ANNALES HISTORICO-NATURALES MUSEI NATIONALIS HUNGARICI
Tomus 87. Budapest, 1995 p. 93–102

Two new Polyommatus species from the Himalayan region (Lepidoptera, Lycaenidae, Polyommatini)*

by ZS. BÁLINT, Budapest

BÁLINT, ZS. (1995): Two new Polyommatus species from the Himalayan region (Lepidoptera, Lycaenidae, Polyommatini). – *Annls hist.-nat. Mus. natn. hung.* **87**: 93-102.

Abstract – Two new polyommatine lycaenids from the Himalayan region which are closely related to *Polyommatus stoliczkanus* (FELDER et FELDER, 1865) are described and discussed: *Polyommatus fraterluci* sp. n. from North India and *Polyommatus pierinoi* sp. n. from Nepal. A survey of the *stoliczkanus* complex is also given. With 18 figures.

In studying lycaenid butterflies of the Central Palaearctic territories, I tried to distinguish the faunistics and also the main phyletic lines of *Polyommatus* sensu ELIOT (1973). Two regions received particular attention because of their very diverse lycaenid fauna. Accordingly, two of my previous works in this series presented new faunistic, biogeographic and taxonomic data to the knowledge of poorly known Old World territories, namely the Turkmenian and Himalayan regions (BÁLINT 1992a, b).

The present paper, as the third part of the series, gives a description of two further, hitherto unknown species from the Himalayan region as a subsequent result of my studies on historical materials of BMNH collections**. The first aim of my visits to the above-mentioned institute was to compile the type catalogue of the Palaearctic lycaenid taxa located there, which is still in progress. Parallel to that study, I obtained many interesting findings, among others a lot of new polyommatine lycaenid taxa from all over the World, such as *Polyommatus annamaria* BÁLINT, 1993, *P. forresti* BÁLINT, 1993, *P. csomai* BÁLINT, 1993, *Pseudolucia sirin* BÁLINT, 1993, *Itylos luzhin* BÁLINT, 1993, *I. pnin* BÁLINT, 1993, *Madeleinea lolita* BÁLINT, 1993, *Polytheclus cincinnatus* BÁLINT et JOHNSON, 1993.

Both of the new species described in the present paper belong to one of the most problematic polyommatine lycaenid butterfly groups of the mentioned area. This is the *stoliczkanus* species group which shows remarkable diversity in the above mentioned regions of the Palaearctic realm. A distinct genus was erected for *P. icarus* (ROTTEMBURG, 1775) and *P. stoliczkanus* (as type species) under the name *Bryna* EVANS, 1912, but FORSTER (1938: 115) synonymized it with *Polyommatus* LATREILLE, 1804. Accordingly, *P. stoliczkanus* and its relatives belong to the same genus as the most common European blue butterfly *P. icarus* or *P. eroides* (FRIVALDSZKY, 1835), both having Transpalaearctic distribution.

One of the recently described polyommatine lycaenid, namely *Polyommatus ciloicus* DE FREINA and WITT, 1983 from Eastern Anatolia, was compared with *P. stoliczkanus*, *P. venus* (STAUDINGER, 1886), *P. wiskotti* (COURVOISIER, 1910) and *P. icarus* (ROTTEMBURG, 1775). The results showed that these taxa are really closely related (DE FREINA & WITT 1983). The works of CARBONELL (1991a) confirmed this.

---

* Studies on Central Palaearctic Lycaenids, Part III.

** The new taxa are dedicated to the brothers, namely brother Luc and brother Pierino of the Taizé Community, who give continuous inspiration to my studies on lycaenid butterflies.

The monophyly of these polyommatines is supported by the following morphological characters: male genital clasper with angulate, remarkable horseshoe-shaped uncus (width 3/4 times of length), penis with conspicuously long subzonal element (four or five times longer than suprazonal), which is straight either in lateral or ventral view, vesica conical (Figs 7-15). Female genitalia with remarkable long ductus bursae with sclerotized genital henia rectangular or rounded shaped in ventral, relatively flat in lateral view, bursa with a sclerotized fork-shaped signum (figs 16-20).

"*P. stoliczkanus*" like butterflies are the most common lycaenids in the Himalayas. It can be presumed that many historical faunistic records of *P. stoliczkanus*, even the most recent ones (e.g. SHIELDS 1982: 75, MÜTING & MÜTING 1988: Figs 4 and 214, VIS & COENE 1987: 22, VERHULST 1987: 82), are questionable, because the students could not apply the available names of the morphologically very similar butterfly individuals. The "*Polyommatus*" taxa of the Himalayas were mainly described in combinations with *P. eros* (cf. EVANS 1925: 348-349). Therefore the correct identification of these taxa is difficult (cf. SAKAI 1981: Pl.44), the illustrations in available literature (EVANS 1925, BOLLOW & GAEDE 1932) do not clearly show the distinguishing characteristics of these lycaenids. The situation outlined above, coupled with the always unstable political situation of the regions, has hindered research on their taxonomy, ecology and biogeography.

The catalogue of BRIDGES (1988), which is a tremendous work giving a world–wide data base of the lycaenids listing all the names that could be found in the taxonomic literature (without trying to solve taxonomic problems), clearly demonstrates that the systematics of these Central Asian polyommatine lycaenids is very confused because many names were listed in wrong or "ancient" combination or status. Therefore, a comprehensive taxonomic work dealing with the *stoliczkanus* group is urgently needed. Very recently two works have contributed data to the knowledge of this group. BALLETTO & KUDRNA (1989: 250-252) discussed some taxa suggesting "tentative synonyms". D'ABRERA (1993: 499-503) figured many of the taxa involved and he selected mainly historical specimens, preserved in the butterfly collection of the BMNH for his folio plates. This work had already figured one of the species (*P. fraterluci* BÁLINT/?, D'ABRERA 1993: 501), which will be formally described below.

TAXONOMIC DESCRIPTIONS

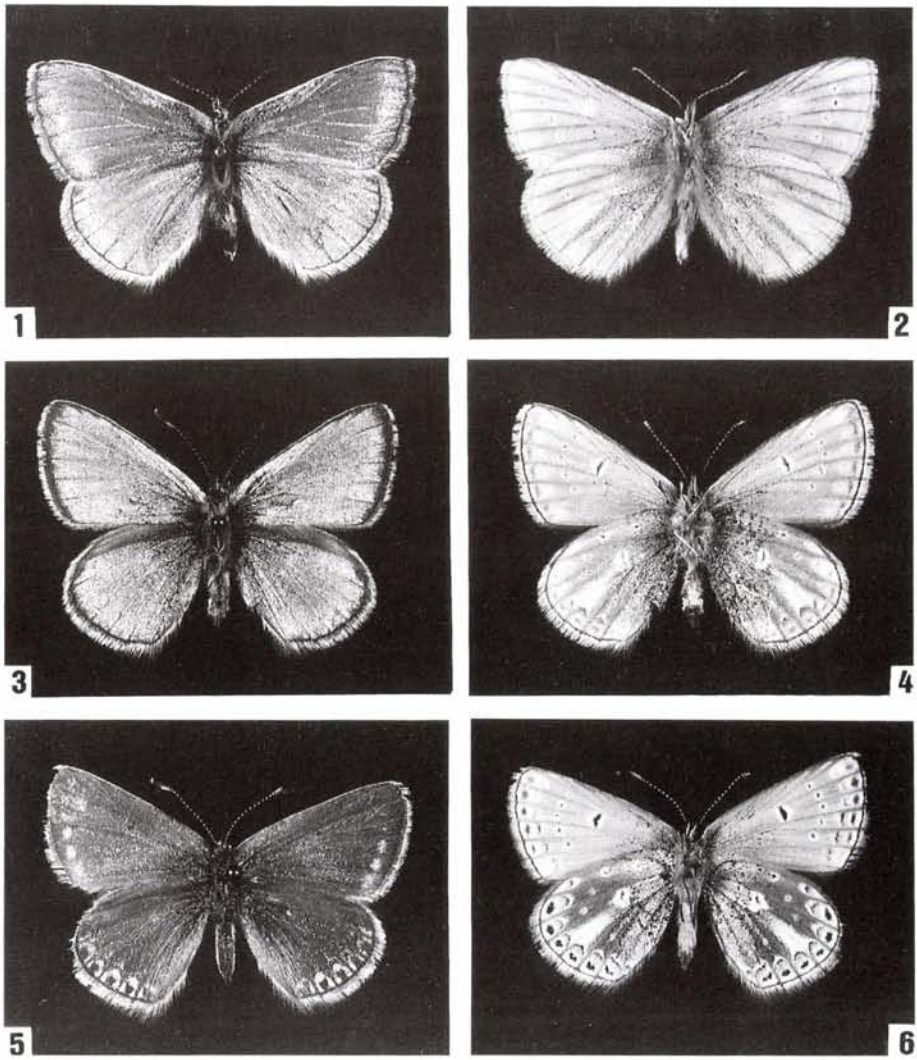
Polyommatus fraterluci sp. n.
(Figs 1-2)

Type material – Holotype, male: "India: E. Punjab., Kangra Dist. Kulu, Dibibokri Nal., Runi Thach., 12.800', M. vii. 1952.; Lycaenid 41; E. A. C.L. F. Schelpe., B. M. 1953 –171; gen. prep. No. 218., Zs. Bálint; Holotypus, P. fraterluci, det. Zs. Bálint, 17. vii. 91." Paratypes: 5 males, with the same data, with glycerin vials gen. prep. No. BÁLINT, 529 and 530.

Diagnosis – Easy to distinguish from all Himalayan polyommatine species by the strongly pigmented veins and the absent markings of the hindwing ventral surface. The most closely related *P. dux* RILEY, 1926 has a more pointed apex and wider forewing shape, its hindwing ventral surface has an extended basal and subbasal metallic green suffusion and the submarginal area marked by intercellular orange spots. Male genitalia commonplace (see Introduction) with wider valvae and stronger costal process.

Description – Forewing length 15.5 mm (Holotype). Forewing apex pointed. Antennae, head, thorax, abdomen and male genitalia as in *Polyommatus* section (sensu ELIOT 1973). Male. Dorsal surface. Forewing: Ground colour shining violet blue; costal area with gleaming blue scales; vein ends suffused with black scales; marginal area lighter; terminal line narrow and black; subterminal cilia blackish, terminal cilia white. Hindwing: as forewing, but costa without gleaming scales, anal part greyish, basal and anal area with bluish pubescence. Ventral surface.

Forewing: Ground colour very light grey but submarginal and marginal area white; basal area with few gleaming blue scales; discoidal spot elongated, large and white, black scales absent; veins strongly marked and conspicuous, visible as relatively wide darker lines from median to termen; postmedian spots blackish and small with vestigial halos; submarginal and marginal markings absent; terminal line greyish; cilia as dorsal. Hindwing: As forewing but with extensive gleaming blue basal suffusion, discoidal and postmedian spots inconspicuous. Genitalia: Uncus strong, horse-shoe shaped, gnathos small with long humerulus, tegumen strong with weak suspensorium, vinculum also strong with about the same length of juxta; valva large with high Baird's angulation, costal process long, strongly sclerotized. Female: Unknown.



Figs 1-6. 1 = *Polyommatus fraterluci* sp. n., holotype, dorsal, 2 = ditto, ventral, 3 = *P. pierinoi* sp. n., holotype, dorsal, 4 = ditto, ventral, 5 = *P. pierinoi* sp. n., allotype, dorsal, 6 = ditto, ventral

D e p o s i t i o n o f t y p e s – All the type specimens deposited in the Butterfly Collection of the BMNH.

D i s t r i b u t i o n – North India, Himachal Pradesh (E. Punjab), at cca. 4,000 m.

B i o n o m i c s – According to type data the species is most probably univoltine, flying in high elevation. The larval hostplant and the nectar sources of the imagines are unknown.

R e m a r k s – The superficial appearance of the known male specimens is so remarkable that it is very easy to distinguish them from all the Himalayan taxa of the *Polyommatus* section by the following character set of wing morphology: (1) Colouration. The underside ground colour is white. (2) Veins. The veins on the underside are suffused with greyish scales appearing as relatively wide, conspicuous lines between median and marginal parts. (3) Pattern. The maculation of the underside is strongly reduced. The species is known from the region of Kangra, where closely related taxa as *sutleja*, *droshana* and *dux* were recorded.

Polyommatus pierinoi sp. n.
(Figs 3–6)

T y p e m a t e r i a l – Holotype, male: "Nepal, Sabze Khola, 13,500 ft., 19. vii. 1950.; B. M. Exp. to Nepal., B. m. 1950–649; Sabze Khola, 13,500', 19. VII. 50; gen. prep. No. 200. Zs. Bálint; Holotypus, P. pierinoi, det. Zs. Bálint, 17. vii. 91.". Allotype (female) and paratypes (4 males and 3 females) with the same data, with glycerin vials, gen. prep. No. BÁLINT, 527 (male) and 528 (female) vials. Paratypes, 5 males and 1 female: "Nepal, Braga, 14,500 ft, 14.vii.1950., from meadowland, B.M. Exped. to Nepal, B.M. 1956-649". Paratype, 1 male: "Nepal: Marsiandi, 12,600 ft, 28.VI.1959, from woodland glade, B.M. Exped. to Nepal, B.M. 1956-649". Paratype, 1 female: "Nepal: Khangsar, 14,500 ft., 24.vii.1950, B.M. Exped. to Nepal, B.M. 1956-649". 1 female: "Nepal: Khangsar, 14,500 ft., 27.vii.1950, B.M. Exped. to Nepal, B.M. 1956-649". Further paratypes, 2 males: "C. Nepal, Marsiyandi T., Pisang 3400 m, 31.VII.'80., leg. Gruber."

D i a g n o s i s – Superficially close to *P. stoliczkanus* and its sister P. *droshana*, but with longer forewing costa and anal margin with deeper blue dorsal ground colour, hindwing ventral basal suffusion extended, submarginal markings strongly reduced but marginal pattern well developed. Male genitalia commonplace with shorter penis and juxta compared with congeners. Female genitalia with very long ductus bursae and showing large anterior lamella sclerotized along two wide lines, henia quadrant shaped.

D e s c r i p t i o n – Forewing length: 15 mm (Holotype), 15 mm (Allotype). Forewing shape somewhat rounded. Antennae, head, thorax, abdomen and genitalia as in *Polyommatus* section (sensu ELIOT, 1973). Male. Dorsal surface. Forewing: Ground colour shining violet blue; vein ends softly covered with black scales; terminal line black, conspicuous; subterminal cilia blackish, terminal cilia white. Hindwing ground and pattern as in forewing. Ventral surface: Forewing: Ground colour cool ash grey, but white in marginal area; discoidal spot long with well visible halo; postmedian spots very small with suffused halos; submarginal markings absent, replaced by larger white spots visible in each cell; marginal spots large and brownish; cilia as in dorsum, but greyish at vein ends. Hindwing: Ground colour somewhat darker than in forewing with brownish shade; basal area strongly suffused with gleaming blue metallic scales; discoidal spot small with large angular halo; conspicuous white stripe in ce3–2; postmedian markings strongly reduced; submarginal markings strongly reduced, only inconspicuous cups visible, but full in ce2 and ce1 with aurora; marginal area, termen and cilia as in forewing. Genitalia: Uncus strong, horseshoe-shaped with plane inner margin, gnathos small with long humerulus, tegumen strong, with short but strong suspensorium, vinculum also strong juxta weak and shorter than vinculum; valva narrow with low Baird's angulation, costal process long, strongly sclerotized, apical lobe prononunced, aedeagus relatively narrow and only slightly shorter than juxta. Female. Dorsal surface. Forewing: Ground colour dark brown; anal area with scattered gleaming deep violet blue scales; discoidal spot present but very small; submarginal aurora visible; cilia as in male, but brownish. Hindwing: Ground colour as in forewing; discoidal absent; marginal area blue with black spots; cilia as in forewing. Ventral surface. Forewing: Ground colour brownish grey; discoidal and postmedian spots as in male, but somewhat stronger; large median and postmedian arrow–head spots absent; submarginal markings visible with aurora in ce3 and ce2; marginal spots large in white ground colour; termen and cilia as in male. Hindwing: Ground colour darker brown; markings as in male, but more developed, submarginal aurora larger than in male, marginal spots black; basal suffusion green; termen and cilia as in male. Genitalia commonplace polyommatine with quadrant-shaped sclerotized henia.

D e p o s i t i o n o f t y p e s – The primary types and the paratypes are deposited in the Butterfly Collection of BMNH (London, UK). Only two paratypes taken by GRUBER are deposited in the "Zoologische Staatssammlung" (Munich, D).

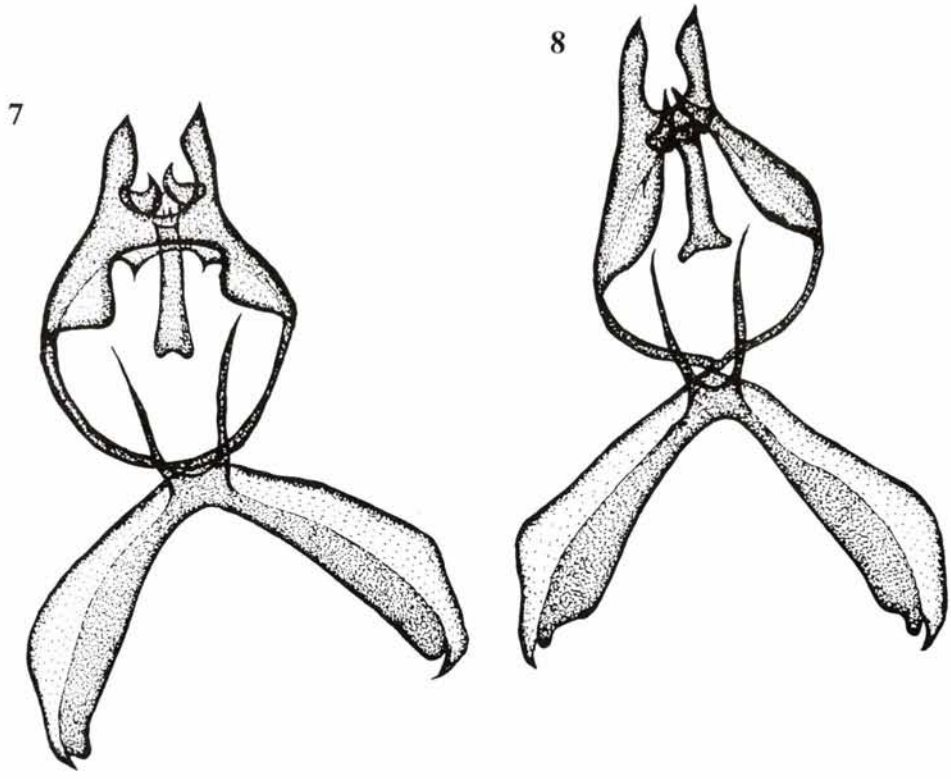
D i s t r i b u t i o n – Known only from high altitudes in Nepal.

B i o n o m i c s – The species is most probably univoltine, flying in mountainous conditions, most probably in the Transhimalayan area. The tendency of loosing the dark elements of the markings suggest that the taxon is breeding under very dry, arid circumstances (HOVANITZ 1979). The larval hostplant and the nectar sources of the imagines are unknown.

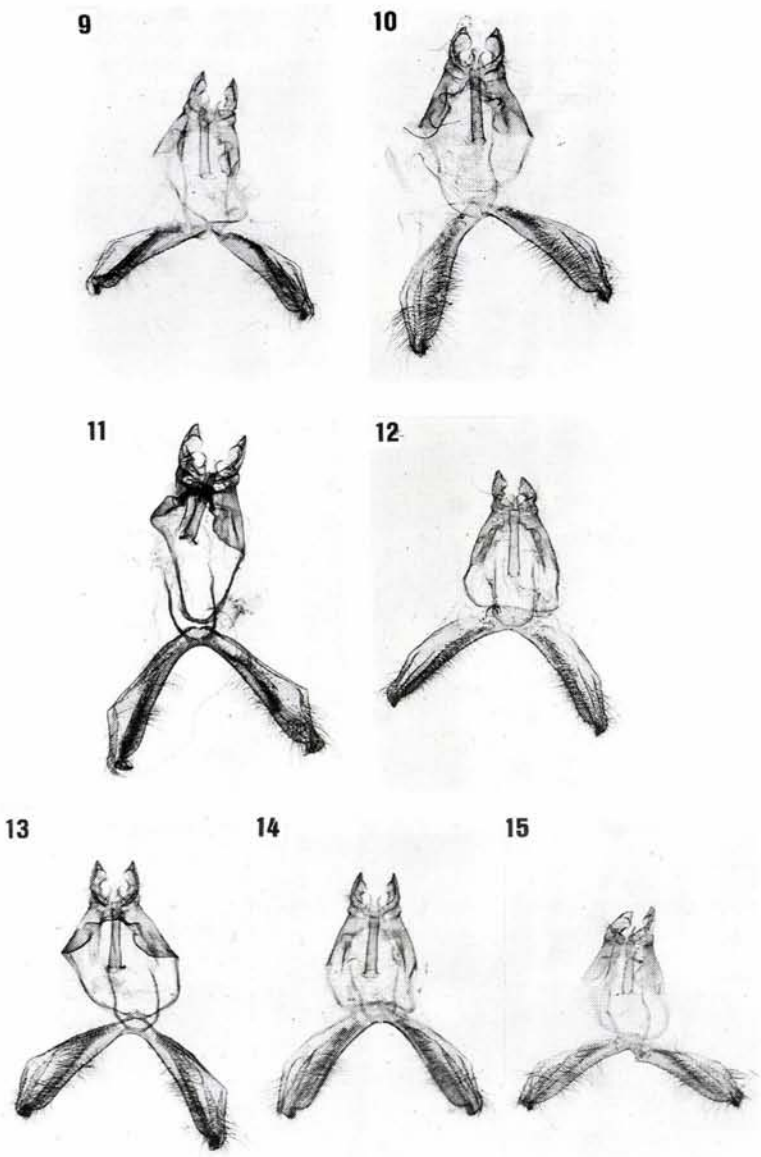
R e m a r k s – The superficial appearance of the taxon is remarkable, and it is easily distinguishable by the following characters: (1) Pattern. The maculations on both of the wings are strongly reduced, the submedian patches are very small, hindwing basal area with extended gleaming bluish scales, submedian and conspicuous white polyommatine spot along vein M3. (2) Sympatry. Other, closely related species as *P. arene* and P. *nepalensis* were also collected along with the type material.

Only two close relatives, namely "*Polyommatus stoliczkanus arene*" and "*Polyommatus nepalensis*" were known to occur in Nepal (SHIELDS 1982: 75–76, SMITH 1989: 136–137). Another species, which is the most closely related species according to its superficial appearance, *P. stoliczkanus* was exclusively reported from the Ladakh region, North India. Consequently *P. pierinoi* and *P. stoliczkanus* are allopatric, while *P. pierinoi*, *P. pseuderos* and *P. arianus* seem to be sympatric (see Discussion).

The BMNH expedition, which resulted in the primary types and several paratype specimens, collected another still undescribed lycaenid species of the *Albulina* s.l. group in Sabze Khola, which shows a remarkable pattern reduction recalling some high Andean polyommatines (BÁLINT, in preparation).



Figs 7-8. 7 = Male genitalia of *Polyommatus fraterluci* sp. n., holotype, gen. prep. No. 218, BÁLINT.
8 = Male genitalia of *P. pierinoi* sp. n., gen. prep. No. 220, BÁLINT



Figs 9-15. Male genitalia of *Polyommatus* species. 9 = *P. stoliczkanus* (FELDER et FELDER), Hindu-Kush, gen. prep. No. 292, BÁLINT, 10 = *P. drunela* (SWINHOE), Punjab, gen. rep. No. 290, BÁLINT, 11 = *P. icadius* (GRUM-GRSHIMAILO), syntype, Beik, gen. prep. No. 225, BÁLINT, 12 = *P. arene* FAWCETT, cotype, Khamba-Jong, Tibet, gen. prep. No. 287, BÁLINT, 13 = *P. everesti* RILEY, syntype, Mt. Everest, gen. prep. No. 226, BÁLINT, 14 = *P. droshana* EVANS, Goorais Valley, gen. prep. No. 293, BÁLINT, 15 = *P. sp. p. kasgharinesis*, Sarafshan, gen. prep. No. 294, BÁLINT

DISCUSSION

Allopatric speciation, which is presumed to be the only speciation possibility amongst *Lepidoptera* by some authors (e.g. DESCIMON 1986: 253–254), is obvious in the case of polyommatine lycaenids. Many studied polyommatine populations, which are highly adapted to the special environmental conditions, are stenochorous today. This applies to the majority of representatives from the polyommatine lineage as well. These populations are breeding in highly specialized environments with autochtonous biota, under very definitive circumstances. The rapid evolution of the "genus" *Agrodiaetus* HÜBNER, [1822] in the Mediterranean region or that of the *Polyommatus* s. str. lycaenids in the high mountains of Central Palaearctic territories (MANI 1968: 155–159) can be easily explained by allopatric speciation. Furthermore, this is the main source of the high diversity of the caryophyllacean *Dianthus* LINNAEUS (a typical nectar source of the polyommatine imagines according to my own observations in the Alps, in the Carpathian Basin and in Dobrogea), and that of some closely related Leguminosae genera, very often recorded as polyommatine larval hostplants (cf. SHIELDS 1982: 75, ZHDANKO 1993: 82).

The *icarus-eros–eroides* group is a typical verticille phenomenon (sensu TEILHARD 1955), which as a monophyletic unit pushes forth a large evolutive flabelliform formation to explore the optimal possibilities for his own phylum. This phenomenon can hardly be interpreted by classical cladistic methods because of the complicated relationships of the evolutive lineages briefly summarized below.

The expansive cold forest steppe phyletic line – the *eros* group. This group is widely distributed in the alpine regions of the Tien–Shan range and in the South Siberian high mountains ("*Polyommatus eros*" – KORSHUNOV 1978: 175), but representatives of the complex were also found e.g. in Yakutia ("*Polyommatus eros erotides*" – MRÁCEK 1989: 182,189), inhabiting tundra–like biotops (*Polyommatus erotides* (STAUDINGER, 1892)) or in the arboreal forest steppe–biom (South Siberian forest–steppe with *Larix–Betula*). Several taxa belonging to this group were also reported from mainland China and the Korean peninsula (*klaphecki* COURVOISIER, 1910 and its related taxa), or even in the high mountains of SW China (*Polyommatus forresti* BÁLINT, 1992).

Allopatric lineages of the group are well known in the western part of the Palaearctic region: the Alpine and Dinaric *eros* (OCHSENHEIMER, 1808), the Russian *boisduvali* (HERRICH–SCHÄFFER, 1844), the Balkan *eroides* (FRIVALDSZKY, 1835) and the Anatolian-Iranian *forsteri* (PFEIFFER, 1938) group of taxa (see BÁLINT 1992b) and highly isolated colonies can also be found at the edge of the eremial biom, e.g. in Mongolia (*Polyommatus aloisi* BÁLINT, 1988).

The stenochorous cold steppe–line – the *stoliczkanus* group.The *stoliczkanus* group is a typical representative of the kryoxerotic fauna of the Himalayas, but it is also found in the Pamirs, as well as at lower elevations below timber line in Nepal at the southern edge of the Palaearctic realm (see SHIELDS 1982: 68). This branch can be divided into several subclades (*icadius–stoliczkanus–pseuderos–arianus*), which again form a large verticille. Most probably each lineage is connected to fundamentally different kinds of habitats but we have no documentation to compile any kind of consideration at this moment. This entity has also a strong affinity towards the eremial biom (cf. the arid plateau of Tibet), and a western isolate of the group was very recently found in Kurdistan, SE Turkey (DE FREINA & WITT 1983).

The expansive xeromontane line – the *icarus* group. The group has successfully adapted itself to the eremial zone of the region (*Polyommatus turanicus* (HEYNE, 1895) and *Polyommatus szabokyi* BÁLINT, 1990), but convergent endeavors can be recognized everywhere at the boundaries of the Palaearctic regions and the eremial zone (e.g. *celina* AUSTAUT, 1879 in NW Africa, *juno* HEMMING, 1933 in Lebanon and Israel).

Several taxa could successfully penetrate different kinds of biotopes: tundra habitats in high altitude (*Polyommatus icarus* in W. Mongolia or *Polyommatus chitralensis* SWINHOE 1910, in the Himalayas) or xeromontane valleys (*Polyommatus bienerti* BÁLINT, 1992 in Turkmenistan or a still undescribed *Polyommatus* sp. in Uzbekistan).

P. icarus is one of the best adapted polyommatine lycaenid of the noosphere (sensu TEILHARD 1955) and its evolutive strength could perhaps have originated from the coalescence of several phyletic lines (see BÁLINT 1992b) as well as from its rather aggressive and vagile behaviour amongst lycaenids (LUNDGREN 1977). This coalescence is most probably the result of a loss of host plant and nectar source specialization which produced the cohesive population structure in the arboreal and xeromontane zone of the Palaearctic regions. This theory, however, must be confirmed by thorough ecologic studies.

The importance of the xeromontane elements in the noosphere is rather conspicuous, because several cultivated plant and animal species had "xeromontane" roots (VARGA 1976: 209).

Figs 16-18. Female genitalia of *Polyommatus*. 16 = *P. szabokyi* BÁLINT, Ih Bogd, Mongolia, gen. prep. No. 438, BÁLINT. 17 = *P. janetae* EVANS, Pakistan, Lalazar, gen. prep. No. 440, BÁLINT. 18 = *P. pierinoi* sp. n., paratype, Sabze Khola, gen. prep. No. 528, BÁLINT

The stenochorous xeromontane line – the *venus* group. The group is distributed at high elevations in the Central Asian mountains and seems to be another stenochorous branch of the group. Its distribution is restricted to the high ranges of Pamirs (*Polyommatus annamaria* BÁLINT, 1992) and Tien Shan where its range overlaps the *icarus* group (e.g. in the district of Kisil–Kum). As the political situation of the region is almost always unstable and it is very difficult to maintain scientific expeditions, we have very little information concerning this group.

The eremial line – the *bilucha* group. This eremial stock of *Polyommatus* is distributed in Beluchistan and W. Tibet. It is supposed to have originated from the line of *pseuderos* MOORE, 1897, which is supported by the occurrence of *florenciae* TYTLER, 1926 in Chitral. There is very little available information concerning this stock of the complex.

The taxonomic problems of the above introduced polyommatine verticille culminates in the Central Asian high mountainous region, where the coalescence, encroachment and flourishing of the phyletic branches are very remarkable. Going eastwards or westwards from this chorological center of *Polyommatus* s.str. we usually find highly isolated, allopatric taxa. The Transpalaearctic *P. icarus* and *P. eroides*, which both seem to be widely distributed in a lot of different kinds of habitats in their range, are the exceptions to the above-mentioned phenomenon.

This brief survey showed us that the Central Palaearctic "*stoliczkanus* complex" of polyommatine lycaenids is a flourishing Himalayan and Turkmenian branch on the phyletic tree of the large and very diverse Holarctic lycaenid genus *Polyommatus* LATREILLE, 1804.

* * *

A c k n o w l e d g m e n t s – I wish to express my sincere thanks to Mr. PHILIP R. ACKERY and Mr. CAMPBELL R. SMITH for the possibility to work in the Butterfly Collection of the Natural History Museum, South Kensington (UK, London) and for their continuous support and encouragement for my studies on Palaearctic lycaenids. I had many interesting and instructive discussions with my friends and colleagues Dr. KONRAD FIEDLER (D, Würzburg), Dr. LÁSZLÓ RONKAY (H, Budapest) and my professor Dr. ZOLTÁN VARGA (H, Debrecen) on lycaenid ecology and systematics as well as on biogeographic and taxonomic problems. The photos were taken by the photographer of the museum staff, Mr. ANDRÁS KEVE.

My interest in lycaenids is inspired by my wife ANNAMÁRIA KERTÉSZ, who is always involved in all of my projects. My principal thanks go to her.

REFERENCES

BÁLINT, ZS. (1988): A new Polyommatus Species from Southern Mongolia: Polyommatus aloisi spec.n. (Lepidoptera: Lycaenidae). – *Atalanta* **18**: 385–394.

BÁLINT, ZS. (1992a): Data to the Lycaenid Butterfly Fauna of the Western Himalayan Region (Lepidoptera, Lycaenidae). – *Linneana Belgica* **13** (8): 395-422,

BÁLINT, ZS. (1992b): Three new species of Polyommatus section (sensu Eliot. 1973) (Lepidoptera, Lycaenidae). – *Linneana Belgica* **13** (8): 423-445.

BALLETTO, E. & KUDRNA, O. (1989): On a small collection butterflies from NW. Afghanistan (Province Herat), with additions to the Afghan fauna and a check list of the species known for this country. – *Ent. Gaz.* **40**: 245-265.

BOLLOW, C. & GAEDE, M. (1932): 7. Familie: Lycaenidae. – In: SEITZ, A. (ed.): *Die Gross–Schmetterlinge der Erde*, Band 1 (Suppl.). Stuttgart, Alfred Kernen Verlag, pp. 239–306.

BRIDGES, C. A. (1988): Catalogue of Lycaenidae and Riodinidae (Lepidoptera: Rhopalocera). C.A. Bridges, Urbana, Illinois, vii+377+ii+115+ii+140+ii+101+ii+37+ii+10.

CARBONELL, F. (1991a): Une espèce jumelle méconnue du genre Polyommatus (Neolysandra) KOÇAK, 1977 (Lepidoptera: Lycaenidae). – *Linneana Belgica* **13** (1): 35–45.

CARBONELL, F. (1991b): Contribution à la connaissance du genre *Polyommatus* en Turquie orientale (Lepidoptera: Lycaenidae) – *Linneana Belgica* **13** (4): 221–235.

DE FREINA, J. J. & WITT, T. J. (1983): Zwei neue Lycaeniden-Arten aus Türkisch Kurdistan: Lysandra dezina sp.n. und Polyommatus ciloicus sp.n. (Lepidoptera, Lycaenidae). – *Entomofauna* **4** (14): 181–200.

DESCIMON, H. (1986): Origins of Lepidopteran faunas in the high tropical Andes. – In: VUILLEUMIER, F. & MONASTERIO, M. (eds): *High Altitude Tropical Biogeography*. Oxford University Press, New York, pp. 500–532.

D'ABRERA, B. (1993): *Butterflies of the Holarctic Region, Part 3, Nymphalidae (concl.), Libytheidae, Riodinidae & Lycaenidae*. – Victoria, Hill House: vii + 336-524.

ELIOT, J. N. (1973): The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. – *Bull. Brit. Mus. nat. Hist. (Entomol.)* **28** (6): 371–505.

EVANS, W. H. (1925): The identification of Indian butterflies, Part VI. – *J. Bombay nat. Hist. Soc.* **30** (2): 322–351.

FORSTER, W. (1938): Das System der paläarktischen Polyommatini. – *Mitt. münch. entomol. Ges.* **28** (2): 97–118.

HOVANITZ, W. (1979): Parallel ecogenotypical color variation in butterflies. – *J. Res. Lepid.* **17** (Suppl.): 25–55.

KORSHUNOV, Y. P. (1978): Ecologic and faunistic classification of Rhopalocera (Lepidoptera, Diurna) of the South Sibirian Mountains. – In: *Fauna Sibirii, No. 34*. Novosibirsk, pp. 168–183.

LUNDGREN, L. (1977): The role of intra– and interspecific male : male interactions in Polyommatus icarus Rott. and some other species of Blues (Lycaenidae). – *J. Res. Lepid.* **16** (4): 249–264.

MANI, M . S. (1968): Butterflies of the Himalaya. – Dr. W. Junk Publishers, Oxford & IBH Publishing Co., New Delhi, 181 pp.

MRÁCEK, Z. (1989): Contribution à la connaissance des Lépidoptères diurnes de la Iakoutie (Lepidoptera Rhopalocera et Hesperiidae). – *Linneana Belgica* **12** (4): 138–188.

MÜTING, D. & MÜTING, E. (1988): Reiseerinnerungen aus Baltistan. – *Ent. Z.* **98** (15): 209–224.

SAKAI, S (1981): (Butterflies of Afghanistan.) – Tokyo, Kodansha, 272 pp.

SCOTT, J. A. (1990): Adult structure and function. – In: KUDRNA, O. (ed.): *Butterflies of Europe*, Vol. 8., Introduction to Lepidopterology. Aula-Verlag, Wiesbaden, pp. 108–151.

SEITZ, A. (1908): 8. Familie: Lycaenidae. – In: SEITZ, A. (ed.): *Die Gross-Schmetterlinge der Erde, Band 1*. Stuttgart, Alfred Kernen Verlag, pp. 257-328.

SHIELDS, O. (1982): International Nepal Himalaya Expedition for Lepidoptera Palaearctica (INHELP) 1977, Report No. 1: Introduction and Lycaenidae. – *J. Res. Lepid.* **20** (2): 65–80.

SMITH, C. (1989): Butterflies of Nepal. – London-New Delhi, 352 pp.

TEILHARD, P. T. (1955): Le phénomène humain. – Éditions de Seuil, Paris, 318 pp.

VARGA, Z. 1976. (Zoogeographische Gliederung der paläarktischen Orealfauna.) – Állatt. Közlem. 63 (1–4): 195–209.

VIS, R. & COENE, H. A. (1987): Lepidopterological investigations in Kashmir and Ladakh (India). – *Nota lepid.* **10** (1): 5–24.

VERHULST, J. (1987): Une expédition de 7 semaines au Ladakh. – *Linneana Belgica* **11** (2): 61–84.

ZHDANKO, A. B. (1993): Polyommatus icadius (Lepidoptera, Lycaenidae), its taxonomy, biology, and distribution. – *Vestnik Zool.* **72**: 80-83.

Author's address: ZSOLT BÁLINT

Department of Zoology
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13
Hungary