

**Notes on *Parnassius LATREILLE, 1804* from Tian-Shan and Alai. Part 1:
Parnassius simonius STAUDINGER, 1889 - *P. boedromius* PUENGELER, 1901**

(Lepidoptera, Papilionidae)

by

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Summary: *Parnassius simonius* STAUDINGER, 1889 is for the first time found in the Tian-Shan mountain system. Examination of the ♂ genitalia confirms the species status of *P. simonius* STGR. as well as *P. boedromius* PUENGELER, 1901; the distinctions are studied in detail for the first time. Two new subspecies are described: *P. simonius saluki* subsp. nov. (TL: Tian-Shan, Naryn reg., Baetovo distr., Bavachal R.) and *P. simonius mentor* subsp. nov. (TL: Alai, Kollektorsky range, Dugoba R.). The subspecific structure of *P. simonius* STGR. is discussed basing on the distribution of taxa and known history of the studied region.

Резюме: *Parnassius simonius* STAUDINGER, 1889 впервые найден в пределах Тянь-Шанской горной системы. Исследование гениталий самцов подтверждает видовую самостоятельность как *P. simonius* STGR., так и *P. boedromius* PUENGELER, 1901; видовые отличия впервые даны в деталях. Описано два новых подвида: *P. simonius saluki* subsp. nov. (Тянь-Шань, Нарынская обл., Баевский р-н, р. Бавачал) и *P. simonius mentor* subsp. nov. (Алай, Коллекторский хр., р. Дугоба). Особенности подвидовой структуры *P. simonius* STGR. обсуждаются с привлечением данных по распространению таксонов и истории территории распространения.

Introduction: *Parnassius simonius* STGR. was found in Tian-Shan in 2007 together with *P. staudingeri* A. BANG-HAAS, 1882. According to all previous studies, Tian-Shan is populated by the vicariants of these species - *P. boedromius* PUENG. and *P. delphinius* EVERSMANN, 1843.

The work with newly discovered populations was not possible without careful checking and summarizing of all available information about the taxa. As a result, short reviews of some *Parnassius* species were prepared. The first part is devoted to the *simonius-boedromius* group (or the genus *Kreizbergia* KORSHUNOV, 1990, according to different points of views); the questions of the generic systematics are out of the limits of this paper.

The holotypes of the new taxa are deposited in the Darwin State Museum (Moscow). The paratypes are preserved in the collections of the author as well as in those of K. ROSE (Mainz, Germany), P. BEDA (Moscow), B. KHRAMOV (S.-Petersburg), V. PLETNEV (Moscow), M. DAVYDOV (Moscow), J. OUVAROFF (Paris), P. BOGDANOV (Moscow).

Abbreviations: FW - fore wing, HW - hind wing, TL - type locality

1. Historical review and the status of the taxon *grayi* AVINOV, 1916

KREUZBERG (1985) was the first who proved the species status for *P. simonius* STGR. and *P. boedromius* PUENG. based on some differences in the genitalia and wing pattern. Now the status is confirmed by the studies of DNA.

P. simonius STGR. includes several taxa:

- simonius* STAUDINGER, 1889 - TL: West Transalai, Aram-Kungei;
- grayi* AVINOV, 1916 - TL: Alai, Tengizbai Pass;
- nigrificatus* KREUZBERG, 1986 - TL: East Transalai, Kyzyl-Art Pass;
- taldicus* GUNDOROV, 1991 - TL: East Alai, Taldyk Pass;
- shuvalorum* KREUZBERG & PLJUSHCH, 1992 - TL: East Alai, Taldyk Pass.

The last two taxa originate from the same locality and are represented even by the series collected mainly in the same year, there is no doubt about the synonymy of *shuvalorum* KREUZBERG & PLJUSHCH.

The nominate taxon is recorded only from the type locality (the well-known Aram-Kungei, Altyn-Dara River valley, West Transalai) and can be easily distinguished from all other taxa by the light colouration, reduced postdiscal band (the spots M3 - Cu2 are usually reduced or even absent) and developed orange eyes.

Parnassius s. nigrificatus KREUZBERG, 1986 was described from the upper stream of Markan-Su River, East Transalai, not far from the well-known Kyzyl-Art Pass situated on the main road "Osh-Murgab". This taxon presents a darkened version of *P. s. simonius* STGR. with reduced eyes (often totally blackish) and more developed black pattern.

The status of *grayi* Av has practically never been doubtful - and this represents a serious taxonomic mistake.

At first, KREUZBERG (1985: 59) in his review of the group did not publish any characters of *grayi* Av., but found AVINOV's types and made a valid lectotype designation. The ♀ with the label "Isfaran, Alai sept., 3400m, August" is similar to the figure published in the original description. The photo of the lectotype was published by TSHIKOLOVETS (2005: pl. XXI, fig.13). The original description does not fully agree with the actual characters of the real specimens described. AVINOV had only 2 specimens of his taxon which were collected in August, a month later the main flight period of the local population. Both butterflies were not fresh; 2 specimens are surely not enough for a serious and reliable comparison; moreover, AVINOV confused the sex of his specimens (supposedly they were both ♂♂).

KREUZBERG (1986) published the description of *P. s. nigrificatus* KREUZBERG, where *P. s. grayi* Av. was not figured at all; the comparison was done only with the nominate subspecies. It seems more than strange because in his own review published one year before *P. s. grayi* Av. was stated as a good subspecies and thus, all new descriptions should include the comparative study of *P. s. grayi* Av. as a neighbouring taxon. The conclusion is simple: no actual material from Tengizbai was available.

Practically at the same time the *simonius*-populations were discovered at Gaumysh and Dugoba passes - situated not so far from Tengizbai in the western direction but not at the main chain of Alai (in Kuruk-Sai and Collectorsky Ranges). These populations are most different from all other *simonius*-taxa: the butterflies are large with considerably extended black pattern, slightly but obviously widened wings and eyes with true reddish or deep orange colour.

WEISS (1991: 19) placed them under the name *grayi* Av. ["Tengizbai, Southern Isfara, Southern Khaidarken (Alai). Characterized by its larger size, its very developed spotting and its black ocelli sometimes with orange centres."], but no photos of the specimens were published.

Later the mistake was conserved in "Guide to the butterflies of Russia and adjacent territories" where *P. simonius* STGR. from Kuruk-Sai ("Southern Khaidarken" according to Weiss) is figured

under the name “*grayi* AVINOV” (TUZOV et al., 1997: plate 9: fig. 9-10; worth to note that the selected pair is not fully typical because of the slight reduction of black pattern; it does not represent aberrations and readily differs from other taxa, but the more common form has more expressed bands). Only DIETZ (2002) published the photos of 3 *simonius*-like butterflies under the name *grayi* A. – which, however, look slightly strange and are labelled „Alai“ without any detail; specimens belonging to „*grayi* sensu KREUZBERG & WEISS“ are absent in this book.

Such a situation led to a great deal of misunderstanding. GUNDOROV (1998) found that the population from Tengizbai Pass had no differences from the nominate taxon, but incorrectly placed *grayi* Av. at Dugoba; his publication was simply ignored. TOROPOV collected many times in the type locality of *grayi* Av. (a few kilometers in the NW direction from the pass, according to the clear remark published by AVINOV); he was absolutely sure that *grayi* Av. is a kind of the nominate *simonius* STGR. - and, thus, *P. s. taldicus* GUNDOROV is a very good subspecies (TOROPOV, pers. comm.). The collectors who had material from Dugoba or Kuruk-Sai discussed the similarity between “*grayi*” and “*taldicus*” while the others discussed the unique distinctions of the last taxon in contrast to the “light *simonius* and *grayi*”. Unfortunately, serious private collections include either Tengizbai material or Dugoba/Kuruk-Sai material; practically nobody has good series from both parts of the Alai system. These simple and accidental circumstances allowed to keep the mistake for many years.

I have examined series from all localities mentioned above and, in addition, a series which was collected by B. KHRAMOV at a pass situated up from Kyzyl-Eshme village. A mountain spur is situated south from Tengizbai - and populated by the butterflies which are also identical to the *P. s. simonius* STGR. The butterflies from Tengizbai (the material is available after several years of collecting) also belongs to the nominate taxon, being only slightly larger statistically. As a result of some hybridization with the populations distributed in West and East Alai, rare specimens have slightly widened blackish pattern (however, it is easy to find such specimens in the nomotypical population as well). It could be possible to keep the subspecies status for *grayi* Av. if somebody wanted to mark the full isolation between these two *simonius*-populations, but from the taxonomic point of view it can not be confirmed. Thus, *Parnassius simonius simonius* STAUDINGER, 1889 = *Parnassius simonius grayi* AVINOV, 1916 **syn. nov.** The photos of a series of true *grayi* Av. from Tengizbai Pass were published by GUNDOROV (1998).

The macropopulation inhabiting the northern macroslopes of West and Central Alai (Dugoba and Kuruk-Sai) presents a definitely another butterfly - as it was stated by WEISS (1991) nor the authors of the Russian ‘Guide’; this taxon is described below under the name *P. s. mentor* **subspec. nov.**

The presence of the nominate *P. s. simonius* STGR. on the main chain of Alai looks out of logic (at the first look) and needs an explanation. Moreover, an analysis of the natural history of Alai/Transalai provides us facts and information important for the study of other species (see below).

The territory of Tian-Shan is populated by *P. boedromius* PUENG., a vicariant of *P. simonius* STGR. According to all published data, the distribution areas of *P. simonius* STGR. and *P. boedromius* PUENG. are widely separated. *Parnassius boedromius* PUENG. populates the Chinese Tian-Shan, including Boro-Khoro Range (*P. s. marcopolo* WEISS, 1994, etc.), Central Tian-Shan (ssp. *boedromius* PUENGELE, 1901), North Tian-Shan (ssp. *martiniheringi* BRYK & EISNER, 1930; ssp. *hohlbeki* AVINOV, 1913; ssp. *sokolovi* KREUZBERG, 1990) and the eastern part of Inner-Tian-Shan (ssp. *prasolovi* KREUZBERG, 1986). It seems not necessary to publish the review of these taxa, all of

them representing good subspecies, in my opinion, and being figured in many recently published books (DIETZ, 2002; WEISS, 1991, TSHIKOLOVETS, 2004; TSHIKOLOVETS, 2005; etc.). Examination of the genitalia shows some important diversity which will be discussed below.

The most western known population of the species was found by the author of the paper and A. ZHDANKO at the south-western edges of At-Bashi Range, near Chatyr-Kul Lake and clearly belongs to *P. s. prasolovi* KREUZBERG. No other material is known from the western ranges of the so-called Inner-Tian-Shan: Dzhaman-Too, Baibiche-Too, Karatau, Moldo-Too, Chaartash (Ak-Shyirak), the western part of Terskey Alatau, the well-known Baiduly Range (Dolon Pass), etc.

The new *simonius*-population was found in the mountain chain situated between Baibiche-Too and Dzhaman-Too at a very high altitude, where it flies together with *P. staudingeri* A. BANG-HAAS, 1882, another representative of the fauna of Pamirs-Alai. This *P. staudingeri* A. B.-H. is closely related not to the neighbouring *P. s. infernalis* ELWES, 1886 distributed in Alai but to *P. s. illustris* GRUM-GRSHIMAILO, 1888 known from Aram-Kungei. Moreover, a detailed examination of new This *P. staudingeri* A. B.-H. shows its close relations with *P. s. nigrificatus* KREUZBERG and even with *P. s. simonius* STGR.

The distance between the new *P. simonius* STGR. population and the known locality of *P. boedromius* PUENG. at At-Bashi is slightly more than 50 km, while the distance from Taldyk Pass, the nearest locality of *P. simonius* STGR. (ssp. *taldicus* GUNDOROV), is not less than 180 km. Another population belonging to *P. s. nigrificatus* KREUZBERG is known from the Irkeshtam area (Chinese Kyzyl-Su R. Valley, found by me and A. ZHDANKO in 2000; later some specimens were collected by A. SOCHIVKO); the distance is more than 160 km (the distance to the type locality of *P. s. nigrificatus* KREUZBERG, Kyzyl-Art Pass, is more than 200 km). The distances between the type localities of other subspecies are as follows: *P. s. simonius* STGR. and *P. s. nigrificatus* KREUZBERG - around 90 km, *P. s. taldicus* GUNDOROV and *P. s. nigrificatus* KREUZBERG - around 40 km, *P. s. taldicus* GUNDOROV and *P. s. mentor* subspec. nov. (nearest Dugoba) - 90 km. So, the new *simonius*-locality is not only situated inside another mountain system, but the territory being added now to the areal is comparable in size to that previously known for the species as a whole!

Another finding of *P. simonius* STGR. and *P. boedromius* PUENG. in Inner Tian-Shan is expected and can clarify the real distribution of these species, which theoretically can fly almost together.

P. simonius m e n t o r subspec. nov. (colour plate 3a: 1a, 1b)

Holotype ♂: Alai, [Collectorsky Range], Dugoba R., 3600 m, 5.VII.1995, A. PETROV leg.

Paratypes: Coll. S. CHURKIN: 9 ♂♂, 10 ♀♀, same data; Coll. K. ROSE: 3 ♂♂, 1 ♀, Kirghizstan, Alai, Kuruksaj, Alauddiusaj [Kyrgyzstan, Alai, Kuruk-Sai Range, Alauddin Pass], 3600-3700m, 27.-30.VII.1987; 1 ♂, 1 ♀, Kirghizstan, Alay [Kyrgyzstan, Alai], Kuruk-Say Mts. [Kuruk-Sai Range], Alauddin pass, 3600 m, 27.-30.VII.1987; 2 ♂♂, Uzbekistan, Alaiski hr. [Alai], Jordon [Iordan], 3300-4000 m, 10.-12.VII.1983, leg. VOLAK (these labels are not correct: Iordan is situated in Uzbekian enclave in Fergana Valley where altitudes are very low; these butterflies were certainly collected on the Kyrgyzian territory and at the passes upper from Dugoba River - S. CH.); 2 ♂♂, 2 ♀♀, Kirgizstan, Pamir Mts. (sic!- S. CH.), Alai range, Dugoba, Jordon vill., [Kyrgyzstan, Alai, Dugoba R.], 3600 m, 12.VII.1995; Coll. P. BEDA: 3 ♂♂, [Kyrgyzstan], N. Alai, Kuruk-Sai Range, Alauddin [Pass], 3700 m, 27.VII.1987; 2 ♂♂, 1 ♀, [Kyrgyzstan], Alai, [Kuruk-Sai Range], Gaumysh-sai, 15.VII.1983, E. TARASOV leg.; Coll. P. BOGDANOV: 1 ♂, [Kyrgyzstan], N. Alai, Kuruk-Sai Range, Alauddinsai R., 3700 m, 28.-30.VII.1987, E. TARASOV leg.; 1 ♂, [Kyrgyzstan], Khaidarken, Alai, [Kuruk-Sai Range], Gaumysh R., 16.VII.1983, ex.coll. SHAPIRO;

3 ♂♂, 2 ♀♀, [Kyrgyzstan], Khaidarken, Alai, [Kuruk-Sai Range], Gaumysh R., 18.VII.1983, 3500 m, S. SAZONOV leg.; Coll. B. KHRAMOV: 1 ♂, 1 ♀, Kyrgyzstan, Dugoba, 3500 m, 27.-30.VI.1995.

Description and diagnosis: A well known butterfly, the largest representative of the species, with contrasting and enlarged black pattern, deeply coloured eyes and widened wings.

Male: FW length 28 mm in the holotype, 25-9 mm (most commonly 27-28) in the paratypes. The size is definitely larger than in all other subspecies (which mostly have FW length 24-25 mm). The ground colour is white with slight yellowish shades, especially on the HW.

The wings are slightly widened, not so extended. The FW semi-transparent marginal band is narrow, as it is in *P. s. simonius* STGR. and *P. s. nigrificatus* KREUZBERG (the actual width of the band is statistically nearly the same as in the mentioned taxa while the size of the butterflies is definitely not the same) - a good distinction from *P. s. taldicus* GUNDOROV: only the last subspecies has wide marginal band, wider than in *P. s. mentor* subsp. nov. this being especially obvious in a comparison of the M2-M3 section of the band which is distinctly enlarged in *P. s. taldicus* GUNDOROV and only very slightly in other taxa.

The FW submarginal band widened, with very rare exceptions, and presents a distinction from all other subspecies, including *P. s. taldicus* GUNDOROV. The postdiscal band is usually full and continuous; only rarely the spots between M3 and 2A are reduced (very rarely - nearly absent). The blackish diffuse spot situated under the cell near the base of the FW is developed and situated closer to the vein A2 - this character is known for *P. s. taldicus* GUNDOROV (where it is not so common, however) while in *P. s. simonius* STGR.-*P. s. nigrificatus* KREUZBERG this spot is much less developed and situated closer to the cell vein and (if conspicuous, that is rarely) continued to a small not dense suffusion under the discal spots. The exceptions can be found and represent the above mentioned aberrations with a considerably reduced postdiscal band.

The HW upperside is typical for the species, but all blackish spots are more expressed and often enlarged. The eyes are large and have more reddish colour than the orange-yellowish eyes of *P. s. simonius* STGR.; both eyes with thick blackish rings around them (in some very rare unusual forms this ring is enlarged and the eye looks totally blackish).

A diffuse blackish oval spot is situated near the base at the costal side of the HW; this spot is reduced in the *P. s. simonius* STGR.-*P. s. nigrificatus* KREUZBERG complex (where the individuals with such a spot - even very diffuse and only slightly visible - represent not more than 10% of the population). This character is also known for *P. s. taldicus* GUNDOROV, being not so common, however.

The ♂ genitalia with a comparatively thick uncus with enlarged distal blades. However, the blades are greatly deflected and the uncus is thin in the lateral view (compared to *P. boedromius* PUENG.) having no large dorsal projection at the distal end (see a more detailed analysis below).

Female: Statistically slightly smaller than the ♂; the ground colour is slightly not so dense, the black pattern is slightly reduced (not continuous postdiscal band is much more common among the ♀♀). In addition, the costal diffuse spot on the HW is often reduced, the eyes are statistically smaller. In general, it shows some similarity to the ♂♂ of *P. s. simonius* STGR.-*P. s. nigrificatus* KREUZBERG, but readily differs from their ♀♀ in the mentioned above subspecific characters, because they also have less developed pattern than the ♂♂. Worth to note that the ♀♀ of *P. s. taldicus* GUNDOROV represent another kind of sexual dimorphism, being more transparent than in all other taxa and, thus, absolutely not contrasting but greyish and darkened.

Distribution: Known from Kuruk-Sai Range (between Sokh River and Ak-Su River, south from Sokh and Khaidarken towns) and Collectorsky Range (between Ak-Su River and Isfaramsai River, south from Iordan and Shakhimordan towns).

Biology: The habitat is typical for the species, as I saw personally in 1995. Different foodplants were noted for the species and subspecies in different publications - these needs confirmation and careful analysis. Flies mainly in uneven years. In my opinion, has a two-years life cycle, but not very expressed.

Etymology: Mentor (Lat.) - the friend of Ulysses.

3. *Parnassius simonius s al u k i* subspec. nov. (colour plate 3a: 2a, 2b)

Holotype ♂: Tian-Shan, Naryn reg., Baetovo distr., Bavachal R., 3600 m, 16.-17.VII.2009, S. CHURKIN leg.

Paratypes: 43 ♂♂, 18 ♀♀, same data, S. CHURKIN & V. PLETNEV leg.; 8 ♂♂, 1 ♀, same data, J. OUVAROFF leg.; 10 ♂♂, 5 ♀♀, same loc., 3700-4100 m, 10.-12.VII.2007, S. CHURKIN, V. PLETNEV & S. SALUK leg.; 2 ♂♂, same loc., 7.VII.2008, S. CHURKIN leg.

Description and diagnosis: The subspecies is close to the *P. s. simonius* STGR. and *P. s. nigrificatus* KREUZBERG but has distinct yellowish hue of the ground colour of the FW in the ♂♂, reduced postdiscal blackish band (as a rule), enlarged and longer discal spots (compared to *P. s. simonius* STGR.); the eyes (ocelli) are usually darkened, sometimes with a small orange-reddish pupil inside.

Male: FW length 25 mm in the holotype, 23.5-25.5 mm in the paratypes.

The wing shape is the same as in *P. s. simonius* STGR. and *P. s. nigrificatus* KREUZBERG, the ground colour of the FW (not only HW as in other taxa) with a distinct yellowish hue; flying ♂♂ look clearly yellowish (in contrast to the whitish *P. s. simonius* STGR.) - so that they can be easily distinguished from *P. staudingeri* ELW. flying together with *P. s. saluki* subspec. nov.

The marginal semitransparent band is narrow, as well as the submarginal band; both are similar to those of *P. s. simonius* STGR. The blackish pattern looks more expressed than in *P. s. simonius* STGR. but the postdiscal band is usually broken between M3 and Cu2 where the spots are reduced - totally or partly. Rare exceptions with a fully developed band look more similar to *P. s. nigrificatus* KREUZBERG but the band is never so distinct and continuous. The discal spots, especially the first spot situated in the cell, are comparatively thin and long, touching both cell veins, while in *P. s. simonius* STGR. the first spot is usually not touching the lower vein (this character is not so constant but well working). The anal spot near the base of the wing is reduced, very diffuse (and often absent), so that the position of this spot is not fixed (however, more similar to its position in *P. s. taldicus* GUNDOROV, not touching the cell).

In contrast to *P. s. nigrificatus* KREUZBERG, the HW eyes are often developed; in the most typical form they have a thick blackish border and a small orange-reddish pupil inside (typical *nigrificatus* has practically fully darkened eyes). The submarginal band is typical for the species, being not so continuous and more similar to *P. s. simonius* STGR. than to *P. s. nigrificatus* KREUZBERG. The diffuse costal spot is absent, with rare exceptions (as in *P. s. simonius* STGR. and *P. s. nigrificatus* KREUZBERG).

Some aberrations were found, with different kinds of the reduction or development of the black pattern and red spots. Important to note unusual specimens with practically totally absent eyes, only the M-eye is visible as a small dot - while the pattern of the FW is full and extended like in typical *P. s.*

nigrificatus KREUZBERG. Such specimens look more or less similar to *P. boedromius* PUENG. (but, at the same time, the specific structure of the HW submarginal band is absolutely clear, the FW is angled and not widened - are and the genitalia are normally developed, with all specific characters).

The ♂ genitalia (fig. 12, 13, 16) have reduced distal blades of the uncus compared to all other subspecies (see below).

Female: The ♀♀ are practically of the same size, similar to the ♂♂ (in contrast to the ♀♀ of *P. s. talidicus* GUNDOROV), with slightly more reduced pattern and eyes. At the same time, the FW is not yellowish but clearly whitish, while the HW is yellowish as it is in other subspecies - so, that the *saluki*-♀♀ demonstrate another kind of sexual dimorphism.

Distribution: Known only from the type locality. I suppose that saluki populates all south-western part of "Inner Tian-Shan", but it is not possible to exclude that we have only one relic macropopulation which is distributed only in several very close small localities.

Biology: Not studied. The habitat is typical for the species. Flies together with *P. staudingeri* A. BANG-HAAS, 1882 (which is close to *P. s. illustris* GR.-GR.).

Etymology: The subspecies is named after Mr. SERGEI SALUK (Minsk), a permanent member of last Kyrgyzian expeditions focused on the *Parnassius* investigations, a professional entomologist and my friend.

4. Male genitalia

The examination of the ♂ genitalia confirms the species status for the 3 related taxa first separated by KREUZBERG (1985): *P. simo* GRAY, 1852, *P. simonius* STGR. and *P. boedromius* PUENG. However, KREUZBERG made some small mistakes with the characters. He also suggested that *P. simonius* STGR. had an intermediate position between *P. simo* GRAY and *P. boedromius* PUENG. - it was even not logical because the base of the new - species - status for these taxa was exactly the structure of genitalia.

The best and detailed research of the genitalia of the group as a whole (together with the muscle system) was published by STEKOLNIKOV & KUZNEZOV (1995, 1998, 2003). In general, the ♂ genitalia of *Kreuzbergia*, except for the aedeagus, consist of 3 main large and comparatively equal parts: tegumen with a single massive uncus and two valvae. It is very different from the structure known for other *Parnassius* and supports the possible generic status.

Each valva has a small harpe - that was not marked by STEKOLNIKOV & KUZNEZOV (l. c.) - which even has a small taxonomic value. The aedeagus is strong and strongly curved; tegumen short and not greatly sclerotized, but not narrow as in *Koramius* or *Kailasius*. The uncus bears the main specific characteristics; some geographical variability is also present. It consists of two sclerites forming a half-tube structure; there are two excavations on both sides of the uncus just near the base (these are the places of the attachment of the muscles) and (in two species) a pair of ventral blade-like structures near its distal end.

Parnassius simo GRAY differs sharply from both other studied taxa, having no distal blades (a specimen of *P. s. avinovi* VERITY, 1911 from East Pamir, 50 km from Murgab was dissected, fig.1). The aedeagus is evidently shorter and thicker than in other species, having nearly the same width throughout its length; the distal end is blunted. The valva is considerably sclerotized and strongly curved. The harpe is very small and weak.

On the contrary, *P. simonius* STGR. and *P. boedromius* PUENG. have distal blades of the uncus, a much longer aedeagus which is thinner and comparatively narrowed towards the pointed distal end. The valva is less sclerotized, not so curved, while the harpe is more developed.

The distinctions between *P. s. simonius* STGR. and *P. boedromius* PUENG. are also significant but the hiatus between both of them and *P. simo* GRAY is evidently much larger.

Parnassius boedromius PUENG. (figs. 2 - 8) has a massive and strong uncus with deep excavations which are well visible in the dorsal view, well shaped by sharp strong borders. The distal end of the uncus is enlarged at the dorsal side which is expanded and produced upwards, making a kind of a dorso-distal projection. Two large blade-like structures are developed at the ventral side of the distal end; these blades are directed as the continuation of the lateral sides of the uncus or are slightly deflected laterally (fig. 4).

Such characters are the same among all populations distributed in Inner or Central Tian-Shan: the specimens from Dzhetim-Bel Range (Suek Pass, *P. b. prasolovi* KREUZBERG), West Kokshaal (Kuldzha-Bashi River, *P. b. prasolovi* KREUZBERG), At-Bashi Range (Karasu River, *P. b. prasolovi* KREUZBERG), Naryn and Borkoldoi Mts. (*P. b. prasolovi* KREUZBERG), Kaingdy-Katta Range (near Tashkoro v., *P. b. boedromius* PUENG.), Kungei Alatau (*P. b. martiniheringi* BRYK & EISNER) were examined (fig. 2, 4, 6).

Parnassius b. marcopolo WEISS is different in the more developed dorsal projection at the distal end of the uncus and smaller blades, which seem to be more or less considerably deflected (fig. 7). I dissected only 2 specimens - so, this characters needs confirmation.

On the contrary, the northern *P. b. hohlbecki* Av. presents more serious differences from the typical *P. b. boedromius* PUENG.: the blades are very small, the dorsal projection is reduced and looks in general comparatively similar to that of *P. simonius* STGR. (figs. 5, 8). The main specific characters are truly the same as in other *P. boedromius* PUENG. (the uncus is massive and wide, the excavations at the base of the uncus are well-developed and sharp, the deflection of the distal blades is not great, the shape of the uncus in the cross-section is the same as in the nominate race. However, the mentioned differences are serious and need further studies.

The valva of all subspecies of *P. boedromius* PUENG. (fig.3) is definitely longer, with a longer median part, than the shorter valva of *P. simonius* STGR. (fig.14). If the valva is not separated from other parts of the genitalia, the comparison is the best not in the lateral view but when looking from the ventral side; this distinction is not so easy to use for taxonomic purposes. The same is true for the harpe which is very small but without any doubt plays an important role in the copulation. The harpe of *P. boedromius* PUENG is wider and more massive than in *P. simonius* STGR. The aedeagus of *P. boedromius* PUENG is very similar to that of *P. simonius* STGR.

P. simonius STGR. (figs. 9-17) has a comparatively long uncus with conspicuous but small blades which are considerably deflected laterally (fig. 10). KREUZBERG (1985) did not clarify this character: the human eye easily registers that the uncus of *P. simonius* STGR. and the uncus of *P. boedromius* PUENG. have different distal ends, but it is not easy to understand what exactly is not the same - and it is nearly impossible to figure it - so, that I am even afraid about my own figures. In *P. simonius* STGR. the blades are more deflected and look larger in the dorsal view (looking not very different in size from the blades of *P. boedromius* PUENG.), but they look much smaller in the lateral view, being at some angle to the observer; in *P. boedromius* PUENG. this angle is small the visible size of the blades more or less corresponds to their real size. For the same reason the blades of *P. simonius* STGR. look more rounded

compared to the angled blades of *P. boedromius* PUENG. In rare cases it is not so easy to understand the degree of the deflection - but two other significant distinctions may complete the undoubtful identification: the excavations at the base of the uncus are smaller in *P. simonius* STGR., with less clear borders, while the uncus is in general thinner and has a different shape in the cross-section. The best position to see the differences between *P. simonius* STGR. and *P. P. boedromius* PUENG. is the lateral view: the uncus of *P. simonius* STGR. is thin and looks longer (because it is thin), while that of *P. boedromius* PUENG. has nearly the same length but is massive and thick, so that it looks shorter.

Some geographical variability has also been found, not so remarkable, except *P. s. mentor subspec. nov.* The *P. s. saluki subspec. nov.* from Tian-Shan has very small reduced distal blades (figs.12-13) - in contrast to the most developed blades of the neighbouring races of *P. boedromius* PUENG. The uncus of the nominate *P. s. simonius* STGR. is often more or less slightly narrowed to the distal end (in the dorsal view) - this character is also found in the *P. s. saluki subspec. nov.* population (figs. 15, 16, 17). However, some specimens of both taxa have practically not narrowed uncus as it is in *P. s. talidicus* GUNDOROV or *P. s. mentor subspec. nov.*

Rarely two lateral parts of the uncus are slightly disjoined at the end, forming a distal incision on the dorsal side (see fig. 15). In general, the incision is not developed but a small distal excavation on the tip of the uncus is a common feature in *P. s. simonius* STGR. (fig. 17). Interesting that *P. boedromius* PUENG. bears only slight traces of this feature; even a small excavation is only slightly visible.

Parnassius s. mentor subspec. nov. has a statistically stronger and wider uncus which is, however, thin and not massive compared to *P. boedromius* PUENG. More important, that the individuals of *P. s. mentor subspec. nov.* have enlarged blades and enlarged harpe - even similar to that of the typical *P. boedromius* PUENG. This clearly shows that the time of the origination of both species was not so remote - because some specimens with comparatively "wrong" characters are still not deleted by the natural selection in the populations distributed far from the former contact zone (I need to remind about the widened and not angled wings of *P. s. mentor subspec. nov.*, too). Worth to note again, that all species features are obvious in *P. s. mentor subspec. nov.* - and it is absolutely impossible to confuse this taxon with any *P. boedromius* PUENG. subspecies.

I did not find any differences in the genitalia between the Alaian and Transalaian populations of the *P. s. simonius* STGR. - so, we can suppose that they were disjoined only very recently or even still have some genetic exchange along the western slopes of both ranges (i.e. along the Karamyk-Keksu area). It means also that the differences between the lines *simonius-nigrificatus* and *mentor-talidicus* were formed far in the past, long before the time of the last glacier period.

I have not examined the genitalia of different *P. simo* GRAY subspecies, this being out of the limits of the paper, but the hiatuses observed in the group show that a serious investigation of the genitalia can clarify all questions about the status of *P. andreji* EISNER, 1930 or any other taxa of the group.

KREUZBERG (1985) includes *P. andreji* EISNER with all related taxa in *P. simonius* STGR. - without any arguments published. The genitalia of *P. andreji* EISNER were not described, the strange distribution area of *simonius* sensu KREUZBERG was not discussed (in this case we have two parts of the area widely disjoined by the area of *P. simo* GRAY!).

Discussion: According to the study of DNA, all taxa of *Kreuzbergia* are relatively young (MICHEL et al., 2008) - so, that it was suggested that they had a period of a very quick evolutional change, possibly because of the abrupt change of the foodplants compared to other *Parnassius* (OMOTO et al., 2004). The idea about the plants needs serious confirmation. For example, the butterflies belong-

ging to the *Plebejus christophi* complex can be divided into two groups: one lives on Alhagi in deserts and semideserts while the other has changed the food plant to *Hyppophae* and now populates mountains valleys. The plants are definitely different but the main colouration of the butterflies and all main features of the genitalia are the same. Thus, if changing of the food plants led to the quick evolution, we need to explain why exactly in this case such a sequence of events took place.

The genitalia of *Kreuzbergia* have so serious differences comparing it with *Kailasius* or *Koramius* (for example) that even the generic status looks logical. In addition, all species studied have sharp distinctions, and we can be sure that they are much older than the young glacial taxa (it does not contradict with the comparatively young origination of *Kreuzbergia* in general). The group is true monofyletic (in confirmation to the DNA studies): it is clear that the first ancestral species was distributed over Asian mountains and than was divided into two races. One race was transformed to *P. simo* GRAY without any blades or projections at the distal end of the uncus, while the other race had enlarged uncus with distal blades. Then the second race was divided once again to *P. simonius* STGR. and *P. boedromius* PUENG. with different details in the uncus structure.

These conclusions seem to be absolutely clear and based on solid facts - the geographical distribution and the hiatuses observed in the genitalia. However, according to the DNA studies, *P. simo* GRAY is related to *P. boedromius* PUENG. (MICHEL et al., 2008) or all 3 taxa have equal and small (!!) "hiatuses" (OMOTO et al., 2004, 2009). In my opinion, it just agrees with the known fact that our methods of the DNA comparison of closely related taxa are still far from being ideal. It would be very good if the DNA-researchers could verify their work by the systematic data - unfortunately, the progress of the DNA research correlates with the disappearing of serious and detailed studies of hard groups based on the methods of "classical" biological systematics. Colourful books and numerous check-lists can not replace professional taxonomic work, which can be helpful to molecular biologists and genetics.

The distribution of the group is connected with the problem of two taxa: *simulator* STAUDINGER, 1889 and *gylippos* FRUHSTORFER, 1901. Both belong to "true" *P. simo* GRAY not to *P. simonius* STGR. - and both are known from the territory where *P. boedromius* PUENG. is distributed. This situation was very important especially for Russian lepidopterists; the discussion was summarized by KREUZBERG (1985). I suppose that both taxa have not been collected in Tian-Shan and represent the cases of mistakes or wrong/confused labels - but we can not fully exclude the opposite version. The position of *P. simo* var. *simulator* f. *subdiaphana* VERITY was clarified by ROSE (2005), but the type localities of *simulator* STGR. and *gylippos* FRUHST. are still not known, being positioned as "somewhere in the southern Tian-Shan".

Note: During a long work with private and museum collections I have found many cases of wrong labels, which can make the taxonomic review very difficult or even impossible. For example, in one case a series of *Erebia* species belonging to the Siberian fauna and originating from East Kazakhstan, Saur Range, is standing with the labels "Padscha-ata" (i.e. Chatkal Range, West Tian-Shan) (CHURKIN, 2005: 148). In another case a series originated from Inner Tian-Shan bears the label "Yulduz" (CHURKIN, 2002b: 29).

All *Kreuzbergia* species can fly nearly together - especially *P. simo* GRAY/*P. simonius* STGR. with *P. boedromius* PUENG., because of distinctively different biotope of the last species. The hiatus between the genitalia of all species is serious - thus, the areals can partly overlap now. But actually *P.*

boedromius PUENG. has changed the biotope only because the true *P. simonius*-biotopes are absent in the main part of Tian-Shan, except its south-eastern part (the biotope of *P. s. saluki* **subspec. nov.** is very similar to that of *P. s. simonius* STGR. or *P. s. mentor* **subspec. nov.**; I can not exclude that a *P. boedromius* PUENG. population can fly nearby but slightly lower at the more wet and grassy stony slopes). However, the taxa are mainly allopatric - and this is a true fact. It means that cohabitation can be found but most probably only at the borders of the distribution of each taxa.

Parnassius simo GRAY has (and had) only one way of distributing to Tian-Shan: along the border of the Pamirs and the southern border of Tian-Shan. All territories to the north of the East Pamirs are populated by *P. simonius* STGR., and *P. simo* GRAY is absent here for sure (however, the hiatus between *P. simonius* STGR. and *P. simo* GRAY is the same as between *P. boedromius* PUENG. and *P. simo* GRAY - thus, we have one more argument against *P. simo* GRAY at Tian-Shan). The above explained way is broken by the presence of *P. simonius* STGR. at the eastern edges of Alai and Transalai (as I mentioned, *P. s. nigrificatus* KREUZBERG was found in the Irkeshtam area on both ranges). Moreover, the species is found now in Tian-Shan and the new population is related to the line *P. simonius* STGR.-*P. s. nigrificatus* KREUZBERG - i.e. *P. simonius* STGR. used exactly the same way as it was possible for *P. simo* GRAY.

All these facts contradict with the Tianshanian origination of *gylippos* FRUHST. and *simulator* STGR, but - however - they are not sufficient to cancel the hypothesis (for example, *P. simo* GRAY could penetrate Tian-Shan at another time, when *P. simonius* STGR. was absent in the eastern Alai/Transalai). There remains a small chance to discover/rediscover *P. simo* GRAY at the southern borders of Tian-Shan - but in this case all 3 species known for the region must fly nearly together.

The biological species conception includes not only the geographical criterion (i.e. the taxa can not be treated without their distribution) but the historical criterion, too. It is possible to verify the species structure of *Kreuzbergia* by the reconstruction of the known history of Central Asia. At the same time, systematic data about the group provide some information for such a reconstruction and clarify some details, that is important for future studies on other groups.

It is clear that *P. b. marcopoloi* WEISS represents the subspecies of *P. boedromius* PUENG. which keeps the oldest pattern of the colouration with developed eyes. The distribution of *P. b. marcopoloi* WEISS covers the most eastern part of the species area. Logically, the natural selection between the ancestral races of *P. simonius* STGR. and *P. boedromius* PUENG. eliminated the individuals with developed eyes among the *P. boedromius* PUENG. populations which fled in the past in the contact zone with *P. simonius* STGR. Later, the genetic exchange distributed such a variant throughout the main area (see in CHURKIN, 2002).

In my opinion, one fact is very important - the external similarity between both subspecies of *P. simonius* STGR from North Alai and *P. boedromius* PUENG. In addition, the most western *P. s. mentor* **subspec. nov.** keeps obviously more features which outline its former relations with *P. boedromius* PUENG. (see above), being even really comparatively similar to the most eastern *P. b. marcopoloi* WEISS.

In nature *P. boedromius* PUENG. contacts with *P. s. saluki* **subspec. nov.**, representing the line *simonius-nigrificatus* which are most different from *P. boedromius* PUENG. This fact is very important because it is possible to suppose the sequence of events:

1. At first the ancestral race of *boedromius-simonius* was divided into two parts by the latitudinal principle; the former territory of North Alai and Tian-Shan was more united while the contact

- between both of them and the territory lying to the south was broken (certainly, it was very far in the past because it must be the time when the recent relief was not finally formed and the Naryn River flew directly from the “old” Tian-Shan mountain platform to the Fergana Valley).
2. When the relief was changed, the former system of the relations between the taxa which composed the ancestral species changed totally; the area was divided by the meridional principle, the western part became totally isolated from the eastern part for a long time (this is fully true only for highland species) - so, that two different species originated in the two parts of the former ancestral area (this certainly reflects the final forming of the high-mountain relief, no other natural event could correspond to the changes described above - it was just the final stage of the forming of Fergansky Mts.)
 3. later, in the glacial age, the contacts between the two “new” species were resumed because *P. simonius* STGR. penetrated Tian-Shan using the “south-western gate”; the natural selection “refined” the main part of the populations and subspecies, but geographically marginal taxa still keep some characters which are not typical for the species now. It is very important to check the data for the relief changing with the data provided by DNA investigations - it is possible to find out some true correlations the actual data of the natural history.

According to the characters of the butterflies and the mountain structure of the studied territory, *P. boedromius* PUENG. includes 3 components (isolated during deglaciation): Kyrgyzsky Range-Suusamyr (two subspecies), “true” North Tian-Shan - “true” Inner Tian-Shan (3 subspecies) and the East Chinese Tian-Shan-Borokhoro (1 taxon). I have no information about *P. boedromius* PUENG. from Yuldus (*pygmaeus* A.BANG-HAAS, 1910) and the mountains between the areas of *P. b. marcopolo* WEISS and the nominate race.

Worth to remember, that the differences in the genitalia between these 3 complexes were also found, and new situation must be clarified - the mentioned hiatuses are really more or less the same as for some true glacial taxa - but the list of these taxa also includes some young but good species. I do not support dividing *P. boedromius* PUENG. into 3 species, but some studies are necessary using more material and detailed DNA investigations.

P. simonius STGR. presents another case with a very interesting structure of the distribution, reflecting the main natural events in the Alai Valley during the Quaternary Period (and partly Tertiary).

The first glaciation was of a cover character and the recent relief with deep river valleys, different kinds of the slopes and so on was formed after deglaciations - the first deglaciation was especially important. It is known that during two (at least) last glacial periods the bottom of the Alai Valley was covered by a giant glacier, which fed small Kyrgyzian Kyzyl-Su (and, so, Surkhob - Vakhsh rivers). This glacier deepened and formed the Alai Valley. However, the valley is relatively young with short and steep borders. The mountain ranges bordering the valley are very high (especially Transalai); thus, both were covered by giant glaciers along the main chains. The life was possible between the bottom and the top glaciers. Later, recently, the fauna of the Alai Valley was completed by some species which migrated from the neighbouring Darwaz (Darvaz) zoogeographical district – and, partly, Alai - but during the glacial time the valley was almost fully isolated. It resulted in the numerous taxa the distribution of which seems now to be disjoined and includes the northern slopes of Transalai and the southern slopes of the main chain of Alai. I have numerous material from both sides of the valley (Aram-Kungei and Daroot-Korgon/Kyzyl-Eshme); many species are fully identical without any even small differences: *Paralasa roxana* Gr.-Gr., 1887, several species of *Karanasa*, etc.

North Alai present completely another structure: it includes long and well developed river valleys, a very long macroslope and includes several smaller (than the main chain of Alai) ranges which are more or less parallel to Alai sensu stricto. The fauna which lives at the northern macroslopes of Alai sensu lato had a possibility to survive during the glaciation as well as during deglaciation only by changing the altitudes of their niches (of course, for some species such changes were bad, for some - even good). The northern race of *P. simonius* STGR. had no contacts with the southern one for a very long time - so, that both accumulated serious distinctions. The tops of Alai were lifeless during the main period of glaciation and not available to *P. simonius* STGR. during the warmest part of the interglacial time - thus, only in the recent period different populations re-established the contacts and genetic exchange.

After the last glacial period, when the main chain of Alai became not completely covered with glaciers, *P. simonius* STGR. from the southern macroslopes penetrated the area around Tengizbai Pass, using some small but available mountain spurs (like Kyzyl-Eshme spur). Now the formerly united areal of the nominate taxon is broken by the bottom of the Alai Valley - but some possible contacts can exist along the western edges of Alai (Karamyk area, Koksu River). The northern race formerly divided into two blackish taxa is disjoined now by the recently settled Tengizbai population of the nominate subspecies. Some contacts are possible through Kichik-Alai, where this species is still not found. Worth to note that the main part of the eastern Alai differs from the central-western Alai in two important features: it has no strongly developed large latitudinal mountain chains and has a much more humid climate. The contacts between East Alai and Kichik-Alai/Collectorsky/Kuruk-Sai ranges existed in the glacial times, while the contacts with the western parts of the main chain of Alai were seriously broken because of the glaciers. Some contacts between *P. s. taladicus* GUNDOROV and *P. s. nigrificatus* KREUZBERG - *P. s. simonius* STGR. were possible along the southern slopes of Alai (from both sides) and the Irkeshtam area (as a result, this dark race has some characters of the *P. simonius* STGR. complex, including not widened marginal band).

The historical reconstruction confirms and even clarifies the observed subspecific structure of *P. simonius* STGR., moreover - the strange position of the Tengizbai population looks now absolutely logical.

All five known subspecies of *P. simonius* STGR. have clear areals and relatively distinctive characters.

Parnassius s. simonius STGR. occurs at the northern slopes of West Transalai and the southern slopes of Alai and penetrates the neighbouring part of the main chain of Alai (Tengizbai Pass). This is a small butterfly with angled wings, reduced black pattern, whitish colouration (except yellowish HW, as it typical for the species, except *P. s. saluki* subspc. nov.) and orange HW eyes.

Parnassius s. nigrificatus KREUZBERG has the same wing shape, but the black pattern is more developed (the FW submarginal band is typically continuous and contrasting, the HW submarginal band looks continuous, not separated to spots), the HW eyes are reduced and blackened. The known areal covers the eastern part of North Transalai from Kyzyl-Art Pass to the Irkeshtam area where I collected it also at the Alai edges. This eastern population has a more united HW submarginal band. Certainly, it populates the main basin of Markan-Su R. in China, where the area may be connected with that of *P. simo* GRAY. The characters of the butterflies which must populate the median part of the northern macroslopes of Transalai is not known - worth to note that such populations must be very local because the slopes here are very steep and developed river valleys are absent. The differences from the nominate *P. s. simonius* STGR. should be not

great, but historically the watershed between the two (Kyrgyzian and Chinese) Kyzyl-Su rivers (3600 m) was fully covered by ice and broke the contacts of two related taxa - so, it is better to keep the subspecies status for *P. s. nigrificatus* KREUZBERG.

Parnassius s. mentor subspec. nov. is populates two large mountain chains situated between Alai sensu stricto and Fergana Valley: Kuruk-Sai and Collectorsky Ranges; it must be found in the neighbouring parts of the main chain of Alai, too. This subspecies has large size, the wing shape comparatively recalling *P. boedromius* PUENG., and more developed black pattern, while the sexual dimorphism is faint (as in *P. simonius* STGR.-*P. s. nigrificatus* KREUZBERG).

Parnassius s. taldicus GUNDOROV also has slightly wider wings than *P. s. simonius* STGR. (but not as in *P. s. mentor* subspec. nov.), developed blackish pattern (more or less similar to that of *P. s. nigrificatus* KREUZBERG but with a widened submarginal band on the FW); the common ♀-form differs considerably from the ♂ because of the greyish suffusion. *Parnassius s. taldicus* GUNDOROV was known only from Taldyk Pass, but A. SOCHIVKO found it in the eastern edges of Alai, at the border with Fergansky Mts. (upper stream of Alaiku River). The small series collected seems to be very similar to the typical *P. s. taldicus* GUNDOROV, only the eyes are more frequently developed, while the black pattern is even enlarged. However, I suppose that this population needs no special name. So, the area covers all northern slopes of East Alai (from the main chain near Taldyk to the north-eastern edges). Certainly, *P. s. taldicus* GUNDOROV is distributed along the southern slopes of Alai too - towards Irkeshtam where this subspecies should meet *P. s. nigrificatus* KREUZBERG. There are no records from the Fergansky Range.

The yellowish *P. s. saluki* subspec. nov. occupies the southern part of the so-called Inner Tian-Shan; its area must be connected with that of *P. boedromius* PUENG. The genitalia of the two species are very different - thus, the hybridization is possible only as extremely rare exceptions. The traces of the former natural selection are present because the nearest *P. boedromius* PUENG. populations have large distal blades of the uncus while *P. s. saluki* subspec. nov. has these blades even smaller than in other subspecies. Some strange phenotypic forms have also been registered. Surprisingly, the Tianshanian butterflies show some similarity to the nominate race and *P. s. nigrificatus* KREUZBERG but not to *P. s. taldicus* GUNDOROV. This important fact demonstrates that serious and productive contacts between the southern Tian-Shan and the Alai Valley took place in the past. This fact, new for the zoogeography, will be discussed further in the second part of the paper.

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References

- AVINOV, A. N. (1913): Quelques formes nouvelles du genre *Parnassius* LATR. - Horae Soc. Ent. Ross. **40**: 1-21, Tab.II, St.-Petersburg (in Russian).
- BRYK, F. (1935): Lepidoptera Parnassiidae pars II. (Subfam. Parnassiinae). - Das Tierreich. Walther de Gruyter & Co, Berlin und Leipzig.
- CHURKIN, S. V. (2002): Review of the *Erebia meta* species-group from the Tian-Shan and Alai regions with some notes on zoogeography and evolution (Lepidoptera, Satyridae). - Helios **III**: 50-93, pls. V-VI, Moscow.
- CHURKIN, S. V. (2006): A new species of *Parnassius* LATREILLE, 1804 from Kyrgyzstan (Lepidoptera, Papilionidae). - Helios **VII**: 142-158, pls. XI-XV, Moscow.
- DIETZ, M. (2002): *Parnassius (Tadumia) simo* GRAY, 1852; *Parnassius (Tadumia) andreji* EISNER, 1930. *Parnassius (Tadumia) simonius* STAUDINGER, 1889. *Parnassius (Tadumia) boedromius* PUENGELER, 1901. *Parnassius (Tadumia) tenedius* EVERSMANN, 1851. *Parnassius (Tadumia) arcticus* EISNER, 1968. - Asiatische Parnassier und ihre Verbreitungs-Gebiete. Teil **13**: 1 -31, figs., Solms.
- GUNDOROV, S. (1991): New subspecies of *Parnassius simonius* from Central Asia (Lepidoptera, Papilionidae). - Lambillionea, XCI (4): 379, Bruxelles.
- Gundorov, S. (1998): Taxonomic notes on the *Parnassius simonius* complex (Lepidoptera, Papilionidae) from Middle Asia (Alai and Transalai Mts.). - Trans. lepid. soc. Japan **49** (3): 196-198, Tokyo.
- KREUZBERG, A. V-A. (1985): Parnassians of the *delphius*, *charltonius*, *simo* groups (Lepidoptera, Papilionidae) of the fauna of USSR. - In: Studies of flora and fauna in Middle Asia, 25-68, 7 figs., Tashkent (in Russian).
- KREUZBERG, A. V-A. (1986): New subspecies of the *Parnassius simo* group (Lepidoptera, Papilionidae) from Central Asia. - Vestn. zool. **1986** (2): 85-87, fig.1-3, St.-Petersburg. (in Russian).
- KREUZBERG, A. V-A. (1989): New subspecies of Papilionids and Whites (Lepidoptera, Papilionidae, Pieridae). - Vestn. zool. **1989** (6): 31-41, fig.1-10, St.-Petersburg (in Russian).
- KREUZBERG, A. V-A. & I. Pljutsh (1992): New *Parnassius* Butterfly Subspecies (Lepidoptera, Papilionidae) from the East Palaeartics. - Vestn. zool. **1992** (2): 78-80, St.-Petersburg (in Russian).
- KUZNETSOV, V. I. & A. A. STEKOLNIKOV (1995): Phylogenetic and taxonomical remarks on the genera *Hypermnestra* and *Parnassius* by the results of study of the male genitalia (Lepidoptera, Papilionidae). - Vestnik SPbU **3** (2): 3-8, St.-Petersburg (in Russian)
- MICHEL, F., REBOURGE, C., COSSON, E. & H. DESCIMON (2008): Molecular phylogeny of Parnassiinae butterflies (Lepidoptera, Papilionidae) based on the sequences of four mitochondrial DNA segments. - Ann. soc. entomol. Fr. **44** (1): 1-36, Paris.
- OMOTO, K., YONEZAWA & T. SHINKAWA (2009): Molecular systematics and evolution of the recently discovered "Parnassian" butterfly (*Parnassius davydovi* CHURKIN, 2006) and its allied species (Lepidoptera, Papilionidae). - Gene, in press.
- PUENGELER, R. (1901): Neue Macrolepidopteren aus Centralasien. - Dt. Ent. Z. Iris **14**: 177-191, pls. 1-3, Dresden.
- ROSE, K. (2005): Zur Verbreitung und subspezifischen Gliederung von *Parnassius simo* GRAY, 1852 in China (Lepidoptera, Papilionidae). - Nachr. Ent.. Ver. Apollo **26** (1/2): 1-14,

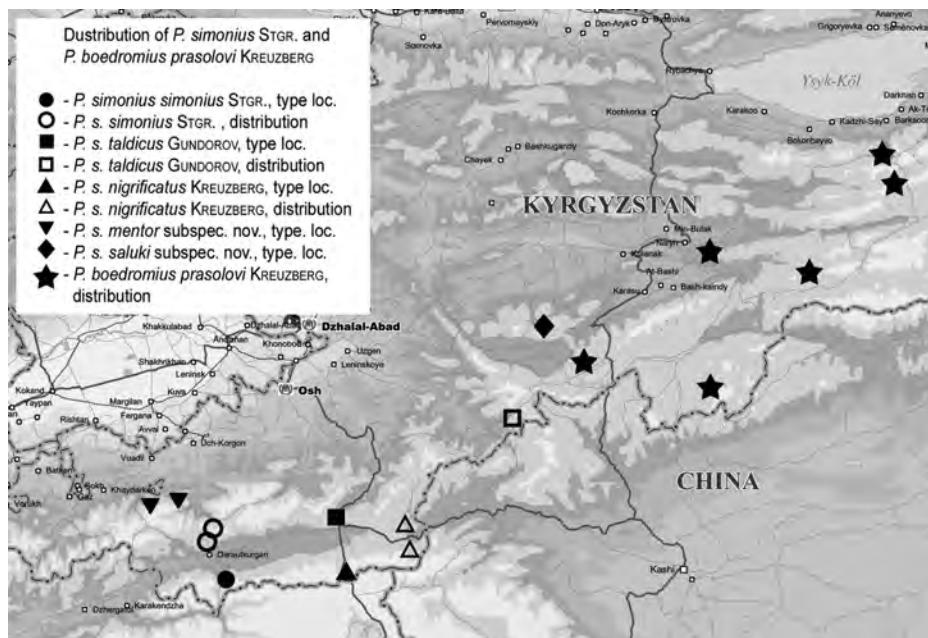
Frankfurt a. M.

- SAKAI, S., INAOKA, S., AOKI, T., YAMAGUCHI, S. & Y. WATANABE (2002): *Parnassius*. The Parnassiology. The *Parnassius* Butterflies. A Study in Evolution. - Tokyo (in Japanese).
- STEKOLNIKOV, A. A. & V. I. KUZNETSOV (2003): Evolution of the male genitalia, phylogeny and systematic position of the subfamilies Baroninae SALVIN, 1893, Luehdorfinae TUTT, 1896, stat. n., and Zerynthinae GROTE, 1899 in the family Papilionidae (Lepidoptera). - Ent. Obozr. 3 : 548-565, St.-Petersburg (in Russian).
- TOROPOV, S. A. & A. B. ZHDANKO (2006): The butterflies (Lepidoptera, Papilionoidea) of Dzhungar, Tien Shan, Alai and Eastern Pamirs. Volume 1. Papilionidae, Pieridae, Satyridae. - Bishkek.
- TSHIKOLOVETS, V. V. [2004]: Butterflies of Tadzhikistan. - Kyiv-Brno.
- TSHIKOLOVETS, V. V. (2005): Butterflies of Kyrgyzstan. - Brno-Kyiv.
- TUZOV, V. K., BOGDANOV, P. V., DEVYATKIN, A. L., KAABAK, L. V., KOROLEV, V. A., MURZIN, V. S., SAMODUROV, G. D. & V. A. TARASOV (2000): Guide to the butterflies of Russia and adjacent territories. Vol. 1. - Pensoft, Sofia-Moscow.
- WEISS, J.-C. (1991): The Parnassinae of the World. Part 1. - Science Nat, Venette.

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Distribution map of the *Parnassius simonius* STAUDINGER, 1889 and *P. boedromius prasolovi* KREUZBERG, 1986.

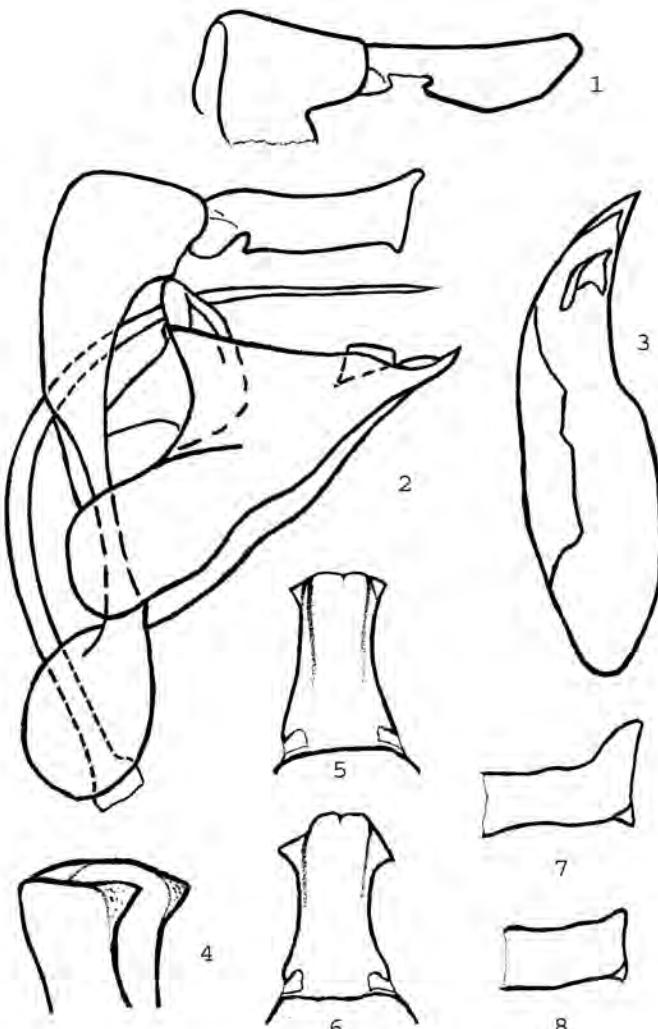


Fig. 1: *Parnassius simo* GRAY, 1852, uncus and tegumen, lateral view, East Pamir, 50 km fr. Murgab.
 Figs. 2 - 8: *Parnassius boedromius* PUENGELE, 1901, ♂ genitalia. 2: *P. b. prasolovi* KREUZBERG, 1986, lateral view of the genitalia, Tian-Shan, Dzhetim-Bel Mts., Suek pass; 3: *P. b. prasolovi* KREUZBERG, valva and harpe, inner view (same loc. as 2); 4: *P. b. prasolovi* KREUZBERG, distal end of uncus, dorsal view (Tian-Shan, SW At-Bashi, Karasu R.); 5: *P. b. prasolovi* KREUZBERG, uncus, dorsal view (same loc. as 2); 6: *P. b. hohlebecki* AVINOV, 1913, uncus, dorsal view, Kirgizsky Mts., Shamsi; 7: *b. marcopolo* WEISS, 1994, distal end of uncus, lateral view, China, Boro-Choro, North from Ad-UNKUR Pass, S. MURZIN leg.; 8: *P. b. hohlebecki* AVINOV, 1913, distal end of uncus, lateral view (same data as 6).

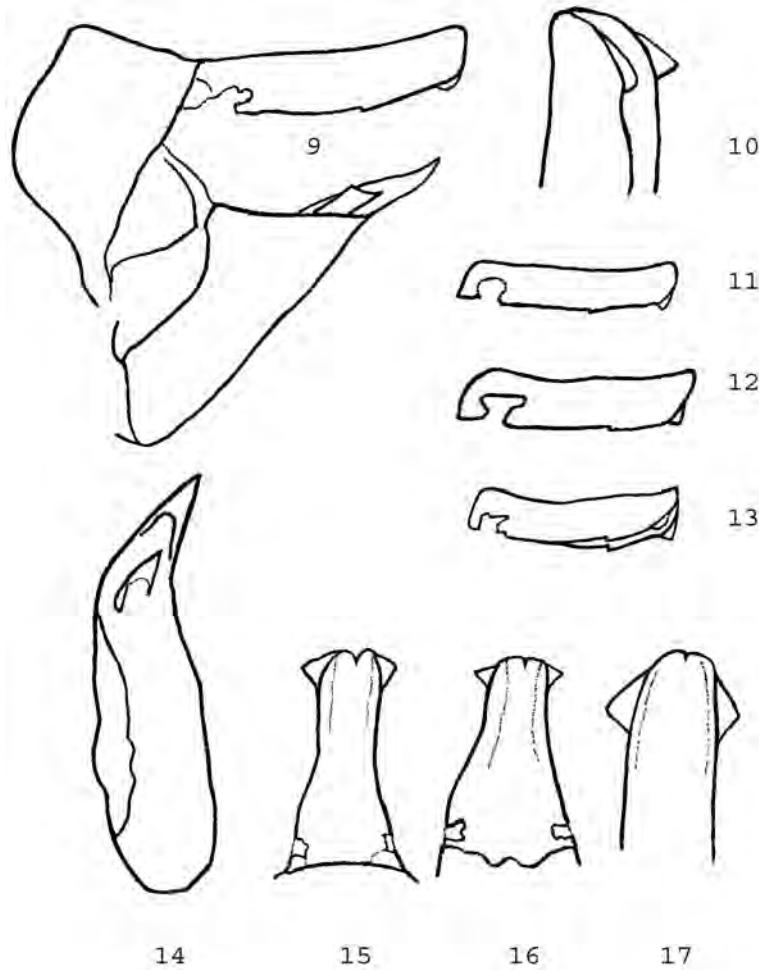


Fig. 9 -17: *Parnassius simonius* STAUDINGER, 1889, ♂ genitalia. 9: *P. s. simonius* STGR., lateral view of the genitalia, W. Transalai, Aram-Kungei; 10: *P. s. simonius* STGR., distal end of uncus, ventral/lateral view (same loc. as 9); 11: *P. s. nigrificatus* KREUZBERG, uncus, lateral view, E. Transalai, Marcansu R.; 12-13: *P. s. saluki* **subspec. nov.**, uncus, lateral and ventral/lateral view, Tian-Shan, Bavachal R.; 14: *P. s. simonius* STGR., valva and harpe, inner view (same loc. as 9); 15: *P. s. simonius* STGR., uncus with incision, dorsal view (Aram-Kungei); 16: *P. s. saluki* **subspec. nov.**, uncus, dorsal view (same loc. as 13); 17: *P. s. simonius* STGR., end of uncus without incision, enlarged, Aram-Kungei.

Colour plate 3/ Farbtafel 3



Fig.1, 2: *Parnassius staudingeri vladimir* subspec. nov., Kyrgyzstan, Tian-Shan, Naryn reg., Baetovo distr., Bavachal R., 3600 m, 10.-12.VII.2007, S. CHURKIN leg., fig. 1: holotype ♂, fig. 2 paratype ♀.

Colour plate 3a/ Farbtafel 3a

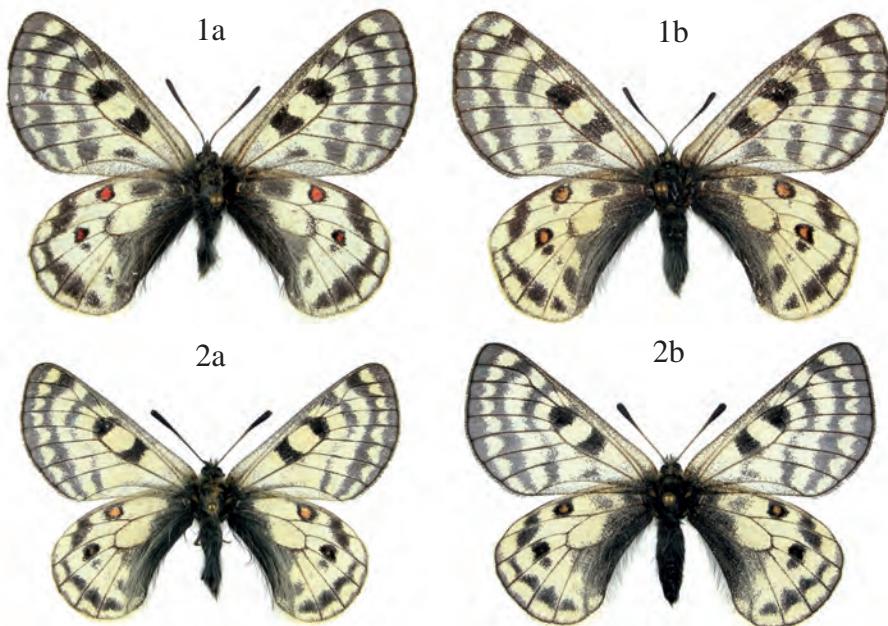


Fig.1a, 1b: *Parnassius simonius. mentor* subspec. nov., (1a) holotype ♂, (1b) paratype ♀, Alai, Collectorsky Range, Dugoba R., 3600 m, 5.VII.1995.

Fig. 2a, 2b: *Parnassius simonius saluki* subspec. nov., (2a) holotype ♀, (2b) paratype ♀, Tian-Shan, Naryn reg., Baetovo distr., Bavachal R., 3600 m, 16.-17.VII.2009, S. CHURKIN leg.