

Sakhalin–Kurile Species of Pearl Mussels (Bivalvia: Margaritiferidae) from Transbaikalye

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ABSTRACT

Two species of pearl mussels, *Dahurinaia (Kurilinaia) laevis* и *D. (K.) zatravkini*, inhabiting fresh waters of Sakhalin, South Kurile and Japan Islands, were found in the upper Amur River drainage basin (Transbaikalye). Considerable likeness of morphological and morphometric shell characters with island species is shown. The problem of ancient origin of pearl mussels of Transbaikalye is discussed.

Keywords: pear mussel, Transbaikalye.

Introduction

Transbaikalye is a region with the extremely complicated geological history of the territory transformation of tectonic and climatic nature. Origin, formation and current distribution of the Transbaikalian malacofauna are associated with the relief and hydrographic systems transformation from the middle Jurassic to low Cretaceous and from the Pliocene to Pleistocene (Klishko, 1998, 2001). However, until recently its species composition has been poorly studied, and information about large bivalves on the territory of Transbaikalye is incomplete (Zatravkin, Bogatov, 1987; Klishko, 2000, 2001, 2003). According to Klishko (2006a), 36 species of naiads from two families and 11 genera have been found in Transbaikalye.

The present paper presents morphological descriptions of two species of pearl mussels *Dahurinaia laevis* (Haas, 1910) and *D. zatravkini* Bogatov, Prozorova et Starobogatov, 2003 belongin to the subgenus *Kurilinaia* and found in the rivers of Transbaikalye. These pearl mussels of Transbaikalye slightly differ by conchological characters from the

same species from Sakhalin, Kurile, and Japan Islands.

Malacologists have no consensus yet on the generic taxonomy of Asian pearl mussels. According to Russian scientists, 12 species of margaritiferids from two genera (*Dahurinaia* Starobogatov, 1970 and *Kurilinaia* Zatravkin et Bogatov, 1989) inhabit the Far East of Russia (Bogatov, 2001 Bogatov *et al.*, 2003; Starobogatov *et al.*, 2004). According to Smith (2001a, b), the genus *Dahurinaia* should be regarded as a junior synonym of the genus *Margaritinoopsis* Haas, 1913. Japanese malacologists (Kondo and Kobayashi, 2005) refer the island pearl mussels to two species of the genus *Margaritifera* Haas, 1910. Nevertheless, *Margaritifera* with rudiments of lateral teeth (species of subgenus or genus *Kurilinaia*) are acknowledged to be more archaic and have been widespread in Asia in the geological past (Kolesnikov, 1980). At present they are known only from the rivers of the South Kurile, Sakhalin, Hokkaido, and Honshu Islands and Kamchatka Peninsula (Bogatov *et al.*, 2003; Starobogatov *et al.*, 2004). The new findings of *Dahurinaia laevis* and *D. zatravkini*, survived as relicts in the upper Amur River drainage basin (Transbaikalye), are of special scientific interest.

Received Jul 3, 2009; Accepted Aug 31, 2009
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1225-3480/24330

Genus *Dahurinaia* Starobogatov, 1970
Subgenus *Kurilinaia* Zatravkin et Bogatov, 1989
Dahurinaia (Kurilinaia) laevis (Haas, 1910)

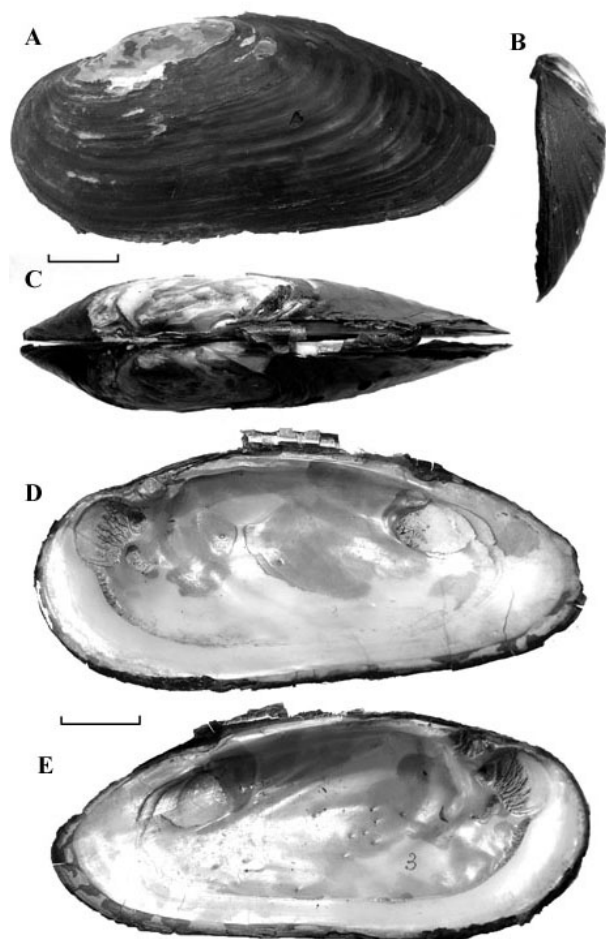


Fig. 1. *Dahurinaia laevis*. Shell: left valve external (A), in front (B), in dorsal view (C); right valve internal (D), left valve internal (E). Scale bar: 1 cm.

(Fig. 1A-E, 2A-E)

Material. 1 shell, Onon River, below the Unda River tributary mouth, the Upper Amur drainage, Transbaikalian region (collected by D.V. Matafonov, 24th June 2004), deposited in Zoological Institute of the Russian Academy of Sciences, St.-Petersburg, No. 1/505-2007 2 fragments of separate valves from Budumkan River, tributary of Argun River, the upper Amur drainage (collected by I.Y. Mikheev, July 2003) and 3 separate valves from Ingoda River, Chita region (collected by O.K. Klishko, September 2005) deposited in the Institute of Natural Resources, Ecology and Cryology, Siberian Branch of the Russian Academy of

Sciences, Chita.

Dimensions (mm). Shell No. 1/505-2007: length - 137.8, height - 66.6, width - 34.6; sizes of 3 separate valves: length - 100.2, 92.0 and 73.3, height - 50.5, 46.0 and 35.6, width - 12.8, 11.9 and 9.2.

Description. The shell is large, elongated, oval-cuneiform, moderately convex, thick-wall, with the curved dorsal border and slightly concave ventral border (Fig. 1A-C). Periostracum is dark-brown, with clear smooth growth lines. The anterior margin of the shell is rounded, the posterior one is elongated and narrow-rounded on the edge. Ligament is well-developed. The wing is low, its apex is located 0.68 of its length from the shell front margin. The umbones are corroded, weakly protruding over the dorsal margin, they are remote from the anterior shell margin by 0.28 of its length. The nacre is bluish white with large olive-violet spots. Anterior adductors muscle scars are deep and wrinkled posterior adductors muscle scars are less deep, but well pronounced and smooth, but in the right valve - with a small area of wrinkles (Fig. 1D-E). The anterior tooth of the right valve is high, massive with the round and dented apex. Its upper surface is covered by deep grooves, the lower one is round, smooth (Fig. 2A-D). The anterior teeth of the left valve are triangular-pyramidal, well developed, denticulated. Vallecule between a high inner and small external tooth is covered by well-pronounced, radial grooves (Fig. 2E). Rudimental posterior lateral teeth (by one in each valve) are as long and curved ridges.

Remarks. Shells from Transbaikalie differ from typical *Dahurinaia laevis* from Sakhalin Island by morphology of the anterior tooth of the right valve and the presence of only one lateral reduced tooth in the left valve.

2. *Dahurinaia (K.) zatrovkini* (Bogatov, Prozorova et Starobogatov, 2003)
(Fig. 3A-E)

Kurilinaia zatrovkini Bogatov, Prozorova et Starobogatov, 2003, 49-50, Fig. 4B, F.

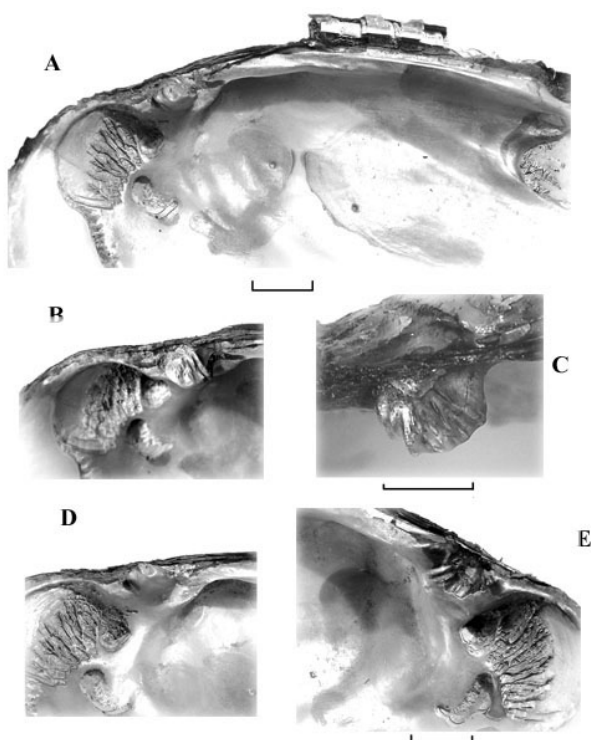


Fig. 2. *Dahurinaia laevis*. Morphology of teeth and muscles scars: anterior tooth and adductor scar of right valve (A), anterior tooth external (B), in dorsal view (C), in ventral view (D); anterior teeth and adductor scar of left valve (E). Scale bar: 1 cm.

Material. 1 shell, Onon River, in littoral alluvium, nearby the mouth of the Unda River tributary, the upper Amur drainage, Transbaikalian region (collected by D.V. Matafonov, 24th June, 2004), deposited in Zoological Institute of the Russian Academy of Sciences, St.-Petersburg, No. 2/505-2007. Dimensions (mm): length is 142.0, height – 73.3, width – 41.7.

Description. The shell is large, elongated, oval-cuneiform, moderately convex, thick-wall, with the curved dorsal border and slightly concave abdominal border (Fig. 3A-C). The anterior and posterior margins are rounded. The wing is not high, its apex is located 0.67 of its length from the shell front margin. Periostracum is dark-brown with clear, smooth growth lines. The umbones are much corroded, weakly protruding over the dorsal margin, they are remote from the shell front margin by 0.26

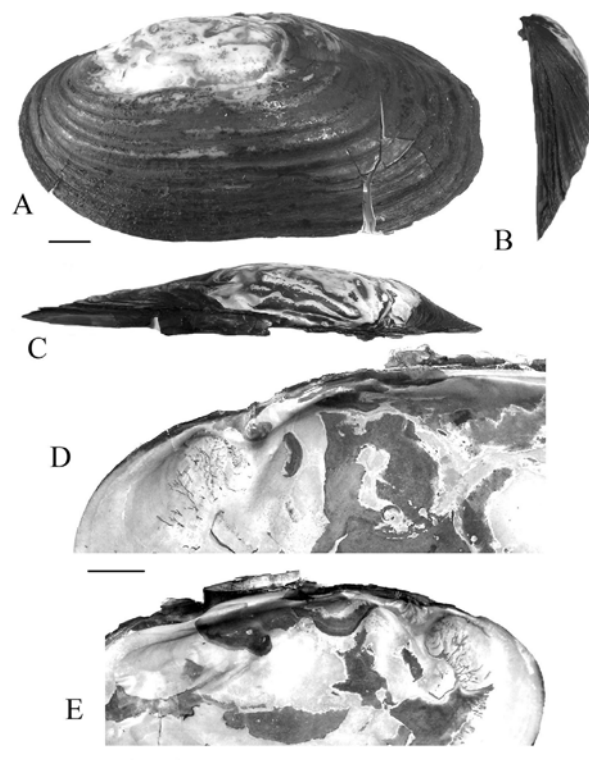


Fig. 3. *Dahurinaia zatravkini*. Shell: left valve external (A), in front (B), in dorsal view (C); anterior tooth and adductor scar of right valve (D), teeth and adductor scar of left valve (E). Scale bar: 1 cm.

of its length. The nacre is pink-white-blue with large olive-brown spots. Anterior adductors muscle scars are deep, round-earlike, with wrinkles. The posterior adductors muscle scars are less deep, smooth. The anterior tooth of the right valve is high, with narrow round and weakly dented apex (Fig. 3D). The anterior teeth of the left valve are triangular, well-developed, valliculate. The inner tooth is much larger than the external one (Fig. 3E). Posterior lateral teeth are as rudimental ridges.

When comparing the relations of pearl mussels' shell parameters found in Transbaikalye with the material of island sites, their rather considerable likeness can be marked (Table 1).

Discussion

In the Upper Amur drainage, on the territory of Transbaikalye 36 naiad species exist (Klishko, 2006a)

Table 1. Morphometric characters of the shells of *Dahurinaia laevis* and *D. zatravkini*

Species	N	L, mm	W/H	W/L	H/L	Locality
<i>D. laevis</i>	1	137.8	0.519	0.251	0.483	Onon River, Transbaikalye
<i>D. laevis</i> (average values of parameters)	24	85.0	0.516	0.241	0.474	Tym River, Sakhalin Island
<i>D. laevis</i>	2	59.0	0.516	0.271	0.525	Sakhalin Island
<i>D. zatravkini</i>	1	142.0	0.569	0.294	0.516	Onon River, Transbaikalye
<i>D. zatravkini</i> (holotype)	1	74.9	0.572	0.291	0.509	Kunashir Island

Note: N – number of measured shells, L – shell length, H – shell height, W – shell width.

known in the Amur River basin, Primorye Territory rivers and in the north-west Sakhalin Island. In the area of collecting *Dahurinaia laevis* and *D. zatravkini* (the lower stream of Onon River and central stream of Ingoda River), additionally four species of pearl mussels (*Dahurinaia prozorovae* Bogatov et Starobogatov 2003, *D. dahurica* Middendorff 1850, *D. ussuriensis* Bogatov, Prozorova et Starobogatov 2003 and *D. tiunovae* Bogatov et Starobogatov, 1988) and two unionid species (*Middendorffinaia mongolica* (Middendorff, 1851) and *Nodularia middendorffi* (Westerlund, 1890)) have been recorded. Three unionid species, *Cristaria herkulea* (Middendorff, 1847), *Sinanodonta amurensis* Moskvicheva, 1973 and *S. likharevi* Moskvicheva 1973 are often found in the upstream of Onon River.

Hence, Sakhalin-Kurile species of pearl mussels *Dahurinaia laevis* and *D. zatravkini*, found in Transbaikalye (as well as above-mentioned species of naiads from the same habitats), have an interrupted and discontinuous distributional range (Fig. 4).

In Transbaikalye, numerous refuges of benthic species are known (Klishko, 2006b). As an example, one can note the habitat of two species of chironomids of the genus *Prosilocerus* (Diptera, Chironomidae) in Kenon Lake (lake-refugium in the upper Amur River drainage). One of them is *P. akamusi* (Tokunaga) spread in Japan, South Korea and in the south of China, the second - *P. paradoxus* (Lundström) is known in North-West Europe (Sæther and Wang, 1996 Petrova *et al.*, 2003).

Palaeontological researches testify to the probability of relict origin of the described pearl mussels species on the territory of Transbaikalye. On the territory of the East Siberia, in the Lena-Kolyma biogeographical province, genera of *Margaritifera* s.l. and *Ptychorhynchus* are known from the Cretaceous deposits (Kolesnikov, 1980). In the eastern Baikal region (district of Tankhoy Village), «*Margaritana*» *elongata* (Martinson, 1956) was observed in the Neogene and Miocene deposits. The latest findings of fossil pearl mussels in Transbaikalye, *Dahurinaia* cf. *dahurica*, have been registered in the Late-Middle-Neo-Pleistocene alluvial deposits of the Ingoda River (Karasyov, 2002).

Distribution of pearl mussels, which larvae are parasitic on fish, is encouraged by active migration of

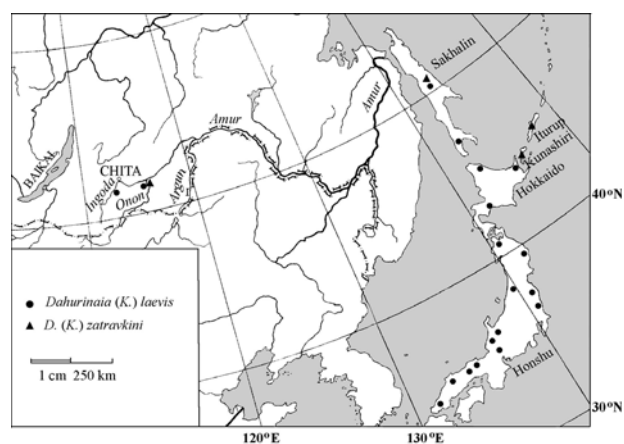


Fig. 4. Site map of the distribution of *Dahurinaia laevis* and *D. zatravkini*.

salmonover river basins. It has been proved that there was a link of Sakhalin Island to the continent and the Lower Amur drainage in the Holocene on the one hand, and on the other hand – the repeated link-up occurred between the southern part of Sakhalin Island, the South Kurile Islands and Japan (Bezverkhny *et al.*, 2002). Linkages between river basins of the continent and islands disappeared in the Pleistocene caused the disintegration of the area into separate parts. In one of them (the upper Amur drainage), the Transbaikalian population of pearl mussels of the subgenus *Kurilinaia* could survive as a relict one.

Indirect confirmation of existence of the river chain between the present basins in the past may be the findings of pearl mussels *D. dahurica* and *D. tiunovae* (Prozorova *et al.*, 2002; Bogatov *et al.*, 2003), known in the whole Amur River basin, including the territory of Transbaikalye, in the northeast of Sakhalin Island. Such patterns also traced in the distribution of two naiad species, *Amuranodonta parva* Moskvicheva, 1973 and *A. sitaensis* Bogatov et Starobogatov, 1996 in the lower Amur River drainage (Starobogatov *et al.*, 2004), northwestern Sakhalin Island (Bogatov, 2001) and lake-refugium Arey on the territory of Transbaikalye (along with five other species of *Amuranodonta*) (Klishko, 2006a).

Acknowledgements

The author expresses sincere thanks to Dr. P.V. Kijashko (Zoological Institute, St.-Petersburg) for consultation and assistance in the study of the collection of pearl mussels. The author is also grateful to D.V. Matafonov for collecting the pearl mussel shells in the Onon River, Dr. A.V. Chernyshev and Dr. K.A. Lutaenko (A.V. Zhirmunsky Institute of Marine Biology FEB RAS, Vladivostok) for critical reading and editing of the paper.

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