

## A new species of the weevil genus *Phyllobius* Germar, 1824 (Coleoptera: Curculionidae: Entiminae) from the Pleistocene of northeastern Siberia

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**ABSTRACT:** Weevils of the genus *Phyllobius* Germar, 1824 (Coleoptera, Curculionidae: Entiminae) are frequent in the Quaternary deposits of northeastern Siberia. A detailed study of the well-preserved Pleistocene fossils (including scales of the vestiture) from the Bolshoy Khomus-Yuryakh River in the Yana-Indigirka lowland (Sakha Republic – Yakutia) results in the recognition of a number of rare weevils including a new species of the genus *Phyllobius* Germar, 1824 — *Ph. (Angarophyllobius) sheri* sp.n. which is described in this paper. The new species is closely related to the recent *Ph. kolymensis* Korotyaev et Egorov, 1977 currently known from only a few localities in the area of the middle section of the Kolyma River, which had a wider distribution range in the Pleistocene. *Phyllobius sheri* sp.n. is probably extinct.

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**KEY WORDS:** Curculionidae, *Phyllobius*, *Angarophyllobius*, new species, Pleistocene, Siberia.

## Новый вид долгоносиков рода *Phyllobius* Germar, 1824 (Coleoptera: Curculionidae: Entiminae) из плейстоцена северо-восточной Сибири

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**РЕЗЮМЕ:** Остатки долгоносиков рода *Phyllobius* Germar, 1824 (Coleoptera, Curculionidae: Entiminae) обильны в четвертичных отложениях северо-восточной

Сибири. Детальное изучение остатков хорошей сохранности (включая чешуйки наружных покровов) из плейстоценовых отложений с р. Большой Хомус-Юрях на Яно-Индибирской низменности (Республика Саха – Якутия) позволило обнаружить несколько редких видов, в том числе новый вид *Phyllobius (Angarophyllobius) sheri* sp.n., описание которого приводится в этой статье. Новый вид близок к *Ph. kolymensis* Korotyaev et Egorov, 1977, найденному ныне только в нескольких местообитаниях в среднем течении Колымы в Магаданской области, но более широко распространенному в плейстоцене. *Phyllobius sheri* sp.n., по всей вероятности, вымер.

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КЛЮЧЕВЫЕ СЛОВА: Curculionidae, *Phyllobius*, *Angarophyllobius*, новый вид, плейстоцен, Сибирь.

## Introduction

Regular study of Quaternary insects dates from the end of the 19th century. The problem of extinct species was raised early on and is still under discussion. The famous palaeontologist S. Scudder, who worked on Scarborough Bluff (Ontario, Canada), described 52 species of extinct Pleistocene beetles (Scudder, 1877, 1886, 1890, 1898, 1900). His collection was lost, but subsequent study of these deposits by modern researchers (Morgan, 1972, 1975; Williams *et al.*, 1981) has found no extinct species. Other early researchers (Horn, 1876; Łomnicki, 1894; Mjoberg, 1904; Wickham, 1917) also identified Pleistocene insects as extinct species; nevertheless the concept of a mixture of extinct and extant species in the fossil (subfossil) Quaternary material was accepted early on (Wickham, 1919). The subsequent revisions of the Łomnicki and Mjoberg collections have shown that all species described by these authors are actually extant (Lindroth, 1960; Coope, 1968a; Angus, 1973).

The modern concept presumes that almost all Pleistocene insects belong to extant species (Elias, 2010) which originated in the Neogene or earlier. The evolutionary stability of insects makes them a perfect tool for palaeoenvironmental reconstructions (Coope, 1959, 1970; Coope *et al.*, 1961; Hopkins *et al.*, 1971; Mat-

thews, 1974, 1976). Yet some extinct species are known. First of all there are parasites of the extinct mammals (Grinin, 1973), for example the mammoth botfly *Cobboldia rusanovi* Grinin, 1973. Several extinct species of Donacinae (Coleoptera: Chrysomelidae) from the Pleistocene of Japan (Hayashi, 1998, 1999a, b) also have been described.

Other evidence of the extinction of Quaternary beetles has been obtained although no descriptions of new species have been published. Kiselev (1981) wrote that at least two fossil beetles from the northeastern Siberia (*Carabus* cf. *hungaricus* Fabricius, 1792 and a weevil of the tribe Ptochini) are probably extinct. Some of the *Phyllobius* remains were reported by him as *Ph. (Angarophyllobius)* sp. Such identifications often indicate the difficulty of working with the fossil material where a beetle is represented by separated parts of the body, often fragmented. With the weevils, often reliable species identification could be made based on the heads; if only the elytra or a pronotum without head are available, the identification mostly could be possible up to the genus or subgenus level.

New collections provide a mass of material including numerous heads and well-preserved elytra (these fragments of *Phyllobius* are relatively soft and are damaged easily); some of them retaining even metallic-shining green



Fig. 1. Map of the location.

Рис. 1. Карта местонахождения.

scales. Here we can see the differences between a number of fossil *Phyllobius* and their modern relatives. The morphology of the scales (investigated with scanning electron microscope) has played a crucial role in this study aimed at description of a new Pleistocene taxon which is probably extinct now.

## Material and Methods

The main source of the new Pleistocene fossils is the key section 83-Khomus-Yuryakh. The section (Fig. 1) is situated at the Bolshoy Khomus-Yuryakh River (70°00'N, 153°37'E) in the Yana-Indigirka lowland between the Alazeya and Indigirka rivers (Lozhkin, 1977; Blinov *et al.*, 2009). The section (Fig. 2) was studied by the expedition of the USSR Academy of Sciences with participation of A.V. Sher, A.Ya. Druk, and D.A. Gilichinsky in 1988 and 1989. Insect samples were collected by A.V. Sher (Kuzmina, Elias, 2019). The location was designated as a key section for the regional horizon — Khomus-Yuryakh Bed (Sher, 1997; Virina, 1997) which is situated at the top of Akansky horizon (upper part of the Upper Neopleistocene, about 500 ka yr). Later the expedition of 2005 sampled ground ice for chlorine isotope method and got  $^{36}\text{Cl}/\text{Cl}$  Age —  $496 \pm 78$  ka yr (Blinov *et al.*, 2009) for the Khomus-Yuryakh Unit. Upper Neopleistocene of the Russian scheme corresponds to the middle Pleistocene (Ionian Stage) of the first draft of the recent international Quaternary scheme (Head *et al.*, 2008). As the discussion of the bound-

aries within the Pleistocene is still in progress and the Russian scheme differs from the international one, we can use the Marine Isotope Scale (MIS), and according to this scheme the interval belongs to MIS13 warm stage.

The sample Khomus-Yuryakh-83.25 comes from a sandy-silt unit with lenses of peat and gravel (Fig. 2). The sample 83.25 yields the richest fossil insect assemblage in our record (Kuzmina, 2014, 2015) for northeastern Siberia. The assemblage includes over 10 000 fragments of insects, mostly beetles.

The volume of the sample was larger than usual. Despite the visible abundance of insect remains A. Sher has decided to screen extensional sediment body (more than 100 kg) trying to get representative assemblage of the rodent teeth for the stratigraphic purposes (Sher, 1997). But Andrei used 0.4 mm mesh (instead of rodent 1mm mesh) having in mind also insect study. The final sample after wet screening and drying in the field weighed about 7 kg what is much more than usual light (0.1–0.5 kg) insect sample. The next step was sieving of this concentrate in the laboratory and picking of rodent teeth by unaided eyes and fossil insects with a binocular microscope.

## Results

### Species composition of the beetles in Khomus-Yuryakh site

Members of the families Carabidae, Chrysomelidae and Curculionidae dominate the as-

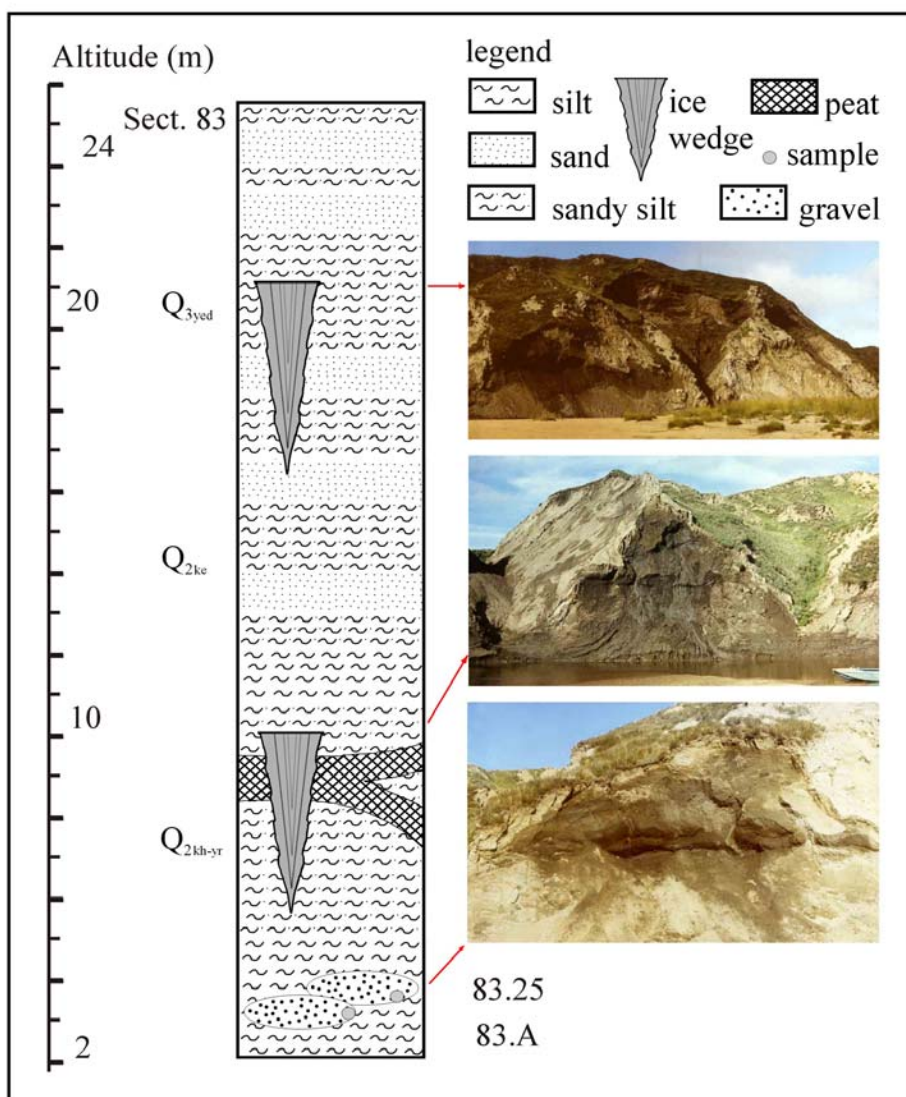


Fig. 2. Scheme of the Khomus-Yuryakh section:  $Q_{2kh-yr}$  — Middle Pleistocene, Khomus-Yuryakh unit;  $Q_{2ke}$  — Middle Pleistocene, Keremesit unit;  $Q_{3yed}$  — Upper Pleistocene, Yedoma unit. Photo of the section by A. V. Sher.

Рис. 2. Схема разреза Хомус-Юрях:  $Q_{2kh-yr}$  — средний плейстоцен, хомус-юряхский горизонт;  $Q_{2ke}$  — средний плейстоцен, керемеситский горизонт;  $Q_{3yed}$  — верхний плейстоцен, едомный горизонт. Автор фото разреза — А.В. Шер.

semblage, but the most abundant species is the extant pill-beetle, *Morychus viridis* Kuzmina et Korotyaev, 1987 (Byrrhidae). The last species is very common in the Pleistocene steppe-tundra communities of the Northeast Asia (Berman, 1990).

Weevils constitute almost a half of the assemblage (44% of fragments); they belong to 21 species including several species of *Stephanocleonus* Motschulsky, 1860, *Coniocleonus* Motschulsky, 1860, *Lepyrus* Germar, 1817, *Hypera* Germar, 1817, *Isochnus* Thomson, 1859,



*Dorytomus* Germar, 1817, *Sitona* Germar, 1817, *Ceutorhynchus* Germar, 1824, and *Phyllobius* spp. These weevils and other beetles (Kuzmina, 2015) indicate mixture of the steppe, tundra, shrub, meadow and wetland habitats. This is a typical pattern of the northeastern Siberian Pleistocene insect faunas (Kiselev, 1981; Kiselev, Nazarov, 2009) representing the extinct steppe-tundra biome (Sher, 1990).

It is noteworthy that the species diversity of the insect fauna is not high despite the large number of the fossils in the assemblage. The core list of the steppe-tundra insect fauna does not exceed 80–100 species (Kuzmina, 2014) while modern Holocene assemblages from this area are less abundant in number of specimens obtained, but are nevertheless more diverse (Kuzmina, Sher, 2006). Nevertheless, the large volume of sample 83.25 provides a slightly longer species list than usual including several problematic identifications for *Lepyrus*, *Ceutorhynchus*, *Phyllobius*, and in addition to weevils also for *Chrysolina* Motschulsky, 1860 (Chrysomelidae) and *Aphodius* Illiger, 1798 (Scarabaeidae).

A thorough investigation of 1460 fragments of *Phyllobius* from the sample Khomus-Yuryakh-83.25 allowed recognition of the following species: 1 — *Ph. virideaeris* Laicharting, 1781 (about 7%); 2 — *Ph. kolymensis* Korotyaev et Egorov, 1977 (about 80%); 3 — *Ph. sheri* sp.n. (about 10%), and 4 — *Phyllobius* sp. 2 (about 3%). *Ph. sheri* sp.n. is described below.

### Description of the new species

Family Curculionidae Latreille, 1802

Subfamily Entiminae Schoenherr, 1826

Genus *Phyllobius* Germar, 1824

Subgenus *Angarophyllobius* Korotyaev et Egorov, 1977

*Phyllobius* (*Angarophyllobius*) *sheri* Kuzmina et Korotyaev sp.n.

Figs. 3C, 4A, B, D.

**Type material.** Holotype: female head, pronotum and fused elytra with abdomen glued on a plate. Label data: Northern Yakutia, Bolshoy Khomus-Yuryakh River, Q<sub>2</sub>, A. Sher, 1988.

Paratypes (all labelled as above): head with deciduous process on right mandible; head with deciduous processes on both mandibles; head with deciduous process on right mandible; pronotum; left female elytron; right less convex (probably male) elytron. All type material is deposited in the collection of the Zoological Institute, Russian Academy of Sciences, St. Petersburg.

**Description.** Body black; head, pronotum and elytra moderately densely clothed with slightly lustrous light green or, rarely, grey rather large round, wide tear-shaped or oval scales with length less than 1.5 widths.

Rostrum considerably narrower than head capsule, weakly transverse in male and broader in female (1.5 times as broad as long); in male weakly, in female moderately narrowing from base toward mid-length, weakly roundly broadened apically. Rostral dorsum forming distinct angle with frons, rather strongly depressed along midline; lateral margins of dorsum moderately convex, parallel in middle part of length and moderately widely roundly diverging apically. Rostral dorsum weakly convex longitudinally, weakly and gently bevelled apically, with well developed epistome rather far producing acute-angularly posteriorly into the depressed part of dorsal surface. Frons flattened; its width triple as great as longitudinal diameter of eye. Head capsule behind eyes not swollen, almost parallel-sided. Punctuation of rostrum and head capsule formed by moderately large but rather deep, moderately dense punctures, not rugose; intervals between punctures mostly (occasionally everywhere) shiny. Eyes small, rather strongly convex, almost round. Antennae not preserved. Some heads retain one (Fig. 3A) or two mandibular appendages.

Pronotum more than 1.4 times as broad as long, broadest at middle or slightly distal to it, with sides moderately rounded, with well developed basal and apical constrictions; base weakly rounded, occasionally shallowly sinuous medially; apical margin shallowly sinuous medially. Pronotal disc slightly convex or flat. Punctuation shallow, relatively fine, dense, not rugose; intervals between punctures mostly shiny, especially on sides. Median line some-

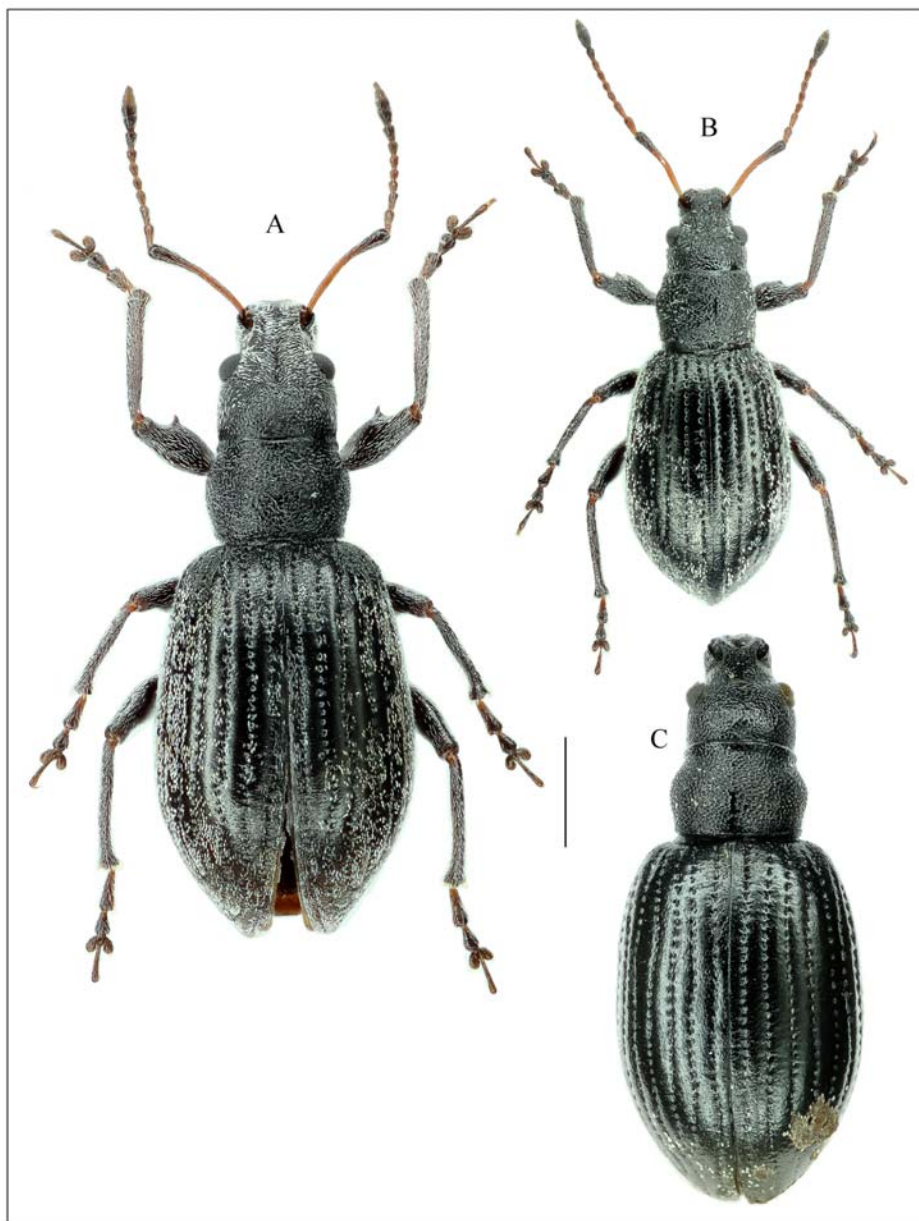


Fig. 3. *Phyllobius* (*Angarophyllobius*), females, habitus. A — *Ph. kolymensis* Korotyaev et Egorov; B — *Ph. virens* (Faust); C — *Ph. sheri* sp.n.

Рис. 3. *Phyllobius* (*Angarophyllobius*), самки, общий вид. A — *Ph. kolymensis* Korotyaev et Egorov; B — *Ph. virens* (Faust); C — *Ph. sheri* sp.n.

times slightly elevated in middle part of its length or in basal part.

Scutellum small, triangular, in the holotype somewhat raised above elytral surface.

Elytra rather broad and convex, their length/width ratio in two well preserved females (with fused elytra and basal abdominal sternites) 1.46 and 1.50. Humeral tubercles present but strongly

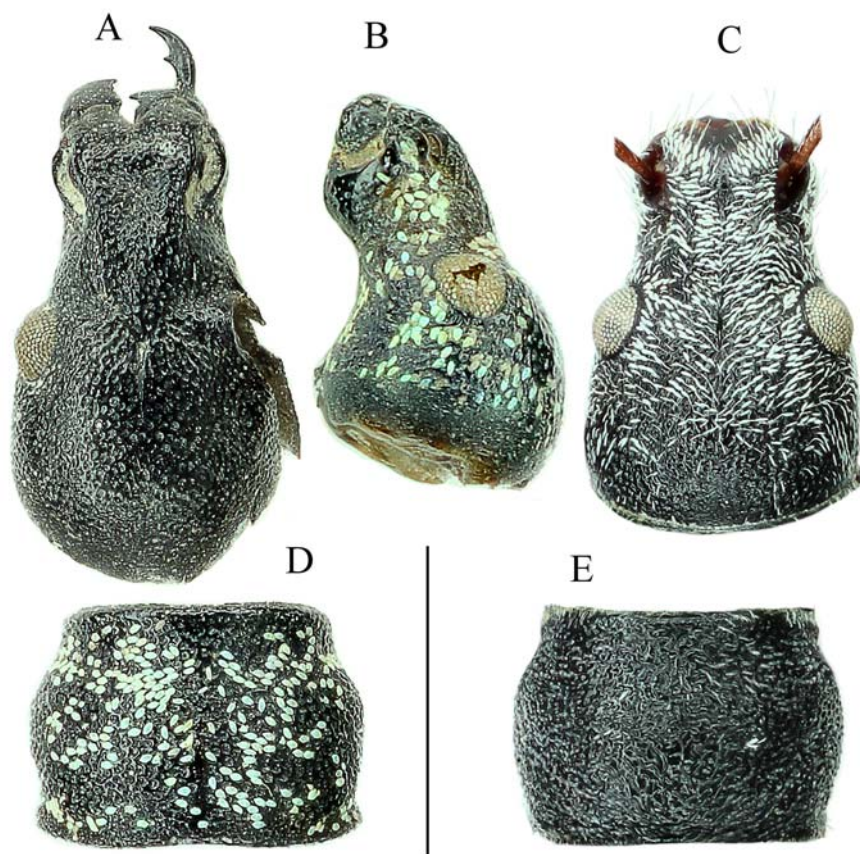


Fig. 4. *Phyllobius (Angarophyllobius) sheri* sp.n. and *Ph. (Angarophyllobius) kolymensis* Korotyaev et Egorov, head dorsally (A, C) and laterally (B), and pronotum dorsally (D, E). A, B, D — *Ph. sheri* sp.n.; C, E — *Ph. kolymensis* Korotyaev et Egorov.

Рис. 4. *Phyllobius (Angarophyllobius) sheri* sp.n. и *Ph. (Angarophyllobius) kolymensis* Korotyaev et Egorov, голова сверху (A, C) и сбоку (B) и переднегрудка сверху (D, E). A, B, D — *Ph. sheri* sp.n.; C, E — *Ph. kolymensis* Korotyaev et Egorov.

rounded. Basal margin of elytra near scutellum almost uniformly smoothed, becoming steeper toward shoulders. Apices of elytra always narrowly rounded. Elytral striae deep and wide; interstriae much broader than striae, slightly or moderately convex, usually moderately shiny.

Legs not preserved.

Distance between middle and hind coxal cavities equal to longitudinal diameter of middle coxal cavities.

Length of pronotum 0.97–1.0, width 1.38–1.40 mm; length of elytron 3.5–4.0 mm.

Male known from several separated elytra.

**Differential diagnosis.** The new species is probably most closely related to *Ph. kolymensis* Korotyaev et Egorov, 1977 (Korotyaev, Egorov, 1977). These two species are very similar in the structure of the head and in the proportions and shape of pronotum; the elytra are also quite similar: in both species they are convex, with rounded shoulders and sides, and also with rounded (probably in *Ph. sheri* sp.n. as well as *Ph. kolymensis*) and slightly divergent apices.

*Phyllobius sheri* sp.n. differs from *Ph. kolymensis* in the larger and wider green scales, sharper angle between the frons and rostral



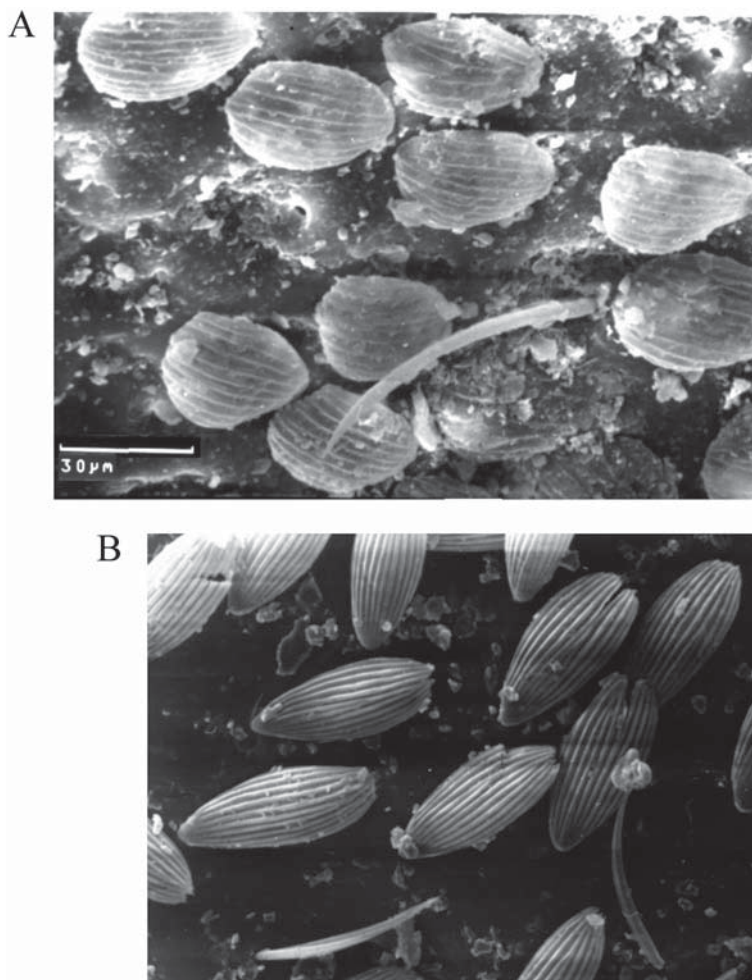


Fig. 5. *Phyllobius* (*Angarophyllobius*), scales. A — *Ph. kolymensis* Korotyaev et Egorov; B — *Ph. sheri* sp.n.  
 Рис. 5. *Phyllobius* (*Angarophyllobius*), чешуйки. А — *Ph. kolymensis* Korotyaev et Egorov; В — *Ph. sheri* sp.n.

dorsum, more elevated lateral margins of the rostrum, and more strongly convex epistome.

**Taxonomic notes.** Taking into account the close similarity of *Phyllobius sheri* sp.n. to *Ph. kolymensis*, we can assume that the femora of the fossil species also had a well-developed tooth, and the anal sternite of male was moderately to deeply depressed. The aedeagus of *Angarophyllobius* species is strongly sclerotized and may occur in the samples containing the remnants of members of this subgenus. The aedeagus of *Ph. kolymensis* has uniformly sclerotized ventral surface with two large oval mem-

branous areas at the apex separated by a sclerotized area; the median apical process is rather broad. These features allow differentiation *Ph. kolymensis* from the closely allied *Ph. fumigatus* Boheman, 1843 which is widespread in East Siberia and in the south of the Russian Far East. The aedeagus of *Ph. fumigatus* has smaller apical membranous areas connected by a membrane; the apical process is half as broad as in *Ph. kolymensis* (Korotyaev, Egorov, 1977: p. 445, figs. 159–161 and 156–158).

**Distribution.** Northeastern Siberia: Kolyma Lowland, Pleistocene.



**Etymology.** The species is named after the famous palaeontologist Andrei Vladimirovich Sher who collected the sample.

## Discussion

*Phyllobius* Germar, 1824 is a Palaearctic genus of the broad-nosed weevils (family Curculionidae, subfamily Entiminae) with 154 species (Alonso-Zarazaga *et al.*, 2017). Most of the *Phyllobius* species are associated with trees and shrubs. This is true also for the subgenus *Angarophyllobius* Korotyaev et Egorov, 1977 (Korotyaev, Egorov, 1977; Korotyaev, 1984), with the only exception of the Mongolian *Ph. grubovi* Korotyaev, 1984 which has been found by I.M. Kerzhner on *Oxytropis oligantha* Bge. in the alpine steppe at an elevation of 3000 m (Korotyaev, 1984). Single specimens of *Phyllobius kolymensis* (Figs 3–5) were found on herbs in the steppe community, and the species was abundant in the mesophytic meadows in the Kolyma River floodplain (Berman *et al.*, 2001). The first two specimens were taken by B.K. from *Spiraea* sp. bushes in the Kolyma flood plain (Korotyaev, Egorov, 1977).

The subgenus *Angarophyllobius* includes 21 species in the East Siberia, the Russian Far East, and Mongolia; in addition *Ph. sauricus* Korotyaev et Egorov, 1977, is known from Eastern Kazakhstan (Saur Range), and *Ph. przewalskii* Korotyaev, 1979, from Northern China. In the modern insect fauna of Yakutia the subgenus is represented by four species: *Ph. fumigatus* Boheman, 1843, *Ph. hochhuthi* Faust, 1883, *Ph. femoralis* Boheman, 1842, and *Ph. virens* (Faust, 1890). The first two species have prominent shoulders and well-developed wings (the fossil weevils have rounded shoulders); *Ph. femoralis* is smaller and has no broad scales on the dorsal surface; and *Ph. virens* has rounded shoulders but it is much smaller than the fossil specimens.

*Phyllobius sheri* sp.n. is known, in addition to the type locality, probably from other sites. Our database of Quaternary fossil insects (Sher *et al.*, 2006) shows that *Phyllobius* sp. has been recorded in 8 samples of 7 sites; *Phyllobius*

(*Angarophyllobius*) sp. in four samples from three sites, but *Ph. kolymensis* is much more common: 184 samples from 29 sites. Why the new species has been recorded from one site only? The reason probably is that *Phyllobius* remains are common in the Late Pleistocene sites while *Ph. sheri* should be associated with older assemblages. *Ph. kolymensis* is presented in some Middle or Early Pleistocene samples such as Krestovka, Chukochya and Keremesit but the number of fossils is small, usually 1–2 specimens per sample. Another problem is that preservation of *Phyllobius* is not always good, elytra are often deformed and crumpled, scales are rarely preserved. We expect the findings of *Ph. sheri*: 1 — in the Early–Middle Pleistocene deposit; 2 — in large assemblages; 3 — in steppe-tundra assemblages; 4 — the preservation of the fossils is good. Right now there is the only one sample which satisfies these requirements — 83.25 from Bolshoy Khomus-Yuryakh River.

## Conclusion

The description of the *Phyllobius (Angarophyllobius) sheri* sp.n demonstrates the existence of extinct beetle species in the Pleistocene steppe-tundra community at least before the Late Pleistocene. The extant species *Ph. (Angarophyllobius) kolymensis* (which is the closest relative of *Ph. sheri* sp.n.) has narrowed down its distribution dramatically since the late Pleistocene and is recently found only in a restricted area in the upper reach of the Kolyma River where it occupies relict steppe patches.

The new species is known from the type locality and floodland habitats only — the Middle Pleistocene of the Bolshoy Khomus-Yuryakh River in the Yana-Indigirka lowland. The description was possible due to excellent preservation of the fossils and extremely large volume of the assemblage. All known other contemporary samples yield only single *Phyllobius* remains. Most probably the distribution of *Ph. sheri* was wider than the type locality; mass collecting of the Early or Middle Pleistocene insects could provide new finds of this species in other areas of the northeastern Siberia.

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