toce Gdańskiej liczbę gatunków typowo morskich (21). Oprócz tego, 30 gatunków helmintów „słodkowodnych" zarejestrowano dotychczas u ryb słodkowodnych, 24 u ryb dwuśrodowiskowych i 16 u morskich. Spośród helmintów „morskich", 17 gatunków stwierdzono u ryb morskich, 13 u dwuśrodowiskowych i 4 u słodkowodnych. Badania autora potwierdzają też wcześniej zaobserwowane zjawisko gatunkowego wzbogacania się parazytofauny żywicieli na granicy ekologicznego zasięgu ich występowania.

A C T A P A R A S I T O L O G I C A P O L O N I C A
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Helminth fauna of fishes of the Gdańsk Bay (Baltic Sea)

Helmintofauna ryb Zatoki Gdańskiej

Abstract

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Examination of 923 fishes of 40 species revealed 42 helminth species. Trematodes (20 species) and cestodes (12) were the predominant parasite groups both as regards the number of species and the incidence and intensity of infection. Nematodes (4 species) and acanthocephalans (6) were much rarer and less numerous parasites. Cestodes *Schistocephalus pungitii* (plerocercoid) and *Proteocephalus longicollis*, the nematode *Camallanus truncatus* and the acanthocephalan *Pomphorhynchus kostylewi* are first records in Poland, the latter being the first record in the Baltic Sea. Of the 42 helminth species recorded, 30 were found to occur in new host species. A total of 62 new parasite-host system which are new for Poland, including 29 systems new to science, have been demonstrated. Descriptions of *Allocreadium isoporum*, *Palaeorchis unicus*, *Asymphylodora kubanicum* and *Pomphorhynchus kostylewi* are supplemented. *Asymphylodora imitans* form "A" of Witenberg and Eckmann 1934 is regarded a synonym of *A. kubanicum* (Issaitschikoff, 1923); *Palaeorchis skrjabini* Koval, 1950 of *Palaeorchis unicus* Szidat, 1943; *Caryophyllaeus* sp. of Janiszewski 1938 is recognized as *C. laticeps* (Pall., 1781). The structure of the helminth fauna of fishes under study, based on the author's findings and on data from literature, is discussed in detail.

Introduction

Out of the about 12,000 fish species living at present, 76 are found in the waters of the Gdańsk Bay and southern Baltic Sea (Gąsowska 1962). Of these, *Clupea harengus* L., *Gadus callarias* L., and *Pleuronectiformes* are the most abundant. Also fish belonging to the south Atlantic fauna occur in the Baltic, e.g. *Scophthalmus maximus* (L.), *Scomber scombrus* L., *Sprattus sprattus* (L.), and *Belone belone* (L.). As regards migrating species, the following live in the Baltic: catadromous *Anguilla anguilla* (L.), anadromous *Salmo salar* L. and *Salmo trutta* L., and *Vimba vimba* (L.). In the relatively poorly salted waters of the Gdańsk Bay the following species live and reproduce: *Rutilus*

Praca wykonana w ramach problemu resortowego Nr. PAN-29.

rutilus (L.), *Abramis brama* (L.), *Esox lucius* L., *Lucioperca lucioperca* (L.) and other fish species whose proper habitat are lakes and rivers. For this reason the Gdańsk Bay is a particularly interesting region for a parasitologist. The river Vistula drains its fertile waters to the Bay, thus creating a favourable environment for many species of marine, fresh-water and migrating fishes. It should be expected that this provides opportunities for an exchange of parasites between the above three groups of fishes.

Markowski 1933, was the first to study the helminth fauna of the Polish Baltic on a wide scale. On the ground of autopsies of 372 fish representing 27 species, he made a taxonomic review of the parasites he had found; despite some errors, his review is a well outlined picture of the parasitic fauna of that aquatic region. Later (in 1935, 1936, 1938 and 1939) Markowski studied the life cycles of some fish parasites, most often living in the Puck Bay. Janiszewska 1938, studied parasites of *Pleuronectes flesus* L. caught in the Polish waters of the Baltic. In the post-war years, intestinal trematodes of salmonid fishes living in southern Baltic waters were studied by Ślusarski 1958, both from the systematic and ecological view-point. Parasites of *Gadus callarias* L. living in the Gdańsk Bay and southern Baltic were described by Studnicka 1965. Sołtyńska 1964, studied cestodes of fishes living in the Puck Bay. Prost 1957, 1959, provided detailed information about the occurrence of *Monogenoidea* in fishes living in southern Baltic. Apart from this, parasitological investigation of the Baltic fishes by research workers from other countries, were for the most part limited to the fauna of the Baltic bays. For instance, the helminth fauna of fishes from the Gulf of Finland was investigated by Schneider 1902, 1904, 1905, Levander 1909, Forssell 1905; of the Kiel Bay by Schultz 1911, of the Neva Bay by Dogel and Petruševskij 1933, and the Greifswald Bay by Engelbrecht 1958. Some of the studies encompassed selected groups of parasites, to mention the investigation of ectoparasites of fishes living in the Kurland Lagoon and the Vistula Lagoon (Wegener 1910), and the investigation of *Acanthocephala* of fishes caught in the Swedish coastal waters (Lundström 1942). Many Soviet parasitologists studied selected problems related to the parasitic fauna of industrial fishes in the eastern part of the Baltic. But often their studies were limited to the drawing up of records of parasites, including data on the incidence and intensity of infection with those parasites (Gecevičjute 1958).

The present study encompasses the region of the Gdańsk Bay. It has been based on comprehensive material obtained from 923 autopsies of fishes and composed of 42 parasite species. It was the present author's aim to get a more thorough knowledge about the occurrence of parasites in fishes living in brackish waters, and to supplement the rather incomplete data earlier collected by other authors about the occurrence of parasites in the Baltic fishes. He also endeavoured to make a tentative comparative analysis of the helminth fauna (excluding *Monogenoidea*) of marine, fresh-water and migrating fish species, living in the same environment of brackish waters which are the natural

border region between the two different habitats: the sea and the inland fresh waters. He tried to trace the natural border line between the ecological range of the fishes belonging to each of the just mentioned two habitats. Such analysis could provide an answer to the question to what an extent the mentioned groups of fishes exchange their parasites with each other and thus help to determine the specificity limit of at least several species towards their proper host groups.

The outlined description of the environment

The Gdańsk Bay is stretching over the region in which the Baltic coastal line changes its direction from parallel to meridional and, according to Łomniewski 1959, it covers the area between the cape Rozevie (54°49′54″ N, 18°20′20″ E) and Brüsterort (54°54′40″ N, 19°58′56″ E), occupying 5.480 sq km. The Bay protrudes in the land forming a semicircle with 55 km radius. The bottom of the Gdańsk Bay descends to the depth of 114 m in the Gdańsk Depth. The characteristic features of the configuration of the bottom is steep inclination near the coast, particularly near the Hel Peninsula, and quite rapid transition to the flat basin of the Gdańsk Depth. Inside the Bay the shallow area situated in the face of the cone-like estuaries of the Vistula is well visible: it is the effect of the sediments brought by the Vistula waters. The Puck Bay, although closely bordering upon the Gdańsk Bay, is nearer to the lagoon-type waters and may be regarded as a subregion. The salinity of water in the Gdańsk Bay is steadily changing. The Vistula fresh water reduces salinity particularly of the surface waters, and, on the other hand, water pouring in from the Baltic sea increases the salinity of deep waters up to 15‰. The low salinity of the brackish waters in the Gdańsk Bay offers fairly good living conditions to fresh-water fishes, particularly in the surface water layers and in shallow regions.

Material and methods

In the years 1967–1971, the present author collected helminth material (with the exception of *Monogenoidea*) obtained from the autopsies of 923 fish representing 40 species. The fishes were caught in the Gdańsk Bay, in the spring, summer and autumn. The following organs were examined: oesophagus, stomach, intestine, heart, liver, gall bladder, kidneys, air bladder, gonads, mesentery, body cavity. The respective sections of the intestine were cut, poured with 0.9% water solution of Na_2CO_3, and their content was examined. Mucus was removed with the help of scalpel together with the content of the duct, and later crushed to form a homogenous suspension in the water solution of Na_2CO_3. After decantation repeated several times, clear sediment was examined through a magnifying glass. The parenchymatous organs, e.g. liver and kidneys, were examined on the surface and later, after fragmentation with the help of preparation needles were examined under a low-power microscope. The heart, the gall bladder, the air bladder and the gonads were examined from outside. Next they were cut and their outer and inner surfaces were examined. The mesentery and the body cavity were superficially examined for the presence of cysts and free helminths. The collected parasites (most often when alive) were placed in a 0.6% solution of Na_2CO_2 in which they lived for a sufficiently long period and easily freed themselves of the remaining mucus. The material obtained this way included trematodes, cestodes, nematodes

and acanthocephala. They were later treated according to the systematic group they belonged.

The number of fish specimens collected varied from species to species; it depended on the number of fishes caught in a given area. The incidence referred to in this study, was only taken in consideration if at least 50 fish specimens were examined. Incidence recorded in a smaller number of fish could only serve to get a general idea about the range infection. The drawings of some helminths hove been made with the help of the Abbe apparatus.

Trematodes. After rinsing live trematodes, in 0.6% Na_2CO_3 solution, to free them of pollution, they were placed in a watch glass containing water and killed by heating, the method recommended by Ślusarski 1958. Only few specimens contracted during this process. Next trematodes were fixed in 75% alcohol. Diluted alum carmine served for staining purposes. When stained and rinsed in water, the material was gradually passed through alcohols with increasing concentration: 50, 75, 96 and 100%, and next placed in creosote. For experimental purposes, carnation oil of cloves was used instead of creosote to clear fixed *Brachyphallus crenatus* trematodes. This oil was found to give poorer exposure than creosote. After a year during which trematodes were kept in it, its colour was darker than that of creosote after the same period.

Ślusarski's method of direct observation (1953) was also applied. It consists in examining parasites loosely immersed in creosote on the depression slide instead of pressing the trematodes and making permanent preparations.

Cestodes. Live cestodes were placed under a stream of tap water in glass vessels protected by dense nets. The death of the helminths was manifested by their immobility and loosening of strobila. Cestodes were stained with lastic acid carmine before fixing, and 10% lactic acid served as decolourizer. After rinsing in water and dehydration in 50, 70, 96 and 100% alcohol, the material was exposed in creosote and permanent preparations were mounted in the Canada balsam.

Nematodes were killed in water on the watch-glass by heating until the body of the helminth was straightened. Next they were placed in 70% alcohol containing 5 ml glycerin. After evaporation of alcohol, nematodes were exposed in glycerin.

Acanthocephala. After thorough rinsing and removal of the remaining mucus and pollution from the rostellum, the helminths were for a short time placed in water. Next they were transferred to a mixture of 75% alcohol and acetic acid, the ratio being 2:1. After a period ranging from several to about 15 days the acanthocephala were again put in water and without staining passed through 50, 70, 96 and 100% alcohols. After such preparation the material was exposed in creosote. No fixed preparations were made.

Systematical review of species recorded

This chapter contains a review of helminths recorded in the fishes caught in the Gdańsk Bay. The review includes 20 trematode, 12 cestode (one identified to its generic group only), 4 nematode, and 6 acanthocephalan species (Tables I, XXIII). The general incidence of parasitic infection in the respective fish species is shown in Table II, the helminth fauna of certain fish species being given in Table III. The descriptions in the present review are more or less comprehensive, depending on the fact whether a species is more or less known, has or has not been recorded in Poland so far, or else reveals a considerable morphological variability, or if the species has not been determined, or if there are new host records. Such descriptions seem justified particularly with regard to those helminths species whose earlier descriptions have been inadequate and not clear as a result of being incomplete.

Table I

Quantitative comparison of helminths recorded in fishes of the Gdańsk Bay

Taxonomic group	No. of species			
	total	new host records		new for Poland
		for science	for Poland	
Trematoda	20	9	14	—
Bucephalidae	3	2	3	—
Hemiuridae	2	1	2	—
Lecithochiriidae	1	1	1	—
Dicrogastridae	1	—	—	—
Azygiidae	1	—	—	—
Allocreadiidae	2	—	1	—
Orientocreadiidae	1	—	—	—
Sphaerostomatidae	2	2	2	—
Coitocaecidae	1	—	1	—
Monorchidae	6	3	4	—
Cestoda	12	3	7	2
Caryophyllaeidae	1	1	1	—
Triaenophoridae	2	—	1	—
Amphicotylidae	1	—	1	—
Bothriocephalidae	1	1	1	—
Ligulidae	2	1	2	1
Proteocephalidae	5	—	1	1
Nematoda	4	2	4	1
Heterocheilidae	1	1	1	—
Camallanidae	2	1	2	1
Cucullanidae	1	—	1	—
Acanthocephala	6	3	5	1
Neoechinorhynchidae	1	1	1	—
Echinorhynchidae	3	1	3	—
Pomphorhynchidae	1	1	1	1
Polymorphidae	1	—	—	—

Trematoda

Bucephalus polymorphus Baer, 1827

Syn.: *Gasterostomum fimbriatum* Siebold, 1848; *Bucephalus markewitschi* Koval, 1949.

Hosts: *Esox lucius, Perca fluviatilis, Lucioperca lucioperca, Aspius aspius.*

Location in the host: intestine.

Incidence and intensity of infection: data related to the occurrence of this helminth in *P. fluviatilis* are summarized in Table III. Out of the 16 pikes examined, a fish was infected with a single trematode. The peak incidence and intensity of infection was recorded in the

Table II

Distribution of four helminth groups in fishes of the Gdańsk Bay

Host family	Host species	No. of fishes		No. of fishes infected with:			
		examined	infected	*Trematoda*	*Cestoda*	*Nematoda*	*Acantho-cephala*
Percidae	*Perca fluviatilis* L.	90	52	24	19	8	23
	Lucioperca lucioperca (L.)	35	20	15	3	6	6
	Acerina cernua (L.)	8	6	5	2	1	1
Zoarcidae	*Zoarces viviparus* (L.)	11	9	1	2	6	1
Ammodytidae	*Ammodytes tobianus* L.	21	4	—	4	1	1
	Hyperoplus lanceolatus (Le Sauvage)	39	6	—	3	4	—
Cottidae	*Myoxocephalus scorpius* (L.)	10	9	2	3	7	2
Bothidae	*Scophthalmus maximus* (L.)	12	12	—	12	—	—
Pleuronectidae	*Platichthys flesus* (L.)	67	52	4	1	44	12
	Limanda limanda (L.)	4	4	3	1	4	—
	Platessa platessa (L.)	12	9	4	—	5	4
Petromyzonidae	*Petromyzon marinus* L.	4	—	—	—	—	—
Liparidae	*Liparis liparis* (L.)	1	1	—	—	1	—
Clupeidae	*Clupea harengus* L.	128	48	28	9	4	25
	Sprattus sprattus (L.)	5	—	—	—	—	—
	? *Alosa fallax* (Lacepede)	1	1	—	1	1	—
Salmonidae	*Salmo salar* L.	1	1	1	1	—	—
	Salmo trutta L.	1	1	—	1	—	—
	Coregonus lavaretus (L.)	7	6	4	4	1	—
Osmeridae	*Osmerus eperlanus* (L.)	76	54	2	44	25	2
Anguillidae	*Anguilla anguilla* (L.)	17	11	6	9	1	3
Esocidae	*Esox lucius* L.	16	13	4	13	6	1
Cyprinidae	*Rutilus rutilus* (L.)	82	36	26	4	5	3
	Vimba vimba (L.)	62	37	17	31	—	2
	Blicca bjoerkna (L.)	70	44	40	9	2	—
	Abramis brama (L.)	53	42	39	29	—	—
	Leuciscus idus (L.)	19	14	7	3	2	10
	Aspius aspius (L.)	6	4	1	4	1	—
	Pelecus cultratus L.	1	—	—	—	—	—
	Tinca tinca (L.)	2	2	2	—	—	—
	Gobio gobio (L.)	2	1	1	—	—	—
	Cyprinus carpio L.	2	2	1	1	—	1
	Carassius carassius (L.)	4	2	1	1	1	—
	Scardinius erythrophthalmus (L.)	3	1	1	—	—	—
Siluridae	*Silurus glanis* L.	4	4	1	2	1	2
Belonidae	*Belone belone* (L.)	2	2	—	—	1	1
Gadidae	*Gadus callarias* L.	7	7	—	1	3	7
	Lota lota (L.)	7	7	—	—	1	7
Gasterosteidae	*Gasterosteus aculeatus* L.	24	15	1	10	1	5
Syngnathidae	*Syngnathus typhle* (L.)	7	3	1	2	—	—
	Total	923	542 (59%)	242 (26.2%)	229 (24.8%)	143 (15.5%)	119 (13%)

Table III

Showing helminth fauna of some fish species, as recorded in the Gdańsk Bay

Fish species	Helminth species	Degree of infection	
		incidence (%)	intensity range
Perca fluviatilis (L.)	*Bucephalus polymorphus*	1	4
	Rhipidocotyle illense	8	1–18
	Bunodera luciopercae	17	1–17
	Azygia lucii	1	1
	Nicolla skrjabini	1	1
	Bothriocephalus scorpii	8	1–16
	Proteocephalus percae	14	1–19
	Triaenophorus crassus	1	3
	Triaenophorus nodulosus	3	1–3
	Contracaecum aduncum	2	1–2
	Camallanus lacustris	3	1–3
	Acanthocephalus lucii	13	1–6
	Neoechinorhynchus rutili	3	2–14
Platichthys flesus (L.)	*Caryophyllaeus laticeps*	2	3
	Cucullanellus minutus	22	1–40
	Contracaecum adnucum	10	2–6
	Echinorhynchus gadi	10	1–32
	Pomphorhynchus kostylewi	10	1–5
Osmerus eperlanus (L.)	*Contracaecum aduncum*, larva	35	1–90
	Proteocephalus longicollis	31	1–410
	Eubothrium crassum	5	1–2
	Neoechinorhynchus rutili	1	1
	Corynosoma semerme	1	4
Rutilus rutilus (L.)	*Asymphylodora kubanicum*	22	1–12
	Asymphylodora markewitschi	1	2
	Asymphylodora imitans	1	1
	Allocreadium isoporum	1	1000
	Palaeorchis unicus	1	2
	Palaeorchis incognitus	11	1–14
	Prosorhynchus squamatus	1	6
	Caryophyllaeus laticeps	1	1
	Camallanus truncatus	1	1
	Acanthocephalus anguillae	1	1
Vimba vimba (L.)	*Asymphylodora kubanicum*	21	1–35
	Asymphylodora markewitschi	2	4
	Palaeorchis unicus	3	1–10
	Palaeorchis incognitus	2	1
	Sphaerostomum maius	2	5
	Caryophyllaeus laticeps	32	1–20
	Ligula inestinalis	8	1–3
	Acanthocephalus anguillae	2	5

Cd. Table III

Fish species	Helminth species	Degree of infection	
		incidence %	intensity range
Blicca bjoerkna (L.)	*Asymphylodora imitans*	31	1–31
	Asymphylodora kubanicum	1	1
	Palaeorchis unicus	30	1–100
	Sphaerostomum maius	6	1–2
	Ligula intestinalis	1	4
	Caryophyllaeus laticeps	6	1–7
Abramis brama (L.)	*Asymphylodora kubanicum*	64	1–400
	Asymphylodora imitans	13	1–19
	Palaeorchis unicus	4	12–40
	Caryophyllaeus laticeps	26	2–120
	Ligula intestinalis	4	1–2

pike-perch: out of 35 fishes examined, 22 were infected with *B. polymorphus*, the intensity varying from 1 to 467 individuals. All the trematodes found were sexually mature.

This helminth occurs in its adult form in fresh water predatory fishes, the pike above all. In Poland it has often been recorded in various predatory fish species caught in fresh-waters. *Aspius aspius* is a new host record of this species in Poland.

The found specimens in general fitted in the description of this species given by Dawes 1947, although trematodes examined by the present author were somewhat smaller than those described by Dawes and by Kozicka 1959. But they correspond to the description by Koval 1949 b, of *B. markewitschi* which, according to Kozicka (loc. cit.) is identical with *B. polymorphus*.

Rhipidocotyle illense (Ziegler, 1883) Vejnar, 1956

Syn.: *Distoma campanula* Duj., 1843; *Gasterostomum illense* Ziegler, 1885; *Gasterostomum fimbriatum* sensu Ziegler 1883; *Bucephalus polymorphus* sensu Lühe 1909; *B. polymorphus* sensu Koval 1949.

Table IV

Distribution of *Rhipidocotyle illense* (Ziegler, 1883)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence %	intensity range
Perca fluviatilis	90	7	8	1–18
Lucioperca lucioperca	35	2	6	3–8
Esox lucius	16	1	6	9
Carassius carassius	4	1	—	1
Salmo salar	1	1	—	1

Hosts: *Perca fluviatilis, Lucioperca lucioperca, Esox lucius, Carassius carassius Salmo salar.*

Location in the host: intestine.

Incidence and intensity of infection: the respective data are shown in Table IV. According to data from literature, the adult form occurs in fishes, most often predatory species, in Central and Eastern Europe. It has many a time been recorded in Poland. *Salmo salar* is a new host record of this parasite. *Carassius carassius* is a new host record in Poland.

Prosorhynchus squamatus Odhner, 1905

Hosts: *Myoxocephalus scorpius, Rutilus rutilus.*

Location in the host: intestine in *R. rutilus,* and pyloric caeca in *M. scorpius.*

Incidence and intensity of infection: the data related to *R. rutilus* are shown in Table III. Out of the 10 specimens of *M. scorpius* that were examined, one fish harboured 20 parasites of this species.

In Poland, it was reported by Markowski 1933 from *Liparis vulgaris* Flem. It has not been recorded in *R. rutilus* so far. *M. scorpius* is a new host record for this parasite in Poland.

The present specimens in principle fit in the description by Odhner 1905 and Issaičikoff 1928, of *Prosorhynchus squamatus,* and the description by Byhovskaja-Pavlovskaja 1962 of *P. crucibulum* (Rudolphi, 1819). But the matter of specific validity of the above two forms calls for further thorough investigation.

Discussion: In the specimens examined by the present author, the cirrus pouch was always situated on the left side. Kniskern 1952 in his diagnosis of the genus mentions that the cirrus pouch is on the left side. Byhovskaja-Pavlovskaja 1962, in her diagnosis, did not mention the position of the cirrus pouch, but in her drawing of *P. crucibulum* the cirrus pouch is situated on the right side. Similarly the ovary and the anterior testis in the present material are on the left side. The measurements of parasites were similar, irrespective of the host they came from.

Hemiurus luehei Odhner, 1905

Syn.: *Distomum appendiculatum* (Rudolphi, 1802) sensu Olsson 1868, *Hemiurus ocreatus* (Rudolphi, 1802) Looss, 1899.

Hosts: *Clupea harengus, Salmo salar.*

Location in the host: stomach.

Incidence and intensity of infection: out of the 128 examined herrings, 10 were infected with this trematode, the intensity ranging from 1 to 4 specimens. Six specimens were found in a single salmon.

In Poland, this species was recorded by Ślusarski 1958 in *Salmo salar* and *Salmo trutta* m. *trutta* in the Baltic. The trematodes Markowski 1935 found in *Clupea harengus* and determined as *H. luehei* actually belonged to the genus *Brachyphallus* Odhner, 1905. So in Poland *Clupea harengus* is a new host record of this parasite.

The morphological data of the present specimens corresponds to the descriptions by Odhner 1905 and Ślusarski 1958.

Hemiurus raabei Ślusarski, 1958

Host: *Clupea harengus.*

Incidence and intensity of infection: two specimens were found in a single herring. This species was only once reported, viz., by Ślusarski 1958 in *Salmo salar* caught in the Baltic. So herring is a new host record of this parasite. The morphology of the present trematodes corresponds to the description of this species given by Ślusarski 1958.

Brachyphallus crenatus (Rudolphi, 1802) Odhner, 1905

Syn.: *Fasciola crenata* Rudolphi, 1802.

Hosts: *Clupea harengus, Salmo trutta* m. *trutta, Lucioperca lucioperca, Gasterosteus aculeatus, Anguilla anguilla.*

Location in the host: stomach, less frequently further sections of the intestine.

Incidence and intensity of infection under hosts is shown in Table V.

Table V

Distribution of *Brachyphallus crenatus* (Rudolphi, 1802)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Clupea harengus	128	18	14	1–6
Lucioperca lucioperca	35	2	—	1–12
Gasterosteus aculeatus	24	1	—	1
Anguilla anguilla	17	1	—	9
Salmo trutta	1	1	—	1

In Poland, it was reported by Markowski 1933 from *Hyperoplus lanceolatus* and by Ślusarski 1958 from *Salmo salar* and *Salmo trutta* m. *trutta. A. anguilla* of the present material is a new host record of *B. crenatus. L. lucioperca* and *G. aculeatus* are new host records of this parasite for Poland.

Derogenes inflata (Molin, 1859) Odhner, 1902

Syn.: *Distoma inflatum* Molin, 1859; *Echinostomum hispida* sensu Beneden 1870.

Host and location: *Anguilla anguilla* intestine.

Incidence and intensity of infection: out of the 17 *A. anguilla* specimens examined, three were infected with that trematode, the intensity ranging from 2 to 30; the mean intensity was 13 parasites. The present specimens did not differ from those described by Markowski 1933.

Azygia lucii (Müller, 1776) Lühe, 1909

Syn.: *Fasciola lucii* Müller, 1776; *Distoma tereticolle* Rudolphi, 1802; *Azygia tereticollis* (Rudolphi, 1802) Looss, 1899.

Host and location: *Perca fluviatilis,* intestine.

Incidence and intensity of infection: a single specimen was found in a perch (Table III).

It was many times recorded in Poland.

Allocreadium isoporum (Looss, 1894) Looss, 1900

Syn.: *Distoma isoporum* Looss, 1894; *Creadium isoporum* Looss, 1899.

Host and location: *Rutilus rutilus* intestine.

Incidence and intensity of infection: about 1000 specimens were found in a single *R. rutilus* individual (more than 1%).

Morphology (measurements in µm): Body length 1450–1550, width 300 × 330. Ślusarski 1958 found nearly twice as large specimens in *Salmonidae* (about 2500–2600). The oral sucker situated subterminally, 150–170 × 220–230; the ventral sucker 190–220 × 190–210. The pharynx is well developed, 80–90 long, 11 wide, the oesophagus 230–236. Anterior testis 160–190 × 140–150, posterior testis 180–200 × 140–160. Ovary 160 × 170–180. Cirrus pouch is oval, 200–220 × 100–120. When filled with spermatozoa, the twisted vas deferens makes an impression that there are 1–4 vesicles. Cirrus is 85 long, 45 wide. The cirrus pouch does not extend farther than the posterior margin of the ventral sucker. Vitellaria as a rule extend as far as half of the ovary. In 200 well fixed specimens selected at random out of 1000, there were only three with the right vitellary reaching the anterior border of the ovary. In a single specimen both vitellaria reached the posterior margin of the ventral sucker, in five the right side vitellaria and in two left vitellaria attained the posterior margin of the ventral sucker. A single case was observed of the left vitellarium slightly exceeding the posterior margin of the ventral sucker and protruding farther forward. According to Koval 1957: While in the trematodes obtained from *Rutilus rutilus* and *Leuciscus idus* the anterior vitelline follicles never reach the posterior end of the ventral sucker and usually are situated at a considerable distance from it, in the specimens found in *Carassius carassius* the anterior margin of the vitellaria reaches the middle of the ventral sucker. So there are many arguments proving that the anterior range of vitelline follicles varies considerably from specimen to specimen of this species. Eggs: 90–90 × 60. The present from corresponds to the data for *A. isoporum* (Looss, 1894) Looss, 1900 sensu Ślusarski 1958.

Bunodera luciopercae (Müller, 1776) Lühe, 1909

Syn.: *Fasciola luciopercae* Müller, 1776; *Bunodera nodulosa*. Looss, 1899.

Hosts: *Acerina cernua*, *Lucioperca lucioperca*, *Cyprinus carpio*, *Perca fluviatilis*.

Location in the host: intestine.

Table VI

Distribution of *Bunodera luciopercae* (Müller, 1776)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Perca fluviatilis	90	15	17	1–17
Lucioperca lucioperca	35	2	6	6–11
Esox lucius	16	1	—	15
Acerina cernua	8	2	—	5–16
Cyprinus carpio	2	1	—	1

Incidence and intensity of infection are shown in Table VI.

In Poland, it is common in predatory fishes. In the present material it was also found in *Cyprinus carpio*, this being a new host record of this parasite of Poland.

The data obtained from the present material correspond in general to the description given by Looss 1894, Hopkins 1934 and Ślusarski 1958.

Orientocreadium pseudobagri Yamaguti, 1934

Syn.: *Orientocreadium siluri* (Bychovsky et Dubinina, 1954) Yamaguti, 1958; *Orientocreadium skrjabini* Koval, 1952; *Paratormopsolus siluri* Bychovsky et Dubinina, 1954.

Host and location: *Silurus glanis*, intestine.

Incidence and intensity of infection: out of the four fishes examined, four *O. pseudobagri* specimens were found in only one host.

This species was only once recorded in Poland, viz., in *S. glanis* caught in the river Biebrza (Ejsymont 1970). The specimens found by the present author in the Gdańsk Bay are smaller than those from Biebrza.

Sphaerostomum globiporum (Rud., 1802) Szidat, 1944 nec Looss 1899, partim

Syn.: *Fasciola globipora* Rudolphi, 1802; *Sphaerostomum bramae* sensu Kozicka 1953.

Hosts and location: *Coregonus lavaretus*, *Leuciscus idus*, intestine.

Incidence and intensity of infection: out of the seven examined specimens of *Coregonus lavaretus*, one was infected with 50 trematodes. Out of the 19 examined *Leuciscus idus* specimens, two were infected, one with a single specimen and the other with five parasites.

In Poland, many records of this parasite have been made. In the present material it was found in *Coregonus lavaretus*, this being a new host record for *S. globiporum*. *Leuciscus idus* is a new host record for Poland. The fact that *Sphaerostomum globiporum* was found in *C. lavaretus* and *L. idus* supports the opinion of Ślusarski 1958 that this trematode is not a specific species of *R. rutilus*, as was considered by Szidat 1943.

Sphaerostomum maius Janiszewska, 1949

Hosts and location: *Vimba vimba*, *Blicca bjoerena*, intestine.

Incidence of infection was about 2% in *V. vimba* and about 6% in *B. bjoerena*, with the intensity of 5 and 1–2 specimens, respectively.

It was found by Janiszewska 1949 in *Leuciscus cephalus*, by Ślusarski 1958 in *Salmo trutta*, m. *trutta*, and by E. Grabda et al. 1961 in *Abramis brama*. Thus, both *V. vimba* and *B. bjoerena* are new host records for this species.

Nicolla skrjabini (Ivanitzky, 1928) Dollfus, 1959

Syn.: *Coitocaecum skrjabini* Ivanitzky, 1928; *Excoitocaecum skrjabini* (Ivanitzky, 1928) Ślusarski, 1958; *Crowcrocaecum skrjabini* (Ivanitzky, 1928) Skrjabini et Koval, 1956.

Hosts: *Perca fluviatilis*, *Acerina cernua*, *Silurus glanis*, *Gobio gobio*.

Location in the host: intestine.

Incidence and intensity of infection are shown in Table VII.

Table VII

Distribution of *Nicolla skrjabini* (Ivanitzky, 1928)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Perca fluviatilis	90	1	1	1
Acerina cernua	8	2	—	1–2
Silurus glanis	4	1	—	2
Gobio gobio	2	1	—	1

It was recorded in various fish species in Poland. *A. cernua* and *G. gobio* are new host records for this parasite in Poland. *Nicolla skrjabini* specimens in the present material do not essentially differ in characters from representatives of the species described by Ivanickij 1928.

Asymphylodora tincae (Modeer, 1790) Lühe, 1909

Syn.: *Fasciola tincae* Modeer, 1790; *Distoma perlatum* Nordmann, 1832, *Asymphylodora perlata* (Nordmann, 1832) Looss, 1899.

Host and location: *Tinca tinca*, intestine.

Incidence and intensity of infection: two young tench specimens were examined, both were infected, each with a single parasite.

In Poland it was recorded many a time by various authors.

Asymphylodora markewitschi Kulakivska, 1947

Hosts and location: *Vimba vimba*, *Leuciscus idus*, intestine.

Incidence and intensity of infection: in the present material it was found in *V. vimba* (Table III) and in four *L. idus* specimens out of 19 examined by autopsy, the intensity of infection ranging from 4 to 300.

V. vimba is a new host record for *A. markewitschi*.

The specimens found in the present material correspond to the description of this species by Kulakivska 1947 and Kozicka 1959. Trematodes obtained from *V. vimba* were larger than those found in *L. idus*.

Asymphylodora imitans (Mühling, 1898) Looss, 1899

Syn.: *Distomum imitans* Mühling, 1898; *Asymphylodora dneproviana* Ivanitzky, 1928.

Hosts and location: *Blicca bjoercna*, and *Abramis brama*, intestine.

Incidence and intensity of infection are seen in Table III.

In Poland, it was recorded by Kozicka 1953 (described as *A. tincae*), Wyrzykowska 1964, Wierzbicka 1964, 1965, Perłowska 1969, Dąbrowska 1970 in *A. brama*, and by Puciłowska 1969 in *Rutilus rutilus*, *A. brama*, *Tinca tinca*, and *Leuciscus idus*. *B. bjoercna* is a new host record of this parasite in Poland.

The present specimens correspond to the description of this species by Markevič 1951.

Asymphylodora kubanicum (Issaitschikoff, 1923) Markewitsch, 1951

Syn.: *A. imitans* Mühling, 1898 form "A" sensu Szidat 1943.

Hosts: *Vimba vimba*, *Coregonus lavaretus*, *Abramis brama*, *Blicca bjoercna*, *Zoarces viviparus*, *Leuciscus idus*, *Rutilus rutilus*.

Location in the host: intestine.

Incidence and intensity of infection are shown in Table VIII.

Table VIII

Distribution of *Asymphylodora kubanicum* (Issaitschikoff, 1923)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Rutilus rutilus	82	18	22	1–12
Blicca bjoercna	70	1	1	1
Vimba vimba	62	13	21	1–35
Abramis brama	53	34	64	1–400
Leuciscus idus	19	3	—	1–10
Coregonus lavaretus	7	3	—	3–45
Zoarces viviparus	11	1	—	1

In Poland it was reported by Rokicki 1970 from *V. vimba*, *C. lavaretus*, *Z. viviparus* and *L. idus* are new host records of this species. *R. rutilus*, *A. brama* and *B. bjoercna* are new host records of this parasite in Poland.

Description. Lancet-shaped body. Specimens found in *A. brama*, *B. bjoercna* and *V. vimba* have a narrow section between suckers, bent ventrally in a characteristic manner. The maximum width is in the region of the ventral sucker. The oral sucker is of moderate size, its position being subterminal. The ventral sucker is somewhat larger. Trematodes obtained from *A. brama*, *B. bjoercna* and *V. vimba* have a short prepharynx and a very long oesophagus: this is not seen in the drawing given by Byhovskaja-Pavlovskaja 1962. In trematodes obtained from *Abramis brama* the length of the oesophagus reaches one fourth of the total length. Trematodes from *Leuciscus idus* have a much shorter oesophagus, only a little longer than pharynx: in this respect the mentioned specimens are similar to *A. demeli*. The cirrus pouch is usually large, extending as far as the anterior margin of the testis. The genital atrium is situated at the line of the ventral sucker, on the left side. There are 7–9 vitellaria situated laterally. They extend from the anterior margin of the ovary beyond the posterior margin of the testis, but they do not reach the posterior end of the body. In two trematodes found in *Leuciscus idus*, in a group of 350 specimens, vitellaria are shifted to the left side (Fig. 1). The measurements of individuals obtained from *V. vimba*, *L. idus* and *C. lavaretus* were, as a rule, smaller than of those obtained from the remaining host species. In specimens found in *L. idus* the intestinal caeca do not extend beyond the posterior margin

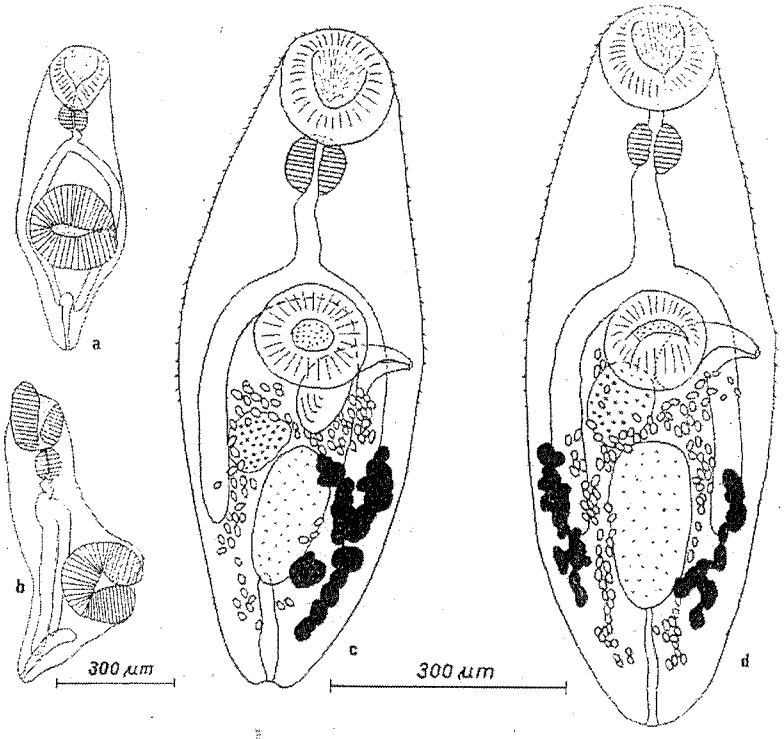

Fig. 1. *Asymphylodora kubanicum:* a and b — two immature specimens from *Abramis brama;* c and d — two mature specimens from *Leuciscus idus* of the Gdańsk Bay; c — showing vitellaria situated in the left area only.

of the testis. On the other hand, the length of eggs in some individuals was somewhat larger than that given by Markevič 1951.

Discussion. Witenberg and Eckmann 1934 classified trematodes obtained from a lake at Antiochia as *Asymphylodora tincae*. Szidat 1943 was of the opinion that their classification was incorrect. He considered the form "B" from *Cyprinus carpio* as a distinct species, *Asymphylodora carpiae* Szidat, 1943, while the form "A" from *Abramis brama,* was *A. imitans* in his opinion. In a new approach, as Markevič 1951 put it, the form "A" reported by Witenberg and Eckmann 1934 cannot be classified as *A. imitans sensu Szidat* 1943. In the present material (*A. kubanicum*) obtained from *Leuciscus idus* (Fig. 1d), specimens identical to those described by Witenberg and Eckmann 1935 form "A" were found. As they belong to the same species, the *A. imitans* form "A" of Witenberg and Eckmann is a synonym of *A. kubanicum.*

Genus *Palaeorchis* Szidat, 1943

In 1943, Szidat created subfamily *Asymphylodorinae* in which he included the genera *Asymphylodora* and *Palaeorchis*. He classified the species *P. incognitus* Szidat, 1943, *P. unicus* Szidat, 1943 and *P. diplorchis* (Yamaguti, 1936) Szidat, 1943 in the genus *Palaeorchis*. Later, one more representative of the same genus was described: *P. skrjabini* Koval, 1950. On the basis of observation of a comprehensive material examined in the present study, a small part of this material was classified in *P. incognitus,* and the remaining part in *P. unicus*. In addition, certain observations have been made in connection with the similarity of the present *P. unicus* specimens to those described as *P. skrjabini*. This applies first of all to the position and mutual proportions of single organs and the position of vitellaria. The body length is, however, a character by which the present material differs from that described by Koval: her specimens were below 0.4 mm long. In the present material, the smallest sexually mature specimens obtained from *Vimba vimba,*

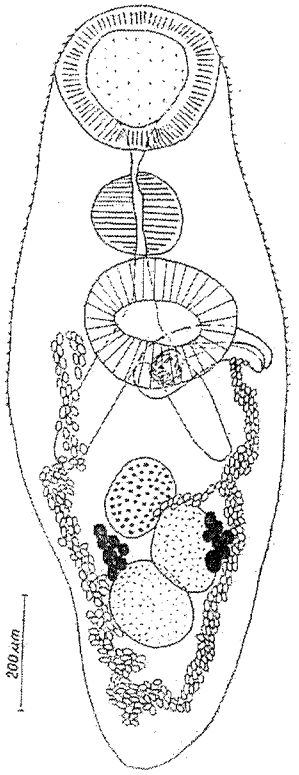

Fig. 2. *Palaeorchis incognitus,* a specimen from *Leuciscus idus* of the Gdańsk Bay.

are over 0.5 mm long (Table X). It is difficult to ascertain whether *P. skrjabini* living in a different host, viz., *Gobius fluviatilis*, is a dwarf form of *P. unicus*, or is it a distinct species.

Palaeorchis incognitus Szidat, 1943 (Fig. 2)

Hosts and location: *Leuciscus idus*, *Rutilus rutilus*, intestine.

Incidence and intensity of infection: in the present material it was found in two specimens of *Leuciscus idus* out of 19 examined, the intensity, ranging from 1 to 4 parasites; the relevant data are in Table III.

In Poland, it was recorded by Puciłowska 1969 and Perłowska 1969 in *Leuciscus idus* and *Rutilus rutilus*.

Table IX

Measurements (in µm) of *Palaeorchis incognitus* Szidat, 1943 from different host species (present material)

Measurements recorded	In trematodes from:	
	Rutilus rutilus	*Leuciscus idus*
Body length	908–1030	700
Body width	300–440	265
Oral sucker	150–170×155–170	135×150
Pharynx	70–100× 90–100	75×90
Oesophagus	135	—
Intestinal caeca	165	—
Acetabulum	140–155×150–155	135×150
Cirrus pouch	290–350× 90–100	185× 65
Ovary	100× 70–100	80× 70
Right testis	150–230×100–135	74× 74
Left testis	145–170×100–165	84× 63
Eggs	14× 6–7	15–15× 7–8

The present specimens do not differ from the descriptions by Szidat 1943 and Koval 1949 a, 1950, except for the dimensions of the eggs (Table IX) which in the present material were larger and corresponded by their size to the eggs of trematodes of the same species obtained from *Rutilus rutilus* and *Leuciscus idus* caught in the Żegrzyński Lake (Puciłowska 1969).

Palaeorchis unicus Szidat, 1943 (Fig. 3 and 4)

Syn.: *Palaeorchis skrjabini* Koval, 1950

Hosts: *Blicca bjoerena*, *Vimba vimba*, *Rutilus rutilus*, *Scardinius erythrophthalmus*.

Location in the host: intestine.

Incidence and intensity of infection are summarized in Table III. Out of the three examined specimens of *Scardinius erythrophthalmus*, only one fish was infected with a single parasite.

In Poland, it was hitherto recorded by Rokicki 1970 in *Vimba*

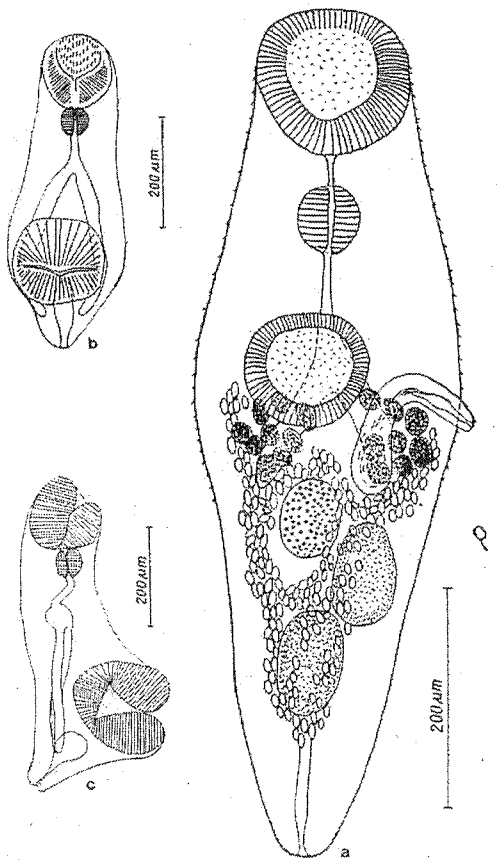

Fig. 3. *Palaeorchis unicus* specimens from fishes of the Gdańsk Bay: a — a sexually mature adult; b and c — immature adults.

vimba. *Rutilus rutilus* and *Scardinius erythrophthalmus* are new host records for this species, and *Blicca bjoerena* is a new host record in Poland.

Description. The lateral body edges are almost parallel. The oral sucker situated subterminally, a little larger than the ventral sucker. The prepharynx leads to the oval pharynx; the oesophagus is long, gradually widening. The bifurcation of the intestine is on the line of the posterior edge of the ventral sucker. Caeca bifurcate at a sharp angle: they end in front of the anterior edge of the ovary. Testes are situated obliquely in the dorsal region of the body. The right testis is posterior and larger than the left testis. The cirrus pouch is on the left side. The

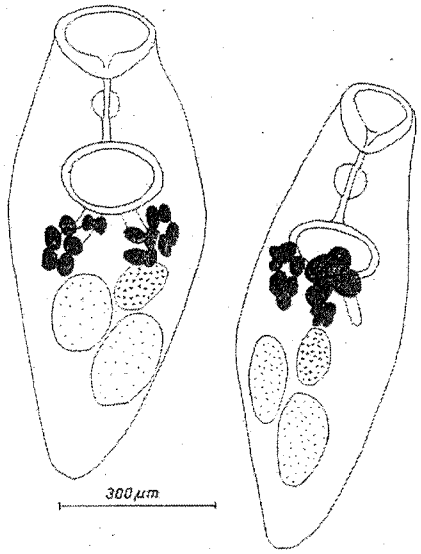

Fig. 4. *Palaeorchis unicus* adults from *Abramis brama* of the Gdańsk Bay (semischematically, some organs are omitted), showing two different positions of vitellaria.

genital pore situated at the level of the ventral sucker (according to Szidat 1943, the genital pore is at the level of the anterior edge of the ventral sucker). The cirrus pouch containing a muscular seminal vesicle, ends at the same line as caeca. The ovary and testes are situated in the posterior third of the trematode. The oval ovary is in the longitudinal middle line of the body. Two groups of vitellaria, 6–9 follicles each, are situated on the region dorsal to the caeca. In the specimens found in the present material they are situated in the middle third of the body, between the middle of the ventral sucker and that of the ovary. Measurements are in Table X.

Discussion. Markevič 1951 in his key of species of the genus *Palaeorchis* mentioned the position of vitellaria in *P. unicus* as anterior. This situation is not fully conform to the drawing by Szidat 1943, according to which vitellaria rather occupy an anterior-central position. A transversal plant dividing the trematode centrally crosses the vitellaria leaving two thirds of vitelline follicles in the anterior half of the body. But taking into consideration *Palaeorchis diplorchis* Yamaguti, 1936, whose diagnostic feature is the anterior position of vitellaria, one must admit that the same discriminating character given by Markevič also applies to *P. diplorchis*. Byhovskaja-Pavlovskaja 1962, was the next after Markevič to give a solution to the key for this genus. Sobolev 1955 evaded difficulties in drawing up the key to the genus *Palaeorchis*: he took into consideration the above mentioned Yamaguti's species (1936) and emphasized other discriminating characters, alongside the criterion of the distribution of vitellaria.

The anterior position of vitellaria is a diagnostic character of *P. di-*

Table X

Measurements (in µm) of *Palaeorchis unicus* Szidat, 1943 from different host species

Measurements recorded	Present material (of the Gdańsk Bay) from:				After Szidat 1943	After Koval 1950
	Blicca bjoerkna	*Rutilus rutilus*	*Vimba vimba*	*Scardinius erythrophthalmus*	*Blicca bjoerkna*	*Gobius fluviatilis*
Body length	700–820	800	560–740	550–870	700	up to 400
Body width	200–260	265	250–270	235–345	380	150–190
Oral sucker	100–150×100–145	100×145	100×120–150	100–160×120–160	120	78×58–91×66
Praepharynx	25–37	35	37	10–15	–	–
Pharynx	55–65 × 60	110×65	55–60 × 55–60	70–100× 75–100	50	40
Oesophagus	121–140	115	75–260× 32	85–125	–	–
Intestinal caeca	70–110	110	90–200× 37	120–140	–	–
Acetabulum	110–130×110–140	68–125	100–125×110–125	110–145×120–155	120	58×49–78×58
Cirrus pouch	187–302× 46–62	187	190–250× 40–120	160–220× 46–80	–	124×29
Ovary	65–85 × 70–80	75×90	40–70 × 45–60	60–110× 70–90	–	–
Right testis	135–150× 85–95	160×100	100×100	140–225×115–200	–	–
Left testis	100–140× 80–85	160×160	120× 65	110–160× 95–160	–	–
Eggs	22–23 × 14–15	23×16	22–23 × 14	23–25 × 14–16	20–23×17	24×14

plorchis, but different features are applied to determine *P. unicus*. The diagnostic key adopted by Byhovskaja-Pavlovskaja 1962 mentions the posterior edge of the ventral sucker as a posterior border line of the distribution of the cirrus pouch in *P. unicus*. Sobolev 1955 mention the posterior edge of vitellaria as a limit of the position of the cirrus pouch in that species. As in the present material the cirrus pouch in some specimens extends farther than the region of the ventral sucker and the posterior limit of vitellaria, the following key to species of *Palaeorchis* is proposed:

I. Vitellaria situated in the posterior half of the body . . . . . *P. incognitus* Szidat, 1943

II. Vitellaria situated in the middle of the body or more to the front:

1. Ovary and testes in the middle third part of the body; (host: fish of the genus *Pseudogobius* in Japan) . . . . . *P. diplorchis* (Yamaguti, 1936)

2. Ovary and testes in the posterior third part of the body . . . . . *P. unicus* Szidat, 1943.

The morphology of individuals found by the present author corresponds to the data given by Szidat 1943. The only difference recorded is confined to the fact that the pore of the cirrus pouch has been shown by Szidat (1943: Fig. 18) on the line of the anterior edge of the ventral sucker, while in the present material it is situated at the line of the ventral sucker, usually its posterior half. This difference may be the result of a different mounting and fixing technique. At the same time the present material also corresponds to the description of *P. skrjabini* Koval, 1950, only insignificantly differring from the latter as regards measurements, which can be the result of differences in the host species. In this connection the present author considers that *P. skrjabini* Koval, 1950 is identical to *P. unicus* Szidat, 1943.

Cestoda

Caryophyllaeus laticeps (Pallas, 1781)

Syn.: *Taenia laticeps* Pallas, 1781; *Caryophyllaeus piscium* Gmelin, 1790; *Caryophyllaeus cyprinorum* Zeder, 1803; *Caryophyllaeus mutabilis* Rudolphi, 1802.

Hosts: *Vimba vimba, Abramis brama, Blicca bjoercna, Rutilus rutilus, Platichthys flesus, Lucioperca lucioperca, Leuciscus idus.*

Location in the host: intestine.

Table XI

Distribution of *Caryophyllaeus laticeps* (Pallas, 1781)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Vimba vimba	62	20	32	1–20
Abramis brama	53	14	26	1–120
Blicca bjoercna	70	4	6	1–7
Rutilus rutilus	82	1	1	1
Platichthys flesus	67	1	2	3
Lucioperca lucioperca	35	1	—	4
Leuciscus idus	19	1	—	1

Incidence and intensity of infection are seen in Table XI. It is a common parasite of many cyprinoid fish in Europe. In Poland, it has been recorded many a time in fresh waters. *Lucioperca lucioperca* and *Platichthys flesus* are new host records for this species.

Triaenophorus nodulosus (Pallas, 1781)

Syn.: *Taenia nodulosa* Pallas, 1781; *Triaenophorus lucii* (Müller, 1776).

Hosts: *Perca fluviatilis, Gasterosteus aculeatus, Esox lucius.*

Location in the host: intestine for adult forms, body cavity and liver for plerocercoids.

Incidence and intensity of infection are compiled in Table XII. The pike was infected with adult forms of this cestode. The perch harboured encysted plerocercoids found in the liver, and one sexually mature specimen in the intestine. The stickleback was only infected with encysted plerocercoids located in the liver and the body cavity.

Table XII

Distribution of *Triaenophorus nodulosus* (Pallas, 1781)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Esox lucius	16	11	—	6–10
Perca fluviatilis	90	3	3	1–3
Gasterosteus aculeatus	24	3	—	1–3

Both adult form and plerocercoid have many a time been recorded in Poland by various authors, most often in predatory fish in fresh and brackish waters.

Triaenophorus crassus Forel, 1868, plerocercoid

Syn.: *Triaenophorus robustus* Olsson, 1893.

Host and location: *Perca fluviatilis*, encysted in the liver.

Incidence and intensity of infection are seen in Table III. In Poland, it was previously recorded in *Esox lucius* by Michajłow 1932. *Perca fluviatilis* is a new host record for this parasite in Poland.

Eubothrium crassum (Bloch, 1779), adult and plerocercoid

Syn.: *Taenia crassa* Bloch, 1779.

Hosts: *Salmo salar, Salmo trutta* m. *trutta, Osmerus eperlanus.*

Location in the host: pyloric caeca and intestine.

Incidence and intensity of infection in *Osmerus eperlanus* are given in Table III. In a single examined specimen of *Salmo salar*, 7 adult parasites were found, and a single *Salmo trutta* m. *trutta* was found to harbour 6 cestodes.

In Poland, this species was hitherto recorded by Markowski 1933 in *Salmo salar*, and by Grabda and Grabda 1968 in *Salmo trutta*. *Osmerus eperlanus* is a new host record for this parasite in Poland.

Remarks: Plerocercoids were found in *Osmerus eperlanus*, while sexually mature specimens occurred in *Salmo salar* and *Salmo trutta*. Rosen 1919 stated that plerocercoids of *E. crassum* sometimes occur in the intestine of the body cavity of young perch. They develop to attain sexual maturity in the intestine of *Salmo trutta*. If perch does not live in the water reservoir in which cestodes are developing, stickleback or any other young fish may be involved as a second intermediate host (Vik 1963). On the other hand, no case of perch performing the role of intermediate host to that cestode was recorded in the Gdańsk Bay. Out of the 90 perch specimens examined, only a single case of cestodes determined as immature forms of *Bothriocephalus scorpii* was recorded: these cestodes corresponded to the drawing by Markowski (1935, Pl. 7, Fig. 5, 6, 7), which reminded plerocercoids of *E. crassum*. Out of the 28 examined stickleback specimens, not a single one was infected with plerocercoids of this cestode, either in the intestine of the body cavity. Among small fishes living in the Gdańsk Bay, immature forms of *E. crassum* have only been found in the intestine of *Osmerus eperlanus*. But the incidence was relatively low. On the other hand, the incidence in salmon and trout was particularly high: out of the 15 *Salmo salar* and *Salmo trutta* additionally examined for the presence of *E. crassum*, all were infected with that cestode.

Vik 1963 reported that in the Norwegian water reservoir Anöya Drainage the trout probably contract infection with that cestode directly from the copepod *Cyclops strenuus*. Thus, further study of the complete life cycle of *E. crassum* in the Gdańsk Bay is needed to draw final conclusions about the source of infection of both salmon and trout with that cestode.

Bothriocephalus scorpii Müller, 1776

Syn.: *Bothriocephalus punctatus* Rudolphi, 1810, *Bothriocephalus bipunctatus* Lühe, 1899, *Bothriocephalus* sp. of Markowski 1933.

Table XIII

Distribution of *Bothriocephalus scorpii* Müller, 1776

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Scophthalmus maximus	12	12	—	30–120 adults
Clupea harengus	128	9	7	1–18 larva
Perca fluviatilis	90	7	8	1–16 larva
Lucioperca lucioperca	35	1	—	2 larva
Myoxocephalus scorpius	10	2	—	3–5 larva
Hyperoplus lanceolatus	39	1	—	1 larva
Gadus callarias	7	1	—	1 larva
Coregonus lavaretus	7	2	—	1 larva
Syngnathus typhle	7	2	—	1 larva

Hosts: in the examined material immature forms of that parasite were found in *Coregonus lavaretus, Perca fluviatilis, Lucioperca lucioperca, Hyperoplus lanceolatus, Scophthalmus maximus, Gadus callarias, Syngnathus typhle, Clupea harengus*; mature specimens were only found in *Scophthalmus maximus*.

Location in the host: intestine.

Incidence and intensity of infection recorded are seen in Table XIII.

In Poland, *B. scorpii* was hitherto recorded by numerous authors. It results from the present study that *Perca fluviatilis, Hyperoplus lanceolatus* and *Coregonus lavaretus* are new host records for this parasite, and herring and cod are new host records in Poland.

Ligula intestinalis (Linnaeus, 1758), plerocercoid

Syn.: *Ligula simplicissima* Rudolphi, 1802; *Ligula piscium* Bloch, 1782; *Ligula monogramma* Creplin, 1839, *Ligula uniserialis* Rudolphi, 1810.

Hosts and location: *Vimba vimba, Abramis brama, Blicca bjoerkna*, body cavity.

Incidence and intensity of infection: cf. Table III. In Poland, this cestode species has many a time been recorded in many fish species. *Vimba vimba* is a new host record for this parasite in Poland. According to estimates available from the Sea Fisheries Cooperative "Wyzwolenie" at Świbno, the percentage of fishes infected with this cestode in the autumn season 1969 varied from 0.06 to 0.12%. *Vimba vimba* specimens weighing one kg and more, are infected with this plerocercoid. The same fish species examined in the middle reaches of the Vistula by the present author, were free of *L. intestinalis* infection (Rokicki 1970). This probably results from the fact that the oldest, and thus the largest fishes account for a very small percentage of individuals which migrate upstream in the Vistula for spawning (Bontemps 1960).

Schistocephalus pungitii Dubinina, 1959, plerocercoid

Host and location: *Gasterosteus aculeatus*, body cavity.

Incidence and intensity of infection: out of the 24 *G. aculeatus* specimens examined, two were infected, the intensity was 1–2 cestodes. So far this parasite has only been recorded in the USSR in *Pungitius pungitius* (L.). Thus, this is the first record of *S. pungitii* in Poland. *Gasterosteus aculeatus* is a new intermediate host record of this parasite.

Proteocephalus percae (Müller, 1780)

Syn.: *Ichthyotaenia percae* (Müller, 1780).

Hosts and location: *Perca fluviatilis, Gasteroteus aculeatus*, intestine.

Incidence and intensity of infection in *Perca fluviatilis* are given in Table XXI. Out of the 24 *Gasterosteus aculeatus* specimens, 7 were infected with 1–4 parasites.

P. percae is a quite frequent parasite of *Percidae* in Europe and Asia. In Poland, it has been hitherto found in various fish species. The specimens of the present material do not differ from those reported by Markowski, 1933.

Proteocephalus osculatus (Goeze, 1782)

Host and location: *Silurus glanis*, intestine.

Out of the four *S. glanis* specimens examined, three were infected with 5–11 parasites. In Poland, it was previously recorded by Ejsymont 1970 in *Silurus glanis* caught in the river Biebrza.

Proteocephalus longicollis (Zeder, 1800)

Host and location: *Osmerus eperlanus*, intestine.

Incidence and intensity of infection are summarized in Table XXIII. This is the first record of this parasite in Poland.

Proteocephalus macrocephalus (Creplin, 1825)

Host and location: *Anguilla anguilla*, intestine.

Out of the 17 *A. anguilla* examined, 7 were found infected with 1–19 parasites. In Poland, it was hitherto by Markowski 1933, Sołtyńska 1964 and Kozicka 1956 in *Anguilla anguilla*. The specimens from the present material do not differ from those reported by Markowski (op. cit.).

Proteocephalus sp

Host and location: *Syngathus typhle*, intestine.

Of the seven fishes of this species examined, only one harboured a cestode specimen.

Remarks on morphology (measurements are in μm): Length 5000, width 150. Suckers 90 × 70. The fifth sucker not visible. Proglottids and organ primordia slightly marked. This cestode is less developed than the specimens described by Markowski 1939, found in *Nerophis ophidion* (L.). The mentioned author determined the juvenile form he had found as *Proteocephalus torulosus*. But, as it results from his description, he was not able to determine either the number of testes or the dimensions of bursa cirri. As long as the complete life cycle of this cestode is not known, the determining of its juvenile specimens cannot be certain.

Nematoda

Contracaecum aduncum (Rudolphi, 1802)

Syn.: *Ascaris adunca* Rudolphi, 1802, *Porrocaecum adunca* (Rudolphi, 1819).

Hosts: *Osmerus eperlanus, Coregonus lavaretus, Platichthys flesus, Clupea harengus, Perca fluviatilis, Myoxocephalus scorpius, Zoarces viviparus, Gadus callarias, Lota lota, Ammodytes tobianus.*

Location in the host: intestine and swim-bladder in certain open swim-bladder fishes: mature nematodes and larvae without cysts. On the peritoneum in the body cavity, on the intestinal walls and liver: encysted larvae were found.

Incidence and intensity of infection recorded are given in Table XIV. In Poland, it has previously been recorded in many fish species. *C. lavaretus, L. lota* and *A. tobianus* are new host records for this nematode in Poland.

Table XIV

Distribution of *Contracaecum aduncum* (Rudolphi, 1802)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Osmerus eperlanus	76	27	35	1–90 larva
Platichthys flesus	67	5	7	2–6 adult
Clupea harengus	128	4	3	1–2 larva
Perca fluviatilis	90	2	2	1–2 adult
Myoxocephalus scorpius	10	6	—	1–9 larva
Zoarces viviparus	11	4	—	4–11 adult
Gadus callarias	7	2	—	2–20 larva and adult
Coregonus lavaretus	7	1	—	1 larva
Lota lota	7	1	—	1 adult
Ammodytes tobianus	21	1	—	1 larva

Camallanus lacustris (Zoega, 1776)

Syn.: *Cucullanus elegans* Zeder, 1800.

Hosts and location: *Perca fluviatilis, Leuciscus idus*, intestine.

Incidence and intensity of infection in *P. fluviatilis* are shown in Table III. In the 19 examined specimens of *L. idus* a single parasite was found. In Poland, it has often been recorded in fresh waters, in several fish species, particularly predatory and cyprinid fishes. *L. idus* is a new host record for this parasite in Poland.

Camallanus truncatus (Rudolphi, 1814)

Syn.: *Cucullanus truncatus* Rudolphi, 1814.

Hosts: *Rutilus rutilus, Lucioperca lucioperca, Hyperoplus lanceolatus, Esox lucius, Silurus glanis, Acerina cernua, Aspius aspius, Lota lota.*

Table XV

Distribution of *Camallanus truncatus* (Rudolphi, 1814)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Rutilus rutilus	82	1	1	1
Lucioperca lucioperca	35	6	—	1–9
Hyperoplus lanceolatus	39	1	—	1
Esox lucius	16	1	—	1
Silurus glanis	4	1	—	1
Acerina cernua	8	1	—	1
Aspius aspius	6	1	—	1
Lota lota	7	1	—	1

Location in the host: intestine.

Incidence and intensity of infection are seen in Table XV. This is the first record of *C. truncatus* in Poland. *Rutilus rutilus* and *Hyperoplus lanceolatus* are new host records of this parasite.

Cucullanellus minutus (Rudolphi, 1819)

Hosts: *Platichthys flesus, Platessa platessa, Limanda limanda.*

Location in the host: intestine.

Incidence and intensity of infection in *Platichthys flesus* are shown in Table III. Out of the 12 specimens of *Platessa platessa* examined, 12 parasites were found in a single fish. Out of the four *Limanda limanda* examined, three were infected, the intensity of infection varying from 3 to 12 specimens.

C. minutus is a common parasite in the brackish waters, mainly occurring in *Pleuronectidae*. In Poland, it was earlier recorded by Markowski 1933 in *Gobius minutus*, by Markowski (op. cit.) and Janiszewska 1938 in *Platichthys flesus*. *Limanda limanda* is a new host record of this parasite in Poland.

Acanthocephala

Neoechinorhynchus rutili (Müller, 1780)

Syn.: *Echinorhynchus rutili* Müller, 1780.

Hosts: *Perca fluviatilis, Osmerus eperlanus, Leuciscus idus, Anguilla anguilla.*

Location in the host: intestine.

Table XVI

Distribution of *Neoechinorhynchus rutili* (Müller, 1780)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Perca fluviatilis	90	3	3	2–14
Osmerus eperlanus	76	1	1	1
Leuciscus idus	19	1	—	1
Anguilla anguilla	17	1	—	2

Incidence and intensity of infection are shown in Table XVI. In Poland, it was many a time recorded by various authors. *O. eperlanus* is the first host record of this species, and *A. anguilla* is the first host record of this species in Poland. The very low incidence of *N. rutili* and the absence of this parasite in sea fish species suggest that it has been carried to the brackish waters of the Gdańsk Bay by fresh water fishes. Engelbrecht 1960, expressed a similar opinion with regard to the fishes infected with this parasite in the Greifswald Bay.

Echinorhynchus gadi Zoega in Müller, 1776

Syn.: *Echinorhynchus acus* Rudolphi, 1802.

Hosts: *Clupea harengus, Gadus callarias, Platichthys flesus, Ammodytes tobianus, Lota lota.*

Location in the host: intestine.

Incidence and intensity of infection: are shown in Table XVII. In Poland, it was earlier recorded by Markowski 1933, 1938 in *Clupea harengus, Enchelyopus cimbrius, Zoarces viviparus, Cottus bubalis, Cottus scorpius, Pleuronectes limanda*; by Janiszewska 1938 in *Pleuronectes flesus*, and by Studnicka 1965 in *Gadus callarias*. It results from the present findings that *A. tobianus* is a new host record for this species, and *L. lota* is a new host record in Poland.

Table XVII

Distribution of *Echinorhynchus gadi* Zoega in Müller, 1779

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Clupea harengus	128	24	19	1–27
Platichthys flesus	67	5	7	1–32
Ammodytes tobianus	21	1	—	1
Gadus callarias	7	7	—	1–117
Lota lota	7	6	—	1–31

Acanthocephalus anguillae (Müller, 1780)

Syn.: *Echinorhynchus anguillae* Müller, 1780; *Echinorhynchus proteus* Porta, 1905; *Echinorhynchus propinguus* Mühling, 1898.

Hosts: *Rutilus rutilus, Vimba vimba, Leuciscus idus, Cyprinus carpio.*

Location in the host: intestine.

Incidence and intensity of infection are shown in Table XVIII. *A. anguillae* has many a time been recorded in Poland. *Vimba vimba* is a new host record for this species in Poland.

Table XVIII

Distribution of *Acanthocephalus anguillae* (Müller, 1780)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Rutilus rutilus	82	1	1	1
Vimba vimba	62	1	2	5
Leuciscus idus	19	5	—	1–8
Cyprinus carpio	2	1	—	2

Acanthocephalus lucii (Müller, 1776)

Syn.: *Echinorhynchus lucii* Müller, 1776; *Echinorhynchus angustatus* Rudolphi, 1809.

Hosts: *Perca fluviatilis*, *Lucioperca lucioperca*, *Silurus glanis*.

Location in the host: intestine.

Incidence and intensity of infection are given in Table XIX. It has many a time been recorded in many fish families in Europe and in Poland. *Lucioperca lucioperca* is a new host record for this parasite in Poland.

Table XIX

Distribution of *Acanthocephalus lucii* (Müller, 1776)

Host species	No. of fishes		Degree of infection	
	examined	infected	incidence (%)	intensity range
Perca fluviatilis	90	12	13	1–6
Lucioperca lucioperca	35	1	—	1
Silurus glanis	4	1	—	1

Pomphorhynchus kostylewi Petročenko, 1956 (Fig. 5)

Host and location: *Platichthys flesus*, intestine.

Incidence and intensity of infection: out of the 67 examined flounder specimens, 5 were infected with 1–5 parasites. So far this parasite has only been found in the USSR in the fish species *Varicorhinus capoeta sevangi*. Thus, this is the first record of *P. kostylewi* in Poland and in the Baltic Sea.

Discussion. Genus *Pomphorhynchus* has been rather poorly explored as far as individual variability is concerned, and this often creates difficulties in determining the species of a specimen. The description of the present material is more detailed because there are differences between it and the descriptions of species known so far. The present specimens

Table XX

Measurements (in mm) of *Pomphorhynchus kostylewi* Petročenko, 1956

Body length	male: 8.7; female: 12–17
Body width	male: 1.3; female: 1.2–2.3
Rostellum	0.720–900×0.250–0.350
Bulb	0.550–1.4×0.55–1.9
Neck	1.5–3.1×1.0–1.4
No. of rows of rostellar hooks	14–16 mostly 15
No. of rostellar hooks per row	10–12 mostly 11
Rostellar sac	0.65×0.26
Lemnisci	0.6–0.9×0.1–0.3
Cement glands	0.5–0.6×0.3–0.4
Testes	0.7–0.46×0.65–0.43
Eggs	0.093×0.016–0.018

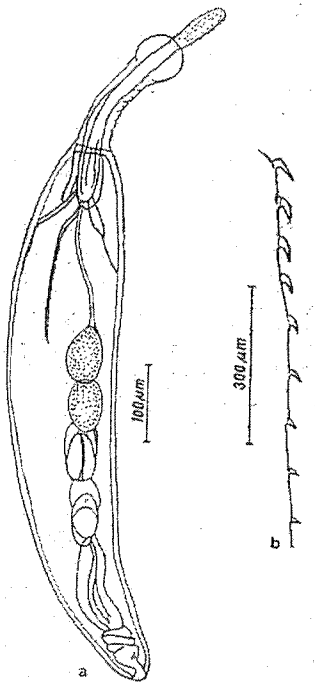

Fig. 5. *Pomphorhynchus kostylewi* from *Platichthys flesus* of the Gdańsk Bay: a — male specimen; b — a row of rostellar hooks.

Table XXI

Length of rostellar hook blades in *Pomphorhynchus kostylewi* (all measurements in µm)

Successive hooks in a row	Specimen 1	Specimen 2	Specimen 3	Specimen 4
I	42	44	46	55
II	46	48	50	55
III	50	50	50	55
IV	46	50	50	50
V	44	37	44	39
VI	39	35	35	32
VII	32	32	23	32
VIII	37	30	21	32
IX	32	28	21	30
X	37	25	21	25
XI	32	23	21	21

Table XXII

Fish species and their helminths recorded in the Gdańsk Bay

Host species	*Bucephalus polymorphus*	*Rhipidocotyle illense*	*Prosorhynchus squamatus*	*Hemiurus luehei*	*Hemiurus raabei*	*Brachyphallus crenatus*	*Deropristis inflata*	*Azygia lucii*	*Allocreadium isoporum*	*Bunodera luciopercae*	*Orientocreadium pseudobagri*	*Sphaerostomum globiporum*	*Sphaerostomum maius*	*Nicolla skrjabini*	*Asymphylodora tincae*	*Asymphylodora markewitschi*	*Asymphylodora imitans*	*Asymphylodora kubanicum*
Perca fluviatilis L.	+	+						+		+				+				
Lucioperca lucioperca (L.)	+	+				X				+								
Acerina cernua (L.)										+				X				
Zoarces viviparus (L.)																		H
Ammodytes tobianus L.																		
Hyperoplus lanceolatus (Le Sauvage)																		
Myoxocephalus scorpius (L.)			X															
Scophthalmus maximus (L.)																		
Platichthys flesus (L.)																		
Limanda limanda (L.)																		
Platessa platessa (L.)																		
Clupea harengus L.				X	H	+												
Salmo salar L.		H		+														
Salmo trutta m. *trutta* L.						+												
Coregonus lavaretus (L.)												H						H
Osmerus eperlanus (L.)																		
Anguilla anguilla (L.)						H	+											
Esox lucius L.	+	+																
Rutilus rutilus (L.)			H						+									X
Vimba vimba (L.)													H			H		+
Blicca bjoerena (L.)													H				X	X
Abramis brama (L.)																	+	X
Leuciscus idus (L.)												X				+		H
Aspius aspius (L.)	X																	
Tinca tinca (L.)															+			
Gobio gobio (L.)														X				
Cyprinus carpio L.										X								

Host species	*Palaeorchis incognitus*	*Palaeorchis unicus*	*Caryophyllaeus laticeps*	*Triaenophorus nodulosus*	*Triaenophorus crassus*	*Eubothrium crassum*	*Bothriocephalus scorpii*	*Ligula intestinalis*, plerocercoid	*Schistocephalus pungitii* (P)	*Proteocephalus percae*	*Proteocephalus osculatus*	*Proteocephalus longicollis* (P)	*Proteocephalus macrocephalus*	*Proteocephalus* sp. larva	*Contracaecum adincum*	*Camallanus lacustris*	*Camallanus truncatus* (P)	*Cucullanellus minutus*	*Neoechinorhynchus rutili*	*Echinorhynchus gadi*	*Acanthocephalus anguillae*	*Acanthocephalus lucii*	*Pomphorhynchus kostylewi* (P) (B)	*Corynosoma semerme*
Perca fluviatilis L.				+	X		H			+					+	+			+			+		
Lucioperca lucioperca (L.)			H				H										X					X		
Acerina cernua (L.)																	X							
Zoarces viviparus (L.)															+									
Ammodytes tobianus L.															H					H				
Hyperoplus lanceolatus (Le Sauvage)							H										H							
Myoxocephalus scorpius (L.)							+								+									
Scophthalmus maximus (L.)							+																	
Platichthys flesus (L.)			H												+			+		+			H	
Limanda limanda (L.)																		X						
Platessa platessa (L.)																		+						
Clupea harengus L.							X								+					+			H	X
Salmo salar L.						+																		
Salmo trutta m. *trutta* L.						+																		
Coregonus lavaretus (L.)							H								H									
Osmerus eperlanus (L.)						X						X			+				H					+
Anguilla anguilla (L.)													+						X					
Esox lucius L.				+													X							
Rutilus rutilus (L.)	+	H	+														H				+			
Vimba vimba (L.)		+	+					X																
Blicca bjoerena (L.)		X	+					+																
Abramis brama (L.)			+					+																
Leuciscus idus (L.)	+		+													X			+		X			
Aspius aspius (L.)																	X							
Tinca tinca (L.)																								
Gobio gobio (L.)																								
Cyprinus carpio L.																					+			

Cd. Table

	XXII
Carassius carassius (L.)	X
Scardinius erythrophthalmus (L.)	
Silurus glanis L.	
Gadus callarias L.	
Lota lota (L.)	
Gasterosteus aculeatus L.	X
Syngnathus typhle (L.)	

For explanation: + — host record; X — first host record for Poland; H — first host record for science; (P) — first record of the helminth species in Poland; (B) — first record of the helminth species in the Baltic.

most resemble *Pomphorhynchus kostylewi* Petročenko, 1956. Their maximum width is in the anterior portion of the body: females are wider than males. The rostellum is cylindrical in shape, slightly thicker in the middle. The main differences have been recorded in the measurements of the body, eggs, collum and hook blades. Also the range of differences in the number of rows of rostellar hooks is greater. Measurements are given in Tables XX and XXI (cf. also Diagram 1).

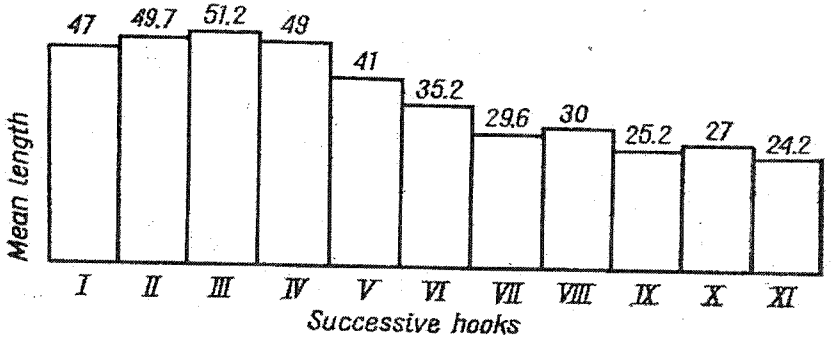

Diagram 1. Showing the blade length of rostellar hooks in *Pomphorhynchus kostylewi* (mean length taken from 4 specimens, in μm). Cf. Table XXI.

The systematic position of *P. kostylewi* is still uncertain. The present author had not an opportunity to check the original material kept at the Moscow Museum of Specimens (VIGIS) so it was impossible to compare the typical *P. kostylewi* specimens with the present material. Markowski 1933, recorded *Pomphorhynchus laevis* from *Zoarces viviparus* and *Anguilla anguilla* caught in the same region as that in which the present *P. kostylewi* specimens were collected. The material described by Markowski (op. cit.) essentially differs from the present one. Lundström 1942, considers that in marine conditions (Baltic Sea) the range of variability of hooks in *Pomphorhynchus laevis* is significant: "Bewaffnung bei marinen Individuen ist 15/10–11, gefolgt von 16/10–11". Adopting such a wide range of specific variability one could assume that

the parasites found by the present author belong to *Pomphorhynchus laevis*. However, as it is not possible for the time being finally to solve the problem of validity of *P. kostylewi*, the present material has been recognized as *P. kostylewi*. The differences between the two species, as far as they result from the original description, are sufficient to recognize *P. kostylewi* as a valid species. Nevertheless, detailed study of more abundant data is necessary to clarify definitively the status of both the species.

Corynosoma semerme (Forssell, 1904) larva

Syn.: *Echinorhynchus semermis* Forssel, 1904; *Echinorhynchus strumosus* Rudolphi, 1802.

Host and location: *Clupea harengus*, *Osmerus eperlanus*, body cavity.

Incidence and intensity of infection in *Osmerus eperlanus* are given in Table III. A single worm was found in a herring. In Poland this helminth was recorded by Markowski 1933 in *Osmerus eperlanus*, Janiszewska 1938 in *Platichthys flesus*, and Studnicka 1965 in *Gadus callarias*. Thus, *C. harengus* is a new host record in Poland.

The morphological data of the present specimens are in concordance with the description of this species by Looss, 1911 (in Petročenko, 1958).

Discussion

General remarks

The present helminths collected in the Gdańsk Bay were obtained by autopsy of various fish species caught in the different seasons of the year, but being not a representative sample of each season. This was the result of technical problems related to fishing.

Tables I and II bring lists of the fish species examined and groups of parasites recorded. The examination has proved that trematodes (20 species) and cestodes (12 species) are the predominant parasite groups both as regards the number of species (Table I) and the incidence and intensity of infection (cf. Tables I and II and those showing infection with respective species). Nematodes (4 species) and acanthocephalans (6) appeared to be much rarer and less numerous parasites of the examined fishes.

The present materials include four helminth species recorded for the first time in Poland. These are: cestodes *Schistocephalus pungitii* (plerocercoid) and *Proteocephalus longicollis*, the nematode *Camallanus trun-*

Table XXIII

Distribution of helminth species within ichthyofauna of the Gdańsk Bay (compiled after present findings and data from literature)

	Helminth species	No. of host species involved (according to their character)			
		total	freshwater	marine	living in both habitats
Species recorded mainly from freshwater or estuarine fishes	*Bucephalus polymorphus*	3	2	—	1
	Rhipidocotyle illense	5	3	—	2
	Azygia lucii	2	1	—	1
	Allocreadium isoporum	1	1	—	—
	Plagiophorus angulatus	1	—	—	1
	Bunodera luciopercae	5	3	—	2
	Orientocreadium pseudobagri	1	—	—	1
	Sphaerostomum globiporum	2	1	—	1
	Sphaerostomum maius	2	2	—	—
	Nicolla skrjabini	4	2	—	2
	Cryptocotyle concavum	2	—	2	—
	Asymphylodora tincae	1	1	—	—
	Asymphylodora demeli	2	—	2	—
	Asymphylodora markewitschi	3	3	—	—
	Asymphlodora imitans	3	3	—	—
	Asymphylodora kubanicum	7	5	1	1
	Palaeorchis incognitus	2	2	—	—
	Palaeorchis unicus	5	5	—	—
	Caryophyllaeus laticeps	7	5	—	2
	Caryoph llaeus spp.	2	—	2	—
	Triaenophorus nodulosus	5	2	3	—
	Triaenophorus crassus	1	1	—	—
	Diphyllobothrium latum, pler.	1	1	—	—
	Ligula intestinalis, pler.	4	3	1	—
	Ligula sp. pler.	1	—	1	—
	Schistocephalus gasterostei, pler.	1	1	—	—
	Schistocephalus pungitii, pler.	1	1	—	—
	Proteocephalus percae	2	2	—	—
	Proteocephalus osculatus	1	—	—	1
	Proteocephalus longicollis	1	—	—	1
	Proteocephalus macrocephalus	1	—	—	1
	Proteocephalus torulosus	1	—	1	—
	Proteocephalus sp. juv.	7	2	4	1
	Camallanus lacustris	2	2	—	—
	Camallanus truncatus	8	3	1	4
	Cucullanellus minutus	4	—	1	3
	Raphidascaris acus	1	—	—	1
	Raphidascaris gracillima	1	1	—	—
	Raphidascaris sp.	4	1	2	1

Cd. Table XXIII

	Helminth species	No. of host species involved (according to their character)			
		total	freshwater	marine	living in both habitats
	Spinitectus inermis	1	—	—	1
	Ascarophis skrjabini	1	—	1	—
	Neoechinorhynchus rutili	9	3	3	3
	Acanthocephalus anguillae	4	4	—	—
	Acanthocephalus lucii	4	1	—	3
	Pomphorhynchus kostylewi	1	—	—	1
	Pomphorhynchus laevis	4	—	2	2
	Echinorhynchus salmonis	2	—	1	1
Species recorded mainly form marine fishes	*Prosorhynchus squamatus*	3	1	2	—
	Hemiurus luehei	3	—	1	2
	Hemiurus raabei	2	—	1	1
	Parahemiurus merus	1	—	1	—
	Aphanurus balticus	1	—	—	1
	Brachyphallus crenatus	8	1	2	5
	Lecithocladium excisum	1	—	1	—
	Lecithaster gibbosus	2	—	1	1
	Deropristis inflata	1	—	—	1
	Pharyngora bacillaris	1	—	1	—
	Eubothrium crassum	3	—	—	3
	Bothriocephalus scorpii	12	1	7	4
	Bothriocephalus claviceps	1	—	—	1
	Bothriocephalus bipunctatus	2	—	1	1
	Proteocephalus gobiorum	1	—	1	—
	Anisakis sp. larva	1	—	1	—
	Contracaecum aduncum	20	1	13	6
	Ascarophis longispicula	1	—	1	—
	Echinorhynchus gadi	11	—	8	3
	Corynosoma semerme	4	—	2	2
	Corynosoma strumosum	4	—	4	—

catus and the acanthocephalan *Pomphorhynchus kostylewi*, the latter species being the first record in the Baltic Sea. In addition, out of the 42 helminth species recorded, 30 were found to occur in new host species, so that a total of 62 new parasite-host systems which are new for Poland, including 29 systems new to science, have been demonstrated. The relevant data are in Tables I and XXII.

In the available literature there are only few data regarding the helminth fauna of fishes of southern regions of the Baltic Sea, including the Gdańsk Bay. Most of publications are of limited scope, either discussing the life cycles of certain species, or tackling purely practical aspects

of the problem, or else giving only a list of found parasites (Levander 1909, Szidat 1927, Markowski 1933, 1935, 1936, 1938, 1939, Janiszewska 1938, Gecevičjute 1958, Sołtyńska 1964, Studnicka 1965). Only a few of the publications contain a tentative analysis of the helminth fauna of brackish waters (Schneider 1904, Engelbrecht 1958, 1960).

The present study encompassed a considerably large material obtained from fishes caught in the Gdańsk Bay and this has made it possible to supplement the list of parasites hitherto recorded in that interesting brackish water region. As a result, a much more comprehensive list of helminths occurring in fishes of the Gdańsk Bay has been drawn up. It includes species found by the present author as well as those recorded earlier (Markowski 1933, 1935, 1936, 1938, 1939, Janiszewska 1938, Ślusarski 1958, Sołtyńska 1964, Studnicka 1965), all in all, obtained from 50 host species. This material served as a basis for a tentative analysis of the qualitative and quantitative structure of the helminth fauna of the Gdańsk Bay. The analysis is given below.

Structure of the helminth fauna in the Gdańsk Bay

The present material and the data supplied by other authors (loc. cit.) revealed the occurrence of 74 helminth species in the Gdańsk Bay, including 29 trematode, 23 cestode (including those whose species has not been determined), 13 nematode (also including forms whose species has not been determined) and 9 acanthocephalan species. The incomplete list, in which certain forms only classified to the generic group, is seen in Table XXIII. The predominance of trematodes and cestodes over the remaining classes is striking and proves that the former have favourable developmental conditions in that region. This means that the necessary assemblages of hosts involved in their complex life cycles occur in the Gdańsk Bay. The data related to the incidence and intensity of infection with the respective groups of helminths found in the course of the present study are summarized in Tables I and II.

Adopting the criterion of the number of the "host-parasite" systems in the taxonomical meaning to define the incidence of representatives of large taxonomic groups of parasites within host species of the ecosystem under study, it may be said that the helminth fauna of fishes of the Gdańsk Bay is rather evenly distributed. *Trematoda* occurred in 30 host species (60% of the fish species examined), *Cestoda* in 27 species (54%), *Nematoda* in 31 species (62%) and *Acanthocephala* in 24 species 48%). On the other hand, if the number of examined host specimens (general incidence of infection) is adopted as a criterion to define the dispersion of representatives of large taxonomic groups, then, on basis of the present findings, it appears that 59% of all fishes were infected with helminths in the Gdańsk Bay, about 26% being infected with *Trematoda*, about 25% with *Cestoda*, about 15% with *Nematoda*, and 13% with *Acanthocephala* (Table II). Taking into consideration that so far 29 trematode and 23 cestode species have been found in the Gdańsk Bay, compared to 13 nematode and 9 acanthocephalan species, the former two classes should be regarded as predominant in the helminth fauna of the Gdańsk Bay.

Table XXIV

Structure of the helminth fauna of fishes recorded in the Gdańsk Bay

Incidence of infection	Occurrence of helminth species, as determined by the number of host species recorded					
	1–4 host species		5–12 host species		20 host species	
low (below 20%)	*Nicolla skrjabini*	(4)	*Brachyphallus crenatus*	(8)		
	Ligula intestinalis	(4)	*Rhipidocotyle illense*	(5)		
	Acanthocephalus anguillae	(4)	*Bunodera luciopercae*	(5)		
	Acanthocephalus lucii	(4)	*Triaenophorus nodulosus*	(5)		
	Corynosoma semerme	(4)	*Bothriocephalus scorpii*	(12)		
	Corynosoma strumosum	(4)	*Bothriocephalus* sp.	(6)		
	and 46 other species (below 4)		*Neoechinorhynchus rutili*	(9)		
			Echinorhynchus gadi	(11)		
			Camallanus truncatus	(8)		
moderate (up to 35%)	*Cucullanellus minutus*	(4)	*Palaeorchis unicus*	(5)	*Contracaecum aduncum* (20)	
			Caryophyllaeus laticeps	(7)		
high (up to 64%)			*Asymphylodora kubanicum*	(7)		

As far as the specific composition of the helminth fauna of the investigated area is concerned, among the 74 species recorded up to now (including the findings of other authors), it is possible to establish a hierarchy from the point of view of the incidence of respective parasites (Table XXIV). The frequency of the occurrence of a certain organism in nature may be determined by different ways; the criteria applied with regard to parasites usually include incidence of infection, intensity of infection and seasonal changes. The criteria should take into account not only the number of host individuals involved, but also the number of host species of a given parasite, which determines the host range. In the present study, two main criteria have been adopted to determine the frequency of occurrence of the respective species composing the helminth fauna. They are: incidence of infection within an infected host species and the number of host species forming the "host-parasite" systems. With the help of the above two criteria it has been possible — to a considerable extent — to determine the frequency of occurrence of a given helminth species in spite of difficulties resulting from the fact that, e.g., the high incidence of helminths does not always parallel the high number of host species involved. In that case the criterion of the number of host specimens and frequency of their occurrence in the biotope, i.e. the numerical strength of the host population, is the decisive criterion.

It has appeared that the nematode *Contracaecum aduncum* is the predominant species in the helminth fauna of fishes in the Gdańsk Bay. It was found in 20 host species, the mean incidence being below 35%. What is more, the said nematode occurred in the majority of fishes that are common in the Bay: *Clupeidae*, *Gadidae* and *Pleuronectidae*. The trematode *Asymphylodora kubanicum* occurred in 7 host species, most of which are cyprinid species common in the Bay; the incidence of infection was high. This trematode is the first subdominant species, followed by two other, namely *Palaeorchis unicus* (five host species) and *Caryophyllaeus laticeps* (7 species). This group is similar to the following as regards the number of host species, but it differs considerably from the latter as far as the incidence of infection is concerned. The mentioned group includes trematodes *Brachyphallus crenatus*, *Rhipidocotyle illense* (adult) and *Bunodera luciopercae*, cestodes *Triaenophorus nodulosus* and *Bothriocephalus scorpii*, a nematode *Camallanus truncatus* and two acanthocephalans *Neoechinorhynchus rutili* and *Echinorhynchus gadi*. The last, supplementary group of helminths includes all the remaining species, characterized by a small number of host species involved and a low incidence. This group is headed by species with the respectively greatest number of hosts (four species): trematode *Nicolla skrjabini*, cestode *Ligula intestinalis* and acanthocephalans: *Acanthocephalus anguillae*, *A. lucii*, *Corynosoma semerme* and *C. strumosum*. The only exception in this group is *Cucullanellus minutus* whose incidence reaches a moderate level.

The hierarchy can also be established in fish groups from the point of view of the extent of their infection with helminth species. Taking into consideration fish species grouped according to families, the predominant families can clearly be distinguished (Table XXV). They are:

Table XXV

Number of helminth species in families of fishes hitherto recorded in the Gdańsk Bay

Host families (No. of fish species)		No. of helminth species				
		T	C	N	A	total
Cyprinidae	(12)	13	2	2	2	19
Percidae	(3)	7	5	3	2	17
Zoarcidae	(1)	1	4	4	5	14
Pleuronectidae	(3)	1	3	3	6	13
Salmonidae	(4)	7	2	1	2	12
Gobiidae	(3)	2	7	2	1	12
Syngnathidae	(2)	2	7	2	—	11
Anguillidae	(1)	3	3	2	2	10
Gadidae	(2)	—	2	4	4	10
Clupeidae	(3)	2	1	1	3	7
Esocidae	(1)	3	3	2	—	8
Gasterosteidae	(1)	1	4	1	1	7
Cottidae	(3)	1	2	1	2	6
Ammodytidae	(2)	1	1	2	1	5
Siluridae	(1)	2	1	1	1	5
Bothidae	(1)	—	2	—	1	3
Lumpenidae	(1)	—	—	1	1	2
Pholidae	(1)	—	—	1	—	1
Scombridae	(1)	—	1	—	—	1
Cyclopteridae	(1)	—	—	—	1	1
Liparidae	(1)	1	—	—	—	1
Belonidae	(1)	—	—	—	—	—

For explanation: T — *Trematoda*, C — *Cestoda*, N — *Nematoda*, A — *Acanthocephala*.

Cyprinidae (19 helminth species with a clear predominance of trematodes), *Percidae* (17 species, trematodes and cestodes prevail), and *Zoarcidae* (14 species with the prevalence of trematodes). The exent to which the respective fish species are infected, coincides in a great measure with the considerably high frequency of the respective host species in the Bay. A similar phenomenon has been observed with regard to other families whose representatives are hosts to numerous parasite species (10–14).

Interchange of helminths between different habitat groups of fishes

The comparison of fresh-water, marine and migrating hosts, according to their helminth fauna and the number of involved host species in the respective habitat groups, provides ground for certain general conclusions (Table XXIII).

The number of helminth species of fresh water origin (47) recorded in the Gdańsk Bay is considerably greater than the number of marine species (21). The classification of parasite species into fresh-water and

marine groups is not simple, in spite of the fact that, according to the adopted criteria, the former are those which, apart from brackish waters do not occur in marine fishes, while species which, apart from brackish waters are not found in fresh-water fish species (apart from migrating species) should be classified in marine species. The classification of fish parasites in fresh-water, marine and estuarine groups, as suggested by Bauer and Šulman 1948, is reasonable, but it depends on the extent to which the life cycles of classified parasites have been explored. The occurrence of certain parasite species in the brackish waters in non-migrating fish species may suggest their estaurine nature, although they may be at the same time marine or fresh-water species.

It is shown in Table XXIII that 30 helminth species classified in the fresh-water group occurred in fresh-water fishes, 24 in two-habitat fishess, and 17 in marine fish species. In the group of marine helminths, 17 occurred in marine fishes, 13 in two-habitat fishes, and 4 in fresh-water fishes. As a result, the helminth fauna of fishes in the Gdańsk Bay is mixed, composed of both marine and fresh-water species. At the same time, species which occur both in typical marine host species and in fresh-water fishes (with the exception of two-habitat fishes) may be regarded, as estuarine helminths assuming — which is most probable — that in the brackish waters of the Gdańsk Bay they find conditions in which they life cycles can be completed. All the fresh-water species (16) and marine species (4) occurring in fresh-water and marine fish species should be ranked into this group.

The activity of water currents, continuous changes in the salinity of the water, cause shifts in the food organisms. This, in the case of the Gdańsk Bay, creates favourable conditions of accidental infection of fishes. *Asymphylodora tincae*, *Orientocreadium pseudobagri* and *Derogpristis inflata* were found each in a single host. On the other hand, *Echinorhynchus gadi*, *Brachyphalus crenatus* and *Bothriocephalus scorpii* were recorded in different fish species. *Asymphylodora kubanicum*, a trematode occurring in cyprinid fishes in other water reservoirs, has found a wide range of hosts in the Bay.

The ways of getting food by certain host species are not indifferent for helminth infection. The trematode *Bunodera luciopercae* is a typical helminth of predatory fishes. The fact that it has also been found in *Cyprinus carpio* is an example of occurrence in an unusual host. On the other hand, *Caryophyllaeus laticeps*, a typical helminth of cyprinid species, was found in *Lucioperca lucioperca*. A similar phenomenon of extended range of hosts has also been observed in many other fish species in the Gdańsk Bay. Smaller fishes, living on plankton, are often intermediate hosts, e.g. *Clupeidae* in which nematodes and trematodes only occur in their larval forms. *Triaenophorus nodulosus*, a helminth of predatory fish, was found in its larval form in the stickleback. It was also found that among several hosts of a certain helminth, one species is remarkable for the highest incidence and intensity of infection (Table III). This phenomenon is most striking in the case of *Contracaecum aduncum* and *Bothriocephalus scorpii*. *Gobius minutus* (41% incidence, according to Markowski 1935) is the main host species of *B. scorpii* larvae. Physiological features of the host are decisive for the possibility of

a helminth settling and developing in it. For instance, the acanthocephalan *Echinorhynchus gadi*, a helminth of marine fish species, mostly gadid fishes, was found in the Gdańsk Bay in four marine and one fresh-water fishes, viz., *Lota lota* (Table XVI). *Lota lota* is the only gadid species living in fresh waters. In the Gdańsk Bay it only occurs accidentally.

It results from studies by Šulman 1950 on the helminth fauna of the Baltic fishes that the lowering of salinity of water brings in its wake a reduction of the number of species of marine parasites. Any changes in salinity have a similar influence on the number of occurring parasites of any category (marine, fresh-water and estuarine parasites). Hence the helminth fauna of brackish waters, compared to that of sea and fresh waters, is characterized by a reduced specific composition of their parasite fauna. If, according to the data collected by the present author and other authors who studied the Gdańsk Bay fauna, this observation may be considered true with regard to marine parasites, it has not been conformed with regard to fresh-water fish parasites. It should be emphasized that the helminth fauna of host species in the Gdańsk Bay has been enriched: that of marine host species by fresh-water helminths and that of fresh-water fishes by marine helminth species. This is a phenomenon similar to that recorded and emphasized by Ślusarski 1958, who observed a maximum concentration of the number of trematode species in *Salmonidae* migrating in both directions through the Vistula estuary zone. The low and medium-size salinity of water in the Gdańsk Bay create particularly favourable conditions in which many euryhalic fish and parasite species are able to live and develop.

Summary and conclusions

Complete helminthological autopsy of 923 fishes of 40 species caught in the Gdańsk Bay in 1967–1971 revealed 20 trematode, 12 cestode, 4 nematode and 6 acanthocephalan species. For technical reasons *Monogenoidea* were omitted in the study. The helminths were recorded mainly in the intestine. *Schistocephalus pungitii* Dubinina, 1959 (plerocercoid) from the body cavity of *Gasterosteus aculeatus* L., *Proteocephalus longicollis* (Zeder, 1800) from the intestine of *Osmerus operlanus* (L.), *Camallanus truncatus* (Rud., 1814) from the intestine of *Rutilus rutilus* (L.), *Aspius aspius* (L.), *Lucioperca lucioperca* (L.), *Acerina cernua* (L.), *Esox lucius* L., *Silurus glanis* L., *Hyperophus lanceolatus* (Le Sauv.) and *Lota lota* (L.); and *Pomphorhynchus kostylewi* Petročenko, 1956 from the intestine of *Platychthys flesus* (L.), are first records in Poland. The latter is the first record in the Baltic Sea.

The morphology of *P. kostylewi*, *Allocreadium isoporum* (Looss, 1894), *Asymphylodora kubanicum* (Issaitschikoff, 1923), and particularly of *Palaeorchis unicus* Szidat, 1943 is discussed. 30 helminth species were recorded in many fish species hitherto unknown in Poland as their hosts, 62 new host-parasite systems, including 29 systems which are new to science, being established.

Asymphylodora imitans (Mühling, 1898) form A described by Witenberg and Eckmann 1934 is regarded a synonym of *A. kubanicum*.

Caryophyllaeus sp. reported by Janiszewska 1938 is recognized as *C. laticeps* (Pall., 1781). *Palaeorchis skrjabini* Koval, 1950 is a synonym of *P. unicus*.

A list based on the present findings and the data from relevant literature is compiled, containing helminth species hitherto recorded in fishes of the Gdańsk Bay. The list includes 29 trematode, 23 cestode, 13 nematode and 9 acanthocephalan species. Considering the structure of the helminth fauna of the investigated area, it was found, basing on the quantitative and qualitative analysis of the incidence and intensity of infection with parasites, as well as of the number of individuals and species of fish host involved, that *Contracaecum aduncum* is the predominant helminth species parasitizing fishes of the Gdańsk Bay. *Asymphylodora kubanicum, Palaeorchis unicus, Caryophyllaeus laticeps* and *Camallanus truncatus* are the subdominant species. The greatest number of helminth species were found in *Cyprinidae* (19, trematodes prevailing) and *Percidae* (17, with the prevalence of trematodes and cestodes). Such a diversified specific composition of the helminth fauna of those fishes corresponds with the quantitative and qualitative prevalence of the two fish families in the Gdańsk Bay.

The mixed helminth fauna of fishes in the Gdańsk Bay is composed of marine and fresh-water species. The number of helminth species known from fresh-water habitats (47) is much greater than that of marine species (21). Moreover, 30 fresh-water helminth species occur in fresh-water fishes of the Bay, 24 in migrating species, and 16 in marine fishes. Of the marine helminth, 17 occur in marine, 13 in migrating and only 4 in fresh-water fishes. It is also concluded that the fresh-water and marine fishes (apart from migrating species living in both habitats) in the Gdańsk Bay mutually contribute to the enriching of the specific composition of their helminth fauna this being a characteristic feature of brackish habitats. It may be expected that this is true wtih regard to other brackish waters as well.

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STRESZCZENIE

Drogą całkowitych sekcji helmintologicznych 923 ryb 40 gatunków, zasiedlających Zatokę Gdańską, w latach 1967–1971 autor zebrał materiał, w którym wyróżnił 20 gatunków przywr (*Trematoda*), 12 gatunków tasiemców (*Cestoda*), 4 gatunki nicieni (*Nematoda*) i 6 gatunków kolcogłowów (*Acanthocephala*). Autor nie badał ryb pod kątem *Monogenoidea*. Największą liczbę gatunków stwierdził w przewodzie pokarmowym ryb. Spośród stwierdzonych gatunków cztery nie były dotąd notowane w obrębie granic Polski. Są to tasiemce *Schistocephalus pungitii* Dubinina, 1959 (plerocercoid) z jamy ciała ciernika *Gasterosteus aculeatus* L. oraz *Proteocephalus longicollis* (Zeder, 1800) z jelita stynki *Osmerus eperlanus* (L.); nicień *Camallanus truncatus* (Rud., 1814) z jelita płoci *Rutilus rutilus* (L.), sandacza *Lucioperca lucioperca* (L.), jazgarza *Acerina cernua* (L.), szczupaka *Esox lucius* L., bolenia *Aspius aspius* (L.), suma *Silurus glanis* L., dobijaka *Hyperophus lanceolatus* (Le Sauv.) i miętusa *Lota lota* (L.); kolcogłów *Pomphorhynchus kostylewi* Petročenko, 1956 z jelita storni *Platichthys flesus* (L.). Autor zamieścił szersze uwagi na temat morfologii tego ostatniego, który nie był dotychczas notowany w wodach Bałtyku, a także podaje własne dane morfologiczne o przywrach *Allocreadium isoporum* (Looss, 1894), *Asymhylodora kubanicum* (Issaitschikoff, 1923) w szczególności zaś *Palaeorchis unicus* Szidat, 1943, proponując własny klucz do rozróżniania gatunków rodzaju *Palaeorchis* Szidat, 1943. 30 gatunków stwierdził autor u wielu gatunków ryb, które nie były dotychczas znane w Polsce jako ich żywiciele, ustalając 62 nowe układy żywiciel-pasożyt, z których 29 stanowią układy nowe dla nauki. Ponadto, opierając się na własnych materiałach, autor jest zdania, że opisana przez Witenberga i Eckmanna 1934 forma A przywry *Asymphylodora imitans* (Mühling, 1828) jest w rzeczywistości *Asymphylodora kubanicum*. Podobnie opisany przez Janiszewską 1938 *Caryophyllaeus* sp. (*laticeps*?) uważa za *Caryophyllaeus laticeps* (Pall., 1781). Oprócz tego nazwę *Palaeorchis skrjabini* Koval, 1950 przenosi do synonimów *Palaeorchis unicus*.

Opierając się na wynikach własnych badań i danych z literatury autor ustalił listę stwierdzonych dotychczas w Zatoce Gdańskiej składników helmintofauny ryb, na której znalazło się 29 gatunków przywr, 23 tasiemców, 13 nicieni i 9 kolcogłowów. Analizując strukturę helmintofauny badanego obszaru pod kątem częstości i intensywności występowania gatunków pasożytniczych oraz liczby zaangażowanych gatunków i osobników żywicielskich, autor uważa nicienia *Contracaecum aduncum* za gatunek dominujący, zaś przywry *Palaeorchis unicus* i *Asymphylodora kubanicum* oraz tasiemca *Caryophyllaeus laticeps* i nicienia *Camallanus truncatus* za subdominantów. Największą liczbę gatunków pasożytów (19 z wyraźną przewagą przywr) zarejestrował u ryb karpiowatych, nieco mniejszą (17 z przewagą przywr i tasiemców) u okoniowatych. Urozmaicony zestaw gatunkowy helmintofauny u tych ryb pokrywa się w znacznej mierze ze znaczną przewagą ilościową i jakościową *Cyprinidae* i *Percidae* nad innymi rodzinami ryb, zamieszkujących Zatokę Gdańską. Helmintofauna ryb Zatoki Gdańskiej jest mieszana, tzn. obejmuje gatunki słodkowodne i morskie. Okazało się też, że liczba gatunków helmintów znanych ze zbiorników słodkowodnych (47) znacznie przewyższa w Za-

Table XXVI

The coincidence of different helminth species in fish host individuals, as shown by number of cases

Helminth species	*Bucephalus polymorphus*	*Rhipidocotyle illense*	*Prosorhynchus squamatus*	*Hemiurus luehei*	*Hemiurus raabei*	*Brachyphallus crenatus*	*Deropristis inflata*	*Azygia lucii*	*Allocreadium isoporum*	*Bunodera luciopercae*	*Orientocreadium pseudobagri*	*Sphaerostoma globiporum*	*Sphaerostomum malus*	*Nicolla skrjabini*	*Asymphylodora markewitschi*	*Asymphylodora imitans*	*Asymphylodora kubanicum*	*Palaeorchis incognitus*	*Palaeorchis unicus*	*Caryophyllaeus laticeps*	*Triaenophorus nodulosus*	*Triaenophorus crassus*	*Eubothrium crassum*	*Bothriocephalus scorpii*	*Ligula intestinalis*, plerocercoid	*Proteocephalus percae*	*Proteocephalus osculatus*	*Proteocephalus longicollis*	*Proteocephalus macrocephalus*	*Contracaecum aduncum*	*Camallanus lacustris*	*Camallanus truncatus*	*Cucullanellus minutus*	*Neoechinorhynchus rutili*	*Echinorhynchus gadi*	*Acanthocephalus anguillae*	*Acanthocephalus lucii*	*Pomphorhynchus kostylewi*	*Corynosoma semerme*
Bucephalus polymorphus		1								3	1			1																		4					3		
Rhipidocotyle illense	1							1		6											1		1														3		
Prosorhynchus squamatus																								1						1								
Hemiurus luehei					1	12																	1	2														
Hemiurus raabei				1		1									1		2	1					1	1														
Brachyphallus crenatus				12	1																		1	3					1	4				10			
Deropristis inflata																													2				1					
Azygia lucii		1																													1	1				1		
Allocreadium isoporum															1		2	1																		1		
Bunodera luciopercae	3	6												1								1		2	1		1		1								1	
Orientocreadium pseudobagri	1													1														1			1	1					1	
Sphaerostomum globiporum															1		2															1						
Sphaerostomum malus															1	1	1	1	1	1											1						
Nicolla skrjabini	1									1	1																								1		
Asymphylodora markewitschi									1			1	1				2	1	1	1											1	2					
Asymphylodora imitans												1					3	1	6	3				2							1						
Asymphylodora kubanicum									2			2	1		2	3		4		22				1							1	1			2		
Palaeorchis incognitus									1				1		1	1	4			1															2		
Palaeorchis unicus													1		1	6																					
Caryophyllaeus laticeps													1		1	3	22	1				1		1	3							1		1	2		
Triaenophorus nodulosus		1								1												1			1	2						1					
Triaenophorus crassus																																						
Eubothrium crassum		1		1		1				2										1	1																
Bothriocephalus scorpii			1	2		3				1							1			1						1				1	1						
Ligula intestinalis, plerocercoid																2				3	1			1						3							
Proteocephalus percae										1				1																								
Proteocephalus osculatus	1										1																											
Proteocephalus longicollis										1																												
Proteocephalus macrocephalus						1	2											1												13							
Contracaecum aduncum			1			4											1																	1				
Camallanus lacustris		2						1		1		1		1	1		1						1	3										3				
Camallanus truncatus	4							1		1	1			1					1	1														1		1		
Cucullanellus minutus							1																		1		1									1		
Neoechinorhynchus rutili																																					1	
Echinorhynchus gadi				3		10														1										3	1			1	2		
Acanthocephalus anguillae												1			2		2	2		2															1		1
Acanthocephalus lucii	3	3						1	1	1																	1				1	1		2	1			
Pomphorhynchus kostylewi																																1						
Corynosoma semerme																																			1			