Acroloxus Beck (Pulmonata, Acroloxidae) from Hokkaido — new genus and family of freshwater molluscs for Japan

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ABSTRACT. For the first time for Japan freshwater limpets Acroloxus orientalis Kruglov et Starobogatov, 1991 were recorded in the stream of central Hokkaido (Tomakomai city vicinities). Both the genus Acroloxus and family Acroloxidae are for the first time found in Japan. External morphology of shell and soft body as well as copulative apparatus are described. Based on soft body morphology and reproductive system structure, Acroloxus Beck, 1837 was established to form its own family Acroloxidae having significant anatomical differences from other freshwater limpet taxa [Hubendick, 1962, 1964, 1969; Burch, 1962; Brown, 1967; Starobogatov, 1967]. Distinction of acroloxid, ancylid and bulinid limpets is supported by molecular phylogenetic approach as well [Albrecht et al., 2006; Walther et al., 2006].

Acroloxus has an entirely Holarctic distribution. On the basis of the studies of both conchological and anatomical characters it has been demonstrated that Russian acroloxids belong to 18 species, grouped in two subgenera: Holarctic Acroloxus s. str. and southern Far East Amuracroloxus Kruglov et Starobogatov, 1991 [Kruglov, Starobogatov, 1991; Prozorova, 1996; Prozorova, Starobogatov, 1998; Starobogatov et al., 2004].

Previously, freshwater limpets of the genera Laevapex Walker, 1903, Ferrissia Walker, 1903 and Pettancylus Iredale, 1943 were known to occur in central and southern Japan [Kuroda, 1963; Burch, 1964; Habe, Burch, 1965; Higo, Goto, 1993]. No limpets were previously recorded from fresh waters of northern Japan. In late May 2001 on central Hokkaido in the Bibi River (42.75°N, 141.71°E) small molluscs with cap-shaped shells were collected. Bibi River of the Abira river system is the natural river remained in Yufutsu plain in Tomakomai city, Hokkaido. This is secondary-level stream with slow current and aquatic vegetation. Nine found limpet specimens with shell length less than 4 mm were collected from submerged aquatic plants in the river bed. Below are the description and discussion of their taxonomy.

Results and discussion

Morphology of the shells, soft body, and copulative apparatus allowed us to assign Hokkaido limpets to the family Acroloxidae. Acroloxids are distinguished from other limpets by having a dextral body [Hubendick, 1962, 1969 and others] and the apex correspondingly directed to the left (Fig. 1, A, B). Besides, acroloxids have three adductor muscles on the dorsal body surface, with two anterior adductors located on both sides and a posterior one on the right side (Fig. 1, C). The posterior adductor of other families of limpets is located in the middle or on the left side of the dorsal body surface. There are also essential differences in the reproductive system structure. The copulative apparatus of acroloxids consists of a praeputium and penis sheath with a massive glandular appendage at its proximal end, and having a lateral inflowing of the vas deferens into a muscular part (Fig.1, E). The copulative apparatus of Ferrissia, Pettancylus, Laevapex, Ancylus Müller, 1774 and other limpets is of a Bulinidae-like or Planorbidae-like structure [Hubendick, 1962, 1964, 1969; Brown, 1967; Starobogatov, 1967].

On the basis of soft body morphology, Hokkaido acroloxids are attributed to the subgenus Amuracroloxus of the genus Acroloxus. Morphology of Japanese acroloxids corresponds to subgeneric characters given by Kruglov and Starobogatov [1991]. These are as follows: mantle pigmentation on the dorsal body side forms two transverse lines in front of and behind the apex (Fig. 1, C, D); seminal receptacle duct is longer than pro-vagina; penis sheath width is less than that of its glandular appendage and sharply converged to the distal end; sarcobellum is rather developed; velum is visible (Fig. 1, E). All specimens have a horn-shaped protoconch with slight reticular sculpture. Baikalian representatives of the Acroloxus except Acroloxus sp. have very similar protoconch characters [Shirokaya et al., 2009].

Conchologically examined acroloxid specimens fall into two groups that differ in shell height. Five specimens have cap-shaped shells with height equal to 0.26-0.29 of the length and 0.43-0.48 of the width...
Four other specimens have higher shells with height equal to 0.30-0.33 of the length and 0.49-0.54 of the width (Fig. 1, B). These are low shelled and high shelled groups correspondingly. Aperture of all specimens is oval elongate and convergent to the back. Anterior and right slopes of the shell are convex, posterior and left are nearly straight. Distance from anterior margin to the apex (in projection to longitudinal axis of aperture) is 0.70-0.74 of the aperture length and the distance from left margin to the apex (in attitudinal projection) is 0.36-0.40 of the aperture width.

On the basis of listed parameters mollusks from both groups might be identified as *A. orientalis* Kruglov et Starobogatov, 1991. Ecological characters of Japanese acroloxids confirm the species identification as well because *A. orientalis* is known to inhabit the macrophytic vegetation of slow rivers and big lakes.

The species is a rather variable in its shell morphology [Shirokaya et al., 2009]. Typical specimens are characterized by a flattened shell (shell height to width ratio 0.45-0.54), more or less deep undertop concavity, straight posterior slope down undertop concavity, evenly convex right slope, rounded front and back aperture edges [Kruglov, Starobogatov,
A. orientalis inhabits Southern Russian Far East including Sakhalin Island on the east [Kruglov, Starobogatov, 1991; Starobogatov et al., 2004]. Recently the species was found in Lake Baikal drainage area [Prozorova, Zasypkina, 2005] and in shallow bay of eastern Baikal [Shirokaya et al., 2009]. Thus, the range of A. orientalis covers the territory from Baikal to Sakhalin and Hokkaido. It is interesting to note, that neither A. orientalis nor other acroloxids are known from the Kurile Islands close to Sakhalin and Hokkaido [Prozorova, 1996].

References


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**Acroloxus** Beck (Pulmonata, Acroloxidae) на Хоккайдо — новый род и семейство пресноводных моллюсков для Японии

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**РЕЗЮМЕ.** Впервые для Японии в малой реке южного побережья центрального Хоккайдо (окрестности г. Томакомай) отмечены пресноводные моллюски *Acroloxus orientalis* Kruglov et Starobogatov, 1991, что является также первой находкой рода *Acroloxus* и семейства Acroloxidae в целом. Приводятся сведения по внешней морфологии раковины, мягкого тела и строению копулятивного аппарата данных моллюсков.

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