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Parasites of Topmouth Gudgeon *Psudorasbora parva* (Schlegel) in Fish Farms in Bulgaria

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Abstract: There are 26 parasite species on the topmouth gudgeon (stone moroko) in Bulgaria (20 Protozoa, 3 Monogenea, 1 Nematoda, 2 Crustacea). Nonspecific widely spread parasites prevail, of which the most common are trichodinids (11 species). In the parasite fauna, after its acclimatisation in Bulgaria, was established only one species – *Gyrodactylus gobioninum* (Monogenea), transferred with the host from its natural area. Asian parasite *Lerrnaea elegans* was established on it as well, introduced with herbivorous fish to Bulgaria. Main parasites in descending ordnung of topmouth gudgeon as trash fish in fish farms are: *Trichodina rectangli rectangli, T. acuta, Gyrodactylus gobioninum, Trichodina reticulata, Pseudocapillaria tomentosa.* Morphometric data of *G. gobioninum* are supplemented. There has been found an exchange of parasites among stone moroko, artificially cultivated fish and trash fish. The updated global list of parasites of topmouth gudgeon consists of 84 species, of which: Protozoa 40, Monogenea 10, Cestoda 3, Trematoda 16, Nematoda 3, Acanhocephala 6, Bivalvia 1, Crustacea 4, Hirudinea 1.

Key words: *Pseudorasbora parva*, *Gyrodactylus gobioninum, Lernaea elegans,* exchange of parasites, trash fish

Introduction

Stone moroko's natural area is East Asia (China, Korea, Japan). During the acclimatization of herbivorous fish from Far East countries it has been transported unintentionally to many new locations. It is established on all 6 continents except for Antarctida. Originally it was accidentally transferred to Romania directly from China with fish fry in 1962 to Nucet fish farm, Dambovita County, then made its way into Danube, thus spreading throughout Europe.

It probably entered Bulgaria via Danube through the herbivorous fish stock from former USSR. It was first found in the country in Mechka fish farm, near Russe, in 1975 (Marinov 1979), 1976 (Manolov, Sivkov 1977). It later spread almost all over the country (Jancovic, Karapetkova 1992, Karapetkova, Živkov 1995). Now it is one of the most common trash fish species in fish farms.

This article aims to clarify the regularities of climate parasite fauna of stone moroko after acclimatization and its role and importance as trash fish.

Materials and Methods

Studies were initially carried out in two farms (Chelopechene, near Sofia and Bezden). Seasonal dynamics of infection were traced in a model fish farm (Chelopechene) in 1987 and 1988, when 125 live fish specimens were examined. Dimensions are within L = 57 – 102 (Mx = 84) mm. In addition 117 more fish specimens, fixed in 4% formaldehyde solution, were later tested for skin, gill helminths and parasitic crustaceans in four fishfarms (Mechka,

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Krusha, Plovdiv and Pisanets), collected respectively in 1975, 1991 and 1997. Dimensions are L = 42 – 94 (Mx = 75) mm. Research in the model fishfarm was carried out by Dogiel's method of complete parasitological analysis (Bykhovskaya-Pavlovskaya, 1952, Musselius 1983). The intensity of infection with unicellular parasites is defined in relative numbers (on average per one visible field of the microscope, at a magnification of 63 times, reading 20-80 of them, depending on intensity). Morphometric studies of the trichdinids were made by Lom's scheme (Ergens, Lom 1970) and of the Monogenea – by that of Gusev (1962, 1983, 1985). Results of fish infection are processed statistically by ANOVA, qualitative for extensiveness and quantitative for intensity of infection. (Plokhinsky 1970).

Results and Discussion

Parasite fauna of the topmouth gudgeon, as trash fish in Bulgarian fishfarms, consists mostly of widespread parasites in artificially cultivated and trash fish (Table 2). *Gyrodactylus gobioninum* and *Lernanea elegans* are the only two species that make an exception. Both are elements of the Asian parasite fish fauna but came to Europe in different ways. The former was transferred with stone moroko and the latter – with herbivorous fish. As a widespecific parasite it infected it later, too.

Result analysis of the species composition of the parasite fauna of Bulgarian topmouth gudgeon confirms Dogiel's basic environmental rules for changes in the parasite fauna of the host on acclimatization (Dogel 1962, Petrushevskiy 1958, Bauer 1975), Gvozdev, Agapova 1977, namely : 1.Parasite fauna impoverishment: 2.Removing or reducing the number of specific species: 3.Transfer of species with direct development from the aboriginal fauna, especially monogeneids which are particularly resistant under acclimatization: 4. Building of the parasite fauna of the host at the new location from local widespread species.

When comparing the number of parasite species by systematic groups of stone moroko, after acclimatization in Bilgaria with those in literature for its natural habitat, the following major conclusions may be drawn: 1. The number of species of protozoan parasites increases. 2. Approximately half of the unicellular parasites of the topmouth gudgeon after the introduction are trichodinids. 3. The number of biohelminths in the parasite fauna of the host is greatly reduced.

Finding *Gyrodactylus gobioninum* on stone moroko in Bulgaria, which is typical for Asian fish parasite fauna, is of particular interest. Its specificity and hosts are still open to discussion. Gussev (1955) described it from the Amur and Mo rivers and Hank lake for 6 species, including stone moroko, that belong to 6 genuses (*Hermibarbus*, *Pseudorasbora*, *Chilogobio*, *Sarcochichtys*, *Pseudogobio* and *Rostrogobio*). Gusev found differences between specimens of the parasite coming from different hosts. Due to insufficient material (1-3 specimens from each host) and mostly because of the considerable similarity between them, he temporarily attributed them to one species, regarding the specimens of *Pseudogobio rivularis* as typical for the whole species (Gussev 1955). Later on the same author (Gussev 1962) takes a similar view of taxonomic situation, specificity and parasite host range. Bykhowsky (1957), Malmberg (1970, by Gläser 1974) was willing to accept *Gyrodactylus gobioninum* as a assembly species. Ergens (1973) redescribes *G. gobionium* on the basis of scarce material (1 sintype). Their varietal origin can only be established with a large quantity of research subjects, as well as in studying the morphometric variability of *G. gobionium*. In this connection, the same author (Ergens, 1985) only points *Abottina rivularis* as the sole host of *G. gobionium*. It should be noted that the publications concerning the issue of *G. gobionium* hosts do not discuss finding the species in Czechoslovakia in the following fish species: *Gobio gobio* (Ergens 1959a, 1962a, Zitnan 1964 f, 1965b, 1966a), *Gobio albipinnatus* (Zitnan 1964f, 1965b, 1966a), *Gobio kessleri* (Zitnan 1966, in Moravec 2001) and in *Barbus meridionalis* in Albania (Ergens 1960).

In contemporary studies of multiple materials of common gudgeon in the Czech Republic has not been found *G.gobioninum* (Blazek et al., 2008). The most recent reports of finding *G. gobioninum* of stone moroko come from Kazakhstan (Gvozdev, Karabekova 2001) and China (Wu Bao-Hua *et al*., 1991, in Gibson 2003).

The question of the origin of *G. gobionium* is also open to discussion. Some authors take it to be an

Table 1. Measurement (mm) of chitinoid haptor parts of *G. gobioninum.*

Morphological data	n	min – max
Overall length of anchors	41	0.052 – 0.060
Length of basal part	41	0.038 – 0.045
Length of inner part	41	0.015 – 0.020
Length of point	11	0.023 – 0.028
Length of principal connecting part	36	0.006 – 0.008
With principal of connecting part	29	0.023 – 0.028
Length of membrane	7	0.013 – 0.018
Length of auxiliary bar	18	0.002 – 0.003
With of auxiliary bar	12	0.018 – 0.025
Overall length of marginal hooks	41	0.024 – 0.027
Length of hooklets	41	0.005 – 0.006

Table 2. Checklist of the parasites of the host with localization according to seasons.

Parasites	Spring	Summer	Autum
Cryptobia branchialis Nie in Chen,1955	g		g
Ichthyobodo necator (Henneguy,1883)	s, g	s, g	s, g
Chilodonella hexasticha (Kiernik,1909)	s	g	g
Chilodonella piscicola (Zacharias,1894)	s, nc		
Amphileptus branchiarum Wenrich,1924	g		
Ichthyophthirius multifiliis (Fouquet,1876)	s, g		
Tetrahymena pyriformis (Ehrenberg,1830)	s, g		
Apiosoma sp.	s		s, g
Epistylis sp.	s,g	s	s, g, nc
Trichodina reticulata Hirschmann et Partsch,1955	s, g	s, g	s, g
Trichodina nobilis Chen,1963		s	
Trichodina acuta Lom,1961	s, g	s	s, g
Trichodina nigra Lom,1961	s	s	
Trichodina rectengli rectangli Chen et Hsien,1964	nc	nc	nc
Trichodina cobitis Lom,1960		s	
Paratrichodina incisa (Lom,1959)	g		
Tripartiella copiosa Lom,1959	g	g	
Tripartiella lata Lom,1953	g	g	
Tripartiella obtusa Ergens et Lom 1970	g	g	
Trichodinella epizootica (Raabe,1950)	g	g	g
Gyrodactylus gobioninum Gusev,1955	g, f, s, cn	g, s, f	f, s
Gyrodactylus cyprini Diarova, 1964	g		
Gyrodactylus katharineri Malmberg, 1964	s, g		
Pseudocapillaria tomentosa (Dujardin, 1843)	i	i	i
Lernaea elegans Leigh-Sharpe, 1925		s, f	
Lernaea sp. larvae			g
Argulus japonicus Thiele, 1900		s	

s-skin g-gills f-fins nc-nasal cavity i-intestine

Table 3. Seasonal and total infection with parasites of *Pseudorasbora parva* in fish farm Chelopechene.

Parasites	Spring		Summer		Autumn		Total	
	ext.	int.	ext.	int.	ext.	int.	ext.	int.
Cryptobia branchialis	3.6	0.05			2.7	0.60	2.3	0.30
Ichthyobodo necator	14.3	0.10	19.0	0.08	13.5	0.06	15.1	0.30
A.branchiarum	10.7	0.01					3.5	0.01
Chilodonella hexasticha	10.7	0.06	4.8	0.06	2.7	0.05	5.8	0.20
Chilodonella piscicola	10.7	0.20					3.5	0.01
Chilodonella sp.	32.1	0.10	9.5	0.08			12.7	0.10
Tetraymena pyriformis	14.3	0.02					4.7	0.02
I.multifiliis	14.3	0.01					4.7	0.01
Epistylis sp.	7.1	0.04	9.5	0.01	16.2	0.02	11.6	0.02
Apiosoma sp.	28.6	0.03			5.4	0.06	11.6	0.04
Trichodina reticulata	7,1	0,03	57,1	0,02	13,5	0,02	22,0	0,02
Trichodina nigra	7,1	0,05	4,8	0,01			3,5	0,04
Trichodina acuta	78,6	0,30	23,8	0,03	48,6	0,05	52,3	0,20
T.rectangli rectangli	7,1	0,20	28,6	0,20	62,2	0,10	56,9	0,20
Trichodina nobilis			4,8	0,01			1,2	0,01
Trichodina cobitis	3,6	0,20	4,8	0,01			2,3	0,09
Paratrichodina incisa	7,1	0,03					2,3	0,03
Tripartiella copiosa	7,1	0,10	4,8	0,05			3,5	0,09
Tripartiella lata	5,4	0,01			5,4	0,01	3,6	0,01
Tripartiella obtusa	3,6	0,10	28,6	0,95			8,6	0,80
Trichodinella epizootica	14,3	0,07			16,2	0,10	11,6	0,08
Gyrodactylus cyprini	2,1	1,00					0,8	1,0
G. gobioninum	23,4	12,1	61,9	10,2	34,5	3,40	34,9	5,1
G. katharineri	23,4	1,4					8,9	1,4
P. tomentosa	10,6	2,6	33,3	1,6	23,6	4,6	20,3	3,4
Lernaea elegans					3,6	1,5	1,6	1,5
L. elegans larvae	2,1	1,0			1,8	1,0	1,6	1,0

ext.-extensity (%) of infection int.-intensity of infection

Asian species (Gussev, 1955, 1978: Shulman 1958), others – a holarctic one (Ergens 1960. 1962, 1973, 1985: Ergens 1959a, 1962a, Zitnan 19664f, 1965b, 1966, 1966a, in Moravec 2001), whereas still others – of unknown origin (Strelkov, Shulman 1971). To our mind the second opinion is not very convincing for the following reasons: Over the past few decades the parasite has not been found in Europe in other fish species but the topmouth gudgeon. Specific parasite fauna of gudgeons, including stone moroko, especially monogeneids in their natural areal in East Asia, have sinoIndian origin. Providing *G. gobionium* crossing from one host to another is possible, it would be more likely that it happens from Asia to Europe and not vice versa. This was the way other fish and their specific parasites have spread (e.g. goldfish, gibel carp and the species specific for it from the genus *Dactylogyrus*).

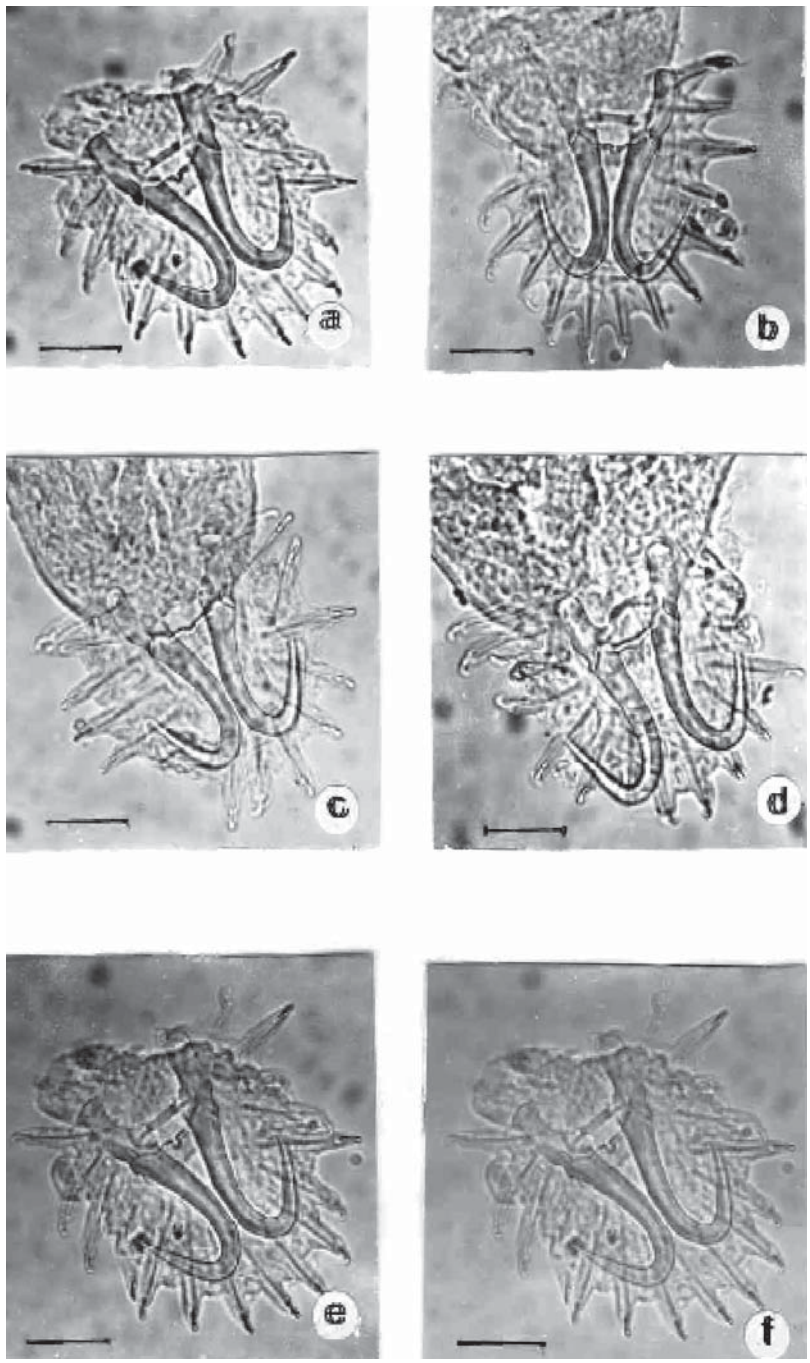

Fig.1. (a-f) – Chitinoid haptor parts of *G. gobioninum*. All adhesive discs are printed to the same scale; bar = 20 μm.

When comparing our own results for *G. gobioninum* with those published so far the following major conclusions can be made:

1. The majority of specimens identified by us from the genus *Gyrodactylus* on stone moroko in fish farms in Bulgaria belong to *G. gobioninum*. *G. katharineri* and *G. cyprini* occur much less frequently (Table 3).

2. The limits of variation of the taxonomic characteristics for the species expand, particularly total length and length of the average of the anchors. (Table 1).

3. Apart from the fins and gills the helminth also infects the body skin and nasal cavity. This complements the information on its localization. (Table 2).

4. *G. gobionium* is one of the main parasites of the topmouth gudgeon as trash fish in fish ponds in Bulgaria. According to general infection (prevalence) it ranks third among them. (Table 3).

5. *G. gobionium* can be referred to warm-loving parasites. Its highest prevalence is observed in summer. (Table 3).

The higher infection of the stone moroko in fish farms, as compared to that under natural conditions and areal, is probably due to the simultaneous operation of two factors: its herd lifestyle and the artificial conditions in the fishfarms.

The species morphologically closest to *G. gobionium* are: *G. gobiensis*, *G.gobii* and *G. parvae.* The latter was described only recently (You et al., 2008). According to the main key morphological characteristics (the hooks, particularly the hooklets and the anchors) they can be divided into two groups: *G.gobii* and *G. parvae* on one side and *G. gobionium* and *G. gobiensis* – on the other. The parasite species from the first group have thick massive hooklets, whereas those of the second one are thinner and more exquisite. Species differentiation can also be made according to the metric values of the various parts of the anchors. These of *G.gobii* and *G. gobiensis* are larger than those of *G. gobionium* and *G. parvae.* According to our observations, upper abdominal bar of hapter of *G.gobioninum* is concave in middle (Fig.1 a-f). This characteristic morphological feature that is seen on light microscope without fazekontrast equipment and with material fixed in formalin. It must be stressed that this sign is indicated in the original description of species by Gussev (1955). However, is not mentioned in the redescription by Ergens (1973), although inclided in the picture (2a).

Finding the Asian parasite *Lernaea elegans* on the stone moroko in Bulgaria is also of particular interest. Regarding natural habitat it has been designated for Korea (Honta *et al*, 1939,.), China (Yin *et al*., 1962, in Nagasava 2007) and Iran (Barzeger, Jalali 2009). These autors consider it synonymous *L.cyprinacaea.* The taxonomic position of both species is still open to discussion. Some expetrs regard them as synonyms, others as independent species. The second group of authors believe that *L. cyrinacea* is highly specific and so infects cruzians, mainly *Carasius carasius*. Unlike it *L. elegans* is widely specific harboured by many artificially bred fresh-water fish: common carp, herbivorous fish, buffalo fish, etc. *L. cyrinacea* is a European parasite, whereas *L. elegans* is considered to be an Asian species. It was brought to Europe with herbivorous fish (Podubnaya 1973, Musselius 1973, Bauer *et al*, 1981). The epizootological observations in fish ponds support this view. In recent decades lerneoza epidemics affect primarily buffalo fish, where there is no balance in the host-parasite system.

After being acclimatized in Bulgaria the topmouth gudgeon has received almost all its parasites from farming and trash fish. It has the following number of common parasites with artificially bred fish: with common carp – 17, with herbivorous fish and tench of 11, buffalo fish 7 and channel catfish 12. With trash fish its common parasites amount to 23 species, of which *Carasius gibelio* – 17, *Lepomis gibbosus* – 14, *Rutilus rutilus* – 12, and *Albumus albumus* – 5. The majority of common species are ubiquitous, widespread parasites.

The topmouth gudgeon is relatively most heavily infected with the following parasites in descending ordnung: *Trichodina rectangli rectangli*, *T. acuta*, *Gyrodactylus gobioninum*, *Trichodina reticulata*, *Pseudocapillaria tomentosa*. Highest infection in spring is observed with *Trichodina acuta*, in summer – with *Gyrodactylus gobioninum*, *Trichodina reticulata*, and *Pseudocapillaria tomentosa*, and in autumn – with *Trichodina rectangli rectangli* (Table 3).

The updated global list of the parasites topmouth gudgeon consists of 84 species, of which: Protozoa 40, Monogenea 10, Cestoda 3, Trematoda 16, Nematoda 3, Acanhocephala 6, Bivalvia 1, Crustacea 4, Hirudinea 1.

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