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New reports of dactylogyridean species (Monogenea) for Central Europe

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Summary

Report of six dactylogyridean parasite species and five hosts for four *Dactylogyrus* species from the gills of cyprinid fish in Central Europe are described. Two species, *D. alatus* forma *major* and *D. dulkeiti*, have not previously been recorded in the Czech Republic; four species, *D. inexpectatus*, *D. ramulosus*, *D. squameus* and *Thaparocleidus magnus* were found as new records in Central Europe. New host records include *Abramis ballerus* for *D. auriculatus*, *Aspius aspius* for *D. ramulosus*, *Rutilus pigus* for *D. rarissimus*, *Pseudorasbora parva* and *Leuciscus idus* for *D. vistulae*.

Key words: Dactylogyridea; fish parasites; Cyprinidae; *Dactylogyrus alatus* forma *major*; *D. auriculatus*; *D. dulkeiti*; *D. inexpectatus*; *D. ramulosus*; *D. rarissimus*; *D. squameus*; *D. vistulae*; *Thaparocleidus magnus*

Introduction

The parasite fauna of freshwater fish is often monitored in connection with the commercial exploitation of cyprinid fish in aquaculture, where precise examinations of fish for potential pathogens are necessary for fish survival and growth. Cyprinid fishes form a large and diverse family with worldwide distribution, with about 2 000 species (Helfman *et al*., 1997). Of the 316 species of fish living in Europe (Maitland, 2000), 34 have been recorded from the Czech and Slovak Republics (Baruš and Oliva, 1995). The Monogenea, a group of ectoparasites living on the skin, fins and gills, present the largest group of fish parasites, with up to 20 000 species described to date (Poulin, 1998). The checklist of monogeneans includes a total of 178 species belonging to 16 genera identified from the Czech and Slovak Republics (Gelnar and Špakulová, 1997; Moravec, 2001), with the highest number of species in *Gyrodactylus* and *Dactylogyrus* (77 and 71 species, respectively). These figures indicate a high level of fish examination and a detailed knowledge of the fish parasite fauna in the region. However, examination of rare fish species, which have not been studied intensively, inhabiting regions which were restricted during the cold war (the south-east part of the Czech Republic), could increase records of parasite diversity and extend the knowledge of the fish parasite fauna in the region.

This study demonstrates six reports of dactylogyridean monogeneans and five new host records for three *Dactylogyrus* species from the gills of cyprinids, contributing to the faunistic knowledge of fish parasites of Central Europe.

Materials and Methods

During the years 1998 to 2003, seven fish species of the order Cypriniformes (six belonging to Cyprinidae, one belonging to the family Siluridae) from several water reservoirs in the Morava and Dyje River Basin, Czech Republic, and Danube River, Slovak Republic, were collected by electrofishing. The fish were examined for the presence of monogenean parasites. Parasites were removed from host tissue, fixed with a mixture of ammonium picrate and glycerin and mounted in Canada balsam for further analyses (Malmberg, 1970). Parasites were identified according to shape of the sclerotized parts of the haptor (anchors, connective bars, and marginal hooks) and reproductive organs (copulatory organ and vaginal armament) (see Gusev, 1985), using a light microscope equipped with phase-contrast, differential interference contrast (DIC) and Digital Image Analysis (Pro Plus 1.3 for Windows 1995).

All measurements, unless specified otherwise, are given in µm (Tab. 1). Material was deposited in the helmithology collection of the Institute of Parasitology AS CzR, České Budějovice, Czech Republic.

Table 1. Measurements of the body and sclerotized parts of the parasite haptor and reproductive organs

Species	*D. alatus* f. *major*	*D. dulkeiti*	*D. inexpectatus*		*D. ramulosus*	*D. squameus*	*T. magnus*	
			juvenile host	adult host				
Body length (mm)	1.8	0.4 (0.32 – 0.48)	0.2 (0.16 – 0.23)	0.26	1.5 (1.3 – 2)	0.6	2.26	
Maximum width (mm)	0.28	0.08	0.05	0.07	0.4	0.09	0.3	
Anchor lengths (μm):							dorsal	ventral
Total length	50	48 (42 – 54)	41 (39 – 42)	49 (48 – 49)	35 (34 – 37)	35	75	32
Base of anchor	27	28 (24 – 30)	23 (21 – 25)	26 (25 – 27)	29 (27 – 30)	30	66	27
Point	15	21.5 (20 – 23)	18 (16 – 21)	21 (20 – 22)	12 (10 – 13)	8	34	18
Inner root	28	26 (23 – 26)	23 (18 – 25)	26 (25 – 27)	10.5 (9 – 12)	8	19	9
Outer root	13	2	1	2	2.5 (2 – 3)	5	4	7
Patches (μm):								
Length							22	
Width							6	
Marginal hook (μm):								
Total length	26 (24 – 30.5)	22 (16 – 26)	20.5 (18.5 – 23)	25.5 (25 – 26)	23 (18 – 26)	21 (18-23)	20 (18-22)	
Dorsal connective bar (μm):								
Length	8	2 (1 – 3)	1.5 (1 – 2)	2	3 (3 – 4)	6	15	
Width	44	31 (28 – 34)	27 (25 – 29)	32 (29 – 34)	24 (23 – 25)	24	56	
Ventral connective bar (μm):							half part length:	
Length	5				10 (6 – 11)		4	
Width	24				20 (18 – 20)		35	
Copulatory organ (μm):	57	28 (24 – 32)	36 (34 – 39)	43 (42 – 43)	35 (31 – 40)	25	403	
Vagina (μm):	non-sclerotized	non-sclerotized	non-sclerotized	non-sclerotized	25 (17 – 31)	non-sclerotized	non-sclerotized	
N	1	12	22	3	6	1	1	

Results and Discussion

New records of dactylogyrideans for Central Europe

Dactylogyrus alatus Linstow, 1878 forma *major* Sidorov, 1956 (Fig. 1, Coll. No. M-15/2)

Host: *Leuciscus idus* (Linnaeus, 1758)

Locality: Kyjovka River: 48º 43' N, 16º 58' E

Previous records: *Dactylogyrus alatus* has been reported as a gill parasite of bleak, *Alburnus alburnus*, and white bream *Abramis bjoerkna* from the European part of Russia, Germany and Sweden (Markewich, 1951), in Poland (Prost, 1972), Hungary (Molnár, 1964) and in Czech and Slovak Republics (Ergens, 1962). According to Gusev (1985), specimens of *D. alatus* described from the gills of *A. alburnus*, *A. bjoerkna*, *Leucaspius delineatus* and *Rutilus rutilus* are identical with the form named *Dactylogyrus alatus* forma *typica*, whereas specimens described from the gills of *Leuciscus* spp. correspond to *D. alatus* forma *major* described by Sidorov (1956). The anchor measurements of our specimen correspond to measurements of *D. alatus* f. *major* published in Gusev (1985).

Comments: This is the first report of *D. alatus* f. *major* from the Czech and Slovak Republics. We suggest that the previous reports of *D. alatus* from the gills of *A. alburnus*, *A. bjoerkna* and *L. delineatus* in the Czech Republic (Ergens, 1962) belong to *D. alatus* f. *typica*.

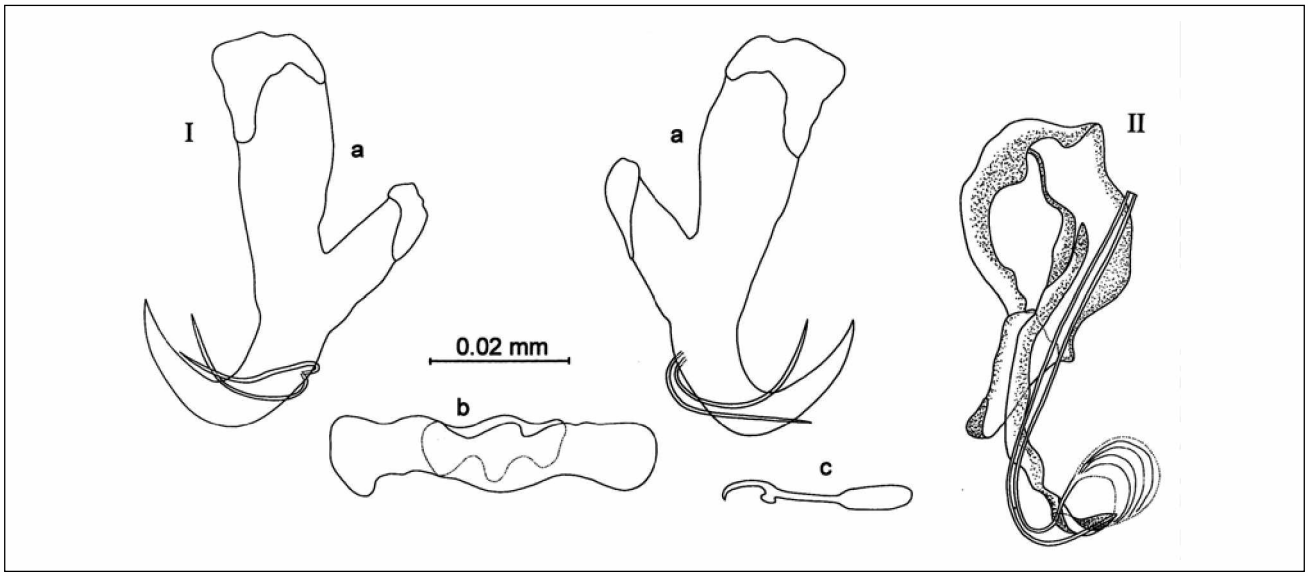

Fig. 1. *Dactylogyrus alatus* Linstow, 1878 f. major Sidorov, 1956. I. Sclerotized parts of haptor: anchors (a), dorsal connective bar (b), marginal hook (c). II. Male copulatory organ

Dactylogyrus dulkeiti Bykhovsky, 1936 (Fig. 2, Coll. No. M-392)

Host: *Carassius auratus gibelio* (Bloch, 1783)

Locality: Gravel pit "Čapí": 48º 37' N, 16º 55' E; Dyje River: 48º 39' N, 16º 56' E

Previous records: The first description of *Dactylogyrus dulkeiti* was published by Gusev (1952). In Europe, *D. dulkeiti* was identified as a specific parasite of *Carassius* spp. in the basin of the Caspian, Black, White and Baltic Seas (Bykhovskaya-Pavlovskaya, 1962). Also, several specimens of *D. dulkeiti* were found from gills of koi carp, *Cyprinus carpio*, in the USA (Kritsky and Heckmann, 2002).

Comments: This is the first report of *D. dulkeiti* from the Czech and Slovak Republics. Distribution of this parasite in Central Europe is closely connected to its host distribution. The origin of *Carassius auratus gibelio* in Europe is not clear and is still controversial (Baruš and Oliva, 1995), but several authors consider this an introduced fish species (Liborsvárský, 1962). Due to the isolated occurrence of this fish in Central Europe during the last two centuries, the parasite fauna has not been studied in detail.

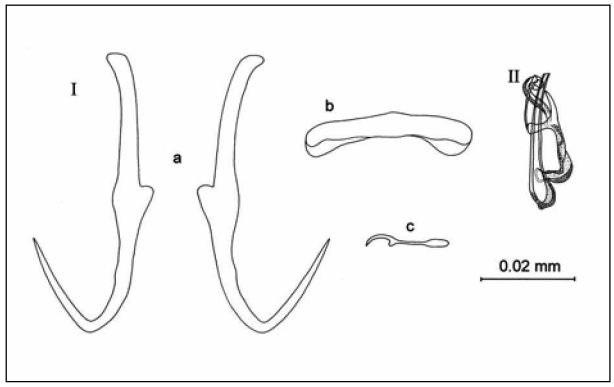

Fig. 2. *Dactylogyrus dulkeiti* Bykhovsky, 1936. I. Sclerotized parts of haptor: anchors (a), dorsal connective bar (b), marginal hook (c). II. Male copulatory organ

Dactylogyrus inexpectatus Izjumova, 1955 (Fig. 3, Coll. No. M-70/2)

Host: *Carassius auratus gibelio* (Bloch, 1783)
Locality: Gravel pit "Čapí": 48º 37' N, 16º 55' E; Dyje River: 48º 39' N, 16º 56' E
Previous records: *Dactylogyrus inexpectatus* was originally described by Izjumova in 1955 (Gusev, 1955) from the gills of *Carassius carassius* and *Carassius auratus gibelio* in southwest Russia. Also, *Ctenopharyngodon* spp. (Gibson *et al*., 1996) or *Cyprinus carpio haematopterus* have been described as hosts of this species (Strelkov, 1971). According to Gusev (1985), distribution of *D. inexpectatus* corresponds to that of the host and includes the Palearctic region. In Europe, *D. inexpectatus* was found in basins of the Black and Baltic Seas, as a specific parasite of *Carassius* spp. (Gayevskaya *et al*., 1975; Izjumova, 1977).

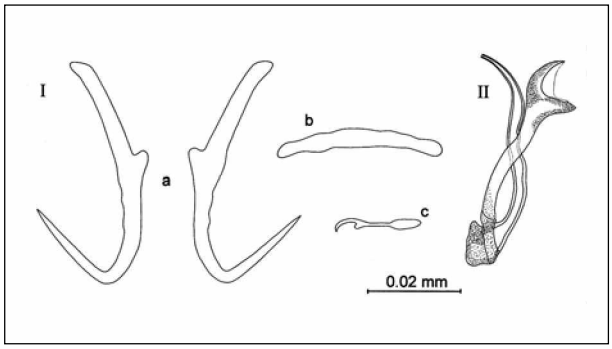

Fig. 3. *Dactylogyrus inexpectatus* Izjumova, 1955. I. Sclerotized parts of haptor: anchors (a), dorsal connective bar (b), marginal hook (c). II. Male copulatory organ

Comments: This is the first report of *D. inexpectatus* from the Czech and Slovak Republics. Analogous to *D. dulkeiti*, distribution of this parasite in Central Europe depends on host occurrence.

Dactylogyrus ramulosus Malewitzkaya, 1941 (Fig. 4, Coll. No. M-49/2)
Host: *Leuciscus idus* (Linnaeus, 1758), *Aspius aspius* (Linnaeus, 1758)
Locality: Kyjovka (*L. idus*): 48º 43' N, 16º 58' E and Morava River (*L. idus*, *A. aspius*): 48º 41' N, 17º 00' E
Previous records: Malewitzkaya (1941) originally described *D. ramulosus* as a gill parasite of ide, *Leuciscus idus*, from the Dnieper River. Except *L. idus*, Markewich (1951) or Izjumova (1977) cite roach *Rutilus rutilus* as a host of this parasite in the European part of the former Soviet Union. Discrepancies in the measurement data from this species described by different authors were noted by Gusev (1966). The original description (Malewitzkaya, 1941) presents *D. ramulosus* as a large worm with a maximum body length 1.5 mm. Data from other authors (Gusev, 1966; Jukhimenko, 1981; Gusev, 1985) on this species vary from the original description and do not overlap.
Comments: This is the first report of *D. ramulosus* from the Czech and Slovak Republics and first record of this species on *Aspius aspius*. The measurements observed in our material correspond to the data originally described by Malewitzkaya (1941) and suggest that the specimens recorded by Jukhimenko (1981) probably belong to *D. micracanthus* or some other species.

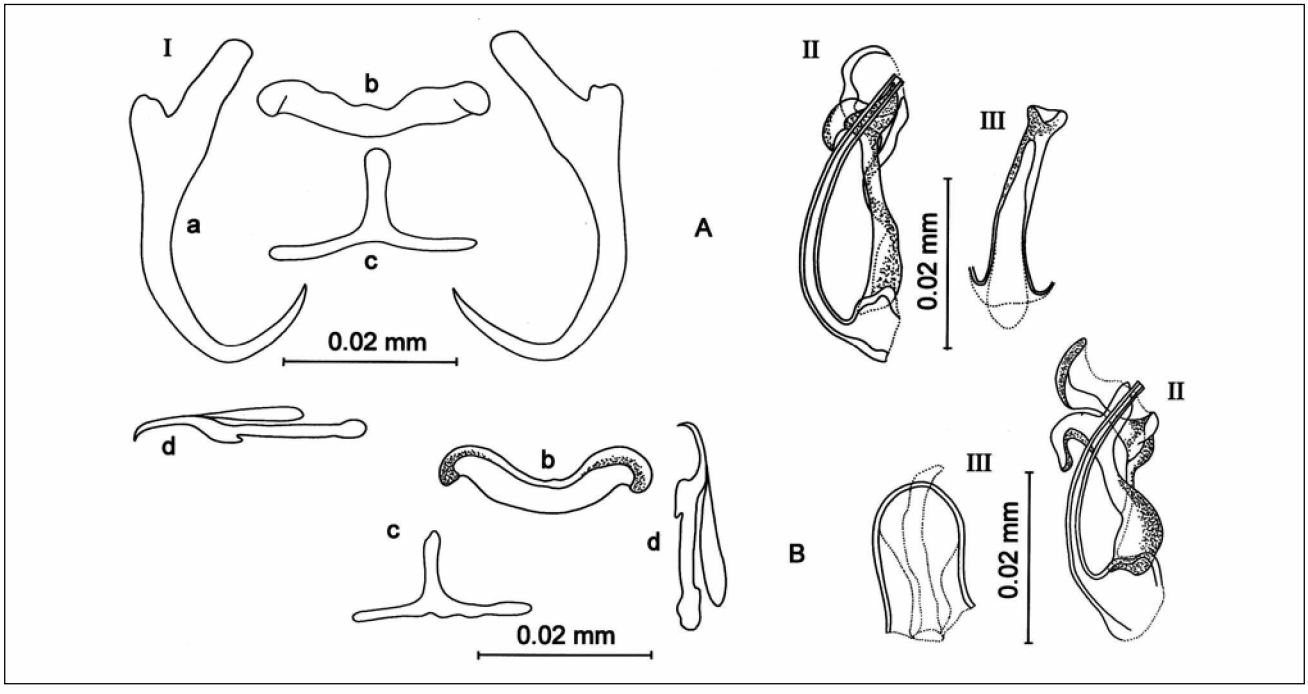

Fig. 4. *Dactylogyrus ramulosus* Malewitzkaya, 1941. I. Sclerotized parts of haptor: anchors (a), dorsal connective bar (b), ventral connective bar (c), marginal hook (d). II. Male copulatory organ. III. Vaginal armament. Host *Leuciscus idus* (A), *Aspius aspius* (B)

Dactylogyrus squameus Gusev, 1955 (Fig. 5, Coll. No. M-393)
Host: *Pseudorasbora parva* (Schlegel, 1842)
Locality: Gravel pit "Čapí": 48º 37' N, 16º 55' E, Kyjovka River: 48º 43' N, 16º 58' E
Previous records: *Dactylogyrus squameus* was originally described by Gusev (1955) from the gills of the stone morocco, *Pseudorasbora parva*, in the Amur River and Lake Chanka. According to Gusev (1985), *D. squameus* is a specific parasite species of *P. parva*, dispersed in connection with its host expansion in Kazakhstan, Tajikistan and Uzbekistan.

Comments: This is the first report of *D. squameus* from the Czech and Slovak Republics. To our knowledge, there is no previously published record from Europe. The occurrence of *D. squameus* in Europe is probably connected with its host expansion. The original distribution of *P. parva* is the Far East (Shatunovsky, 1983). In recent years, this species has spread to the rest of the former Soviet Union and many European countries as fry with imported herbivorous fishes. At present, the distribution of *P. parva* is almost continuous in the east of Europe (Šebela and Wohlgemuth, 1984); however, there are few parasitological studies focused on this fish species. Sporadic finding of

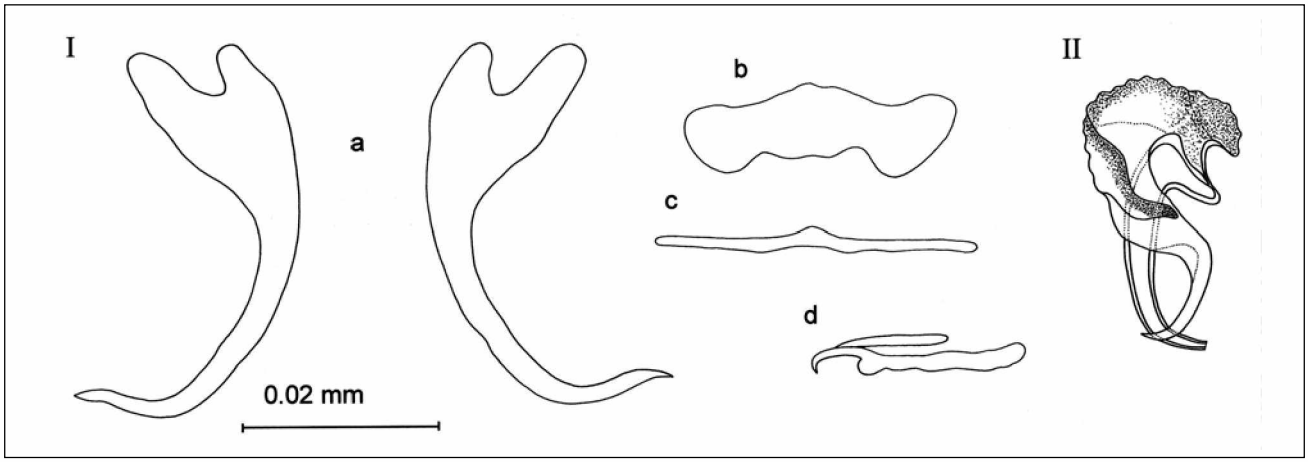

Fig. 5. *Dactylogyrus squameus* Gusev, 1955. I. Sclerotized parts of haptor: anchors (a), dorsal connective bar (b), ventral connective bar (c), marginal hook (d). II. Male copulatory organ

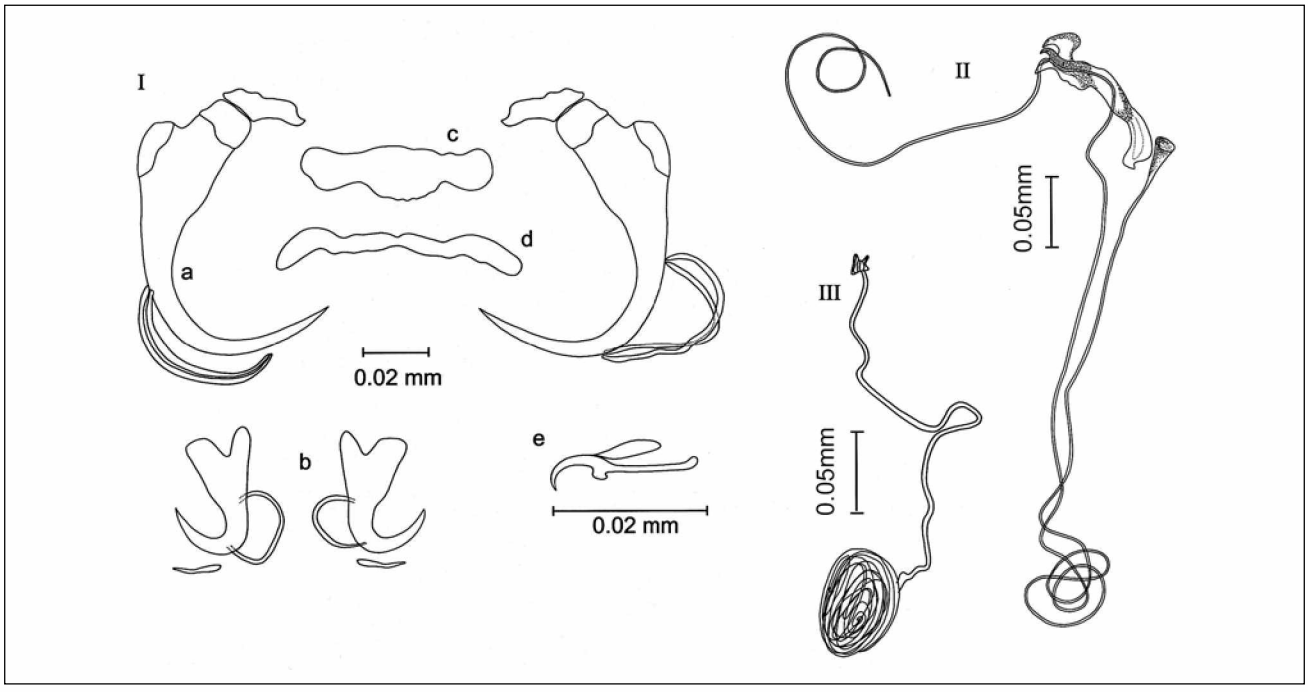

Fig. 6. *Thaparocleidus magnus* (Bykhowsky & Nagibina, 1957) Lim, 1996. I. Sclerotized parts of haptor: dorsal anchors (a), ventral anchors (b), dorsal connective bar (c), ventral connective bar (d), marginal hook (e). II. Male copulatory organ. III. Vaginal armament.

D. squameus corresponds with a generally small parasite fauna for *P. parva* in the Czech Republic (Gelnar *et al*., 1994, Adámek *et al*., 1996).

Thaparocleidus magnus (Bykhowsky & Nagibina, 1957) Lim, 1996 (Fig. 6, Coll. No. M-394)
[Syn. *Ancylodiscoides magnus* Bykhowsky & Nagibina, 1957; *Silurodiscoides magnus* (Bykhovsky & Nagibina, 1957) Gusev, 1985]
Host: *Silurus glanis* (Linnaeus, 1758)
Locality: Morava River: 48º 41' N, 17º 00' E
Previous records and comments: *Thaparocleidus magnus* is the gill parasite of wels catfish, *Silurus glanis*, distributed in the European part of the former Soviet Union (Bykhowsky and Nagibina, 1957). This is the first report of this species from the Czech and Slovak Republics. To our knowledge, there is no report of this parasite species from any other European country except the former Soviet Union.

New host records for dactylogyrids
Dactylogyrus auriculatus (Nordmann, 1932) Diesing, 1850 (Coll. No. M-33/2)
Host: *Abramis ballerus* (Linnaeus, 1758)
Locality: Kyjovka River: 48º 43' N, 16º 58' E
Comments: *Dactylogyrus auriculatus* is a common gill parasite of *Abramis brama* (Kennedy, 1974; Lambert, 1977) or *Abramis bjoerkna* (Markewich, 1951; Prost, 1957) in the Palaearctic region. In the Czech Republic, there are many records of *D. auriculatus* from the gills of *A. brama* (Lucký, 1959; Gelnar *et al*., 1994), and two uncertain findings on *Cyprinus carpio* and *Barbus barbus* (see Moravec, 2001). Izjumova (1970) designed an experiment with transmission of larval *D. auriculatus* to a non-specific host, *Abramis ballerus* and observed maturation and production of eggs on this host. Thus, *A. ballerus* is suggested as a possible natural host, but records from nature are lacking. This present finding of *D. auriculatus* on *A. ballerus* is a new host record from the Czech and Slovak Republics.

Dactylogyrus rarissimus Gusev, 1966 (Coll. No. M-19/2)
Host: *Rutilus pigus* (Lacépède, 1804)
Locality: Danube River (confluence of the river and Gabčíkovo dam): 49º 50' N, 17º 36' E
Comments: According to Gusev (1985), *D. rarissimus* is a gill parasite specific for roach, *Rutilus rutilus*, and also occurs in the Czech and Slovak Republics (see references in Moravec, 2001). Two common *Dactylogyrus* species, *D. crucifer* and *D. vistulae*, are known from *R. pigus* (see Žitňan, 1965); *D. rarissimus* presents new parasite species for this host in the Czech and Slovak Republics. To our knowledge, there is no report of *D. rarissimus* found on *Rutilus pigus* from any other European country.

Dactylogyrus vistulae Prost, 1957 (Coll. No. M-45/2)
Host: *Leuciscus idus* (Linnaeus, 1758), *Pseudorasbora parva* (Schlegel, 1842)
Locality: Kyjovka River: 48º 43' N, 16º 58' E
Comments: *Dactylogyrus vistulae* is a parasite of the gills of several cyprinid species from European waters (i.e. Molnár, 1964; Kennedy, 1974; Lambert, 1977; Lambert and Romand, 1984), and also occurs in the Czech and Slovak Republics (see references in Moravec, 2001). In spite of many fish species being described as a host of *D. vistulae, L. idus* and *P. parva* present new host records for this parasite species in the Czech and Slovak Republics. To our knowledge, there is no report of these hosts for *D. vistulae* from any other European country.

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