

# Taxonomic review of the *Plebejus christophi* (Staudinger, 1874) species group from Central Asia with the descriptions of new taxa (Lepidoptera, Lycaenidae)

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## Abstract

The review includes the comparative analyses of *Plebejus christophi* (Staudinger, 1874), *P. argivus* (Staudinger, 1886), *P. argivus noah* (Herz, 1900), comb. nova et stat. novus, and *P. roxane* (Grum-Grshimailo, 1887). Three new taxa are described: *P. karinae* sp. nova (NW Kazakhstan, Atyrau reg., NW Kulsary town), *P. paveli* sp. nova (E Kazakhstan, south of Lake Zaisan, Zhagalbaily Mts.) and *P. argivus kazakh* ssp. nova (Kazakhstan, Transili Alatau Mts., northern foothills). The distinctions of the genitalia are discussed in details. Some notes about *P. bergi* Kuznetsov, 1908 are added, including designation of the neotype.

## Keywords

Biogeography, biodiversity, genitalia, morphology, new species, new subspecies, taxonomy, Kazakhstan

## Introduction

The full review of the species complex of *Plebejus christophi* (Staudinger, 1874) was published more than 20 years ago (Zhdanko and Churkin 2001). We present the following step of the investigations summarizing newly collected material together with new and more detailed study of the male genitalia. In the present study, we describe three new taxa of the *P. christophi* complex from Kazakhstan; other taxa known from Tajikistan, Kyrgyzstan and Turkmenistan are also discussed, while those inhabiting countries situated at the southern margin of the distribution range of the complex are not covered by this work.

The group includes only a few taxa: *P. christophi* (Staudinger, 1874), *P. argivus* (Staudinger, 1886), *P. agnatus* (Staudinger, 1889) and *P. roxane* (Grum-Grshimailo, 1887); the species status of the latter was confirmed recently (Churkin and Pletnev 2012). *Plebejus agnatus* from Kashgaria (China) is beyond the scope of the present paper, while our studies have shown the need to restore the taxon *noah* Herz, 1900 (see below). Another taxon, *P. aleremiticus* Churkin et Pletnev, 2012 (Tajikistan), is also excluded from the present paper due to the lack of new material for a detailed study. We will not repeat here the information from the previous revision (Churkin and Pletnev 2012) on the establishment of type localities, study of type specimens, etc., publishing only explanations and additions where necessary.

## Materials and methods

The present study is based upon the collections of the following institutions: Zoological Institute of Russian Academy of Sciences (ZISP, St. Petersburg), Darwin State Museum (SDM, Moscow), The 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), A.G. Makarov (Moscow) and R.V. Yakovlev (Barnaul). The locality data are given as it is on the labels. Totally, we examined more than 500 butterflies (below are listed only specimens that were thoroughly studied, including genitalia dissections).

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 glycerin, aedeagus and valva were separated. The images of specimens were taken with a digital Canon EOS 5D II camera with a Sigma 150 mm lens, and a custom-made lighting setup; the images of genitalia were taken using Canon EOS 6D mark II camera with a Canon MP-E 65 mm lens. Extended focus technology was used.

Holotypes are deposited in the collection of the Darwin State Museum (Moscow, Russia), paratypes are in the collections of the authors and the Museum of Natural History St. Alexis Hermitage and P. Beda (Ljubertzy, Russia).

## Abbreviations

FW – forewings

HW – hindwings

TL – type locality

m – m. a. s.l., meters above sea level.

## Results

### 1. The taxonomic problems of the complex

The first review of the complex in question (Zhdanko and Churkin 2001) included *P. christophi* complex *sensu lato*, i.e. all species utilizing *Alhagi* spp. (Elaeagnaceae) and a group of species utilizing *Hyppophae rhamnoides* L. (Elaeagnaceae). Species of the latter group were fully forgotten in the past and have been always treated as synonyms of *P. christophi*. During the last two decades A. Zhdanko, S. Churkin, V. Pletnev and R. Yakovlev found and described many species belonging to this complex, which inhabit mountain valleys where they live on *Hyppophae*, and valleys or oases in the deserts where they live on *Halimodendron halodendron* (Pall.) (Fabaceae) (Zhdanko 2001; Zhdanko and Churkin 2004, Churkin and Zhdanko 2004; Churkin and Zhdanko 2008; Churkin and Pletnev 2012; Yakovlev 2012). Recently, related species were found in China by Krupitsky & Li (2024).

Species of the *P. christophi* group *sensu stricto* utilize *Alhagi* spp.; they are characterized by small wingspan and some features of the male genitalia, namely small size of labides and short thin falces, which, however, are not so small as those in the *P. idas* complex of species (comparing with the size of the adults and genitalia in general, see below).

The actual taxonomic position of the numerous taxa developing on *Hyppophae* as well as *Halimodendron* is not clarified yet; these species cannot be simply united in the same complex with *P. christophi*. We cannot exclude that they present independent phylogenetic lineages of *Plebejus*. Morphologically this complex unites larger taxa with medium or large-sized labides and falces and usually large-sized aedeagus.

According to these characters, *P. bergi* Kuznetzov, 1908 (TL: North Aral) should be excluded from the *P. christophi* complex (see Samodurov et al. 2000, fig. 50: 2; Zhdanko and Churkin 2001: fig. 3) in opposite to the position in the first review (Churkin and Zhdanko 2001: 58–59).

This taxon was described as a form of *P. argyrognomon* (Bergstrasser, [1779]) using 3 males and 8 females (Kuznetsov 1908: 107) from 3 localities situated at the northern coast of the Aral Sea. The lectotype of *bergi* was designated by A. Zhdanko in “The butterflies of Russia and adjacent territories” (Samodurov et al, 2000). Three photos of *P. bergi* are figured in this book at the colour plate 74: 28–30) but only the female is true paralectotype of *bergi* (29). The depicted male (cpl. 74: 28 and 30, upperside and underside) is not the former syntype but definitely belongs to this species and was collected in the Malye Barsuki Desert, very close to one of the original type localities (Agespe village, 46°47'01" N 60°30'18" E).

Later the photos of one male and two females were published by V. Tshikolovets et al. (2016) in “The butterflies of Kazakhstan”, colour plate XXV: 6,7,8. The male was marked as “lectotype”, the females as “paralectotypes”. Exactly this male is deposited in ZISP and figured in the present paper at the Fig. 1. It has the following labels: “Ала-Козе / 2.V.06” [Northern coast of Aral See, Ala-Koze, 2.05.1906], “Lectotypus/ bergi Kuzn./ design. Zhdanko”. Unfortunately, the genitalia are absent, but the genitalia figures of the species were published twice as we noted above.



**Figure 1.** *Plebejus bergi*, paralectotype, male, upperside, underside, labels (see in the text).

According to the designation, the lectotype bears the following labels: «Биль-Арай, 17.05.1906» [Northern coast of Aral See, Bil-Arai, 17.05.1906], yellow rectangular piece of paper, “bergi”, “lectotypes Zhdanko design.” (Samodurov et al. 2000: 168).

These data include some mistakes:

1) the collecting date marked with Arabic numerals while true labels includes Latin numerals for the month;

2) the locality is not Bil-Arai, but Bil-Aran (“Биль-Аранъ”) according to the original description.

However, the lectotype designation is valid and the specimen figured as “lectotype” is actually a paralectotype. We will add the following label to this male: PA-RALECTOTYPE/ *Plebejus argyrognomon* var. *bergi* nova/ Kuznezov, 1908/ Churkin et Krupitsky des., 2025.

The lectotype is absent in ZISP, and A. Zhdanko informed us that he has no any information about it and that it is not stored in his collection. We conclude that the lectotype is lost.

In such a complicated situation as we know for the studied complex it is absolutely necessary to have name-bearing specimen to preserve the stability of zoological nomenclature fixed by the neotype designation (ICZN: Article 75).

Unfortunately, the male figured as lectotype formerly do not presents the useful option: it is in bad condition, the genitalia is lost, and (that is most important) it is originated from another locality than the lectotype, while ICZN recommended to use the topotypes in such cases (ICZN: Article 75A, 76A).

As we noted, three localities were mentioned: Ala-koze, Agespe and Bil-Aran. We found two of them on the maps according the big book published by Berg (1908) after his travel. Unfortunately, the first locality is not clarified. The locality Agespe presents small village at the Aral coast, the Malye Barsuki Desert continues from this point in north and northeast directions on approximately 75 km.

The locality Bil-Aran presented small sandy hills just westward from former Tushebas bay (the bay is practically disappeared now): “...далее к западу к берегу подходит невысокая гряда Биль-Аранъ (на некоторых картах Бишъ-Аранъ), покрытая песком...здесь были 16 (29) мая 1906 года собраны растения...” [further to the west, a low ridge called Bil-Aran (on some maps Bish-Aran), covered with sand, approaches the shore...the plants were collected here on May 16 (29), 1906...] (Berg 1908: 157).

We found this place at the Soviet military maps where it figured under the name “Bel’-Aral”, it is situated far from the recently existed Aral water surface.

For the stability of the nomenclature we select as the neotype the female figured in the book “The butterflies of Russia and adjacent territories” (Samodurov et al. 2000) on the colour plate 74: 29. This female is true paralectotype and was collected in Bil-Aran. Thus, the type locality is: northwest from former Tuzhebas bay of the Aral Sea, Bil-Aran (Bel-Aral) loc., appr. 100 m.a.s.l., 46°20' N, 59°30' E, see Fig. 7). The female has no antennae but colouration is fully agreed with that figured on the illustration for the original description (Kuznezov 1908: 1–2) and characterized by the enlarged black spots on the underside. We will add to this female the red label: NEOTYPE/ *Plebejus argyrognomon* var. *bergi* nova/ Kuznezov, 1908/ Churkin et Krupitsky des. 2025.

Worth to note that two paralectotypes (females) figured in “The butterflies of Kazakhstan” were collected in Agespe (Tshikolovets et al. 2016, cpl. XXV: 7–8).

*Plebejus kapanovi* Zhdanko et Churkin, 2004 described from Lake Balkhash (Fig. 7), which is sometimes considered a subspecies of *bergi*, is close to this species in both colouration and structure of the male genitalia. Despite the huge distance between the Aral and Balkhash, the subspecies status of *P. kapanovi* is possible; the colouration of the dorsal side of the wings of these taxa is nearly identical, while the black spots on the HW underside is definitely smaller. The final decision of this taxonomic problem is impossible without new material, but the close relationship of these taxa is obvious.

The host plant of *P. kapanovi* was also originally assumed as *Alhagi*, but later S. Toropov breed this species and found out that the actual host plant is *Halimodendron halodendron* (Toropov and Zhdanko 2015: 335). We suppose that the same is true for *P. bergi* and the common opinion about *Alhagi* was also wrong. The latter was translated without critical analyses in the first review (Zhdanko and Churkin 2001) while the original description has no any information about the host plant. Moreover, *Alhagi* is absent in the list of the plants collected by Berg at Bil-Aran (Berg 1908:157).

In addition, the flight period known for *P. bergi* in May is definitely too early comparing with species hosting on *Alhagi* but the same as for species utilizing *Halimodendron*.

Holotype (male) and female paratype of *P. kapanovi* are figured in Helios V at the plates III-IV: 22 and 23, topotypes also available for comparison at the present Figs 2–3: 28–29 (Zhdanko, Churkin 2004).

Note. We will not to discuss other identifications of the butterflies in this book and in other Central Asian books prepared by Tshikolovets (2003, 2005) because it includes dozens of wrongly identified specimens and odd combinations (as example of fault: “*Plebejus gabrieli lepidus*”). For this reason it is impossible to use the maps and locality points.

## 2. Diagnostic characters of the male genitalia

As noted in the revision by Zhdanko and Churkin (2001), the male genitalia of the species in this group are very similar and the differences are not so obvious. Having many times more material, we are forced to confirm this conclusion. There is no doubt about the existence of *P. argivus* as a biological species, and coexistence over a huge territory with the closely related *P. christophi* is impossible without reliable reproductive isolation. However, at the genital level, the differences are minor. We can suggest that this means our inability to detect some essential features. This conclusion is consistent with the fact that differences performing reproductive isolation between representatives of different species groups living together are still unknown, despite the fact that such differences should exist. Such differences are most likely associated with the general structure of the genitalia, which characters have only been partially studied.



The falces and size of the labides are most important to divide genus *Plebejus* into the 3 big groups of species: *argyrognomon*, *idas* and *christophi* (Zhdanko 2004). The taxa belonging to the *P. argyrognomon* group have longest falces and biggest labides (also comparing to the size of imago), while in two other groups the falces are short and the labides are obviously smaller.

Our investigation shown that especially representatives of the *P. idas* group have very short but moderately thick falces, definitely too small comparing with the size of the imago.

The *P. christophi* group is characterized by moderately long falces which are very thin, needle-shaped, being strongly different from those of the *P. idas* group. Sometimes they recall falces of small-sized taxa belonging to the *P. argyrognomon* group. In this case the main features are the size and shape of labides. However, the latter depend on the size of the insect and thus sometimes is not so distinctive.

The taxonomically important genitalia characters separating *Hyppophae* – *Hali-modendron* group from others are not clarified yet. This complex of numerous local species might be confused with the representatives of the *P. argyrognomon* group basing on the falces-labides-aedeagus size, but usually have developed hook on the dorsal process of the valva, which is a character of the *P. idas* and the *P. christophi* groups. However, falces look short and too thin compared with the species of the *P. argyrognomon* species group and size of the insect (these differences are obvious only during comparison under stereomicroscope).

We also suppose that *P. christophi sensu lato* and *P. argyrognomon* groups differ in the two different variants of the joining between labides and tegumen, but this idea needs in additional investigation. Appearance of this joint depends on the muscle efforts, and thus it is not so easy to use it in taxonomic sense although the actual functional role could be important.

The genitalia often provide good features when comparing different species that belong to one related complex. The problem comes when we need to find the true differences among the genitalia of different complexes and groups.

In the *P. christophi* complex, external differences in colouration make it easy to distinguish taxa, even subspecies (if we have small series of both sexes), from each other, and therefore genital characters play a secondary role from a taxonomic point of view. The distinct genital characters of the new species from Western Kazakhstan (see below) indicate its isolated position.

We examined 60 male genitalia from all species of the complex (Figs 4–6); the most important characters of the species level are size and shape of the labides, shape of the valva and shape of the aedeagus. The shape of the labides is the most important character, and if we can confirm the stable distinctions of the labides of any taxon, it is serious argument for the species status. The valva and the aedeagus seem more variable both individually and geographically, but often provide the distinctive characters on the species level. The characters of the processes of the valva and the furca seem to be not so important as the shape of the valva and not so useful in actual identification.

The general lateral view is too variable depending on the angle of examination, and the analyses of the genitalia without the comparison of separated valva and aedeagus can not be evidential. However, after analyses of separated sclerites it is possible to check and understand the characters using only the general view.

The widened central parts of the tegumen are usually flattened dorsally, so that it looks moderately narrow from the lateral view. In new taxa these parts are turned in another position being not flattened dorsally and looking widened and big from the lateral view. This feature divides the group into two parts (all known taxa versus two new species), but the actual value of this character is not known.

It should be noted that attempts to fixate the shape of processes using a cover glass are recognized as having no serious practical meaning; another approach is recommended (see Churkin and Krupitsky, 2024). Processes of the complex were figured for the first time in Churkin and Pletnev (2012: fig. 2, a–h).

### 3. *Plebejus christophi* (Staudinger, 1874)

Figs 2–3: 1–4, 21, 25

*Lycaena christophi* Staudinger – Ent. Ztg., 1874, 35: 87.

*Plebejus christophi eminens* Korb et Egorov, 2014 in Korb, 2014 – Eversmannia, 40: 15–16; figs. 7, 8. (Type locality: SE Kazakhstan, bridge on Ili river near Kok-Tal).

Type locality: “Schachrud” (NE Iran).

Lectotype: Pl. XLVII: 5 (Tshikolovets 2005)

**Material:** 8 males, 8 females, Turkmenistan, Bakharden vic., desert, 21–22.05.1996, A. Petrov leg.; 4 males, 5 females, Turkmenistan, Krasnovodsk vic., 18.06.1981, Kazakrayan leg.; 1 male, 1 female, E. Turkmenistan, Kushka distr., Sary-Jazy vic., 6.05.1990, M. Ivanov leg.; 5 male, 5 female, Turkmenistan, Mary reg., Bairam-Ali vic., 27.04.1986, Kipnis leg.; 9 males, 9 females, Kazakhstan, Aral Sea, Karakalpak Rep., Zamesov leg.; 3 males, 2 females, South Tadjikistan, Vakh R., Dzhilikul st., 2–15.05.1948, Y. Shchetkin leg.; 1 male, 1 female, South Tadjikistan, Dusti v., 8.06.1982, S. Bogachev leg.; 1 male, Tajikistan, Kurgan-Tyube environs, 20.05.2002, V. Shablya leg.; 1 female, S Tajikistan, Tabakchi Mts., 700 m a.l.s., 10.05.1995, V. Gurko leg.

2 males, 1 female, Tajikistan, Tigrovaya balka res., 6.05.2001, A. Petrov leg.; 1 male, 1 female, same loc., 25.06.1965, A. Tsvetaev leg.; 10 males, 6 females, Uzbekistan, Fergana valley, 20 km N Margelan, 8.06.1997, A. Zhdanko leg.; 2 males, 1 female, Komsomolobad, 10.04.1999, V. Tuzov leg.; 1 male, 1 female, Uzbekistan, Bukhara vic., 10.06.1996; 2 males, S Uzbekistan, Syrdarya reg., Katta-Kum des., Dzharkurgan v., 2.05.2003; 27 males, 20 females, S. Uzbekistan, Surxondaryo Region, 4 km NW Termez, Khakim-at-Termezi Mausoleum, 28–29.04.2022, leg. R. Yakovlev; 2 male, 1 female, Kazakhstan, Ili desert, 60 km E Chilik v., 10–20.05.1990, A. Zhdanko leg.; 5 males, 1 female, SE Kazakhstan, Ili valley, 20 km N Chun-



dzha, 20.06.1999, S. Churkin leg.; 4 males, 4 females, SE Kazakhstan, Ili valley, 30 km N Chundzha, 14.06.2010, 1000 m (female for breeding, hatched from pupa 15.07.2010), S. Toropov leg/breed.; 8 males, 2 females, SE Kazakhstan, Dzhungarsky Alatau, Katutau Mts., Atyzhek Range, Kokterek r., 900–1000 m, 12–13.06.2008, N. Rubin leg.; 2 males, 2 females, SE Kazakhstan, Dzhungarsky Alatau, Katutau Mt. R., Atyzhek Mts., Kokterek river gorge, 950–1000 m, 12–13.06.2008, N. Rubin leg.; 1 female, SE Kazakhstan, Alma-Ata reg., Darbazakum loc., 7.06.2023, A. Makarov leg.; 1 male, SE Kazakhstan, Almaty Region, Sharyn river valley, Sarytogai, 12 km NWW Chundzha, 700 m, 11.06.2008, N. Rubin leg.; 1 female, SE Kazakhstan, Almaty Region, Sharyn river valley, Sarytogai, 2 km N Tashkarasu, 550 m, 11.06.2008, N. Rubin leg.; 30 males, 20 females, SW. Kazakhstan, Sauskan sands, 120 km E Aktau, 10 km E Uchtagan v., 15–17.05.2000, J. Miatleusky leg.; 1 female, W Kazakhstan, Mangystau Region, Ustyurt Plateau, Manashi river valley, 45°01'N, 054°56'E, 50 m a.s.l., 10–13.05.2017, Ye. Dzerzhinsky leg.; 10 males, 4 females, NW Kazakhstan, Mangystau reg., 100 km NEE Beyneu, Usturt Plateau, N chink Donyztau, 9.06.2023, V. Pletnev and S. Churkin leg.

**Description** (only taxonomically important characters). FW length 12–15 mm (usually 13–14 mm) in males and 12.5–16 mm (usually 13.5–14.5) in females, everywhere through the distribution range.

**Male.** Wings dorsally violet-blue with narrow (but not filiform) black border, with distinct and sharp inner edge. Fresh butterflies have dull shine and bluish, which disappears after a few years (in the photo, numbers 2 and 3 were collected in 2023, 1 and 4–20 years ago). Sometimes tips of veins are darkened on 1–3 mm from edge of wing, but main discal space always uniform. Hindwing often with marginal black dots. Underside uniformly gray with rows of medium-sized black spots and indistinct submarginal pattern, colour of underside becomes slightly brownish with time. Underside of hindwing with loose but distinct greenish basal suffusion. Submarginal pattern, as a rule, with small yellowish-orange inner elements, outer elements with metallic scales, usually small and not strongly expressed.

**Male genitalia** (Fig. 4: 1; Fig. 5: 3–4; Fig. 6: 1–2) are variable both individually and geographically.

Valva with expressed but not sharp dorsal hump, proximal part slightly but obviously longer than the distal part (ratio is 1: 0.6; we divide these parts by the vertical line across centers of hump).

Both processes of valva short, dorsal at least twice (usually more) wider, very strong with small but developed upper hook distally.

Laterally, labides with oval and dorsally flattened bases which narrowed to slightly longer distal parts, these distal parts are gradually narrowed distad. Falces very thin and short, not reaching ends of labides far.

Tegumen oval, with angled proximal parts, central widened parts flattened dorsally (so, they do not look wide from lateral view). Furca V-shaped, with strong wide base uniting its branches.

Aedeagus in lateral view with proximal part looking shorter than distal part, wide and strong, while its distal part thin and curved down after 1/3 of its length. In dorsal view aedeagus with slightly expressed narrowing at distal part, distal end slightly widened and shortly pointed.

Labides sometimes slightly longer, valva roughly shaped, aedeagus more curved. Comparing with typical specimens from Turkmenistan and West Kazakhstan, Dzhungarian males have some minor differences, which seem not important. Specimens from Tajikistan seem to have the ventral process reduced also with expressed hole between the processes.

**Female** violet-blue, varying from slightly darkened form with 2–3 mm black marginal stripe on forewing to half-darkened wings on outer/costal edge. Hindwing dorsally with developed enlarged black dots on edge. Underside similar to that of male, but slightly darker, with non-contrasting light rings often developed near black spots, metallic spots somewhat better developed. Submarginal orange-yellow spots also often somewhat expanded.

**Variability.** Specimens from the type locality were studied previously, they look similar to that from South Tadjikistan (Zhdanko and Churkin 2001). New series from Iran are required for comparison.

**Male.** Very rarely the marginal border is thickened to 1 mm. The postdiscal row on the underside of the forewing may be straight or curved. Very rarely the spots are enlarged, but they are almost always larger than the submarginal pattern. Occasionally on the underside of the hindwing the pattern is more developed, the orange elements become clearly visible, the metallic spots are more expressed; the suffusion sometimes is well developed (especially in the western half of the distribution area). The space between the postdiscal and submarginal rows sometimes has unclear whitish triangular spots. Butterflies from the Dzhungarian foothills have a clearly lightened, even whitish underside, however, similar specimens are found even in Tajikistan, the other features remain unchanged.

The populations from the Fergana Valley are needed in detailed investigations but material is insufficient.

**Female.** Dark females are extremely rare, but they are known from all parts of the range (we have such from Chundzha and Western Kazakhstan, see Fig. 2–3: 21 – normal blue form, 25 – brown form); the underside of such females is always typical for the species.

**Diagnosis.** *Plebejus christophi* can be easily distinguished from all species of the group by the filiform black border of the males, blue females, specific gray colour of the underside with a non-contrasting pattern and a loose but noticeable basal greenish-bluish suffusion. Male genitalia with specific characters of the labides (distal part longer than the bases), valva with moderately long proximal part, aedeagus with curved thin distal part and peaked distal end.

**Distribution.** It inhabits deserts and semi-deserts throughout the region from Iran to the Ili River valley, and is still unknown in northern Kazakhstan and Mongolia (Fig. 7).

**Bionomics.** Host plant is *Alhagi* spp. The species inhabits sandy and clay deserts, sparse tugai forests up to 1000 meters (in studied territory), where populations can alternate with *P. argivus*, absent in mountain valleys. Biology was studied by Yu. Shchetkin and V. Degtyareva (1975), breeding was done by S. Toropov (Toropov and Zhdanko 2015: 330). Flies in several generations per year.

**Etymology.** Hugo Theodor Christoph (1831–1894) – Russian entomologist of German origin, member of the Russian Imperial Entomological Society, participant of expeditions to Transcaucasia. From 1880 he was one of the curators of the collection of Grand Duke Nikolai Mikhailovich.

#### 4. *Plebejus argivus argivus* (Staudinger, 1886)

Figs 2–3: 5, 6, 7, 8, 23

*Lycaena argiva* Staudinger – Ent. Ztg., 1886, 47: 204.

Type locality: Fergana valley (Margelan or Namangan according to syntypes, Fig. 7). Syntype: cpl. XXV: 9 (Tshikolovets et al. 2016).

Note. Very good photos of the taxon were published by Toropov and Zhdanko (2009: 274).

**Material:** 2 males, 2 females, Kyrgystan, Naryn r., 10 km W. Tash-Kumyr, 8.07.2001, A. Petrov and S. Churkin leg.; 50 males, 30 females, Kyrgyzstan, Fergana Valley, 16 km S Shamaldy-Sai v., 520 m, 21.06.2008, S. Churkin and V. Pletnev leg.; 3 males, 3 females, same loc., 19.06.2009, S. Churkin and V. Pletnev leg.; 3 males, 3 females, same loc., 17.06.2012, S. Churkin and V. Pletnev leg.; 8 males, 7 females, Kyrgystan, West Tian-Shan, Bosbu-Too Mts. (south. Sl.), 1300 m, 10 km E Karavan v., 9.07.2001, S. Churkin leg.; 15 males, 6 females, Kyrgystan, SW Chatkal, Sumsar v., 1200 m, 6.06.2001, S. Churkin and V. Pletnev leg.

**Description** (only taxonomically important characters). Smaller than *P. christophi*. FW length 12–14 mm (as a rule, 12.5–13.5 mm) in males and 12–14.7 mm (as a rule, 13–14 mm) in females. Females slightly bigger than males.

**Male.** Wings violet-blue dorsally, with extended black border with fuzzy, unclear inner edge. Tips of veins darkened, sometimes over extended distance, in which case discal strokes are visible. Hindwing usually with marginal black dots, which often blur and merging with outer border. Underside light gray with small postdiscal black spots, submarginal pattern sharp, usually more distinct than postdiscal pattern. Submarginal pattern on underside of hindwing unusual: inner black elements of spots thin, even streaky (arcuate), orange-yellow elements also thin and dim, outer elements looking like extended rounded dark spots forming single band. Metallic scales in spots barely noticeable, almost undeveloped. Basal suffusion absent.

**Male genitalia** (Fig. 4: 2; Fig. 5: 1, 2; Fig. 6: 3) are similar to those of *P. christophi*, but smaller. Valva with short processes, dorsal process rectangular and strong, ven-

tral process reduced and thin comparing to that of *P. christophi* (the cutting under this process is obviously more developed). Dorsal process with small hook at tip, but it seems variable and sometimes absent. Proximal part of valva shorter than in *P. christophi*, dorsal hump is not expressed, the general shape is smooth, not sharp, including the ventral surface too.

Bases of labides oval and even inflated, looking like balls, distal parts shorter than bases, sharply narrowed to thin ends.

Dorsally, aedeagus similar but distal part with more obvious narrowing and more obviously widened at pointed end.

Base of furca not widened, but thin, branches spread apart.

**Female** dark brown, often with black spots showing through along edge of hindwing. Underside with same features as in male, but yellow-orange elements of submarginal pattern more developed.

**Variability** is not great.

**Male.** Marginal border rarely thickened, occasionally with dark spot developed in marginal region of cubital zone (Figs 2–3: 6). Two specimens with border of 2–3 mm. Postdiscal row of underside of forewing straight or curved. Black spots sometimes slightly enlarged, sometimes very small, in the latter case unusual colouration of outer edge of hindwing not so pronounced. Space between postdiscal and submarginal rows sometimes with unclear whitish triangular spots. Some specimens with lighter underside.

Female. Blue females are as rare as the dark ones in the previous species, we know three such females, two similar to *P. christophi*, one to a male with a sharp expanded black marginal border, in all cases underside is typical for the species (Figs 2–3: 23).

**Diagnosis.** *P. argivus* is distinguished by an extended black border (often with an unclear inner edge) and brown females, the basal suffusion on the underside of the hindwing is practically absent. The nominative subspecies has a specific underside pattern with extended rounded outer elements of the submarginal spots, which form a tight "blind" band along the edge of the wing (the metallic scales are poorly developed).

Male genitalia: the distal part of the labides is thin and short compared with oval inflated bases; the dorsal part of the valva without sharply expressed hump, smoothly general shape, proximal part of the valva is shorter than in *P. christophi*, aedeagus with expressed thick distal end (better obvious from dorsal view, laterally aedeagus looks not so pecked and thin at the end).

**Distribution.** Eastern part of the Fergana Valley, lower reaches of the Naryn River (Fig. 7).

**Bionomics.** Host plant is *Alhagi* spp. Inhabits dry semi-desert thickets, banks of small streams, river valleys at the foot of mountains, and climbs up dry foothills. Currently local due to destruction of natural habitats.

**Etymology.** Argive (Latin) usually was used as a synonym of Greek.

**5. *Plebejus argivus noah* (Herz, 1900), comb. nov. et stat. nov.**

Figs 2–3: 9–12

*Lycaena alcedo* Chr. var. *noah* Herz nov. – Ann. Mus. Zool. Acad. Sci. St.-Petersb. 1900, 5 (4): 442

*Plebejus noah*, lectotype male and paralectotype female – Samodurov et al., 2000, 83: 28–30 (photos)

Type locality: “Noah-Pairambar” (Uzbekistan, western edges of Ghissar system, Aktau Mts., Navoi region, 10 km S Chuja village, near Ljanger, 1000 m, 40°24'39"N, 66°00'8" E, Fig. 7).

Note. The type locality was correctly disclosed by Zhdanko and Churkin (2002). We only specify it finally: O. Herz stayed with camp 10 km from Chuja village in low mountains – it could be only Ljanger, according to the map and logic (Ljanger (turk.)– the place where the caravan had a point with meal and sleeping places).

**Material:** 4 males, 2 females, E. Kyzyl-Kum, 35 km SW Bairkum v., 9–11.05.1992, A. Zhdanko leg. (the other specimens of the series listed in first review is not available now); 1 males, 1 female, Kazakhstan, Kyzylorda reg., 11 km W Besaryk, Syr-Darya r., 150 m, 43°34' N, 67°30' E, 5.05.2016, N. Rubin leg.; 3 males, 2 females, Tajikistan, Sogdia Province, Fergana valley, Kairakkum Reservoir north bank, 40°18' N, 69°53' E, 350 m, 28–29.06.2015, N. Rubin leg.; Uzbekistan, Dzhizak Region, Kyzyl-Kum Sands, Farish environs, 11.07.1990, A. Gromov leg.

**Description** (only taxonomically important characters). Slightly bigger than nominate taxon: FW length 12.5–14.2 mm in males and 12.0–15.0 mm in females. Females slightly bigger than males.

**Male.** Wings violet-blue dorsally, slightly lighter and more deep blue than those of nominative subspecies, black border widened to 1–1.5 mm, inner edge relatively distinct. Tips of veins darkened, discal stroke often visible. Hindwing usually with marginal black dots, often blur and merging with outer border. Underside noticeably darker than *P. argivus*, gray-brown, so that light rings around the black spots are more noticeable. Entire pattern of underside small, undeveloped. Outer elements of submarginal row on underside of hindwing widened only in cubital region, so overall colouration has nothing unusual, but at the same time, metallic scales are better developed than in *P. argivus* and visible in 2–4 spots. Inner elements of submarginal pattern dull, yellowish. Space between postdiscal and submarginal rows with light, elongated triangular spots. Basal suffusion absent.

**Male genitalia** (only 2 males dissected, both from Bairkum) (Fig. 4: 3; Fig. 5: 8; Fig. 6: 8) seem not fully identical with the nominate subspecies being large, 10–15% more than in two other subspecies. Labides are similar to those of ssp. *argivus*, but larger. Valva narrow with long proximal part (ratio proximal/distal part is 2:1). Dorsal process of valva rectangular and strong but usually without hook at tip.

Aedeagus similar to other subspecies but larger, thick, with massive proximal part, distal part sharply curved, dorsally with thick distal end. Furca with narrow base.

We cannot exclude that some distinctions are artifacts due to small quantity of the dissections.

**Female** dark brown, sometimes base of wings bluish. Underside same as in male, with spots slightly larger, yellow-orange elements of submarginal pattern may be more developed. There is no noticeable lightening of stripe between postdiscal and submarginal rows compared to males.

Individual variability is unknown, the series are small. Sometimes the underside is lighter, the submarginal pattern on the hindwing resembles that of *argivus*. Blue females are unknown.

**Variability.** Males from Baiurkum often have thinner black margins (with distinctive inner border). The submarginal pattern on the hindwing underside sometimes reduced, sometimes more developed.

**Diagnosis.** This taxon differs from the nominate subspecies in the absence of the unusual submarginal pattern on the underside of the hindwing described above, the more bluish colour of the wings of males and the general gray colour of the underside with more or less developed metallic scales. The valva has a long proximal part and rough general form, the aedeagus is massive. We can not exclude that it is a separate species, but new material is needed.

**Distribution.** A wide area from the middle reaches of the Amu Darya to the middle reaches of the Syr Darya rivers (in Uzbekistan, Tajikistan and Western Kazakhstan), including the outer edge of the Fergana Valley (collection of N. Rubin). There are no confirmed materials from the foothills of the Kyrgyz Range and the Western Tien Shan.

**Bionomics.** Habitats are similar to those of the nominative subspecies (see Toropov and Zhdanko 2015: 333). Host plant is *Alhagi maurorum* Medik. (*A. kirgizorum* Schrenk auct.).

Note. Specimens depicted in the photos in nature from Syr Darya river (Toropov and Zhdanko 2015: 333) are very similar to our material, while the spreaded butterflies (Toropov and Zhdanko 2015: 332) look different. Unfortunately, the collection is not existed now, and we cannot check these specimens. This book included many technical mistakes and misprints; they will be corrected in the new version, which is currently being prepared. However, in *P. argivus* case it is impossible to find the truth.

**Etymology.** Toponymic name of the place of the religious worship nearby Christoph's camp. Noah is known as the last of the patriarchs in the traditional Abrahamic religions.



**6. *Plebejus argivus kazakh* ssp. nova**

<http://zoobank.org/C58C90AB-03C9-4830-8084-3C373F00CD17>

Figs 2–3: 13–16

**Holotype:** male, Kazakhstan, Transili Alatau Mts. (northern foothills), 7 km E Tausugur v., 1070 m, 43°25' N, 78°18' E, 10.07.2009 (ex ovo, female for breeding was collected in May), S. Toropov leg. and breed.

**Paratypes:** 4 males, 5 females, same data.

The holotype is deposited in the collection of Darwin State Museum, inventory number: main collection ОФ 20925-414.

**Description** (only taxonomically important characters). Holotype FW length 13 mm, paratypes 13–13.5 mm in males and 13–14 mm in females.

**Male.** Wings violet-blue dorsally, black border wide (1.5–2.00 mm) with fuzzy inner edge. Tips of veins darkened for at least 3 mm, discal stroke usually visible. Hindwing usually with fuzzy marginal black dots. Underside light gray with lighter outer half of wings. Underside pattern developed, spots of normal size or enlarged. Submarginal pattern on underside of forewing uncontrasted, weakly developed. On underside of hindwing submarginal pattern distinct, typical for the complex, outer black elements thin, yellow-orange elements thin, not bright, outer elements also thin but with developed metallic scales inside. Due to the lightening of the entire outer half of the wing, edge of hindwing is whitish with sharply distinguished black areas of fringe near veins. Space between postdiscal and submarginal rows lightened, merging with indistinct whitish rings around spots of postdiscal row. Basal suffusion very weak, developed only at base (possibly it is noticeable only because the butterflies are very fresh, just after hatching).

**Male genitalia** (only 2 specimens dissected similar to that of ssp. *argivus* (Fig. 4: 9; Fig. 6: 4)).

Labides with oval inflated bases and blunt short distal parts. Falces thin, not long but needle-shaped. Distal part of valva longer (about 10%) than in *argivus*, general shape of valva typical for the species, processes also similar but the hook at the end of dorsal process reduced.

Furca with long branches spreaded apart, with thin weak base. Tegumen same as in *argivus*. Aedeagus also similar with thin distal end.

**Female** grey-brown, without the obvious pattern on the upperside. Underside with the same features as in male, spots larger, yellow-orange elements of submarginal pattern thickened, which is noticeable even on the forewing. Outer elements of submarginal spots on underside of hindwing sometimes enlarged, resembling those of *P. argivus*, with clearly visible dim metallic scales and bright white stripe between postdiscal and submarginal rows.

**Variability** is not known.

**Diagnosis.** *Plebejus argivus kazakh* ssp. nova differs from the nominative subspecies in the absence of an unusual pattern on the underside of the hindwing (as well as in developed metallic scales), from ssp. *noah* – in a wide black border with

a fuzzy outer edge, as well as a darker colour of the wings (identical to ssp. *argivus*). It differs from both subspecies in the developed lightening of the outer half of the wings on the underside, including a bright whitish stripe in the postdiscal space of the hindwing.

The male genitalia are similar to those of the nominative subspecies, but the distal part of the valva is somewhat longer.

**Distribution.** Reliably known only from the type locality (Fig. 7). All locations in popular books on the territory of Kazakhstan need to be verified. Most likely, the distribution range covers the foothills of the Zailiysky Alatau and the Chu-Ili Mountains.

**Bionomics.** The butterflies were bred by S. Toropov, photo of the larvae were published (Toropov and Zhdanko 2009: 275) with wrong locality “Kok-Pek”, which is corrected in the present paper according to the information from S. Toropov. Food plant – *Alhagi kirgizorum* Schrenk (presently all the taxa are united under the species name *A. maurorum* Medvik.). The new species inhabits dry foothills (S. Toropov, pers. comm.).

**Etymology.** Kazakh – ethnic group native to Kazakhstan.

## 7. *Plebejus roxane* (Grum-Grshimailo, 1887)

Figs 2–3: 22, 24, 26

*Lycaena roxane* Gr.-Gr. – Romanoff Mémoires Lépidopteres 3: 400.

*Plebejus christophi submontanus* Shchetkin – In: Proc. Inst. Zool. Parasitol. SSR Tadzhikistan, 1960, 24: 121 (Type locality: “...ближайшие окрестности Сталинабада (урочище Заграр...)” [Tajikistan, Dushanbe vicinity]).

Lectotype was designated by Bálint (1999: 55) with the labels “Shir-Abad / 18.05. [18]85/ coll. Gr.-Gr./ Elwes coll./ 1902-85”, deposited in the British Museum, number 265209.

Type locality: “Shir-Abad” [Shuarobad, Tadzhikistan] (Fig.7).

Note. The applying of the names *roxane* and *submontanus* were discussed previously (Zhdanko and Churkin 2001). The situation is still not fully clarified, the lectotype is not studied. However, some facts confirmed our opinion about *roxane*. The figures published by Grum-Grshimailo later (1890, pl. VII – 3 a, b) are not the syntypes but present material from Osh identified as *roxane*. The figured pair without any doubts presents a pair of *argivus* – the nearest relative of *roxane* (the photo of these figures was republished in: Tshikolovets et al. 2005: XLVII – 13). In addition, our specimens from Shuarobad – TL of *roxane* – presents typical *roxane* and have nothing with *christophi* (Figs 2–3: 22).

**Material:** 5 males, 2 females, Tadzhikistan, Dushanbe vic., Karabulok v., 1200 m, 15.05.2000, S.Churkin leg.; 10 males, 5 females, same loc., 12–15.05.2001, A. Petrov leg.; 6 males, 2 females, Tadzhikistan, Babatag Mts., Dzhartepa v., 1000 m, 18.05.2000,

S. Churkin leg.; 4 males, 1 female, same loc., 8-9.05.2001, 1000 m, A. Petrov leg.; 2 males, 1 female, Tadjikistan, Karatau Mts., Pastakon v., 17. 05.200, 700 m, S. Churkin leg.; 2 males, 1 female, Tadjikistan, Karatau Mts., Chalchal v., 16. 05.200, S. Churkin leg.; 1 male, 1 female, Tadjikistan, Tabakchi range, 1200 m, 21.05.2001, A. Petrov leg.; 1 male, 1 female, Tadjikistan, Baisuntau range, 6 km N derbent v., 28.09.2003, A. Petrov leg.; 10 males, 5 females, Tadjikistan, Khodzha-Mumin Mt., 1200 m, 26-28.05.2001, A. Petrov leg.; 8 males, 5 females, same loc., 1.06.2003, A. Petrov leg.; 8 males, 3 females, same loc., 2-9.06.2006, V. Perepechaenko leg.; 3 males, Tadjikistan, Peter the Great range, Tadzhibikobad, Ganishou v., 20-30.06.2003, A. Petrov leg.; 2 males, 1 female, Tadjikistan, 30 km S Dushanbe, Chimbulak, 1.06.2003, O. Pak leg.; 2 males, 1 female, Tadjikistan, Shuroabad vic., 3-5.07.2003, V. Perepechaenko leg.

**Description** (only taxonomically important characters). FW length 14–15 mm in males and females, very rarely 13–13.5 mm, females slightly larger than males.

**Male.** Wings violet-blue dorsally, noticeably darker than in *P. argivus*, with very wide black border (usually 2 mm), usually with fuzzy inner edge. Veins clearly darkened at ends, indistinctly almost along entire length, giving the butterflies a characteristic striation. Discal stroke usually visible. Hindwing with fuzzy marginal black dots that merge with border. Underside dark gray, much darker than in *P. argivus*, resembling darkened *P. christophi*. Underside pattern is typical for the group. Postdiscal spots on underside of hindwing enlarged, usually irregularly stretched. On underside of hindwing, submarginal pattern distinct, orange elements usually distinct, but thin, outer elements not expanded, metallic scales present, but not conspicuous: in general, pattern resembling that of *P. christophi*. Spots of postdiscal row noticeably smaller than those on underside of forewing. Space between postdiscal and submarginal rows without significant lightening, at most with unclear light spots. Basal suffusion absent.

**Male genitalia** (Fig. 4: 8; Fig. 5: 6; Fig. 6: 9). Valva similar to *P. christophi*, with sharp outlines of hump. Processes similar to that of *P. christophi*, but obviously longer and often with expressed split between them, dorsal process with triangular hook at end which often noticeable even from lateral side.

Labides with flattened oval parts so that general shape from lateral view looking plane, the distal parts have the same length as proximal parts or shorter, thick and not looking pointed from the lateral view.

Tegumen oval but stretched, 1.3–1.5 times longer than in *P. christophi* (5 measurements), this distinction is obvious when the genitalia of both taxa compared together. Widened lateral parts of tegumen flattened dorsally. Furca as in *P. christophi* with widened and strong base.

Aedeagus similar to that of *P. argivus* but massive with moderately thick distal part (narrowing of distal part only slightly expressed from dorsal view), but not so curved and looking almost unbend from lateral view. Aedeagus small (especially comparing with large tegumen), not longer than in *P. christophi*.

**Female.** Brown, often with slight bluish suffusion at base of wings. Dorsal side of hindwing often with noticeable orange arcuate spots in submarginal zone, and

occasional orange spots noticeable on forewing. Ventral side same as in male, but black pattern smaller, and background is not darker (which is unusual for the genus), while metallic scales much brighter, and orange elements larger. There is no lightening between postdiscal and submarginal rows.

**Variability.** Male: sometimes the black border is enlarged, very rarely it is narrowed to 1 mm (Figs 2–3: 24), in this case the veins are without darkening; sometimes in the cubital zone on the forewing above there is an unclear black spot. The background colour of the underside varies little. Blue females are unknown.

**Distribution.** Dry foothills around the South Tajik Depression (*P. christophi* lives in deserts and tugai forests along the Amu Darya). It rises in the mountains along the Vakhsh to the Tajikobad region (like other arid species). It can be confused with a local representative of the *P. idas* complex – *P. shuroabadicus* J.L. Shchetkin, 1963. There is no material from the west of the South Gissar, the Kugitang and the northern end of the Gissar Range.

**Bionomics.** Host plant is *Alhagi* sp. This species prefers the same habitats as *P. argivus* and inhabits dry foothills of mountains; rises into the mountains along river valleys.

**Etymology.** Roxana (Roksolana) is a female name, a wife of Alexander the Great.

## 8. *Plebejus paveli* sp. nova

<http://zoobank.org/DC757EDE-5241-49EA-ABF7-DFEC3AD35579>

Figs 2–3: 17–20, 29, 30

**Holotype:** male, E Kazakhstan, SW Zaisan lake, Abai reg., Zhagalbaily Mts., 47°53'21" N, 82°05' E, 800 m, 30.05.2011, K. Dovgailo leg.

**Paratypes:** 6 males, 3 females, same data, K. Dovgailo leg.

Additional material: 4 males, 4 females, SE Kazakhstan, SE Lake Balkhash, 35 km NE Taldy-Korgan, 700 m, 45°19' N, 78°36' E, 4.06.2011, N. Rubin leg.; 1 female, SE Kazakhstan, Alma-Ata reg., 11 km NEE Nura v., 11.06.2022, A. Makarov leg.; 23 males, 16 females, SE Kazakhstan, Alma-Ata reg., Zhangylsu r., N Shoshkaly ridge, 12 km NEE Nura v., 43°35' N, 78°37' E 17–18.05.2023, A. Makarov leg.; 2 males, 2 females, same loc., 27.05.2023, A. Makarov leg.

The holotype is deposited in the collection of Darwin State Museum, inventory number: main collection ОФ 20925-411.

**Description** (only taxonomically important characters). Holotype FW length 14 mm, paratypes 13–15 mm in males and 12–16 mm in females (variability of sizes is typical for the series from Zhyngylsu). Obviously larger than related taxa.

**Male.** Wings violet-blue above, black border widened to 1–1.5 mm, with fuzzy inner edge. Vein tips darkened by 2–4 mm, discal stroke often visible. Hindwing usually with distinct marginal black dots. Underside light gray, uniform. Postdiscal spots on underside of forewing enlarged, irregular in shape, with barely noticeable light rings. Submarginal pattern not sharp, but developed, often erased from costal

edge, with unclear, but enlarged black spots and small orange inserts. Underside of hindwing with distinct submarginal pattern typical for the complex, inner elements thin, red-orange elements thin, but bright, outer elements widened, with bright greenish metallic scales inside. Postdiscal spots somewhat smaller than on forewing, rings around them barely noticeable. Space between postdiscal and submarginal rows lightened, with unclear white triangles. Basal greenish suffusion sparse and narrow, but clearly visible.

**Male genitalia** (Fig. 4: 4, 5; Fig. 5: 5; Fig. 6: 5–6) much larger and stronger (15% bigger comparing with that of local *P. argivus*). Labides large, 1.5 times larger than in other species, oval base moderately gradually narrowed to thin distal ends (in *P. argivus*, oval base quickly and sharply narrowed to thin distal parts), distal parts short and not pointed at ends, looking shorter than bases from lateral view.

Valva with sharp outlines, expressed hump and developed ventral cutting, proximal part long, ratio distal/proximal part 1:2. Dorsal process very strong and tilted inward forming crook but hook on end absent. Ventral process short and thin. Furca with widened strong base.

Widened lateral parts of tegumen convex and not dorsally flattened, i.e. from lateral view this part of tegumen looking wide and big. The tegumen as a whole very long and big comparing to *P. christophi* and *P. argivus*.

Aedeagus massive and thick but similar to that of *P. argivus* (curved, distal end widened and pointed, narrowing not so expressed), distal part looks longer than proximal part, the curving is not so expressed.

**Female** brown, often with weak bluish suffusion at base of wings. Hindwing with developed submarginal pattern with unclear black and arcuate orange spots dorsally. Underside same as in male, metallic and red-orange spots larger and brighter. Whitish area between postdiscal and submarginal rows non-contrasting.

**Variability.** Some males from the type series have very thin marginal border, but always with cloudy, fuzzy inner edge. Specimens from Zhyngylsu have somewhat reduced pattern on the underside, the size of the spots is smaller, but even narrow metallic spots are bright and clearly visible, while the basal coating is more developed than in the other two populations. Several males have large submarginal blackish spots in the cubital-anal zone along the edges of the forewing. This feature is also known for other species of the complex, especially *P. roxane*, such spots are an addition to the border, but not part of it. Only one female of all available specimens is completely dark.

**Diagnosis.** *Plebejus paveli* sp. nova is distinguished by a light, non-contrasting underside with developed metallic spots, females usually with a developed submarginal orange pattern on the dorsal side of hindwing, from the closest *P. argivus kazakh* it additionally differs in a narrow black border. It differs from *P. christophi* in dark females, light underside with a developed enlarged spots.

Male genitalia clearly differs in the combination of large labides, long tegumen with wide not flattened central parts, aedeagus with obviously long distal part, dorsal process is very strong.

Material from Zhangylsu is included in this species provisionally (however, the genitalia looks very similar), while the specimens from Lake Balkhash look identical to the paratypes. It is better to limit the type series in such a complicated complex.

**Distribution** (Fig. 7). East Kazakhstan from Zaisan to the foothills of the Zailiysky Alatau. We have no reliable material from Central Kazakhstan at our disposal.

**Bionomics.** Host plant on Zhyngylsu river is *Alhagi* sp., there are no data for other populations. Habitats are the same as of *P. argivus*. Inhabits the foothills of mountains, dry spurs.

**Etymology.** The new species is named after Pavel Ivanovich Beda (Russia, Lyubertsy), Russian engineer, founder of eddy current aircraft flaw detection, well known amateur lepidopterist and collector.

### 9. *Plebejus karinae* sp. nova

<http://zoobank.org/8B4C7F6E-172E-4EAF-AA1B-2C0F1954A26E>

Figs 2–3: 31–40

Holotype: male, NW Kazakhstan, Atyrau reg., 55 km eastward Kulsary town, Emba r., 6.06.2023, S. Churkin leg.

Paratypes: 115 males, 61 females, same data, S. Churkin and V. Pletnev leg.

The holotype is deposited in the collection of Darwin State Museum, inventory number: main collection ОФ 20925-412.

**Description** (only taxonomically important characters). Holotype FW length 13 mm, paratypes 12–14 mm in males (13 mm as a rule, one male 14.5, one male 15.0) and 13–15 mm (13.7–14.3 mm as a rule) in females.

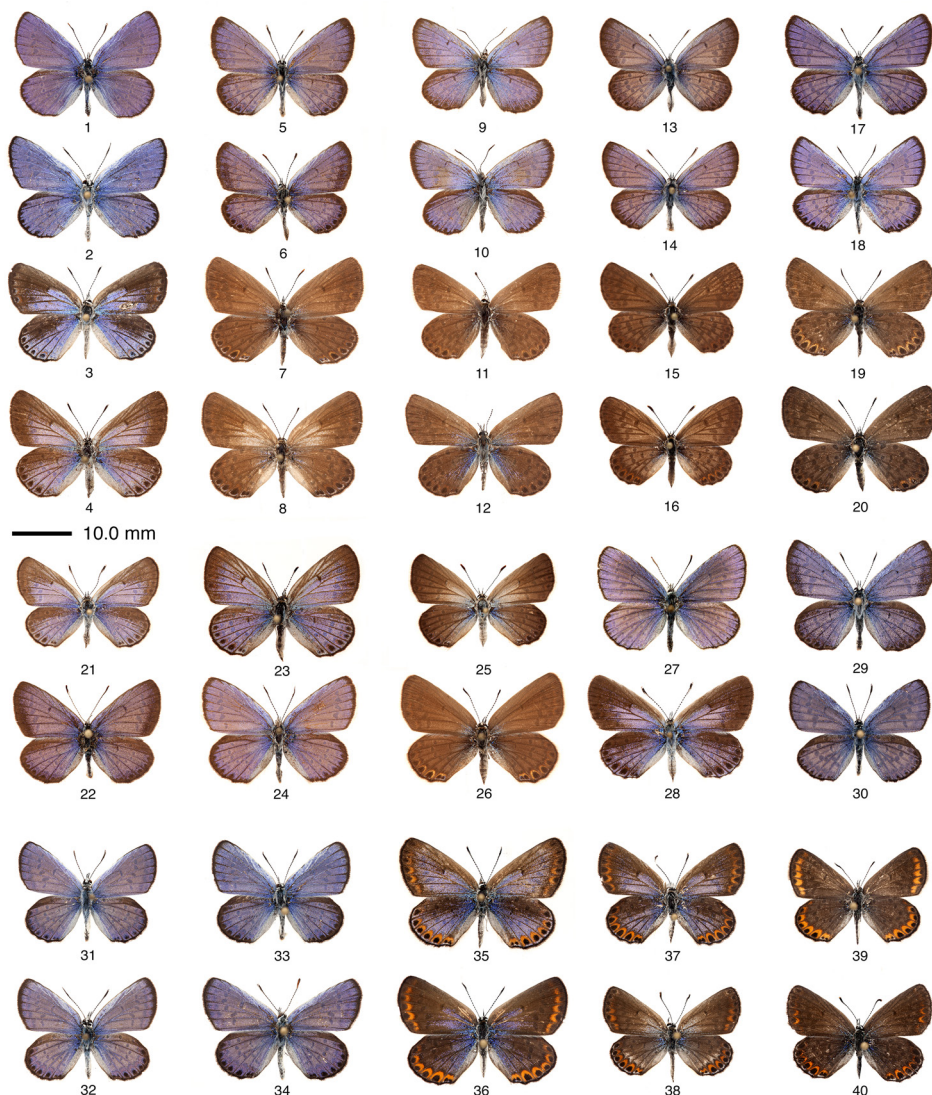
**Male.** Wings violet-blue above with dense white coating on costal edge. Black border narrow, up to 1 mm, often almost filiform, but always with fuzzy inner edge (specimens with expanded border absent). Tips of veins slightly darkened, discal stroke absent. Hindwing usually with small marginal black dots. Fringe white. Underside of forewing white with grayish suffusion, black spots small, with barely noticeable rings, submarginal pattern developed, inner elements reddish-orange. Underside of hindwing white, black spots smaller than on forewing, without rings, submarginal pattern thin, but middle elements bright, yellowish or yellow-orange, often partially divided and never forming wide fused band; outer elements with bright metallic scales inside. Basal suffusion barely noticeable at very base of wing.

**Male genitalia** (Fig. 4: 7; Fig. 5: 7; Fig. 6: 7). Labides very small with small thin distal parts obviously shorter than oval proximal parts. Falces very thin and short.

Valva long and narrow, with small hump, distal part short, ratio distal/proximal part appr. 1:2. Dorsal process very wide, massive and tilted inward forming crook, actual hook on tip absent but process slightly widened distally. Ventral process not normally developed, 3 times narrower than dorsal process, cutting under ventral process not so expressed.

Tegumen of oval shape, widened lateral parts not flattened dorsally and look widened from lateral view. Furca with widened strong base, its branches are parallel.





**Figure 2.** Adult specimens of *Plebejus* (upperside).

1 – *Plebejus christophi*, male, SE Kazakhstan, Dzhungarsky Alatau, Katutau Mt. R., Atyzhek Mts., Kokterek river gorge, 950-1000 m, 12-13.06.2008, N. Rubin leg.;

2 – *P. christophi*, male, NW Kazakhstan, Mangystau reg., 100 km NEE Beyneu, Usturt Plateau, N chink Donyztau, 9.06.2023, V. Pletnev and S. Churkin leg.;

3 – *P. christophi*, female, same data as 2;

4 – *P. christophi*, female, same data as 1;

5 – *P. argivus argivus*, male, Kyrgyzstan, Fergana Valley, 16 km S Shamaldy-Sai v., 520 m, 21.06.2008, S. Churkin and V. Pletnev leg.;

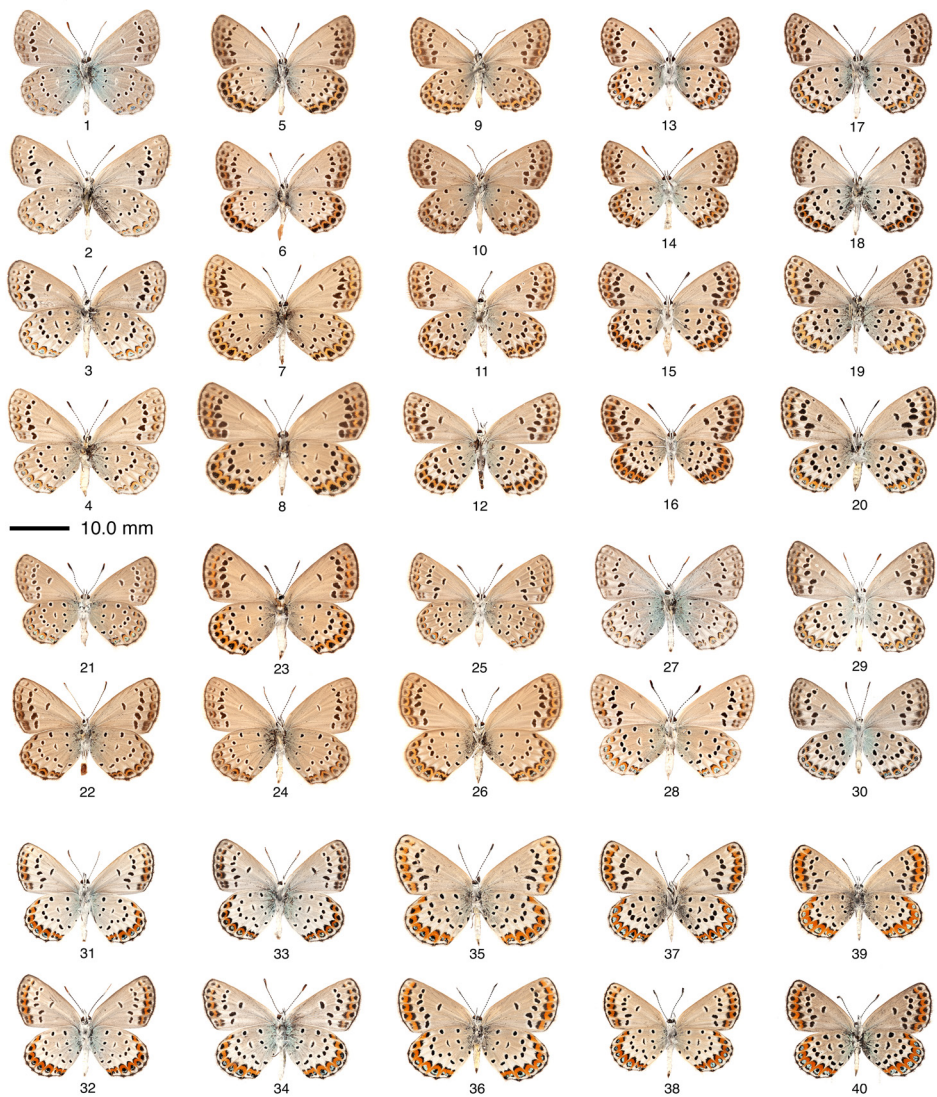
6 – *P. a. argivus*, male, same data as 5;

7 – *P. a. argivus*, female, same data as 5;

8 – *P. a. argivus*, female, same data as 5. Continued on the next page.

**Figure 2.** Continued from the previous page.

- 9 – *P. a. noah*, male, Kazakhstan, E. Kyzyl-Kum, 35 km SW Bairkum v., 9 – 11.05.1992, A. Zhdanko leg.
- 10 – *P. a. noah*, male, same data as 9;
- 11 – *P. a. noah*, female, same data as 9;
- 12 – *P. a. noah*, female, same data as 9;
- 13 – *P. a. kazakh* ssp. nova, holotype, male, Kazakhstan, Transili Alatau Mts. (northern foothills), 10 km E Tausugur v., Chilik valley, 1070 m, 10.07.2009 (female for breeding), S. Toropov leg. and breed.
- 14 – *P. a. kazakh* ssp. nova, paratype, male, same data as 13;
- 15 – *P. a. kazakh* ssp. nova, paratype, female, same data as 13;
- 16 – *P. a. kazakh* ssp. nova, paratype, female, same data as 13;
- 17 – *P. paveli* sp. nova, holotype, male, E Kazakhstan, southern towards Zaisan lake, Abai reg., Zhagalbaily Mts., 800 m, 30.05.2011, K. Dovgailo K.;
- 18 – *P. paveli* sp. nova, paratype, male, same data as 17;
- 19 – *P. paveli* sp. nova, paratype, female, same data as 17;
- 20 – *P. paveli* sp. nova, female, SE Kazakhstan, Alma-Ata reg., Zhangylsu r., 12 km NEE Nura v., A. Makarov leg.;
- 21 – *P. christophi*, female, SE Kazakhstan, Ili valley, 30 km N Chundzha, 14.06.2010, 1000 m (female for breeding, hatched from pupa 15.07.2010), S. Toropov leg./breed.;
- 22 – *P. roxane*, topotype, male, Tadjikistan, Shuroabad vic., 3.07.2003, V. Perepechaenko leg.;
- 23 – *P. a. argivus*, female (blue aberration), same data as 5;
- 24 – *P. roxane*, male (very rare form), Tadjikistan, Khodzha-Mumin Mt., 1200 m, 26–28.05.2001, A. Petrov leg.;
- 25 – *P. christophi*, female (dark aberration), same data as 21;
- 26 – *P. roxane*, female, same data as 24;
- 27 – *P. (bergi?) kapanovi*, male, Kazakhstan, Lepsy river sands, Lepsy st., 28.05.2011, S. Toropov;
- 28 – *P. (bergi?) kapanovi*, female, same data as 26;
- 29 – *P. paveli* sp. nova, male (form), same data as 20;
- 30 – *P. paveli* sp. nova, male, same data as 20;
- 31 – *P. karinae* sp. nova, holotype, male, NW Kazakhstan, Atyrau reg., NW Kulsary town, Emba r., 6.06.2023, S. Churkin leg.;
- 32 – *P. karinae* sp. nova, paratype, male, same loc., 6.06.2023, S. Churkin and V. Pletnev leg.;
- 33 – *P. karinae* sp. nova, paratype, male, same data as 32;
- 34 – *P. karinae* sp. nova, paratype, male, same data as 32;
- 35 – *P. karinae* sp. nova, paratype, female, same data as 32;
- 36 – *P. karinae* sp. nova, paratype, female, same data as 32;
- 37 – *P. karinae* sp. nova, paratype, female, same data as 32;
- 37 – *P. karinae* sp. nova, paratype, female, same data as 32;
- 38 – *P. karinae* sp. nova, paratype, female, same data as 32;
- 39 – *P. karinae* sp. nova, paratype, female (rare form), same data as 32;
- 40 – *P. karinae* sp. nova, paratype, female, same data as 32.



**Figure 3.** Adult specimens of *Plebejus* (underside). The description is the same as in Fig. 2.

Aedeagus very short, only  $2/3$  of valva length (i.e. equal in length with proximal part of valva), proximal part thick and massive from lateral view. Distal part gradually but not strongly curved after  $1/3$  of its length, looks unbend. From dorsal view narrowing at distal part only slightly expressed, end shortly pointed. Proximal part of aedeagus much longer than distal part.

**Females** extremely polymorphic. More frequent form violet-blue (darker than males) with developed orange submarginal pattern on dorsal side of both wings. Dark forms, as a rule, with developed orange pattern at least on hindwing, blue colour is completely absent. To the available all kinds of variants of transitions between the two forms, we should add the extremely rare completely brown (2 specimens) and very light white-blue forms (also 2 specimens). Underside darker than that of males, with brown tint, spots slightly larger, but without white rings, submarginal spots with expanded yellow-orange elements and thin black ones, metallic spots bright. Dark females with darker underside and developed white band in postdiscal field, but orange elements enlarged and often form single band.

**Variability** is not so expressed among the males in opposite the females. The males sometimes have larger spots on the underside, sometimes the colour of the inner elements of submarginal pattern is brighter, being even reddish (that is rare case), sometimes these spots are moderately enlarged. The biggest male (15 mm) is very unusual, having grey underside with widely separated submarginal spots.

Females have more variable underside colour than the males, sometimes lighter and sometimes darker. Numerous colourful forms are described above.

**Diagnosis.** *P. karinae* sp. nova differs from all species of the complex in the structure of the aedeagus with a very long proximal part, very small labides with short distal parts, tegumen with an unusual structure of lateral thickened elements. Externally, it is easily distinguished by the white colour of the underside with small spots, which resembles the underside of the nominative *P. maracandicus* (Erschoff, 1874) – but not *P. caspicus* (Forster, 1936), with which it flies and which is easily distinguished by the grayish colour of the underside with medium-sized spots and the structure of labides and falces.

It is possible to confuse males of *P. karinae* with males of the last two species due to the narrow border (if you do not pay attention to the fact that its inner edge does not have a distinct border, which immediately gives away its belonging to another complex of species), but it is impossible to confuse unusually coloured females. It should be noted that the aedeagus of males of both *P. maracandicus* and *P. caspicus* resembles that of *P. argivus* in the ratio of the distal and proximal parts and in the general shape (but is noticeably larger), i.e. the features of the aedeagus make it easy to distinguish the new species from any of its “neighbors”. We have not found specimens of the new species in either private or museum collections, which is surprising given its distribution. It should be noted that the combination of three colours at the same time in the colouration – brown, orange and violet-blue – is extremely rare for Eurasian representatives of the genus.

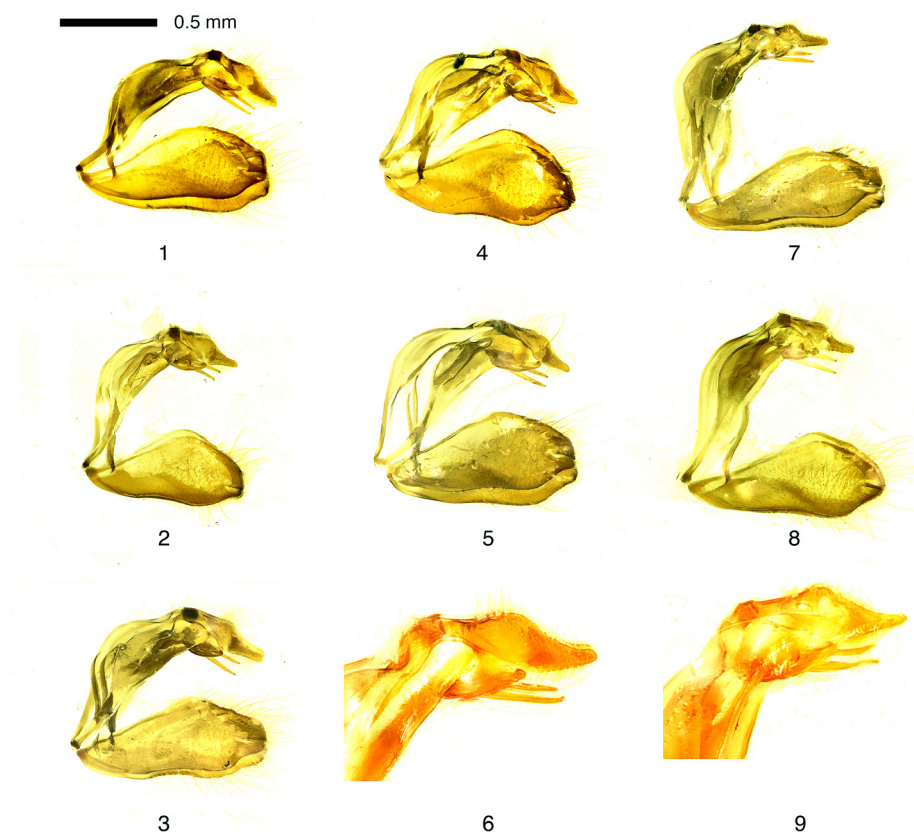


The new species strongly differs from *P. bergi* by the much smaller black spots on the HW underside and not filiform black marginal line (Figs 2–3: 28–29). The genitalia is also different and belong to the complex of species associated with *Hali-modendron*. Worth to remember that *P. bergi* was described as the form of *P. argyrognomon* because of very thin marginal line, the expressed and big black spots on the HW underside is outlined as the main feature of the species (Kuznezov 1908).

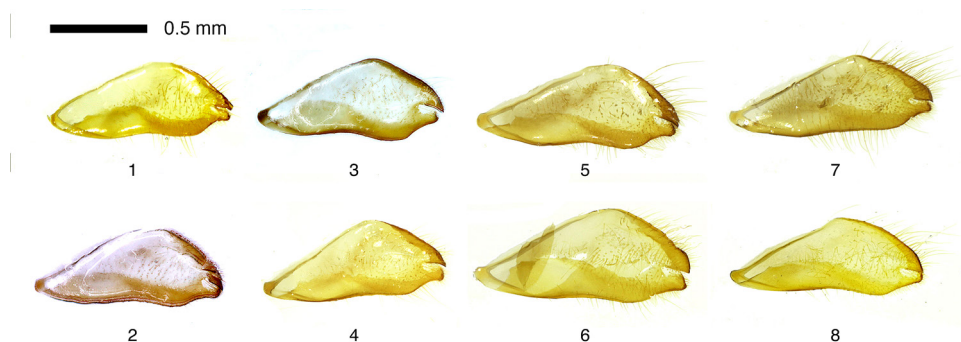
**Distribution.** NW Kazakhstan, Emba river valley (Fig. 7).

**Bionomics.** Host plant – *Alhagi maurorum* Medik. (= *pseudalhagi* M. Bieb.). Inhabits riverine thickets, not found in deserts or open steppe. Very local species.

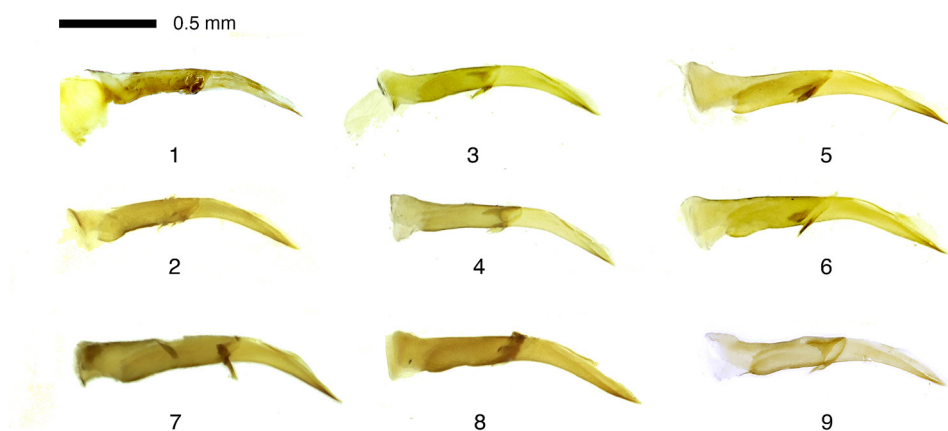
**Etymology.** The new species is named after Kazakh insect collector Karina R. Sarsenova (Almaty), who is a popularizer of the study of nature among young people.



**Figure 4.** *Plebejus* spp., male genitalia, lateral view, aedeagus is deleted (1–5, 7–8 – general view; 6, 9 – labides and falces): 1 – *P. christophi* (W. Kazakhstan, Sauskan), 2 – *P. argivus argivus* (Fergana valley, Sumsar), 3 – *P. argivus noah* (E. Kyzyl-Kum, Bairkum), 4, 6 – *P. paveli* (paratype, E Kazakhstan, Zhagalbaily), 5 – *P. paveli* (SE Kazakhstan, Zhangylsu), 7 – *P. karinae* (paratype, W. Kazakhstan, Emba), 8 – *P. roxane* (S. Tadjikistan, Karabulok), 9 – *P. argivus kazakh* (paratype, SE Kazakhstan, Tausugur).

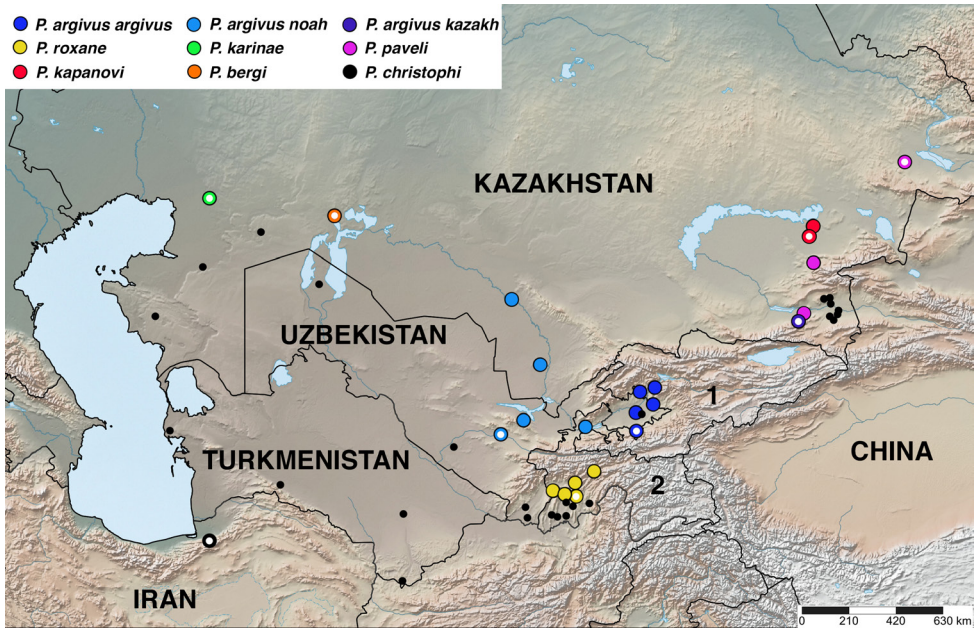


**Figure 5.** *Plebejus* spp., valva, lateral view: 1 – *P. argivus argivus* (Fergana valley, Sumsar), 2 – *P. argivus argivus* (Fergana valley, Shamaldy-Sai), 3 – *P. christophi* (W. Kazakhstan, Sauskan), 4 – *P. christophi* (E. Kazakhstan, Dzhungaria), 5 – *P. paveli* (paratype, E Kazakhstan, Zhagalbaily), 6 – *P. roxane* (S. Tadjikistan, Karabulok), 7 – *P. karinae* (paratype, W. Kazakhstan, Emba), 8 – *P. argivus noah* (E. Kyzyl-Kum, Bairkum).



**Figure 6.** *Plebejus* spp., aedeagus, lateral view: 1 – *P. christophi* (W. Kazakhstan, Sauskan), 2 – *P. christophi* (E. Kazakhstan, Dzhungaria), 3 – *P. argivus argivus* (Fergana valley, Sumsar), 4 – *P. argivus kazakh* (paratype, SE Kazakhstan, Tausugur), 5 – *P. paveli* (paratype, E Kazakhstan, Zhagalbaily), 6 – *P. paveli* (SE Kazakhstan, Zhangylsu), 7 – *P. karinae* (paratype, W. Kazakhstan, Emba), 8 – *P. argivus noah* (E. Kyzyl-Kum, Bairkum), 9 – *P. roxane* (S. Tadjikistan, Karabulok).





**Figure 7.** Distribution of the *Plebejus* taxa in question. White dot – type locality (for *P. a. argivus* – provisional). For *P. christophi* the localities are marked by smaller circles to avoid overlapping with other taxa.

## Conclusions

At present, the *P. christophi* complex includes five species ecologically connected with *Alhagi* as a host plant. Given the difficulties described at the beginning of the article, it would be more logical to call this group of species the *Alhagi* group, due to the host plants that make it easy to distinguish between the existing complexes.

The complex is divided into two unequal parts: the first includes *P. christophi* itself with a narrow marginal border and, possibly, *P. agnatus*, which is not considered in this article; the second group includes all the remaining taxa.

Another part unites all other known species of the complex. *Plebejus argivus* includes three subspecies, each has its own characteristics even in the structure of the male genitalia. The subspecies *noah* differs so much that we cannot exclude the species status. The latter assumption requires the study of new material, in addition, it is necessary to re-examine the type specimens. *Plebejus argivus kazakh* ssp. nova has features similar to both the nominotypical subspecies and *noah*, but the amount of studied material is also small. The range of *P. argivus* covers the foothills of a huge system of Central Asian mountains, from the Aktau-Naratau ridge to the Zailiysky Alatau, as well as the valleys of the middle reaches of the Syr Darya and Amu Darya rivers. This is a butterfly of the foothills and sparse tugai forests. The nominotypical

subspecies lives along the edges of the Fergana Valley, penetrating shallowly into the mountains along large rivers. *Plebejus argivus noah* occupies the Syr Darya/Amu Darya area, and *P. a. kazakh* ssp. nova – the foothills of the Zailiysky Alatau. There is no material between the indicated areas of the subspecific ranges.

Both new species were collected in areas where the presence of butterflies of this group has never been recorded. *Plebejus paveli* sp. nova is related to *P. argivus* and in some features resembles *P. roxane*, a common species in the territory of the South Tajik Depression. The range of *P. paveli* sp. nova occupies East Kazakhstan, touching the range of *P. a. kazakh*. It is possible to assume the presence of hybridization, as we believe – negative, given the significant difference in colour and genitals.

*Plebejus karinae* sp. nova from the Emba River in northwestern Kazakhstan differs sharply from all other species of the group in the structure of the aedeagus, the diversity of colour forms of females hints at the complex history of this species. Perhaps additional field studies will shed light on this issue. The obvious diversity of the complex proves the zoogeographic heterogeneity of the Turan deserts and steppes, as well as the need for a detailed study of this territory.

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## References

- Bálint Z (1999) Annotated list of type specimens of *Polyommatus* sensu lato Eliot of the Natural History Museum London (Lepidoptera, Lycaenidae). Neue Entomologische Nachrichten 46: 1–89.
- Bálint Z (2022) Guide to the butterflies of the Palaearctic Region. Lycaenidae, part V. Tribe Polyommadini. Milano, Omnes Artes, 106 pp., figs.
- Berg L (1908) Der Aral-See. Versuch einer physisch-geographischen Monographie. Izvestiya Turkestanskogo otdela Imperatorskogo Russkogo Geographicheskogo obschestva. Vol. 5. Scientific results of the Aral expedition 9, 580 pp., maps. [In Russian]
- Churkin SV, Zhdanko AB (2004) A new species of blues, *Plebejus murza* sp. n., from East Tian-Shan (Lepidoptera, Lycaenidae). Helios 5: 60–63.

- Churkin SV, Zhdanko AB (2008) New taxa of blues from Tian Shan (Lepidoptera, Lycaenidae). *Atalanta* 39(1–4): 297–309.
- 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.
- Churkin SV, Kolesnichenko KA (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, Krupitsky AV (2024) 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. pseudaegeon ussuricus* (Forster, 1936) and *P. transbaicalensis* (Kurentzov, 1970), stat. nov. (Lepidoptera, Lycaenidae), with some notes. *Acta Biologica Sibirica* 10: 1229–1258. <https://doi.org/10.5281/zenodo.13989525>
- Degtyareva VI, Shchetkin YuL (1975) Christoph's Blue – *Plebejus christophi* Stgr. (Lycaen.) in Tadzhikistan. *Entomology of Tadzhikistan*. Donish, Dushanbe, 120–125. [In Russian]
- Grum-Grshimailo GE (1887) Bericht über meine Reise in das östliche Buchara. In: *Mémoires sur les Lépidoptères* 3: 357–402.
- Grum-Grshimailo GE (1890) Le Pamir and sa faune lepidopterologique. In: *Mémoires sur les Lépidoptères* 4:1–9, 1–557.
- Herz O (1900) Meine Lepidopteren-Ausbeute in nordlichen Buchara und im Serafschan-Gebiete im Jahre 1892. I. Rhopalocera. *Annuaire du Musée zoologique de l'Académie des sciences de St. Pétersbourg* 5: 428–457.
- ICZN (1999) International Code of Zoological Nomenclature. Fourth edition. London, International Trust of Zoological Nomenclature, XXIX + 306 pp.
- Korb S (2014) New and little known blues (Lepidoptera, Lycaenidae) from Middle Asia and Kazakhstan. *Eversmannia* 40: 15–16; figs. 7, 8.
- 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. <https://doi.org/10.15298/rusentj.33.1.10>
- Kusnetzov NY (1908) List of Lepidoptera collected by L.S. Berg on the northern shores of the Aral Sea in the year 1906. *Izvestiya Turkestanskogo otdela Imperatorskogo Russkogo Geographicheskogo obshchestva*. Vol. 4. Scientific results of the Aral expedition 8 : 103–121. [In Russian]
- Miller LD ([1970]) Nomenclature of wing veins and cells. *Journal of Research on the Lepidoptera* 8(2): 37–48.
- Nekrutenko YuP (2000) A catalogue of the type specimens of Palaearctic Riodinidae and Lycaenidae (Lepidoptera, Rhopalocera) deposited in the Collection of the Museum für Naturkunde der Humboldt Universität zu Berlin. *Nota lepidopterologica* 23(3/4): 192–352.

- Samodurov GD, Zhdanko AB, Tuzov VK, Dantchenko AV (2000) Genus *Plebejus*. In: Guide to the Butterflies of Russia and adjacent territories. Vol. 2. Pensoft, Sofia–Moscow, 158–169.
- Shchetkin YuL (1960) Higher Lepidopterans of the Vakhsh Valley (Tajikistan). Part 1. Lepidoptera Rhopalocera and Heterocera (without of Noctuidae and Geometridae). Proceedings of Institute of Zoology and Parasitology SSR Tadjikistan named after Akad. E.N. Pavlovskiy 19, 303 p. [In Russian]
- Staudinger O (1874) Einige neue Lepidopteren de europäischen Faunengebiets. Entomologische Zeitung (Stettin) 35: 87–98.
- Staudinger O (1886) Centralasiatische Lepidopteren. Entomologische Zeitung (Stettin) 47: 193–215.
- Staudinger O (1889) Centralasiatische Lepidopteren. Entomologische Zeitung (Stettin) 50: 16–60.
- Toropov SA, Zhdanko AB (2009) The butterflies (Lepidoptera, Papilionidae) of Dzhungar, Tien Shan, Alai and Eastern Pamirs. Vol. 2. Danaidae, Nymphalidae, Riodinidae, Lycaenidae. Bishkek, 380 + XV pp.
- Toropov SA, Zhdanko AB (2015) The Butterflies (Lepidoptera, Papilionoidea) of Eastern Turan, Tarbagatai, Saur and South-western Altai. Vol. 2. Danaidae, Nymphalidae, Lycaenidae. Bishkek, 425 + IV pp.
- Tshikolovets VV (2003) The butterflies of Tajikistan. Konvoj, Kiev-Brno, 500 pp.
- Tshikolovets VV (2005) The butterflies of Kyrgyzstan. Konvoj, Kiev-Brno, 511 pp.
- Tshikolovets V, Kosterin O, Gorbunov P, Yakovlev R. (2016) The butterflies of Kazakhstan. Tshikolovets Press, Pardubice, 384 pp.
- 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 (2001) A new species of blues, *Plebejus churkini* sp. n. (Lepidoptera, Lycaenidae) from Inner Tian-Shan. Helios 2: 74–78.
- Zhdanko AB, Churkin SV (2001) A review of the *Plebejus christophi* complex (Lepidoptera, Lycaenidae) from the Central Asia with description of new taxa. Helios 2: 50–73.
- Zhdanko AB, Churkin SV (2004) A new species of blues, *Plebejus kapanovi* sp. n., from East Kazakhstan (Lepidoptera, Lycaenidae). Helios 5: 64–67.
- Zhdanko AB (2004) A revision of the supraspecific taxa of the lycaenid tribe Polymmatini (Lepidoptera, Lycaenidae). Entomologicheskoe Obozrenie 83: 645–663. [In Russian]