

A new species of *Parnassius* LATREILLE, 1804 from Kyrgyzstan (Lepidoptera, Papilionidae)

BY SERGEI CHURKIN

SUMMARY

A new species, *Parnassius davydovi* sp. nova, from Kyrgyzstan (type locality – Moldo-Too *Mis.*, Sary-Bulak loc.) is described. The new species belongs to the *charltonius* group of species, being closely related to *P. loxias* PÜENGELER, 1901 but differing significantly in some external characters and the genitalia. The relations within whole group of species are discussed basing on the structure of the genitalia.

РЕЗЮМЕ

В статье описан новый вид аполлонов из Киргизии *Parnassius davydovi* sp. nova (типовая местность – хребет Молдо-Тоо, Сары-Булак). Новый вид относится к группе видов *charltonius* и тесно связан с *P. loxias* PÜENGELER, 1901, от которого серьезно отличается как по внешним признакам, так и по признакам гениталий. На основании строения последних обсуждается структура всей группы видов.

KEY WORDS

Parnassius, davydovi, autocrator, charltonius, loxias, zoogeography, Tian-Shan, Lepidoptera, taxonomy, Kyrgyzstan, new taxon.

INTRODUCTION

The new species of *Parnassius* LATREILLE, 1804 was collected in 2005. Several years ago I supposed that such a butterfly could be found; however, it was very possible that this species had been totally extinct in the past or extremely local. Fortunately, it is alive and exists. The new species is closely related to *P. loxias* PÜENGELER, 1901, described from Chinese Aksu. The nominotypical *P. loxias* is not identical to *P. loxias tashkorensis* KREUZBERG, 1984, populating Kaingdy-Katta Range (Sarydzhas River valley, Kyrgyzstan). The status of the last taxon is out of the limits of the present paper (it is necessary to have fresh and more or less numerous *P. loxias loxias*, what is impossible now) but the diagnosis will be made in comparison with the Kyrgysian /oxias-populations as being the nearest to the new taxon.

The questions of the generic and subgeneric systematics of different complexes of *Parnassius* are not discussed here.

The holotype will be deposited in the Darwin State Museum (Moscow), a paratype is preserved in the collection of the Museum of the Zoological Institute of the Russian Academy of Sciences (S.Petersburg). Other paratypes are preserved in the collections of the author as well as in those of K. ROSE (Mainz, Germany), K. MATSUMOTO (Tokyo, Japan), A. HOSHINO (Yokohama, Japan), P. BEDA (Moscow, Russia), B. KHRAMOV (S.-Petersburg, Russia), V. PLETNEV (Moscow, Russia), M. DAVYDOV (Moscow, Russia).

ABBREVIATIONS

FW – fore wing HW – hind wing TL – type locality

Parnassius davydovi sp. nova

Holotype: male, Tian-Shan, Moldo-Too Mts., Sary-Bulak loc., 10-12.07.2005, 2500-2600 m, S. CHURKIN leg.

Paratypes: 29 males, 9 females, same data, S. CHURKIN, V. PLETNEV & S. SALUK leg.

Colour plates XI [the holotype and a female paratype]; **XII**: 3, 4; **XIII**: 3, 4; **XIV**: 3, 4; **XV**: 3, 4.

Description and diagnosis.

The colouration of the body, antennae, etc. seems to be without valuable characters.

Male. FW length: 37 mm in the holotype, 35.5 – 39 mm in the paratypes (average wingspan 65-69 mm),

The size is much larger than in *P. loxias* (32-34 mm, average wingspan – 56-57 mm), being larger than in *P. autocrator* AVINOV, 1913 but slightly smaller than in *P. charltonius romanovi* GRUM-GRSHIMAILO, 1885 (i.e. nearly the same as in the smaller *P. charltonius vaporosus* AVTNOV, 191

The main pattern is similar to that of *P. loxias* but nearly all characters are not identical. The ground colour is milky-whitish. The wing shape is more extended than in *P. loxias*.

The dark submarginal band on the FW is not blackish as in *P. loxias*, having the same degree of darkening as the the marginal subhyaline band. The whitish band between the submarginal and marginal dark bands is not crossed by darkened veins and is obviously wider than in *P. loxias*. The submarginal band sometimes is divided to clearly separate spots.

The two black spots situated in the discal cell have the same shape as in *P. loxias* – i.e. often rectangular (especially the first spot), but sometimes more or less oval. A dark (but not black) spot is always present in the postdiscal area

between Cu2 and 2A veins, this being one of the most serious distinctions (this spot is developed in *P. charitonius*).

HW with two large red ocelli; the costal eye-spot is much larger than the median one. This character is opposite to that in *P. charltonius* or *P. autocrator*, being typical *ior ioxias* – but in the last species the differences in size between the very small costal and median eyes are not so sharp, sometimes even not conspicuous. The shape of the costal spot is not rounded but angled being relatively square (only very rarely it is a little bit rounded), the colour is deep red in fresh specimens. Two males have distinct whitish touches inside, while some more individuals have indistinct whitish suffusion. The median eye consists of two parts, as it is in *P. charltonius* (only their size is small) – the larger part is situated between M1 and M2, while the smaller, sometimes not conspicuous appendix is between M2 and M3. The whitish suffusion inside the median spot is practically absent. The position of the median spot is very important: this spot is placed closer to the discal cell than to the nearest submarginal spot. In *P. loxias* the position of the median eye is opposite: this has obviously moved towards the submarginal spot.

The submarginal pattern is also different from that of *P. loxias*: the bluish suffusion in spots is considerably reduced, the submarginal and marginal areas are not darkened but have normal white ground colour, only the very narrow marginal dark band is developed; rarely, a diffuse dark area is present around the submarginal spots not touching the margins (in addition, the ends of the veins can be slightly darkened).

The underside represents the same pattern as the upperside, with 3 exceptions on the HW: the discal vein is dark, the anal marks are present (two dark spots in the basal area situated between anal margin, 2A and Cu2), and an additional dark line is developed near the base of the HW between SC + R and Rs. This line is distinctly and widely bordered with reddish colour from the inner side. *P. loxias* has neither anal markings, nor the basal costal line (except very rare cases when the latter is faintly visible but is never bordered with reddish).

The discal vein is rarely darkened in *P. loxias*, and this is correlated with the development of dark basal suffusion (worthy to note that in the new species this suffusion is significantly reduced, the underside being more whitish). The black-and-red costal basal line is developed only in *P. charltonius*; the same is true for the anal markings (which in the latter often have reddish spots inside).

Female. FW length is 39 – 41 mm (maximum average wingspan 76 mm). The size is larger than in the males statistically but obviously – in contrast to *P. loxias*, in which this difference is nearly absent (FW length 32-35 mm). The shape of the wings is more extended than in the males and much more obviously extended than in the females of *P. ioxias*.

In general, in comparison to the males the black pattern is reduced, but all specific features are distinct. The submarginal dark band is often divided to separate spots, the dark postdiscal spot between Cu2 and 2A veins being small.

The size of the HW ocelli is only slightly statistically larger than in the males, while the submarginal spots are significantly reduced, having no complete shape and often losing the main part of the bluish scales – so that the differences between the females of the new species and the *loxias*-females are more than between the males. However, the *tox/os*-females rarely have small but distinct anal markings (the female figured at the colour plate XfV: 2 presents a very rare form with developed yellow anal spot).

Genitalia. The recent serious comparative study of the structure and evolution of the male genitalia in different Papilionidae were published by V.I. KUZNETZOV and A.A. STEKOLNIKOV (1988, 1995, 2003). These authors discover the functions of different muscles and sclerites and show that Parnassinae have some apomorphic characters; the evolution of the uncus being discussed is also very important for the present work (some confusion in the terminology and identification of the uncus and related sclerites takes place in the paper published by OGATA et al. (1957) where the structure of the Parnassus-genitalia was also investigated). The male genitalia (and sphragis) of the *P. charltonius* group of species are figured by SAKAI et al (2002). I have examined the genitalia of 4 species, while *P. inopinatus* KOTZSCH was excluded because of the lack of sufficient material (this species is often treated as belonging to this group but this needs confirmation – the (“*nopmapus*-sphragis seems to be different from those of *autocrator-davydovi-loxias*),

Firstly, it is important to subdivide the group into two parts: *P. charltonius* has distinct and deep differences from all other related species.

The general structure of the genitalia is shown on the fig. 1. The uncus is represented by two separate sclerites, the valvae are widely joined in their basal parts, each valva having a screw-like shape, long distal process (ending with very long and thick hairs] and a strong harpe. The aedeagus seems to bear apomorphic characters, being long and thin.

P. charltonius (fig. 2 – a; 4 – a, e; 5 – a, d; 6 – a) sharply differs from other species in the absence of the distal process of (the valva which is simply rounded at the end; the harpe is slightly reduced in size, while the juxta and saccus are enlarged. In addition, the valvae of *P. charltonius* are not placed in a ventral position, but slightly more divided in their basal parts and moved to the lateral positions, being flattened and losing a screw-like shape. All these characters are apomorphic. In addition, the *charltonius*-females have a very special and unusual sphragis – snail-formed. Such serious differences would be enough to place *P. charltonius* into separate group of species (monotypical) but a more detailed

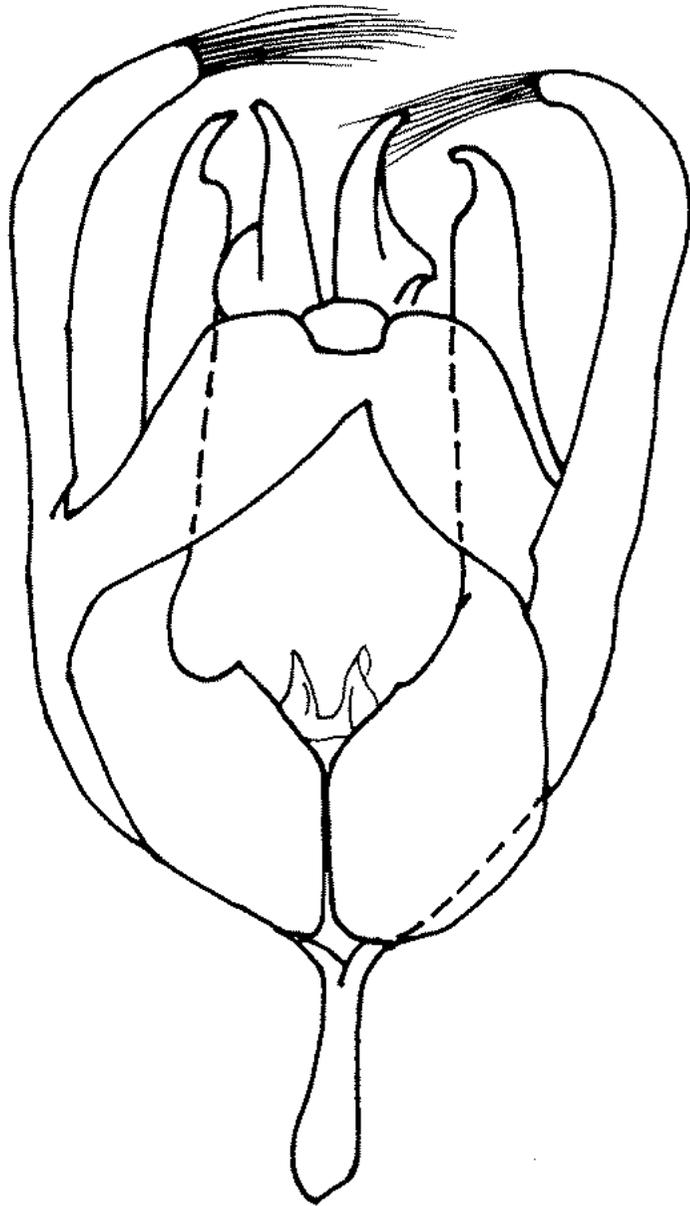


Fig. 1. *Parnassius autocrator*, male genitalia, dorsal view (Tadjikistan, Vanch Mts., Gyshkhun)

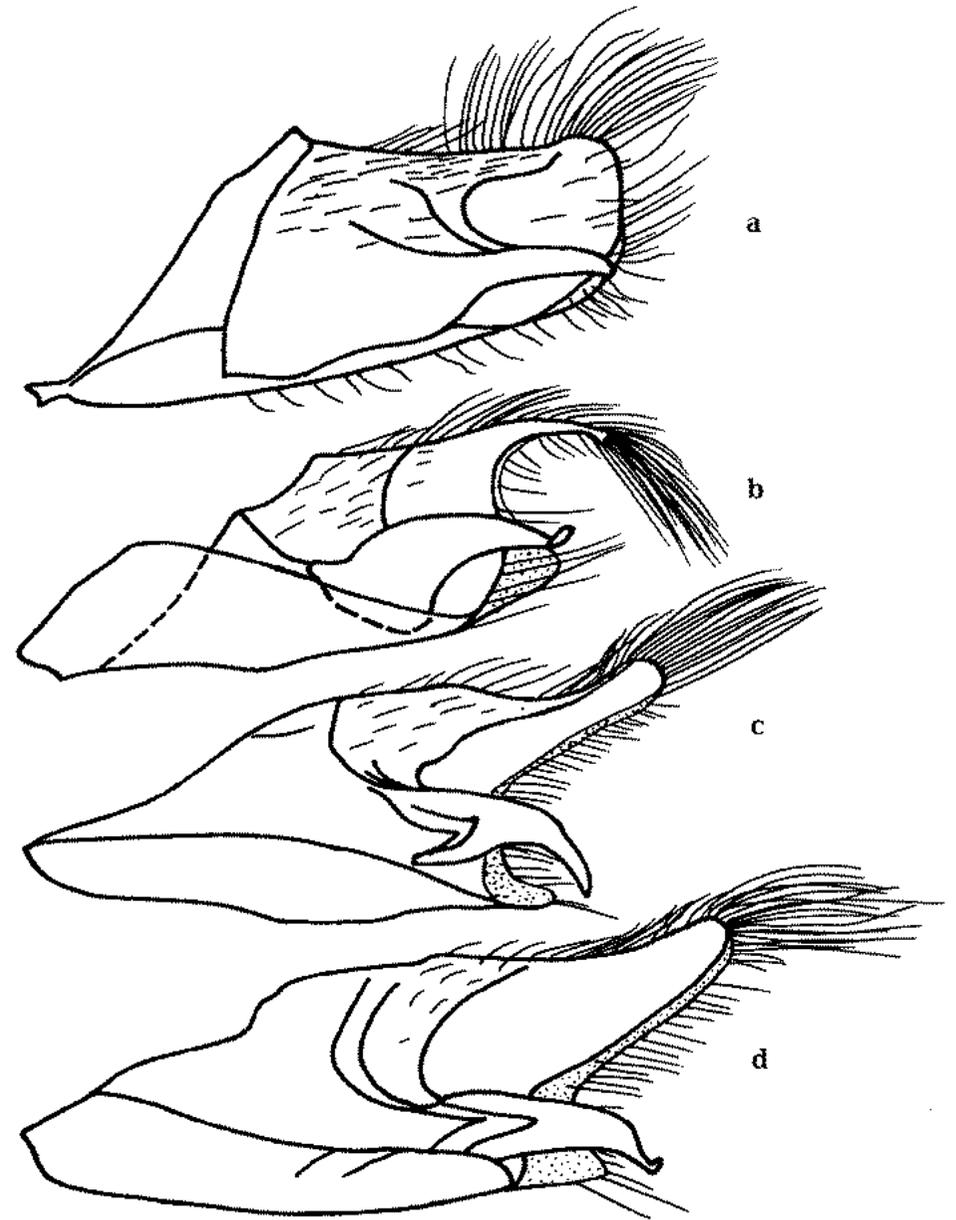


Fig. 2. *Parnassius* spp., valva, inner lateral view: a – *P. charltonius* (Transalai, Aram-Kungei); b – *P. autocrator* (Vanch, Gyshkhun); c – *P. loxias* (Kaingdy-Katta, Tashkoro); d – *P. davidovi* (paratype)

analysis and historical reconstruction do not support this system: all 4 species have monophyletic origin (see below).

Three species – *P. autocrator*, *P. loxias* and *P. davydovi* – have an identical structure of the genitalia (and sphragis), with some plesiomorphic characters. The existing constant distinctions clearly confirm the species status of the taxa – moreover, the hiatuses between them are much more significant than those between the younger species in other known complexes of the vicariants (in *Erebia* or *Melitaea*, for example).

The distal process of the valva has no important taxonomic value, but the distal membranous haired area is nearly identical in *P. autocrator* and *P. davydovi* being obviously narrower in *P. loxias* (fig. 2). The harpe has more important characters, the differences in the shape are obvious even from the simple angle of view (fig.3).

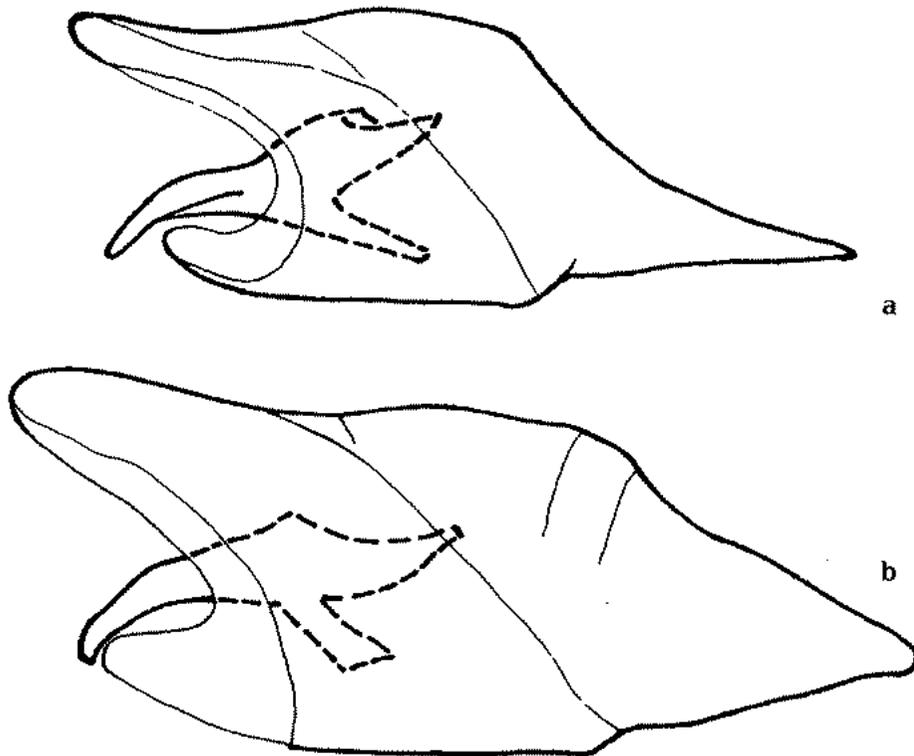


Fig. 3. *Parnassius* spp., valva, lateral view: a – *P. loxias* (Kaingdy-Katta, Tashkoro); b – *P. davydovi* (paratype)

Actually, the harpe of *P. autocrator* and *P. davydovi* is much stronger, larger and flattened, while *P. loxias* displays a gracile type, the “legs” being strongly moved apart and the hollow in the median part being much more developed (i.e., the harpe is not flattened); the distal process is thin, with an evenly tapered end. In *P. davydovi* the distal process is much stronger, the distal end is short and looks like a real hook (fig. 5: g, h, i).

The saccus (fig. 1, fig. 5 – a, b, c) is not so taxonomically valuable, while the juxta has really different shape in all 3 species (fig. 1, 5 – d, e, f – only the right part is figured) – but it is not so easy to use it because of the small size and complex shape which is difficult to understand.

The aedeagus (fig. 6) looks nearly identical in *P. autocrator* and *P. loxias*, being straight (but in *P. autocrator* the basal part is longer), while in *P. davydovi* it is always undulate.

The uncus (fig. 4) provides the most obvious and valuable distinctions. In *P. charitonius* its two parts are not so widely separated (even slightly recalling a very old plesiomorphic variant with a single uncus) but have some additional small spines on the ventral side, two spines on each sclerite. I believe that such a structure represents the second return of the old character correlated with the lateral position of the valvae and their simplification.

The uncus of *P. loxias* and *P. autocrator* is relatively similar, being strong with a widened base and large basal process developed at the ventral-lateral side of each sclerite. In *P. autocrator* the uncus is much more massive and widened. *P. davydovi* has clearly another type of the structure: the bases of the sclerites are nearly not widened, having the same width throughout; the ventral-lateral processes are conspicuously reduced. I suppose that it represents a simplification for the second time, because all other external features show the old (plesiomorphic) characters – large eye-spots, large size, simple sphragis, etc.

The sphragis (colour plate XV) of all 3 species has a simple shape, being short in *P. loxias*, long in *P. autocrator*. The females of the new species have the sphragis even more similar to the *autocrator*-females – relatively long. It seems very important that the inner structure of the sphragis is also different between *loxias* and *autocrator-davydovi*: in the last two species it consists of linear “fibres”, which can be seen even without considerable magnification. In *P. loxias* the distal third part (at least] of the sphragis is composed by the circular fibres (which are developed in both other species only at the narrow distal margins). Worth to note that the bend which is conspicuous on the ventral surface of the sphragis of *P. loxias* and *P. davydovi* does not represent a taxonomically valuable character – it is variable and not constant (but, at the same time, not found in *P. autocrator*).

Biology and distribution. Known only from the type locality. The foodplant is *Corydalis* sp. The butterflies populate a very small dry steep rocky valley (200 m x 100 m) – certainly having water and small waterfalls in spring – situated inside the 10-km rocky bridge. Except very rare cases, the butterflies did not visit other parts of this giant rocky system.

The behaviour of the butterflies is very similar to that known for *P. loxias* and *P. autocrator* (KREUZBERG, 1985, 1987, 1989],

Etymology. The species is named after Mr. Mikhail DAVYDOV (Moscow), my friend, who has one of the Russia's largest collection of the world Lepidoptera.

DISCUSSION

The new species has the pattern of the external colouration as in *P. loxias*, but readily differs from it in the developed additional spot on FW, shifted position of the median ocelli on the HW upperside, large size of the ocelli and developed reddish-and-dark basal line on the HW underside (and many other minor distinctions). A part of the pattern, especially the underside of the HW, looks more similar to that of *P. charltonius* [developed anal markings, reddish-and-dark basal line, additional spot on the FW upperside), while the genitalia combine the characters of *P. autocrator* and *P. loxias*, being more similar to the genitalia of *P. autocrator*. The uncus and the aedeagus have specific features, the structure of the harpe and juxta being not so valuable but also important. The sphragis shows closer relations to *P. autocrator* than to *P. loxias*.

Such a version of the relations seems to be very interesting. It is clear that the ancestor of this group had the genitalia relatively similar to those of the *autocrator-loxias* complex (which have more plesiomorphic characters), only the shape of the uncus was later seriously transformed. It was a large butterfly with large angled ocelli, inhabiting hot dry rocks – exactly *P. davydovi* seems to be most close to the ancestor.

Later, the ancestor populations divided into two parts – one represented the former ancestor of the 3 species, while another transformed to *P. charltonius* with the relatively apomorphic genitalia and rounded ocelli. A very wide distribution of the last species confirms its relatively better adaptation compared to other species which keep the old characters and genes and represent the relicts. However, the natural selection between the two parts of the first ancestor clearly separated the forms with an enlarged median eye (*charltonius*) and with an enlarged costal eye (*loxi-as-davydovi*; the position of *autocrator* being not so clear). It is easy to find, that the small costal eye in *P. charltonius* has an angled shape (especially a straight basal side, and especially in the oldest races like ssp. *aenigma* DUBATOLOV & MILKO, 2003), while the shape of the small median eye in *P. davydovi* is nearly

the same as in *P. charltonius*. It means that at first the size of both eyes was simply the same (in the ancestor), while now we observe the results of the former natural selection which acted long time ago when the two old taxa had conjoined areals.

This hypothesis is confirmed by the keeping of some external plesiomorphic characters in the colouration of *P. charltonius* and *P. davydovi* – both species have anal markings (spots) on the HW underside, as well as a relatively coloured and complete underside pattern as a whole.

P. charltonius and *P. autocrator* now may fly together (and this is theoretically possible for *P. davydovi*, but the possibility is very small, in my opinion). This fact supports the idea that the areals of the two “second” ancestor taxa were isolated during a long time. Only later the contacts were restored – but *P. charltonius* became so different from its former relatives that it penetrated their areals.

At the same time or later, the other ancestor “second” race was divided into the known species – *P. autocrator*, *P. loxias* and *P. davydovi*.

All 3 species now represent the relicts the habitats of which are not numerous and the areals of which have decreased. It was a chain of vicariants in the past. *P. autocrator* populated the basin of the tributaries of Amu-Darja River (in Tadjikistan and Kyrgyzstan it includes Pjanzh River with tributaries, and, certainly, Vakhsh River- Kyrgyzian Kyzyl-Su River system, where at present *P. autocrator* is unknown or extinct). *P. davydovi* inhabited / inhabits the basin of Naryn River sensu lato – where now it is nearly absent. It seems that the main part of the former endemics of this (Naryn) zoogeographical district is alive mostly around the upper tributary of Naryn – in the Kekemeran River valley, Suusamyr Range and the northern slopes of Moldo-Too – especially now, when the microclimate of the Naryn River valley sensu stricto was seriously changed by the existing series of water reserves. *P. loxias* populates the territory around the Aksu River valley and its tributary – Sarydzhaz River.

Important, that the known differences between *P. loxias loxias* and *P. loxias tashkorensis* – the enlargement of the dark-black pattern in the last subspecies – represents an opposite cline compared to the distinctions of the whitish *P. davydovi*. The new species displays a combination of the most complete pattern of black spots (similar to that of *P. charltonius*, as I marked) with the general reduction of the dark suffusion; the degree of the blackening of spots is smaller than in *P. loxias tashkorensis*. This variant shows that the origination of *P. loxias* is relatively young but much older than in the really young “glacier” taxa: the broken cline may exist only as a result of the “work” of the natural selection. For such a selection, the areals of *davydovi* and *loxias* should have been connected in the past, this being possible only before all glacier periods, in much warmer climate even than now – at the time when the areals of all species studied were

much larger. The cold period of the history resulted in a total isolation of the Aksu and Naryn valleys by the highlands of Inner Tian-Shan where available conditions for these species are absent. This much longer time of the isolation (compared to the youngest “glacier” species of some *Erebia* or *Melitaea*) resulted in the numerous and clear genitalia distinctions observed above.

This historical reconstruction is not complete, indeed, and may contain some mistakes – but the main hypothesis seems to be logical, having no contradictions and explaining the main known phenomena in the group in study.

ACKNOWLEDGEMENTS

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The photos were made by V. PLETNEV.

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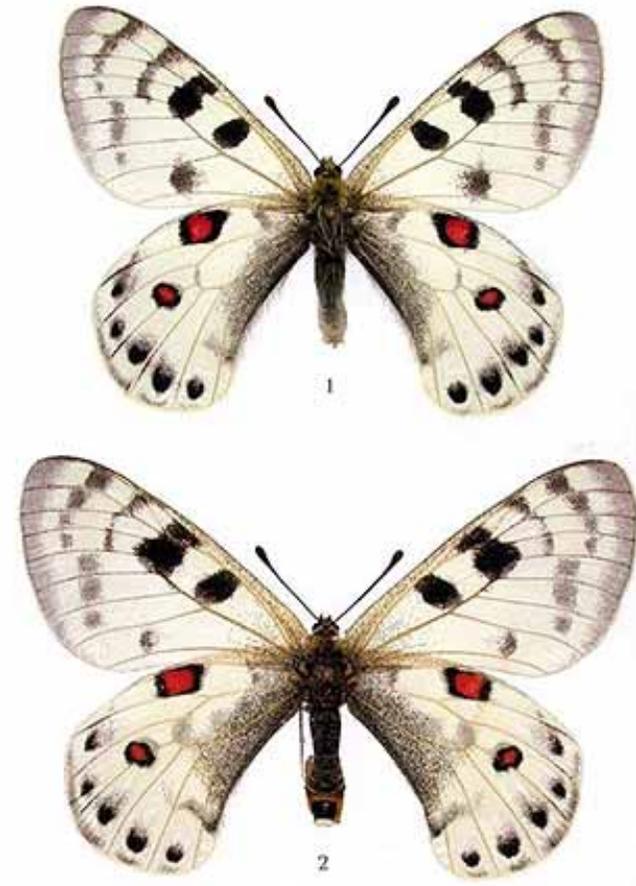
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COLOUR PLATE XI (underside)

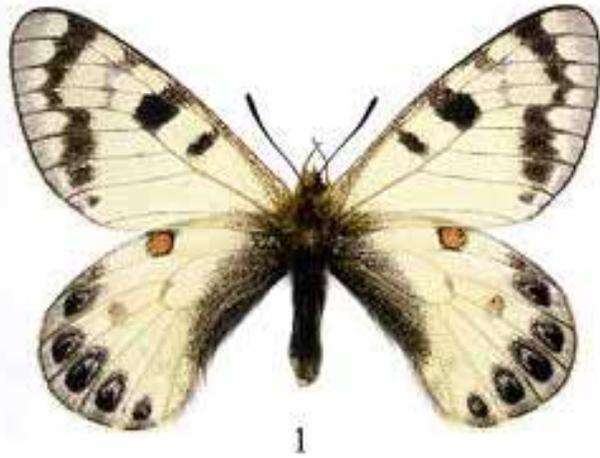
1. *Parnassius davydovi* sp. n., holotype, male, data in the text
2. *P. davydovi* sp. n., paratype, female, same data



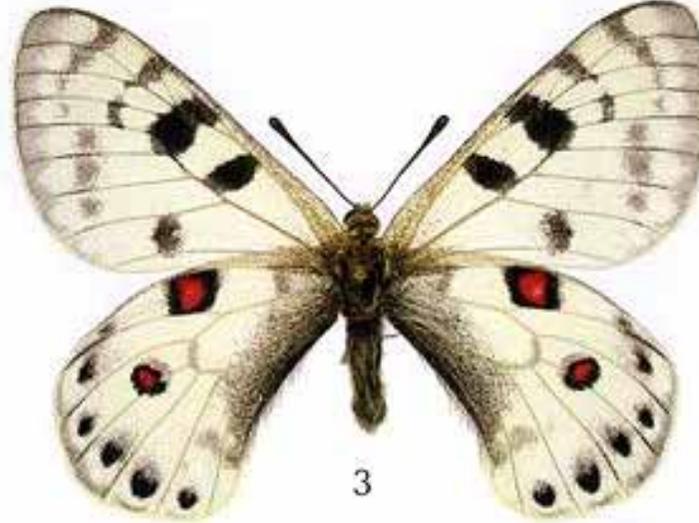
COLOUR PLATE XII (underside)

1. *Pamassius loxias*, male, Tian-Shan, Sary-Dzhas R., Kaingdy-Katta Mts.,
5 km WTashkoro v., 5.07.1989, 3000 m, S. CHURKIN leg.;
2. *P. loxias*, male, same data as 1;
3. *P. davydovi* sp. n., paratype, male, data in the text;

4. *P. davydovi* sp. n., paratype, male, data in the text;
5. *P. charltonius romanovi*, male, West Transalai, Altyn-Dara R.,
Aram-Kungei valley, 3500 m, 10.07.1992, S. CHURKIN
6. *P. charltonius romanovi*, male, same data



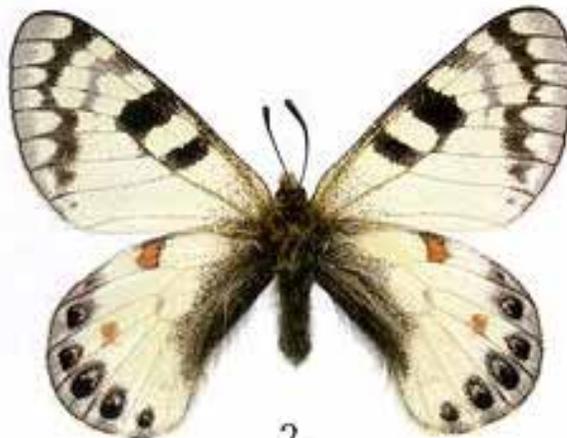
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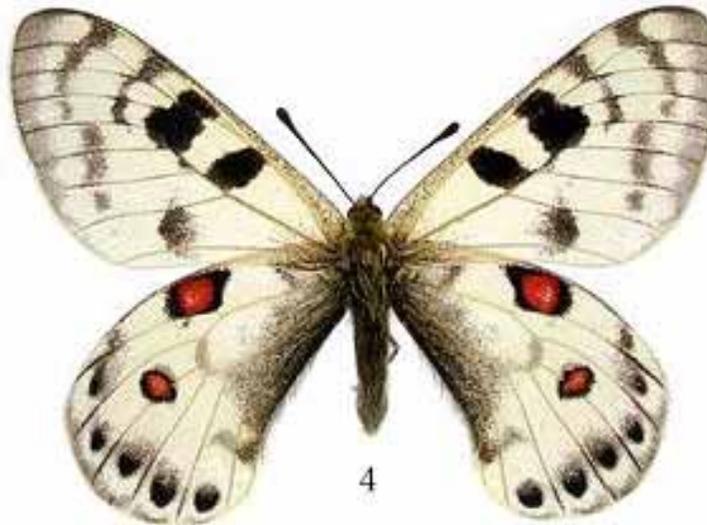
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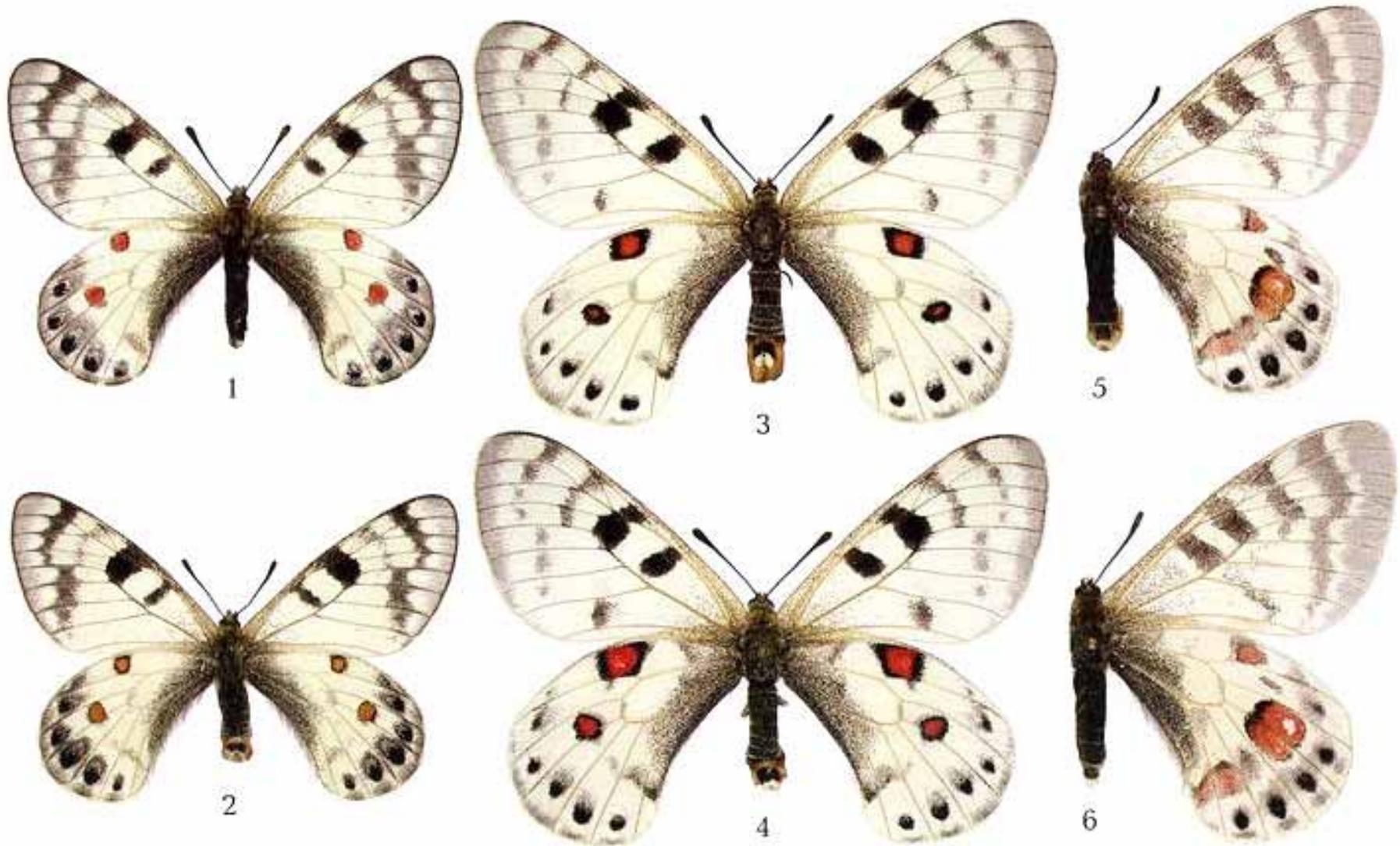


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COLOUR PLATE XIII (underside)

1. *Parnassius loxias*, female, Tian-Shan, Sary-Dzhas R., Kaingdy-Katta Mts., 5 km W Tashkoro v., 7.07-1989, 3000 m, S. CHURKIN leg.;
2. *P. loxias*, female, same loc., 10.07.1998;
3. *P. davydovi* sp. n., paratype, female, data in the text;

4. *P. davydovi* sp. n., paratype, female, data in the text;
5. *P. charltonius romanovi*, female, West Transalai, Altyn-Dara R., Aram-Kungei valley, 3500 m, 10.07.1992, S. CHURKIN leg.;
6. *P. charltonius romanovi*, female, same data as 5



COLOUR PLATE XIV (underside)

1. *Parnassius loxias*, male, Tian-Shan, Sary-Dzhas R., Kaingdy-Kalta Mts.,
5 km W Tashkoro v., 5.07.1989, 3000m, S. CHURKIN leg. ;

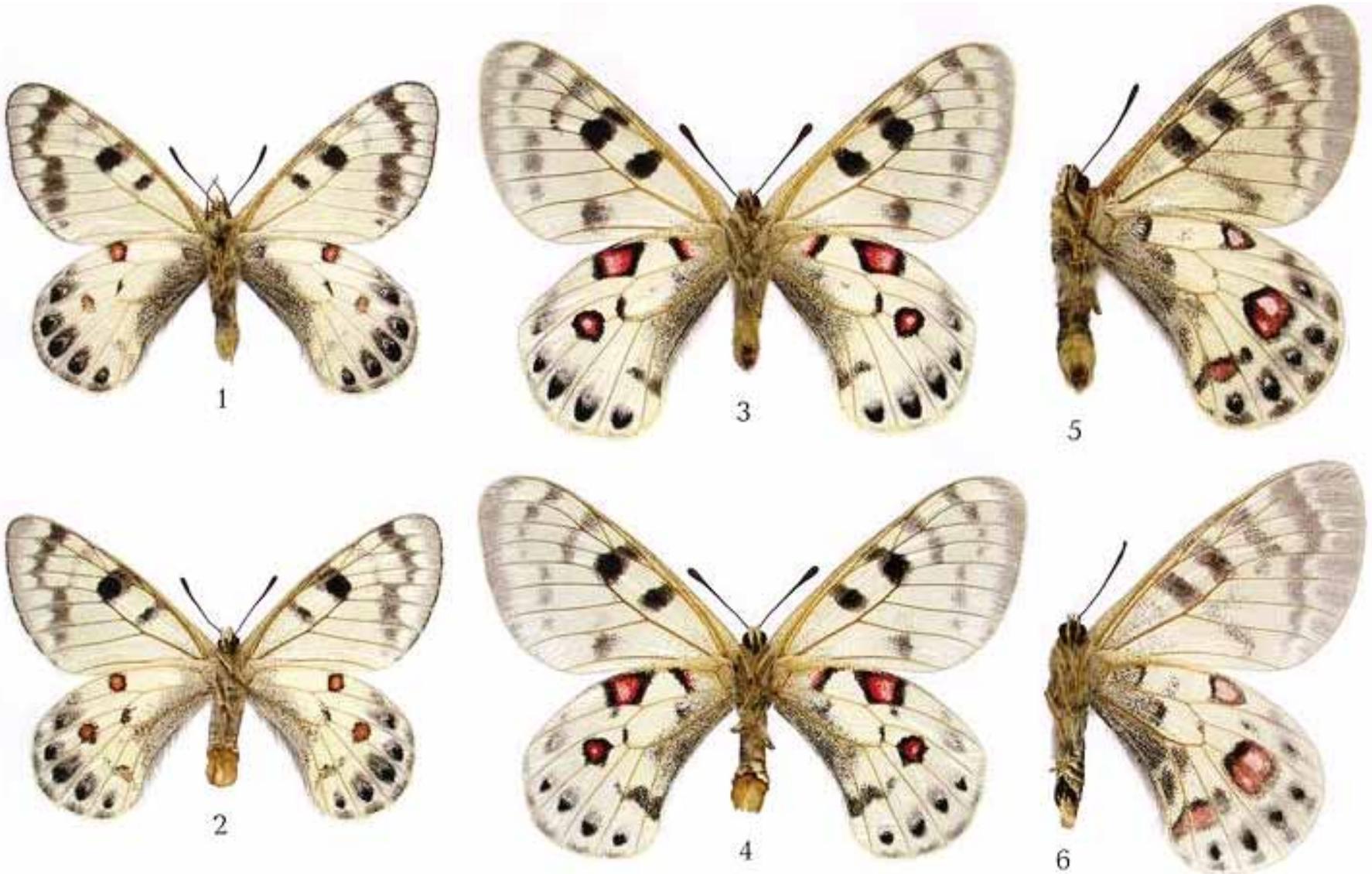
2. *P. loxias*, female, same data as 1;

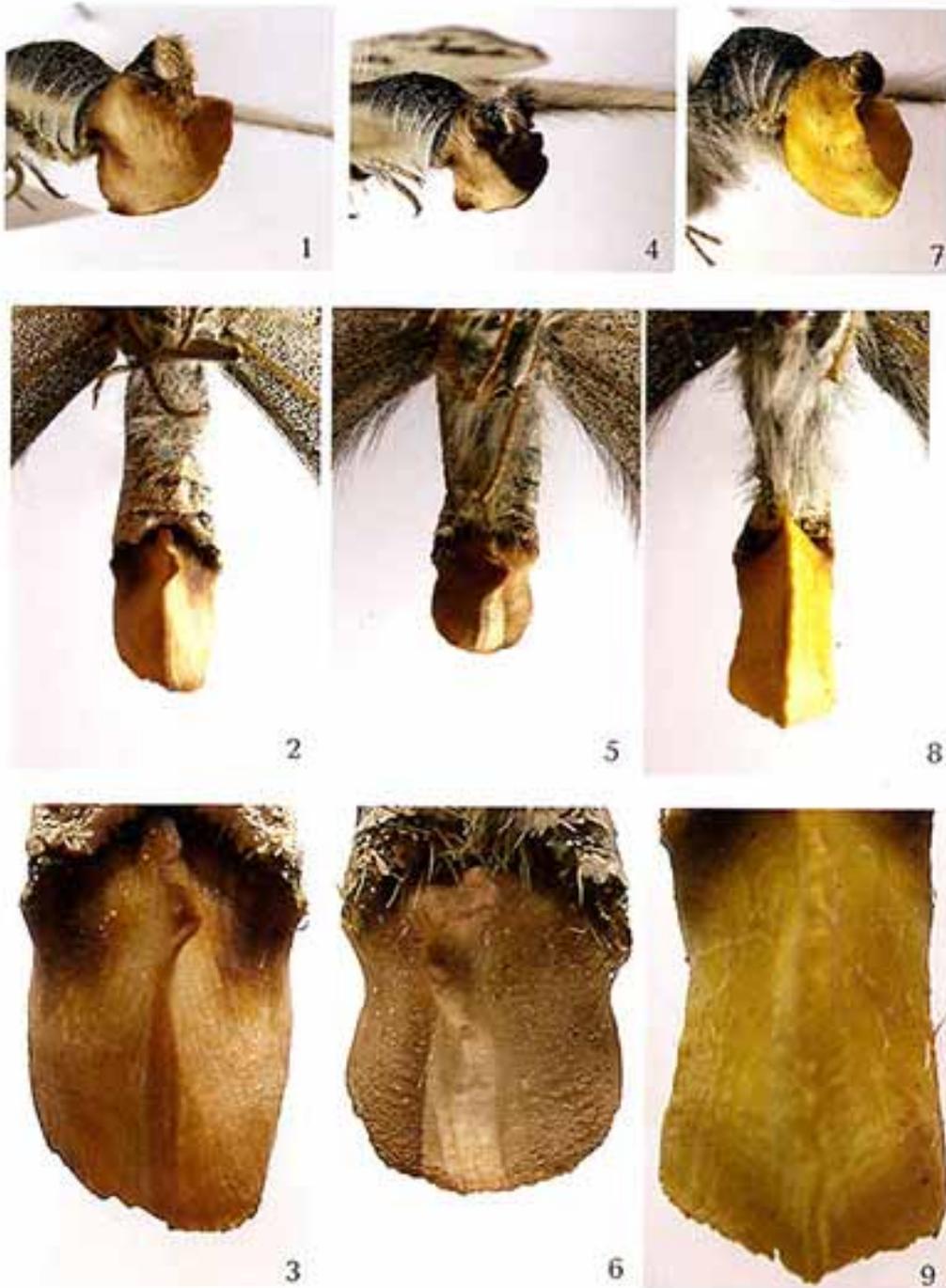
3. *P. davydovi* sp. n., paratype, male, data in the text;

4. *P. davydovi* sp. n., paratype, female, data in the text;

6. *P. charltonius romanovi*, male, West Transalai, AJtyn-Dara R.,
Aram-Kungei valley, 3500 m, 10.07.1992, S. CHURKIN leg.;

6. *P. charltonius romanovi*, female, same data as 5.





COLOUR PLATE XV

1. *P. davydovi* sp. n., sphragis, lateral view;
2. *P. davydovi* sp. n., sphragis, ventral view;
3. *P. davydovi* sp. n., structure of the sphragis (enlarged);
4. *Parnassius loxias*, sphragis, lateral view;
5. *Parnassius loxias*, sphragis, ventral view;
6. *Parnassius loxias*, structure of the sphragis (enlarged);
7. *P. autocrator*, sphragis, lateral view;
8. *P. autocrator*, sphragis, ventral view;
9. *P. autocrator*, structure of the sphragis (enlarged)