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Parasite fauna of the Caspian Sea cyprinid fish (Cyprinidae) in near-shore area of the Absheron Peninsula

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Abstract
In 2012-2014 in the near-shore area of the Absheron Peninsula on the border of the Middle and South Caspian 156 cyprinid fishes of 4 species were investigated, and 32 species of the parasites were found, 14 of them were specific for cyprinids. Except of 7 species of monogeneans, all the parasites of cyprinids evolve with the change of hosts. Most of them infect the fish when it eating benthic invertebrates, intermediate hosts of nematodes can be zooplankton organisms too. Roach was infected with 19, kutum with 16, shemaya with 12, and carp with 14 species of parasites. Between the parasite fauna of 4 fish species was not too high similarity (26.1-54.6%), because every fish species had its own specific parasites. Differences in the parasite fauna of the various fish species are mainly connected with peculiarities of their life-style and food compositions.

Keywords: caspian sea, fish, cyprinids, parasite.

1. Introduction
The Absheron Peninsula is located on the border of the Middle and South Caspian, its coastal waters are quite shallow, the depth of water is approximately 5-6 m at a distance of 1 km from the coast and about 20-25 m at a distance of 5 km from the coast. Water salinity here is about 13 ‰, and in this regard in this area of the sea only typical marine and anadromous fish inhabited. The latter include, in particular, Caspian roach – *Rutilus rutilus caspius* (Yakowlev, 1870), kutum – *R. frisii kutum* (Kamensky, 1901), shemaya – *Chalcalburnus chalcoides* (Güldenstaedt, 1772) and carp – *Cyprinus carpio* Linnaeus, 1758, which are important commercial fishes. All of these fish mainly feed on benthic organisms, but in the diet of shemaya the components of the zooplankton has an important place and carp eats also plants. Although data on the parasites of the cyprinids of the Caspian Sea fish were contained in some references [1, 2, 3, 4, 5, 6, 7], till our researches parasites of these fish near-shore area of the Absheron Peninsula absolutely were not studied.

2. Materials and methods
In 2012-2014, in shallow-waters of the Caspian Sea on the seven points of near-shore area of the Absheron Peninsula by the method of complete parasitological dissection surveyed 156 cyprinid fish (Cyprinidae) of four species: Caspian roach, kutum, shemaya and carp. The points of the study were located as follows: point 1 – near the city of Sumgait, point 2 – near Pirshagi town, point 3 – near Bilgah town, point 4 – in warm water canal of "Janub" power plant, point 5 – near Housan town, point 6 – in the Baku Bay, point 7 – near Bibiheybat town (shown in Fig.). Autopsies of fish, collecting, fixing, painting and diagnostics of parasites were carried by the standard technique [8]. For the assessing of infection quantity the extensiveness of infestation (the percentage of infected specimens in the total number of fish examined) and the intensity of infestation (the number of parasites of one species in a single fish) were used. For an objective assessment of the similarities and differences in the fish parasite fauna of various reservoirs the formula of Czekanowski-Sorensen [9, 10] was used.

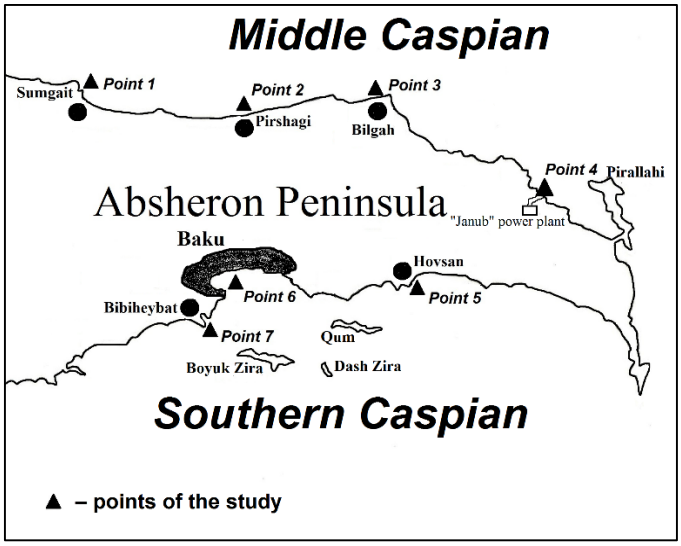

Fig: The location of points of the study.

3. Results and discussion
As a result of this research 32 species of parasites from following taxonomic groups were found: flagellates – 1, myxosporeans – 8, ciliates – 1, monogeneans – 7, aspidogastrea – 1, trematodes – 9, nematodes – 4, acanthocephalans – 1. Roach was infected with 19, kutum – with 11, shemaya – with 12, carp – with 14 species of parasites. Below a taxonomic review of all found parasites, also hosts, infection rates and detection points are shown. As in common practice of parasitological researches of fish, for the parasitic protozoa only extensity of infestation (%), for all other parasites – extensity (%) and intensity of infestation (specimens) are given.

Class FLAGELLATA
Family BODONIDAE Stein, 1878
Cryptobia borelli (Laveran et Mesnil, 1901). Host: Caspian roach (2.1%); localization: bloodstream; sampling point: 1.
Class MYXOSPOREA

Family MYXIDIIDAE Thelohan, 1892
Myxidium rhodei Leger, 1905. Host: Caspian roach (6.2%); localization: kidneys; sampling point: 7.
Family MYXOSOMATIDAE Poche, 1913
Myxosoma circulus (Achmerov, 1960). Host: Caspian roach (6.1%); localization: kidneys, spleen; sampling point: 1.
Family MYXOBOLIDAE Thelohan. 1892
Myxobolus bramae Reuss, 1906. Hosts: Caspian roach (34.3%), shemaya (26.2%), carp (31.7%); localization: gills, kidneys, spleen; sampling points: 1, 2, 3, 4, 6, 7.
M. cyprini Doflein, 1898. Hosts: Caspian roach (10.4%), kutum (28.9%), carp (7.3%); localization: gills, kidneys, spleen, gallbladder; sampling points: 2, 7.
M. diversicapsularis Sluchai in: Schulman, 1966. Host: carp (4.9%); localization: gills, urinary bladder; sampling point: 7.
M. muelleri Butschli, 1882. Hosts: Caspian roach (34.2%), kutum (15,2%), shemaya (23.8%), carp (24.4%); localization: gills, subcutaneous connective tissue, kidneys, urinary bladder; sampling points: 1, 2, 4, 5, 6, 7.
M. musculi Keyserlitz, 1908. Host: shemaya (14.6%); localization: gills, muscles, brain, kidneys, spleen; sampling points: 5, 7.
M. pseudodispar Gorbunova, 1936. Hosts: Caspian roach (20,4%), kutum (13.2%), carp (19.5%); localization: gills, muscles, kidneys, urinary bladder; sampling points: 1, 2, 3, 7.
Class PERITRICHA
Family TRICHODINIDAE Claus, 1874
Trichodina jadranica Raabe, 1958. Host: shemaya (6.5%); localization: gills, surface of body and fins; sampling points: 4, 5, 6, 7.
Class MONOGENEA
Family DACTYLOGYDIDAE Bychowky, 1933
Dactylogyrus chalcalburni Dogiel et Bychowsky, 1934. Host: shemaya (26.2%; 1-19 specimens); localization: gills; sampling points: 1, 7; *D. crucifer* Wagener, 1857
Host: Caspian roach (28.6%; 2-23 specimens); localization: gills; sampling point: 1, 7.
D. frisii Bychowsky, 1933. Host: kutum (65.8%; 4-39 specimens); localization: gills; sampling point: 1, 3, 4, 5, 7.
D. nybelini Markewitsch, 1933. Host: kutum (41.2%; 3-18 specimens); localization: gills; sampling point: 1, 5, 7.
D. turaliensis Aligadziev, Gussev et Kazieva, 1984. Host: Caspian roach (56.3%; 6-46 specimens); localization: gills; sampling points: 1, 2, 3, 6, 7.
Family DIPLOZOIDAE Palombi, 1949
Paradiplozoon chazaricum (Mikailov, 1973). Hosts: kutum (7.9%; 1-2 specimens); localization: gills; sampling points: 1, 6, 7.
P. homoion (Bychowsky et Nagibina, 1959). Host: Caspian roach (2.1%; 2 specimens); localization: gills; sampling point: 7.
Class ASPIDOGASTREA
Family ASPIDOGASTRIDAE Poche, 1907
Aspidogaster limacoides Diesing, 1835. Hosts: Caspian roach (6.3%; 1-3 specimens), kutum (2.6%; 2 specimens), carp (2.4%; 1 specimen); localization: intestine; sampling points: 1, 2.
Class ТРЕМАТОДЫ
Family HAPLOPORIDAE Nicoll, 1914
Asymphylodora kubanica Issaitschikoff, 1923. Hosts: kutum (7.9%; 1-5 specimens), shemaya (2.4%; 2 specimens), carp (2.4%; 1 specimen); localization: intestine; sampling points: 1, 2.
Family ALLOCREADIIDAE Loss, 1902
Sphaerostoma bramae Mueller, 1776. Host: carp (2.4%; 1 specimen); localization: intestine; sampling point: 1.
Family DIPLOSTOMATIDAE Poirier, 1896
Diplostomum chromatophorum (Brown, 1931). Hosts: Caspian roach (22.9%; 2-11 specimens), kutum (17.1%; 1-9 specimens), carp (12.2%; 1-10 specimens); localization: crystalline lens; sampling points: 1, 2, 5, 7.
D. paraspathaceum Schigin, 1965. Hosts: Caspian roach (11.4%; 5-8 specimens), carp (4.9%; 2-7 specimens); localization: crystalline lens; sampling points: 1, 2.
D. rutili Razmaschkin, 1969. Hosts: Caspian roach (5.7%; 2-6 specimens), shemaya (7.1%; 1-5 specimens); localization: crystalline lens; sampling points: 7.
Tylodelphys clavata (Nordmann, 1832).Hosts: Caspian roach (5.7%; 2-4 specimens), carp (2.4%; 4 specimens); localization: crystalline lens; sampling point: 1.
Posthodiplostomum cuticola (Nordmann, 1832). Hosts: Caspian roach (11.4%; 1-9 specimens), kutum (18.5%; 2-6 specimens); localization: muscles, skin; sampling points: 1, 5, 6, 7.
Family CLINOSTOMATIDAE Luhe, 1901
Clinostomum complanatum (Rudolphi, 1819). Hosts: Caspian roach (14.3%; 1-3 specimens), carp (9.8%; 1-4 specimens); localization: muscles; sampling point: 1, 7.
Family HETEROPHYIDAE Odhner, 1914
Ascocotyle coleostoma Looss,1896. Host: shemaya (2.3%; 2 specimens); localization: gills, heart; sampling point: 7.
Class NEMATODES
Family ANISAKIDAE Skrjabin et Karokhin, 1945. *Anisakis schupakovi* Mosgovoy, 1951. Host: shemaya (2.4%; 1 specimen); localization: body cavity; sampling point: 1, 2, 3.
Porrocoecum reticulatum (Linstow, 1890). Host: shemaya (2.4%; 4 specimens); localization: body cavity; sampling point: 1, 3.
Contracaecum microcephalum (Rudolphi, 1819)
Hosts: Caspian roach (8.6%; 2-3 specimens), shemaya (4.8%; 1-2 specimens), carp (2.4%; 1 specimen); localization: serous cover of internal organs; sampling point: 1, 2.
C. spiculigerum (Rudolphi, 1809). Host: каспийский carp (2.4%; 2 specimens); localization: splanchnic walls; sampling point: 1, 3.
Class ACANTHOCEPHALA
Family POLYMORPHIDAE Meyer, 1931
Corynosoma caspicum Golvan et Mokhayer, 1973. Hosts: Caspian roach (5.7%; 3-4 specimens), kutum (5.3%; 1-4 specimens), shemaya (2.4%; 1 specimen); localization: splanchnic walls; sampling point: 1, 2, 3, 4, 5, 6, 7.
Among the parasites, which we found in cyprinid fish in the near-shore area of the Absheron Peninsula, *Cryptobia borelli*, *Myxidium rhodei*, *M. circulus*, *Myxobolus bramae*, *M. cyprini*, *M. diversicapsularis*, *M. musculi*, monogeneans *Dactylogyrus chalcalburni*, *D. crucifer*, *D. frisii*, *D. nybelini*, *D. turaliensis*, *Paradiplozoon chazaricum*, *P. homoion* are parasites of only the fishes of this family. Of these, *D. chalcalburni* is specific for shemaya, *D. crucifer* and *D. turaliensis* – for roach, *D. frisi*, *D. nybelini* and *P. chazaricum* – for kutum.
All four species of cyprinids that we studied, are semi-migratory fishes, which during their spawning period live in freshwater tributaries of Caspian. Juveniles of roach, shemaya and carp after leaving the eggs live in fresh water some period, but fries of kutum almost immediately are carried away by flow into the sea. As a result of stay in fresh water, in the parasite fauna of

cyprinid fish has a typical freshwater species, which include flagellate *Cryptobia borelli*, trematodes *Sphaerostoma bramae, Diplostomum chromatophorum, D. paraspathaceum, D. rutili, Tylodelphys clavata, Posthodiplostomum cuticola, Clinostomum complanatum*, nematodes *Porrocoecum reticulatum, Contracaecum microcephalum, C. spiculigerum*. These parasites make up 34.4% of parasite fauna of cyprinids in our research area.

Of the remaining parasites such species as infusorian *Trichodina jadranica*, myxosporeans *Myxidium rhodei, M. circulus, Myxobolus bramae, M. cyprini, M. diversicapsularis, M. muelleri, M. musculi, M. pseudodispar*, monogeneans *Dactylogyrus chalcalburni, D. crucifer, D. frisii, D. nybelini, D. turaliensis Paradiplozoon homoion, P. chazaricum*, aspidogastrea *Aspidogaster limacoides*, trematodes *Asymphylodora kubanica* and *Ascocotyle coleostoma* cyprinids acquire both in brackishwater and freshwater areas, but the nematode *Anisakis schupakovi* and acanthocephalan *Corynosoma capsicum* – only in brackishwater areas of the Caspian Sea.

Except of 7 species of monogeneans (21.9% of all parasite fauna) all the parasites of cyprinids evolve with the change of hosts. Most of them infect the fish when it eating benthic invertebrates, intermediate hosts of nematodes can be zooplankton organisms too. Trematodes *Diplostomum chromatophorum, D. paraspathaceum, D. rutili, Tylodelphys clavata, Posthodiplostomum cuticola* and *Clinostomum complanatum* on the stage of cercaria actively penetrate into fish. Infection with these trematodes occurs in spatial proximity to the pond bottom or in the thickets of aquatic vegetation were usually live clams, of which overlook cercariae.

Of the remaining parasites with a complex life cycle flagellate *Cryptobia borelli* transferred from one fish to another by leeches; but nematodes, acanthocephalans and flukes (except of the above-mentioned representatives of the genera *Diplostomum, Tylodelphys, Posthodiplostomum* and *Clinostomum*) infect fish when it eating their intermediate hosts.

Due to the fact that kutum spends in fresh water a relatively short time, the share of typical freshwater species (18.2%) in its parasite fauna is significantly less, than in parasite fauna of all cyprinids (34.4%). The proportion of typical freshwater species is very small (8.3%) in parasitofauna of shemaya, which most of its life spends in brackish water areas. However in parasite fauna of roach typical freshwater species make up 36.8%, in the parasite fauna of carp – 36.7%.

Caspian roach, kutum and carp are typical benthophages, but shemaya feeds also on plankton. Therefore in parasite fauna of shemaya only 2 species of trematodes (*Diplostomum rutili* and *Ascocotyle coleostoma*), which infect fish at the bottom or in the thickets of aquatic vegetation, where inhabit mollusks (intermediate hosts of flukes).

Among the studied cyprinids of the Absheron near-shore area, parasite fauna of roach and carp have a greatest similarity (54.6%) by Czekanowski-Serensen. These are benthophages that during the spawning period stay in fresh water quite long time. In the parasite fauna of kutum and carp (48.0%), roach and kutum (46.7%) the resemblance is slightly less. As noted above, kutum remains relatively short time in fresh water, so the proportion of freshwater species in its parasite fauna is less than in parasite fauna other cyprinids. The pairs roach and shemaya (32.3%), shemaya and carp (30.1%), kutum and shemaya (26.1%) follow them according to the degree of similarity.

4. Conclusion

As a result of parasitological researches of 156 cyprinid fishes of 4 species in 2012-2014 in the near-shore area of the Absheron Peninsula on the border of the Middle and South Caspian Sea 32 species of the parasites were found, 14 of them were specific for cyprinids. Except of 7 species of monogeneans (21.9% of all parasite fauna), all the parasites of cyprinids evolve with the change of hosts. Most of them infect the fish when it eating benthic invertebrates, intermediate hosts of nematodes can be zooplankton organisms too. Roach was infected with 19, kutum with 16, shemaya with 12, and carp with 14 species of parasites. Between the parasite fauna of 4 fish species was not too high similarity (26.1-54.6%), because every fish species had its own specific parasites. Differences in the parasite fauna of the various fish species are mainly connected with peculiarities of their life-style and food compositions.

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