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Parasitology

**PRELIMINARY SURVEY ON PARASITE FAUNA OF PUMPKINSEED
SUNFISH, *LEPOMIS GIBBOSUS* (LINNAEUS, 1758) (PISCES, TELEOSTEI,
CENTRARCHIDAE) FROM WARM-WATER DISCHARGE CANAL OF
THE "POMORZANY" POWER PLANT IN SZCZECIN, POLAND ***

**BADANIA WSTĘPNE NAD PARAZYTOFAUNĄ BASA SŁONECZNEGO,
LEPOMIS GIBBOSUS (LINNAEUS, 1758) (PISCES, TELEOSTEI,
CENTRARCHIDAE) Z KANAŁU ZRZUTOWEGO ELEKTROWNI
"POMORZANY" W SZCZECINIE, POLSKA**

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A total of 103 pumpkinseed sunfish *L. gibbosus* was surveyed for parasites. Fourteen parasite species representing six higher taxa were recovered. Of the fish examined, 72.8 % were found to harbour parasites. The most prevalent were glochidia of *Unio* sp. (43.7 %) and metacercariae of *Diplostomum* sp. (38.8 %). Findings of *Ichthyocotylurus platycephalus*, *Tylodelphys clavata*, *Ergasilus sieboldi* and *Caligus lacustris* constitute new host records. None of the species found, poses a human health threat.

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INTRODUCTION

Pumpkinseed sunfish, *Lepomis gibbosus* (L.), a common North American fish was imported to Europe on the end of nineteenth century as an ornamental, aquarium species. In the first half of the twentieth century it was apparently introduced to the wild environment either on purpose or as an escapee. Since that time the fish has been reported several times from European water bodies (Berg, 1949; Wiktor, 1959; Balon, 1964). In the past decade, the population of *L. gibbosus* in the lower Odra River area reached considerable size (Heese and Przybyszewski, 1985). The fish tend to occur more often in warm-water discharge canals of power plants.

The parasite fauna of the North-American population of pumpkinseed sunfish has been extensively studied. Most of the findings are summarized by Hoffman (1967). More recent surveys include: Burris and Miller (1972), Cone and Anderson (1977), Hanek and Fernando (1978a, b), Beverley-Burton (1981), Beverley-Burton and Suriano (1981), Arthur and Lom (1984), Lewis et al. (1984), Rye and Baker (1984), Li and Dessler (1985), Nicola and Cone (1987), Measures (1988), Ashley and Nickol (1989).

Parasitological findings on the European populations of the fish were usually confined to single parasite species only (Šul'man, 1948; Ghittino, 1961; Lambert, 1975; Kritscher, 1979). There was only one broader survey by Aisa and Gattaponi (1981).

MATERIAL AND METHODS

Sunfish were collected from the warm-water discharge canal of the "Pomorzany" Power Plant in Szczecin. The water temperatures in the canal vary from 7.5°C to 8.5°C in winter and 16–20°C in fall (Ostrowski, 1987).

The 500 m-long canal flows directly to the Odra River, and its fauna and flora does not differ essentially from those of the neighbouring waters.

The majority of the fish were caught by the authors on hook and line, by seine, or using an electro-fishing device. Some were purchased from anglers. The fish were collected within May 15 – June 25, 1990, from September 12 to November 21, 1990, and on September 4, 1991. A total of 103 fish was examined. The total lengths (l.t., *longitudo totalis*) of the fish ranged from 7.5 to 16.0 cm (10.8 cm mean), while their masses were within 9.0 – 100.0 g (29.0 g mean).

The host specimens were examined either fresh after capture, or the next day following refrigeration or were kept in an aquarium for up to 14 days.

Standard parasitological procedures were applied for fish necropsy (Kabata, 1985). The skin, fins, opercula, mouth cavity, branchial cavity, gills, body cavity, liver, kidney,

stomach, intestine, gonads, muscles, and eyes were examined. The parasites were identified under a Carl Zeiss compound microscope at magnifications up to 400 \times . Prevalence, intensity (range and mean), and abundance of each parasite species were calculated.

Voucher specimens of some parasites were deposited in the Museum of Natural History, Wrocław University, Wrocław, Poland.

RESULTS

Fourteen parasite species, belonging to six higher taxa were recovered from 103 hosts studied. There were: one protistan, three digeneans, four nematodes, three acanthocephalans, one mollusc, and two copepods. Seventy five (72.8%) fish were found to harbour parasites. Out of infected fish, 39 (52%) had only one parasite species, 22 (29.3%) had two, 9 (12%) had three, 2 (2.7%) had four, and 1 (1.3 %) had five.

PROTISTA

Eimeria Schneider, 1875

Eimeria sp. (Fig. 1)

Intestinal smears of one fish revealed the presence of a few sporocysts. Intensity of infection was low and no complete oocyst was found.

Sporocysts are fusiform, 15–25 μ m in length. Inside are two elongated, sporozoites joined together, and either one big spherical body or several, small opalescent ones in the centre. Some of sporocysts show small polar granules. No suture or other structures were observed.

DIGENEA

Diplostomum von Nordmann, 1832

Diplostomum sp. (Fig. 2–3)

Metacercariae of these parasites were found in eye lenses of 40 fish. A total of 57 flukes was found. It was the second most prevalent (38.83%) parasite of this host. The highest observed intensity was 4. The smallest fish found to harbour *Diplostomum* sp. measured 8.5 cm. Fish were grouped into classes based on their length. The prevalence of infection for each class showed a general increase from small to larger fish (34.8% for fish 8.0–8.9 cm to 54.5% for fish 13.0–13.9 cm). Fish longer than 14 cm were all infected. The highest mean intensity (2.0) was observed for the class 11.0–11.9 cm. The highest abundance (0.82) occurred among fish 13.0–13.9 cm.

Dimensions of specimens (based on 6 individuals) are: length: 295–447 μ m (400 μ m, mean); width: 218–326 μ m (290 μ m, mean); oral sucker: 42–50 \times 49–59 μ m (50 \times 53 μ m, mean); ventral sucker: 49–59 \times 45–52 μ m (55 \times 51 μ m, mean); Brandes organ: 68–108 \times 52–76 μ m (79 \times 67 μ m, mean); oesophagus: 23–29 \times 31–35 μ m (27 \times 33 μ m, mean); distance of centre of ventral sucker from anterior end: 180–277 μ m (239 μ m, mean).

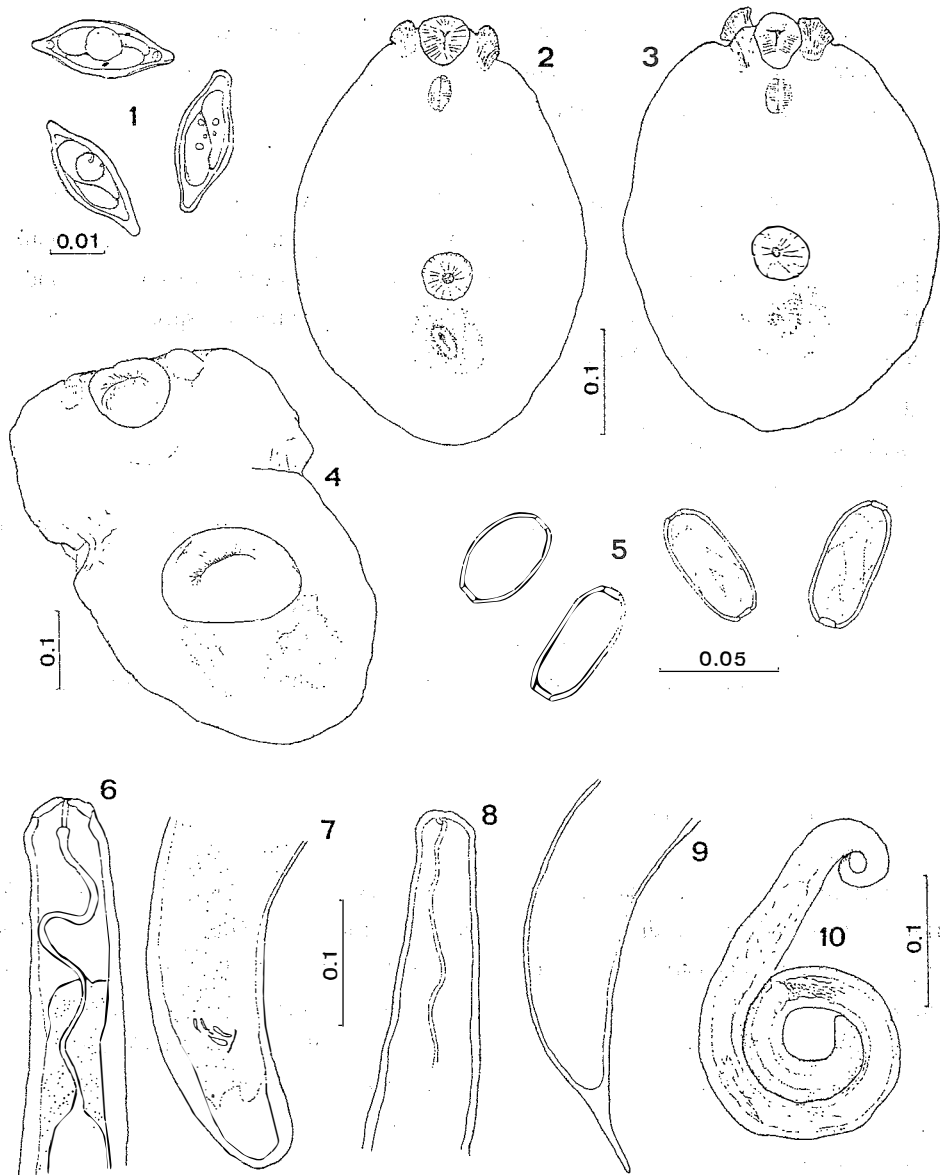


Fig. 1-10. Parasites of pumpkinseed, *Lepomis gibbosus*

Fig. 1. Sporocysts of *Eimeria* sp. Fig. 2-3. Metacercariae of *Diplostomum* sp. Fig. 4. Metacercaria of *Ichthyocotylurus platycephalus*. Fig. 5. Eggs of *Schumana* (S.) *petruschewskii*. Fig. 6. Nematoda gen. sp. I; anterior end. Fig. 7. Nematoda gen. sp. I; posterior end. Fig. 8. Nematoda gen. sp. II; anterior end. Fig. 9. Nematoda gen. sp. II; posterior end. Fig. 10. Nematoda gen. sp. III. Scale bars in millimetres.

Ichthyocotylurus Odening, 1969

Ichthyocotylurus platycephalus (Creplin, 1825) (Fig. 4)

A total of three metacercariae of this parasite was found on two fish. One of the hosts (15.0 cm l.t.) was collected on Sept.12, 1990, the other one (10.6 cm) on Sept.4, 1991. The flukes were encysted in the anterior part of the body cavity.

Dimensions of the depicted specimen (Fig. 4) are: length: 545 μ m; width: 382 μ m; oral sucker: 104 \times 87 μ m; ventral sucker: 184 \times 132 μ m; distance of centre of ventral sucker from anterior end: 305 μ m.

Tylodelphys Diesing, 1850

Tylodelphys clavata (von Nordmann, 1832)

A total of 11 metacercariae was found in 8 fish. The highest intensity was 2 individuals. Their total length did not exceed 0.6 mm. Live individuals were whitish and transparent.

NEMATODA

Schulmanella Ivaškin, 1964

Schulmanella (*Schulmanella*) *petruschewskii* (Šul'man, 1948) Ivaškin, 1964

Numerous specimens were found in livers of 15 fish. Intensity of infection was difficult to determine, but undoubtedly it was high. Squashed samples of liver tissue revealed the presence of many nematodes and hundreds of their eggs. Some of the eggs contained already formed, coiled larvae. The eggs (43–51 μ m \times 24–27 μ m) were elongated with polar opercula (or plugs) (Fig. 5). The parasites occurred mostly on bigger fish (11–15 cm), especially in the 13.0–13.9 cm class, the smallest host infected measured 9.2 cm.

The high intensity of infection influenced the appearance of the liver and apparently also its function. The bulk of the liver was saturated with numerous nematodes and their eggs. Infected livers were easy to recognize on first sight, due to their bright brown colour.

Nematoda gen.sp. I (Fig. 6–7)

A single nematode, preserved in poor condition, was found in the intestine of a fish caught on 7th June, 1990. The host was 12.5 cm long. In addition to the nematode mentioned, it hosted also glochidia on its gills.

Measurements of the nematode are: total length: 22.3 mm; width: 0.13 mm. Anterior part blunt, without labia, papilla or any other structures. Inside is a terminally-open, short tubule connected to an s-shaped, thin tube, which becomes eventually a wider vesicle. Posterior end is narrower and gently rounded. Other internal structures were not discernible.

Nematoda gen.sp. II (Fig. 8–9)

A single specimen was found in the stomach of a fish caught on 7th June, 1990. The host, 12.5 cm long, hosted also glochidia of *Unio* sp., metacercariae of *Diplostomum* sp. and its liver was heavily infected with *Schulmanella* (S.) *petruschewskii*.

Measurements are: total length: 16.4 mm; width: 0.10 mm. Anterior end rounded without any external structures. Inside is a thin tubule terminating apically at the anterior end. Posterior end is conical, surmounted with elongated cuticular process.

Nematoda gen.sp. III (Fig. 10)

A single specimen was found in the dorsal muscles of a fish collected on Sept. 4, 1991. The host measured 11.7 cm and was not infected by other parasites.

The nematode was coiled and small (704x38 µm). It did not reveal any observable internal structures.

ACANTHOCEPHALA

Acanthocephalus Koelreuther, 1771

Acanthocephalus lucii (Müller, 1776) (Fig. 11)

The parasite was found in intestines of three fish. A total of 5 specimens was found. Three of them were females, one was male, and one was not determined due to damage to its body. The host fish were collected in June, 1990. Their lengths were 12.0, 14.3, and 16.0 cm. Highest intensity was 3.0. Only one host showed mixed infection with *Paracanthocephalus* sp. No significant pathological changes in host were caused by the parasite.

Measurements are: total length: 8.9–12.7 mm (females); 6.2 mm (male). Proboscis armed with 13–15 longitudinal rows of hooks (8–9 in a row). Hooks similar in dimensions except for posterior one being definitely smaller. Roots of the hooks oval. Females filled with fully-developed, fusiform eggs (64 µm long). Lemnisci longer than proboscis receptacle.

Paracanthocephalus Ahmerov and Dombrovskaja–Ahmerova, 1941

Paracanthocephalus sp. (Fig. 12–17)

Only two fish harboured this parasite. They were collected in June and they measured 14.0 and 14.5 cm. Invasion parameters are given in Table 1. A total of four specimens was found. Three individuals were females, the fourth remained undetermined, because most of its body was missing.

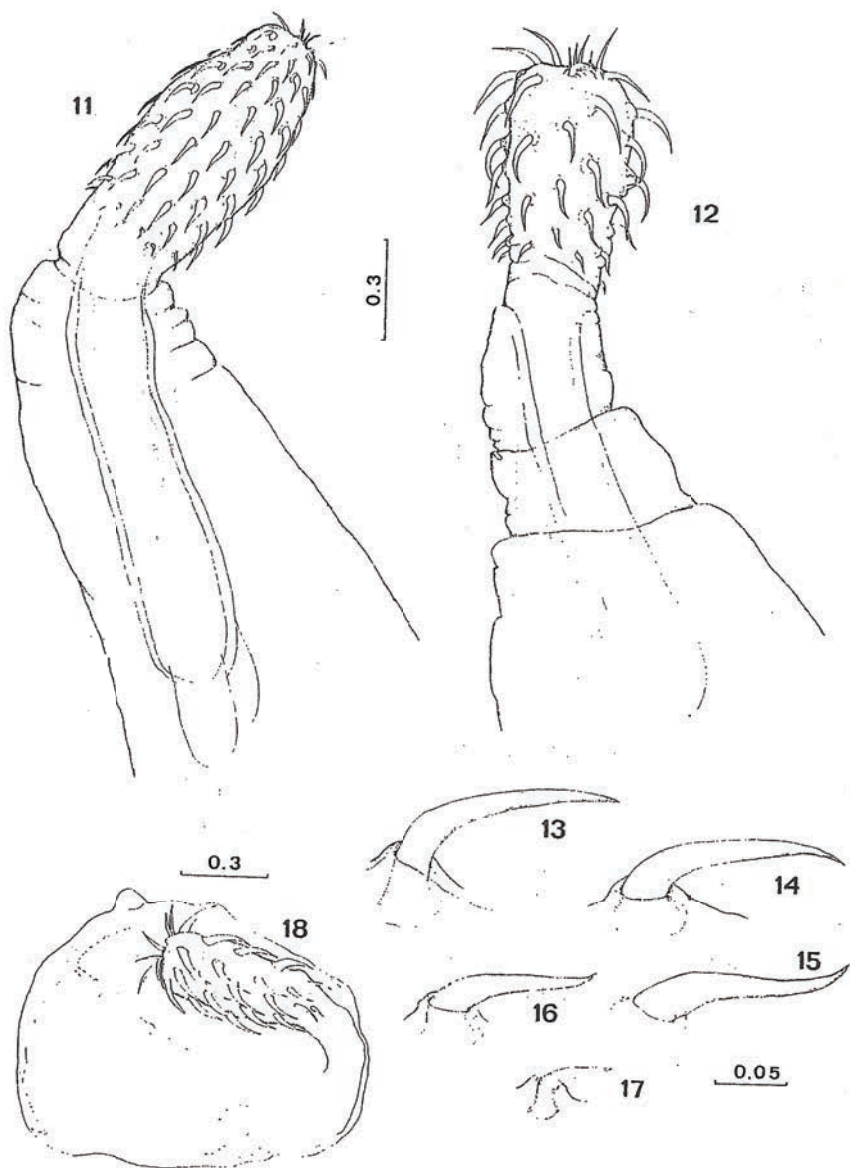


Fig. 11-18. Parasites of pumpkinseed, *Lepomis gibbosus*.

Fig. 11. *Acanthocephalus lucii*; anterior end. Fig. 12-17. *Paracanthocephalus* sp.
 Fig. 12. Anterior end of body. Fig. 13. Hook; 4th from posterior. Fig. 14-15. Hooks; 3rd from
 posterior. Fig. 16. Hook; 2nd from posterior. Fig. 17. Hook; 1st from posterior.
 Fig. 18. *Acanthocephala* gen. sp. Scale bars in millimetres.

Table 1

Infection parameters of parasites of *Lepomis gibbosus*

Species	Prevalence (%)	Intensity (range)	Intensity (mean)	Abundance
<i>Eimeria</i> sp.	0.97	v. low	undet.	undet.
<i>Diplostomum</i> sp.	38.83	1 – 4	1.43	0.55
<i>Ichthyocotylurus platycephalus</i>	1.94	1 – 2	1.50	0.03
<i>Tylodelphys clavata</i>	7.77	1 – 2	1.38	0.11
<i>Schumanella</i> (S.) <i>petruschewskii</i>	14.56	v. high	undet.	undet.
Nematoda gen. sp. I	0.97	1	1.00	0.01
Nematoda gen. sp. II	0.97	1	1.00	0.01
Nematoda gen. sp. III	0.97	1	1.00	0.01
<i>Acanthocephalus lucii</i>	2.91	1 – 3	1.67	0.05
<i>Paracanthocephalus</i> sp.	1.94	1 – 3	2.00	0.04
<i>Acanthocephala</i> gen. sp.	0.97	1	1.00	0.01
<i>Unio</i> sp.	43.69	1 – 132	25.51	11.15
<i>Ergasilus sieboldi</i>	5.82	1	1.00	0.06
<i>Caligus lacustris</i>	1.94	1	1.00	0.02

Measurements are: total length: 8.45–9.75 mm (9.06 mm mean). Soma elongated, sub-cylindrical, slightly wider in anterior part, narrowing into distinctly separated pseudo-collum. Anteriorly to it elongated collum (neck). Collum surmounted with elongated, club-shaped proboscis, scarcely covered with hooks arranged in 10–11 longitudinal rows (7 hooks in a row). Hooks slim and sharp; their size gradually diminishing posteriorly (Fig. 13–17). Bases of hooks (roots) almost oval with small antero-lateral lobes. Lemnisci almost equal in size with proboscis receptacle. One female filled with fusiform eggs (65 μ m long), other two with "oocyte balls".

Acanthocephala gen. sp. (Fig. 18)

A single specimen, encysted in the liver, was recovered from a 10.6 cm fish collected on Sept. 4, 1991. Proboscis well-developed with at least 9 rows of hooks (5 hooks in a row).

MOLLUSCA (Bivalvia)

Unio Philipsson, 1788

Unio sp.

A total of 1146 specimens was recovered from 45 hosts. Other infection parameters are shown in Table 1. Glochidia were attached to gill filaments and only three were found on operculum. Most of glochidia were found on the second gill arch, some on the third, fewer on the fourth, and sporadically on first. They were located in the medial part of each gill. Glochidia did not occur in the fall samples.

COPEPODA

Ergasilus von Nordmann, 1832*Ergasilus sieboldi* von Nordmann, 1832

Single specimens were found in six fish in the spring. Fish measured 11.8–14.0 cm and they harboured also numerous glochidia. Copepods were found on gills with the exception of one found attached to the anal fin. All specimens were adult, ovigerous females. Their dimensions are as follows: total length (without uropods): 1.18–1.52 mm (1.33 mm mean); width of cephalothorax 0.38–0.55 mm (0.46 mm mean); cephalothorax length: 0.82–1.0 mm (0.9 mm mean); egg sacs length: 0.7–1.3 mm (1.02 mm mean).

Caligus lacustris Steenstrup et Lütken, 1861

Two, single larval specimens (chalimus IV stage) were noticed on two host fish (11.8 cm and 12.5 cm long) caught on June 7. The copepods were attached by means of their frontal filaments to anal and second dorsal fin, respectively. The chalimi measured: 3.2 and 3.19 mm (total length excluding frontal filament and uropods); with a cephalothorax width of 1.15 and 1.67 mm.

DISCUSSION

Parasites of pumpkinseed sunfish exhibit variability in the prevalence, intensity of infection and abundance. Glochidia of *Unio* sp. found in 43.7 % of fish and metacercariae of *Diplostomum* sp. infecting 38.8 % of the hosts showed the highest prevalence. Less prevalent was *Schulmanella* (*S.*) *petruschewskii* parasitizing 14.6 % of the pumpkinseed. Species like: *Tylodelphys clavata*, *Ergasilus sieboldi*, *Acanthocephalus lucii*, *Paracanthocephalus* sp., *Caligus lacustris* and *Ichthyocotylurus platycephalus* occurred each in few fish only. Single hosts revealed presence of: *Eimeria* sp., Nematoda gen. sp. I, II and III, and *Acanthocephala* gen. sp.

Glochidia of *Unio* sp. are easy to distinguish from the other common mollusc larvae, *Anodonta* sp. The former are smaller and brighter. Adult *Unio* sp. are dominant bivalves in the canal studied. The third genus *Margaritifera*, known in its larval stage to invade European fishes, does not occur in the lower Odra River. The glochidia found on pumpkinseed in Northern America belonged to *Lampsilis radiata* (Hanek and Fernando, 1978). Cone and Anderson (1977) did not specify what bivalve species they dealt with. Presently observed maximal intensities (132) of glochidia of *Unio* sp. are much higher than those given by Cone and Anderson (1977) for the other glochidia.

There are 18 species of *Diplostomum* known to infect Palaearctic fishes (Šigin, 1986) and further new species are described (Niewiadomska, 1988). Distinguishing between the

Diplostomum species is difficult. It requires extensive experience, preparation uniformity and, preferably, extensive material. Considering the above and the small number of worms presently preserved, the authors did not attempt to identify these flukes to species level. May be that more than one species is present in present findings. *Diplostomum* spp. have not been reported from "European" pumpkinseed. North American records, referred to as *Diplostomulum* spp. (Hoffman, 1967), probably belong to the genus *Diplostomum*.

The nematode *Schulmanella* (S.) *petruschewskii* is the third most prevalent species, but it is certainly the most important, considering the impact on fish health. It occurs in high numbers and substantially damages the liver. The parasite has been reported to infect "European" pumpkinseed three times (Šul'man 1948; Ghittino, 1961; Aisa and Gattaponi, 1981). *S. petruschewskii* is a common parasite of European freshwater fishes and in the lower Odra River it was found in perch (*Perca fluviatilis*) (Trocińska-Augustyniak, 1982).

Tylodelphys clavata is very common parasite of European fishes. Hoffman (1967) lists representatives of the genus *Tylodelphys* infecting *L. gibbosus* and gives no further details. He probably meant the American population of that host. Present findings of *T. clavata* constitute a new host record.

The recovered specimens of *Acanthocephalus lucii* match a description of this common, non-specific parasite (Bauer, 1987). The only difference was in the roots of hooks. In the present material they are oval, while in the description mentioned above they are more elongate and possess small lateral lobes. *A. lucii* was reported from European pumpkinseed by Kritscher (1979).

There were four species of the genus *Paracanthocephalus* described: *P. gracilacanthus* (Meyer, 1932); *P. curtus* (Ahmerov and Dombrovskaja-Ahmerova, 1941); *P. tenuirostris* (Ahmerov and Dombrovskaja-Ahmerova, 1941); and *P. rauschi* Schmidt, 1969. First of the species mentioned occurs in Europe; the next two occur in Asia (Grabda and Grabda-Kazubska, 1967) and the last one in America. Both Asian species differ essentially from the present finding in the shape of the proboscis and number of hooks in a row. *P. gracilacanthus* differs in proportions of its praesoma. *P. rauschi* has fewer rows of hooks and fewer hooks in a row. Its proboscis, neck and pseudocollum are slim and are definitely more elongate than the presently-found *Paracanthocephalus* sp. The latter acanthocephalan does not show clear antero-lateral lobes of the hook roots which is a typical feature for the genus. The present findings may represent a new species, but it must be proved on more abundant material.

Adult females of *Ergasilus sieboldi* occurred sporadically in the studied host. This parasite is abundant in European water bodies. It parasitizes most of the native fish. There were records of *E. sieboldi* from two other species imported to Europe: *Oncorhynchus mykiss* (Walbaum, 1792) ("*Trutta iridea*") and *Micropterus salmoides* Lacépède (Geyer,

1940). In northern America there were three *Ergasilus* species reported from *L. gibbosus*: *E. caeruleus* Wilson, 1911, *E. centrarchidarum* Wright, 1882 (see Hoffman, 1967), and *E. rhinos* Burris and Miller, 1972. Present findings of *E. sieboldi* constitute a new host record.

Caligus lacustris is a common parasite of many European fishes of different families. It is the only freshwater representative of its genus, comprising more than 200 species. In favourable conditions it may become a harmful pest of fish in extensive aquaculture (Rokicki, 1986). Larval stages of this parasite were described by Kozikowska, 1957. Correct identification of a stage of presently-collected chalimus larvae was facilitated by the report of Piasecki and MacKinnon, 1993. Present findings of *C. lacustris* constitute a new host record.

The dimensions of the attachment organs of the recovered specimens of *Ichthyocotylus platycephalus* allow for distinguishing it from the other three known species (*I. variiegatus*, *I. erraticus*, *I. pileatus*) having their suckers definitely smaller (Sudarikov, 1984). The present findings of *I. platycephalus* constitute a new host record.

The population of pumpkinseed studied, revealed a relatively narrow range of parasite species and relatively low infection parameters.

What may be an important conclusion of the present survey is the lack of monogeneans, cestodes or adult digeneans. Examined pumpkinseed tended to acquire common European fish parasites, known for their broad range of hosts. None of the American parasites were found. The parasites possibly brought by imported ancestors of the pumpkinseed presently occurring in the Odra river estuary, must have been lost.

Populations of pumpkinseed sunfish in France were found to harbour two monogeneans *Actinocleidus oculatus* and *A. recurvatus* (Lambert, 1975). These monogeneans are known to parasitize *L. gibbosus* in North America.

None of the parasites found is potentially harmful for humans.

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BADANIA WSTĘPNE NAD PARAZYTOFAUNĄ BASA SŁONECZNEGO, *LEPOMIS GIBBOSUS* (LINNAEUS, 1758) (PISCES, TELEOSTEI, CENTRARCHIDAE) Z KANAŁU ZRZUTOWEGO ELEKTROWNI "POMORZANY" W SZCZECINIE, POLSKA

STRESZCZENIE

Przebadano 103 osobniki basa słonecznego *Lepomis gibbosus* poddając je pełnej sekcji parazytologicznej. Znaleziono czternaście gatunków pasożytów reprezentujących sześć grup taksonomicznych. Zarażonych było 72,8 % ryb. Najczęściej występowały glochidia *Unio* sp. (43,7 %) oraz metacerkarie *Diplostomum* sp. (38,8 %). Bas słoneczny okazał się nowym żywicielem dla czterech gatunków pasożytów: *Ichthyocotylurus platycephalus*, *Tylodelphys clavata*, *Ergasilus sieboldi* i *Caligus lacustris*. Żaden ze znalezionych pasożytów nie stanowi potencjalnego zagrożenia dla zdrowia człowieka.

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