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A Revision of the Leaf Beetles of the Poorly Known *Chrysolina* (*sahlbergiana*) Species-Group in the Subgenus *Pezocrosita* (Coleoptera, Chrysomelidae)

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Abstract—The subgenus *Pezocrosita* Jacobson, 1901, genus *Chrysolina* Motschulsky, 1860, currently includes 38 species, being divided into 7 species-groups. Among them, the *Chrysolina* (*sahlbergiana*) group remains the least studied, although it comprises the type species of the subgenus. The latter, *Chrysolina sahlbergiana* (Jacobson, 1901a), is shown to encompass 2 subspecies: *Ch. sahlbergiana sahlbergiana* and *Ch. sahlbergiana jacobsoni* (Lopatin, 1970). An amended description of *Chrysolina hyperboreica* Mikhailov, 2002, a local species endemic to the northern Ural Mountains within Sverdlovsk Province and previously known only from the male holotype, is given based on new material. A new species, *Ch. korgonica* **sp. n.,** is described from western Altai. A key is given to all the four species of the group. The relict character of the *Chrysolina* (*sahlbergiana*) group is discussed based on disjunct distributions of its species and their associations with the former tundra-steppe communities.

Keywords: leaf beetles, *Chrysolina*, *Pezocrosita*, the northern Urals, the Minusinsk Hollow, Altai, disjunct distribution, tundra-steppe species, relicts

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The subgenus *Pezocrosita* was established by Jacobson (1901a) with the type species *Crosita kuznetzowi* Jacobson, 1901, by original designation and monotypy. In another publication, Jacobson (1901b) described *Crosita sahlbergiana* Jacobson, 1901, in the same subgenus, and clearly stated that *C. kuznetzowi* was the type species of this subgenus (p. 120). Both papers were almost simultaneously published in different journals, but the year of the description of the species *Crosita kuznetzowi* and the subgenus *Pezocrosita* had long been ranged from 1900 to 1902 (Mohr, 1966; Lopatin, 1970; Bienkowski, 2001). The exact date of this publication in the journal "Tr. Russ. Entomol. Obshch." / "Horae Societatis Entomologicae Rossicae," in this case, not the whole volume but copy prints of this paper, according to article 21.8 of ICZN, can be established due to Kerzhner's (1984) paper. This was December 1900, which should be considered as the 31st January 1901 because of the calendar change and according to article 21.3.1 of ICZN. The journal "Ofversigt af Finska Vetenskaps-Societetens Forhandlingar," in which *C. sahlbergiana* was described, was published in 1901. Separate copy prints from the journal also exist (Bienkowski, 2019), but the exact publication date of this journal is not known. Therefore, according to article 21.3.1 of ICZN (International Code..., 2004), December 31, 1901 should be considered the publication date of this volume.

Jacobson (1901a, 1901b) reported that both species described by him differ from the other species of the genus *Crosita* Motschulsky, 1860 in the coloration and in the structure of the tibiae. All species of *Crosita* have metallic coloration, but *C. kuznetzowi* and *C. sahlbergiana* resemble *Chrysolina limbata* (Fabricius, 1775) in appearance. Based on examination of the shape of the aedeagus, Kontkanen (1957) suggested that this sub-

genus should be transferred from the genus *Crosita* to the genus *Chrysomela* Linnaeus, 1758. Although Jacobson himself had transferred his species *C. sahlbergiana* to the genus *Chrysomela* much earlier (Jacobson, 1925). It is uncear why he did not mention *C. kuznetzowi* in this publication. The transfer of the subgenus *Pezocrosita* to the genus *Chrysomela*, finally formalized by Mohr (1966), caused secondary homonymy of *Chrysomela kuznetzowi* (Jacobson, 1901a) with *Chrysomela kuznetzowi* Jacobson, 1897. This circumstance was noticed by Lopatin (1970) who gave to *Chrysomela kuznetzowi* (Jacobson, 1901a) a replacement name *Ch. jacobsoni* Lopatin, 1970. This name has never been used, since Medvedev (1982) synonymized *Ch. kuznetzowi* with *Ch. sahlbergiana* but did not explain his decision.

Mohr (1966) and Lopatin (1970) began to add the known or newly described species to the subgenus *Pezocrosita*, and Bienkowski (2001) increased the number of the species to 48 and divided them into 9 species-groups. Later, some of these species were transferred to other subgenera: *Allohypericia* Bechyne, 1950, *Chalcoidea* Motschulsky, 1860, *Jeanclaudia* Mikhailov, 2009, and *Hypochalcoidea* Bourdonne, 2012. In Bourdonne's (2012) opinion, the subgenus *Pezocrosita* should retain only 7 species. In the recently published World review of the genus *Chrysolina*, Bienkowski (2019) left 38 species and 7 species-groups in *Pezocrosita* sensu lato and pointed out heterogeneity and possible paraphyly of this subgenus. Indeed, this is the only subgenus of *Chrysolina* in which species-groups are distinguished, a number of the diagnostic features of the subgenus are characteristic of only some of the species-groups, and representatives of the closely related subgenera *Allohypericia* and *Jeanclaudia* have been included in the key to the species-groups (Bienkowski, 2019). However, in any concept of the subgenus, it includes a group of the species most closely related to *Ch. sahlbergiana* and in fact represents *Pezocrosita* s. str.

The *Ch.* (*sahlbergiana*) species-group initially comprised 7 species (Bienkowski, 2001), 5 of which were later transferred to the subgenus *Jeanclaudia*, and only *Ch. sahlbergiana* and *Ch. medvedevi* Lopatin, 1970 remained in the group. The second species was described from Kent (Lopatin, 1970), a low mountain range in Central Kazakhstan 1200 km southwest of the type locality of *Ch. sahlbergiana*. *Chrysolina hyperboreica* Mikhailov, 2002 became the third species of the group. The only male of this species was found by Yu.E. Mikhailov in 2000 in the Northern Ural mountains. Attempts to find this species again during the subsequent expeditions to the same mountain range failed, and a series of beetles was collected only in 2016. As the original description of the species (Mikhailov, 2002) was based on a single male and some characters necessary for its placement in a subgenus or a species-group (Bienkowski, 2019) were not given, the amended description is provided herein.

The finding of an unknown species in 2019 in Western Altai by the expedition of Novosibirsk entomologists (in which S.V. Reshetnikov took part) gave an additional incentive to write the present paper. This species turned out to be very closely related to the preceding one and became the fourth member of the species-group.

MATERIALS AND METHODS

For the first time since the record of a single type specimen of *Ch. hyperboreica* in 2000, this species was collected again in July 2016 during the investigation of the peaks of the Kytlymskii Massif in the mountainous part of Sverdlovsk Province, which was performed within the framework of GLORIA International Program (Global Observation Research Initiative in Alpine Environments). This time it had been already assumed that *Artemisia norvegica* is a host plant of this chrysomelid, and after careful inspection of the clumps of this species larvae and beetles of *Ch. hyperboreica* were found.

The species of this group are characterized by night activity and, therefore, collecting in the dark with a headlight was most productive.

The specimens mentioned here, including the type ones, are deposited in the following collections: ZIN, the Zoological Institute, Russian Academy of Sciences (St. Petersburg); ISEA, Institute of Systematics and Ecology of Animals, Siberian Branch, Russian Academy of Sciences (Novosibirsk); ZMUH, Zoological Museum, University of Helsinki (Finland); CLM, L.N. Medvedev's collection (at present granted to ZIN); CSR, S.V. Reshetnikov's collection (Novosibirsk); CHK, H. Kippenberg's collection (Herzogenaurach,

Germany); CYM, Yu.E. Mikhailov's collection (Yekaterinburg).

The collection specimens were examined and measured using a MBS-10 binocular microscope and an eyepiece-micrometer.

RESULTS

Subgenus ***Pezocrosita*** Jacobson, 1901

Type species *Crosita kuznetzowi* Jacobson, 1901 [*Chrysolina sahlbergiana jacobsoni* (Lopatin, 1970)], by original designation.

Chrysolina* (*sahlbergiana*)** species-group [Pezocrosita*** s. str.]

Chrysolina* (*Pezocrosita*) *sahlbergiana (Jacobson, 1901)

Crosita kuznetzowi was described by Jacobson (1901a) based on a single male found in Uzun-shul (currently in Askizskii District of Khakassia). In this locality the goldmine and summer residence of Pyotr Ivanovich Kuznetsov, after whom the species was named, were situated (Kalemeneva, 2018).

Crosita sahlbergiana was described based on a series of specimens (7 ♂, 3 ♀) from the environs of Minusinsk (Jacobson, 1901b). Thus, both species are described from the Minusinsk Hollow but separated by the Yenisei River valley which is a significant zoogeographical boundary. In the description of *Crosita sahlbergiana*, Jacobson (1901b) noted its differences from the first species but with the reserve that the *C. kuznetzowi* may be a teratological specimen. The indicated differences between these two species were rather clear, but after Medvedev (1982) synonymized *Ch. sahlbergiana* with *Ch. kuznetzowi* the subsequent authors accepted the act and did not come back to this question any more (Bienkowski, 2001, 2019; Mikhailov, 2002; Kippenberg, 2010).

However, the specimens at our disposal, which are topotypes of both taxa described by G. Jacobson, demonstrate the differences reported for these taxa (see the key below). Particularly, the male from the left-bank (Khakass) part of the Minusinsk Hollow (corresponding to *Ch. kuznetzowi*) has distinctly shining dorsum, more regular elytral striae (Fig. 1, *a*), a deeper sulcus on the fore tibia, and a very strongly widened fore tarsus (Fig. 2, *a*). At the same time, the males from the right-bank part of the Minusinsk Hollow (including the syntypes of *Ch. sahlbergiana*) have weakly shining or silky dorsum, less regular elytral striae (Fig. 1, *b*), a shallow sulcus on the fore tibia, and less widened fore tarsus (Fig. 2, *b*). The females of the both taxa are matt dorsally, but they also differ (the female of *Ch. kuznetzowi* was not known to G. Jacobson). The glabrous median line on the basal tarsomeres is wide in the female from Khakassia and narrower in the females from the environs of Minusinsk. Thus, the taxa described by Jacobson are well distinguishable. However, as the specimens from Khakassia and Krasnoyarsk Territory exhibit no significant differences in the coloration and shape of the aedeagus, they can be considered as belonging to different subspecies.

Chrysolina* (*Pezocrosita*) *sahlbergiana sahlbergiana (Jacobson, 1901)

Crosita (*Pezocrosita*) *sahlbergiana* Jacobson, 1901b : 120 ("Fl. Jenissej: Ajatschinskaja, ad ripam Taganskoi protok et Minussinsk," syntypes in ZIN, ZMUH, CLM, and CHK; examined).

Chrysomela sahlbergiana: Jacobson, 1925 : 26.

Pezocrosita sahlbergiana: Kontkanen, 1957 : 89.

Chrysomela (*Pezocrosita*) *sahlbergiana*: Mohr, 1966 : 90.

Chrysolina (*Pezocrosita*) *sahlbergiana* (partim): Medvedev, 1982 : 245; Medvedev and Dubeshko, 1992 : 100; Bienkowski, 2001 : 182 (note); Mikhailov, 2002 : 70; Kippenberg, 2010 : 410 (note); Bienkowski, 2019 : 133 (note), 503–504.

Material. Syntypes, 2 ♂, 2 ♀, with labels: "Minusinsk," "K. Ehnberg" or "Hammarstr.," "*Crosita* (*Pezocrosita*) *sahlbergiana* Jacobs. typ. G. Jacobson det." (ZIN, ZMUH, CLM, CHK); 2 ♂, 2 ♀, *Krasnoyarsk Territory*, 5 km NW of Minusinsk, steppefied hills, under clumps of *Potentilla sericea*, 31.VII.2002, Yu.E. Mikhailov (CYM); 1 ♀ without geographical data with the labels: "Coll. Mannh.," "*cruenta* Gebler. ex Sibir," "Ny for Samlingen" (ZMUH).

Fig. 1. *Chrysolina* (*sahlbergiana*) species-group, habitus: (*a*) *Ch. sahlbergiana jacobsoni* (Lop.), male (Khakassia, environs of Birikchul' Vill.); (*b*, *c*) *Ch. sahlbergiana sahlbergiana* (Jcbs.), Krasnoyarsk Territory, environs of Minusinsk [(*b*) male, (*c*) female]; (*d*) *Ch. medvedevi* (Lop.), holotype, male (Kazakhstan, Kent Mts., SE of Karkaralinsk); (*e–h*) *Ch. hyperboreica* Mikhailov [(*e*) holotype, male (Sverdlovsk Prov., Serebryanskii Kamen'); (*f*) typical form, female; (*g*) red form, male; (*h*) red form, female (all from Sverdlovsk Prov., the Tylaisko-Konzhakovsko-Serebryanskii Mt. Range)]; (*i–l*) *Ch. korgonica* sp. n. [(*i*) holotype, male; (*j*) paratype, female; (*k*, *l*) paratypes, males (all from Altai Terr., the Korgonskii Mt. Range)]. Scale 1 mm.

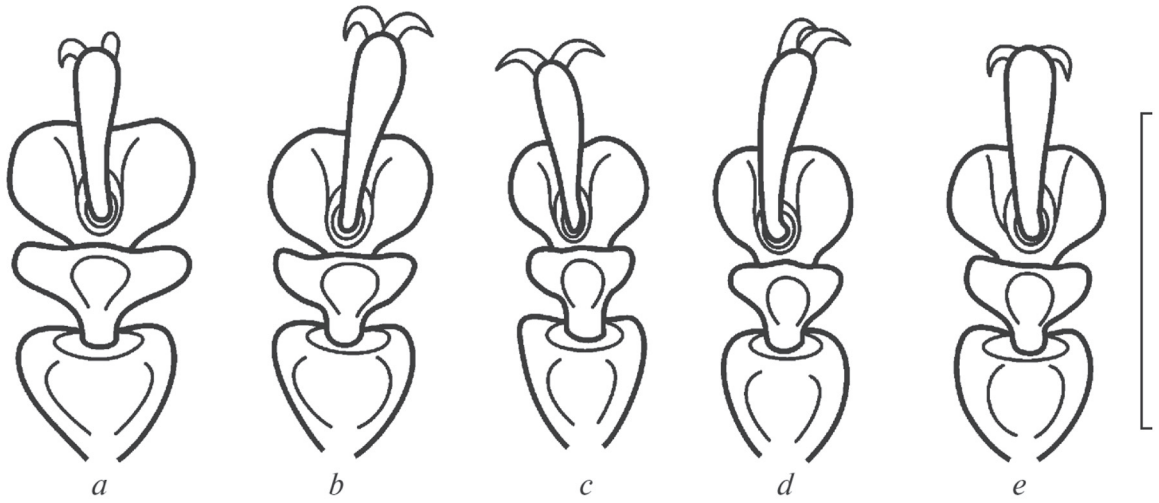

Fig. 2. *Chrysolina* (*sahlbergiana*) species-group, male fore tarsus: (*a*) *Ch. sahlbergiana jacobsoni* (Lop.), (*b*) *Ch. sahlbergiana sahlbergiana* (Jcbs.), (*c*) *Ch. medvedevi* (Lop.), (*d*) *Ch. hyperboreica* Mikhailov, (*e*) *Ch. korgonica* sp. n. Scale 1 mm.

Distribution (Fig. 3). The right-bank part of the Minusinsk Hollow in Krasnoyarsk Territory (environs of Minusinsk). The record from the Darkhad Valley in Northern Mongolia (Medvedev, 1982) requires confirmation.

Biotopes. A stony steppe on the hills at the periphery of the hollow, under clumps of *Potentilla sericea* and under stones (Mikhailov, 2006).

Host plant. Wormwood (*Artemisia* spp.) (Asteraceae). The feeding of the beetles and larvae was confirmed in cages (Mikhailov, 2006).

Etymology was not explained by the author (Jacobson, 1901b). However, it is clear from the introduction to the paper with the description that the species was named after the Finnish entomologist John Sahlberg (1845–1920).

Chrysolina* (*Pezocrosita*) *sahlbergiana jacobsoni
(Lopatin, 1970), stat. resurr., comb. n.

Crosita (*Pezocrosita*) *kuznetzowi* Jacobson, 1901a : 78 (Uzun-shul).

Chrysomela (*Pezocrosita*) *kuznetzovi*: Mohr, 1966 : 90 (incorrect subsequent spelling).

Chrysolina kusnetzovi: Kontkanen, 1957 : 89; Medvedev, 1982 : 245 (incorrect subsequent spelling).

Chrysomela (*Pezocrosita*) *jacobsoni*: Lopatin, 1970 : 183, nom. subst. pro *Chrysomela kuznetzowi* Jacobson, 1901b, non *Chrysomela kuznetzowi* Jacobson, 1895.

Chrysolina jacobsoniana: Medvedev and Korotyaev, 1976 : 243 (incorrect subsequent spelling).

= *Chrysolina* (*Pezocrosita*) *sahlbergiana*: Medvedev, 1982 : 245.

Chrysolina (*Pezocrosita*) *sahlbergiana* (partim): Medvedev, 1982 : 245; Medvedev and Dubeshko, 1992 : 100; Bienkowski, 2001 : 182 (note); Mikhailov, 2002 : 65, 66 (figures of the pronotum and fore tarsus), 70; Kippenberg, 2010 : 410 (note); Bienkowski, 2019 : 133 (note), 503–504.

Material. Holotype (?), ♂ with labels: "1150," "*Cr*. (*Pezocrosita*) *rufolimbata* G. Jacobs. typ. G. Jacobson det." (CLM). 1 ♂, 1 ♀, *Khakassia*, Askizskii District, 8 km SE of Birikchul', steppe slopes, 18–19.VII.1990, S.E. Tchernyshev, D.V. Logunov (ISEA).

Distribution (Fig. 3). The left-bank part of the Minusinsk Hollow (Askizskii District of Khakassia).

Biotopes. Steppefied slopes of the hills.

Host plants. Probably wormwood (*Artemisia* spp.).

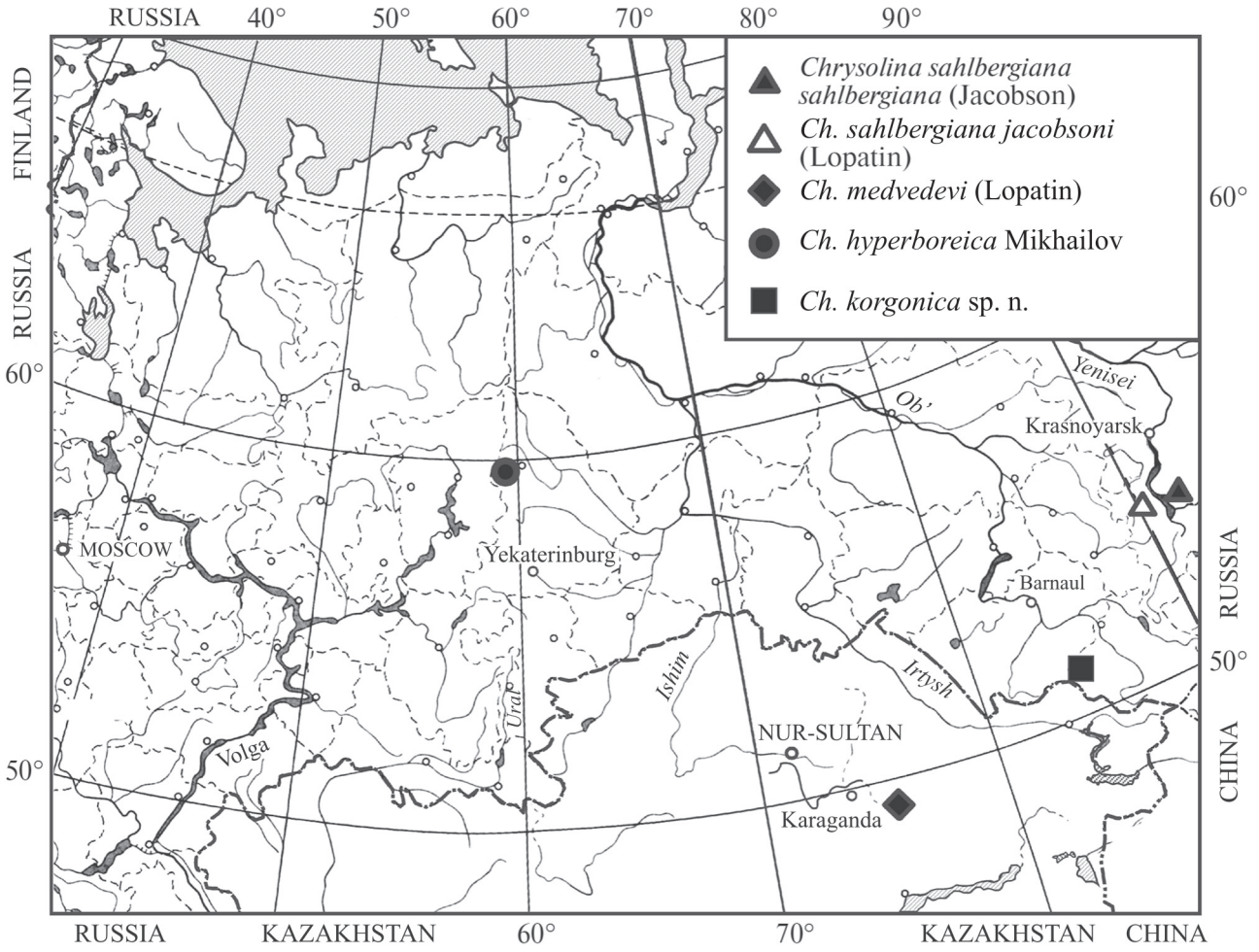

Fig. 3. Distribution of leaf beetles of the *Chrysolina* (*sahlbergiana*) species-group.

Etymology. The replacement name was given in honor of G.G. Jacobson. Originally, the taxon was named in honor of Pyotr Ivanovich Kuznetsov in whose house Aleksei, G.G. Jacobson's brother, stayed in 1897 during the expedition over Southern Siberia.

Chrysolina* (*Pezocrosita*) *medvedevi (Lopatin, 1970)

Chrysomela (*Pezocrosita*) *medvedevi* Lopatin, 1970 : 186 (Kazakhstan, Karaganda Prov.: Kent Mts. SW of Karkaralinsk, 1464 m, holotype in ZIN, examined); Arnoldi and Medvedev, 1969 : 413 (nomen nudum); 1975 : 1636, 1639 (ecology).

Chrysolina (*Pezocrosita*) *medvedevi*: Lopatin, 1977 : 152; Lopatin and Kulenova, 1986 : 105; Bienkowski, 2001 : 182 (note); Mikhailov, 2002 : 67 (figure), 70; Kippenberg, 2010 : 410 (note); Bienkowski, 2019 : 133 (note), 503–504.

Material. Holotype, male, with labels: "Kent SO of Karkaralinsk, Karag., G. Medvedev, 21.VII.962" [printed], "*Chrysom*. (*Pezocrosita*) *medvedevi* sp. n. [handwritten] I.K. Lopatin det., 1967 [printed]," "Holotypus [printed] *Chrysomela* (*Pezocrosita*) *medvedevi* Lopatin [handwritten]," *Chrysolina* (*Pezocrosita*) *medvedevi* (Lopatin, 1970), Yu. Mikhailov det., 2010 (ZIN).

Distribution (Fig. 3). A local endemic of the Kent Mt. Range (Karkaralinsk-Kent mountain system) in Karaganda Province of Kazakhstan. Known only from the type locality (Arnoldi and Medvedev, 1969, 1975; Lopatin, 1970).

Biotope. Rocky and gravel top plateaus in the highest southeastern part of the mountain range at the elevations of 1300–1464 m (Arnoldi and Medvedev, 1975).

Host plants. Probably wormwood *Artemisia* spp.

Etymology (Lopatin, 1970). The species was named after Gleb Sergeevich Medvedev (1931–2009), a well-known expert in darkling beetles (Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia).

Chrysolina (*Pezocrosita*) *hyperboreica* Mikhailov, 2002

Chrysolina (*Pezocrosita*) *hyperboreica* Mikhailov, 2002 : 64 (the Northern Urals: Konzhakovskii Kamen' Mt. Range, Serebryanskii Kamen' Mt., holotype in ISEA); Kippenberg, 2010 : 413 (note); Bienkowski, 2019 : 132 (note), 503–504.

Material. Holotype, male with labels: "Northern Urals, Konzhakovskii Kamen' Mt. Range, southern spur of Serebryanskii Kamen' Mt., tundra, 9.VIII.2000, Yu.E. Mikhailov leg.," "HOLOTYPE *Chrysolina hyperboreica* n. sp. Yu. Mikhailov det., 2000" (ISEA).

1 ♀, *Sverdlovsk Prov*., Tylaisko-Konzhakovsko-Serebryanskii massif, Trapetsiya Mt. top plateau, h = 1200 m, alpine tundra, pitfall traps, 25.VII.2016, Yu.E. Mikhailov leg. (CYM); 2 ♂, 3 ♀, same locality, western slope of Trapetsiya Mt., h = 1150 m, alpine tundra, in clumps of *Artemisia norvegica*, 25.VII.2016, Yu.E. Mikhailov leg. (CYM); 2 ♂, 3 ♀, same locality, eastern spur of Trapetsiya Mt., h = 1150 m, alpine tundra, in clumps of *Artemisia norvegica*, 29.VII.2016, Yu.E. Mikhailov leg. (CYM).

Description. Male oblong-oval, silky shining; body length (mm) 6.2–7.1, width 4.0–4.3. Female oblong-oval, matt; body length (mm) 6.9–8.3, width 4.2–5.0. Elytra bronze; head, pronotum, and scutellum bronze-green (bronze form) (Fig. 1, *e*, *f*), or elytra brick-red with blackened suture and punctures of punctation; pronotum dark brown (red form) (Fig. 1, *g*, *h*). Legs black; antennae, maxillary palpi, and tarsi dark brown; 1st and 2nd antennal segments ventrally and claws rufous.

Clypeus densely and finely punctate; frons with sparser punctation. Frontal suture ill-defined, deepened only at sides; epicranial suture designated only in upper half (frequently missing in females). Ultimate segment of maxillary palpus of male transverse, ax-like widened, with straightly truncate apex, 1.2 times as wide as long, 1.6 times as long and 1.5 times as wide as preceding segment; that in female oblong-oval, with straightly truncate apex, 1.3 times as long as wide, 1.7 times as long and 1.1 times as wide as preceding segment.

Distance from antenna to eye 1.4 times that from antenna to clypeus. Length ratio of 1st–3rd antennal segments 8 : 4 : 6. 10th segment 1.2 times as long as wide; 11th segment twice as long as wide. Orbital lines distinct and deepened only in upper quarter of eye.

Pronotum 1.8–1.9 times as wide as long, widest before midlength; disc weakly regularly convex, distinctly shagreened, densely and finely punctate, except for the smooth midline (punctures on disc in male and female of equal size). Sides rounded only in distal part, almost rectilinearly converging in basal part, rarely slightly emarginate in female. Basal width 1.3 times width between anterior angles in both sexes. Anterior angles moderately prominent, rounded-triangular; basal angles nearly straight or obtuse-angled in male, occasionally slightly pointed in female. Anterior margin bordered and widely emarginate, covered with short numerous setae; posterior margin considerably arcuately projecting medially. Anterior setiferous pores absent. Lateral calli wide, at base, constituting 1/4–1/3 of pronotum width in both sexes, with punctation slightly finer than but as dense as that on disc. Lateral depressions arcuate, not interrupted and distinct along entire length, formed by entirely merged coarse punctures, with steep walls, strongly deepened in basal quarter or one-third.

Propleura longitudinally convex; their outer side with system of transverse and longitudinal wrinkles, without outer margination; basal fold shallow. Intercoxal process of prosternum in both sexes with weak longitudinal depression coarsely punctate. Prosternum as long as metasternum. Metasternum deeply bordered at anterior margin; abdominal sternite I 1.4 times as long as metasternum.

Scutellum triangular with rounded apex, as long as wide or 1.2 times as wide as long, with punctation similar to that on pronotal disc. Elytra at base slightly wider than pronotum, widest before midlength, without humeral calli, 2.2–2.3 times as long as wide (in both sexes; measured as a ratio of the total length of an elytron to

its width, not to the joint elytral width.—Author). Primary punctation of elytra fine, slightly coarser in male than in female, forming paired rows partly masked by dense secondary punctation; secondary punctation only two-thirds as coarse as primary one; wide even-numbered intervals considerably more densely punctate than the narrow odd-numbered intervals. Nearly all rows of punctures confused to various extent, especially 4–7th rows behind the middle where 5th and 6th rows occasionally indistinct. Scutellar row short, consisting of 7–9 punctures. Intervals flat; occasionally only 3rd interval weakly convex. Punctures of lateral stria larger and sparser than those in elytral rows. Sutural stria absent. Epipleura inclined, visible along entire length, with small wrinkles. Dense short setae present only in distal part of epipleura. Wings rudimentary, narrow, only slightly projecting beyond posterior margin of metasternum.

Fore tarsus of male moderately widened (Fig. 2, *d*), 2.3 times as long as wide (excluding claw-segment.—Author); width ratio of 1st–3rd segments of fore tarsus 3.1 : 2.8 : 3.4. Hair brushes on sole surfaces of all male tarsi entire. Tarsi of female narrow, 2.5–2.7 times as long as wide (see author's note above); width ratio of 1st–3rd segments of fore tarsus 2.4 : 2.0 : 2.7; basal segment of all tarsi ventrally with narrow glabrous line.

Pygidium with shallow wide depression in basal third in both sexes. Abdominal sternite I widely bordered on anterior margin; process between hind coxae covered with coarse and rugose punctation; rest of surface finely and sparsely punctate. Apical abdominal sternite of male very weakly convex in the middle, nearly flat, with row of medium-sized punctures only along posterior margin, slightly depressed and covered with wrinkles at sides, bordered and slightly arcuately emarginate apically. Apical abdominal sternite of female regularly convex, sparsely covered with medium-sized punctures in posterior part and with small punctures in anterior part; its apex straightly truncate. Aedeagus (Fig. 4, *c*) slightly curved laterally, with shortly narrowed apex.

Differential diagnosis. *Chrysolina* (*Pezocrosita*) *hyperboreica* differs from *Ch. sahlbergiana* and *Ch. medvedevi* in a more slender (narrower) body and in the entirely metallic coloration (in the typical form); the lateral pronotal calli are wide, separated from the disc by entire shallow sulci which are strongly deepened and have steep walls in the basal quarter (Fig. 1, *e*–*h*). The shape of the aedeagus with the flagellum is typical of the group, but the aedeagus is distinctly smaller and narrower and differs in a weak curvature in lateral view and in the shape of the apex (Fig. 4, *c*, *d*).

Distribution (Fig. 3). A Northern Ural alpine-tundra species, a local endemic of the Kytlymskii (Tylaisko-Konzhakovsko-Serebryanskii) Mountain Range in Sverdlovsk Province.

Biotopes. Mossy-grass-shrublet alpine tundra.

Host plant. *Artemisia norvegica* (Asteraceae). The beetles and larvae were collected in the clumps of this plant and received the same feeding in the cages.

Etymology (Mikhailov, 2002). The name derives from the Hyperborean Mts., the ancient name of the northern part of the Ural Mt. Range.

Chrysolina* (*Pezocrosita*) *korgonica
Mikhailov et Reshetnikov, sp. n.

Material. Holotype, male with labels: "Altai, Korgonskii Range, upper course of Kuma River, 10 km SW of Ust-Kumir Vill., 2150–2200 m, 6.VII.2019, A.A. Gurina, R.Yu. and E.R. Dudko," "HOLOTYPE *Chrysolina korgonica* n. sp. Yu. Mikhailov et S. Reshetnikov design., 2019" (ISEA); paratypes: 14 ♂, 1 ♀, same locality, 6.VII.2019, A.A. Gurina, R.Yu. and E.R. Dudko leg. (CYM); 13 ♂, 8 ♀, same locality, 6.VII.2019, S.V. Reshetnikov leg. (CSR).

Description. Male (holotype) oblong-oval; body length 7.4 mm, width 4.7 mm. Elytra dark green; head, pronotum, and scutellum dark bronze. Legs black; antennae, maxillary palpi, and tarsi dark brown; 1st and 2nd antennal segments ventrally and claws rufous.

Clypeus densely and coarsely punctate; frons with similar coarse punctation. Frontal suture ill-defined, deepened only at sides; epicranial suture distinct only in upper half. Ultimate segment of maxillary palpus transverse, ax-like widened, with straightly truncate apex, 1.3 times as wide as long, 1.6 times as long and 1.3 times as wide as preceding segment.

Distance from antenna to eye 1.4 times that from antenna to clypeus. Length ratio of 1st–3rd antennal segments 9 : 5 : 7. 10th segment 1.2 times as long as wide;

11th segment 1.8 times as long as wide. Orbital lines narrow, deepened only in upper quarter of eye.

Pronotum twice as wide as long, widest before midlength; disc regularly convex, finely shagreened, densely covered with medium-sized punctures. Sides widely and regularly rounded (Fig. 1, *i*). Basal width 1.4 times width between anterior angles. Anterior angles strongly prominent, rounded; basal angles weakly obtuse-angled, nearly straight. Anterior margin widely bordered and ciliate; posterior margin considerably arcuately projecting medially. Anterior setiferous pores absent. Lateral calli wide, basally constituting 1/4 of pronotum width, covered with punctures distinctly smaller than those on disc. Lateral depressions arcuate, continuous and distinct along entire length, consisting of entirely merged coarse punctures, with steep walls in basal third. Propleura longitudinally convex, with irregular transverse wrinkles on outer side, without outer edging; basal fold shallow. Intercoxal process of prosternum covered with large coarse punctures, without pronounced longitudinal depression. Prosternum and metasternum equal in length. Metasternum deeply bordered at anterior margin; abdominal sternite I 1.25 times as long as metasternum.

Scutellum triangular with pointed apex, 1.1 times as wide as long, smooth, impunctate. Elytra at base slightly wider than base of pronotum, widest behind midlength, without humeral calli, 2.3 times as long as wide (see comments to *Ch. hyperboreica*). Punctures of primary punctation of elytra medium-sized, dense, forming paired, slightly confused rows masked by dense secondary punctation. Secondary punctation slightly finer than primary one; wide even-numbered intervals wrinkled and covered with punctures denser and larger than those on the narrow odd-numbered intervals. Scutellar row short, inconspicuous, formed by 5 or 6 punctures. All intervals flat. Punctures of lateral stria larger and sparser than those in discal rows. Sutural stria absent. Epipleura inclined, visible along entire length, with small wrinkles. Dense short setae present only in distal part of epipleura. Wings rudimentary, short, rounded, reaching only posterior margin of metasternum.

All tarsi moderately widened (Fig. 2, *e*); fore tarsus 2.4 times as long as wide (see comments to *Ch. hyperboreica*); width ratio of its 1st–3rd segments 3.2 : 3.0 : 4.0. Hair brushes on sole surfaces of all tarsi entire.

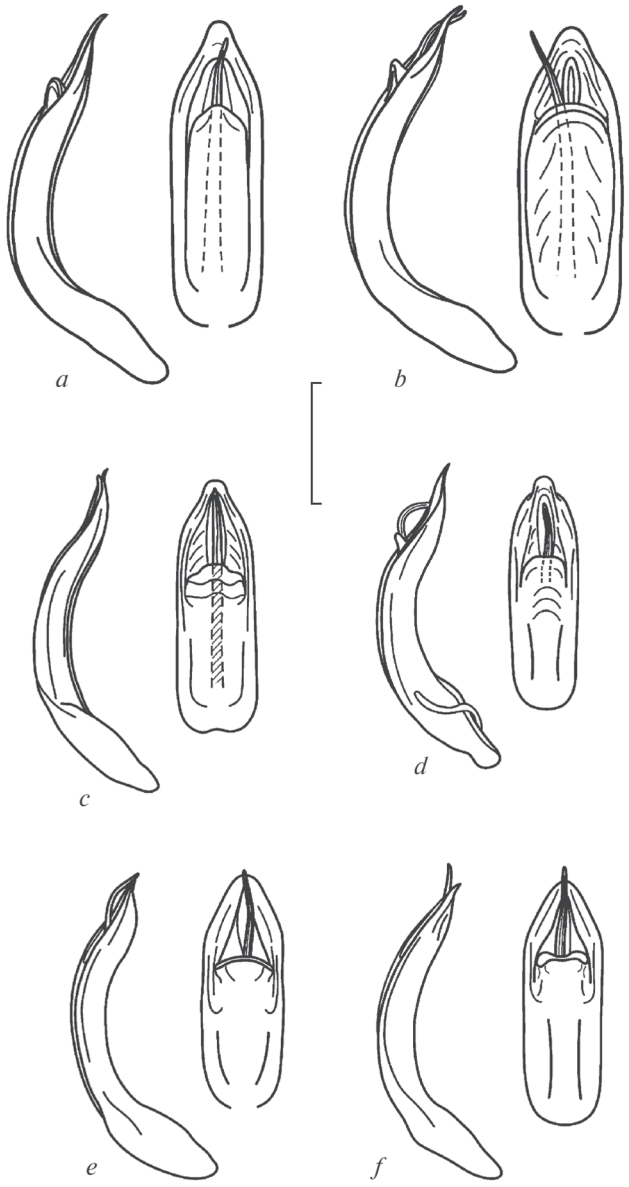

Fig. 4. *Chrysolina* (*sahlbergiana*) species-group, aedeagus, dorsal (left) and lateral (right) view: (*a*) *Ch. sahlbergiana sahlbergiana* (Jcbs.), topotype (environs of Minusinsk); (*b*) *Ch. medvedevi* (Lop.), holotype; (*c*, *d*) *Ch. hyperboreica* Mikhailov [(*c*) holotype, (*d*) Trapetsiya Mt.]; (*e*, *f*) *Ch. korgonica* sp. n., holotype and paratype. Scale 1 mm.

Pygidium with shallow wide depression in basal third. Apical abdominal sternite transversely convex, with coarse and large punctures, with apex bordered and slightly arcuately emarginate. Aedeagus (Fig. 4, *e*, *f*) distinctly curved in lateral view, not narrowing arcuately toward the widely rounded triangular apex.

Variability. Males. Body length (mm) 6.8–7.5, width 4.2–4.7. Prevailing coloration as that in holotype; less frequently entire dorsal side violet with green tint or blackish bronze (Fig. 1, *k*, *l*).

Females (Fig. 1, *j*) oblong-oval or ovate, matt; body length (mm) 7.4–8.0, width 4.5–4.9. Elytra dark green; head, pronotum, and scutellum dark bronze. Less frequently, entire dorsal side violet with green tint, or blackish bronze. Tarsi narrow; basal segments of all tarsi with narrow glabrous median line. Apical abdominal sternite weakly transversely convex, covered with medium-sized punctures, with very weakly arcuately emarginate apex.

Etymology. The name of the species derives from that of the Korgonskii Mt. Range in Altai, where this species was found.

Differential diagnosis. Among the apterous (with reduced wings) species, the *Ch*. (*sahlbergiana*) species-group in the subgenus *Pezocrosita* is most similar in appearance to the *Ch.* (*convexicollis*) species-group, and in the genus *Chrysolina*, to the subgenus *Jeanclaudia* Mikhailov, 2006. The differences are listed in the key:

1 (2) Elytra with confused punctation, occasionally only with traces of rows of punctures. Pronotum with lateral sulci strongly deepened and widened only in basal third. Tarsi of males weakly widened .... Subgenus ***Pezocrosita*** (***Ch. convexicollis*** species-group).

2 (1) Elytra with rows of punctures.

3 (4) Pygidium with deep median sulcus in apical half. Pronotum with anterior setiferous pores; its lateral calli narrow, shallow and not interrupted along entire length (only in basal third in some species). Aedeagus without flagellum, or flagellum short and not projecting ..... Subgenus ***Jeanclaudia.***

4 (3) Pygidium without deep median sulcus in apical half. Anterior setiferous pores on pronotum absent. Lateral calli of pronotum narrow, not interrupted along entire length, moderately or strongly deepened. Flagellum of aedeagus narrow, whiplike, always projecting from apical opening .... Subgenus ***Pezocrosita*** (***Ch. sahlbergiana*** species-group).

Key to the Species of the Ch. sahlbergiana Group

1 (6) Pronotum black; elytra with wide red margination or almost entirely red (Fig. 1, *a–d*). Abdomen red. Lateral pronotal calli wide, convex, separated from disc by moderately deepened sulcus with steep outer wall. In females, basal segments of all tarsi ventrally with more or less wide glabrous line.

2 (5) Body more elongate. Elytra black; their wide basal margination and lateral, gradually narrowing posteriad margination, and also epipleura rufescent-red (Fig. 1, *a–c*). Tarsi of male strongly widened. Pronotum with regularly rounded lateral margins. Aedeagus narrower, parallel-sided, smoothly narrowed toward the more strongly attenuate apex (Fig. 4, *a*).

3 (4) In male, dorsal side silky; fore tarsus strongly widened (Fig. 2, *b*). Glabrous ventral line on first tarsal segment of female moderately wide. Scutellum semi-oval. Rows of punctures on elytra more confused; punctures in rows in male smaller. Length 6.0–7.5 mm (males), 7.5–8.2 mm (females); width 4.1–4.9 mm (males), 5.0–5.5 mm (females). Minusinsk Hollow in Krasnoyarsk Territory, (?) Darkhad Valley in Northern Mongolia ..... ***Ch. sahlbergiana sahlbergiana*** (Jacobson, 1901a).

4 (3) In male, dorsal side shining; fore tarsus very strongly widened (Fig. 2, *a*). Glabrous ventral line on first tarsal segment of female wide. Scutellum triangular. Rows of punctures on elytra regular; punctures in rows in male larger. Length 7.4–8.0 mm (males), 8.0 mm (females); width 4.5–5.0 mm (males), 5.2 mm (females). Minusinsk Hollow in Khakassia .... ***Ch. sahlbergiana jacobsoni*** (Lopatin, 1970).

5 (2) Body more rounded. Elytra one-colored, brick-red to reddish brown, with narrow black margination of base, lateral margins, and suture (Fig. 1, *d*). Tarsi of male moderately widened (Fig. 2, *c*). Sides of pronotum weakly rounded, nearly straight in middle part. Scutellum widely triangular (1.5 times as wide as long), shining, sparsely punctate, with acute-angled apex. Punctures of primary punctation of elytra medium-sized, forming paired rows. Aedeagus larger and wider, less strongly narrowed to the less attenuate apex (Fig. 4, *b*). Length 7.0–8.0 mm (males), 7.0–9.0 mm (females); width

5.4 mm (males). Central Kazakhstan: Karaganda Prov., the Kent Mt. Range .... ***Ch. medvedevi*** (Lopatin, 1970).

6 (1) Dorsal side entirely metallic-colored; when elytra brick-red, pronotum brown. In female, first segment of all tarsi ventrally with narrow glabrous line.

7 (8) Smaller; body more slender (narrow): length 6.2–7.0 mm (males), 6.9–8.3 mm (females); width 4.0–4.3 mm (males), 4.2–5.0 mm (females). Pronotum narrower (1.8–1.9 times as wide as long), with sides nearly straight in basal part and slightly converging toward base, occasionally slightly emarginate in females. Elytra bronze; pronotum and scutellum bronze-green (typical form), or elytra brick-red with blackened suture and punctures of punctation; pronotum dark brown (red form). Lateral pronotal calli wide, separated from disc by shallow entire sulci strongly deepened in basal quarter. Aedeagus (Fig. 4, *c*, *d*) less strongly curved in lateral view, with shortly narrowed apex. Sverdlovsk Prov.: the Tylaisko-Konzhakovsko-Serebryanskii Mt. Range .... ***Ch. hyperboreica*** Mikhailov, 2002.

8 (7) Larger (length 6.8–7.5 mm (males), 7.4–8.0 mm (females); width 4.2–4.7mm (males), 4.5–4.9 mm (females); pronotum wider (twice as wide as long), with sides widely and regularly rounded. Elytra dark green; head, pronotum, and scutellum blackish bronze; less frequently entire dorsal side violet with green tint or blackish bronze. Aedeagus (Fig. 4, *e*, *f*) more strongly curved in lateral view, with widely rounded triangular apex. Altai Territory: the Korgonskii Mt. Range .... ***Ch. korgonica*** sp. n.

DISCUSSION

The species of the *Chrysolina* (*sahlbergiana*) group are very similar in the structure of the aedeagus (Fig. 4) and in a number of important taxonomic characters, but clearly differ in the coloration and shape of the body (Fig. 1). The representatives of the species-group are also ecologically similar, though *Chrysolina sahlbergiana* occurs in stony steppe on the slopes of low hills in the Minusinsk Hollow, and *Ch. medvedevi*, on the top plateaus of the Kent Mountain Range in Central Kazakhstan at approximately 1400 m a.s.l. It is noteworthy that the Kent Mts. are characterized by well-defined altitudinal zonation, and stony wormwood steppes are present only in their highest parts. *Chrysolina korgonica* described in this paper has turned out to be geographically closer to the first two species; it was found in the mountains of Western Altai at the altitude of 2200 m a.s.l. The record of the Northern Uralian *Ch. hyperboreica* is the most remote from all the others. However, the two latter species also prefer stony top plateaus, with the only difference: in the mountains of Altai and the Urals this is the alpine tundra belt.

However, the differences between the modern alpine-tundra and the steppe landscapes are smoothed over, if taking into consideration the fact that the cryo-xerophytic plant associations combining elements of both the tundra and the steppe biotas existed in the large Holarctic areas during the four cold periods (stadials) of the Pleistocene. During the Sartansk stadial (MIS-2), at the end of the Pleistocene, the so-called tundra-steppes were distributed over nearly the entire territory of Russia (Matrosova, 2009). At present, only small fragments have remained from the formerly large zonal biom, and the coleopterous species co-occurring in the Pleistocene sediments of the northeast or southwest of Siberia are associated nowadays with different and even rather remote territories (Zherikhin, 2003; Gurina et al., 2019).

Chrysolina (*Allohypericia*) *arctica* L. Medvedev, 1980 and *Ch.* (*Chalcoidea*) *brunnicornis vrangeliani* Voronova, 1982 from Wrangel Island (Khruleva, 2009) are classical examples of the tundro-steppe leaf-beetle species. They belong to the *Chrysolina* subgenera other than *Pezocrosita*, but also feed on various wormwood species.

The species of the *Chrysolina* (*sahlbergiana*) group can also be considered a relict tundro-steppe leaf-beetle group. The type species of the group was described from Askizskii District of Khakassia, with areas of the relict *Festuca–Dryas* tundra-steppes (Ershov and Maskaev, 1998–2000) remained on the spurs of the Abakan Mt. Range in the Minusinsk Hollow. In addition, all the known species of the group are local endemics with the ranges restricted to a single mountain range or an intermountain hollow, with the distances between the locations of different species occasionally exceeding 1000 km (Fig. 3). Such a strong fragmentation of the range (in the Minusinsk Hollow, Kazakh Hummocks,

and Altai) cannot be explained only by difficulties of collecting, and the data of paleoentomology should also be used. It turned out that the ranges of a considerable part of the coleopterous species from the Late Pleistocene complexes of the south of the West Siberian Plain are now shifted northwards, southwards, or eastwards. Thus, the species with the ranges shifted southwards and eastwards now inhabit the mountain steppes of Central and Eastern Kazakhstan or the intermountain hollows of the Altai-Sayan Highland (Gurina et al., 2019).

A special case is *Ch. hyperboreica* from the alpine tundra of the Northern Urals. However, the composition of the montane flora of the Kytlymskii and Denezhkin Kamen' ranges shows that tundra-steppe associations also existed on these ranges during the Pleistocene, but only some of them have remained until present because of characters of the thermal and water regimes of the ultrabasic rocks (Kulikov, 2002). At the same time, a number of the arthropod species from the relict tundra-steppes in the northeast of Asia is recorded at present in the mountains of not only Southern Siberia but also the Urals (Khruleva, 2009). Among the coleopterans, in addition to *Ch. hyperboreica*, the leaf beetle *Chrysolina* (*Lithopteroides*) *exanthematica gemmifera* Motschulsky, 1860 and the carabid beetle *Carabus sibiricus* Fischer von Waldheim, 1822 can also be attributed to the tundra-steppe species in the Ural Mountains.

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COMPLIANCE WITH ETHICAL STANDARDS

The authors declare that they have no conflict of interest. All the applicable international, national, and institutional guidelines for the care and use of animals were followed. All the procedures performed in studies involving animals were in accordance with the ethical standards of the institution or practice at which the studies were conducted.

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