COMPARATIVE NOTES ON CERTAIN WEST-PALEARCTIC SPECIES OF *AGRIADES*, WITH DESCRIPTION OF A NEW SUBSPECIES OF *A. PYRENAICUS* FROM TURKEY (LYCAENIDAE)

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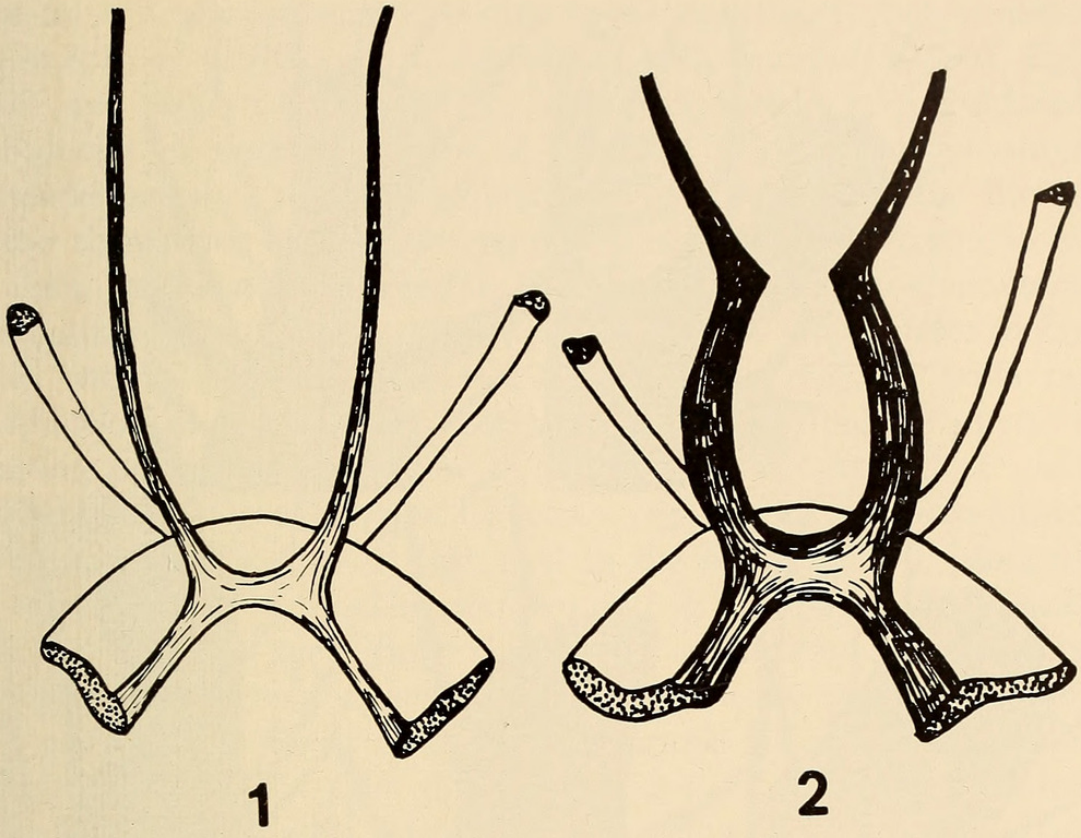
A study of the composition, spatial differentiation and zoogeographic connections of the Caucasus butterfly fauna requires verification of the species determinations given by former authors. Direct comparison of material collected in the Caucasus area with published data often shows disagreement between the species and the names attributed to them by different authors. Such a case has been exemplified recently with *Eumedonia eumedon* Esper (Nekrutenko, 1972). One of the most important points in taxonomically-based faunistic speculations is good knowledge of the fauna in adjoining areas. It would be no exaggeration to say that a reliable, 'three dimensional' picture of the Caucasus butterfly fauna requires two essential conditions: familiarity with the European fauna in order to compare the local forms with their nomenotypic subspecies and, on the other hand, knowledge of the fauna of Turkey and Iran in order to detect clinal intergradations where they exist.

In this paper I consider another case of taxonomic uncertainty regarding the position of the Caucasian representative of the [sub] genus *Agriades* Hübner (*Polyommatus* Latreille, pars), and I describe a new subspecies of *A. pyrenaicus* from Ulu-Dağ, Turkey, as a link in the intergrading chain of its geographic subspecies.

As is fairly obvious from synonymic lists, under the description of *A. pyrenaicus latedisjunctus* Alberti, authors almost unanimously have attributed Caucasian *Agriades* to *dardanus* Freyer, which is considered by them to belong, as a subspecies, to *glandon* Prunner (= *orbitulus* auct., for history see Hemming, 1967), or to *pyrenaicus* Boisduval. Such a situation necessitates answers to two essential questions: (1) to what species does *dardanus* really belong, and (2) do Caucasian *Agriades* belong to *dardanus*. As part of the alternative (*glandon* versus *pyrenaicus*), there are two other possible taxonomic interpretations of these forms: (3) to synonymize *dardanus* with *pyrenaicus* (Forster, 1938) and/or (4) to consider *dardanus* as a distinct species, according to Freyer's (1845) original combination (Sauter, 1968).

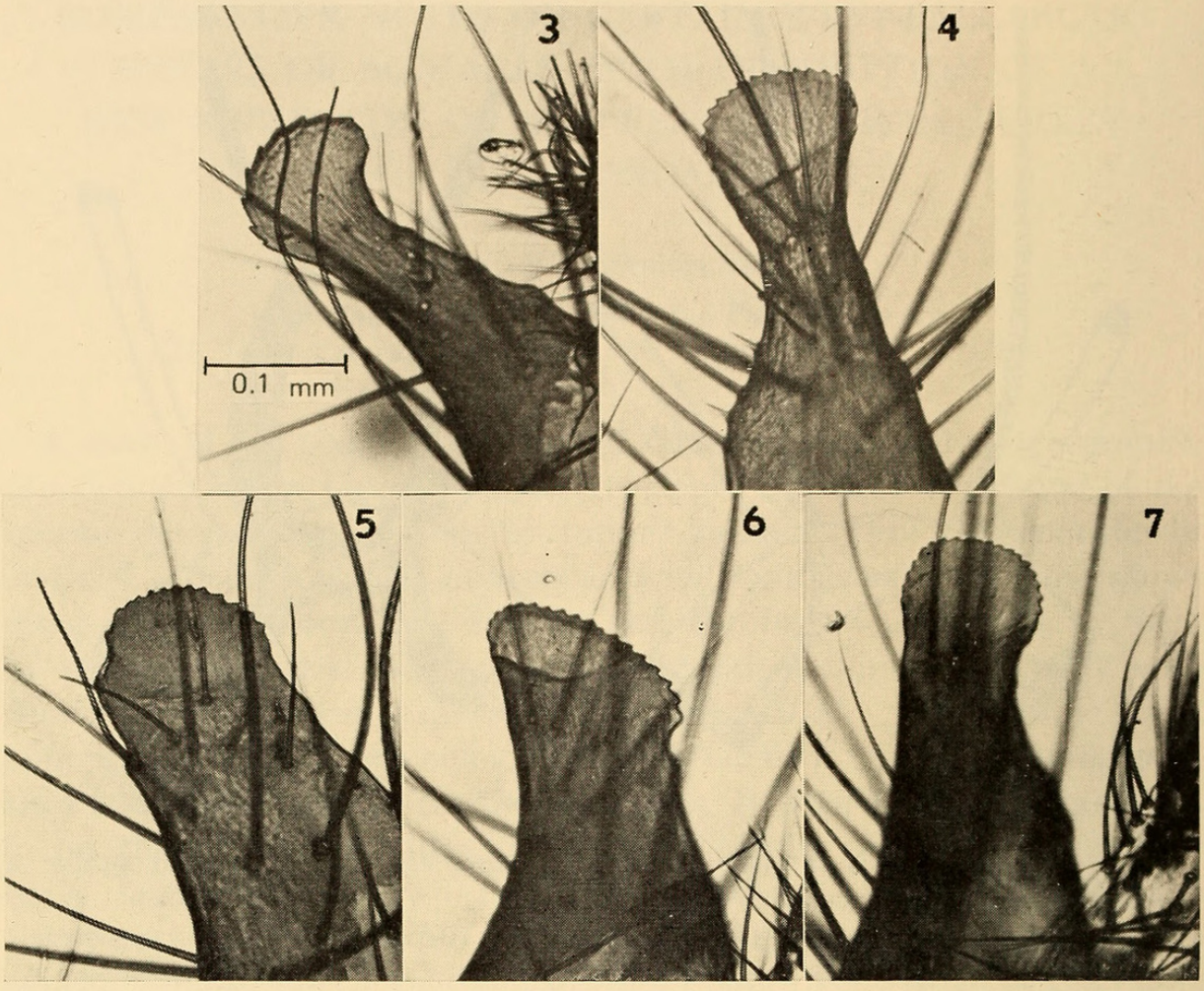


Figs. 1, 2. Two types of juxta structure in *Agriades*: 1, *glandon* and *aquilo*; 2, *pyrenaicus* and its subspecies.

As has been shown by Chapman (1908) and Bethune-Baker (1913) the peculiarities of the "ancillary appendages," especially differences in the structure of the tip of the upper valval lobe, are of high value for recognition, so that there are no problems with exact determination of *glandon* and *pyrenaicus* on the basis of the male genitalia (see also Oberthür, 1910); however, they are practically unrecognizible on female genitalic characters. When dissecting a large sample of both *glandon* and *pyrenaicus*, collected over an extended area, I found an additional, highly exact character permitting the determination of these species at a glance with 100% confidence. This diagnostic character consists of a pronounced structural difference in the juxta between *pyrenaicus* and other *Agriades* species, as depicted in Figs. 1 & 2. It is curious that this character, so clearly visible on the excellent microphotographs of Chapman (1908), and in illustrations in the recent paper of Fernández-Rubio (1970), was not pointed out in the text of either author and thus seems to have been overlooked.

The type locality of "*Lycaena dardanus*" was designated by Freyer (1845) as "europäische Türkei."[1] The illustrated text of its original

[1] Not "Freyer 1844 (Typenfundgebiet "Türkei")" as stated by Alberti (1973).



Figs. 3–7. The tip of the upper valval lobe (right): 3, *glandon*, Col d'Allos, Basses Alpes, 2500 m, Gallia mer., 11 August 1968, G. Hesselbarth leg.; 4, *pyrenaicus*, Cèdre, Htes Pyrénées, Rondou (Zool. Mus. Kiev Univ.); 5, *dardanus*, Cvrstnica Planina, Hercegovina, O. Leonhard leg. (Zool. Mus. Kiev Univ.); 6, *latedisjunctus*, Kazbek Mt., C. Caucasus (Y. Nekrutenko); 7, *hesselbarthi*, Ulu-Dağ, Prov. Bursa, Anatolia sept. 17 July 1973, G. Hesselbarth leg.

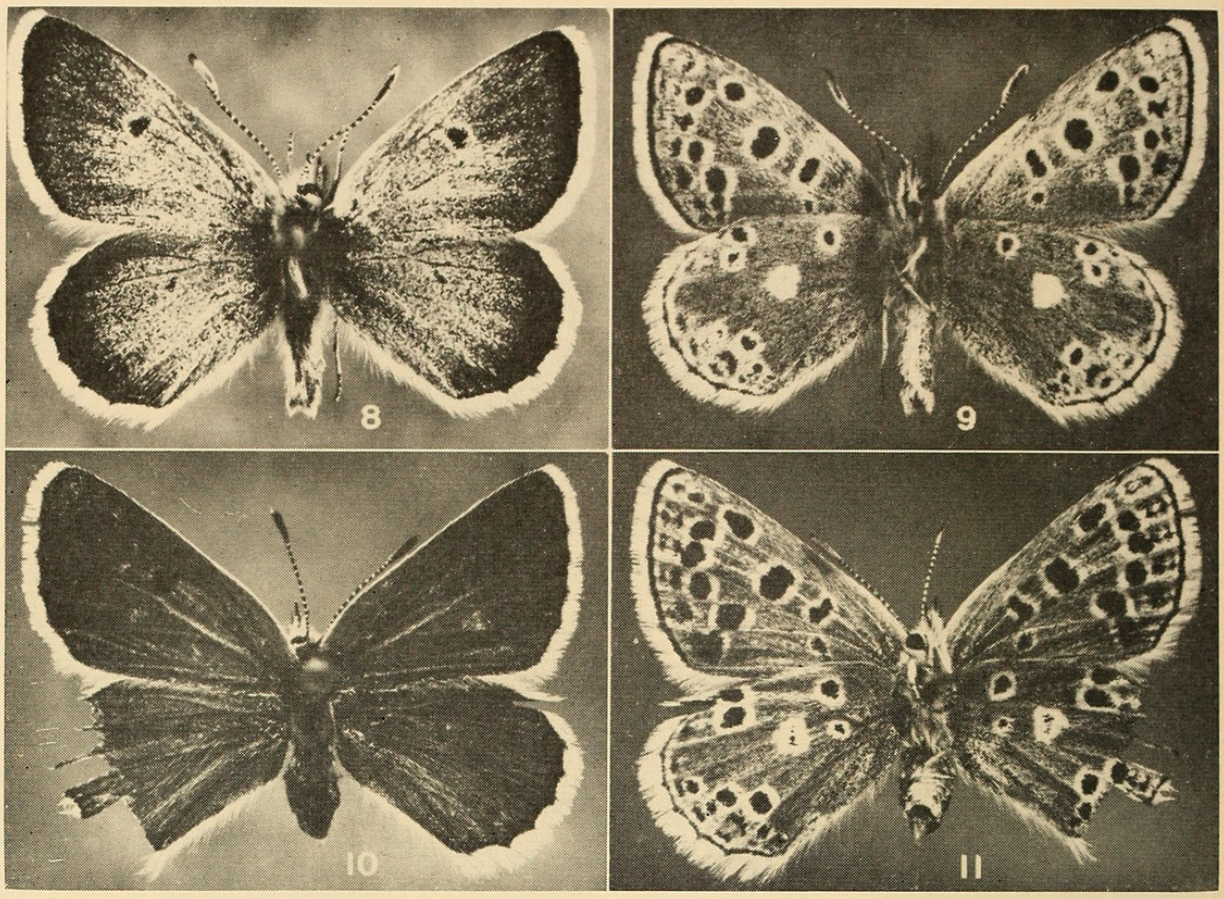
description agrees fully with characteristics given by Higgins & Riley (1970) of specimens from Cvrstnica Planina in Hercegovina (Yugoslavia), so that specimens from this locality may be considered as "true" *dardanus*. In addition to specimens from Cvrstnica Planina, in the collection of the Kiev State University Zoological Museum, there is also a short series of similar specimens labelled "Alibotusch Gebirge, 1900 m, Al.K.Drenowski leg.," determined by L. Sheljuzhko (in litt., labels) and by Buresh & Tuleshkov (1930) as *dardanus*. Dissection of the male genitalia showed the complete identity in juxta shape in these two samples with *pyrenaicus* from Pyrenees and *latedisjunctus* from Caucasus, respectively. At the same time, the shape of the upper valval lobe tip decidedly differs in *glandon*, *pyrenaicus*, "true" *dardanus*, *latedisjunctus* and *hesselbarthi* n. subsp. (Figs. 3–7).

The aforementioned may lead only to the conclusion that, contrary to Higgins & Riley (1970), and in agreement with Bramson (1890), Egorov (1903) and Alberti (1970, 1973), *dardanus* should be considered as a subspecies of *pyrenaicus*, not of *glandon*. This way, the range of *pyrenaicus* becomes far more extended than is seen from the literature, and the occurrence of *glandon* should be restricted, according to available data, to the Alps. However, there are no genitalic characteristics to recognize *glandon* from *aquilo* Boisduval, a circumpolar holarctic species with a significant number of subspecies over its wide range. The question of interrelations between these taxa remains open. Also remaining open is the question of the possible occurrence of *glandon* (a geographic isolate?) in the Caucasus region. As has been observed by Fernández-Rubio (1970), the spot in the forewing cell (underside) may or may not be present in *glandon* and its subspecies (e.g. *zuellichi* Hemming). At the same time, this spot is present in all specimens of *pyrenaicus* ever seen in collections or figured in the available literature. When counting all names of the specific group involved in *Agriades*, I drew attention to the fact that a specimen of "*orbitulus*" *araraticus* Gerhard (Bischoff in litt.) from Turkey, figured and described under this (patronymic?) name by Gerhard (1853), showed the lack of this spot. This may indicate the conspecificity of *araraticus* with *glandon* and, thus, the possible occurrence of this species in the Caucasus area. However, only a genitalic survey of material available from the easternmost part of Turkey can answer the question of its real taxonomic position. Except for *araraticus* with its uncertain position, all authors attribute *Agriades* of Asiatic Turkey to *dardanus* (for a review of the literature, see Kuznetsov, 1929, p. DLXXII; and De Lattin, 1950). The specimens collected in the westernmost part of Asiatic Turkey (Bursa) in 1973 by G. Hesselbarth were very different than the 'true' *dardanus* and other subspecies of *pyrenaicus*, and belong to a distinctly marked and previously undescribed subspecies.

Agriades pyrenaicus hesselbarthi Nekrutenko, **new subspecies**
(Figs. 8–11)

General. Smallest butterfly in the group. This subspecies differs from the other three hitherto known subspecies of *A. pyrenaicus* by having no traces of the diffused submarginal spots in the hindwing cells M_3-Cu_1 and M_2-M_3 (venation and cell terminology after Miller, 1969) in both males and females. Veins do not differ by color from the upperside ground color. The underside ground color is grey, markings contrasting, almost as in *glandon*. The female's upperside is not powdered with blue scales. From all other subspecies of *pyrenaicus* and *glandon*, this one differs clearly by the male genitalia (Fig. 7).

Male. Length of forewing (base to tip) of holotype 10.7 mm (variation in the



Figs. 8–11. *Agriades pyrenaicus hesselbarthi* n. ssp.: 8, 9, ♂ holotype upper and undersides, Anatolia sept., prov. Bursa, Ulu-Dağ Ms., 2300 m, 17–23 July 1973, G. Hesselbarth leg; 10, 11, ♀ allotype, upper and undersides, same label data.

type series 10.4 to 11.0 mm). Upper side of both wings of vivid silvery blue color, becoming darker toward the margins. This darker zone begins on the forewing from discal spot and occupies about ⅓ of the wing length; between veins it does not bear diffused patches of the ground color. At the margins, the dark color zone reaches the intensity of the female upperside ground color. Discal spot on the upper side of the forewing always contrasting, and because it lies on the area shaded with the basal diffused end of the marginal dark zone, it is rounded with a bright ring of blue ground color (not white). Fringe white, with black strokes at the end of each vein, that do not reach the outer margin. Ground color of the forewing underside rather dark, brown. The central cell spot in all specimens examined, varied in size, but was always contrasting, rounded with a white ring. Postdiscal spots complete, but not as uniform in size and shape as in other subspecies, each spot being rounded with a white ring. Submarginal spots complete, present in all wing cells. A very narrow, precise dark line goes along the outer wing margin. Underside of the hindwing brown, basally powdered with blue scales; this bluish zone rather narrow. Black markings rounded with narrow white rings. Discal spot with or without black pupil (some dark scales almost always present). Yellow submarginal lunule in the cell M_3-Cu_1 closed with black contrasting patches from basal and marginal sides; basally this cell always bears a well developed black spot.

Female. Length of forewing of allotype (base to tip) 10.8 mm (in 3 female paratypes ranges from 10.6 to 10.8 mm). Ground color of the upperside of both wings dark, brown-black. Black discal spots visible on both wings. Underside color and pattern as in male, ground color more vivid, markings developed more strongly.

Male genitalia (Fig. 7). General appearance as in all other *Agriades*. Juxta horseshoe-shaped, strongly chitinized. The tip of the upper valval lobe rounded, symmetric, head-shaped, bears about 20 teeth. The isthmus between the body of valva and the head is well expressed. This character, more than any other, shows a similarity to *A. pyrenaicus pyrenaicus*. **Female genitalia.** No diagnostic features (3 specimens dissected).

Material studied. Holotype, male, and allotype, female: Turkey in Asia, Anatolia sept., prov. Bursa, Ulu-Dağ Ms., 2300 m, 17–23 July 1973, G. Hesselbarth leg. Paratypes, 11 ♂♂, 3 ♀♀, same locality, dates and collector. Holotype, allotype and 5 ♂♂, 2 ♀♀ paratypes and genitalic slides deposited in the collection of the Kiev State University Zoological Museum. About 85 paratypes are in the collection of G. Hesselbarth (Quakenbrück, West Germany).

Because Alberti's original description of *latedisjunctus* is not informative enough to give reliable diagnostic features, and is not illustrated, I give here a detailed description of this taxon, based on specimens from the type locality, with complete synonymy and additional information regarding the type locality. This is a part of my Rhopalocera Caucasica Programme having as its aim the compilation in one source of a comprehesive and detailed analysis of the recent state, origins and zoogeographic features of the Caucasus Region butterfly fauna.

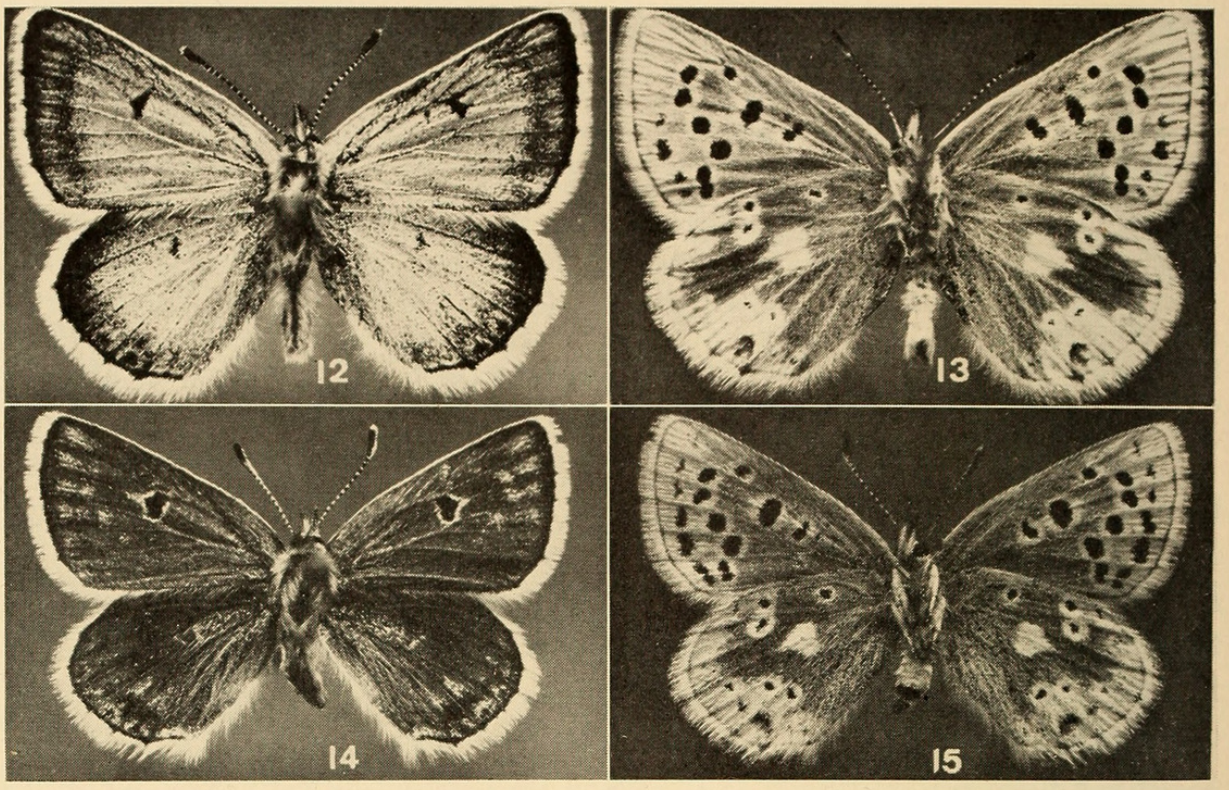
Agriades pyrenaicus latedisjunctus Alberti (1973)

(Figs. 12–15)

Lycaena orbitulus Prun. var. *dardanus* Frr.: Romanoff, 1884, p. 51.
L. pyrenaica var. *dardanus* Frr.: Bramson, 1890, p. 51.
L. orbitulus var. *dardanus* Frr.: Radde, 1899, p. 420.
L. pyrenaica B.: Egorov, 1903, p. 13.
L. orbitulus Prun. var *dardanus* Frr.: Shaposhnikov, 1904, p. 206.
L. orbitulus Prun. var. *dardanus*: Alpheraky, 1907, p. 204.
L. orbitulus dardanus (?) Frr.: Riabov, 1926, p. 294.
L. orbitulus var. *dardanus* Frr.: Warnecke, 1943, p. 175.
L. orbitulus Prun. var. *dardanus* Frr.: Wojtusiak & Niesiolowski, 1947, p. 58.
L. orbitulus Prun.: Miljanowski, 1964, p. 114.
L. pyrenaica ssp. *dardanus*: Alberti, 1970, p. 123.
Polyommatus (*Agriades*) *glandon dardanus* Frr.: Korshunov, 1972, p. 363.
Lycaena pyrenaica latedisjuncta Alberti: 1973, p. 221.

General. Upperside wing color closely similar to *A. pyrenaicus pyrenaicus*, differing from *dardanus* by the more vivid, silvery blue male coloration; dark veins are clearly visible on the ground color. Differs from *pyrenaicus* and *dardanus* by the significant reduction of submarginal spots on the forewing underside, especially in males. Female's wing upperside more abundantly powdered with bright blue scales than in both *pyrenaicus* and *dardanus*. This character transitional to females of *pyrenaicus asturiensis* Oberthür. Subspecies differs from all other *pyrenaicus* ssp. by male genitalia characters (see text below and Fig. 6).

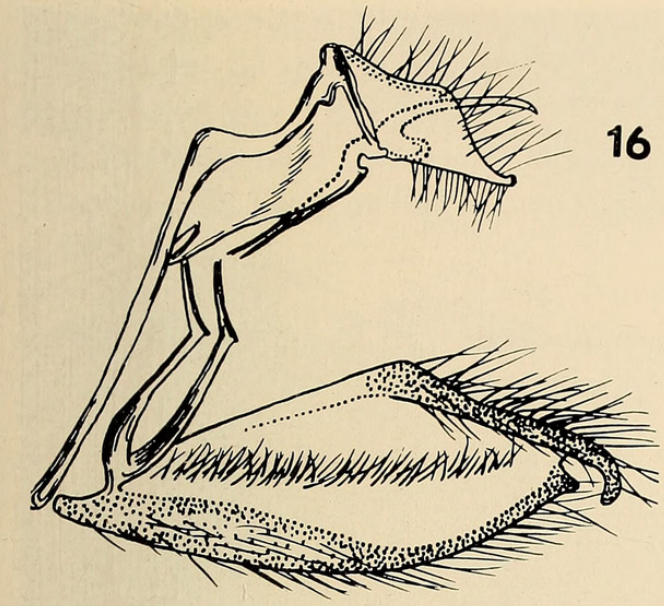
Male. Length of forewing (base to tip) 10.0 to 12.5 mm. Upperside of both wings of vivid silvery blue shining color, becoming darker toward the margins. This darker zone occupies about ⅕ of the wing length, and between veins bears diffused patches of the ground color. Hindwing bears on its upperside 2 to 3 well developed diffused submarginal spots, *always* present in cells M_3-Cu_1 and M_2-M_3, in some

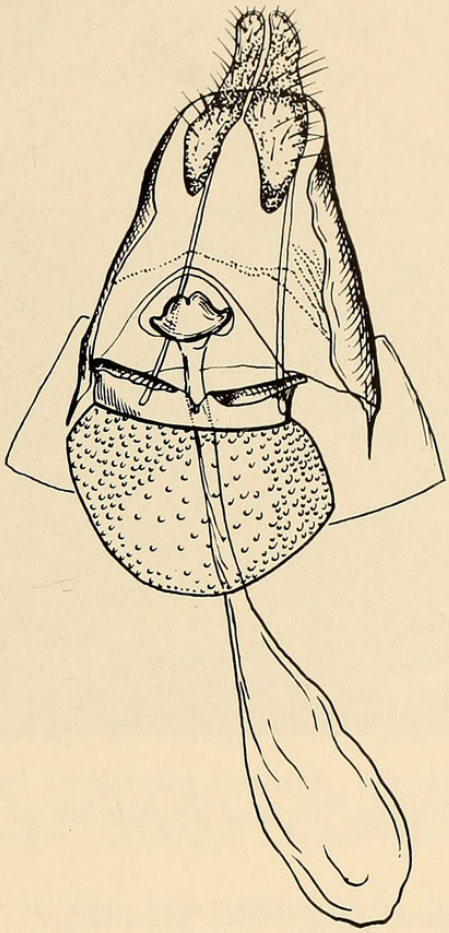


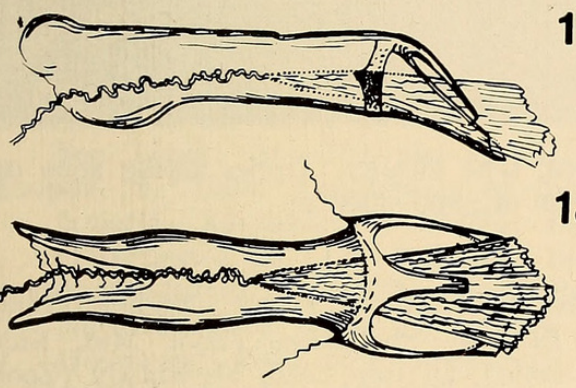
Figs. 12–15. *Agriades pyrenaicus latedisjunctus*: 12, 13, ♂ upper and undersides, C. Caucasus, Kazbek Mt., 2900–3000 m, 26 July 1972, Y. Nekrutenko; 14, 15, ♀ upper and undersides, same label data.

specimens also in Cu_1-Cu_2. Discal spot on the upper side of the forewing always contrasting, rounded with a white ring (weakly visible on black-and-white photographs). Fringe white, with black strokes at the end of each vein, that do not reach the outer margin. Ground color of the forewing underside bright, whitish grey, not brownish, somewhat darker toward the base and anal margin. The central cell spot in all specimens examined varies from a thin, but contrasting patch to the size of a discal spot. Postdiscal spots complete, forming S-shaped row, each spot being rounded with a white ring. Submarginal spots incomplete, toward the apical part of the forewing gradually disappearing, always present only in cells M_3-Cu_1, Cu_1-Cu_2 and Cu_2-2A. A very narrow, precise dark line goes along the outer wing margin. Underside of hindwing bears three distinct color zones: distal, formed with confluent white postdiscal spots; medial, bright, whitish-grey; and basal, bluish grey, with metallic tint. Black markings widely ringed with white, present in cells Sc+R_1-Rs (2 spots), Rs-M_1, M_3-Cu_1 and M_2-M_3. Discal spot always without black pupil. Yellow submarginal lunule in M_3-Cu_1 shaded with black from basal side only; toward the margin gradually transitional into the ground color, some specimens bear a black pupil at this point.

Female. Length of forewing (base to tip) ranged from 10.0 to 12.5 mm. Ground color of the upperside of both wings dark, brown-grey. Forewing bears discal spot of deep black color, ringed with white broad circle, with characteristic drawing off toward the outer margin. Discal spots on the hindwing upperside variable: from almost complete disappearance to the size of the forewing discal spot. Hindwings bear on their upperside diffused submarginal spots as in males. Wings of many females bear bright diffused postdiscal and submarginal spots of the male color, often with greenish tint. Underside color and pattern as in male, but ground color more vivid, brownish, markings developed more strongly.







Figs. 16–19. *Agriades pyrenaicus latedisjunctus*, genitalia: 16, male, general view, aedeagus removed; 17, 18, male, aedeagus, lateral and dorsal projections; 19, female, general view, ventral projection.

Male genitalia (Figs. 6, 16–18). General appearance as in all other *Agriades*. Juxta horseshoe-shaped, with divergent upper extremities, strongly chitinized. The tip of the upper valval lobe obtuse, oblique (in *dardanus* rounded, symmetric—see Fig. 5), bears 15 to 21 teeth (20 specimens dissected). The isthmus between the body of valva and the tip broad, poorly expressed.

Female genitalia (Fig. 19). I have found no feature of diagnostic value in the female genitalic armatures in all specimens of all species of *Agriades* ever examined. The female genitalia of *latedisjunctus* are figured here to complete the description and this figure covers all *Agriades*.

Material studied. 49 ♂♂, 10♀♀, C. Caucasus, Georgian Soviet Socialist Republic, Kazbek Mt., 2900–3000 m, 26 July 1972 (Y. Nekrutenko); 12 ♂♂, 3 ♀♀, Kazbegi circ., 1850 m, 24 July 1972 (Y. Nekrutenko); 3 ♂♂, Abkhasia, Mzy (Mzym) Lake, 2300 m, 12 July 1972 (Y. Nekrutenko); 2 ♂♂, 1 ♀, Abkhasia, Awadhara, 2000–2200 m, July–August 1967 (E. Miljanowski); 1 ♂, Georgia, Lebarde, 8 June 1962, E. Didmanidze (coll. S. Miljanowski); 2 ♂♂, Teberda, N. W. Caucasus, July 1935, L. Sheljuzhko (Zool. Mus. Kiev Univ.); 4 ♂♂, 3 ♀♀, Daghestan,

Fig. 20. *Agriades pyrenaicus latedisjunctus*, type locality. Upper alpine zone on the Eastern slope of Kazbek Mt. at an elevation of 2900–3000 m.

Levashi, June 1926, M. Riabov (Zool. Mus. Kiev Univ.); 2 ♂♂, Tskhra-Tskaro, Borzhomi, Caucasus Minor, 2520 m, July 1914, L. Sheljuzhko (Zool. Mus. Kiev Univ.); 1 ♂, Armenia, Amamly (subalpine zone), 20 July 1925, M. Riabov (Zool. Mus. Kiev Univ.); 1 ♂, Armenia, Alagëz Mt., 15 May (?) 1935, B. Tkatshukov (Zool. Mus. Kiev Univ.).

Type locality (Fig. 20). In addition to the data given by Alberti (1973), the type locality should be restricted to the area on the Eastern slope of the Kazbek Mt., where the butterflies are most abundant. This place is situated between the Tsminda Sameba (St. Trinity) church over the Gergeti village and the Gergetskiy glacier tongue margin and fore moraine. It is in an hour or two of rather easy climbing from the Georgian Military Highway at Gergeti village, on the left bank of Terek river. In the Kazbegi village vicinity on the opposite side of Terek (1850–1900 m) the butterfly is rather scarce.

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RESISTANCE IN BUTTERFLY FOODPLANTS

Plant resistance to insect attack has been studied largely in connection with agricultural practices and crop plant breeding (Beck 1965, Ann. Rev. Entomol. 10: 207–232), although the principles gained therefrom should apply to natural situations as well. Butterfly larval foodplants in the wild likewise have probably developed strains that are resistant to attack. This fact would account for spotty or discontinuous distributions of some species, although the effect would be difficult to distinguish from extinction due to other causes. In the field, one frequently encounters areas where a known foodplant is present but the butterfly is absent. E.g., *Papilio indra fordi* Comstock & Martin feeds on *Cymopterus panamintensis* Coult. & Rose but not on the subspecies *acutifolius* (Coult. & Rose) Munz (Shields, Emmel, & Breedlove 1969, J. Res. Lepid. 8: 21–36). Toxic secondary plant substances may act as repellents; ecdysone or juvenile hormone or their analogues in plants may protect them from attack (Fraenkel 1969, Entomol. Exp. Appl. 12: 473–486; Hsiao 1969, Entomol. Exp. Appl. 12: 777–788). Plant resistance can disturb the insect's normal behavior, growth, and survival (Beck, 1965).

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