

The review of the *Plebejus argyrognomon* (Bergstrasser, [1779]) species group from the East Palaearctic. Part 1: Valuable characters of the male genitalia, *Plebejus mongolicus* (Rühl, [1893]), *P. pseudaeagon ussuricus* (Forster, 1936) and *P. transbaicalensis*

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The paper presents the first part of the review of the *Plebejus argyrognomon* (Bergstrasser, [1779]) species complex focused on the territory of the East Palaearctic. The general characters of the male genitalia are discussed, taxonomically valuable sclerites are pointed out. The male genitalia of *P. maracandicus* (Erschoff, 1874), *P. argyrognomon* and *P. caspicus* (Forster, 1936) are described and figured, the species status of the taxon *caspicus* is confirmed. Three eastern species are reviewed: *P. mongolicus* (Rühl, [1893]), *P. pseudaeagon ussuricus* (Forster, 1936) and *P. transbaicalensis* (Kurentzov, 1970), stat. nov. Two new subspecies are described: *P. mongolicus okianus* ssp. nova (type locality: Russia, Buryatia, East Sayan, Oka Valley) and *P. m. barguzin* ssp. nova (type locality: Russia, Buryatia, Barguzin Valley).

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Introduction

The genus *Plebejus* Kluk, 1780 (Lepidoptera, Lycaenidae) comprises about 50 species distributed across the Holarctic region, with peak number of species in mountain regions of Asia (Churkin and Zhdanko 2003; Yakovlev 2012; Talavera et al. 2013; Churkin et al. 2019; Krupitsky et al. 2021; Churkin and Yakovlev 2024a, b; Krupitsky and Li 2024; Zhdanko and Churkin 2001b; Churkin and Pletnev 2012). The *P. argyrognomon* (Bergstrasser, [1779]) complex comprises several species distributed across the Palaearctic region. Despite the vast range of the group, its taxonomy still needs to be reviewed: the last thorough review of the group was published by Forster (1936) in his fundamental revision of the Palaearctic *Plebejus*. Species of this group are characterized by very thin blackish wings margins (with one exception, see below), the labides pointed at the tips and the longest falces among *Plebejus* spp. Males of the *P. argyrognomon* complex are violet blue, females of all previously known species are fully brownish or with moderately expressed violet-bluish suffusion.

Some controversies in taxonomic treatment of the taxa belonging to the *P. argyrognomon* complex of Dauria (steppe part of South Siberia), a region spanning modern Buryatia, Zabaikalsky Region and Amur Region in Russia, as well as some neighbouring regions of Mongolia and China, have risen in different publications. Two taxa belonging to this group originally described as *Lycaena argus* var. *mongolica* Rühl, [1893] and *Lycaena argyrognomon transbaicalensis* Kurentzov, 1970 are known from this region.

The taxon *mongolica* has been further considered a separate species by Samodurov et al. (2000). *Plebejus mongolicus* is large lycaenid widely distributed from Amur Region to the Darkhad Valley in northwestern Khuvsgul (Khövsgöl) aimag, Mongolia. The western limit of its range is not studied yet, and the eastern part of the range is limited by the range of closely related taxon *P. pseudoaegon ussuricus* (Forster, 1936) from eastern Amur Region and Primorsky Region, Russia. The neotype of *P. mongolicus* was correctly designated by Samodurov et al. (2000: 166, pl. 83, figs 26, 27) based on material collected by S.A. Andreev (Novomoskovsk), with the type locality in Ero-Gol (Eree-Gol) river valley (Darkhan-Uul aimag, North Mongolia) in the Mongolian part of the zoogeographic Dauria.

Another taxon of the *P. argyrognomon* complex, *transbaicalensis* Kurentzov, 1970, was described as a subspecies of *P. argyrognomon* from the valley of the Chita River in Zabaikalsky Region (former Chita Region). Status of this taxon is still undefined: different authors treated *transbaicalensis* as a subspecies of different taxa. For example, Samodurov et al. (2000) and Stradomsky (2005) considered it as a subspecies of *P. maracandicus* (Erschoff, 1874), Korshunov (2002) treated it as a subspecies of *P. argyrognomon*, while Tshikolovets et al. (2009, 2009a) considered both *mongolicus* and *transbaicalensis* as subspecies of the latter, despite nearly complete overlap of the ranges of these taxa demonstrated by the author on the published maps (Tshikolovets et al. 2009).

Our study of external characters and the male genitalia confirmed specific status of the taxa *mongolicus*, *transbaicalensis* and *pseudoaegon* (Butler, [1882]), which is demonstrated in details in the present paper. Morphological differences revealed between these species co-habiting on a vast territory without any known cases of hybridization play a key role in understanding taxonomically valuable characters of the entire *P. argyrognomon* species complex. Additionally, our study revealed two undescribed subspecies of *P. mongolicus* from the Oka Valley in the Eastern Sayan Mountains and from the Barguzin Valley in Buryatia, which are totally isolated from the nominotypical subspecies. These subspecies are described herein.

Materials and methods

The present study is based on the collections of the following institutions: Zoological Institute of Russian Academy of Sciences (ZISP, St. Petersburg), Darwin State Museum (SDM, Moscow), Museum of Natural History St. Alexis Hermitage (MSAH, Yaroslavl Reg.), collections of the authors, K.A. Kolesnichenko (Moscow), V.K. Tuzov (Moscow), P.I. Beda (Lyubertsy, Moscow Reg.), N.I. Rubin (Belarus, Grodno), S.A. Andreev (Novomoskovsk, Tula Reg.). The locality data are given as it is on the labels. Totally, external morphological features of more than 2000 specimens were studied; below, only specimens for which the genitalia were dissected are mentioned.

For wing venation, the Comstock-Needham nomenclature adopted for butterflies (Miller 1970) was used. Genitalia nomenclature is used according Bálint (2022) with one exception: we prefer to name two processes of the valva as dorsal and ventral, that is more correctly and do not confuse the readers.

The genitalia were dissected using conventional techniques. The abdomen was heated in hot 10% KOH solution.

The genitalia were placed in glycerol, juxta, aedeagus and valva were separated. The images of specimens were taken with a Canon EOS 5D II camera with a Sigma 150 Macro lens, and a custom-made lighting setup. The photos of the male genitalia were taken with a Canon 50D camera and an MP-E 65 lens. Digital processing of the photographs was performed using the Picolay program and Adobe Photoshop CS6.

Holotypes will be deposited in the collection of the Darwin State Museum (Moscow), paratypes are in the collections of the authors and the Museum of Natural History St. Alexis Hermitage, V. Tuzov (Moscow), K. Kolesnichenko (Moscow) and P. Beda (Lyubertsy, Moscow Reg.).

Results

1. Status of the taxa *mongolicus* and *transbaicalensis*

Plebejus mongolicus and *P. transbaicalensis* are widespread in Dauria. These species clearly differ in size, but at the same time they are somewhat similar externally. Actually, a classic case of coexistence of two closely related species occurs: the two taxa present over a vast territory of thousands of kilometers without forming transitional forms or detected hybrids, they occupy somewhat different habitats, so usually real populations do not occur together, but often live at a distance of 2–5 km from each other, both taxa are frequent in nature, and their flight periods are shifted relative to each other.

The abovementioned facts are evidences of high degree of reproductive isolation between these taxa. Otherwise, numerous transitional specimens should occur, varying at least by size, but they are not detected in nature. We cannot exclude hybridization between these species as it was revealed in other Lycaenidae species (Shapoval et al. 2021) but it is probably infrequent as no hybrid specimens have been detected so far. Such a case of coexistence of closely related reproductively isolated species is not so frequent, so the next step is search for taxonomically valuable characters discriminating *P. mongolicus* and *P. transbaicalensis*, which will reveal relationships in the whole *P. argyrognomon* species group.

As we have already noted above, the only explanation for the error in statuses of *P. mongolicus* and *P. transbaicalensis* is some external similarity between the taxa. This is an important fact, and we hope to discuss it in subsequent studies. For example, such similarity is also observed between taxa living together in Mongolia.

The study of large series of specimens shows that only a few characters partially coincide: the average size of the spots on the dorsal side of the wings, the general colour of the ventral side and the degree of development of metallic scales of the submarginal band. On the contrary, the development of a bluish suffusion of the dorsal side of the hindwing, the difference in the development of the orange band in the males and the females (expressed in *P. transbaicalensis*, and almost not expressed in *P. mongolicus*), the different colouration of these bands (reddish or yellowish) and a number of other features make it easy to separate the two species (apart from the difference in size). Once again, it should be noted that there are no transitions in size between the species: very rarely quite large specimens of *P. transbaicalensis* and small *P. mongolicus* can be found, but transitional forms are never observed.

By the single and/or widened orange band formed in females, *P. transbaicalensis* is close to the taxon *ussuricus*, but for some reason no one has tried to unite these taxa, ignoring their size, as it was done when uniting *P. transbaicalensis* with *P. mongolicus*. It is noteworthy that both the ranges of *P. transbaicalensis* and *P. pseudaeagon* *ussuricus* are allopatric, i.e. uniting these two taxa would be much more logical.

Finally, the two new subspecies of *P. mongolicus* described below are easily distinguished from *P. transbaicalensis*, which puts an end to any speculation about the status of the latter.

2. Status of the taxon *maracandicus*

The second widespread hypothesis on the status of the taxon *transbaicalensis* is its inclusion in *P. maracandicus* (Erschoff, 1874) as a subspecies. As we have noted, this tradition began with the book «Butterflies of Russia and adjacent territories» as an attempt to solve the problem of the coexistence of two species (Samodurov et al. 2000). It was obvious to the authors of the book that the unification of the semi-desert Central Asian taxa with the Yakut-Magadan ones was possible only as a preliminary palliative, but subsequently this option was used and consolidated by other authors.

Notable steps in the development of the taxonomy of the complex were made by B.V. Stradomsky (Stradomsky and Arzanov 2003; Stradomsky 2005). Based on the features of the distal processes of the valva and partly the gnathos, he found and illustrated the distinctive characters of *P. argyrognomon* and *P. maracandicus caspicus* (Forster, 1936). The latter taxon was described from the South Urals. It is distributed throughout the south of the European part of Russia and Western Kazakhstan; the closely related *P. m. sauromaticus* Stradomsky & Arzanov, 2003 was described from the lower Don River. Initially, Stradomsky also united a wide variety of taxa within *P. maracandicus* (Erschoff, 1874), but subsequently *caspicus* was separated from *maracandicus* as a bona species, while *sauromaticus* was transferred to *caspicus* as a subspecies (Stradomsky 2005). It was also Stradomsky who first pointed out the stability and importance of the size of the genitalia in the taxonomy of the studied species (Stradomsky 2005: 81). Our studies fully confirm the species status of *P. caspicus*. Moreover, this species is distributed in the European part of Russia wider than previously indicated; we examined the genitalia of specimens collected not only in Volgograd and Astrakhan regions, but also, for example, in Penza region of Russia (Krasnopolye village).

Plebejus maracandicus (Type locality: Samarkand, Uzbekistan) is distributed from the Kugitang Mts. and the Tajik Depression to the Syr Darya River (where it comes very close to the range of *caspicus*) and Eastern Kazakhstan. Distribution and taxonomy of this species in Mongolia will be considered in a separate study.

At least four subspecies of *P. maracandicus* are distinguished:

1. ssp. *maracandicus* (= *dschagatai* Grum-Grshimailo, 1887, syn. nov., the type locality is nearby Shuaroabad in Tadjikistan) – entire southern part of the range including Fergana Valley. Possibly the taxon *dschagatai* needs subspecies status, but material is not sufficient; the status of

populations from the valley of the Syr Darya also needs clarification;

2. ssp. *excellens* Zhdanko et Churkin, 2001 (type locality and range – Naryn Valley in Tian Shan);

3. ssp. *ionovi* Zhdanko, 2000 (type locality and range – Issyk-Kul lake shores and neighbouring valleys);

4. ssp. *planorum* (Alpheraky, 1881) (= *aegina* Grum-Grshimailo, 1891, syn. nov.; = *calmuca* Grum-Grshimailo, 1891, syn. nov.; type locality – Ili River valley, the range includes the territory from Lake Zaysan area to the Ili River basin). In addition, the type locality of *calmuca* is “In provincial Iliensis, inter flumen Chorgoss et urbem Sujdun lecta” (Grum-Grshimailo 1891: 450), i.e. also in Ili River basin. The type locality of *aegina* is “montibus Boro-Choro” (Grum-Grshimailo 1891: 451), on the southern macroslope of this range and thus inside of Ili River basin too. The difference between these two taxa is only the size of the underside spots, which variability is well known.

Note. The lectotype of *aegina* is figured in: Tshikolovets 2005: cpl. XLVIII: 14. Paralectotypes of *calmuca* figured at the same plate, cpl. XLVIII: 5–6, syntypes of *planorum* – cpl. XLVIII: 1–3, paratype of *excellens* – cpl. XLVIII: 4, paratypes of *ionovi* – cpl. XLVIII: 7–8.

All the subspecies of *P. maracandicus* are closely related and similar to each other. The basal host plant of the latter is *Glycyrrhiza* spp. (Fabaceae), according to observations of S. Churkin and A. Zhdanko in the Fergana Valley, Naryn Valley and Issyk-Kul area (Churkin and Zhdanko 2001a; Toropov and Zhdanko 2009, S. Churkin, pers. data). For Syr Darya Valley, another host plant looking similar to *Glycyrrhiza*, *Sophora alopecuroides* L. (Fabaceae), was recorded (Toropov and Zhdanko 2015). Only for Ili deserts some *Astragalus* (Fabaceae) were considered as host plants by A. Zhdanko, but these records were based on old observations and were not supported by breeding data (S. Toropov, pers. comm.). Thus it needs in confirmation because *Glycyrrhiza* spp. is also known as host plant for *maracandicus* in Dzhungarian and Transaltaian Gobi (S. Churkin, pers. data).

The host plants of *P. caspicus* are *Astragalus longipetalus* Chater and *Chamaecytisus ruthenicus* (Fisch. ex Woł.) Klásk. (Fabaceae) in Rostov Region according to Stradomsky (2005), *A. longipetalus* or a close species based on the material collected in the vicinity of the Kamyshinsky farm, Volgograd Region (S. Andreev, pers. comm.), *A. varius* S.G. Gmel. and *C. ruthenicus* in Volgograd region based on studies by G. Kuznetsov (Tikhonov et al. 2024), *A. longipetalus* and *A. brachylobus* Fisch. ex DC in Dagestan Republic (Russia, North-Eastern Caucasus) based on studies by V. Tikhonov (Tikhonov et al. 2024).

Therefore, *P. maracandicus* is exclusively Central Asian species: it cannot be found in Yakutia, Dauria, or the European part of Russia. *Plebejus transbaicalensis* is similar to *P. caspicus* based on some external characters, and on the base of this similarity some authors included the former species in “*maracandicus*”. However, both the genitalia and the external characters of these species are not identical, and the ranges are widely disjointed by several thousand kilometers.

3. Structure of the genitalia and features of species differences within the *P. argyrognomon* group of species

We have undertaken a detailed study of nearly all taxa included in the *P. argyrognomon* complex. More than 200 male genitalia were examined in total. In this article, we will discuss only the general taxonomically important characters of the complex as a whole and the three species in question.

Species of the *P. argyrognomon* complex can be distinguished by the large size of the labides and long falces (uncus and branches of brachia, auct.), which are almost twice as large and long as

those of the geographically corresponding taxa of the *P. idas* complex. Compared with the *P. christophi* complex, the difference is not so strong. The size of the labides apparently provides reliable reproductive isolation between the two complexes (*idas* and *argyrognomon*). Within each complex the shape of the labis can be quite diverse. Here we face with the importance of the actual size of the genitalia, a character that should be recognized as one of the most important within the *P. argyrognomon* complex as a whole. This situation is not typical for butterflies, where the size of the genitalia does not depend very much on the size of the adult insect, even in the groups where there is a visible stratification of a single population into parts that differ from each other depending on the altitude and/or biotope (for example, *Melitaea arcesia* Bremer, 1861 complex, S. Churkin pers. data).

Individual variability within each species is small and amounts to about $\pm 5\%$ of the average size of the genitalia: 10 males of *transbaicalensis* and 10 males of *mongolicus* collected in the Talacha river valley were measured, and additionally 15–20 specimens of each species from other localities of the range. At the same time, the difference in the size of the genitalia (and main sclerites) between *transbaicalensis* and *mongolicus* in all the Dahurian populations amounts to 20–25% (23% average, in a total of 40 specimens measured). We consider exactly 20% of difference as the morphological distinction that serves a copulation barrier between representatives of different species within the complex (Fig. 3: 1–3; Fig. 4: 12, 13). This conclusion is based on the above-mentioned absence of noticeable hybridization between taxa.

In general, study of the entire *P. argyrognomon* complex shows that specific differences can be found in almost all sclerites. The following are taxonomically important:

1. General shape of the valva, including the expression of its dorsal hump, the ratio of the proximal and distal parts of the valva (considering the top of the hump dividing the two parts);
2. Shape of the aedeagus, the ratio of its proximal and distal parts, the expression of the curve, the pointedness and length of its tip;
3. Total length and general shape of the tegumen (together with the vinculum); this parameter is useful in characterizing the general size of the genitalia. Shape of the furca (juxta) is also important but it is too small and variable depending on the way of the separation;
4. Size and expression of the processes of the valva, including developed or undeveloped notch on the valva under these processes;
5. Shape of the labides and the length of the falces: given that the characters of the uncus separate complexes of species within the genus *Plebejus*, it is obvious that if we find visible differences in labides/falces in any taxon, then this is significant.

However, it is difficult to use both the shapes of labides and processes of the valva, despite the fact that Stradomsky (2005) concentrated on them, ignoring the general shape of the valva and the aedeagus. These difficulties prevented him from formulating the distinctive characters of the taxon *caspicus*. Shape of the labides is much dependent on the angle, which makes it difficult to use photographs. Shape of the processes of the valva is important, but it is not always specific, moreover, it changes depending on the force with which we press on valva to straighten it, as well as depending on the angle of pressure. What is worse, the straightening of this sclerite strongly depends on the time of boiling in KOH. Stradomsky (2005) placed the valva under a cover glass and pressed it, believing that this allows to see the true shape of the processes. We think this technique is successful, but the same valva, when pressed repeatedly with a glass, gives different versions of the general shape and processes. It is much easier and more efficient to straighten the processes manually (e.g., with a blunt pin), doing this several times and noting the real shape that can be described. This does not allow taking a photograph, but it is much more reliable in terms of the result (see Fig. 2: a–h in Churkin and Pletnev 2012). In general, photo of the valva gives a quite

acceptable idea of the main characters of both processes that are necessary for identification. We divided the genitalia into different sclerites, examining both the valva and the aedeagus separately. Each of these sclerites has a complex spatial shape, and it is possible to compare them only by placing on a flat surface in the same position. For difficulties in making photographs suitable for taxonomic purposes, see Churkin and Kolesnichenko (2019: 46).

4. Characters of the male genitalia of *P. maracandicus* Erschoff, 1874, *P. argyrognomon* (Bergstrasser, [1779]) and *P. caspicus* Forster, 1936

General differences in the genitalia of *P. argyrognomon* and *P. caspicus* are shown in the illustrations (according to Stradomsky's work) on the website "Butterflies of the Caucasus" (<http://www.babochki-kavkaza.ru>), where the second species appears under the false name *maracandicus*. *Plebejus argyrognomon* is easily distinguished by significantly larger and more massive labides, which in *P. caspicus* look significantly thinner and shorter laterally (approximately a third shorter) (Fig. 3: 5, 6; Fig. 4: 10 A, B; 11 A, B; we examined specimens of the subspecies *danapriensis* (Stempffer et Schmidt, 1932), which range is very similar to the range of *caspicus*, according to the currently accepted systematic version).

In addition, the falces in the latter species are somewhat shorter (and often look thinner, although this is not confirmed upon careful comparison from different angles). However, other equally important characters are not visible in the photographs provided or look distorted.

The aedeagus of *P. caspicus* looks obviously more curved at the base of the distal part, this distal part from the lateral side looks thin forming sharp narrow tip, while the aedeagus of *P. argyrognomon* looks not so curved at a certain point (sometimes it looks slightly arcuate), it is more widened before the tip, this tip is shortly pointed, the distal part have no dagger-like form.

The tegumen bears another important distinction: in lateral view, two laterally situated widened parts are strongly narrowed towards thin proximal arcs in *P. caspicus* and only gradually narrowed in *P. argyrognomon*.

The valva of *P. argyrognomon* has longer proximal part, the ventral cutting is less expressed, the dorsal process is less developed, narrow, the distinctive inner gap is obvious between two processes from the lateral side, which looks longer than in *P. caspicus*.

The furca is more variable but also bears some important additional characters: in *P. caspicus* its branches are more or less straight, slightly gradually curved, while in *P. argyrognomon* furca has angled shape, the upper 1/3 part of each branch is obviously curved forming obtuse angle.

The genitalia of the taxon *sauromaticus* (topotypes were studied) are very similar to that of *P. caspicus*, only the aedeagus looks not so thin at the base of the distal part. Both taxa without any doubt belong to the same species. We are unable to discuss the subspecific status of *sauromaticus*: more specimens are needed, especially from the type locality of *caspicus*.

We dissected 10 different specimens of *P. maracandicus* belonging to all known subspecies, including paratypes of *ionovi* and *excellens*, specimens from the Ili River, the Syr Darya River, the Fergana Valley and Samarkand. Generally, the genitalia are small, much smaller than in *P. argyrognomon* and usually not more than in smallest representatives of *P. caspicus* (Fig. 3: 4; Fig. 4: 8 A, B; 9 A, B).

The labis is even shorter than in *P. caspicus*, the distal part of each labides is not longer (even shorter) than the oval proximal part, these distal parts are sharply and quickly narrowed towards tips. The valva with long proximal part (somewhat similar to *P. argyrognomon* but obviously smaller), with even outlines, dorsal hump is not so expressed comparing with *P. caspicus*, ventral cutting is weak. The shape of the tegumen and general shape of the aedeagus are similar to those

of *P. caspicus*. The processes are longer than in *caspicus*, but the ventral process is obviously less developed (it means that the cutting under this process is not so big as in *P. caspicus*).

We didn't record any differences between the genitalia of specimens from the Ili River, the Syr Darya River, Zaisan Lake area or Issyk-Kul Lake. However, some variability was found in the Fergana Valley and Samarkand, where valvae become more similar to those of *P. caspicus*, but the aedeagus is curved too much (only two dissections, so, it could be an artefact).

Worth to note that the genitalia of the nominate *P. argyrognomon* (e.g., published by Forster, 1936) are not fully identical to those of the subspecies *danapiensis* discussed above. It is quite possible that this situation is typical for the latter species and the entire group of the related species, which easily generate local forms with some differences even at the genital level (e.g., *P. mongolicus* – see below). However, given the obvious confusion in the identification of various *Plebejus* species, a new in-depth study of various populations of this species from the territory of the Euro- pean part of Russia and adjacent countries is required.

5. *Plebejus transbaikalis* (Kurentzov, 1970), status nov.

Figs 1 (dorsal side), 2 (ventral side): 19–25

Lycaena argyrognomon transbaikalis Kurentzov, 1970; Butterflies of the USSR Far East: 133, fig. 100–4.

Type locality: Chita River valley («северное лесостепное Забайкалье» [North forest-steppe Transbaikalia]).

The type series includes specimens from the Chita River valley and several specimens from Yakutia (Azarova 1986). Most of the specimens were collected near Mukhor-Konduy vill. (52°25'00"N, 113°16'35"E) and Krasny Yar (53°55'00"N, 114°40'22"E) of Zabaykalsky Krai (former Chita Region of Russia). The Chita (Chitinka) River is a left tributary of the Ingoda River, thus the specimens from the Talacha River are close to the type locality.

Material: 9 males, 7 females, Russia, Chita Reg., N. Tsasuchei v., Borun-Torei L., 14–15.06.1995, K. Kolesnichenko leg.; 6 males, 3 females, Russia, Chita Reg., Onon vall., 5 km W N. Tsasuchei v., 650 m, 30.05.2005, P. Bogdanov leg.; Russia, 14 males, 6 females, S. Chita Reg., Nerchinskyi Mts., 25 km NEE Kovyly st., 10.06.2000, M. Skomorokhov leg.; Russia, 2 males, 2 females, Chita Reg., Onon R., Zun-Tarei loc., A. Devyatkin leg.; 1 male, 6 females, Russia, S. Chita Reg., Argun R. valley, Doroi v., 17.06.2000, M. Skomorokhov leg.; 6 males, 3 females, Russia, Chita Reg., Yablonovyi Mts., 15 km W Chita, 600 m, 22.06.2005, P. Bogdanov leg.; 2 males, 1 females, Yablonovyi Mts., 70 km W Chita, Yablonovaya st., 6–23.06.1999, A. Aniskovich leg.; 12 males, 1 females, Russia, Chita Reg., Ingoda R. valley, Talacha R., 27–30.06.1995, K. Kolesnichenko leg.; 1 male, Russia, Buryatia, Brjanka R., Zaigraevo, 9.07.2003, A. Aniskovich, 2 males, 2 females, Russia, Buryatia, 70 km E Ulan-Ude, Uda R., Pervomaevka, 14.06.1993, 200 m, S. Churkin leg.; 1 male, 1 female, same loc., 8.06.2003, A. Aniskovich leg.; 2 males, 2 females, Russia, Buryatia, Tataurovo v., 11.06.1997, S. Churkin leg.; 2 females, Russia, Buryatia, Tugnui R., 10 km E Ust-Sakhara, 12.06.1997, A. Petrov leg.; 2 males, Russia, Buryatia, Bar R., Barsky Mts., 12.06.1997, A. Petrov leg.; 3 males, Russia, Buryatia, Small Khamar-Daban Mts., Taezhnyi vill., 10.07.1988, S. Churkin leg.; 3 males, 1 female, Mongolia, Central aimag, 25 km W Erdenesant, 1260 m, 3.06.2004, S. Churkin leg.; 3 males, Mongolia, Dornod aimag, 33 km E Sumber somon, Khakkhin-Gol R., 47°32'N 118°59'E (SW border of Mongolia), 740 m, 19.06.2004, Ts. Odbayar leg.; 1 male, East Mongolia, Dornod aimag, Khan-Chandman' Mt., frontier guards of Numrog, 20.06.2004, Odbayar Tz. leg.; 3 males, 2 females, SE Mongolia, Sukhe-Bator aimag, Tumenzogt somon, Bayan-Ovoo Mt., 1.08.1984, Odbayar Tz. leg.; 2 males, Mongolia, Bayan-Khongor aimag, South Khangai, Tuin-Gol R., 2200 m, 26.07.2002, S. Churkin leg.; 2 males, Mongolia, 5 km NE Bayan-Khongor city, South Khangai, 2000 m, 17.07.2003, S. Churkin leg.; 1 male, Russia, Irkutsk Reg., Lena R., Kachug vic., 500 m, 20.06.2023, S. Churkin

leg.; 1 male, Russia, Irkutsk Reg., Lena R., Kachug vic., 650 m, 21.06.2023, S. Churkin leg. 1 male, 1 female, Russia, Irkutsk Reg., Lena R., 8 km NNW Kachug v., 600 m, 22.06.2023, S. Churkin leg.; 1 male, Russia, Buryatia, East Sayan, Oka R. 20 km SW Khuzhyr v., Zham-Bolot spr., 1350–400 m, 30.06. 2023, S. Churkin leg.; 2 males, Russia, Irkutsk Region, 45 km N Irkutsk, 8.07.2022, A. Kosarev leg.; 10 males, 5 females, Mongolia, Darkhan aimag, Darkhan vic., 5–14.06.1983, S. Andreev leg.; 10 males, 5 females, Mongolia, Darkhan aimag, Darkhan vic., 21–23.07.1985, S. Andreev leg.

Redescription (only taxonomically important characters are listed).

Forewing length 12.5–14.5 mm, males and females, everywhere throughout the range. As a rule, 13–13.5 mm and very rarely 12 mm or 15 mm.

Male. Dorsal side of wings violet blue with dull shine, usually somewhat lighter than in *P. mongolicus* and *P. ussuricus* (in specimens deposited in collections; this character should be rechecked in freshly collected specimens). Wings narrowed, elongated (forewing elongated along costal edge, hindwing in middle part), outer margin of forewing straightened. Marginal black border very thin, filiform, very rarely slightly thickened. Veins darkened along margin. Fringe usually white above, including inner part, with narrow internal dark parts at veins, but specimens with almost completely darkened inner part are not rare. Hindwing often with small marginal black dots between veins.

Ventral side of wings light grey, as in *P. mongolicus*, spots medium-sized.

Forewing: submarginal pattern usually unclear, blackish elements of spots small, some postdiscal spots stretched or enlarged, yellowish elements of submarginal pattern together look like a single, albeit broken band.

Hindwing: basal suffusion usually dense, noticeable and usually barely extending beyond basal spots. Other characters resemble that of *P. mongolicus*: postdiscal band lightened or with blurred light triangles, lacking rings around spots, pattern developed, but uniform bands are not formed. Internal elements of submarginal spots usually yellow orange, light, without distinct red tint, often somewhat expanded. Metallic scales usually developed in 2–3 spots, but specimens with 4 and even 5 metallic spots are not uncommon. Black elements of submarginal row spots small, narrow.

Male genitalia (Fig. 3: 1; Fig. 4: 1 A,B; 2 A,B; 3 A,B; 12). The size is as in *caspicus* (somewhat larger than in *maracandicus*).

Valva with moderately even outlines, proximal part is not extended, about 40% of total length of valva. Dorsal process thick and short, only slightly longer than ventral process, latter is not well developed, narrow (because cutting under ventral process is not expressed), both processes obviously shorter than in European taxa (including *P. caspicus*). Obvious inner gap between processes is visible.

Labis laterally similar to that of *caspicus* (distal parts narrow and moderately long but only slightly longer than oval-shaped basal parts).

Aedeagus in general like in *caspicus*, not thin, distal part slightly longer than proximal part, but without long and spiky tip laterally. Dorsally distal end of aedeagus only slightly widened after not expressed narrowing, with pointed tip. Two lateral widened parts of tegumen sharply narrowed towards thin proximal arcs (as in *P. caspicus* and *P. maracandicus*). General shape of tegumen oval, even rounded. Worth to note that this shape could be damaged during the preparation, especially during separating from valvae (while the shape is not so obvious without such separation), so, it is necessary to put attention to this character during the work.

Branches of furca (juxta) with obtuse angle at half of their length.

Female. Either brown or brown with violet blue field (always poorly developed on forewing, but almost all hindwing can be violet blue), but the transitional forms between the above-mentioned variants always constitute the majority. Submarginal orange pattern usually developed on dorsal side of hindwing and often on dorsal side of forewing, but forms without expressed orange spots predominate. Despite apparent variability described above, females are easily recognizable and quite uniform throughout the range. Ventral side is like that of males, only slightly darker, metallic spots more developed, but still remain small and narrow.

The main characters are usually sharply expanded orange elements forming united band on both wings and the submarginal space between the postdiscal row and the submarginal pattern never contrasting with white.

Variability is weak. Both melanistic males (with a strongly darkened colouration and widened black margins) and males with a shiny blue dorsal side are very rare. Occasionally, specimens with slightly extended spots on ventral side are found, sometimes with a certain degree of reduction of these spots, sometimes rings are noticeable around the spots. The development of the metallic spots is obviously stronger in the west and in the north of the range, but the spots are still small and non-contrasting.

The variability of the genitalia is not expressed, it seems that southern Mongolian populations are characterized by the smaller and more extended valvae (somewhat similar to *maracandicus* by this character), other distinctions are obvious.

Diagnosis. A very characteristic small species with a violet dorsal side and a narrow marginal border, females with varying degrees of development of the violet blue field (in the series, in any place of the range, different forms of females co-exist), a pattern of small spots on a light ventral side, where the metallic scales are poorly developed; females differ greatly from males in the development of the orange band. In general, the colouration is the same throughout the range in both sexes, the colour of the bright elements of the submarginal pattern is easily recognizable: pale, lightened, yellowish-orange (orange red in *P. mongolicus*), at the same time these elements (segments) are more expressed than in *P. mongolicus*.

The male genitalia are similar to those of *P. caspicus*, but both processes are shorter, the aedeagus has different shape of the distal end. From *P. mongolicus* it can be distinguished by the definitely smaller size (20–25% less), more or less rounded general shape of the tegumen (Fig. 4: 12–13), short and small labides, different shape of the widened lateral parts of the tegumen, shorter aedeagus with different general shape.

Note. In a book «Butterflies of Russia and adjacent territories. Vol. 2» (Samodurov et al. 2000) *P. transbaicalensis* was depicted twice (as subspecies of *P. maracandicus*): under its name (Pl. 73: 10–12) and under the name *chalcha* (Pl. 73: 7–9); the apparent difference in the color of the dorsal side is due to sexual dimorphism: in the first case a male is depicted, and in the other – a female. The photos of the taxon *chalcha* are missed.

Bionomics. Data on the biology of the species are scarce. Apparently it flies earlier than *P. mongolicus*, in two generations, the second one is fewer in number. *Plebejus transbaicalensis* prefers dry meadows and steppe outcrops; it is associated with drier biotopes than *P. mongolicus*. Usually, only one of the species flies, i.e. their biotopes are spaced apart. Nevertheless, cases when populations of two species fly nearby, and butterflies feed on the same meadows, are not rare. A worn specimen was caught in the Oka Valley inside the East Sayan mountain system (on the dry foot of a slope, collected together with the local *P. idas reshetnikovi* Churkin et Yakovlev, 2024). It can be easily distinguished from a new subspecies of *P. mongolicus* described below, the population of which was found several kilometers away. In

general, there are no differences comparing with the Daurian specimens, as well as with several available specimens from Irkutsk region. The presumable host plants are *Astragalus* spp. *Plebejus transbaicalensis* is very common in Dauria, but practically does not inhabit the mountains, therefore it is absent or quite rare in the mountain valleys.

Distribution. Across all Dauria: Buryatia, Zabaikalsky Reg. (former Chita Reg.) and certainly neighbouring part of Amur region. Two specimens are known from Irkutsk region (collected by A. Kosarev), and several specimens were collected in the Lena valley (uppersteam, Kachug vic.). The western and northern border of the range is not known, but it is obviously absent in Priamurye and Primorye regions.

In Mongolia, it inhabits all central and eastern aimags including northern half of Sukhe-Bator. Specimens collected nearby Darkhan together with nominotypical *P. mongolicus* are the same as everywhere. In western direction, the species penetrates Khuvsugul (Khövsgöl) area and the Khangai Mts. (including its southern slopes).

Etymology. Toponymic name.

6. *P. pseudaeagon ussuricus* (Forster, 1936)

Figs 1 (dorsal side), 2 (ventral side): 26–27

Lycaena argyrognomon ussurica Forster, 1936. – Mitt. Münch. Ent. Ges. 26 (2): 79. Type locality: Nikolsk (now Ussuriysk, Primorsky Krai).

Material: 2 males, 1 female, male, Russia, Primorye, Pogranichnyi district, Barabash-Levada v., 30.05.2002, A. Aniskovich leg.; 3 males, 3 females, same loc., 14.07.1995, K. Kolesnichenko leg.; 1 male, 1 female, Russia, Primorye, Oktjabr'skiy Distr., 31.05.2018, K. Prokopenko leg.; 2 males, Russia, Primorye, Patrizanskiy Distr., Brovnichi v., S. Churkin leg.; 3 males, 2 females, Russia, Primorye, Anuchino v., 11.06.2013, V. Golovizin leg.; 2 males, Russia, Primorye, Khasan vic., 30.05.1989, S. Churkin leg.; 2 males, Russia, Primorye, Khasan Distr., Rjazanovka, 24.06.1989, D. Tatarenko leg.; 2 males, Russia, Primorye, Khasan Distr., Zarubino vic., 19.06.2017; 3 males, 2 females, Russia, Khabarovsk, Pobeda park, 12–19.06.2005, S. Koshkin leg.; 1 male, Russia, Primorye, Nakhodka vic., July 1997, Tuzov V. leg.; 3 males, 2 females, Russia, Primorye, Nakhodka Distr., Ekaterinovka vic., 200 m, 26.07.1997, Tuzov V. leg.; 1 male, Komsomol'sk-on-Amur, 15.08.2006, A. Kapkaev leg.

Redescription (only taxonomically important characters are listed).

FW length 15.5–18.0 mm, males and females, everywhere thought the range.

First generation is smaller.

Male. Wings broadened, dorsally violet blue, with widened black margins, its inner border blurred. Tips of veins blackened near edge, veins often stand out over entire field of wing. Hindwing almost always with black marginal dots often merged with margin dorsally. Fringes white dorsally, with darkening near veins usually spreading out over entire inner side of fringe. Dorsal side of wings lightened or whitish. Spots medium-sized or small, pattern sharp, fully-developed, orange red elements of submarginal ventral pattern thick, merged into united band. Metallic spots narrowed, small, 2–4, barely noticeable.

Male genitalia (Fig. 4: 7 A,B). Large and massive, as in *P. mongolicus*.

Valva with extended proximal part, ca. 33–37 % of total length of valva. Dorsal side of distal part of valva moderately flattened (not abruptly narrowed towards end) as dorsal process very long, thick

and massive, often with small upper hook. Ventral process also more developed than in *P. mongolicus*. Labis, falces and tegumen similar to the latter.

General shape of tegumen narrow, stretched, oval, even rectangular with rounded angles.

Aedeagus long, obviously longer than in *mongolicus* (each part is bigger), but not so thick especially the base and extended tip.

Branches of furca (juxta) with unusually narrow base, branches with obtuse angle at 1/3 of their length from top, upper parts of branches not parallel, but gradually curved inward.

Female brown, very similar to that of ssp. *mongolicus* (and also *P. idas barabash* Churkin et Zhdanko, 2003), but ventral side of both wings with pronounced thick orange red stripe. Blue (violet) forms absent. Metallic spots even less developed than in males.

Variation. It should be noted that in Khabarovsk region, in the west of the range, specimens with small reduced spots on ventral side are often found. The only specimen from Nakhodka is somewhat unusual, but overall the material looks quite uniform.

Diagnosis. *Plebejus pseudaeagon ussuricus* can be easily distinguished from the closely related *P. mongolicus* by the widened black margin merged with submarginal black spots, developed orange band and the lightened ventral side. From *P. transbaicalensis*, in addition to all of the above, it differs by large size. Aberrant and very rare dark specimens of *P. mongolicus* with a strong development of black marginal band are very similar to *ussuricus*, however, they do not have an extended orange pattern. The male genitalia are close to *P. mongolicus*, differ in more developed strong processes of the valva and shape of the furca. *Plebejus pseudaeagon ussuricus* easily differs from *P. transbaicalensis* by larger size and rectangular shape of the tegumen. **Bionomics.** The species in question inhabits meadows, steppe outcrops, mountain foothills.

Distribution. Priamurye and Primorye regions (also Japan, Korean Peninsula and neighbouring regions of China, but we did not consider specimens from these regions).

Etymology. Toponymic name.

7. *Plebejus mongolicus mongolicus* (Rühl, [1893])

Figs 1 (dorsal side), 2 (ventral side): 28–29 (topotypes), 1–6

Lycaena argus var. *mongolica* Grum-Grshimailo. – Rühl, [1893]; Palaearkt. Grossschm., 1: 235.

Neotype: male, designated and figured by Samodurov, Zhdanko, Tuzov et Dantchenko 2000: 166, pl. 83 – 26, 27.

Type locality: Darkhan (Mongolia) by neotype (49°25'20"N, 107°16'7" E, Bugant somon vicinity, Ero-Gol K., 95 km NEE Darkhan, Mongolia).

We have studied the series (6 specimens) collected by S. Andreev together with designated neotype. He also clarified the full data about the type locality and provided us with the colour photos of some males and females. Photo of the topotypic female is published here for the first time.

Material: 4 males, 2 females, Mongolia, Darkhan aimag, Ero R., Bugant somon, 5 and 8.07.1993, S. Andreev (topotypes according the neotype designation); 17 males, 12 females, Amur Reg., Svobodnyi Distr., Kostjukovka v., 6–9.07.1995, V. Tuzov & K. Kolesnichenko leg.; 20 males, 5 females, Chita Reg., Ingoda R., Talacha, 15 km from Urulga v., 8–13.07.1996, S. Churkin & L.

Salmanova leg.; 3 males, 2 females, same data, V. Pletnev leg.; 4 males, 2 females, same data, V. Tuzov leg.; 13 males, same loc., 27–30.06.1995, K. Kolesnichenko leg.; 4 males, Yablonovyi Mts., 70 km W Chita, Yablonovaya st., 6–23.06.1999, A. Aniskovich leg.; 6 males, 3 females, Russia, Buryatia, Ulan-Ude, Sotnikovo, 16.07.1982, A. Zamesov leg.; 6 males, 2 females, same loc., 30.06–5.07.1994, S. Churkin & V. Pletnev leg.; 6 males, 2 females, Buryatia, Brjanka R., Zaigraevo, 8.07.1994, S. Churkin leg.; 2 males, Buryatia, Selenga R., Mostovoi, 17.07.1994, V. Pletnev leg.; 3 males, Russia, Buryatia, Tataurovo v., 11.06.1997, S. Churkin leg.; 4 males, Buryatia, M. Khamar-Daban Range, Tazhnyi v., 12.07.1989, S. Churkin leg.; 2 males, 1 female, East Mongolia, Dornod aimag, 5 km N Bayandun, 19.07.1985, Odbayar Tz. leg.; 2 males, 2 females, Mongolia, Arkhangai aimag, northern slopes of Khangai Range, Urd Tamir R., 50 km SW Tzetterleg, 2000 m, 29.07.2002, S. Churkin leg.; 3 males, Russia, East sayan, Tubar R., Kuragino vic., 22.06.1991, D. Zamolodchikov leg.; 1 male, 1 female, Russia, Irkutsk region, 45 km N Irkutsk, 8.07.2022, A. Kosarev leg.; 1 male, Russia, Irkutsk Reg., Baikal L., B. Goloustnoye v., 20.06.2015, A. Kosarev leg.

Redescription (only taxonomically important characters are listed).

One of the biggest species of the genus. Forewing length in nominotypical population and neighbouring parts of Buryatia and Russian Dauria is 15.5–18.0 mm in the males and 16.0–18.5 in the females; as a rule, 16.5–17.0 mm (topotypes: 17.0–18.0 mm in males; 15.5 and 16.0 in females). Specimens from Amur region are bigger, 17.0–18 mm as a rule, while in northwest Mongolia the size is slightly smaller, 14.5–16.5 mm (15.0–16.0 mm as a rule, the females seem smaller than the males, but material is not numerous).

Antennae, palpi, body colouration and hairs seem to have no taxonomically valuable characters.

Male. Wings broad, both forewing and hindwing with convex outer edge, violet blue dorsally (fading in collections). Black marginal border thin, but not filiform. Tips of veins blackened by 2–3 mm (especially on forewing) along veins, but this effect is often not so noticeable at certain angles, especially in eastern populations. Fringe white with darkening on inner side near veins, so wide that usually along the edge of the wing there is also a low-contrast stripe of black-brown color. Hindwing usually without black marginal dots between veins, except for very rare melanistic forms, in which marginal border is noticeably widened (but never blurry), and black spots merging with this border; these features usually correlate with the general darkening of the color of the upper side of the wings.

Ventral side of wings light gray with medium-sized or slightly enlarged spots, with thin, non-contrasting rings around spots. Ventral side of forewing with developed pattern, often at least one spot of postdiscal row is stretched. Orange elements of submarginal spots usually not sharp, forming dim stripe, outer black elements of submarginal spots not contrasting, grouping in complete row of semicircular shape. Ventral side of hindwing with weak bluish suffusion usually developed only near basal part, but can be extended to basal row of spots. Postdiscal space of inner side of submarginal pattern usually lightened or with blurry light triangles. Submarginal pattern developed, orange elements relatively thick, almost fused together, black elements less developed. Outer black elements thin, small, only lower two or three elements slightly enlarged, but almost completely occupied by metallic scales. Inner elements triangular, wide, but flattened and poorly developed near costa.

Male genitalia (Fig. 3: 2; Fig. 4: 4 A,B; 13). Size is as in *ussuricus*, 20–25% bigger than in *transbaicalensis* (and twice more massive).

Valva with extended proximal part, distal part not more than 33–37 % of the total length of valva (i.e., similar to *argyrognomon* but bigger). Worth to note that distal parts of valvae of *transbaicalensis* and *mongolicus* similar and even their sizes are relatively same (10% of difference), while proximal parts totally different in shape and size. Both processes of valva well-developed, thick and moderately long, but obviously shorter and not so massive as in *ussuricus*.

Lateral sides of tegumen also similar to *argyrognomon*, but narrowing of widened parts not so gradual. General shape of tegumen as in *ussuricus*, i.e. rectangular with rounded angles. Aedeagus long, with obviously long and thin medium part (actually, basal side of distal part of valva), obviously widened distal end with short pointed tip. Branches of furca (juxta) similar to that of *ussuricus*, but upper parts of branches parallel.

The variability is existed, especially in the aedeagus and processes, but it is more expressed in isolated populations (see below).

Female. Wings brown dorsally, usually with developed submarginal orange-red spots on hindwing (in form of elongated triangles or letter V with black rounded or oval spots inside). Ventral side slightly darker than that of males, only occasionally brownish. Submarginal pattern more developed (including usually developed anal spot on ventral side of forewing, which is not typical for males), but single red-orange fused stripe is not formed. Bluish suffusion as in males.

Individual variation. In addition to the rare lightened or darkened forms described above, the details of the pattern may vary. The shape of the postdiscal row of the forewing is extremely variable, as well as the degree of development of the reddish pattern in females on the dorsal side of the hindwing.

Occasionally, females with noticeable but dull violet dusting, spreading base of wing root to cubital-anal zone (more often expressed on hindwing) occur. Frequency of these females does not change from east to west, with the exception of northwestern Mongolia (see the next taxon). Regularly, but also not often, females are completely brown.

Diagnosis. The following characters seem to be very important: large size, narrow but not thread-like marginal border, inner part of fringe darkened on top (entirely or almost entirely), relatively light ventral side, no single thick orange band, females are brown.

The male genitalia relates with *argyrognomon* but differs in the size and shape of the labides. Easy differs from *transbaicalensis* by the size and shape of the valvae and the tegumen, the aedeagus and furca are also not identical. Distinctions from *ussuricus* were discussed above.

Differences between the labides of this species and *transbaicalensis* are similar to the pair *caspicus/argyrognomon* (see above), but comparing with the latter, the labides of *mongolicus* are obviously shorter and not so massive, the distal parts are only slightly longer than the basal parts.

The aedeagus is much longer than in *transbaicalensis*, but differences look not so serious as between the valvae or the labides of these two taxa.

Notes. Females of *P. m. mongolicus* and females of *P. idas kenteana* (Staudinger, 1892) are very similar, identification may be difficult in places where both species fly together. Females with a violet suffusion are generally not found among *kenteana* (which very rarely have a weak bluish sheen right at the base of the wings), the ventral side of this taxon, as a rule, is noticeably darker than that of females of *mongolicus* (and also of males of *kenteana*) (Churkin and Yakovlev 2024).

Bionomics. *Plebejus mongolicus* inhabits various types of meadows, often on forest edges. It can be easily found in mountains, unlike the smaller and more thermophilic *P. transbaicalensis*. Apparently, butterflies fly in two generations. There are almost no actual data on its biology. The series, including the neotype, was collected in large clearings (near the edge) in a birch forest with an undergrowth of Daurian rhododendron, *Rhododendron dauricum* L. (Ericaceae). Possibly, the food plant is bird wetch, *Vicia cracca* L. (Fabaceae), which grew in abundance in the clearings.

Distribution. *Plebejus mongolicus* is distributed from the Amur region to Baikal and further along the both sides of the East Sayan Mountains and in the adjacent part of Mongolia. In Mongolia it is

known from the parts of Mongolian Dauria adjacent to Russia and to the west to the eastern Khangai. Few specimens of *P. mongolicus* are known from Kuragino, Krasnoyarsk region, which is likely the westernmost edge of the distribution of the species situated far away from its known main range. Amount of specimens from this locality deposited in collections is not enough to determine the status of this population, but its belonging to *P. mongolicus* is undoubted, as well as its closeness to the nominative subspecies.

Etymology. Toponymic name.

8. *Plebejus mongolicus okianus* ssp.

nova <http://zoobank.org/E8A918F4-4467-4C0D-9F7F-09EBDA492368> Figs 1 (dorsal side), 2 (ventral side): 7–12

Holotype: male, Russia, East Sayan Mts., Buryatia, Oka R. valley, 15 km NW Orlik v., 1300 m, 3.07.2023, S. Churkin leg.

Paratypes: 34 males, 9 females, same data, S. Churkin leg.; 4 males, 2 females, same data, V. Tuzov leg.; 14 males, 9 females, same loc., 6.07.2023, S. Churkin leg.; 12 males, 17 females, same loc., 13.07.2023, S. Churkin leg.; 10 males, 4 females, same loc., 3-6.07.2023, K. Kolesnichenko leg.

Additional material: 1 female, Mongolia, Khubsugul, Arsain-Gol R., 26.07.1964,

V. Soljanikov leg.; 1 female, Mongolia, Khubsugul L., Ulaan-Uul, 25.07.2003, Odbayar Tz. leg.; 10 males, Mongolia, north coast of Khubsugul L., Haah v., 1700–2000 m, 2–5.07.1995, A. Nikolaev leg.

Description. Holotype FW length 16.2 mm, male and female paratypes 15–17.5 mm (16–16.5 as a rule).

Antennae, palpi, body colouration and hairs seem to have no taxonomically valuable characters.

Male. Wings wide, with convex outer edge, apex slightly pointed, violet blue dorsally, black marginal border thin, but not filiform. Tips of veins are blackened by 2–3 mm (especially on forewing) along veins. Fringe white with darkening on inner side near veins, this darkening extended along external part of fringes. Hindwings usually lacking black marginal dots between veins.

Ventral side of wings gray-steel, dark, with medium-sized spots surrounded with contrasting white rings. Ventral side of forewing with discal spot and postdiscal row of typical for *P. mongolicus* shape. Submarginal pattern somewhat reduced, orange elements dull, small, black elements of outer row small, poorly visible, especially on costal edge. Ventral side of hindwing with weak bluish suffusion, not dense, in some cases extending to basal row of spots. Postdiscal space on inner side of submarginal pattern gray with thin white V-shaped lines. Submarginal pattern with thin inner black elements, orange elements separated, outer black elements small, metallic scales developed almost along entire row, grouped usually in 4–5, sometimes 6 metallic spots.

Male genitalia (Fig. 3: 3; Fig. 4: 5 A,B,C). The general size of the genitalia is slightly smaller than in the nominate subspecies (10–15%), but all characters of the labides, tegumen, valva and furca are the same. The dorsal process seems thicker and longer. More important that aedeagus is less curved, while the curving is moved from the beginning of the distal part towards the 1/3 of its length. In addition, the thinning and following thickening of the distal part is more expressed.

Female. Dorsal side of wings usually either violet blue or with violet blue sheen (brown females usually constitute no more than a quarter of populations). Forewing with brown costa and margin, discal line obvious, rest of wing violet. Dull orange red spots usually developed in submarginal area, sometimes this row is complete, sometimes absent. Hindwing almost entirely violet blue,

submarginal pattern consisted of dull orange-red elongated V-shaped spots with black rounded or oval spots inside.

Brown forms usually still have violet highlights on the wings, orange red submarginal spots are developed, often on forewing (more often than in blue forms) and sometimes on hindwing while even on forewings black internal spots are noticeable. Ventral side dark gray, pattern more developed than in males, including outer black submarginal semicircular or diamond-shaped elements on forewing. Fringe generally darker than in males. Orange elements thickened, but not merged into single band. Metallic scales developed in all outer spots of submarginal row, but these spots not enlarged.

Variability. The colour of the ventral side of the wings is occasionally lightened, in these cases the rings around the spots disappear, and low-contrast whitish fields appear on the inner side of the submarginal pattern on the ventral side of the hind-wing. Very rarely (observed in 3 females) a united orange band is developed on this side. Completely brown forms are extremely rare (2 specimens).

Diagnosis. The new subspecies clearly differs from the nominative one by slightly angular wings with a slightly pointed apex, a dark color of the ventral side (so that the rings around the spots become contrasting, while the size of the spots is statistically smaller), and the reduced submarginal pattern on the dorsal side of the forewing. Metallic spots are developed on the ventral side of the hindwing along the entire edge. In addition, females are violet blue with developed red pattern. As important features that bring it closer to the nominative subspecies we can note large size, narrow but not filiform margin and darkening of the entire inner part of the fringe dorsally. Differences in the structure of the aedeagus are confirmed in the series, only one of the five dissected specimens has the aedeagus more or less similar to that of the nominative subspecies. Such differences seem to be important, but we do not support the species status for the taxon. We suppose that the distinctions of the aedeagus have only a subordinate role comparing with the distinctions of the labides and the valva. The Oka Valley is also inhabited by recently described *P. idas reshetnikovii* Churkin et Yakovlev, 2024, the brown females of which are easily distinguished from females of *P. mongolicus*.

Bionomics. The new subspecies inhabits wet foothills of a dry mountain range. Specimens seem to be extremely local. The host plant is unknown: despite abundance of various legumes, egg laying was not observed.

Distribution. The new subspecies inhabits the closed Oka Valley inside the Eastern Sayan mountain system. However, the butterflies from Khuvsgul (Khövsgöl) Lake and western part of the Tunkin River valley (nearby Mondy village, W Buryatia) are similar to those from the Oka Valley (including the presence of the blue females).

The butterflies from the northern Khangai are smaller and somewhat darker than the nominative ones, but they undoubtedly belong to the nominative subspecies.

Etymology. Toponymic name.

9. *Plebejus mongolicus barguzin* ssp.

nova <http://zoobank.org/FD5D9EFF-76EA-4163-AA14-7E7F3B1C306C> Figs 1 (dorsal side), 2 (ventral side): 13–18

Holotype: male, Russia, Buryatia, Barguzin Mts. (foothills), Nesterikha R., 500 m., 14-16.07.2007, S. Vashchenko leg.

Paratypes: 12 males, 7 females, same data, S. Vashchenko leg.

Additional material: 3 males, Russia, Baikal See, Maritui st., 7.06.1993, S. Churkin leg.

Male. Wings broad with convex outer margin. Dorsally wings violet blue, black margin thin, but not filiform. Tips of veins blackened by 2–3 mm along veins, especially on forewing. Fringe white with darkening on inner side near veins, on forewing extending along entire wing. Hindwing usually with distinct black marginal dots between veins. Ventral side of wings whitish or white, with medium-sized spots lacking white circles. Ventral side of hindwing with sharp pattern, discal line expressed, postdiscal spots mostly irregular, stretched or curved. Submarginal spots with bright reddish-orange inner elements, inner blackish elements small and degraded, but external blackish elements well-expressed, semicircular or rhomboid. Ventral side of hindwing with bluish suffusion varying from almost complete disappearance to rather dense and extended to basal spots. Submarginal pattern with thin inner black elements and bright but not expanded orange elements; 5–6 metallic scales usually developed in all or almost all outer elements.

Male genitalia (Fig. 4: 6 A,B,C). All structures are the same as in the nominate taxon, except the aedeagus. The latter is thinner, proximal part is obviously shorter than in the nominate subspecies, so that the distal part is obviously longer than the proximal part. From the dorsal side, the thinning and following thickening of the distal part is more expressed, the same as in the subspecies *okianus*.

Female. Wings brown dorsally, blue forms are unknown. Reddish spots usually developed on both wings, spots usually distinct, sharp, with dense black dots inside. Ventral side dark with brown tint, spots either with white rings (rarely), or light stripe is developed in postdiscal area. Metallic plates like in male.

Variability. The ventral side is occasionally somewhat darkened. One male has no marginal black spots on the hindwing, another male has only 4 (but not 3) metallic spots. One female (Figs 1–2: 18) is almost completely dark with a barely noticeable violet sheen, another female has a full row of sharp reddish spots on the forewing.

Diagnosis. The ssp. *barguzin* can be clearly distinguished from the ssp. *okianus* by brown females, wide wings and white ventral side of the wings. It differs from the nominate subspecies in lighter, often white ventral side of the wings and 5–6 well-developed metallic spots on the ventral side of the hindwing (vs. usually only 3 spots developed in ssp. *mongolicus*). The dorsal side of the wings in females is brownish, not dark or light gray, as in other subspecies. The submarginal pattern is sharply developed on the ventral side of the forewing, representing an extreme form not only in contrast to *okianus*, but also in comparison with *mongolicus*. Females with a developed red orange pattern (although they do not constitute the majority) are unusual for the species as a whole. The following important features that bring the subspecies *barguzin* closer to other subspecies can be noted: large size, narrow (but not filiform) margin and darkening of the entire inner part of the fringe dorsally. The genitalia show unusual features of the aedeagus, partly resembling those of *okianus*, but not identical to either this subspecies or the nominotypical one.

Bionomics. The new subspecies inhabits dry meadow outcrops in the forested foothills of the Barguzin Range. The host plant is unknown.

Distribution. According to the known specimens, the new subspecies is endemic to the Barguzin Valley; possibly, the range should also include part of the coast of Lake Baikal, but the amount of material is insufficient for the final conclusion.

Etymology. Toponymic name.

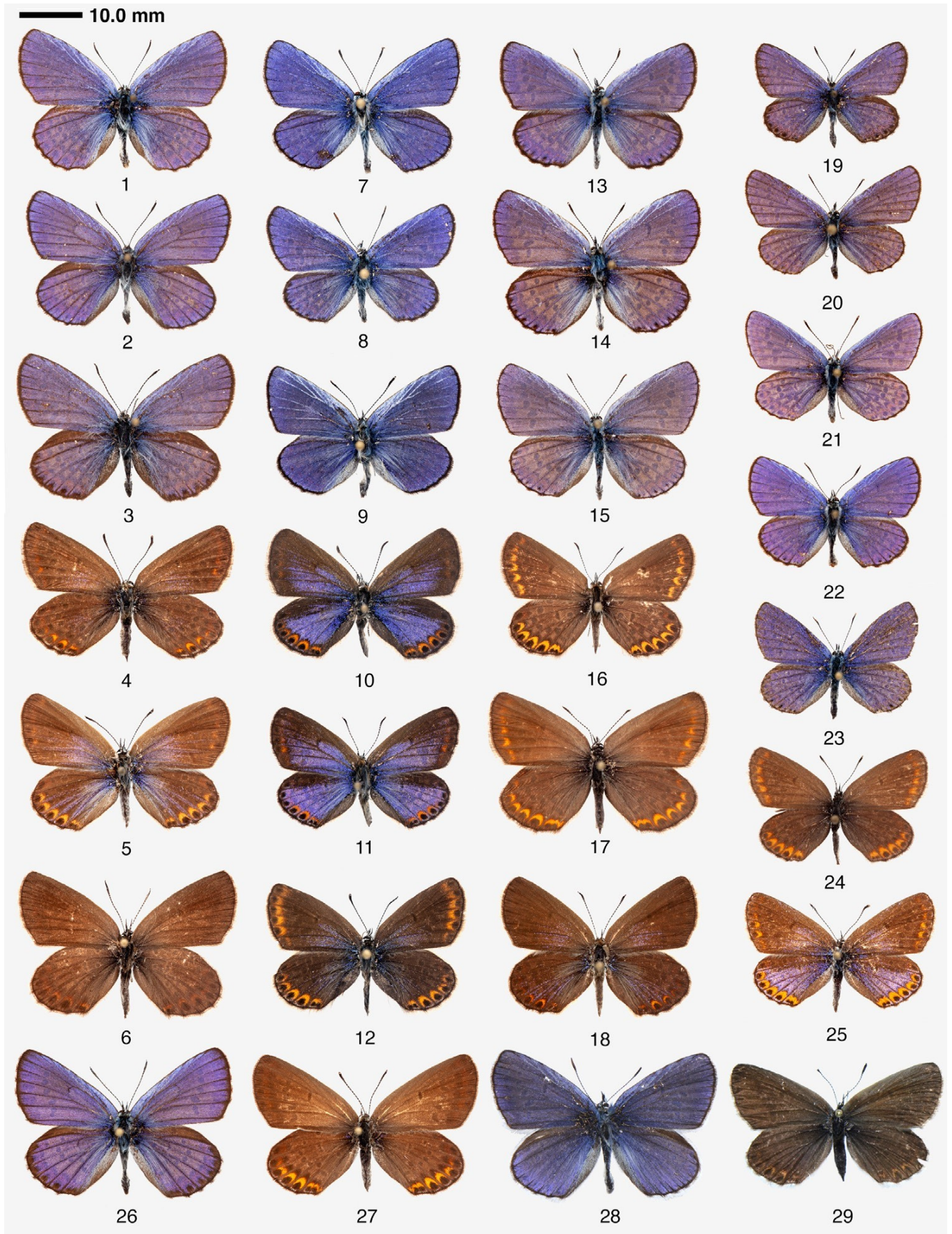


Figure 1. *Plebejus* spp., dorsal side. **1** - *Plebejus mongolicus mongolicus*, male, Russia, Buryatia, Brjanka R., Zaigraevo,

8.07.1994, S. Churkin leg. **2** - *P. m. mongolicus*, male, Russia, Buryatia, Chita Reg., Ingoda R., Talacha, 15 km from Urulga v., 8-13.07.1996, S. Churkin leg. & L. Salmanova leg. **3** - *P. m. mongolicus*, male, same data as 2, dark aberration with widened blackish margins. **4** - *P. m. mongolicus*, female, Russia, Buryatia, Ulan-Ude, Sotnikovo, 16.07.1982, A. Zamesov leg. **5** - *P. m. mongolicus*, female, same loc., 30.06 - 5.07.1994, S. Churkin & V. Pletnev leg. **6** - *P. m. mongolicus*, female, Amur Reg., Svobodnyi Distr., Kostjukovka v., 6-9.07.1995, K. Kolesnichenko leg. (dark form). **7** - *P. m. okianus* ssp. nova, holotype, male, Russia, East Sayan, Buryatia, Oka river valley, 15 km NW Orlik v., 1300 m, 3.07.2023, S. Churkin leg. **8** - *P. m. okianus* ssp. nova, paratype, male, same data as 7. **9** - *P. m. okianus* ssp. nova, paratype, male, same data as 7. **10** - *P. m. okianus* ssp. nova, paratype, female, same loc., 6.07.2023, S. Churkin leg. **11** - *P. m. okianus* ssp. nova, paratype, female, same data as 10. **12** - *P. m. okianus* ssp. nova, paratype, female, same data as 10 (dark form). **13** - *P. m. barguzin* ssp. nova, holotype, male, Russia, Buryatia, Barguzin Mts. (foothills), Nesterikha R., 500 m., 14-16.07.2007, S. Vashchenko leg. **14** - *P. m. barguzin* ssp. nova, paratype, male, same data as 13. **15** - *P. m. barguzin* ssp. nova, paratype, male, same data as 13. **16** - *P. m. barguzin* ssp. nova, paratype, female, same data as 13. **17** - *P. m. barguzin* ssp. nova, paratype, female, same data as 13. **18** - *P. m. barguzin* ssp. nova, paratype, female, same data as 13 (dark form). **19** - *P. m. transbaicalensis*, male, Russia, Chita Reg., Ingoda river valley, Talacha R., 27- 30.06.1995, K. Kolesnichenko leg. **20** - *P. m. transbaicalensis*, male, Russia, Buryatia, Tataurovo v., 11.06.1997, S. Churkin leg. **21** - *P. m. transbaicalensis*, male, Mongolia, Central aimag, 25 km W Erdenesant, 1260 m, 3.06.2004, S. Churkin leg. **22** - *P. m. transbaicalensis*, male, Mongolia, Dornod aimag, 33 km E Sumber somon, Khalkhin-Gol R., 47°32'N;118°59'E (SW border of Mongolia), 740 m, 19.06.2004, Ts. Odbayar leg. **23** - *P. m. transbaicalensis*, male, Russia, Buryatia, East Sayan, Oka R. 20 km SW Khuzhyr v., Zham-Bolot spr. , 1350-400 m, 30.06.2023, S. Churkin leg.; **24** - *P. m. transbaicalensis*, female, Russia, Buryatia, 70 km E Ulan-Ude, Uda R., Pervomaevka, 14.06.1993, 200 m, S. Churkin leg.; **25** - *P. m. transbaicalensis*, female, Russia, Chita Reg., Yablonovyi Mts., 15 km W Chita, 600 m, 22.06.2005, P. Bogdanov leg. **26** - *P. pseudaeon* ussuricus, male, Russia, Primorye, Anuchino v., 11.06.2013, V. Golovizin leg. **27** - *P. p. ussuricus*, female, Russia, Khabarovsk, Pobeda park, 12-19.06.2005, S. Koshkin leg. **28** - *P. m. mongolicus*, male, topotype, Mongolia, Darkhan aimag, Ero R., Bugant somon, 5.07.1993, S. Andreev leg. **29** - *P. m. mongolicus*, female, topotype, same loc., 8.07.1993, S. Andreev leg.

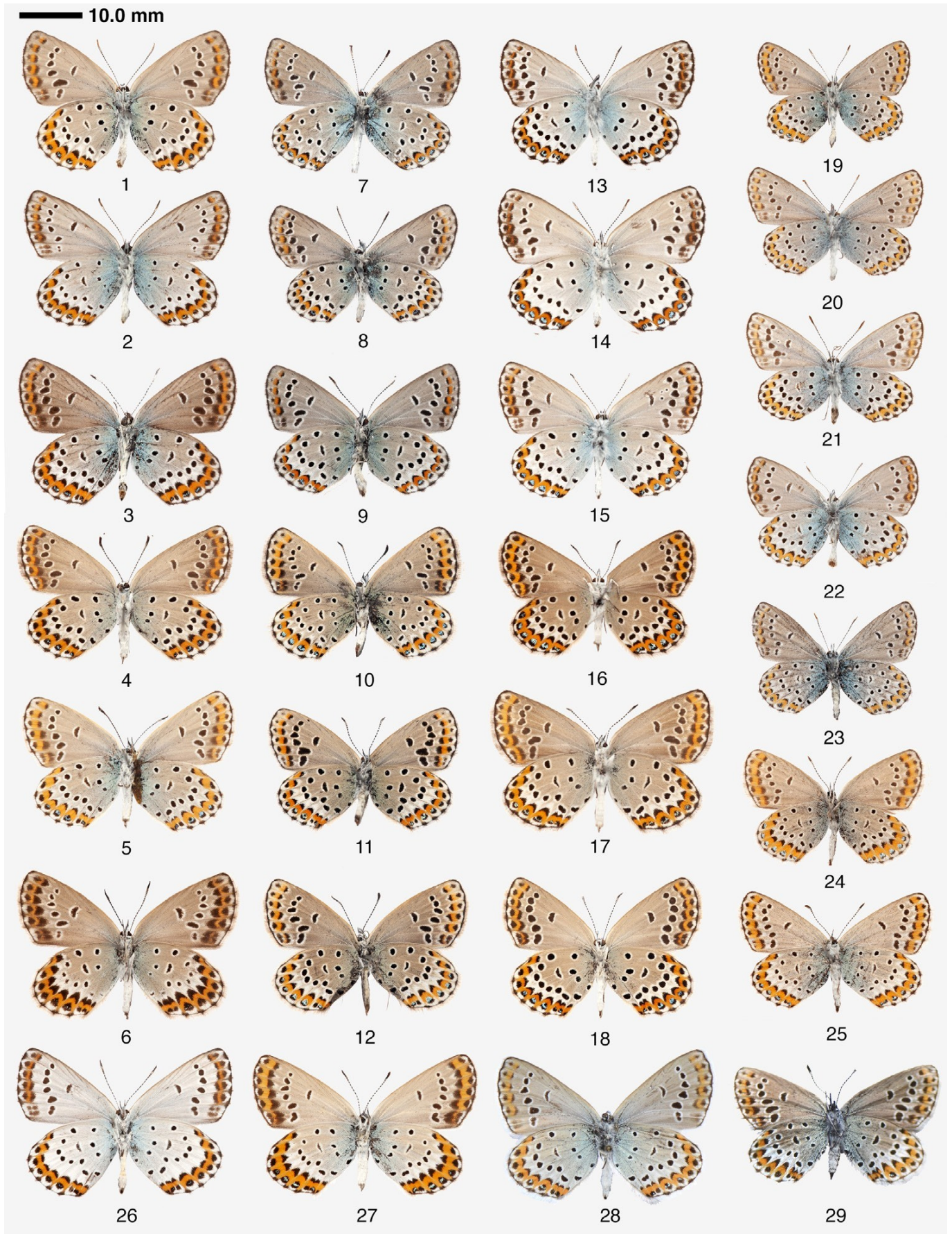
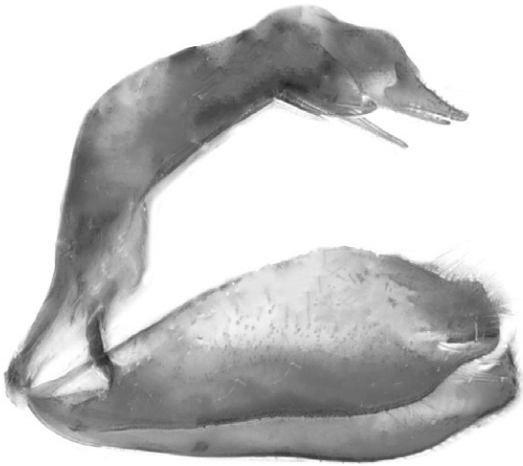


Figure 2. *Plebejus* spp., ventral side (the same specimens as on the plate I, except 28 and 29, both latter specimens have

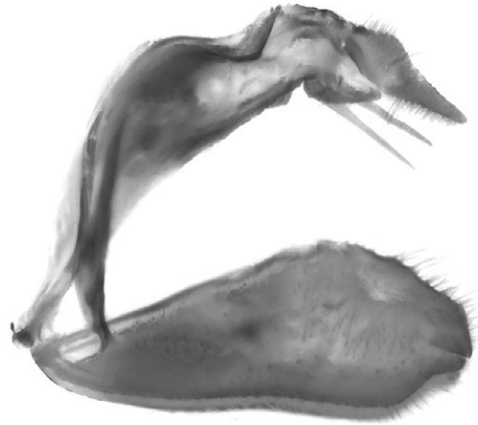


the same labels as 28 on Fig.1).

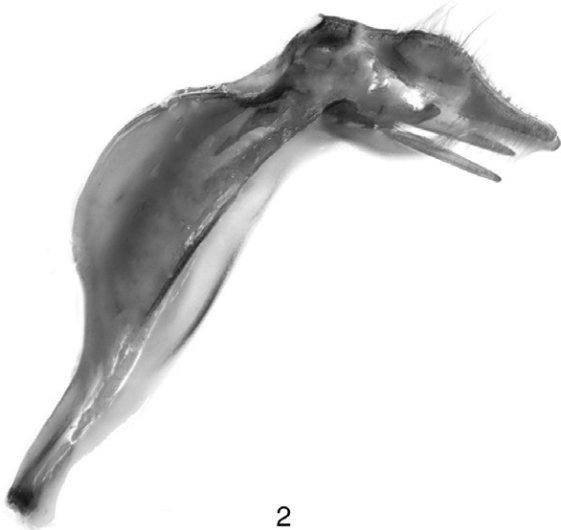
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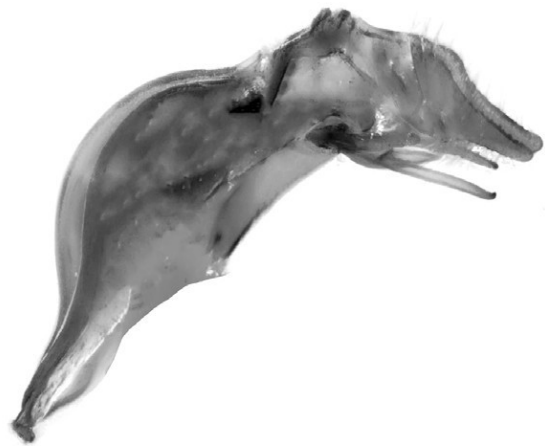
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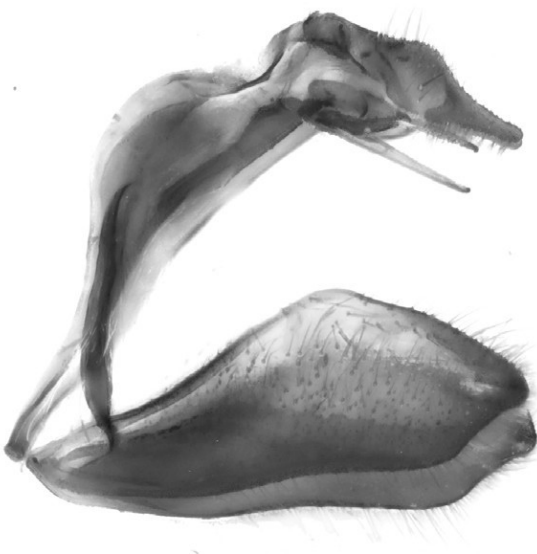
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2



5



3



6

Figure 3. *Plebejus* spp., male genitalia, lateral view (1, 3, 4, 6 – general view; 2, 5 – valvae and furca are deleted): **1** – *P. transbaicalensis* (Russia, Chita Reg., Yablonovy Mts.), **2** – *P. mongolicus mongolicus* (Russia, Chita Reg., Yablonovy Mts.), **3** – *P. mongolicus okianus* ssp. nova (Russia, Buryatia, Oka Valley, paratype), **4** – *P. maracandicus ionovi* (Kyrgyzstan, Issyk-Kul Lake, Kadzhisai v., paratype), **5** – *P. argyrognomon danapriensis* (Russia, Voronezh Reg., Don R., Kuvshin v.), **6** – *P. caspicus caspicus* (W Kazakhstan, Emba R., Kok-Zhide loc.).

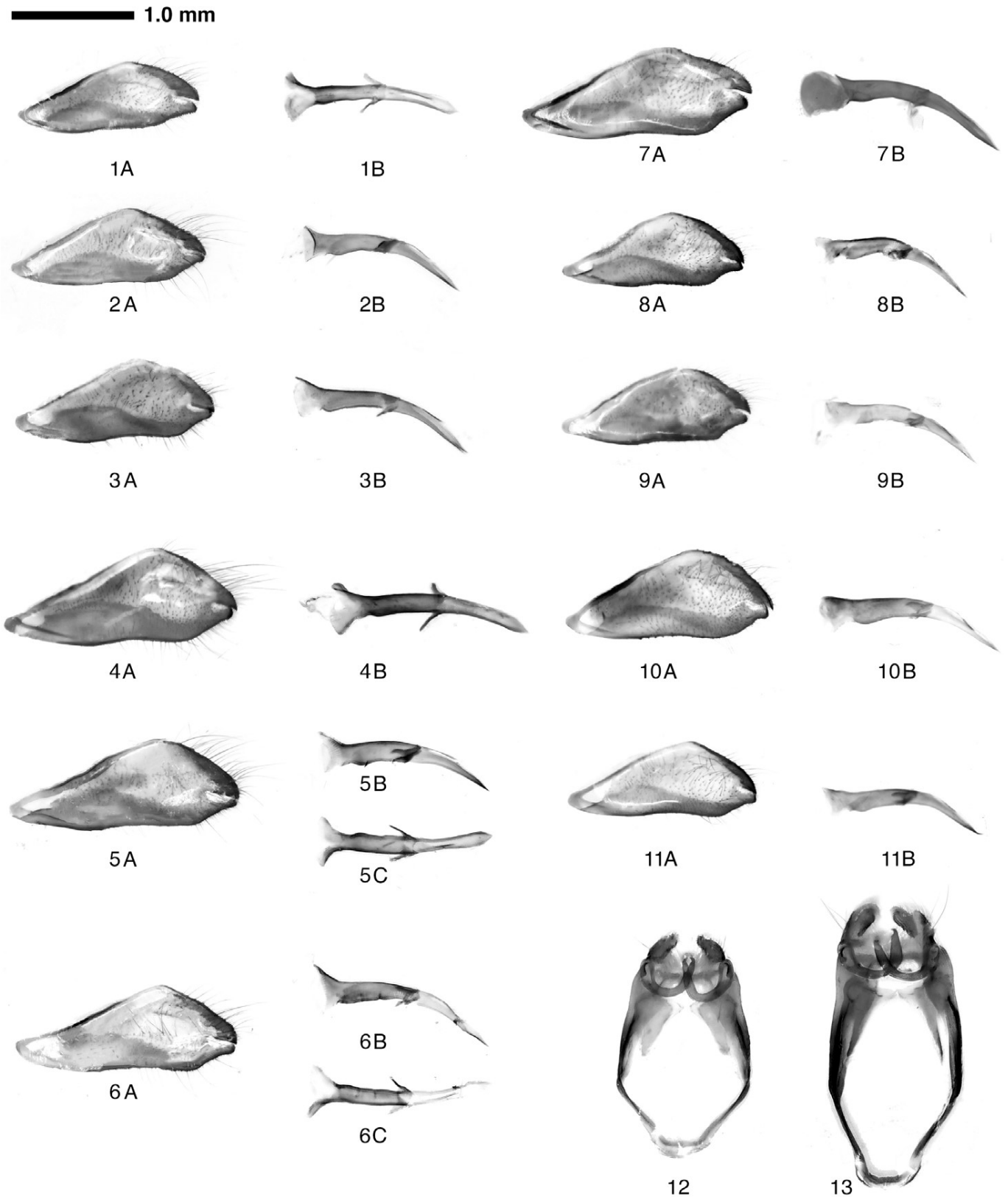


Figure 4. *Plebejus* spp., valva (1A-11A, lateral view), aedeagus (1B-11B, lateral or ventral view), tegemen (12-13): 1 A,B – *P.*

transbaicalensis (Russia, Buryatia, Barsky Mts.); 2 A,B - *P. transbaicalensis* (Russia, Chita Reg., Yablonovy Mts.); 3 A,B - *P. transbaicalensis* (Mongolia, Central aimag, Erdenesant); 4 A,B - *P. mongolicus mongolicus* (Russia, Chita Reg., Yablonovy Mts.); 5 A,B,C - *P. mongolicus okianus* ssp. nova (Russia, Buryatia, Oka Valley, paratype); 6 A,B,C - *P. mongolicus barguzin* ssp. nova, (Russia, Buryatia, Barguzin Mts., paratype); 7 A,B - *P. pseudaeagon ussuricus*, male, Russia, Russia, Primorye, Barabash-Levada v.); A,B - *P. maracandicus maracandicus* (Kyrgyzstan, Fergana Valley, Shamaldy-Sai). 8 A,B - *P. maracandicus planorum* (Kazakhstan, Ili Valley, Bakanas vic.); 9 A,B - *P. argyrognomon danapriensis* (Russia, Voronezh Reg., Don R., Kuvshin v.); 11 A,B - *P. caspicus sauromaticus* (Russia, Don R., Vyezdinsky v.); 12 - *P. transbaicalensis* (Russia, Chita Reg., Yablonovy Mts.); 13 - *P. mongolicus mongolicus* (Russia, Chita Reg., Yablonovy Mts.).

Discussion

The detailed maps of the main distribution of *transbaicalensis* and *mongolicus* was published by Tshikolovets (2002: 113) and it is not important to repeat it. We published here the map with type localities of all taxa in study (Fig. 5).

Based on our analysis we can conclude that *P. transbaicalensis* is clearly related to *P. caspicus*, and *P. argyrognomon* is related to *P. mongolicus*. All taxa have species status. The position of the taxon *maracandicus* seems to be separated, which is confirmed by a special host plant. The general structure of the Siberian part of the range of *P. idas* complex is represented by a succession of very different subspecies with wide zones of intergradation, with each zoogeographic districts inhabited by its own taxon (Churkin and Zhdanko, 2003; Churkin and Yakovlev 2024a). The structure of the *argyrognomon* complex is clearly different: in this case, two (and possibly more) species can cohabit in one territory, but the ranges of these species are quite large, and different species have particular patterns of subspecies structure.

Plebejus transbaicalensis is very uniform, the subspecies are not found across its range. On the contrary, *P. mongolicus* tends to form local subspecies in mountain valleys. According to the analysis of morphology, we can suggest that it can quickly accumulate differences, including those in the structure of the male genitalia, especially the aedeagus (see the above-described stable differences between ssp. *mongolicus* and ssp. *okianus*). However, within the range of *P. mongolicus*, a clear cline represented in decreasing size of the male genitalia from east to west is observed. We consider a difference of 10% in the size of genitalia as not essential for reproductive isolation (see above). It is important to note that the subspecies *barguzin* also has differences in the structure of the aedeagus.

The territory north of Lake Baikal and its shores remain practically unexplored, although the presence of both Daurian species there, *P. mongolicus* and *P. transbaicalensis*, is undoubted. It is extremely important to determine the western boundary of the ranges of these species, which is extended at least as far as to Kuragino in Krasnoyarsk region, not far from Minusinsk and Krasnoyarsk, and the zones of possible contact with European species.

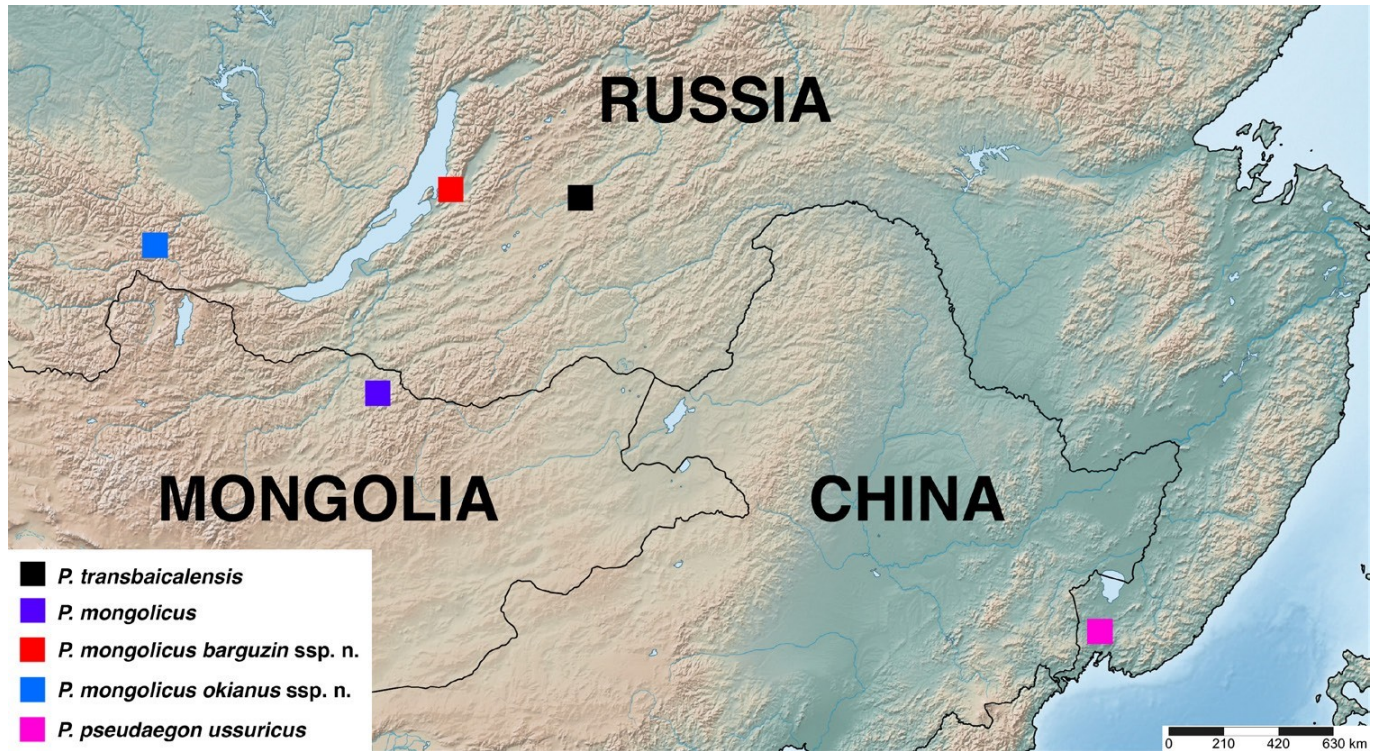


Figure 5. Type localities of the *Plebejus* taxa in question.

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References

- Alphéraky SN (1881) Lépidoptères du district de Kuldja et des montagnes environnantes. Partie 1. Rhopalocères. Horae Societatis Entomologicae Rossicae 16(3-4): 334-435, pls. 14, 15.
- Azarova NA (1986) Type material of butterflies taken by A.I. Kurentzov in the Collection of the Biology-Soil Institute of FENC SA USSR. In: Systematic and ecology of the Lepidoptera of Russian Far East: 121-128. [In Russian]
- Balint Z (2023) Guide to the butterflies of the Palaearctic Region. Lycaenidae, part V. Tribe Polyommataini. Milano, Omnes Artes, 106 pp., figs.
- Churkin SV (2004) New taxa of blues (Lepidoptera, Lycaenidae) from Mongolia. Helios 5: 45-59, 1 fig., cpl. III (1-19).
- Churkin SV, Kolesnichenko KA, Yakovlev RV (2019) Two new taxa of *Plebejus* Kluk, 1780 (Lepidoptera, Lycaenidae) from the Gobi desert, Mongolia. Zootaxa 4695(1): 45-58. <https://doi.org/10.11646/zootaxa.4695.1.3>
- Churkin SV, Pletnev VA (2012) Taxonomic notes on the *Plebeius christophi* complex (Lepidoptera, Lycaenidae) with descriptions of new taxa. Atalanta 43(1/2): 108-113, 2 figs., 1 cpl.

Churkin SV, Yakovlev RV (2024a) New data about *Plebejus idas* (Linnaeus, 1761) (Lepidoptera, Lycaenidae) from Russia, with the description of the new subspecies. *Ecologica Montenegrina* 73: 106–115. <https://dx.doi.org/10.37828/em.2024.73.11>

Churkin SV, Yakovlev RV (2024b) New data about *Plebejus idas* (Linnaeus, 1761) (Lepidoptera, Lycaenidae) from Mongolia with the descriptions of new subspecies. *Ecologica Montenegrina* 73: 116–124. <https://dx.doi.org/10.37828/em.2024.73.12>

Churkin SV, Zhdanko AB (2003) A review of the *Plebejus idas*- subsolanus complex of the Asian part of Russia and Mongolia with the descriptions of new taxa (Lepidoptera, Lycaenidae). *Helios* 4: 3–74, 5 figs., cpls. I–II (1–32), III–IV (1–36).

Dubatolov VV, Streltsov AN, Sergeev MG (2005) Fam. Lycaenidae – Blues. In: Key to the insects of Russian Far East 5(5): 341–393, figs. 195–215. [In Russian]

Forster W (1936) Beitrag zur Systematik des Tribus *Lycaenini* unter besonderer Berücksichtigung der *argyrognomon* und der *argus*-Gruppe (Lycaenidae). *Mitteilungen der Münchner Entomologischen Gesellschaft* 26(2): 41–150, pls. III–XV.

Gorbunov PY, Kosterin OE (2007) The Butterflies (Hesperioidea and Papilionoidea) of North Asia (Asian part of Russia) in Nature. Volume 2. Moscow, 408 pp., 852 figs.

Grum-Grshimailo GE (1887) Bericht über meine Reise in das östliche Buchara. *Romanoff Mémoires Lépidopteres* 3: 357–402, 1 pl.

Grum-Grshimailo GE (1891) Lepidoptera nova in Asia Centrali novissime lecta et descripta [New Lepidoptera from Central Asia recently founded and described]. *Proceedings of the Russian Entomological Society* 25(3–4): 445–465. [In Latin]

Korshunov YuP (2002) Butterflies of northern Asia. KMK Press, Moscow, 424 pp. [In Russian]

Krupitsky A, Pljushtch I, Skrylnik Yu. (2021) A new species of the *Plebejus samudra* (Moore, 1874) (Lycaenidae: Polyommatainae) group from Afghanistan. *Zoology in the Middle East* 67(2): 152–158.

Krupitsky AV, Li Z (2024) Notes on the *Plebejus christophi* (Staudinger, 1874) (Lepidoptera: Lycaenidae) species group of China, with a description of a new species from the Eastern Tian Shan. *Russian Entomological Journal* 33 (1): 102–109.

Kurentsov AI (1970) Butterflies of the USSR Far East. A Guide. Nauka, Leningrad, 164 pp. [In Russian]

Miller LD ([1970]) Nomenclature of wing veins and cells. *Journal of Research on the Lepidoptera* 8(2): 37–48.

Radde G (1861) Journey to South-Eastern Siberia (1855–1859). Notes of the Imperial Russian Geographical Society 4: 1–78. [In Russian]

Rühl F ([1893]) Die Palaearktischen Grossschmetterling und ihre Naturgeschichte 1. Leipzig, 857 pp.

Samodurov GD, Zhdanko AB, Tuzov VK, Dantchenko AV (2000) Genus *Plebejus*. In: Butterflies of Russia and adjacent territories 2: 158–169, cpls. 70 (figs. 41–46), 72 (figs. 19–48), 73, 74 (figs. 1–33), 83 (figs. 26–39).

Shapoval NA, Yakovlev RV, Kuftina GN, Lukhtanov VA, Knyazev SA, Romanovich AE, Krupitsky AV

(2021) Identification of Natural Hybrids between *Ahlbergia frivaldszkyi* (Lederer, 1853) and *Callophrys rubi* (Linnaeus, 1758) (Lepidoptera, Lycaenidae) using Mitochondrial and Nuclear Markers. *Insects* 12: 1124. <https://doi.org/10.3390/insects12121124>

Stradomsky BV, Arzanov YG (2003) A new western subspecies of *Plebeius maracandicus* Erschoff, 1984 (Lepidoptera, Lycaenidae) from the lower Don river. *Euroasian entomological journal* 2(3): 195–196.

Stradomsky BV (2005) Taxonomy of allied species *Plebeius argyrognomon* (Bergsträsser, [1779]), *P. maracandicus* (Erschoff, 1874) and *P. caspicus* (Forster, 1936) stat. n. (Lepidoptera, Lycaenidae). *Caucasian entomological Bulletin* 1(1): 81–84. [In Russian]

Staudinger O (1892) Lepidopteren des Kentei-Gebirges. *Deutsche entomologische Zeitschrift Iris* 5: 300 – 393, Taf. III.

Toropov SA, Zhdanko AB (2009) The butterflies (Lepidoptera, Papilionoidea) of Dzhungar, Tien Shan, Alai and Eastern Pamirs 2. Danaidae, Nymphalidae, Libytheidae, Riodinidae, Lycaenidae. Al Salam Publishing House, Bishkek, 378 + XIII pp.

Toropov SA, Zhdanko AB (2015) The butterflies (Lepidoptera, Papilionoidea) of Eastern Turan, Tarbagatai, Saur and South-western Altai. Vol. 2. Danaidae, Nymphalidae, Lycaenidae. Al Salam Publishing House, Bishkek, 425 pp.

Tshikolovets VV, Bidzilya AV, Golovushkin MI (2002) The butterflies of Transbaikal Siberia. Kiev-Brno, 320 pp., 48 cpls.

Tshikolovets VV, Yakovlev RV, Kosterin OE (2009) The Butterflies of Altai, Sayans and Tuva (South Siberia). Kyiv-Pardubice, 374 pp., 43 pls.

Tikhonov VV, Stradomsky BV, Kuznetsov GV, Andreev SA (2024) The butterflies of Caucasus and South Russia. <http://www.babochki-kavkaza.ru>.

Yakovlev RV (2012) Checklist of Butterflies (Papilionoidea) of the Mongolian Altai Mountains, including descriptions of new taxa. *Nota lepidopterologica* 35(1): 51–96.

Zhdanko AB (2000) New taxa of Palaearctic Blues (Lepidoptera, Lycaenidae). *Helios* 1: 99– 103, 1 fig.

Zhdanko AB, Churkin SV (2001) New subspecies of Centralasian Blues (Lepidoptera, Lycaenidae). *Helios* 2: 46–49, cpl. V (1–18).

Zhdanko AB, Churkin SV (2001b) A review of the *Plebejus christophi* complex (Lepidoptera, Lycaenidae) from the Central Asia with description of new taxa. *Helios* 2: 50–73.