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**NEW DATA ON THE SUBGENUS *Callophrys* (*Ahlbergia*)
(LEPIDOPTERA: LYCAENIDAE) FROM EAST ASIA, WITH
DESCRIPTION OF A NEW SPECIES FROM CHINA AND
CONFIRMATION OF THE RECORD OF *C. (A.) ferrea* FROM RUSSIA**

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Summary. A new species of elfin butterflies, *Callophrys* (*Ahlbergia*) *abae* sp. n., previously misidentified as the widely distributed North Asian species *C. (A.) frivaldszkyi* (Lederer, 1855), is described from Aba Prefecture in Sichuan Province, China. The new species differs from the latter in the absent androconial spot on the forewing, more distinct paler pattern of the ventral side of the wings, curved outer margin of the valva in the male genitalia and strongly sculptured lamella postvaginalis in the female genitalia. Additionally, the finding of *C. (A.) ferrea* (Butler, 1866) in Kunashir Island and thus Russia in general is confirmed on the base of an analysis of the male genitalia and the barcode region of COI gene.

Key words: elfin hairstreaks, Theclinae, Eumacini, taxonomy, new species, morphology, DNA barcoding.

А. В. Крупицкий, Н. А. Шаповал, Г. Н. Шаповал. Новые данные о подроде *Callophrys* (*Ahlbergia*) (Lepidoptera: Lycaenidae) Восточной Азии с описанием нового вида из Китая и подтверждением находки *C. (A.) ferrea* в России // Дальневосточный энтомолог. 2024. N 494. С. 21-28.

Резюме. Из автономного округа Аба, провинция Сычуань, Китай описан новый вид бабочек-хвостаток, *Callophrys* (*Ahlbergia*) *abae* sp. n., ранее трактовавшийся как широко распространённый североазиатский вид *C. (A.) frivaldszkyi* (Lederer, 1855). Новый вид отличается от него отсутствием андрокониального пятна на переднем крыле,

более контрастным светлым рисунком испода крыльев, изогнутым наружным краем вальвы в гениталиях самца и сложно скульптурированной поствагинальной пластинкой в гениталиях самки. Кроме того, на основе анализа гениталий самца и баркодингового региона гена COI подтверждена находка *C. (A.) ferrea* (Butler, 1866) на острове Кунашир и в России в целом.

INTRODUCTION

The Palearctic elfin butterflies, members of the subgenus *Ahlbergia* Bryk, 1947 of the genus *Callophrys* Billberg, 1820, have attracted much attention of lepidopterists during the last decade. Numerous publications were devoted to the taxonomy, nomenclature, bionomics and phylogeny of this taxonomically complicated group (Huang & Zhou, 2014; Huang & Sun, 2016; Huang & Zhu, 2016; Krupitsky, 2018; Huang, 2021; Krupitsky *et al.*, 2022; Krupitsky *et al.*, 2023a,b; Huang, 2023). Taking into account the high rate of endemism of the group, which resulted in the descriptions of seven taxa only during the last year (Krupitsky *et al.*, 2023a; Huang, 2023), it seems that the number of described species of *Ahlbergia* is far from final.

Recently, the first thorough review of the species of *Ahlbergia* of Russia was published (Krupitsky *et al.*, 2023b), based on an extensive material from museum and private collections. The examination of numerous specimens of *C. (A.) frivaldszkyi* (Lederer, 1855) originating from most of North Asia revealed the diagnostic characters and the range of the individual variation of this species. After that study, it has become clear that specimens from Sichuan Province, China, previously determined as *C. (A.) frivaldszkyi* actually belong to an undescribed species, which we describe below.

Additionally, we were able to examine a specimen from Kunashir Island, Russia, previously identified as *C. (A.) ferrea* (Butler, 1866) (Rybalkin *et al.*, 2022) without dissection of the genitalia or molecular phylogenetic analysis. According to our previous studies, the range of this species is limited to the Japanese Archipelago (Krupitsky *et al.*, 2023b). On the basis solely of external characters, it can be easily confused with continental species *C. (A.) korea* (Johnson, 1992). Examination of the male genitalia and COI barcode of the specimen in question confirmed that it belongs to *C. (A.) ferrea*, which is reported and discussed in this study.

MATERIAL AND METHODS

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 mark II digital camera equipped with a Canon MP-E 65 mm f/2.8 lens, using two Micromed Dual Goose illuminators. The characters used for species delimitation in the Palearctic elfin butterflies are selected following Johnson (1992), Huang & Zhou (2014) and Huang & Zhu (2016). The nomenclature of the genitalia and wing pattern is adapted after Johnson (1992) and Krupitsky (2018). The nervation nomenclature follows the Comstock–Needham system adapted for butterflies (Miller, 1970).

DNA extraction, amplification and sequencing were described in detail recently (Krupitsky *et al.*, 2023b). Sequencing was carried out at the Research Resource Center for Molecular and Cell Technologies (St. Petersburg State University, St. Petersburg, Russia) using ABI 3500xL Genetic analyzer (Applied Biosystems, Waltham, MA, USA). Minimal uncorrected COI p-distances were calculated using MEGA7 (Kumar *et al.*, 2016).

Abbreviations of the collections are as follows: AKM – private collection of Anatoly Krupitsky, Moscow, Russia; VTM – private collection of Vasily Tuzov, Moscow, Russia; ZISP – collection of Zoological Institute, St. Petersburg, Russia.

RESULTS

Callophrys (Ahlbergia) abae Krupitsky, N. Shapoval et G. Shapoval, sp. n.

<https://zoobank.org/NomenclaturalActs/FDF96D67-D268-43F3-AEB9-AFB5BEF5935D>

Figs 1–9

MATERIAL. Holotype: ♂, **China:** Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Songpan County, Guihuagou vill., ca. 32°27'28.4"N 103°42'12.5"E, 9500 ft. [2900 m above sea level] and higher, 6.V.1894, M.M. Berezovsky leg. [Сы-ч., Сунпань / 9500 ф. и выше, Гуй Хуа / 6.V.1894, Березовск. 6.V.94] (ZISP). Paratypes (7♂, 2♀): 5♂, same label as in holotype (ZISP); 1♀, same locality and collector but 24.VI.1894 (ZISP); 1♂, voucher No. CAL074, GenBank accession No. OM630562, **China:** Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Wenchuan County, Wenchuan env., 1900 m, 04.VI.2011 (VTM); 1♂, voucher No. CAL075, GenBank accession No. OM630563, **China:** Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Jinchuan County, Jinchuan env., 1900 m, 07.VI.2015, V. Patrikeev leg. (VTM); 1♀, **China:** Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Jiyuding Mts. between Maoxian and Wenchuan, 18.VI–08.VII.2018, 3500 m, V. Patrikeev leg. (AKM).

DESCRIPTION. **Male** (holotype) (Figs 1, 6–8). Forewing length 12.0 mm, wingspan 22.0 mm, body length 11.0 mm.

Head: antenna brown, white-ringed at bases of antennomeres, antennal club brown; eye surrounded with white stripe, light brown with very short sparse hairs; frons with brown hairs, top of head with brown scales and hairs; palpus: palpomere 2 covered with whitish hairs and scales, palpomere 3 black.

Thorax: dark brown with bluish-grey hairs dorsally, densely covered with brown and rusty brown hairs ventrally; femur dark brown, tibia and tarsus brown with whitish stripes.

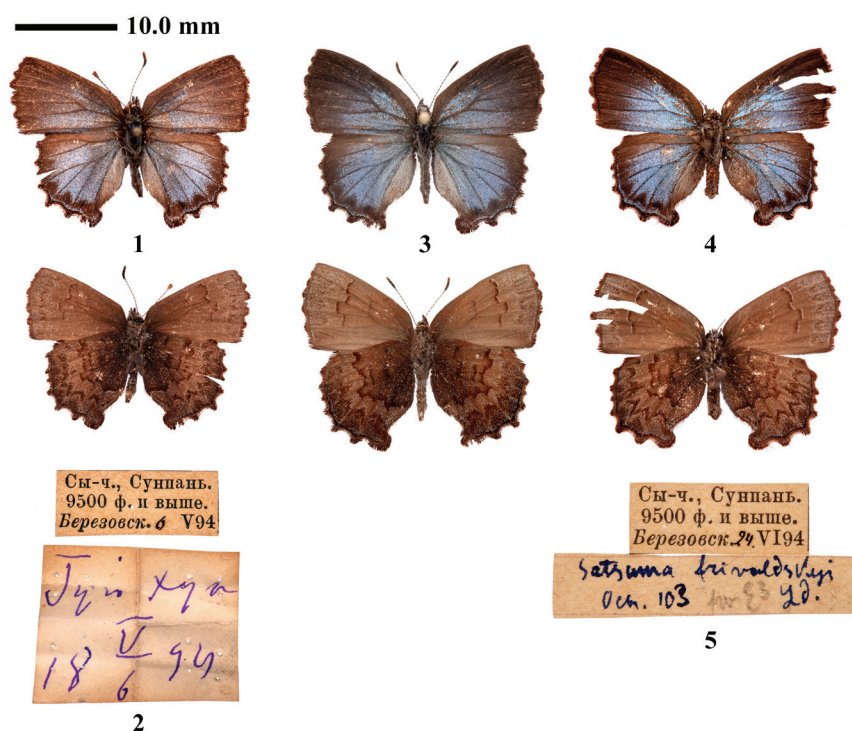
Abdomen: dark brown with whitish hairs dorsally and whitish hairs ventrally.

Forewing: triangular, with rounded apex and termen, outer margin arquate, serrated; androconial spot untraceable. Dorsal side brown with strong steel tint, cell blue-grey, discal area in spaces M3–2A covered with celestial blue scales; veins brown; margin dark brown; fringe dark brown at veins, dark brown with admixture of whitish scales between veins. Ventral side brown, with dark brown scales at base; postmedial line wavy, brown with white scales proximally; spaces R3–CuA1 with crescent line consisting of blurred dark brown elements surrounded with groups of whitish scales; outer margin and fringe brown, dark brown at tornus.

Hindwing: costal area curved, with developed basal lobe, apex rounded, outer margin serrated; anal lobe well-developed, large, rounded. Dorsal side brown with broad celestial blue field in spaces Rs–CuA2 extending to submarginal area in spaces M3–CuA2, with V-shaped dark brown incisions separating it from margin; veins dark brown; spaces 2A–3A greyish; outer margin black, bordered by blue scales, more densely in spaces M3–CuA2, and with whitish scales in half of space CuA2 and 2A near anal lobe; basal half of wing and inner margin covered with long sparse whitish hairs; fringe dark brown proximally, whitish distally, with long dark brown scales at veins; anal lobe with long dark brown scales. Ventral side with dark brown base, postbasal marks distinct, dark brown, present in space Sc+R1 and cell; marginal band of disc consisting of dark brown broken lines, bold in spaces Sc+R1, Rs, CuA2–3A, with projection in space M3; space between postbasal marks and marginal band of disc covered with brown and whitish scales; crescent line dark brown, distinct; limbal area with distinct dark brown spots surrounded with whitish scales; anal lobe with brown spot; fringe as on dorsal side.

Male genitalia. Falx stout; lobes of uncus rather long, with well-developed inner processes; vinculum broadened, with developed inner lobes; valva covered with hairs of different lengths, very robust, proceeding beyond lobes of uncus; basal part slightly broadened, reaching vinculum and abruptly turning into distal part with curved outer margin; distal third of valva in outer edge tapering to rounded apex; in bilobed configuration of valvae, their distal parts rather gradually tapering after medial flexure; valvae strongly jointed, with small groove between apices; saccus narrow, triangular with rounded apex, 0.25 times as long as genitalia; aedeagus rather slender, arcuate, about 1.8 times as long as genital capsule, with two rather straight small cornuti, upper cornutus with 8 rather small spines, lower cornutus with several large spines.

INDIVIDUAL VARIATION. Forewing length 12.0–13.0 mm, wingspan 22.0–25.0 mm. Intensity of blue suffusion slightly varies between specimens.

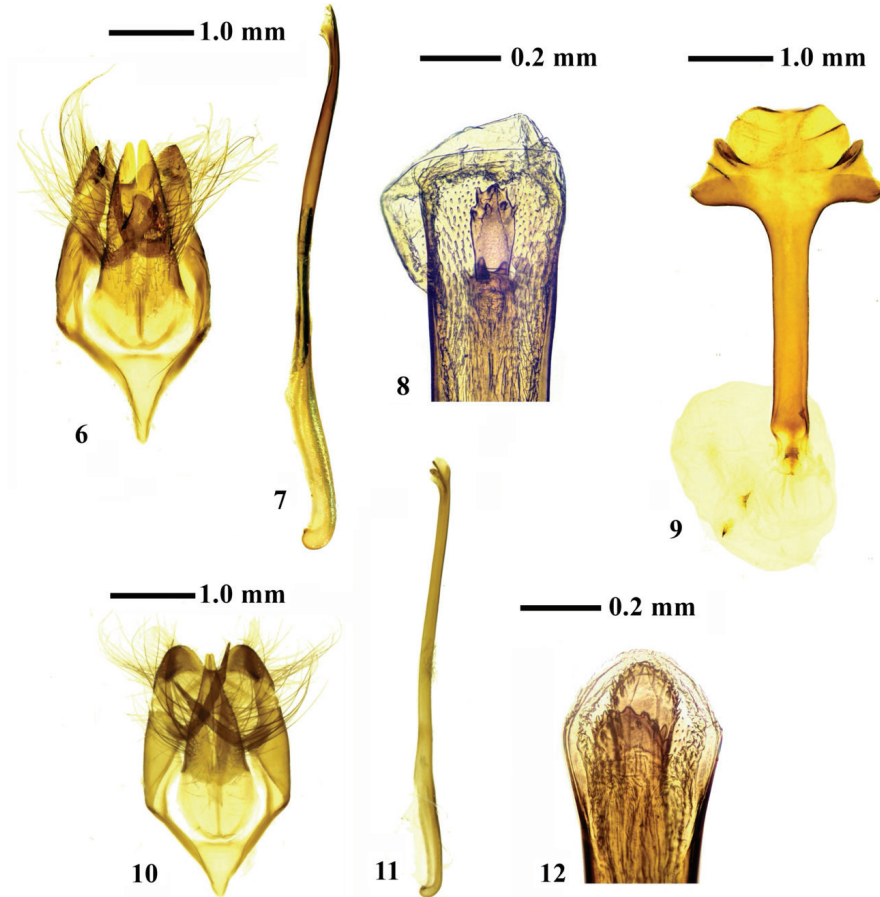


Figs 1–5. *Callophrys (Ahlbergia) abae* sp. n., adults, dorsal view (above), ventral view (below) and corresponding labels. 1 – holotype, ♂ (ZISP); 2 – labels of the holotype; 3 – paratype, ♂, voucher No. CAL075, GenBank accession No. OM630563, China, Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Jinchuan County, Jinchuan env., 1900 m, 07.VI.2015, V. Patrikeev leg. (VTM); 4 – paratype, ♀, [China, Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Songpan County / 9500 ft. [2900 m] [above sea level] and higher / M.M. Berezovsky leg. 24.VI.1894] (ZISP); 5 – labels of previous specimen.

Female (Figs 4, 9). Generally similar to male but blue fields broader. Forewing length 13.0 mm, wingspan 23.0 mm.

Female genitalia. Lamella postvaginalis long, trapezoidal, with strongly convoluted lateral lobes; ductus bursae stout, with broadened antrum, about 3 times as long as antrum; corpus bursae with two small unispined signi.

DIAGNOSIS. *Callophrys (Ahlbergia) abae* sp. n. differs from *C. (A.) frivaldszkyi* in the absent androconial spot on the forewing of male (narrow but distinct androconial spot in *C. (A.) frivaldszkyi*, see Figs 1,3,4,7 in Krupitsky *et al.*, 2023b), more distinct paler pattern of



Figs 6 – 12. *Callophrys (Ahlbergia)* spp., genitalia. 6-9 – *C. (A.) abae* sp. n.: 6 – holotype, ♂, genital capsule with valvae, ventral view; 7 – Id., aedeagus, lateral view; 8 – Id., vesica of aedeagus with cornuti; 9 – paratype, ♀, China, Sichuan Province, Ngawa Tibetan and Qiang Autonomous Prefecture, Songpan County, 2900 m and higher, 24.VI.1894, M.M. Berezovsky leg., lamella postvaginalis, antrum, ductus bursae and bursa, ventral view; 10-12 – *C. (A.) ferrea* (Butler, 1866): 10 – ♂, Russia, Kunashir Island, 4.5 km NW Mendeleevo airport, Tretyakovo village, 19.V 2021, S. Rybalkin leg., genital capsule with valvae, ventral view; 11 – Id., aedeagus, lateral view; 12 – Id., vesica of aedeagus with cornuti.

the ventral side of the hindwing with well-defined postbasal marks and crescent line (elements of pattern of the ventral side of the hindwing darker, blurred in *C. (A.) frivaldszkyi*, see Figs 1–8 in Krupitsky *et al.*, 2023b), long broad valva with the bent outer margin in the male genitalia (shorter narrower valva with straight outer margin in *C. (A.) frivaldszkyi*, see Figs 17, 20 in Krupitsky *et al.*, 2023b), strongly sculptured trapezoidal lamella postvaginalis in the female genitalia (less sculptured semicircular lamella postvaginalis in *C. (A.) fri-valdszkyi*, see Figs 35, 36 in Krupitsky *et al.*, 2023b). Moreover, according to our previous data (Krupitsky *et al.*, 2023a), the new species (mentioned there as *C. (A.)* sp., vouchers CAL074–075, GenBank accession numbers OM630562, OM630563) differs from *C. (A.) frivaldszkyi* by $0.61 \pm 0.29\%$ (uncorrected pairwise genetic divergence).

In the absent androconia and the shape of the valva with bent outer margin in the male genitalia, *C. (A.) abae* sp. n. seems to be similar to the recently described peculiar elfin species from Gansu Province, *C. (A.) tianjianbeii* (Huang, 2021), **comb. nov.**, which, in its turn, is believed to be close to *C. (A.) frivaldszkyi* by the author of the description. The new species readily differs from *C. (A.) tianjianbeii* in the well-developed blue fields of the dorsal side of the wings in both sexes (only scattered blue scales present on the dorsal side of the wings of both sexes of *C. (A.) tianjianbeii*, see Fig. 266 in Huang, 2021), brown contrasted pattern of the ventral side of both wings (greyish yellow uncontrasted pattern of the ventral side of both wings in *C. (A.) tianjianbeii*, see Fig. 266 in Huang, 2021), broadened trapezoidal lamella postvaginalis in the female genitalia (rounded lamella postvaginalis in *C. (A.) tianjianbeii*, see Fig. 267 in Huang, 2021).

ETYMOLOGY. The specific epithet is derived from Aba Prefecture, also known as Ngawa Tibetan and Qiang Autonomous Prefecture, where the type specimens of the new species were collected in different localities.

DISTRIBUTION, BIONOMICS AND DISCUSSION. The new species is known to date from four localities in Ngawa Tibetan and Qiang Autonomous Prefecture, Sichuan Province, China. The type locality of the new species coincides with that of another recently described elfin butterfly species, *C. (Cissatsuma) berezowskii* (Krupitsky, 2018). As in the case of most of the type series of *C. (A.) abae* sp. n., the type series of *C. (C.) berezowskii* was also collected by the Russian geographer Mikhail Berezovsky (1848–1912), explorer of Mongolia and China. The detailed survey on a proper collection locality of both mentioned species was published recently (Krupitsky *et al.*, 2022).

According to the labels of the type specimens, *C. (A.) abae* sp. n. is confined to the montane forest belt from 1900 to 3500 m above sea level, with a flight period from early April to early July, depending on the altitude, which is typical for many species of the subgenus *Ahlbergia*.

We cannot exclude the possibility that at least specimens from South Gansu Province previously identified as *C. (A.) frivaldszkyi* by Huang & Zhu (2016) actually belong to *C. (A.) abae* sp. n. It would be hard to believe that the same species of such a diverse group as elfin butterflies, which comprises numerous local endemics, inhabits the vast and heterogeneous territory from Yakutia to Central Sichuan; thus, the distribution of both the mentioned species in China must be revealed taking into account the diagnostic characters of “true” specimens of the *C. (A.) frivaldszkyi* from the northern part of its range.

***Callophrys (Ahlbergia) ferrea* (Butler, 1866)**

Figs 10–12

MATERIAL EXAMINED. 1 ♂, voucher No CAL165, GenBank accession No. PP130632, **Russia:** Kunashir Island, 4.5 km NW Mendeleev airport, Tretyakovo village, 19.V 2021, S. Rybalkin leg. (AKM).

RESULTS AND DISCUSSION. Analysis of the genitalia of the specimen in question revealed their similarity with that of the specimens from Japan studied during our previous revision (Krupitsky *et al.*, 2023b), namely the valvae gradually pointed to apices (in bilobed configuration) and the cornuti with numerous small spines. Compared to the specimens from Japan, the valva of the analyzed specimen is somewhat longer, but fits into the individual variation of the genitalia of *Ahlbergia*.

The COI barcode of the specimen in question differs by 1.67% from *C. (A.) korea* from Primorsky Krai, Russia (GenBank accession No. OQ701610), and from South Korea (GenBank accession No. GU372579), and it is identical to those of two analyzed specimens of *C. (A.) ferrea* from Hokkaido, Japan (GenBank No. OM630560–OM630561).

Taking into account these results, we confirm the presence of *C. (A.) ferrea* on Kunashir Island. We can not exclude the possibility of the presence of the latter species on other islands of the southern Kuril Islands Archipelago. Thus, four species of the subgenus *Ahlbergia* have been recorded in Russia to date: *C. (A.) frivaldszkyi*, *C. (A.) confusa* (Huang, Chen & Li, 2006), *C. (A.) korea* and *C. (A.) ferrea*.

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