Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2017, 7(4), 627–632, doi: 10.15421/2017_170

ORIGINAL ARTICLE

Aquatic macroinvertebrates of the Lower Amu Darya

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Submitted: 13.09.2017. Accepted: 25.11.2017

Total of 50 species of macroinvertebrates have been found in the Lower Amu Darya River. The most diverse and productive assemblages of macroinvertebrates are formed on flooded woody objects, while the most depleted ones occur on washed sand and clay.
Key words: Amu Darya; Central Asia; macrobenthos; communities; river ecology; environmental factors

Introduction

The Amu-Darya is the largest river in Central Asia. In the lower course its width ranges from 400 m to 1.2 km, the depth reaches 10 m, and maximal flow velocity is 0.6-0.8 m/s. The river is characterized by a strong turbidity of water, whose transparency at the flood stage is almost zero. The bottom is predominantly sandy, highly mobile, having variable relief. In the medial zone one can observe clay bottom local sites and pebble and stone islets partially submerged in sand or clay. In rhypal, there are areas of soft silt (especially in small bays without currents), buckwheat and thickets of amphibious vegetation; there are virtually no real macrophytes.
The main watershed of the Amu-Darya is located in the mountainous areas of the Pamir and Hindu Kush (Gorno-Badakhshan Autonomous Region of Tajikistan and Badakhshan province of Afghanistan); it is mainly glacier- and snow-fed. Thus, it undergoes summer floods and winter (January-February) low flow, which is typical for most of Central Asian lowland rivers.
Fauna and assemblages of benthic invertebrates of the Amu Darya have not been adequately studied, despite the fact that many of them are a valuable food resource for the endemic (*Pseudoscaphirhynchus kaufmanni* (Bogdanow, 1874)*, Pseudoscaphirhynchus hermanni* (Kessler, 1877), etc.) and commercial fish species. Sponges (Rezvoj, 1926), mollusks (Lindholm, 1914, Zhadin, 1950), caddisflies (Martynov, 1914), Chironomidae (Pankratova, 1933, 1950, Shilova, 1955; Sagitov, 1971, 1983) of the Lower Amu-Darya were dealt with in a few studies, fragmentary information is also available on mayflies (Kluge, 1987). Nevertheless, general hydrobiological research was conducted only in the Amu Darya delta zone (Dengina, 1957), but exclusively the lake fauna was considered. The purpose of this work is to describe the fauna of macroinvertebrates and their assemblages in the lower course of the Amu Darya.

Materials and methods

Macrobenthos samples were obtained at the Pitnak-Qipchaq site (Fig. 1), from June 22, 2017 to June 27, 2017. Total of 23 samples were collected, both in the river itself and in the additional reservoirs, 17 of them were quantitative. The given characteristics of benthic assemblages are based on quantitative data. Samples of macrobenthos were collected with a spherical scraper with 0.5 mm mesh from all available biotopes up to 1 m depth. Samplings with grabber were taken in deep places from 1.5 to 10 m. One quantitative test corresponded to 5 scoops of soil with a scraper or one scoop with a grabber.
Unfortunately, a considerable freshet (about 1.5 m) prevented a detailed examination of a few biotopes.

Results

In general, the fauna of macroinvertebrates of the Amu Darya is significantly depleted. A total of 50 species are identified. Some of these have been introduced into Central Asian waterbodies over the past 70 years (see Table 1).
The least diverse communities of invertebrates are formed on sandy and clay soils On the clay substrate only single, randomly entered, specimens of chironomids were detected. Apparently, there is no permanent animal population here.

Fig. 1. Pitnak-Qipchaq site with sampling plots

Assemblages of sandy soils. Sand forms the bottom and condenses under a strong current (0.6-0.8 m / s), which makes it difficult to move inside it. Specialized chironomid larvae predominate here; they probably represent a particular undescribed genus, Chironomini gen? l. *amudarjensis* sensu Pankratova, 1980 (60-100% of the total abundance). The subdominants are the psammorheophilic larvae of *Macropeza albitarsis* Meigen, 1818 and *Stylurus flavipes liniatus* Bartenef, 1929 represented by first-instar larvae. The total biomass of benthos is quite small and does not exceed 0.2-0.4 g / m^2.

With a decrease in the current to 0.1-0.2 m/s and the appearance of some silting, a number of chironomid larvae join this assemblage. They are endemic *Acalcarella nucus* Pankratova, 1950, *Demicryptochironomus vulneratus* (Zetterstedt, 1838), *Harnischia* sp. In this case, the first species goes becomes dominant, amounting to 40% of the total abundance.

Assemblages of muddy soils. Invertebrate complexes associated with silt are more species-rich; however, chironomid larvae (*Tanypus vilipennis* (Kieffer, 1918) constituting 25-60% of the total abundance, *Paramerina* sp. and others) remain the most abundant group. There are also the mayflies *Caenis* spp. (the most common is *Caenis pseudorivulorum* Keffermüller, 1960), as well as the larvae of the horseflies (Tabanidae: *Chrysops* sp.) and the biting midges (Ceratopogonidae: *Palpomyia* sp.) here. Local high numbers (100 and more specimens/m^2) are reached by the sludge worms *Branchiura sowerbyi* Beddard, 1892 occupying a dominant position in the community.

In flow of slower current, above the muddy soils, one can foind numerous flocks of Mysidae comprised of the two species of the genus *Paramysis*, *P. intermedia* (Czerniavsky, 1882) and *P. kessleri* (Grimm, 1875). These are adventive species introduced into the Amu-Darya (and into other waterbodies and watercourses of Central Asia) in the late 60s and early 70s (Embergenov, Sagitov, 1980). The mysid flocks are quite numerous (20-50 specimens/m^2 and more) and serve as a valuable food resource for many fish species.

Assemblages of rhypal biotopes (shore roots and other mosaic substrates). At a moderate (0.1-0.3 m/s) current, submerged amphibiotic vegetation is inhabited by actively swimming *Baetis* (*Labiobaetis*) *desertus* (Novikova et Kluge, 1987) previously known only from the Chu River in southern Kazakhstan (Novikova, Kluge, 1987); it constitutes 55-65% of the total abundance. The subdominants are represented by the specific Central Asian *Heptagenia perflava* Brodsky, 1930, previously recorded from the Lower Amu Darya (Kluge, 1987). They are less numerous than the previous species, accounting for 15-35% of the total community. The mayflies *Baetis* (*Nigrobaetis*) *digitatus* Bengtsson, 1912 and chironomids *Polypedilum* spp. occur singly.

With a decrease in the current to 0-0.01 m/s, limnophilic larvae of a few dragonfly species, the mayflies *Cloeon dipterum* Linnaeus, 1761 and the mollusks *Physella acuta* (Draparnaud, 1805) and *Radix auricularia* (Linnaeus, 1758) also join this biotope. Furthermore, the beetles, *Aulonogyrus concinnus* Klug, 1834 and *Gyrinus distinctus* Aubé, 1864, form local large concentration in the rhypal zone.

Table 1. Species of invertebrates found in the Lower Amu Darya

Number	Вид	Biotope	Records
	Annelida: Oligochaeta: Tubificidae		
1.	*Branchiura sowerbyi* Beddard, 1892	Amu Darya	Firstly recorded
	Mollusca: Gastropoda: Physidae		
2.	*Physella acuta* (Draparnaud, 1805)	Amu Darya; Floodplain lakes	Firstly recorded
	Mollusca: Gastropoda: Lymnaeidae		
3.	*Radix auricularia* (Linnaeus, 1758)	Amu Darya	Lindholm (1914) Zhadin (1950)
4.	*Radix* sp.	Floodplain lakes	Firstly recorded
5.	*Orientogalba viridis* Quoy et Gaimard, 1833	Wet silt near the shore	Firstly recorded
	Mollusca: Gastropoda: Planorbidae		
6.	*Gyraulus albus* (Müller, 1774)	Floodplain lakes	Zhadin (1950)
7.	*Trochorbis* sp.	River sediments	Firstly recorded
	Mollusca: Gastropoda: Succinidae		
8.	*Oxyloma* sp.	Wet silt near the shore	Lindholm (1914)
	Mollusca: Bivalvia: Unionidae		
9.	*Sinanodonta* sp.	Floodplain lakes	Firstly recorded
	Crustacea: Mysidacea: Mysidae		
10.	*Paramysis intermedia* (Czerniavsky, 1882)	Amu Darya	Embergenov, Sagitov (1980)
11.	*Paramysis kessleri* (Grimm, 1875)	Amu Darya	Embergenov, Sagitov (1980)
	Crustacea: Decapoda: Palaemonidae		
12.	*Macrobrachium nipponense* (De Haan, 1849)	Floodplain lakes	Firstly recorded
	Insecta: Odonata: Coenagrionidae		
13.	*Ischnura* spp.	Floodplain lakes	Borisov, Kharitonov (2007)
	Insecta: Odonata: Gomphidae		
14.	*Stylurus flavipes liniatus* Bartenef, 1929	Amu Darya	Borisov, Kharitonov (2008)
	Insecta: Ephemeroptera: Heptageniidae		
15.	*Heptagenia perflava* Brodsky, 1930	Amu Darya	Kluge (1987)
	Insecta: Ephemeroptera: Baetidae		
16.	*Baetis* (*Labiobaetis*) *desertus* Novikova et Kluge, 1987	Amu Darya	Firstly recorded
17.	*Baetis* (*Nigrobaetis*) *digitatus* Bengtsson, 1912	Amu Darya	Firstly recorded
18.	*Cloeon dipterum* (Linnaeus, 1761)	Amu Darya	Sagitov, (1983)
	Insecta: Ephemeroptera: Caenidae		

19.	*Caenis macrura* Stephens, 1835	Amu Darya	Firstly recorded
20.	*Caenis pseudorivulorum* Keffermüller, 1960	Amu Darya	Firstly recorded
21.	*Caenis robusta* Eaton, 1884	Amu Darya	Firstly recorded
	Insecta: Heteroptera: Nepidae		
22.	*Ranatra unicolor* Scott, 1874	Floodplain lakes	Kanyukova (2006)
	Insecta: Coleoptera: Dytiscidae		
23.	*Hydroglyphus geminus* (Fabricius, 1792)	Floodplain lakes	Known for Uzbekistan Nilsson (2001)
	Insecta: Coleoptera: Noteridae		
24.	*Noterus clavicornis* (De Geer, 1774)	Floodplain lakes	Known for Uzbekistan, Nilsson (2011)
	Insecta: Coleoptera: Gyrinidae		
25.	*Aulonogyrus concinnus* (Klug, 1834)	Amu Darya	Known for Uzbekistan, Mazzoldi (2003)
26.	*Gyrinus distinctus* Aubé, 1864	Amu Darya	Known for Uzbekistan Mazzoldi (2003)
	Insecta: Coleoptera: Hidrophilidae		
27.	*Laccobius decorus* Gyllenhal, 1827	Floodplain lakes	Known for Uzbekistan (Hansen, 1999)
	Insecta: Coleoptera: Elmidae		
28.	*Potamophilus acuminatus* (Fabricius, 1792)	Amu Darya	Known for the adjacent regions of Turkmenistan Kirejtshuk (2001)
	Insecta: Coleoptera: Hydraenidae		
29.	*Ochthebius* sp.	Floodplain lakes	A few species of the genus are known from the Amu Darya Basin Jäch (2004)
	Insecta: Trichoptera: Hydropsychidae		
30.	*Hydropsyche* sp.	Amu Darya	A few species of the genus are known from the Amu Darya Basin (Martynov, 1914)
	Insecta: Trichoptera: Leptoceridae		
31.	*Ylodes internus* (McLachlan, 1875).	Amu Darya	Martynov (1914)
	Insecta: Diptera: Chironomidae		
Orthocladiinae			
32.	*Orthocladius* sp.	Amu Darya	Firstly recorded
33.	*Rheocricotopus* sp.	Amu Darya	Firstly recorded
Chironominae			
34.	*Acalcarella nucus* Pankratova, 1950	Amu Darya	Pankratova (1933, 1950); Shilova (1950)
35.	Chironomini gen? l. *amudarjensis* sensu Pankratova, 1980	Amu Darya	Pankratova (1933, 1950);

36.	*Demicryptochironomus vulneratus* (Zetterstedt, 1838)	Amu Darya	Firstly recorded
37.	*Endochironomus* cf. *stackelbergi*	Amu Darya	Firstly recorded
38.	*Harnischia* sp.	Amu Darya	Pankratova (1933)
39.	*Polypedilum scalaenum* group	Amu Darya	Sagitov, (1983); Shilova (1950)
40.	*Rheotanytarsus* sp.	Amu Darya	Pankratova, (1933)
Tanypodinae			
41.	*Paramerina* sp.	Amu Darya	Firstly recorded
42.	*Tanypus vilipennis* (Kieffer, 1918)	Amu Darya	Firstly recorded
43.	*Thienemannimyia* sp.	Amu Darya	Firstly recorded
	Insecta: Diptera: Ceratopogonidae		
44.	*Macropeza albitarsis* Meigen, 1818	Amu Darya	Pankratova (1933)
45.	*Palpomyia* sp.	Amu Darya	Firstly recorded
	Insecta: Diptera: Simuliidae		
46.	*Psilocnetha* sp.	Amu Darya	Firstly recorded
	Insecta: Diptera: Limoniidae		
47.	*Erioptera* sp.	Amu Darya	Firstly recorded
	Insecta: Diptera: Tabanidae		
48.	*Tabanus* sp.	Amu Darya	Sagitov, (1983);
	Bryozoa: Plumatellida: Plumatellidae		
49.	*Plumatella* sp.	Amu Darya	Firstly recorded
	Bryozoa: Ctenostomata: Victorellidae		
50.	*Victorella* sp.	Amu Darya	Firstly recorded

Xylophilous assemblages. Benthic communities forming on the current (from 0.3 m/s) on flooded wood objects, bushes and branches of riparian plants reach the largest total biomass. Larvae of the caddisflies *Hydropsyche* sp. (300-400 specimens/m^2, up to 80% of the total abundance in a sample), *H. perflava*, chironomids *Orthocladius* spp dominate here. The xylophilous beetles *Potamophilus acuminatus* (Fabricius, 1792) and caddisflies *Ylodes internus* (McLachlan, 1875) occur singly but quite regularly. In the area where the river runs near the ridge of Karatau, filter-feeding simulid larvae *Psilocnetha* sp. begin to contribute to this community. In Central Asia these insects are also known from the Syr Darya (South Kazakhstan) (Iankovskiy, Koshkimbaev, 1988). It is not entirely clear why they do not live upstream.

According to local residents, during low water this biotope is inhabited by the large shrimp *Macrobrachium nipponense* (De Haan, 1849) which was introduced in the Amu Darya in the 70s. We observed it only in the reservoirs of the Amu-Darya floodplain.

The surface of driftwood and other submerged wood objects is overgrown with colonies of bryozoans, mainly of the genera *Plumatella* and *Victorella*, and with the oligochaetes *Nais* spp. when silting.

Due to the significant freshet, we were unable to examine in detail the population of stony substrates. Small parts of the rocky ground were met by us only in the district of the village Pitnak. It was inhabited by larvae of caddisflies of the genus *Hydropsyche* and the chironomid larvae of the genus *Rheotanytarsus*. Apparently, population of this biotope is in fact significantly richer. Probably for the same reason, in our collections there are no known for the region rheophilic caddisflies *Neureclipsis bimaculata* (Linnaeus, 1758) (Martynov, 1914), mayflies *Oligoneuriella*, a number of chironomids (Sagitov, 1971, 1983), and sponges (Rezvoj, 1926).

Wet silt along the water's edge is inhabited by the amphibiotic amber snails *Oxyloma* and *Succinea*, less often by the pond snails *Orientogalba viridis* Quoy et Gaimard, 1833. Various larvae of dragonflies (for example, numerous larvae *Anax* spp.), Noteridae, Dytiscidae, large bivalve mollusks *Sinanodonta*, gastropods *Gyraulus*, *Radix* and *Trochorbis* have been found in floodplain waterbodies. A complete list of organisms from the Amu Darya floodplain waterbodies is shown in Table 1.

Thus, the fauna of macroinvertebrates of the Lower Amu Darya River is rather depleted: only 50 species have been found. The reasons of this phenomenon are: 1) the predominance of fine sand among the bottom grounds; it is inconvenient for attachment, 2) general deficiency of organic food resources, 3) high turbidity of the river's waters (the suspended particles

settle on the respiratory organs of animals, making breathing difficult). The richest communities of macroinvertebrates, in terms of both abundance and biomass, are formed on flooded woody objects, while the most depleted ones occur on washed sand and clay.

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Citation:

Palatov, D.M., Rajabov, Z.P. (2017). Aquatic macroinvertebrates of the Lower Amu Darya. *Ukrainian Journal of Ecology, 7*(4), 627–632.