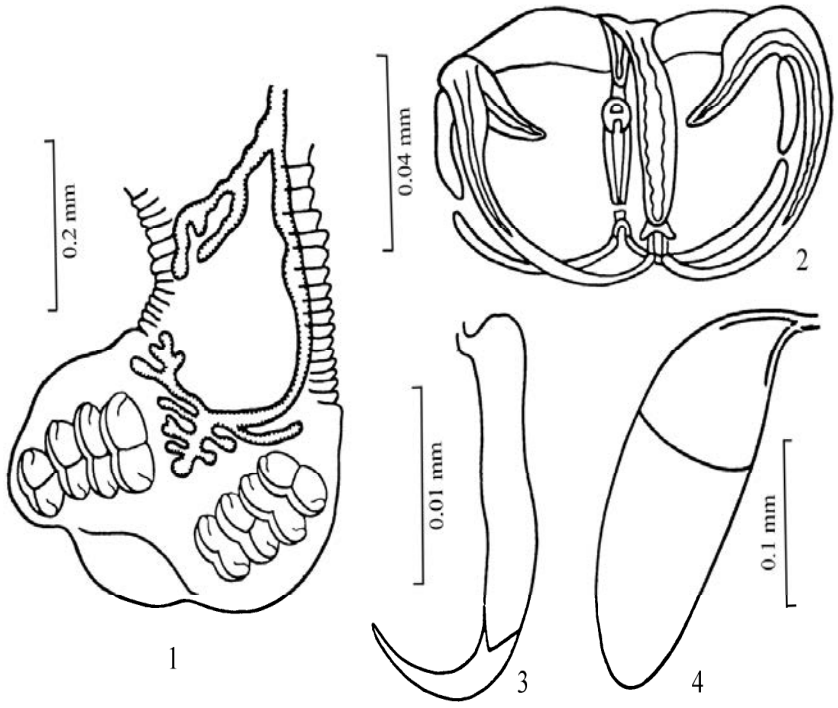

Fig. 694. - *Paradiplozoon zeller*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

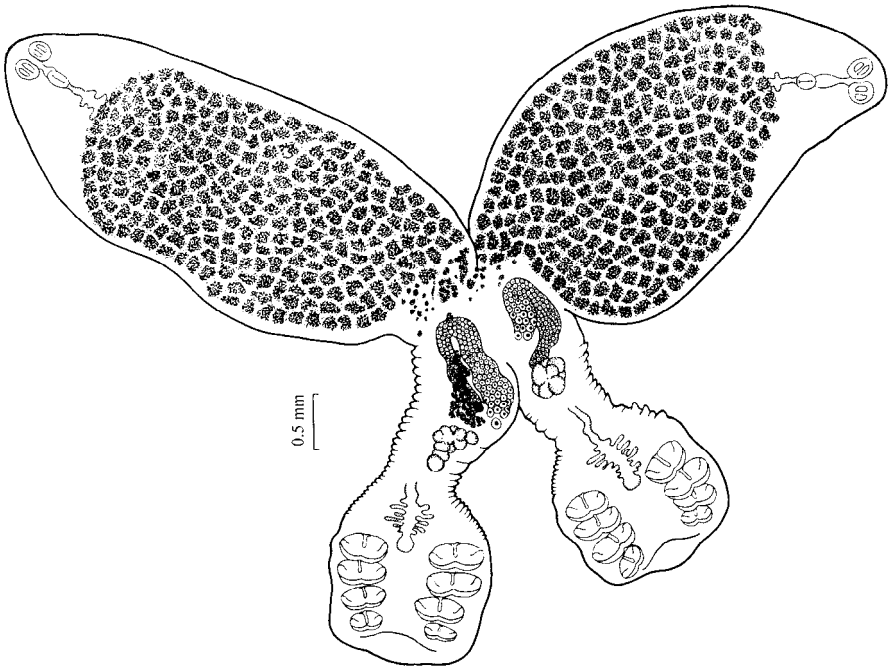

Fig. 695. - *Paradiplozoon vojteki*, total view (after Khotenovsky, 1985b).

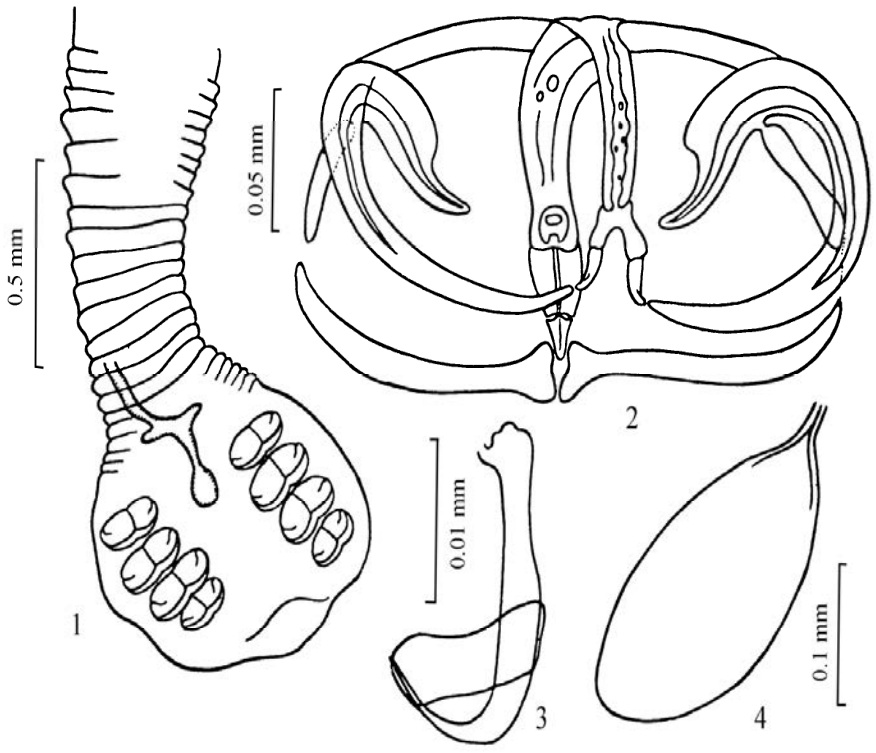

Fig. 696. - *Paradiplozoon vojteki*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

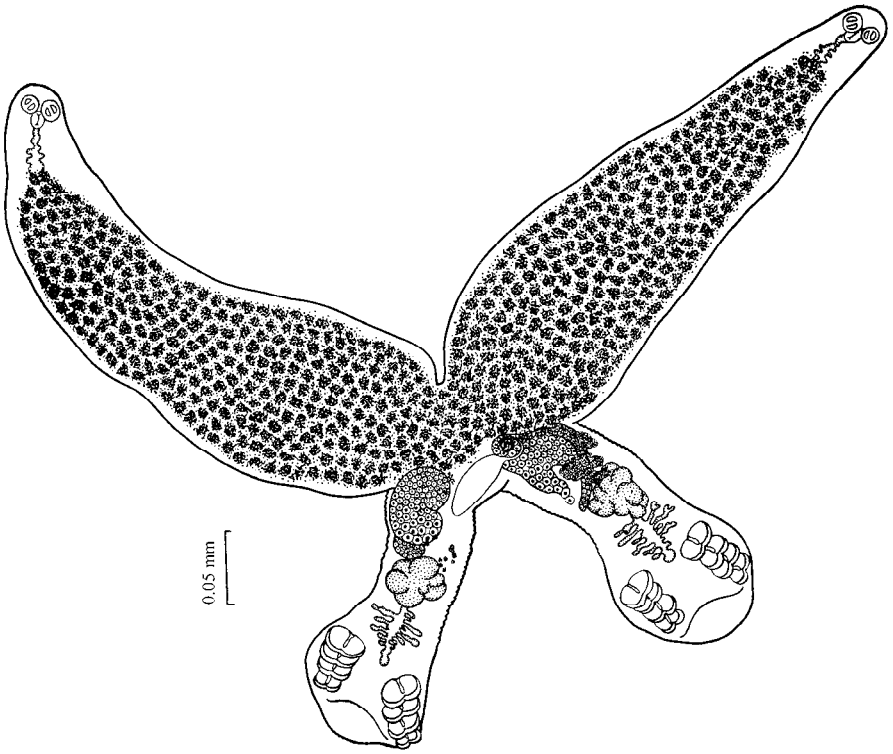

Fig. 697. - *Paradiplozoon homoion homoion*, total view (after Khotenovsky, 1985b).

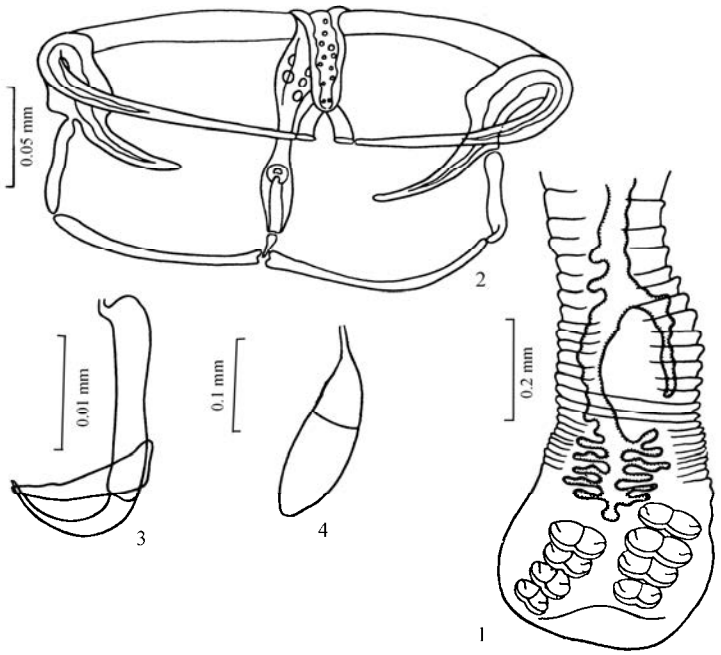

Fig. 698. - *Paradiplozoon homoion homoion.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

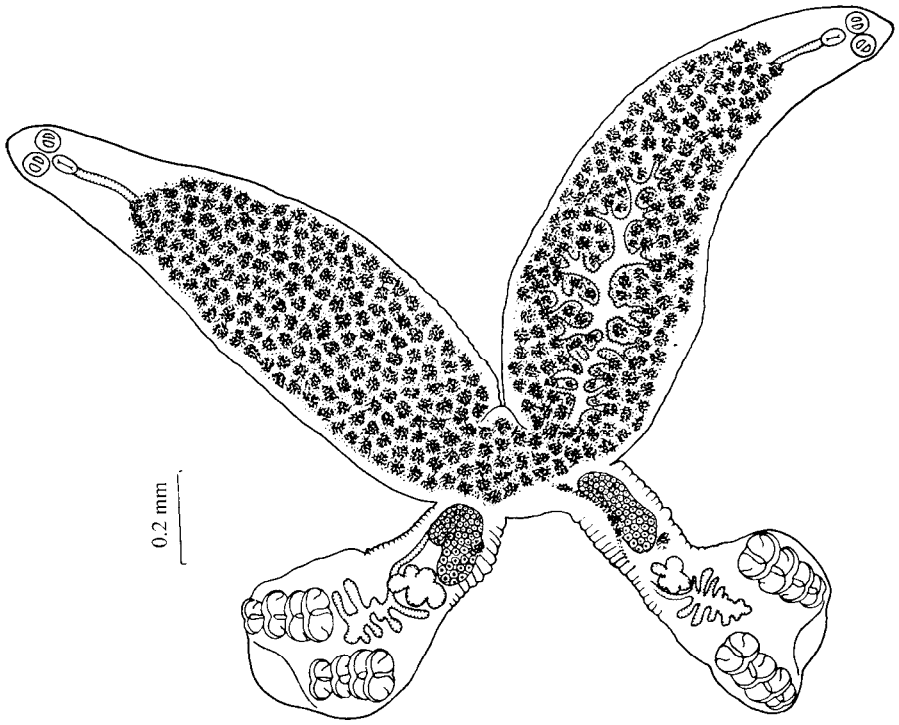

Fig. 699. - *Paradiplozoon homoion gracile*, total view (after Khotenovsky, 1985b).

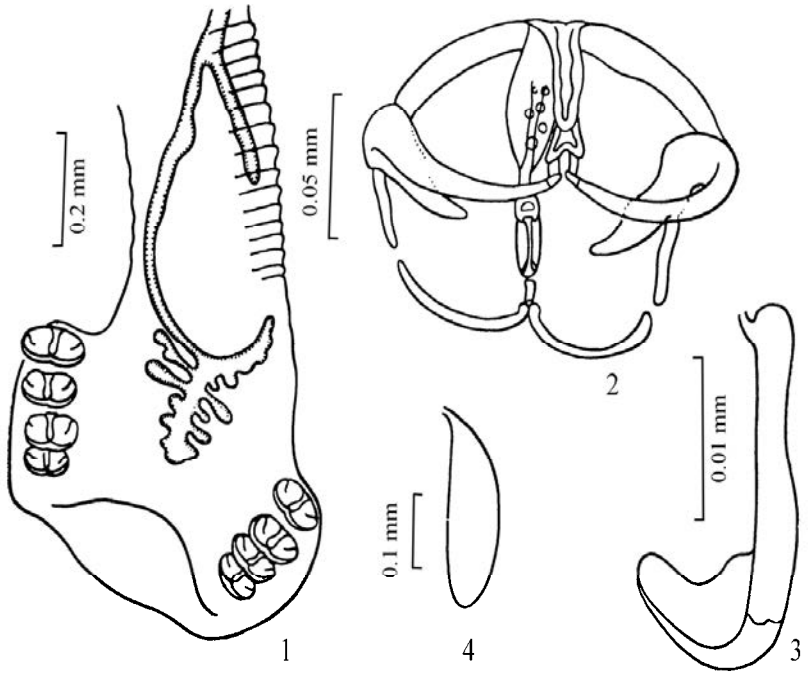

Fig. 700 - *Paradiplozoon homoion gracile*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

48 (47). The vitellaria at the anterior part of the body are dispersed. Length of eggs is less than 0.26 mm.
P. homoion gracile (Reichenbach-Klinke, 1961) (Fig. 699, 700)
Syn.: *Diplozoon gracile* Reichenbach-Klinke, 1961; *D. homoion gracile*: Oliver, Reichenbach-Klinke, 1973; *D. gobii* Iksanov, 1968 (nom. nud.)

Body length is 1.6–4.3 mm, anterior part 0.9–2.5 mm, posterior part 0.5–1.2 mm; latter has 11–18 minute folds. Size of clamps: I: 0.04–0.07 x 0.06–0.11; II: 0.04–0.08 x 0.08– 0.13: III: 0.04–0.09 x 0.09–0.15; IV: 0.04–0.08 x 0.08–0.16 mm. The anterior end of the median sclerite is broadened, fish tail shaped, and connected to the clamp jaws by an arcuate sclerite. The lateral edges of the posterior end of the median sclerite are rounded. Length of anchors is 0.018–0.021 mm, handles 0.040–0.048 mm. Diameter of suckers is 0.03–0.06 mm, pharynx 0.03– 0.06 mm. The posterior part of the intestine has few lateral diverticula. The testis is lobed. Vitellaria follicles are dispersed in the anterior part of the body. Size of eggs is 0.22–0.26 x 0.09–0.10 mm.

Found on gills of *Gobio gobio, Phoxinus phoxinus,* and *Barbus petenyi*; rivers of the Baltic, Black, and Aral Seas; Issyk Kul' Lake (Kirgizstan), Ob' River (Russia).

Species inquirenda

P. agdamicum (Mikailov, 1973)
Syn.: *Diplozoon agdamicum* Mikailov, 1973

These are small worms; body length is 0.79–0.88 mm. The posterior end of the body has folds. The clamps are small: The width of the first pair is 0.07–0.10; II: 0.11–0.12; III: 0.12–0.13; IV: 0.12 mm. The anterior end of the median sclerite is broadened and has a longitudinal cut in the middle. Length of anchors is 0.019–0.022 mm, handles 0.034–0.039 mm. Size of suckers is 0.04 x 0.04–0.05 mm, pharynx 0.03–0.04 mm.

Found on gills of *Squalius cephalus orientalis*; Kura River Basin (Azerbaijan).

P. chazaricum (Mikailov, 1973)
Syn.: *Diplozoon chazaricum* Mikailov, 1973

These are large worms; body length is 6.7–7.6 mm. The forepart of the posterior section lacks folds. The ratio of the lengths of the anterior and posterior parts is 1.9:1. The clamps are large: The width of the first pair is 0.19–0.25: II: 0.36–0.37; III: 0.37–0.40; IV: 0.25–0.35 mm. The anterior end of the median sclerite is broadened and has a deep cut. Length of anchors is 0.033–0.035 mm, handles 0.061–0.068 mm. Size of suckers is 0.12–0.13 x 0.14–0.15 mm, pharynx 0.09–0.12 mm.

Found on gills of *Rutilus frisii kutum*; Kura River Basin (Azerbaijan).

P. erythroculteris (Akhmerov, 1974)
Syn.: *Diplozoon erythroculteris* Akhmerov, 1974

Body length is 2.1–4.5 mm, anterior part 1.5–2.8 mm, posterior part 0.6–1.7 mm; latter has folds. Size of clamps: I: 0.05–0.06 x 0.06–0.12; II: 0.05–0.07 x 0.12–0.16; III and IV: 0.06–0.08 x 0.14–0.18 mm. Length of anchors is 0.018–0.020 mm, handles 0.04 mm. Size of suckers is 0.05–0.08 x 0.03–0.06 mm; pharynx 0.07–0.09 x 0.06–0.08 mm. The intestine has few diverticula in its posterior part. Size of eggs is 0.19–0.32 x 0.01 mm.

Found on gills of *Chanodichthys mongolicus*; Amur region.

P. kasimii (Rahemo, 1980)
Syn.: *Diplozoon kasimii* Rahemo, 1980

Body length is about 4.0 mm; anterior part 1.6–2.8 mm, posterior part 1.1 mm. Size of clamps is 0.090 x 0.110 mm. Suckers are present. Pharynx length is 0.070 mm and width is 0.050 mm. The posterior part of the intestine lacks diverticula and comes to an end at the level of the clamps. The single smooth-edged testis is situated near the worm's cross region. Size of eggs is

small, at 0.08 x 0.04 mm.

Found on gills of *Cyprinion macrostomus*; Iraq.

P. kuthkaschenicum (Mikailov, 1973)
Syn.: *Diplozoon kuthkaschenicum* Mikailov, 1973

These are small worms; body length is 0.9–1.0 mm. The forepart of the posterior section has minute folds. Clamps are small, with widths of: I: 0.07–0.08; II and III: 0.08–0.10; IV: 0.08–0.09 mm. The anterior end of the median sclerite is slightly bifurcated and is not broadened. Length of anchors is 0.023–0.025 mm, handles 0.034–0.038 mm. Size of suckers is 0.03–0.04 mm, pharynx oval 0.02–0.04 mm.

Found on gills of *Alburnus hohenackeri* and *A. filippi*; Kura River Basin (Azerbaijan).

P. schulmani (Mikailov, 1973)
Syn.: *Diplozoon schulmani* Mikailov, 1973

These are small worms; body length is 1.9–2.1 mm. The ratio of the length of the anterior and posterior parts is 2.4–2.5:1. The forepart of the posterior section has folds. Clamps are small, with widths of: I: 0.06; II: 0.07; III: 0.10–0.11; IV: 0.09–0.10 mm. The anterior end of the median sclerite is connected to the ends of the clamp jaws by an arcuate sclerite. Length of anchors is 0.022–0.023 mm, handles 0.040–0.047 mm. Size of suckers is 0.05 x 0.05 mm, pharynx 0.05 x 0.07 mm.

Found on gills of *Alburnoides bipunctatus eichwaldi*; Kura River Basin (Azerbaijan).

Genus *Inustiatus* Khotenovsky, 1978

The posterior part of the body can be subdivided into three distinct sections: an anterior part without folds; a middle one with a discal widening; and a posterior triangular-shaped section with anchors and clamps. The intestine in the middle part of the posterior end of the body forms a dense net of diverticula that penetrate into the discal widening. Gonads lie at the border of the anterior and posterior parts of the body. There are many testes. The uterus opens laterally into the middle of the anterior part of the body. Eggs have a filament but lack additional projections at the opposite pole; they are situated in the uterus with the filament directed backwards.

The type and single species is *I. inustiatus* (Nagibina, 1965).

I. inustiatus (Nagibina, 1965) (Fig. 701, 702)
Syn.: *Diplozoon inustiatus* Nagibina, 1965; *D. aristichthysi* Ling, 1973

Body length is 7.1–10.9 mm, anterior part 4.0–7.0 mm, posterior part 2.2– 4.2 mm. Size of clamps: I: 0.05–0.08 x 0.07–0.10; II: 0.05–0.09 x 0.07–0.13; III: 0.06–0.18 x 0.08–0.14; IV: 0.06–0.10 x 0.08–0.12 mm. The anterior end of the median sclerite is slightly widened and connected to the ends of the clamp jaws by an arcuate sclerite. Length of anchors is 0.027–0.030 mm, handles 0.05–0.06 mm. Diameter of suckers is 0.05–0.09, pharynx 0.07– 0.10 mm. The intestine is tube shaped at the beginning of the body's posterior part. Eggs are oval, and their size is 0.28–0.31 x 0.10–0.12 mm.

Found on gills of *Hypophthalmichthys molitrix*; Amur River Basin.

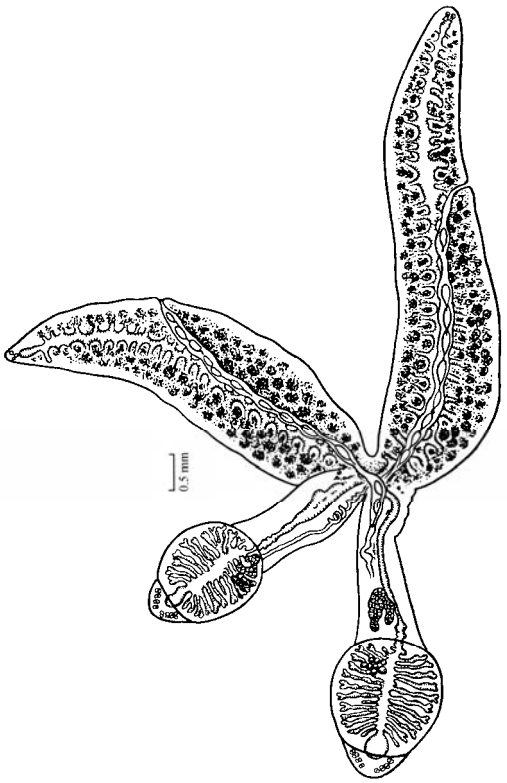

Fig. 701. - *Inustiatus inustiatus,* total view (after Khotenovsky, 1985b).

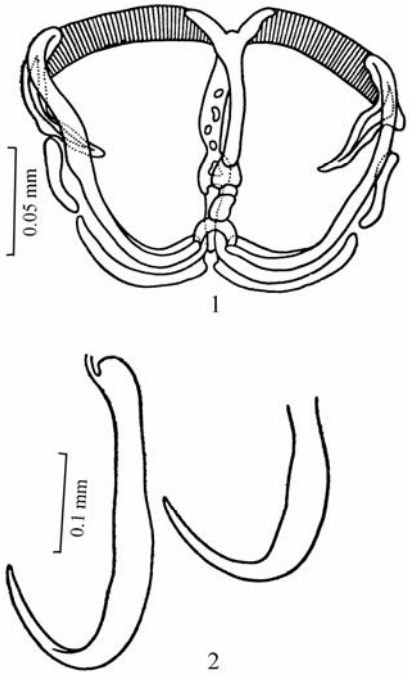

Fig. 702. - *Inustiatus inustiatus.* 1 – clamp, 2 – anchors (left anchor does not lie in the same plane) (after Khotenovsky, 1985a).

Genus *Eudiplozoon* Khotenovsky, 1985

The posterior part of the body is divided into three distinct sections. The first section has large folds, the middle one has a widening with large lateral tooth-like folds, and the posterior one has clamps and anchors. Two large rounded glandular structures lie at the anterior part of the body before the suckers. The intestine in the middle section of the posterior part can form few small diverticula. The uterus opens laterally at the border of the anterior and posterior parts of the body. Eggs have a filament at the pole opposite the cap and are situated in the uterus with the filament directed forward.

The type and single species is *E. nipponicum* (Goto, 1891).

E. nipponicum (Goto, 1891) (Fig. 703, 704)
Syn.: *Diplozoon nipponicum* Goto, 1891; *Sindiplozoon nipponicum* Khotenovsky, 1981

Body length is 3.0–6.7 mm, anterior part 1.8–4.5 mm, posterior part 1.1–2.9 mm. The first section of the posterior part has 11–15 folds. Size of clamps: I: 0.05–0.10 x 0.08–0.15; II: 0.05–0.11 x 0.09–0.19; III: 0.05–0.11 x 0.10–0.17; IV: 0.05–0.11 x 0.10–0.16 mm. The anterior end of the median sclerite has a small projection that connects to an arcuate sclerite; the latter is connected to the ends of the clamp jaws. Length of anchors is 0.020–0.023 mm, handles 0.05 mm. Diameter of suckers is 0.08–0.10 mm, pharynx 0.05–0.09 mm. The intestine is tube shaped in the posterior part of the body. Testes are ribbon shaped and coiled many times. Size of eggs is 0.25–0.34 x 0.10–0.12 mm.

Found on gills of *Cyprinus carpio*, *C. c. rubrofuscus*, *Carassius carassius*, *C. auratus gibelio*, *Abramis brama*, *Capoeta capoeta heratensis*, and *Luciobarbus capito conocephalus*; river basins of the Baltic and Black Seas, lakes of West Siberia, the Amur River Basin, and carp farms in many regions. Its original area likely was the Amur River region; it probably was introduced to other areas via the transfer of *Cyprinus carpio rubrofuscus* to fish farms of the Palaearctic to improve the quality of cultured carp.

Genus *Sindiplozoon* Khotenovsky, 1981

The posterior part of the body can be divided into three sections: an anterior one without folds, a middle one that forms a rounded widening, and posterior one with clamps and anchors. The intestine in the middle section of the posterior part of the body has few lateral diverticula. Testes are numerous. The uterus opens at the border of the anterior and posterior parts of the body. Eggs have a cap and a filament at the cap top; a projection at the opposite end is absent; eggs lie in the uterus with filaments directed forward.

The type species is *S. strelkowi* (Nagibina, 1965)

The genus contains two species spread throughout the Amur region.

Key to species of the genus *Sindiplozoon*

1 (2). The widening of the middle section of the posterior part of the body has a cup-shaped socket on one side.
S. strelkowi (Nagibina, 1965) (Fig. 705, 706)
Syn.: *Diplozoon strelkowi* Nagibina, 1965; *D. bychowskyi* Nagibina, 1975; *D. ctenopharyngodoni* Ling, 1973

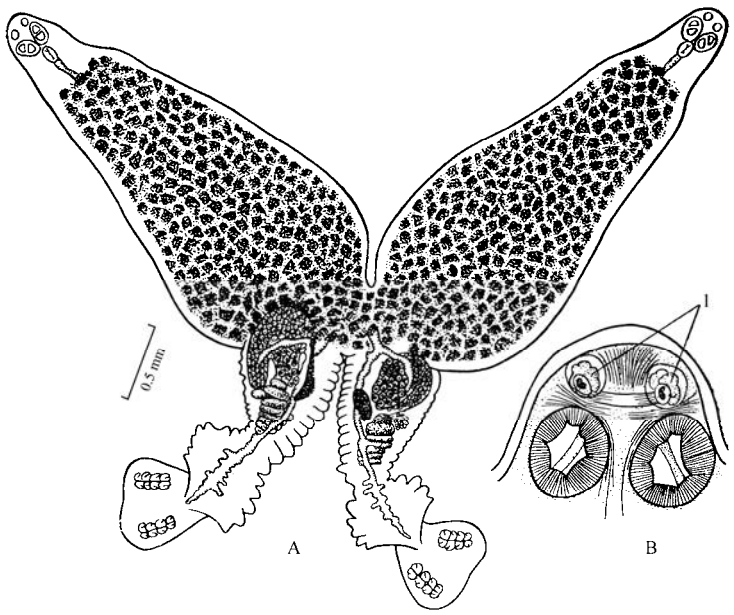

Fig. 703. - *Eudiplozoon nipponicum.* A – total view; B – anterior end, 1 – glandular formations.

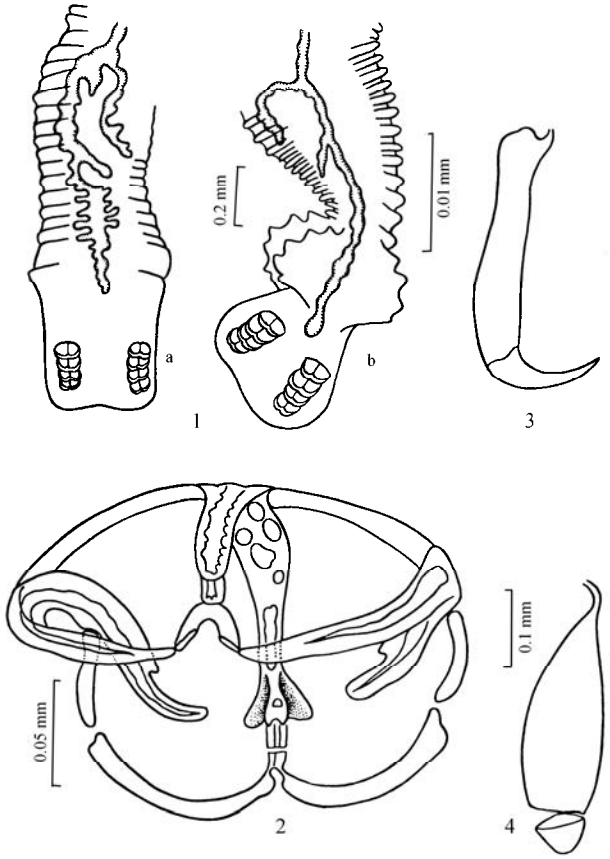

Fig. 704. - *Eudiplozoon nipponicum.* 1 – posterior end (a – front view, b – side view), 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

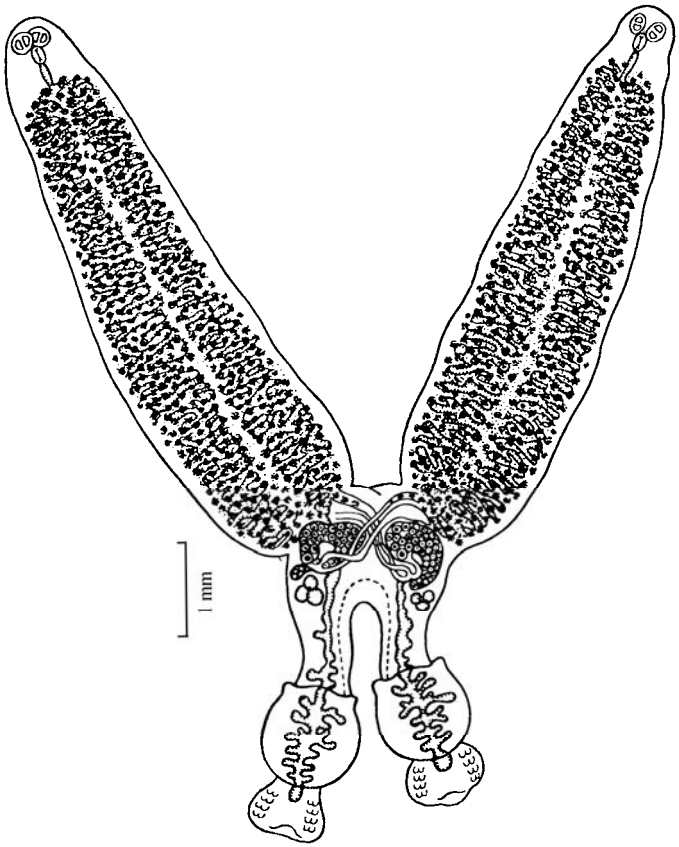

Fig. 705. - *Sindiplozoon strelkowi*, total view (after Khotenovsky, 1979).

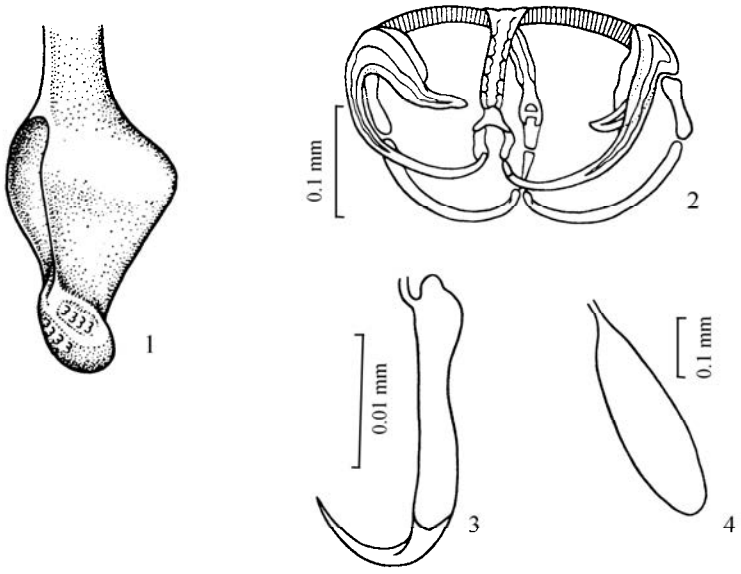

Fig. 706. - *Sindiplozoon strelkowi*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1979).

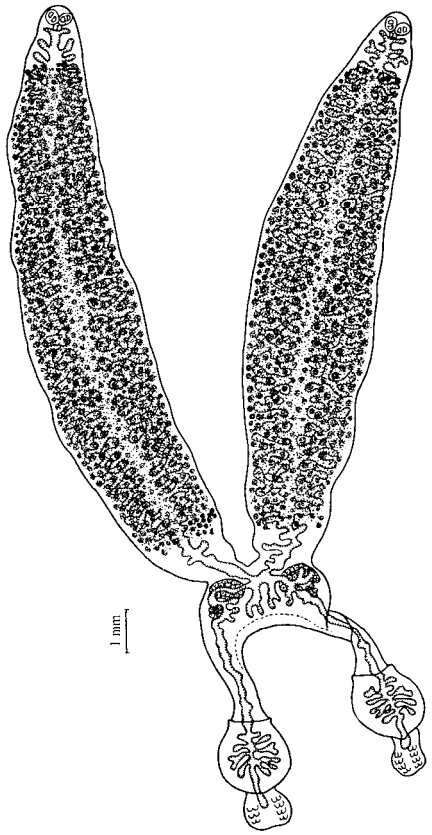

Fig. 707. - *Sindiplozoon diplodiscus*, total view (after Khotenovsky, 1979).

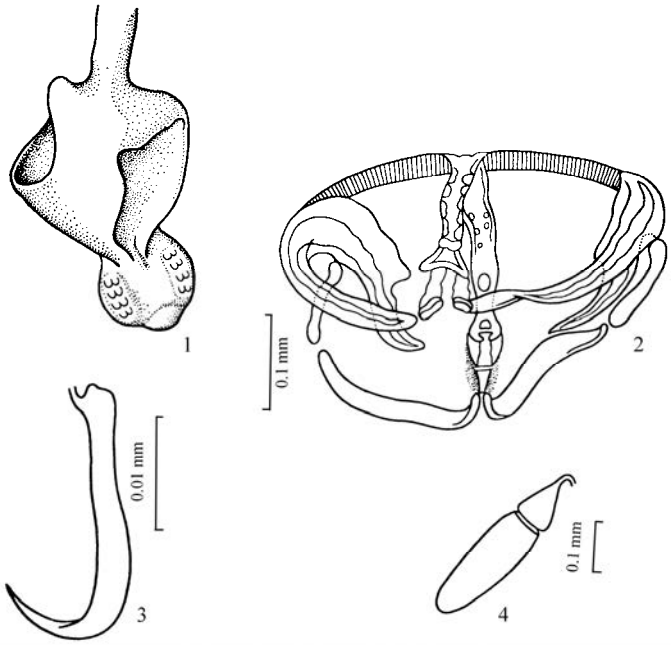

Fig. 708. - *Sindiplozoon diplodiscus.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1979).

Body length is 5.6–12.1 mm, anterior part 2.5–7.5 mm, posterior part 1.4–2.7 mm. The widening of the middle section of the posterior part (diameter 0.9–1.4 mm) has a deepening on the ventral side. Size of clamps: I: 0.07–0.10 x 0.12–0.15; II: 0.07–0.09 x 0.13–0.18; III: 0.07–0.10 x 0.12–0.17; IV: 0.07–0.10 x 0.13–0.18 mm. The anterior end of the median sclerite has a wing-shaped projection and is connected to the clamp jaws by two sclerites. Length of anchors is 0.018–0.023 mm, handles 0.037–0.050 mm. Diameter of suckers is 0.13–0.19 mm, pharynx 0.08–0.11 mm. The intestine may have small diverticula in the first section of the posterior part of the body, which are better developed in the second section. The testes are separate dense structures. Size of eggs is 0.32–0.40 x 0.08–0.13 mm.

Found on gills of *Ctenopharyngodon idella* and *Hemibarbus labeo*; Amur River Basin; China.

2 (1). The widening of the middle section of the posterior part of the body has a cup-shaped socket on both sides.
S. diplodiscus (Nagibina, 1965) (Fig. 707, 708)
Syn.: *Diplozoon diplodiscus* Nagibina, 1965; *D. mylopharyngodonis* Akhmerov, 1974

Body length is 6.3–14.9 mm, anterior part 3.4–10.2 mm, posterior part 1.8–5.3 mm. The widening of the middle section of the posterior part (diameter 1.1 x 1.4 mm) has deep sockets on the dorsal and ventral sides. These may or may not be clearly visible. Size of clamps: I: 0.07–0.12 x 0.12–0.19; II: 0.07–0.13 x 0.14–0.23; III: 0.08–0.13 x 0.14–0.25; IV: 0.08–0.12 x 0.14–0.23 mm. The anterior end of the median sclerite has a wing-shaped projection; it is connected to the jaws by two small sclerites. Length of anchors is 0.017– 0.022 mm, handles 0.038–0.047 mm. Size of suckers is 0.11–0.22 x 0.11–0.24 mm, pharynx 0.09–0.13 x 0.07–0.10 mm. The intestine in the first section of the posterior part of the body can form short diverticula, which are well developed in the disc-like middle section. Testes are isolated dense bodies. Size of eggs is 0.34–0.37 x 0.09–0.10 mm.

Found on gills of *Mylopharyngodon piceus*, *Chanodichthys mongolicus*, and *Elopichthys bambusa*; Amur River Basin.

Genus *Diplozoon* Nordmann, 1832

The posterior part of the body can be divided into three sections: an anterior section with few folds on the ventral side, a middle cup-shaped section, and a posterior section with anchors and clamps. The intestine in the middle section of the posterior part of the body forms lateral diverticula. Gonads lie in the first part of the posterior section. The opening of the uterus lies at the border of the anterior and posterior parts of the body. A single lobed testis is present. Eggs have filaments but lack additional projections at the opposite pole.

The type species is *D. paradoxum* Nordmann, 1832.

The genus contains two species, both of which have been found in the Palaearctic.

Key to species of the genus *Diplozoon*

1 (2). The anterior section of the posterior part of the body has 4–8 folds. Length of the anchors is 0.028–0.033 mm.
D. paradoxum Nordmann, 1832 (Fig. 709, 710)

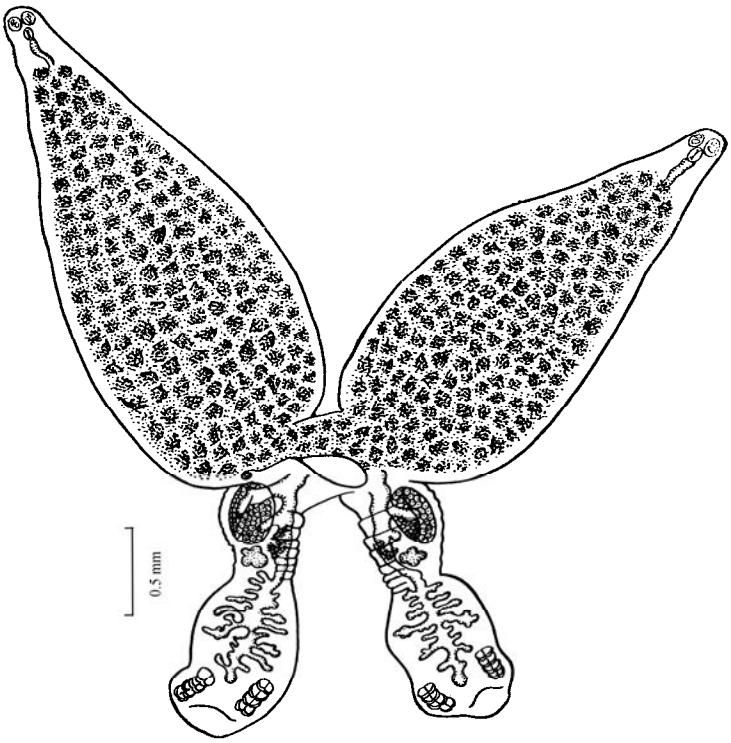

Fig. 709. - *Diplozoon paradoxum*, total view (after Khotenovsky, 1985b).

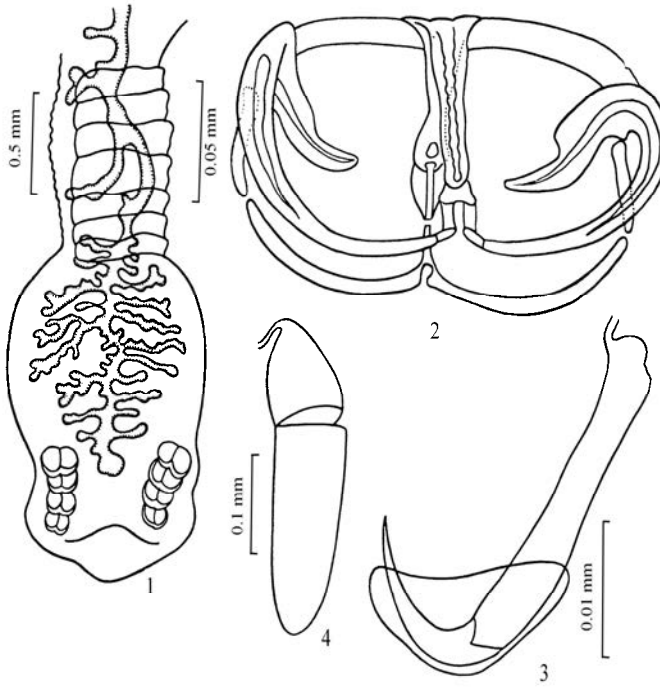

Fig. 710. - *Diplozoon paradoxum*. 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

Body length is 2.2–10 mm, anterior part 1.5–6.4 mm, posterior part 0.7–3.0 mm. The anterior section of the posterior part has 4–8 folds. Size of the clamps: I: 0.06–0.12 x 0.08–0.19; II: 0.05–0.12 x 0.11–0.23; III: 0.05–0.13 x 0.13–0.26; IV: 0.06–0.14 x 0.13–0.26 mm. The anterior end of the median sclerite is slightly widened and is connected to the clamp jaws by two sclerites. Length of anchors is 0.028–0.033 mm, handles 0.058–0.071. Diameter of suckers is 0.07–0.19 mm, pharynx 0.06–0.13 mm. The intestine in the middle section of the posterior part of the body has diverticula, which have secondary projections. Size of eggs is 0.32–0.43 x 0.08–0.12 mm.

Found on gills of *Abramis brama*, *Carassius carassius*, *Ballerus ballerus*, *Blicca bjoerkna*, *Rutilus rutilus*, *R. r. heckelii*, *R. r. lacustris*, *Vimba vimba*, *Lota lota* (?), and *Perca fluviatilis* (?); basins of the Baltic, Black, Caspian, and Aral Seas; Norway, Great Britain Ob', Yenisey, and Lena Rivers (Russia); Lake Issyk-Kul' (Kirgizstan).

2 (1). The anterior section of the posterior part of the body has 8–13 folds. Length of anchors is 0.022–0.025 mm.

D. scardinii Komarova, 1966 (Fig. 711, 712)

Body length is 2.6–6.5 mm, anterior part 1.5–3.8 mm, posterior part 0.9–2.0 mm. The anterior section of the posterior part of the body has 8–13 folds at its ventral side. Size of clamps: I: 0.05–0.07 x 0.08–0.11; II: 0.05–0.07 x 0.08–0.13; III: 0.05–0.07 x 0.08–0.12; IV: 0.05–0.08 x 0.09–0.12 mm. The anterior end of the median sclerite is slightly widened and is connected to the clamp jaws by two sclerites. Length of anchors is 0.022–0.025 mm, handles 0.043–0.053 mm. The intestine in the middle section of the posterior part of the body has diverticula, which have secondary projections. Size of eggs is 0.26–0.27 x 0.10–0.13 mm.

Found on gills of *Scardinius erythrophthalmus*; rivers of the Baltic and Black Seas.

Family Discocotylidae Price, 1936

Mature Discocotylinea worms are solitary and are variable in size. The posterior part of the body is isolated from the body by a slight constriction and has four pairs of clamps and two anchors. Marginal hooks are absent in mature specimens. Larvae have three pairs of marginal hooks, which are situated laterally at the edges of the posterior part of the body. In some cases there are 1–2 pairs of small hook-shaped structures. Two suckers lie along the edges of the oral funnel; in larvae they are absent. A pharynx, esophagus, and bucco-esophagial duct are present. The intestine has two trunks with many diverticula that are not connected to one another. Testes are numerous. The copulatory organ is a muscular penis. Vaginal ducts and a seminal receptacle are present. Eggs lack filaments.

The family consists of two genera, one of which is found in the Palaearctic.

Genus *Discocotyle* Diesing, 1850

The body is longitudinal with a slight constriction near the openings of the vaginal ducts. The genital atrium lacks armament. Vaginal ducts are paired at the beginning and then merge into one.

The type species is *Discocotyle sigittata* (Leuckart, 1842).

The genus contains two species, one of which is widespread in the Palaearctic.

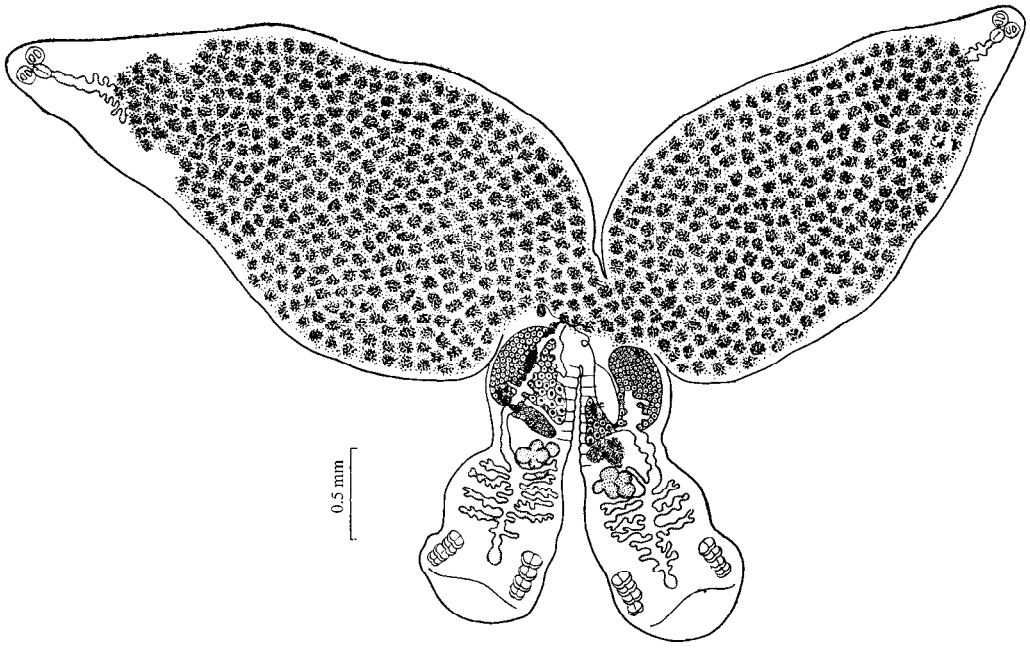

Fig. 711. - *Diplozoon scardinii*, total view (after Khotenovsky, 1985b).

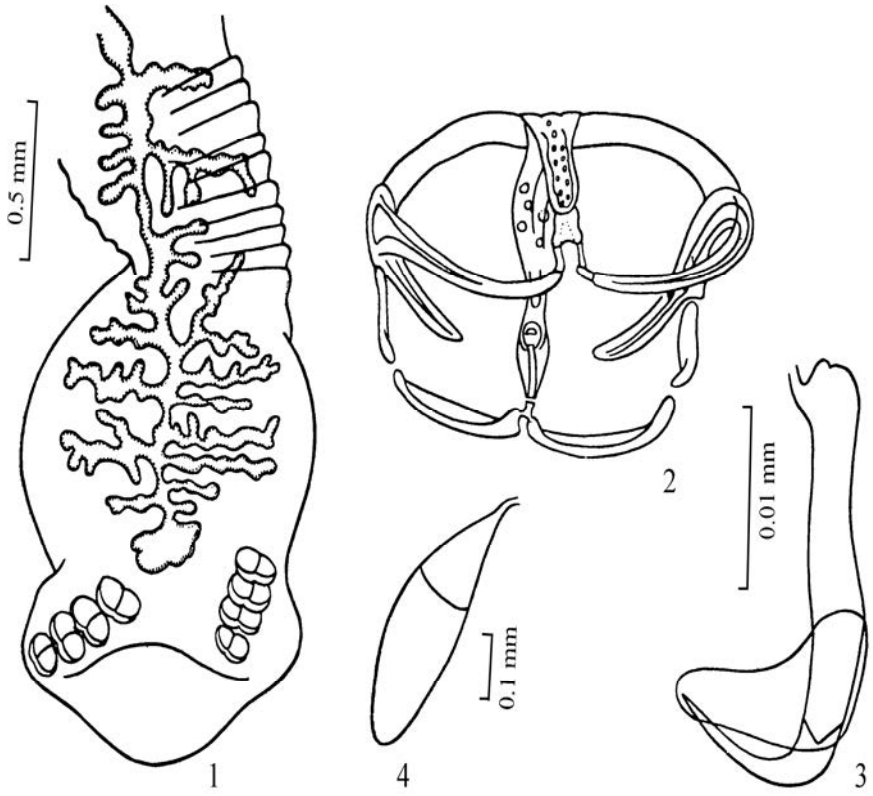

Fig. 712. - *Diplozoon scardinii.* 1– posterior end, 2 – clamp, 3 – anchor, 4 – egg (after Khotenovsky, 1985a).

D. sagittata (Leuckart, 1842) (Fig. 713)

Body length is 2.1–10.6 mm. Size of clamps: I: 0.15–0.32 x 0.21–0.40; II: 0.16–0.33 x 0.22–0.46; III: 0.15–0.32 x 0.22–.47; IV: 0.14–0.30 x 0.18–0.45 mm. The anterior end of the median sclerite has small lateral projections connected to the jaws by two sclerites. Length of anchors is 0.020–0.022 mm, handles 0.041–0.061 mm. Size of suckers is 0.11–0.17 x 0.08– 0.16 mm, pharynx 0.08–0.14 x 0.07–0.12 mm. The ovary lies in the middle third of the body. Vitellaria are lateral. Size of eggs is 0.025–0.035 x 0.11–0.16 mm.

Found on gills of *Salmo trutta*, *Salvelinus alpinus*, *Stenodus leucichthys*, *Coregonus albula*, *C. sardinella*, *C. muksun*, *C. nasus*, *C. lavaretus*, *C. peled* (?), *C. tugun* (?), *Prosopium cylindraceum*, *Thymallus thymallus*, *T. arcticus*, *Hucho taimen*, and *Acipenser baerii* (?); estuaries of rivers of the Arctic Ocean; Ladoga Lake; Anadyr' River (Russia).

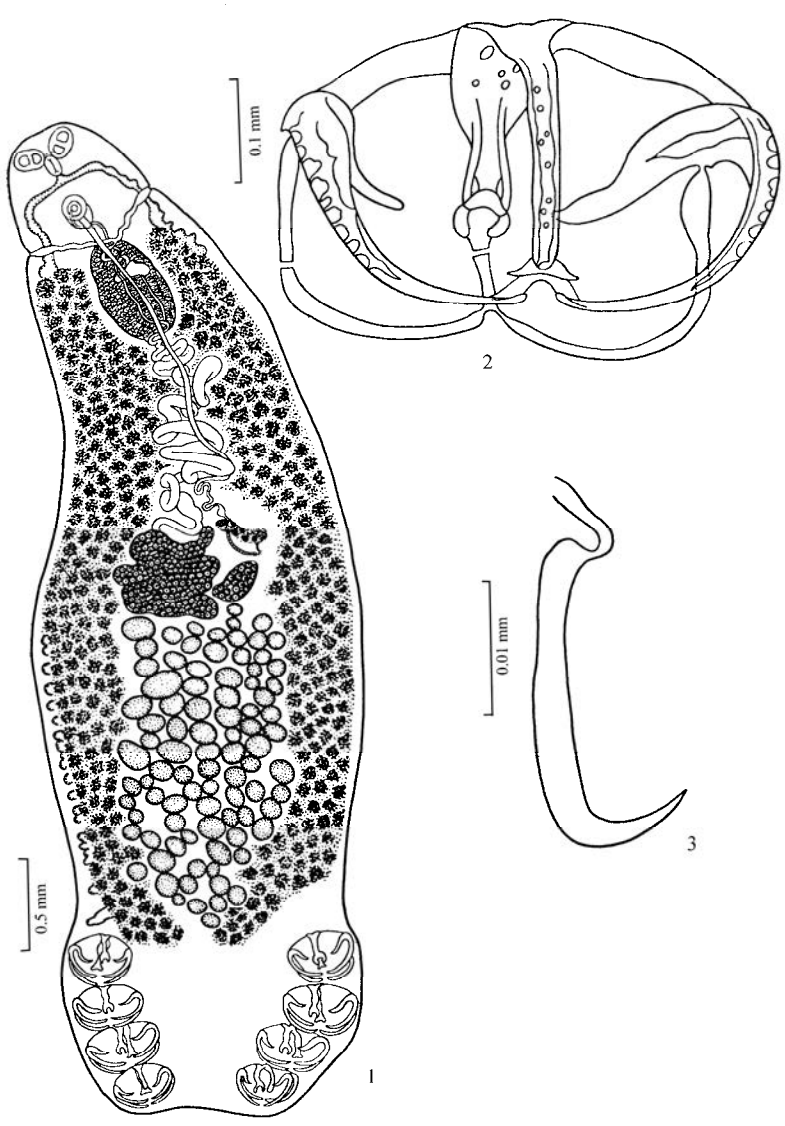

Fig. 713. - *Discocotyle sagittata.* 1 – total view, 2 – clamp, 3 – anchor (after Khotenovsky, 1985a).

Family Octomacridae Yamaguti, 1963

Mature Discocotylinea worms are solitary. Length of the elongated body is less than 1.0 cm. The haptor is divided from the body by a slight constriction. Four pairs of adhesive clamps are situated along the haptor edges. Two anchors are present. An oral funnel is present and has two suckers along its edges. Pharynx, esophagus, and bucco-esophagial duct are present. The intestine has two trunks and many lateral diverticula that do not merge together. A genital sucker with a sclerotized penis at its bottom is present, and the testis is single. No vaginal duct is present; the uterus opens into the genital atrium ventrally from the genital sucker.

Family consists of one genus, *Octomacrum* Mueller, 1934.

Genus *Octomacrum* Mueller, 1934

Posterior jaws of the clamps are not divided into separate sclerites. The penis is a tube and is pointed at its end, and the testis is lobed. Eggs have long twisted filament at one pole and a pointed projection at the other pole.

The type species is *O. lanceatum* Mueller, 1934.

The genus contains five species, one of which has been found in the Palaearctic.

O. europeum Roman et Bychowsky, 1956 (Fig. 714).

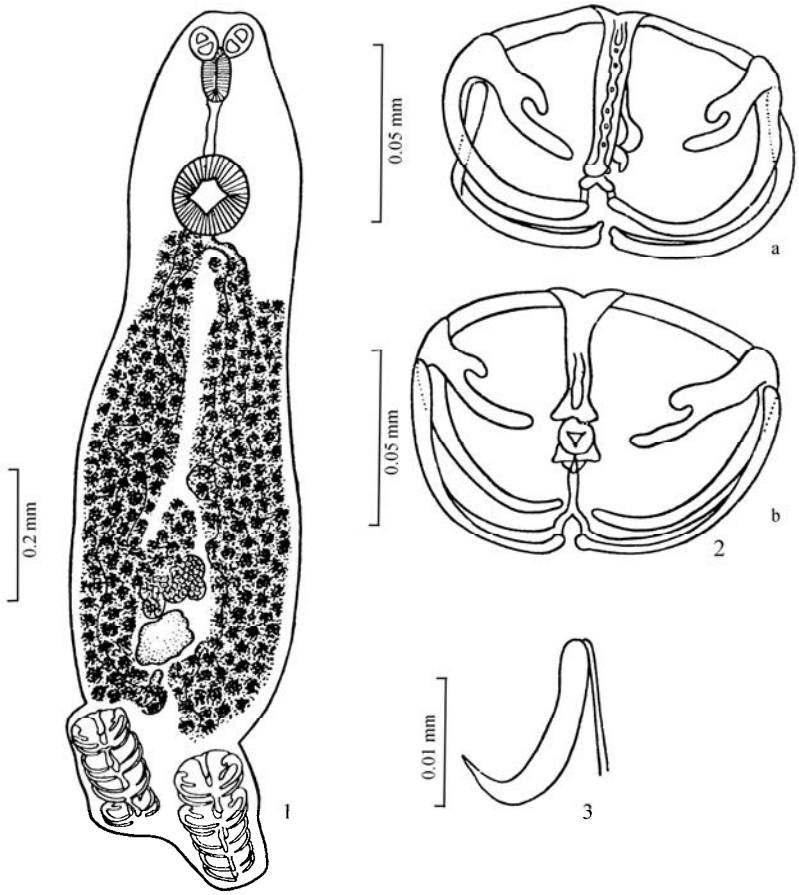

Fig. 714. - *Octomacrum europeum*. 1 – total view, 2 – clamp (a – ventral view, b – dorsal view), 3 – anchor (after Khotenovsky, 1985a).

These are small worms; length of body is 0.6–1.5 mm. Size of clamps: I: 0.07–0.08 x 0.10–0.11; II: 0.07–0.09 x 0.11–0.12; III: 0.07–0.08 x 0.11–0.12; IV: 0.08–0.09 x 0.10–0.12 mm. The anterior end of the median sclerite is fish tail shaped and is connected to the clamp jaws by two sclerites. Length of anchors is 0.014–0.016 mm, handles 0.047–0.048 mm. Diameter of sucker is 0.04–0.05 mm, pharynx 0.08 x 0.03–0.04 mm. The ovarium lies in the posterior part of the body.

Found on gills of ***Alburnoides bipunctatus***; Danube River, rivers of Crimea (Ukraine).

Host-parasites list

Fish latin names according Russian edition are in parentheses. Fish species (in bold italics) are arranged in systematic order. The higher taxa names are given for fish only. Parasite names designated by asterisk (*) are accidental or doubtful host records.

Superclass Gnathostomata
Teleostomi
Class Actinopterigii
Subclass Chondrostei
Order Acipenseriformes
Suborder Acipenseroidei
Family Acipenseridae
Acipenser baerii
Diclybothrium armatum
**Discocotyle sagittata*
Acipenser gueldenstaedtii
Diclybothrium armatum
Nitzschia sturionis
Acipenser medirostris
Paradiclybothrium pacificum
Acipenser nudiventris
Diclybothrium armatum
Nitzschia sturionis
Acipenser ruthenus
Diclybothrium armatum
Acipenser stellatus
Diclybothrium armatum
Nitzschia sturionis
Huso dauricus
Diclybothrium armatum
Huso huso
Diclybothrium armatum
Nitzschia sturionis

Subclass Neopterygii
Order Anguilliformes
Suborder Anguilloidei
Family Anguillidae
Anguilla anguilla
Gyrodactylus anguillae
Pseudodactylogyrus anguillae
P. bini
P. microrchis
Anguilla japonica
Gyrodactylus anguillae
Pseudodactylogyrus anguillae
P. bini
P. microrchis

Order Clupeiformes
Suborder Clupeoidei
Family Clupeidae
Alosa braschnikowi
Mazocraes alosae
Alosa caspia
Mazocraes alosae
Alosa fallax
Mazocraes alosae
Alosa kessleri
Mazocraes alosae
Alosa maeotica (A. braschnikowi maeotica)
Mazocraes alosae
Alosa tanaica (A. caspia tanaica)
Mazocraes alosae
Alosa tanaica nordmanni (A. caspia nordmanni)
Mazocraes alosae

Order Cypriniformes
Family Cyprinidae
Subfamily Danioninae
Aspidoparia mora
Dactylogyrus mobedii
D. yousefpouri

Subfamily Acheilognathinae
Acanthorhodeus asmussi
Acolpenteron petruschewskyi
Dactylogyrus bicornis
D. triaxonis
Gyrodactylus acanthorhodei
Pseudacolpenteron ignotus
Acheilognathus chankaensis (Paracheilognathus imberbis)
Dactylogyrus liaohoensis
D. triaxonis
Rhodeus amarus (R. sericeus amarus)
Dactylogyrus bicornis
D. sphyrna
Gyrodactylus rhodei
Paradiplozoon zeller
Rhodeus sericeus
Acolpenteron petruschewskyi
Dactylogyrus papillus
Gyrodactylus macrorhodei
G. rhodei

Subfamily Barbinae
Barbus barbus (B. barbus borysthenicus)

D. carpathicus
D. dyki
D. malleus
Gyrodactylus barbi
G. hemibarbi
G. katharineri
G. malmbergi
G. markewitschi
Markewitschiana triaxonis
Paradiplozoon homoion homoion
P. tisae
P. zeller
Barbus canis
Dactylogyrus lenkorani
**D. varicorhini*
Barbus grypus
Dogielius persicus
Barbus goktschaicus
Dactylogyrus goktschaicus
Barbus haasi
Dactylogyrus bocageii
D. lenkoranoides
D. mascomai
Barbus harterti
Dactylogyrus marocanus
D. oumiensis
Barbus kersin
Dactylogyrus deziensioides
D. deziensis
D. kersini
Barbus kubanicus (B. tauricus kubanicus)
Dactylogyrus carpathicus
D. goktschaicus
D. petenyi
Barbus lacerta cyri
Dactylogyrus affinis
D. akaraikus
D. jamansajensis
D. goktschaicus
D. gracilis
D. kulwieci
D. linstowi
D. orbus
D. persis
D. pulcher
Gyrodactylus barbi
G. hemibarbi
Paradiplozoon tadjikistanicum
Barbus longiceps
**Dactylogyrus kulwieci galilensis*
Barbus luteus
Dactylogyrus persis
Dogielius persicus
Barbus mursa
Dactylogyrus akaraikus
D. goktschaicus
D. linstowi
Barbus paytonii
Dactylogyrus draaensis
D. marocanus
D. oumiensis
Barbus petenyi (B. meridionalis petenyi)
Dactylogyrus carpathicus
D. dyki
D. malleus
D. petenyi
Gyrodactylus barbi
G. malmbergi
G. markewitschi
G. vimbi
Paradiplozoon homoion gracile
P. tisae
Barbus prespensis
Dactylogyrus balcanicus
D. crivellius
D. prespensis
Barbus sharpeyi
Dactylogyrus pavlovskyi
Dogielius persicus
Barbus tauricus
Dactylogyrus carpathicus
D. goktschaicus
Gyrodactylus markewitschi
Capoeta capoeta (Varicorhinus capoeta)
Dactylogyrus chramulii
D. gracilis
D. lenkorani tbilisi
D. pulcher
D. varicorhini
Markewitschiana triaxonis
Capoeta capoeta gracilis (Varicorhinus capoeta gracilis)
Dactylogyrus chramulii
D. gracilis
D. lenkorani lenkorani
D. varicorhini
Gyrodactylus capoetai
G. ibragimovi
G. mikailovi
G. varicorhini
Capoeta capoeta heratensis (Varicorhinus capoeta heratensis)
** Dactylogyrus longicopula*
D. pulcher
D. varicorhini
Markewitschiana crucifera

**Pseudacolpenteron pavlovskii*
Paradiplozoon tadjikistanicum
Eudiplozoon nipponicum
Capoeta capoeta sevangi (Varicorhinus capoeta sevangi)
Dactylogyrus chramulii
D. gracilis
D. kendalanicus
D. lencorani araxicus
D. lenkorani lenkorani
D. varicorhini
Paradiplozoon tadjikistanicum
***Capoeta capoeta steindachneri (Varicorhinus capoeta heratensis* natio steindachneri)**
D. narzikulovi
D. pulcher
D. varicorhini
Gyrodactylus mutabilitas
Capoeta damascina (Varicorhinus damascinus)
Dactylogyrus capoetae
**D. dyki*
D. rohdeianus
**D. varicorhini*
Dogielius planus
Capoeta trutta
Dactylogyrus microcirrus
Carasobarbus luteus
Dactylogyrus carassobarbi
Crossocheilus latius
Dactylogyrus eslamii
D. faridpaki
Cyprinion macrostomum
Dactylogyrus cyprinioni
D. macrostomi
D. pallicirrus
Dogielius molnari
Cyprinion watsoni
Dactylogyrus pallicirrus
Garra rufa
Dactylogyrus acinacus
D. rectotrabus
Labeobarbus fritschii
Dactylogyrus kulindrii
D. marocanus
D. volutes
D. zatensis
Labeobarbus reinii
Dactylogyrus kulindrii
D. marocanus
D. oumiensis
D. reinii
Luciobarbus barbulus
Dactylogyrus barbuli
Luciobarbus bocagei (Barbus barbus bocagei)
Dactylogyrus balistae
D. bocageii
D. legionensis
Luciobarbus brachycephalus (Barbus brachycephalus)
Dactylogyrus affinis
D. kulwieci
D. linstowi
D. scrjabinensis
Gyrodactylus markewitschi
**Pseudacolpenteron pavlovskii*
Paradiplozoon tadjikistanicum
Luciobarbus brachycephalus caspius (Barbus brachycephalus caspius)
Dactylogyrus affinis
D. kulwieci
D. linstowi
D. malleus
Luciobarbus callensis
Dactylogyrus heteromorphus
D. tunisiensis
Luciobarbus capito (Barbus capito)
Dactylogyrus affinis
D. goktschaicus
D. kulwieci
D. linstowi
Luciobarbus capito conocephalus (Barbus capito conocephalus)
Dactylogyrus affinis
D. jamansajensis
D. kulwieci
D. linstowi
Markewitschiana crucifera
**Pseudacolpenteron pavlovskii*
Paradiplozoon tadjikistanicum
Eudiplozoon nipponicum
Luciobarbus comizo
Dactylogyrus ballistae
D. comizae
D. doadrioi
D. guadianensis
Luciobarbus figuiensis
Dactylogyrus fimbriphallus
Luciobarbus graellsii
Dactylogyrus bocageii
D. legionensis
D. lenkoranoides
D. linstowoides
Luciobarbus grypus
Dactylogyrus barbioides

D. pavlovskyi
Luciobarbus guiraonis
Dactylogyrus bocageii
D. legionensis
D. lenkoranoides
D. linstowoides
D. mascomai
Luciobarbus issenensis
Dactylogyrus fimbriphallus
Luciobarbus ksibi
Dactylogyrus ksibii
D. marocanus
Luciobarbus lepineyi
Dactylogyrus fimbriphallus
Luciobarbus magniatlantis
Dactylogyrus ksibii
Luciobarbus massaensis
Dactylogyrus fimbriphallus
Luciobarbus microcephalus
Dactylogyrus andalousiensis
D. doadrioi
D. guadianensis
Luciobarbus moulouyensis
Dactylogyrus fimbriphallus
D. ksibioides
Luciobarbus nasus
Dactylogyrus borjensis
D. marocanus
Luciobarbus pallaryi
Dactylogyrus atlasensis
D. fimbriphallus
D. guirensis
Luciobarbus sclateri
Dactylogyrus andalousiensis
D. ballistae
D. bocageii
Luciobarbus setivimensis
Dactylogyrus ksibii
D. ksibioides
D. marocanus
Luciobarbus xanthopterus
Dactylogyrus inutilis
Tylognathus steinitziorum
Paradiplozoon minutum

Subfamily Schizotoracinae
Diptychus maculatus
Dactylogyrus drjagini
D. simplex
Gymnodiptychus dybowskii (Diptychus dybowskii)
Dactylogyrus drjagini
D. simplex
Gyrodactylus aksuensis
G. karabekovi
G. longihamus
G. tokobaevi
Schizothorax argentatus
Dactylogyrus longicopula
Schizothorax intermedius
Dactylogyrus linstowi
D. longicopula
D. modestus
Dogielius forceps
D. planus
Gyrodactylus hemivicinus
G. kafirniganensis
G. marjami
G. montanus
G. narzikulovi
G. seravshani
G. vicinoides
G. vicinus
Markewitschiana crucifera
Paradiplozoon schizotorazi
Schizothorax pseudaksaiensis
Dactylogyrus linstowi
D. longicopula
Dogielius forceps
Paradiplozoon schizotorazi
Schizothorax pseudaksaiensis issykkuli
Dactylogyrus linstowi
Dogielius forceps
Schizopygopsis stoliczkai
Dactylogyrus editus
D. irinae
D. pamirensis
D. schizopygopsis
Gyrodactylus dzhalilovi
G. editus
G. narzikulovi

Subfamily Ctenopharyngodoninae
Ctenopharyngodon idella
**Ancyrocephalus subaequalis*
Dactylogyrus ctenopharyngodonis
D. lamellatus
D. magnihamatus
D. vaginulatus
D. vistulae
D. yinwenyingae
**Pseudacolpenteron pavlovskii*
Paradiplozoon alburni
P. marinae
Sindiplozoon strelkowi
Mylopharyngodon piceus

Dactylogyrus magnihamatus
D. nasali
Sindiplozoon diplodiscus
Squaliobarbus curriculus
Dactylogyrus charbinensis
D. chenchihleui
D. chenyenhsinae
D. chinesis
D. duplus
D. knobihamatus
D. longsoi
D. magnicirrus
D. magnihamatus
D. mantschuricus
D. panchinpeii
D. squaliobarbi
D. squaliobarbi tienmensis
D. sungariensis

Subfamily Cultrinae
Chanodichthys dabryi (Erythroculter dabryi)
Dactylogyrus alatocirrus
D. foliicirrus
D. pterocleidus
Chanodichthys erythropterus (Erythroculter erythropterus)
Dactylogyrus chenminjungue
D. contortus
D. erythroculteris
D. erythropteris
D. flagellicirrus
D. foliicirrus
D. magnihamatus
D. mongolicus
D. pellucidus
D. peltatus
D. pseudoflagellicirrus
Chanodichthys mongolicus (Erythroculter mongolicus)
Ancyrocephalus (=Cleidodiscus) brachus
Dactylogyrus erythroculteris
D. floricirrus
D. fragilis
D. gussevi
D. magnihamatus
D. scalpelliformis
D. tongtinensis
Paradiplozoon parabramisi
Sindiplozoon diplodiscus
Chanodichthys oxycephalus (Erythroculter oxycephalus)
Dactylogyrus branchialis
D. erythroculteris
D. pterocleidus
D. pterygialis
Culter alburnus
Dactylogyrus alatocirrus
D. chenminjungue
D. curvicirrus
D. flagellicirrus
D. helictocirrus
D. magnihamatus
D. montschadskyi
D. parapterocleidus
D. pellucidus
D. peltatus
Paradiplozoon marinae
Hemiculter leucisculus (H. leucisculus, H. eigenmanni)
Dactylogyrus alatoideus
D. brachius
D. chini
D. clavaeformis
D. eigenmanni
D. hemiculteris
D. latituba
D. leucisculus
D. magnihamatus
D. nikolskyi
D. ornithopodus
D. pannosus
D. peculiaris
D. proprius
D. pusillus
D. tridigitatus
Paradiplozoon hemiculteri
Hemiculter lucidus (H. leucisculus lucidus)
Dactylogyrus leucisculus
D. peculiaris
D. pusillus
D. tridigitatus
Gyrodactylus hemiculteris
Megalobrama skolkovii (M. terminalis)
Dactylogyrus magnihamatus
D. palliatus
**D. parabramis*
D. pekinensis
D. petruschewskyi
D. strelkowi
Paradiplozoon megalobramae
Parabramis pekinensis
Dactylogyrus falciunguis
D. jukhimenkoi
D. magnihamatus
D. palliatus

D. parabramis
D. pekinensis
D. petruschewskyi
D. strelkowi
Paradiplozoon parabramisi

Subfamily Cyprininae
Carassius carassius
D. anchoratus
D. arcuatus
**D. baueri*
D. crassus
D. dulkeiti
**D. extensus*
D. formosus
D. inexpectatus
D. intermedius
D. vastator
D. wegeneri
Gyrodactylus carassii
G. katharineri
G. longoacuminatus f. typica
G. schulmani
G. sprostonae
G. vimbi
Paradiplozoon homoion homoion
Eudiplozoon nipponicum
Diplozoon paradoxum
Carassius auratus gibelio
Dactylogyrus anchoratus
D. arcuatus
D. baueri
D. crassus
D. dogieli
D. dulkeiti
**D. extensus*
D. formosus
D. inexpectatus
D. intermedioides
D. intermedius
D. spiralis
D. vastator
D. wegeneri
Gyrodactylus carassii
G. katharineri
G. kobayashii
G. longoacuminatus f. minor
G. longoacuminatus f. typica
G. schulmani
G. sprostonae
**G. stankovici*
Eudiplozoon nipponicum
Cyprinus carpio
Dactylogyrus achmerovi
D. anchoratus
D. baueri
**D. crassus*
D. extensus
**D. formosus*
**D. inexpectatus*
**D. intermedius*
D. minutus
**D. tuba*
D. vastator
D. yinwenyingae
Gyrodactylus carassii
G. cyprini
G. derjavini
G. katharineri
G. kherulensis
**G. longoacuminatus* f. typica
G. medius
G. procerus
G. schulmani
G. sprostonae
G. stankovici
G. vimbi
Pseudacolpenteron pavlovskii
Paradiplozoon alburni
P. homoion homoion
P. zeller
Eudiplozoon nipponicum
Cyprinus carpio rubrofuscus (C. carpio haematopterus)
Dactylogyrus achmerovi
D. anchoratus
D. biwaensis
D. extensus
D. falciformis
D. lopuchinae
D. minutus
D. molnari
D. mrazeki
G. nagibinae
D. sahuensis
D. takahashii
D. vastator
Gyrodactylus kherulensis
G. ophiocephali
G. schulmani
G. sprostonae
G. longoacuminatus f. minor
Pseudacolpenteron pavlovskii
Paradiplozoon cyprini
Eudiplozoon nipponicum

Subfamily Gobioninae
Abbottina rivularis (Pseudogobio rivularis)
Dactylogyrus facetus
D. gobioninum
D. markewitschi
D. pseudogobii
Gyrodactylus gobioninum
Gnathopogon strigatus (Paraleucogobio strigatus)
Dactylogyrus trullaeformis
Gobio acutipinnatus (G. gobio acutipinnatus)
Dactylogyrus gobii
Gyrodactylus markakulensis
Gobio carpathicus (G. gobio carpathicus)
Gyrodactylus markakulensis
Gobio cynocephalus (G. gobio cynocephalus)
Dactylogyrus cristatus
Gobio gobio
**Dactylogyrus anchoratus*
D. cryptomeres f. tisae
D. cryptomeres f. typica
D. finitimus
**Gyrodactylus decorus*
G. dykovae
G. gobiensis
G. gobii
G. gobioninum
G. longiradix
G. markakulensis
G. prostae
G. vimbi
Paradiplozoon homoion gracile
P. homoion homoion
P. zeller
Gobio lepidolaemus (G. gobio lepidolaemus)
Dactylogyrus cryptomeres f. typical
Gyrodactylus markakulensis
Gobio soldatovi
Dactylogyrus cryptomeres f. amurensis
Hemibarbus labeo
Ancyrocephalus hemibarbi
A. pavlovskyi
A. skrjabini
A. subaequalis
Dactylogyrus hemibarbi
D. rarus
D. rostrum
D. securiformis
D. spirocirrus
Sindiplozoon strelkowi
Hemibarbus maculates
Ancyrocephalus hemibarbi
A. pavlovskyi
A. subaequalis
Dactylogyrus grandicirrus
D. hemibarbi
D. rarus
D. rostrum
D. securiformis
D. spirocirrus
Microphysogobio tungtingensis (Rostrogobio amurensis)
Dactylogyrus sparsus
Pseudorasbora parva
Ancyrocephalus pseudorasborae
Bivaginogyrus obscurus
Dactylogyrus squameus
Romanogobio albipinnatus или (Gobio albipinnatus)
Dactylogyrus cryptomeres f. typica
Gyrodactylus gobioninum
G. markakulensis
Romanogobio kesslerii (Gobio kessleri)
Gyrodactylus gobiensis
Romanogobio tenuicorpus (Gobio albipinnatus tenuicorpus)
Gyrodactylus markakulensis
Romanogobio vladykovi
Dactylogyrus finitimus
Sarcocheilichthys czerskii (Chilogobio czerskii)
Ancyrocephalus assimilis
Dactylogyrus laymanianus
D. maximus
D. navicularis
D. singularis
Sarcocheilichthys sinensis lacustris
Ancyrocephalus hangchowensis
Dactylogyrus navicularis
Saurogobio dabryi
Dactylogyrus facetus
D. gobioninum
D. guangxiensis
D. guizhouensis
D. markewitschi
D. pseudogobii
Squalidus chankaensis (Gnathopogon chankaensis)
Ancyrocephalus hoffmani
A.kamegaii
A. ogawai
A. polymorphus
Dactylogyrus clypeatus

D. gnathopogonis
**D. trullaeformis*
D. zachvatkini
Gyrodactylus gnathopogonis

Subfamily Leuciscinae
Tribe Abramidini
Abramis brama
** Dactylogyrus alatus* f. typica
D. auriculatus
**D. chranilowi*
**D. cordus*
**D. crucifer*
D. distinguendus
D. falcatus
**D. propinquus*
**D. similis*
D. sphyrna
**D. suecicus*
D. wunderi
D. zandti
D. yinwenyingae
Pellucidhaptor pricei
Gyrodactylus elegans
G. prostae
G. sommervillae
G. vimbi
Paradiplozoon bliccae
P. homoion homoion
P. sapae
Eudiplozoon nipponicum
Diplozoon paradoxum
Abramis brama orientalis
Dactylogyrus auriculatus
D. falcatus
Gyrodactylus elegans
Ballerus ballerus (Abramis ballerus)
Dactylogyrus chranilowi
Paradiplozoon homoion homoion
P. nagibinae
P. sapae
Diplozoon paradoxum
Ballerus sapa (Abramis sapa)
**Dactylogyrus cornoides*
D. propinquus
**D. similis*
**D. wunderi*
Gyrodactylus elegans
G. vimbi
Paradiplozoon sapae
Ballerus sapa bergi (Abramis sapa bergi)
Paradiplozoon sapae
***Ballerus sapa bergi* natio aralensis *(Abramis sapa bergi* natio aralensis)**
Dactylogyrus propinquus
Blicca bjoerkna
**Dactylogyrus alatus* f. typica
D. cornoides
D. cornu
**D. difformis*
D. distinguendus
**D. falcatus*
D. fallax
**D. nanus*
D. similis
D. sphyrna
D. vistulae
D. volgensis
**D. wunderi*
**D. zandti*
D. yinwenyingae
Gyrodactylus bliccensis
G. carassii
G. gracilihamatus
G. prostae
G. vimbi
Paradiplozoon bliccae
P. homoion homoion
Diplozoon paradoxum
Acanthobrama terraesanctae
Dactylogyrus sphyrna
Capoetobrama kuschakewitschi
Dactylogyrus capoetobramae
D. turkestanicus
Paradiplozoon capoetobrame

Tribe Alburnini
Alburnus alborella (A. albidus alborella)
Dactylogyrus minor
D. fraternus
D. neoparvus
D. parvus
Alburnus alburnus
Dactylogyrus alatus f. typica
D. fallax
D. fraternus
D. minor
**D. nanus*
D. parvus
D. tissensis
**D. similis*
**D. vistulae*
Gyrodactylus carassii
G. decorus
G. glaeseri

G. gracilihamatus
G. katharineri
G. vimbi
Paradiplozoon alburni
Alburnus chalcoides (Chalcalburnus chalcoides)
Dactylogyrus chalcalburni
**D. haplogonus*
D. holciki
Paradiplozoon pavlovskii
Alburnus chalcoides aralensis (Chalcalburnus chalcoides aralensis).
Dactylogyrus chalcalburni
Alburnus chalcoides mento
Dactylogyrus chalcalburni
Alburnus filippi
Dactylogyrus minor
Alburnus hohenackeri (A. charusini, A. charusini hohenackeri)
Dactylogyrus fraternus
D. parvus
Alburnus mossulensis
Dactylogyrus holciki
Alburnoides bipunctatus
Dactylogyrus minor
D. rysavyi
D. tissensis
D. vistulae
Gyrodactylus gracilihamatus
Paradiplozoon alburni
Octomacrum europeum
Alburnoides bipunctatus eichwaldi
Dactylogyrus caucasicus
D. minor
**D. tuba*
Alburnoides bipunctatus fasciatus
Dactylogyrus tauricus
***Alburnoides bipunctatus rossicus* natio kubanicus**
Dactylogyrus caucasicus
Alburnoides oblongus
Dactylogyrus minor
Alburnoides taeniatus
**Dactylogyrus chalcalburni*
**D. fraternus*
D. minor
D. neoparvus
Leucaspius delineatus
**Dactylogyrus anchoratus*
**D. fraternus*
**Gyrodactylus carassii*
**G. decorus*
**G. prostae*
Elopichthys bambusa
Dactylogyrus achmerowianus
**D. gussevi*
D. magnihamatus
Sindiplozoon diplodiscus

Tribe Hypophthalmichtyini
Aristichthys nobilis
Dactylogyrus aristichthys
D. nobilis
D. taihuensis
D. vaginulatus
Hypophthalmichthys molitrix
Dactylogyrus hypophthalmichthys
D. magnihamatus
D. scrjabini
D. suchengtaii
D. vaginulatus
D. wuhuensis
D. yinwenyingae
Gyrodactylus hypophthalmichthysi
Paradiplozoon marinae
Inustiatus inustiatus

Tribe Leuciscini
Aspius aspius
**Dactylogyrus robustus*
D. rysavyi
D. tuba
**D. similis*
**D. sphyrna*
**D. vistulae*
D. yinwenyingae
Paradiplozoon homoion homoion
P. pavlovskii
P. vojteki
Aspius vorax
Dogielius mokhayeri
Aspiolucius esocinus
Dactylogyrus tuba
Chondrostoma colchicum
Dactylogyrus dirigerus
Chondrostoma knerii
Dactylogyrus chondrostomi
D. dirigerus
D. elegantis
D. ergensi
Chondrostoma kubanicum (C. colchicum kubanicum)
Dactylogyrus ergensi
Chondrostoma nasus
Dactylogyrus chondrostomi
D. dirigerus

D. elegantis
D. ergensi
**D. nybelini*
**D. similis*
**D. sphyrna*
D. vistulae
D. yinwenyingae
Gyrodactylus chondrostomi
G. macrocornis
G. paraminimus
Chondrostoma oxyrhynchum (C. cyri)
Dactylogyrus chondrostomi
D. ergensi
D. vistulae
Gyrodactylus derjavini
Chondrostoma polylepis
Dactylogyrus ergensi
D. polylepidis
Leuciscus idus
Dactylogyrus alatus f. major
**D. alatus* f. typica
D. fallax
D. micracanthus
**D. nanus*
D. ramulosus
D. robustus
**D. similis*
**D. sphyrna*
D. tuba
D. yinwenyingae
Gyrodactylus carassii
G. laevis
G. prostae
G. tulensis
G. vimbi
Paradiplozoon alburni
P. homoion homoion
P. megan
Leuciscus idus oxianus
Dactylogyrus alatus f. major
D. tuba
**Pseudacolpenteron pavlovskii*
Leuciscus lehmanni
Dactylogyrus cordus
D. tuba
Leuciscus leuciscus
**Dactylogyrus alatus* f. typica
D. cordus
**D. fallax*
D. ramulosus
**D. similis*
**D. sphyrna*
D. tuba
**D. vistulae*
Gyrodactylus carassii
**G. decorus*
G. leucisci
G. osoblahensis
G. prostae
G. vimbi
Paradiplozoon homoion homoion
P. leucisci
Leuciscus leuciscus baicalensis
Dactylogyrus alatus f. major
D. cordus
D. ramulosus
D. tuba
Pellucidhaptor rogersi
Gyrodactylus carassii
G. laevis
G. prostae
G. tulensis
Paradiplozoon homoion homoion
Leuciscus waleckii
Dactylogyrus ramulosus
D. robustus
Gyrodactylus sergeji
Paradiplozoon skrjabini
Pachychilon pictum
Dactylogyrus ivanovici
D. martinovici
D. petkovici
D. rosickyi
D. sekulovici
Rutilus caspicus
Dactylogyrus crucifer
D. nanus
D. turaliensis
Paradiplozoon homoion homoion
Rutilus frisii
**Dactylogyrus frisii*
D. nybelini
R. frisii kutum
Dactylogyrus frisii
D. nybelini
D. sphyrna
Rutilus rubilio
Dactylogyrus erhardovae
Rutilus rutilus (R. r. fluviatilis)
**Dactylogyrus alatus* f. typica
D. caballeroi
D. crucifer
**D. difformis*
D. fallax
**D. folkmanovae*
**D. macracanthus*

D. micracanthus
D. nanus
D. ramulosus
D. rarissimus
D. rutili
D. similis
D. sphyrna
D. suecicus
**D. tuba*
D. vistulae
D. yinwenyingae
**D. zandti*
Gyrodactylus bliccensis
G. carassii
G. decorus
**G. gasterostei*
G. gracilihamatus
**G. magnificus*
G. prostae
G. rutilensis
G. sommervillae
G. vimbi
Paradiplozoon alburni
P. homoion homoion
P. rutili
P. zeller
Diplozoon paradoxum

Rutilus rutilus aralensis (R. r. aralensis* natio bucharensis*)

Dactylogyrus crucifer
D. nanus
D. sphyrna
D. suecicus

Rutilus rutilus lacustris

**Dactylogyrus alatus* f. major
D. crucifer
**D. difformis*
D. erhardovae
D. micracanthus
D. nanus
D. ramulosus
D. rarissimus
D. similis
D. sphyrna
D. suecicus
**D. tuba*
D. vistulae
D. yinwenyingae
Gyrodactylus carassii
G. longiradix
G. macronychus
**G. magnificus*
G. prostae
G. vimbi
P. homoion homoion
Diplozoon paradoxum

Rutilus rutilus heckelii

Dactylogyrus crucifer
D. nanus
Diplozoon paradoxum

Scardinius erythrophthalmus

Dactylogyrus difformis
D. difformoides
**D. fallax*
D. izjumovae
**D. micracanthus*
**D. similis*
**D. sphyrna*
D. vistulae
D. yinwenyingae
Gyrodactylus carassii
G. decorus
G. katharineri
G. scardiniensis
G. vimbi
Paradiplozoon alburni
P. bliccae
P. homoion homoion
P. zeller
Diplozoon scardinii

Squalius cephalus (Leuciscus cephalus cabeda)

** Dactylogyrus borealis*
**D. difformis*
D. fallax
D. folkmanovae
D. gracilis
D. micracanthus
D. nanoides
**D. nanus*
D. naviculoides
**D. parvus*
D. polylepidis
D. prostae
**D. rutili*
**D. similis*
D. sphyrna
D. vistulae
D. vranoviensis
Gyrodactylus carassii
**G. decorus*
G. leucisci
G. gracilihamatus
G. hemibarbi
G. kearni
G. lamberti

G. lomi
G. osoblahensis
G. prostae
G. scardiniensis
G. vimbi
Markewitschiana triaxonis
Paradiplozoon ergensi
P. homoion homoion
P. leucisci
P. megan
P. rutili
Squalius cephalus orientalis (Leuciscus cephalus orientalis)
Dactylogyrus nanoides
D. prostae
Telestes agassizii (Leuciscus agassizi)
Dactylogyrus soufii
Telestes souffia (Leuciscus souffia)
Dactylogyrus soufii
Vimba vimba
**Dactylogyrus cordus*
D. cornoides
D. cornu
D. distinguendus
D. haplogonoides
D. haplogonus
**D. similis*
D. sphyrna
**D. tuba*
D. vistulae
Gyrodactylus prostae
G. vimbi
Paradiplozoon bliccae
P. homoion homoion
Diplozoon paradoxum
Vimba vimba persa
Paradiplozoon bliccae
Vimba vimba tenella
Paradiplozoon bliccae

Tribe Pseudoaspinini
Oreoleuciscus humilis
Dactylogyrus ersinensis
D. oreoleucisci
D. phoxini
Gyrodactulus limneus
G. magnificus
G. malmbergensis
G. minimus
G. mongolicus
G. oreoleucisci
G. pewzowi
G. pseudonemachili
Oreoleuciscus potanini (O. pewzowi)
Dactylogyrus ersinensis
D. oreoleucisci
D. phoxini
D. yinwenyingae
Gyrodactylus llewellyni
G. magnificus
G. minimus
G. mongolicus
G. nordmanni
G. oreoleucisci
G. pewzowi
Phoxinus brachyurus
Dactylogyrus borealis
Phoxinus czekanowskii czerskii
Dactylogyrus czerskii
D. gvosdevi
Gyrodactylus aphyae
G. llewellyni
G. magnificus
Pellucidhaptor merus
Phoxinus lagowskii
Dactylogyrus amurensis
D. borealis
Gyrodactylus konovalovi
G. laevis
G. lagowskii
Phoxinus oxycephalus
Dactylogyrus amurensis
Gyrodactylus konovalovi
G. limneus
Phoxinus percnurus
**Dactylogyrus amurensis*
D. ersinensis
D. malewitzkajae
D. oreoleucisci
D. phoxini
**D. vastator*
Pellucidhaptor fidus
Ancyrocephalus (=Cleidodiscus) brachus
Gyrodactylus laevis
G. limneus
G. macronychus
G. magnificus
G. malmbergensis
G. minimus
Ph. percnurus mantschuricus
Dactylogyrus gvosdevi
D. malewitzkajae
D. phoxini
Gyrodactylus limneus
G. mantschuricus
Phoxinus phoxinus

Dactylogyrus borealis
D. malewitzkajae
D. phoxini
D. yinwenyingae
Pellucidhaptor merus
P. rogersi
Gyrodactylus aphyae
**G. carassii*
G. dulmaae
G. konovalovi
G. laevis
G. limneus
G. llewellyni
G. longoacuminatus f. minor
G. macronychus
G. magnificus
G. malmbergensis
G. minimus
G. pannonicus
G. prostae
G. somnaensis
Paradiplozoon homoion gracile
P. zeller
Pseudaspius leptocephalus
Dactylogyrus pseudaspii
Gyrodactylus sprostonae
Paradiplozoon amurensis
Pseudophoxinus kervillei
Paradiplozoon minutum
Tribolodon brandtii (Leuciscus brandti)
Dactylogyrus pseudaspii

Subfamily Pelicinae
Pelecus cultratus
Dactylogyrus simplicimalleata
Paradiplozoon vojteki

Subfamily Rasborinae
Aphyocypris chinensis
Dactylogyrus niedashui
Opsariichthys bidens (O. uncirostris amurensis)
Dactylogyrus kurenkovi
D. leewanweii
D. magnihamatus
D. primarius
Paradiplozoon hemiculteri

Subfamily Tincinae
Tinca tinca
Dactylogyrus macracanthus
**D. similis*
D. tincae
D. triappendixis
Gyrodactylus tincae

Subfamily Xenocyprininae
Plagiognathops microlepis
Ancyrocephalus zhejiangensis
Dactylogyrus ancistroides
D. auriformis
D. ornithorrhynchus
D. petaloideus
D. rimskykorsakowi
D. slastnikowi
D. tendiculus
D. wuhanensis
D. zalesskyi
Xenocypris macrolepis
Ancyrocephalus (=Cleidodiscus) brachus
**Dactylogyrus alatoideus*
D. chernyshevae
D. juveniformis
D. limleehongae
D. ornithorrhynchus
D. rimskykorsakowi
D. slastnikowi
D. tendiculus
D. tihsiukangi
D. xenocypris
Paradiplozoon marinae

Family Catostomidae
Catostomus catostomus rostratus
Gyrodactylus spathulatus

Family Cobitidae
***Cobitis taenia* - complex**
Gyrodactylus cobitis
G. latus
G. matovi
G. molnari
Cobitis lutheri
**Gyrodactylus monstruosus*
Cobitis melanoleuca (C. taenia sibirica)
Gyrodactylus anudarini
G. cobitis
G. micracanthus
G. misgurni
G. sibiricus
G. yukhimenkoi
Misgurnus fossilis
Ancyrocephalus cruciatus
**Dactylogyrus extensus*
Gyrodactylus cobitis
G. fossilis

G. misgurni
Misgurnus mohoity (M. anguillicaudatus)
Gyrodactylus macracanthus
G. micracanthus
G. misgurni
G. monstruosus
G. strelkovi

Family Balitoridae
Barbatula barbatula (Nemacheilus barbatulus)
Gyrodactylus barbatuli
G. jiroveci
G. menschikowi
G. pavlovskyi
G. sedelnikowi
Barbatula bergiana (Nemacheilus angorae)
Gyrodactylus angorae
Barbatula toni (Nemacheilus barbatulus toni)
Dactylogyrus barbatuli
D. tonii
Gyrodactylus barbatuli
G. dulmaae
G. jiroveci
G. menschikowi
G. nemachili
G. paranemachili
G. pseudonemachili
G. sedelnikowi
G. tonii
Paragyrodactylus barbatuli
Barbatula toni markakulensis (Nemacheilus barbatulus toni* natio markakulensis*)
Gyrodactylus barbatuli
G. menschikowi
G. sedelnikowi
Lefua pleskei
Gyrodactylus costatae
G. curiosus
G. lefua
G. monstruosus
Triplophysa dorsalis (Nemacheilus dorsalis)
Acolpenteron nephriticum
Dactylogyrus meridionalis
Gyrodactylus gvozdevi
G. nemachili
G. paranemachili
G. pseudonemachili
Paragyrodactylus iliensis
Triplophysa lacusnigri (Nemacheilus lacusnigri)
Dactylogyrus assimovi
Triplophysa stoliczkai (Nemacheilus stoliczkai)
Dactylogyrus assimovi
D. meridionalis
Gyrodactulus nemachili
G. karatagensis
G. paranemachili
G. parvus
G. tibetanus
Paragyrodactylus iliensis
Triplophysa strauchi (Nemacheilus strauchi)
Dactylogyrus meridionalis
D. stankovici
Acolpenteron nephriticum
Gyrodactulus incognitus
G. luckyi
G. nemachili
G. paranemachili
G. parvus
G. pseudonemachili
Paragyrodactylus iliensis

Order Siluriformes
Family Ictaluridae
Ameiurus catus (Ictalurus catus)
Ancyrocephalus (=Ligictaluridus) monticelli
Ameiurus nebulosus (Ictalurus nebulosus)
Ancyrocephalus (=Ligictaluridus) pricei
Gyrodactylus fairporti
Ictalurus punctatus
Ancyrocephalus (=Ligictaluridus) pricei

Family Bagridae
Pelteobagrus brashnikowi (Liocassis brashnikowi)
Bychowskyella pseudobagri
Pseudancylodiscoides strelkowi
Pelteobagrus fulvidraco (P. fulvidraco)
Bychowskyella pseudobagri
Pseudancylodiscoides gigi
P. strelkowi
Pseudobagrus ussuriensis (Liocassis ussuriensis)
Pseudancylodiscoides rimskykorsakowi

Family Siluridae
Silurus asotus (Parasilurus asotus)
Ancylodiscoides parasiluri
Thaparocleidus asoti
T. botulovagina
T. cochleavagina
T. cornucirrus

T. curvilamellis
T. disjunctus
T. dorsocirrus
T. hamatovagina
T. infundibulovagina
T. japonicus
T. lingmoeni
T. magnicirrus
T. markewitschi
T. mediacanthus
T. mutabilis
T. obscurus
T. omegavagina
T. sigmoidovagina
T. varicus
Silurus glanis
Thaparocleidus magnus
T. siluri
T. vistulensis
Silurus soldatovi
Ancylodiscoides parasiluri
Thaparocleidus infundibulovagina
T. longitubus
T. macracanthus
T. magnicirrus
T. mediacanthus
T. rarissimus
T. soldatovi

Order Esociformes
Family Esocidae
Esox lucius
**Ancyrocephalus paradoxus*
Tetraonchus monenteron
Gyrodactylus lucii
Esox reichertii
Tetraonchus monenteron

Family Umbridae
Umbra krameri
Gyrodactylus moldovicus
G. slovacicus
G. umbrae

Order Osmeriformes
Suborder Osmeroidei
Family Osmeridae
Hypomesus olidus
Gyrodactylus bolonensis

Order Salmoniformes
Family Coregonidae
Coregonus albula
Discocotyle sagittata
Coregonus autumnalis
**Salmonchus alaskensis*
S. grumosus
Coregonus chadary
Salmonchus kifai
Coregonus lavaretus
Salmonchus grumosus
Gyrodactylus lavareti
Discocotyle sagittata
Coregonus muksun
Discocotyle sagittata
Coregonus nasus
**Salmonchus alaskensis*
S. grumosus
Gyrodactylus lavareti
Discocotyle sagittata
Coregonus peled
Salmonchus grumosus
**Discocotyle sagittata*
Coregonus sardinella
Salmonchus grumosus
Discocotyle sagittata
Coregonus tugun
**Discocotyle sagittata*
Prosopium cylindraceum
Salmonchus variabilis
Discocotyle sagittata
Stenodus leucichthys
Salmonchus grumosus
Discocotyle sagittata

Family Thymallidae
Thymallus arcticus
**Salmonchus alaskensis*
Tetraonchus borealis f. minor
T. borealis f. rauschi
T. borealis f. typica
Gyrodactylus brachymystacis
G. magnus
G. thymalli
Discocotyle sagittata
Thymallus brevirostris
Tetraonchus borealis f. typica
Gyrodactylus thymalli
Thymallus thymallus
Tetraonchus borealis f. minor
T. borealis f. typica
Gyrodactylus thymalli
G. truttae
Discocotyle sagittata

Family Salmonidae

Brachymystax lenok
Salmonchus ergensi
S. gvosdevi
S. lenoki
S. pseudolenoki
S. rogersi
S. roytmani
S. skrjabini
S. spasskyi
S. strelkowi
Gyrodactylus asiaticus
G. brachymystacis
G. lenoki
G. taimeni
Brachymystax tumensis
Salmonchus awakurai
Hucho taimen
Salmonchus gvosdevi
S. huchonis
S. pseudolenoki
S. roytmani
S. skrjabini
S. spasskyi
Gyrodactylus taimeni
Discocotyle sagittata
Oncorhynchus gorbuscha
Salmonchus kifai
Gyrodactyloides bychowskii
Laminiscus strelkowi
Oncorhynchus keta
Salmonchus alaskensis
**Gyrodactylus somnaensis*
Laminiscus strelkowi
Oncorhynchus kisutch
Salmonchus alaskensis
Gyrodactylus salmonis
Laminiscus strelkowi
Oncorhynchus masou
Gyrodactylus masu
Salmonchus awakurai
S. oncorhynchi
Oncorhynchus nerka
Gyrodactylus nerkae
Parasalmo clarki
Gyrodactylus salmonis
Parasalmo gairdnerii
Gyrodactylus colemanensis
G. masu
G. salmonis
Salmonchus awakurai
Parasalmo mykiss
Salmonchus alaskensis
Gyrodactylus bohemicus
**G. truttae*
Salmo salar
**Salmonchus alaskensis*
Gyrodactylus salaris
Gyrodactylus salmonis
Gyrodactyloides bychowskii
Salmo trutta
Salmonchus gussevi
Discocotyle sagittata
Salmo trutta caspius
Gyrodactylus derjavini
Salmo trutta (*fario*)
Gyrodactylus truttae
Salmo trutta (*lacustris*)
Gyrodactylus derjavini
G. truttae
Salvelinus albus
Salmonchus alaskensis
Salvelinus alpinus
**Salmonchus alaskensis*
Discocotyle sagittata
Salvelinus fontinalis
Gyrodactylus bohemicus
G. colemanensis
G. salmonis
G. truttae
Salvelinus leucomaenis
Salmonchus alaskensis
Gyrodactulus birmani
Salvelinus malma
Salmonchus alaskensis
Gyrodactulus birmani

Order Gadiformes
Family Lotidae
Lota lota
Gyrodactylus lotae
***Diplozoon paradoxum*

Order Gasterosteiformes
Suborder Gasterosteoidei
Family Gasterosteidae
Gasterosteus aculeatus
Gyrodactylus alexanderi
G. arcuatus
G. branchicus
G. gasterostei
**G. rarus*
Pungitius pungitius
Gyrodactylus arcuatus
G. gasterostei
G. pungitii
G. rarus

Pungitius sinensis (Pungitius pungitius sinensis)
Gyrodactylus pungitii
G. rarus

Order Scorpaeniformes
Suborder Cottoidei
Family Cottidae
Subfamily Cottinae
Cottus cognatus
Gyrodactylus cotti
Cottus czerskii
Gyrodactylus konovalovi
***Cottus gobio* s.l.**
Gyrodactylus cotti
G. hrabei
G. katharineri
G. longiradix
G. rogatensis
Cottus poecilopus
Bothitrema cotti
Gyrodactylus cotti
G. hrabei
Cottus szanaga
Gyrodactylus szanagai
Leocottus kesslerii
Gyrodactylus baikalensis
Mesocottus haitej
Gyrodactylus haiteji
Paracottus knerii
Gyrodactylus baikalensis

Subfamily Cottocomephorinae
Cottocomephorus grewingkii
Dactylogyrus colonus
Gyrodactylus bychowskianus
Cottocomephorus inermis (C. comephoroides)
Gyrodactylus bychowskianus
Comephorus dybowskii
Gyrodactylus comephori

Subfamily Abissocottinae
Asprocottus herzensteini
Gyrodactylus baikalensis
Batrachocottus multiradiatus
Gyrodactylus baikalensis
Batrachocottus nikolskii
Gyrodactylus baikalensis
Cyphocottus megalops (Limnocottus megalops)
Dactylogyrus colonus
Gyrodactylus baikalensis
Limnocottus bergianus (Abissocottus bergianus)
Dactylogyrus colonus
Limnocottus godlewskii (Abissocottus godlewskii)
Dactylogyrus colonus
Gyrodactylus baikalensis
Limnocottus pallidus
Dactylogyrus colonus

Order Perciformes
Suborder Percoidei
Family Percichthydae
Siniperca chuatsi
Ancyrocephalus mogurndae

Family Centrarchidae
Lepomis gibbosus
Actinocleidus oculatus
A. recurvatus
Haplocleidus dispar
Urocleidus similis
Micropterus dolomieu
Acolpenteron ureteroecetes
Micropterus salmoides
Acolpenteron ureteroecetes

Family Percidae
Gymnocephalus cernuus (G. cernua)
Dactylogyrus amphibothrium
D. hemiamphibothrium
Gyrodactylus cernuae
G. longiradix
G. luciopercae
Gymnocephalus schraetser
Dactylogyrus amphibothrium
D. hemiamphibothrium
Perca fluviatilis
Ancyrocephalus paradoxus
Ancyrocephalus percae
**Gyrodactylus cernuae*
**G. gasterostei*
G. longiradix
G. lucii
G. luciopercae
** Diplozoon paradoxum*
Sander lucioperca (Stizostedion lucioperca)
Ancyrocephalus paradoxus
Ancyrocephalus percae
Gyrodactylus longiradix
G. lucii

G. luciopercae
Sander volgensis (Stizostedion volgensis)
Ancyrocephalus gussevi

Suborder Gobioidei
Family Odontobutidae
Odontobutis obscura (Mogurnda obscura)
Ancyrocephalus mogurndae
Perccottus glenii
Ancyrocephalus curtus
Gyrodactylus glehnii
G. perccotti

Family Gobiidae

Gymnogobius urotaenia (Chaenogobius annularis urotaenia)
Ancyrocephalus mogurndae
Proterorhinus marmoratus
Gyrodactylus arcuatus
G. proterorhini
Zosterisessor ophiocephalus (Gobius ophiocephalus)
G. proterorhini

Suborder Channoidei
Family Channidae
Channa argus (Ophiocephalus argus warpachowskii)
Gyrodactylus ophiocephali

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