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A new species of *Helophorus* FABRICIUS, 1775 from the Chinese Altai, with notes on the former subgenus *Atractohelophorus* KUWERT, 1886 and selected species (Coleoptera: Helophoridae)

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Abstract

Helophorus sinoglacialis sp.n. (Coleoptera: Helophoridae) is described from a single female taken among gravel at the edge of the Kran river in the Chinese Altai (Xinjiang Province) and postglacial fossils representing about seven specimens. The possible habitats are discussed and illustrated and the fossil site, the Halashazi Wetland, is described. The status of the former subgenus *Atractohelophorus* KUWERT, 1886 is discussed, and an illustrated account is given of species of the *Helophorus glacialis* and *H. guttulus* groups, as set out by ANGUS (1985), as well as of other relevant species.

Key words: China, Xinjiang, Altai, Kran river, Halashazi Wetland, postglacial fossil, *Helophorus sinoglacialis*, new species, *Atractohelophorus*, *Helophorus glacialis* species group, *Helophorus guttulus* species group, *Helophorus altaicus*, *Helophorus angusi*.

Introduction

In October 2016 S. Ryndevich wrote to R. Angus concerning a strange *Helophorus* FABRICIUS, 1775 from the Chinese Altai (Xinjiang Uyghur Autonomous Region), which had been sent to him by I.I. Kabak (All-Russian Institute of Plant Protection, St. Petersburg, Russia). Examination of a photograph showed that it belonged to an undescribed species, which, although represented by only a single female, was sufficiently distinctive to be described as new. At the same time Angus, working with Tianshu Zhang on postglacial fossil material from the Chinese Altai, which she was researching for her Ph.D. degree, realized that the new species was present among her material. It was therefore decided that the description of the new species should be based not only on the modern female but also should include the fossil material. It was also decided that an illustrated account of species most resembling the new species would be very helpful.

Material and methods

The holotype was examined using a Nikon SMZ-745T stereomicroscope. Habitus photographs were taken using Nikon D5100 digital camera with attached Nikkor 60 mm 1:2.8G macro lens and Meike Macro Extension Tube Set, and subsequently adapted in Adobe Photoshop CS5.

Other material, including the fossils, was examined with a Zeiss binocular microscope and photographed with a Leica M125 stereomicroscope + Canon EOS 550D digital camera in the Sackler Bioimaging Laboratory of the Natural History Museum, London. Images were stacked using Helicon Focus software.

Aedeagi were mounted on slides in DMHF and photographed using various photomicroscopes over the years.

Examined specimens are deposited in the following collections:

BMNH Natural History Museum, London, UK (M.V.L. Barclay)
ZISP Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia (A.G. Kirejtshuk)

***Helophorus sinoglacialis* sp.n.**
(Figs. 1–9)

TYPE LOCALITY: China, Xinjiang, Altai.

TYPE MATERIAL: **Holotype** ♀, China, Xinjiang, Altai, Kran river, S of Altai Town, 47°56'03"N 88°08'012"E, ca 990 m a.s.l., 3.VIII.2015, leg. I.I. Kabak (ZISP). **Paratypes**: 1 prothorax and 11 elytra, postglacial fossils from the China, Xinjiang, Altai, Halashazi Wetland, 48°06'54"N 88°21'48"E, 2450 m a.s.l., leg. T. Zhang (5 elytra in BMNH, the rest of the material in Coll. T. Zhang).

DIFFERENTIAL DIAGNOSIS: With the characters of the former subgenus *Atractohelophorus* KUWERT, 1886 (apical segment of maxillary palpi symmetrical oval, elytral flanks in ventral view broadly visible outside epipleura) and of the *H. glacialis* and *H. guttulus* groups of species (ANGUS 1985) (maxillary palpi more or less black with metallic bronze reflections, legs blackish brown, body slightly less elongate than some *H. glacialis*-group species). Body elongate but rather robust. Pronotum shining, with bronze reflections, internal intervals punctate, near anterior and posterior margins with weak granulation, middle intervals weakly granulate, middle part punctate, external intervals clearly granulate. Elytra strongly striate, intervals weakly but distinctly convex, almost 2 × width of striae. Elytral flanks clearly visible below, width opposite metaventrite as epipleura of elytra.

DESCRIPTION OF HOLOTYPE: **Form and Colour.** Body elongate but robust (Fig. 1), length 3.1 mm, width 1.5 mm. Head black with green-purple-bronze metallic reflections. Maxillary palpomeres with green-bronze metallic reflections, last palpomere with metallic purple-bronze reflections Antennae dark brown. Pronotum black, internal intervals with green-bronze metallic reflections, middle and external with green-purple-bronze metallic reflections. Elytra brownish with extensive darker mottling including a sutural Λ-shaped spot at base of apical third and small yellowish spots in middle near lateral margin and near apex, and small black spots near base and apex, near middle of lateral part. Ventral surface black, ventral side of head brown. Epipleura brownish. Legs slightly shining, dark brown (Figs. 1–3).

Head. Dorsal side without microsculpture, granulate. Eyes small, somewhat protruding, interocular distance ca. 5.2 × as wide as one eye in dorsal view. Stem of Y-shaped groove narrow near base, widened towards apex. Mentum glabrous, ca. 2.5 × as wide as long, with sparse coarse punctation, shining between the punctures, slightly depressed anteromedially (Fig. 2). Antennae with nine antennomeres, scapus ca. 2.6 × as long as antennomeres 2–5 combined, club compact. Last maxillary palpomere symmetrical, almost equal to palpomere 3 in length.

Thorax. Pronotum (Fig. 3) ca. 1.7 × as wide as long, narrower than elytra, very weakly arched. Internal intervals punctate, near anterior and posterior margins with weak granulation. Middle intervals weakly granulate, middle part punctate. External intervals clearly granulate. Pronotal grooves with small tubercles. Elytra with 10 rather strongly impressed punctate striae, striae 1–6 clearly reaching base of elytra inside humeral callus. Elytral intervals distinctly convex, almost twice as wide as striae. Intervals 1–6 more convex than the others. Ground punctures on intervals very sparse and tiny (Fig. 1). Humeral bulge (callus) distinct. Elytra and pronotum without setae. Elytral flanks clearly visible below, width opposite metavenrite as epipleura of elytra (Figs. 2–8). Tarsi without long natatorial setae, first metatarsomere about as long as metatarsomeres 2–3 combined.

Abdomen. Abdomen with five exposed ventrites, first ventrite distinctly longer than other ventrites, ca. 1.6 × as long as second (Fig. 2).

VARIATION: In addition to the holotype we have seen postglacial fossil material comprising one well-preserved pronotum and eleven sufficiently complete elytra to be designated as paratypes as well as other elytral fragments, which probably belong to this species. The fossil pronotum has the granulation of the middle intervals reduced, so they are almost entirely punctate (Fig. 4). The

elytra have the intervals less raised than those of the holotype (Figs. 5–6), but this appears to be a post mortem effect as specimens of fossil *Helophorus sibiricus* MOTSCHULSKY, 1860 from the same site also have the elytral ridging weaker than in modern material. The fossil material is slightly smaller than the holotype, with the pronotum about 0.96 mm wide, as against 1.04 mm in the holotype. This represents about 93 % of the width of the holotype pronotum, suggesting a beetle length of about 2.9 mm. The elytra range in length from 2.29–2.07 mm, compared with 2.33 mm in the holotype. This suggests a beetle length range of 2.72–3.04 mm.

BIOLOGY: Hydrobiont, holotype was collected in the gravel on the river bank (Fig. 10), but the river at this site appears to be torrential and seems unlikely to be the true habitat of the beetle. The fossil site (see below) hints at small pools being a more normal habitat, which would be more in accord with what is known of other *H. glacialis*-group species.

ETYMOLOGY: The name is derived from Latin "sino" (China) and "glacialis" (referring to its position in the *H. glacialis* species group).

DISTRIBUTION: China: Xinjiang: Altai.

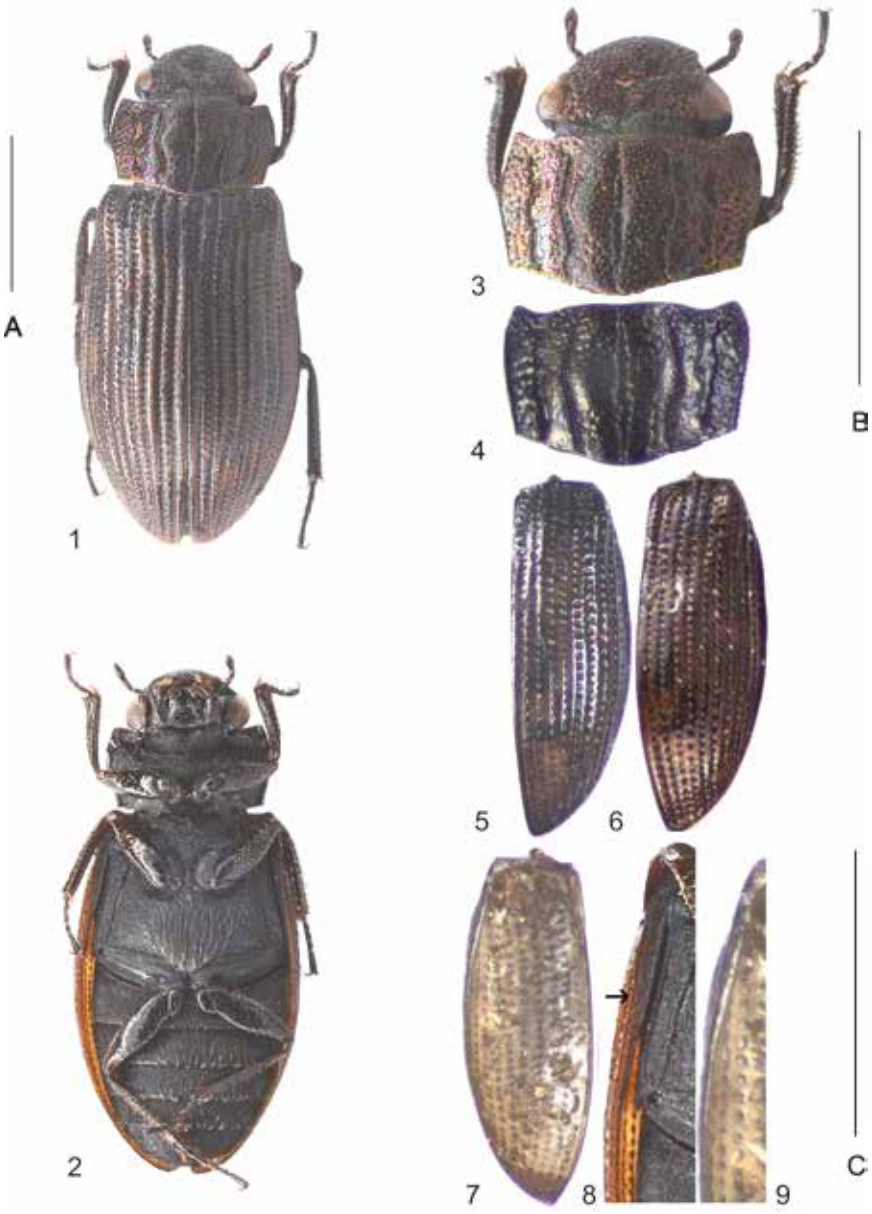
The fossil site

The fossil site, Halashazi wetland, 48°06'54"N 88°21'48"E, is in the Chinese Altai mountains in the Xinjiang Uyghur Autonomous Region. The wetland lies on a plateau 2450 m a.s.l. The fossiliferous deposits occur in approximately 50 peat hummocks in the wetland, with heights varying from 0.5–5.0 m (Fig. 11). These hummocks result from frost-heave upthrust of areas of the bog. Although the whole area is in a permafrost zone, these hummocks thaw out during the summer, facilitating sampling of the material.

The sampled deposits are made up entirely of sedge peat. Two different profiles were sampled. The first profile had a depth of 160 cm. Sampling began below the disturbed surface layers (approximately 35 cm) to avoid contamination by modern material. The top 70 cm of the sample was completely thawed, but sampling of the lower 90 cm required a small lateral shift as the area immediately below the sampled top 70 cm was still frozen. The second profile, about 200 m E of the first, had a depth of 200 cm. In this profile sampling began below a slumped layer approximately three metres thick, to get properly stratified material down to the bottom of the thawed layer. In both profiles it was not possible to sample the frozen peat. Both profiles were sampled as 5 cm units, with approximately 2 kg of material in each unit.

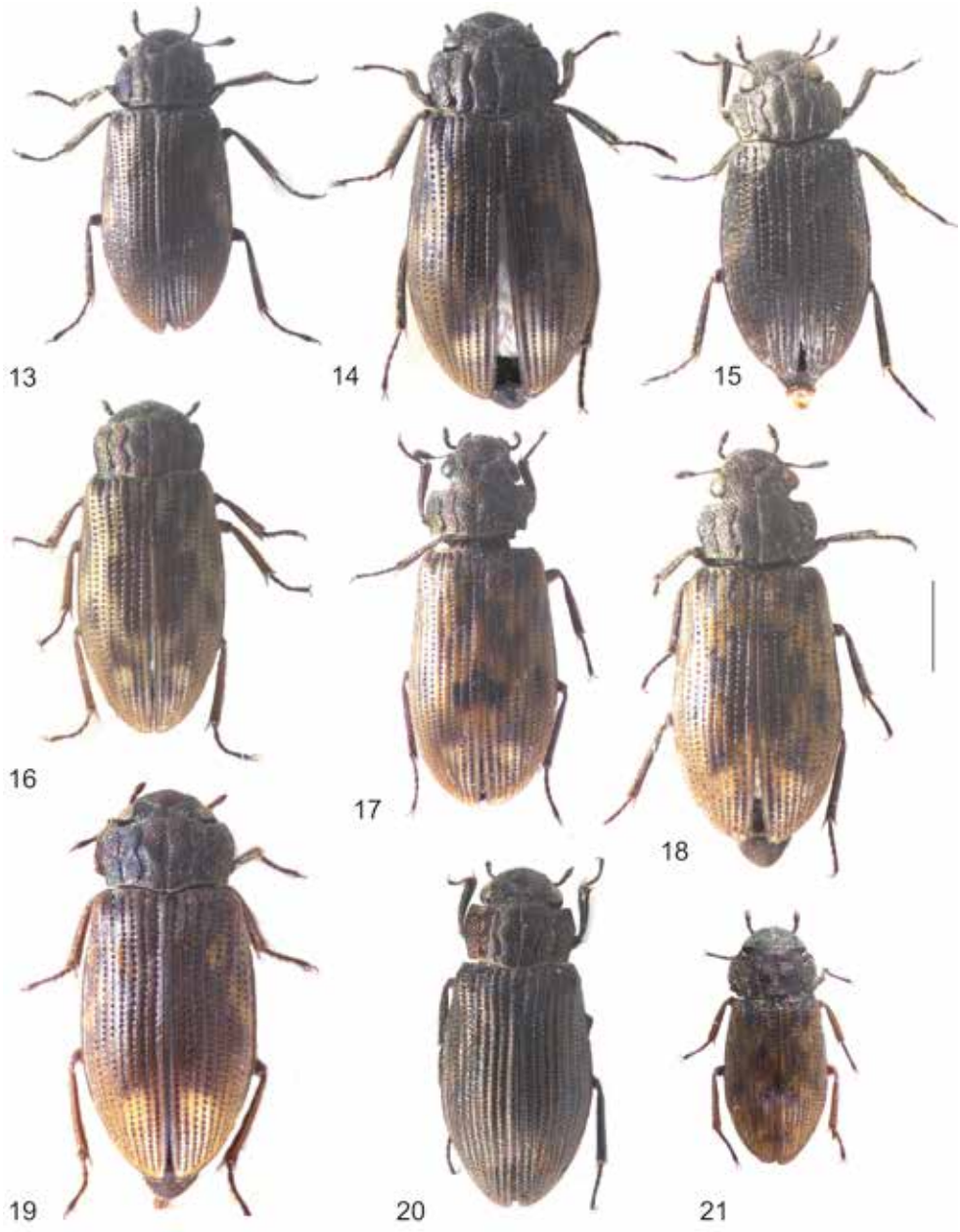
Five samples from each profile were sent for radiocarbon dating by Accelerator Mass Spectrometry. The AMS ^{14}C references for these samples are LZU16206 – LZU16215. The samples spanned the height of the profiles and were taken at intervals of 30–40 cm. After calibration, the ^{14}C dates from the first profile range from 4430-4250 cal. yr BP to 6438–6311 cal. yr BP and those of the second profile range from 9461–9563 cal. yr BP to 10280–10523 cal. yr BP. The *H. sinoglacialis* fossils were found throughout the second profile, but only in the lowest (oldest) layer of the first profile.

The fact that the sampled material is composed entirely of sedge peat and the whole area lies on a high plateau implies that it was an extensive peat bog. This plateau drains into the Kran river, where the modern holotype was collected. It is not possible to say whether the fossil *Helophorus* lived in small pools in this bog or whether they had come in from nearby streams. At present this wetland has a number of small pools among the peat hummocks (Fig. 11) as well as some larger ones (Fig. 12). The modern fauna of these pools has not been sampled, but the smaller pools look like suitable *Helophorus* habitats.

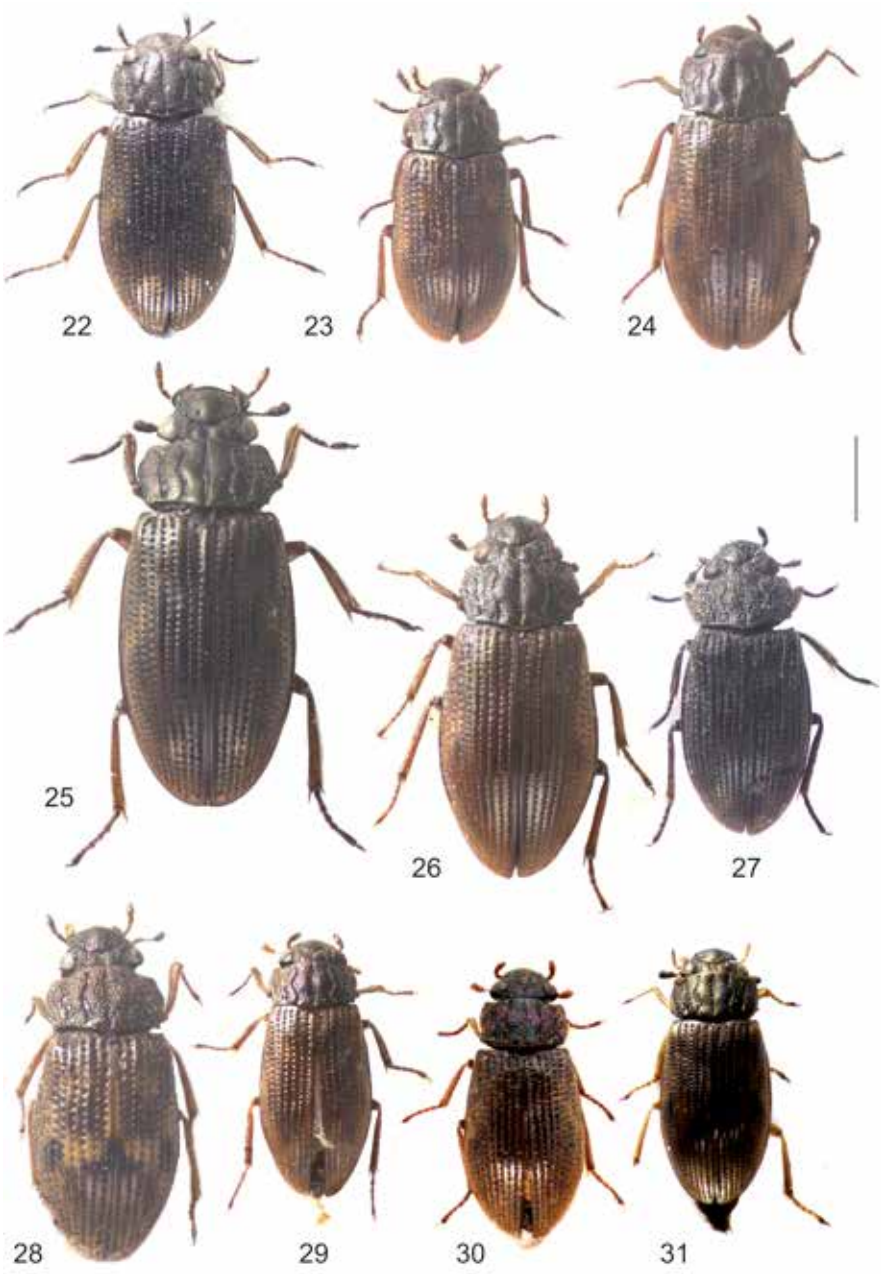


Figs. 1–9: *Helophorus sinoglacialis* sp.n.: 1–3, 8: holotype; 4–7, 9: paratypes (fossil); 1) dorsal view of whole beetle, 2) the same, ventral view, 3) head and pronotum, 4) pronotum, 5–6) the same elytron, dorsal view, 5 illuminated to show the relief, 6 to show the colour pattern, 7) the same elytron, ventral view, 8) detail of epipleura and flank, outer edge of epipleura arrowed, 9) the same paratype as 5–7, detail of epipleura and flank. Scale A = 1 mm for 1–2, 5–7, scale B = 1 mm for 3–4, scale C = 1 mm for 7–8.

Figs. 10–12: Collecting sites for *Helophorus sinoglacialis*: 10) gravel at edge of torrential Kran river, 11) Halashazi Wetland showing peat hummocks and natural pools, 12) Halashazi Wetland showing larger pool beside peat hummocks.



Figs. 13–21: *Helophorus glacialis* group – whole beetles, dorsal: 13) *H. glacialis*, small dark male, 14) *H. glacialis*, large female with obviously mottled elytra, 15) *H. ponticus*, paratype, 16) *H. abeillei*, 17) *H. longipennis*, 18) *H. maculatus*, 19) *H. faustianus* from Tbatani, Georgia, 20) *H. sinoglacialis*, holotype, 21) *H. zagrosicus*. Scale = 1 mm.



Figs. 22–31: *Helophorus* spp. – whole beetles, dorsal: 22) *H. faustianus*, small beetle from Turkey, 23) *H. guttulus*, male from Russia (Adygea), 24) *H. guttulus*, female (*H. dormitans* SHARP, 1916, holotype), 25) *H. apfelbecki* from Macedonia, 26) *H. nivalis*, 27) *H. fauveli*, 28) *H. arvernicus*, 29) *H. montenegrinus*, 30) *H. altaicus* from the Sayan mountains, 31) *H. angusi*, paratype. Scale = 1 mm.

Figs. 32–40: *Helophorus glacialis* and *H. guttulus* group – heads and pronota: 32) *H. glacialis*, 33) *H. ponticus*, paratype, 34) *H. abeillei*, 35) *H. longipennis*, 36) *H. maculatus*, 37) *H. zagrosicus*, 38) *H. faustianus*, 39) *H. guttulus*, 40) *H. sinoglacialis*, holotype. Scale = 1 mm.

Discussion

Atractohelophorus is one of the subgenera erected by KUWERT (1886). Its principal diagnostic character, among the aquatic species of *Helophorus* which lack scutellary striae on the elytra, is that the apical segment of the maxillary palpi is (more or less) symmetrically oval, as against asymmetrical and generally more elongate in the other group of these species, to which he gave the name *Rhopalohelophorus*. As pointed out by SHARP (1916: 234), KUWERT (1886) apparently

reversed the names of these subgenera: *atracto* means drawn-out, and *rhopalo* means knobbly! These names were emended to *Atracthelophorus* and *Rhopalhelophorus* by KUWERT (1990), but these are unjustified emendations (HANSEN 1999).

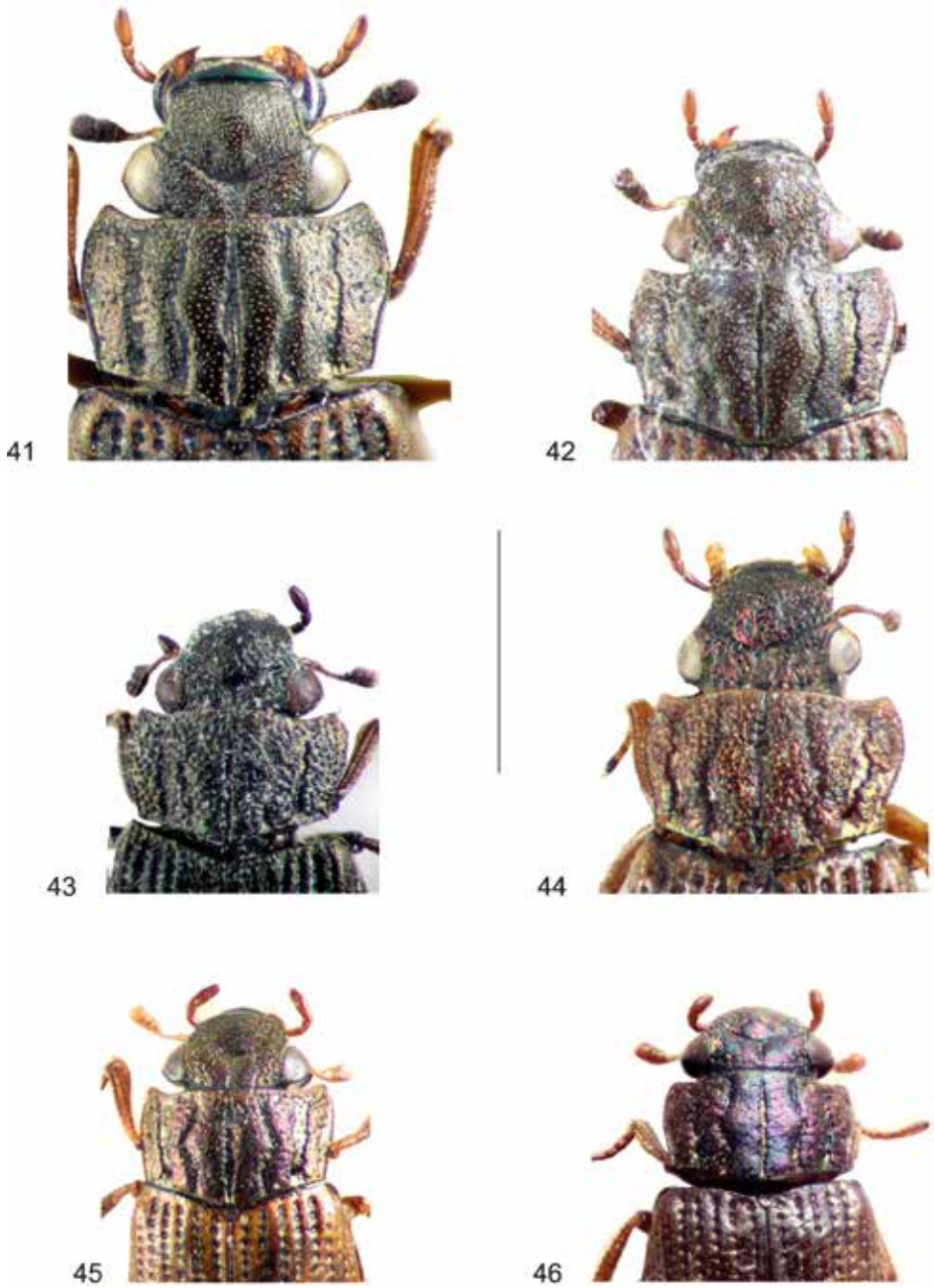
SHARP (1915: 193) noted that the maxillary palp character used as the principal separation of *Atractohelophorus* and *Rhopalohelophorus* is a slight one, but added the narrowness of the elytral epipleura which are narrower than the flanks (pseudepipleura) formed by the outer part of interstice 10, opposite the metaventrite, when viewed from below. He added that most of the species had smaller stiffer tarsi with the natatorial setae less developed than in *Rhopalohelophorus* and suggested that most of the species were less aquatic than species of *Rhopalohelophorus.*

Within the Palaearctic *Atractohelophorus*, as delimited by the symmetrical palpi and wider elytral flanks, generally appears a discrete group of species. There are, however, some species which have symmetrical apical segments to the maxillary palpi but have the elytral flanks either only narrowly or not at all visible from below. ANGUS (1970) treated these as "dubious *Atracthelophorus*". Later, ANGUS (1985), in his review of the Palaearctic species of the subgenus, abandoned this distinction and included some of the "dubious" species in *Atractohelophorus* but excluded others. Meanwhile SMETANA (1985), revising the Nearctic species, found the separation of *Atractohelophorus* and *Rhopalohelophorus* to be unworkable, and synonymized the two under the name of *Rhopalohelophorus*. This arrangement was adopted by HANSEN (1999) and is in current use. It may be noted that the Nearctic *Helophorus* fauna includes only two *Atractohelophorus* species, the Holarctic *H. auricollis* ESCHSCHOLTZ, 1822, native to Alaska and Chukotka, and *H. brevipalpis* BEDEL, 1881, introduced to Logan Canyon, Utah, where it occurs as females only (ANGUS 1971). SMETANA's (1985) reference to additional American *H. brevipalpis*, including males, some of which the senior author has seen, is based on misidentification of *H. orientalis* MOTSCHULSKY, 1860. These species have 9-segmented antennae but most Nearctic *Rhopalohelophorus* have the antennae 8-segmented and some of these have the elytral flanks wider than the epipleura and the apical segment of the maxillary palpi symmetrical oval.

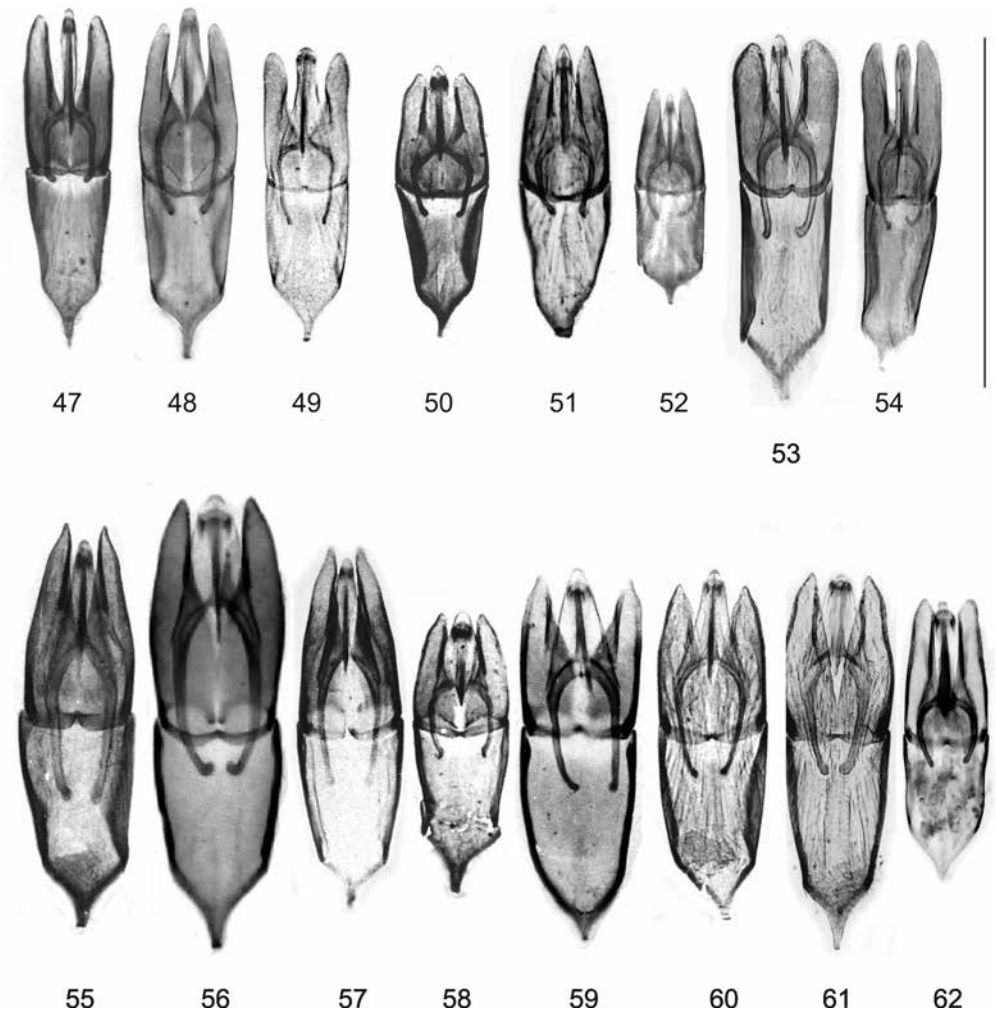
The upshot of this is that in the Palaearctic *Atractohelophorus* comprises a distinct group of species and is therefore useful. It is premature to formally reinstate *Atractohelophorus* as a subgenus, as molecular (DNA) data on more species should be studied first. At the moment the data on four species show an intermingling of *Atractohelophorus* and *Rhopalohelophorus* species (Fikáček et al., unpublished). For the moment it is convenient to regard *Atractohelophorus* as an informal species group.

***Helophorus glacialis* and *H. guttulus* species groups**: ANGUS (1985) listed four species, *H. glacialis* VILLA & VILLA, 1833, *H. abeillei* GUILLEBEAU, 1896, *H. maculatus* MOTSCHULSKY, 1860 and *H. longipennis* GANGLBAUER, 1901 in the *H. glacialis* group. Two further species of this group have since been described, *H. ponticus* ANGUS, 1988 and *H. zagrosicus* ANGUS, 1988. The *H. glacialis* group species are characterized by their metallic bronze maxillary palpi and their elongate rather flat body form. Their ground colour is dark blackish brown with some species having extensive pale mottling on the elytra.

Helophorus glacialis has the legs shining blackish brown (Fig. 32), sometimes with bronze reflections. The elytra are generally dark brown (Fig. 13) but may have extensive dull yellowish brown mottling (Fig. 14). The aedeagus (Fig. 47) is very distinctive, with the parameres narrow elongate and the aedeagal tube also elongate but the struts very short. It is widely distributed in the alpine zone of European mountains and on lower ground in the far north. Its dark colour matches the substratum of ground recently uncovered my melting snow.



Figs. 41–46: *Helophorus* spp. – heads and pronota: 41) *H. apfelbecki*, 42) *H. nivalis*, 43) *H. fauveli*, 44) *H. arvernicus*, 45) *H. montenegrinus*, 46) *H. altaicus*. Scale = 1 mm.



Figs. 47–62: *Helophorus* spp. – aedeagi: 47) *H. glacialis*, 48) *H. ponticus*, paratype, 49) *H. abeillei*, 50) *H. maculatus*, 51) *H. longipennis*, 52) *H. zagrosicus*, 53) *H. faustianus* from Tbatani, Georgia, 54) *H. faustianus*, holotype, 55) *H. nivalis*, 56) *H. apfelbecki*, 57) *H. fauveli*, 58) *H. guttulus* lectotype, 59) *H. arvernicus*, 60) *H. montenegrinus*, 61) *H. altaicus*, lectotype, 62) *H. angusi*, paratype. Scale = 0.5 mm.

Helophorus ponticus (Figs. 15, 33) closely resembles *H. glacialis* in general appearance but its legs are paler, mid-brown, and the aedeagus (Fig. 48) has the parameres less elongate and the struts longer. It inhabits the Pontic Alps of northern Anatolia.

Helophorus abeillei, *H. maculatus* and *H. longipennis* (Figs. 16–18, 34–36) all have the elytra extensively mottled with pale yellowish brown and the legs pale brown. The aedeagus of *H. abeillei* (Fig. 49) is smaller than that of *H. glacialis* and its elongate parameres have blunt apices. The struts are relatively longer than those of *H. glacialis*. It is found in Lebanon/Israel and in the Transcaucasus. *Helophorus maculatus* cannot be distinguished from *H. abeillei* except by the aedeagus (Fig. 50), which is clearly less elongate and appears identical with that of *H. guttulus* MOTSCHULSKY, 1860 (Fig. 58). The beetles, however, are quite different. *Helophorus maculatus*

was described from Arganety in the mountains of northern Kazakhstan and is also known from the Transcaucasus.

Helophorus longipennis is clearly more elongate than the other two species (Fig. 17) and its aedeagus (Fig. 51) is also distinct, larger and slightly more elongate than that of *H. maculatus*. It occurs in the mountains of southern Kazakhstan and Kyrgyzstan.

Helophorus zagrosicus (Figs. 21, 37) has the same colour pattern as the three preceding species but is much smaller, as is its aedeagus (Fig. 52). It was described from the Zagros mountains of northern Iran and also occurs in eastern Anatolia.

ANGUS (1985) listed five species, *H. guttulus*, *H. faustianus* SHARP, 1916, *H. nivalis* GIRAUD, 1852, *H. fauveli* GANGLBAUER, 1901 and *H. costulatus* KUWERT, 1887 in the *H. guttulus* group. *Helophorus apfelbecki* KNIŽ, 1910, now recognized as a distinct species (ANGUS 2009), must be added to this group. Members of this group have somewhat varied appearances but all are more robust and frequently more highly arched than those of the *H. glacialis* group.

Helophorus faustianus (Figs. 19, 22, 38) is to some extent intermediate in appearance between the *H. guttulus* and *glacialis* groups. The maxillary palpi are mid- to dark brown with distinct bronze reflections, and the legs are mid brown. The elytra are dark brown, often with distinct paler mottling. The beetles are more robust than the *H. glacialis* group, and the aedeagus (Figs. 53–54), while of a similar elongate shape to that of *H. glacialis* (Fig. 47) has the parameres relatively wider and with straighter outer margins, and the aedeagal struts relatively longer. It is known from the alpine zone of the North Caucasus (Karachaevo-Cherkesia), Georgia and northern Anatolia (ANGUS 1992, RYNDEVICH 2001).

Helophorus guttulus (Figs. 23, 24, 39), endemic to the Transcaucasus and Anatolia, is on the whole more robust (less elongate) than *H. faustianus*, and the internal intervals of the pronotum are less flattened. The elytra are dark brown, with variable paler mottling. The aedeagus (Fig. 58) is shorter and less elongate than that of *H. faustianus* and, as already mentioned, has the same shape and size as that of *H. maculatus*.

Helophorus nivalis (Figs. 26, 42), *H. apfelbecki* (Figs. 25, 41) and *H. fauveli* (Figs. 27, 43) have very similar aedeagi (Figs. 55–57), but very different appearances. *Helophorus nivalis*, quite widely distributed in the Alps, is a rather bulky beetle with a dark head and pronotum and mid- to dark brown elytra. The palpi are brown, not bronzed. *Helophorus apfelbecki*, known from Macedonia, is larger and darker than *H. nivalis* and the aedeagus is also larger (Figs. 55–56). *Helophorus fauveli* is a very distinctive species, blackish or purple-bronze (including the maxillary palpi and legs) and with the head and pronotum closely and coarsely granulate. The aedeagus (Fig. 57) is the same shape as those of *H. nivalis* and *apfelbecki*, but smaller than either of them. This appears to be a rare species, known from the Swiss and Italian Alps.

Helophorus costulatus is a small rather parallel-sided cylindrical beetle, known only from the holotype female, described as coming from the Caucasus. ANGUS (1985: fig. 20) gives a drawing of the holotype, and scanning electron micrographs of the whole beetle and its pronotum are given by ANGUS (1992: figs. 17k, 28e).

***Helophorus sinoglacialis* within the *H. glacialis* and *H. guttulus* species groups**: *Helophorus sinoglacialis* (Figs. 1–9, 20, 40) appears as more highly arched and with the elytra more strongly striate than in any of the other *H. glacialis* group species. The metallic bronze maxillary palpi and shining black-brown legs agree with *H. glacialis*, but are also shown by *H. fauveli* in the *H. guttulus* group. The coarsely granulate head and pronotum of *H. fauveli* are totally unlike those of *H. sinoglacialis*, which is clearly a very distinctive species. It occupies an intermediate position between the *H. glacialis* and *H. guttulus* groups and in this respect may be compared with *H. faustianus*.

Other relevant species: *Helophorus arvernicus* MULSANT,1846 (Figs. 28, 44, 59) was grouped with *H. brevitarsis* KUWERT, 1890 and *H. richterae* ANGUS, 1985 as being conspicuously robust and highly arched. It is included here as it is one of the few *Helophorus* to be definitely associated with running water. It is very different from *H. sinoglacialis*.

Helophorus montenegrinus KUWERT, 1885 (Figs. 29, 45, 60) was grouped with *H. brevipalpis* BEDEL, 1881 (Figs. 29, 45, 60) by ANGUS (1985) on the grounds that it has the same shape and sculpture as *H. brevipalpis*, differing most obviously in its darker colour and bronze maxillary palpi, as well as its larger and somewhat differently shaped aedeagus. It is included here because of its bronzed maxillary palpi. ORCHYMONT (1927) wrongly synonymized *H. montenegrinus* with *H. guttulus*, and, also wrongly, placed *H. brevipalpis* as a subspecies of it. This was corrected by ANGUS (1985) but, having been used on Central European textbooks, still sometimes crops up. References to *H. guttulus* from areas other than the Transcaucasus and Anatolia are almost certainly errors.

Helophorus altaicus GANGLBAUER, 1901 (Figs. 30, 46, 61) and *H. angusi* HEBAUER, 1999 (Figs. 31, 62) are included here as *H. altaicus* was an obvious candidate for *H. sinoglacialis*, and *H. angusi* appears to be related to it. Both *H. altaicus* (from the Altai and Sayan mountains) and *H. angusi* (from Nepal) differ from *H. sinoglacialis* (and most other species) in having only five (as against six) reaching the base of the elytra, between the suture and the inner edge of the humeral callus. The aedeagi of *H. altaicus* and *H. angusi* (Figs. 61–62) are clearly different.

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