

## A new species of the *Plebejus christophi* (Staudinger, 1874) (Lepidoptera: Lycaenidae) species group from Iran

### Новый вид из группы видов *Plebejus christophi* (Staudinger, 1874) (Lepidoptera: Lycaenidae) из Ирана

A.V. Krupitsky<sup>1,2,\*</sup>, A. Naderi<sup>3</sup>  
А.В. Крупицкий<sup>1,2,\*</sup>, А. Надери<sup>3</sup>

<sup>1</sup> Department of Entomology, Faculty of Biology, Lomonosov Moscow State University, Leninskie gory, GSP-1, korp. 12, Moscow 119991 Russia.

<sup>2</sup> A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky prospekt 33, Moscow 119071 Russia.

<sup>3</sup> National Natural History Museum & Genetic Resources, Tehran, 1136917111, Iran.

<sup>1</sup> Кафедра энтомологии, биологический факультет, Московский государственный университет им. Ломоносова, ГСП-1, корп. 12, Москва 119991 Россия.

<sup>2</sup> Институт проблем экологии и эволюции им. А.Н. Северцова РАН, Ленинский проспект, 33, Москва 119071 Россия.

\* Corresponding author

Anatoly V. Krupitsky: nephurus@yandex.ru ORCID: <https://orcid.org/0000-0002-6095-3570>

Alireza Naderi: a2naderi@yahoo.com ORCID: <https://orcid.org/0009-0003-5878-6333>

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КЛЮЧЕВЫЕ СЛОВА: Polyommatainae, Polyommataini, Polyommataina, Палеарктика, Белуджистан, биогеография, гениталии, морфология, ДНК-баркодинг.

**ABSTRACT.** A new species of the *Plebejus christophi* (Staudinger, 1874) species group, *P. ehsanii* **sp.n.**, is described from Sistan and Baluchestan Province, Iran. The new species differs from other members of the *P. christophi* species group in violet blue colouration restricted to the postdiscal area of the dorsal side of both wings in the male, small disconnected lunules of the ventral side of the hindwings in both sexes, details of the male genitalia morphology and DNA barcodes.

**РЕЗЮМЕ.** Из провинции Систан и Белуджистан, Иран, описан новый вид из группы *Plebejus christophi* (Staudinger, 1874), *P. ehsanii* **sp.n.** Новый вид отличается от других видов группы *P. christophi* фиолетово-синей окраской с широкой тёмной каймой на верхней стороне крыльев, маленькими разъединёнными лунками на заднем крыле снизу у обоих полов и особенностями морфологии гениталий самцов и баркодами ДНК.

### Introduction

The *Plebejus christophi* (Staudinger, 1874) species group is the most species-rich in the genus, with about 25 species known to date. They are distributed from Southwest Asia to China through Central Asia and

the Himalayas. Most of the species in this group were discovered in desert regions and mountains of Central Asia, Mongolia, Afghanistan and China during the last 25 years [Churkin, Zhdanko, 2004, 2008; Zhdanko, Churkin, 2004; Churkin, Pletnev, 2012; Yakovlev, 2012; Churkin *et al.*, 2019; Krupitsky *et al.*, 2021; Krupitsky, Li, 2024]. Recently, an extended review was published, which dealt with Central Asian species of the group and revealed important diagnostic characters in the male genitalia [Churkin, Krupitsky, 2025].

Ecologically, the species of the *P. christophi* group can be divided into two complexes utilizing different host plants. Based on the recent revision [Churkin, Krupitsky, 2025], the first complex includes at least six species related to *P. christophi*. They are distributed mostly in xeric regions and deserts of Eastern Anatolia, Transcaucasia, the Iranian Plateau and Central Asia. Recently, a species of this complex was reported for Russia and Europe for the first time [Churkin *et al.*, 2025]. The members of this complex utilize species of the genus *Alhagi* (Eleagnaceae) as host plants. The second complex includes the remaining species distributed in mountains from the Tian Shan, Mongolian Altai and Pamir-Alai to the Himalayas and northeastern ranges of the Tibetan Plateau. Their caterpillars develop on *Hippophae rhamnoides* L. (Eleagnaceae), *Halimodendron halodendron* (Pall.) Voss (Fabaceae) and, probably, on *Corethroden-*

*dron multijugum* (Maxim.) B.H. Choi & H. Ohashi (Fabaceae) [Churkin, Pletnev, 2012; Churkin *et al.*, 2019; Krupitsky, Li, 2024; Churkin, Krupitsky, 2025]. Most species of this complex are local endemics, and discoveries of new species are possible in remote mountain regions of the southeastern Palaearctic.

Among the species of the first complex, *P. christophi* is characterized by the broadest distribution range covering Eastern Anatolia, Transcaucasia, most of the Iranian Plateau and desert regions of Central Asia. It was described from Shahrud, Semnan Province, Iran; the lectotype was designated by Olivier *et al.* [1998]. *Plebejus christophi* is the only species of the group reported from Iran and inhabiting most of its territory [Tshikolovets *et al.*, 2014]. According to the latter, two subspecies are recognized in Iran besides the nominotypical: *P. c. transcausicus* (Rebel, 1901) reported from northwestern Iran and *P. c. bracteatus* (Butler, 1880) from southeastern Iran (Sistan and Baluchestan Province). Status of the former subspecies requires confirmation; based on the external morphology, it likely represents a separate species. This issue will be considered in a separate publication. The latter subspecies likely represents a synonym of *P. christophi* [Bálint, 1999]; it was described from environs of Kandahar, Afghanistan, and, based on the original description [Butler, 1880] and subsequent publications (e.g., Evans [1932]), does not differ from *P. christophi*.

Field studies of the second author on the Taftan Mountain, an isolated stratovolcano in Sistan and Baluchestan Province, Iran, revealed three specimens (two males and female) of distinctly looking *Plebejus*, which were tentatively attributed to the *P. christophi*

species group based on the pattern of the wings. Our further studies of their external morphology and the male genitalia supplemented with molecular phylogenetic analysis revealed that these specimens belong to an undescribed species, which we describe in the present paper.

## Material and methods

### Morphology

The dissection, photography of specimens and image processing techniques were described in detail earlier [Krupitsky *et al.*, 2015]. Images of the genitalia were taken with a Canon EOS 6D digital camera equipped with a Canon MP-E 65 mm f/2.8 lens, using two Micromed Dual Goose illuminators. For wing venation, the Comstock-Needham nomenclature adapted for butterflies [Miller, 1970] was used. The nomenclature of the male genitalia and terms used for the colouration and wing pattern follow Krupitsky *et al.* [2021].

Abbreviations of the collections are as follows: ARNT, private collection of Ali Reza Naderi, Tehran, Iran; NNHM, collection of National Natural History Museum and Genetic Resources, Tehran, Iran; PZT, private collection of Payam Zehzad, Tehran, Iran.

### Molecular phylogeny

The molecular phylogenetic analysis was based on 13 specimens belonging to five available species of the *P. christophi* group and *P. argus* (Linnaeus, 1758) used as out-group. Standard 658 bp barcodes of mitochondrial *COI* gene were analyzed. Laboratory techniques and Maximum Likelihood analysis were described in details in Krupitsky, Kolesnichenko [2025]. All sequences obtained in the present study were deposited at GenBank (Table 1).

**Table 1.** Specimens sequenced for the molecular phylogenetic analysis and their corresponding GenBank numbers.

**Таблица 1.** Экземпляры, отсеквенированные для молекулярно-филогенетического анализа, и соответствующие номера последовательностей из базы данных GenBank.

| Voucher No. | Species                                            | Locality                                                                                                     | COI      |
|-------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------|
| PLB027      | <i>Plebejus ehsanii</i> sp.n.                      | IRAN, Sistan and Baluchestan Province, Taftan Mt., Dareh Gol                                                 | PZ482111 |
| PLB028      | <i>Plebejus ehsanii</i> sp.n.                      | IRAN, Sistan and Baluchestan Province, Taftan Mt., Dareh Gol                                                 | PZ482112 |
| CH1         | <i>Plebejus karinae</i> Churkin et Krupitsky, 2025 | NW Kazakhstan, Atyrau reg., 55 km eastward Kulsary                                                           | PZ482108 |
| CH2         | <i>Plebejus karinae</i> Churkin et Krupitsky, 2025 | NW Kazakhstan, Atyrau reg., 55 km eastward Kulsary                                                           | PZ482107 |
| CH3         | <i>Plebejus karinae</i> Churkin et Krupitsky, 2025 | RUSSIA, Astrakhan Oblast, Liman Distr., Zarechnoe vill.                                                      | PZ482109 |
| CH4         | <i>Plebejus karinae</i> Churkin et Krupitsky, 2025 | RUSSIA, Astrakhan Oblast, Liman Distr., Zarechnoe vill.                                                      | PZ482110 |
| LEP1        | <i>Plebejus fantomas</i> Krupitsky et Li, 2024     | CHINA, Xinjiang Uygur Autonomous Region, Tian Shan Mts., Karlik Shan Range S slope, 53rd km Hami–Barkol road | PZ482103 |
| LEP2        | <i>Plebejus fantomas</i> Krupitsky et Li, 2024     | CHINA, Xinjiang Uygur Autonomous Region, Tian Shan Mts., Karlik Shan Range S slope, 53rd km Hami–Barkol road | PZ482104 |
| LEP9        | <i>Plebejus nanshanicus</i> (Forster, 1936)        | CHINA, Gansu Prov., Qilianshan Mts., Sunan Yugur Autonomous County, Jingtieshan work area env.               | PZ482105 |
| LEP10       | <i>Plebejus nanshanicus</i> (Forster, 1936)        | CHINA, Gansu Prov., Qilianshan Mts., Sunan Yugur Autonomous County, Jingtieshan work area env.               | PZ482106 |

## Taxonomic account

*Plebejus ehsanii* Naderi et Krupitsky, **sp.n.**

Figs 1–8, 11.

**MATERIAL.** **Holotype** ♂ (Figs 1, 3–8), IRAN, Sistan and Baluchestan Province, Taftan Mt., Dareh Gol, 2300 m, 16–20.V.2019, A. Naderi leg., voucher PLB027 (NNHM). **Paratypes:** 1♂, same data (PZT); 1♀, same label as in holotype, voucher PLB028 (ARN) (Fig. 2).

**DESCRIPTION.** **Male** (holotype) (Fig. 1). Antenna black, white-ringed at base of antennomeres, club dark. Eye brown, surrounded with white scales. Frons black, top of head dark with white hairs. Palpus: 2nd palpomere white with black scales, 3rd palpomere dark. Thorax: dark brown with bluish grey hairs dorsally, white ventrally. Legs: femur and tibia white, tarsus brown. Abdomen: dark with bluish-grey hairs dorsally, whitish ventrally.

Forewing length 13.0 mm, wingspan 22.0 mm, body length 1.2 mm.

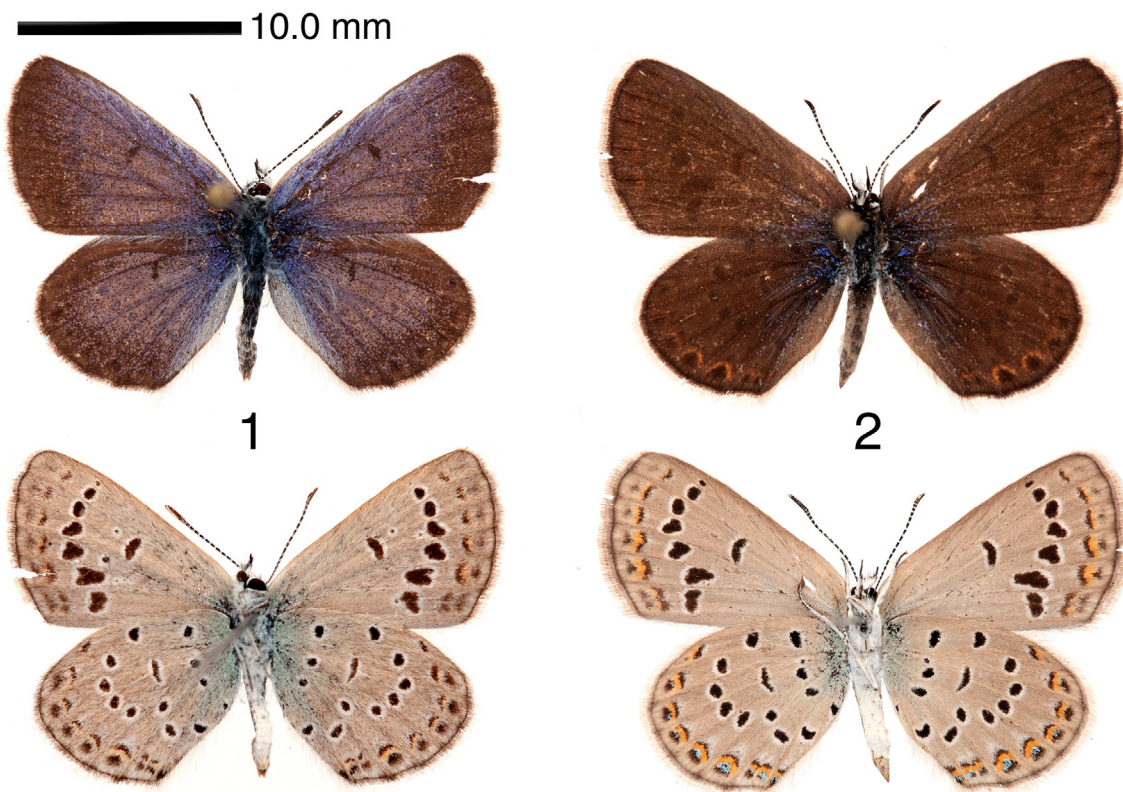
Dorsal surface of forewing violet blue from base to postdiscal area, dark brown with suffused violet blue scales from postdiscal area to margin; cell with dark brown discal spot; veins dark brown; costal area and veins Sc–R4+5 with suffusion of whitish scales. Margin black, thin. Fringe beige with darker inner part.

Ventral surface of forewing beige with turquoise scales at very base; discal spot large, bean-shaped, surrounded with white scales. Postdiscal pattern well-developed, slightly curved, consisting of four large and two smaller dark brown spots of irregular shape. Submarginal markings blurred, rather well-developed and supplemented with orange scales in spaces M3–Cu2, represented only by diffused scales in R3–M2. Margin dark, very narrow. Fringe beige.

Dorsal surface of hindwing violet blue from base to postdiscal area, dark brown with suffused violet blue scales from postdiscal area to margin and dark circles surrounded with diffused violet blue scales in submarginal area; space Sc+R1 brownish black; blue field in space Rs with deep indentation, space 2A with bluish grey scales; discal spot well-developed, narrow. Margin brownish black, thin. Fringe beige with darker inner part.

Ventral surface of hindwing beige with turquoise suffusion reaching basal pattern of spots; basal, discal and postdiscal spots complete and well-developed, typical for the genus; submarginal pattern reduced, lunules lacking metallic scales. Black margin thin, somewhat broadened near veins. Fringe beige with darker inner part.

Male genitalia (Figs 3–8). Labis long and thin, with somewhat broadened base, S-shaped, claw-like with pointed apex from above; falx rather short, stout; laterally, dorsal edge of valva with somewhat convex proximal part gradually turning into shorter straight distal part angled at about 125°, ventral edge wavy, with moderate rounded projection in distal portion turn-



**Figs 1–2.** *Plebejus ehsanii* sp.n., imago (dorsal side above, ventral side below): 1 — holotype, male, voucher PLB027; 2 — paratype, female, voucher PLB028.

**Рис. 1–2.** *P. ehsanii* sp.n., имаго (вид сверху и вид снизу): 1 — голотип, самец, образец PLB027; 2 — паратип, самка, образец PLB028.

ing into straight lower distal projection; upper distal projection of valva well-developed, with large prominent inwardly directed roughly serrated appendage; lower distal projection smaller, with small claw-like pointed tooth; juxta V-shaped, branch straight, thick, with thin pointed apex; aedeagus rather long, about  $\frac{3}{4}$  of valval length, slightly curved, with straight stout basal half and slightly curved distal half gradually pointed to apex.

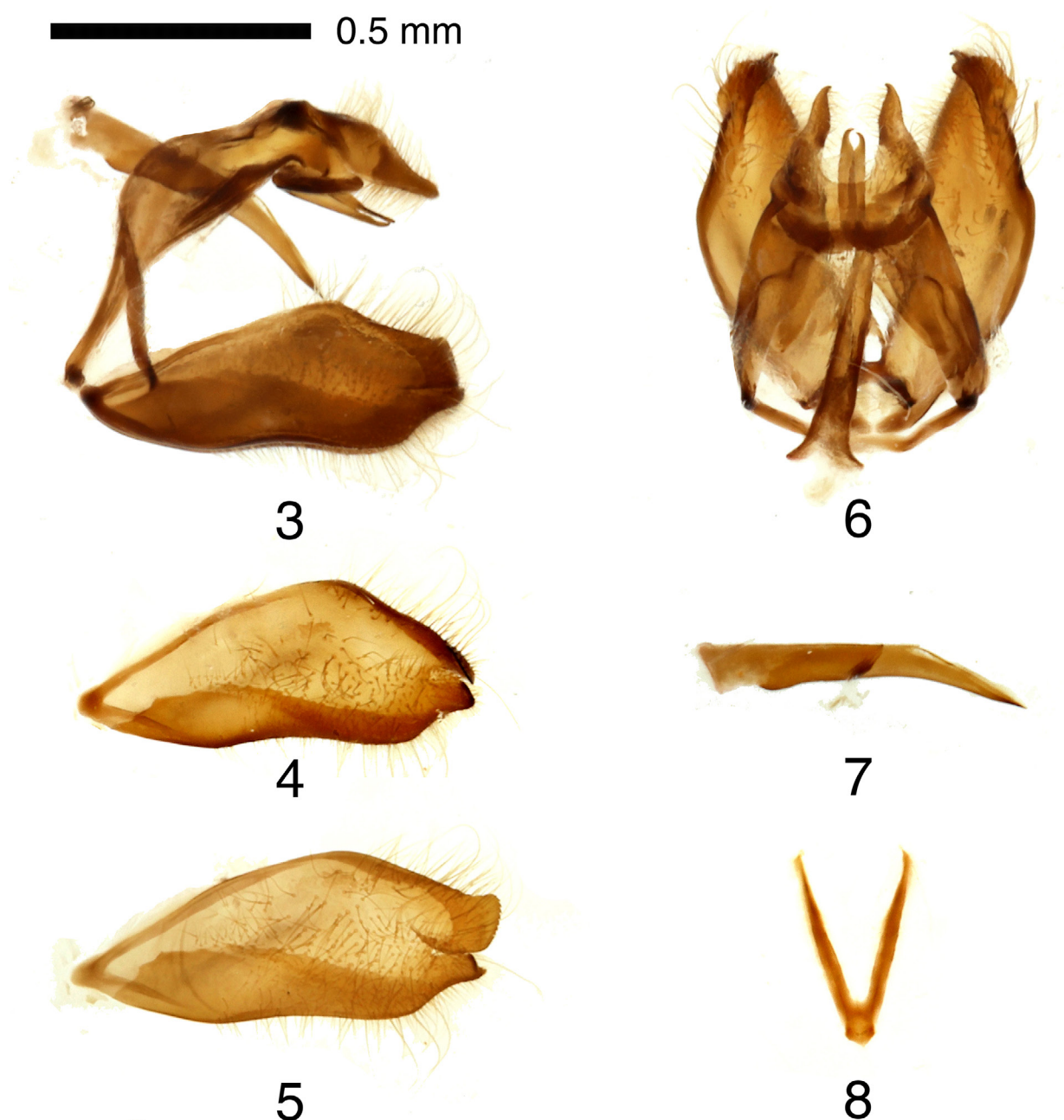
**Female** (Figs 2, 11). Head, thorax and abdomen as in male. Forewing length 15.0 mm, wingspan 26.0 mm, body length 1.15 mm.

Dorsal surface of forewing brown with blue scales at very base, spaces near margin with poorly developed suffusion of orange scales. Fringe beige.

Ventral surface of forewing as in male but with more developed submarginal pattern. Fringe beige.

Dorsal surface of hindwing brown with blue scales at very base, submarginal pattern with darker spots bordered with U-shaped orange strokes from above.

Ventral surface of hindwing as in male but with more developed submarginal pattern, each spot with larger orange ele-



**Figs 3–7.** *P. ehsanii* sp.n., male genitalia (holotype): 3 — lateral view; 4 — valva, lateral view; 5 — id., view from inside; 6 — genitalia, dorsal view; 7 — aedeagus, lateral view; 8 — juxta.

**Рис. 3–7.** *P. ehsanii* sp.n., гениталии самца (голотип): 3 — вид сбоку; 4 — вальва, вид сбоку; 5 — то же, вид изнутри; 6 — гениталии, вид сверху; 7 — эдеагус, вид сбоку; 8 — юкта.

**DIFFERENTIAL DIAGNOSIS.** Male of *P. ehsanii* **sp.n.** can be readily distinguished from other species of *Plebejus* by the violet blue field with blurred edge restricted to the postdiscal area of the dorsal side of both wings and small disconnected lunules of the ventral side of the hindwing. Among the *P. christophi* species complex (*Alhagi*-feeding), two Central Asian species, *P. argivus* (Staudinger, 1886) and *P. roxane* (Grum-Grshimailo, 1887), also share broad black margin of

the dorsal side of the wings with the new species, but they are characterized by well-developed contrasted submarginal pattern of the ventral side of the hindwing (cp. Fig. 1 in this article with fig. 2: 5, 6, 22 in Churkin & Krupitsky [2025]) and broadly geographically disconnected with the new species. Female of the new species differs from females of the all known species of *Plebejus* by the combination of small broadly disconnected elements of the submarginal pattern of the ventral side of the hindwing combined with nearly uniformly brown dorsal side of the wings. The male genitalia of the new species differ from those of the congeners in the combination of the

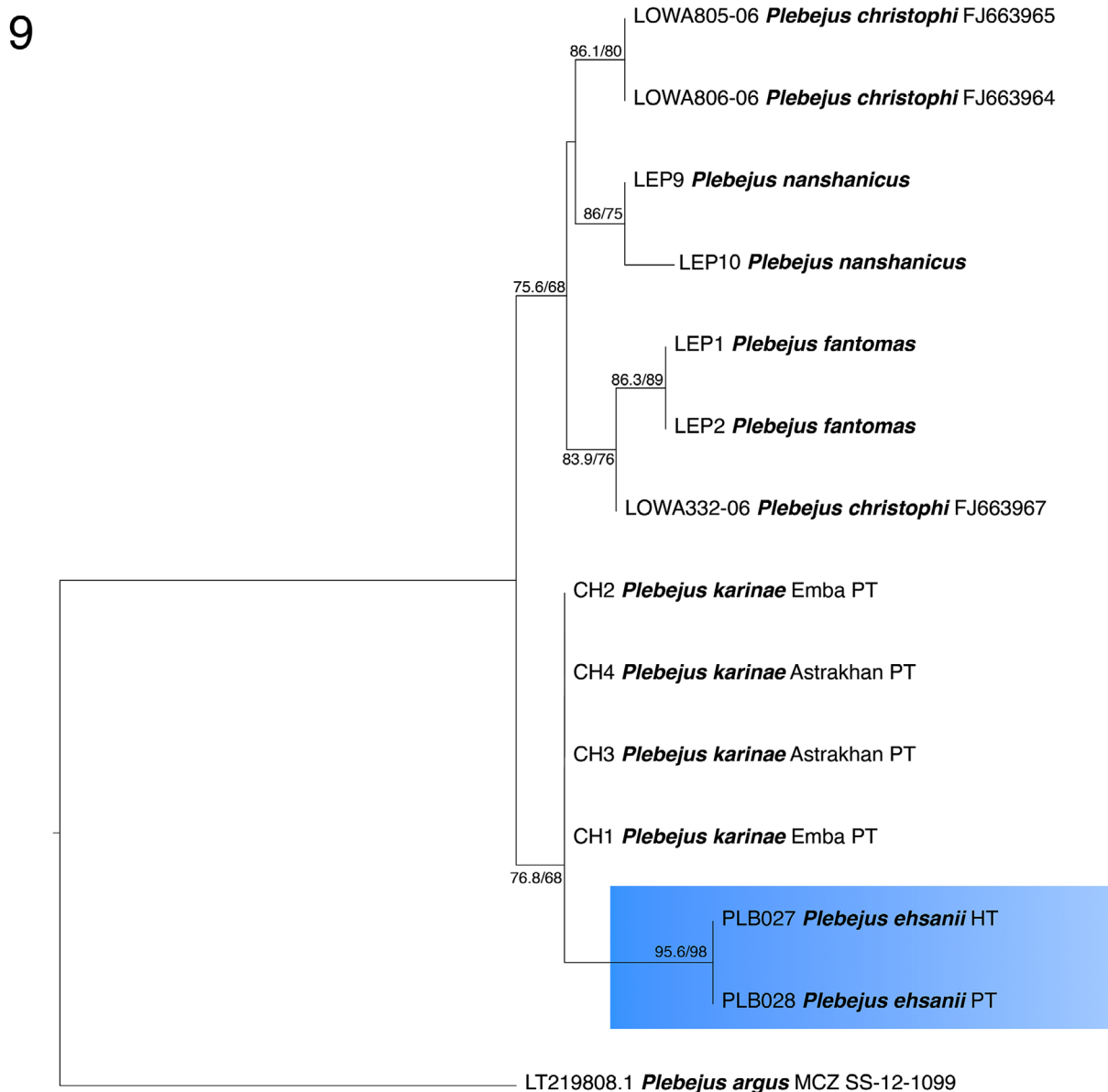
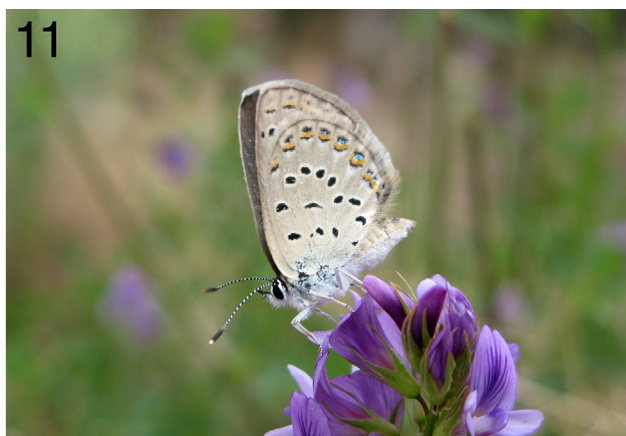


**Рис. 9.** Филогенетическое дерево, полученное методом максимального правдоподобия на основе анализа баркодов гена *COI* пяти видов из группы *P. christophi*. Значения в узлах показывают SH-aLRT/UFboot-поддержки, соответственно.



**Figs 10–11.** *P. ehsanii* sp.n., type locality and imago in nature: 10 — type locality; 11 — imago, female, paratype (voucher PLB028).

**Рис. 10–11.** *P. ehsanii* sp.n., типовое местонахождение нового вида и имаго в природе: 10 — типовое местонахождение; 11 — имаго, самка, паратип (образец PLB028).

sculptured valva with very large upper process, rather small slightly curved aedeagus and small juxta.

**MOLECULAR PHYLOGENETIC ANALYSIS.** All the analyzed species of the *P. christophi* group demonstrated low genetic differentiation, and the resulting phylogenetic tree lacks resolution due to low node supports (Fig. 9). The new species is characterized by the unique haplotype, which differs by 6–7 substitutions from *P. christophi* (0.9–1.1%, uncorrected p-distance) and by three substitutions from *P. karinae* Churkin et Krupitsky, 2025 (0.5%). Such a low genetic differentiation between morphologically well-defined species was already revealed in other groups of the genus *Plebejus* [Talavera *et al.*, 2022; Toro-Delgado *et al.*, 2025] as well as in other genera of Lycaenidae, e.g. *Chrysoritis* [Talavera *et al.*, 2020], *Callophrys* [ten Hagen, Miller, 2010; Krupitsky *et al.*, 2023a, b], *Tomares* [Krupitsky *et al.*, 2022], *Lysandra* [Talavera *et al.*, 2013] and *Polyommatus* [Lukhtanov *et al.*, 2015] which can be explained by incomplete lineage sorting occurred in evolutionarily young lineages, interspecific hybridization leading to mitochondrial introgression or impact of the rickettsial bacterium *Wolbachia* Hertig, 1936 [Lukhtanov *et al.*, 2015b; Bartoňová *et al.*, 2021; Shapoval *et al.*, 2021].

**ETYMOLOGY.** The new species is named after Mohamad Reza Ehsani, professional nature photographer and mountaineer, the second author's good friend who accompanied him on many field trips.

**DISTRIBUTION AND BIONOMICS.** Three specimens of *Plebejus* from Sistan and Baluchestan (two males and a female) depicted in Tshikolovets *et al.* [2014] (as *P. christophi bracteatus*) and two specimens of *P. christophi bracteatus* (male and female) from Pakistani Baluchestan depicted in Tshikolovets, Páges [2016, plate XXXI, figs 1,2] share the diagnostic characters with the new species and apparently belong to the latter, thus we can conclude that the new species inhabits Baluchestan in its broader sense. It is worth noting that, according to the original description [Butler, 1880] and revision by Zhdanko, Churkin [2001], the taxon *bracteata* is characterized by a very thin black margin of the wings dorsal surface similar to that of *P. christophi* or *P. samudra*, thus the specimens in question do not belong to *bracteata* regardless of the status of the latter taxon.

The new species was collected in a valley with rich vegetation on the western slope of the Taftan volcano (Figs 10–11). The specimens were collected among lush vegetation near the

dry bed of a river densely covered with bushes of *Alhagi* sp., the probable host plant of the new species. The butterflies were associated with *Alhagi* bushes. In this area, the vegetation varies from year to year depending on precipitation. In dry years this locality does not yield in butterflies, but in wet ones the following species occur: *Colotis vestalis* (Butler, 1876), *Bele-nois aurota* (Fabricius, 1793), *Hyponephele cyri taftana* Eckweiler & Bozano, 2011, *Lycaena phlaeas* (Linnaeus, 1761), *Lampides boeticus* (Linnaeus, 1767), *Polyommatus bogra taftanus* Eckweiler, 1997, the third and the latter of which are endemics of the Taftan volcano.

#### Compliance with ethical standards

**CONFLICT OF INTEREST:** The authors declare that they have no conflict of interest.

**Ethical approval:** No ethical issues were raised during our research.

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