

*Pleuroxus pamirensis* (Werestschagin, 1923) (Crustacea: Cladocera),  
first record for the fauna of Russian Federation

*Pleuroxus pamirensis* (Werestschagin, 1923) (Crustacea: Cladocera),  
первая находка для фауны России

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КЛЮЧЕВЫЕ СЛОВА: Crustacea, Cladocera, новая находка, фауна, Россия.

**ABSTRACT.** This communication provides the first record of *Pleuroxus pamirensis* (Werestschagin, 1923) (Crustacea: Cladocera) from the Russian Federation. It belongs to a unique pair of chydorid species having lateral horns on valves. It differs from closest *P. annandalei* (Daday, 1908) in: (1) postanal teeth predominantly solitary; (2) spine on proximal exopod segment of antenna II longer than half of second segment; (3) seta i on limb I long (as long as seta g of h). Our study has demonstrated that the mountain regions could be regarded as sources for such new findings of the cladocerans even in well-studied countries.

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**РЕЗЮМЕ.** Данное сообщение посвящено первой находке *Pleuroxus pamirensis* (Werestschagin, 1923) (Crustacea: Cladocera) в Российской Федерации. Этот таксон принадлежит к уникальной паре видов хидорид, имеющих боковые роговидные выросты на створках. Он отличается от ближайшего *P. annandalei* (Daday, 1908) по: (1) преимущественно одиночным постанальным зубцам; (2) длинному шипу на проксимальном членике экзоподита (длиннее половина длины следующего членика); (3) длинной щетинкой i на внутренней части первого торакопода (сопоставимой по длине с щетинками g или h). Наше исследование продемонстрировало, что

горные районы могут быть рассмотрены как источник новых находок ветвистоусых ракообразных даже в странах с хорошо изученной фауной.

## Introduction

Unfortunately, taxonomy (being an important direction of biological sciences and basis for all types of biological analysis) is now in a deep crisis [Agnarsson, Kuntner, 2007; Wägele *et al.*, 2011; Vinarski, 2020]. Nowadays we observe a very rapid decline in taxonomists in Western countries, and only some developed countries care about taxonomic studies. Even the interest in molecular biology-based taxonomic studies has recently decreased for many freshwater animal groups.

Fortunately, Cladocera (Crustacea: Branchiopoda) is an exception to this rule. This is a group of microscopic organisms undergoing rapid progress in taxonomy and faunistic studies. New groups of taxonomists have appeared in some developed countries [Eliás-Gutiérrez *et al.*, 2006, 2008; Fuentes-Reines, 2014; Sousa, Elmoor-Loureiro, 2018; Sousa *et al.*, 2021], and a paradoxical situation has emerged: cladoceran fauna of Mexico, Brazil and Thailand are studied more intensively now compared to those of the USA or Canada.

Europe is traditionally the best studied region of the planet with a very long history of animal, including cladoceran, studies [Korovchinsky, 1996; Dumont, Negrea, 2002]. It is also a hub for molecular biological investigations, although the latter are focused primarily on a single genus, *Daphnia* O.F. Müller [Petrušek *et*

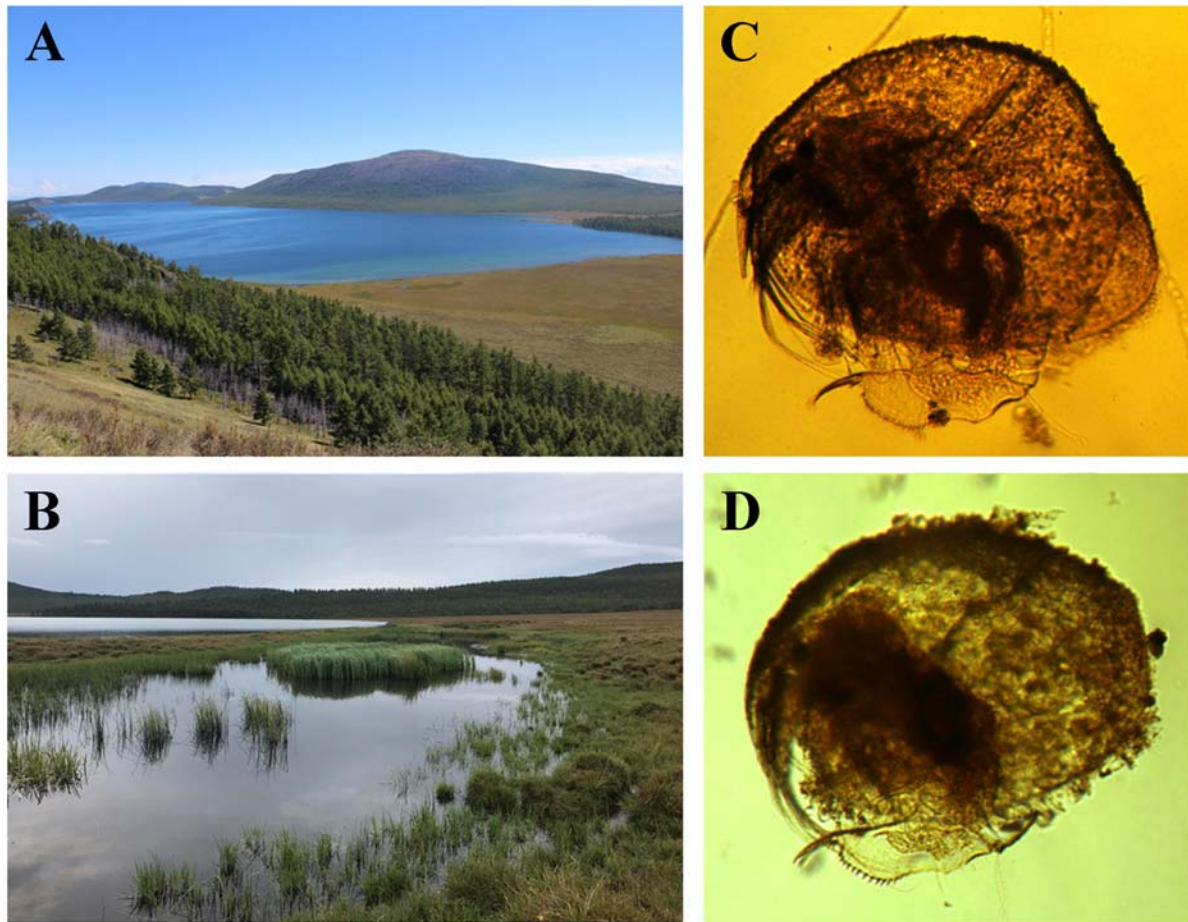


Fig. 1. Water bodies (A–B) where *P. pamirensis* (C–D) was found. A — the north-western shore of Lake Sut-Khol'; B — a shallow pool near Lake Sut-Khol'; C–D — *P. pamirensis*, parthenogenetic female, optical photo. Scale bars: 0.1 mm for C–D.

Рис. 1. Водоёмы (А–В), в которых был найден *P. pamirensis* (С–D). А — северо-западное побережье озера Сут-Коль; В — мелкий водоём около озера Сут-Коль; С–D — *P. pamirensis*, партеногенетическая самка, фотография под оптическим микроскопом. Масштабная линейка: 0,1 мм для С–D.

*al.*, 2008; Thielsch *et al.*, 2017]. More recently, the Far East of Eurasia became another center of intensive morphological and molecular works [Kotov *et al.*, 2012; Ma *et al.*, 2015; So *et al.*, 2015; Xiang *et al.*, 2015; Kotov *et al.*, 2021].

However, less attention is paid to Western Siberia and western portion of Eastern Siberia, a huge territory with millions of water bodies [Pirozhnikov, 1937; Korovchinsky, Dubovskaya, 2014; Kirova, 2021]. Southern Siberia is an especially interesting region: presumable refugia for freshwater fauna were located there during Pleistocene glaciations [Zuykova *et al.*, 2019]. Few endemics are known from this area [Sars, 1903; Zuykova *et al.*, 2013], also some Arcto-Alpine taxa are present in the region [Zuykova *et al.*, 2018; Sinev *et al.*, 2021]. Nevertheless, in general, the fauna of high mountains is studied insufficiently and new findings are possible there.

This short communication provides the first record of *Pleuroxus pamirensis* (Werestschagin 1923) (Crustacea: Cladocera) from the Russian Federation.

## Material and methods

Eleven parthenogenetic females were collected from the northwestern shore of Lake Sut-Khol' (51.52697°; 91.13585°) (Fig. 1A) and a shallow pool (51.52736°N; 91.13432°E) 2–5 m from the shore of the former (Fig. 1B), Alash Nagorie, Western Sayan mountains, Tyva Republic, Russia collected in 22.8.2020. The lake surface is 13.3 km<sup>2</sup>, predominant depths are 15–20 m, maximum depth is 148 m. Littoral zone is expressed in the northwestern shore, its width is 15–20 m, and *P. pamirensis* was found there, on a muddy bottom. The water was fresh, with mineralization of 0.16 g/l, pH 7.84, water temperature at time of sampling was 14 °C. The closest shallow pool had 9 m in length, width of 3–5 m, muddy bottom and a developed macrophyte zone, mainly represented by *Carex* sp. Water temperature at sampling time was 16 °C.

Specimens were selected from formalin-preserved samples under a compound microscope and studied under an optical microscope *in toto* in a drop of a glycerol-formaldehyde mixture. Two adult specimens were dissected under a stereoscopic microscope for the study of appendages and postabdomen. Drawings were prepared using a *camera luci-*

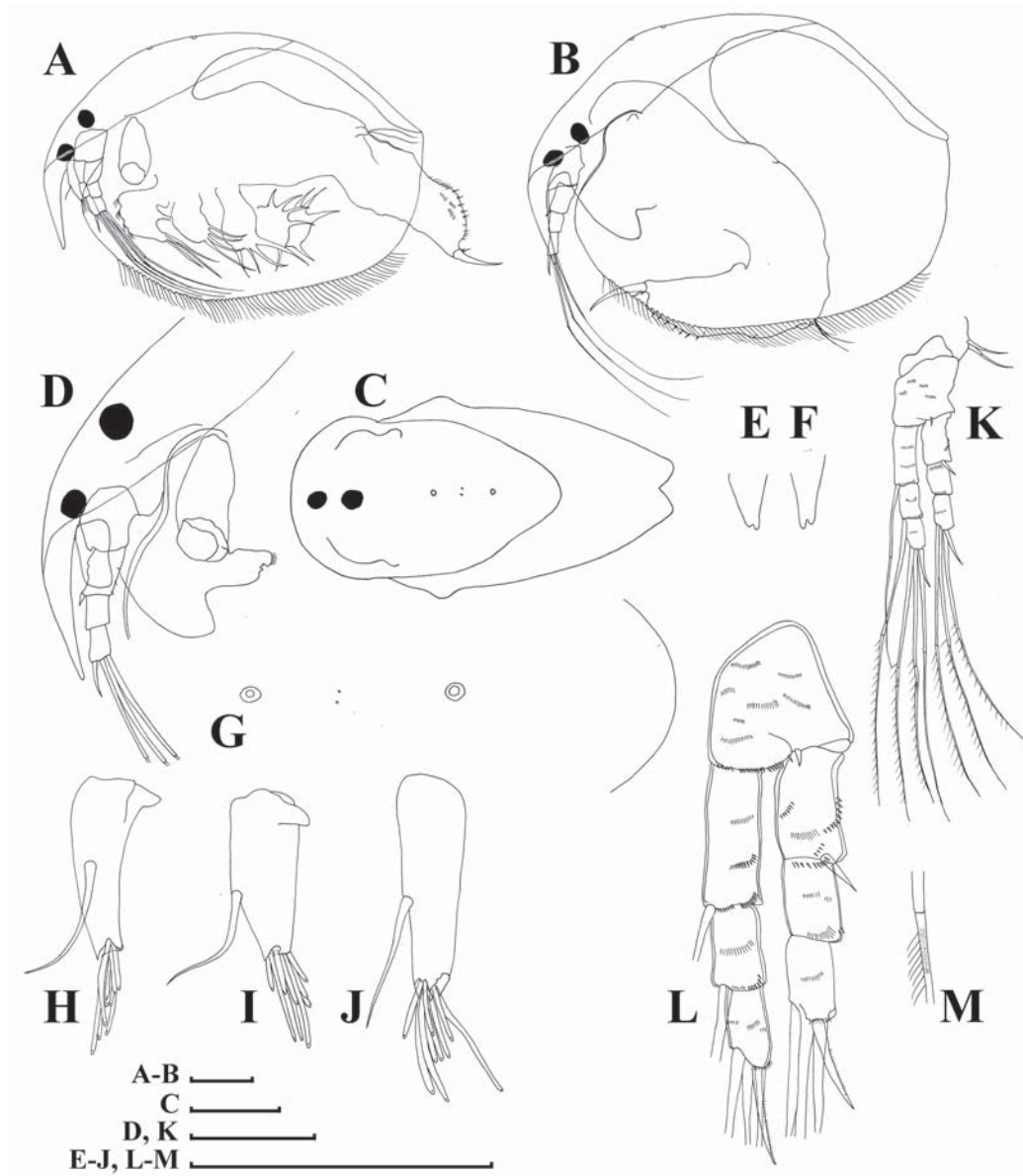


Fig. 2. Parthenogenetic female of *P. pamirensis* from a shallow pool near Lake Sut-Khol'. A–B — adult female, lateral view; C — dorsal view; D — head; E–F — tip or rostrum, G — dorsal head pores; H–J — antenna I; K–L — antenna II; M — apical “swimming” seta of antenna II. Scale bars: 0.1 mm.

Рис. 2. Парthenогенетическая самка *P. pamirensis* из мелкого водоема у озера Сут-Коль. А–В — взрослая самка, вид сбоку; С — вид со спинной стороны; D — голова; E–F — кончик роstrума, G — спинные головные поры; H–J — антенна I; K–L — антенна II; M — апикальная «плавательная» щетинка антенны II. Масштабная линейка: 0,1 мм.

da attached on Olympus CX41 compound microscope. A system of enumeration for different setae on thoracic limbs was proposed by Kotov [2013].

## Results

Order Anomopoda Sars, 1865  
 Family Chydoridae Dybowski et Grochowski, 1894  
 Subfamily Chydorinae Dybowski et Grochowski, 1894  
 Genus *Pleuroxus* Baird, 1843

## *Pleuroxus pamirensis* (Werestschagin, 1923)

Fig. 1–3.

SHORT DIAGNOSIS OF PARTHENOGENETIC FEMALE. Body of moderate height, postero-ventral angle without denticles (Figs 1C–D, 2A–B). No medial keel on dorsum, valves with paired lateral projections (Fig. 2C). Rostrum long (Fig. 2D), protruding ventrally behind apex of labral keel, with a pair of tubercles on tip (Fig. 2E–F). Ocellus somewhat smaller than compound eye. Labral keel relatively small, with broadly rounded apex. Head shield posteriorly rounded, postpore distance = about 1.2 interpore

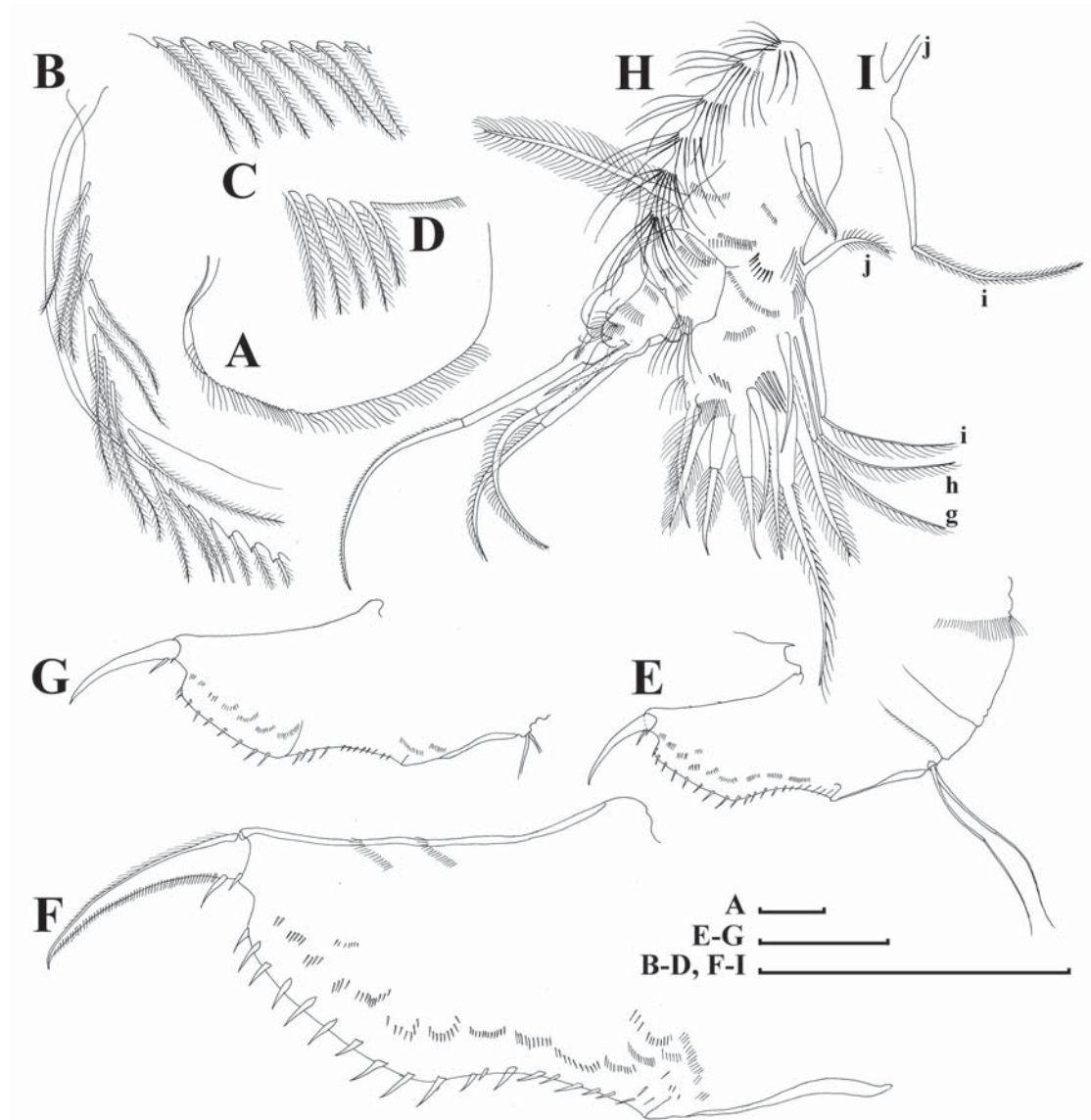


Fig. 3. Parthenogenetic female of *P. pamirensis* from a shallow pool near Lake Sut-Khol'. A — valve; B — its anterior portion; C — its ventral portion; D — its postero-ventral portion; E–G — postabdomen; H — thoracic limb I; I — setae i and j. Scale bars: 0.1 mm.

Рис. 3. Партеногенетическая самка *P. pamirensis* из мелкого водоема у озера Сут-Коль. А — створка; В — ее передняя часть; С — ее брюшная часть; D — ее заднебрюшная часть; E–G — постабдомен; H — торакопод I; I — щетинки i и j. Масштабная линейка: 0,1 мм.

distance (Fig. 2C, G). Marginal setae relatively long (Fig. 3A); setae at anterior margin lie at a distance from valve edge (Fig. 3B); all setae of valve ventral margin exactly marginal (Fig. 2C–D). Postabdomen wide, narrowing distally, its preanal margin approximately as long as anal margin, preanal and postanal angle well-defined, postanal margin with series of solitary postanal teeth (Fig. 3E–G), postabdominal claw with two basal spines of remarkably different size (distal spine 2–4 times longer than proximal one). Antenna I not reaching tip of rostrum, with a low basal peg (Fig. 2H–J)). On antenna II, all apical “swimming” setae subequal in size, lateral seta on proximal segment of endopod shorter than other setae (Fig. 2K). Spine on proximal segment of exopod longer than half of next segment length (Fig. 2L). All setae on antenna I with a short setulation (Fig.

2M). All thoracic limbs as described by Kotov & Sheveleva [2008]. On limb I, seta i long (Fig. 3H–I).

Length in our material 0.4–0.71 mm, height 0.32–0.53 mm.

EPHIPPIAL FEMALE, MALE. Not found.

EMENDED DIFFERENTIAL DIAGNOSIS WITH BRIEF COMMENTS. The only other taxon of *Pleuroxus* with lateral projections is *P. annandalei* (Daday, 1908), the close congener of *P. pamirensis* [Kotov, Sheveleva, 2008]. According to Kotov & Sheveleva [2008] the latter differs from the former in (1) preanal margin of postabdomen longer than anal margin; (2) postanal teeth predominantly solitary; (3) antenna I thick; (4) spine on basal exopod segment of antenna II longer than half of second segment; (5) seta i on limb I long (as long as seta g of h). According to our new

data, characters 1 and 3 are too subjective. Indeed, our specimens have preanal and anal margin subequal in size, thereby compromising use of this character as diagnostic. Also “thickness” of the antenna I is strongly dependent on the observation foreshortening as this appendage is not ovoid but ellipsoid in section. However, the characters 2, 4 and 5 are found here to be adequate (and discrete) for the two species delimitation.

**DISTRIBUTION.** Type locality of the species is Lake Zorkul, East Pamirs, border of Tajikistan and Afghanistan (4126 m a.s.l., 37°26'N, 73°37'E) (according to the lectotype selected by Smirnov [1971]). Kotov & Sheveleva [2008] concluded that the species is distributed “in high mountain (3700 m a.s.l. and more) lakes and small pools near these lakes in Tajikistan, East Pamirs”. Now we found it in a mountain (1817 m a.s.l.) in Altai. Its exact distribution pattern is unknown, we can expect it occurs in the Tien Shan also.

## Discussion

In Northern Eurasia, the genus *Pleuroxus* is represented by 15 species [Korovchinsky *et al.*, 2021]. Two taxa, *P. pamirensis* (Werestschagin 1923) and *P. annandalei* (Daday 1908), have lateral “horns” of unknown function on the valves, very rare character for the chydorids, although analogous structures are described in other cladocerans: ilyocryptids, macrothricids, daphniids [Kotov, 2006, 2013]. Horned species of *Pleuroxus* seem to be endemics of mountain regions of Central Asia. Unfortunately, discussion of their exact distribution patterns is premature, as only few records of both taxa are known to date, i.e. due to difficulty of access to the water bodies where they live. However, we can confirm that they belong to the “Mountain endemic” faunistic complex according to Kotov [2016], which is studied inadequately, and its exact species composition is very obscure to date. High endemism level and inadequate level of study are characteristic of the mountain cladocerans from other continents [Van Damme, Eggermont, 2011; Paggi, Herrera-Martinez, 2020; Neretina, Sinev, 2021].

We have found *P. pamirensis* in Russia for the first time and demonstrated that new records are possible even for the countries with well-studied cladoceran faunas [Korovchinsky *et al.*, 2021], and just the mountain regions could be regarded as sources for such new records.

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