A SPECIAL COMPILATION—

Neotropical "Blue" Butterflies

REPORTS of the
Museum of Natural History, University of Wisconsin
Stevens Point

NO.'s 43-54

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Available December 28, 1995[1]

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[1] There will be three subsequent mailings: (1) UWSP *Reports* general mailing list; (2) *Reports* 43-54 special domestic mailing list; (3) *Reports* 43-54 special overseas mailing list.

A MESSAGE FROM THE MUSEUM

Over the last five years the UWSP Museum *Reports* have been able to contribute a significant volume of descriptive research concerning tropical butterflies of the New World.

Since 1993 we have assembled the contents of the present pioneer volume treating the Neotropical "Blue" Butterflies (Lepidoptera, Lycaenidae, Polyommatini). It has been a special challenge since only one contributing author used English as his first language; placing texts into English from authors usually using Hungarian and Hebrew added an additional demand.

In the present volume three genera are formally revised and several others synoptically reviewed; over a dozen species are described as new and the previously unknown life histories of over twenty species are elucidated. Complex mimicry rings among the butterflies, as well as symbiotic relationship with ants, are explored. The Neotropical Polyommatini are shown to be far more diverse (and ecologically complex) than ever anticipated. Both black & white and color illustrations are used.

An interesting sidelight of this work is the fact that the seminal nomenclature for most of these butterflies was authored in 1945 by Vladimir Nabokov (the Russian/ American writer now famous for works like **Lolita**, **Ada**, **Pale Fire** etc.) during his tenure as an entomologist at the Museum of Comparative Zoology, Harvard University. Many of the new taxa in the volume are named after characters in Nabokov's life and works and a number of scholars of Nabokov's literary work have helped in the proposing of appropriate names.

In a time when it is difficult for institutions to support the publication of substantial descriptive work, the Museum is happy to be able to make this contribution and takes this opportunity to thank those who also contributed to this volume, both by financial support and volunteer effort.

Frank Bowers, Ph.D.
Director

SOME TECHNICAL COMMENTS

General— This volume was produced by offset printing from electronically generated camera-ready copy and assembled mostly from diskettes provided by authors subsequent to the review process. The printing method is consistent with our view of requirements of the ICZN Code (although electronically producing each page would, in fact, produce a cleaner copy). The circumstance of the first language of two authors being either Hungarian or Hebrew provided a challenge, along with the fact that although many countries have up-to-date computer technology, operators producing diskettes from such systems may not always be fully trained. Thus, some format problems were extremely difficult with the diskettes supplied. Editorial errors, perhaps minimizable only with a very large budget, thus resulted in certain instances. Where spellings differed between certain "Old World" and "New World" usages (grey/gray, color/colour, etc.) usages of the particular authors were followed. To avoid possible loss of information, the *Reports* sometimes opted for page formats varying somewhat from those in in the past. Similarly, since some kinds of graphics reproduced better on various grades of paper (or with certain reproduction techniques, like lasered masters versus photographed masters) changes were also made regarding the kind of paper used for certain reproductions. To accommodate the size of the volume, and the number of anticipated overseas mailings, a reinforcing binder was used over the perfect binding.

Taxonomic Format— Technicians noted that "Old World" taxonomists used a somewhat different format than "New World" authors. For instance, Old World authors consider the Latin binomial, author and publication date as standard and include the latter without necessarily a reference in the accompanying bibliography. This makes sense in that citations like "*Cyclargus* Nabokov 1945" are consequently consistent in all papers instead of appearing as "*Cyclargus* Nabokov 1945a" in one paper, "*Cyclargus* Nabokov 1945b" in another, if keyed to individual bibliographies. Query of the authors indicated they considered standard nomenclatorial dates (often as established by decisions of the ICZN) readily available in synonymic catalogues (like Bridges 1988, 1994) and not necessarily requiring complexly lettered bibliographic citations unique to each paper. Accordingly, in these regards, the *Reports* followed the formats of the individual authors.

Photographic Plates— Budget constraints required that photographic figures be plated in clusters each referring to various papers in the volume. Accordingly, as in past *Reports*, photoplates are interspersed throughout the volume and faced by a usually unpaginated caption page. At the end of each *Report* within the volume, a cross-referenced list is provided concerning where either color or black & white illustrations can be found relevant to the taxa of a particular paper.

Volunteer Staff— A significant volunteer staff, aside from individuals acknowledged in each of the *Reports*, aided in the assembly of this volume. Of particular help in assembling and disseminating material were the following individuals. Graphics— Laura Duffy, Rose Castro; Assembly— David Grossman, Adetne Smith, Cecil Jennings, Beverly Darwin, Ken Sevitsky, Constance Pigozzi, Marion Kronheim, Charlotte Alper. The services of several of these persons were provided through the support of the Environmental Action Committee, Brooklyn Society for Ethical Culture, for which the *Reports* particularly thanks BEAC coordinators Charles Horwitz, Esq. and Lisel Burns.

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Itylos: Bálint, Zs. and K. Johnson. 1994. Polyommatine lycaenids of the oreal biome in the neotropics, Part II. The *Itylos* section (Lepidoptera: Lycaenidae, Polyommatini). Annls hist.-nat. Mus. natn. hung. 86: 53-77.

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Bálint, Zs. and K. Johnson. 1995. Polyommatine lycaenids of the oreal biome in the neotropics, Part IV. Description of a new *Madeleinea* (Lepidoptera, Lycaenidae) species from Ecuador. Acta zool. hung. 41: 25-34.

Bálint, Zs. and K. Johnson. 1996. Systematic position and generic status of *Lycaena cogina*, Schaus, 1902: an endemic Neotropical Lycaenopsina. Acta zool. hung. 41 (in press)

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Smith, D. S., L. D. Miller and J. Y. Miller. 1994. The Butterflies of the West Indies and South Florida. Oxford University Press. Lycaenidae, pp. 107-131, plates 12 & 13. *Note*: The completeness of this treatment, which in the Lycaenidae drew to a great degree on the work of authors in the present UWSP volume was one reason for limiting several of the treatments in the present volume to the continental Neotropical fauna.

SECTION I

Continuation of the Series "Polyommatine Lycaenids of the Oreal Biome in the Neotropics"

The first four papers of this volume continue a series of papers by Zs. Bálint (with K. Johnson or G. Lamas) which have been cumulatively titled "Polyommatine Lycaenids of the Oreal Biome in the Neotropics". Parts I-IV were previously published in *Acta zool. hung.* [Budapest] and ***Annls hist.-nat. Mus. natn. hung.*** [Budapest]. Herein, articles which (a) continue alpha taxonomic elaboration of polyommatines of the oreal biome and (b) are consistent with the original authorship of this series are published as Parts V-VIII as noted immediately below. These four "parts" should be cited as indicated below, as also noted on the backside of each article's cover page. Following these "parts" of the polyommatine lycaenid series, papers by various other authors (treating either biological topics concerning the Polyommatinae or taxonomic commentary) are published as separate articles in **Section II.**

Polyommatine Lycaenids of the Oreal Biome in the Neotropics, part V: Synopsis of the High Andean and Austral Polyommatine Genus *Madeleinea* Bálint 1993 (Lepidoptera, Lycaenidae) by Zs. Bálint and K. Johnson, ***REPORT* 43**

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Synopsis of the High Andean and Austral Polyommatine Genus *Madeleinea* Bálint 1993 (Lepidoptera, Lycaenidae)

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Polyommatine Lycaenids of the Oreal Biome in the Neotropics, part V: Synopsis of the High Andean and Austral Polyommatine Genus *Madeleinea* Bálint 1993 (Lepidoptera, Lycaenidae) by Zs. Bálint and K. Johnson

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NO. 43

ABSTRACT.

The name *Madeleinea* Bálint 1993 is generally construed by lepidopterists to be the valid name for the Neotropical polyommatine assemblage sometimes referred to as "*Itylos sensu* Nabokov" [misidentification], "*Itylos* Nabokov" [invalid attribution] or *Nivalis* Balletto 1993 [invalid under Article 11g of the ICZN Code]. The genus inhabits xeromontane oreal biomes in the high Andes. At the time of this writing, twelve species are known, although new species are being discovered regularly. The genus is divided here into four species groups: "***lolita*** **Species Group**": *M. lolita* Bálint; "***koa*** **Species Group**": *M. koa* (Druce), *M. nodo* Bálint and Johnson **n.sp.**, *M. odon* Bálint and Johnson **n.sp.**, *M. vokoban* Bálint and Johnson **n.sp.**; "***huascarana*** **Species Group**": *M. huascarana* Bálint and Lamas; "***moza*** **Species Group**": *M. moza* (Staudinger), *M. pacis* (Draudt), *M. cobaltana* Bálint and Lamas, *M. tintarrona* Bálint and Johnson **n. sp.**, *M. ludicra* (Weymer), *M. pelorias* (Weymer).

Madeleinea mashenka Bálint 1993a, described from a specimen lacking an abdomen but since determined from recent material, proved to be an *Itylos* (Draudt 1921) species.

Madeleinea belongs in Eliot's (1973) *Polyommatus* section. Within that section, although the morphologies of *Madeleinea*, *Pseudolucia* Nabokov 1945 and *Paralycaeides* Nabokov 1945 clearly suggest a common origin, distinctive structural differences (particularly considering both sexes) support their separate generic status. *Paralycaeides* appears closest to *Madeleinea* but an immediate sister relationship is supported only by the female genitalia. Because *Madeleinea* is speciose and has taxa exhibiting a variety of silver-marked ventral patterns it is suspected that some workers may desire to split the genus into several genera (as proposed recently for *Pseudolucia*). However, as with *Pseudolucia*, study of characters of both sexes in *Madeleinea* shows that such subdivisions would be arbitrary, ambiguous and thus ill-advised.

Further testifying to the diversity of *Madeleinea*, specimens obtained subsequent to printing of the present paper necessitate description of additional new species elsewhere.

INTRODUCTION

The genus *Madeleinea* Bálint, 1993 is a Neotropical group of polyommatine lycaenids curiously patterned on the hindwing ventrum but with very "Holarctic-looking" male and female genital structures (Nabokov 1945: 39). The genus is restricted to the paramo and puna regions of southern Colombia, Ecuador, Peru, Bolivia, northeastern Chile and northwestern Argentina.

To many, this distinctive and attractive lycaenid genus has been historically known as *Itylos* (*e.g.* Descimon 1986: 509) based on the original work of Nabokov (1945) which, until very recently, was the first and only paper strictly dealing with Neotropical polyommatine lycaenids. In his original work, Nabokov did not recognize the nomenclatorial action of Hemming (1929: 240, *cf.* 1967: 236) who had validly designated the type species of *Itylos* Draudt 1921 as *Cupido speciosa* Staudinger, 1894. Nabokov ignored this action (1945: 38) and designated another type species for the genus, *Cupido moza* Staudinger, 1894.

This caused great confusion regarding the meaning of Draudt's original generic name and, even though the original group of taxa discussed by Draudt (1921, *Itylos* s.str.: *Cupido speciosa* and *Lycaena titicaca* Weymer 1890) strongly differed in morphology from the *moza* assemblage treated by Nabokov, no valid generic name for the latter group actually existed until the senior author (Bálint 1993a: 24) proposed the name *Madeleinea*. Balletto (1993: 242) had also proposed a name, *Nivalis*, in another paper predating Bálint's but because the name was explicitly denoted as an adjective, taxonomists have opined that it is invalid under Article 11g of the ICZN Code (see Bálint 1993b, 1994a from G. Lamas, in litt.).

Nabokov had very scanty material (cf. Bálint 1993a, table 1) but his review of Neotropical polyommatines was generally fruitful on the generic level. At the species level, however, the work was far more incomplete, with many species not discussed and others misinterpreted. Particularly regarding *Madeleinea*, the result was that numerous entities belonging to this distinct group of high Andean lycaenids remained either undescribed or only haphazardly determined up to very recent times.

In the seminal treatment of *Madeleinea* (Bálint 1993a: 24-28), the senior author summarized the known taxa of the genus and also described two species, *M. lolita* and *M. mashenka*. These species were each described from single specimens found at The Natural History Museum, London (BMNH) and the precise infrageneric position of *M. mashenka* remained uncertain because the holotype lacked an abdomen. Bálint and Gerardo Lamas were able to pursue the status of *M. mashenka* from newly collected material preserved at the Museo de Historia Natural Universidad Nacional Mayor de San Marcos (Lima, Peru) (MUSM) (cf. Bálint 1993b: 3) and, as will be published in detail elsewhere, *mashenka* belongs in *Itylos* (Draudt 1921). Bálint and Lamas (1994) described several unique *Madeleinea* taxa also represented in MUSM material and it has been possible to include these species in the present study at proof. A recent visit by Bálint to Peru (February-March 1995) was subsequent to review of the present study and additional species were discovered then which will require treatment elsewhere.

The present paper summarizes, in a revisionary format, the *Madeleinea* entities known previous to Bálint's 1995 visit to Peru. It includes all previously described taxa, four new species, and synthesizes what is presently known of the genus. Since many of the taxa described herein derive from recently surveyed historical material previously unidentified at various museums, it has appeared likely that additional species of *Madeleinea* would be discovered. A short trip to Peru by Bálint in 1995 combined field collection with review of unmounted museum material. His discovery of still more *Madeleinea* species supports comments by Bálint and Lamas (1994) that sibling species diversity among high Andean and austral Polyommatinae now appears to be the rule rather than the exception. Previously noted lack of diversity in these groups (Larsen 1991) appears to have been an artifact of poor sampling and lack of taxonomic work. The widening collecting activities of various biodiversity surveys in high mountain areas of Colombia, Ecuador, Peru, Bolivia, Chile and Argentina are promising. At proof of the present paper the authors received new *Madeleinia* material from the Pululahua Preserve in Ecuador which will require description elsewhere.

MATERIALS AND METHODS

Materials. Extensive material in the present study derives from unelaborated samples at the American Museum of Natural History (AMNH). As noted by the junior author in various studies of high Andean "elfin butterflies" (Lycaenidae, Theclinae) the AMNH houses specimens from high Andean and austral collections of F. M. Brown, H. Descimon, R. Eisele, B. MacPherson, Luis Peña and A. M. Shapiro as well as early historical material purchased by E. I. Huntington. Recently, the AMNH has sponsored several expeditions to Argentina and Chile and these have resulted in significant new material; also, there has been a recent infusion of material from high montane Ecuador by G. Kareofelas' and C. Witham's survey of several high Andean preserves (see Bálint and Johnson 1995). Since much of the material previously published on *Madeleinea* derived from high Andean and austral samples at the BMNH (Bálint 1993a) we have incorporated data on these specimens as well (in Appendix 1) updated to the new nomenclature. Further historical materials were found and studied very recently by the senior author in the Zoologische Staatssammlung (Munich, Germany) (ZSBS) (Bálint 1994b).

Shapiro (1978: 71) has emphasized that particular care must be taken not to describe widely disjunct montane or austral South American taxa from single dissections. Accordingly, using the combined material available in the present study, numerous genitalic dissections were prepared in order to assess ranges of structural variation in known species and compare these to the additional specimens which appeared to represent unique entities. BMNH dissections are mounted on microscope slides with appropriate BMNH numbers (see Bálint 1993a); AMNH is preserved in glycerin vials bearing the number sequence of the senior author and has been placed on the pins of the relevant specimens.

Methods. Since all *Madeleinea* taxa can be readily identified by VHW pattern (as originally analyzed by Nabokov, 1945: 42-43), we present Keys for the determinanation of the taxa based both on wing color and pattern and structural characters of the male and female genitalia. Concerning the latter, we have concentrated on characters generally familiar from the historical polyommatine literature.

A rather detailed descriptive synopsis of the genus was given by Nabokov (1945: 38-43, as *Itylos*, see Bálint 1993a: 24). Nabokov precisely described four historical entities and, accordingly, we do not repeat this work. Also, we do not give a detailed redescription for the taxa *M. moza* (Staudinger, 1894), *M. koa* (Druce, 1896), and *M. pacis* (Draudt [1921]) and we consider two other taxa, *Lycaena ruberrothei* Weeks, 1902 and *L. babhru* (Weeks, 1901) as synonyms of *M. moza*. These taxa have all been treated previously by Bálint (1993a) and the Keys and supplementary notes of the present paper are more than adequate to incorporate these historical taxa into this overall treatment of *Madeleinea*.

Nabokov mainly utilized wing pattern and male genitalic characters (Nabokov 1945, 1949). He did not incorporate female genitalic structures into his minutious descriptions although he addended some supplemental drawing of these structures. In the case of *Madeleinea* this is understandable because he indicates that only two female specimens were available to him (cf. Bálint 1993a, table 1). In the present study, we incorporate fully all the female genitalic structures of the genus (including the historical entities). The morphology of the female genitalia, especially in the ventral view, proved very useful for identification. Also, these are vital to understanding the intergeneric position of *Madeleinea* among the other South American polyommatines. Terminology follows Bálint (1993a) and Bálint and Johnson (1993a,b; 1994a,b; 1995), including their abbreviations to wing habitus (DFW [dorsal forewing, etc.]) and geographic direction (NE [northeast], etc.). Wing color notations follow Maerz and Paul (1950).

Thus far, "hard" biologic data (descriptions of early stages, hosts, biotope preferences, etc.) are not available for *Madeleinea* but these will be extremely important to discover and integrate into the growing knowledge of South American polyommatines.

CHARACTERIZATION OF *MADELEINEA*

MADELEINEA Bálint, 1993

Type species. – *Cupido moza* Staudinger, 1894 (Bálint 1993a: 24)

Itylos Nabokov, 1945: 38 [nec *Itylos* Draudt, 1921: 821.]. Lamas and Pérez, 1983: 36; Descimon, 1986: 519.
Nivalis Balletto, 1993: 242 [invalid under Article 11g of ICZN Code, explicitly proposed as an adjective].
Madeleinea Bálint 1993a: 24; Bálint 1993b: 3. Bálint and Lamas 1994: 234.

DIAGNOSIS. ***Wings***. Generally homogeneous in external appearance: DW ground color blue with prominent checkered fringes (only *M. moza* with brown DW ground has white unicolorous cilia). VFW pattern normal polyommatine, VHW markings with various combinations of brown postbasal and postmedian spots with whitish halos and, in the cell interspaces, extraordinary white or gleaming silver markings or suffusions. Sexual dimorphism various, weak to absent in some cases (*e.g. M. moza*), strong in others (*e.g. M. nodo*).

Morphology. Genital structure typical polyommatine (*s.str. sensu* Hirowatari 1992) in both sexes. Male genitalia with uncus and gnathos well-developed and straight in dorsal view, uncus variously horseshoe-shaped in lateral view; tegumen robust but of commonplace polyommatine shape, appendix angularis absent ("suspensorium" *sensu* Eliot 1973); furca weak and elongate; valvae overall of commonplace polyommatine shape but with rostellum produced; aedeagus resembling Old World's *Aricia*-group in structure and shape and with sagum absent. Female with eighth tergite showing remarkable posterior apophysis. Female genitalia also somewhat resembling that of *Aricia*-group (especially "*Eumedonia*" cf. Nekrutenko 1975, fig. 120); anterior lamella elongate and digital- or quadrant-shaped with encircled, strongly sclerotized, henia; ductus bursae finely undulate (hereafter, "corrugated" *sensu* Johnson 1991) along entire outer contour, well developed and eversible, much longer than henia; corpus bursae commonplace and shorter than the everted ductus bursae.

Species Groups. We divide *Madeleinea* into four species groups, each characterized and discussed below. One includes a single, very poorly known, taxon; two others include historical entities previously diagnosed by Nabokov; another was only recently distinguished. However, even the groups of historical taxa contain some species currently represented by specimens of a single sex or very few specimens of either gender. *Madeleinea mashenka* (cf. Bálint, 1993a, described from a primary type lacking an abdomen) has been omitted, consistent with recent work in preparation by Bálint and Lamas indicating it is a species of *Itylos* (Draudt 1921).

KEY TO SPECIES GROUPS

Wings (character italicized)
Genitalia (character not italicized)

1a. *HW 1A+2A with short pseudotail.* Male genital aedeagus outstanding with suprazonal element strongly sclerotized, gnathos appearing weak and elongate; valvae robust with high Baird's angulation................***lolita*-group** (female genitalia unknown)

b. *HW not tailed.* Male genital aedeagus not outstanding as "1" above; gnathos shorter and stout; valvae of commonplace polyommatine shape, costa not inclined or sharply angled.. **2**

2a. *VW with reduced pattern, VHW with dark suffusion in marginal areas of veins 1A and 2A; FW apex pointed*.......... ....***huascarana*-group**

b. *VW with complete pattern, VHW without dark suffusion along veins 1A and 2A; FW apex not pointed*..................3

3a. *VHW postmedian spots indistinct or hardly visible, intercellular stripe along M1 usually present.* Male genital aedeagus with suprazonal element angled, penis with zonal element produced; uncus narrow in lateral view. Female genital henia elongate with oval anterior lamella; ductus bursae contour relatively uncorrugated.............. ***koa*-group**

b. *VHW without conspicuous intercellular stripe, postmedian spots hardly visible, suffused or strongly developed and confused into a large postmedian band.* Male genital aedeagus with suprazonal element straight, narrow and long, zonal element slender with parallel edges; uncus robust and horseshoe-shaped in lateral view. Female genital henia diapason-like, anterior lamella quadrant-shaped; ductus bursae contour strongly corrugated .... ***moza*-group**

Geographic and Temporal Occurrence.

Geographically, *Madeleiena* is restricted to the Neotropical Realm, occurring mainly in the Andes and austral regions (see Brown 1993, fig. 2.). Specimens are currently known from Colombia and Ecuador southward to NW Chile and NE Argentina. Therein, typical habitats include the puna and the paramo regions for numerous high Andean taxa (Colombia, Ecuador, Peru, Bolivia, NE Chile and NW Argentina) and chaco and monte regions for more austral taxa (cf. *M. pacis*, *M. moza*). Altitudinal data is various, including *M. moza* recorded as low as 600 m. (Tucumán, Argentina) and the holotype of *Lycaena pelorias* collected on the volcan Sajama (NW Bolivia) at the high elevation of 3600-4600 m.

Temporally, wide geographic spread has resulted in material presenting every month of the year. Data need to be analyzed, and new information gathered on a species basis, concerning local "seasonal pulses" which probably typify certain paramo populations. Field workers noted syn- and allochronic paramo dwelling species among the Eumaeini lycaenids typifying either year-round "wet" or "dry" paramos or "seasonally wet" or "seasonally dry" paramos (Johnson 1990, 1992). These types of data may also distinguish *Madeleinea* species.

Biology.

Heretofore, the only detailed data has been that of Lamas and Pérez (1983: 36) regarding the habitat of *M. koa* and *M. huascarana*. These taxa are synchronic and syntopic at high elevations (3350-4700 m.) among *Polylepis* shrubs. Brown (1993, Table 2) listed the genus as inhabiting south Andean scrub. Label data on several *M. koa* and *M. pacis* specimens suggest syntopic occurrences at numerous historical collection sites (see material examined in Bálint 1993a and here below). In addition, *M. pelorias*, *M. tintarrona* and *M. ludicra* also show label data indicating occurrence with the above two species around Lake Titicaca. Accordingly, the habitat of the taxa may be identical or similar. Bálint's 1995 visit to Peru allowed the opportunity for more extensive notes on *Madeleinea* biotopes and these will be published in detail elsewhere. However, immediately below, a section has been added at proof providing a basic synopsis of information being more fully developed for eventual publication (it now possible to make general comments about Bálint's recent field observations but more time is necessary for full determination of plant samples, etc.).

There has previously been no detailed published data concerning early stages, hostplant preferences, adult or larval ecology, or the presumed myrmecophily of larvae among many Neotropical polyommatines. Dubi Benyamini (an Isreali lepidopterist resident in Chile) has recently produced voluminous results concerning life histories of various austral polyommatinae. It will take some time, however, before these are published. Similarly, results from Bálint's recent trip to Peru will be eventually forthcoming. In the meantime, to summarize basic observations concerning *Madeleinea*, Benyamini (pers. comm. to Bálint) observed *M. pelorias* ovipositing on *Lupinus* in northeastern Chile. Bálint saw an undescribed species near *M. pacis* ovipositing on small violet-flowered *Astragalus* species at Quebrada Chinchán, Dept. Lima at 4250 m. *Madeleinea huascarana* oviposited on small white *Astragalus* species at Laguna Parón, Dept. Ancash at 4300 m. *Madelienea koa* oviposited on a pink-flowered *Trifolium* species at Llanganuco, Dept. Ancash, 3850 m. *Madeleinea pacis* oviposited on a large light blue-flowered *Astragalas* species at Incuyo, Dept. Ayacucho at 3300 m., and on a small violet-flowered *Astragalas* at Paso de los Vientos, Dept. Tacna at 3900 m. Note that we have not cited the authors of these various *Madeleinea* species since they are contained in the taxonomic list immediately below.

TAXONOMIC SYNOPSIS OF *MADELEINEA*

*species described herein

lolita **Species Group**

Madeleinea lolita Bálint, 1993

huascarana **Species Group**

Madeleinea huascarana Bálint and Lamas, 1994

koa **Species Group**

Madeleinea koa (Druce, 1876)
Madeleinea nodo Bálint and Johnson*
Madeleinea odon Bálint and Johnson*
Madeleinea vokoban Bálint and Johnson*

moza **Species Group**

Madeleinea moza (Staudinger, 1894)
= *babhru* Weeks, 1901
= *rubberothei* Weeks, 1902
Madeleinea pacis (Draudt, [1921])
Madeleinea cobaltana Bálint and Lamas, 1994
Madeleinea tintarrona Bálint and Johnson*
Madeleinea ludicra (Weymer, 1890)
Madeleiena pelorias (Weymer, 1890)

Lolita Species Group

KEY CHARACTERIZATION

Wings (character italicized)
Genitalia (character not italicized)

DW ground blackish brown with iridescent metallic suffusion, HW with conspicuous pseudotail; VHW pattern complex. Male genitalia with uncus robust...................... *M. lolita.*

Madeleinea lolita **Bálint**

Photoplate I; Figures 3, 31.
Madeleinea lolita Bálint 1993: 24.

DIAGNOSIS. ***Wings.*** FW costal margin slightly convex, outer margin elongate; DFW,DHW ground blackish brown with iridescent metallic blue basal and medial suffusion; VHW ground greyish brown with pattern complex: subbasal spots large, postmedian spots converging into a dark wavy band, postmedian areas strongly mottled; pseudotail present at 1A+2A present and prominent suggesting an elfin butterfly appearance.

REMARKS. The original diagnosis was based on a single specimen and its male genitalic structure described (Bálint 1993a: 24, figs. 67, 115). Additional data was reported subsequently (see Bálint 1993b: 3). This very distinctive species can be readily distinguished from the following entity, formal description of which appeared only recently.

Huascarana Species Group

KEY CHARACTERIZATION

Wings (character italicized)
Genitalia (character not italicized)

DW ground deeper blue without iridescent metallic suffusion, HW pseudotail indistinctive; VHW pattern resembling koa. Male genitalia with uncus less developed ....*M. huascarana.*

Madeleinea huascarana Bálint and Lamas
Photoplate I, Figure 4.
Madeleinea huascarana Balint and Lamas 1994: 234.

DIAGNOSIS. ***Wings***. FW with costal margin straight and long, outer margin almost straight; DW ground color blue with strong black FW apical suffusion, marginal border conspicuous; VHW ground ash grey with noncomplex pattern similar to *M. lolita*; VHW pattern sharp, contrasting shiny ground, marginal area with dark suffusion at 1A+2A suggesting false tail.

Morphology. Fig. 4. Male genitalia most like *M. lolita* but with far less prominent uncus and gnathos and a more outstanding vesica.

DISTRIBUTION. ***Spatial***: known only from the Cordillera Blanca at high elevations (3850-4400 m.). ***Temporal***: specimens were recorded throughout the year.

REMARKS. Lamas and Pérez (1983:36; figs. 39, 40) mentioned and figured an "*Itylos* sp.n." originally supposed by the senior author to be identical with *Lycaena ludicra* (Bálint 1993a: 27). After the original description of *Madeleinea* it became apparent that specimens Lamas and Pérez represented an undescribed member of this genus (Bálint and Lamas, 1994) and a sister of *M. lolita* which, because of their divergent characters, had also appeared quite remarkable when first discovered.

In 1995 the senior author located the species not only at its type locality (Quebrada Llanganuco) but also at Laguna Parón, a glacial valley immediately north of the type locality in the Cordillera Blanca. The species occurs within *Polylepis* shrublands at both localities.

Koa Species Group

KEY TO SPECIES

Wings (character italicized)
Genitalia (character not italicized)

1a. *Male DW ground lighter violet blue; female DW brown with extensive blue suffusion. VFW discoidal and postmedian spots emphatic and surrounded by white halos, VHW ground mottled drab and patterned with emphatic postmedian spots showing gleaming whitish discocellular coloration in cells Rs and Sc+R1; Rs postmedian spots well patterned.* Male genital aedeagus with suprazonal element elongate; uncus typical polyommatine but slightly pointed and with relatively parallel edges. Female genital henia elongate with two strongly sclerotized apical apohysis; anterior lamella ovate distally, arched basally ....*M. koa.*

b. *Male DW ground deep violet blue. Female DW ground brown. VFW maculation indistinct, VHW with dark, suffused elements of pattern, strongly contrasting light discocellular coloration.* Male genital aedeagus with shorter uncus and stronger gnathos. Female genitalia henia more ovate or tailed 2

2a. *VFW maculation hardly visible, VHW with extensive dark discal line and gleaming whitish our brownish intercellular colors in cells Rs and Sc+R1; Rs postmedian spots suffused and hardly visible.* Male genital aedeagus with suprazonal and subzonal elements of about equal length; uncus with less remarkable innovation than *koa*. Female genital henia wide with indistinct apophysis, anterior lamella ovate but elongate, somewhat pointed terminad .... *M. odon.*

b. Female genital henia with four apical apophyses, anterior lamella more ovate or pointed....................................3

3a. *VFW almost without pattern, VHW ground patterned but not so complex as in* koa, *postmedian pattern coelescent, gleaming whitish discocellular coloration in ce Rs, Sc+R1 and Rs postmedian spots visible.* Male genital uncus commonplace as in *M. koa*, suprazonal part of aedeagus somewhat longer than subzonal; female genitalia henia very narrow and pointed, anterior lamella tailed but not pointed... ....*M.nodo.*

b. (Male unknown) *Female DW with long outer margin, VHW ground unicolorous, patterned only with suffused postmedian band and two black antemarginal spots.* Female genital henia shorter and more corpulent; anterior lamella tailed, strongly pointed..................*M. vokoban.*

Madeleinea koa (H. Druce)

Photoplate I, Figures 5, 14, 27, 29, 30.

Lycaena koa H. Druce 1876: (I)239; pl. 18, f. 7.

DIAGNOSIS. Nabokov 1945: 42 (figs. KOA pl. 6,7).

Additional Data. ***Female Genital Morphology.*** Fig. 14. Genitalia with henia narrow (length two times width) and slightly pointed, apical apophysis strong and sclerotized; anterior lamella elongate and ovate, with length comprising 5/4 of width.

TYPE. Druce stated that the type specimen of "*Lycaena koá*" was in the Godman-Salvin Collection and he also mentioned that two or three specimens were collected (1876: 240). A lectotype was designated by Bálint (1993a: 26) from one syntype located at the BMNH. Subsequently another syntype of paralectotype value (according to BMNH procedures) has been identified (Bálint 1993a: 26, fig. 74).

REMARKS. This is the most well represented *Madeleinea* species in historical collections. In the field it has been documented as the dominant polyommatine species in humid valley bottoms covered with high *Calamagrostis* (e.g. Parque Nacional Huascarán, February 1995, unpublished data of Bálint).

Bálint (1993b: 3) provisionally stated that *Lycaena koa* and *Lycaena ludicra* Weymer (1890) were synonyms. This statement is clarified below in the entry concerning *Madeleiena ludicra*. Hayward (1973: 166) questioned reports of "*Itylos koa*" from Misiones, northeastern Argentina, most probably based on mislabeled specimens.

MATERIAL EXAMINED. AMNH. *Peru*: 1m: Huasahuasi, Tarma, Junin, 2700 m, 26.IV.1940.; collection of F.M. Brown. 2ms: Ollantaitambo, Cuzco, Alt. 9200 ft, 3.III.1940; collector J.C. Pallister. 1m: Huancayo, Alt. 10.636 ft, 27.VII.1917; H.S. Parrish, ex coll. W.P. Comstock. 1f: Ollantaitambo, Cuzco, Alt. 9200 ft, 3.I.1947; collector J.C. Pallister. ***Bolivia***: 1m: La Paz, 3600-4000 m, coll. Fassl; ex coll. W.P. Comstock. 1f: Titicacasee, 398; Collection E.I. Huntington, No. 1053. 1f: Titicaca, 397; Collection E.I. Huntington, No. 1053. Genitalia dissections (gen. prep. No. Bálint), males: 368 (Ollantaitambo), 371 (Bolivia), 373 (La Paz), 478 (Huancayo), 480 (Titicaca); female: 388 (La Paz).

ETYMOLOGY. The name "Koa" refers to an Inca queen.

Madeleinea nodo Bálint and Johnson
NEW SPECIES

Photoplate I, Figures 7, 17, 25, 26.

DIAGNOSIS. ***Wings.*** FW costal margin straight, outer margin relatively short and slightly convex, with apex pointed. Sexual dimorphism very strong. *Male* DW ground very deep flame blue with wide black margin; VW with almost no pattern. *Female* DW ground unicoloured brown, DHW as in male.

Morphology. Male genitalia resembling *M. koa* with somewhat stronger gnathos and more prominent suprazonal element on aedeagus; female genitalia with posterior plate of fibula very large and bifed in lateral view.

DESCRIPTION. ***Male.*** DW ground unicolourous flame blue (Maerz and Paul 1950: 45/F11); veins gleaming, wide marginal border black and very wide; fringes long, prominently checkered. VFW ground tawny brown (Maerz and Paul 1950: 13/D10) in postmedian and marginal area; basal part suffused with grayish scales, discoidal and postdiscal spots scarcely visible by only lighter halos; veins lighter; submarginal pattern absent; VHW pattern with costal subbasal and postmedian spots in cell Sc+R1 suffused into one long but pale brown macule; postmedian spot in Sc+R1 and Rs present but hardly visible; silvery stripe of cell RS absent; FW length: 9.0 mm (allotype, male). ***Female.*** DW ground unicolourous chocolate brown (Maerz and Paul 1950: 8/H10). VW as in male. FW length: 8.5 mm. (allotype). ***Male Genitalia.*** Figs. 7,25,26. Uncus shorter than in *M. koa*, gnathos stronger; aedeagus with suprazonal element largest and without parallel edges; valvae small with a long costal process; anal lobe weaker than in *M. koa*. ***Female Genitalia.*** Fig. 17. Genital henia weaker than in *M. koa* and very narrow and pointed with strong bifed apical apophysis; anterior lamella tailed but not pointed with length about twotimes maximal width.

TYPES. Holotype male, label data "South America, Ecuador, Pichincha Province, Pululahua Geobotanical Reserve, Loma los Monjas, 2700 m., moist montane (cloud forest), 22-XII-93 (1), G. Kareofelas, deposited AMNH. Allotype female, label data "Mirador, Équateur, Dr. G. Rivet, 1902" deposited MHNP [respective genitalia dissections are gen. prep. No. Bálint, 442 (holotype), 370 (allotype)]. *Paratypes* (all deposited MHNP): 3ms: Pifo, Equateur; 1920-1932, coll. L. & J. De Joannis. 1m: [?] Petit Nono, Prés Quito. 1m: Quito, Équateur, R. Benoist, 1930. 2ms: San Gabriel, Équateur, Dr. G. Rivet, 1901. 1m: Caritagua, 3600 m d'alt., Équateur, P. Rivet, 1903. Genital dissections (gen. prep. No. Bálint), males: 390 and 393 (Quito), 394 (Pifo), 481 (Pifo), 484 (Env. de Quito); female: 482 (San Gabriel).

DISTRIBUTION. ***Spatial***: currently known only occurring in the Ecuadorian Andes, at high elevation (2700-3600 m). ***Temporal***: the holotype specimen was collected in December.

REMARKS. This species is closely related to the familiar species *M. koa* and underlines the biogeographic importance of the equatorial Andes for diversity in the oreal lycaenids. Johnson (1990, 1992) noted a high diversity in the Ecuadorian paramo-dwelling and forest-paramo margin "elfin butterflies" (Lycaenidae, Eumaeini). Johnson, G. Kareofelas and C. Witham are currently documenting an even wider diversity of such elfins from Ecuador's Puluahua Geobotanical Preserve in Pichincha Province. Recent samples from previously uncollected areas of montane Colombia also continue to add unique, and apparently locally endemic taxa, to this ever-growing list. Many such discoveries have resulted simply critical study of already available samples. For instance, Johnson (1990, 1992) documented similar-looking orange elfins in two disparate high Andean genera whose members are usually blue or purple. Because of the orange dorsal color and cryptic ventral markings, common usage classification might have placed these as the same species. Subsequently, Salazar E., Cardona and Johnson (in press) noted an orange member of *Profieldia* (usually purple or blue) from high altitude dry tropical forest in Colombia. These specimens were among pinned samples of usually orange *Electrostrymon* (the latter from a very different locality and habitat). Since *M. nodo* was first recognized from recent samples of Kareofelas, it is likely that additional high Andean collection in Ecuador, as well as other regions, will result in the discovery of additional new species.

Madeleinea nodo is rather polytypic in its VHW pattern, showing light and dark phenotypes in long series. Eumaeine "elfins", particularly in *Rhamma* Johnson, also show such variations in wing facies. Fortunately, external androconial clusters and differences in HW tail structures help diagnose these hairstreaks. The latter show interesting pattern of syn- and allochrony in paramo habitats that have been distinguished as "wet" or "dry" year round, or seasonally "wet" or "dry". Such segregations probably also exist in *Madeleinea* populations and will deserve more thorough study as the genus becomes much more well known.

According to its label data, the holotype specimen of *M. nodo* was collected in moist montane (cloud) forest, an attribution which must be taken seriously since each specimen from the Pululahua survey is individually enveloped with detailed data. It may be that the specimen derived from moist forest/ paramo ecotone, oft-noted as rich in elfin species in Colombia (J. Salazar, J.F. Le Crom, pers. comm.). Such a microhabit could occur not only along the margin with paramo but at sites of weedy vegetation along roads or paths traversing cloud forest habitats.

ETYMOLOGY. Named for "Nodo", half-brother of Odon (Nabokov 1962: 311), signifying the sister relationship with *M. odon* and the fact that, of the two, "Nodo" occurs geographically to the [no]rth.

Madeleinea odon **Bálint and Johnson**
NEW SPECIES

Photoplate I, Figures 6, 16.

DIAGNOSIS. ***Wings.*** FW costal margin straight and long, outer margin slightly convex, apex pointed. DW ground beautiful imperial blue with prominent wide black wing margin; discoidal spot very small, almost invisible. VFW almost without pattern, VHW resembling *M. koa* but with less complex maculation.

Morphology. Male genitalia most resembling *M. nodo* but differing by somewhat longer uncus and slender gnathos; valvae robust. Female genitalia with fibula showing prominent and expansive anterior plate less pointed at the apex than in congeners.

DESCRIPTION. ***Male.*** DW ground unicolorous imperial blue (Maerz and Paul 1950: 37/C12) with prominent darkly colored veins; margin wide especially at FW apex; fringes long, slightly checkered. VFW ground Arizona drab (Maerz and Paul 1950: 13/E6) in postmedian and marginal area; basal region suffused with grayish scales. Discoidal and postdical spots scarcely visible except by lighter halos; submarginal pattern indistinct. VHW ground with costal, subbasal and postmedian spots in cell Sc+R1 suffused into one long macule; cell RS silver and extending to outer margin with brownish postmedian spot; discal and M1-2 cells brown ("pseudovitta"); gleaming spot in cell CuA2-M3 as typical of group; submarginal pattern suffusive. FW length: 10.0 mm. (holotype, paratype). ***Female.*** DW ground brown; VHW as in male. FW length: 7.0 mm. (allotype). ***Male Genitalia.*** Fig. 6. Uncus appearing intermediate between *M. koa* and *M. nodo* in width and length; gnathos relatively strong; tegumen and vinculum typical and indistinctive compared to congeners; juxta long, extending half the length of the tegumen (circa valvae length). Valvae with strong rostellum, humped proximally in the last eigth of its length. Aedeagus with suprazonal element equal with subzonal length, narrow and with pointed distal end; proximal tabs strongly developed, alulae week, zonal element strong; suprazonal sheath narrow above the zone and of about same length, edges parallel; vesica originating almost at the zone. ***Female Genitalia.*** Fig. 16. Genitalia with henia very produced, slightly longer than wide and somewhat pointed with a weak apical apohysis; anterior lamellae ovate but slightly pointed with length about 1.3 times maximal width.

TYPES. **Holotype** male, label data "Paramo Tinpullo, Cotopaxi, Ecuador, 3500 m, 6.XI,1938, Acc. 36379,

Figures 1-2

Distributions of high Andean and austral taxa of *Madeleinea* Bálint, 1993 in continental South America

Fig. 1. Distribution of *lolita*-group

●	*M. huascarana*
○	*M. lolita*

Distribution of *koa*-group

□	*M. koa*
■	*M. nodo*
◨	*M. odon*
◪	*M. vokoban*

Fig. 2. Distribution of *moza*-group

●	*M. cobaltana*
○	*M. ludicra*
⊙	*M. moza*
◑	*M. pacis*
◐	*M. pelorias*
◒	*M. tintarrona*

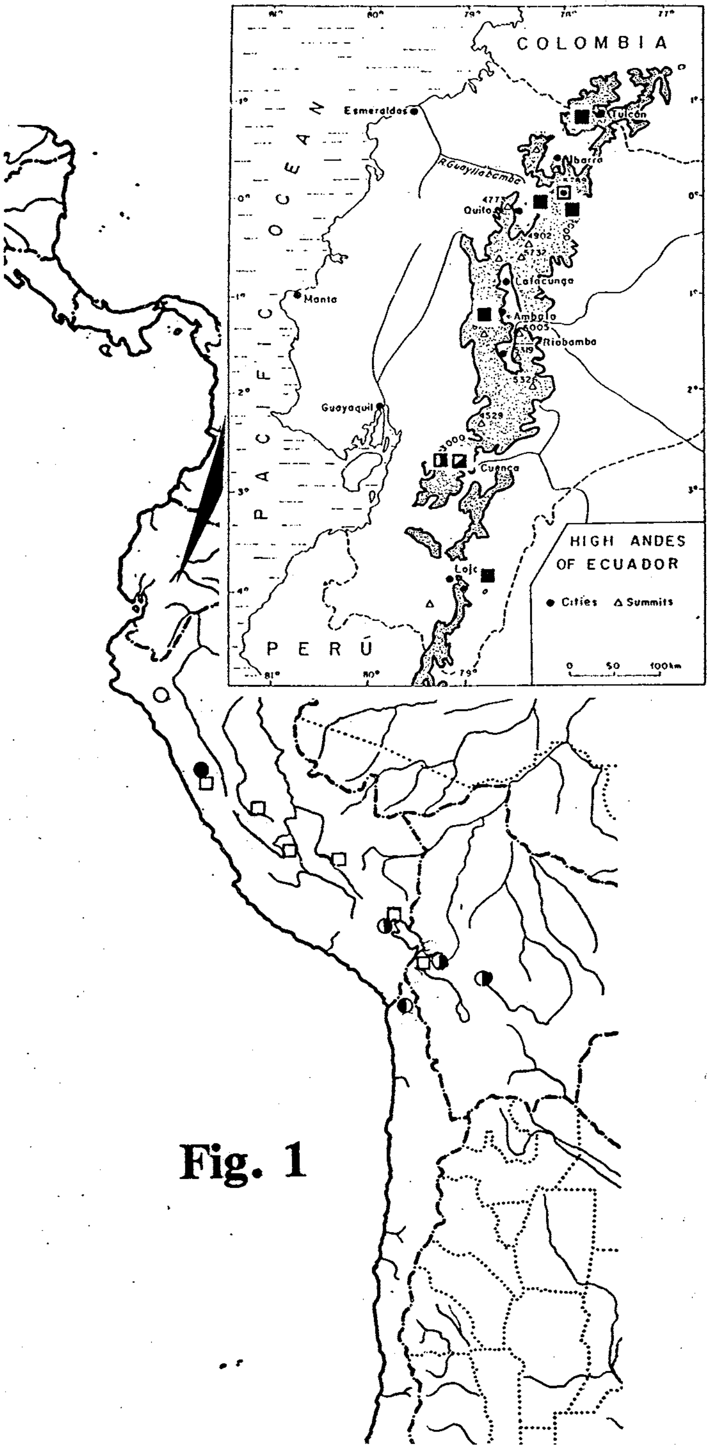

Fig. 1

NOTE re FIG. 1

at proof the map has been updated to include additional taxa from subsequent *Reports* or other literature, as follows:

M. lea	○
M. sigal	◐
(*Report* No. 47)	
M. carolityla	⊡
(Bálint & Johnson 1995)	

M. lea and *M. sigal* belong to the *moza*-Group (Fig. 2) but were arbitrarily added to Figure 1 for clarity of symbol location

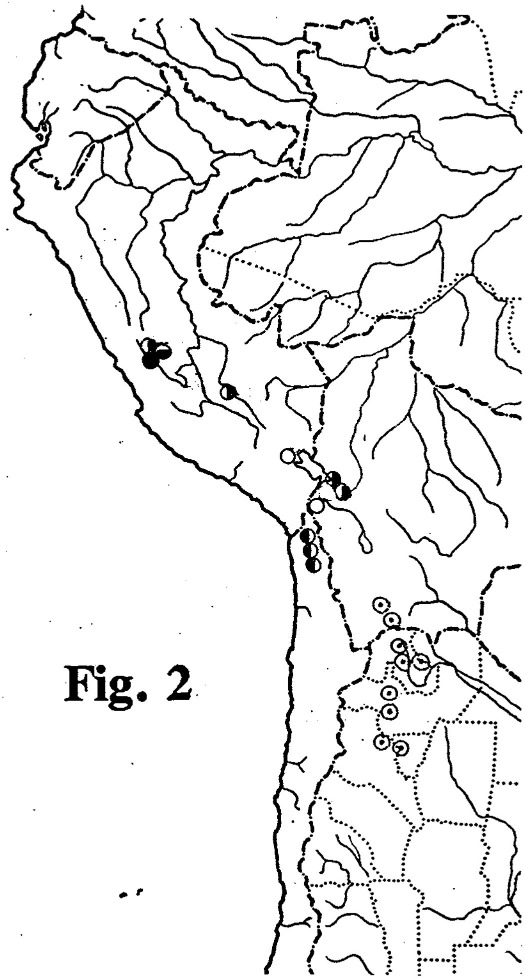

Fig. 2

Symbol location— given the nature of some historical data (e.g. historical citation of generalized regions or locales [like "Lake Titicaca", etc.]) symbols for more well-known species may represent more than one, closely clustered, locality. Similarly, clustering of several symbols at one locale may result in slight distortion of actual location.

For additional distributional data concerning Chilean *Madeleinea* see Benyamini, 1995, UWSP *Report* 52

Col. F. M. Browm". **Allotype** female, label data "Cuenca, Azuay, Ecuador, 2500 m, 23.II.'39.; collector F. M. Brown" both deposited AMNH. Genitalic dissections in glycerin vials as Bálint gen. prep. no. 375 (holotype), Bálint, gen. prep. no. 377 (allotype). ***Paratype***. **HN-HM**. Male, label data "Uyumbicho, Ecuador, 2700 m, 4.XI.1938; Acc. 36379, Col. F. M. Brown" (Bálint gen. prep. no. 380).

DISTRIBUTION. ***Spatial***. Currently known only from the Ecuadorian Andes at elevations 2500-3500 m. ***Temporal***. The holotype and paratype males were collected in the first half of November, the allotype female in February.

REMARKS. During the senior author's visit to the ZSM (November, 1993) a female *Madeleinea* specimen with the label "Chimborazo (Ecuad.), R. Haensch" was noted that represented this species. A specimen loan was not possible but it is apparent now that the specimens represents *M. nodo*.

ETYMOLOGY. Named for "Odon", half brother of Nodo (Nabokov 1962: 311) and further suggesting the interesting diversity of the *koa* Species Group.

Madeleinea vokoban **Bálint and Johnson**
NEW SPECIES

Photoplate I; Figure 15.

DIAGNOSIS. ***Wings***. FW of known female with costal margin straight, outer margin long and slightly convex, apex pointed. The male is unknown. Female DW ground unicolorous chocolate brown, VHW with pale submedian band.

Morphology. Female genitalia with posterior plate of fibula very large and bifed in lateral view.

DESCRIPTION. ***Male***. Unknown. ***Female***. DW ground unicolorous chocolate brown (Maerz and Paul 1950: 8/H10); fringes long and checkered. VFW ground Arizona drab (Maerz and Paul 1050: 13/E6), discoidal and postdiscal spots visible only by lighter halos; VHW ground somewhat darker thatn FW with strongly suffused and reduced pattern, costal, subbasal and postmedial spots in cells Sc+R1 and Rs somewhat darker; postmedian wave weakly bordered with blackish scales in cells M2, M3 and CuA1; very small black marginal spot in cell CuA2 and cell 1A+2A. FW length: 9.0 (holotype). ***Female Genitalia***. Fig. 15. Genital henia stronger than in *M. koa*, slightly logner than wide, pointed with strong bifid apical apophysis; anterior lamella tailed with length about two-times maximal width.

TYPES. Holotype female, label data "Seville de Oro, 2500 m, Azuay, Ecuador, 15.II.'39, collector F. M. Brown", deposited AMNH (respective genitalia dissection is gen. prep. No. Bálint: 369).

DISTRIBUTION. ***Spatial***: currently known only from the Ecuadorian Andes, at high elevation (2500 m.). ***Temporal***: the holotype specimen was collected in February.

REMARKS. According to superficial wing characters, especially the postmedian band of the VHW, this species could easily be placed in the *moza* Group, between the taxa *M. moza* and *M. pacis*. However, the female genital morphology bely this inference and clearly suggest kinship with the *koa* Group, a relationship also more compatible with the geographic position of *M. vokoban*'s type locality. As a result, *M. koa* and *M. vokoban* are immediately separable by wing pattern, the VHW of all the known *M. koa* (see Material Examined and Appendix I) being contrasted and colorful while that of *M. vokoban* unicolorous and dull. Since the *Madeleinea* VHW pattern generally shows no sexual dimorphism, these differences should also occur in the males and readily separate both sexes of the species in a sympatric population.

ETYMOLOGY. The name is an anagram of Nabokov, the first reviser of the genus. An anagram is appropriate in *Madeleinea* because most holotypes are males. Not only has the situation been reversed here, the holotype female of *M. ludicra* was historically considered a male, emphasizing the homoplasy in wing characters noted in the description of *M. vokoban* above.

Moza Species Group

KEY TO SPECIES

Wings (character italicized)*
Genitalia (character not italicized)

1a. *DW ground brown, VHW ground mottled drab with fine maculation, gleaming intercellular patterns absent.* Male genitalia large with strong uncus and weak gnathos, aedeagus long and slender, valva very large; female genitalia with strongly sclerotized edge of henia outwardly curved.......... ....*M. moza*.

b. *DW ground any hue of blue*.................................2

2a. *DW ground violet blue, VHW with prominent submedian band*..............................3 [*M. pacis* or *M. tintarrona*].

b. *DW ground metallic blue, VHW with very wide postmedian band*......... 4 [*M. ludicra, M. cobaltana, M. pelorias*].

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*Wing characters are quite definitive in this group. Accordingly, genitalic characters are provided as a reference only in the final identification couplet. Workers may want to verify identifications by dissection, especially if undescribed species are suspected.

3a. *DW ground violet blue, VFW apex with a whitish shade, VHW pied with wide submedian band.* Male genitalia with strong and pointed gnathos, subzonal part of aedeagus slender and very long with prominent alulae; female genitalia with strongly sclerotized edge of henia outwardly curved and with contour broken twice.. *M. pacis*.

b. *DW gleaming violet blue, VFW with greyish ground, VHW pied with extended white elements and strongly interrupted postmedian band.* Male genitalia relatively weak horse-shoe shaped uncus in dorsal view, subzonal part of aedeagus strongly expanded; female genitalia not known...*M. titarrona*.

4a. *FW apex slightly rounded, VFW maculation well visible; VHW resembling* M. koa *but DW gleaming lighter blue.* Uncus of male genitalia commonplace with slightly stronger gnathos, aedeagus with longer suprazonal part; female genitalia with strongly sclerotized edge of henia generally evenly contoured......................*M. ludicra*.

b. *DW ground darker blue (greyish or metallic) in male, VHW with conspicuous postmedian band resembling M. pacis*; male genitalia with weaker gnathos, female genitalia with margin of henia undulate.........................5

5a. *DW ground greyish blue in male, cobalt blue in female, VFW white apical suffusion not so distinct, VHW paler with very wide submedian band, gleaming silvery elements extended.* Male genitalia with weak and straight gnathos, aedeagus with strongly curved suprazonal and subzonal parts, alulae not so developed as in *M. pacis*; female genitalia with strongly sclerotized edge of henia apically curved outward and with broken contour.......... ....*M. cobaltana*.

b. *DW ground gleaming metallic blue, VHW submedian band very near or almost suffused with postbasal markings, gleaming silvery elements reduced.* Male genitalia with weak but straight and long gnathos, aedeagus with curved suprazonal part, subzonal long and robust with parallel edges; female genitalia with strongly sclerotized edge of henia undulate..........................*M. pelorias*.

Madeleinea moza (Staudinger)

Photoplate I, Figures 8, 18, 33, 34.

Cupido moza Staudinger 1894: 79, pl. 2, f. 5.

Lycaena babhru Weeks (1901: 357). Weeks 1905: 98; Comstock and Huntington 1959: 88; Bridges 1988: I.44 [cited as synonym of *moza*].

Lycaena rubberothei Weeks (1902: 104). Weeks 1905: 99; Comstock and Huntington 1963: 52; Bridges 1988: I.305; Bálint 1993: 26. **NEW SYNONYMY** (see Remarks).

DIAGNOSIS. Nabokov 1945: 40 - 41 (figs. MOZ, pl 6,7).

Additional Data. ***Female Genital Morphology.*** Fig. 18. Henia with strongly sclerotized edges slightly curvate distally; anterior lamella with width and length about equal and apically somewhat rounded.

REMARKS. Bálint listed *M. moza* not only from Bolivia, but also from Paraguay (possibly mislabelled, but the Cordilleran fauna there is poorly known) and several Argentine provinces (Bálint 1993a: 25). Accordingly, besides *M. koa*, *M. moza* is spatially one of the most widely distributed *Madeleinea* species.

Most of the specimens collected in Bolivia have darker and more clearly patterned DHW markings than the specimens originating from Tucumán and Salta regions of Argentina (cf. Bálint 1993a, figs 69-73). The DHW pattern of the austral specimens of *M. moza* is quite indistinct, sometimes almost totally white. This phenomenon varies individually, however, and the extremes can also be seen amongst some Bolivian and Argentine specimens as well. The genitalia were accurately reported by Bálint (1993a: 25) and who also suggested there was no support to accord the Bolivian taxon *ruberrothei* Weeks, 1902 species status. The latter taxon was described on the basis of smaller, less pigmented, specimens and examination of the types showed no significant structural differences, only some variations in structural size (cf. Nabokov 1945: 41). Thus, we confirm *Lycaena rubberothei* Weeks, 1902 as a new junior synonym of *Lycaena moza* Staudinger, 1894 herein since this had not been done formally by Nabokov (cf. Nabokov 1945: 41, footnote).

M. moza is thus a polytypic species showing a cline from north to south in the VHW markings. This phenomenon can be also seen in *M. koa*. and could be presumed that it is a common adaptive feature of *Madeleinea* taxa due to environmental variations. Further fieldwork on the biology and ecology of *Madeleiena* may elaborate this phenomenon in the genus.

MATERIAL EXAMINED. AMNH. *Argentina.* 1m: Rio Lozano, Morro de Alizar, Jujuy, Argentina, 1750 m, 15.I.1977, R. Eisele. 1m: Cerrillos, 3 km W on corpl. of Río Manzano, Salta, Argentina, 1200 m, 21.X.1976, R. Eisele. 2ms: El Rodeo, Catamarca, 2000 m, 8.I.1959, R. Golbach. 1m: [?] de Sala, Jujuy, 13.II.1951. 2 ms: Parque Nacional Calilegua, Jujuy Province, along river near park entrance off Rt. 34, 14 Febr. 1991, 1991 AMNH Expedition; 1m: upland walking trail, Leon to Taraxi, Jujuy Province, 29 January 1991, 1991 AMNH Expedition; 1m: Tafí del Valle, Dept. Tafí del Valle, Tucumán, 2200 m., 5 Febr. 1991, boulders and flowers east of town, leg. 1991 AMNH expedition. 1m, Río Lazano to Huacalera, "El Volcán", Tilcará

Dept., Jujuy Province, 30 January 1991, paramo and boulder fields, 1991 AMNH expedition; 2ms: climbing Cerro Amarillo nr Huacalera along Arroyo Quitacara, 3200-4000 m, Dept. Tilcará, Jujuy, 1 Febr. 1991, xeric scrub-steppe to upland paramo, 1991 AMNH expedition. 1m: climbing Abra de las Cruces, 11-13 km. on footpath, E. of Huacalera, Dept. Tilcará, Jujuy, arid scrub 3650-4000, 2 Febr. 1991, 1991 AMNH expedition; 2ms: El Carril to Cachi, Rt. 33 at km 23-25: "Quebrada de Escoipe", Dept. Chicoana, Salta, 1600 m., steep quebrada with xeric/mesic woodland margin and wet marshland in bottoms, 10 Febr. 1991, 1991 AMNH expedition. **Roberto Eisele Collection** (Jujuy, Argentina). *Argentina*. 1m: Coralitos, Dept. Rosario de Lerma, 3 km. W at "quebrada", confluent with Río Manzano, 1600 m., 21.X.76; lm: "Morro de Alizar", Río Lozano, Dept. Capital, 1800 m., 30.X.76; lf: same data but 1750 m., 12.I.72. **HNHM**. Argentina: 1m: Tilcares, Jujuy, 20.II.1992, leg. R. Eisele. 1m: Rio Lozano, 1200, Jujuy, 30.X.1976, leg. R. Eisele. Genital dissections (gen. prep. No. Bálint), males: 474 (El Rodeo), 475 (Rio Lozano); females: 476 (Cerillos), 477 (Leon). AMNH vials with pinned specimens by Johnson, 3 males: "Escoipe", "Amarillo", "Las Cruces" [see data above].

ETYMOLOGY. "*Moza*" – "origin" in Hebrew, but also biblical name (1 Chron 2.46, 8.36, 9.42-43); "*ruberrothei*", patroynm formed from Ruberroth in the original description by Weeks. The etymology of "*babhru*" is unknown to us.

Madeleinea pacis (Draudt)

Photoplate I, Figures 9, 19, 35, 36, 40.

Itylos pacis Draudt 1921: (5) 821, pl. 1441.

DIAGNOSIS. Nabokov 1945: 41 - 42 (figs. PAC, pl. 6).

Additional Data. ***Female Genital Morphology***. Figs. 19,40. Genitalia with henia strongly sclerotized and with distal edges slightly curvate caused by constriction at midpoint and in the terminal one-fourth; anterior lamella with width about equal to length and with edges very parallel.

REMARKS. The *M. pacis* material listed by Bálint (1993a: 27) contained three provisionally determined specimens marked with [?]. All these specimens proved to be identical or very close to *M. pacis* with further investigation. For additional remarks on BMNH material of *M. pacis* see below under *M. ludicra*.

TYPES. The types of *Lycaena pacis* are preserved in the Senckenberg Natur Museum, Frankfurt am Main, Germany (SMF) with other historical materials elaborated by Draudt according to G. Lamas (in litt, cf. Bálint and Johnson 1993b: 3). Topotypes (Cuzco) have been available for us to study.

MATERIAL EXAMINED. AMNH. *Bolivia*: 1m: Titicaca, Coll. E. I. Huntington, No. 1053. 1f: Yungas Valley, 37 mi. n.e. La Paz, 10,000 ft., 7.VI.1958, leg. F. Walsh. *Peru*: 1m: Ollantaitambo, Cuzco, Peru, Alt. 9200 ft., 3.I.1947; collector J.C. Pallister. **IML**. *Peru*: 1f: Eldorado, ex Colleccion Inst. Fund, M. Lillo, Tucumán. Genitalic dissections (gen. prep. nos. Bálint), males: 374 (Ollantaitambo), 393 (Titicaca); females: 376 (Eldorado), 372 (La Paz). **HNHM**. *Peru*: 2ms: La Oroya, 23.X.1983, ex coll. McPherson.

ETYMOLOGY. *Pacis* – gender feminine; most probably from wrongly suffixed "Pactio" (correct feminine "Pactiscor"); with meaning between two persons (between "I. pelorias Weym." and "I. koá Drc." according to Draudt 1921: 821).

Madeleinea tintarrona Bálint and Johnson, NEW SPECIES

Photoplate I, Figures 11, 32.

DIAGNOSIS. ***Wings***. FW outer margin relatively convex, wingshape rounded; DW dark blue although somewhat lighter than in *koa* with wide discoidal spot and wide black margin. VFW ground grayish white, lighter than *koa*. VHW pattern *koa*-like with narrower Rs gleaming stripe and extended white patterns appearing like a shiny marbled "V".

Morphology. Male genitalia with distinctively produced uncus.

DESCRIPTION. ***Male***. DW ground cloisonne blue (Maerz and Paul 1950: 34/D12); black margin very wide at apex but narrow at tornus; DHW with small marginal spot in cell CUA2; fringes brownish white. VFW ground sky grey (Maerz and Paul 1950: 34/B2) with large light grayish brown (close to Smoked pearl in Maerz and Paul 1950: 46/E3) discoidal and postmedian spots surrounded by light halos; submarginal polyommatine pattern well developed but also pale; VHW pattern with dark elements light grayish brown colored and reduced; whitish intercellular elements extended, stripe in Rs indistinct, apical postbasal spots in Sc+R1 and Rs present, submedian band interrupted, submaginal part with large arrow head making in ce CuA1-2, anal spot missing; FW length: 8.0 mm. (holotype and paratype males). ***Male Genitalia***. Fig. 11. Uncus strongly produced and not pointed, widest in posterior one fifth where width is nearly one-third length; gnathos relatively strong and equalling full length of uncus; tegumen and vinculum commonplace; juxta commonplace and about one-half length of valva; valvae relatively short but with a long rostellum, valve strongly convex in terminal one-third; aedeagus commonplace, length of suprazonal element slightly shorter than subzonal element and distally narrow; proximal tabs strongly developed, alulae week, zonal part with produced edges; suprazonal sheath about equal to zone length but strongly tapered; in lateral view, dorsal vesical opening originating near midpoint of suprazonal element. ***Female.*** Unknown.

TYPES. **Holotype** male, labelled "La Oroya, Peru, Little rain (Simons); Rothschild Bequest, Brit. Mus. 1926 -239." Slide: B.M. No. 19151 (m), deposited BMNH. ***Paratype.*** A male in the BMNH, believed to be labelled "La Oroya" Peru but, in any case, labelled as a paratype of *M. tintarrona*. As noted hitherto (Balint 1993a), certain data files were lost in shipment to Hungary after the first author's 1993 trip to the BMNH and there has been on ongoing effort to reconstruct certain data records by correspondence. At this writing, followup correspondence with the BMNH concerning the above specimen has not been answered and we record the data as remembered by the first author (which can be verified later).

DISTRIBUTION. ***Spatial:*** currently known only from the type locality. ***Temporal:*** the holotype is undated but, according to Chubb (1919), Simons collected in the puna of La Oroya on March 1, 1900.

REMARKS. This taxon is a good example of a "look-alike" species. According to the upper surfaces of the wings it could be easily overlooked as a female specimen of *M. koa* since the VHW also resembles the pale pattern of that taxon. The genitalia, however, are quite distinctive and suggest an entity phylogenetically between *M. koa* and *M. pacis*.

ETYMOLOGY. From Nabokov's "Tintarron", a precious deep blue glass made in the mountains of Zembla (Nabokov 1962: 314), here referring to the dorsal ground color of this species.

Madeleinea ludicra (Weymer)

Photoplate I, Figures 10, 20, 23, 28.

Lycaena ludicra Weymer 1890: 122, p. 4, f. 3.

DIAGNOSIS. ***Wings.*** Sexes similar. FW costa straight, outer margin rounded, convex and relatively short. DW ground gleaming greenish blue with wide black margin; VFW with large discal and postdical spots, VHW resembling *M. tintarrona*.

Morphology. Male genitalia resembling *M. koa* but with notably longer and weaker gnathos and with suprazonal element of the aedeagus elongate; female genitalia, on the contrary, close to *M. pacis* with anterior lamella edges parallel.

DESCRIPTION. ***Male.*** DW ground gleaming metallic ceramic blue with cyanide overlay (Maerz and Paul 1950: 36/K7); veins gleaming, marginal border black and only a slightly wider at apex; fringes long, prominently checkered; DHW with prominent marginal spot in cell CuA2. VFW ground beige with large discal and postdiscal spots, submargin with a full row of indistinct spots, margins slightly darker; VHW with complex pattern: costal margin with suffused spot at postbasal and postmedian area, Rs with suffused gleaming silvery white line extending to margin, postmedian spots with relatively sharp outer edges. FW length: 7.5 mm. (n= 2). ***Female.*** Similar to male, differing only in slightly more suffusive VHW markings. FW length: 9.0 (holotype). ***Male Genitalia.*** Figs. 10, 28. Uncus slender and pointed, gnathos dorsally elongate; aedeagus with suprazonal element elongate, length about equal to that of subzonal element. ***Female Genitalia.*** Fig. 20. Genitalia with henia showing strongly sclerotized edges of quite even contour (not constricted or undulate contour as in congeners), anterior lamella with width about equal to length and with with raised edges parallel as typical of *moza*-group; fibula trapezoidal in shape, weakly sclerotized and with raised edges parallel.

TYPE. **Holotype** female labelled "Holotype; Tacora; Zool. Mus. Berlin; 3004; Lycaena ludicra", deposited MNHU. Genitalia dissection, Bálint gen. prep. slide no. 346.

DISTRIBUTION. ***Spatial:*** along with the type locality (Tacora, in presentday Chile), also known from Puno, Peru, in the vicinity of Lake Titicaca at 12,500 ft. as well as on the Bolivian side of the volcano Sajama, at 3600-4600 m. ***Temporal:*** the known specimens were collected in November.

REMARKS. The original description of *Lycaena ludicra* is based on a single specimen (Weymer, 1890: 122) which is therefore the holotype. The specimen is a female and, although not specified on the type labels, the type locality is today in Chile (an area which, at the time of the discovery of the species, was a Bolivian territory). The type bears a red-bordered label, placed by Dr. G. Lamas, acknowledging it as the type.

We have fully redescribed this taxon because the taxonomic position of the species has been historcially uncertain. Nabokov considered the taxon "sp. incertis" (Nabokov 1945: 39); Bridges listed it as a valid species (Bridges 1988: II.51). Originally, the senior author was also unclear about the identity of *M. ludicra* because of the polytypic material from Puno which contained female specimens with unusual genitalic structures. Without access to the type it could not be certain if *L. ludicra* was identical with the taxon "*Itylos* sp. n." cited by Lamas and Pérez (1983) (Bálint 1993a: 26) or perhaps a synonym of *M. koa* (Bálint 1993b: 3). Now that the type of *ludicra* has been examined it is clear that Puno specimens figured by Bálint (1993a, as "No. 82 *Madeleinea* sp.?") in fact represent typical *ludicra*. Thus, the female structural characters reviewed herein can be associated with *M. ludicra* for the first time. The unique morphological features are another example of the complex character distributions apparent in the Neotropical polyommatine. As the authors have noted in their study of Argentine *Pseudolucia* (Bálint and Johnson, 1995), the divergent morphologies within *Madeleinea*, if not seen in context of its entire diversity, might lead some workers to want to form several genera from the assemblage. *Madeleinea*, like *Pseudolucia*, shows strong monophyly coupled with remarkable autapoomorphies in some species. However, it is doubtful any scheme for splitting *Madeleinea* into several genera would be any less arbitrary or less prone to requiring monotypic genera for each of the highly autapomorphic taxa.

Ureta (1963: 107) lists "*Itylos moza ludicra* (Weymer) n. comb." from "Cordillera de Tarapacá" and "*pelorias*" in the "Cordillera de Antofagasta". *Madeleinea pelorias* was very recently collected in the Tarapacá region (see Material Examined, *M. pelorias* below). It is probable that Ureta's "*moza ludicra*" refers to *pelorias*.

ETYMOLOGY. "Ludicra", gender feminine, an "amuser" or "entertainer" (as in the works of some early poets live Livius, Cicero, Horatius, etc.). As "ludicrus, ludicer" (Schellers 1812: 816) it has a slightly different meaning, that of short-sighted or haphazard.

Madeleinea cobaltana **Bálint and Lamas**

Photoplate I, Figures 12, 21.

Madeleinea cobaltana Bálint and Lamas 1994: 235.

DIAGNOSIS. ***Wings***. FW with costal margin slightly convex, outer margin long and convex; sexes otherwise strongly dimorphic. Male [described here for first time] DW grayish blue, female DW cobalt blue with a strong metallic shade; marginal border wide. VW resembling *M. pacis* but not so pied [e.g. "colorfully spotted"] and with more extended DW submarginal band.

Morphology. Male genitalia [described here for first time] similar to *M. pacis* but with slightly more slender uncus and aedeagus spinate and more recurved in the suprazonal element; female genitalia with strongly hooked anterior plate of fibula in lateral view.

DESCRIPTION. ***Male***. DW ground pale campanula blue (Maerz and Paul 1950: 42/B8) with grayish hue; veins gleaming, discoidal spot outstanding, wide marginal brownish border narrow at tornal area but becoming very wide at apex; fringes long and prominently checkered. DHW delicately spotted along outer margin. VFW ground pale Aztec drab (Maerz and Paul 1950: 13/I8) basally suffused grayish, discoidal and postdiscal spots medium sized with notable halos; veins colored lighter than ground, submarginal area polyommatine pattern indistinct; VHW with large costal postbasal spots in cell Sc+R1; discal and postmedian area with large brownish spot of typical generic pattern (much as in *M. pacis*), cell Rs lacking silvery stripe, submarginal pattern suffusive and erratic. FW length: 9.0 mm. (holotype). ***Female***. DW ground pale cobalt blue (Maerz and Paul 1952: 34/L7) with a metallic hue, discoidal spot outstanding; VW as in male. FW length: 10.0 (allotype). ***Male Genitalia***. Fig. 12. Uncus horse-shoe shaped, slightly slender in lateral view; gnathos pointed in dorsal view; valvae relatively slender and with a thin costal rostellum; aedeagus robust with elongate and produced subzonal element. ***Female Genitalia***. Fig. 21. Genitalia with henia showing densely sclerotized edges strongly curvate at the apex, anterior lamella with width about three-fourths length and with lateral edges prominently convex.

TYPE. Holotype female labelled as "Peru, Jn., Ondores, 4080 m., 30.1.'87, O. Karsholt". Genitalia dissection in glycerin vial Bálint No. 390, deposited MUSM (see reference to Paratypes in Distribution, below).

DISTRIBUTION. ***Spatial***: the type locality is at very high elevation (4200 m.), paratypes were collected at 4000 m. (Pachachaca) and 4200 m. (La Oroya) . ***Temporal***: the type specimen, as well as recently located additional examples, were collected in January; a paratype female is from May.

REMARKS. The type locality of the original description was "Ondores, 4080 m, Department Junín, Peru". The species was formerly known only from the holotype and paratype females and the male was not described. We have integrated the description of the male here from additional material found at the AMNH.

MATERIAL EXAMINED. AMNH. Additional material provided us subsequent to original description, apparently collected on same day as one original female paratype, 1m,1f: "Peru, 34 mi E of La Oroyo on road to Tarma, + 4200 m, 22. I. '75", leg. H. Descimon. Genitalia dissections (in glycerin vials), Bálint gen. prep. nos. 366 (male), 379 (female).

Madeleinea pelorias **(Weymer)**

Photoplate I, Figures 13, 22, 24, 37, 41.

Lycaena pelorias Weymer 1890: 121, pl. 4, f. 2.

DIAGNOSIS. ***Wings***. Sexes similar. FW costa slightly convex, outer margin convex and relatively short, apex pointed. DW ground gleaming greenish blue with very wide black margin. VFW with large postdical spots, VHW with largely extended dark elements.

Morphology. Male genitalia with distinctively robust aedeagus; female genitalia reminiscent of *M. pacis* but showing a much more strongly hooked anterior plate in the lateral view.

DESCRIPTION. ***Male***. DW ground gleaming harbor blue (Maerz and Paul 1950: 38/H6); veins gleaming,

MORPHOLOGICAL FIGURES

(pages 15-22)

Captions for Figures on Pages 17-19

Figs. 3-13 (stippled line drawings).

Male *Madeleinea* morphological features. Male valvae, uncus, gnathos and penis (historically used also by Nabokov) appear rather uniform when seen together, although species groups and each species differ in overall outer lateral shape (e.g. polyommatine distinction of "Baird's angulation", *e.g.* degree and location of "hump") as in drawn figs. 3-13 or apparent in corresponding views from valvae out-turned from overall dorsal view of entire genital apparatus (high contrast photograph reproductions, figs. 25-37). Particularly distinctive are sclerotized elements of the valve terminus (oriented toward bottom of page, figs. 3-13, and as characterized in text). Additional species differences are readily recognized in the aedeagus and uncus/gnathos (both drawn in lateral view). Species and species group differences are corroborated in characters of corresponding females (figs. 14-22).

3........*M. lolita*, holotype.
4........*M. huascarana*, holotype.
5a.......*M. koa*, central Peru.
5b.......*M. koa*, northern Bolivia.
6........*M. odon*, holotype.
7........*M. nodo*, northern Ecuador.
8........*M. moza*, northwestern Bolivia.
9........*M. pacis*, central Peru.
10.......*M. ludicra*, southern Peru.
11.......*M. tintarrona*, holotype.
12.......*M. cobaltana*, central Peru.
13.......*M. pelorias*, northeastern Chile.

Figs. 14-22 (stippled line drawings from high magnification).

Female *Madeleinea* morphological features. From known females the genus shows two different configurations, best viewed as figured herein– (1) female genital henia elongate with oval anterior lamella, or (2) female genital henia diapason-like, anterior lamella quadrant-shaped. In the *lolita*-group, where females are unknown, wing pattern and shape are so divergent a distinctive female genital habitus is also predicted.

14........*M. koa*, central Peru.
15........*M. vokoban*, holotype.
16........*M. odon*, allotype.
17........*M. nodo*, allotype.
18........*M. moza*, northwestern Argentina.
19........*M. pacis*, southern Peru.
20........*M. ludicra*, northwestern Bolivia
21........*M. cobaltana*, holotype.
22........*M. pelorias*, holotype.

Captions for Figures at Page 19 (bottom) and Pages 20-22

Figs. 23-24. Historical labelling of the two *Madeleinea* taxa described by Weymer in 1890.

Fig. 23. Labels of "*Lycaena ludicra*" (MNHU).
Fig. 24. Labels of "*Lycaena pelorias*" (MNHU).

Figs 25-37 (pages 20-22).

Male genitalic armatures of *Madeleinea* (shown out-turned from overall dorsal view of entire genital apparatus in dorsal view, aedeagus usually removed and placed aside in lateral view). High contrast photograph reproductions are used, figs. 25-37; some photographs are slightly unclear due to having to use prepared slides).

25........*M. nodo*, "Zamora, Ecuador, No. 19185" (BMNH).
26........*M. nodo*, "Cayambé, Ecuador, No. 19152" (BMNH).
27........*M. koa*, "Challabamba, Peru, No. 19171" (BMNH).
28........*M. ludicra*, "Puno, Peru, No. 19116" (BMNH).
29........*M. koa*, "Titicaca, Peru, No. 19174" (BMNH).
30........*M. koa*, "Illimani, Bolivia, No. 19158" (BMNH).
31........*M. lolita*, "Holotype, No. 19173" (BMNH).
32........*M. tintarrona*, "Holotype, No. 19151" (BMNH).
33........*M. moza*, "Uspallata, Mendoza, Argentina, No. 19159" (BMNH).
34........*M. moza*, lectotype, (MNHU).
35........*M. pacis*, "Titicaca, Peru, No. 19168" (BMNH).
36........*M. pacis*, "Cuzco, Peru, No. 19153" (BMNH).
37........*M. pelorias*, "Zapahairia, Chile, gen. prep. No. Bálint 345" (HNHM).

Figs. 38-39 (page 22).

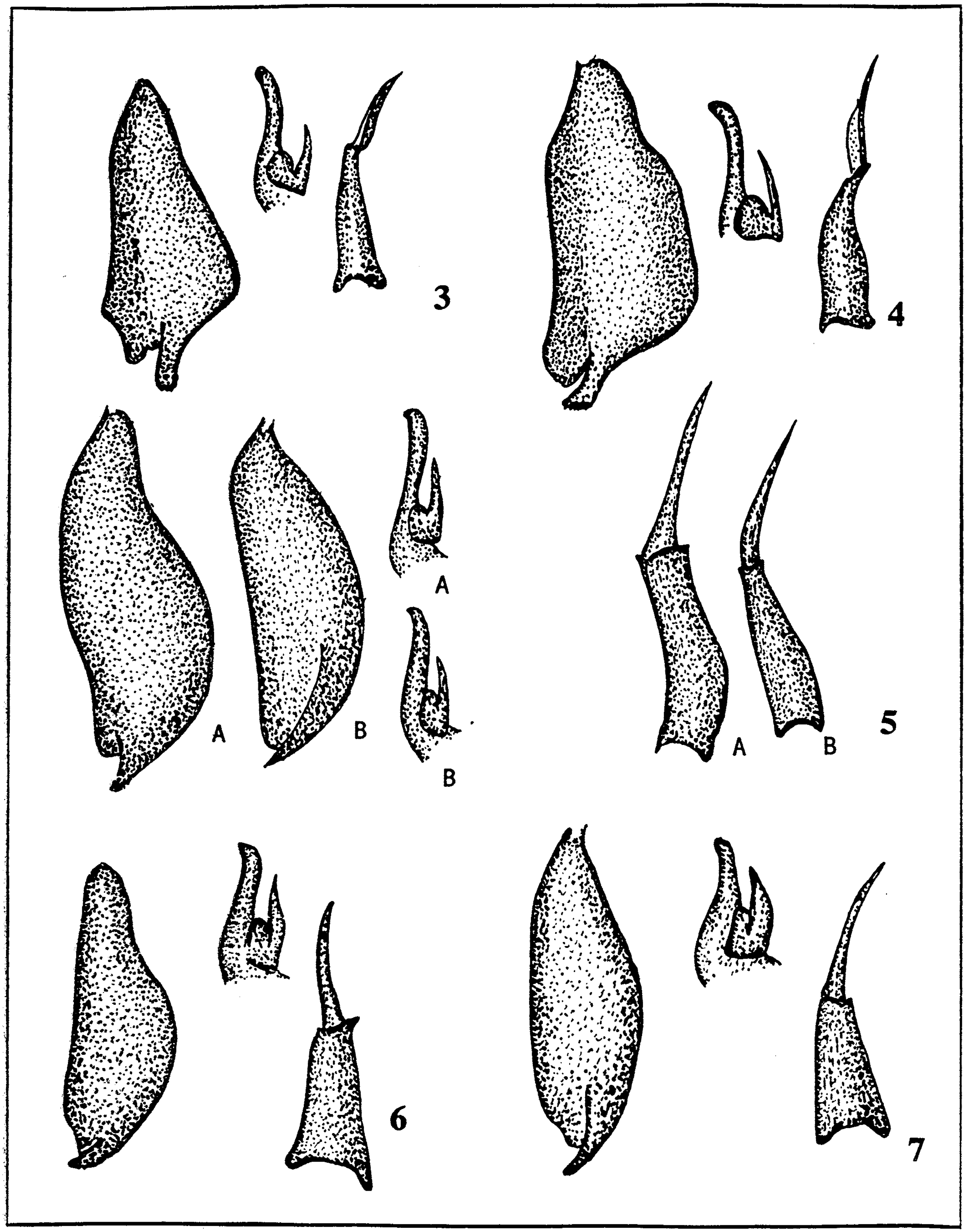
For comparative purposes, genitalic armatures of *Paralycaeides* Nabokov, 1945 (using photographic methods of figs. 25-37).

38. Male genitalia of *P. vapa*, "Cochabamba, Bolivia, No. 19160" (BMNH).
39. Female genitalia of *P. oreopola*, "Topotype, No. 19183" (BMNH).

Figs. 40-41 (page 22).

Female genitalic armatures of *Madeleinia* taxa (high contrast photographs, some unfortunately blurred by having to use prepared slides).

40........*M. pacis*, "Cuzco, No. 17563" (BMNH).
41........*M. pelorias*, "Puno, Chile, No. 17559" (BMNH).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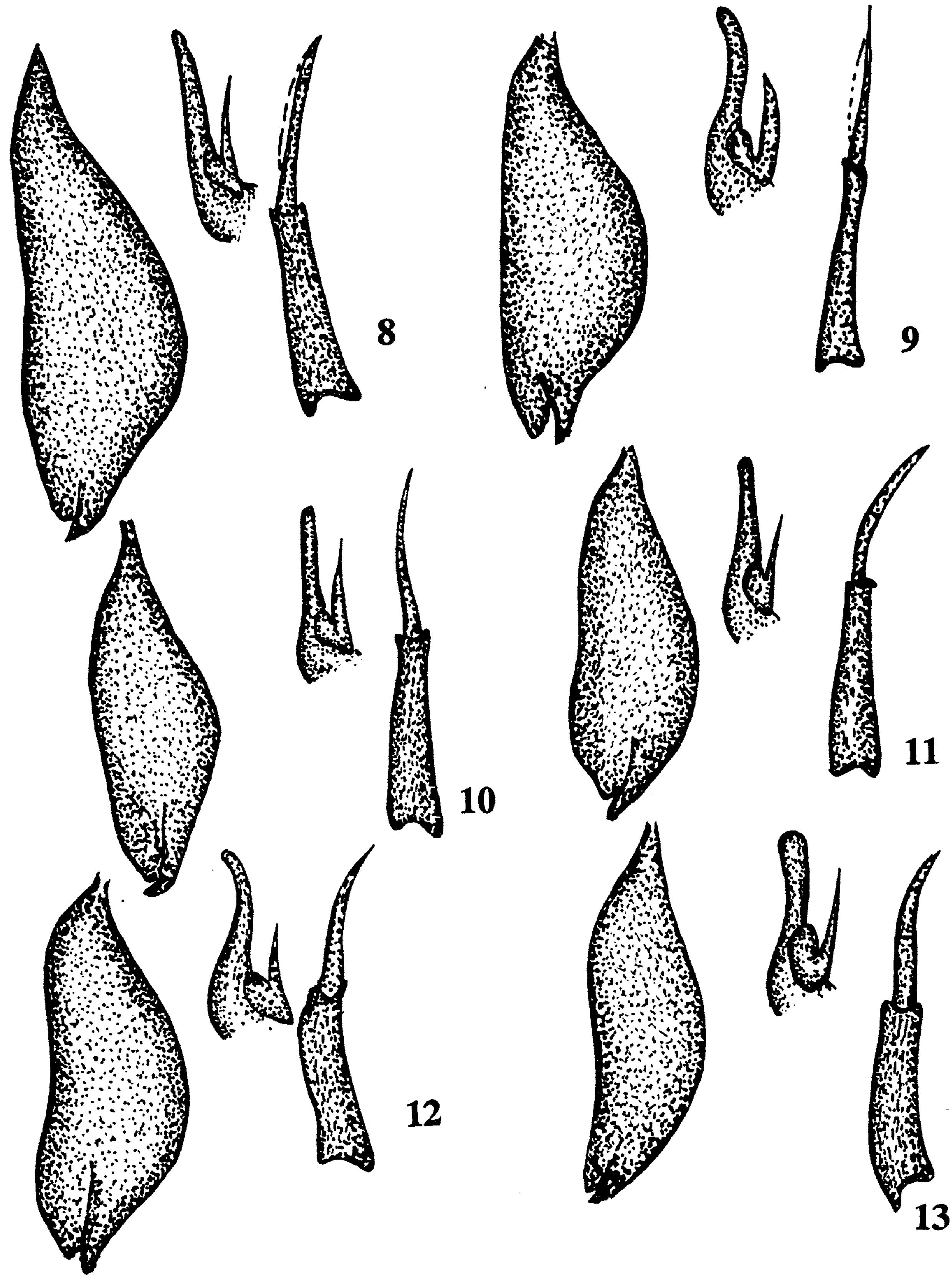
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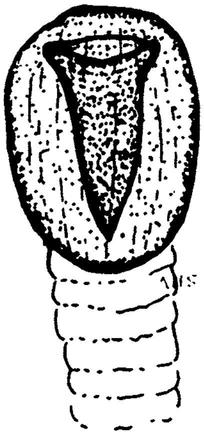

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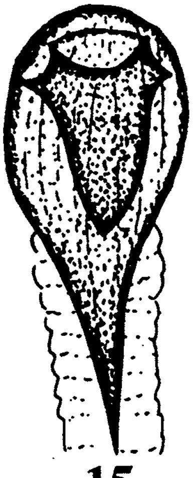

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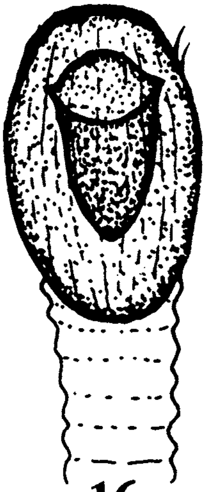

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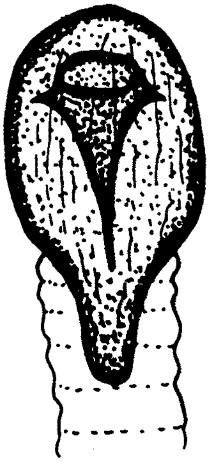

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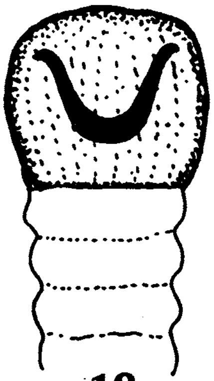

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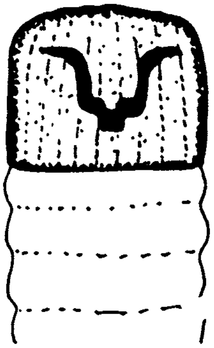

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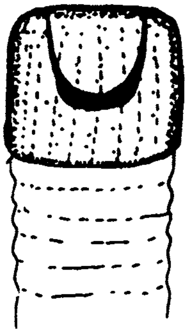

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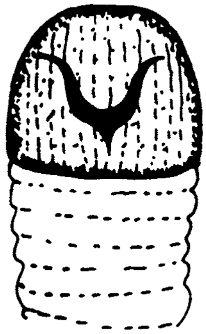

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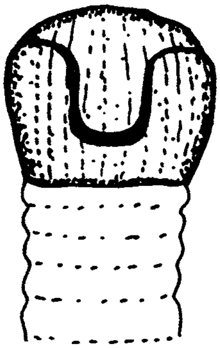

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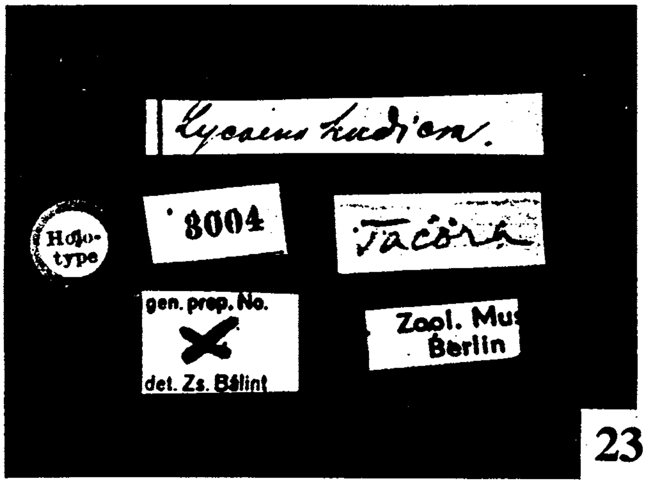

Lycaena ludicra.

Holo-type

8004

Tacora

gen. prep. No.

det. Zs. Bálint

Zool. Mus

Berlin

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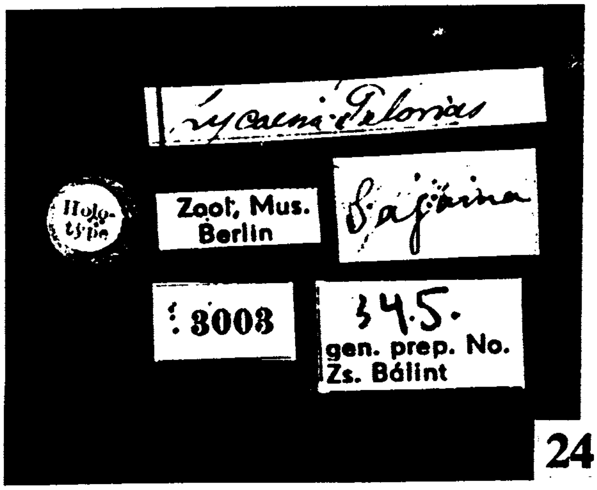

Lycaena Pelorias

Holo-type

Zool. Mus.

Berlin

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gen. prep. No.

Zs. Bálint

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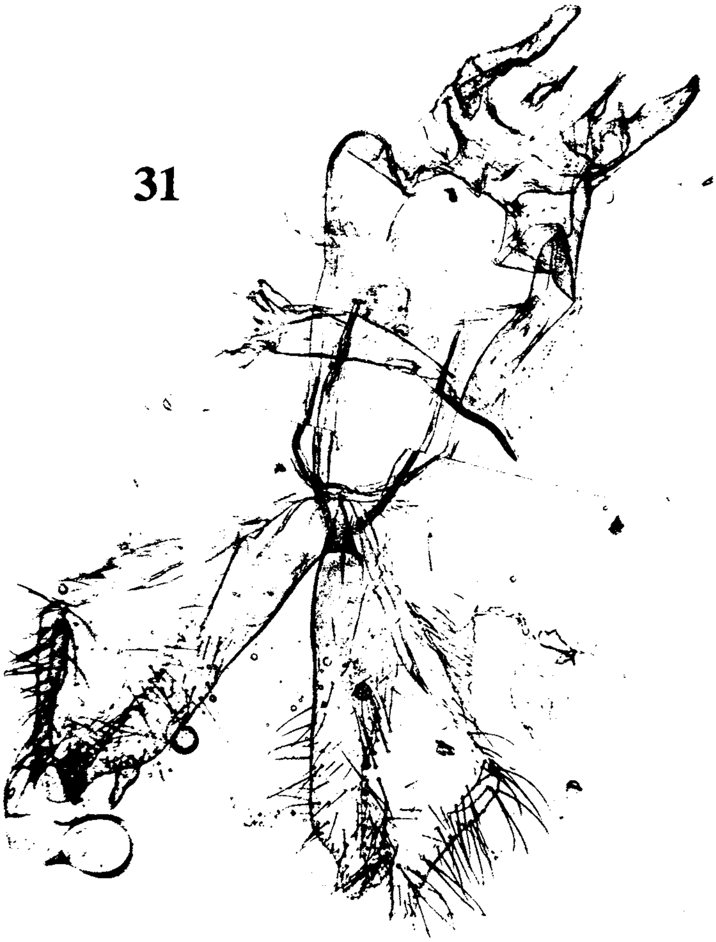

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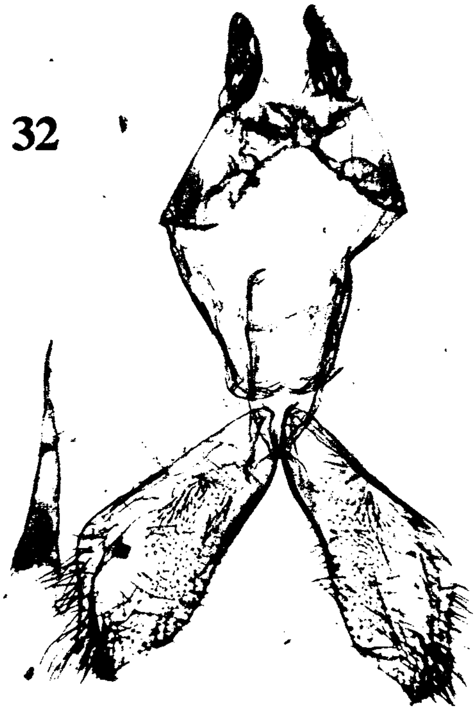

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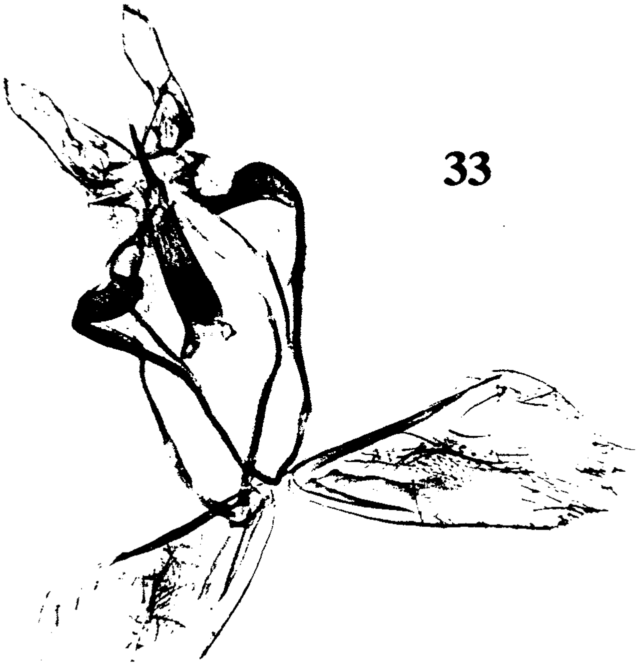

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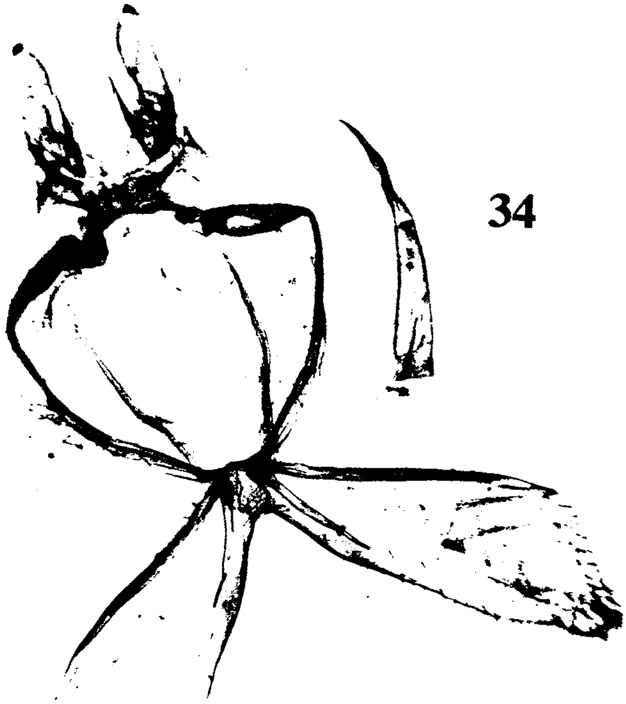

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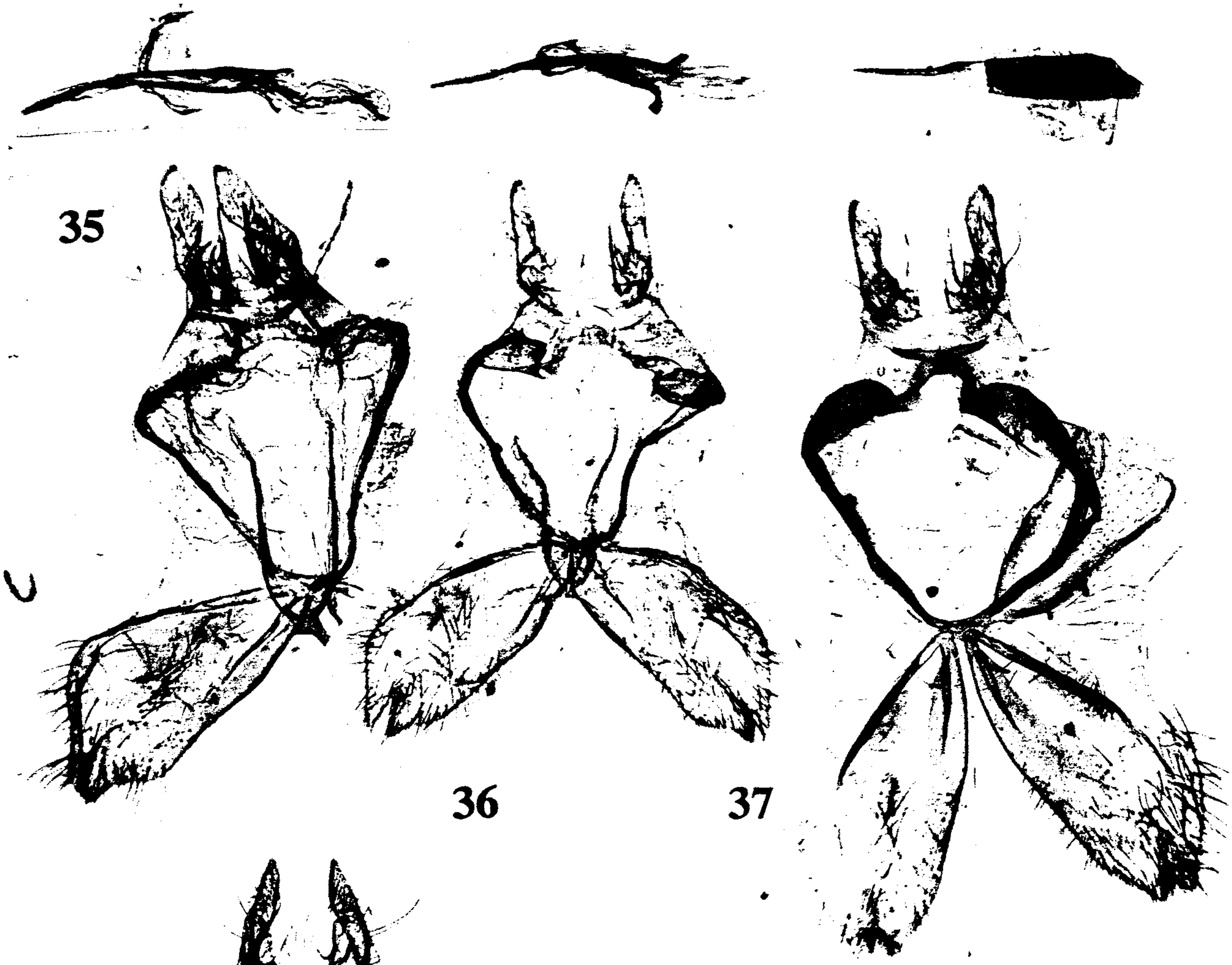

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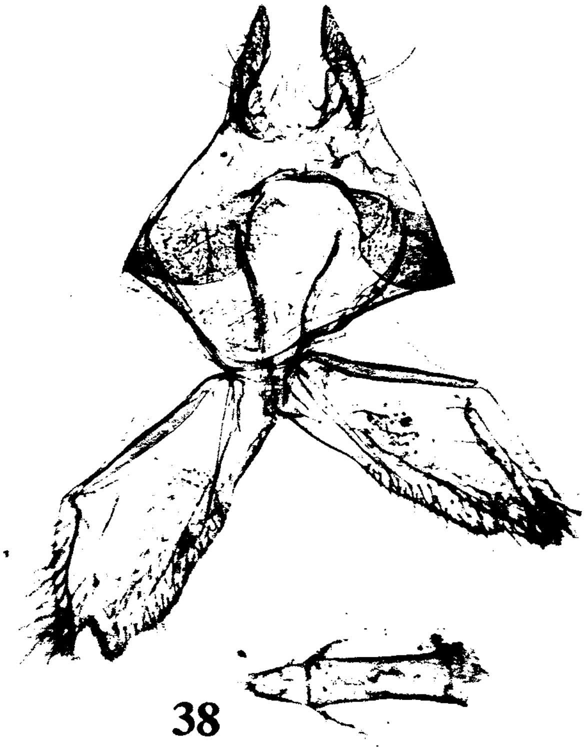

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wide marginal brownish border narrow at tornal area but very wide at apex; fringes long, prominently checkered; DHW with outstanding marginal spot in cell CuA2. VFW ground Aztec drab (Maerz and Paul 1950: 13/I8); basal part lighter, discoidal and postdical spots large with halos; veins lighter; submarginal area with suffusive polyommatine pattern; VHW with costal, subbasal and postmedian spots in cell Sc+R1 conjoined into one suffisive small dark brown macule; postbasal spots close to postmedian band or adjoined, postmedian spot in Sc+R1 and Rs present and coalescent with postmedian spots creating a large wavy band; cell RS silvery stripe typical of some congeners absent; submarginal pattern erratic. FW length: 9.0 mm. (holotype); 8.8 – 9.2 mm. (7 males). ***Female.*** Similar to male. FW length: 9.0 (2 females). ***Male Genitalia.*** Figs. 13, 37, 41. Uncus horse-shoe shaped with gnathos pointed in dorsal view, valvae relatively slender with a thin costally oriented rostellum, aedeagus robust with robust and elongate subzonal element. ***Female Genitalia.*** Fig. 22. Genital henia very strongly sclerotized with edges sigmoidal ("S"-shaped), anterior lamella with length about two-thirds width and lateral edges greatly convex.

TYPE. Original description of *L. pelorias* was based on a single specimen (Weymer, 1890) and is thus the holotype (Fig. 24). The type locality was "Volcano Sajama, Bolivia" [today situated in Chile]. The holotype bears a red-bordered label placed prior to our study by Dr. Lamas indicating it as the type.

DISTRIBUTION. ***Spatial***: In addition to the type locality on the Chilean side of the volcano Sajama from 3300-4600 m., also known from Puno in the vicinity of Lake Titicaca at cited elevations of circa 4000 m.; ***Temporal***: the known specimens are noted as collected in "September-November" and again in "April".

REMARKS. We provide a full redescription of this species because of it uncertain historical status. Nabokov (1945: 39) treated the taxon under his entry for *Itylos pacis*, adding a question to suggesting the taxa were synonyms. Bridges (1988: II.51) listed both taxa as good species. The species was correctly identified by the senior author in his catalogue (Bálint 1993a: 27), but the Puno specimens deposited in BMNH showed a slightly more azure DW ground than subsequently studied specimens, a condition perhaps resulting from age or chemical stain. In contrast, the holotype (see below) and the newly collected Chilean material show a gleaming "harbor blue" (Maerz and Paul 1950: 38/H6) DW ground color. We also have a small, recently collected, specimen from NE Chile on the western side of the Mount Sajama (type locality of *L. pelorias*) collected by Mr. Peña. Peña correctly determined this specimen as "*Itylos*" *pelorias*.

TYPE. Holotype male; "Sajama; Lycaena pelorias; 3003; Zool. Mus. Berlin; Holotype". Genitalia dissection Bálint slide, gen. prep. No. 345.

MATERIAL EXAMINED. AMNH. *Chile*: 2ms: Tarapacá, Zapachuira, 21.XI.1952., L.E. Peña; 1m: Tarapacá, Chapiquiña, 5.X.1952, L.E. Peña; 1m: Tarapacá, Camino a Cancosa, 3300 mts., 19.IV.1969, L.E. Peña; 1m: Tarapacá, S. Chiapa, 3800 mts., 23.IV.1969, L.E. Peña; 1m: Iquique, Caritaya, 18.IX.1952, L.E. Peña. Genitalia dissections, Bálint glycerin vials, gen. prep. nos., males: 367 (S. Chiapa), 389 (Chapiquiña), 472 (Camino a Cancosa), 473 (Zapachuira).

ETYMOLOGY. Gender feminine (*idem quod Pelorus*) a character of Ovidius (Schellers 1812: 1058).

DISCUSSION

Monophyly of *Madeleinea* Species Groups

As we have noted previously, it is probable in the future that some workers will desire to split speciose *Madeleinea* into several genera, as has been suggested for the genus *Pseudolucia* (cf. Balletto 1993, see Bálint 1993a [pp. 29-30] and various Remarks and Discussion in Bálint and Johnson 1995). *Madeleinea* is indeed speciose but, like *Pseudolucia*, when considered species by species its diversity defies a set of objective criteria by which species could be grouped unequivocally into subset genera. Such attempts, as with *Pseudolucia*, require arbitrary selection of characters and also result in situations where the sexes of species "end up" in different genera. As with *Pseudolucia*, some *Madeleinea* species show strong sexual dimorphism while others show little at all. In addition, some species appearing radically different in external characters are also those with outstanding morphological autapomorphies. As with *Pseudolucia*, splitting based on such criteria often can achieve only monotypic groups. Although this situation typifies *Madeleinea* and *Pseudolucia*, there are South American polyommatine genera with distinctive hiatus's between groups of taxa. *Paralycaeides* is an example. The morphologies of *Madeleinea*, *Pseudolucia* and *Paralycaeides* clearly suggest a common origin. However, there are large structural gaps which support their generic distinction. Within *Madeleinea*, species show a tight structural monophyly in spite of considerable divergence in wing pattern.

Monophyly of the groups comprising *Madeleinea* is supported by numerous characters:

(1) ***Male aedeagus structure.*** The most significant shared character is the very long suprozonal element of the aedeagus which shows a length at least equal to that of the subzonal element. There can be little confusion of the *Madeleinea* aedeagus with other Neotropical polyommatine genera.

Each Neotropical genus has a distinctive aedeagus structure (see morphological figures in Bálint 1993a, figs. 95-102 and 108-123). Regarding *Madeleinea*, it is interesting that a similarly shaped aedeagus occurs the holarctic "*arcia* group" of genera (*Aricia* R.L. 1819: *Pseudaricia* Beuret, 1959; *Ultraaricia* Beuret, 1959 and *Icaricia* Nabokov 1945, whose relationships will be clarified by Bálint, in preparation). Similarity to structures of the "*aricia* group" was also mentioned by Nabokov (1945: 39).

(2) ***Female henia and lamellae.*** A robust anterior lamella and highly sclerotized fibula typifies all the species of *Madeleinea*. This contrasts *Pseudolucia*, in which these structures sometimes strikingly differ (Bálint and Johnson 1993a and 1994c). *Paralycaeides* has female structures similar to *Madeleinea* which, if they suggest a relationship, require consideration within the context that the male genitalia of these genera are very different. In addition, female genitalia of *Madeleinea* differ markedly from the other Palaearctic genera mentioned above. *Paralycaeides*, interestingly, shows some marked differences between the female genitalia of its Neotropical and Nearctic elements (compare figures of Bálint 1993a to Ferris 1976, figs. 34, 37-38).

(3) ***Ventral silvery wing pattern.*** All species of *Madeleinea* show a complex silvery pattern of the VHW which results from stark contrasts between dark basal, discoidal and postdiscal elements (often strongly coalescent) and gleaming white or silvery discocellular pigmentations. Nabokov considered the VHW pattern of *Madeleinea* related to some taxa of *Pseudolucia* and to the entities of his *Paralycaeides* and *Parachilades*. This view was somewhat skewed by the sampling error in Nabokov's study. Actually only the ventral pattern of *Paralycaeides vapa* (Staudinger, 1896) can be readily compared to *Madeleinea* species (cf. Bálint 1993a, figs. 31-90). Two other *Paralycaeides* either not known or not associated with *Paralycaeides* by Nabokov (*P. inconspicua* (Draudt, 1921) and *P. shade* Bálint, 1993) are very differently marked. Wing patterns in high Andean and austral polyommatines, as well as Eumaeini, appear strongly adaptive (see for instance, eumaeine "elfin" genera of Johnson 1992) and only a thorough cladistic analysis can properly discern their phylogenetic importance.

The Sister (or Outgroup) Genus of *Madeleinea* among Neotropical Taxa: *Paralycaeides*

Based on wing characters, the genus *Paralycaeides* Nabokov 1945 (type species: *Itylos inconspicua* Draudt (1921), by original designation) appears to be a close relative of *Madeleinea*. As mentioned above, *P. vapa* shows a striking DHW pattern resemblance to *M. koa*. *Paralycaeides*, as traditionally viewed by taxonomists, actually consists of two morphologically distinct segregations: the polytypic *P. inconspicua-vapa-orepopla* group and the [as yet] unique *P. shade*. Other characters suggesting a sister relationship between *Madeleinea* and *Paralycaeides* are as follows:

(1) ***Male genitalia.*** Aedeagus thick and slightly recurved inward in the subzonal element, suprazonal element up to three times shorter; alulae large; uncus strong and elongate with a "cupola"-shape; gnathos strongly hooked; tegumen robust. (This configuration also somewhat resembles that in *Nabokovia*).

(2) ***Female genitalia.*** Henia narrow and elongate; anterior lamella weakly sclerotized along apex; ductus bursae not corregated.

Nabokov, considering only characters of the male, viewed *Paralycaeides* as an anestral form of *Lycaeides* Hübner [1819] (hence the etymology of his genus). As noted above, he considered *Madeleinea* (as "*Itylos*") closest to *Aricia* R.L., 1817 (Nabokov 1945: 238). Accordingly, Nabokov did not consider *Paralycaeides* and *Madeleinea* to be sister groups. However, female genitalia of *Lycaeides* and *Aricia* are quite distinctive (cf. Nekrutenko 1985, figs. 113 and 121) making Nabokov's view untenable. As noted before, *Madeleinea* and *Paralycaeides* closely resemble each other in the female genitalia although the male structures are not strong in shared characters. This matter is being investigated in more detail in a study in progress concerning affinities among the higher categories of Polyommatinae now known to be represented in the Neotropical Realm (Bálint and Johnson, in prep.). The latter study updates analysis of polyommatine affinities to recently increased knowledge of polyommatine diversity in the Neotropics and thus exceeds the breadth of comment on any single genus. However, it may not be premature to suggest that strong relations in the female genitalia and wing characters, but poorer corroboration from the male genitalia, may suggest that *Madeleinea* and *Paralycaeides* are (1) Neotropical members of a clade which also includes some other polyommatine genera more prominent elsewhere in the world and (2) the sister relationship of *Madeleinea* and *Paralycaeides* is, therefore, older within that clade rather than immediate. The present study of *Madeleinea*, and several others recent collection results have required to be initiated in its wake, deal with updating historical knowledge of this recently named assemblage and elaborating the many newly discovered polyommatine species which are assignable to it.

Madeleinea As Elaborated by the Present Study

Premature attempts to lump species, or split genera, in the high Andean oreal Polyommatinae appear ill-advised. Not only have the species diversities of these groups been poorly understood until recently, almost nothing is known of the biologies and local distributions even the commonest species. Eight of the twelve taxa of *Madeleinea* treated herein (*M. mashenka*, *M. lolita*, *M. huascarana*, *M. nodo*, *M. odon*, *M. tintarrona*, *M. cobaltana*, *M. vokoban*) have been described since 1993. Some of these species are still known from only a few specimens or in series from, as yet, only one incipient collection site. Two historical taxa (*M. ludicra* and *M. pelorias*) are also represented by few specimens and these originate from only a few collecting localities (Tables 1,2). Even the distribution of the few "widespread", and historically relatively well-defined taxa (*M. koa*, *M. pacis* and *M. moza*) cannot be considered "well-known" since additional taxa (*M. nodo*, for instance) have been found within their old series.

All these new developments and problems— species diversity, local distributions, and biological data drastically affect the situation of polyommatine higher categories in the Neotropical Realm. It is well known that current workers are suggesting to the ICZN (see, e.g. Rabinowitz, Cairns and Dillon 1986) new criteria for assessing the taxonomic status of organisms. The success of these newly proposed alternatives often depends on the amount of biological data available. Considering the oreal Andean Polyommatini, we are at a stage now with more advanced knowledge of diversity, an updated reference to many type specimens, and attention to details of morphology in both males and females. However, in most cases sampling error remains a problem with current work still based on small aggregate samples from scattered localities and disparate collections representing a span of some one hundred years (Tables 1,2). Thus, as with *Pseudolucia* (even more well-known than *Madeleinea*), we consider it unwise to rush into further infrageneric splitting.

Madeleinea in the Context of Eliot's *Polyommatus* Section.

Following on Nabokov's original error, the genus was listed as "*Itylos*" by Eliot (1973: 449-450) and placed in his *Polyommatus* Section. According to the characters listed by Eliot (wing venation, eyes, palpi and male genital uncus, gnathos, valva, tegumen and penis) the diagnosis of this section fits *Madeleinea* well. However, in the male, the sagum (noted by Eliot as "nearly always present" in Neotropical species), is absent. Also, Eliot's system included no reference to the females. As a result, although *Madeleinea* appears to belong in the generic sequence of Eliot's *Polyommatus* Section when viewed by the limited data delimiting it, its phylogenetic position is actually more complex.

The battledore scales of the genus are unusual, with excavate or crenulate outer margins [Eliot 1973, Fig. 145: "*Itylos moza*" (Staudinger)]. This remarkable character was noted by Eliot as unique to "*Itylos*" [*Madeleinea*] among the genera of his *Polyommatus* Section. Eliot states that "the battledore scales usually provide good characters at the genus and species-group level, and sometimes at section level also, but they may exhibit quite remarkable individual variation and are often strongly asymmetrical" (Eliot 1973: 406). We have already noted above that new data, including reference to the female and other characters just mentioned, link *Madeleinea* to *Paralycaeides*. As we will treat in detail in a forthcoming paper examining higher categories of Polyommatini represented in the Neotropical Realm in light of recent progress on diversity (Bálint and Johnson, in press), these new data finally clarify the position of *Madeleinea*. They invite a reformation of Eliot's *Polyommatus* Section to include consideration of, among other things, (1) new data from increased diversity in *Pseudolucia* and (2) study of the relationship of *Paralycaeides* and *Madeleinea* to the Holarctic genus *Plebejus*. These genera may well comprise the only Neotropical elements with the "northward" relationships typifying traditional views of New World polyommatine affinities (Descimon 1986).

CONCLUSION

The phylogenetic position of *Madeleinea* can reliably be placed within Eliot's (1973) *Polyommatus* Section but new data on additional characters of the male, and first reference to the females, requires a reformation of that Section of the Polyommatini. This situation contrasts results on some other high Andean and austral Polyommatini we have studied, these appearing to clearly represent autochthonous Neotropical entities which have arisen from the South American lowland fauna (e.g *Nabokovia*, Bálint and Johnson 1994a; *Itylos*, Bálint and Johnson 1994b). *Madeleinea* itself is comprised of four clades of taxa (now that *mashenka* has been removed) whose overall admixture presents a totally different complexion than Nabokov's original "*Itylos*". The monophyly of the genus is clear in the structures of male genital uncus, gnathos and aedeagus and the female genital henia and anterior lamella. *Paralycaeides* is the most likely outgroup (or sister group) of *Madeleinea* based on the female genitalia.

Lack of distributional data is still a particular problem in assessing *Madeleinea* taxa, as it is with other oreal butterfly faunas in the Neotropics. Given the spotty availability of samples and the frequency of new species in collections from areas previously unstudied, it is likely that additional, highly stenotypic species will be discovered within the farflung and fragmented biotopes of the high Andean regions (cf. Fjeldsa 1992). More and more, in all the oreal polyommatines, we are seeing how the deeply dissected mountain topographies, accompanied by unique microclimates and vegetation, lead to a preponderance of regional endemics (cf. Bálint and Johnson 1993, Bálint and Lamas 1994).

The present work is aimed at placing knowledge of *Madeleinea* on a more equal footing with other lineages of high Andean Polyommatinae. With at least a basic taxonomy available for the genus, it may be possible for future workers to expand their local studies to include the important aspects of biology and ecology.

POSTSCRIPT [at proof]

The authors' publication concerning higher categories of the Polyommatini, based on what is now known of the Neotropical fauna, appeared shortly before publication of the present work. It contains the most current assessment of the reformed Polyommatus Section referred to just above. For consistency we cite it here as in the body of the text (Bálint and Johnson, in prep.).

APPENDIX I

Illustration of paucity of historical material on the genus *Madeleinea* hitherto. Table 1— data available to Nabokov in 1945 compared to similar small samples in other groups of Polyommatini; Table 2— meager additional data available after culling European collections in the present study. Note how these small samples compare to those of *Madeleinea* species (a) recently collected [*M. pelorias* entry, etc. here] or (b) recently discovered [Bálint and Lamas 1994, Bálint and Johnson 1995; Benyamini, Bálint and Johnson 1995]. Such data account for the "spotty" distributions characterizing the genus. For instance, species of the genus would appeaer still discoverable from Colombia.

Table 1

Material available for Nabokov's (1945) study with names updated to current taxonomic usage (Pacific and Caribbean localities are omitted).

Species	**Material/Locality**
Itylos titicaca	5m 1f/ Titicaca Lake (Bolivia)
Nabokovia faga	1m/ Peru
Hemiargus ceraunus	28m 1/ Colombia
H. hanno	small series/ Cota (Colombia), Chulamani, Coroico (Bolivia)
H. ramon	2m/Quayaquil, San Rafael (Ecuador)
Pseudolucia collina	1m 1f/ Penco (Chile)
P. chilensis	3m 1f/ Penco, Central Chile (Chile)
Paralycaeides inconspicua	1m/ Cuzco (Peru)
Madeleinea moza	1m 1f/Sicasica (Bolivia)
M. rubberothei (*)	2m/ Sicasica (Bolivia)
M. pacis	1m/ Cuzco (Peru)
M. koa	2m 1f/ Puno (Peru)

(*) this taxon considered as synonym of *M. moza*

Table 2

Additional Historical Material with Data More than Simple Listing of a Country (all BMNH, m=♂, f=♀).

Species	**Material/Locality**
Madeleinea koa	**Bolivia**, 5ms: Illimani. **Peru**, lm,1f: Acopampa, lM Cajamarca. lm: Chachapoyas. lm: Challabamba. lf: Corongo. 10ms, 1f: Puno. lm: Pozzuzo. lm: Vilcanota.
Madeleinea moza	**Argentina**, 2ms: Salta. 4ms,1f: Tucuman. 3 ms: Uspallata
Madeleinea nodo	**Ecuador**, 2ms: Cuenca.
Madeleinea odon	**Ecuador**, 17ms: Cayambé (Cayambé, Cayambé Mount). lm: Guachamana to Cilica. 21ms, 8fs: Loja (Environs de Loja, El Monje pres Loja, Valle de Loja). lm: Palanda. lm: Polocate. lm: Puobamba, 2m: Zamora.
Madeleinea pacis	**Bolivia**, 2fs: Guaqui. **Peru**, 2ms: Challabamba. lm: Cuzco. lm: Oconeque to Agualani. 2ms. Palea. lm, lf: Quencha.
Madeleinea pelorias	**Peru**, 2ms,2 fs: Puno.

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[Literature Cited continued on back of Photoplate II]

PHOTOPLATE I, KEYED ON OVERLEAF, CONTAINS B&W PHOTOGRAPHS OF *MADELEINEA* TAXA OF *REPORT* NO. 43

Below is a cross reference to photographs (color and B&W) in addition to these, elsewhere in the volume:

Madeleinea lea, M. sigal, M. pacis: B&W— **PHOTOPLATE VI**

Madeleinea lea, M. moza: color— **PHOTOPLATE XIII**

Madeleinea pelorias, M. sigal: color— **PHOTOPLATE XIV**

CAPTIONS FOR PHOTOPLATES I and II

(facing page & overleaf "**Photoplate I**"; overleaf and following page, "**Photoplate I, continued & Photoplate II**")

[*format*: photographs are grouped by REPORT No.'s indicated; photograph rows are numbered, top to bottom, as 1-5, photos in each row as **L** (left), **M** (middle), **R** (right), further keyed as necessary to special notations, if any, in the text and each is captioned on the plate with genus, species, gender and view (D =dorsal, V= ventral)]

PHOTOPLATE I (facing page and overleaf): ADULT PHOTOGRAPHS FOR *REPORT* NO. 43

1L. Type species *Madeleinea moza*, male, Bolivia (AMNH), also seen by Nabokov, FW: 11.0 mm.
1M. *M. moza*, male, Argentina, Dept. Jujuy, Rio Lozano, Morro de Alizar, 1750 m., 1.V.1977 (AMNH), FW: 11.0 mm.
1R. *Madeleinea lolita*, holotype (BMNH).
2L. *Madeleinea huascarana*, holotype (MUSM).
2M. *Madeleinea koa*, male, Peru, Huanuco, Tingo Maria, 670 m, 21-22.I.1947 (AMNH), FW: 9.5 mm.
2R. *M. koa*, female, Bolivia, "Titicacasee" (AMNH), also seen by Nabokov, FW: 9.0 mm.
3L. *Madeleinea vokoban*, holotype (AMNH).
3M. *Madeleinea odon*, holotype (AMNH).
3R. *M. odon*, allotype (AMNH).
4L. *Madeleinea nodo*, holotype (AMNH).
4M. *M. nodo*, paratype male, Ecuador, "Prés Quito" (HNHM), FW: 9.0 mm.
4R. *M. nodo*, paratype male, Ecuador, "Pifo, 1920-1932, coll. L. & J. De Joannis" (MHNP), FW: 9.0 mm.
5L. *Madeleinea pacis*, male, Peru, Cuzco, 3500 m. (AMNH), also seen by Nabokov, FW: 10.5 mm.
5M. *M. pacis*, female, Bolivia, Yungas Valley, 37 mi NE La Paz, 10.000', 7.VII.1958 (AMNH), FW: 10.0 mm.
5R. *Madeleinea tintarrona*, holotype (BMNH).

[overleaf, below]

1L. *Madeleinea ludicra*, holotype (MNHU).
1M. *Madeleinea cobaltana*, male, Peru, 34 mi. E of La Aroyo on road to Tarma, +4200 m., 22.I.1975 (HNHM), FW: 9.5. mm.
1R. *M. cobaltana*, paratype female, Peru, 34 mi E of La Aroyo on road to Tarma, +4200 m., 22.I.1975, Descimon" (AMNH), FW: 11.0 mm.
2L. *Madeleinea pelorias*, male, Chile, Zapahuira, Reg. Tarapacá, 21.XI.1952, L.E. Peña" (AMNH), FW: 9.0 mm.
2M. *M. pelorias* (Weymer, 1890), holotype (MNHU).
2R. *Itylos mashenka* (orignally described as *Madeleinea mashenka* Bálint 1993), holotype (BMNH).

PHOTOPLATE II (overleaf and following page): ADULT PHOTOGRAPHS FOR *REPORT* NO. 44

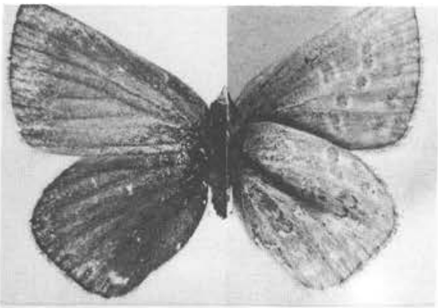
1L. Type species *Leptotes cassius*, male, Argentina, Salta, IV-V 1921 (BMNH).
1M. *L. cassius*, female, Argentina, Salta, IV-V 1921 (BMNH).
1R. *Leptotes andicola*, male, Ecuador, Cayambe Mts., alt. 10,000', VI.1897 (BMNH).
2L. *L. andicola*, male, Ecuador, Cayambe Mts., alt. 10,000', VI.1897 (BMNH).
2M. *Leptotes callanga*, male, Peru, Limbani, Carabaya, alt. 10,000', XI.1901 (BMNH).
2R. *L. callanga*, female, Peru, Limbani, Carabaya, alt. 9,500', IV.1904 (BMNH).
3L. *Leptotes krug*, holotype (Mus. Hist. Nat., Univ. Caldas, Bogota, Colombia).
3M. *Leptotes bathyllos*, male, Peru, Río Tigre, Intuto, 9.V., Dept. Loreto (MUSM).
3R. *L. bathyllos*, female, Peru, Río Samiria, Cocha Shinquito, 130 m., 11.VI.91 (MUSM).

[overleaf, below]

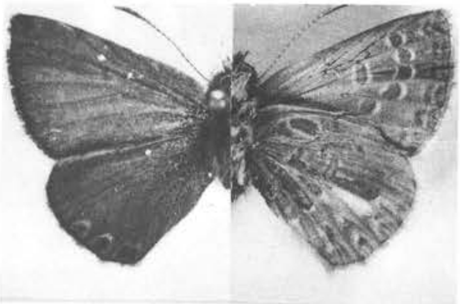
1L. *Leptotes trigemmatus*, male, Chile, Choapa, 5 km. N. of Illapel, 12.Xi.1993 (AMNH).
1M. *L. trigemmatus*, female, Chile, Choapa, 5 km. N. of Illapel, 12.Xi.1993 (AMNH).
1R. *Leptotes parrhasioides*, male, [Peru], Charles Island, Galapagos Islands, 12.III.02. (BMNH).
2L. *L. parrhasioides*, female, [Peru] Charles Island, Galapagos Islands, 12.III.02. (BMNH).
2M,R. *L. parrhasioides*, syntype male (NRS), 3L (labels).
3M. *Leptotes cassius*, male, Colombia, Cundinamarca, Silvania, 10.VI.1990 (AMNH).
3R. *L. cassius*, female, Colombia, Cundinamarca, Silvania, 10.VI.1990 (AMNH).
4L,M. *Leptotes lamasi*, holotype (MUSM).
4R,5L.*L. lamasi*, allotype (MUSM).
5M. *Leptotes delalande*, holotype (BMNH).
5R. *L. delanande*, allotype (BMNH).

PHOTOPLATE I

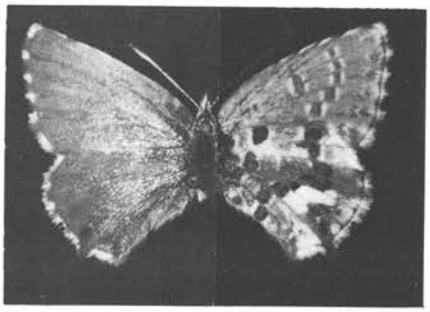
Madeleinea



M. moza ♂ D/V type species



M. moza ♀ D/V



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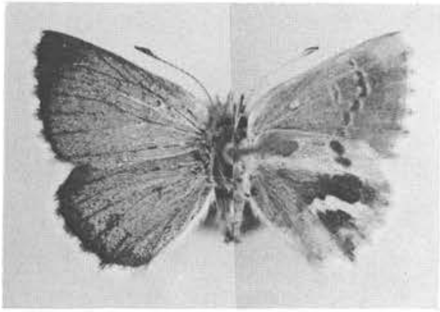

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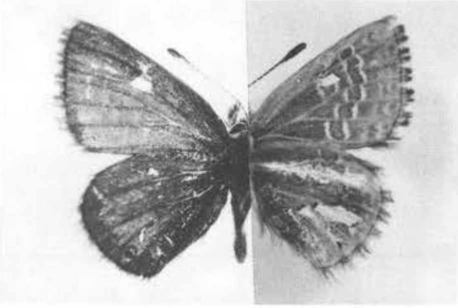
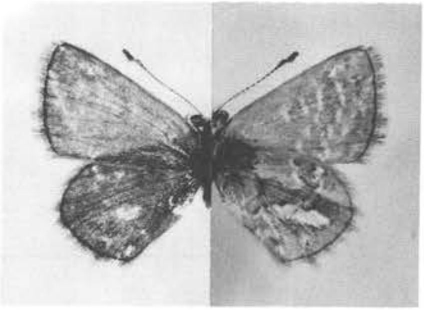
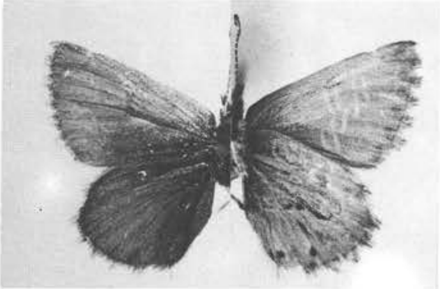


M. koa ♂ D/V



M. koa ♀ D/V



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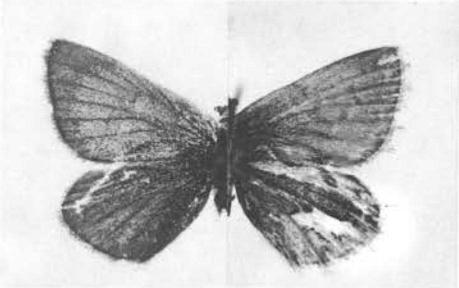

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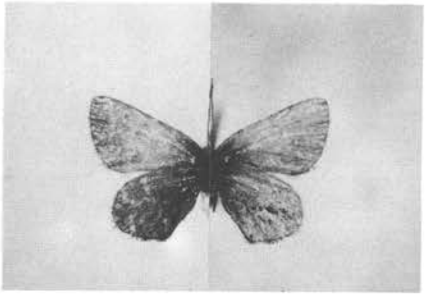

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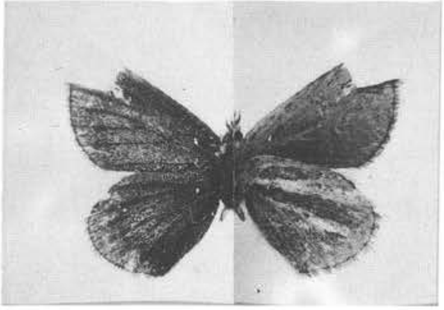

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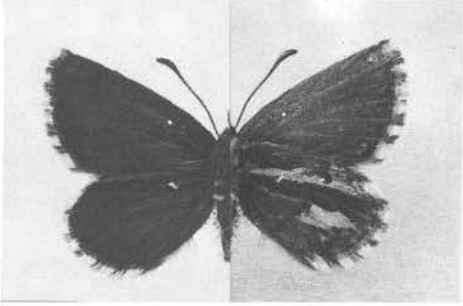

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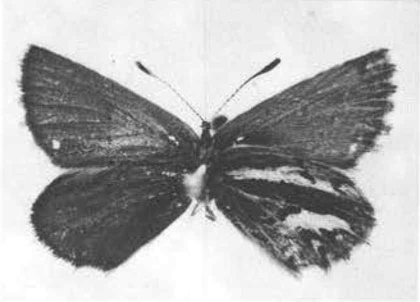

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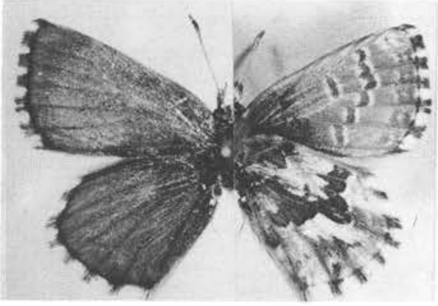
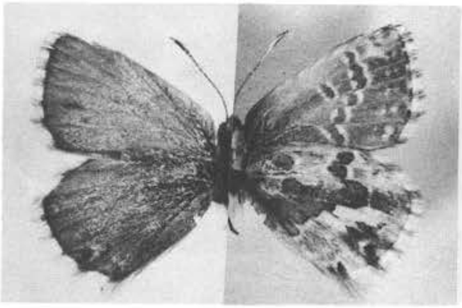


M. pacis ♂ D/V

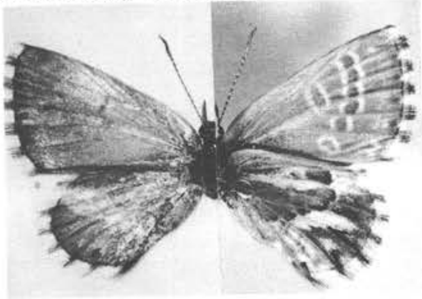


M. pacis ♀ D/V

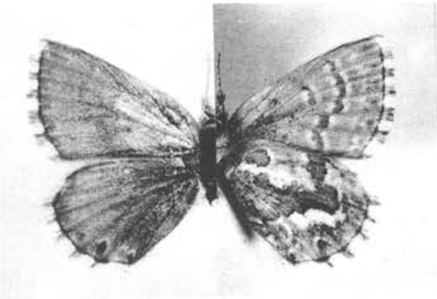
M. tintarrona ♂ D/V

PHOTOPLATE I, continued

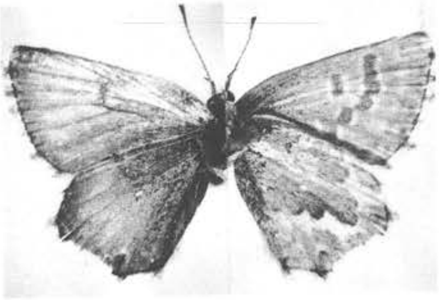
Madeleinea, continued



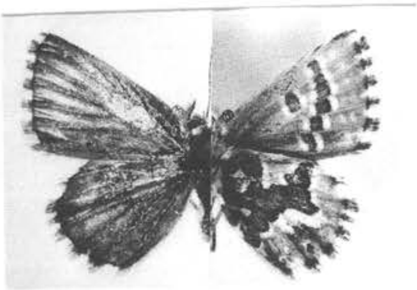
M. ludicra ♂ D/V



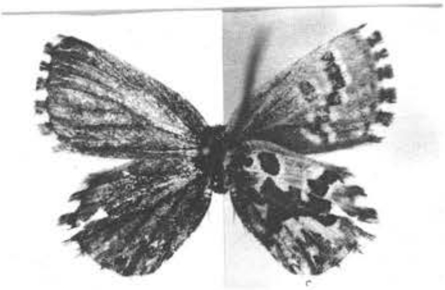
M. cobaltana ♂ D/V



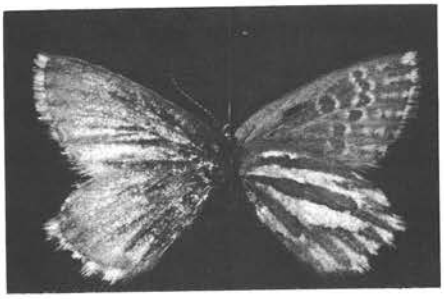
M. cobaltana ♀ D/V



M. pelorias ♂ D/V



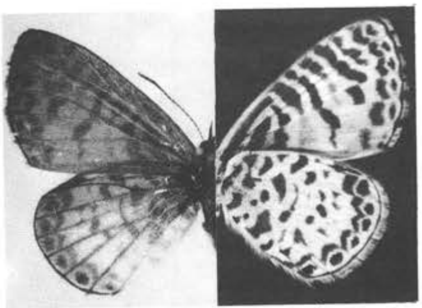
M. pelorias ♀ D/V



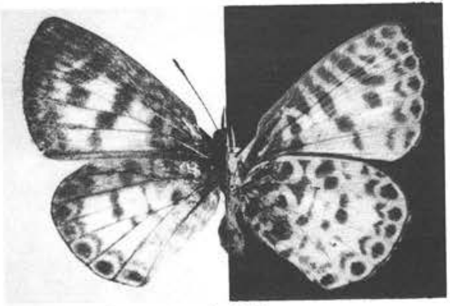
mashenka ♂ D/V [to *Itylos*]

Leptotes

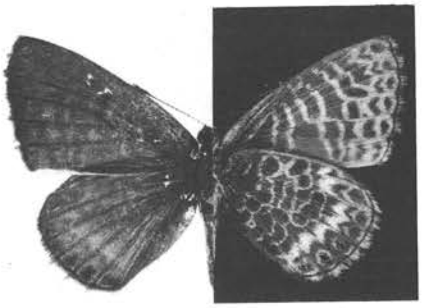
PHOTOPLATE II



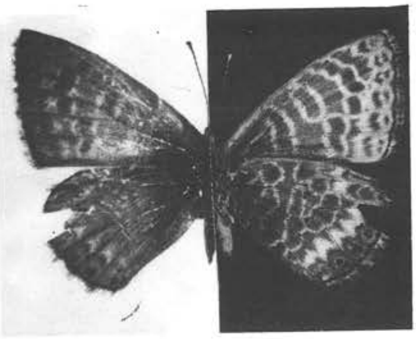
L. cassius ♂ D/V **type species**



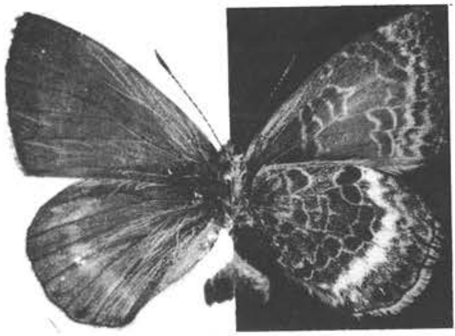
L. cassius ♀ D/V



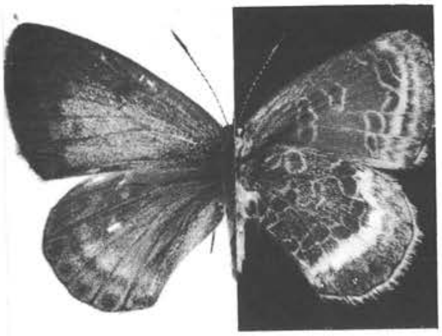
L. andicola ♂ D/V



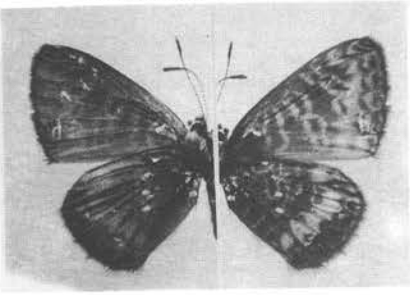
L. andicola ♀ D/V



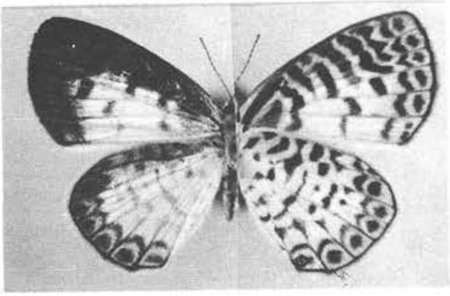
L. callanga ♂ D/V



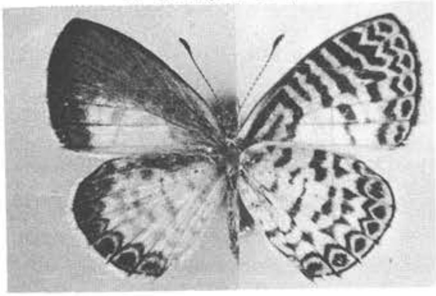
L. callanga ♀ D/V



L. krug ♂ D/V

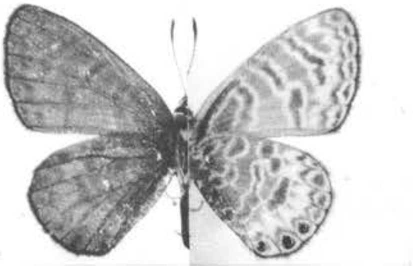


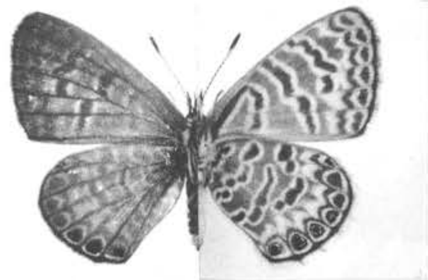
L. bathyllos ♂ D/V



L. bathyllos ♀ D/V

Leptotes, continued


L. trigemmatus ♂ D/V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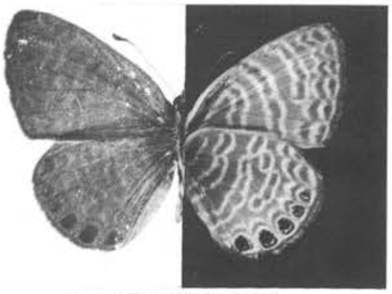
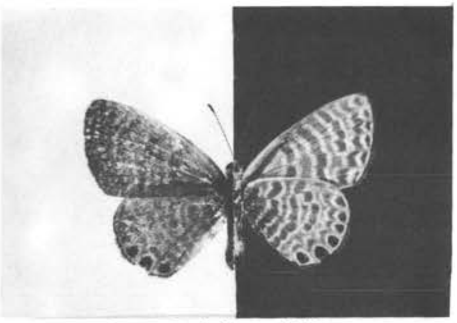
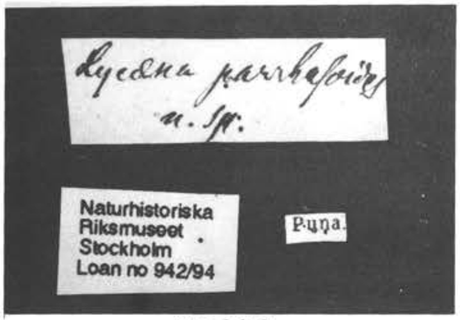

L. parrhasioides ♂ D/V


L. parrhasioides ♀ D/V


type *L. parrhasioides* ♂ D

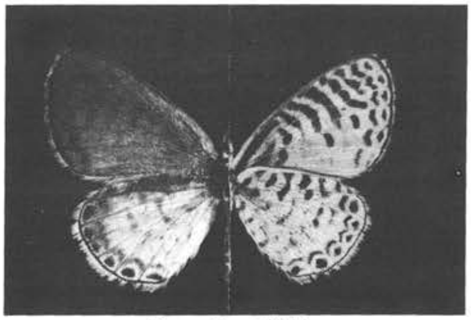

L. parrhasioides ♂ V

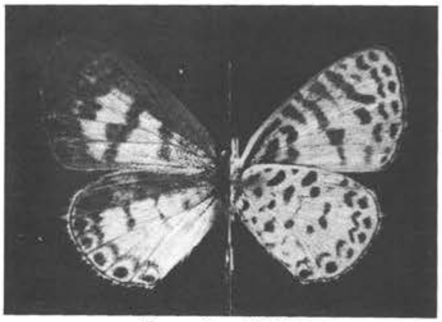

Lycæna parrhasioides
n. sp.

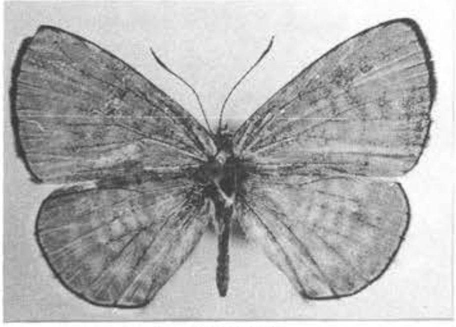
Naturhistoriska
Riksmuseet
Stockholm
Loan no 942/94

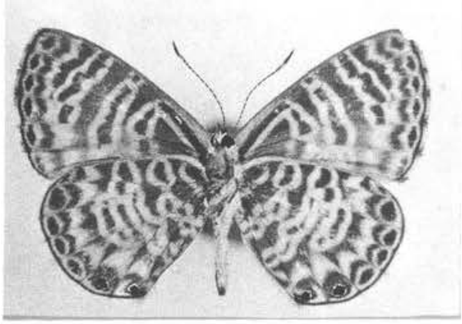
Puna.

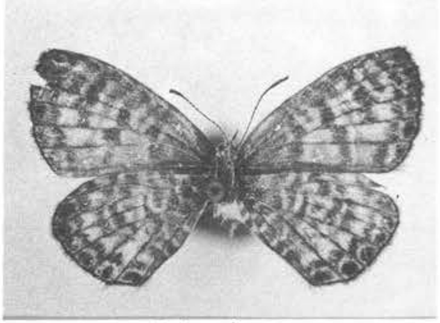
type labels

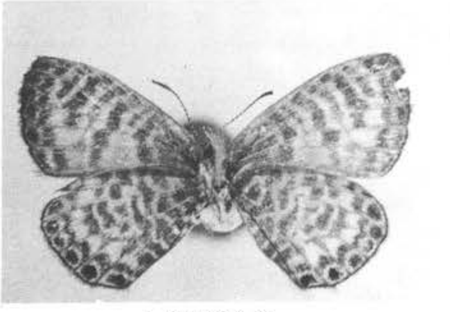

L. cassius ♂ D/V


L. cassius ♀ D/V


L. lamasi ♂ D


L. lamasi ♂ V


L. lamasi ♀ D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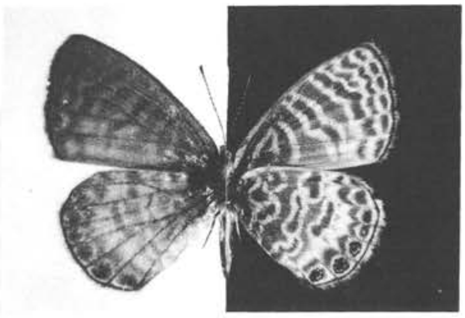
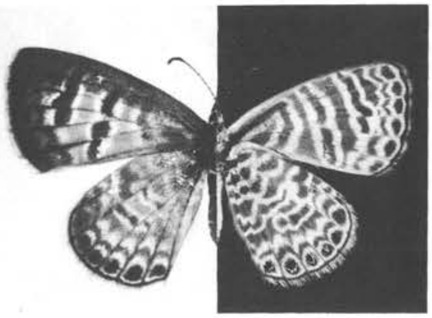

L. delalande ♂ D/V


L. delalande ♀ D/V

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CAPTIONS FOR PHOTOPLATE III

BIOTOPES OF VARIOUS NEOTROPICAL POLYOMMATINI INCLUDED IN *REPORTS* 44, 45, 46, 48, 51 & 52.

See cross-references ("CR") in each entry for referral to the color Photoplates, particularly those placed after page 7 in *Report* No. 52.

Fig. 1. ***Leptotes trigemmatus***. Near Santiago Chile, 700 m., at Las Condes, 24.4.1995. A large *Plumbago capensis* bush (next to the figure); here were found perching adults and various larval stages of *L. trigemmatus*. CR: color, PHOTOPLATE VIII.

Fig. 2. ***Pseudolucia benyamini***. The type locality in sand dunes south of Pichicuy, Chile (in background) and large cushion-like *Chorizanthe vaginata* which are the foodplants, 6.11.1993. CR: color, PHOTOPLATE X.

Fig. 3. ***Pseudolucia collina***. The biotope at Rio la Laguna, Elqui, Chile, 2650 m., 3.12.1994. CR: color, PHOTOPLATE IX.

Fig. 4. ***Pseudolucia lyrnessa* and *P. chilensis***. Their coastal biotope, 2 km. south of Constitución, Chile. Shrubs at bottom are *Chorizanthe vaginata*, the foodplant of *P. lyrnessa*. On the small sand dunes along the coast grow *Ambrosia chamissonis* and its parasite *Cuscuta racemosa*, the foodplant of *P. chilensis*. At this locality the author observed oviposition of *P. chilensis* for the first time (on 2.2.1995, the date of this photograph). CR: *lyrnessa*, color, PHOTOPLATES VII, X; *chilensis*, color, PHOTOPLATE XIII.

Fig. 5. ***Pseudolucia lyrnessa***. The biotope of *P. lyrnessa* at San José de Maipo, 900 m., Santiago Metropolitan Region, Chile, 22.10.1994. Here, in sandy soils, grows the hairy foodplant species *Montiopsis capitata*. CR: color, PHOTOPLATE X.

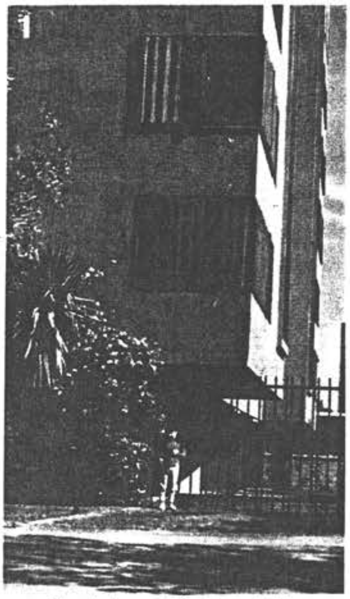
Fig. 6. ***Pseudolucia avishai***. The biotope at the type locality, in a green "vega", 2550 m., along the Los Pelambres Valley, Chile, 2.4.1994. Here, myrmecophily was first observed among South American Lycaenidae (see Benyamini and Bálint, *Report* 51 and Benymaini, *Report* 52). CR: color, PHOTOPLATES VII, XII.

Fig. 7. ***Pseudolucia oligocyanea***. The type locality at Tumbre, Chile, 3600 m., near Talabre with the smoking Volcan Lascar in the background, 28.1.1994. CR: color, PHOTOPLATE XI.

Fig. 8. ***Pseudolucia annamaria***. The biotope at Cerro La Virgen, Chile, 2200-3000 m.; here the foodplant was documented as *Adesmia* aff. *confusa* on 28.11.1993. CR: color, PHOTOPLATE XI.

Fig. 9. ***Pseudolucia annamaria***. The biotope at Batuco, Chile, 1800-2200 m. *Adesmia* aff. *confusa* growing along this was the source of material for rearing experiments Sept. 1993 and Sept.-Oct. 1995. CR: color, PHOTOPLATE XI.

Fig. 10. ***Pseudolucia scintilla***. The landscape between Hurtado and Ovalle, Coquimbo Region, Chile, in particularly rainy season. The species was collected on 18.7.1993 at 1300 m. The prostrate dark colored plants at the front of the cacti are *Aristolochia chilensis*, the foodplant of *Battus archidamas* (Papilionidae).

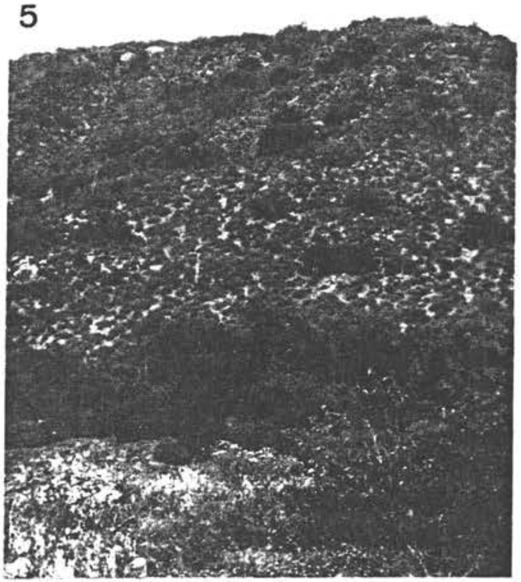


Leptotes trigemmatus

Pseudolucia benyamini

Pseudolucia collina

P. lyrnessa / P. chilensis



Pseudolucia lyrnessa

Pseudolucia avishai

Pseudolucia oligocyanea

Pseudolucia annamaria / Pseudolucia clarea

Pseudolucia scintilla

Species Diagnostics of the Genus *Leptotes* In Continental South America (Lepidoptera, Lycaenidae)

By Zsolt Bálint
Zoological Department
Hungarian Natural History Museum
H-1088 Budapest, Baross u. 13.
Hungary

and

Kurt Johnson
Department of Entomology
American Museum of Natural History
Central Park West at 79th Street
New York, New York 10024 U.S.A.

Polyommatine Lycaenids of the Oreal Biome in the Neotropics, part VI: Species Diagnostics of the Genus *Leptotes* in Continental South America (Lepidoptera, Lycaenidae), by Zs. Bálint and K. Johnson

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REPORTS **of the**
Museum of Natural History, University of Wisconsin
Stevens Point

NO. 44

ABSTRACT

Members of the genus *Leptotes* Scudder, hitherto poorly elaborated in South America, are reviewed with emphasis on the South American fauna and reference to the Central American fauna and more well-documented Caribbean fauna. Eight species are documented from continental South America, including three which are described as new. The entire Neotropical fauna includes thirteen well-defined species at present. Estimates as recently as 1993 of only eight species took into account only species more well-known in common usage. Previous concepts of species groups in *Leptotes*, based on fewer species, are inadequate for the fauna as a whole. The present paper elaborates the morphological groupings among the South American species; overall, a revised set of species groups for the entire fauna is used, based on the superficial characters most often employed by curators and fieldworkers. The latter is as follows (South American representatives asterisked) based on superficial characters: the "***andicola*-Group**": *L. andicola* (Godman and Salvin)*, *L. callanga* (Dyar)*, *L. bathyllos* Tessman*, *L. krug* **n.sp.***; the "***marina*-Group**": *L. marina* (Reakirt), *L. perkinsae* Kaye 1931, *L. idealus* Johnson and Matusik, *L. trigemmatus* (Butler)*, *L. parrhasioides* (Wallengren); the "***cassius*-Group**": *L. cassius* (Cramer)*, *L. hedgesi* Schwartz and Johnson, *L. lamasi* Bálint and Johnson*, **n. sp.**, *L. delalande* Bálint and Johnson*, **n.sp.** The genus *Leptotes* is of great biogeographic interest because some its members (as well as others historically discussed as possible members) are from outside the New World, including distributions in Africa and Atlantic and Pacific ocean basins. Assuming that *Leptotes* is monophyletic, modern views of biogeography consider two possible origins of these farflung distributions: dispersal across preexisting barriers ("dispersal") or fragmentation of an ancestral distribution ("vicariance"). Considering the off-noted African/ Neotropical disjunctions of some *Leptotes* and Atlantic and Pacific Island occurrences of others, both factors may have influenced the present distribution of *Leptotes*. Consequently, it is important to proceed from regional elaborations of the genus (like the present paper) to generic cladistic study including the worldwide elements. Absent such study, the monophyly of *Leptotes*, or existence of any trans-continental subunits, cannot be recognized. Without knowledge of trans-continental relationships within the genus, neither dispersal or vicariance can be invoked. Previous speculation concerning these topics is weak because of poor knowledge of Neotropical diversity. The present paper, in tandem with recent Caribbean studies, alleviates this historical problem of sampling error in *Leptotes*. However, it is still likely that additional *Leptotes* species will be discovered in the Andean region.

INTRODUCTION

The genus *Leptotes* Scudder (1876), as construed by common usage and reviewed here, is pantropical in distribution and placed in Eliot's (1973) *Leptotes*-section. This section contains four genera which Eliot (1973: 446), and others, considered closely related. Of these, a close relationship between genera *Syntarucus*, *Leptotes* and *Cyclyrius* had been first suggested by Clench (1963: 255) and Stempffer (1967: 219) and is indicated both by their genital morphology (cf. Stempffer 1967, figs. 190-192, Fernandez- Rubio 1976, lamina 20-21) and known biology (cf. Fiedler 1991: Table 17). As a result, several recent authors have considered the Old World genera *Syntarucus* Butler, 1901 and *Cyclyrius* Butler, 1897 as synonyms of *Leptotes* (Fiedler 1991: 187). In his introduction to the genus *Leptotes*, Larsen (1991: 230-233) practically synonymized *Syntarucus* with *Leptotes* based on the male genitalic structures. Also, according to Larsen, the main center of the genus is Africa where thirteen species occur (cf. Stempffer 1967: 221, under *Syntarucus*).

The diversity of the genus in the Neotropics was never thoroughly investigated, in spite of the fact that Draudt (1921: 820-821) listed the occurrence of seven "species" on the American continents. Brown (1993: Table 2) estimated the number of the Neotropical *Leptotes* species as eight. H. K. Clench (1963), in a survey of the West Indian lycaenids, offered a brief synopsis of the American members of the genus. He divided *Leptotes* into three species groups: (1) the *cassius*-Group, in which he included only the widely distributed species *cassius* Cramer [1775] and "a still undescribed taxon from the Colombian Andes"; (2) the *marina*-Group, in which he included *marina* Reakirt (1868), *perkinsae* Kaye (1931) and *parrhasioides* Wallengren (1860). He noted that this group had several members in the Afrotropical region (Clench 1963: 255 and 266); and (3) the *callanga*-Group, in which Clench recognized divergent taxa, including high Andean *callanga* Dyar (1913) and *webbianus* Brullé (1850) of the Canary Islands. Surprisingly, Clench overlooked the taxa *andicola* Godman and Salvin, *trigemmatus* Butler and *ochsenheimerii* Godart, all described from the Neotropical realm and often well-represented in collections. Recently, two decades later after the early work of Clench, two further *Leptotes* taxa were discovered in the Caribbean region— *L. idealus* Johnson and Matusik (1988) (Hispaniola) and *L. hedgesi* Schwartz and Johnson (1992) (Cuba). Since the description of these species both have been supported by additional samples (*idealus*, Johnson and Matusik 1992; *hedgesi*, S. Blair Hedges, in litt. to Johnson 1994). As a result, the Neotropical diversity of *Leptotes* is comparable to that of Africa. As with many other groups of Neotropical polyommatines, previous characterizations of Neotropical "paucity" have been simply due to sampling error. This probably resulted because, while the *Leptotes* taxa occurring north of Mexico were quite thoroughly studied both as to taxonomy and biology (Scott 1986: 394), the South American taxa were studied only sporadically.

The aim of the present study is thus quite straightforward— to fill this gap in information concerning taxonomy and occurrence of Neotropical "Striped Blues" (*sensu* Scott 1986) or "Zebra Blues" (*sensu* Larsen 1991). The present study will show that few of the previously published generalizations about *Leptotes* in the New World stand up under modern scrutiny. This results because more Neotropical species of *Leptotes* are now known and studies have been made of the morphology of both sexes. Within this larger view of Neotropical *Leptotes*, we hope future Neotropical museum and field workers can now pay more attention to this interesting group of polyommatine butterflies.

MATERIALS AND METHODS

Collections. The senior author recurated the Neotropical *Leptotes* collection of The Natural History Museum, London (BMNH) in September 1993. Unfortunately, extensive distributional data compiled there by him and his wife were lost in subsequent transit between Britain and Hungary. As a result, the present study cannot include a complete list of the BMNH's rich holdings in Neotropical *Leptotes* as was possible for the genus *Madeleinea* in the a companion study (Bálint and Johnson in press). BMNH distributional data for *Leptotes* is instead summarized from briefer notes kept by the senior author and immediately amended from his and his wife's memory once the original documents were suspected lost. Other collections of *Leptotes* are listed in full, including the collections of the American Museum of Natural History (AMNH), Hungarian Natural History Museum (HNHM), Luis Peña material borrowed from the Field Museum of Natural History (FMNH) and material provided by Julián Salazar E. and Jesus Velez of the Museo de Historia Natural de la Universidad del Caldas, Manizales (Colombia).

Study Group. It would have been desirable to include here all the taxa of the Neotropical Realm, including the continents and the Antilles. However, in the case of the Antilles and surrounding "Caribbean region" we have deferred to the recent publication by Smith, Miller and Miller (1994) (see Johnson and Kroenlein 1993: 39) since (i) the junior author has previously provided rather complete data concerning certain Antillean *Leptotes* for this latter study and (ii) Smith *et al.* have already analyzed most museum label data for *Leptotes* in southern parts of North America (*L. marina* and *L. cassius*), relevant areas of Central America (*L. marina* and *L. cassius*) and the West Indies (*L. cassius*, *L. marina* complex, *L. idealus*, *L. perkinsae* and *L. hedgesi*). In fact, text of the present paper was prepared before the issuance of Smith *et al.* and prepared with consideration not preempt or repeat data published by them. Consequently, the present study of *Leptotes* in limited to (i) continental South America and (ii) the unique offshore population of the Galapagos Islands (a species interestingly related to a widely distributed austral taxon on the mainland). We include the Caribbean *Leptotes* only in our synoptic scheme and species list. This is because the new list is based on our recent synthesis of taxonomic characters involving all the currently known New World *Leptotes*.

Methods. Most Neotropical *Leptotes* can be readily identified by VW pattern, a fact we acknowledge here by summarizing the historical "wing-resemblance groupings" of the genus (cf. Clench 1963). However, to build a phylogenetic base for understanding the genus, we supplement the historical reliance on these and characters of the male genitalia by more detailed reference to the morphology of both sexes. In particular, the male valvae and female henia supply excellent specific characters. These allow unambiguous diagnosis of every taxon, a situation somewhat problematic in the past (cf. Larsen 1991 and Stempffer 1967, cited places). In our study of *Leptotes* taxa involving intra- or infraspecific synonymic problems, our morphological analysis has been based on uniform dissection of 5 male and 2 female specimens [*L. trigemmatus* males: gen. prep. nos. Zs. Bálint 451-455, females: 466-467 (HNHM); *L. cassius* males: gen. prep. nos. Zs. Bálint, 456-460, females: 468-469 (HNHM); *L. pulcher* (Murray 1874) males: gen. prep. nos. Zs. Bálint, 461-465, females: 470-471 (HNHM)]. In the cases of taxa new or poorly known, we have relied on series aggregated from the major collections studied (a majority from a 1993 BMNH specimen loan to the senior author).

Along with illustrating adults, we describe and figure taxonomic features which have proved most informative. Fortunately, consistent with publications heretofore noted concerning Caribbean region *Leptotes*, the most diagnostically useful position for the genital structures appears to be the ventral view. We thus illustrated all structures in the ventral view at 350x magnitude. We deemphasize the penis (all *Leptotes* show the same generally bifurcate structure) and falces which, contradicting the situation in the Old World taxa (cf. Stempffer 1967), are generally uniform. All dissected material is preserved in glycerin vials on the pins of individual specimens which bear the number sequence used by the senior author at the HNHM.

Format. Original combinations for each taxon are cited along with the location of the original description. We then cite the most recently available catalog of Lycaenidae (Bridges 1988). For familiarity, we initially refer to historical wing-resemblance groupings in *Leptotes* (e.g. Clench 1963). However, superficial similarity in the ventral wing pattern of *Leptotes* species appears to be adaptive (e.g. convergent) and it is readily demonstrated that there is no overall consilience between wing pattern in the genus and male and female morphology. Accordingly, we delineate alternative groupings for the species based mainly on structural characters. These new groupings are also necessary because previous studies of the genus did not include its entire diversity.

After introductory comparison of wing pattern and morphological groupings within the genus, we return for synoptic purposes to taxon entries based on the traditional wing-resemblance groupings, but including the various taxa new to the group. We do this assuming that the presentation of morphologically-based groups is less useful to most workers for initial diagnosis of specimens. However, as familarity increases with the diversity of *Leptotes* we anticipate that a phylogenetic approach to the genus will prefer groupings more akin those we cite here from the structural characters. Spatial and temporal distributions are generalized from aggregate label data, each taxon illustrated by photographs of adults, and the selected genital structures presented in equally scaled line drawings. We use the terminology and abbreviations of our previous works (cf. Bálint and Johnson 1993, 1994a and 1994b); color codes are from Maerz and Paul (1950).

CHARACTERIZATION OF NEOTROPICAL *LEPTOTES*

LEPTOTES Scudder 1876.

DIAGNOSIS. ***Wings.*** **Male.** DFW,DHW ground blue with VW markings showing through, margin with black border and DHW marginal spots. VFW,VHW ground basically white or greyish but heavily overlaid with various dark "*marbled*" patterns [gray, beige or blackish], the latter occurring in more spotted or orbed patterns [*andicola*-Group], lineal or "zebroid" patterns [*marina*-Group and some other taxa] or sometimes with white more dominant and marbled elements reduced [*L. cassius*]). Distal of marbled pattern on FW, postmedian spots of cells CuA1-CuA2 connect with discoidal, often coelescent, VHW marginal spots enclosing iridescent ["metallic"] scales; on HW, postmedian spots are boldly white or sometimes congealed to a white band, marginal spots are often produced and enclose brightly iridescent ["metallic"] scales as on FW. **Female.** As male but DFW,DHW ground brown sometimes with very strong white and/or blue overcast extending through the submargin.

Morphology. **Male.** Uncus blunt; gnathos commonplace polyommatine (almost straight, tapering gradually from base to narrowly pointed apices and costally dentate); vinculum dorsally very wide; furca consisting two relatively strongly curved arms; valvae oblongate with anterior more ovate, posterior terminating in a variously-produced spatulate lobe marked by an angled inwardly-directed margin producing various dentations or prominent prongs, depending on the species; aedeagus with massive and large subzonal element, suprazonal ending in two long, strongly sclerotized and slightly arched cornuti; vesica with single small hooklike cornutus. **Female.** Terminal tergite heavily sclerotized and with strong apophyses, papillae anales commonplace polyommatine with long apophyses. Genitalia with terminal fibula produced and adjacent henia slightly sclerotized toward anterior, depending on the species.

ORIGINAL GENERIC DESCRIPTION. Scudder, 1876, Bull. Buffalo Soc. Nat. Sci. 3: 124. Additional important contributions: Stempffer 1967, Bull. Brit. Mus. (Nat. Hist.) Ent. Ser. Suppl. 10: 217-221 (discussion of genera *Cyclyrius* Butler 1897 and *Syntarucus* Butler 1901).

TYPE SPECIES. *Lycaena theonus* Lucas (1857) by original designation. This taxon is currently considered a subspecies of *Leptotes cassius* Cramer [1775] in the Greater Antilles, Bahamas, Cayman Islands and Florida (Alayo and Hernández 1981: 71, Schwartz and Johnson 1992: 149).

DISTRIBUTION. ***Spatial***: pantropical, occurring across the Neotropical Realm from the southern United States to Argentina and including the West Indies and Galapagos Islands; several taxa migrate, sometimes founding resident populations which survive for years or decades (Gall and Ardale 1993). ***Temporal***: varying across taxa with disparate ranges but generally including all months of the year.

BIOLOGY. The biology of *L. cassius* and *L. marina* are sufficiently known (Fiedler 1997: 205 and references therein). The caterpillars feed on inflorescences, seed capsules and young buds, mainly of various Fabaceae and Plumbaginaceae (cf. Downey and Allyn 1979, Ballmer and Pratt 1988: 53; for further comparison see Fiedler 1991: 187). The taxa are multibrooded with *L. cassius* and *L. marina* recorded as migrators (Scott 1986, Gall and Ardale 1993). In South America, *L. trigemmatus* was thoroughly studied by Klein and Campos (1978).

THE PROBLEM OF SPECIES GROUPS IN NEOTROPICAL *LEPTOTES*

Clench (1963) stated that the pan-American species of *Leptotes* divide neatly into three groups according to the male genitalia and that each of these groups also occurs in the Old World. Our studies indicate this view resulted simply from the small sample of taxa and male genitalic characters Clench considered. In the larger context of additional taxa and characters (particularly of both sexes) the historical wing-resemblance groups of *Leptotes* are not supported by a consilience of morphological characters. Rather, a situation exists much as we have shown in the Andean and austral polyomlyommatine genus *Pseudolucia* Nabokov (Bálint and Johnson 1993a & in press; Bálint 1993a,b). Like *Pseudolucia*, *Leptotes* shows a strongly monophyletic structural ground plan. However, structural autapomorphies in diverse taxa, coupled with what appears to be a convergent [e.g. adaptive] ventral hindwing pattern (see Discussion), belie a simple method for subdividing the group. Because of this, the traditional intrageneric groupings of *Leptotes* also do not apply well to the Old World taxa. Consider, as an example, the historical "*callanga*-Group" of Clench (1963). Two taxa were included, *L. callanga* of the New World and *L. webbianus* of the Old World. It is true that the morphology of these species is distinctive. However, the Neotropical fauna actually includes three additional sister species of *L. callanga* and their wing patterns are divergent. New species *L. lamasi* and new combination *L. bathyllos* attach by wing pattern to the traditional "*cassius*-Group" recognized by Clench; *L. krug* shows a mosaic of external characters reminiscent of both *L. callanga* and *L. andicola*. Accordingly, both homoplasy and retained primitive characters appear to play some part in wing pattern expression among Neotropical *Leptotes*.

The old wing pattern groupings of *Leptotes* do hold a heuristic value— as initial steps for keys or for seminal diagnostic recognition in the field or lab. Considering the continental South American species of *Leptotes*, composition and distribution of three traditional wing pattern groupings can be summarized as follows (using the early names denoted by Clench 1963).

Clench's (1963) Species Groups and Their Neotropical Members, Then and Now—

callanga-Group: VW pattern with expansive dark marbled elements more "spotted" or "orblike" and with HW postmedial elements congealed into a prominent white band; restricted in the Neotropical Realm to the high Andes. Subsequent to Clench's inclusion of *L. callanga*, common usage recognized *L. andicola* as a member. The group is more diverse, however, with additional divergent elements only recently discovered: *L. krug*, described herein, showing a mosaic of characters between the two historically known species (perhaps relict of an ancestral population); *L. bathyllos*, long overlooked in the common usage of the genus (and brought to our attention by a reviewer), morphologically belonging here but with general pattern characters also allowing it to be placed in the *cassius*-Group (see below).

marina-Group: VW pattern with dark marbled elements more lineal and "zebroid"; in Neotropical Realm diverse in the Antilles and in northern Andean region; also represented in the Galapagos Islands (*L. parrhasioides*) and austral South America (*L. trigemmatus*). Five species, two of relatively recent description, currently show this general wing pattern (*L. marina*, *L. perkinsae*, *L. idealus*, *L. trigemmatus* and *L. parrhasioides*). One often strays into North America (*L. marina*, cf. Ferris and Brown 1981, map 162). Additional undescribed entities may exist in Central America.

cassius-Group: Widespread titular species shows reduced dark marbling over more prominently white ground, darker elements often occurring only as spots, slashes or stripes; most widely distributed of the groups, occurring from the southern part of the United States to Argentina. The present study describes two new species which have been confused with *L. cassius*; these depart from the above pattern by showing more "zebroid" or "leopard-like" pattern elements. They also show genitalia of diverse affinity in the genus (see *L. lamasi* and *L. delalande*, below). In addition, previously overlooked *L. bathyllos* aptly fits here by general superficial appearance. A closer look, however (including morphological examination), shows this species has diverged from the *callanga*-Group.

Groupings according to wing characters require a reassessment in light of new species and the fact that certain taxa were initially omitted in Clench's (1963) original scheme. Below, we organize the species of continental South American *Leptotes* by the structural characters reviewed in the present study. We add the common species *L. andicola*, overlooked by Clench, but for historical consistency retain Clench's "*callanga*-Group" notation. As noted above, study of structural characters readily separates members of the historical "*callanga*-Group" into those morphologically like *L. callanga* and another group including *L. andicola*. Since two newly added species, *L. krug* described as new, and *L. bathyllos* new combination, reflect this discovery we turn to *L. andicola* as a titular group name in our listings hereafter.

Morphological Groupings—
[separating *callanga* and *andicola* lineages for first time]

callanga-Group

Valvae of male genitalia with anal process; anterior margin of female genitalia with fibula heavily sclerotized.

Leptotes callanga (Dyar)
Leptotes lamasi, new species
Leptotes bathyllos Tessmann
Leptotes krug, new species

andicola-Group

Valvae of male genitalia with strong tornal dentation; anterior margin of female genitalia with fibula not so heavily sclerotized.

Leptotes andicola (Godman and Salvin)
Leptotes trigemmatus (Butler)
Leptotes parrhasioides (Wallengren)
Leptotes delalande new species

cassius-Group

Valvae of male genitalia with strongly incurved anal edge lacking any visible process; female genitalia with fibula not sclerotized at anterior.

Leptotes cassius (Cramer)

The above scheme is a radical departure from the view of *Leptotes* familiar to lepidopterists but probably the one of most phylogenetic value (particularly once the Caribbean taxa are included). How then to organize Neotropical *Leptotes* for external diagnostic purposes?

Since the purpose of the present paper is to facilitate superficial recognition of the known Neotropical species of *Leptotes* (including two new species and another long-neglected one hitherto confused with *L. cassius*) we reorganize the traditional "wing-resemblance groups" to include all the currently known taxa. This appears below as a modernized "Synoptic List" of Neotropical *Leptotes* organized by Species Groups and should allow the quickest route to superficial recognition, either in the museum or in the field. Bracketed species represent taxa (principally Caribbean), not fully elaborated in the present study but treated in detail recently by Smith *et al.* (1994). The biggest problem with this list, from a phylogenetic standpoint, is the above- mentioned distinction of the *callanga*- and *andicola*- related lineages. Taking this into account (that the relationship of taxa in the "*andicola*-Group" below is purely superficial, all the Neotropical *Leptotes* can be grouped on external characters as below. Note also that we introduce here, for the first time in the present volume, distinction of various authors for certain new names. This is because multiple authors became involved in desribing some new taxa discovered by regional biodiversity surveys. These workers are not authors of taxonomic commentary herein but should be recognized as authors of appropriate taxa. Without such cooperation, efforts to fully elaborate *Leptotes* would not have been possible.

andicola-Group

1. *Leptotes andicola* (Godman and Salvin 1891)
2. *Leptotes callanga* (Dyar 1913)
3. *Leptotes krug* Bálint, Johnson, Salazar and Velez 1995

marina-Group

1. [*Leptotes marina* (Reakirt 1868)]
2. [*Leptotes perkinsae* Kaye 1931]
3. [*Leptotes idealus* Johnson and Matusik 1988]
4. *Leptotes trigemmatus* (Butler 1881)
5. *Leptotes parrhasioides* (Wallengren 1860)

cassius-Group

1. *Leptotes cassius* (Cramer, [1775])
2. [*Leptotes hedgesi* Schwartz and Johnson, 1992]
3. *Leptotes lamasi* Bálint and Johnson 1995
4. *Leptotes delalande* Bálint and Johnson 1995
5. *Leptotes bathyllos* Tessmann 1928

DIAGNOSTICS OF SOUTH AMERICAN *LEPTOTES*

andicola Species Group

Male DW ground either lighter or deeper blue than congeners and with distinctive purplish tint; female brown with bluish basal overcast. VW ground in both sexes with dark elements more "spotted" or "orbed" than in more "zebroid" or "marbled" congeners and always with the VHW postmedian band pronounced and broadly white. Male and female genitalia typical of genus "Characterization" above, varying wit the species but lacking any particular coherence as a Group.

Leptotes andicola (Godman and Salvin 1891) NEW COMBINATION

Photoplate II; Figs. 7,17.
Lycaena andicola Godman and Salvin, Suppl. Append. Trav. Among Great Andes: 104.
Lycaena andicola: Bridges 1988, I.22,II.60.

Lectotype Designation. We select a BMNH male, in the general collection, labelled "Godman-Salvin Coll. 1911.-93, B.C.A. Lep. Rhop. Lycaena andicola, G. & S., Cayambe to Otavalo" which we have labelled "Lectotypus Lycaena andicola, des by Zs. Bálint and K. Johnson". There are additional specimens in the BMNH, labelled as above except for additional localities "Guallabamba", "Quito", "Machachi" and "Cotocachi". According to the original description these would qualify as syntypes and, therefore, by BMNH curatorial method, paralectotypes. P. Ackery (pers.

comm. to Bálint) notes the number of extant syntypes is uncertain because these could reside either in the general, type, or World War II reference collections. The latter, moved to the Tring Annex during the war and subsequently back to London, is only partially intact (see Johnson and Smith 1993: 3-4). It must be mentioned that when the lectotype was designated, a specimen with an additional label bearing a BMNH historical "type" label and number was not locatable. This may be because, contrasting the Theclinae, a formally numbered reference collection for BMNH Polyommatinae was never fully organized and Polyommatine specimens in the reference collection were probably moved in a random way before the transport to Tring (P. Ackery, pers. comm. to Johnson). The situation is the same for the Riodinidae (P. Ackery, pers. comm. to Johnson and C. Callaghan). As noted by Johnson and Austin (in press), preferred methodology in the Theclinae has been to select a lectotype consistent with a formerly attributed BMNH type number (except in cases where an abdomen is missing).

Type Locality. ECUADOR, "Cayambe to Otavalo" (by lectotype designation).

DIAGNOSIS. ***Wings.*** Male. DW deep violet blue (Pl 44G11), VW markings showing through, marginal area black, DHW with suffused antemarginal spots, fringes checkered. VW ground greyish brown with spotted and marbled pattern as described below, individual elements often strongly bordererd or "haloed" with white— VFW with basal triangle and subbasal bar, discoidal and postmedian bar, postmedian bar strongly divided; marginal area with submarginal triangle and marginal spot row, outer margin greyish brown; VHW ground greyish brown with strongly interdigitated markings: subbasal and postmedian row of spots with a discoidal patch between them, each spot ringed by white color; submarginal area with a full line of white arrowhead-like markings extending from costal margin to tornus; marginal area with more typical polyommatine markings (marginal spots with caps); cells 1A+2A-CuA1 with small marginal spots amid pale orange ground, each having a black center with metallic scales. [See Remarks regarding similar-looking species]. FW length: 11.5-12.5 mm. **Female.** FW apex more pointed; DW ground brown with blue basal suffusion, VW markings strongly showing through. VW similar to male. FW length: 11.5-12.5 mm. ***Male Genital Morphology.*** Fig. 7. Valval shape oblong with a narrow neck in posterior one-fourth, anal part concave, apex dentate, tornus with only slightly larger tooth. ***Female Genital Morphology.*** Fig. 17. Fibula elongate (length two times maximal breadth) with apex relatively rounded, anterior sclerotized; tergite with anterio-ventral apophysis narrow and elongate.

DISTRIBUTION. ***Spatial:*** specimens currently known from Colombia, Ecuador and Peru. ***Temporal:*** specimens studied were from June.

REMARKS. ***Historical Comments.*** The more "spotted" VW pattern of this species may explain Clench's having overlooked it as a *Leptotes*. Another reason may be that the CMNH collection, although rich in Lycaenidae, has a relatively smaller Andean component than other well-known collections (Johnson 1992). *Leptotes andicola* is well-represented in BMNH and AMNH material from the paramo region of the equatorial Andes but appears to be fully replaced southward by *L. callanga* in the puna. Recent specimens attest the frequency of *L. andicola* among paramo samples of Lycaenidae. Substantial series have been assembled by the authors from Michael Adams' Ecuadorian work (BMNH, Johnson and Adams 1993), surveys in 1992-1993 of the Pululahua Geobotanical Preserve (Napo, Ecuador, AMNH) by Gregory Kareofelas and Carol W. Witham, and collecting by Alan Cassidy in the Manchu Piccu region of Peru (BMNH).

Similar-looking Species. There is some variation in the degree of ventral "marbling" (versus discrete spots and/or congealed ventral bands) in *L. andicola*. If these are the only differences in local samples, workers will probably need to take some care so as not to think that individually oddly marked specimens might represent an unknown taxon. More drastic differences (dorsal color, addition or deletion of ventral pattern) should be investigated by dissection (contrast Figures herein of *L. callanga*, *L. bathyllos* and *L. krug* against *L. andicola*). The problem is brought home by the recent documentation of *L. krug* (Photoplate II) a species added to this paper at proof. The population which is now *L. krug* was, in fact, known as an oddity to Colombian lepidopterists. Specimens were reputed as "*callanga*"-like (*L. callanga* does not occur in Colombia) and quite rare even at their collection sites. A special expedition to Volcan Galeras to investigate its endemism (see under *L. krug*) turned up other lycaenids with similar species only southward in Peru (Salazar, Velez and Johnson, in press). Dissection of the population showed males to have the sclerotized process along the anal margin of the valvae which typify only the *callanga* lineage (see Morphological Groupings, p. 4). This species, and *L. lamasi* described subsequently, illustrate the problem with over reliance on wing characters. Yet, *L. krug* would not be readily confused with *L. andicola*; the latter was well known to Colombian lepidopterists who also knew of *L. krug*. *Leptotes krug* stands out enough to elicit further interest and investigation and it is hoped that any additional surprises in high Andean *Leptotes* will be marked enough by some "red flag" to invite morphological study. There has been little historical confusion of *L. callanga* with *L. andicola*; however, as noted subsequently under the former species, some its populations also diverge to extremes in apsects of wing pattern and dissection is required to assure the homogeneity of the structural characters.

Leptotes callanga **(Dyar 1913)**
Photoplate II; Figs. 2,3,5,16.
Lycaena callanga Dyar, Proc. U.S. Nat. Mus. 45: 638.
Leptotes callanga: Bridges 1988, I.67, II.57.

Type. Lectotype, deposited USNM, designated here by G. Lamas[1]. Male specimen with slightly broken left FW and right HW, otherwise in excellent condition, labelled as "Lectotype, male, Lycaena callanga, Dyar, 1913, by G. Lamas '90" [red-bordered, red printed "Lectotype" and "by", remaining texts written with black ink]; "published 1995, in Bálint and Johnson 1995, UWSP Reports No. 44"; *and*, "San Miguel 6000 ft., 24. July, 1911, Yale Peruv Exp" [printed, date filled in with black ink]; "100" [written with black ink]; *and*, "Cyclirius, callanga, Stgr, possibly a ms [?] name" [written with black ink].

Type Locality. PERU, San Miguel (by lectotype designation, see above); also syntypically recorded as Urubamba (Bridges 1988, I.67).

DIAGNOSIS. *Wings*. FW apex conspicuously convex, apex sharply pointed. **Male.** DW gleaming aster blue (Pl 44F7), margin with very narrow black border, DHW with suffused antemarginal spots and eugenie (Pl 44E5) postmedian band showing through from VW, dirty brown on FW, white on HW. VW pattern elaborately marbled as described below— VFW ground reddish titian brown (Pl 13J12), basal part with greyish shade, markings complex bordered by very thin whitish color: subbasal bar and discoidal pattern commonplace, postmedian row of spots very close to marginal area; marginal area with white submarginal zigzagged line, antemarginal region with spots creating an other greyish brown colored zigzagged pattern and with wide greyish brown border, outer margin with brownish line; VHW ground ash brown with brown subbasal, discoidal and postmedian spots, submargin with a conspicuous white band, marginal area with very suffused almost inconspicuous spots, few gleaming scales present in cells Cu1A+2A and CuA2, outer margin with brownish line. FW length: 13.5-14.5 mm. **Female.** FW with more rounded apex. DW ground brown with blue basal suffusion extending into postmedian area, VW markings strongly showing through. VW similar to male. FW length: 11.5-13.5 mm. **Male Genital Morphology.** Figs. 2,5. Valval shape oblong with a narrow neck in the posterior one-third, anal part concave with a large sclerotized process, costal part relatively straight in posterior two-thirds, apex slightly dentated, tornal tooth only very slightly larger. *Female Genital Morphology*. Figs. 3,16. Fibula extremely elongate (length three times maximal breadth) with apex pointed, anterior heavily sclerotized; tergite with anterio-ventral apophysis pointed and of moderate length.

DISTRIBUTION. *Spatial*: S. Ecuador (perhaps questionable, see Remarks), Peru, NW Bolivia. *Temporal*: data suggest multibrooded occurrence from October to April.

REMARKS. This lycaenid is one of the most beautiful high Andean polyommatines, although currently represented by rather haphazard samples. A relatively long series from one locality at the BMNH suggests the species can show a high density in its biotope. Current samples probably reflect considerable sampling error. Some specimens at the BMNH labelled only "S. Ecuador" might be viewed with some caution until additional such samples can be authenticated. The species has not appeared in recent Ecuadorian samples we have been able to study.

Leptotes krug **Bálint, Johnson, Salazar and Velez**[2]
NEW SPECIES
Photoplate II, Fig. 22.

DIAGNOSIS. *Wings*. DW iridescent violet blue with hue obviously brighter than the "deep violet blue" of *L. andicola*, making antemarginal spots not well visible; not brilliant gleaming blue as in *L. callanga*; however, compared to *L. andicola*, DHW betraying a rather full band of white showing through from the VW. VW with both HW and FW postmedial areas showing widened elements of a white band— on HW all postmedial cells broadly white (*L. andicola* with chevrons), on FW cells from CuA2 to M1 and M2 broadly white (*L. andicola* with white outlines of greyish brown chevron-shaped patches or orbs).

Morphology. Male genital valvae with distinctive dentate process along inner anal margin in the terminal one-third (as seen in *L. callanga* and *L. bathyllos* but not *L. andicola*) (see Remarks).

DESCRIPTION. *Wings*. **Male.** DW ground lustrous violet blue, VW markings showing through, particularly white band of VHW; margin with very narrow black border, wing fringes short and white. VW ground gray brown with pattern as follows— FW with orb-like chevron-edged white markings encircling brown ground across submargin; postmedial area from inner margin to cell M1 with coalesced white markings forming a bandlike habitus, basad of which are four wide ellipses of white surrounding brown ground

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[1] As noted on the title page, the lectotype designated here is contributed by an additional collaborator, Dr. Gerardo Lamas, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru.

[2] Since this species has been described with two additional collaborators, we depart from normal format in this volume and add the names of authors directly. These include here Julián Salazar E. and Jesus Velez, Museo de Historia Natural, Universidad de Caldas, Manizales, Colombia.

across the postdiscal area, two elongate ellipses of white surrounding brown ground across the medial area and a large ellipse of white surrounding brown ground across the postbasal area; HW with postmedial area dominated by a white band formed of arrow-head shaped white patches, distally with submarginal arc of black spots surrounded by narrow white margins, basally with complex marbling of white edging surrounding orbs and ellipses of brown ground from the medial area to the wing base. FW length: 12.0 mm. (holotype). ***Female***. Unknown. ***Male Genital Morphology***. Fig. 22. Valval shape more typical of that seen in *L. callanga* and *L. bathyllos* than *L. andicola* (see Remarks), showing a distinctive dentate process along the inner anal margin in the terminal one-third located anterior of a deep concavity just below the dentate apex; the latter is tapered to a prominent, inwardly directed, tornal tooth.

TYPES. Holotype male, labelled "Colombia, Nariño, Volcan Galeras, 3500 m., 7 August 1994, leg. J. Salazar. ***Paratypes***. Three males, same data. All deposited Museo de Historia Natural, Universidad del Caldas, Manizales, Colombia. It is anticipated that additional specimens will be secured on future expeditions and voucher material distributed to the AMNH, BMNH and HNHM (see Remarks).

DISTRIBUTION. ***Spatial:*** currently known only from the remote type locality (see below). ***Temporal***: known here from the 7 August type series; however, other lepidopterists have collected this species and additional data may be forthcoming.

REMARKS. The population named above as *L. krug* was known among Colombian lepidopterists as divergent from *L. andicola*, more similar in some ways to *L. callanga*, and of uncertain status. To evaluate this entity the third and fourth authors of the description, Julian Salazar E. and Jesus Velez (Museo de Historia Natural, Universidad del Caldas, Manizales, Colombia) travelled to the remote area of Volcan Galeras. Collection and subsequent dissection of individuals from that expedition showed males to possess the sclerotized process along the anal margin which typifies only the *callanga* lineage (see Morphological Groupings, p. 4). Thus, *L. krug* (along with *L. bathyllos* and *L. lamasi* treated subsequently) illustrate the complexity of the *callanga* lineage and the probability that other species level taxa from this lineage occur in isolates yet uncollected by Andean workers.

This species was added to this paper at proof and, since the South American authors did not have access to the color codes used by the primary authors, the former's English text was adapted without use of this reference.

ETYMOLOGY. Proposed for this species by Dieter E. Zimmer, who summarizes it as a patronym for the "unfortunate professor" Krug in Vladimir Nabokov's novel **Bend Sinister**. The "i", often typifying a patronym, is omitted to reflect the fact that "*krug*" also means "circle" in Russian. Nabokov was fond of circular structures and, in **Bend Sinister**, probably intended a double meaning (German, "jug"/Russian, "circle") since the novel concerned a German/Soviet style dictatorship. The name is extremely apt for a species of *Leptotes* because, as noted in the Diagnosis and Description, ventral maculation in this genus includes circles or ellipses of white which enclose patches of brown ground color.

Leptotes bathyllos Tessman 1928

Leptotes bathyllos Tessman 1928: 126; Bridges 1988: I. 49. Photoplate II, Fig. 23.

Type. [Following here the format used above (*L. callanga*) when a lectotype is designated by an additional collaborator]. **Lectotype**, deposited Zoologishes Museum de Humboldt Universität zu Berlin (ZMHU), designated here by G. Lamas, labelled "Leptotes bathyllos Tessm." (red bordered, written with pencil), "1921" (written with pencil); "Type" (red, printed); "syn-, type" (rounded with blue border, printed); "O. Peru, Rio Pachitea, G. Tessman S." (green, printed).

Type Locality. PERU, Dept. Loreto, Río Pachitea.

DIAGNOSIS. ***Wings***. Sexes similar. FW with very wide and rounded outer margin, VW markings shining through. DW anal area white; costa, median and submedian area aster blue (Pl44F7) with wide black marginal border (brown in old specimens); HW ground white with large black marginal spots in each cell. DW ground white with *cassius*-like pattern but VW submedian and marginal markings more developed. FW length: 10.0 - 13.0 mm. *Male Genital Morphology*. Fig. 23, left. Valval shape resembling *L. lamasi* but narrower, oblong, and terminating in a spatulate lobe; costal margin with serrations of more or less equal size. Inner margin slightly concave with a second, inwardly-directed, spike occurring in the terminal one-fifth along the anal margin. *Female Genital Morphology*. Fig. 23, center and right. Resembling other members of *L. callanga* lineage, shape of fibula also extended but longer (length three and a half times maximal breadth) with apex pointed, anterior heavily sclerotized; tergite with anterio-ventral apophysis short and with its apex rounded.

DISTRIBUTION. ***Spatial***: known only from the eastern Peruvian Departments of Loreto and Pasco in lowland tropical forests between the elevations of 130 - 300 m. ***Temporal***: Museo de Historia Natural, Universidad Nacional Mayor de San Marcos (Lima, Peru) (MUSM) specimens are dated March, June, August and September.

REMARKS. This species most likely also occurs in Amazonian Colombia and Ecuador but, aside from the type, is currently (among museums visited by us) represented only in the MUSM collection. The genital morphology suggests that the Andean representatives of the genus (*L. callanga*, *L. krug*, *L. lamasi*) may have arisen from the lowland *cassius* lineage. Of the above taxa, *L. bathyllos* appears as the most obvious evidence of such a divergence of the group from lowland ancestry.

Wing Character Versus Morphological Placement. As with *L. krug*, this species has been added to the present paper at proof. To conserve regarding necessary expenses for these lengthy additions, we have chosen to insert these two species in sequence, although we have noted in our list of **Species Groups** (page 5) that, based on the wing pattern, *L. bathyllos* (like *L. lamasi*, already known to us at the time of our original manuscript) would reside in the *cassius*[like]-Group. Hereafter, we return to the original sequence of the paper, which includes the placement of *L. lamasi* (discussed in numerous Remarks above) in this latter Species Group.

marina Species Group

Male DW ground dark violet blue; female brown. VW ground with grey to more blackish marbled elements far more lineal and "zebroid" than in the other Groups. Male and female genitalia typical of genus "Characterization" above, varying with the species but lacking any particular coherence as a Group.

Leptotes trigemmatus (Butler 1881)

Photoplate II; Figs. 1,10,21.

Lampides trigemmatus Butler 1881, Trans. Ent. Soc. Lond. 29: 468.

Leptotes trigemmatus: Bridges 1988, I.353,II.57.

Leptotes trigemmatus borealis Ureta 1949 (see Remarks).

Lectotype Designation. – Lectotype male, Paralectotype, female, designated here, both labelled data: "Copiapo, Chili, 82-17" and respectively "Lectotypus Lampides trigemmatus, des by Zs. Bálint and K. Johnson" and "Paralectotypus...", both deposited BMNH

Type Locality. CHILE, Copiapó.

DIAGNOSIS. ***Wings.*** FW apex slightly convex. Male. DW gleaming hyacinth blue (Pl 44F12), margin with very narrow black border, DHW with suffused antemarginal spots, pattern slightly showing through from VW both on FW and HW; VW ground warm brownish grey, markings greatly marbled white over grayish and bordered by pronounced whitish color as described below— FW with basal triangle, subbasal bar and discoidal pattern commonplace wide and somewhat darker, submarginal area commonplace polyommatine; HW with basal, subbasal discoidal, postmedian row of spots, submarginal area commonplace polyommatine with conspicuous row of white arrow-head markings, marginal area with three gleaming spots in orange and black ground in cells Cu1A+2-A and CuA1, some gleaming scales also in cell M3, outer margin with brownish line both on FW and HW. FW length: 10.0-13.0 mm. **Female.** DW ground brown with very few blue basal scales, VW markings strongly showing through. VW similar to male. FW length: 10.0-14.0 mm. ***Male Genital Morphology.*** Figs. 1,10. Valval shape oblong, anal and costal edges convex, apex with three or four very large teeth. ***Female Genital Morphology.*** Fig. 21. Shape of fibula oviform (length two-times maximal breadth) with a greatly produced and bluntly terminated apex with anterior moderately sclerotized; tergite with anterio-ventral apophysis blunt and long.

DISTRIBUTION. ***Spatial:*** Southern Peru, Chile. ***Temporal:*** AMNH/FMNH specimens are dated June, August (Peru), December, January (Chile).

REMARKS. ***Subspecies.*** *Leptotes trigemmatus borealis* Ureta (1949) was described from Arica, Chile and has been considered a valid subspecies (Bridges 1988: I.56). According to the samplings of the AMNH Expedition of 1992 the species is the most widely distributed and frequent lycaenid butterfly in central Chile. It is also recorded from southern Peru (Klein and Campos 1978: 91). Most probably it is migratory or highly vagrant (as the temporal *Leptotes* species in the Old World, *e.g. L. pirithous* Linnaeus 1767). ***Similar Species.*** A superficially somewhat similar North and Central American species, *L. marina*, might be confused with *L. trigemmatus* and, given the note immediately below, some warning should be given regarding such possible misidentifications. If there is any question concerning possible South America identifications of "*marina*" the latter can be distinguished by the male genital valve which is very delicately dentate at its apex with an extended shape and sclerotized anal process. Accordingly, *L. marina* can be considered a member of the *callanga* lineage which, as noted in entries concerning the Species Group just above, has very distinctive male genitalia.

Larsen (1991: 230) mentioned *L. trigemmatus* from the Galapagos Islands. We have not found any specimens marked as the Galapagos Islands and suspect Larsen's note concerned the sister taxon *L. parrhasioides* (Wallengren) reviewed immediately below.

Leptotes parrhasioides (Wallengren 1869)

Photoplate II; Figs. 9,19.

Lycaena parrhasioides Wallengren 1869, Wien. Ent. Monats. 4: 37.

Leptotes parrhasioides: Bridges 1988, I.268, II.57.

Types. As summarized below in our Remarks,

MORPHOLOGY OF *LEPTOTES*

(facing and following pages, Figures 1-21)

Figures 1-3 (high contrast photographs)—

Fig. 1. Male genital structure with aedeagus removed, *L. trigemmatus*, Chile, Huasco (HNHM, gen. prep. no. 340).

Fig. 2. Male genital structure with aedeagus removed, *L. callanga*, Peru, Huancoya (MHNP, gen. prep. no. 337).

Fig. 3. Female genital structure of *L. callanga*, Peru, Huancoya (MHNP, gen. prep. No. 337).

Figures 4-14 (line drawings of male valve showing ventrolateral shapes with characteristic terminal and apical dentations)—

Fig. 4a. *L. lamasi*, Peru, Junín, Huancabamba (holotype).
Fig. 4b. *L. lamasi*, Peru, Junín, Huancabamba.
Fig. 5. *L. callanga*, Peru, Carabaya.
Fig. 6. *L. webbianus*, Canary Islands.
Fig. 7. *L. andicola*, Ecuador, Cayambé.
Fig. 8. *L. delalande*, Ecuador, Chimbo (holotype).
Fig. 9. *L. parrhasioides*, Galapagos, Charles Island.
Fig. 10. *L. trigemmatus*, Chile, Huasco.
Fig. 11. *L. cassius*, Argentina, Salta.
Fig. 12. *L. cassius*, Colombia, Sierra Nevada de Santa Marta.
Fig. 13. *L. cassius*, Florida.
Fig. 14. *L. cassius*, Florida.

Figures 15-21 (stippled renderings of tergal and genital features of females; fibula in dorsal view placed at left, terminal tergite and apodemes in lateral view placed at right)—

Fig. 15. *L. lamasi*, Peru, Huanuco, Cushi (allotype).
Fig. 16. *L. callanga*, Peru Carabaya.
Fig. 17. *L. andicola*, Ecuador, Cayambé.
Fig. 18. *L. delalande*, Ecuador, Huigra (allotype).
Fig. 19. *L. parrhasioides*, Galapagos.
Fig. 20. *L. cassius*, Argentina, Salta.
Fig. 21. *L. trigemmatus*, Chile, Huasco.


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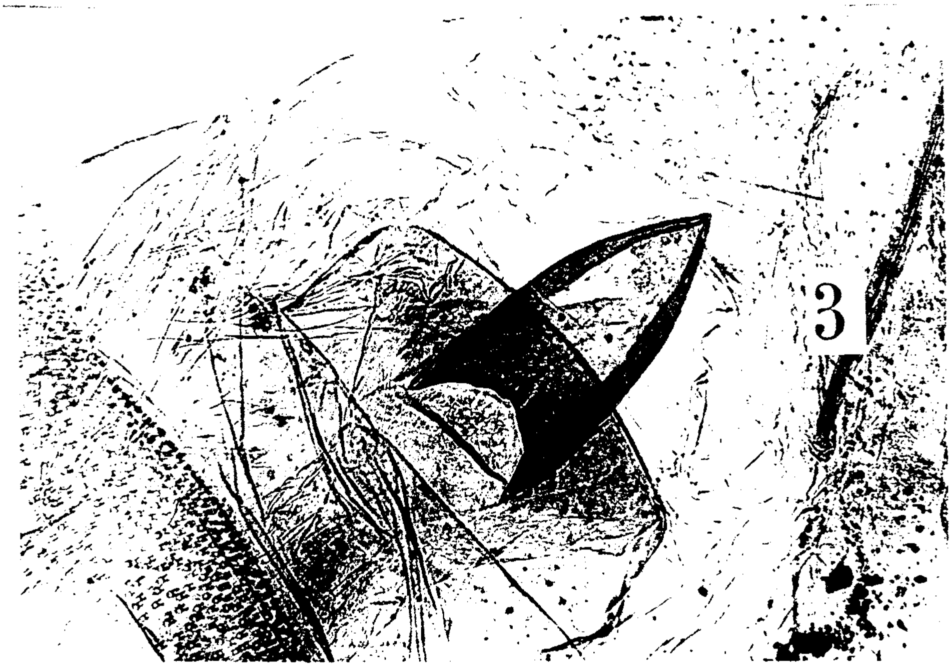
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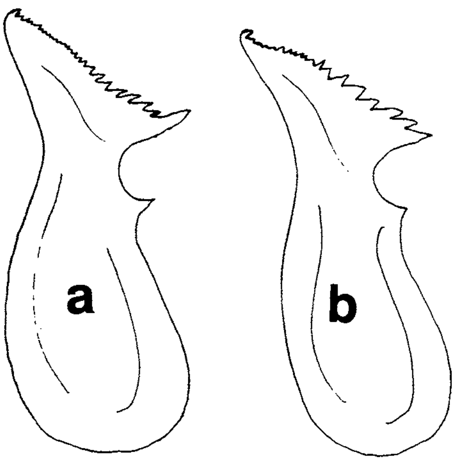

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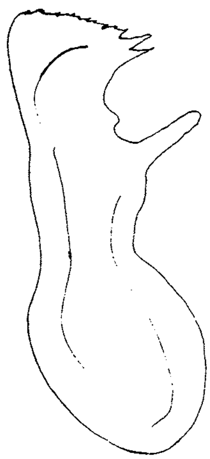

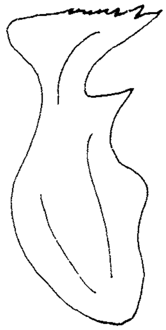
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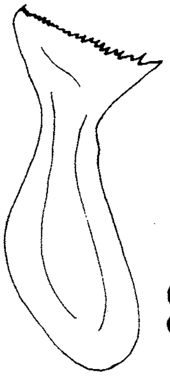

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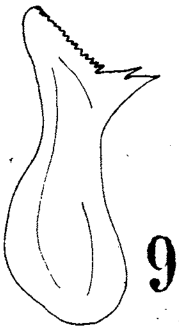

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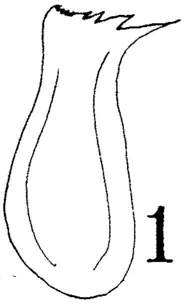

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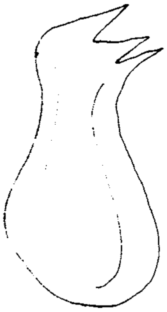

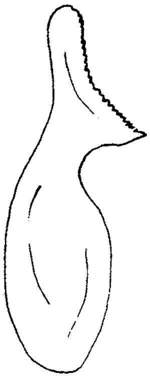
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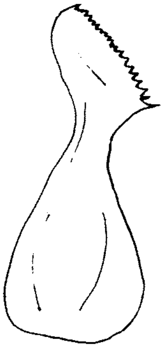
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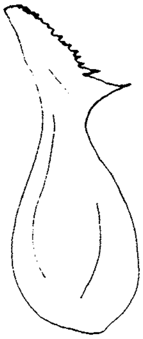
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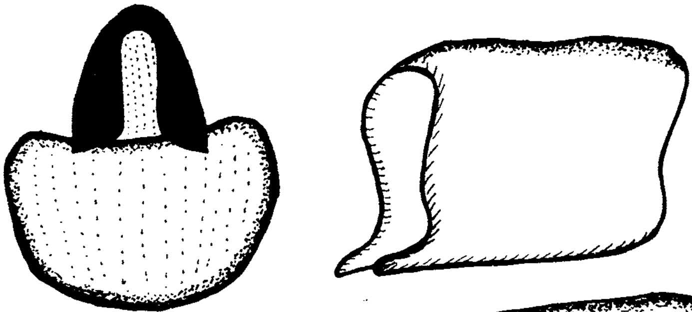

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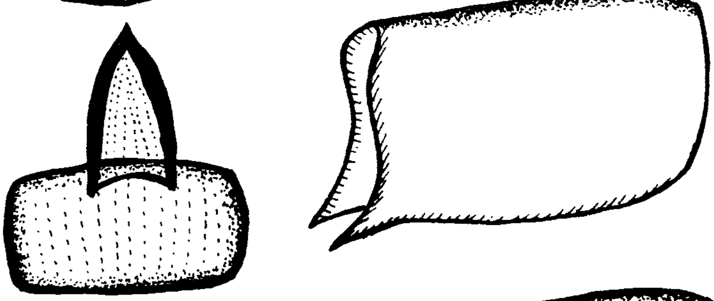

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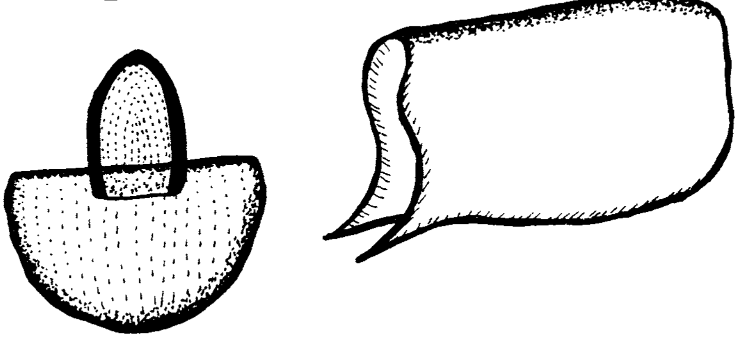

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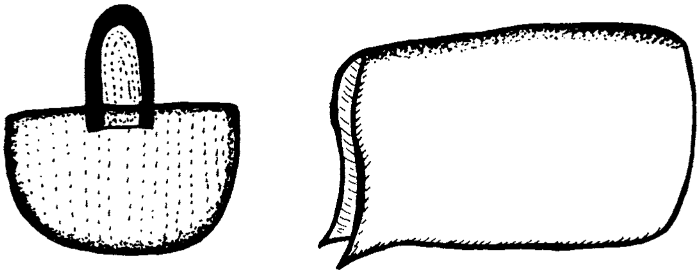

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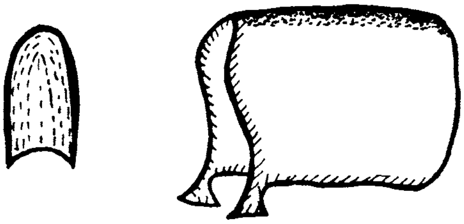

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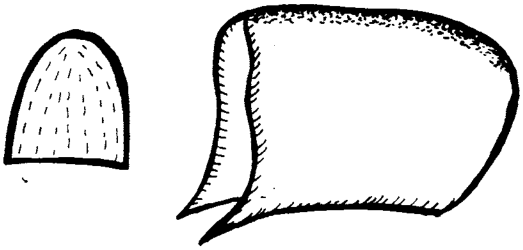

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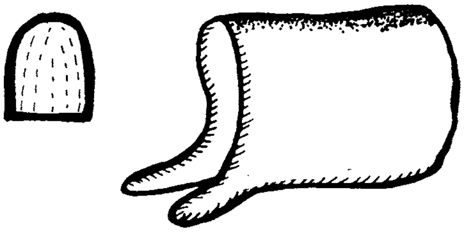

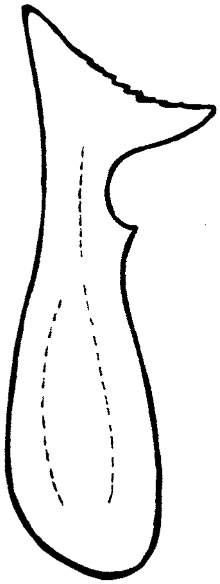

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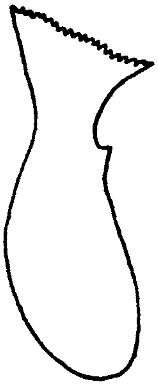

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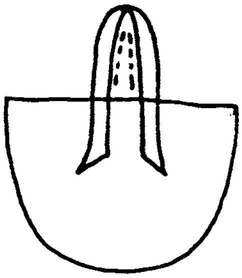

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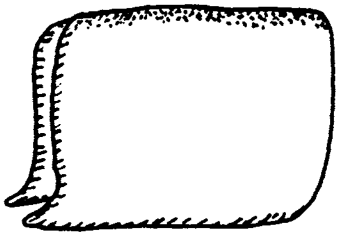

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Morphological Captions, continued...

Facing page: Figs. **19-21** from caption page 10 plus Figs. **22** and **23** added at proof.

Fig. 22. *L. krug*. Male genital valva of holotype figured in the format of Figs. **4-14**, with scale somewhat larger.

Fig. 23. *L. bathyllos*. Left, male genital valva, gen. prep. No. 565 Bálint, Peru, Río Tigre (MUSM), figured in form and scale of Figs. **4-14**. Middle, terminal tergite and apodemes in lateral view as in Figs. **15-21**. Right, fibula and anterior plate in form and scale of Figs. **15-21**.

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specimens constituting syntypes of this species were most probably extant in the Naturhistoriska Riksmuseet, Stockholm, Sweden (NRS) (G. Lamas in litt. to Bálint). However, we have come to doubt the applicability of specimens from the NRS examined by us and therefore do not designate a lectotype (see Remarks).

Type Locality. [ECUADOR], Galapagos Islands.

DIAGNOSIS. ***Wings***. FW apex slightly convex. **Male.** DW darker gleaming hyacinth blue (Pl 44E11), otherwise much like *L. trigemmatus* but with large marginal spots in cells Cu1A+2A to cell M2. FW length: 8.0 - 10.0 mm. **Female.** DW ground brown or blue, VW markings strongly showing through. VW similar to male. FW length: 8.0 - 10.0 mm. ***Male Genital Morphology***. Fig. 9. Valval shape oblong with a rounded and strong costal apex, anal edge concave, costal edge convex, upper part of apex slightly dentate, lower part with two large teeth. ***Female Genital Morphology***. Fig. 19. Shape of fibula oviform but elongate (length three times maximal breadth) with apex rounded, anterior weakly sclerotized; tergite with anterio-ventral apophysis robust and terminally hooked.

DISTRIBUTION. ***Spatial***: restricted to the Galapagos Islands. ***Temporal***: material examined indicates January-May occurrence.

REMARKS. ***Taxonomic Position***. This species is the sister of *L. marina*/ *L. trigemmatus*. The biogeographic origin of this Galapagos Islands disjunct is unclear but appears more likely to have arisen from a founder event than tectonic history. Given the phylogenetic position of *L. parrhasioides* this event must have taken place quite early. We are perhaps fortunate that the Galapagos has elicited so much attention from biologists. Without the long history of specimen acquisition from these islands, it is possible that *L. parrhasioides* might be unknown.

Status of Type Specimens. The taxon was originally described in 1860 from at least one male and one female syntype from the Galapagos Islands, collected in May. Later, however, Wallengren (1861) redescribed it with additional specimens which he stated were from "Puna" (in March) and "San Jose Island" [Panama] (in April). Dr. G. Lamas was kind enough to inform us that this material was most likely in the Naturhistoriska Riksmuseet in Stockholm, Sweden. We were able locate, however, only one male specimen (which *is*, in fact, labelled as a type in the NRS [Photoplate II, last three entries]). It is from the "Puna" locality. We dissected this specimen because of its apparent differences from other specimens of *L. parrhasioides* and, as we suspected, it proved to be an *L. trigemmatus* individual (gen. prep. No. 540, det. Zs. Bálint). Thus, we consider this specimen inappropriate as a lectotype because it is possible that either (a) it represents a specimen of *L. trigemmatus* mislabelled as one of Wallengren's original series or (b) that perhaps Wallengren's 1861 specimens did not represent the same species as that described by him in 1860. In the first description, Wallengren (1860) clearly states the specimens were collected in the Galapagos Islands. The localities he cited for specimens in his 1861 description appear odd in this context and the entire matter requires more thorough review, particularly if furtner search of the NRS collection locates the original specimens from 1860. In the meantime, in light of documented Galapagos specimens, we consider the original description of *L. parrhasioides* unambiguous. Designation of a lectotype from the single "type" specimen at the NRS (which is of doubtful authenticity) would, at present, only serve to unduly complicate the identity of this species.

cassius Species Group

Male DW ground light violet blue with HW suffusion of white scales; female with strong white basal overcast on both wings. VW ground best noted as "white" in the well known titular species (due to profuse white marbling across entire wing surface, broken only by various darker discrete spots, slashes or lines indicative of more typical polyommatine pattern). In new species of the Group described below the black/brown elements overlaying the white ground are far more outstanding and succinct, themselves becoming the prominent "marble" pattern over much more limited white ground. In Cuban *L. hedgesi*, more prominent black occurs across the postdiscal HW areas, in prominent elements of the medial and limbal patterns.

Male and female genitalia typical of *Leptotes* "Characterization" cited heretofore. Two new species of the Group described herein differ markedly from *L. cassius* in male and female structural characters. Diagnoses below are thus amended to include an initial statement summarizing the most obvious wing and genitalic differences among these three taxa.

Leptotes cassius (Cramer [1775])

Photoplates I,II; Figs. 11-14,20.

Papilio cassius Cramer 1775, Uitl. Kapellen 1: 36.

Leptotes cassius: Bridges 1988, I.72, II.57.

Type Material. Not found.

Type Locality. "Surinam".

DIAGNOSIS. ***Wings.*** Compared to other recently described species of the Group the VW pattern of *L. cassius* is more dominated by white, with various occurrence of the beige to blackish markings indicative of more typical polyommatine pattern. In *L. lamasi* and *L. delalande* described below, these latter dark pattern elements become dominant, succinctly marbling the more insignificant white background. The same is true in *L. hedgesi* of Cuba, although in the latter species dominance of the dark markings is more limited to postdiscal areas of the VHW.

Morphology. The terminus of the male valvae in *L. cassius* shows a spatulate terminus with rather evenly graded serrations angled from outer to inner terminal margins; on *L. lamasi* there is a second, greatly concave incision, below the spatulate terminus which forms another inwardly-directed prong in the terminal one-fourth of the valvae; *L. delalande* lacks the second concave incision but shows, at the inner angle of the spatulate terminus, greatly elongate inwardly directly prongs. Males of *L. hedgesi* have not been described. The female of *L. cassius* shows a relatively diminutive fibula compared to its three sisters. The fibula in *L. lamasi* and *L. hedgesi* is extremely robust (but in the latter species far more pointed); in *L. delalande* the fibula and henia are of comparatively equal size. The anterio-ventral apophyses of the terminal tergite are short in *L. cassius*, *L. lamasi* and *L. delalande*, greatly elongate in *L. hedgesi*.

Wings. White ground beneath is profuse, causing the entire ground to appear mostly white (except for variously occurring spots or slashes [beige to blackish] indicative of more typical polyommatine pattern). ***Male Genital Morphology.*** Figs. 11-14. Valval shape oblong with a narrow neck in the terminal one-fourth and an extremely long valval costa; valval costal edge concave, apical part rounded, apex strongly dentate with tornal teeth somewhat variable in size and length but far more uniform than in any sister species of the Group; anal edge of valve convex. ***Female Genital Morphology.*** Fig. 20. Shape of fibula triangulate and stout (length about same as maximal breadth) with apex slightly pointed, anterior very veakly sclerotized; tergite with anterio-ventral apophysis narrow, pointed and of moderate length.

DISTRIBUTION. ***Spatial:*** pan-Neotropical, specimens known from Colombia, Ecuador, Peru, Bolivia, Chile, Brazil, Paraguay, Argentina and the Caribbean region. ***Temporal:*** given widespread distribution, known from every month in the year.

REMARKS. Wing morphology and pattern of this widespread taxon are well-diagnosed in the historical literature; we cite here three readily available sources: Howe 1975: 319 (pl. 57, figs 21-22; pl. 97, figs 7-8); Riley 1975: 108 (pl. 12, figs. 10a,10b); Scott 1986: 394 (pl. 35, figs 387a-c). Schwartz and Johnson (1992) figured the female genitalia for comparison to *L. hedgesi* of Cuba. *Leptotes cassius* is the most well known *Leptotes* species in the Neotropical region. Riley (1975: 108) listed three subspecies from the West Indies. We could not distinguish any morphologically isolated colonies in material examined from continental South America. The latter included the material examined at the BMNH, recently prepared additional AMNH Hoffman material from Mexico and recently collected samples sent to the junior author high montanes areas of Colombia (J. Salazar), Ecuador (G. Karefelas) and Argentina

(R. Eisele and B. MacPherson). However, given the distinctive *L. hedgesi* of Cuba and the new species we describe below from Peru, we will continue to look closely for divergent populations in the mainland *cassius*-Group with an interest to identifying additional local endemics. In this regard, we are aware of substantial papered material that has not yet become available for study.

Leptotes lamasi **Bálint and Johnson**
NEW SPECIES
Photoplate II; Figs. 4,15.

DIAGNOSIS. *Wings*. Male. Compared to *L. cassius*, *L. lamasi* and new species *L. delalande* (entry below), showing VW beige to blackish elements broadly and succinctly marbled over a diminished white ground. Compared to *L. delalande*, *L. lamasi* showing these dominant dark elements more disjunctive and "leopard-like", *L. delalande* comparatively more "zebroid", particularly on FW.

Morphology. *L. lamasi* male valve with distinctive, greatly concave, incision anterior of spatulate terminus, forming a second inwardly directed spike in the terminal one-fourth of the valve's inner margin; female with robust terminal fibula.

DESCRIPTION. *Wings*. Male. DW ground cathedral blue (Pl 43C10), VW markings showing through, margin with black border somewhat wider on FW, fringes: type 3.Dark. VW with darkly marbled elements describable as follows— VFW with basal and subbasal bar, discoidal and postmedian bar; submarginal and marginal area with normal pattern greatly distended with white; VHW similar to VFW in ground color and pattern but with white marbling more complex— basal, subbasal and postmedian spots more or less disruptive, discoidal spots with attached anal spots coelescent; submarginal area with a full line of white arrowhead-like markings extending from costal margin to tornus; marginal area more typical polyommatine (marginal spots with caps); cells Cu1A+2A-CuA1 with pronounced orange marginal spot centered with black and metallic scales. FW length: 13.5-15.0 mm. **Female.** FW apex more pointed. DFW ground white with blue basal suffusion, a wide outer marginal brown area extending along costa; DHW ground white with bluish base, markings strongly shining through, submarginal and marginal areas with pronounced pattern; VW as in male. FW length: 14.5 mm. ***Male Genital Morphology***. Fig. 4. Valval shape oblong terminating in spatulate lobe, inwardly angled margin of which is covered with serrations of quite equal size; anterior of lobe, inner margin of valvae greatly concave, producing a second inwardly-directed spike in the terminal one-fourth of the valve's inner margin. ***Female Genital Morphology***. Fig. 15. Fibula wide and robust (length about equal to width) with apex flat, anterior and apex heavily sclerotized; tergite with anterio-ventral apophysis robust.

TYPES. Holotype male labelled "Peru, AM, 11 km E Chachapoyas, 1850 m, 23.II.'78, G. Lamas"; allotype female labelled "Peru, HU, 6 km S Huáncayo, 1900 m, 4. VI.'78, G. Lamas", both deposited MUSM. ***Paratypes***. MUSM [not dissected; listed in *Reports* format: 2 males, JU, Pente Yanángo, 2000 m., 27.X.1965, P. Hocking; 1 male, JU, Puente Yanángo, 2000 m., 28.X.1965, P. Hocking; 1 male, Chinchao, 1700 m., 19.VIII.1967, G. Lamas; 1 male, JU, Puente Yanángo, 2000 m., 26.X.1965, P. Hocking; 1 male, JU, 0-1 km E. Mina Pichita, Hda. Naranjal, 2000 m., 18.XI.1984, G. Lamas & J.E. Pérez; 1 male, AM, 13 km. E Chachapoyas, 1900 m., 10.III.1985, G. Lamas; 1 male, LL, Pataz, Quebrada Frances, 1800 m., 3.XI.1988, R. Tejada; 1 female, HU, 6 km. S Húanuco, 1900 m., 4.VI.1978, G. Lamas. BMNH [dissected, listed by label data]. 1 male labelled "Huancabamba, Junin, 5000 ft., Aug. 1905 (Boettger); Rothschild Bequest, B.M.1939-I.; gen. prep. No. 408, det. Zs. Bálint", 1 female labelled "Cushi, Huanuco, 1820 m., 1904., (W. Hoffmans); Rothschild Bequest, B.M.1939-I.; gen. prep. No. 409, det. Zs. Bálint; BMNH [not dissected except as noted at end of entry, itemized in *Reports* format as follows]: ECUADOR. 1 male, Paramba, 3500'. iv.97. dry season. (Rosenberg), Rothschild Bequest. B.M. 1939-1. PERU. 16 males, 5 females, Prov. Huanuco (W. Hoffmanns), Rothschild Bequest. B.M. 1939-1; 1 male, Carabaya Peru 3100ft. vi.'04. G.Ockenden, ex Coll. Hamilton Druce 1919, Joicey Bequest, Brit.Mus. 1934-120; 1 male, Peru, H.Fruhstorfer, Fruhstorfer Coll. B.M. 1933-131; 1 male, Pozuzo, Peru, 5000 to 6000 ft., Native Collector, ex Coll Hamilton Druce 1919, Joicey Bequest. Brit.Mus. 1934-120; 1 male, Palea 3000 m. to Huancapiotana 2000 m. 3.00. Wet S[eason], (Simons), Rothschild Bequest. B. M. 1939-1; 1 male, Huancabamba, Junin, 5000ft., Aug.1905. (Boettger), Rothschild Bequest, B.M. 1939-1; 6 males, Huancabamba, Cerro de Pasco (E. Boettger), Rothschild Bequest. B.M. 1939-1; 1 male, Chanchamayo, S.E.Peru, Joicey Bequest. Brit.Mus. 1934-120; 1 male, Huancabamba, E.Peru, 6000-10000ft. Boettger, ex Coll. Hamilton Druce 1919, Joicey Bequest. Brit. Mus. 1934-120; 1 male, San Ramon Cent. Peru 6000- 8000ft. Aug-Oct.1921, Joicey Bequest. Brit.Mus. 1934-120; 1 male, Pozuzo, Huanuco, 800-1000 m. (W. Hoffmanns), Rothschild Bequest. B.M. 1939-1; 1 male, River Tabaconas, N. Peru, 6,000ft. A.E. & F. Pratt. 1912, Joicey Bequest. Brit.Mus. 1934- 120; 1 male, Cushi, Huanuco, 1820m. 1904. (W. Hoffmanns), Rothschild Bequest. B.M. 1939-1; 1 male, La Merced, Peru. 2500 ft,. Joicey Bequest. Brit.Mus. 1934-120; 3 males, Pozzuzo; Godman-Salvin Coll. 1909-28; 1 male, Perou, Dept. Amazonas (Chanchapoyas), M. de Mathan, 1889, Ex Oberthur Coll. Brit.Mus. 1927-3; 1 male, [Unintelligible.]; Joicey Bequest. Brit.Mus. 1934-120.

Dissections: 418, 419 (Huancabamba males). Based on ongoing activity preparing samples of this species, effort will be made to place additional voucher material at the HNHM and AMNH.

DISTRIBUTION. ***Spatial***: known from the Andean region of Peru, at altitudes between 800-3000 m. ***Temporal***: dates on types indicate April-May and October-November flight periods.

REMARKS. The discovery of this species came as a surprise because although it is readily distinguished superficially from *L. cassius*, it was mixed haphazardly with this species and one other undescribed entity (see *L. delalande* below) at the BMNH. Once the entities were noticed, we found it possible to separate them readily in other collections of polyommatines at various museums (Bálint, in preparation). We thus suspect that most collections with series identified as "*L. cassius*" may most likely have two or all three of these species. Occurrence of these two additional entities in the *cassius*-Group also points up the significance of *L. hedgesi*, a *cassius* sister recently described from Cuba. It is possible that other local endemics occur in the *cassius* Group and workers should be on the lookout for these.

Leptotes delalande Bálint and Johnson

NEW SPECIES

Photoplate III; Figs. 8,18.

DIAGNOSIS. ***Wings***. **Male.** Compared to *L. cassius*, *L. delalande* and *L. lamasi* (entry above) have the VW beige to blackish elements broadly and succinctly marbled over diminished white ground. Contrasting *L. lamasi*, *L. delalande* has the VW dark elements more continuous and "zebroid", particularly on FW) (*L. lamasi* with markings more disjunctive and "leopard-like").

Morphology. *L. delalande* male valve with terminal spatulate lobe showing greatly elongate, inwardly-directed, spines, not rather even serration like *L. cassius* or this and greatly concave anterior incision as in *L. lamasi*; female genitalia with terminal fibule and henia of about equal prominence.

DESCRIPTION. ***Wings***. Costa convex and relatively, outer magin also convex. **Male.** DW ground pale gentian blue (Pl 43D10), VW markings showing through, margin with black border, fringes type 3. VW dark marbled pattern describable as follows: VFW with basal and subbasal bar, discoidal and postmedian bar; submarginal and marginal area commonplace; VHW similar to VFW in ground colour, pattern very complex: basal, subbasal and postmedian spots more or less coelescent, dicoidal and anal spots not united; submarginal area with a full line of very wide arrow head markings extending from costal margin to tornus; marginal area with typical polyommatine markings: very large marginal spots and strong caps; cells ce 1A+2A-M3 with pronounced marginal spot in week pale orange ground having large black center bordered anteriorly with metallic sclales. FW length: 12-13.0 mm. **Female.** FW costa longer. DFW ground blue with a wide outer marginal brown area extending along costa, discoidal, anal and postmedian spots large and brown, ringed with white color; DHW ground whitish blue base, markings identical with VHW pattern; VW as in male. FW length: 13.0 mm. ***Male Genital Morphology***. Fig. 8. Valval shape oblong, terminating in a spatulate lobe the inwardly-angled margin of which shows increasingly elongate dentations, those finally at the inner angle being pronounced as extremely elongate spines. ***Female Genital Morphology***. Fig. 18. Shape of fibula relatively elongate (length 1.8 that of maximal width) with slighty rounded apex, adjacent henia with heavily sclerotized area about as pronounced as fibula; tergite with anterio-ventral apophysis short and blunt.

TYPES. Holotype male, [Ecuador], labelled "Chimbo, 1000', VIII 97., (Rosenberg); Rotschild Bequest, B.M. 1939-I.; gen. prep. No. 414, det. Zs. Bálint; Holotype, Leptotes delalande Bálint and Johnson, II. 1994, Budapest". Allotype female labelled "W. Ecuador, [?] Huigra, 24. Feb. 1913, 3000 ft, A. Hall; Ex Coll. Bethune-Baker, B.M. 1927-360, gen. prep. No. 415, det. Zs. Bálint. Allotype, Leptotes delalande Bálint and Johnson, II. 1994, Budapest". Both deposited BMNH.

DISTRIBUTION. ***Spatial***: known only from the Ecuadorian type data (see Remarks). ***Temporal***: known only from the August and February type data.

REMARKS. This species points out the interesting incongruence between external and internal characters in the Neotropical *Leptotes*. *L. delalande* suggests a close phylogenetical relationship to *L. andicola* with the absence of the anal apophysis of the valva and the shape of the fibula in the female genitalia. This relationship is also supported by the geographical distribution of the taxa. Considering our presentation here of a seminal taxonomy of *Leptotes*, we have included *L. delalande* with *L. cassius* and *L. lamasi* here because they have been historically confused and initially need to be separated by their superficial characters.

Clench (1963), in discussing the continental occurrence of *L. cassius*, noted the existence of an undescribed "look-alike" from the Colombian Andes. Most recent samples known to us (see Remarks under *L. cassius*) have included only *L. cassius*. However, it is possible that Clench has seen specimens referable to *L. delalande* with Colombian data and/or that this latter new speciews will eventually be located in Colombian samples.

ETYMOLOGY. Named for "Delalande", a philosopher invented by Nabokov as his alter-ego, here reflecting the sister relationship of this new species with *L. lamasi*.

Taxa of Uncertain Status

Two historical names, to our knowledge lacking type material, are perhaps associable with *Leptotes* as defined herein. We review these below in the interest of completeness but cannot render any taxonomic resolution concerning them at this time. It is possible that, in the future, studied decisions concerning neotypes for these taxa may be advisable.

Polyommatus ochsenheimeri **Godart, 1823**
Ench. Méth. IX, p. 683
Leptotes ochsenheimeri – Bridges 1988: I.254,II.57.

This taxon is attributed, by description, to the Antilles. Efforts to locate at type at the MNHN (Paris) (both the by junior and senior authors since 1991) have not been successful (last correspondence with Mrs. Ngyen Thi Hong, October 1993, with the senior author). Draudt (1921: 821) mentioned this taxon as close to *L. callanga*. Dr. Lamas (in litt. to the senior author) has tentatively considered *P. ochsenheimeri* as a synonym of *L. callanga*.

Some circumstances suggest that *P. ochsenheimeri* may actually be *L. webbianus*. A character distinguishing this taxon from *L. callanga* is checkered wing fringes, a trait included in the description of *P. ochsenheimeri*, along with the ventral wing base "reddish yellow". Nothing like either *L. callanga* or *L. webbianus* is known from the Antilles. It is most likely that Godart's material was mislabelled. Could this have resulted because *L. webbianus* was also from an island?

Papilio numerius **Stoll [1790].**
In Cramer, uitl. Kapellen Aanh: 169, pl 38, fig. 7,7g.
Leptotes numerius – Bridges 1988: I.249,II.57.

The type locality is "Surinam". As no *Leptotes* material was located from Surinam in the present study these data give no clue as to the possible taxonomic status of *P. numerius*. However, the original figures of *P. numerius* could be interpreted as synonymous with *L. marina*. If so, the latter would be a junior synonym. We take no action on this matter until this can be confirmed objectively, from Surinam material and/or designation of a neotype. Without a studied procedure resulting in the latter, it does not appear advisable to subjectively replace the well established name *marina*.

DISCUSSION

Affinities of Neotropical *Leptotes* Species Groups— Ongoing Questions Concerning Monophyly and Biogeography.

The major goal of the present work has been to bring knowledge of species diversity in the genus *Leptotes* up to date. As with all Neotropical polyommatine assemblages, previous views of taxonomic relationships and biogeography within *Leptotes* have been hampered by sampling error. The latter has resulted in erroneous views concerning the relationships of the "few" species of *Leptotes* and members of other groups of the Polyommatini. With knowledge of *Leptotes* diversity brought up "at least" to include (a) species which have remained undesribed in the old [particularly European] collections, and (b) new species apparent from recent biodiversity surveys in Latin America. We use the words "at least" because, even as we conclude the present study, we are aware of other undescribed species of *Leptotes*, the latter referred as late as mid-1995.

Historical Views. Stempffer (1967) wrote "it is interesting to note that the VW markings of *Leptotes cassius* Cramer, *L. theonus* Lucas and *L. marina* Reakirt recall species of *Syntarucus*". Clench (1963) also noted this apparent "Neotropical/ African" affinity represented in some *Leptotes* species (particularly member of the Caribbean fauna). Reflecting the dispersalist views of his era, Clench proposed over water dispersal as the origin for New World *Leptotes* species— from the area of greatest species diversity (Africa) to the Caribbean (Clench 1963: 266-267). This view is appears quite questionable in light of today's knowledge of plate tectonics (Shields and Dvorak 1979, Miller and Miller 1989, Johnson 1991). Shields and Dvorak (1979) cited certain Caribbean Polyommatinae as evidence of an early African/ South American "Gondwanian connection". However, their study actually preceded modern vicariance biogeography and relied strictly on coincident distributions; their taxonomies did not identify monophyletic groups and they did not recognize the need for comparing area statements involving at least three monophyletic taxa. Weaknesses in Shields and Dvorak's methodology do not detract, however, from the importance of investigating the nature of the African/ Neotropical affinity suggested by the wing patterns within *Leptotes*. Such external evidence appears to be corroborated by, at least, the valvae of male *Leptotes*, which show two types, both occurring in South America and Africa (cf. Larsen 1991: figs. A2 and 15). However, as we have noted in our more thorough studies of the genus *Pseudolucia* (Bálint and Johnson 1993 & in press), reference solely to the male valvae can sometimes be misleading. A complete morphological study of *Leptotes*, including the entire currently known diversity and analyzed by numerical cladistic methods, should be able to resolve whether there is a primary, basal, bifurcation among monophyletic taxa comprising the genus which supports the view of an ancient Gondwanian disjunction. In the present study the task of updating knowledge of *Leptotes* diversity in the continental New World has been formidable enough, aside from the fact that the significant Caribbean fauna has only been satisfactorily reviewed in the last few years (Johnson and Matusik 1988, 1992; Miller and Miller 1989, Smith, Miller and Miller 1994).

Bases of a Modern View. The potential of interplay between vicariance and dispersal in *Leptotes* is intriguing because of the attention given previously to migratory behavior in some species of the genus (e.g. *L. marina* and *L. cassius*, Scott 1986: 393). Such data, and the evidence of dispersal reviewed just above, will assume a significant role in any future evaluations of the taxonomy and biogeography of the group. However, the overall biogeographic picture of *Leptotes* far exceeds re-evaluation of the previous speculations concerning its more illustrious and farflung taxa. The Andean diversity of *Leptotes* is far larger than previously suspected. The pan-Andean diversity of the morphologically based "*andicola*-Group" (including *L. callanga*, which in wing features resembles so many other farflung members of *Leptotes*) calls for a full re-evaulation of whether the historically touted wing resemblance affinities of *L. callanga* (to Africa and elsewhere) are not simply homoplasy. Clench (1963: 255), for instance, placed the taxa *callanga* and *webbianus* in the same species group. Stempffer (1967: 218-219) also noted that the ventral patterns of *L. callanga* recalled the Canary Islands' species "*Cyclirius webbianus*". According to this view, the "*callanga*-Group" (*sensu* Clench and Stempffer) would comprise a Holotropical entity with species having disjunct distributions of some thousands of kilometers— an Andean entity (*L. callanga*); an offshore African entity (Canary Island *L. webbianus*) and an entity from Mauritius (*L. mandersi*). If this is actually a monophyletic group it represents either (a) an ancient vicariance, (b) rather phenomenal founder dispersals, or (c) extinction-related remnants of a more widespread or more haphazard long term distribution. The male genitalia of each of these species show a similar-looking anal process on the valvae which, if homologous, might support the monophyly of this group (cf. herein figs. 4-6, 22-23 and Fernández-Rubio 1976: lamina 20, Stempffer 1967: fig 190). However, attention must be paid first to the array of new species in and "*andicola*-Group" (*L. krug*, *L. lamasi*, *L. delalande* and other recently acquired undescribed species) and the variety of their structural and wing pattern characters. For instance, *L. lamasi* shows some distinctive morphological links not to the farflung taxa previously associated with *L. callanga* but to the taxa of the *cassius*-Group. *Leptotes krug*, to an unkeen eye, might be passed over as a variant *L. andicola* but its valvae clearly shown the anal process of *L. callanga*. Indeed, *L. andicola* and *L. callanga* have not been associated before in discussions of *Leptotes* or its biogeography. The former species was, in fact, completely overlooked by Clench. Another new species described herein, *L. delalande*, shows *cassius*-like wing pattern but *trigemmatus*-like genital structures. Armed with these data one might suspect that the entire array of wing pattern similarities used hitherto to link *Leptotes* species from farflung areas of the world are simply homoplasious. It is relevant here to note surprising parallelisms among the wing patterns in some other polyommatine assemblages occurring both in the Old World and austral Neotropics: *Polyommatus ripartii*-Group/ *Pseudolucia chilensis*-Group and *Polyommatus sikkimus*-group/ *Paralycaeides vapa*-Group (latter cf. Nabokov 1945: 37). Very recently, two strikingly obvious cases of this phenomenon in the Hesperiidae were discussed by Shapiro (1993). Thus, a full numerical cladistic study of entire worldwide assemblage associated here with *Leptotes* is required. Likewise, biological studies are necessary to suggest an additional array of characters with which to test hypotheses. Suffice it to say, for now, that new data on the diversity of continental New World *Leptotes* (particularly in the Andes) suggest there may be equally plausable hypotheses concerning the origins and affinities among taxa now comprising the genus. We review some of these possibilities below.

It is possible that *Leptotes*, even as we have viewed it in the present study (combining the historically acknowledged taxa with several previously undescribed South American species), is not monophyletic. If so, complex explanations accounting for the farflung distributions of some of the taxa now included in *Leptotes* may not be necessary. If *Leptotes*, as now comprised, is monophyletic, a cladistic analysis would most likely suggest a rudimentary, ancient, vicariance embracing two (or perhaps more) Pangaean subunits followed by some haphazard dispersal (as in the case of the Galapagos). If the ancient ancestral distribution embraced a significant part of Africa/South America, disper*sion* [emphasis added here *sensu* Platnick and Nelson 1976] followed by subsequent off-shore vicariance could readily account for the Canary Islands and Maritius distributions. At least it is safe to say that, after publication of the present study, searches for answers concerning the monophyly and biogeography of *Leptotes* should at least start asking the right questions. With questions of "centers of origin/diversity" and "dispersal into a vacuum" discounted, the monophyly of the group should first be queried, followed by analysis of area relationships among sister taxa. If *Leptotes* as presently comprised proves monophyletic, the contemporaneous distributions of its taxa may actually represent remnats of an ancient vicariance. If so, it is possible these distributions may be shown to occur in a pattern coherent with one, or another, demonstrable continental (or island-building) tectonic sequence. If a coherent biogeographic pattern is not discoverable, it may be that (a) evidence of such a pattern is no longer retrievable from available data or (b) farflung dispersal has actually affected the group (the latter being untestable). The question of monophyly regarding *Leptotes* is thus crucial and one that needs to be approached with (a) a large array of data and (b) the concurrence of a number of coworkers. If *Leptotes* as presently comprised is not monophyletic, problems regarding the farflung distributions disintegrate into smaller questions. The present authors consider this latter question the starting point for the next step in studying *Leptotes*. It appears to be a "tough call" as to which way the "chips will fall".

Acknowledgements

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MATERIAL EXAMINED

Note: contrary to statements in the Materials and Methods, full BMNH data was able to be inserted at proof, following completion of the paper and a subsequent trip to London by the senior author; in is included below in full for all species except *L. cassius*. ***Format***: material is listed by (a) species, (b) institution, and (c) country; it is enumerated "as received" from collaborators, reorganized only to general format of the *Reports* and placement the country first in each entry. Some data was scanned from hard copies created by diskette conversion from Mac to DOS; there may be minor spelling errors in certain indigenous words in these texts. ***Acknowledgement***: Karl Kroenlein (Dartmouth College) aided in compiling AMNH data as part of a research semester at the AMNH, 1995.

Leptotes cassius

AMNH. ARGENTINA. 5 males, Argentina, La Rioja, leg. E.I. Huntington; 1 male, Argentina, Salta, Serrania de Las Pavas, km. 27 at Upper Confluence of Rio Arrazayal, 600 m., 31.X.72, leg. R. Eisele; 6 males, 2 females, Argentina, Salta, Saucelito, 5 km. W, 5.I.73, leg. R. Eisele; 1 male, Argentina, Salta, Serramia del Divisadera, km. 30 at Abra del Pescado, 750 m., 31.X.72, leg. R. Eisele; 1 male, Argentina, Salta, Serrania del Divisadera, km. 30 at Abra del Pescado, 750 m., 21.X.72, leg. R. Eisele; 2 males, Argentina, Jujuy, Rio Guerrero, 1600 m., 22.I.73, leg. R. Eisele; 1 male, Argentina, Jujuy, Rio Guerrero, 1600 m., 27.I.73, leg. R. Eisele; 1 male, 2 female, Argentina, Salta, Rivadavia, St. Maria, 9 km. SE on Rio Pilcamaro, 5.XI.74, leg. R. Eisele; 1 female, Argentina, Jujuy, Rio Guerrero, 1600 m., 29.I.73, leg. R. Eisele; 2 females, Argentina, Salta, Rivadavia, St. Maria, 9 km. SE on Rio Pilcamaro, 4.XI.74, leg. R. Eisele; 1 female, Argentina, Salta, 1 km E Pichanal, 28.X.76, leg. R. Eisele; 1 female, Argentina, Jujuy, Tilcara at Rio Grande, 2450 m., 26.XI.76, leg. R. Eisele; 2 males, 1 female, Argentina, Jujuy, Tilcara, 20.II.1992, leg. B. MacPherson. **BOLIVIA.** 4 males, Bolivia, Pitiguaya, Rio Unduavi, V.26.; 1 male, Bolivia, Pitiguaya, 5800', 10.V.29. **BRAZIL.** 1 male, Brazil, Santos, 1.VI.19; 1 male, 1 female, Brazil, Santos, 22.V.19; 1 male, Brazil, Castro, Parana; 2 male, Brazil, Belem., 12.I.46, leg. Klots. 1 male, Brazil, Caviuna, III.45, A. Maller coll/F. Johnson donor; 1 male, Brazil, Novo Friburgo, leg. Hy. Edwards; 1 male, Brazil, Rio de Janeiro, 12.IX.64, leg. K. Brown; 1 male, Brazil, Pelotas, 9.XI.43, leg. C. Biezanko; 1 female, Brazil, Santos, 20.V.19; 1 female, Brazil, Santos, 24.V.19; 1 female, Brazil, Rio Janiero, leg. W.P. Comstock. **COLOMBIA.** Colombia, Silvania, Cundinamarca, 10.VI.1990; 1 male, Colombia, San Antonio del Tequerdama, 500 m., Cundinamarca, 17.VI.1990; 1 male, Colombia, La Soledad-Felisa [Caldas], 850 m., leg. J. Salazar; 1 male, Colombia, Cali District, Bet. Cali and Buga, 3200-3500', 2.II.35, leg. H. F. Schwarz; 4 males, Colombia, Bogota, I.26, leg. E.I. Huntington; 5 males, Colombia, SA, leg. Felipe Ovalle; 1 male, 2 females, Colombia, Velez, Sant. d'Sur, 7.VIII.46, L. Richter coll/F. Johnson donor; 9 males, Colombia, Rio Cocoma, Antioquia, 800-1100 m., 21-28.VIII.46, L. Richter coll/F. Johnson donor; 3 males, 1 female, Colombia, Caldas, 10.V.14, leg. W.P. Comstock; 2 males, Colombia, Caldas, 14.V.14, leg. W.P. Comstock; 1 male, Colombia, Caldas, 13.V.14, leg. W.P. Comstock; 1 female, Colombia, Cali District, Cauca Valley, 3260 ft, 26.I.35, leg. E.I. Huntington; 1 female, Colombia, Pto., 28.III.33, leg. E.I. Huntington; 1 female, Colombia, Isla La Rounde, Amazonas, 24.X.46, L. Richter coll/F. Johnson donor; 1 female, Colombia, Cali District, Cauca Valley, 6.II.35, leg E.I. Huntington; 1 female, Colombia, Hacienda Garcia, Cauca Valley, 3500', 29.I.35, leg. E.I. Huntington; 1 female, Colombia, Hormiguero, Cauca Valley, 3260', 25.I.35, leg. E.I. Huntington. **COSTA RICA.** 14 males, Costa Rica, Turrialba, Ais, 620 m., 24.V.46, H.H. & F.M. Brown; 2 males, Costa Rica, Turrialba, Ais, 620 m., 25.V.46, H.H. & F.M. Brown; 2 males, Costa Rica, Turrialba, Ais, 620 m., 27.V.46, H.H. & F.M. Brown; 1 male, Costa Rica, Turrialba, Ais, 620 m., 30.V.46, H.H. & F.M. Brown; 1 male, 1 female, COE ta Rica, Cartago, 5000 ft, leg. E.I. Huntington; 1 female, Costa Rica, Turrialba, Ais, 620 m., 29.V.46, Hy.H. & F.M. Brown. 1 female, Costa Rica, Puntarenas, Monteverde, 4600 ft, 1022.II.62, leg. C W.P.almer; 1 male, Costa Rica, Hacienda Comelco, 24 km NW Canas, InterAm H'wy, Guanacaste Province, 50 m., leg. E R Heithaus. **ECUADOR.** 1 male, Ecuador, 2°-4° S 78° W, 875 m., 11.XII.34, leg. W. von Hagen; 2 males, Ecuador, Zamora, 1000 m., 20.X.41, leg. F.M. Brown; 1 male, Ecuador, Gualla Vaisa, 1000 m., 22.XII.41, leg. F.M. Brown. **GUATEMALA.** 1 male, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 13.XII.65, leg. E.C. Welling; 1 male, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 3.XII.65, leg. E.C. Welling; 1 male, Guatemala, Penajahal, Mpio San Pedro, Yepocapa Chimaltenango, above 1250 m., 2.I.66, leg. E.C. Welling; 1 male, Guatemala, Baleu, Municipio San Cristobal Verapaz, Alta Verapaz, above 1350 m., leg. E.C. Welling; 2 males, 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 17.XII.65, leg. E.C. Welling; 3 males, 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 16.XII.65, leg. E.C. Welling; 1 male, 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m, 10.XII.65, leg. E.C. Welling; 1 male, 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 11.XII.65, leg. E.C. Welling; 1 male, Guatemala, La Soledad-Mpio, Acatenango Chimaltenango, 2600 m., 15.XII.65, leg. E.C. Welling; 1 male, Guatemala, Tamahu, Alta Verapaz, 1100 m., 10.XI.63, leg. E.C. Welling; 2 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 15.XII.65, le g. E.C. Welling; 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 26.XI.66, leg. E.C. Welling; 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 25.XI.66, les . E.C. Welling; 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 14.XII.65, le g. E.C. Welling; 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 31.XII.65, leg. E.C. Welling; 1 female, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 4.XII.65, leg. E.C. Welling; 3 females, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 9.XII.65, leg. E.C. Welling; 3 females, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 6.XII.65, leg. E.C. Welling; 2 females, Guatemala, Mpio Acatenango Quisache Chimaltenango, 1750 m., 12.XII.65, leg. E.C. Welling. **GUYANA.** 1 female, Br. Guiana, Potaro R., 3000', I.28, leg. Tukert. **NICARAGUA.** 5 males, Nicaragua, N side Cosiguina Vofeano Gulf of Fenseca, 23.XII.38, Zaca Exped. **PANAMA.** 1 male, Panama, Ancon, 13.XI.16, leg. T Hallinan; 1 male, Panama, New Culebra, 25.XI.14, leg. T Hallinan; 1 male, Panama, Gatun, 1.V.07, leg. W.P. Comstock; 1 male, Panama, Corozal, 17.XI.20, leg. E.I. Huntington; 1 male, Panama, Barro Colorado, 13.III.36, leg. W.J. Gertsch; 1 male, Panama, Taboga Island, 14.IV.08, leg. W.P. Comstock; 1 male, Panama, Juan Mina, 1.III.45, leg. C.D. Michener. **PARAGUAY.** 7 males, 4 females, Paraguay, Cordillera, Santisima Trinidad, 25°15' S, 57°38' W, VII, leg. B. Podtiaguin; 1 male, 1 female, Paraguay, Cordillera, Santisima Trinidad, 25°15' S, 57°38' W, VIII, leg. B. Podtiaguin; 8 males, 10 females, Paraguay, Cordillera, Santisima Trinidad, 25°15' S, 57°38' W, V, leg. B. Podtiaguin; 10 males, 5 females, Paraguay, Cordillera, Santisima Trinidad, 25°15' S, 57°38' W, VI, leg. B. Podtiaguin; 3 males, 3 females, Paraguay, Central Asuncion, VII-IX. **PERU.** 1 male, Peru, VI.91; 1 male, Peru, San Martin, 1500', 15.XII.46, leg. J.C. Pallister; 2 males, Peru, Quillabamba, Cuzco, 3400', 13.III.47, leg. J.C. Pallister; 3 males, 1 female, Peru, Quillabamba, Cuzco, 3400', 17.III.47, leg. J.C. Pallister. 1 male, Peru, Quillabamba, Cuzco, 3400', 14.II.47, leg. J.C. Pallister; 1 male, Peru, Quillabimba, Cuzco, 3400 ft, 3.III.47, leg. J.C. Pallister; 1 male, Peru, Iquitos, 19.VII.30, leg. E.I. Huntington; 1 male, Peru, San Pablo de Loreto, 8.VIII.20, leg. A.B. Klots; 1 male, Peru, Lower Rio Ucayali, 11.II.28, leg. H. Bassler; 1 male, Peru, Iquitos, 26.VIII.30, leg. E.I. Huntington; 2 males, Peru, Quillabamba, Cuzco, 3400', 15.III.47, leg. J.C. Pallister; 1 male, Peru, Chanchmayo, leg. F. Johnson; 1 male, Peru, San Ramon, Pueblo Pardo, Chanchamayo, 17.VI.30, Cornell Exped., leg. A.B. Klots; 3 males, 1 female, Peru, Quillabamba, Cuzco, 3400', 14.III.47, leg. J.C. Pallister; 1 male, Peru, Quillabamba, Cuzco, 3400', 11.III.47, leg. J.C. Pallister; 1 male, Peru, Quillabamba, Cuzco, 3400', 10.III.47, leg. J.C. Pallister; 1 male, Peru, Tingo Maria, Huan., 2200' 27.XI.46, leg. J.C. Pallister; 1 male, Peru, San Ramon, Chanchamayo, leg. W.P. Comstock; 1 female, Peru, Quillabamba, Cuzco, 3400', 12.III.47, leg. J.C. Pallister; 1 female, Peru, La Merced, Chanchamayo, VII, leg. E.I. Huntington; 2 females, Peru, Balsapuerto, Paranapura Rio, IV.33, leg. A.S. Pinkus; 1 female, Peru, Iquitlos, 25.V.31, leg. E.I. Huntington; 1 female, Peru, San Martin, Moyobamba, 19.XII.46, leg. J.C. Pallister. **VENEZUELA.** 1 male, Venezuela, Caripito, 1942, leg. H. Fleming; 1 male, Venezuela, leg. F. Johnson; 1 male, 2 females, Venezuela, Rancho Grande nr Maracay, 28.V.46; 1 male, Venezuela, Puerto Cabello, 11.X.07, leg. W.P. Comstock; 1 male, Venezuela, Rancho Grande (Maracay), 21.VI.45, leg. Flemming; 1 female, Venezuela, Rancho Grande nr Maracay, 28.V.46; 1 female, Venezuela, Caripito, 19.VIII.37, leg. F. Johnson; 2 females, Venezuela, Ranco Grande (Maracay), 16.IV.46, leg. Flemming; 1 female, Venezuela, Summit Rancho Grande Nat'l Park Edo, Aragua, 26.XII.59, leg. F.W. Preston; 1 female, Venezuela, Island of Margarita, 20.IV.34, leg. A.S. Pinkus; 1 female, Venezuela, Puerto Cabello, IV.08, leg. W.P. Comstock; 1 female, Venezuela, State of Bolivar, El Pao Mine, 1300', 8.VIII.38, leg. F. Johnson; 3 males, Venezuela, Yaracuy, Hacienda Tropicale Ecological Center, 100 m., 2.II.1993, G. Kareofelas.

MUSM. PERU. 1 male, Peru, CA, Tambillo, 21.--.1877, leg. Col. A. Raimondi; 1 male, 1 female, CA, km. 103, Jaen-Jan Ignacio, Puerto Quiracas, 500 m., 15.xi.1985, leg. G. Lamas; 1 male, AM., 20 S of Pedro Rúz, 1500 m., 26.II.1976, leg. G. Edblom; 1 male, AM, 6 km N Pedro Rúz, 1200 m., 15.XII.1975, leg. G. Lamas; 1 male, HU, P.N. Tingo Maria, 750 m., 21.VI.1982; 1 male, PA, Cacazú, 23.VIII.1968, P. Hocking.1 male, JU, Yurinaqui, alto 1400 m., 23.IX.1981, leg. P. Hocking; 1 male, JU, Valle de Chanchamayo; 1 male, JU, Yurinaqui, alto 1000 m., 28.IX.1984, leg. P. Hocking; 1 male, 1 female, JU, Yurinaqui, 1000 m., 2.V.1983, leg. P. Hocking; 1 male, JU, Yurinaqui, 1000 m., 20.V.1983, leg. P. Hocking; 1 male, JU, 0-1 km E Mina Pichita, Hda. Naranjal, 1000 m., 23. VIII.1988, leg. G. Lamas; 1 male, JU, Satipo, 17.IX.1967, leg. P. Hocking; 1 male, CU, Echarate, Rio Chaupimayo, 800 m., 9.VIII.1989, R. Tejada; 1 female, CA, Chabarpe, 1200 m., 10.XI.1985, leg. G. Lamas; 1 female, CA, km. 132 Celendin-Balsas, 2150 m., 6.III.1985, leg. G. Lamas; 1 female, AM., Piruro, 3 km. N Nueva Esperanza, 1700 m., 8.III.1986, leg. B. Calderón; 1 female, SM., 15-20 km. NE Tarapoto, 700-1100 m., 9.V.1979, leg. G. Lamas; 1 female, SM., Rio Huambo, Mashoyacu, II.1993, leg. B. Calderón; 1 female, JU, La Merced, 23.V.1979, 750 m., leg. G. Lamas.

Leptotes andicola

AMNH. COLOMBIA. [Note: AMNH voucher specimens from the Colombia biodiversity survey are unincorporated at present]. **ECUADOR.** 1 female, Ecuador, Prov. Pichincha, Pululahua Geobotanical Reserve, Moraspungo, 3080 m., 23.XII.1993, leg. Kareofelas; 1 male, 1 female, Ecuador, Prov. Pichincha, Pululahua Geobotanical Reserve, La Rinconada, 2600 m., 27.I.1992, leg. Kareofelas; 1 female, Ecuador, Prov. Pichincha, Pululahua Geobotanical Reserve, La Rinconada, 2600 m., 10. II.1992, leg. Kareofelas; 1 male, 1 female, Ecuador, Prov. Pichincha, Pululahua Geobotanical Reserve, La Rinconada, 2600 m., 21.II.1992, leg. Kareofelas; 1 male, 1 female, Ecuador, Cuicocha Imbabura, 3300 m., 17.V.39, leg. F.M. Brown; 7 males, 8 females, Ecuador, Cuicocha Imbabura, 3300 m., 27.V.39, leg. F.M. Brown; 2 males, 9 females, Ecuador, Cuicocha Imbabura, 3300 m., 30.V.39, leg. F.M. Brown; 1 male, Ecuador, Hda San Rafael, Rio San Pedro, 2700 m., 8.XI.38, leg. F.M. Brown; 1 male, Ecuador, vic. Banos, 1900 m., 9.IX.38, leg. F.M. Brown; 1 male, Ecuador, vic. Banos, 1900 m., 12.IX.38, leg. F.M. Brown; 1 male, 2 females, Ecuador, vic. Banos, 1900 m., 13.IX.38, leg. F.M. Brown; 1 male, Ecuador, vic. Banos, 1900 m., 18.IX.38, leg. F.M. Brown; 1 male, Ecuador, Vic. Banos, 1900 m., 19.IX.38, leg. F.M. Brown; 1 male, Ecuador, Vic. Banos, 1900 m., 4.XII.38, leg. F.M. Brown; 1 male, Ecuador, Rio Ulva, nr Banos, Tungurahua, 1700 m., 23. X.38, leg. F.M. Brown; 1 male, Ecuador, Rio Ulva, nr Banos, Tungurahua, 1700 m., 24.X.38, leg. F.M. Brown; 1 male, Ecuador, Rio Ulba, 1600 m., 8.IX.38, leg. F.M. Brown; 2 males, Ecuador, Sacre Azuay, 2600 m., 16.II.39, leg. F.M. Brown; 1 male, 2 females, Ecuador, Banos, 1800 m., II.39, leg. F.M. Brown; 1 male, Ecuador, Sacre Azuay, 2600 m., I.39, leg. F.M. Brown; 1 male, Ecuador, Juives, nr Banos, Tungurahua, 1900 m., 27.X.38, leg. F.M. Brown; 5 male, 1 female, Ecuador, Cuenca Azuay, 2500 m., 20.II.39, leg. F.M. Brown; 3 male, Ecuador, Cuenca Azuay, 2500 m., 23.II.39, leg. F.M. Brown; 1 male, Ecuador, Cuenca Azuay, 2500 m., 25.II.39, leg. F.M. Brown; 1 female, Ecuador, Ugambiobe, 2650 m., 13.IX.38, col F.M. Brown; 1 male, Ecuador, Ugambiobe, 2650 m., 15.XI.38, col F.M. Brown; 1 male, Ecuador, Seville de Oro Azuay, 2500 m., 15.II.39, leg. F.M. Brown.

BMNH. COLOMBIA. 8 males, Colombia, Torne, Cauca, Jan. 1907, leg. Paine and Brinkley; 1 male, Colombia, Cigasi, Villagomez "New Grenada". **ECUADOR.** 2 males, 1 female, Ecuador, Andes of Ecuador, Ed. Whymper; 1 male, Ecuador, Banos, Amazon, leg. Stuart; 4 males, Ecuador, Banos, Rio Pastaza, E. Ecuador, 5-7000', leg. M. G. Palmer; 9 males, 1 female, Ecuador, Cayambe, 9000', VI.97, leg. Rosenberg; 1 male, Ecuador, Cuenca; 1 male, Ecuador, Banos, 6800', April-May 1912, leg. M. G. Palmer; 4 males, Ecuador, Banos, E. Ecuador, 6800', Feb. 1912, leg. M. G. Palmer; 4 males, "Ecuador"; 1 male, Ecuador, "Equateur", Env. d'Ambato, leg. R. P. Irene Blanc; 1 male, Ecuador, Quito; 1 male, Peru, Tambo Valley.

MUSM. PERU. 1 male, LI, Huarochiri, 3150 m., 29.IV.1981, leg. P.Hocking; 3 males, Pumacocha (entre Jaura y Satipo), 4000 m., 22.IX.1947, leg. Vellard; 1 female, LI, Huarochiri,3150 m., 2.V.1981, P. Hocking.1 female, LI, Huarochiri, 3150 m., 29.III.1981, leg. P. Hocking.

Leptotes callanga

AMNH. BOLIVIA. 1 male, Bolivia, Okaza Ankoma, 7500-13700 ft, 19.IV.25; 1 male, Bolivia, La Paz, Sorata, 2800 m., Nov. 11-13, 1984, Luis E. Peña. **PERU.** 3 males, 1 female, Peru, Ollantaitambo, Cuzco, 9200', 28.II.47, leg. J.C. Pallister; 12 males, 1 female, Peru, Ollantaitambo, Cuzco, 9200', 1.III.47, leg. J.C. Pallister; 11 males Peru, Ollantaitambo, Cuzco, 9200', 3.III.47, leg. J.C. Pallister; 2 males, 2 females, Peru, Ollantaitambo, Cuzco, 9200', 24.III.47, leg. J.C. Pallister; 1 male, 1 female, Peru, Callanga, 3000 m., leg. E.I. Huntington; 2 males, Peru, Tarma, 30.V.20, leg. E.I. Huntington; 2 males, Peru, Huacapistana Rio Tarma, 1-2.VI.20; 1 male, 1 female, Peru, Ob. Madre de Dios Sud, 2500 m., leg. Fassl; 2 males, Peru, Huancayo, 3500 m., leg. F Johnson; 2 males, Peru, Macchu Picchu Ruins, Cuzco, 9500', 20.III.47, leg. J.C. Pallister; 1 female, Peru, Macchu Picchu Ruins Cuzco, 9500', 6.III.47, leg. J.C. Pallister; 1 male, Peru, Quillabamba Cuzco, 3400 ft, 13.III.47; 1 male, Peru, Opara, 1600 m., 3.VI.41, leg. P. Toytkowski; 1 female, Peru, Cuzco, 3300 m., 5-12.VIII.65, leg. P.&B. Wygodzinsky.

BMNH. BOLIVIA. 1 female, Bolivia, "high Bolivia", Umpasa, 19 Sept., leg. M. Conway. **PERU.** 4 males, Peru, Agualani, Carabaya, 9000', Aug. 1905, dry season, leg. Ockenden; 3 males, 1 female, Peru, Agualani, Carabaya, 9000', July 1905, dry season, leg. Ockenden; 4 males, Peru, Agualani, Carabaya, 9000', Oct. 1905, dry season, leg. Ockenden; 1 male, Peru, Agualani, Carabaya, 9000', Sept. 1905, dry season, leg. Ockenden; 8 males, Peru, Agualani, S.E. Peru, 10,000', leg. Ockenden; 1 male, Peru, Limbane, Dept. Puno, 1901-56, 1800 m., July 1900; 2 males, Peru, Limbani, Carabaya, 9000', II.III.04, leg. G. Ockenden; 3 males, Peru, Limbani, Carabaya, 9000', wet season, March .04, leg. G. Ockenden; 1 male, Peru, Limbani, Carabaya, 9000', wet season, Nov. .04, leg. G. Ockenden; 2 males, 1 female, Peru, Limbani, Carabaya, 9500', dry season, Apr. .04, leg. G. Ockenden; 1 male, Peru, Limbani, Carabaya, 9500', dry season, May .04, leg. G. Ockenden; 3 males, Peru, Marcapata, E. Peru, 4500'; 3 males, Peru, Marcapata, E. Peru, 10,800'; 4 males, Oconeque to Agualani, Carabaya, 6-9000', March .05, leg. G. Ockenden; 1 male, Peru, Palea 3000 m. to Huacapistana 2000 m., 3.00. wet season, leg. Simons; 1 male, Peru, "Peru", 3000 m.; 3 males, 1 female, Peru, Agualani, Carabaya, 9000', June .05, dry season, leg. Ockenden; 1 male, Peru, Cuzco, 3000 m., leg. H. Druce; 3 males, Peru, "Peru"; 2 males, Peru, Prov. Cuzco, Callanga, 1500 m., 1899, leg. Garlepp; 1 male, Peru, "Peru"; 1 female, Peru, R. Inambari to Limbani, S.E. Peru, III.04. leg. G. Ockenden; 1 male, Peru, Santo Domingo Carabaya, 6500', Ja.02., dry season, leg. G. Ockenden; 1 male, 2 females, Peru, Tarma.

MUSM. PERU. 1 male, JU, Yurinaqui, alto 1000 m., 28.VII.1983, leg. P. Hocking; .1 male, JU, Puente Yanángo, 2000 m., 27.X.1965, leg. P. Hocking; 1 male, 2 females, Acolla (cerca Jauja), 3460 m., VII.1958, leg. F. Blancas; 1 male, Pumacocha (entre Jauja u Satipo), 4000 m., 22.IX.1947, leg. Vellard; 4 males, AP, Abancay, 2500 m., 4.IV.1978, leg. P. Hocking; 1 male, 1 female, AP, Kuchiwa, Pachaconas, 3200 m., 8.VII.1979, leg. V. Pacheco; 1 male, CU, Chincheros, 3600 m., leg. P. Hocking; 1 male, CU, Cuzco, 26.II.1975, leg. Col, Y. Carrasco; 1 male, CU, Cuzco, 3600 m., 9. VIII.1975, leg. E. Bauer; 1 male, CU, Abra Lares, 4500 m., 28.VIII.1983, leg. J.L. Venero; 1 male, CU, 0-7 km E Buenos Aires, Rio Cosñipata, 2-2300 m., 6.XII.1979, leg. G. Lamas; 1 female, JU, 5 km W Tarma, 3200 m., 29.V.1979, G. Lamas; 1 female, CU, Calca, 2950 m., 8.VIII.1983, leg. J.L. Venero; 1 male, AP, 25 km S Chalhuianca, Rio Cotaruse, Lacaica, 3500 m., 14-15.III.1987, Karsholt (No. 44).

Leptotes bathyllos

BMNH. PERU. 1 male, Peru, Rio Ampayam, Dept. Loreto. [Note: there are several other specimens whose data outside Peru appear to be questionable; we do not include them here until there can be further verification].

MUSM. PERU. 1 male, Peru, PA, Paujil, Puerto Bermúdez, 300 m., 29.IX.1982, leg. D. Smith; 1 male, Peru, LO, Rio Tigre, Marsella, 14.III.1977, leg. A. Luscombe; 1 male, Peru, LO, Rio Tigre, Marsella, 19.III.1977, leg. A. Luscombe; 1 male, Peru, LO, Rio Tigre, Intuto V.1991, J. Alvarez. 1 male, Peru, LO, Yurimaguas, Muyuna, 25.IX.1993, 180 m., leg. F. Chang; 1 female, Peru, LO, Boca Rio Samiria, 130 m., 12.VIII.1990, leg. H. Lequerica; 1 female, Peru, LO, Rio Samiria, Cocha Shinguito 130 m., 11.VI.1990, leg. G. Lamas.

Leptotes trigemmatus

AMNH. ARGENTINA. [Note, material from 1991, 1992 AMNH expeditions have not yet been prepared but has been sorted to ascertain positive identifications of each specimen]. **CHILE.** 22 males, 2 females, Chile, Huasco, 7 km NE of Domegko, 2.XI.1993, AMNH Expedition; 4 males, 1 female, Chile, Choapa, 5 km N of Illapel, 12.XI.1993, AMNH expedition; 4 males, 1 female, Chile, Elqui, 6 km S of Vicuña, 23.X.1993, AMNH Expedition. [Note, additional AMNH material not sent to the senior author for identification is still unprepared at the AMNH].

BMNH. ARGENTINA. 2 males, Argentina, "B. Aires". **CHILE.** 3 males, 3 females, Chile, Arica; 2 males, 1 female, Chile, "Chili"; 1 male, 1 female, Chile, "Chili", leg. Edmonds; 1 male, Chile, Coquimbo, leg. Walker. **ECUADOR.** 2 males, Ecuador, Loja, 1896, leg. Dognin; 2 males, Ecuador, Zamora, 1896, leg. Juillet. **PERU.** 8 males, 9 females, Peru, Pisco, leg. W. Hofmanns; 1 male, 3 females, vic. Tarapaca [Chile]; 1 male, 5 females, Peru, Lima to Chosica, leg. A. M. Moss; 3 male, 2 females, Peru, Elen, 20 m., X.99, dry season, leg. Simons; 3 females, Peru, Chosica, 2800', 17.III.1912, leg. H. O. Forbes.

MUSM. PERU. 1 male, Peru, CA, Hda. La Viña, 1100 m., 8-10.X.1974, leg. G. Lamas; 1 male, Peru, CA, La Mónica, 800 m., 6.IX.1974, leg. G. Lamas; 1 male, Peru, CA, entre Cascas y Contumaza, 2000 m., 11.V.1982, leg. G. Lamas & E. Pérez; 1 male, Peru, CA, Pucará, 1000-1300 m., 9.XII.1975, leg. G. Lamas; 1 male, Peru, LL, Hacienda Collambay, Cerca Otuzco, 850 m., flores de coca, 3.III.1976, leg. T.P. Plowman; 1 male, Peru, LL, Rio Huamanzaña, S de Viru, 80 m., 28.V.1982, leg. G. Lamas & E. Pérez; 1 male, Peru, AN, Santo Toríbio, 3000 m., 28.IV.1978, leg. P. Hocking; 1 male, Peru, LI, 1510 m., 20.IV.1968, leg. G. Lamas; 1 male, Peru, I, Autisha, 2180 m., Vi.1953, leg. F. Blancas; 1 male, Peru, LI, Cocachacra, 1400 m., 7.IV.1974, leg. G. Lamas; 1 male, Peru, LI, Huaral, 150 m., 7.IX.1969, leg. G. Lamas; 4 males, Peru, LI, La Molina, 3.III.1974, leg. G. Lamas & N. Medina; 3 males, peru, LI, Tambo de Viso, 2600 m., 22.VI.1974, leg. G. Lamas; 1 male, 1 female, Peru, LI, Churín, 2000 m., 29.VII.1975, G. Lamas; 1 male, Peru, LI, Quintay, 7 km E Sayán, 850 m., 4-6.V.1982, leg. G. Lamas & E. Pérez; 1 male, Peru, LI, Quebrada Canchahuari, Cerca Langa, 2400 m., 4.VII.1983, leg. G. Lamas & E. Pérez; 3 males, 2 females, Peru, IC, Ica, 400 m., 3.X.1984, leg. G. Lamas & J.E. Pérez; 5 males, 2 females, Peru, MO, Moquegua, 1350 m., 17.X.1986, leg. G. Lamas; 3 females, Peru, AN, Rio Portaleza, Raquia, 2150 m., 8.X.1982, leg. G. Lamas & E. Pérez; 1 female, Peru, LI, Geneguilla, 360 m., 24.III.1974, leg. G. Lamas & N. Medina; 1 male, Peru, AR, 7 km., E. C.hapamara, 1450 m., 14.IX.1988, leg. G. Lamas.

Leptotes lamasi

BMNH. MUSM. [Note, this material was listed as paratypical in the body of the paper].

Leptotes delalande

BMNH. [Note, the return of the senior author to the BMNH resulted in the discovery of additional material which we hereby designate as additional **PARATYPES: ECUADOR.** 8 males, 1 female, Ecuador, Chimbo, 1000', VIII.97, leg. Rosenberg; 1 male, Ecuador, Quayaquil; 1 male, W. Ecuador, Huigra, 23 Febr. 1913, 3000', leg. A. Hall; 1 male, Ecuador, W. Ecuador, Huigra, 4 Febr. 1913, 3000', leg. A. Hall.

Leptotes parrhasioides

BMNH. PERU (Galopagos Islands). 1 male, 1 female, Peru, Galopagos Islands, Indepatigable Island, 28.7.1924, leg. C. L. Collenette; 19 males, 26 females, Peru, Galopagos Islands, Tagus Cove, leg. C. L. Collenette; 1 male, 1 female, Galopagos Islands, Wenman, I.II.01; 3 males, 2 females, Peru, Galopagos Islands, Tagus Cove, Albemarlel, 6.8.1924, leg. J. B. Hicks; 1 male, 1 female, Peru, Galopagos Islands, Charles Island, leg. R. H. Beck.

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Notes Added at Proof

Note that in the Material Examined, under the entry *Leptotes delalande*, additional **PARATYPES** are designated.

Also, concerning the "Nabokovian" etymology of *L. delalande*, we have noted, rather by chance, a Pierre Antoine Delalande, a French naturalist who collected in Brazil (Papanero, N., 1971. Essays on the history of Neotropical Dipterology with Special Reference to Collectors (1750-1905), vol. 1, São Paulo, 216 pp.). Given the personae of Nabokov's character "Delalande" (see ETYMOLOGY under *L. delalande*) it is interesting to query whether Nabokov might have run across this historical name in his studies of Entomology.

The Argentine Fauna of *Pseudolucia* Nabokov (Lepidoptera, Lycaenidae)

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Polyommatine Lycaenids of the Oreal Biome in the Neotropics, part VII: The Argentine Fauna of *Pseudolucia* Nabokov (Lepidoptera, Lycaenidae), by Zs. Bálint and K. Johnson

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REPORTS **of the**
Museum of Natural History, University of Wisconsin
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NO. 45

ABSTRACT

Based on historical and newly acquired specimens, the taxonomy of *Pseudolucia* species occurring in Argentina is examined. Nine species of *Pseudolucia* are presently known to occur in Argentina. Of these, three were reported in the historical literature (but sometimes misidentified), three were described in 1993, two are described herein as new from recently acquired material, and another (common to Chile) is reported for the first time from Argentina. Of the nine species, four are presently indicated as endemic to the Argentine flank of the austral Andean region and five occur both in Argentina and Chile.

Among species historically reported from Argentina, *P. andina* (Bartlett-Calvert) is unambiguous as to identification, as is the recently recorded *P. chilensis* (Blanchard). However, regarding *P. andina* our research indicates NE Andean (Argentina: Mendoza) and Patagonian populations are distinct enough to warrant description of *P. andina neuqueniensis*, new subspecies. The status of two other historically reported taxa, *Pseudolucia grata* (Kõhler) and *Pseudolucia patago* (Mabille), required review and revision. Concerning the first, *Itylos grata* (TL "Las Lajas" Argentina) is clarified from its type and, though poorly known, appears to be an authentic Argentine endemic. *Lycaena patago* (long an austral nomenclatorial enigma) is clarified by recent location of type specimens, designation of a lectotype and, based thereon, placement as a subspecies of *Lycaena lyrnessa* Hewitson (*Pseudolucia lyrnessa patago* **new combination, revised status**). Further, *P. lyrnessa* is shown to be conspecific with *P. zembla* Bálint and Johnson, **new synonym.**

Concerning recently described species, *Pseudolucia lanin* Bálint and Johnson 1993 is elaborated further to include its female and documented with wider geographic distribution. *Cherchiella argentina* Balletto [1993] takes priority over *P. sirin* Bálint [1993], **new synonym.** Additional records of Argentine endemic *P. charlotte* Bálint and Johnson are provided and this species distinguished from a "look-alike" **new species** *P. shapiroi* whose females show the deep orange FW orb which occurs hazily in males of *P. charlotte*. Another **new species**, *P. humbert* is described from SE Salta Province.

Pseudolucia chilensis (Blanchard), common in Chile, is reported for the first time from Argentina. Further taxonomic analysis of northern Argentine populations of this species are recommended from additional material.

External and morphological characters of Argentine *Pseudolucia*, compared to those of Chilean congeners, illustrate (1) the structural diversity but clear overall monophyly of the genus and (2) that splitting of *Pseudolucia* into separate genera based on its putative "species groups" can be achieved only through the use of arbitrary characters and selected taxa. Accordingly, and since *Cherchiella* as constituted by Balletto is paraphyletic within *Pseudolucia*, the latter is maintained as the generic name for the entire assemblage (*Cherchiella* and *Pallidula* Balletto being synonyms).

INTRODUCTION

Recently, we established the occurrence of numerous species of the polyommatine lycaenid genus *Pseudolucia* in Chile and the Patagonian Region of Argentina (Bálint and Johnson 1993). The genus is remarkably diverse in the Chilean administrative regions of Elqui, Coquimbo and Bío-Bío where several distinctive species groups co-occur. Among these, the *plumbea*-Group of taxa is remarkably speciose, with five species occurring in central Chile alone (Bálint 1993a, Table 2). The central Chilean diversity in *Pseudolucia* is particularly notable because, within a relatively small geographic region, numerous sister species are both sympatric and synchronic. These species, nearly all recently described, are readily recognized by wing pattern and their interspecific differences clearly corroborated by genitalic characters in both sexes. Recent description of the species results primarily from the many specimens having been previously unavailable to specialists (series derive, in most cases, from throughout the twentieth century). Chilean lepidopterists were, in fact, aware of the diversity suggested by local samples but unable until recently to collaborate with specialists who could locate type material, properly diagnose historical taxa, and describe new entities.

Systematic work elaborating austral diversity in the polyommatine lycaenids is paralleled by recent work on the sister group – eumaeine lycaenids. In this group, the junior author and colleagues have enumerated some half dozen new austral taxa in the "hairstreak butterfly" genera *Eiseliana* and *Heoda* (Johnson, Miller and Herrera 1992, Johnson and Miller 1992). These genera also showed a pattern of diversity, sympatry and synchrony, particularly in central Chile. As with their polyommatine counterparts, the "new" hairstreak species derived from large (mostly twentieth century) samples not previously seen by specialists and showed outstanding wing and structural characters.

In a recent catalog of polyommatine lycaenids from montane and austral South America, the senior author (Bálint 1993a) emphasized the biogeographic importance of newly-documented lycaenid endemics from austral South America. He particularly commented on the diversity indicated within the geographically compact (but ecologically varied) region of central Chile. The present paper has been prepared to emphasize the similar, but previously poorly-documented, diversity of *Pseudolucia* in the Andean and austral provinces of Argentina. These Argentine *Pseudolucia* are important not only for their diversity but because analysis of their taxonomic characters compared to Chilean congeners enlightens the distinction of subclades ("species-groups") within the genus. Particularly, the Argentine taxa illustrate that, though clearly sharing a common overall ground plan, *Pseudolucia* taxa show a remarkable, and (considering characters of both sexes) often contradictory, diversity of characters. Lack of an unequivocal basis for dividing *Pseudolucia* into objective "species-groups", which would embrace both the Argentine and Chilean taxa, directly addresses the controversy surrounding whether workers should further "split" this large genus into several genera based on a synoptic view of the common usage species groups (see Balletto 1993). For this reason, despite some recent synoptic work cited immediately above, we continue to treat *Pseudolucia* here as one genus.

MATERIALS AND METHODS

Collections. Study concerning Chilean Polyommatinae was aided by the concentation of large specimen series in the hands of three or four local collectors or institutions. This was not the case for Argentine material and is what has generally prevented progress on the Argentine Polyommatinae. To prepare the present paper we aggregated small samples from various sources and sorted from this larger set the specimens relevant to taxonomic groups eventually included. In one case, study material was compiled from the main collection of the Zoologisk Museum, Copenhagen (ZMK) by its curator and forwarded to the senior author for study. Both authors assembled material at The Natural History Museum, London (BMNH[1]) and the junior author assembled specimens from the American Museum of Natural History (AMNH), Field Museum of Natural History (FMNH), Instituto Miguel Lillo (Tucumán, Argentina) and from collectors Robert C. Eisele (Jujuy, Argentina), Arthur M. Shapiro (University of California, Davis), Luis E. Peña (Santiago, Chile) and the late Jose Herrera G. (Santiago, Chile). From these generic samples, representatives either directly listed below, or relevant for comparative study, were culled for analysis and elaboration at the species level. Since the aim of the present paper is to provide a compact picture of *Pseudolucia* in Argentina, including elaborated geographic distributions, we again report full collection data from the BMNH and ZMK material listed by Bálint (1993a). Following this analysis of *Pseudolucia*, certain voucher material has been deposited at the Hungarian Natural History Museum (Budapest) (HNHM). Such material is cited below and in subsequent entries as appropriate. In some cases these deposition notations replace others cited heretofore in Bálint (1993a) and Bálint and Johnson (1993). In addition, we have consulted various material at the Museum National d'Histoire Naturelle, Paris (MNHN) (visited most recently by the junior author in 1994), or herein cite certain material from the MNHN called to our attention by Dr. Gerardo Lamas.

Terminology. In preparing the taxonomic text we have used the terminology from our previously published work on *Pseudolucia* (Bálint and Johnson 1993, as amended by comments in Bálint 1993b). Intrageneric comparisons follow taxa described in, or commented about, in the above citations, including (1) the species groups (cited as "*x*-Group") for intrageneric structural subgroups of Bálint and Johnson (1993) and (2) clusters of species superficially similar in overall wing patterns (cited as "*x*-like taxa") consistent with Bálint and Johnson (1993). All the color definitions in descriptive entries have been conformed to Maerz and Paul (1950).

Format. **Text.** We arrange the taxonomic entries in three categories— first, taxa historically attributed to the Argentine fauna; second, recently described austral taxa which occur in Argentina; and third, two new species and one new subspecies described here from Argentina. Because of the frequency of historical misidentifications, we have had to depart from the usual practice or organizing the text around taxon entries. Instead, we have employed subtitles appropriate introducing historical nomenclatorial problems, followed closely thereafter by the taxon citation (as "Argentine *Pseudolucia* Species '*#N*'") revised by us recent evidence (especially reference to type material).

This format is useful for three reasons. First, it avoids introducing taxa by incorrect former usages; second, since our new synonymies result mainly from review of type material, after the initial revised taxon citation we can readily list the appropriate new synonymies; third, the species entry numbers correspond to a summarial synoptic list of Argentina *Pseudolucia* presented at the end of the paper for rapid reference.

Considering the total result, it is helpful to note here that (as with so many poorly-studied Lycaenidae from southern South America) the status of recently described species stands up well under further scrutiny and additional specimen series; the statuses of some old names, however, often involve synonymy. This probably results from early specimen series representing a few well collected localities while many modern series come from concerted local collecting in areas known for biological endemism.

Illustrations. Illustrations have been organized to accommodate considerations both of the present paper and review of pertinent illustrations made of various taxa in the past. For instance, after publication of Bálint and Johnson (1993) the authors had numerous requests to elaborate the specimens figured by the publisher in "Photoplate V" of that paper, particularly in regard to statuses as types. To meet

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[1] We use this abbreviation consistent with the United Kingdom ("UK") statutory name "British Museum (Natural History)" which, for legal purposes in the UK, has remained unchanged.

this need we have reprinted the original Photoplate V (herein Photoplate V) and give an annotated picture key to the plate on a facing page. Photographs of specimens pertinent to new treatment herein are incorporated in Photoplate IV. In each taxon entry below, pertinent illustrations are listed after an initial subtitle "Figures." In these captions, for rapid reference, figures that are included in the present paper are **bolded** (*e.g.* as "**Photoplate IV**" or "**V**", or as listed immediately after the bolded citation "**Figs.**"). Unbolded citations refer to illustrations in previously published works.

HISTORICAL *PSEUDOLUCIA* FAUNA OF ARGENTINA

Species Correctly Cited in the Historical Literature

Historical literature on Argentine *Pseudolucia* is basically limited to K. J. Hayward's 1973 "Catalog"; P. Köhler (1934) contributed one species description but this postdated his 1928 "Catálogo" which listed no high Andean or austral blues. One *Pseudolucia* species previously attributed to Argentina has no nomenclatorial problems. This species, widespread in Chile and southern Argentina is

Argentina *Pseudolucia* Species 1—

Pseudolucia andina **(Bartlett-Calvert)**

Scolitantides andina Bartlett-Calvert 1894.

Synonym: *Scolitantides horsti* Ureta 1949 (Boln. Mus. Nac. Hist. Nat. Chile 24: 122, pl. 6,f).

Early Argentine citations—

S. andina Calvert [sic]: Hayward 1973: 166 (generic usage archaic).

Figures. *Adults*— **Photoplate IV: A-D, V: U,V**; Bálint 1993a, IVA,53-55. *Genitalia*— **Figs. 3,9,11**; Bálint and Johnson 1993, ♂J,♀L.

DIAGNOSIS. ***Wings.*** Large (FW to 13.5 mm.) easily recognized by overall brownish DFW,DHW (bronze in nominate, darker in new subspecies described herein, sometimes finely grizzled with blue); VHW with jagged brown crescents comprising the VHW V-shaped band. Confusable only with some smaller *P. plumbea* specimens in which ruptive elements approach the more jagged habitus typifying *P. andina*. Patagonian (Neuquén and Chubut) specimens are very large (13.0-13.5 mm.) and generally darker than bronze-colored Chilean examples. We segregate the Patagonian population as *P. andina neuquenensis* new subspecies, hereafter). The nominate and new subspecies do not differ in the genitalia.

Morphology. Male showing genitalia with distinctive valvae— lacking the hooked terminal rostellum of other congeners and instead showing a "fleshy" terminal lobe tapering to a blunt end; female terminalia reminiscent of elements in the "*plumbea*-Group", central structure ellipsoid, with diminutive and with a thickened nodule terminad somewhat like "*chilensis*-Group".

DESCRIPTION. See Bálint and Johnson 1993: 19 (regarding original figure citations, Bálint and Johnson 1993 figured the Chilean population, Photoplate V: U,V [same herein]; Bálint 1993a, Figs. 53-55, figured the Argentine population). Adult photographs herein, **Photoplate V,U-V** illustrate respective upper and undersurfaces of a male.

DISTRIBUTION. ***Spatial***: Fig. 1. Argentine members of the nominate subspecies are known only from Mendoza Province at high elevations (2400-3100 m.); the new Patagonian subspecies occur at considerably lower elevations (700-1200 m.). ***Temporal***: Nominate specimens (including Chile and Argentina) date from October to January; Patagonian specimens of the new subspecies have labels ranging from November to March. However, sparse data to date suggests both these summaries still reflect sampling error.

REMARKS. **Characters and composition of the "*andina* Group" of *Pseudolucia*.**

Bálint and Johnson (1993) stated that they would initially cluster *Pseudolucia* taxa based on the traditional characters stressed by Nabokov (1945). They also noted that eventual study of additional characters would probably reinforce the strong monophyly of the numerous taxa placed in this genus. Consisent with the first point, the *andina*-Group was initially defined by the male genitalia lacking a hooklike rostellum (Nabokov 1945, Bálint and Johnson 1993). However, consistent with the second point (and pertinent to our comments about the inadvisability of further splitting of *Pseudolucia* into several genera) study of the sagum indicated is presence in taxa of the *andina*-, *chilensis*- and *collina*-Groups and absence in the *plumbea*- and *sibylla*-Groups. By this criterion, *Pseudolucia lanin* (placed by Bálint and Johnson in the *plumbea*-Group and treated in subsequent entry) would be along with *Pseudolucia andina*.

Such a ready shifting of species between various *Pseudolucia* "species groups", based simply on the consideration of additional characters, underscores the monophyly of *Pseudolucia* and the questionable monophyly of subset genera that might be erected.

Infraspecific Taxonomy of *P. andina*. Below, we distinguish two subspecies of *P. andina*.

Subspecies

Pseudolucia andina andina **(Blanchard)**
Figures. See citation for species just above.

DIAGNOSIS. *Wings*. Smaller (FW alar 8.0 - 10.8 mm.) compared to new subspecies (11.5 - 13.5 mm.) below. Male FW lighter brown, often bronze, occasionally strewn with silvery blue scales. Females larger considerably larger (9.8-10.8 mm.) but not approaching female size in new subspecies below (10.5-13.5 mm.).

MATERIAL EXAMINED. Argentina. 2♂♂, 1♀, Prov. Mendoza, Parque Pral. Aconcagua, between Laguna Horcones and El Durazno, ca. 8400', 30.xi.1989, A.M. Shapiro (HNHM); 1♂, Prov. Mendoza, Valle de Las Leñas, ca. 7000', 3.xii. 1989, A.M. Shapiro (HNHM); 1♂,1♀: Puente del Inca, Mendoza, H. J. Elwes (BMNH).

Pseudolucia andina neuqueniensis **Bálint and Johnson NEW SUBSPECIES**
Figures. *Adults—* Photoplate IV: A,B; Bálint 1993a, IVA,53-55. *Genitalia—* Figs. 9,11.

DIAGNOSIS. *Wings*. Larger (FW alar 11.5 - 13.5 mm.) than *P. andina andina* (8.0 - 10.8 mm.). Male FW ground darker brown, never bronze as *P. a. andina*. Females considerably larger than nominate subspecies (10.5-13.5 mm./ 9.8-10.8, n=4). VHW pattern jagged as in nominate but somewhat more ruptive in females.

Morphology. Figs. 9,11. As noted above, quite identical with *P. a. andina* except for somewhat larger overall facies paralleling the larger body and wing size of the new subspecies.

TYPES. Holotype male, allotype female, labelled "Neuquén 20: Paso del Córdoba, 1200 m., 1. xii. 1981, Nielsen & Karsholt", respective genitalia dissections, ZMK slides #15 (male), #29 (female), both deposited HNMH. *Paratypes*. 7♂♂,1♀, Valley del Lago Blanco, Chubut, Thursby (BMNH); 1♂, Territory of Chubut, N. W. Patagonia, 2500 ft, March 1920, Maiten (BMNH); 4♂♂, 2♀♀, Neuquén 20: Paso del Córdoba, 1200 m, 1.XII.1981, Nielsen & Karsholt (ZMK); Prov. Neuquén, San Martín de los Andes, 1946, leg. Hayward and Willink, 3♂♂ (IML).

REMARKS. **Biogeography.** The distinction of the high Andean and Patagonian populations is biogeographically well defined (see *e.g.* Shapiro 1991). Further investigations must be made to study the biology of *P. andina* populations existing at different longitudes.

ETYMOLOGY. Named for the type locality.

A second species often cited in the historical literature was described from Argentina and its types has been recently examined by a colleague. Given what can be surmised form the type and the type locality vis-a-vis material in our possession, the species appears unambiguous as follows—

Argentine *Pseudolucia* Species 2—

Pseudolucia grata **(Köhler)**
Itylos grata Köhler 1934.
Early Argentine Citations—
Pseudolucia collina grata Hayward 1973 (***nec collina*** Philippi [combination in error based on simplistic view of VHW pattern, see Remarks and Bálint and Johnson 1993, Bálint 1993a, 1993b]).
Figures. *Adult—* Photoplate IV; Bálint 1993a, IVA,49-50; *Genitalia—* Fig. 5; Bálint 1993a, 114.

DIAGNOSIS. *Wings*. Medium sized (FW 10.0 - 11.0 mm.) easily recognized by overall ether blue (35K2) DFW, DHW of males, females brown with suffusion of orange across FW medial area; VHW with spotted postmedial band comprised of irregularly shaped brown elements extending from the HW costa to anal margin and offset by a full band across HW postbasal area. The only similar Argentine congener, *P. argentina*, is smaller with different VHW pattern (see below).

Morphology. Male showing genitalia with commonplace polyommatine valve, relatively robust with sclerotized terminalia, terminal rostellum well-hooked, with large arch of hook (contrasting *P. argentina*), sagum absent (contrasting *P. andina* and *P. lanin*). Female genitalia not known, most probably showing winged habitus of the *plumbea*-Group.

DESCRIPTION. See Köhler 1934: 39-40.

DISTRIBUTION. *Spatial*: Fig. 1. Only known from the type locality ("Primer Pino", Ilegué, Neuquén, Dept. Las Lajas) and from other specimens with data listed as "Nahuel Huapí" and "Tecka" at "1500-1600 m.". *Temporal*: dates of specimens range from January to February.

REMARKS. **The Identity of *Pseudolucia* grata and its Affinities.** Bálint (1993a) summarized Argentine specimens suggesting Köhler's name and commented on which of these appeared most like the original description. The holotype of *Itylos grata* is preserved in Museo La Plata, Argentina (Dr. Gerardo Lamas, in litt. to Bálint) and not in a private collection (Bridges 1988: I. 148). Although we were unable to obtain the type specimen directly, it has been recently examined by Dr. Lamas. His comments concerning the type (G. Lamas in litt. to Bálint) support our recognition of the previously noted specimens from Nahuel Huapí, Argentina (Bálint 1993a) as being typical of the taxon (Bálint 1993a, photoplate IVa 49, 50.). This further confirms that

P. grata is structurally typical of the *plumbea*-Group and also appears to suggest that *P. grata* is most closely related to *P. annamaria* Johnson and Bálint (1993: 7) described from central Chile.

Bálint (1993a: 20) originally listed three Argentine specimens under *P. grata* [beyond those above discussed under *P. lanin*]: (1) 1♀, "Nahuel Huapí, Patagonia", Jan. 1912 (Bálint 1993a, Photoplate IVa, 50) (BMNH); (2) 1♂, "Tecka, Territory of Chubut, N.W. Patagonia", 3000 ft, Jan.-Feb. 1920 (Bálint 1993a, Photoplate IVa, 49) (BMNH); and (3) 1♀, with more current data— Salta, Rosario de la Frontera, Los Banos, 8.iv. 1979 (ZMK). The latter specimen was noted as diverging from the facies of the first two but, based on a conservative notion, suggested as perhaps meaning there was some polytypy in the species if it indeed ranged northward. For purposes of superficial diagnosis, the first specimen shows a DHW pattern appearing identical with the holotype specimen of *grata* illustrated by Köhler (1934. figs.1-2). Unfortunately, as noted by Bálint (1993a), the genitalia of this specimen are lost (a female *Madeleinea moza* abdomen having been attached to the specimen, as BM. No. 19179). Considering Lamas' recent examination of the type of *grata* and sexual dimorphism typical in "*plumbea*-like" taxa, the second noted male specimen appropriately complements the Nahuel Huapí female for purposed of characterizing *grata*. This allows us some confidence in drawing inferences from the intact genitalia of this Chubut male (Bálint 1993a, fig. 114) which typify the *plumbea*-Group of *Pseudolucia* (Bálint and Johnson 1993). Accordingly, we figure this male/female herein to represent *P. grata* (Photoplate IV). Based on this diagnosis it can be readily seen that the divergent specimen originally listed under *P. grata* (from Salta) represents an undescribed entity and we treat it subsequently as *Pseudolucia humbert*, new species. Separation of the above specimen from a cluster initial considered as possibly representing Köhler's 1934 "*Itylos grata*" typifies what we showed from extensive series of Chilean *Pseudolucia*, that divergence but overall phylogenetic unity of the genus strongly recommends no further splitting of the large assemblage into additional genera.

MATERIAL EXAMINED. Argentina. 1♀: Nahuel Huapí, Patagonia,I.1912 (BMNH); 1♂: Tecka, Terr. Chubut, N. W. Patagonia, 3000 ft, I-II. 1920 (BMNH).

Species Incorrectly Cited in the Historical Literature

The Problem of "Argentine" *Lycaena patago* Mabille 1899.

A major obstacle to fully understanding early species names applied to Argentine *Pseudolucia* lies in the uncertain identity of *Lycaena patago* Mabille 1899. Historically, type material for this species has been reputed from the Museum National d'Histoire Naturelle, Paris (MNHN) (Bridges 1988) but had remained undocumented. Fortunately, we were able to ascertain from MNHN staff that the relevant "*patago*" material (from the Cape Horn Expedition) was not maintined in Paris but sold to Oberthür, whose collection went to the BMNH, London (Viette 1956). Thus, the single extant male specimen with the label "Chili" in the Oberthür Collection (listed by Bálint 1993a: 18) is a syntype and can finally clarify the identify of this long enigmatic taxon. During a recent visit to the MNHN, Dr. Gerardo Lamas (pers. comm. to Bálint) located a female of *Pseudolucia andina* with a "Santa Cruz" label attributable to Mabille. Dr. Lamas suggested that this might be the type of *L. patago*. We are reluctant to share this view, however, since the original description clearly states: "Alae griseae, caeruleo parce micantes...Punta-Arena iun exemplaire mâle".

Historically, "*patago*" has always been considered part of the "Argentine problem" in *Pseudolucia* even though its putative type locality (Punta Arenas) is part of modernday Chile. Current knowledge of austral *Pseudolucia* distributions suggests that these "blues" do not occur as far south as Punta Arenas or the Brunswick Peninsula and that the cited type locality for "*patago*" should be considered suspect. Dr. Arthur M. Shapiro (in litt. to Johnson) notes that the southernmost records of Lycaenidae known to him are from Última Esperanza, some 200 km. farther north. Bálint (1993a: 18) took into account the southerly location of the "*patago*" type locality in properly identifying the species prior to location of a type. However, with a type in hand, further synonymic problems arise with "*patago*" and these require some historical review.

Historical Review. Bálint (1993a: 19, figs 38- 40) originally discussed *Pseudolucia patago* (Mabille, 1889) from sparse material identified from Argentina. As noted in Bálint's Catalog, "*patago*" has been historically construed as synonymous with *Lycaena collina* Philippi 1859 (based on common usage identifications of this latter taxon in Chile) or *Scolitantides plumbea* Butler 1881 (Bridges' 1988 combination, given without explanation). Subsequently, Balletto (1993) construed yet another identity for "*patago*" from Argentine material examined by him and this identification has not been further discussed by other workers.

Concerning *Lycaena collina*, Bálint (1993b) has summarized a variety of evidence suggesting that *collina* (although lacking extant type material) is most likely described properly by Bálint and Johnson (1993: 5-6). Considering the large number of specimens now representing this entity and its consistency with historical identifications by experienced Chilean workers (L. Peña, in litt. and in press) we have to conclude that Nabokov (1945: plate 7 "col. 4") inadvertantly chose a female of the "look-alike" congener *P. lyrnessa* (*zem-*

bla sensu Bálint and Johnson 1993) for his illustration of female "*collina*" (see fig. 16 herein). Certainly, Nabokov was not aware of the diversity of taxa which share the "V"-shaped VHW band in *Pseudolucia* (see Bálint and Johnson 1993) since Nabokov does not even mention the female of "*collina*" in his text attributed to that taxon (1945: 34). As noted by Bálint and Johnson (1993) and Bálint (1993b) there is no difference within *Pseudolucia* as dramatic as that of the bifurcate female genitalia attributed to *P. collina* by us and the facies of *plumbea*-Group taxa shown now to include historical "*patago*".

Bridges' (1988) placing of "*patago*" with *plumbea* as a subspecies obviously resulted from the former synoptic approach to all taxa resembling "*plumbea*" and the "bibliographic" method used by Bridges to compile his catalog list.

Balletto (1993) appears to have surmised the meaning of "*patago*" from some specimens he returned to the Copenhagen museum, without specific identification labels but which (from his Material Examined) correspond with the description of his "*Cherchiella patago*" Balletto (1993: 234 and 236). Examination of these specimens by the senior author indicates clearly that they are conspecific, indeed identical, with *Pseudolucia lanin* Bálint and Johnson 1993. Since, among the many recently described austral *Pseudolucia*, *P. lanin* does not correspond strongly with the original description of "*patago*", Balletto's identification of "*Cherchiella patago*" apparently resulted from the sampling error inevitable in the few Argentine specimens available to him. Undoubtedly, another factor was Dr. Balletto not knowing that common usage of the name "*collina*" actually embraced two "look-alike" species (*collina* and *lyrnessa* [=*zembla* in Bálint and Johnson 1993]) actually belonging to different structural groups of the genus. Balletto most likely supposed that *P. lyrnessa*, occurring syntopically with "*C. patago*", was the historical "*collina*". Since Balletto applied the name "*patago*" to the material he viewed, and not a new name, *P. lanin* remains the valid name for this population and is reviewed subsequently in light of additional material now available to us.

The generic validity of "*Cherchiella*" (as noted in more detail below and in Bálint, in press) hangs on the aforementioned problem of whether it is desirable to split *Pseudolucia* into several genera. The proposal by Balletto (1993) is not preferred among resident New World students of the Polyommatinae (Bálint 1993b follows Gerardo Lamas, in litt.) because of the sampling error evident in the criteria for Balletto's additional genera. For example, if one follows the combinations of Balletto, whose type species for "*Cherchiella*" was "*Cherchiella argentina*" (identical with but having priority over more elaborately treated "*Pseudolucia sirin*" Bálint 1993a: 20), "*Cherchiella*" is not monophyletic. It contains "*C. argentina*", structurally a member of the *plumbea*-Group (e.g. "*sibylla*-[sub]Group") of *Pseudolucia*, and "*C. patago*" *sensu* Balletto (synonym of *Pseudolucia lanin* Bálint and Johnson 1993), structurally a member of the "*andina*-Group" of *Pseudolucia* according to the male genitalia.

Identification and Status of *Lycaena patago*.

Fortunate as a footnote to this historical confusion, our location of a *Lycaena patago* syntype allows final resolution of the matter conistent with the original treatment of *patago* by Bálint (1993a: 19, figs 38-40). This type also allows us to objectively place "*patago*" as a subspecies of another early name for which there is also an extant type— *Lycaena lyrnessa* Hewitson 1874— and place the *Pseudolucia zembla* Bálint and Johnson 1993 as a junior synonym consistent with Bálint (1993b).

TYPE MATERIAL EXAMINED. LECTOTYPE of *Lycaena patago*, designated here: "Chili; ex Oberthür coll., Brit. Mus. 1927-3; Lectotypus, designated by Zsolt Bálint and Kurt Johnson 20.II.1994, Budapest", BMNH.

This placement allows us to treat the Argentine occurrence of *P. lyrnessa* as follows:

Argentina *Pseudolucia* Species 3—

***Pseudolucia lyrnessa patago* (Mabile), NEW COMBINATION, REVISED STATUS.**

Lycaena lyrnessa Hewitson 1874.
Lycaena patago Mabille 1889, **REVISED STATUS.**
Pseudolucia zembla Bálint and Johnson 1993 (synonym after Bálint 1993b).

Figures. *Adult*— Photoplate IV,E [*lyrnessa*] F [*patago*]; Photoplate V: C,D originally as *zembla*; Bálint 1993a, IIIB, 38-40 (discussed therein under *lyrnessa patago*). *Genitalia*— Figs. 7,17; Bálint and Johnson 1993, ♂B,♀B.

DIAGNOSIS. ***Wings.*** Small (7.5-10.0 mm.), easily recognized by lustrous, deeper salvia blue (33D10) of male DFW, DHW ground, females DFW, DHW ground brown invaded by suffusive median orange and costal blue. VHW with "V"-shaped band comprised of rather concisely aligned brownish spots contrasting gray ground. Immediately separable from sympatric *P. charlotte* by unicoloured DFW median area (*P. charlotte* orange colored) and jagged VHW pattern (*P. charlotte* ruptive).

Morphology. Male (fig. 7) showing the genital valvae steeply sloped in the posterior and less produced Baird's angulation (contrasting *P. collina)*, sagum present, uncus strong and horse-shoe shaped (contrasting *P. charlotte*), female terminal tergite typical of species Group (see Bálint and Johnson 1993, 12 fig. B), genitalia with sclerotized terminalia elongate and winged, very narrow compared to congeners (*P. humbert*, *P. shapiroi*) (figs. 17,20,21).

DESCRIPTION. See Bálint and Johnson 1993: 6 (under *P. zembla*).

TYPES. See above discussion and Bálint 1993b.

DISTRIBUTION. ***Spatial***: Fig. 1. Represented by few specimens from Argentina. Specimens from Nahuel Huapí ("Eastern End"), Camino del Tronador, Río Negro Prov. and Paso del Córdoba, Lago Tromen, Neuquén Prov. suggest an altitudinal range of 800-1200 m. More well known from Chile, with numerous specimens from Coquimbo Region localities south to the Bío Bío Region at altitudes of 2000-4300 m. ***Temporal***: dates on Argentine specimens range from November to December.

REMARKS. There is a great need for data on the life histories of austral "blues" before any generalities can be drawn concerning their biogeography. The distribution of *P. lyrnessa* warrants comparison to some austral pierids reviewed by Shapiro (1991), e.g. *Tatochila mercedis* Eschscholtz and *T. theodice* Boisduval which occur in Patagonia north to Neuquén and south toward Tierra del Fuego. The northward distribution of *P. lyrnessa* appears much like these two pierids. However (as noted above under *P. grata*), Patagonian *Pseudolucia* do not appear to duplicate this distribution southward. This may result because of the lack of suitable lycaenid foodplants, a matter which can only be further enlightened by much-needed life history work on these austral "blues". However, some interesting comparisons can be made from apparent sister taxa indicated by morphological study.

First of all, as with pierids, there are sister pairs of species or subspecies occurring on the respective eastern and western flanks of the Andes. The distributions of little-known *P. grata* in Patagonia and its distinctive sister species (*P. annamaria* and *P. plumbea*) in the Santiago region of Chile offer a good example when compared to the *P. lyrnessa* complex (as redefined herein by a number of new synonymies). Reminiscent of the the taxonomically isolated pierid *Eroessa chiliensis* Guérin, *P. lyrnessa* appears as a very distinctive and relatively homogenous lineage compared to the "*grata/ annamaria/ plumbea*" triad. *P. lyrnessa* is widely but disjunctly distributed in Chile; it appears mesically adapted but barely crosses into Argentina via the mountain passes. Considering variation in currently known samples, the isolates of *P. lyrnessa* scattered in Chile from the Andean flank to sea level appear only of subspecific worth. This contrasts the entities of the sister triad wherein historical circumstances appear to have produced three quite distinctive species. Regarding this difference, the *lyrnessa* complex may illustrate either recent dispersion (*sensu* Platnick 1976) into restricted niches or vicariance of a larger ancestral range into farflung and hardly-differentiated isolates. Further insight concerning these contrasting regional distributions in *Pseudolucia* may come only from life history information.

Another example of the urgent need for life history information concerns the commonly collected species *P. andina*, a species far more well known than most *Pseudolucia* but showing much the same distribution as *P. lyrnessa*. *P. andina* is collected often and "weedy roadside" is a comment frequenting *P. andina* labels. One might infer from this that *P. andina* is an ecological generalist perhaps increasing its distribution with the aid of deforestation and domestic farming. For instance, Shapiro (1991: 179) notes deforestation in and around the Nahuel Huapí "Lake District" commenced in the 19th Century. However, current distributional data on *P. andina* shows it to be sympatric with highly endemic taxa like the pierid *Colias mendozina* and polyommatine congeners *P. shapiroi* and *P. argentina*. Shapiro (in litt. to Johnson) says his experience does not suggest *P. andina* as a weedy opportunist; rather, the insect is already at home in the barren areas of naturally treeless regions. Frequency of "weedy roadside" data on labels for *P. andina* may simply reflect an ancillary habitat for the butterfly more often frequented by collectors. Schwartz (1989) and Smith, Miller and Miller (1994) have noted that little is known of the natural habitats of certain rare West Indian *Calisto* (Satyridae). Known specimens of these species appear to represent fortuitous collections of individuals which have strayed into cultivated areas with further sampling of the cultivated areas and their surroundings yielding no additional examples of these distinctive taxa. Consistent with this, other *Calisto* species once considered poorly known, have proven readily collectable when their natural habitat was finally located. We suspect that the situation is similar in some austral "blues". Such species will need to be located in their natural habitats and then studied as to life history and ecology. On this larger picture will clarify the factors governing species distributions and circumstances concerning individual specimens.

MATERIAL EXAMINED. Argentina. 2 ♂♂ 1♀: Nahuel Huapí, Easten End, Terr. Río Negro, 17.IX. 1926, F. & M. Edwards (BMNH); 1♂: Río Negro 16: S. C. de Bariloche, Camino del Tronador, 800 m, 29.IX. 1978, Misión Científica Danesa (ZMK); 1♂: Neuquén 20: Paso del Córdoba, 1200 m, 1.XII.1981, Nielsen & Karsholt (ZMK); 2♂♂: Neuquén 42: Lago Tromen, 1000- 1100 m, 1.XII.1981, Nielsen & Karsholt (ZMK).

RECENTLY DESCRIBED *PSEUDOLUCIA* SPECIES OCCURRING IN ARGENTINA

The present authors described three new species of *Pseudolucia* from Argentina in 1993 noting the scarcity of material available compared to large recent samples from Chile. Additional material has since allowed clarification of some of these names. In addition, Balletto (1993) proposed a new species name from Argentine material and the specimens representing this taxon have required review by us in relation to the larger Argentina fauna.

From Neuquén and Mendoza material (some received while their original manuscript was in press) Bálint and Johnson (1993) described *Pseudolucia charlotte*. Subsequently it was discovered that a small and oddly marked "male" in Mendoza samples was a female representing a distinctive but undescribed austral entity which must now be separated from *P. charlotte* as discussed below.

Argentina *Pseudolucia* Species 4—

***Pseudolucia charlotte* Bálint and Johnson**

Pseudolucia charlotte Bálint and Johnson 1993.

Figures. *Adult*— Photoplate IV: F,G; V: Q,R; Bálint 1993a, IIIB,43-44. *Genitalia*— Figs. 4,18; Bálint and Johnson 1993, ♂I,♀I.

DIAGNOSIS. A *chilensis*-Group member, whose males' characteristic DFW medial burst of dark orange over iridescent blue will subsequently require separation from females of a new species (*P. shapiroi*, below) which show a bold DFW dark orange patch against blue-gray ground. *P. charlotte* is otherwise recognized by the V-shaped VHW band appearing more ruptive than in *P. collina* and *P. lyrnessa* of the *plumbea*-Group. The female of *P. charlotte* is brown with a burst of FW orange.

DESCRIPTION. See Bálint and Johnson 1993: 17.

DISTRIBUTION. ***Spatial***: Fig. 2. Known from Neuquén Province. ***Temporal***: dates of specimens range from early to late December.

REMARKS. The species distinction of this taxon has been further strengthened by our location of the types of *Lycaena patago* Mabille.

MATERIAL EXAMINED. 1♂, Valle de las Leñas, Prov. Mendoza, 3. XII. 1989, A. M. Shapiro (Holotype) (AMNH); 3♂♂ 4♀♀: Pucará, Neuquén (Allotype, Paratypes) (AMNH: 1♂ 2♀♀); LPC: 1♂ 1♀; IML 1♂ and Allotype); 2♂♂ 1 f: Pucará, Neuquén, 8-20. XII. 1952, S. Schajovskoj (Paratypes) (ZMK: 1♂ 1 f; HNHM: 1♂).

Balletto (1993: 237) described an entity "*Cherchiella argentina*" which represents a species in the *Pseudolucia* clade and takes priority over two other names proposed by the present authors. We treat this species next in order to have Balletto's name available for subsequent diagnostic discussions.

Figures 1 and 2

Argentinean distributions of high Andean and austral taxa of *Pseudolucia* Nabokov, 1945.

Fig. 1. Distributions of:

○ ***P. andina andina***
◐ ***P. andina neuquenensis***
⊙ ***P. grata***
● ***P. lyrnessa patago***

Fig. 2. Distributions of:

○ ***P. argentina***
◐ ***P. charlotte***
◧ ***P. chilensis***
⊕ ***P. humbert***
● ***P. lanin***
⊙ ***P. shapiroi***

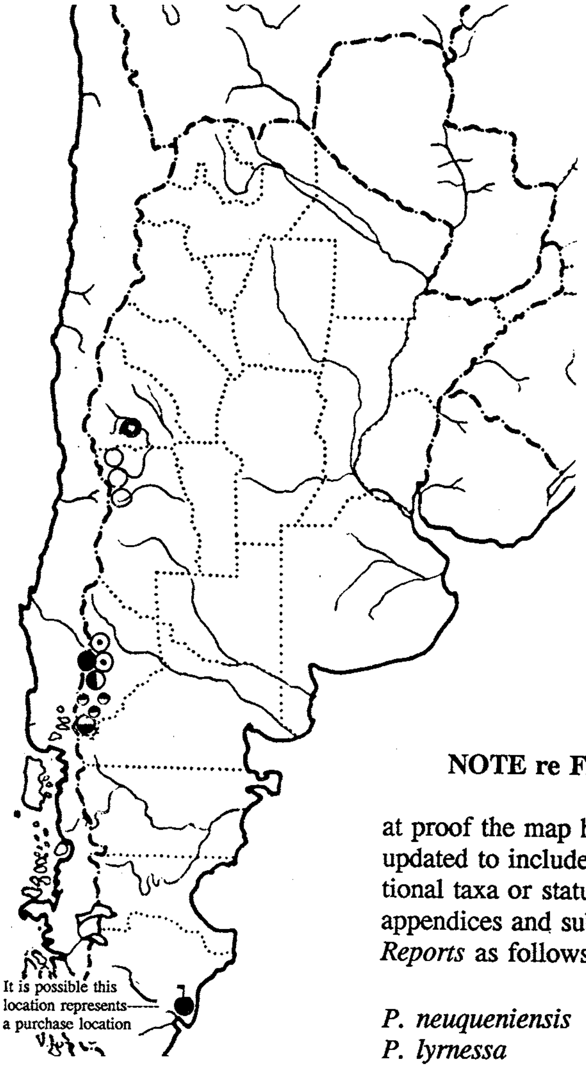

Fig. 1

NOTE re FIG. 1

at proof the map has been updated to include additional taxa or statuses of appendices and subsequent *Reports* as follows:

P. neuqueniensis	◐
P. lyrnessa	●
P. patago	●
P. tamara	◓
P. whitakeri	◒
P. talia	◉

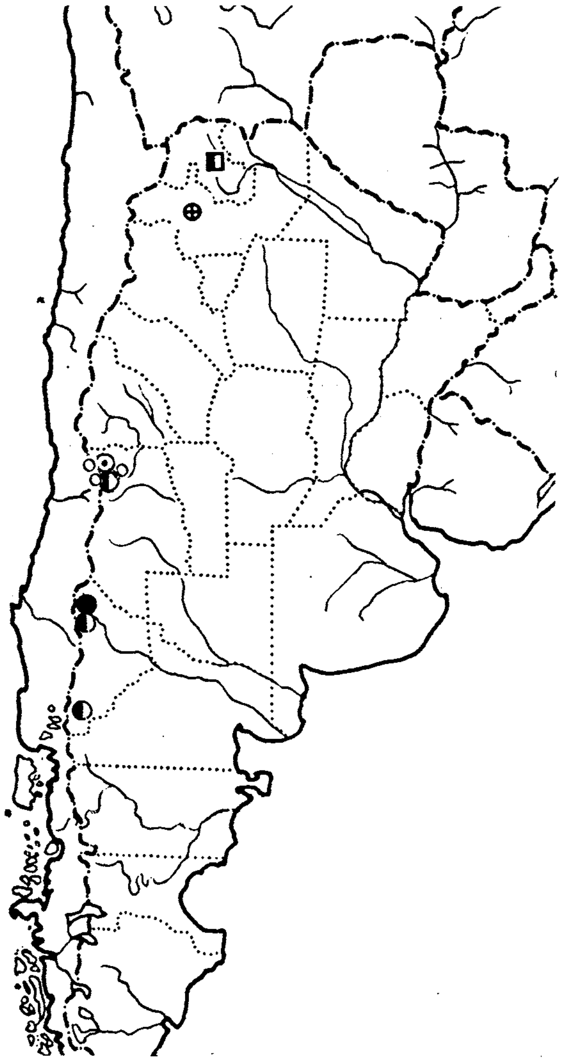

Fig. 2.

Symbol location— given the nature of some historical data (e.g. historical citation of generalized regions or locales [like "Nahuel Huapi", etc.]) symbols for more well-known species may represent more than one, closely clustered, locality. Regarding some new species (see cf. *tamara*), if only a few discrete localities are known, efforts are made to protray their geographic spread with a smaller symbol.

For distributions of Chilean *Pseudolucia* see Benyamini, 1995, **UWSP *Report* 52**

Argentina *Pseudolucia* Species 5—

Pseudolucia argentina **(Balletto)**
Cherchiella argentina Balletto 1993.
Pseudolucia sirin Bálint, 1993, **NEW SYNONYM.**
Pseudolucia aconcagua Bálint and Johnson, 1993, **NEW SYNONYM.**

Figures. *Adult*— Photoplate IV: H; V: ZZ originally as *aconcagua*; Bálint 1993a, IIIB,45 (originally as *sirin*) [adult *argentina* not figured by Balletto]. *Genitalia*—Figs. 6,19; Bálint and Johnson 1993, ♂Q,♀L (*aconcagua*); Bálint 1993a, 112 (*sirin*).

DIAGNOSIS. Somewhat smaller than *P. grata*; male DFW,DHW lustrous "grainy" azure blue strewn over brown, female blue. Both sexes with margins uncheckered and with prominent black CuA1 spot on DHW, VHW. Submargins of male with thin yellowish DFW, DHW band (reminiscent only of the white band seen in *P. sibylla*). VHW of both sexes showing, in addition to succinct markings extending from 1A+2A to M1, equally emphatic marks invading the entire discoidal area of cells CuA1 to 1A+2A; postmedial area covered by prominent white auroras.

Female Morphology showing a robust but simple eighth tergite; genitalia with winged habitus like the *plumbea*-Group (see Remarks), terminalia with central elliptical element and winglike flaps both robust. *Male Morphology* showing valvae greatly produced in the posterior, generating a nearly entire anterior slope devoid of Baird's angulation; terminal rostellum sharply hooked.

DISTRIBUTION. ***Spatial***: Fig. 2. Known exclusively from the Aconcagua region (Mendoza Province) at high elevation. ***Temporal***: dates of specimens range from the middle of November to the very beginning of January.

REMARKS. Unfortunately, this distinctive species has received three different names almost at the same time.

Balletto (1993: 237) described the entity as *Cherchiella argentina* (with the type locality somewhat obscured by a misspelling from label data) based on a single historical specimen collected by Elwes (1903: 288-289, cf. Bálint 1993: 20). Bálint and Johnson (1993: 22-23), in a description added at proof, gave the species the name *Pseudolucia aconcagua* based on distinctive recent samples received by Johnson while their paper was in press. Meanwhile, Bálint had elaborated the collection of the BMNH and, from three specimens of Elwes, described *Pseudolucia sirin* (Bálint 1993a: 20). Since Johnson and Bálint were able to exchange material of *P. aconcagua*/*P. sirin* material only after publication of Bálint (1993a) and Bálint and Johnson (1993) a synonym resulted.

The systematic position of *P. argentina* is important regarding the monophyly and phylogeny of *Pseudolucia*. The species was noted by Bálint and Johnson (1993) as the easternmost (and specifically Argentine) member of the central Chilean *sibylla*-Group but also suggesting, by the female genitalia, a close relationship with the *plumbea*-Group. This assessment holds up well with the aggregate of the historical material now considered. If the genital characteristics of both genders of *P. argentina* are considered, one must actually "weight" a specific character to determine which "species-Group" it belong to. Thus, in a cladistic context, although the *sibylla*- and *plumbea*-Groups form a clear cladistic couplet in *Pseudolucia*, *P. argentina* arises as a basal branch from this network and does not belongs clearly in either (*cf.* female genital structures of figs 13-21). Thus, it again is a good example of the strong monophyly of *Pseudolucia*.

The uniqueness of *P. argentina* is further emphasized by its occurrence in the endemic biological community containing *Colias mendozina* Breyer, 1939 (Shapiro 1991: 181-182).

MATERIAL EXAMINED. Argentina. 1♂ 1♀: Parque Pral. Aconcagua, Prov. Mendoza, between Laguna Horcones and El Durazno, ca. 8400', 30. XI. 1989, A. M. Shapiro (Holotype and Allotype of *Pseudolucia aconcagua*) (AMNH); 8♂♂: Parque Pral. Aconcagua, Prov. Mendoza, vic. Confluencia, below Lower Horcones Glacier, 11000-12000', 15. XI. 1989, A.M. Shapiro (Paratypes) (AMNH: 4♂♂; HNHM: 2♂♂; BMNH: 1♂; UCD: 1♂); 3♂♂: Cerro de los Fosiles, nr. Las Leñas, ca. 9600', 3.XII. 1989, A.M. Shapiro (Paratypes) (UCD); 3♂♂: (Chile-Argentina), Puente del Inca, Elwes (Holotype and Paratypes of *Pseudolucia sirin*) (BMNH); 3♂♂: Aconcagua, 3350 m., 2. I. 1993, leg. D. Benyamini (HNHM); 1♀: Los Puguios, near Puente del Inca, Mendoza, 2400 m., 2. I. 1993, leg. D. Benyamini (HNHM).

Bálint and Johnson (1993: 17) described *Pseudolucia lanin* based on a single specimen from Lago Hermosa, Parque Nacional Lanín. Given the isolated type specimen, the authors suggested that additional material might eventually indicate the taxon as a subpopulation of some other species. Contrary to this original notion, however, study of additional material and characters confirms the distinctness of *P. lanin* and indicates it is a major faunal component of the genus in Argentina and immediately adjacent areas of Chile. Accordingly, the original description of *P. lanin* is supplemented below to add additional information, including first reference to the female. Balletto (1993) appears to have identified this entity as *Lycaena patago*, including the entity in his genus "*Cherchiella*" as *C. patago*. This misidentification, now apparent from the type of *Lycaena patago*, is also discussed below.

Argentina *Pseudolucia* Species 6—

***Pseudolucia lanin* Bálint and Johnson**
"Cherchiella patago" sensu Balletto 1993
(***nec*** *patago* Mabille 1899, misidentification)
Pseudolucia lanin Balint and Johnson 1993: 17.

Figures. *Adult*— Photoplate IV: I,J; V: S. *Genitalia*— Figs. 8,15; Bálint and Johnson 1993, ♂I,♀I.

DIAGNOSIS. ***Wings*** with DFW, DHW ground gentian blue lacking the FW orange flush that would superficially suggest affinity to *P. charlotte*; smaller than *P. plumbea*, more similar in size to *P. argentina*. ***Genitalia*** of male with distinctive habitus– rostellum club-ended, valvae gently sloped anteriorly (differing here from *charlotte* and *plumbea*-like taxa), aedeagus surrounded by strongly developed sagum (not present in *grata* and *argentina*); female with tergite eight showing short apodeme, genitalia showing slender winged habitus.

DESCRIPTION. ***Male***. See: Bálint and Johnson 1993: 17-18; FW length: 8.5-10.0 mm (n=5). ***Female***. Similar to male on VFW, VHW; DFW ground orange-colored with wide brown costal and marginal border, veins prominently brown, basal area suffused with ultramarine blue scales; DHW brown with blue basal suffusion along veins; margin with slightly lighter, hardly visible, intercellular patches; fringes as in male. FW length: 8.5-10.5 mm. (n=6). ***Male Tergal Morphology and Genitalia*** Fig. 8. *Sipc* lacking. Genitalia with valvae shape relatively expansive, terminal rostellum long and strongly hooked, uncus weaker compared to *"chilensis*-Group" relatives, gnathos long and very thin; aedeagus with strong bulbous subzonal portion, suprazonal portion small and pointed, about one-fifth length of subzonal portion; sagum large and with strong spiny scletrotization at base. ***Female Tergal Morphology and Genitalia***. Fig. 15. *Sipc* showing laterally robust eight tergite with a simple and relatively short apodeme. Genitalia with sclerotized terminalia slender and with winglike sclerotized element tapered posteriorly about the same as the terminus length; central element slender with bulbous, slightly pointed, apex and wider, open, anterior.

DISTRIBUTION. ***Spatial***: Fig. 2. Currently known from Neuquén region in Argentina and adjacent along the Chilean-Argentine border, elevation 1100-1300 m. ***Temporal***: known from the first half of December.

REMARKS. Sexual Dimorphism in *P. lanin*. In wing characters the sexes of *P. lanin* can be distinguished by the blue DW ground from *P. andina* and by the jagged crescent like elements forming the medial band of VHW from the various "*plumbea*-like" taxa (cp. Bálint 1993a, photoplate IIIb and IVa, figs. 45-49 and 51-52). Just as *P. charlotte* resembles *P. collina* and *P. lyrnessa* in its wing characters, *P. lanin* with its *andina*-like appearance cannot be misidentified as *P. charlotte*. This is why Bálint and Johnson (1993: 18) noted that *P. lanin* cannot be considered as a subspecies of *P. charlotte* or *P. patago* [concerning *P. patago* see details above regarding its new status with *P. lyrnessa*] as might have been suggested by workers considering only the original single specimen and the geographically "intermediate" location of the type locality. Too often in austral and high Andean Lycaenidae descisions concerning taxonomic status have been made by cursory consideration of specimen localities instead of structural analysis of the specimens themselves. Johnson (1992: 45-57 and 136-148) pointed out numerous cases in the Andean Eumaeini genus *Rhamma* were heterogeneous (even noncongeneric) assemblages had long been recognized as single species even though differences as obvious as presence or absence of outstanding forewing androconial "brands" were apparent in specimen series.

Morphological Characters of *P. lanin*. The male genitalia of *P. lanin* shows a remarkably developed sagum typical of the "*chilensis*-Group" (like *P. chilensis* and *P. charlotte*) and also taxa like *P. andina*, *P. parana*, *P. collina* and *P. lyrnessa*. This well developed male genitalic structure is not represented amongst other "*plumbea*-like" taxa (or the species belonging to the *sibylla*-Group). Accordingly, *P. lanin* can be easily separated from any *plumbea*-like specimen by the presence of the male genital sagum. The valval shape of *P. andina* is so curious that it cannot be mistaken for *P. lanin* (cf. figs 3,8,9). The female genital morphology is most similar to that of *plumbea*-Group with differencies primarily in the apical and tornal parts of the central element, and shorter wings with a generally tubular slender habitus. This *plumbea*-like habitus in the female (compared to the affinities indicated by the males) again underscores the over structural unity of the genus and suggests the comparative problems that would result from a further generic splitting of *Pseudolucia* (see Balletto 1993). Indeed it is problematic to determine an absolute "species-Group" position for *P. lanin* as noted below.

***P. lanin* and the "*andina*-Group" of *Pseudolucia*.** The "*andina*-Group" of *Pseudolucia* was originally defined by the male genitalia lacking hooklike rostellum (Bálint and Johnson 1993). Bálint and Johnson (1993) noted that their original diagnoses would follow traditional characters and that further studies would be needed to amplify the importance of other characters not traditionally used for the group. Accordingly, the presence of a sagum in *P. lanin* has not been discussed hitherto. *P. lanin* and *P. andina* both have a prominent sagum (cf. figs. 3,8,9). Accordingly, a species group nomenclature based on more characters than the traditional ones suggests it is better to place *P. lanin* in the *andina*-Group of *Pseudolucia*.

As noted above (see Bálint and Johnson 1993, figs. F-I), the female genitalia of *P. charlotte* are quite similar to

Figure Captions for Genitalic Illustrations

Figs 3-10. Male genitalic armatures of *Pseudolucia* in dorsal view.

3. *P. andina andina*, Valle Las Leñas, Mendoza.
4. *P. charlotte*, holotype, aedeagus removed.
5. *P. grata*, Tecka, Chubut.
6. *P. argentina*, holotype of *P. sirin* Bálint, 1993, aedeagus removed.
7. *P. lyrnessa patago*, Pucara, Nequén, aedeagus removed.
8. *P. lanin*, Lago Tromen, Nequén, aedeagus removed, penis in lateral view, sagum in dorsal view.
9. *P. andina nequeniensis*, holotype, aedeagus removed.
10. *P. chilensis*, Choapa, 5 km N of Illapel, Chile, aedeagus removed, sagum and penis in lateral view.

Figs 11-21. Different configurations of female genitalic terminalia in *Pseudolucia*.

11. *P. andina nequeniensis*, Nequén, in dorsal view.
12. *P. lyrnessa patago*, Nahuel Huapí, Nequén, in lateral view.
13. *P. chilensis*, Coquimbo, C. Chile, in dorsal view.
14. *P. aconcagua*, paratype, in dorsal view.
15. *P. lanin*, Paso Puyehue, Nequén, in dorsal view.
16. *P. collina*, Elqui, Vicuña, C. Chile, in dorsal view.
17. *P. lyrnessa*, Coquimbo, C. Chile, in dorsal view.
18. *P. vera*, Araucania, S. Chile, in dorsal view.
19. *P. argentina*, Puente del Inca, Mendoza, in dorsal view.
20. *P. humbert*, holotype, in dorsal view.
21. *P. shapiroi*, holotype, in dorsal view.

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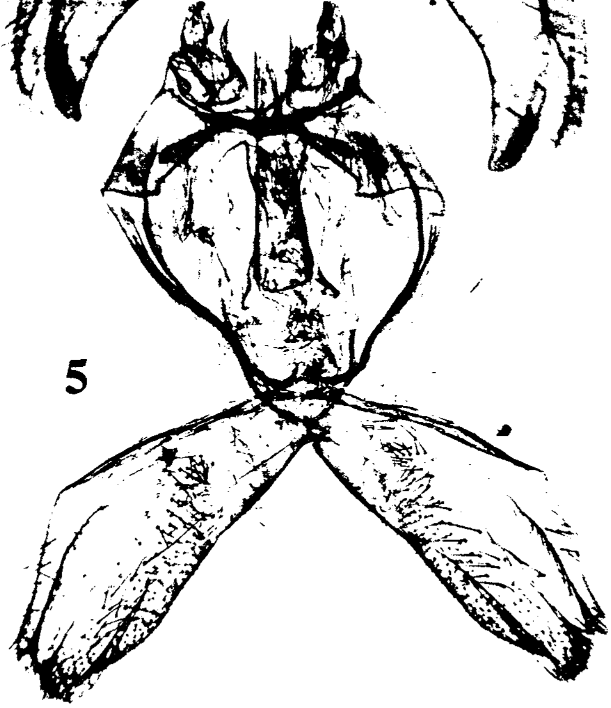

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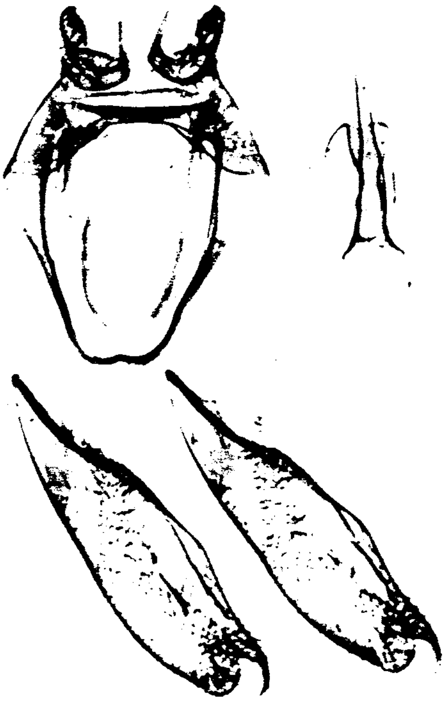

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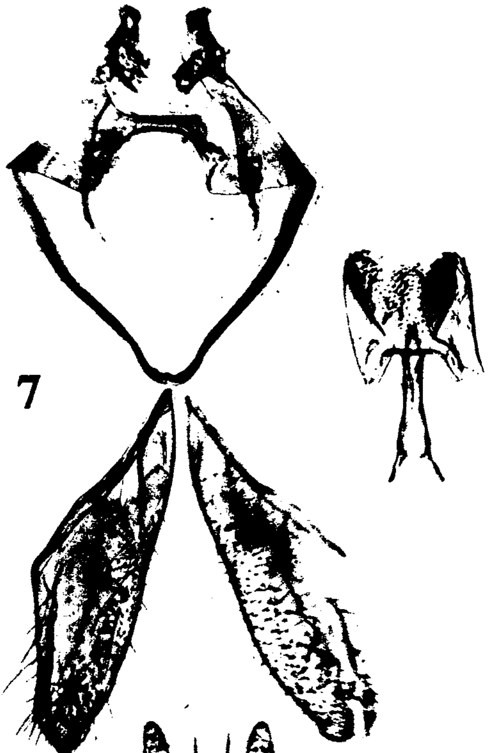
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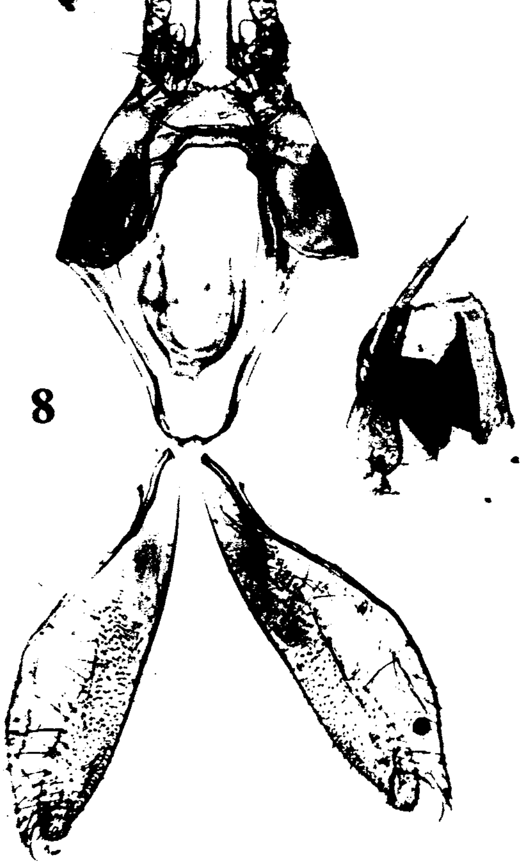
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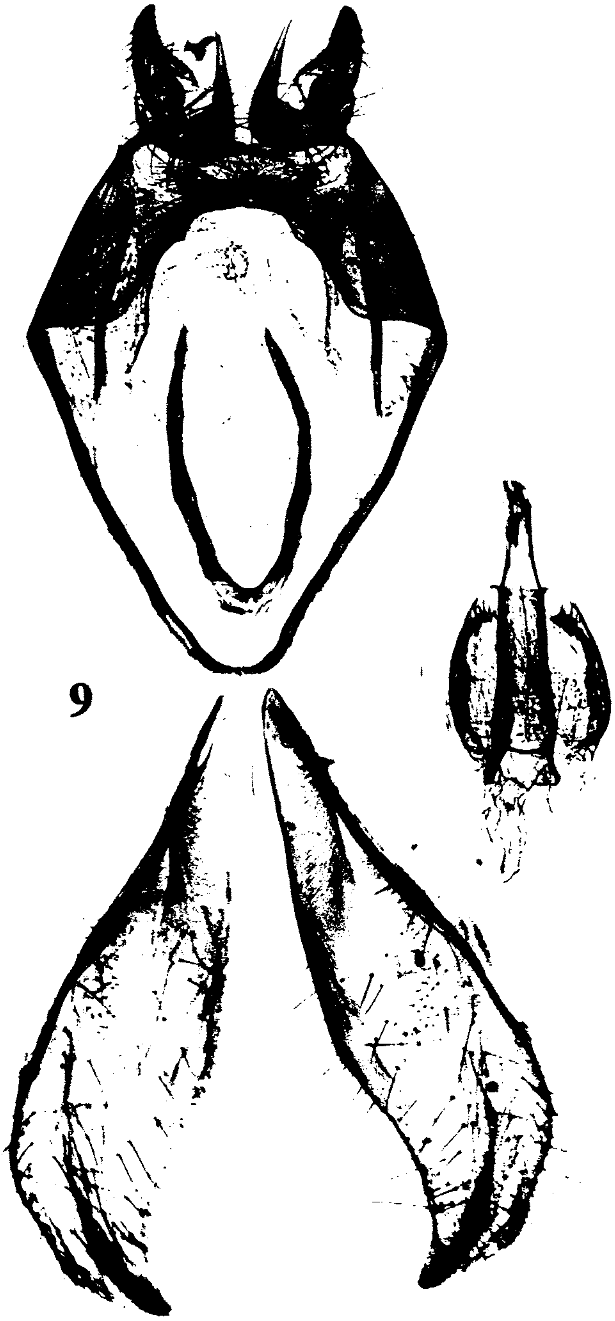
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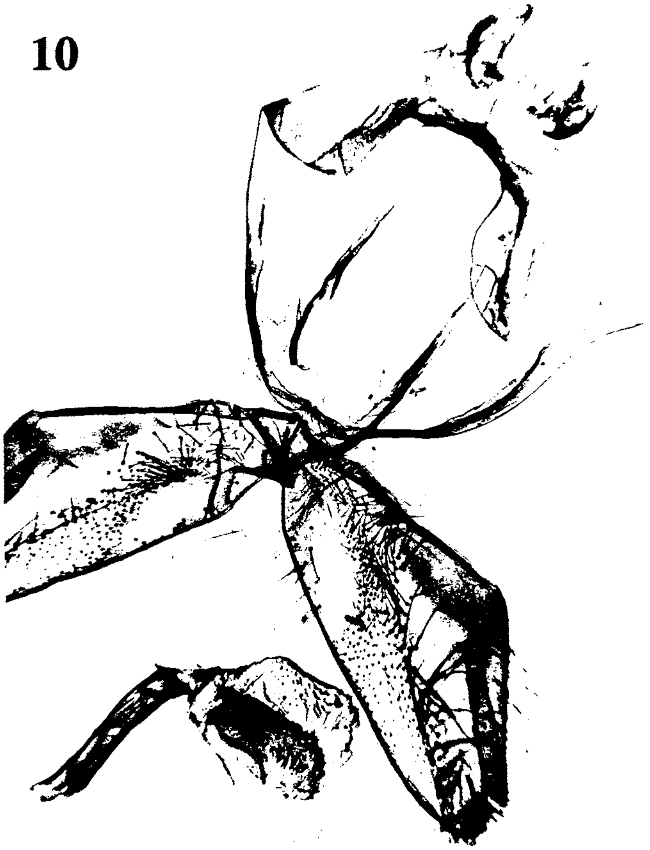

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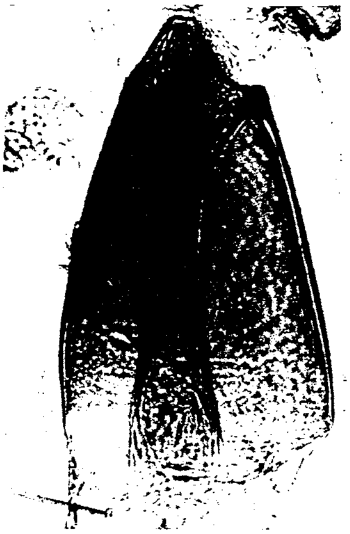

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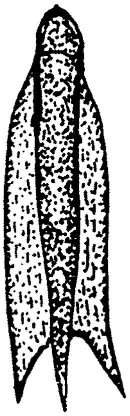

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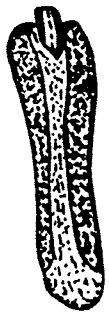

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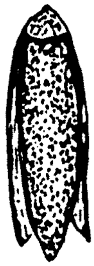

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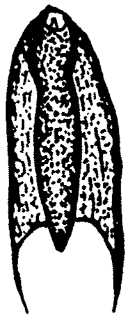

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those of *P. chilensis* and *P. andina* has a slightly similar situation with its tubular but winged terminalia (see above Diagnosis of *P. andina*). With the female of *P. lanin* now known it must be emphasized that its genitalia appear quite intermediate between the conditions associated with the traditional views of the "*andina-*" and "*plumbea*" Species Groups. *Pseudolucia lanin*, belying its original representation by a single specimen now appears as a major austral fauna component of *Pseudolucia*. Its diverse and polymorphic wing and genital facies further attest to the problem of "quick-fixing" subdivisions of the genus based on arbitrary characters.

MATERIAL EXAMINED. Argentina. Lago Hermosa, Parque Nacional Lanín, xi. 1949, leg. Schahovskoj (Holotype, AMNH); 3♂♂, 3♀♀: Neuquén, 45: Paso Puyehue, 1300 m, 10.xii.1981, Nielsen & Karsholt (ZMK). Chile. 2♂♂,3♀♀: Osorno 37: Parque Nacional Puyehue, Antillanca, 1100-1300 m, 11.xii.1981, Nielsen & Karsholt (ZMK).

NEW SPECIES OF ARGENTINE *PSEUDOLUCIA*

Our treatments above of various *Pseudolucia* taxa occurring in Argentina result in distinction of two additional species which must be described as new. These populations further underscore the diversity and phenetic complexity of *Pseudolucia* in austral South America, strongly paralleling the taxonomic and biogeographic complexity seen in the genera *Tatochila* and *Hypsochila* of the Pieridae (Shapiro 1991: 154-169).

Considering the divergent facies of these new species, we suspect there will be further eventual additions to the *Pseudolucia* in Argentina. Hopefully, these descriptions, following on the entries above, will provide a context for ready recognition of additional Argentine *Pseudolucia* should these occur.

Argentina *Pseudolucia* Species 7--

Pseudolucia humbert Bálint and Johnson, NEW SPECIES

Figures. *Adult*— Photoplate **IV**: K. *Genitalia*— **Fig.** 20.

DIAGNOSIS. ***Wings***. A small species (FW alar 9.0 mm.), resembling *P. vera* and *P. lyrnessa* in DHW pattern but also close to *P. grata* (see above) with its blue female DHW ground color. FW shape expanded with pointed apex. VHW with almost antemarginal occurrence of medial marks betraying a V-shaped appearance.

Morphology with female showing sclerotized genital terminalia elongate and winged, but with somewhat wider central element compared to *P. lyrnessa*.

DESCRIPTION. ***Male***. Unknown. ***Female***. Costa straight, expanded, apex pointed, outer margin relatively short. DFW with extended submarginal orange suffusion: median and submedian area orange, marginal part dark brown, anal part bonnie blue (Maerz and Paul 1950: 43/A12) coloured; DHW ground bonnie blue with greyish submarginal area and thin black border. VFW ground lighter beige with black, small and indistinct submarginal polyommatine markings, margin lighter grey with indistinct antemarginal aptterns, anal area darker grey. VHW ground with "V" shaped band of somewhat cinnamon ground, basal part darker, marginal area slightly polyommatine patterned. FW alar length: 9.0 mm (holotype). ***Female Genitalia***. Fig. 20.

Showing "winged" habitus, central element stronger with a pointed apex. *Sipc* is not evaluatable (see Remarks).

TYPE. Holotype female: Argentina, Salta 72: Rosario de la Frontera, Los Baños, 8.iv.1979, Misión Científica Danesa. Slide: M.K. 29. Deposited in ZMK.

DISTRIBUTION. ***Spatial***: currently known only from SE Salta, elevation 1100-1300 m. *Temporal*: known only from the type data.

REMARKS. The curiosity of the specimen and its tentative determination was already noted (Bálint 1993a: 20), but it could not be throughly analyzed in the context of the originally small Argentine samples and the poor condition of the genitalic dissection which accompanies the holotype. This problem is sufficiently clarified by the morphological and specimen series data we have reviewed above.

P. humbert shows close affinity to *P. lyrnessa* as we have redefined that species herein. Given our new combinations and synonymy regarding the names *P. patago*, *P. zembla* and *P. lyrnessa*, the distinction of *P. humbert* appears even more compelling. In fact, given these affinities it appears probable that more species may eventually be discovered in a group comprised by *humbert*, *lyrnessa* and relatives. Thus, further exploration of the austral polyommatine fauna is emphasized. In fact, as noted in another paper herein, biological studies of isolated populations of *Pseudolucia* in Chile have already pointed to additional species in that fauna. The same must be true in Argentina, as has been show in various other austral butterfly groups (cf. Johnson et al. 1992 and Shapiro 1991).

The type locality is subtropical forest according to the "list of sampling localities" of Schmidt-Nielsen (Madsen et al., 1980: 11). The specimen may be mislabelled (note the two previous localities, No. 70 and 71, are situated in the subtropical bush steppe zone [the "Monte"]). However, it is not impossible that an ancient congener might represent a different habitat-- as has been noted first by Riley (1975) and then again by additional species (Johnson and Matusik 1988, 1992; Schwartz 1990; Smith, Miller and Miller 1994), new Caribbean species of *Leptotes* have been associated with broken or dense mesic woodland. It is also worth noting that *P. humbert* hails from quite far north in Argentina, an area where (in numerous publications cited in Johnson et al. 1992) there has been concerted collecting of Lepidoptera by locals over the last fifteen years. It is thus likely that additional specimens of this species will be readily located once the present description and figures have been adequately circulated.

ETYMOLOGY. Named from Humbert, a central character in Nabokov's novel *Lolita*. We refrain here from adding the genitive "i" since the character was imaginary and obviously masculine.

Argentina *Pseudolucia* Species 8—

Pseudolucia shapiroi **Bálint and Johnson,**
NEW SPECIES

Figures. *Adult*— Photoplate IV: L. *Genitalia*— **Fig.** 21.

DIAGNOSIS. ***Wings.*** FW shape not expanded, apex rounded. Very small species (FW alar 7.0 mm.) female standing out by the presence a brilliant DFW burst of well-defined orange on the FW like males of *P. charlotte* (see Remarks) but over a blue-gray (wide DFW margin nearly gray-white), not dark iridescent blue ground. On VFW, VHW resembling *P. lyrnessa* and *P. humbert* but with more random occurrence of medial marks betraying a the V-shaped hindwing band. ***Morphology*** with female showing sclerotized genital terminalia elongate and winged, shorter and stronger in the central central element compared to *P. lyrnessa*.

DESCRIPTION. ***Male.*** Unknown. ***Female.*** Costa straight, apex rounded, outer margin relatively long. DFW median and submedian area orange, marginal part ground dark brown with large whitish blue patches in each cell, anal part campanula blue (Maerz and Paul 1950: 42/B8) coloured; DHW ground unicoloured campanula blue with thin black border and very small antemarginal spots attached to margin. Fringes chequered. VFW ground cinnamon orange (Maerz and Paul 1950: 12/E7) with black, small and indistinct submarginal polyommatine markings, margin lighter grey with indistinct antemarginal patterns, anal area slightly patterned. VHW ground beige with darker "V" shaped band of somewhat smoke brown (Maerz and Paul 1950: 16/A2) ground, basal part darker, marginal area slightly ityloid patterned. FW alar length: 7.0 mm (holotype). ***Female Genitalia.*** Fig. 21. Showing "winged" habitus, central element stronger but shorter than wing about 1/3 wing's length, somewhat bulbous, wing slender as in *P. lyrnessa*. *Sipc* showing robust eight tergite. Dorsal process absent (present in *P. lyrnessa*), ventral apodeme short but strong, hooked.

TYPE. Holotype female: Argentina, Prov. Mendoza, Valle de Las Leñas, ca. 7000', 3. XII.1989, A.M. Shapiro. Deposited in AMNH.

DISTRIBUTION. ***Spatial***: currently known only from Mendoza, at elevation ca. 2500 m. ***Temporal***: known only from the type data.

REMARKS. As it turns out, the discoverer of this species, Arthur M. Shapiro, was more observant than the present authors in pointing out this species as something remarkable.

Dr. Shapiro sent us some austral Polyommatinae just as our 1993 paper was going to press and, in a cover letter, pointed out the vivid orange FW on the species now noted as Type above. At the time, we were fixated on the unusually brilliant burst of orange on males of what we were describing as *P. charlotte* and, considering Shapiro's specimens as the first "in hand" series of this remarkable Argentine species, used a Shapiro male as the holotype. Having responded to Shapiro that the specimen drawn by him (with pen and ink) in his cover letter was a "bright" male of "our" *P. charlotte*, the junior author designated a type male of *P. charlotte* for the AMNH and immediately shipped the entire lot to the senior author even as Bálint and Johnson (1993) went into print. Fortunately, the smaller and brighter orange Shapiro specimen (immediately questioned as to gender by the senior author) was never listed or figured as part of *P. charlotte*. The latter mistake might have been made were the authors not wary of choosing "extreme" specimens as types. Dissection of the "small" "bright" additional specimen of "*P. charlotte*" indicated the specimen was not a male and thus showed not only external facies unknown in any previous *Pseudolucia* species but unique internal characters as well. As a result Argentina has yet another distinctive *Pseudolucia* species about which much further knowledge must be sought. Clues to the uniqueness of this little species can be found in noting that Shapiro also collected *Phulia nymphula* with the type specimen (Shapiro 1991: 176, Plate IV/E-F) as well as three *Hypsochila* specimens whose taxonomic position could not be readily interpreted (Shapiro 1991: 169, figs 18-19). As Shapiro notes, there is a distinctive Argentine fauna in this region which must be studied in far more detail to assess it distinction and significance amongst the high Andean and austral biota. This is one of our motivations for immediately describing this unusual new *Pseudolucia* species.

ETYMOLOGY. Named for Dr. Arthur M. Shapiro who collected the type and noted it as most probably an undescribed species.

RECENT ADDITION TO ARGENTINE *PSEUDOLUCIA* FAUNA

Argentina *Pseudolucia* Species 9—

Pseudolucia chilensis **(Blanchard)**

Figures. *Adult*— Photoplate V: O,P; Bálint 1993, IIIB: 31,21. *Genitalia*— Figs. 10,13; Bálint and Johnson 1993, ♂H,♀H.

DIAGNOSIS. ***Wings***. Unmistakable due to the spotted habitus of the VFW,VHW in which each cell in the medial/postmedial area of the VHW is marked with a crisp white-haloed black lunule over orange FW ground and yellow to tan HW ground. Male DFW,DHW with brown to ttawny ground; female orange throughout FW medial area; both sexes submargins' marked throughout with thin orange dashes.

Female Morphology showing eighth tergite laterally robust and with thick and stout anterior process; genitalia with sclerotized terminalia robust and tubular, tapering somewhat in dorsal/ventral view to a terminal nodule. ***Male Morphology*** with genital valvae greatly produced in the posterior, steeply sloped to the anterior; terminal rostellum short and stout, arch well below Baird's angulation.

ARGENTINE RECORDS. In review of this paper, Roberto Eisele (Libertador General San Martin, Jujuy, Argentina) reported that he had collected two specimens near his summer home at Huacalera, Jujuy Province, Dept. Tilcara (see site description 53A in Johnson, Eisele and MacPherson 1990). The junior author actually examined one of these specimens in 1991 when he was in Argentina but, at that time, work on *Pseudolucia* had not been initiated and the specimen was not borrowed. Eisele (in litt. to Johnson) reported that the second specimen had been sent to Allyn Museum of Entomology, Florida Museum of Natural History (AME). L. D. and J. Y. Miller (AME) report that this specimen must still be in unaccessioned materials and has not been able to be located. At the present writing, Eisele has been in the United States for several months for special medical care. Since the identification of this species is unambiguous, and the junior author has confirmed the specimens, we include the record here. However, more details (including genitalic examination) of this northern Argentine population are pertinent (Eisele, in litt. to Johnson), especially since a sister species (P. parana Bálint 1993a: 17-18) is known from eastern Brazil. As is well known, various Lepidoptera common in Chile find there way into Argentina in the uplands of Jujuy, Salta and Catamarca Provinces (Shapiro 1991; Johnson, Eisele and MacPherson 1988,1990) and frequency of local collecting in upland areas appears to increase the number of these records. It is worth noting that the junior author has in hand an undescribed species of *Yramea* (Nymphalidae) from this region, collected years ago by Eisele, but lost on loan for many years to L. P. Grey. This species is a sister of a more well-known Chilean *Yramea*.

Acknowledgements

We thank the following curators for access to specimens (including comparative Chilean material)— AME: L. D. and J. Y. Miller; AMNH: F. H. Rindge; BMNH: P. Ackery, C. Smith, J. Pope; FMNH: D. Matusik, A. Newton; HNHM: A.Vojnits; IML: Z. I. de Toledo; MNHN: J. Pierre; UCD: A. Shapiro; ZMK: O. Kaisholt. Also, we

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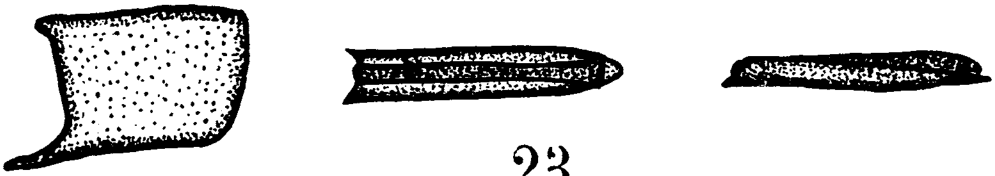

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Figs. 22, 23. Morphological figures for taxa treated in Appendices

thank A. Shapiro, R. Eisele, L. Peña and the late J. Herrera G. for access to private material. We are extremely grateful to A. M. Shapiro and R. Eisele for reading drafts of this paper and offering suggestions. For financial and/or technical assistance we thank the Trustees of the Museum of Natural History, University of Wisconsin (Stevens Point), the Theclid Research Fund (AMNH).

APPENDICES

This foregoing paper was prepared relatively early in the process of assembling this volume and completed for eventual binding in 1994. This preceeded the virtual "explosion" of additional members of the genus *Pseudolucia* which resulted from responses to the authors' initial papers of 1993 (Bálint 1993, Bálint and Johnson 1993) (particularly overseas' workers locating type material), and the infusion of material from Mr. L. Peña during preparation of his Chilean butterfly guide. The cost of preparing the paper a second time was prohibitive; however, it is important to add certain significant data as appendices.

The Identity of "*Lycaena patago*" and "*Itylos grata*" Two New, Historically Misinterpreted *Pseudolucia* Species from Argentina

The body of this paper concerned an overview of the Argentine *Pseudolucia* fauna. We recorded the occurrence of nine species.

For one species, *P. andina*, we described a new subspecies, *P. andina neuqueniensis*, from Neuquén Province. However, ongoing studies of the austral *Pseudolucia* fauna (recorded in numerous subsequent ***Reports*** herein) showed that this conservative approach was incorrect. The more learned concerning the diversity and biology of *Pseudolucia*, the more it was apparent that many more populations were specificially distinct than formerly anticipated (particularly in a region where the polyommatine fauna had been looked upon as depauperate). Thus, in ***Report* 48** we treated the Argentine populations formerly called *P. andina neuqueniensis* as distinctive along with an "*andina*-Group" of *Pseudolucia* including some additional members in Chile. These views were supported both by morphological and biological results (see Benyamini 1995, herein).

In addition, important information was eventually forthcoming concernings the historical names *Lycaena patago* Mabille, *Lycaena lyrnessa* Hewitson and *Itylos grata* Köhler. As has come to be nearly "expected" among the Lycaenidae, the identities of these taxa proved quite different vis-a-vis the types than the subjective guesses of even specialists. In turn, firm identifications of these entities allowed resolution of those represented among remaining specimens or series from Argentina which had previously been uncertain (Bálint 1993).

Material discussed in the entries below is deposited at the following institutions, listed in alphabetical order along with their abbreviations: The Natural History Museum, London (BMNH), Hungarian Natural History Museum, Budapest (HNHM), Museum Nationale d'Histoire Naturelle, Paris (MNHN), Museo Nacional de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM), Zoological Museum, Copenhagen (ZMC), Zoologische Staatssammlung des Bayerischen Staates, Munich (ZSM).

Below are the appropriate taxonomic entries; subsequently we then list the additions to the Argentine fauna within the numerical scheme initiated in the text hitherto.

Location of the Holotype of *Lycaena patago*

Very recently, Dr. Gerardo Lamas located the holotype specimen in the collection of the MNHN and sent it to the senior author for examination (Photoplate IV: E; genitalic figure 22).

TAXONOMIC CONSEQUENCES. The BMNH lectotype selected by Bálint and Johnson, p. 6 herein is invalid. Location of the holotype belies the citations called to our attention by MNHN staff (see p. 5 herein and Horn and Kahle 1936: 162; Viette 1956) suggesting that the original Mabille material had been sold to Oberthür and could be, therefore, in the BMNH. This report was the basis for construing an Oberthür specimen, with data duplicating that reported by Mabille, as syntypical. We had previously (p. 5) opined that a female specimen located by Dr. Lamas at the MNHN could not be the type of *L. patago*. Location of a male attributable to Mabille, however, is compelling since the original description is clear on this point. The Oberthür specimen previously reported by us was clearly conspecific the *Lycaena lyrnessa*, the lectotype of which was designated by Bálint (1993).

TYPE. Holotype, male, specimen labelled: "Lyc. patago, Mab." (written with black ink); "2519, 83" (rounded label, written with black ink); "Museum Paris, Santa-Cruz, Patagonie, Lebrun 1883" (green label, printed); "Holotype ó, Lycaena patago, Mabille, 1889, G. Lamas det. '94" (red label with black border, written with ink, printed only: "Holotype").

DESCRIPTION. Holotype specimen, male, FW length circa 10 mm. Dorsal ground lustrous blue (like *plumbea*), VFW and VHW with wide black marginal border, veins and cells strongly suffused with black scales, VFW with discodal line finely marked; VFW ground orange with large submedian spots, VHW with V-shaped pattern of ruptive brown elements, submedian spots white and roundish. Male genitalia (Fig. 22, left) with valvae elongate like *P. annamaria* with robust and dentate terminal rostellum; aedeagus (Fig. 22, right) without sagum.

REMARKS. According to the male genital structure (fig. 22) the species belongs to the *plumbea* lineage of *Pseudolucia*— male genital sagum absent, uncus horseshoe shaped. The heavily dentate valval rostellum appears to be a unique character further supporting the specific distinction of the taxon.

From all these new data we conclude the following: ***Pseudolucia patago*** **(Mabille), REVISED STATUS.**

A new collina-*like species from Austral Argentina*

Readers will note that in Bálint (1993) the then uncertain meaning of the name "*patago*" was mentioned with regard to a number of confusing specimens of *Pseudolucia* from austral South America. With typical material now validated for both *Pseudolucia lyrnessa* and *P. patago*, the identities of these other specimens can be addressed. Firstly, based on an expanded number of specimens, we describe a new Argentine species below from this original "*patago*" material. In external features, it belongs to the "*collina*-like" group of *Pseudolucia* taxa (see "Wing Resemblance Groupings", Bálint and Johnson 1993: 2). However, the female genital terminalia show it is a member of the *plumbea* lineage of *Pseudolucia* (Bálint and Johnson 1993: 4).

Pseudolucia tamara Bálint and Johnson
NEW SPECIES

Pseudolucia patago Bálint 1993: 19, figs. 38-40.

Pseudolucia lyrnessa patago, previous text, page 5.

Figures. *Adult*— Photoplate **IV** (5M). *Genitalia*— **Fig. 23** [both added at proof]

DIAGNOSIS. ***Wings***. VWH with "V"-shaped submedian marking, extending completely to the wing margin and comprised of continuous elements angled from cell M1 to the ana margin and offset by a single black spot costed in cell SC+R1, differing from the phenologically most similar *P. lyrnessa* (Hewitson) by the dark discal area and *P. benyamini* Bálint and Johnson (see Report No. 46 of this volume) by light submarginal; area patterned with white arrow-head markings. Female dorsal ground blue with extended submedian orange suffusion on DPW.

Morphology. Male with valvae reminiscent of habitus seen in *P. collina* (Bálint and Johnson 1993, ♂A, ♀A) and *P. lyrnessa* (herein figs. 7, 17) but distinctive with a broken (e.g. dorsally undulate) Baird's angulation and uncus more robust than in either *P. collina* or *P. lyrnessa*. Female tergal morphology and genitalia distinctive (fig. 23) with *sipc* (left) showing robust eighth tergite with pronounced ventral anteriorly-directed apophysis and shorter dorsal apophysis (latter longer in *P. lyrnessa*, absent in *P. collina*); genitalia showing winged habitus but with more elongate and thin terminal elements compared to *P. lyrnessa* (genitalia in *P. collina* are unwinged and laterally bifurcate like no other congeners [herein fig. 16]).

TYPES. Holotype male, labelled "Argentina, Neuquén 42: Lago Tromen, 1000-1100 m, 1.Xii. 1981, Nielsen & Karsholt; Slide MK 12; Holotype: Pseudolucia tamara Bálint and Johnson, de. 1955." deposited in HNHM. Allotype female, labelled "Nahuel Hulapí, Patagonia, Dec. 1923; Rothschild Bequest, 1939-I; Allotype: Pseudolucia tamara Bálint and Johnson; gen. prep. No. 580, det. Zs. Bálint," deposited in BMNH. ***Paratypes.*** There are two sets: the first includes those specimens listed under *Pseudolucia patago* Material Examined in Bálint's 1993 catalogue of Neotropical polymmatines (1933a: 19); the second includes additional paratypes, deposited in ZSM: 4 males, 4 females: "Confluencia Traful, Prov. Nequén, Argentinien, 20.XII.1956, leg, Fleiss". 1 male: "Lago Aluminé, Prov. Nequén, Argentinien, 16.II.1958, leg. E. Fleiss".

DISTRIBUTION. ***Spatial:*** Argentina, territories Neuquén and Río Negro, most probably also in Chubut, at elevations cca. 1000 m. ***Temporal:*** the type material was collected in November, December and February.

REMARKS. Dr. D. Barton Johnson, Professor of Russian, University of California (Santa Barbara) and recently editor of ***Nabokov Studies*** has suggested the Nabokovian name "tamara". He states "Tamara" [is] a name with deep Nabokovian resonance. "Tamara", with its echo of the Russian word *tam* ("there"— as opposed to the "here" of his life-long exile), signified many things to Nabokov, among them the idea of a transcendent world. But most obviously...it evokes Tamara, his first love, described in Chapter XII of ***Speak, Memory***. Separated first by whim and then by revolution and exile, "Tamara" became the theme of Nabokov's first novel, the 1926 ***Mashenka*** or ***Mary***". Dr. Johnson continues, "As the Nabokovs sailed into their final exile, the young Nabokov was tormented not so much by the sense of leaving Russia but 'by the agonizing thought that...letters from Tamara would still be coming, miraculously and needlessly, to southern Crimea, and would search there for a fugitive address, and weakly flap about like bewildered butterflies set loose in an alien zone, at the wrong altitude, among an unfamiliar flora' (last sentence of Chapter XII)."

ETYMOLOGY. As elaborated above, derived from the "Tamara", a name with various significances in Nabokov's life and writings.

Notes on "Pseudolucia grata *(Köhler, 1934)*"

A glossy photo of the holotype specimen was made available to the senior author, during a recent visit to Lima, Peru, from a large photo folio of Neotropical butterfly types specimens at the MUSM. The specimen is labelled as: "Itylos ó[-(not readable)- male signe---], grata Khlr., Det. Köhler" (black bordered label, specific name handwritten with black ink, printed: "Det. Köhler"); "Holo,tipus" (red label, handwritten with black ink: "Holo", printed: "tipus"); "2828" (written with black ink); "Rio Agrio, Nequén, 1800 m, 30.12.932, leg. Köhler" (black bordered label, printed, temporal data handwritten with black ink). According to both dorsal and ventral wing characters the taxon appear distinct but, among all *Pseudolucia*, related most closely to *P. lanin* Bálint and Johnson (1993). Unfortunately, only dissection of the type could unequivocally place the species within the genus. However the following brief description of the specimen may be helpful.

Specimen in perfect condition, only right antenna missing; VFW, VHW ground lustrous blue (like *P. plumbea*, less a deep gentian blue as in *P. lanin*), VFW with wide black marginal border and fine discoidal line, outer margin long (longer than that of *P. lanin*, therefore making the wings look wider), veins and cells with black scale suffusion on both wings, DHW with black antemarginal semicircle in each cell; VHW multicoloured as in *P. lanin* but with reduced white pattern elements in discal and anal areas.

The different wingshapes, DW color, and pattern details of this holotype clearly suggest that *P. lanin* and *P. grata* are not conspecific. This view should be verified by study of the genitalia. However, from the pattern characters it appears that a hitherto unrecognized "*grata* Wing Resemblance Group" could be recognized among the *Pseudolucia*, containing at least *P. grata* and *P. lanin*. Notably, the male and female genital structures of *P. lanin* are rather unique among *Pseudolucia*; thus, it is possible that such a "*grata* Wing Resemblance Group" (VHW, ruptive elements limited to "bottom" of medial band, cf. Bálint and Johnson 1993: 4) might well be supported structurally as a *grata* Species Group or lineage. Knowledge of the taxonomy suggested among the small numbers of specimens from extreme southern Argentina is just now beginning to take some shape, as noted further in the entry below.

The plumbea-*like taxon of Chubut and Neuquén*

The senior author previously listed three specimens deposited in BMNH as "*Pseudolucia grata*" in his "Catalogue" (Bálint 1993a: 30), noting their status as tentative. Previously (p. 16 in main body of the present paper), it was apparent that the female from Salta, Argentina represented an undescribed species (*P. humbert*). With the information now reviewed above concerning extreme austral representatives among the undetermined specimens, it is clear that the two remaining specimens (labelled from Argentine locales "Tecka, Chubut" and "Nahuel Huapí, Patagonia") repesent a different, hitherto undiagnosed species belonging to the *plumbea* lineage of *Pseudolucia*. This latter species group is diverse in Chile; we describe the new Patagonian representative below.

***Pseudolucia whitakeri* Bálint and Johnson,**
NEW SPECIES

Pseudolucia grata Bálint 1993: 20, figs 49-50, 114.

Pseudolucia grata, main text: 3.**Figures.** *Adult*—Photoplate IV (5R) [added at proof].

DIAGNOSIS. ***Wings***. Historically confused with *P. grata* Köhler. Readily diagnosed by large size (FW 10.5-11.5 mm.) and general similarity to *P. annamaria* but with light lustrous blue DW in contrast to that species. VHW with spotted postmedial band comprised of irregularly shaped dark brown "patchlike" elements extending from the HW costa to anal margin and offset by a full band across the HW postbasal area.

Morphology. Male with genital valvae elongate and an extremely produced Baird's Angulation compared to all congeners. Female with sclerotized terminalia tubular (Bálint 1993a: 20).

TYPES. Holotype male, labelled "54.21; Tecka, Territory of Chubut, N.W. Patagonia, 3000 ft., Jan/Feb. 1920; Joicey Bequest; gen. prep. 19167, Bálint", deposited in BMNH. Allotype female, labelled "Nahuel Huapí, Patagonia, Jan. 1912; Rothschild Bequst; gen. prep. No. 19167, dety Zs. Bálint", deposited in BMNH. Paratype female: "Nahuel Huapí, Patagonia, Jan. 1912, Rothschild Bequest, Brit.-Mus. 1939-I.; gen. prep. No. 19179, det. Zs. Bálint", deposited in BMNH.

DISTRIBUTION. *Spatial*: currently known only from two Argentine locations: Nahuel Huapí, Neuquén and Tecka, Chubt, from elevations cca. 1000 m. *Temporal:* dates on known specimens include January-February.

ETYMOLOGY. A patronym honoring G. Warren Whitaker. Mr. Whitaker, an avid reader of Nabokov and practicing New York attorney, offered his services to the authors in 1993 to provide etymologies of "Nabokovian names". The authors mentioned their interest to Mr. Whitaker while discussing with him Nabokov's 1945 article in ***Psyche***. This practice, initiated by the authors and Whitaker in 1993 "took on a life of its own" following publication of the 1993 UWSP *Reports*. This resulted because a number of projects concerning Nabokov as a lepidopterist had been initiated in the literary community. Later, in a response to several requests, Johnson, Whitaker and Bálint prepared an analysis of Nabokov's work in Lepidopterology which will appear in *Nabokov Studies* in 1996. During preparation of the latter work, various Nabokov scholars volunteered their services to provide additional "Nabokovian names" since it appears the numbers of new Neotropical Polyommatini are far from abating. Thus, it is appropriate to honor Mr. Whitaker with a patronym among the "Nabokovian" blues of South America. Without a chance conversation in 1993, the entire practice of proposing "Nabokovian" names might not have become a reality.

Additional Remarks on Argentine ***Pseudolucia***

Concerning the Taxonomic Status of ***Pseudolucia chilensis*** in Argentina

This taxon was noted as occurring in Salta Province, Argentina, based information provided by Mr. R. Eisele and examination of the specimens first hand by the senior author while in Jujuy, Argentina. It is worth noting that since these specimens were not available for review at the time of this writing, the significant disjunction of this distribution may have taxonomic significance. This is of particular interest in this species because of the occurrence of a sister species of *P. chilensis* in montane southeastern Brazil (*P. parana* Bálint). It is possible that the Argentine population will factor into the biogeography of this distribution as a distinct entity. As a matter of interest, therefore, we summarize below what is now apparent concerning Argentine/Chilean vicariant distributions in *Pseudolucia*.

Table. Sister Taxa of *Pseudolucia* Disjunct at the Chilean/Argentine "Continental Divide".

Chile	Argentina
P. lyrnessa	*P. tamara*
P. annamaria	*P. whitakeri*
P. vera	*P. charlotte*
P. avishai	*P. neuqueniensis*

A New *Pseudolucia* Species in the Argentine Fauna and Final Current Tallies of Species Diversity In Argentina

Report No. 48 of the present volume describes a recently discovered *Pseudolucia* species from San Juan Province; the life history of the species is discussed in *Report* No. 52.

Accordingly, final numerical tallies for *Pseudolucia* species occurring in Argentina, based on text, appendices, and additional *Reports* herein are as follows:

***Pseudolucia patago* (Mabille), revised status** (name replaces *lyrnessa* Hewitson in Argentine fauna)

ADDITIONAL SPECIES

10. ***Pseudolucia neuqueniensis* Bálint & Johnson, new status.**
11. ***Pseudolucia tamara* Bálint & Johnson**
12. ***Pseudolucia whitakeri* Bálint & Johnson**
13. ***Pseudolucia talia* Benyamini, Bálint & Johnson** (*Report* 48).

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PHOTOFIGURES for *REPORT* 45 follow hereafter, on PHOTOPLATE IV, keyed on the overleaf of this page

CROSS REFERENCE to ADDITIONAL PHOTOGRAPHS for species included in *Report* No. 45

Pseudolucia talia: color— **PHOTOPLATE XI**

Pseudolucia andina: color— **PHOTOPLATES VII, XII**

Pseudolucia chilensis: color— **PHOTOPLATE XIII**

Pseudolucia lanin: color— **PHOTOPLATE XIII**

Pseudolucia charlotte: color— **PHOTOPLATE XIII**

Pseudolucia argentina: color— **PHOTOPLATE XIV**

In addition, the **PHOTOPLATE V** from Bálint and Johnson (1993) is reproduced and recaptioned in detail after *Report* No. 46. It contains B&W photos of many of the species treated herein from Argentina.

CAPTIONS FOR PHOTOPLATE IV

ADULT PHOTOGRAPHS FOR *REPORT* NO. 45

[*format*: photographs are captioned with genus, species, gender and view (D =dorsal, V= ventral) **and** with the alphabetical notation (**A**,**B**, etc.) used in the text; photograph rows are numbered in the caption, top to bottom, as 1-5, photos in each row as **L** (left), **M** (middle), **R** (right); taxonomic names are updated to the appendices of *Report* 45 and additional *Reports* from Section II of the volume]

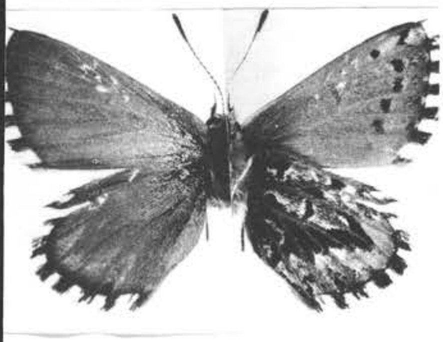
Note: the B&W photographs of *Pseudolucia lyrnessa* were removed to allow for the types of additional new species *P. tamara* and *P. whitakeri*. Instead, the type of *P. lyrnessa* is figured in color on PHOTOPLATE VII.

1L. *Pseudolucia nequeniensis*, holotype (HNHM) [revised to species status in *Report* **48**].
1M. *P. nequeniensis*, allotype (HNHM).
1R. *Pseudolucia andina*, male, Argentina, Prov. Mendoza, Valle de Las Leñas, ca. 7000', 3.XII.1989 (HNHM), FW: 9.0 mm.
2L. *P. andina*, male, Argentina, Reg. Santiago: Portillo, ex larva, 1993 (HNHM), FW: 10.0 mm.
2M. *Pseudolucia patago*, holotype (MNHN).
2R. *P. patago*, holotype (MNHN).
3L. *Pseudolucia charlotte*, male, Argentina, Neuquén Prov., Pucara (HNHM), FW: 8.0 mm.
3M. *P. charlotte*, paratype female, Argentina, Neuquén Prov., Pucara, 8-20.XII.1952 (ZMK), FW: 9.0 mm.
3R. *Pseudolucia argentina*, paratype male of junior synonym *P. aconcagua*, Argentina, Prov. Mendoza, Parque Pral. Aconcagua, between Laguna Horcones and El Durazno, ca. 8400 ft., 30.XI.1989 (HNHM), FW: 9.0 mm.
4L. *Pseudolucia lanin*, male, Argentina, Neuquén, Paso Puyehue, 1300 m., 10.XII.1981 (HNHM), FW: 9.0 mm.
4M. *Pseudolucia lanin*, female, Argentina, Neuquén, Paso Puyehue, 1300 m., 10.XII.1981 (HNHM), FW: 9.0 mm.
4R. *Pseudolucia humbert*, holotype (ZMK).
5L. *Pseudolucia shapiroi*, holotype (AMNH).
5M. *Pseudolucia tamara*, holotype (BMNH) [added to plates at proof].
5R. *Pseudolucia whitakeri*, holotype (BMNH) [added to plates at proof].

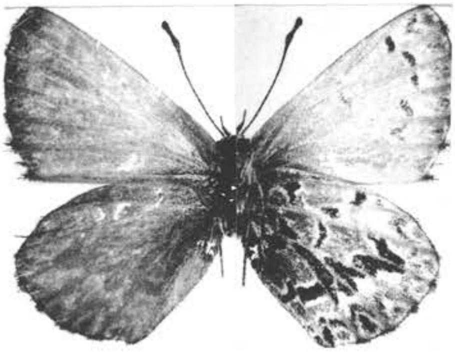
In addition, concerning Argentine *Pseudolucia*, and *Pseudolucia* in general, numerous species are included in B&W **PHOTOPLATE V** (which is reproduced and recaptioned, in more detail, from Bálint and Johnson 1993). Numerous recent queries of the authors concerning the current status of species and specimens included in that Plate prompted this reproduction. The following color Photoplate cross-references may also be helpful (these Photoplates placed after page 7 in, Benyamini, D., *Report* No. **52**).

Pseudolucia sibylla (type in color, PHOTOPLATE VII).
Pseudolucia avishai (color, PHOTOPLATES VII, XII).
Pseudolucia andina (color, PHOTOPLATES VII, XII).
Pseudolucia vera (color, PHOTOPLATE IX).
Pseudolucia collina (color, PHOTOPLATE IX).
Pseudolucia benyamini (color, PHOTOPLATE X).
Pseudolucia lyrnessa (color, PHOTOPLATE X).
Pseudolucia talia (color, PHOTOPLATE X).
Pseudolucia plumbea (color, PHOTOPLATE XI).
Pseudolucia aureliana (color, PHOTOPLATE XI).
Pseudolucia oligocyanea (color, PHOTOPLATE XI).
Pseudolucia annamaria (color, PHOTOPLATE XI).
Pseudolucia zina (color, PHOTOPLATE XI).
Pseudolucia hazeorum (color, PHOTOPLATE XI).
Pseudolucia asafi (color, PHOTOPLATE XII).
Pseudolucia magellana (color, PHOTOPLATE XII).
Pseudolucia chilensis (color, PHOTOPLATE XIII).
Pseudolucia lanin (color, PHOTOPLATE XIII).
Pseudolucia charlotte (color, PHOTOPLATE XIII).
Pseudolucia penai (color, PHOTOPLATE XIV).
Pseudolucia argentina (color, PHOTOPLATE XIV).

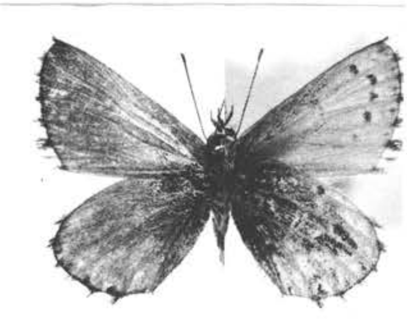
Pseudolucia



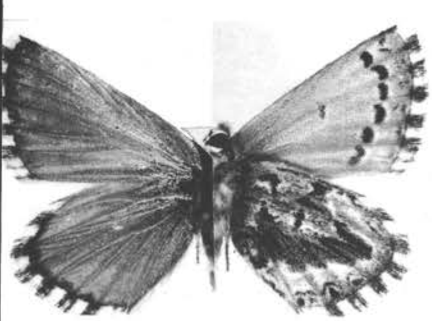
A. *P. neuqueniensis* ♂ **D/V**



B. *P. neuqueniensis* ♀ **D/V**



C. *P. andina* ♂ **D/V**

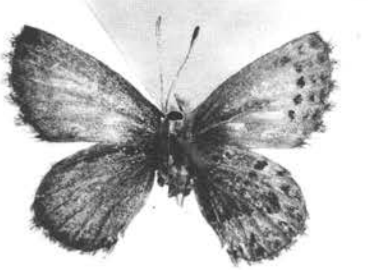


D. *P. andina* ♀ **D/V**

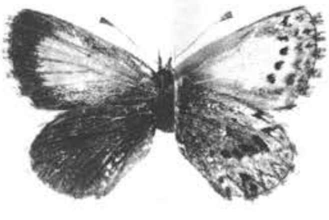
E. *P. patago* ♂ **D**

(*lymessa* [color] moved to Photoplate VII)

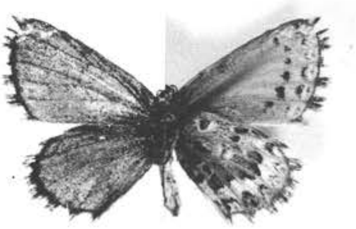
(E). *P. patago* ♂ **V**



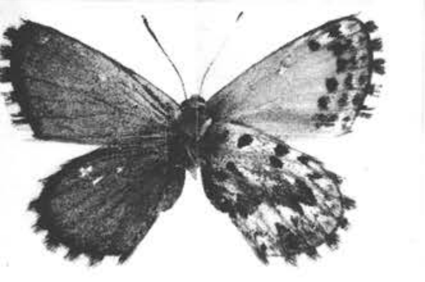
F. *P. charlotte* ♂ **D/V**



G. *P. charlotte* ♀ **D/V**



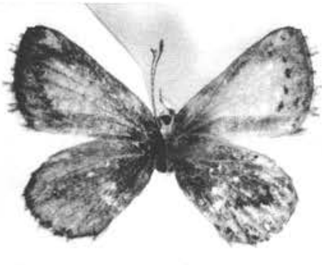
H. *P. argentina* ♂ **D/V**



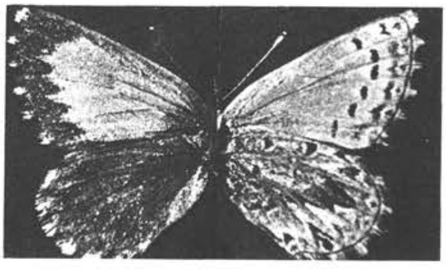
I. *P. lanin* ♂ **D/V**

J. *P. lanin* ♀ **D/V**

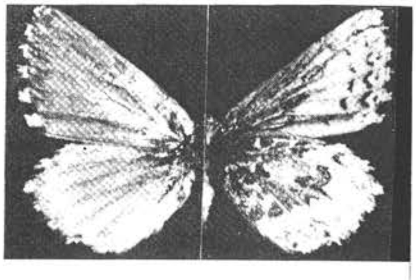
K. *P. humbert* ♀ **D/V**



L. *P. shapiroi* ♀ **D/V**



P. tamara ♀ **D/V**



P. whitakeri ♂ **D/V**

A New Species of *Pseudolucia* Nabokov From the Coastal Region of Chile (Lepidoptera, Lycaenidae)

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Polyommatine Lycaenids of the Oreal Biome in the Neotropics, part VIII: A New Species of *Pseudolucia* Nabokov from the Coastal Region of Chile (Lepidoptera, Lycaenidae), by Zs. Bálint and K. Johnson

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ABSTRACT

A new species of *Pseudolucia*, with major phylogenetic implications concerning the genus, is described. Hitherto, ventrally bifurcate female genital terminalia of *Pseudolucia collina* Phillipi have appeared unique among congeners, with no evidence of a transformation series to the tubular or winged-tubular configurations dominating the rest of the genus. This was one possible argument for splitting *Pseudolucia* into additional genera. However, the new species, *Pseudolucia benyamini* (coastal regions near Santiago, Chile) shows female terminalia appearing in a previously unknown configuration— "C"-shaped in the lateral view. Like *P. collina*, *P. benyamini* shows a "V"-shaped ventral hindwing pattern. The "C"-shaped genital habitus (along with previously known tubular, winged-tubular, and ventrally bifurcate types) are reexamined in light of previous recognition that "V"-shaped ventral hindwing patterns occur universally across *Pseudolucia* irrespective of female genital type. Considering the new data from *P. benymamini*, a parsimonious hypothesis of wing pattern and genital evolution in *Pseudolucia* can be proposed: (1) "V"-shaped wing patterns and tubular female genitalia constitute the primitive ground plan; (2) phylogeny has been bifurcate with tubular female genitalia diverging to winged-tubular structures along one branch and "C"-shaped and bifurcate structures along another. Accordingly, various complex congurations in the wing patterns (coalesced spot-bands, stripes, additional elements etc.) are also derived. The genital stuctures of *P. benyamini* provide the first clear "cipher" regarding direction of polarity in *Pseudolucia*. Their discovery supports the strong monophyly of *Pseudolucia* and argues against splitting of the taxon into additional genera. The implications of known geographic distributions in *Pseudolucia* species exhibiting the various female genital types are also discussed.

INTRODUCTION

When the genus *Pseudolucia* was erected by Nabokov (1945) only two species were included, namely the type species *Lycaena chilensis* Blanchard, 1852 and *Lycaena collina* Philippi, 1859. However, the genus has proved extremely rich in taxa, with an unexpected diversity in the Chilean and Argentine Andes and austral areas (Bálint and Johnson 1993, 1995). Well over twenty species are now recognized in the genus.

Historcially, the scientific literature has paid very little attention to the female genital structures of lycaenid butterflies. This resulted partly from traditions in methodology but also because early studies consistently stressed the utility of characters in the valvae, and a few other elements, of the male genitalia. Thus, most historical work on the Lycaenidae, and many other butterflies, has been dominated by comparisons of select characters of males (Eliot 1973, Higgins 1975, Zhdanki 1983). Nabokov (1945) illustrated some female genitalic components of polyommatine lycaenids; he also considered some new characters of the male penial apparatus. However, his actual use of these characters (particularly female terminalia and the sagum of the male penus) was mostly anecdotal and he did not revert to these structures as primary evidence concerning relationships.

Female genital characters have been shown to have great utility in the thecline lycaenids (numerous publications of the junior author, see *e.g.* Appendix II, Johnson and Kroenlein 1993) and have also been a primary tool for the present authors' studies of Neotropical *Pseudolucia* (Bálint and Johnson 1993, 1995). These authors distinguished three structural types among the sclerotized female genitalia of the genus: (l) a ventrally bifurcate type (as in *P. collina* and previously unrecognized in the scientific literature), (2) a configuration with winglike flaps extending laterally from a central tubular structure, and (3) a simple tubular configuration lacking any additional components. Hitherto, the salient differences between these types (particularly the bifurcate type versus the tubelike types) appeared to support the view of some authors (like Balletto 1993, even though he did not cite the bifurcate condition *per se*) that *Pseudolucia* should be subdivided into more than one genus.

In fact, apparent great differences in the overall shapes and configurations of female genitalia in *Pseudolucia* were not the only remaining hurdle concerning subgrouping members of the genus. As Bálint and Johnson (1993) noted, various species in *Pseudolucia* showed a "V"-shaped ventral hindwing pattern irrespective the kind of female genitalic configuration represented. Thus, when both male and female genitalia were consulted, it was apparent that *Pseudolucia* harbored a number of "look-alike" species which, aside from some minor wing pattern difference most apparent in long series, could not be readily diagnosed without reference to the structural characters. Further, some species with highly divergent wing patterns (like "*sibylla*-Group" taxa) had quite commonplace genitalia for the genus. This led Bálint and Johnson (1995) and Bálint (1995) to argue that, despite the variety of structural features in species associated with the genus, *Pseudolucia* was strongly monophyletic and should not be further split. In addition to noting the characters in common among species assignable to the genus, these authors also gave examples of how splitting of *Pseudolucia* would result in inability to unambiguously assign certain species, or even certain sexes of some species, to such additional genera.

It is always gratifying when a new species is discovered showing structures strongly suggesting a clear transformation series within an otherwise structurally confusing group. Our colleague Dubi Benyamini, working in Chile, has discovered such a species and we are pleased to describe this new entity as follows:

Pseudolucia benyamini, NEW SPECIES

Photoplate VI,4.

DIAGNOSIS. ***Wings***. VHW with "V"-shaped band, contrasting *P. collina*, extending completely to the wing margin and comprised of continuous elements angled from cell M1 to the anal margin offset by a single black spot in cell SC+R1. In the male, superficially suggestive of *P. lyrnessa* but with dorsal ground deeper blue, VFW postdiscal spots more emphatic and VHW "V"-shaped band much more prominent.

Morphology. Male resembling congeners *P. lyrnessa* and *P. collina* with sagum surrounding aedeagus; however, aedeagus much slimmer in *P. benyamini* with extremely short suprazonal element and a much longer gnathos. Female tergite eight with a long anterioventral apodeme, resembling *P. vera*, but apodeme much longer and not club-ended as in the latter species; genitalia with unique configuration: a terminally open tubular habitus, shorter and more robust than in *P. vera* but, most distinctly, showing a strongly "C"-shaped curvature in lateral view. This latter characteristic suggests a clear transformation series within *Pseudolucia* from the tubular ductus of some congeners through a "C"-shaped tube to the ventrally bifurcate configuration of *P. collina*.

DESCRIPTION. ***Male***. DFW, DHW ground violet blue with thin but pronounced dark marginal border; DHW with black eyespot at cell CuA1 barely notable, if occurring at all. VFW ground deep orange, framed by prominent postmedial band of five black spots; distally, costa, anal and submarginal areas with emphatic gray-colored borders, antemarginal area with inconspicuous polyommatine pattern. VHW ground very dark ash-gray with outstanding "V"-shaped band comprised of continuously aligned (to only occassionally broken) blackish to deep brown spots contrasting the ground color and extending to the submargin, offset usually by a single or double black spot costad in cell SC+R1; submargin of cell CuAl with prominent elongate black pattern (seldom reflected on the DHW); submargins and antemarginal area with suffusive gray "arrowhead"-shaped markings and marginal spots. FW length: 7.5-8.2 mm. (n=6). ***Female***. Similar to male on VFW, VHW but with DFW, DHW marked deep orange within wide brownish-black submarginal borders. FW length 8.0-8.3 mm. (n=4). ***Male Tergal Morphology and Genitalia***. Fig. 1A. Terminal tergite lacking *sipc* ("subcordate incised posterior cavity" *sensu* Bálint and Johnson 1993). Genitalia with valval shape very similar to that of *P. lyrnessa*: hemielliptical and deeply sloped at the anterior after extreme production at Baird's angulation; height of curvate terminal rostellum somewhat less than height of Baird's angulation; uncus small, compressed and with strong apical sclerotization; gnathos more elongate and curved than in *P. lyrnessa*, extending the height of the uncus; aedeagus stout with suprazonal element extremely short (1/4 aedeagus length); sagum somewhat shorter than aedeagus (3/4 aedeagus length) oviform and serrate. ***Female Tergal Morphology and Genitalia***. Fig. 1B. Eighth tergite modified to laterlly robust *sipc* with an elongate, anterioventrally directed, apodeme with rounded apex; genitalia with sclerotized terminalia comprised of a short stout tube (laterally with graded edge, dorsally with widely open terminus closed by an apical nodule) which, in the overall lateral view, shows a strongly "C"-shaped configuration similar only to the more radically bifurcate habitus seen in *P. collina*.

TYPES. Holotype male (FW length 8.0 mm.), allotype female (FW length 8.0 - 9.0 mm.) and 8 paratypes (5 males, 3 females), CHILE, Pichicuy, at sea level along coast, 150 km NW of Santiago, 17 September 1993, leg. Dubi Benyamini. Primary types deposited in Hungarian Natural History Museum (HNHM), Budapest. *Paratypes*. 2 males, 1 female, deposited at American Museum of Natural History (AMNH), 1 male, 1 female at the Natural History Museum (London) (BMNH). Additional specimens are in the collection of Dubi Benyamini (Los Condes, Chile) but due to uncertainy of eventual deposition are not herein itemized as paratypes. Dissections are as follows (in glyerin vials kept with relevent specimens): olotype, allotype, as yet with unassigned numbers at HNHM; paratypes numbered according to scheme of the senior author (paratype male 427, paratype females 391, 428, 437).

DISTRIBUTION. ***Spatial***: currently known from several sea level costal sites in the close vicinity of the primary type locality detailed above (see Biology, below). ***Temporal***: the flight period apparently includes the entire year, to date at least three generations having already been documented by Mr. Benyamini (Benyamini, in press).

BIOLOGY. Habitats are typical of the Coquimban Desert Biotic Province (Davis 1986: 4, 14). Biology of the species is being treated in detail in a separate paper (Benyamini, in press).

ETYMOLOGY. Named for the discoverer of the species, Mr. Dubi Benyamini.

DISCUSSION

"*Lycaena collina*" was among the first names available for Neotropical polyommatines occurring in austral region of South America. Indeed, *Pseudolucia collina* and *P. chilensis* (Blanchard) were considered the "best known" taxa of the genus after the work of Nabokov (1945). For instance, in an example typical of the "common usage taxonomy" in butterflies, Lewis (1975, pl. 67: 25-26) purported to illustrate both these species in his world butterfly guide, suggesting that their identities were quite straightforward. However, as we showed earlier, *collina*-like phenotypes embrace three structurally different taxa (Bálint and Johnson 1993), the one figured by Lewis proving to be *P. lyrnessa* Hewitson 1874, a species widely distributed in the austral region of South America. *Pseudolucia chilensis* did not fare much better regarding overall recognition either, being redescribed as recently as 1993 by a European worker as *Pallidula vichuna* (Balletto 1993). Such situations testify to the overall instability characterizing Neotropical polyommatines until very recently, as do the innumerable new species described in the last few years by the present authors.

Bálint and Johnson (1993) utilized a superficial wing resemblance cluster, the "*collina*-like Group" [pp. 2-3], in first stressing the homoplasy apparent in wing patterns of various austral Polyommatinae. As noted by them, nothing could have been more startling than the bipartite female genitalia apparent in some "*collina*-like" populations compared to winged or tubular female structures occurring in others. In first treating "*collina*-like" taxa, Bálint and Johnson (1993) named the first "*collina*-like" sibling, *P. zembla*, a species later proving to be a synonym of *P. lyrnessa* (Bálint 1993b). Together with sharing the "V"-shaped ventral hindwing pattern, such populations were also typified by small individuals (FW lengths < 9.0 mm.), males with blue dorsal grounds, and females showing extensive orange dorsal forewing suffusion. Bálint and Johnson (1993) also noted two other taxa externally sharing the "*collina*-like" ventral "V" pattern but otherwise less startlingly like *P. collina* than *P. lyrnessa*: *P. charlotte* Bálint and Johnson and *P. vera* Bálint and Johnson, both species with divergent female genitalia. As recently as the present volume, Bálint and Johnson (1994a) have added two more new Argentine species also sharing this generalized external phenotype with *P. collina*. Comment on the geographic distributions of these entities is pertinent here.

Representatives of each female genitalic type sharing "V"-shaped ventral hindwing patterns occur in central Chile: *P. vera* (with tubular habitus), *P. lyrnessa* (with winged habitus), *P. collina* (with bifurcate habitus) and *P. benyamini* with the newly recognized "C"-shaped habitus. Overall, the winged female genital type has the widest geographic distribution, including other "*collina*-like" species from the central west and southwest of Argentina northward to Salta Province. This range embraces a variety of biotic provinces (Davis 1986, Map 2). In addition, the winged female genital type also is common to the "*plumbea* Group" (originally Bálint and Johnson 1993: 4) which is generally restricted to central Chile. This structural group embraces five taxa, many of which have been documented as locally sympatric and synchronic (e.g. Hacienda Illapel in the Coquimbo Region of Chile). In addition to this closeknit group of Chilean taxa, and often overlapping in distribution, are members of the "*sibylla*-like Group" (originally Bálint and Johnson 1993: 4), an assemblage of divergently marked *Pseudolucia* which, with their winged female genitalia and male genitalia lacking a sagum (cf. Bálint and Johnson, 1994a) are best considered a structural subgroup of the *plumbea* Group (or lineage). Several new "*sibylla*-like" taxa have also been distinguished in recent years (Bálint and Johnson 1993) and together occur from central Chile and central west Argentina northward to the Antofagasta region.

In light of the rather tightknit distributions evidenced by the diverse *Pseudolucia* noted above, attention must be drawn to what has previously been considered the rather far-flung range of the "species" *P. andina* (Bartlett-Calvert). The latter taxon shows not only a peculiar female genitalia (with a mixture of characters evident in other *Pseudolucia* taxa) but also a uniquely shaped male genital valve (cf. Bálint and Johnson 1993: 19, fig. J or Balletto 1993, fig. 3d.). Traditionally, a wide berth has been accorded identification of the taxon "*andina*", including records on both side of the Andes (cd. data published by Balint 1993a, Balint and Johnson 1993, 1994a). Bálint and Johnson (1993) recognized the first clear sister species of *P. andina*, *P. lanin*. Its discovery suggested the existence of an "*andina* lineage" within *Pseudolucia* and the necessity for a more thorough analysis of the various and farflung *andina*-like populations occurring across southern South America. *Pseudolucia lanin*, a strict high Andean endemic mostly inhabiting the alpine region of the Valdivian Cordillera biotic province (Davis 1986: 12) exhibited a female genitalia more clearly winged than typical *P. andina*. Indeed, as now confirmed by more recent research on this assemblage (Balint, Benyamini and Johnson, in press), *P. andina* has proved to be at least two species, one typically Andean (in addition to *P. lanin*) and one typically Patagonian.

The two "*collina*-like" taxa having tubular female genitalia presently show restricted distributions: *P. vera* from the southern La Araucania region of Chile and *P. charlotte* from the Patagonian Steppe biotic province (Davis 1986: 14; Shapiro 1991: 149-150) in Argentine Mendoza and Neuquén. By contrast, the "*chilensis* Group" (originally Bálint and Johnson 1993: 4 and comprised of two sister species showing tubular female genitalia) occurs from Atacama in the north southward to the Valparaiso region of Chile and disjunctly eastward in Paraná State, southeastern Brazil.

Considering the above, it has always appeared highly unlikely that the "V"-shaped ventral wing pattern in *Pseudolucia* could be synapomorphic and the various corresponding female genitalic configurations all independently evolved. Accordingly, Bálint and Johnson (1993) considered the wing patterns of *Pseudolucia* highly homoplasious. However, until

TABLE 1

Female genitalic types in *Pseudolucia* species with "*collina*-like" external phenotypes— relation of genitalic types, taxa and currently known geographic distributions.

Taxon	Type of Female Genital Terminalia	Known Geographic Distribution
P. benyamini	C-shaped	central Chile
P. collina	bifurcate	central Chile
P. lyrnessa	winged	central Chile and southwestern Argentina
P. humberti	winged	northwestern Argentina
P. shapiroi	winged	central western Argentina
P. vera	tubular	central Chile
P. charlotte	tubular	south Chile, central and southwestern Argentina

the discovery of *P. benyamini*, a mode of transformation between the divergent bifurcate female genitalia of *P. collina* and the winged and tubular female structures of other *Pseudolucia* was not apparent. In fact, no one could suggest a hypothetical intermediary step that might mediate the great difference between *P. collina*'s bifurcate female habitus and the tubular and winged structures of other *Pseudolucia* species. With *P. benyamini* now available, a parsimonious view of character evolution in *Pseudolucia* can be proposed including wing pattern and male morphology.

The "C"-shaped female genitalia of *P. benyamini* serves as a kind of "cipher" for proposing a transformation of characters in *Pseudolucia* embracing wing pattern as well as male and female morphology. This view stems from the realization that *P. collina* and *P. benyamini*, both with limited central Chilean distributions, appear to be sister species which share the synapomorphy of a curvate tube in the female genitalia (one a minor bifurcation from a tubular ground plan [*e.g.* "C"-shaped], the other a widely bifurcate derivation). Consistent with this view, winged tubular terminalia can also be considered a condition derived from the primitive tubular ground plan. With this in mind, it is consistent to view the "V"-shaped "*collina*-like" wing pattern in *Pseudolucia* as a primitive character, thus explaining the occurrence of three very different female genitalia in specimens with a hindwing "V" dominating the ventral habitus. This scheme proposes a bifed (two-branched) evolutionary tree, tubular at base, bifurcating to "C"-shaped and fully bifurcate conditions on one branch, "wing"-like lateral extensions on the other.

The above hypothesis appears compelling because, for the first time, it offers a view of character evolution in *Pseudolucia* able to include character states in the companion males. Males of all taxa having females with tubular genitalic terminalia also possess the genital sagum. The sagum, an outlying element of the penial apparatus is, according to Eliot (1973), an ancestral character which, as an "early synapomorphy" among polyommatines phylogenetically links ancient Caribbean and mainland faunas in such genera as *Echinargus* Nabokov (1945) and *Hemiargus* Hübner (1818). Both these genera have trans-Caribbean, continental lowland and high Andean components (see Bálint 1993a, 14-16 and Johnson and Bálint, in prep.). Considering this, loss of the sagum (e.g. consequent reliance on a penial apparatus without this outlying element) may be construed as synapomorphic for

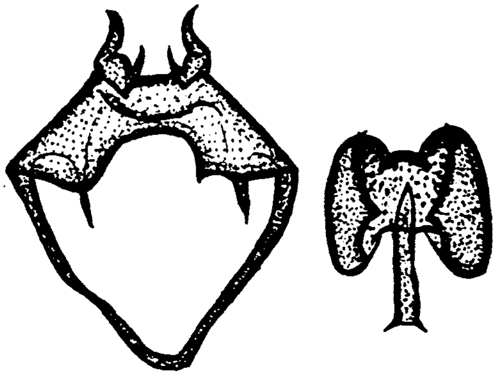


Figure 1a

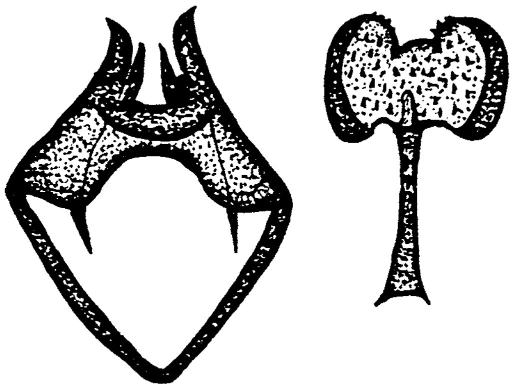


Figure 1b

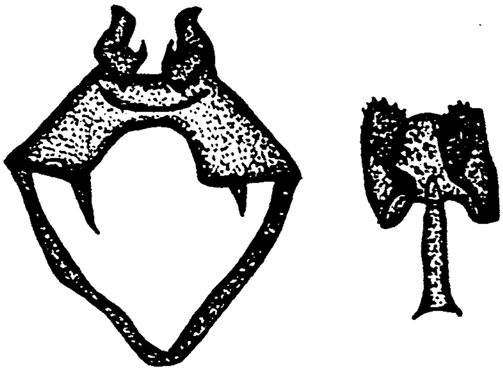
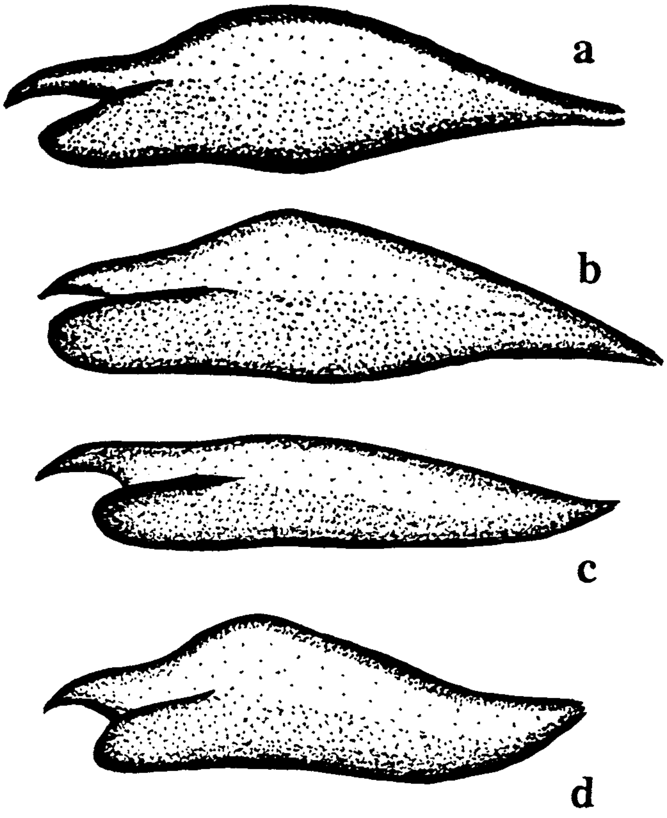


Figure 1c

Figure 2



MORPHOLOGICAL FIGURES

(above and overleaf)

Figure 1. Male genital uncus and gnathos (left) and aedeagus with sagum (right), ventral views, of *P. lyrnessa* (a), *P. benyamini* (b), *P. collina* (c).

Figure 2. Male genital valvae, lateral views, of *P. lyrnessa* (a), *P. benyamini* (b), *P. collina* (c), *P. vera* (d).

Figure 3. Female morphological features: left, terminal tergite in lateral view; middle, genital terminus in ventral view; right, genital terminus in lateral view, of *P. lyrnessa* (a), *P. benyamini* (b), *P. collina* (c), *P. vera* (d).

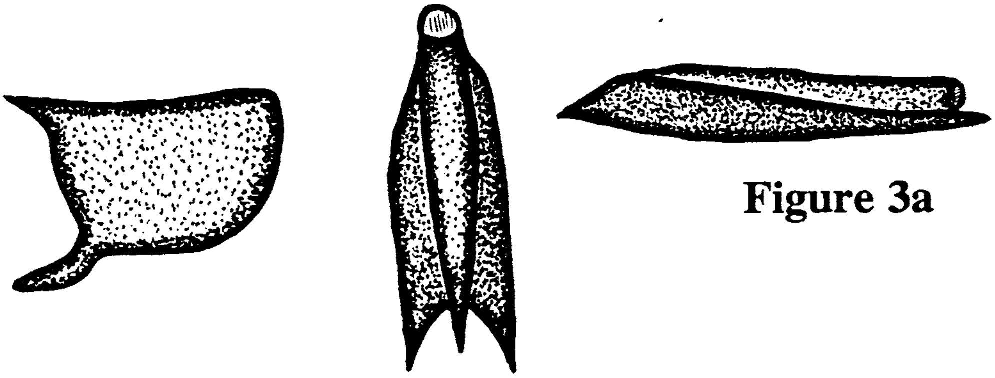


Figure 3a

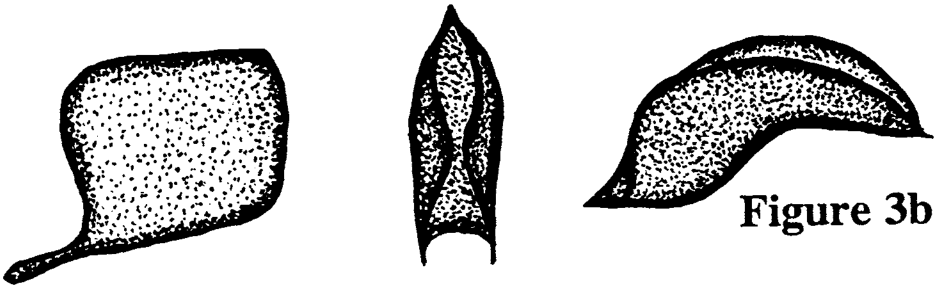


Figure 3b

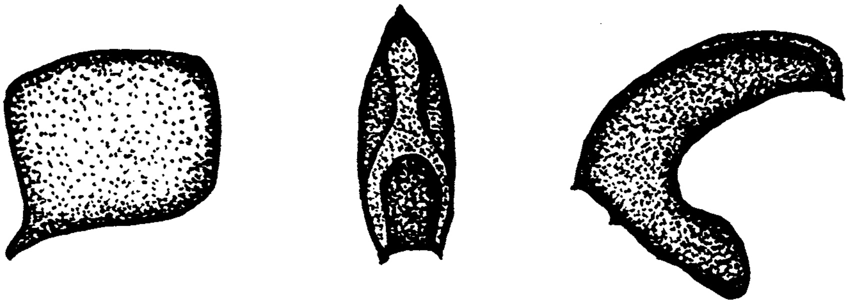


Figure 3c

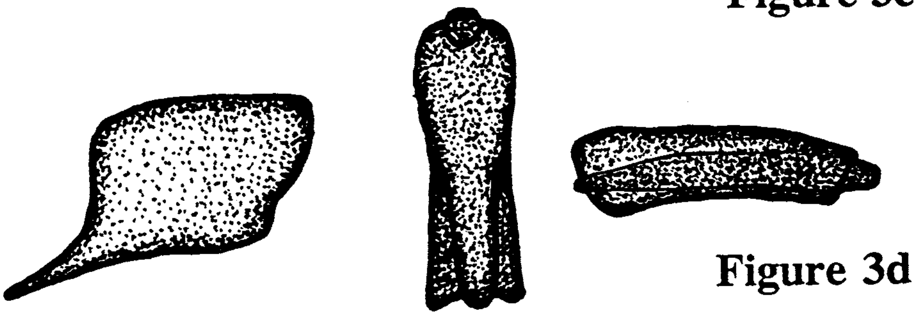


Figure 3d

certain other assemblages within *Pseudolucia,* a suggestion of particular interest because all *Pseudolucia* lacking a sagum also show winged terminalia in the female genitalia. Moreover, these latter groups of *Pseudolucia* show the highest species diversity in the genus and the widest geographic distributions, including high Andean and austral populations. If the view that absence of a sagum in males and the presence of winged tubular genitalia in females is a derived state, the wide adaptive radiation represented by these many species of *Pseudolucia* (members of the "*plumbea*-Group" [including the divergent "*sibylla*" Subgroup, see Photoplate VII: 11,12]) would be a relatively recent event, consistent with the comments of Shapiro (1991). Similarly, with the above view, the tubular habitus in the female genitalia could be considered a basic synapomorphy of the Polyommatini. The female genitalia of *Nabokovia faga* (Dognin 1913) a member of the NABOKOVIA SECTION also exhibit tubular terminalia (Bálint and Johnson 1995, figs. 29-30) as well as the Oriental *Polyommatus cleotas* Guer. and Men., [1831], type species of the polyommatine genus *Luthrodes* H. H. Druce (1895). In contrast, female genital terminalia of Holarctic genera with clear Neotropical kin (*Paralycaeides* Nabokov 1945 and *Madeleinea* Baliint 1993 [see Bálint and Johnson 1995]) are not tubular, having only minor sclerotal formations at the genital terminus. Such Holarctic stock also show a characteristic sclerotized region on the lower part of ductus bursae which is lacking in the Neotropical genera (for European genera see Nekrutendo 1985, figs. 112-123).

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CROSS REFERENCE TO PHOTOGRAPHS

(*Report* No. 46, B & W, PHOTOPLATE VI)

***Pseudolucia benyamini*:** color— **PHOTOPLATE X**
B & W (habitat)— **PHOTOPLATE VII**
***Pseudolucia collina*:** color— **PHOTOPLATE XII**

CAPTIONS TO PHOTOPLATE V

For purposes of identification, historicity and recording of eventual type depositions, Photoplate V from the original treatment of new Argentine and Chilean Pseudolucia is reproduced from UWSP Museum *Report* No. **27**: Bálint, Z. and Johnson, K., New Species of *Pseudolucia* Nabokov from Chile and Patagonia (Lepidoptera, Lycaenidae, Polyommatinae), 25 pp.

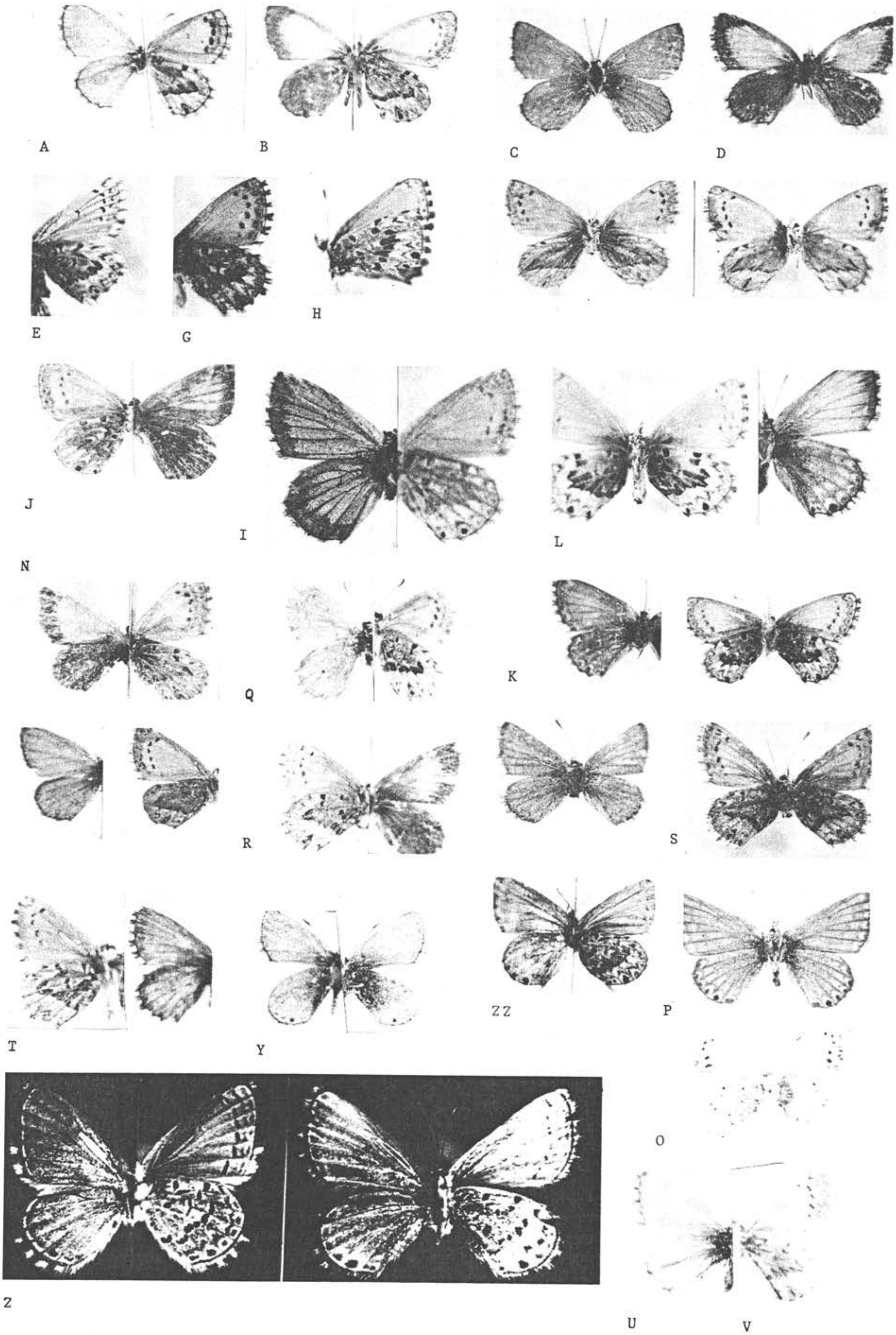
The original plate published in 1993 was a combination of many photographs of various types and other specimens and its original caption was very generalized (although it was implicit in the text that, consistent with the volume of ***Reports* 24-30** the photographic figures were those of the type specimens). The degree of additional work on *Pseudolucia* since 1993 has clarifed the identities and statuses of numerous species and, in addition, various workers have inquired as to which of the figured specimens were types. Moreover, before their deaths both Dr. J. Herrera G. and Luis Peña returned, by hand, to the American Museum of Natural History type specimens that had derived from their personal collections after it had been forwarded to each of them for Chilean deposition. Both workers stated that lack of permanent staff lepidopterists at both the Instituto Entomología Universidad Metropolitana de Ciencias de la Educación (Santiago) ("IEUMCE" according to *Acta Entomologia Chilena*, 1993) and Museo Nacional de Historia Natural (Santiago) ("MNHNC" according to Bridges 1994, summarizing most convention) made the future of butterfly type material in Chile questionable. Further, as mentioned by Johnson (1993: UWSP *Report* No. **30**, 2 pp.) some of the material in Herrera's possession had originated from a loan to him from Peña, given Peña the ultimate discretion on its deposition. Thus, since all this material derives from the the private collections of Herrera or Peña (mostly the latter), consistent with the deposition of types previous publications either involving Herrera as a co-author (Johnson, Miller and Herrera 1992) or Peña material (Johnson, Eisele and MacPherson 1990) final deposition of certain material included in this plate is now AMNH, as noted in appropriate entries below.

Caption (D = dorsal, V = ventral, "halfside" = left- or righthand side of fore- and hindwings only, "fullside"= fore- and hindwings of both left- and righthand sides). **A,B**: **A**— D/V "halfsides", ***Pseudolucia collina***, ♂ example; **B**— D/V "halfsides", ***P. collina***, ♀ example. **C**: D above, V below, "fullside", ***Pseudolucia zembla*** holotype ♂ (AMNH). **D**: D above, V below, "fullside", ***P. zembla*** allotype ♀ (AMNH). **E**: V "halfside", ***Pseudolucia plumbea*** example. **G**: V "halfside", ***Pseudolucia annamaria***, holotype ♂ (AMNH). **H**: V "halfside", ***P. annamaria***, allotype ♀ (AMNH). **I**: D/V "halfsides", ***Pseudolucia hazeorum*** paratype ♂ (HNHM). **J**: D/V "halfsides", ***P. hazeorum*** allotype ♀ (AMNH). **K**: to right of letter, at left, V "halfside", ***Pseudolucia clarea*** holotype ♂ (AMNH), at right, V "fullside", ***P. clarea*** holotype ♂. **L**: left, V "fullside", ***Pseudolucia clarea*** allotype ♀ (AMNH), right, D "halfside", ***P. clarea*** allotype ♀. **N**: immediately below letter— D/V "halfsides", ***Pseudolucia charlotte***, paratype ♀ (AMNH); below left, D "halfside", ***Pseudolucia vera*** holotype ♂ (AMNH), right, V "halfside", ***P. vera*** holotype ♂. **O**: V "fullside", ***Pseudolucia chilensis*** ♂ example. **P**: V "fullside", ***Pseudolucia chilensis*** ♂ example. **Q**: D,V "halfsides", ***Pseudolucia charlotte*** paratype ♂ (AMNH). **R**: V,D "halfsides", ***Pseudolucia charlotte*** allotype ♀ (IML). **S**: left, D "fullside" ***Pseudolucia lanin*** holotype ♂ (AMNH), right, V "fullside" ***P. lanin*** holotype ♂. **T**: left, V "halfside", right, D "halfside", ***Pseudolucia kinbote*** holotype ♂ (FMNH). **U,V**: **U**— D "halfside", ***Pseudolucia andina*** ♂ example; **V**— V "halfside", ***P. andina*** ♂ example. **Y**: D/V "halfsides", ***Pseudolucia penai*** ♂ (AMNH). **Z**: left, D/V "halfside", ***Pseudolucia aureliana*** ♂ (AMNH); right, D/V "halfside", ***P. aureliana*** allotype ♀ (AMNH). **ZZ**: D/V "halfside", ***Pseudolucia aconcagua*** holotype ♂ (AMNH).

Deposition Abbreviations: AMNH (American Museum of Natural History, New York, USA); FMNH (Field Museum of Natural History, Chicago, USA), HNHM (Hungarian Natural History Museum, Budapest, Hungary); IML (Instituto Miguel Lillo, Tucaman, Argentina).

Some of the original haphazardness of this plate resulted from the provision by overseas workers of photographs (and abdomens) rather than specimens and the subsequent selection of only some of these as types by the taxonomic authors. Better quality photography of these specimens was only possible once they were in hand.

Photoplate V



SECTION II

Eight New Contributions
to Neotropical Polyommatine Taxonomy and Biology

The last eight papers of this volume include contributions that departed from either the standard authorship or contemplated topics of the series "Polyommatine Lycaenids of the Oreal Biome of the Neotropics". These ***Reports* 47-54** include three papers adding recently discovered species to the genera *Pseudolucia* and *Madeleinea*, two papers (one very extensive) concerning the biology and myrmecophily of Neotropical Polyommatini, and three others including historical or systematic commentary. The contents are as follows[1]:

Additions to the Diversity of the Polyommatine Genus *Madeleinea* Bálint (Lepidoptera, Lycaenidae), by D. Benyamini, Zs. Bálint and K. Johnson, ***REPORT* 47**

Two New *Pseudolucia* Species from the High Andean Region of Temperate South America with Revision of the Status of *P. andina nequeniensis* Bálint and Johnson, by D. Benyamini, Zs. Bálint and K. Johnson, ***REPORT* 48**

A Review of Recent Literature and Taxonomic Synonymy is the Neotropical Polyommatinae (Lycaenidae), by Zs. Bálint, ***REPORT* 49**

Further Historical Data Concerning Neotropical Polyommatinae (Lycaenidae) from European Collections, by Zs. Bálint and K. Johnson, ***REPORT* 50**

Studies of Life History and Myrmecophily in Certain Chilean *Pseudolucia* Nabokov (Lepidoptera, Lycaenidae), by D. Benyamini and Zs. Bálint, ***REPORT* 51**

Synopsis of Biological Studies of the Chilean Polyommatini (Lepidoptera, Lycaenidae), by D. Benyamini, ***REPORT* 52**

Recently Discovered New Species of *Pseudolucia* Nabokov (Lepidoptera, Lycaenidae) from Austral South America, by D. Benyamini, Zs. Bálint and K. Johnson, ***REPORT* 53**

Distinction of *Pseudochrysops*, *Cyclargus*, *Echinargus* and *Hemiargus* in the Neotropical Polyommatinae (Lepidoptera, Lycaenidae), by K. Johnson and Zs. Bálint, ***REPORT* 54**

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[1] Note that due to different dates of prepublication for eventual binding in this volume (1993-1995) some variance in the use of Polyommatinae versus Polyommatini (current usage as a Tribe) has resulted.

Additions to the Diversity of the Polyommatine Genus *Madeleinea* Bálint (Lepidoptera, Lycaenidae)

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REPORTS of the
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NO. 47

ABSTRACT

Two new species of the genus *Madeleinea* Bálint (1993), *M. lea* **new species** and *M. sigal* **new species**, are described from high Andean areas of Bolivia of Chile, respectively. The first is from relatively well-collected locales, Cochabamba and Lake Titicaca regions, the latter restricted with some other endemic butterflies to the narrow puna vegetational zone in Tarapacá. The fact that both new species have been discovered by recent "spot" collecting and both are most similar to other recently described congeners confirms original predictions by the authors that *Madeleinea* is a speciose, but simply poorly elaborated, genus. *Pseudolucia* Nabokov and *Madeleinea*, each now with dozens of recognized species in high Andean and austral areas of South America bely the notion of low species diversity in the Neotropical Polyommatini and suggest this common assertion is greatly influenced by sampling error.

INTRODUCTION

Madeleinea Bálint (1993) is a Neotropical, high Andean and austral, genus of polyommatine lycaenid butterflies. It occurs from the paramo regions of high montane Colombia, Ecuador and northern Peru southwards to the waste puna region/ altiplano abutting Peru, Bolivia, Argentina and Chile. Interestingly, the genus is also represented in the chaco regions of Argentina and Paraguay.

In their revision of *Madeleinea*, Bálint and Johnson (1995c) distinguished three species groups of *Madeleinea*: the *lolita*-group (very restricted in distribution and represented, to date, by few museum specimens) and two groups with more familiar taxa, the *koa*-group and *moza*-group. The latter groups are widely distributed in the Andes and well represented in both historical and recent collections (Bálint 1993; Bálint and Johnson 1995c).

Considering what is presently known of the *koa*- and *moza*-groups, members of the former typify more northern distributions. In contrast, taxa of the *moza*-group are more known from more southern ranges (Bálint and Johnson 1995c, figs. 1-2). The *koa*-group presently appears less speciose than the *moza*-group. The latter is, in fact, diverse enough to consider three lineages: (1) the *M. moza* complex, a widely distributed polytypic entity, with brown wing surfaces on both sexes; (2) *M. ludicra* and *M. tintarrona*, both superficially confusable with certain members of the *koa*-group but morphologically similar to *M. moza* and *M. pacis*; and (3) the *M. pacis*, *M. cobaltana*, *M. pelorias* triad, which share a characteristic ventral hindwing macular pattern.

The purpose of the present paper is to add an additional member to the *pacis*-lineage of the *moza*-group, a new species from the altiplano region in Bolivia, plus a new member of the *ludicra*-lineage from northeastern Chile. Description of these entities, which were unknown at the time of the previous revisionary work on *Madeleinea*, adds yet another remarkable example of polyommatine diversity in the oreal biome of the Neotropical Realm.

MATERIAL AND METHODS

This paper expands from the data base and material examined in previous comparative studies of *Madeleinea* (Bálint 1993: 27; Bálint and Johnson 1995c). Some specimens included herein were previously noted as odd or needing additional study (Bálint 1993, Bálint and Johnson 1995c). However, their species level significance was only recognized recently by additional firsthand collections in the field. Some of the cited individuals in one species may have been among samples originally viewed by Nabokov (1945). However, since Nabokov did not dissect these specimens, it appears their significance may have been overlooked. Additional material, including types designated herein, was collected in the context of ecological and distributional studies of *Madeleinea* pursued by the senior author. Observation of individuals in the field, along with noting behavior and ecology of sympatric and synchronic congeners, was pivotal in recognizing the significance of the historical museum material already in place in these taxa. Our experience in this case strengthens the view that, irrespective of similar external features (particularly in diminutively patterned groups of taxa) specimens with extremely divergent morphologies should be regarded as "red flags" for possible sibling or sister taxa. Every effort should be made to followup on morphological observations by investigations in the field.

In taxonomic entries below, we follow the terms and abbreviations previously used in Bálint and Johnson (1995a, 1995b) and Bálint and Lamas (1994).

TAXONOMIC DESCRIPTIONS

Madeleinea lea Benyamini, Bálint and Johnson

Photoplate VI,5; Figs. 1,2.

DIAGNOSIS. ***Wings.*** FW costal margin almost straight, outer margin long and slightly convex, apex pointed. Male DW violet blue, marginal border wide; VHW somewhat resembling *M. pacis* but with very suffused pattern covered by grayish green scales (not colorfully spotted) and with the inconspicuous submarginal band very wide with relatively parallel edges.

Morphology. Male closest to *M. pacis* and *M. cobaltana* but with genitalia showing conspicuous subbasal elements; females with genital anterior lamella edges relatively parallel, henia resembling *M. pacis* most but with parallel anterior lamella edges of extreme width.

DESCRIPTION. ***Male.*** DW ground bright violet liberty blue (Maerz and Paul 1950: 44/B10); veins gleaming, discoidal line not visible, wide marginal black border narrow at tornal area but wider at apex; fringes long, checkered; DHW black, antemarginal coloring in cell CuA2 absent. VFW ground beige, basally with strong yellowish gray suffusion, discoidal and postdiscal spots medium sized with pale halos; veins somewhat lighter colored than ground; submarginal area with typical polyommatine pattern very indistinct; VHW with small costal postbasal spot in cell Sc+R1, discal and postmedian area with grayish brown spot typical of subgroup pattern but indistinct, postmedian spot in Sc+R1 and Rs present but independent, postmedian spots pale, creating a continuous but pale wavy band only slightly interrupted; cell RS lacking silvery stripe; submarginal without pattern, with only a pale spot present in cell CuA2. FW length: 11.0 mm. (holotype), 11.0 mm. (two paratypes). ***Female.*** Similar to male, but larger with longer FW costa. Wings somewhat brighter with grayish pale DW ground; VW similar to male but paler, VHW ground grayish. FW length: 11.5 (allotype), 11.0 mm. (paratype). ***Male Genitalia.*** Fig. 1. Uncus "horseshoe"-shaped with pointed gnathos in dorsal view, valvae relatively slender with thin costal rostellum, aedeagus robust with long and strong subzonal element, subbasal portions strongly pronounced. ***Female Genitalia.*** Fig. 2. Henia showing strongly sclerotized edges with slightly convex contour (constricted and undulate in *M. pacis* and *M. moza*, respectively), anterior lamella width two-times lamella length and with distal edges parallel.

TYPES. Holotype male labelled "Pongo, 4000 m., Cochabamba, Bolivia, 13.II.1994, leg. D. Benyamini", genitalia dissection in glycerin vial Bálint No. 496, deposited in HNHM; allotype female labelled "Bolivia, Titicaca, Guaqui, V [May?], coll. W. Schnuse" "ex. coll. Bethune-Baker, B.M. 1927-360", genitalia dissection in BMNH slide No. 19150, deposited in BMNH. *Paratypes.* One male labelled "Titicaca, Bolivia", "387", "collection E. I. Huntington", "No. 1053", gen. prep. No. 392, Bálint, deposited in AMNH; one female data same as allotype, genitalia dissection in BMNH slide No. 19151, deposited in BMNH.

DISTRIBUTION. ***Spatial:*** known only from the altiplano region of SE Bolivia (Guaqui and Lake Titicaca) and from the Bolivian type locality (Pongo), at considerable elevation (3700-4300 m.). ***Temporal:*** the holotype and one male paratype were collected in February; the allotype and female paratype appear to be marked as May.

REMARKS. The ventral similarity of this species (along with that of the species described immediately below) to *M. pacis* is homoplaseous, a fact apparent when the morphologies of all these species are examined. Thus, *Madeleinea* (like *Pseudolucia*, with its morphologically disparate group of taxa showing ventral "V"-shaped bands) contains morphologically disparate species all showing ventrally dull and unremarkable wing patterns when compared to colorfully spotted congeners. Previously known specimens of these dull ventrally dull taxa were misidentified as either *M. pacis* and *M. moza*. The discovery of additional dull colored species expands our concept of diversity in both the *pacis*-lineage (*M. lea*, new species) and *ludicra*-lineage (*M.* new species below) of *Madeleinea*. Given this fact, the reader should consult the Diagnoses of both the new entities herein, along with the character table (Table 1), to gain an overall familiarity with the diagnostic characters distinguishing the various dully marked taxa now included in the genus. To this end, the Diagnosis of *M. lea*, first described, is basically rudimentary, with that of the subsequently described *M. sigal* fashioned to be comparative both with newly described *M. lea* and the other duller congeners now that the set of these species is more complete.

As noted in the Introduction to this paper, the status of *M. lea* as a new species became apparent when the senior author collected the holotype and one male paratype and was thus able to observe the entity firsthand in the field. This, in part, amounted to a "rediscovery" since historical specimens of this species had been formerly noted as distinctive but needing further study (Bálint 1993, Bálint and Johnson 1995c). The recent collections authenticate the historical material as taxonomically significant and show that the very different VHW patterns and morphological characters in these old specimens were accurate "red flags" marking the existence of an additional species.

As noted in the subsequent Table, *M. lea* is readily separated from *M. pacis*. The distinctive VHW patterns of the species are actually recognizable by the collector in the field. Considering the existence of *M. lea*, it is apparent now that *M. pacis* maintains a quite constant phenotype across its wide distribution-- central Peru [Cuzco, Challabamba] to Bolivia [Cochabamba] (figs. 84, 85, and 88 in Bálint 1993). This matter was unclear until *M. lea* was clearly differentiated.

ETYMOLOGY. A patronym dedicated to the wife of the senior author.

Madeleinea sigal Benyamini, Bálint and Johnson

Photoplate VI,6; Figs. 3,4.

DIAGNOSIS. ***Wings.*** Male DW gleaming "yale blue" (*M. lea* deep violet blue), VHW postmedian spots in cells M1 and M2 equal in size (*M. lea* variable). Otherwise, compared to other congeners, like *M. lea* in FW costal margin (almost straight) and outer margin (long and slightly convex with pointed apex) and clear dimorphism of the sexes.

VHW similar also to *M. lea*, somewhat resembling *M. pacis* but with very suffused (not colorfully spotted) pattern, covered by grayish green scales and with wide but inconspicuous submarginal band with relatively parallel edges. Differing, however, in morphology as noted below.

Morphology. Resembling *M. pacis* and *M. cobaltana* most but male with aedeagus thin and with long suprazonal element; female genitalia with edges of anterior lamella relatively parallel and henia showing strongly broken distal edges.

DESCRIPTION. ***Male***. DW ground yale blue (Maerz and Paul 1950: 44/D12); veins gleaming, discoidal line not visible, wide marginal black border narrow at tornal area but wider at apex; fringes long, checkered; DHW black antemarginal in cell CuA2 absent. VFW ground beige, basally strongly suffused yellowish gray, discoidal and postdiscal spots medium sized with pale halos; veins somewhat lighter colored than ground; submarginal area polyommatine pattern very indistinct; VHW with small costal postbasal spot in cell Sc+R1; discal and postmedian area with grayish brown spot of typical subgroup pattern but indistinct, postmedian spot in Sc+R1 and Rs present but independent, postmedian spots pale, creating a continuous pale wavy band, very slightly interrupted; spots of M1 and M2 equal in length; cell RS with pale silvery stripe; submargin without pattern, only pale spot present in cell CuA2, some arrowhead submarginal markings present in CuA2 and CuA1. FW length: 10.0 mm. (holotype), 10.0 mm. (two paratypes). ***Female***. Similar to male, but larger with longer FW costa. Wings somewhat brighter with grayish pale DW ground, VW similar to male but paler, VHW ground grayish. FW length: 10.0 mm. (allotype). ***Male Genitalia***. Fig. 3. Gnathos with *koa*-like uncus and pointed gnathos in dorsal view; valvae typical of group (see Bálint and Johnson 1995), aedeagus very slender with first strong, then weak and long, suprazonal element, subbasal portions also weak and slightly indented. ***Female Genitalia***. Fig. 4. Henia strongly sclerotized and with distal edges strongly broken at midpoint and longer than anterior lamella; anterior lamella with width two times that of length.

TYPES. Holotype male labelled "Chile, Tarapacá, Putre, 3400 m., 16 April 1994, leg. D. Benyamini", genitalia dissection in glycerin vial Bálint No. 495, deposited in MNHM. Allotype female and two paratypes males with same data, genitalia dissections gen. prep. Nos 495 and 521 (males), 522 (allotype). Allotype deposited HNHM, paratype males deposited AMNH (gen. prep. No. 495) and in private collection of D. Benyamini (gen. prep. No. 521).

DISTRIBUTION. ***Spatial***: known only from the type locality at high elevation (3400 m.). ***Temporal***: the type material was collected in April.

REMARKS. *Madeleinea pacis*, according to recurated museum samples (Bálint 1993, Bálint and Johnson 1995) exhibits a relatively wide distribution and is well represented in some Peruvian and Bolivian samples (respectively, material at BMNH and AMNH [see Bálint 1993, Bálint and Johnson 1995] as well as in the Forster material [see Bálint 1995]). From current data, *Madeleinea sigal* and *M. pacis* appear non-sympatric, but the wide occurrence of *M. ludicra* embraces both of these distributions. Identification of all these species should not cause serious problem, even in the field. Moreover, if sympatry and synchrony between *M. sigal* and *M. pacis* was eventually discovered, these taxa are sufficiently different in external features to cause little additional diagnostic problem (readily checked, in any event, by the morphology) (see Table 1).

The genitalia of *M. sigal* are quite remarkable. They would appear closely related to the *tintarrona-ludicra* lineage (as indicated by the slender uncus of the male genitalia) except that female structures are closer to *M. pacis* and *M. moza*. Ureta (1963: 107) mentioned "*Itylos pelorias*" and "*Itylos moza ludicra*" from Chile. Considering current knowledge of polyommatine affinities, these binomial combinations are quite erroneous. However, it is most likely Ureta's data pertain to *Madeleinea pelorias* in the first case and *M. ludicra* in the latter (see Bálint and Johnson 1995).

TABLE 1

Characters typifying ***M. pacis*, *M. pelorias*, *M. cobaltana*, *M. lea* and *M. sigal*.**

DW ground:

M. pacis: deep violet blue
M. pelorias: gleaming greenish blue
M. cobaltana: gleaming cobalt blue
M. lea: lighter deep violet blue
M. sigal: gleaming yale blue

VHW postmedian spots in cells M1-M2:

M. pacis: equal in size or spot in M2 somewhat larger, both rounded
M. pelorias: spot in M2 always larger, both quadrant
M. cobaltana: M2 always larger, both very big
M. lea: variable
M. sigal: equal in size

Aedeagus of male genitalia (ventral view):

M. pacis: subzonal sheath narrow, with elongate and narrow suprozonal element
M. pelorias: subzonal sheath conspicuously robust with elongate but shorter suprazonal element
M. cobaltana: subzonal sheath robust with elongate and produced suprazonal element
M. lea: subzonal sheath robust with relatively short and slender suprazonal element
M. sigal: subzonal sheath robust with long suprazonal element

Henia of female genitalia (ventral view):

M. pacis: edges bent twice
M. pelorias: edges curved and wavy
M. cobaltana: gently curved
M. lea: gently curved
M. sigal: edges broken at middle

ETYMOLOGY. A patronym dedicated to a son of the senior author.

DISCUSSION

The discovery of these new species is not surprising. Bálint (1992) predicted that once *Madeleinea* was more well known among Latin American workers, additional new species would be readily recognized. Bálint and Lamas (1994) and Balint and Johnson (1995) have already described new species.

Fjeldså (1992), in studies of mountain birds in the altiplano regions of several Andean countries, pointed out the contradiction of conspicuous uniformity among environs of the high flat plateau of the altiplano (probably a result of long term human influence) and diversity among ecologies and microhabitats characterizing the edge of the plateau and myriad quebradas extending westward and eastward towards lower elevations (Fjeldså 1992: 43-45). Among butterflies, Polyommatine lycaenids are comparatively nonvagile organisms, often typifying highly specialized or isolated biotopes. Such microvicariance can lead to rapid and striking speciation, also well known for the Old World polyommatine fauna. Recent work in the Antilles has discovered isolated species of *Leptotes* and *Cyclargus* (Johnson and Matusik 1988, 1992). Similar situations are recorded more and more among eumaeine lycaenids as modern fieldwork expands. In Argentina, Johnson, Eisele and MacPherson (1990 & in press) note a species of *Strymon* known from a single quebrada in Salta Province and Johnson (1992) described a species of *Terra* known only from a single, extremely isolated, high montane oasis in Jujuy. In Chile, a species of *Heoda* occurs only along an extremely narrow belt of Puna vegetation in a sector of Tarapacá province (Benyamini and Johnson, 1995). There are many more examples. Appreciation of such unique diversity among high Andean lycaenids has been hindered hitherto by pervasive sampling error.

The new species described in the present paper are clearly descendants of the diverse *pacis*-subclade of *Madeleinea*. All the formerly known taxa of this lineage (*M. pacis*, *M. cobaltana* and *M. pelorias*) are very closely related in wing pattern and genital morphology. The allotype and the paratype specimens of *M. lea* derive from old samples collected in the vicinity of the Titicaca Lake. In this region numerous *Madeleinea* species occur, including *M. pelorias*, *M. pacis*, *M. tintarrona*, *M. koa* and *M. ludicra*. In spite of this, more precise examination of available data suggests none of these species are sympatric with *M. lea*. Interestingly, *M. koa*, *M. ludicra*, *M. pacis* and *M. pelorias* (in the vicinity of Puno) and *M. ludicra* and *M. pelorias* (in the Sajama region) are readily documented as sympatric and synchronic. Accordingly, when a larger faunistic database is available, it is likely that such overlap with *M. lea* will also be discovered.

Madeleinea sigal presents a different situation. Benyamini and Johnson (1995) have examined the extremely limited Puna vegetation biotope in Tarapacá in some detail and linked it to the occurrence of a number of poorly known endemic lycaenids, some of which were formerly known only from the regionalized data of old specimens. Considering these data, two possibilities exist— 1) that additional, previously described, polyommatine species may eventually be recorded from the Puna (a limited oasis of mild climate and profuse, albeit seasonal, vegetation), and 2) that additional new endemics may be discovered from the zone given its elongate and ribbon-like occurrence as an ecotone between higher (alpine) and lower (absolute desert) habitats.

MORPHOLOGICAL FIGURES

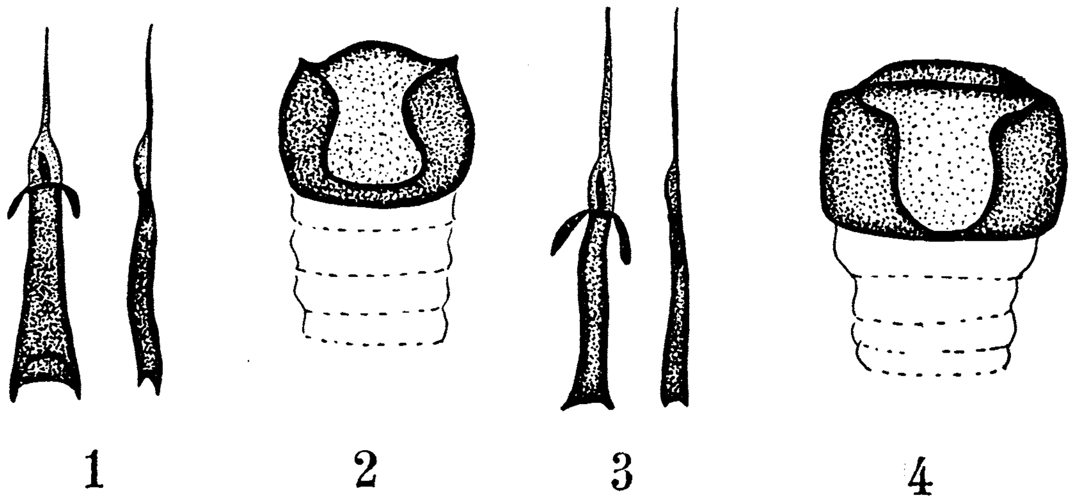
(facing page, as keyed therein)

Figure 1. Male genital features of *Madeleinea lea*.

Figure 2. Female genital features of *Madeleinea lea*.

Figure 3. Male genital features of *Madeleinea sigal*.

Figure 4. Female genital features of *Madeleinea sigal*.



1. ***M. lea***, aedeagus of male genitalia, dorsal (left), lateral (right); **2.** ***M. lea***, sclerotized female genital terminalia (dark stipples above, ventral view); **3.** ***M. sigal***, aedeagus of male genitalia, dorsal (left), lateral (right); **4.** ***M. sigal***, sclerotized female genital terminalia (dark stipples above, ventral view).

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Two New *Pseudolucia* Species From the High Andean Region of Temperate South America

with Revision of the Status of *P. andina neuquenensis* Bálint and Johnson

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ABSTRACT.

Two new species of *Pseudolucia* Nabokov are described, *P. avishai* **new species** and *P. talia* **new species.** The first comprises an important addition to the clade of species including *P. andina* Bartlett-Calvert. Consideration of overall habitus and distribution of this new entity strongly suggests the respective high Andean and austral elements of *P. andina* (*a. andina* and *a. neuqueniensis* Bálint and Johnson) have species worth. Accordingly, infraspecific nomenclature of *P. andina* is revised to recognize *P. andina* (*sensu stricto*) and *P. neuqueniensis*, **new status.** *Pseudolucia talia* appears to be a sister species of *P. argentina* Balletto and is a member of the distinctively marked *sibylla*-related subclade of the *plumbea* species group of *Pseudolucia*.

INTRODUCTION

Recent studies of the austral polyommatine fauna documented that the genus *Pseudolucia* (described by Nabokov in his seminal paper of 1945), has a remarkable diversity on the eastern and western flanks of the Andes (Bálint and Johnson 1993, 1995a). Another taxon, *Lycaena griqua* Schaus, 1902, an unavailable homonym subsequently replaced by Bálint (1993) with *Pseudolucia parana*, occurs in montane southeastern Brazil. Thus, the genus is widely distributed across the temperate region of the Neotropical Realm.

The senior author ("Benyamini") has been conducting concerted investigations of the ecology of Chilean butterflies. This work has already resulted in two papers concerning the biology of Chilean polyommatine lycaenids (Benyamini 1995, Benyamini and Bálint 1995). During this fieldwork, several new species of Chilean butterflies were discovered (Bálint and Johnson 1995b; Bálint, Benyamini and Johnson 1995; Johnson and Benyamini 1995). Two more new species of blues assignable to the genus *Pseudolucia* are described in the present paper.

Pseudolucia species currently show strikingly disjunct distributions in Chile and adjacent Argentina (including Patagonia) with numerous allopatric species suggesting a high rate of endemicity. In noting this phenomenon, Shapiro (1994) comments that although some sampling error undoubtedly still influences current knowledge of these distributions, there seems to be little doubt concerning the distinctness of the various species. It remains a priority for austral workers to continue amplifying knowledge of these distributions. Interestingly, however, discovery of new species continues at a frequent rate and this suggests that austral biomes utilized by these polyommatines show a far more complex and intriguing evolutionary history than previously expected. In the case of the two new species described herein, not only are both interesting in overall habitus and ecology, both suggest clear sister species affinities to other other recently described austral or high Andean entities.

Historical Review. In a very recently published synopsis on Argentine *Pseudolucia*, Bálint and Johnson (1995[1]) treated the respective high Andean and Patagonian populations of *Pseudolucia andina* as separate subspecies. This was a conservative taxanonic approach based on a desire not to proliferate species usages in this region without compelling reason. However, in recent fieldwork, Benyamini discovered a striking new member of the *andina* clade, characteristics of which strongly suggest species status validity for each member of this clade. Accordingly, we describe the new species below and then revise the taxonomy of *P. andina* to recognize the respective high Andean and austral populations (*a. andina* and *a. neuqueniensis*) as separate species.

TAXONOMIC ENTRIES

Pseudolucia avishai Benyamini, Bálint and Johnson

NEW SPECIES

Photoplate VI,1.

DIAGNOSIS. ***Wings.*** A large species (FW length to 14.00 mm.) comparable only with *P. andina nequeniensis* [latter subsequently of new status] (*Adults*— Photoplate IV: A,B; Bálint 1993a, IVA,53-55. *Genitalia*— Figs. 9,11). *P. avishai* is easily distinguished by it overall greyish DFW, DHW being finely grizzled with blue; sympatric *P. andina andina* is brown with only a copper shade (*Adults*— Photoplate IV: A-D, V: U,V; Bálint 1993a, IVA,53-55. *Genitalia*— Figs. 3,9,11; Bálint and Johnson 1993, ♂J,♀L). On the VFW of *P. avishai* postmedial spots appear disordered compared with *P. andina*— the jagged brown crescents of the VHW "V"-shaped band broken with suffusion and patterned with arrowhead-like markings more sharply pointed than in this latter species.

Morphology. The female is most similar to *P. andina* but has both wider and shorter sclerotized terminalia (cf. Fig 4b). The male shows the distinctive valval terminus typical of *P. andina* (lacking the hooked terminal rostellum of other congeners and, instead, showing a "fleshy" terminal lobe tapering to a blunt end) but in *P. avishai* shows a pointed uncus in ventral view (cf. Fig 3a).

DESCRIPTION. ***Male.*** DFW, DHW ground color smoked pearl gray (Maery an Paul 1950: 46b3) finely grizzled with light blue overscaling; veins lighter, gleaming; fringe long and checkered. VFW ground generally tawny to beige, postmedial area marked emphatically with dark spots from cell CuA1 to the costa in a disordered line, each paralleled by brown submarginal crescents; VHW ground tawny

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[1] Although included in the same bound volume, this paper was already printed and awaiting binding at the time of preparation of the present article. Thus, the Argentine paper is considered by us as amended by usages herein, adding two additional species to the Argentine *Pseudolucia*: *P. neuqueniensis* and *P. talia* (of subsequent entry).

to beige, marked with jagged brown chevrons comprising a medial "V"-like band, sharply jagged; postbasal intercellular spaces marked rather randomly with suffusion and sharply pointed; submarginal area with some suffusive white, often coalesced into chevrons; marginal cell CuA1 marked with sharply V-sahped blackish chevron enclosing a brown spot. FW length: 12.5 mm. (holotype); 11.5-14.5 mm. (paratypes, n= 3). *Female.* Similar to male in VHW markings, differing by being generally darker and larger (*e.g.* with wider wings), DFW with pale median orange suffusion and VFW ground orange. FW length: 14.5 mm. (allotype); 13.5-14.8 mm. (paratypes, n= 3) ***Male Tergal Morphology and Genitalia.*** Fig. 1. Terminal tergite without *sipc* ["subcordate incised posterior cavity"]. Genitalia with valvae shape unique for the species group, lacking terminal rostellum and showing instead a "fleshy" tapered anterior, terminating in a blunt and slightly down-turned end; juxta strong and longer than suspensorium; tegumen strongly sclerotized with uncus "horseshoe"-shaped but pointed, gnathos strong and curvate, about same length as uncus; penis with pronounced subzonal element, suprazonal element thicker and shorter, length about one-third that of subzonal element, alulae very weak; sagum present and strongly sclerotized toward costa. ***Female Tergal Morphology and Genitalia.*** Fig. 2. Terminal tergite modified to *sipc*, showing robust eighth tergite with stout anteriorly-directed process. Genitalia with large sclerotized terminalia marked by a smaller sclerotized elliptic tube (resembling the central element of the *plumbea*-Group) but showing also a thickened terminal nodule and little evidence of any lateral wings.

TYPES. Holotype male, allotype female, CHILE, 2900 m., Coquimbo Reg., Illapel, Los Pelambres, ex larva, adult emerged 20.II.1993, leg. D. Benyamini, gen. prep. nos. 538 (holotype) and 539 (allotype), Zs. Bálint, both deposited in HNHM. *Paratypes*: 1 male with the data of the primary types (deposited in HNHM); same locality, 3300 m, ex larva, 6.III.1994, 1 male (HNHM); same locality, ex larva, 27.III.1994, 1 female (gen. prep. No. 494, Zs. Bálint) (HNHM); same locality, 2950 m, ex larva, 3.VI.1994, 1 male and 1 female (gen. prep. No. 493 Zs. Bálint), (both deposited in AMNH)); same locality, 2600 m, ex larva, 28.I.1994, 1 female (HNHM).

DISTRIBUTION. ***Spatial***: currently known only from the close vicinity of Los Pelambres, Illapel, Chile between altitudes of 2600 and 3300 m. ***Temporal***: dates on specimens reared from larvae reared by Benyamini range from end of January to beginning of June. Due to laboratory conditions, this probably does not exactly reflect the natural flight period.

REMARKS. The species was discovered during breeding experiments on *P. andina* conducted by Benyamini (Benyamini and Bálint 1995).

ETYMOLOGY. The name, *avishai*, is a Latinized substantive patronym of the Hebrew *Avi-shi* (meaning "the gift of Avraham") and is named for the son of the senior author— Avishi Benyamini.

The Status of *Pseudolucia andina nequeniensis* Bálint and Johnson, 1995.

Originally, Bálint and Johnson (1995) noted that the morphology of Andean and Patagonian populations of *Pseudolucia andina* (*sensu lato*) was similar enough to suggest a conservative taxonomic approach, *e.g.* no division at the species level of the respective farflung populations of this complex on either side of the Andean/ austral continental divide. This was consistent with outstanding difference in the male valve terminus in *P. andina* compared to all other congeners (Bálint 1993: 21; Bálint and Johnson 1993, figs. 3,9, 11). The discovery of *P. avishai*, however, shows that outstanding characters previously attributable to only one entity— *P. andina*— actually charactize a clade of entities. Once a third member of this group was know, exhibiting a divergent morph of the "*andina* habitus" a new evaluation was needed of the structural and distributional integrity of the respective Andean and Patagonian *andina* populations: nominate *andina* and *a. neuqueniensis* Balint and Johnson 1995.

Summarized from above, the following morphological characters distinguish *P. avishai*: (1) shape of male genital uncus, (2) overall sclerotal form and dentation of the male genital sagum, (3) shape and size of sclerotized terminal tube in female, and (4) habitus of female ductus bursae. Occurrence of these salient characters in a Chilean entity, *P. avishai* (sympatric with *P. andina*), requires a reevaluation of characters previously seen only in the Patagonian and Andean forms trinomially assigned to *P. andina*. Characters appear clearly shared between *P. avishai* and the Patagonian entity "*neuqueniensis*" (Table 1, below) and, if synapomorphic, suggest this latter entity and *P. avishai* are immediate sister taxa (with *P. andina* as their outlying sister). Not only is this relationship apparent in the morphology, it in concilient with differences in the superficial characters previously noted by Bálint and Johnson (1995).

In this light, *P. neuqueniensis* must be considered a distinct species, a Patagonian endemic like its sympatric congeners *P. lanin* Bálint and Johnson and *P. charlotte* Bálint and Johnson (Bálint and Johnson 1993, 1995). Thus, for taxonomic purposes we propose the following:

Pseudolucia neuqueniensis **Bálint and Johnson 1995**
NEW STATUS.
Pseudolucia andina neuqueniensis Bálint and Johnson 1995, p. 5.

REMARKS. The discovery of *P. avishai*, with characters suggesting it is the immediate sister species of Patagonian *P. neuqueniensis*, mirrors similar phenomena in the austral Theclinae. For instance, Johnson, Miller and Herrera (1992) separated the Andean and Patagonian populations of the autochthonous South American Strymonina lineage *Eiseliana* into two species, Andean *E. punona* (Clench) and a new species *E. patagoniensis*. This was not a matter of simple splitting since the Peruvian and Argentine Andean populations of *E. punona* (formerly regarded as *Thecla punona* and *Eiseliana koehleri* de Toledo, respectively) were judged conspecific as part of this revision. To date, however, Johnson and others (Johnson, Miller and Herrera 1992, Johnson and Miller 1992) have considered widely disjunct Patagonian, Andean, and Valdivian populations of *Heoda nivea* Johnson, Miller and Herrera and *Heoda suprema* Johnson, Miller and Herrera as comprising only two species. As with *Pseudolucia* this view stems purely from a conservative taxonomic approach since, even though series of some populations of these species exceed ten specimens, most are from single-day fortuitous collections by various austral workers. In correspondence, Johnson has consistently advised Benyamini that biological data should be gathered on Patagonian and Chilean populations of both *H. nivea* and *H. suprema*. In these species, differences between Andean, Patagonian and Valdivian elements are apparent in the wing pattern and it is also unlikely that populations from very different habitats (in the case of *H. suprema*, austral shrub-steppe/ Valdivian forest) are biologically conspecific. However, because genitalia of *Heoda* disjuncts show many haphazard autapomorphies, it has been difficult to support infraspecific division of these taxa strictly by morphology. All three authors of the present paper suspect that eventual evidence will support species level separation of the respective Chilean and Argentine elements of both *H. suprema* and *H. nivea*. The life history of the latter is already under study by Benyamini. In addition, Benyamini's recent discovery that *H. atacama* Johnson and Miller extends southward to central Chile suggests that, like *P. avishai* in *Pseudolucia*, the former species may figure more prominently in deciphering the austral phylogeny of *Heoda* than previously supposed from *H. atacama*'s supposed restriction to the Atacama coastal habitat.

MATERIAL EXANINED.

Pseudolucia andina – males: 353 (Aconcagua), 354 (Aconcagua), 435 (Portillo), 515 (Aconcagua), females: 352 (Aconcagua), 516 (La Parva).

Pseudolucia avishai – see Type Material of the taxon above.

Pseudolucia neuqueniensis – males: MK 15 (paratype, Paso del Cordóba), 518 (paratype, Paso del Cordóba); female: MK 21 (paratype, Paso del Cordóba).

Pseudolucia talia Bálint, Benyamini and Johnson
NEW SPECIES

Photoplate VI,3

DIAGNOSIS. ***Wings.*** Slightly larger than its apparent sister species *P. argentina* (Photoplate V), wings appearing somewhat "longer". Male and female DFW,DHW lustrous "grainy" azure blue. Both sexes with very thin black marginal border and small, but very visible, black CuA1 spot on both DHW and DHW. Submargins of male DFW, DHW with greyish band (white in *P. argentina*). VFW postmedial area covered by prominent auroras, patterned by coalesced submedian spots (all distinct in *P. argentina*); VHW of both sexes showing, in addition to succinct markings extending from 1A+2A to M1, equally emphatic marks invading the entire discoidal area of cells CuA1 to 1A+2A, although with smaller basal and larger discoidal spots as in *P. argentina*. Postmedial area with wide white markings as in *P. argentina*. Fringes long and checkered.

Morphology. Female terminal tergite robust and simple, similar to *P. argentina*; genitalia showing winged habitus like closely related species (*P. argentina*, *P. sibylla*, etc.) but with terminalia distinctly pointed (markedly bulbous in *P. argentina*, cf. fig. 4b) and with central elliptical element and winglike flaps both robust. Male morphology closest to *P. argentina* but with a markedly more pointed "horseshoe"-shaped uncus (cf. fig 3b).

DESCRIPTION. ***Male.*** DFW,DHW ground grainy lustrous blue (Maerz and Paul 1950: 36K7), narrow black marginal borders not emphatic; fringes checkered. VFW ground brownish orange in medial area, submedian spots coalesced, submargin darker gray and marked only with extremely faint (almost invisible) spots across the wing; VHW ground much obscured by gray-brown grizzling but with evident pattern including succinct brown elliptic orbs (extending on HW from cell 1A+2A to M1 as typical of *sibylla* subgroup), discoidal pattern of equally intense orbs extending from CuA1+2A and, in the postmedial area, prominent white auroras. Limbal area with emphatic black orb at CuA1 typical of subgroup. FW length: 9.5 mm. (holotype and paratype). ***Female.*** DFW,DHW brown; VFW, VHW similar to male except for postmedial area of HW. FW length: 11.0 mm. (allotype). ***Male Tergal Morphology and Genitalia.*** Fig. 3. Terminal tergite lacking *sipc*. Genitalia with valvae shape robust, terminal rostellum long and strongly hooked; juxta slender equalling the length of suspensorium, tegumen moderately sclerotized with a stronger suspensorium; uncus bulbous, horseshoe shaped and pointed; gnathos curved and equalling length of uncus; penis with wide subzonal element, suprazonal element thicker and about half subzonal length; alulae long and slender; sagum present but very weakly sclerotized. *Female Tergal Morphology and Genitalia*. Fig. 4. Eighth tergite showing *sipc* laterally very robust but with a simple apodeme; genitalia with sclerotized terminalia showing winged habitus with central tubular element relatively long (length about six times diameter at widest point), pointed terminally, robust at the anterior, and with winged elements extremely diminutive (length about two-thirds that of tube).

TYPES. Holotype male, ARGENTINA, San Juan, 4200-4500 m., Paso del Agua Negra, 20.II.1994, leg. D. Benyamini, gen. prep. no. 501, Zs. Bálint, deposited HNHM; allotype female, with same data, gen. prep. no. 489, Zs. Bálint, deposited in HNHM. *Paratype*: male with same data as primary types, in the private collection of Dubi Benyamini (Santiago, Chile).

DISTRIBUTION. *Spatial*: known from the high deserts surrounding the pass at Agua Negra, Argentina, elevation above 4000 m. *Temporal*: currently known only from the type data December and January.

REMARKS. Some notes concerning the interesting biology of the species and other congeners appear in this same volume of papers (see Benyamini 1995).

ETYMOLOGY. The name is a Latinized substantive of the Hebrew *Tal-ya* (meaning "dew of God") and is named for the first daughter of the senior author—Talia Benyamini.

DISCUSSION and CONCLUSIONS

The present paper further strengthens the view that the Neotropical polyommatine genus *Pseudolucia* shows both remarkable diversity and endemism in the Chilean and Patagonian subregions. It is also evident that the oreal fauna of the Neotropical Realm still contains additional unelaborated diversity, the last decade witnessing continual discovery of new species even from the most historically well-known collecting areas. Adding to this spectrum of diversity are new species discovered either by frequenting of habitats previously recognized for local endemism (as with *Madeleinea sigal* Benyamini, Bálint and Johnson and *Heoda erani* Johnson and Benyamini) or the fortuitous discovery of new species during field biology and rearing studies (as with *P. avishai*).

To augment current diagnostic data on *Pseudolucia* we addend, on the page following Table 1, a wing character KEY to the *plumbea*- and *andina*-Groups of this genus. Recent publications on the genus have added numerous new species to both of these groups. Also, recent emphasis on morphological study of the genus has shown that the *plumbea*-Group actually includes the divergently marked members of the previously recognized *sibylla*-Group. Since the latter are readily recognized by wing pattern, a key including both the *plumbea* and *sibylla* subgroups of the larger *plumbea*-Group is also useful at this time, particularly since it can include notation of the current status accorded some of the recent names of Balletto (Balletto 1993).

TABLE AND KEYS

TABLE 1.

Characters typifing the taxa *P. andina*, *P. avishai* and *P. neuqueniensis*

	P. andina	*P. avishai*	*P. neuqueniensis*
male genital uncus	wide and blunt	slender, sharply pointed	long, pointed
male genital sagum	heavy and slightly dentate	less sclerotized and less dentate	strongly dentate
female genital terminalia	long and narrow	wide but small relative to tergite	wide and very large relative to tergite

KEYS

to *plumbea*-Group and *andina*-Group of *Pseudolucia*

Using combined wing, male and female genitalic characters to allow worker to key from whichever gender is available or from dissected or undissected specimens. If usage of single character by worker is not remedial, reference can be made to additional characters cited in same entry.

plumbea-Group

Male genitalia with sagum weakly sclerotized or absent; female genital terminalia with winglike flaps.

1a. *Wings.* DW burnished brown in either sex or male DW lustrous blue and female brown with orange medial suffusion; VHW with grizzled lunulate postmedian band. *Genitalia.* Male valvae elliptic, terminal rostellum very hooked; female with very long ductus bursae (cca. 7 times longer than sclerotized terminalia)................ ***plumbea* Subgroup**: *P. annamaria*, *P. hazeorum*, *P. clarea* and *P. plumbea*

b. *Wings.* DW ground lustrous blue or flat brown in either sex. *Genitalia.* Female with ductus bursae shorter than specified above..........................2

2a. *Wings.* DW ground lustrous azure or dark brown with deep violet basal suffusion; VHW with concise brown patchlike markings or yellowish ground extending across wing in an oblique pattern directed closely to the margin and costa, limbal area with bright metallic spots along the margin. *Genitalia.* Male valvae very robust with terminal rostellum elongate and greatly hooked; female with ductus bursae approximately four or less times longer than sclerotized terminalia.................... ***sibylla* Subgroup**: *P. sibylla*, *P. penai*, *P. aureliana* and *P. oligocyanea*

b. *Wings.* DW ground lustrous grainy azure with deep violet basal suffusion; VHW ground much obscured by gray-brown grizzling. *Genitalia.* Male valvae greatly produced in posterior, terminal rostellum sharply hooked; female with ductus bursae approximately five times or more longer than sclerotized terminalia...........3 **[*argentina* Subgroup]**

3a. *Wings.* VHW postmedian area conspicuously white. *Genitalia.* Female genital terminalia with bulbous apex.. *P. argentina*

b. *Wings.* FW costa longer, outer margin shorter; VHW conspicuous white postmedian area wider. *Genitalia.* Female terminalia with pointed apex .... *P. talia*

andina-Group

Male genital sagum large, strongly sclerotized; female genital terminalia with central tube.

1a. *Wings.* Male DW ground gentian blue; female DW ground brown with orange and blue medial suffusion; VHW with "V"-shaped band formed by small ruptive gray-brown spots. *Genitalia.* Male gnathos thin, uncus long and relatively slender, aedeagus with widened and slightly pear-shaped subzonal element and pointed suprazonal element; female terminalia long with very narrow central tube and pointed apex .... *P. lanin*

b. *Wings.* DW ground of either sex brownish or brown, VHW with "V"-shaped band formed by large ruptive gray-brown spots. *Genitalia.* Male gnathos and uncus strong, aedeagus with strong parallel subzonal edges, suprazonal element not sharply pointed; female terminalia heavily sclerotized with a large central tube .... 2 **[*andina* Subgroup]**

2a. *Wings.* DW ground of either sex deep brown. *Genitalia.* Male gnathos long and pointed; female genital terminalia with large central tube .... *P. neuqueniensis*

b. *Wings.* DW ground bronze or grizzled blue. *Genitalia.* Male gnathos shorter; female genital terminalia with weaker central tube .... 3 [*P. andina* and *P. avishai*]

3a. *Wings.* DW ground bronze. *Genitalia.* Male gnathos with bulbous apex; female terminalia with long but slender central tube .... *P. andina*

b. *Wings.* DW ground grizzled blue. *Genitalia.* Male gnathos weak and pointed; female terminalia with relatively small central tube .... *P. avishai*

MORPHOLOGICAL FIGURES
(pages 7-8)

Fig. 1. ***P. avishai.*** Male genital uncus, gnathos, tegumen, suspensorium, vinculum (left), valva (middle) and aedeagus with sagum (right).

Fig. 2. ***P. avishai.*** Female genital terminalia in ventral view (left) and eighth tergite in lateral view (right).

Fig. 3. Male comparative morphology of *P. avishai* and *P. neuqueniensis*. a. *P. avishai*; **b.** *P. neuqueniensis*. Format: Male genital uncus, gnathos, tegumen, suspensorium, vinculum (left), valva (middle) and aedeagus with sagum (right).

Fig. 4. Female comparative morphology of *P. avishai* **and *P. neuqueniensis*.** a. *P. avishai*; b. *P. neuqueniensis*. Format: Female genital terminalia in ventral view (left) and eighth tergite in lateral view (right).

Fig. 5. Male comparative morphology of *P. talia* and *P. argentina*. a. *P. talia*; b. *P. argentina*. Format: Male genital uncus, gnathos, tegumen, suspensorium, vinculum (left), valva (right), all in lateral views.

Fig. 6 (oriented above, right, on plate). **Female comparative morphology of** *P. talia* **and *P. argentina*.** a. *P. talia*; b. *P. argentina*. Female genital terminalia, ventral view.

Figure 1

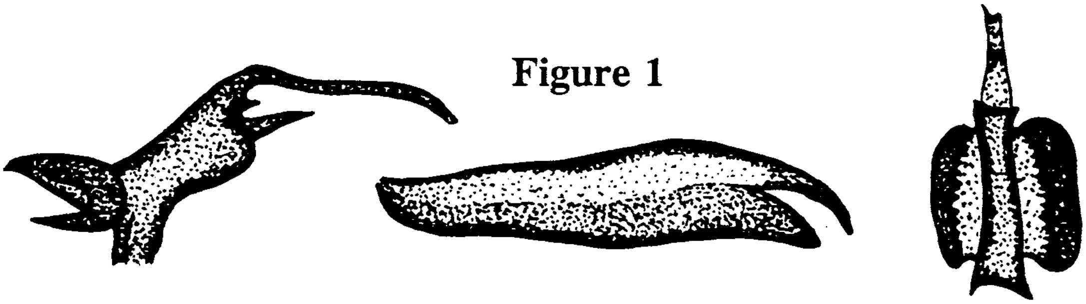
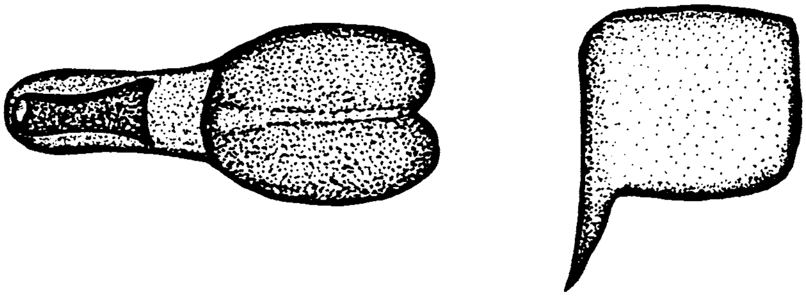


Figure 2



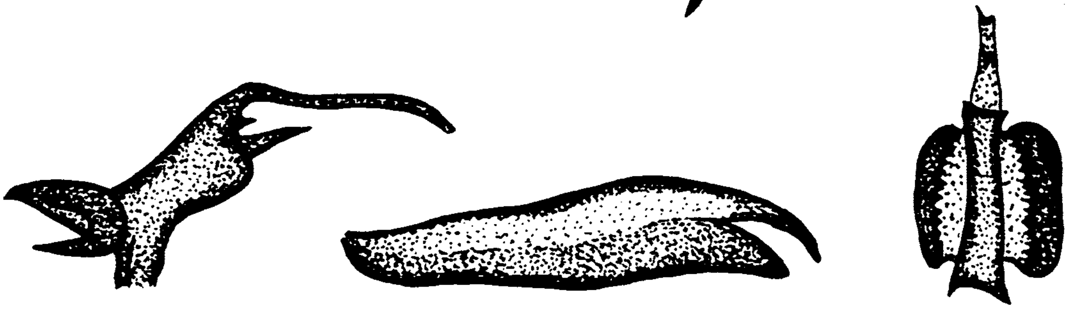


Figure 3a

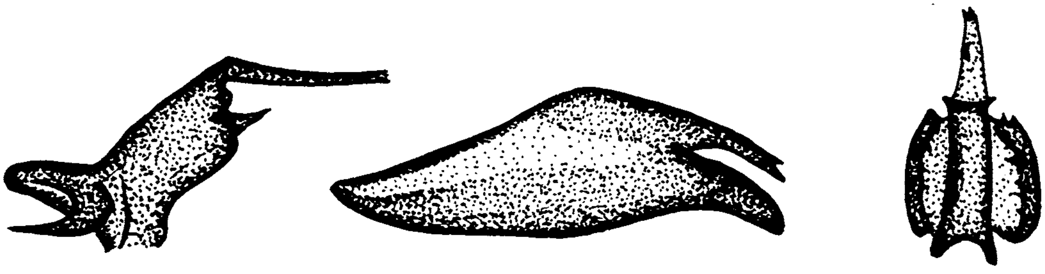
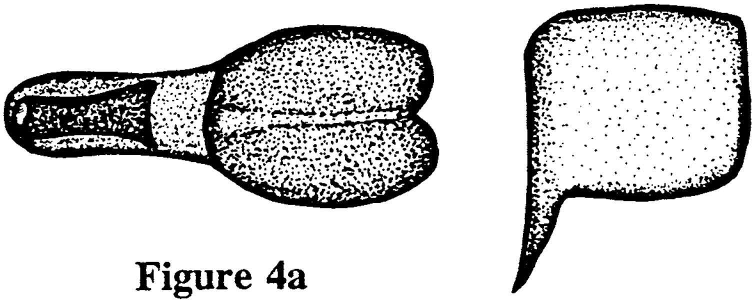


Figure 3b



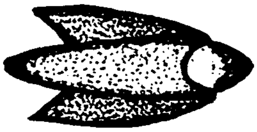
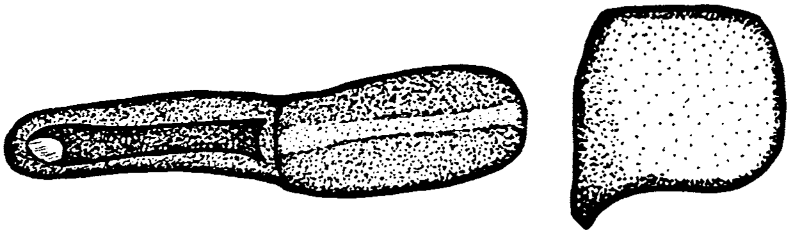


Figure 6a

Figure 4a



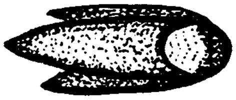


Figure 6b

Figure 4b

Figure 5a

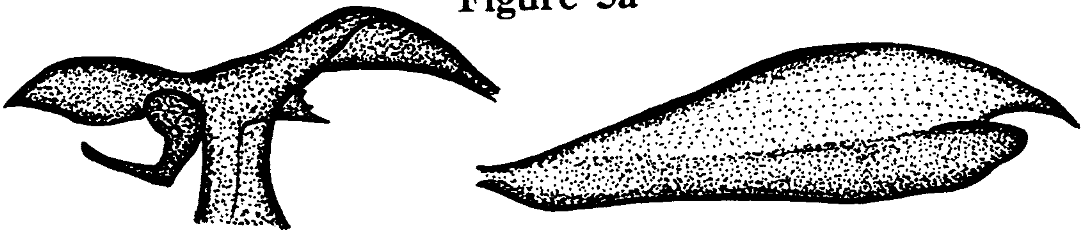
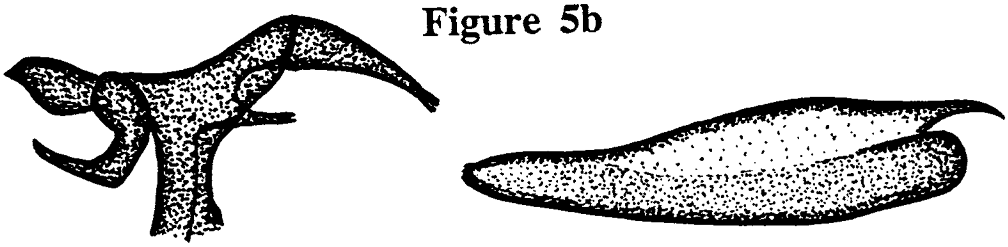


Figure 5b



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CROSS REFERENCE TO ADDITIONAL PHOTOGRAPHS

for species included in *Report* No. 48

Major taxonomic entries—

Pseudolucia avishai: color— **PHOTOPLATE XII**

Pseudolucia neuqueniensis: B & W— **PHOTOPLATE IV**

Pseudolucia talia: color— **PHOTOPLATE XI**

Comparative species mentioned—

Pseudolucia andina: color— **PHOTOPLATE XII**

CAPTIONS TO PHOTOPLATE VI

(facing page and overleaf "**Photoplate VI**" and "**Photoplate VI, continued**")

[*format*: photographs are grouped by REPORT No.'s indicated; photograph rows are numbered, top to bottom, as **1-5**, photos in each row as **L** (left), **M** (middle), **R** (right), further keyed as necessary to special notations, if any, in the text **and** each is captioned on the plate with genus, species, gender and view (D =dorsal, V= ventral)]

PHOTOPLATE VI (facing page)

ADULT PHOTOGRAPHS FOR *REPORT* NO. 48— (facing page)

Text "1"= **1L**, *Pseudolucia avishai*, holotype male (HNHM)
Text "1", **1M**, *P. avishai*, allotype female (HNHM)
1R, *Pseudolucia argentina*, male, Aconcagua, Argentina (HNHM) [for comparative purposes]
2L, *P. argentina*, female, Aconcagua, Argentina (HNHM) [for comparative purposes]
Text "2" = **2M**, *Pseudolucia andina*, male, ex larva, Portillo, Chile (HNHM)
Text "2", **2R**, *P. andina*, female, ex larva, Portillo, Chile (HNHM)
Note: for *Pseudolucia neuqueniensis*, **new status**, see Photoplate IV (1L, 1M)
Text "3" = **3L**, *Pseudolucia talia*, holotype male (HNHM)
Text "3", **3M**, *P. talia*, allotype female (HNHM)

ADULT PHOTOGRAPHS FOR *REPORT* NO. 46— (facing page)

Text "4"= **3R** for *Pseudolucia benyamini*, holotype male (HNHM) (then reverting to "4")
Text "4"= **4L**, *P. benyamini*, allotype female (HNHM)
4M, *Pseudolucia lyrnessa*, male, Chile, Concepción, 30 XI 1907, P. Herbst (HNHM), FW 8.2 mm. [for comparative purposes, see also color photograph of type, Photoplate VII]
4R, *P. lyrnessa*, female, Chile, Concepción, 30 XI 1907, P. Herbst (HNHM), FW 8.2 mm. [for comparative purposes]
5L, *Pseudolucia collina*, male, Chile, Elqui, XI.1991, Castillo (HNHM), FW 10 mm. [for comparative purposes]
5M, *P. collina*, female, Chile, Elqui, XI.1991, Castillo (HNHM), FW 9 mm. [for comparative purposes]
5R, *Pseudolucia charlotte*, holotype male (AMNH) [for comparative purposes]

PHOTOPLATE VI, continued (overleaf)

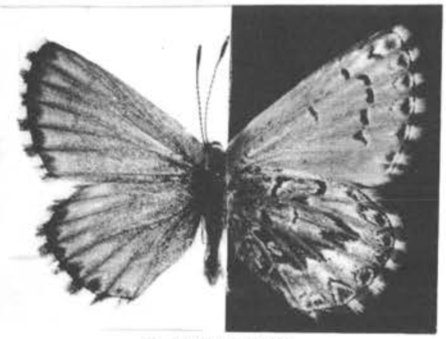
ADULTS PHOTOGRAPHS FOR *REPORT* NO. 47— (overleaf)

1L, (continued from VI for *Report* 46, *Pseudolucia charlotte*, allotype female (AMNH)
Text "5"= **1M**, *Madeleinea lea*, holotype male (HNHM)
Text "5", **1R**, *M. lea*, paratype male, Lake Titicaca, Bolivia (AMNH)
Text "5", **2L**, *M. lea*, allotype female (HNHM)
Text "5", **2M**, *M. lea*, paratype female, Guaqui, Bolivia (BMNH)
Text "6", **2R**, *Madeleinea sigal*, holotype male (HNHM)
Text "6", **3L**, *M. sigal*, paratype male, Putre, Chile (AMNH)
3M, *Madeleinea pacis*, male, La Oroya, Peru (HNHM) [for comparative purposes]
3R, *M. pacis*, female, "Peru" (NHB) [for comparative purposes]

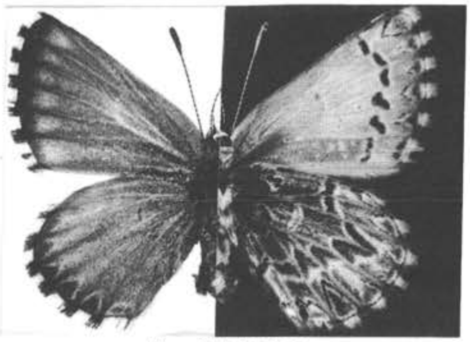
ADULT PHOTOGRAPHS FOR *REPORT* NO's. 53-54— (overleaf)

Text "7"= **4L**, *Pseudolucia zina*, holotype male (HNHM)
Text "7", **4M**, *P. zina*, allotype female (HNHM)
[Insert for *Report* 54 at proof]: **4R**, *Cyclargus shuturn*, holotype male (AMNH)
Text "8"= **5L**, *Pseudolucia asafi*, holotype male (HNHM)
Text "8", **5M**, *P. asafi*, allotype female (HNHM)
[Insert for *Report* 54 at proof]: **5R**, *Cyclargus shuturn*, allotype female (AMNH)
P. magellana removed to color photograph, PHOTOPLATE XII: 26,27

Pseudolucia



P. avishai ♂ D/V



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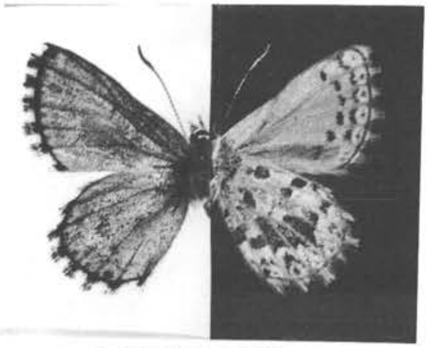
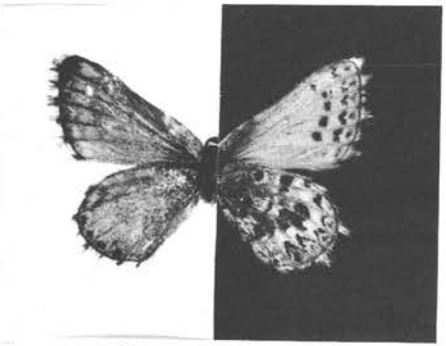


P. argentina ♂ D/V



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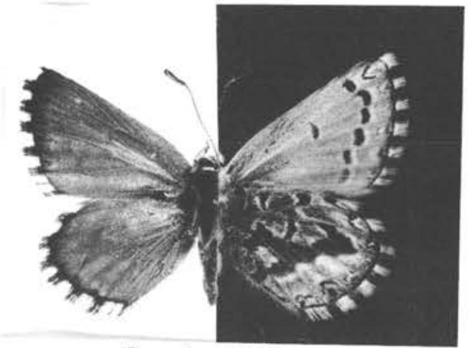
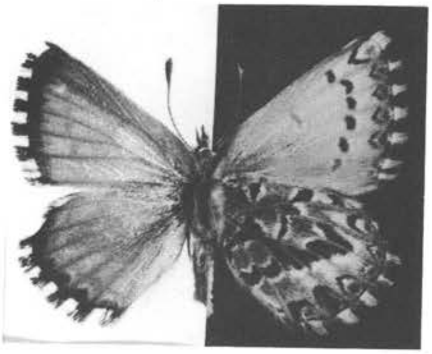


P. andina ♂ D/V



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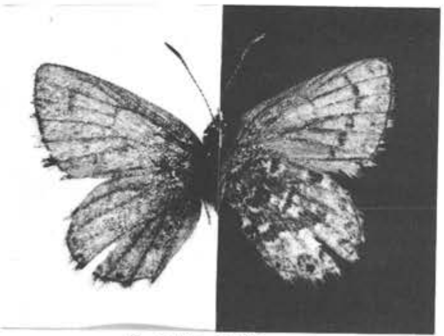

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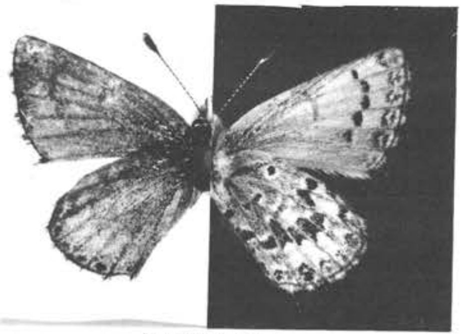

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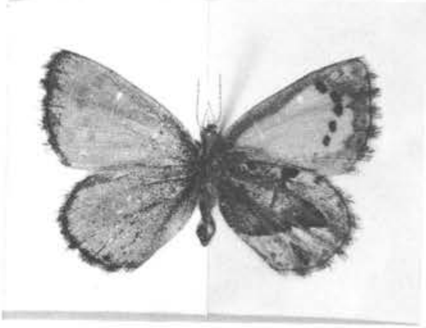

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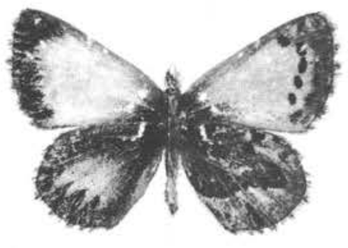

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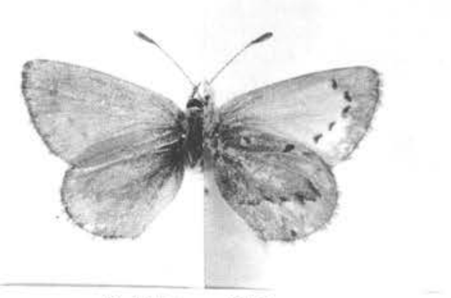

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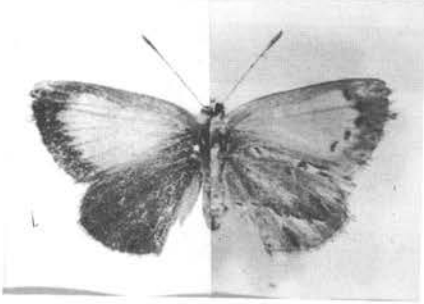

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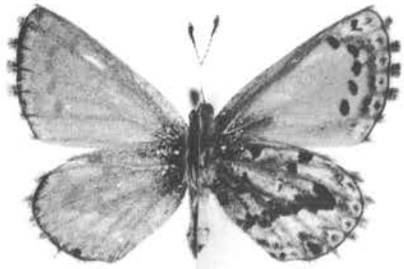

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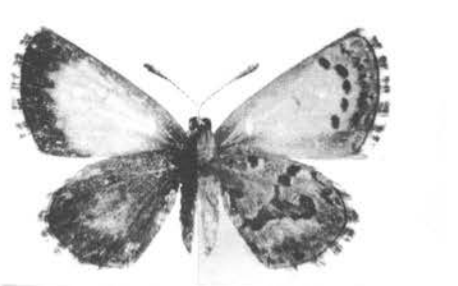

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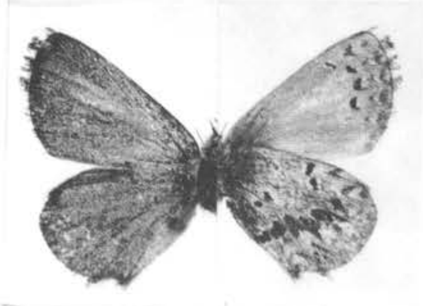
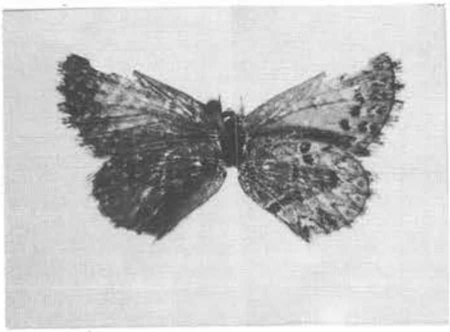


P. charlotte ♂ D/V

PHOTOPLATE VI, continued

Pseudolucia, Madeleinea



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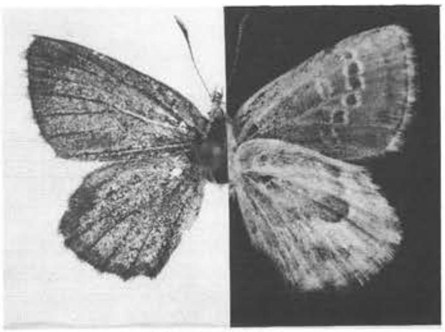

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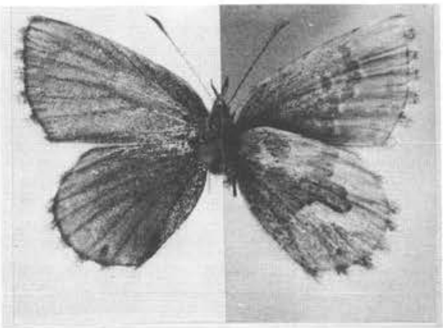
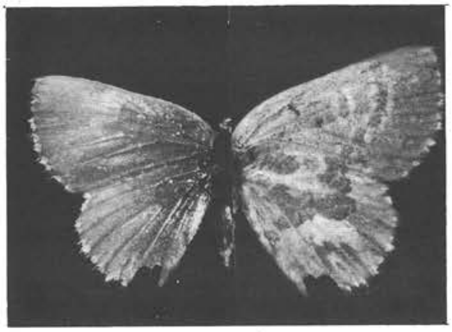


M. lea ♂ D/V

M. lea ♀ D/V



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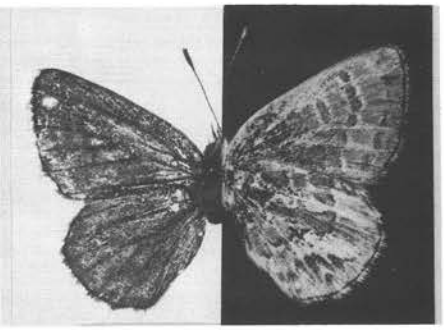

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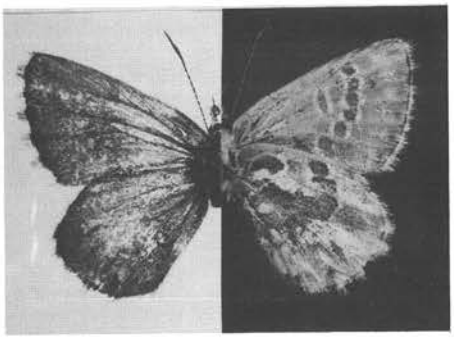

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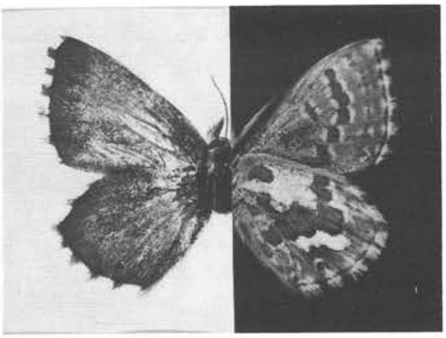
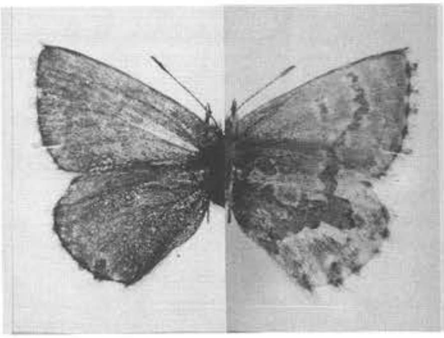


M. pacis ♂ D/V



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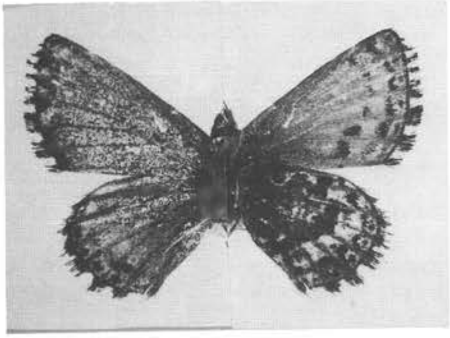
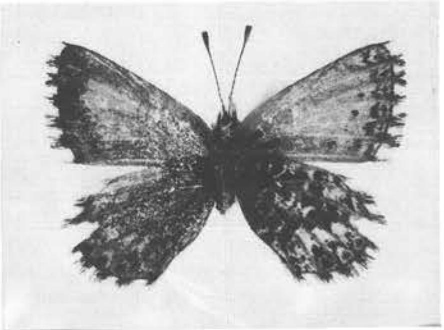


P. zina ♂ D/V



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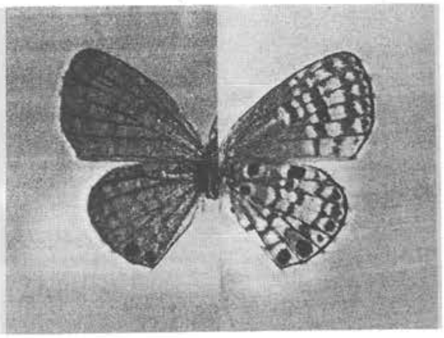
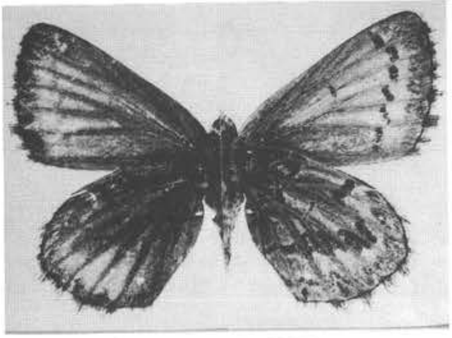
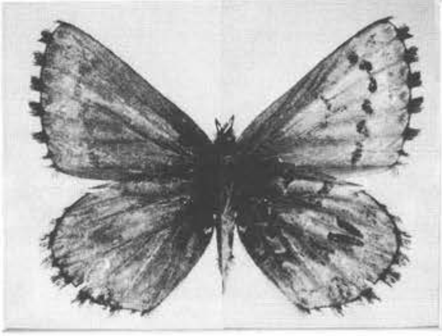


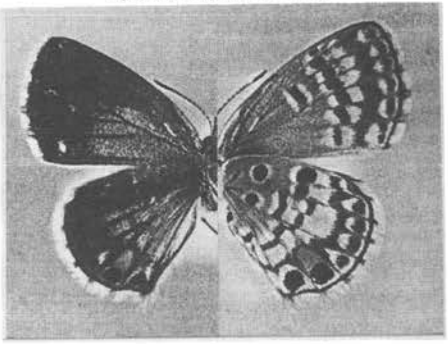
Cyclargus shuturn ♂ D/V



P. asafi ♂ D/V



P. asafi ♂ V



Cyclargus shuturn ♀ D/V

Cyclargus

A Review of Recent Literature and Taxonomic Synonymy in the Neotropical Polyommatinae (Lycaenidae)

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REPORTS **of the**
Museum of Natural History, University of Wisconsin
Stevens Point

NO. 49

ABSTRACT

A systematic evaluation of numerous new names recently made available for various Neotropical Polyommatinae is presented. The overview is based on review and comparison of several recent papers which, because produced independently and based on quite different specimen samples, differed significantly in taxonomic results. The present view is based on (1) all currently known taxa,a number twice or more exceeding that available to some of the original studies and (2) reliance of recent location of many type specimens not available to the other studies.

Synonymic results include, at the generic level: *Boliviella* Balletto, **new synonym** of *Paralycaeides* Nabokov; *Cherchiella* Balletto, **new synonym** of *Pseudolucia* Nabokov; *Eldoradina* Balletto, **new status** (genus [described as subgenus of *Nabokovia* Hemming]); *Polytheclus* Bálint and Johnson, **new synonym** of *Eldoradina*; *Facula* Balletto, **new synonym** of *Pseudolucia* Nabokov; *Ityloides* Balletto, **new synonym** of *Itylos* Draudt [*nec Itylos sensu* Nabokov]; *Nivalis* Balletto, **unavailable name** (explicitly described as adjective); *Pallidula* Balletto, **unavailable name** (explicitly described as adjective). If the latter two names might be considered available by another interpretation of Article llg of the ICZN Code, *Pallidula* is, further, a synonym of *Pseudolucia* Nabokov (same types species) and *Nivalis* (proposed as a replacement name for a name that was not a homonym) is, further, a synonym of *Itylos* Draudt [*nec Itylos sensu* Nabokov].

At the species level: *Pseudolucia sirin* Bálint and Johnson, **new synonym** of *Cherhiella argentina* Balletto; *Polytheclus cincinnatus* Bálint and Johnson, **new synonym** of *Nabokovia (Eldoradina) cyanea* Balletto; *Itylos luzhin* Bálint, **new synonym** of *Ityloides fumosus* Balletto; *Pseudolucia kinbote* Bálint and Johnson, **new synonym** of *Cherchiella scintilla* Balletto; *Pallidula vichuna* Balletto, **new synonym** of *Lycaena chilensis* Blanchard; *Itylos oreopola* Hayward, **new synonym** of *Cupido vapa* Staudinger.

The view presented favoring maintenance of *Pseudolucia* Nabokov as a single genus (not several as otherwise proposed) is based on an evaluation that no subdivisions of *Pseudolucia* proposed to date allow unambiguous grouping of member species. All subset "genera" proposed to date for *Pseudolucia* require reliance on arbitrary character choices or consideration of characters in only one sex. Addition of these latter data shows all such groups, as proposed, are nonmonophyletic unless monotypic.

INTRODUCTION

Until very recently, little attention was paid to the taxonomy of Neotropical polyommatine lycaenids— a group showing remarkable diversity in the high Andean and austral regions of South America. The lack of interest in Neotropical "blue butterflies" resulted primarily because of the assumption that diversity of Polyomatinnae in the Neotropical Realm was not significant compared to other regions of the world. For instance, Larsen (1991: 213) stated "there are very few members in the Neotropical region and these are probably not members of the original fauna of that region".

Surveying European collections of the *Polyommatus*-section of the Polyommatinae (*sensu* Eliot 1973) I readily recognized the contradiction between the generally accepted assumptions concerning the Neotropical fauna and the actual situation. The problem was not that there was a lack of Neotropical diversity; rather, so few species had actually been described that there was a great gap between the diversity represented in museum collections and that reflected in the historical literature. A rapid effort to close this gap appeared necessary, particularly because the European collections offered a unique source of material that had been collected in the "New World" along the cusp of the 19th and 20th centuries.

Due to several factors, my work on Neotropical Polyommatinae expanded rapidly. After initiating study of the European collections and assembling type specimens necessary to judge the status of the few available historical names (Bálint 1993a), I happened to contact the American Museum of Natural History. I learned that Dr. Kurt Johnson (in his work on Neotropical Theclinae, the sister group of Polyommatinae) had assembled large samples of polyommatine material recently collected by workers in Argentina and Chile. Luis Peña (Santiago, Chile) was completing a book on Chilean butterflies and, while Dr. Johnson had elaborated the Chilean "hairstreaks", someone was needed to work on identifying the austral "blues". Because I had access to the European type specimens, I volunteered. However, I did not anticipate the large number of species that would be involved.

I also learned that, on another front, Dr. Gerardo Lamas (Lima, Peru) was attending the project to provide a checklist of butterflies for the Atlas of Neotropical Lepidoptera. Contact with Dr. Lamas indicated there was mutual interest in a rapid assessment of the European type material as well as the newly available material. Dr. Lamas noted too that numerous polyommatine entities in Peruvian collections remained undescribed (cf. Lamas and Pérez 1983).

The combination of this work resulted in number of recent taxonomic papers (Bálint 1993a, 1993b; Bálint and Johnson 1993a, 1993b; Bálint and Lamas, in prep.).

Problems developed, however, in the coordination of press schedules at various publishers. While one publication (including a "Catalog" of Neotropical Polyommatine and descriptions of new austral Polyomatinnae for Peña's book [Bálint 1993a; Bálint and Johnson 1993a, 1993b]) went to press on a spring schedule, other work previously prepared and accepted for publication in Hungary lagged behind. Thus, to avoid problems with the ICZN Code, some duplication of treatments had to be instituted with the goal being to make needed names available but reserve necessary "revisionary" complexities to the papers already in press at the Hungarian publishers. This effort was generally successful with the aid of a short concerning the content of all these publications (Bálint 1993b).

However, a further complication was introduced when another worker, Dr. Emilio Balletto (Turin, Italy) happened to publish a short synoptic paper on Neotropical "blues" including many new names for Neotropical Polyommatinae (Balletto 1993). Since Dr. Balletto's publication, another effort has been needed assess the status of various names.

Previously, I had been in some contact with Dr. Balletto. However, in hindsight it appears that neither of us were sufficiently informed about the status of each other's work. Although most of my results stemmed from recently acquired material that Dr. Balletto had not seen, required attention to the small historical samples meant that, in some cases, we reviewed the same material.

As it turns out, circumstance led to the overlap of my work that of Dr. Balletto's— when Dr. Johnson (a Theclinae specialist) requested my help in identifying Peña's Chilean Polyommatinae, he had not heard of Dr. Balletto's work; when I offered to compare the European types to Chilean material, I had no idea of the number of species that would eventually be involved. It appears nearly humorous now that I told Dr. Johnson (in litt. 1993) that it would not be difficult to assess the Chilean fauna since comparatively few taxa were probably involved. In fact, when all this material came together for Mr. Peña's work, we had overwhelmed any previous notion of polyommatine diversity in the Neotropical Realm.

TAXONOMIC REVIEW

Purpose. Several kinds of reassessments have been necessary concerning the various recent publications on Neotropical Polyommatine. Comment was needed on disparities between publications of mine that appeared almost immediately and others that lagged behind "in press"; also, corrections were needed concerning one paper whose proofs had been lost in the international mail. To a great extent, these problems were addressed by a short "Comments" paper (Bálint 1993b). However, a review has been needed of the relationship of names published by me and co-authors and those of Dr. Balletto.

In hindsight, two fortuitous factors appear among those leading to the overlap of my work and Dr. Balletto's. Firstly, the voluminous recent material examined in these studies indicates, unequivocally, that "sampling error" in the small historical samples available to Dr. Balletto (as with Nabokov [Bálint 1993a]) has a significant effect on the validity of some of his names. Secondly, since other international workers have been involved in recently assessing polyommatine taxonomy, it has been possible for me to follow other workers and not rely soley on my own opinions concerning the status of the many recent names.

Taxonomic opinion is best rendered in the context of complete revisionary work. As a result, it has not been the aim of this paper to be the primary source concerning the status of names. Rather, at the time of this writing, most cases involving problems with newly available names for Neotropical Polyommatinae have been the subject of some primary taxonomic work which is cited here. The purpose of this paper is to condense *in one place* all these result and provide a concise secondary source.

Format. Reviewed first below are the various dates of publication concerning new names for Neotropical Polyommatinae. Then, in subsequent entries, I review the various problems between newly available names for Neotropical Polyommatinae. Since Dr. Balletto's (1993) publication has priority I organize the list according to the names he proposed, in alphabetical sequence. I then summarize the resolution of each taxonomic problem, citing either recent literature or the opinions (in litt.) of workers involved in producing forthcoming standard secondary source materials concerning the Neotropical fauna.

Concerning Dr. Balletto's taxa I review the ***Species Level*** taxa first. This is because review of these taxa introduces some of the problems of "sampling error" which affect the status of various generic names that Dr. Balletto proposed. I then review the ***Generic Level*** taxa proposed by Dr. Balletto. Lastly, I discuss the overall higher classification of high Andean and austral polyommatine, providing various comparisons of proposed higher taxa and reviewing characters which support my positions. Consistent with the treatment of species level taxa herein, most of this character information and related conclusions have been previously published. However, since each of these publications usually involved a single genus it has proved useful to discuss clusters together in the present treatment and condense the character treatments for rapid reference.

Dates of Publication

The publication date of Dr. Balletto's paper is cited as "28.02.1993"; the mailing date is not indicated. As cited, the publication date is a Sunday so it cannot be the mailing date. The issue arrived to the central libarary of the Hungarian Natural Histroy Museum on March 9, 1993, so I presume that the original mailing of Balletto's paper was most likely March 1, 1993. Accordingly, Dr. Balletto's paper has the priority over my paper, which was mailed, as indicated, on March 29, 1993.

Species Names of Balletto (1993)

argentina Balletto, 1993.

Boll. Soc. ent. ital. 124: 237 (in genus *Cherchiella*).
Type locality. "Argentina: Chilean border: Fuente de Inca" (misspelling, corrected to "Puente del Inca" by Bálint 1993a: 20).
Comment. As Bálint and Johnson (1994c) have shown, the type material is identical with that of *Pseudolucia sirin* Bálint, 1993 (p. 13). Accordingly, Bálint and Johnson (1994c) designated *Pseudolucia sirin* Bálint as junior SYNONYM of *Cherchiella argentina* Balletto.

cyanea Balletto, 1993.

Boll. Soc. ent. ital. 124: 242. (in genus *Nabokovia* [*Eldoradina*]).
Type locality. "Chosica, W. Peru, 2000'" (Bálint 1993b has noted that Moss did not give the exact collecting locality on his labels; the species occurs at much higher elevations).
Comment. As Bálint (1993a) noted, the type material is identical with that of *Polytheclus cincinnatus* Bálint and Johnson (1993b: 2). Bálint and Johnson proposed the latter name in a manuscript accepted for publication in Hungary in 1992; they made the name available in 1993 for Peña's Chilean book. However, given the priority of Balletto (1993), Bálint (1993b) designated *Polytheclus cincinnatus* Bálint and Johnson as junior SYNONYM of *Nabokovia (Eldoradina) cyanea* Balletto. Unfortunately, it is likely the name will appear as *Polytheclus cincinnatus* in the Chilean fieldguide treatment of *Nabokovia*.

fumosus Balletto, 1993.

Boll. Soc. ent. ital. 124: 234. (in genus *Ityloides*).
Type locality. "Paramo: Barages [?], Peru, 3600-4000" (Bálint [1993a: 13] notes the labels of the type material as hardly readable; Bálint [1993b: 1], based upon data provided by G. Lamas (in litt.), corrected the spelling and general location of the type locality to "Peru: páramos above Corongo, Ancash (0833/7752)".
Comment. Bálint (1993b) noted the type material as identical with that of *Itylos luzhin* (Bálint 1993a: 13) and, accordingly, designated *Itylos luzhin* Bálint as junior SYNONYM of *Ityloides fumosus* Balletto.

scintilla Balletto, 1993

Boll. Soc. ent. ital. 124: 238. (in genus *Cherchiella*).
Type locality. "Hacienda Illapel, 2500-2900" (clarified as in the Coquimbo region of Chile [Bálint and Johnson 1993a: 18].
Comment. The present comment is the first concerning this taxon since its description. The data of the type material are almost identical with that of *Pseudolucia kinbote* described by Bálint and Johnson (1993a: 18). The primary type of *P. kinbote* was collected at the same locality (2500-2900 m, Hacienda Illapel, Coquimbo Reg., Chile), but two days later by the same collector, namely Mr. Luis Peña. The diagnoses of the two taxa also suggest that the same species is described. Accordingly, I designate *Pseudolucia kinbote* Bálint and Johnson as junior synonym of *Cherchiella scintilla* Balletto, a NEW SYNONYMY.

vichuna Balletto, 1993.

Bull. Soc. ent. ital. 124: 239. (in genus *Pallidula*).
Type locality. "Chile: [Pr. La Seerena]: Vicuña".
Comment. This is the first published comment on this species taxon since its description, although Neotropical workers have corresponded at some length concerning the genus and species citation and Bálint and Johnson (1994c) commented on the status of "*Pallidula*" in Argentina. According to its diagnosis, *P. vichuna* appears identical with the widely distributed Chilean species *Pseudolucia chilensis* (Blanchard 1852), the latter well-characterized by Nabokov (1945: 33-34, although an adult is not figured). Accordingly, and upon attendant opinion (G. Lamas, K. Johnson in litt.) I consider *Pallidula vichuna* Balletto a junior synonym of *Lycaena chilensis* Blanchard, a NEW SYNONYMY.

Generic and Subgeneric Names of Balletto (1993)

Boliviella Balletto, 1993.

Boll. Soc. ent. ital. 124: 232.
Type species. *Cupido vapa* Staudinger, 1894.
Comment. Structurally, the type species is very similar to *Paralycaeides inconspicua* (Draudt, [1921]) and the two are probably sister taxa. This is apparent from the male genitalia (cf. Bálint 1993a: figs. 109 and 111., Balletto 1993: fig. 1.) and also the female genitalia (Bálint and Johnson in prep.). Thus, the taxon *vapa* should belong in *Paralycaeides* Nabokov since its type species is *Itylos inconspicua* by original designation (Nabokov 1945: 36). If species *vapa* and *inconspicua* form a sister couplet it appears inadvisable to put each in a different genus (a view which may have resulted from Dr. Balletto considering the taxa as more distantly related). *Bolivella* as a synonym of *Paralycaeides* is also preferred by Dr. Lamas (in litt.) and, accordingly I here cite *Boliviella*

Balletto as a **NEW SYNONYM** of *Paralycaeides* Nabokov. The matter is discussed in the wider context of other polyommatine genera in the "Comparative Notes".

Cherchiella Balletto, 1993.

Boll. Sec. ent. ital. 124: 234.
Type species. *Lycaena grata* Köhler, 1934.
Comment. Bálint and Johnson (1994c) have commented on the status of *Itylos grata* based on an examination of the type by Dr. Lamas. This has confirmed that *I. grata* is structurally typical of the "*plumbea*-Group" of *Pseudolucia* Nabokov as defined previously by Bálint and Johnson (1993a). Thus, the matter falls under the purview of whether *Pseudolucia* should be subdivided into a number of additional genera, as preferred by Dr. Balletto.

Bálint and Johnson (1994c) provide six discussions of species in the larger *Pseudolucia* clade wherein either (i) each sex or (ii) immediate sister species must be placed in different genera if the generic criteria of Balletto (1993) are followed. The problem of indistinction among the "genera" of Balletto appears to have resulted inadvertantly— from Dr. Balletto's character inferences being drawn from only nine of the twenty-four actual species comprising the larger *Pseudolucia* clade. In considering the twenty-two species (and adding two more Argentine congeners) Bálint and Johnson (1994c) have concluded that *Pseudolucia* is strongly monophyletic but shows no objective criteria by which its species can be unequivocally subgrouped (either as subgenera or separate genera). Dr. Lamas shares this view and, consequently, I cite *Cherchiella* Balletto here as a **NEW SYNONYM** of *Pseudolucia* Nabokov. Usually, matters of generic nomenclature are purely subjective and arbitrary. However, in the present case, *Pseudolucia lanin* Bálint and Johnson (misidentified as *Cherchiella patago* (Mabille) by Balletto 1993) could be construed as belonging either in *Cherchiella* or as the sister species of *Pseudolucia andina* if separate genera are invoked. *Cherchiella* is discussed in the wider context of other polyommatine genera in the final section of this paper: Comparative Notes on Higher Taxa of the Polyommatinae Proposed by Various Authors (hereafter, the "Comparative Notes").

Eldoradina Balletto, 1993

Boll. Soc. ent. ital. 124: 241. (as subgenus of *Nabokovia*).
Type species. *Eldoradina cyanea* Balletto 1993.
Comment. Bálint (1993b) noted that according to its description and taxonomy this taxon is identical with *Polytheclus* Bálint and Johnson (1993b: 2) and has cited *Polytheclus* Bálint and Johnson as a junior **SYNONYM** of *Eldoradina* Balletto [e.g. *Nabokovia (Eldoradina) sensu* Balletto] the status of the latter being a subject for separate discussion below.

As noted above under species *cyanea*, Bálint and Johnson proposed *Polytheclus* as genus in a manuscript accepted for publication in Hungary in 1992 (but independently made the name available Peña's Chilean book in Bálint and Johnson 1993b). *Eldoradina* Balletto has priority but, unfortunately due to printing dates, *Polytheclus* will probably appear in the Chilean fieldguide treatment regarding *Nabokovia*. Readers will note that I (Bálint 1993b) suggested by synonymizing *Polytheclus* with *Eldoradina* that the latter should be accorded generic status. This follows on my view that *Nabokovia* and *Eldoradina* are not monophyletic and that the concept that they are sister groups (Draudt 1921, Balletto 1993) results from viewing them in isolation. The non-monophyly of *Nabokovia* and *Eldoradina* (a view also held by Dr. Lamas, in litt.) is articulated in detail in a revision of the *Nabokovia*-section of the Polyommatine (Bálint and Johnson (1994a). I comment further on this in comparative remarks contained in the "Comparative Notes".

Facula Balletto, 1993.

Boll. Soc. ent. ital. 124: 231.
Type species. *Cupido sibylla* Kirby, 1861.
Comment. – This taxon, proposed as a monotypic genus, contains one species of the "*sibylla*-Group" of *Pseudolucia* recognized by Bálint and Johnson (1993a). Balletto was aware of only one possible member of the group. As Bálint and Johnson (1993a, 1994c) have pointed out, a precise admixture for the "*sibylla*-Group" is problematic when more taxa of the larger *Pseudolucia* clade are considered.

To summarize, the problem with the "*sibylla*-Group" (and therefore "*Facula*" as a taxon) is that it can be differently defined based on external and internal characters and characters of each gender (Bálint and Johnson 1993a and 1994c Remarks under *P. grata* and *P. patago*). Seen in isolation, the species *sibylla* is indeed oddly marked for *Pseudolucia*. However, its sister taxa can ascertained by structural characters and only one of these was available to Dr. Balletto. However, the form of the valve terminus confuses such determinations with members of the "*andina*" or "*chilensis*"-Groups (see *P. lanin*, Bálint and Johnson 1993a versus 1994c). On the other hand, wing pattern similarity among Argentine populations can suggest membership of *P. aconcagua* Bálint and Johnson in this group [see *sibylla*-like Group, Bálint and Johnson 1993a) a taxon which, interestingly enough, Dr. Balletto had seen (although in very small numbers)]. Study of Dr. Balletto's shows *P. anconcagua* to be identical with the taxon described by Dr. Balletto "*argentina*", but in his genus *Cherchiella*. My view is that this kind of circularity results from the strong monophyly of *Pseudolucia* and the fact that character hiatus defining used to define additional genera within *Pseudolucia* are basically artifactual to sampling makeup. Considering *Cupido sibylla* alone, *Facula* might well be proposed as a genus. However, upon further study of additional species in the larger *Pseudolucia* clade one discovers that (as predictable from allopatric speciation) *sibylla* has extant sister taxa. However, it is very unclear which of these would be attributable to "*Facula*" taxon as opposed to the more speciose "*plumbea*-Group" which Balletto called "*Cherchiella*". The above comments concerning *P. argentina* (described in *Cherchiella*) being a senior synonym of *P. aconcagua* (descibed in the equivalent of Balletto's *Facula*) typify this situation. Thus, consistent with my view of the monophyly of *Pseudolucia* (see "Comparative Notes" below) I consider *Facula* Balletto as a **NEW SYNONYM** of *Pseudolucia* Nabokov.

***Ityloides* Balletto, 1993.**

Bol. Soc. ent. ital. 124: 232.

Type species. *Ityloides fumosus* Balletto 1993.

Comment. – For some time, Bálint and Johnson (1994b) have had in press a revision of the larger *Itylos* assemblage of the Neotropical Polyommatinae. It is unfortunate that the "hard data" included in this revision has not been available in the recent discussion involving this high Andean group. Again, the group is larger than the taxa consulted by Nabokov (1945) and Balletto (1993) and a problem arises with arbitrarily dividing the clade into subgroups. When *Itylos pnin* Bálint 1993 and an other, still undescribed taxon, are considered by cladistic methods all are highly autapomorphic. Considering Balletto species *fumosus* as a type species (= *Itylos luzhin* Bálint 1993) one can recognize *Ityloides* as a genus only if separate genera are erected for each species in this small clade. To rectify the problem in this group concerning the present discussion, although I cannot describe the new species of *Itylos* herein, I review the characters of this assemblage in the subsequent "Comparative Notes". The strong monophyly of *Itylos* and the inadvisability of breaking the clade into monotypic genera for each species leads me to consider *Ityloides* Balletto 1993 as a **NEW SYNONYM** of *Itylos* Draudt 1921.

***Nivalis* Balletto, 1993**

Bol. Soc. ent. ital. 124: 242.

Type species. – *Cupido moza* Staudinger, 1894.

Comment. – Balletto also discovered the taxonomic confusion concerning *Itylos* Draudt [1921] (see Bálint 1993a: 24). Balletto's *Nivalis* is identical with *Madeleinea* Bálint, 1993 (p. 24), each taxon also sharing the same type species following the designation of Nabokov. *Nivalis* would have priority over *Madeleinea* if not for the fact that, according the Dr. Lamas, the name is unavailable according to Article 11g of the ICZN Code (having been explicitly described as an adjective).

Considering the apparent arbitrariness of this latter circumstance, Bálint (1993b: 3) has made some further comments concerning why various Neotropical workers have determined that *Madeleinea* should be used subsequently as the generic name for the *moza* assemblage. In this context, Bálint and Lamas (in prep.) will describe further species of the genus and Bálint and Johnson (1994d) provided a fully elaborated generic revision for this large and extremely pretty polyommatine assemblage. Since Bálint (1993b) all works cited above consider *Nivalis* Balletto an **UNAVAILABLE NAME** in the synonymy of *Madeleinea* Bálint 1993.

***Pallidula* Balletto, 1993.**

Bol. Soc. ent. ital. 124: 238.

Type species. *Pallidula vichuna* Balletto 1993.

Comment. According to Dr. Lamas (in litt.) *Pallidula* is unavailable under Section 11g of the ICZN Code because its etymology explicitly states it is described as an adjective. The genus, as Dr. Balletto envisioned it, was one of several used to split *Pseudolucia* Nabokov into separate genera.

Of the genera used by Dr. Balletto to subdivide *Pseudolucia*, *Pallidula* is at first the most difficult to understand since the diagnosis is not accompanied by any supplementary figures. However, as I have noted above, under comment on the type species *vichuna* Balletto, this species appears to be a synonym of the widespread austral polyommatine *Lycaena chilensis* Blanchard (the type species of *Pseudolucia* Nabokov). Thus, although neotropical workers consider *Pallidula* an **UNAVAILABLE NAME** in the synonymy of *Pseudolucia*, it would in any event be considered a junior **SYNONYM** of *Pseudolucia* based on the synonymy of its type species.

Bálint and Johnson (1993a: 4) delineated the "*chilensis*-Group" of *Pseudolucia* based on structural characters. The reader is referred to previous entries in the present paper (cf. "*vichuna*", "*Cherchiella*" and "*Facula*") regarding the problems of invoking *Pallidula* as a name for only some elements of the "*chilensis*-Group". These are discussed further in context with the other proposed names for the *Pseudolucia* clade in the "Comparative Notes".

COMPARATIVE NOTES ON HIGHER TAXA OF THE POLYOMMATINAE PROPOSED BY VARIOUS AUTHORS

Basic conceptual differences, following from study of a different variety of taxa, separate my view of higher polyommatine taxonomy and those of Dr. Balletto. For instance, Dr. Balletto has argued for splitting *Pseudolucia* into four genera based on his analysis of nine seminal taxa. I have stressed the strong monophyly of *Pseudolucia*, and lack of objective criteria for further splitting this taxon, based on the study of twenty-four species of the clade. Balletto (1993) have posited one set of phylogenetic relations involving the *Itylos* assemblage of high Andean polyommatines and I have proposed another (Bálint and Johnson 1994b). Since these opinions have been proposed in a variety of publications, it is useful here, particularly given the treatments of species and genera immediately above to (1) review the respective options for either splitting or lumping, and (2) summarize the taxonomic characters on which my opinions are based.

For rapid reference in entries below, I repeat the original authors and dates of description for generic level taxa proposed.

Monophyly Versus Splitting of *Paralycaeides* Clade

Subject Taxa: *Boliviella* Balletto 1993 and *Paralycaeides* Nabokov 1945.

I have noted above under "*Bolivella*" that the type species of *Boliviella* (*Cupido vapa* Staudinger 1894) is structurally very similar to the type species of *Paralycaeides* Nabokov (*Itylos inconspicua* Draudt [1921]) (Bálint 1993a, figs. 109 and 111) and, among the larger clade of taxa comprising the assemblage the two appear as probable immediate sister taxa. To avoid separating the taxon couplet into two genera I have considered *Boliviella* Balletto 1993 as a junior synonym of *Paralycaeides* Nabokov. Some comments on the wider assemblage are requisite for a clear understanding of this group.

Paralycaeides is confined to the altiplano and adjacent regions of the high Andes. The type species chosen by Balletto for "*Boliviella*" is the most widely distributed taxon of this assemblage, historically known from Bolivia and NW Argentina and noted recently by regional field workers as locally rather common (D. Benyamini, pers. comm.). In northern Argentina *P. vapa* is identical with *Itylos oreopola* Hayward 1949 (which I make here a **NEW SYNONYM** based on the study of some paratype material in a recent revisionary work on the genus [Bálint and Johnson, ms.]). The *P. vapa* complex also extends into NE Chile where it is part of the high Andean fauna including other high Andean species like *Nabokovia faga*, *Madeleinea pelorias*, *M. ludicra* and *Itylos titicaca*. The sister species (*P. inconspicua*) is currently known only from Peru. There are, however, further members of the clade. One is the superficially very different-looking species *P. shade* Bálint 1993 which structurally appears to be the sister of the *P. vapa*/*P. inconspicua* pair (Bálint 1993a, fig. 110). *P. shade* is also known only from Peru. Thus, the problem with continuing usage of *Boliviella* is, again, what admixture of species to include and on what criteria.

Monophyly Versus Splitting of the *Itylos* Clade

Subject Taxa: *Ityloides* Balletto 1993 and *Itylos* Draudt 1921.

Regarding splitting of the *Itylos* assemblage into two genera, as suggested by Dr. Balletto, it is unfortunate that data in the revision by Bálint and Johnson (1994b [but accepted for publication in 1992]) was so late in publication. The problem with separating these taxa into separate genera is that if one considers all the taxa comprising the clade, each is highly autapomorphic. In this context, one can recognize *Ityloides* as a genus only if separate genera are erected for each species in this small clade. Accordingly, I have considered *Ityloides* a junior synonym of *Itylos* Draudt as noted in the *Ityloides* generic entry above. The *Itylos* clade is structurally very tightknit and surprisingly appears to be monophyletic only with the genus *Hemiargus* of the *Polyommatus*-section (*sensu* Eliot) (Bálint and Johnson 1994b). Below I review the relevant characters.

Ityloides can be characterized as showing: (1) a strong, bulbous uncus apex with dentated lobe, (2) thin, long and dentated costal process of valve, (3) penis with sclerotized and straight suprazonal edges, (4) very week alulae. These genitalic structural characters are unique to the taxon *fumosus*. On the one hand, as Balletto notes, these characters appear isolate the taxon. However, it is not the autapomorphies of *fumosus* which require consideration regarding its placement in a higher taxon, but the synapomorphies that relate it to the larger clade.

The monophyly of the four currently known taxa (*Itylos fumosus* – *I. pnin* – *I. pasco* – *I. titicaca*) can be delineated by the following character states. Although certainty regarding apomorphy relative to a common outgroup is difficult because of the apparent autochthonous nature of this Neotropical clade, one could assume the shared ground plan as including: (1) shared unique wingshape, (2) shared unique VHW pattern, (3) absence of suspensorium ("absence" used strictly in the sense of being informative vis-a-vis this structure in the *Polyommatus*-section of Eliot 1973), (4) very small valvae with unique shape, (5) very large penis departing from the polyommatine shape, (6) large uncus and gnathos, (7) overall restricted distribution suggesting a clear ancestral monophyletic population.

Also of interest are the female genital structures. Recently studied *H. bogotana* and *H. ramon* suggest a very close relationship with *I. titicaca* in the female organs. Comparatively, *I. pnin* appears more divergent (cf. Bálint and Johnson 1994, figs. 62,70). Most surprisingly, the female structures of all these taxa more resemble *Glaucopsyche*

Scudder, further supporting separation of the *Itylos* assemblage from the traditional *Polyommatus*-section of Eliot (1973).

Monophyly Versus Splitting of *Pseudolucia* Clade

Subject Taxa: ***Pseudolucia*** Nabokov 1945; ***Facula, Cherchiella*** and ***Pallidula*** of Balletto 1993.

In my 1993 "Catalog" (Bálint 1993a) I anticipated that, in the European tradition, future workers would suggest splitting the *Pseudolucia* lineage into several genera (Bálint 1993: 16-17, 25, 29-30). Most probably, the speciose genus *Madeleinea* will also be a future candidate for such splitting. Generic splitting or lumping is usually considered a matter of taxonomic "taste". However, compelling arguments against taxonomic splitting can be made in instances where it is impossible to subgroup species of a clade without contradictions in characters. In my view, *Pseudolucia* was originally split by Dr. Balletto because of the hiatus of characters among the small number of species [nine] he examined. For workers in the Neotropics familiar with the more than two dozen species now known for this genus (Bálint and Johnson 1993a, 1994c), it appears that there are no objective or unambiguous criteria for the subgroupings proposed from the nine species Balletto examined (K. Johnson, D. Benyamini, pers. comm.; G. Lamas, in litt.). Regarding this problem in the subject taxa of this entry, the following comments are pertinent.

1. *Cherchiella* and *Facula*

These taxa do not have the problem of unavailability *vis-a-vis* the ICZN Code as do *Pallidula* and *Nivalis*. However, as structurally envisioned by Balletto, neither *Facula* or *Cherchiella* can include a clearcut group of species.

The type species of *Cherchiella* is, by Balletto's original designation, *Lycaena grata* Köhler 1934. The type of this species is in the Museo La Plata (Argentina) and has been seen first-hand (among current workers studying Neotropical blues) only by Dr. Lamas. I construe the identity of this species from information passed on to me by Dr. Lamas (Bálint and Johnson, 1994c). Accordingly, Köhler's *grata* is a member of the clade referred to by Bálint and Johnson (1993a) as the "*plumbea*-Group" of *Pseudolucia*. The taxon *grata*, as construed by Balletto (1993: 234), has winged female genitalic structure and a male genitalia with no sagum. It is identical with the facies of the lectotype of *Scolitantides plumbea* established by me (Bálint 1993a: 19) [according to the data of Balletto 1993, figs 3a and 3b.; "Chile: Pemehue" = Chile, Punehue; "Chile: B. de Chillon" = Chile: B. de Chillán; cf. Bálint 1993a: 19-20]). Thus, *Cherchiella* must be reexamined in light of its types species' actual identity and this diagnosis then compared to *Facula*. However, before I do this, I must mention the other congener included by Balletto in *Cherchiella*.

Curiously, Balletto's *Cherchiella* also contains the taxon *andina* [*Scolitantides andina* Bartlett-Calvert 1894]. The extant type of *S. andina* was very recently located by Dr. Lamas (G. Lamas, pers. comm.). Previously, however, I had located original Bartlett-Calvert specimens in The Natural History Museum (London) (Bálint 1993a: 19). The species is, along with *P. chilensis*, among the most unambiguous of South American *Pseudolucia* and also well-represented in many current collections from temperate South America. *Pseudolucia andina* is so distinctive structurally that, of all congeners, it might be the best candidate for a separate generic status— the male genitalia have a sagum and unique valvae terminus (Bálint and Johnson 1993a, fig. L; Bálint 1993a, fig. 100), the female genitalia show a terminal nodule and are also weakly winged (Bálint and Johnson 1993a, fig. J). Placement of *andina* in *Cherchiella* makes *Cherchiella* curiously polytypic and it is possible this problem also arose from sampling error. Although *P. andina* is common in many current southern South American collections, it is worth noting that Nabokov (1945) also had difficulty recognizing this species. Because Nabokov's work does not ever mention this apparently common austral "blue", it is possible he either disqualified it from his study group due to its odd facies or, somehow, overlooked it completely.

The type species of *Facula* is, by Balletto's original designation, *Cupido sibylla* Kirby 1961. Bálint and Johnson (1993a) distinguished a "*sibylla*-Group" of *Pseudolucia* based on some distinctive wing characters (mostly ventral obsolescence) in several *Pseudolucia* species. They also noted that male and female genitalic structures of these species, except for a more produced male rostellum in examined taxa, were quite similar to species of the *plumbea*-Group. These distinctions fell away quickly with the recognition of additional *Pseudolucia* species (cf. Bálint and Johnson 1993a, 1994c; Benyamini, Bálint and Johnson 1995). As a result, there is no structural hiatus between between members of the "*plumbea*-Group" and "*sibylla*-Group" (e.g. *Cherchiella* and *Facula*) [cf. Bálint and Johnson 1993a, figs C, D, E, F, G, M, N, O (males); C, D, E, G, K, L (females)]. Athough one might recognize a "*sibylla*-Group" of *Pseudolucia* including the few members showing ventral obsolescence (Bálint and Johnson 1993a, fig. 6) this distinction could have not phylogenetic value.

Finally, the problem of *P. andina* being included in any subgroup of *Pseudolucia* including *P. grata* is complicated by the recent discovery of the sister species of *andina*, *P. lanin* Bálint and Johnson, 1993 (see Bálint and Johnson 1994c. This discovery, based on eludication of additional specimens and the female of *P. lanin*, allows recognition of a true "*andina*-Group" of *Pseudolucia*. However, this group is not taxonomically congruent with Balletto's *Cherchiella*. As noted by Bálint and Johnson (1994c), based on location of type material of *Lycaena patago* and comparison the Diagnosis by Dr. Balletto for "*Cherchiella patago*" (Balletto 1993: 236), Dr. Balletto inadvertantly misidentified *P. lanin* as "*patago*".

All these factors lead current Neotropical workers to conclude that taxa of *Pseudolucia* cannot be clearly subgrouped within *Cherchiella* or *Facula*. This results in the assessment that these latter two names must be considered synonyms of *Pseudolucia*. In all fairness to the arbitrage involved in naming genera, one must note that a far stronger entity for Balletto would have been a monotypic genus based on *Scolitantides andina*.

2. ***Pallidula*.**

Dr. Lamas has already opined that, like *Nivalis*, *Pallidula* is unavailable according to Article 11g of the ICZN Code. However, discussion of the taxon as envisioned by Balletto provides another useful of the problem surrounding subdivision of *Pseudolucia* into separate genera.

It is at first very difficult to clarify the identity of Balletto's *Pallidula*. The diagnosis has no supplementary figures and terminology applied is seldom used for the subfamily (cf. Glossary in Scott 1986 [132-149]). The type species, *P. vichuna*, is a newly described entity but its Diagnosis and associated collection data indicate that, without any doubt, *P. vichuna* is identical with Blanchard's *Lycaena chilensis* (as detailed in the previous for "*vichuna*"). *P. chilenis*, a species unmistakable in its spotted ventral habitus, has a southeast Brazilian sister species (*P. parana* Bálint 1993a, fig. 97). These well-marked species show an affinity to *P. andina* in the presence of female genital nodule (Bálint and Johnson 1993a, fig. H) and male genital sagum.

Regarding the status of *Pallidula*, an unfortunate consequence of *P. vichuna* and *L. chilensis* being synonyms is that *chilensis* is the type species of *Pseudolucia*. Considering this, one must guess that *Pallidula* was described either because, given his samples, Dr. Balletto (1) did not recognize *P. vichuna* as *L. chilensis* or (2) thought some other species was the type species of *Pseudolucia*. The latter is suggested because although Dr. Balletto was splitting *Pseudolucia* into separate genera, his paper nowhere cited the type species of that genus. If one considers Balletto's genera purely in light of the taxa he examined, *Lycaena collina* Philippi 1859 is suggested as the logical type species of *Pseudolucia*. Along with *P. andina* and *P. chilensis*, *collina* is the only other very distinctive *Pseudolucia* not recognized in a separate genus by Dr. Balletto.

The Status of *Eldoradina*

Subject Taxa: *Nabokovia* Hemming 1960, *Eldoradina* Balletto 1993.

Departing from his treatment of the above discussed genera, Balletto (1993: 241) described *Eldoradina* as a subgenus of *Nabokovia* Hemming. This suggests to me that he considered the two to be sister groups. Indeed, a sister group relationship between *Eldoradina* and *Nabokovia* could be proposed from superficial characters (tailed hindwing and peculiar shared pattern elements). Progressive loss of iridescent blue scales has been proposed among some groups of polyommatine lycaenids (*e.g.* *admetus*-Group in *Polyommatus*; *vogelii* in *Plebejus*; *dis*-group in *Agriades*, etc.) and could suggest that *Nabokovia* is a relatively recent segregate. However, the genitalic structures are more problematical in interpretation.

(1) The alulae of the aedeagus is well developed in both *Nabokovia* and *Eldoradina* but *Eldoradina* has a very strong sagum, a structure absent in *Nabokovia*; (2) the aedeagus terminus is pointed in *Nabokovia* while in *Eldoradina* it is obtuse; (3) the uncus and gnathos are far more slender in *Nabokovia* than in *Eldoradina*; (4) the shapes of the valvae in the two taxa differ drastically in the rostellum. In regard to entry (2) above, Eliot (1973: 389-390) considered characters of the aedeagus extremely significant in the phylogeny of the Lycaenidae. Thus, quite the opposite of the superficial similarities, morphological features in *Nabokovia* and *Eldoradina* could be used to argue that the groups are not direct sister taxa (Forey et al. 1992: 11). Interestingly, both *Nabokovia* and *Eldoradina* are species poor, each comprised of only two species. Historically, I think this fact further influenced the view that the groups are sisters (cf. Nabokov 1945: 11) since it was a convenient way to interpret two little-known and superficially similar taxa. If we now consider their disparate morphologies, it might alternatively be suggested that *Nabokovia* and *Eldoradina* are either (1) Neotropical descendants of quite different, non-Neotropical ancestors or (2) descendants from an ancient and now extinct Neotropical common ancestor (in both cases with low species numbers further suggesting their antiquity).

Dr. Lamas (in litt.) has opined that, from a modern Neotropical worker's standpoint, *Eldoradina* is the only entity described by Balletto that appears to have generic worth. Given the hiatus in structural characters reviewed above, I concur and accord the taxon full generic status as *Eldoradina* Balletto, 1993; NEW STATUS.

Subject Taxa: ***Nivalis*** **Balletto 1993,** ***Madeleinea*** **Bálint 1993.**

As with *Pallidula*, the published etymological statement in the original description of *Nivalis* explicitly states it is an adjective. Thus, as noted first by Dr. Lamas (in litt.), the name is unavailable according to Article 11g of the ICZN Code. This aside, a second problem with *Nivalis* is that Balletto proposed the name as a "replacement name" for "*Itylos* Nabokov" (i.e. Nabokov, 1945) a name that was not a homonym but a misidentification by Nabokov of *Itylos* Draudt [1921]. As a result, if some other interpretation of the ICZN Code might consider *Nivalis* an available name it is, nevertheless, a junior synonym of *Itylos* Draudt [1921].

TAXONOMIC SUMMARY

As condensed in the Abstract above, reviewed below are the taxonomic changes established in the present paper. The list cites the valid name (and/or combination) first and then the synonyms; taxa are listed in alphabetical order. For completeness, I include notation of Balletto's (1993) names which would secondarily qualify as synonyms *if* first judged "available" by some other worker's interpretation of the ICZN Code. Since I consider such names unavailable, there is no technical reason to cite them below "NEW SYNONYM".

Generic Names

Eldoradina Balletto, 1993, NEW STATUS = *Polytheclus* Bálint and Johnson, 1993, NEW SYNONYM.

Itylos Draudt, [1921] = *Ityloides* Balletto, 1993, NEW SYNONYM; *Nivalis* Balletto 1993, UNAVAILABLE NAME [alternatively, synonym of *Itylos*].

Paralycaeides Nabokov, 1945 = *Boliviella* Balletto, 1993, NEW SYNONYM.

Pseudolucia Nabokov, 1945 = *Cherchiella* Balletto, 1993, NEW SYNONYM; *Facula* Balletto, 1993, NEW SYNONYM; *Pallidula* Balletto, 1993, UNAVAILABLE NAME [alternatively, synonym of *Pseudolucia*].

Species Binomials

Eldoradina cyanea (Balletto, 1993) = *Polytheclus cincinnatus* Bálint and Johnson, 1993, NEW SYNONYM.

Itylos fumosa (Balletto, 1993), NEW COMBINATION = *Itylos luzhin* Bálint, 1993, NEW SYNONYM.

Pseudolucia argentina (Balletto, 1993) = *Pseudolucia sirin* Bálint, 1993, NEW SYNONYM.

Pseudolucia chilensis (Blanchard, 1852) = *Pallidula vichuna* Balletto, 1993, NEW SYNONYM.

Pseudolucia scintilla (Balletto, 1993) = *Pseudolucia kinbote* Bálint and Johnson, 1993, NEW SYNONYM.

CONCLUSION

Given the historical time period during which Nabokov pursued, and subsequently published, his 1945 compilation concerning neotropical Polyommatinae, it was virtually impossible for him to obtain historical material from European museums or contemporary samples from Latin America.

Current progress on elaborating Neotropical polyommatine faunas results basically from the confluence of three historical factors: (1) a profusion of field activity by recent Latin American lepidopterists, (2) the opening up of the eastern bloc in Europe, with its many historical and scientific resources, and (3) the modern "information revolution" whereby (with equipment like the PC, Scanner, Fax, Modem, E-mail, etc.) it is possible to readily communicate and circulate information and material. This "political melting" is an important aspect of what is going on in taxonomy today. However, an unfortunate aspect of this "revolution" is that work sometimes progresses very quickly by more than one investigator at a time. If there is little communication between such workers, however inadvertant, subsequent overlap can result in published results.

This kind of situation has now occurred concerning taxonomic names recently published by Dr. Balletto and me (some only twenty-eight days apart!). Given the rapid dissemination of published information in taxonomy today, it was important to move quickly and prepare a comparative study of the names, sample sizes, and sample origins involved in the works by Dr. Balletto (Balletto 1993) and me (Bálint 1993a; Bálint and Johnson 1993a and 1993b). In doing so, I have been fortunate to have as inadvertant arbiters two workers preparing international lists— first Dr. Lamas, and most recently Charles A. Bridges— as well as comment from my earlier co-author, Dr. Johnson.

Establishment of a stable and generally acceptable classification for the neotropical polyommatine fauna is important for several reasons. Their diversity (now seen as far richer than previously estimated) invites investigation of important evolutionary and biogeographical questions. Also, because of their ecological diversity, polyommatines are important bioindicators for ecological and conservation-related studies. Consequently, it is essential that their taxonomy and systematics be as simple and impressive as possible, accessable to all workers, even non-lepidopterists. This is primarily why I have opted, along with other workers, for a conservative nomenclature, avoiding highly split and monotypic entities.

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[Note: some of the changes in the above bibliography ("in prep." to published, etc.) were necessitated by the fact that Report 49 was completed early in the compilation of this volume but, in its later formating, placed in Section II]

Additional Historical Data for Neotropical Polyommatine Lycaenid Butterflies in European Collections (Lepidoptera)

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ABSTRACT

Additional records for Neotropical polyommatine butterflies are reported from two large European museum collections not previously surveyed: Zoologisches Staatssammlung, Munich (Germany); Naturhistorisches Museum, Basel (Switzerland). These museum contain, respectively, large lycaenid collections of specialists W. Forster and L. G. Courvoisier. New records for the following species are reported (in order of taxonomic treatment): *Eldoradina sylphis* (Draudt), *Nabokovia faga* (Dognin), *Lycaena cogina* Schaus, *Itylos titicaca* (Weymer), *Leptotes callanga* (Butler), *Leptotes andicola* (Godman and Salvin), *Leptotes cassius* (Cramer), *Leptotes lamasi* Bálint and Johnson, *Leptotes trigemmatus* (Butler), *Hemiargus hanno* (Stoll), *Hemiargus bogotanus* (Draudt), *Cyclargus dominica* (Moeschler), *Echinargus isola* (Reakirt), *Echinargus huntingtoni* Rindge and Comstock, *Paralycaeides inconspicua* (Draudt), *Paralycaeides vapa* (Staudinger), *Madeleinea odon* Bálint and Johnson, *Madeleinea nodo* Bálint and Johnson, *Madeleinea koa* (Druce), *Madeleinea cobaltana* Bálint and Lamas, *Madeleinea pacis* (Draudt), *Madeleinea moza* (Staudinger), *Pseudolucia chilensis* (Blanchard), *Pseudolucia lyrnessa* (Hewitson), *Pseudolucia collina* (Philippi), *Pseudolucia vera* Bálint and Johnson, *Pseudolucia plumbea* (Butler). Significance of the material is indicated by the fact that five of these entities would have been undescribed if not for very recent work by the present authors and three represent very poorly known species (*E. sylphis*, *L. cogina* and *P. lyrnessa*) regarding which additional material is particularly important to current taxonomic studies.

INTRODUCTION

We have emphasized that a major factor in the poor undertanding of Neotropical Polyommatini until very recently (including the historical view that this fauna was of rather small diversity) was the lack of any concerted study of samples already available in major museum collections (both European and American) (Bálint 1993ab, Bálint and Johnson 1993a,b; 1995). Within most major museums worldwide, polyommatine lycaenids have been haphazardly determined (based mostly on common usage without regard to type species) and housed along with significant backlogs of uncurated (or even unaccessioned) materials. Much of our initial work on Neotropical polyommatines (Bálint 1993ab, Bálint and Johnson 1993ab) was based on surveys of this material, coupled with efforts to locate and refer to the historical type material. This initial work on old polyommatine material touched off a flurry of papers based on recently collected samples (Bálint and Johnson 1993b, 1995abcd; Bálint and Lamas 1994; Bálint, Benyamini and Johnson 1995ab). Gratifying as this progress has been, it is still important to consult remaining depositories of old material, particularly since the high number of new species discoveries in Neotropical polyommatines in recent years seems fairly evenly divided between old and new source material (Bálint and Johnson 1995d). Thus, the senior author has continued to visit additional European museums to survey polyommatine holdings, while the junior author has pursued contacts with various regional South American depositories whose holdings are also poorly known.

One of the most obvious European depositories still requiring survey has been the Bavarian Zoologische Staatssammlung (Munich, Germany) (ZSM) where the late Dr. Walter Forster worked for several decades on lycaenid butterflies. Forster, an acknowledged authority on lycaenids (Witt 1988), housed his own collection at the ZSM. In addition, significant collections of Ernst Pfeiffer (see Kudrna and Wiemers 1986: 62) are also located at the ZSM. As a result, the ZSM is comparable in species richness and numbers of specimens to the Natural History Museum (London) (NHM), which was a primary source for our early work on new and poorly known Neotropical Polyommatini. Similar to the NHM, the ZSM collections also contain important historical material from early workers like Staudinger and Fassl. In addition, Forster himself collected extensively in Latin American on several occasions. However, since he was primarily a European taxonomist (and because of the poor development of Neotropical lycaenid taxonomy until very recently), much of Forster's Latin American material was never elaborated (Bálint 1993a: 31).

The present paper enumerates identifications of ZSM material for the polyommatine lycaenids. However, we must note that there are ample drawers of Eumaeini, including many Andean region "elfin-like" hairstreak butterflies (drawers 68/155-158). These need to be studied in reference to the junior author's extensive recent monographs of this fauna (Johnson 1990, 1992) and, since the volume of specimens requires study on site, offer a great opportunity for a European worker interested in Neotropical hairstreak butterflies. Dr. Forster pursued long-term relations with prominent Chilean and Argentine workers (respectively, W. Heimlich and E. Fleiss, among others). As a result, there is also significant recent material in the ZSM lycaenid butterfly collections from high Andean and austral regions of Latin America.

The other collection studied in the present paper was brought to our attention by Professor Varga (Debrecen, Hungary) and is the collection at the Naturhistorisches Museum of Basel (Basel, Switzerland). This is the collection of the Swiss worker Professor L. G. Courvoisier, who also studied lycaenid butteflies, particularly with an enthusiasm for infraspecific forms, variations and gynandromorphs (cf. Bridges 1988, III.18-20). Given what we know today about the morphology of Latin American lycaenids and the historical problems of sampling error, there appeared to be high probabilities that various of the odd specimens acquired by Courvoisier actually represent poorly known, or even new, species from isolated localities.

Samples at the ZSM and NHB typify those at other European museums for Neotropical lycaenids— they include longer series of the more well known species (*Madeleinea koa*, *Paralycaeides vapa* etc.), single or a few specimens of various poorly known species (*Lycaena cogina*, *Eldoradina sylphis*, etc.) and occasional examples of species described only very recently from other old historical material (*Madeleinea nodo*, *M. odon*, etc.). Thus, the importance of continued elaboration of such material is obvious: it is the only way to increase eventual knowledge of geographic distributions, character variation in poorly known species, and continue the search for incipient representatives of species as yet unknown. In a terminal section of this paper we give a brief report on certain other European collections whose holdings in Lycaenidae also appear important in this ongoing effort to elaborate historical materials.

MATERIALS AND METHODS

Study Group. Taxa included in the present report reflect the recently published "Catalogue" by the senior author (Bálint 1993a) which included Neotropical members of the "*Polyommatus* Section" (*sensu* Eliot 1973) (as amended in that catalogue)— *Echinargus* Nabokov 1945, *Hemiargus* Hübner 1818, *Itylos* Draudt 1921, *Nabokovia* Hemming 1961, *Pseudolucia* Nabokov 1945, *Madeleinea* Bálint 1993 and *Polytheclus* Bálint and Johnson 1993 (synonym of Eldoradina Balletto 1993). However, consistant with the additional treatments of polyommatine lycaenids in the present volume concerning "Neotropical Blue Butterflies", Neotropical representatives of additional Polyommatini sections are also included— *Leptotes* Section (*Leptotes* Scudder 1876), *Lycaenopsis* Section (*Lycaena cogina* Schaus [being treated as a new Neotropical genus elsewhere by Bálint and Johnson 1995e]), *Zizeeria* Section (*Zizina* Chapman 1910). This treatment follows a recent reanalysis of higher categories of Polyommatini occurring in the Neotropical Realm (Bálint and Johnson 1995e) and will be followed subsequently in reports of material in various South American collections arranged through the junior author.

Materials. **Zoologisches Staatssammlung (Munich).** Neotropical lycaenid material is preserved in drawers 68/50 and 68/213-216. These include historical specimens of Staudinger and Pfeiffer as well as material collected subsequent to World War II, the largest portion of the latter (circa 90%) being from Dr. Forster's own work in Bolivia. Forster's Bolivian material is readily distinguished by similarly typeset/printed labels. There are smaller numbers of specimens collected by various workers in Chile. These bear handwritten labels prepared by Forster.

Naturhistorisches Museum, Basel. Neotropical lycaenid material is preserved in the Courvoisier collection drawers 10, 30A, 50, 51. The original labels appear to be only preserved haphazardly since all specimens have a uniformly prepared blue-green label handwritten in black ink. The labels follow a standard format: (1) country and locality (sometimes with elevation), (2) year, (3) source or collector of specimens (often abbreviated as "Fa" [Fassl], "Frhst." [Fruhstorfer], "P." [Plötz?], "Ro." [Rolle], "Sw." [Swinhoe?], "Sta." [Staudinger] (some workers readily recognizable by additional information known concerning Courvoisier's collection (Dr. Brancucci, NHB), others ["?"] merely guesses by the present authors).

Format and Terminology. We use "Sections" of the Polyommatini according to Eliot (1973) as amended by certain recent publications (Bálint and Johnson 1994a,b and 1995e). Each section will have a brief introduction. Regarding taxonomic entries in the Polyommatus Section, extensive historical citations have already been given by Bálint 1993a and, so as not to be cumbersome, we do not repeat them here. With regard to specimen sources in the Courvoisier collection, we use the abbreviated collector notations from the labels summarized immediately above.

RESULTS

NABOKOVIA SECTION

This section was erected by Bálint and Johnson (1994a) and proposed as separate from Eliot's Polyommatus Section. It is one of several assemblages of polyommatines Bálint and Johnson have shown to be autochthonous South American lineages not monophyletic with Eliot's original definition of the *Polyommatus* Section. The *Nabokovia* Section has two genera (*Nabokovia* and *Eldoradina* [=*Polytheclus*]) each with two extant species. The Section was reviewed by Bálint and Johnson (1994a).

Eldoradina sylphis **(Draudt 1921)**
Polytheclus sylphis: Bálint 1993a: 28.

Material Examined.

NHB. 1♂, 1♀: PERU, Cuzco, 4200 m., Fa.

Note. This is the first known female specimen of the taxon. The specimens were incorporated amongst the *Thecla* (*sensu lato*) [Neotropical Eumaeini] without a name. Given the data on these specimens, it is important that they undoubtedly derive from the same series Draudt (1921: 823) used for his original description.

Table I
Institutional Abbreviations

At proof of this paper we noted a recently published source Bridges (1994) used a combination of institutional abbreviations drawn from Heppner & Lamas (1982) and Arnett, Samuelson and Nishida (1993). We had employed common usage abbreviations of the senior author from the Hungarian Museum of Natural History and propose that in the future we follow, for consistency, the sources of Bridges. Below we list the name and citation differences between our text and that of Bridges (1994).

Herein: Bavarian Zoologische Staatssammlung (Munich, Germany) (ZSM) =
Bridges et al.: Zoologische Sammlung des Bayerischen Staates, Munich (ZSBS)

Herein: Naturhistorisches Museum, Basel (NHB) =
Bridges et al.: Naturhistorisches Museum, Basel (NMB)

RESULTS*, *continued—

***Nabokovia faga* (Dognin 1895)**

Material Examined.

NHB. [see Table 1] 1♂, PERU, Cuzco, 4200 m., Fa.; 1♂, PERU, Cuzco, 1906, Fa.; 1♂, PERU, Cuzco.

LYCAENOPSIS SECTION

The section, recently revised by Eliot and Kawazoé (1983), is very diverse in the Oriental region. There is only one known Neotropical taxon, only recently recognized as belonging in the the Section and treated as a new Neotropical genus (Bálint and Johnson 1995e). So as not to create a *nomen nudum* below, we refer to the taxon by its original name pending publication of the citation just above.

***Lycaena cogina* Schaus (1902)**
"Everes" cogina: Brown 1993: 52.

Material Examined.

ZSM [see Table 1]. 2♂♂: BRAZIL, São Paulo, Campos de Jordao, 1600 m., 26.I.66., leg. H. Ebert.

Note. Forster identified the taxon as *"Cupidopsis"*, in that sense properly placing it in the *Lycaenopsis* Section. The formal placement of *L. cogina* has been made by morphological examination (Bálint and Johnson 1995e). Brown (1993: 52, Table 2, note c) (in what appears to have been a publication not aimed directly at taxonomic questions) included both *Lycaena cogina* and *Lycaena griqua* Schaus (1902: 407) in an *"Everes* section" (as *"Everes" cogina* and *"Everes" griqua*, also including *Everes comyntas*, which occurs in Central America). Considering morphology this placement is erroneous, *Everes* clearly belonging in the *Cupido* Section of the Polyommatini (Eliot 1973). Bálint examined the morphology of *L. griqua* and showed it to be the sister species of *Pseudolucia chilensis* (Blanchard) the two species forming the "*chilensis* Group" of the diverse genus *Pseudolucia* Nabokov (Bálint 1993a: 17-18, figs. 33, 34, 97, 98).

ITYLOS SECTION

The section includes an autochthonous South American lineage, *Itylos* Draudt 1921, with four species (three of which have been recently described). Bálint and Johnson (1994b) revised the genus (including two newly described species) and proposed the Section based on analysis of male and female morphology; Bálint and Lamas (1994) added an additional new Peruvian species. The *Itylos* Section contains genera originally placed by Eliot (1973) in his *Polyommatus* Section based on characters of the male. Bálint and Johnson (1994e) have discussed the polyphyly of Eliot's *Polyommatus* Section in detail, sampling error having been a major factor in its misconformation. Revising the section, they note that female genital structures of *Itylos*, including heavily sclerotized henia and bilobed fibula, support synapomorphy with the Holarctic *Glaucopsyche* Section. However, because of unique characters, the *Itylos* Section and *Glaucopsyche* Section are not synonymous but, rather, sister groups.

***Itylos titicaca* (Weymer 1890)**

Material Examined.

NHB. 1♂, PERU, Cuzco, 4200 m., 1906, Fa.; 1♂, PERU, Cuzco, 1902, Ro.; 1♀, PERU, Cuzco, 1906, Fa.; 1♀, PERU, Callan. [sic], Garl. [sic] [see Appendix I]; 1♀, Callan., 4500 m., 21.6.98, Sta.; 1♂, PERU, Cuzco; 3♀♀, Campamento Turpi, 4380 m., "bei Huarmicocha bei Puguio (Huancayo)", Januar 1939, Dr. Otto Gutzwiller, ex. Sammlung Dr. O. Gutzwiller, Barcelona 1958.

ZSM. 1♂,1♀, BOLIVIA, Titicacasee (ex. Coll. E. Pfeiffer, Munich); 33♂♂, 22♀♀, BOLIVIA, Illimani, "Westhang", 4500-5000 m., 5.IV-1.V. 50, leg. W. Forster; 4♂♂, 2♀♀, BOLIVIA, Cochabamba, Umg., Cumbre de Iunari, 4200 m., 10.X.1953, leg. W. Forster. 1♂, 1♀, CHILE, Antofagasta, Mucar, 4200 m., 18.XII.1952. 3♂♂, 1♀, PERU, Cuzco, 3500 m., Coll. Fassl. (ex. Coll. E. Pfeiffer, Munich); 6♂♂,2♀♀, PERU, Cordillera Regal, Hichucota, 23-27.6.1930 leg. W. Forster; 2♂♂,1♀, PERU, Puno, 4000 m.

Note. This species is widely distributed but very local and, as typical of many such taxa, can be very common at certain times within a restricted area. Interestingly, the recently described species of *Itylos* are still known only from Peru and from single localities. These species may also be common in restricted areas, although perhaps not ones often frequented by entomologists.

LEPTOTES SECTION

The section is represented by several taxa in the African and Oriental region. There are three clades in the Neotropical Realm, recognized as early as Clench's (1963: 255) work. The male genital aedeagus is hooked, biapical and strongly pointed; female genitalia have a heavily sclerotized fibula and the ductus bursae is not eversible. Neotropical members of the section have been revised recently by Bálint and Johnson (1995d).

Leptotes callanga (Butler 1896)

Material Examined.

NHB. 1♂, BOLIVIA, 1904, Ro.; 1♂, BOLIVIA, La Paz, 1903, Ro.; 1♂, PERU, 1904, Sta.; 1♂, PERU 1900, Sta.; 1♂, PERU, 1904, Frhst.; 1♂, 1♀, PERU, Madre Dios, 1909, Ro.; 1♂, PERU, Cuzco, 4000 m., 1902, Ro.; 1♀m, PERU, Cuzco, 1906, FA.; 1♂, 1♀, PERU, Cuzco.

ZSM. 1♂, BOLIVIA, Sorata Umg. [sic], 2900 m., 25.8.1950.

Leptotes andicola (Godman and Salvin 1891)

Material Examined.

NHB. 2♂♂, ECUADOR, 1906, N.

ZSM. 8♂♂, COLOMBIA, Pasto, "Rep. Columbien", 2300 m., Werner Hopp; 6♂♂, ECUADOR, Hazienda Piman, 2200 m., 4.VI.1977, leg. G. Riedel; 1♀, PERU, "Caras, Nd Peru", 2200 m., 3.VI.1957, "Anden Exped.".

Leptotes cassius (Cramer 1775)

Material Examined.

NHB. 2♂♂, 3♀♀, HAITI, 1900, He.; 1♀, TRINIDAD-TOBAGO, "Trinidad", 1906, N.; 1♀, NICARAGUA, "Nicaragua", 1900; 2♂♂, 2♀♀, BRAZIL, Espirito [sic] Santo, 1898, Sp.; 1♀, BRAZIL, "Centr. Brasil", 1896, Sti.; 2♂♂, COLOMBIA, "Colombia", 1895, Sta.

ZSM. 1♂, PERU, "Caras, Nd. Peru", 2200 m., 3. VI.1957, "Anden Exped."; 1♂, same data as previous entry but 23.VI.1957; 1♀, BOLIVIA, Sarampiuni, Rio San Paolo [sic], 400 m., 2.9.50. leg. W. Forster.

Leptotes lamasi Bálint and Johnson 1995

Material Examined.

NHB. 2♂♂, PERU, Huanabamba, 1904, Ro. **Paratype**, *Leptotes lamasi.*

Note. This species appears to be a high Andean vicariant sister species of *L. cassius*. It has been found in several disjunct high Andean localities in Peru (Bálint and Johnson, 1995d).

Leptotes trigemmatus (Butler 1821)

Material Examined.

NHB. 1♂, CHILE, 1896, He.; 2♂♂, CHILE, Iquique, 1909, Ro.

Note. The species is very distinctive compared to the widely distributed *L. marina* (Reakirt 1868). The *marina*-Group shows an interesting diversity in the Caribbean region (cf. Johnson and Matusik 1988, 1992), and the group has an endemic representative in the Galapagos Islands: *L. parrhasioides* (Wallengren, 1869) (see Bálint and Johnson 1995d).

POLYOMMATUS SECTION

This section, as proposed by Eliot (1973), proved to be polyphyletic (Bálint and Johnson 1995e) primarily due to the sampling error associated with previous poor knowledge of Neotropical diversity. In the Neotropics, Eliot referred a number of lineages to this section which clearly do not belong once additional, newly elaborated, sister groups are considered. Some of these groups represent autochthonous South American elements with very ancient overseas affinities. Such relationships were simply not comprehensible from the diversity known at the time of Eliot's work.

Awaiting publication of the relevant new higher categories for Neotropical Polyommatini, the present paper is organized according to Eliot's original sections. However, we add here for the sake of accuracy that *Hemiargus* Hübner belongs with *Itylos* in the recently proposed *Itylos* Section (see above and Balint and Johnson 1994b). This separates *Hemiargus* from *Cyclargus* Nabokov, *Pseudochrysops* Nabokov and *Echinargus* Nabokov (all which have major Caribbean elements). Still residing in the *Polyommatus* Section but with altered affinites are the genera *Paralycaeides* Nabokov, *Pseudolucia* Nabokov and *Madeleinea* Bálint. Of these, *Pseudolucia* must be distinguished as an ancient and autochthonous high Andean and austral lineage comprising a basal stem in the section; its members show a transformation series in the condition of the male genital sagum. *Paralycaeides* and *Madeleinea*, on the other hand, where the sagun is totally absent, show a close relationship to Holarctic *Plebejus* Kluk, a relationship more typical of the original concept Eliot held for his *Polyommatus* Section. *Pseudolucia*, *Paralycaeides* and *Madeleinea* have all been reviewed or revised in recent papers by the present authors. We list species below starting with *Hemiargus* and following with *Echinargus*, *Paralycaeides*, *Madeleinea*, and *Pseudolucia*.

Hemiargus hanno (Stoll 1790)

Material Examined.

NHB. 1♂, 2♀♀, PANAMA, Lino, "NS Panama", 1912, Fa; 1♂, BRAZIL (?), "Amazonas", 1899, Sta.; 1♂, BOLIVIA, La Paz, 1903, Ro.

ZSM. 1♀, COLOMBIA, "Andes, Columb."; 4♀♀, BOLIVIA, Rio Yacuma, Espiritu, 250 m., 23.IV. 1954, leg. W. Forster; 1♂, 1♀, same data as previous but 26.IV.1954; 1♀, same data as previous but 22.IV.1954; 1♂, same data as previous but 17.VII.1950; 1♂, BOLIVIA, Chiquitos, Robore, 300 m., 16.XII.1953, leg. W. Forster; 1♂, same data as previous but 12.XII.1953; 1♂, BOLIVIA, Yungas, Coroico, 1900 m., 15.V.1950, leg. W. Forster; 1♂, BOLIVIA, Rio Yacuma, Espiritu, 250 m., 31.VII.1950, leg. W. Forster; 2♂♂, same data as previous but Santa Rosa, 8.VII.1950; long series of ♂♂,♀♀, VENEZUELA, Ejido Mérida, leg. Huber, 1970, 1971, including localities Tabay, Chizuara, La Mucuy, Tal de Rio Albarregas.

Note. According to Brown (1993: 55) and the samples preserved at various museums (cf. Bálint 1993a: 14-15) this small species is one of the most widespread and common polyommatine lycaenids in the Neotropics.

Hemiargus bogotanus (Draudt 1921)

Material Examined.

ZSM. 12♂♂, 2♀♀, COLOMBIA, Kolumbien, Medellin, La Estrella, 1700 m., 23.VIII.1959, leg. Pater B. Schneble; 1♂, COLOMBIA, Kolumbien, Proc. Cundimarca [sic], Monteredondo, 1420 m., 4.IX.1959, leg. Pater B. Schneble; 2♂♂, 2♀♀, COLOMBIA, Bogota, 28-3200 m., Coll. Fassl, ex. coll. E. Pfeiffer, Munich.

Cyclargus dominica (Möschler 1886)

Material Examined.

NHB. 1♂, DOMINICA, "Dominique", 1906, N., ex. coll. Neuburger.

Note. This specimen was found among unelaborated South American Eumaeini.

Echinargus isola (Reakirt 1866)

Material Examined.

NHB. 1♂, PANANA, "Panama", 1893, Sta.

ZSM. 1♂, VENEZUELA, Edo Mérida, Ejido, 11-40 m., 17.X.1971, leg. H. Huber.

Note. The Venezuelan specimen collected by Huber appears to be the first record of *E. isola* for the South American continent.

Echinargus huntingtoni Rindge and Comstock 1953

Material Examined.

NHB. 1♂, VENEZUELA, Sierra Parime, 1897, Sp.; 1♀, VENEZUELA, San Antonio, 27.V.08, Fa.

ZSM. 2♂♂, 1♀, VENEZUELA, Ejido Mérida, 11-40 m., 05.9.1970, leg. Huber; 1♂, same data as previous but 1140 m., 17.10.1971; 2♂♂, same data as previous but 1150 m., 12.1.1971; 1♂, same data as previous but 14.1.1971.

Note. These specimens were identified with an unpublished manuscript name. We checked this name with C. A. Bridges' records and the Zoological Record and found no evidence that it was ever published. The data above concerning *Echinargus* species expands comments by Bálint (1993a: 15) and indicates the occurrence of three species in Venezuela. This emphasizes the importance of our continued publication of additional specimen data for various Latin American blues.

Paralycaeides inconspicua (Draudt 1921)

Material Examined.

NHB. 1♂, PERU, Cuzco, 4200 m., 1906, Fa.; 1♂, PERU, Cuzco, 1906, Fa.; 1♀, PERU, Cuzco, 1906, Fa., 1♂, PERU, Cuzco [no other data].

ZSM. 2♂♂, 1♂, PERU, Cuzco, 3500 m., Coll. Fassl, ex. coll. E. Pfeiffer, Munich; 1♂, PERU, "Peru" [no other data]; 1♀, PERU, Puno , 4000 m.

Note. The specimens at both museums were misidentified as "*vapa* Staudinger". These misidentifications appear to stem from Nabokov's (1945) original misdiagnosis of similar material as "*vapa*".

Paralycaeides vapa (Staudinger 1896)

Material Examined.

NHB. 1♂, BOLIVIA, "Bolivia", 1897, Sta.; 1♂, PERU, Cuzco, 1902, Ro.; 1♂, BOLIVIA, "Bolivia", 1896, Sta.; 1♂, PERU, Cuzco, 4200 m., 1906, Fa.; 1♂, PERU, "Peru", 1917, Fr.

ZSM. 20♂♂, BOLIVIA, Titicacasee, Huatajata ca 4000 m., 6-15.I.1954, leg. W. Forster; 20♂♂, BOLIVIA, Titicacasee, Huatajata ca 4000 m., 6-15.I.1954, leg. W. Forster; 7♂♂, 4♀♀, BOLIVIA, La Paz Umgbg., 3600-4000 m., 10-22.III.1950, leg. W. Forster; 4♂♂, 2♀♀, BOLIVIA, La Paz Umgbg., 3600-4000 m., 10.III.1954, leg. W. Forster; 4♂♂, 2♀♀, BOLIVIA, La Paz, Altiplano, 4000-4500 m., 7.III. 1950, leg. W. Forster; 16♂♂, 12♀♀, BOLIVIA, Westkordillere, Rio Mauri, General Campero, 3960 m., 14-17.II.1954, leg. W. Forster; 1♂, BOLIVIA, Guerrero, 21.V., "[ms. name, see below] ex coll. Stg."; 1♂, PERU, Chucuito am Titicacasee, 19.III.1953, leg. Koepcke; 1♂, PERU, "Peru", H. Fruhstorfer.

Note. Some of these specimens appeared with a manuscript name attributed to Staudinger. This name also appears on some specimens of *P. vapa* in the London and Vienna museums. We checked records of C. A. Bridges and the Zoological Record and found no evidence that the name was ever published. In Munich, this species was noted as undescribed.

Madeleinea odon Bálint and Johnson 1995

Material Examined.

ZSM. 2♂♂, COLOMBIA, Rep. Columbien, Pasto, 2300 m., April, leg. Werner Hopp.

Note. This is the only Colombian record for this recently described species; it is also the northernmost record for the genus. Consistent with our note at the beginning of *REPORT* #43 we construe that Bálint and Johnson (1995, Acta Zool. Acad. Sci. Hung. 41(1): 25-24) inadvertantly constituted the original description of this species (meeting the requirements of Articles 12(a), 13(a)(i) and Recomm. 13A, 73(a) of the ICZN Code).

Madeleinea nodo Bálint and Johnson 1995

Material Examined.

ZSM. 1♀, ECUADOR, Chimborazo, leg. R. Haensch.

Note. It is worth noting that this species was discovered in the recent survey of the Pululahua Geobotanical Reserve in Ecuador by Greg Kareofelas and Carol W. Witham of the United States. However, the species had actually been in European collections for many years. This underscores the magnitude of the problem of sampling error which resulted from the lack of previous elaboration of the historical material of the Neotropical Polyommatini. Our comment regarding the original description of *M. odon* (Note, previous entry) also applies to *M. nodo*.

Madeleinea koa (Druce 1896)

Material Examined.

NHB. 1♂, CHILE, Coronel 1909, Ro.; 2♂♂, PERU, Cuzco, 1906, Fa.; 1♂, PERU, Cuzco, 1906, Fa.

ZSM. 3♂♂, 1♀, BOLIVIA, La Paz, Umgbg., 3600-4000 m., 22.III.1950, leg. W. Forster; 1♂, same data as previous but 20.III.1050; 1♂, same data as previous but 24.III.1950; 1♀, BOLIVIA, La Paz, Altiplano, 4000-4500 m., 7.III.1950, leg. W. Forster; 1♂, BOLIVIA, La Paz Umgbg., Achocalla, 3600-4000 m., 22.XI.1953, leg. W. Forster; 13♂♂, 1♀, BOLIVIA, La Paz Umgbg., 3600-4000 m., 15-25.III.1950, leg. W. Forster; 4♂♂, BOLIVIA, La Paz Umgbg., Achocalla, 3600-4000 m., 22.XI.1953, leg. W. Forster; 2♂♂, BOLIVIA, La Paz Umgbg., 3600-4000 m., 10. III.54, leg. W. Forster; 1♀, BOLIVIA, La Paz, Altiplano, 4000-4500 m., 7.III.1950, leg. W. Forster; 1♂, BOLIVIA, "Bolivien", La Paz, 3250 m., leg. Schulze; 3♂♂, PERU, Cuzco, 3500 m., coll. Fassl, ex. coll. E. Pfeiffer, Munich.

Note. The Basel specimens were identified with a manuscript name. Again, we checked records of C. A. Bridges and the Zoological Record and found no evidence that the name was ever published. The Chilean data ("Coronel") invites confirmation; it is possible this specimen is mislabelled. The only other specimen of *M. koa* attributed to Chile is also doubtfully labelled (see Bálint and Johnson 1995d). The ZSM material was mixed in with *M. pacis* (see below).

Madeleinea cobaltana Bálint and Lamas 1994

Material Examined.

NHB: 1♂, PERU, Callan. [see Appendix I], Garl. [see Appendix I], 1900, Stgr.

Note. This specimen was misidentified as *M. koa*; our comments concerning recently named species and old material under *M. nodo* also pertains here.

Madeleinea pacis (Draudt 1921)

Material Examined.

NHB. 1♀, PERU, Cuzco, 1906, Fa; 1♂, PERU, Cuzco.

ZSM. 3♂♂, 2♀♀, PERU, Cuzco, 3500 m., coll.

Fassl, ex. coll. E. Pfeiffer, Munich; 2♂♂, PERU, Cuzco, 4000 m; 1♂, PERU, Prov. Puno. Umgeb. Titicaca See, Puno, 3810 m., 30.XII.1972, Gv. Rosen; 1♂, 1♀, PERU, Puno, 4000 m. (two dwarf specimens); 1♂, BOLIVIA, La Paz, 3600-4000 m., coll. Fassl; 2♂♂, 1♀, BOLIVIA, La Paz Umgbg., 3600-4000 m., 22.III.50, leg. W. Foster; 1♂, same data as previous but 16.III.1950; 1♂, same data as previous but 15.III.1950; 1♂, same data as previous but 22.III.1950.

Note. Almost half of the above listed specimens were misidentified as "*Itylos koa* Draudt".

Madeleinea moza (Staudinger 1894)

Material Examined.

NHB. 1♀, ARGENTINA, Catamarca, leg. H. Rolle; 1♂, ARGENTINA, "Argentinien", 1910, Ro.; 1♂, BOLIVIA, 1895, Sta..

ZSM. 1♂, ARGENTINA, San Javier, Tucuman, 22.IX.1949. ex. coll. E. Pfeiffer, Munich; 4♂♂, BOLIVIA, Cuesta von Cillutincara, 3000-3500 m., coll. Fassl, ex. coll. E. Pfeiffer, Munich; 1♂, BOLIVIA, "Boliv.", x..

Pseudolucia chilensis (Blanchard 1852)

Material Examined.

NHB. 1♂, 1♀, ARGENTINA, "Patagonien", 19-00, p.; 2♂♂, CHILE, "Chili", 1906, Ri.; 1♂, 1♀, CHILE, "Chili", 1904, Ro.

ZSM. 1♂, 1♀, CHILE, Prov. Coquimbo, Hda. Illapel, 2400 m., XI.1954.; 1♂, CHILE, Prov. Santiago, Los Maitenes, 2000 m., 9.X.1954.

Note. Curvoisier identified this species as "*Aricia* sp."; Forster called it "*Hemiargus* sp.". This is an interesting lesson in sampling error. Although workers familiar with representative Chilean samples known that *P. chilensis* is one of the most common austral polyommatines, persons unfamiliar with it can assume that is either very peculiar or even undescribed. As recently as 1993, Balletto described a synonym of this common species.

Pseudolucia lyrnessa (Hewitson 1874)
(= *Pseudolucia zembla* Bálint and Johnson 1993)

Material Examined.

NHB. 1♂, CHILE, Penco, 1906, Sw.; 1♂, CHILE, 1906, Ro.

ZSM. 4♂♂, 4♀♀, ARGENTINA, Prov. Neuquen, Confluencia Traful, 20.12.1956, leg. Fleiss; 1♂, ARGENTINA, Prov. Neuquen, Lago Alumine, 16.II.1958, leg. E. Fleiss; 2♂♂, CHILE, Cuesta Sapata, entre Santiago, Valparaiso-Chile, 13.X.1952. ex. coll. P. Pfeiffer, Munich; 2♂♂, CHILE, Prov. Nuble, Chillan, 4.I.1955, leg. W. Heimlich; 2♂♂ CHILE, Chillan, 3.I.1960 leg. W. Heimlich; 1♀, CHILE, Cordillera Chillan, 1800 m., 1.I.1955, leg. W. Heimlich; 6♂♂, CHILE, Prov. Nuble, Las Cabras, 1400 m., 23.XII.1954; 2♂♂, CHILE, Prov. Linares, Estero Leiva, I.1953; 1♂, CHILE, Prov. Coquimbo, Hda. Illapel, 1800 m., 6.XI.1954; 2♂♂, CHILE, Prov. Linares, Hda. San Manuel, I.1953.

Note. These specimens were misidentified at both museums as "*Itylos collina*". As can be seen below, only a few of the specimens so determined actually represented *P. collina*. Bálint and Johnson (1993b) and Bálint (1993b) first noted the "look-alike" ventral "V"-like pattern in a number of *Pseudolucia* species (of several species groups) historically attributed solely to "*collina*". Of these, only true *collina sensu stricto* has a bifurcate female genitalia, among other distinctive structural characters. Some familiarity with series of *P. collina* allows an experienced worker to distinguish the look-alikes by more subtle wing differences. Accordingly, the series at these museums have been properly sorted as noted above and in the subsequent entry. Another interesting point is that some of the localities listed above are common collecting areas for several of the recently described endemic Chilean *Pseudolucia* species. Some of these were also discovered in these series and are noted in subsequent entries.

Pseudolucia collina (Philippi 1860)

Material Examined.

ZSM. 4♂♂, 2♀♀, CHILE, Prov. Coquimbo, Hda. Illapel, 2900 m., 9.XI.1954.

Note. The males specimens were identified as "*Itylos collina*" and the females as "*Hemiargus chilensis*" by Dr. Forster. This attests to the sexual dimorphism in *P. collina*. The collecting site, Hacienda Illapel, is now well known for *Pseudolucia* diversity (Bálint and Johnson 1993b) being an area of sympatry and synchrony for *P. annamaria* Bálint and Johnson, *P. lyrnessa* (= *P. zembla* Bálint and Johnson), *P. collina*, and *P. scintilla* Balletto (= *P. kinbote* Bálint and Johnson).

Pseudolucia vera Bálint and Johnson 1993

Material Examined.

ZSM. 1♀, CHILE, Prov. Linares, Hda. San Manuel, I.1953.

Note. This specimen was mixed with the *P. lyr-*

nessa females. The general collecting area is well known for series of several of the recently described Chilean endemics of *Pseudolucia* (Bálint and Johnson 1993b).

Pseudolucia plumbea (Butler 1881)

Material Examined.

ZSM. 2♂♂, CHILE, Prov. Nuble, Las Cabras, 1480 m., 23.XII.1954; 1♂, CHILE, Chillán, 3.I.1960, leg. W. Heimlich.

Note. As typical of situations noted in several entries above, both specimens originate from well-known collecting areas for this particular species. Knowledge of *Pseudolucia* species in Chile, in a number of cases, is still tied to local collectors having located collecting sites particularly rich in certain species. Interestingly, some of these locales are also the sources of historical material. In the present case, the identity of *P. plumbea* has been recently clarified by work on the species' type material and distinguishing the taxon from several other recently described Chilean *Pseudolucia* (Bálint and Johnson 1993b).

DISCUSSION

Until quite recently, general knowledge of Neotropical polyommatines inhabiting oreal biomes in the high Andes and adjacent austral South America was extremely poor (Descimon 1986, Shapiro 1991). Studies after 1990 by the present authors, and others, have substantially increased knowledge of the actual diversity of polyommatine lycaenids in these regions. Many taxonomic problems have finally been clarified by work on the historical type material. However, even with this progress, the problem of sampling error is amply apparent and hampers an accurate knowledge of distributional limits on most of these taxa (Bálint and Lamas 1994). It is important, therefore, to continue elaboration of the many European collections which house significant historical material of these groups. In addition, as has been shown in the listings above, some of these collections also include relatively recent material. A good example is the ZSM material listed in the present paper. A combination of old and relatively recent material, along with some published contributions (Forster 1955, 1964), provide one of the first general pictures of butterfly distributions in oreal habitats of the region surrounding La Paz, Bolivia.

Below, we review the status of several other European collections of Polyommatini, some which have been surveyed and others which still need to be studied in more detail. Some collections already surveyed, such as The Natural History Museum (London), still harbor additional material in their uncurated holdings (Johnson and Smith 1993). Collections at the Museum für Naturkunde der Humbolt-Universität zu Berlin are still being studied to ascertain the amount of actual loss during World War II. As late as 1992 (E. May, in litt. to Johnson; L. Miller, pers. comm.), Weymer material once thought lost was located in dilapidated sections of the museum being surveyed for rain damage. Recent discoveries by Dr. Gerardo Lamas at the Senckenberg Museum in Frankfurt also underscore this problem. There are instances in which materials considered lost are actually found to be extant.

Neotropical Polyommatine Holdings in European Collections

Bálint has personally elaborated the Neotropical polyommatine collections at five European collections. These include the following on which specific comments are made below:

The Natural History Museum, London **(BMNH).** Note that, consistent with the original statutory name for this institution (which, for legal purposes in the United Kingdom, has remained unchanged), we have generally continued use of the abbreviation "BMNH". This is consistent with that employed by Bridges (1994), as noted heretofore. Without any doubt, the BMNH collections are the richest both in numbers of individuals and synoptic wealth of taxa. The collection includes primary types of numerous recently described entities (*Itylos fumosus* (Balletto), *I. pnin* Bálint, *Pseudolucia argentina* (Balletto), *Madeleinea mashenka* Bálint, *M. lolita* Bálint, *M. tintarrona* Bálint and Johnson, *Leptotes lamasi* Bálint and Johnson). The collection also houses a major portion of historical primary types for Neotropical Polyommatini (Bálint 1993b). Bálint has prepared lists of material in the general and type collections at the BMNH, as well as recent incorporations to the general collection from searches of previously uncurated backlog by him and Johnson.

Naturhistorisches Museum**, Basel (NHB [NMB,** Bridges 1994 et al.]). As noted in the entries of this paper, holdings in Neotropical Polyommatini are relatively substantial and synoptically strong. The collection holds, to date, the only known female of *Eldoradina sylphis* (Draudt), apparently from the original series of Fassl. The collection also houses representatives of two of the recently described Neotropical polyommatines (*Leptotes lamasi* Bálint and Johnson, *Madeleinea cobaltana* Bálint and Lamas).

Bavarian Zoologisches Staatssammlung**, Munich** (ZSM) [***Zoologische Sammlung des Bayerischen Staates***, Munich (ZSBS), Bridges 1994 et al.]. As noted in the present paper, this is an important collection both for its historical holdings and the materials gathered by W. Forster from personal collections and collaboration with various colleagues in Latin America. Along with additional samples of many previously described Polyommatini, representatives of two recently described species (*Madeleinea nodo* Bálint and Johnson, *M. odon* Bálint and Johnson) were also located. The collection is particularly strong in localities from Bolivia and Chile. This makes the samples a fine complement to the Bolivia material of the NHB and the recent Chilean material elaborated by the present authors.

Zoologisk Museum, Kobenhaven (ZMK) [***Zoological Museum of Copenhagen***, Copenhagen (ZMC), Bridges 1994 et al.]. This museum contains small additional samples of Patagonian material collected by an expedition from the 1980's. Within the material is the longest known series of *Pseudolucia lanin* Bálint and Johnson. There are also series of various species of *Hemiargus*.

Naturhistorisches Museum, **Wien (NMW) [not listed for Lycaenidae in Bridges 1994]**. Examination of this collection indicated few representatives of Neotropical Polyommatini.

In addition, the senior author is primarily responsible for curation of Polyommatini at the ***Hungarian Natural History Museum***, **Budapest (HNHB)** [= ***Ungar National Museum***, **Budapest (HNHM)** in Bridges 1994]. Due to the many recent works of the senior author, the voucher collection at the HNHB is ever increasing and there are also primary type specimens being deposited there.

It is also useful to review below institutions where there is either already indication of important lycaenid holdings or where there should be survey made to assess the status of such holdings.

Museum für Naturkunde der Humbolt-Universität, **Berlin, Germany (MNHU)** [=***Zoologische Museum der Humboldt Universität***, Berlin (ZMHU) in Bridges 1994 et al.]. This museum contains the important specimens of Staudinger and also material of Weymer. The size of the collection is emphasized by the large number of type specimens recorded (291, Bridges 1994). Considering the important Andean material already mentioned among the "elfin"-like hairstreak butterflies (Johnson 1990, 1992), samples of the oreal Polyommatini can be expected to be equally outstanding. With political access to these collections now no longer a problem, survey of this collection should be a priority among lycaenid taxonomists. As noted previously, recent correspondence with curators at the MNHU indicates there is still some question about the location of certain materials in some damaged or unrestored areas of this museum.

Senckenberg Museum, **Frankfurt am Main, Germany (SMF)** [=***Senckenbergische Naturforschende Gesselschaft Natur-Museum***, Bridges 1994 et al.]. Dr. Gerado Lamas recently discovered polyommatine type specimens of M. Draudt [1921] at this institution. Given this important discovery it is possible that additional useful series of Neotropical Polyommatini are in these collections.

NaturhistoriskaRiksmuseet, **Stockholm (NRS)** [listed the same in Bridges 1994]. Wallengren types of *Polyommatus atahualpa* and *P. parrhasioides* are located here. Considering this, there may more polyommatine specimens of interest at this museum.

CONCLUDING NOTE

In hindsight, it is evident that the current proliferation of taxonomic work concerning Neotropical Polyommatini has resulted to a great degree from the ability of workers based on three continents to have ready access to current samples, historical collections, *and* type material. Similarly, an important interplay has developed between the ongoing description of material, from whatever source, and continuing efforts to consult as many collections (large and small) as possible. As a result, species described from recent material in one year are often found to be represented in historical material soon after. Species described from historical uniques are soon located in nature by some field worker. Other links in this developing network are the various biodiversity now in progress throughout Latin America. With taxonomies available for formerly little-known groups, progress is now much faster than in the past. Even a decade ago, workers in the field were hampered by the meager taxonomic progress made on historical material; conversely, curators of historical material were reluctant to base work on the few unique specimens represented in their collections. As additional public and private collection of Lycaenidae are studied it can be fully expected that new taxa will be discovered from both the historical and the recent material. Happily, the two sources often complement each other in producing series from which reliable taxonomic conclusions can be drawn. We are indebted to the curators at all the institutions listed in the present study and it is our hope that, based on the present volume, more and more workers (both in museums and in the field) will begin focusing increased attention on their samples of Neotropical Polyommatini.

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Studies of Life History and Myrmecophily in Certain Chilean *Pseudolucia* Nabokov (Lycaenidae)

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ABSTRACT

Two larval-attendant ant species (*Camponotus ovaticeps* and *Dorymyrmex tener*) are recorded in myrmecophily with *Pseudolucia avishai* Bálint, Benyamini and Johnson 1995 and *Pseudolucia andina* (Bartlett-Calvert 1894) at three high Andean Chilean localities (2500-3200 m.). Field and laboratory observations are reported and behavioral interactions recorded and discussed. Close-up color photographs record various aspects of the larva and ant relationship in these two *Pseudolucia* species.

INTRODUCTION

Ants and caterpillars of polyommatine butterflies have been expected to show myrmecophilous relationships in the high Andean and austral biotopes characterizing various genera of the Latin American "blue butterflies" but no studies have previously been available (cf. Pierce 1987, Fiedler 1991a). Similarly, because of poorly elaborated taxonomies [until very recently] among high Andean and austral lycaenid butterflies, life histories of these butterflies were little studied (Brown 1993). Nonetheless, Fiedler (1991a) predicted that caterpillars of oreal lycaenids living in eremial (e.g. Atacama region), xeromontane (e.g. certain high Andean regions) or tundral (e.g. other high Andean or Patagonian regions) were likely myrmecophilous because several other worldwide groups, either phylogenetically related or ecologically analogous to Neotropical blues showed remarkable myrmecophily.

During fieldwork in 1993 and 1994, the senior author paid special attention to habitat preferences and oviposition behavior among various high Andean and austral polyommatine lycaenids and was able to begin assembling significant data on larval foodplants and myrmecophilous relationships with ants.

The present paper reports some of these data for two species of the diverse South American lycaenid genus *Pseudolucia* Nabokov 1945.

MATERIALS AND METHODS

During several expeditions made by the senior author in 1993 and 1994 (Fig. 1), observations on adult polyommatine behavior (including habitat preferences, nectar sources and oviposition) were recorded. Along with collections of butterflies, plant samples relevant to determination of nectar sources and larval foodplants by specialists, were collected. This work led to location and observation of myrmecophilous activity, concerning which elaborate photo studies were made and attendant ant samples collected for referral to specialists (see Acknowledgements) (for convenience, a list of plant/author and ant/author names is addended as an Appendix).

The present study draws on materials assembled during fieldwork originally initiated on *Pseudolucia andina* (Bartlett-Calvert) during which a closely related, look-alike, species (*Pseudolucia avishai* Benyamini, Bálint and Johnson 1995) was discovered. Field activity associated with differentiating these two species led to discovery that both are myrmecophilous.

At collecting sites of *Pseudolucia andina* and *Pseudolucia avishai*, caterpillars and ant workers were collected in the field and transferred on the cut stems of foodplants into translucent plastic vials; larvae were then separately reared but with the various instars segregated into laboratory groups as appropriate for comparative observation and photography. In addition to studying ant/caterpillar combinations found in the field, experiments were conducted to check the interactions of caterpillars and ant individuals originating from different colonies. In these latter cases, caterpillars were first introduced into a plastic box and then ant workers of various origins, as desired for study, introduced or withdrawn. Relevant behaviors were recorded and photographed.

RESULTS

Localities and Initial Field Observations

The first data concerning myrmecophily of a polyommatine lycaenid butterfly occurring on the continental mass of South America was collected on March 6, 1994, when the senior author found caterpillars of *Pseudolucia avishai* in the nests of two different ant species. The locality was Los Pelambres, Illapel (Coquimbo, central Chile) at an elevation of 2550 m. along the dry edge of a wet meadow ("vega") at the base of a steep slope (Fig. 2). Originally, study at this habitat involved thoroughly checking individuals of *Astragalus looseri* for polyommatine eggs. When eggs were located, stones were turned over near the plants. Eventually, five typically lycaenid-shaped caterpillars were found resting on the lower surface a certain stone. Beneath the caterpillars under this stone was a nest of reddish black mid-sized ants. Ants from this colony immediately began running from the proximity of the caterpillars, carrying their own larvae into the ground in what appeared to be an effort to escape the light. About ten meters away another stone was turned over near a large and partly defoliated *Astragalus derubium* cluster. Underneath were observed eight lycaenid larvae and a nest of another ant species, this one with large black and golden colored adults. These beautiful insects showed an unusually aggressive behavior when workers were collected for identification. When field vials first inadvertantly mixed the two different ant species, they started to fight, the black and golden ants quickly dismembering reddish-black ones.

The second locality where myrmecophilous activity was discovered was in La Parva. Here, the occurrence of ants attending a more well-known polyommatine, *Pseudolucia andina*, was discovered. La Parva is a famous Chilean winter ski resort situated some 40 km east of Santiago at 2800 m. elevation, about 195 km. south of Los Pelambres. On

March 27, 1994, at 2975 m. above La Parva, a cluster of *Astragalus looseri* was found and, under a little stone nearby, sixteen diapausing brown larvae of *Pseudolucia andina*. With the larvae were two reddish-black ants. At 2850 m. nearby, the bases of two clusters of *Astragalus looseri* (some 0.5 m. apart from each other) contained *Pseudolucia andina* larvae surrounded by many attendant reddish-black ants. Even though the ants from these plant clusters appeared identical, when they were stored together in the same plastic container they begin fighting and dismembering each other.

At a third locality, Portillo at elevation 3050 m., larvae of *Pseudolucia andina* were also found. This locality is situated high on a mountain pass (Paso Bermejo, about 65 km. northeast of La Parva) which connects to Argentina. Here, on April 1, 1994, the senior author located a biotope for *Colias mendozina* (Pieridae) (Benyamini, in press) and immediately began to search for polyommatines which might also be associated with this habitat. Indeed, *Pseudolucia andina* was located (in an area between Portillo and the international border tunnel) but here the larval foodplant was *Astragalus monticola* (Appendix I). When caterpillars were located they were also attended by reddish-black ants. At this locality, contrasting the other ones, the ants were observed above ground as well as under the plantbases and stones (Fig. 3). Also in contrast to the other localities, ants from different larvae-supporting nests at this locality did not fight each other when placed together [without a larva] in plastic vials. However, if ants from a different nest were placed with other ants already attending a larva, fighting ensued immediately.

On April 2, 1994, the senior author returned to Los Pelambres, one month after initially discovering the myrmecophily of *Pseudolucia avishai*. At this time, few adults of this polyommatine were still flying; the temperature was much lower than a month before. Interestingly, a check of larvae/ant relations on April 2 indicated that only the reddish-black ants were still present (at 2550 m. and 2950 m.). The black and golden ants were no longer there.

Identification of the Attendant Ants

The bigger ("black and golden") ant species, which was observed to attend *Pseudolucia avishai* caterpillars, is 10.0-11.0 mm. long with a black head and thorax and golden-yellow abdominal pubescence. It was identified as *Camponotus* (*Tanaemyrmex*) *ovaticeps* (Appendix I and Fig. 4). The type locality of the taxon is Valdivia, Chile, and it is distributed from the central Coquimbo and Metropolitan regions to Concepción and Valdivia (1000 km. to the south).

The smaller ("reddish-black") ant is 5.0-6.0 mm. long with red head and thorax but eyes, abdomen, and legs black. It was identified as *Dorymyrmex tener* (Appendix I and Fig. 5).

Behavioral Interaction between Attendant Ants and Pseudolucia *Larvae and Pupae*

In the laboratory, a fully grown fifth instar larva of *Pseudolucia avishai* found in a *Dorymyrmex tener* nest at Los Pelambres (2550 m.) was introduced into a plastic box containing two *Camponotus ovaticeps* workers. The ants ignored the larva for nearly two days; however, late in the second day (at 23:50 hrs.) one of the ants was observed palpating the caterpillar with a high frequency, first near the larva's head and, later, what proved to be the larva's "honey gland". A transparent droplet emerged from this region and the ant consumed it immediately. No more then five seconds later another droplet was secreted and consumed by the ant. Thereafter, the larva twice produced two droplets (almost immediately one after the other) and, finally, only a single droplet. After consuming all the droplets the ant started to clean its antennae with its front legs.

On another occasion, four larvae from the La Parva site (at 2950 m.), originally attended by *Dorymyrmex tener*, were introduced to a worker of the same ant species but originating from a different larva/ant nest (from La Parva but at 2850 m., about 500 meters away from the location of the other nest). This ant started to feed on the caterpillars within less than three minutes after the introduction.

In the field, a *Pseudolucia andina* caterpillar being attended in a *Dorymyrmex tener* nest at Portillo (3050 m.) was removed and introduced into another nest of the same ant species. The later had lacked larvae but was located just six meters away. At first, ants in the second next showed aggressive behavior toward the caterpillar (typical to that when any extraneous object is introduced into the nest), flocking to the larvae and appearing to bite at it. However, whereas such behavior usually continues unabated with introduction of an object, after a few minutes the ants ceased investigating the larvae and showed no reaction to it. The investigator was unable to stay in the field longer to observe subsequent behavior but wonders whether this larvae was eventually utilized by the ants of this second nest.

To investigate this question somewhat, the senior author (at Los Pelambres, 2850 m.) removed workers of *Dorymyrmex tener* from a large nest which had had no *Pseudolucia* larvae and was located at least 50 m. away from any other *Astragalus looseri* clusters he had searched. In the laboratory, two workers from this nest were introduced to a larva which had been attended by the workers of another *Dorymyrmex tener* nest at Los Pelambres, this one situated at elevation 2950 m. and some 800 m. away from the one first mentioned. Initially, these two ants tried to bite the larva but then left it alone. Later, however, after four days with no interaction with the larvae, the ants died (we suspect of starvation considering the report below).

In the laboratory, ten *Dorymyrmex tener* workers from Portillo (3050 m.) were kept together with nine caterpillars of *Pseudolucia andina* in the fifth larval instar. These ants and larvae had orginated from the same nest in the field. Conditions were set so that these ants had no other food source than the larval secretions. They lived for over three weeks. However, after three weeks, six of the larvae pupated, instead of diapausing as they would normally. Interestingly, the ants continued their palpation activity on the pupae. This phenomenon of early pupation was also observed with caterpillars of *Pseudolucia avishai* confined in the laboratory as sole food source for *Camponotus ovaticeps*. *Camponotus ovaticeps* workers intensely palpated the *Pseudolucia avishai* pupae around the prothorax and sixth abdominal segment. Important to these observations, larvae confined in the laboratory without attending ants, and with otherwise identical conditions, passed into diapausal rest without pupation.

Larval Defense

Observations readily support the mutual benefit of the myrmecophilous relationship between the polyommatines *Pseudolucia andina* and *Pseudolucia avishai* and *Camponotus ovaticeps* and *Dorymyrmex tener* worker ants. Of some fifty fourth and fifth instar larvae collected from El Morado (Maipo River), La Parva, Portillo and Los Pelambres (cumulatively, elevations 2500 m. to 3200 m.), only a single ant-attended larvae was found to be parasitized. This was a fourth instar larva of *Pseudolucia avishai* found in a *Dorymyrmex tener* nest at Los Pelambres (2550 m.) and parasited by an unidentified Ichneumonidae wasp species. This amounts to a 2% vulnerability regarding parasitism. By contrast, studies of myrmecophily in another Chilean polyommatine, *Pseudolucia benyamini* (see Benyamini 1995), showed 40% to 70% parasitism in a myrmecophilous relationship involving a different genus of ants and typified by what appears to be a lesser degree closeness in the ant/larvae companionship.

In the laboratory, the protective behavior of attending *Camponotus ovaticeps* workers could be observed in detail. Even when the plastic box containing the ants and larvae was nudged, or slid along the laboratory table, the ants would move close to the larvae and stand with their mandibles open. When an object (finger, brush or forceps) was moved in the direction of the larvae to "test" the vigilance of the ants, the ants would bite the object. This protective behavior by the ants was the same towards both the larvae and pupae of these polyommatines.

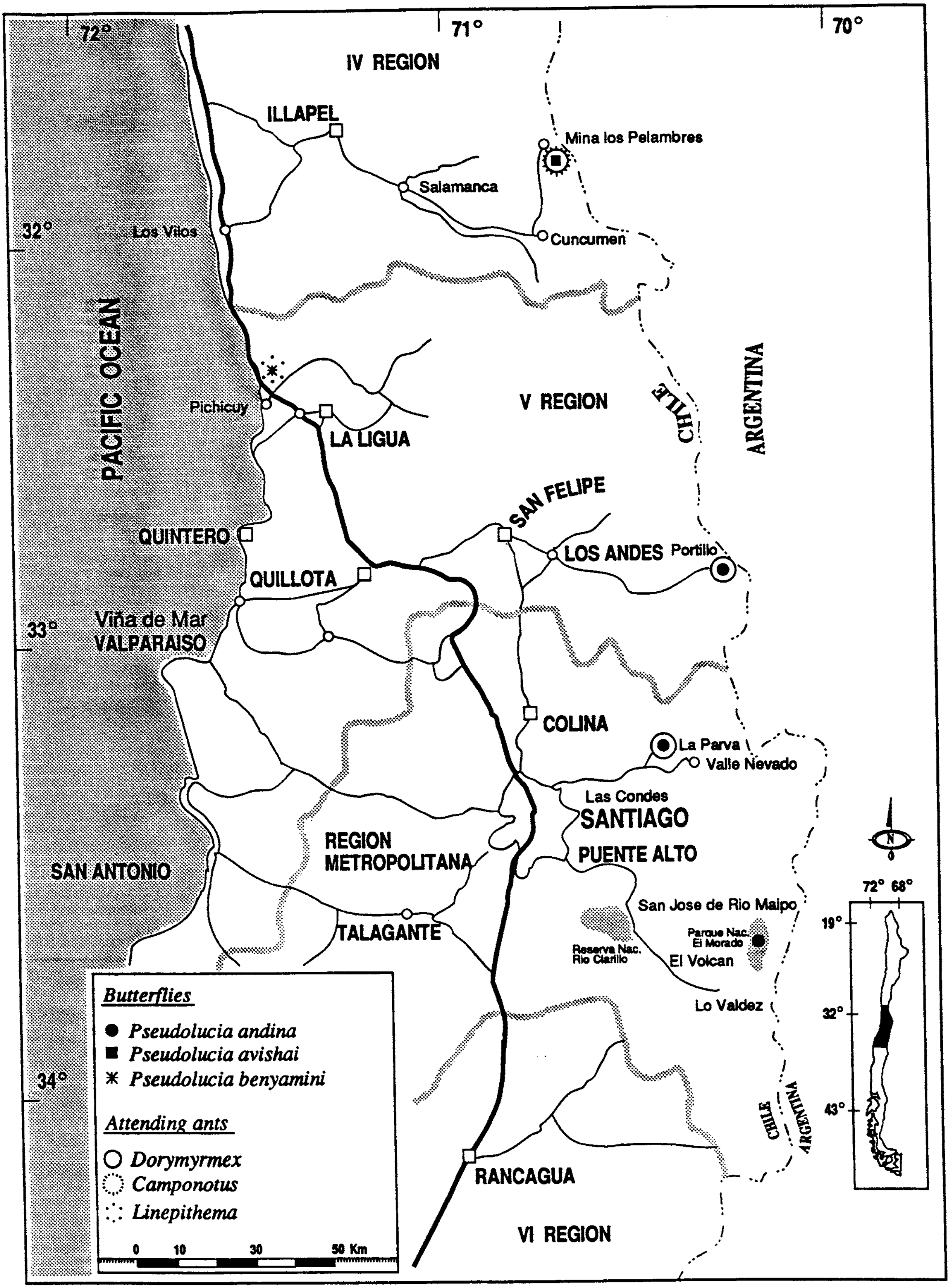
Dorymyrmex tener's protective activity in the vicinity of larvae was less conspicuous, an interesting correlation with the single parasitized *Pseudolucia avishai* larva that originated in a *Dorymyrmex tener* nest. This is interesting in itself because, at least in these field studies, myrmecophilous activity between *Dorymyrmex tener* and larvae of *Pseudolucia andina* and *Pseudolucia avishai* was found to be the most common. Larvae of *Pseudolucia andina* and *Pseudolucia avishai* were found with *Dorymyrmex tener* attendants in a total of nine nests at three different localities. In contrast, *Camponotus ovaticeps* was found attending only *Pseudolucia avishai* and only at a single locality.

DISCUSSION

The ecology in these two study cases of austral South American myrmecophily between polyommatine larvae and ants recalls that of several very recently studied Holarctic species (see Fiedler and Bálint 1994, Fiedler et al. 1994). The larval foodplant is of the Leguminosae with the caterpillars prefering the most nutrient-rich part of the plant. Further, the polyommatine species are well adapted to unpredictable climatic conditions (e.g. irregular annual arrival of spring) with caterpillars showing the ability to hibernate not only as pupae but as fourth or fifth instar larvae.

Previously predicted myrmecophily among austral South American polyommatines (Bálint 1993:17) is now confirmed for the genus *Pseudolucia*. Since caterpillars of *Pseudolucia avishai* and *Pseudolucia andina* have been shown to mature successfully with or without ant attendant activity, their known myrmecophily to date can be categorized as "facultative myrmecophily", according to the methods of Fiedler (1991a). In addition, since the observed ant/larvae association involves rather constant activity between ants and larvae, these *Pseudolucia* species appear to be "facultative myrmecophilous species" with "steady ant association". As such, the interactions between *Pseudolucia avishai* and *Pseudolucia andina* immatures and ants resemble the myrmecophilous associations typical of Holarctic lycaenids living in similar xeromontane conditions (see Fiedler 1991b and Ballmer and Pratt 1992). As the observations show, there is no evidence to suggest a specific association with particular ants. In the case of *Pseudolucia avishai*, two very different ant species (of different genera) are involved in the myrmecophily. The data showing only a single ant species (*Dorymyrmex tener*) in association with *Pseudolucia andina* may, at this early point in such studies, simply reflect sampling error.

Fiedler (1991a) stated that lycaenid myrmecophily is an ancestral characteristic of the family and that it has been secondarily lost along several phylogenetic lines. Important to testing this view in the New World tropics is that the *Polyommatus* Section proposed by Eliot (1973) (of which the


72°
71°
70°
IV REGION
ILLAPEL
Mina los Pelambres
Salamanca
Cuncumen
32°
Los Vilos
PACIFIC OCEAN
Pichicuy
LA LIGUA
V REGION
CHILE
ARGENTINA
SAN FELIPE
LOS ANDES
Portillo
QUINTERO
QUILLOTA
Viña de Mar
VALPARAISO
33°
COLINA
La Parva
Valle Nevado
Las Condes
SANTIAGO
REGION
METROPOLITANA
PUENTE ALTO
SAN ANTONIO
San Jose de Rio Maipo
Parque Nac. El Morado
Reserva Nac. Rio Clarillo
El Volcan
TALAGANTE
Lo Valdez
34°
CHILE
ARGENTINA
RANCAGUA
VI REGION
Butterflies
● Pseudolucia andina
■ Pseudolucia avishai
✳ Pseudolucia benyamini
Attending ants
○ Dorymyrmex
⁘ Camponotus
⁖ Linepithema
0 10 30 50 Km
N
72° 68°
19°
32°
43°

GEOGRAPHIC AREA AND STUDY GROUPS

Figure 1 (facing page). Map of Regions IV, V and VI in Chile showing sites of initial myrmecophily studies for *Pseudolucia andina* and *P. avishai* discussed in the text, along with comparative study areas later utilized for *P. benyamini* (see Benyamini 1995). Both *Pseudolucia avishai* and *P. benyamini* were discovered during initial studies of myrmecophily in Chile leading to eventual comparative data on other polyommatine species and attendant ants (see Table 2, page 6, and Benyamini 1995).

Table 1 (below). Parasitic "kill-ratio" data for *Pseudolucia benyamini* for comparison to that noted for *P. avishai* and *P. benyamini* in the text.

Table 2 (opposite page, 6). Ant relations from initial study of *Pseudolucia andina* and *P. avishai* compared to that eventually developed for *P. benyamini* and numerous other Chilean Polyommatini by Benyamini subsequent to 1994. As noted therein, once initial progress was made on such studies (not pursued hitherto by lepidopterists of the region) substantial data was readily forthcoming.

COLORPLATE FIGURES FOR STUDY GROUP SPECIES AND HABITATS

Color figures of polyommatine study group taxa, their habitats and relations with attendant ants are included both herein and also in Benyamini (1995). These are keyed in a separate caption at the conclusion of this paper.

Table 1. Kill-ratios of Parasitic wasps & flies in four annual broods of the Chilean Pacific coastal ***Pseudolucia benyamini*** Bálint & Johnson. * = After diapause.

Note: The figeres are related only to fully grown larvae and ignores others that died of deseases and starvation. Period of experiment: 9.1993-11.1994. All the presented data is from the type locality at Pichicuy.

BROODS	1st	2nd	3rd	4th
No. OF LARVAE (100%)	*3(100)	21(100)	7(100)	9(100)
No. & % OF PARASITIC WASPS	1(33.3)	9(42.8)	2(28.6)	7(77.7)
No.& % OF PARASITIC FLIES	1(33.3)	1(14.3)	1(14.3)	1(11.1)
TOTAL KILL RATIO IN %	66.6	47.6	42.8	88.8

Table 2. Larvae/Ant Relations Specific to Initial Studies in Chile Compared to Other Myrmecophilous Relations Now Known from the Region (see Benyamini 1995).

DNO - Dorsal Nectaryn Organ.
TOs - Tentacle Organs.
(**PCOs** - Pore Cupola organs, not checked)

SPECIES	DNO	TO'S	ANT SPECIES
H. ramon	+		?
N. faga	+	+	?
L. trigemmatus	+		?
P. collina	+		?
P. benyamini	+		***Linepithema*** sp.
P. lyrnessa	+		***Dorymyrmex agallardoi*** Snelling
P. hazeorum	+		***Dorymyrmex tener*** Mayr
P. plumbea	+		***Dorymyrmex tener*** Mayr
P. vera	+		***Dorymyrmex tener*** Mayr
P. avishai	+		***Dorymyrmex tener*** Mayr ***Camponotus ovaticeps*** Spinola
P. andina	+		***Dorymyrmex tener*** Mayr
P. argentina	+		***Dorymyrmex tener*** Mayr
P. talia	+		?
P. chilensis	+		***Dorymyrmex tener*** Mayr ***Tdapinoma antarcticum*** Forel ***Soleniosis gayi*** Spinola ***Brachymyrmex leavis*** Enery

Comparative Notes

No. of Genera and Species of Ants Discovered as Attendants in Initial Observations of *Pseudolucia andina*, *P. avishai* and *P. benyamini* = **3 genera; 3 species**

No. of Additional Ant Genera Discovered as Attendants in Subsequent Studies of Seven Additional Polyommatine Species = **3 genera; 4 species**

No. of Additional Polyommatine Species, Subsequently Studied, Found to Utilize only those Genera and Species of Ants Discovered in the Initial Studies = **6** (of 7)

No. of Ant Species Discovered as Attendants Still not Identifiable by Specialists = **1**

No. of Polyommatine Species with Only One Attendant Ant Species Indicated to Date = **7**

No. of Polyommatine Species with More than One Attendant Ant Species Indicated to Date = **2** (minimum 2, maximum 4).

genus *Pseudolucia* is a part) is obviously not monophyletic according to our studies (see Bálint and Johnson 1995). The entire spectrum of myrmecophilous relationships among the Neotropical polyommatines will need to be considered in light of the data expected to be published by the senior author as he completes his several years of biological studies in Chile and adjacent Argentina. It is likely that the data prepared for the present paper, available from late 1993 through 1994, will be greatly expanded both as to detail and diversity when these ongoing studies of Andean and austral "blues" are completed. Thus, the present analysis is only a preliminary report based on the first data available from the region. As can be seen from Table 2, we have taken the liberty of incorporating some very new data (at proof) to foreshadow the volume of results that are presently being produced in the Chilean studies.

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COLOR PHOTOGRAPHS FOR *REPORT* NO. 51

PHOTOPLATE VII (placed after p. 8 in *Report* 52 and captioned on its facing page):

Fig. 2. Type locality of *P. avishai;* **Fig. 3.** *Astragalus monticola* Phil. under which *P. andina* L5 caterpillars were found tended by *Dorymyrmex tener* Mayr workers; **Fig. 4.** *Camponotus ovaticeps* Spinola worker tending a *P. avishai* L5 caterpillar; **Fig. 5.** *Dorymyrmex tener* worker tending a *P. avishai* L5 caterpillar; **Fig. 6.** Adult *P. andina* from El Morado glacier, 2550 m.; **Fig. 7.** *P. andina* pupae and larvae; **Fig. 8.** Adult *P. avishai* from Los Pelambres study area, reared by D. Benyamini; **Fig. 9:** P. avishai pupae and larvae. also Benyamini 1995, photoplate XII); **Fig. 10.** Parasitic Campopleginae wasp typical of those recorded for both *P. avishai* and *P. benyamini.*

Synopsis of Biological Studies of the Chilean Polyommatini (Lepidoptera, Lycaenidae)

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NO. 52

ABSTRACT

Thirty-one species of Polyommatini (Lycaenidae) occurring in Chile, two others from nearby Argentina, and three occurring in Argentina and adjacent Bolivia are discussed. Foodplants are documented for 30 of the 36 species noted (83.3%). Myrmecophily is recorded in 17 species and 7 attendant ant species (of 6 genera) identified. Important new data concerning toxicity of certain foodplants and an apparent mimicry ring among a diverse group of Lycaenidae and other Lepidoptera is explored. Data concerning habitat, life history, adult behavior and myrmecophily are given for the following species: *Itylos titicaca* (Weymer, 1890); *Hemiargus ramon* (Dognin, 1887); *Nabokovia faga* (Dognin, 1895); *Nabokovia ada* Bálint and Johnson, 1993; *Leptotes trigemmatus* (Butler, 1881); *Leptotes cassius* (Cramer, 1775); *Pseudolucia collina* (Philippi, 1860); *Pseudolucia benyamini* Bálint and Johnson, 1995; *Pseudolucia lyrnessa* (Hewitson, 1874); *Pseudolucia hazeorum* Bálint and Johnson, 1993; *Pseudolucia clarea* Bálint and Johnson, 1993; *Pseudolucia plumbea* (Butler, 1881); *Pseudolucia zina* Benyamini Bálint and Johnson, 1995; *Pseudolucia annamaria* Bálint and Johnson, 1993; *Pseudolucia scintilla* Balletto, 1993; *Pseudolucia vera* Bálint and Johnson, 1993; *Pseudolucia chilensis* (Blanchard, 1852); *Pseudolucia charlotte* Bálint and Johnson, 1993; *Pseudolucia lanin* Bálint and Johnson, 1993; *Pseudolucia grata* Köhler, 1934; *Pseudolucia andina* (Bartlett-Calvert, 1894); *Pseudolucia avishai* Benyamini, Bálint and Johnson, 1995; *Pseudolucia asafi* Benyamini, Bálint and Johnson, 1995; *Pseudolucia magellana* Benyamini, Bálint and Johnson, 1995; *Pseudolucia sibylla* (Kirby, 1871); *Pseudolucia penai* Bálint and Johnson, 1993; *Pseudolucia aureliana* Bálint and Johnson, 1993; *Pseudolucia oligocyanea* (Ureta, 1956); *Pseudolucia argentina* Balletto, 1993; *Pseudolucia talia* Benyamini, Bálint and Johnson, 1995; *Madeleinea ludicra* (Weymer, 1890); *Madeleinea pelorias* (Weymer, 1890); *Madeleinea sigal* Benyamini, Balint and Johnson, 1995; *Madeleinea lea* Benyamini, Balint and Johnson, 1995; *Madeleinea moza* (Staudinger, 1894); *Paralycaeides vapa* (Staudinger, 1894) as well as three new species, as yet undescribed in *Pseudolucia*.

Regarding larval foodplants, widespread usage of *Adesmia* (Fabaceae) is documented for the first time for Lycaenidae, being used by 13 species (41.9% of the Chilean Polyommatini). Portulacaceae species are also recorded for the first time for Lycaenidae, used by four species (12.9% of the Chilean Polyommatini). Toxic Cuscutaceae, previously recorded only once as a butterfly foodplant, is utilized by the widely distributed *Pseudolucia chilensis*. Its orange dorsal coloration appears to be the model for a diverse mimicry ring including many orange-colored Polyommatini, Theclinae, and day-flying moths whose congeners are otherwise brown, blue, or gray. Widespread *Astragalus* usage by many other Chilean Polyommatini in this mimicry ring probably also contributes to the toxic plant-use basis for such a mimicry phenomenon. The resulting high number of species with orange coloration on the dorsum and cryptic basal markings (marked most often by a prominent "V"-shaped pattern) appears to explain why so many biologically distinct Andean and austral polyommatine species have remained unrecognized. The morphologies of many of these similar-looking entities differ drastically and readily facilitate taxonomic distinction. These distinctions are supported by the studies of life history and behavior.

Although the relative number of polyommatine species in Andean and austral South America is comparable to other regions of the world, the number of families and genera of foodplants utilized is shown to be much lower. This may reflect the unique geographic location and palaeobotanical history of the region.

INTRODUCTION

During the two summers of 1993-94 and 1994-5, an extensive field survey was carried out by the author, including visitation of over 250 selected biotopes in the field (both within and around Chile). During this period all the type localities of the known Chilean species of Polyommatini were visited, many several times. Other previously unexplored or remote sites, suggested by Chilean lepidopterists or interested specialists, were also visited. Eight new polyommatine species were added to the Chilean fauna, one to the Bolivian list and one to the Argentinian. Only four previously recorded species (12.9%) were not observed. The foodplants were identified for 24 polyommatine species (77.4%) and for another 17 polyommatine species (54.8%) rearing allowed the elaboration of the entire life cycle.

The author is a lepidopterist who, as a resident of Israel, has previously published numerous works on the fauna and biology of butterflies in the "Middle Eastern" region of the Holarctic. Having the opportunity to reside in Chile for several years, he was keenly aware of the large number of new taxa (particularly in the Lycaenidae) described from the region since 1992 by Drs. Zs. Bálint, K. Johnson and E. Balleto. This work, and the fact that Mr. L. Peña, an emanent Chilean lepidopterist, was in the process of completing a national butterfly book made the residence of a butterfly "biologist" extremely timely and the author vowed to use the time to work out the biologies of as many of these taxa as possible. Having the cooperation from Drs. Bálint and Johnson regarding taxonomy, and Mr. Peña regarding work in the field, the studies progressed speadily and, with the initiation of the compilation **"Neotropical 'Blue' Butterflies"** by the Museum of Natural History at the University of Wisconsin (Stevens Point) there was an early opportunity to publish a detailed synopsis of the results.

Historical Review

The first paper dealing with Chilean butterflies was written by Blanchard in Gay (1852) with only three lycaenids treated (including two polyommatines). Over thirty years later the first catalogue of Bartlett-Calvert appeared (1886) summarizing the works of Philippi (1860, 1873), Hewitson (1874), Felder and Rogenhofer (1875), Reed (1877), Butler (1881-1883) and especially Kirby (1879). This catalogue included only seven lycaenids, of which five were Polyommatinei and did not give any biological data. Dr. Emilio Ureta Rojas, who served many years as manager of the Entomological Section in Museo National de Historia Natural, Santiago de Chile, published several works (Ureta 1936, 1937, 1939, 1956), including (in 1963) his Rhopalocera Catalogue summarizing all was known of the Chilean butterflies at the time. The catalogue included 23 Lycaenidae and 11 Polyommatini.

Ureta included the field data of more than a dozen collectors, the most important being Guillermo Kuschel (who collected in 1946 and 1948 in the far northeast corner of Chile), Rodolfo Wagenknecht (who collected between 1938 and 1946 in the central regions of Chile, especially in the Coquimbo Region). Other important contributors to his papers were Jose Herrera, Luis Peña, Roberto Donoso Barros, Sergio Barros Valenzuela, Edwyn Reed, and others (Ureta 1956: 159-160). Only in Ureta's works appeared the first signs of biological data; foodplants were given for *Leptotes trigemmatus* and nectar sources were given for "*Itylos endymion*" (*Pseudolucia sibylla*). This situation of little knowledge of, and perhaps also little interest in, the biology of Chilean Lycaenidae continued until the 1990's. The authors that studied museum specimens, and some few others out in the field, were busy with collecting and preparing inventory lists describing the adults, their shapes and colors, and who collected them and where. Also, these workers were greatly hampered; lacking reference to historical type material, morphology, and life history data made it nearly impossible for them to recognize new species. Only in the early 1990's began the recent "new order" of morphologically-based taxonomic work and biological study on the Chilean fauna. Particularly since workers like Peña and the late J. Herrera seized the opportunity to supply their many unidentified specimens for these new studies, the result was a host of new publications (particularly by Drs. Zsolt Bálint and Kurt Johnson) describing a diverse fauna that had previously been unapproachable by the local workers.

Accordingly, arrival of the present author in Chile at the end of 1992 could not have been more timely. This "Synopsis" summarizes results effected since then concerning the Polyommatini. It is hoped that a separate publication can contain the results on the Theclinae.

TABLE OF CONTENTS

Discussion

LIST I

Annotated List of Chilean Polyommatini Including Reports on Habitat, Adult Behavior, Life History, Larval Foodplants and Myrmecophily

Format. Species are listed and numbered in the order treated in text and photoplates. As appropriate to data available as of the end of calendar year 1995, comments are summarized under the subheadings of Habitat, Adult Behavior (including nectar sources), Life History (including larval foodplants) and Myrmecophily. Entry items are cross-referenced to photoplates, figures and tables found elsewhere in the paper. Consistent with format in the rest of the paper dates are noted as day, month, year (19.2.94 = 19 February 1994) and/or month, year (2.94 = February 1994). Authors for Latin names of plants or ants accompany the first citation of such species. As in the photoplate captions, larval instars are noted as L1, L2, etc.

1. *Itylos titicaca* **(Weymer, 1890)** (Photoplate XIII, fig. 36).

Habitat. Inhabits the green wet "Bofedales" of the upper Puna and lower Alpine belts at 3800-4500 m. on the "Altiplano" of northern Chilean Regions Tarapacá and Antofagasta, where it is locally common. The species also occurs in the similar same biotopes within northwestern Argentina (Peña, 1971), the Bolivian Altiplano, and southern Peru (Bálint & Lamas 1994). Adults are able to survive intermittent snowy and icy conditions that persist on the Altiplano during their flight period (pers. obs. by author, 2.94, Parinacota, Tarapacá Region).

Adult Behavior. Adults fly from late October to April in more than one brood. The author observed adults in a green wet river "vega" near Cosapa, Oruru Region, southwestern Bolivia, at 4000 m., on 7.2.1994, sitting on the ground, upon a "carpet" of prostrate, green, cushion-like plants. Adults were also often gathered at droppings of domesticated Llamas and Alpacas. The same behavior was observed, on 4.11.94, near the Termas of Huaras de Jurasi, at 4000 m., between Putre and Parinacota, Tarapacá Region, Chile. This behavior suggests these butterflies get some necessary minerals from animal droppings, as frequently observed in tropical rain forests.

2. *Hemiargus ramon* **(Dognin, 1887)** (Photoplate VIII, figs. 19-22).

Habitat. Locally common in the Tarapacá Region of northern Chile, in the east-west evergreen valley "quebradas" ("Qda.") that dissect the surrounding desert. Records are from Rio Lluta, Qda. de Azapa, Qda. Vitor, Codpa, Iquique, and Mamiña, and also Rio Loa in Quillagua of the Antofagasta Region. On 2.94 a specimen was seen flying along the coast in Antofagasta; in such habitats the species might be confused in the field with *L. trigemmatus*.

Life History. This species is regarded as the "alfalfa blue" in Chile but, in Quillagua, I found it also associated with *Acacia* (2.94, 7.94). The species flies throughout the year with apparently short diapauses during the June-August months. Eggs are conspicuously white and laid on the leaves and flower buds of *Medicago sativa* L. (photoplate VIII: 19). The species was easily reared as the author travelled to Bolivia, 2.94. Larvae are velvet-green with tiny white spots, a middorsal darker green strip, weak subdorsal oblique greenish-white dashes, and a white lateral line (photoplate VIII: 20); there is a prominent dorsal nectaring organ ("DNO"). After reaching about 9 mm. in length, larvae become a light brown prepupa. The resulting pupa is about 7 mm. in length, light-brown, mottled with brown spots throughout (photoplate VIII: 21); a few short "hairs" exist among the abdominal segments and the pupae are connected to their base with several silken threads, not a single girdle. Of pupae reared, two did not hatch and may have entered a short diapause (uncertain since it was not possible to maintain these pupae while travelling and they eventually died). During 7.93 and 7.94 there was a noticeable break in the flight period of adults observed at Rio Lluta and Valle de Azapa in Arica. This also may indicate the species enters a short "diapause" either as a slow-growing larvae or pupae.

3. *Nabokovia faga* **(Dognin, 1895)** (Photoplate VIII, figs. 1-18 & Photoplate XVIII).

Habitat. Found in the Puna belt of the Tarapacá Region of northern Chile from October to April in successive generations. There are many specimens in Chilean collections from Rio Camarones (October to December); L. Peña who collected this material noted that the species descends along water courses to altitudes below 1000 m. and can be seen commonly in alfalfa fields. On 5.2.94 the author observed the species in a low ravine, some 10 km. west of Zapahuira (ca. 3000 m.) and also about 90 km. east of Arica (photoplate XV: 26). In both cases, these ravines were recently flooded by the Bolivian winter rains and full of newly flowering and budding plants.

Life History. Females were observed laying eggs on *Adesmia melanthes* Phil. (photoplate VIII, 2,3,5) (a foodplant also used by *Madeleinea pelorias* (Weymer), photoplate XIV: 27); individuals of this plant which can reach heights of 1.5 m. The biotope where these observations were made marks the lower edge of the Puna vegetation belt and is dominated there by the large *Baccharis petiolata* bushes. Adults of *N. faga* were using both *A. melanthes* and the weedy *Verbena hispida* R. et P. as nectar sources. On 16.4.94, *N. faga* was common near Putre at 3500 m. Here, the females were laying eggs on the prostrate *Dalea* cfr. *cylindrica* Hook var. *sulphurea* (Ulbrich) Barneby. At Socoroma, ca. 3100 m., in a narrow ravine, males were common and aggressively territorial, patrolling at intervals of some 8 m. from perches on bare soil or stones. Females were laying eggs (white, ca. 0.45 mm. in diameter) on the *A. melanthes* stems (photoplate VIII: 5) close to young flower buds. This contrasted egg laying on *Dalea* near Putre, where the eggs were laid directly on the flower buds or calyx. The L1 larva is ca. 1.0 mm. long, light brown with a shiny brown head

(LIST 1, *continued...*).

[*N. faga*, **continued]** capsule, two dorsal rows of long white "hairs", and white "hairs" along its sides. The L1 larva does not consume the egg shell; the larvae feed on flower buds (figs. VIII: 6,8,9) into which they burrow from the side through the calyx. After it begins feeding it becomes fully green. With the L3 larva, additional external markings begin to appear (photoplate VIII: 7,8,9). The fully grown larva is up to 10 mm. long. It is green with very small white spots, a middorsal white-edged reddish-brown stripe (which widens cephalad), subdorsal oblique dark green to brownish dashes, and white lateral stripes bordered ventrally with brown and dorsally reddish-brown in a dashlike (segmental) pattern. The head capsule and true legs are brownish-black. Segments three and four show a light "wasp mark", similar to that also seen in some species of *Pseudolucia* (*P. plumbea*, *P. talia* etc.); the DNO is well marked by a lateral brown line and enclosed by a brown circle. The prepupa (photoplate VIII: 13,14) is ca. 7.5 mm. long and dark green with faint white and brownish lines; a girdle is usually apparent. The pupa is 6.5 - 7.5 mm. long, transparent green after molting, and later light-brown with a dorsal dashed (segmental) reddish-brown to brown line (photoplate VIII: 11,12). The head area and thorax show two white circles that give the pupa the lateral appearance of a snake head (photoplate VIII: 10). When reared, adults emerge after 14-17 days. Wasp parasitized pupa turn dark brown with whitish marks along the wing veins (photoplate VIII: 15) with wasps emerging in about four weeks (photoplate VIII: 16, 17). The same species of wasps also attack pupae of *Tatochila autodice* reared from Zapahuira. The *Adesmia* foodplants used by *N. faga* were simultaneously utilized, in some cases, by green-colored larvae of a moth (family Ptesophoridae).

Adult Behavior. As noted above, males exhibit territorial behavior, patrolling at 8-10 m. intervals from perchs on bare ground, stones, or even high branches of some plants (like *Atriplex imbricata* Moq.). Recently, Benyamini and Johnson (in press) showed that in habitats of limited spatial occurrence, recognition of frequently sympatric species can be important to eventual location of more poorly known butterflies or ones to date known only from old historical material. Such "indicator species", often occupying the same biotopes as certain rarely collected lycaenids, include *Tatochila autodice ernestae* Herrera & *Tericolias zelia kuscheli* Ureta (Pieridae) and *Pyrgus bochoris trisignatus* Mabille (Hesperiidae). These species mark the habitats around Putre (3500 m.) where *N. faga* has been collected and, indeed, closer examination of these biomes produced *Abloxurina muela putreensis Johnson* (Lycaenidae) (associated with large *Baccharis* bushes), *M. pelorias*, the new *Madeleinea* species *sigal* (described in the present volume), and an undescribed thecline of the infratribe Strymonina (Benyamini and Johnson, in press). These environs comprise the narrow "Puna Belt" of vegetation, typified both by high diversity and density of plant cover compared to immediately adjacent environs (see Fig. A) and appears to harbor much of the upland insular butterfly fauna that has been historically attributed to the "Tarapacá" region (see Benyamini and Johnson, in press).

Myrmecophily. Given the prominence of the DNO in *N. faga*, myrmecophily can be suspected. As an experiment, a *Dorymyrmex tener* Mayr ant, actively feeding on *Pseudolucia avishai* at Los Pelambres, was introduced to an *N. faga* larva. However, no interaction took place and the ant died two days later. Given the myrmecophilous behavior reported hitherto in this volume (Benyamini and Bálint 1995), it appears that *N. faga* probably has a different genus of attendant ants and therefore did not respond to *D. tener*.

4. *Nabokovia ada* Bálint and Johnson, 1993.

Habitat. The type locality of the only known specimen is "Totoralillo", Coquimbo Region, labelled by Rodolfo Wagenknecht over forty years ago. Two "Totoralillo"'s occur in the Coquimbo Region: one is a small coastal village located 21 km. south of La Serena; the other is Cta. (Caleta=bay) Totoralillo on the pacific coast, 64 km. north of La Serena. Both are easily reached by travelling from from Santiago northward on the Pan-American Highway (Ruta 5). Both L. Peña and the present author have visited these localities at regular intervals since 1993, between August and November, in attempts to locate additional material and the precise habitat of *N. ada*. To date, there has been no success. Some forty years have passed since Rodolfo Wagenknecht collected the holotype. However, both "Totoralillo"'s are in semidesert biotopes and, in the Neotropics, such habitats are well known for erratic and fortuitous collecting (note, for instance, well-publicized disjointed historical records for species like *Atlantea cryptadia* Sommer and Schwartz & *Adelpha lapitha* Hall (Nymphalidae) and *Heraclides aristor* (Godart) (Papilionidae) in the semideserts of Hispaniola). Similarly, regarding *N. ada*, it is worth noting that the recently described *Pseudolucia aureliana* Bálint and Johnson of northern Chile was discovered during a "desert bloom", subsequently not locatable, but then collected once again during another "desert bloom" in northern Chile.

5. *Leptotes trigemmatus* (Butler, 1881) (Photoplate VIII, figs. 23-28 & Photoplate XV, fig. 1).

Habitat. Known from the northern and central regions of Chile, from Tarapacá in the north through Antofagasta, Atacama, and Valparaíso southward to Metropolitan Santiago. Its distributional pattern is scattered with local dispersions showing a clear influence of human activities, inhabiting northern east-west water courses ("quebradas"), desert oases, agricultural areas, planted *Acacia* fences and forests, as well as cities and villages, wherever it can find one of its many foodplants, Fabaceae, Mimosaceae or Plumbaginaceae. As such, *L. trigemmatus* is the only Chilean polyommatine with previous records of biological data: Ureta (1949) reported *Prosopis chilensis* (Mold) Stuntz, *Medicago sativa* L. and *Alousia looseri* Mold. as foodplants and *Verbena littoralis* as a nectar source. In the north, the species occurs in successive broods from October to May. In the warm oases of the far north, it can be found year-round (La Tirana-July, San Pedro de Atacama-July, Copiapo August-Sep.), although in smaller numbers than during the winter. Southward, seasonal populations are regularly established, although not every summer, depending on the weather. The present author has seen egg-laying on alfalfa (Arica 2.94), cultivated *Acacia karroo* plantation fences (Copiapo 8-10.94), cultivated *Acacia* forests (San Pedro de Atacama and Toconao, in 1-2.94) and inside the city San Pedro de Atacama (7.93). In Copiapo (9-10.94) adults were seen around *Geoffroea decorticans* (H. & A.) Burk. On 3.9.95, near Alcohuaz, 1450 m., Coquimbo Region, a female was observed nectaring on the locally widespread *Adesmia*. Mr. L. Peña reported (pers. comm.) the species' larvae

(LIST 1, *continued...*).

[*L. trigemmatus*, **continued]** on *Prosopis tamarugo* Phil. and *Scripus americanus* Pers. In Santiago, in the gardens of Las Condes, the species established a summer community during 4-5.94 wherever cultivated *Plumbago capensis* L. could be found. This was apparently not the first time since the collection of the national museum in Santiago showed specimens from the museum gardens (April) and from Viña del Mar (December). This kind of establishment is known elsewhere among polyommatines; in Israel, for instance, *Leptotes pirithous telicanus* L. occurs on this same foodplant, *P. capensis*, inside Tel Aviv (Benyamini, pers. obs.).

Life History. Rearing in Chile was conducted 4-5.94 on *Plumbago capensis*. The eggs are typically lycaenid, white and round and laid on the leaves, flowers and fruits of the foodplant (photoplate VIII: 23). The young larva does not consume the egg shell; the L1 larvae are yellowish-green to fully green (photoplate VIII: 24) with shiny "hairs"; the head capsule is shiny black. Larvae utilize many areas of the plant, consuming leaves, flower buds (which are penetrated from the side, photoplate VIII: 25) and flowers (leaving only the corolla behind). Fully grown larvae measure ca. 9-11 mm. and are green with tiny white spots, a continuous middorsal green line, and a whitish-green patch on the subdorsal area of each segment (photoplate VIII: 26) except the fourth. The fourth segment has a green wing-like mark instead of the whitish-green patch, suggesting the "wasp mark" seen in some *Pseudolucia* species (*P. talia*, *P. plumbea*, *P. hazeorum*, etc.). The prepupa is grey and the young pupa light greyish brown changing eventually to light brown, with a continuous brown dorsal line and dashed (segmental) brown subdorsal line. The "wasp mark" remains apparent but becomes somewhat reduced and blackish (photoplate VIII: 27). The pupae measures 8.5-9 mm. long and has a girdle. Adults emerged in Santiago (temperatures 20°C day/16°C night) after 13-14 days.

Myrmecophily. The species has a prominent DNO but, to date, no attending ants have been observed during studies in Santiago.

6. ***Pseudolucia collina* (Philippi, 1860)** (Photoplate IX, figs. 25-45, Photoplate XV, fig. 3 & Photoplate XVII).

Habitat. Inhabits the Precordillera of central Chile north of the Aconcagua River (northern Valparaíso Región) up to 2650 m. elevation and extends northward to the Pacific Coast from Los Vilos (in southern Coquimbo Región) to Pan de Azucar at the northern extreme of the Atacama Región (Map. X). The flight period is from mid-August to March in two to three annual broods, depending on altitude and availability of foodplants. On 3.12.94, at 2650 m. along Rio La Laguna, 15 km. east of Juntas on the international road from La Serena (Coquimbo, Chile) to San Juan (Argentina) females were observed on the yellowish perenial *Chorizanthe viridis* Phil. (photoplate IX: 25, 27; photoplate XV: 3). The stems of this white-flowered shrub were 15-20 cm. tall, protruding from a clump some 20 cm. in diameter near the ground. A few adult *P. collina* were clustered on the ground, on the foodplant, and on nearby flowers of *Adesmia aphyla* Clos. and various *Senecio* bushes. On 24.12.94, at 1800 m. in front of "El Chaco" (the private road of the Copper Mine of Los Pelambres), a large population of *P. collina* was discovered in association with *Chorizanthe paniculata* Benth. (photoplate VIII: 26). This bush grows to heights of 70 cm. and also has white flowers (photoplate IX: 28,29). Adult *P. chilensis* were very abundant on this foodplant, on the ground nearby, and on adjacent flowers of *Pleurophora pungens* D. Don (Lythraceae). On 7.1.95, 20 km. north of Caren, Hda. Illapel, from 1600 to 2500 m., *P. collina* adults (although few in number) were observed around the small *Chorizanthe* aff. *densa* Phil. plants which occur there along sandy slopes. In Los Vilos, Coquimbo Region, and 20 km. northward along the Pacific coast, *Corizanthe vaginata* Benth. bushes were noted as particularly abundant. These cushion-like plants also serve as the foodplant for *Pseudolucia benyamini* & *P. lyrnessa* in southern coastal localities and can grow in clusters up to 1 m. in diameter and to 30 cm. in height. On these plants, which are nearly always limited to coastal dunes or sandy soils, adults of *P. collina* were very common on any sunny day betweem September and March. However, this location appears to be the southern coastal limit for *P. collina*'s distribution. Some 40 km. to the south *P. benyamini* becomes the dominant *Pseudolucia* in coastal communities; *P. collina* occurs sparingly thereafter but, interestingly, has adapted in this region to also use *Montiopis* species as a foodplant. On 13.8.94 adults of *P. collina* were collected along the Pan-American Highway at km. 423 [from Santiago] opposite Tongoy. It was immediately noted that the only possible foodplant in this area was the annual *Montiopsis capitata* (H. & A.) Ford. but, on that trip, no time was available to search for eggs. However, on 14.8.94, 50 km. north of La Serena (Coquimbo Region near Totoralillo Bay, the type locality of *Nabokovia ada*) oviposition was noted on *Montiopsis* (*Calandrinia*) *discolor* Schraud., a succulent-like plant that frequents edges of the Absolute Desert biome (and it particularly common in the Atacama Region). It is worth noting that climatic conditions in 8.94 were extremely dry; thus, usage of *Montiopsis* by *P. collina* appears to let this butterfly produce an annual brood even in years when rainfall is far below normal.

Life History. As noted above, eggs can be laid on either *Corizanthes* (a perenial) or *Montiopsis* (an annual). On 2.9.95 and 23.9.95, at Cuesta los Cristales, 450 m. (about 10 km. south of Illapel, Coquimbo Region) eggs were found on both plant genera. However, regular monitoring of the locality established that eggs are laid first on *Montiopsis*, which blossoms earlier. Eggs are white (0.40-0.45 mm. diameter) and deposited almost exclusively on the calyx (photoplate IX: 30.31). The emerging larva does not consume the egg shell (photoplate IX: 32). It feeds on the buds, penetrating them from the side (photoplate IX: 33, 34). Larvae observed at Rio La Laguna were yelowish and well-camouflaged since the foodplant is also yellow-colored. Young L2 larvae are 2.0 mm. long, yellowish-white to light yellow-green with a variously prominent red dorsal line; the head capsule is black and the segmental texture smooth with only a few "hairs" at the terminus of the abdomen. By L4 the larvae are a greener yellow-green (photoplate IX: 35,41) with a red middorsal line edged with yellow, markings that can persist recognizably into L5, the instar in which diapause takes place. The L5 larva (photoplate IX: 36) is 8-10 mm. long and 2.5 mm. wide, yellow-green with the red segmental dorsal line persisting and, laterally, with a white line edged with reddish orange. Some individuals of L5 also show brown subdorsal oblique dashes (photoplate IX: 39). Before entering the prepupa stage the colors are darker, usually reddish brown with greenish brown oblique dashes on the flanks (photoplate IX: 40). Such variation appears to be typical of the species, depending on overall color of the fooplant. For instance, at El Chaco, Los Pelambres, the larvae are markedly darker in overall appearance, approaching a brownish red tint corresponding to a darker colored foodplant (photoplate IX: 32,33,34). Such fully grown L5 larvae (photoplate

(LIST 1, *continued...*).

[*P. collina*, **continued**] IX: 37,38) are 7.5-8 mm. long with reddish to violet tint, a red middorsal line (marked with white margins) widening cephalad, oblique subdorsal dark brown dashes (also edged with white) and white lines along the side. Irrespective of overall color, all larvae of *P. collina* are covered with tiny white spots, short "hairs" along the lateral margins and show a brown head capsule mottled with black. Some interesting contrasts are apparent in the behavior of *P. collina* versus *P. benyamini* larvae. Larvae of *P. benyamini* sit externally on the foodplant buds and eat the flower from the top; in contrast, larvae of *P. collina* consume the internal areas of buds, flowers and fruits by burrowing into these structures from the side. Similarly, *P. collina* larvae also seem to be generally more secretive. Contrasting *P. benyamini*, when some larvae of *P. collina* were transferred from one foodplant individual to another they descended to the bottom of the second plant and hid. The prepupa of *P. collina* is 6-7 mm. long (photoplate IX: 42), reddish- or dark greenish-brown with faint white lines. In the laboratory, larvae descend to the botton or sides of the rearing box. The pupae are 5.5-6.5 mm. long and have a girdle. The head, thorax and wing cases are greenish while the abdomen is colored toward a lighter brown; the middorsal line and subdorsal marks are reddish brown; the head and abdomen show a few short "hairs" (photoplate IX: 43). After a few days the pupae become completely light brown (photoplate IX: 44), a process which begins by the eye areas initially becoming reddish brown. During rearing in Santiago, two females emerged after 8-9 days and one male after 6 days. One pupa from Los Pelambres was only 3 mm. long with the female emerging from it having a wing span of only 6 mm.

Myrmecophily. The DNO was observed in L5 larva from Los Pelambres; it is demurely marked, appearing like a lateral brown line intersecting the red middorsal line. Since the larvae were reared without attending ants this species can be regarded as facultative (Fiedler 1991). Seven larvae that were collected in Rio la Laguna and Los Pelambres and bred in Santiago had no parasites. It is possible that *P. collina* is either better protected by its ant attendants in nature or its secretive feeding behavior as a larvae protects it more from external parasitism.

A Taxonomic Note. The isolated population of *P. collina* along the Atacama coast at Parque Nacional Pan de Azucar (the coastal habitat of the insular thecline *Heoda wagenknechti* (Ureta)) was a focus of interest during the recent studies of *Pseudolucia* in Chile. Zsolt Bálint examined Wagenknecht's historical *P. collina* from the site and found them interestingly divergent from other *P. collina*. It was of interest to see if additional specimens from the locality might help further elaborate any significant differences between these and nominate *P. collina*. Two visits were made to the area (8.93, 9.95 [Wagenknecht's collecting dates were 28.1. 1946, 8.1.49 & 25.2.1949]). *P. collina* was not seen. Regarding a possible biotope for *P. collina* at the locality, a few desicated *Chorizanthe* were located in the coastal habitat of *H. wagenknechti* and these might represent the local foodplant for *P. collina*. The areas will be visited again in hopes of collecting modern series corresponding to those originally recorded by Wagenknecht.

7. ***Pseudolucia benyamini* Bálint and Johnson, 1995** (Photoplate X, figs. 1-23, Photoplate XV, fig. 2 & Photoplate XVII).

Habitat. Inhabits dunes of the Valparaíso Regi6n in Central Chile, distributed from Pichicuy, 150 km. NW of Santiago (the type locality) to San Antonio some 150 km. to the south. The historical material of "*collina*" at the Museo Nacional de Historia Natural in Santiago includes 25 specimens of *P. benyamini* (from Reñaca [10 km. north of Valparaíso], Algarrobo, Papudo & Zapallar, 7 specimens of true *P. collina*, and 11 specimens of *P. lyrnessa*. Considering that the original type material of *collina* is considered lost and Bálint and Johnson (1993, 1995) have articulated their view of the facies of true *collina* in detail, it is probably advisable that a neotype for *Lycaena collina* be designated from the seven specimens mentioned just above. The type locality is situated in a dune area about 1 km. south of Pichicuy where a high water table creates a fresh water lagoon about 100 m. from, and parallel to, the Pacific coast. This biotope belongs to the Esclerofilous Central Mediterranean Zone (Fig. C) but the wet areas around the lagoon support hydrophylic elements and the high water table enables an extended flowering period for the *Chorizanthe* foodplants. During the flight period, both sexes of *P. benyamini* are readily seen on and around the local foodplant, *Chorizanthe vaginata* Benth. It is, in fact, the dominant plant of the biotope, widespread in extensive cushion-like formations. Such "cushions" measure up to 1.5 m. in diameter and 25 cm. high and account for over 50% of the total local plant coverage. Thus, this biotope supports not only a longer flight period (up to four annual broods) for *P. benyamini* but an extremely insular environment for development of the species. A longer blossoming period is afforded for all plants in this biome due to the consistently mild climatic conditions maintained by persistent coastal fog. Even on sunny days, cool breezes moderate temperatures to a 20°C maximum daily temperature. A detailed plant list was compiled for this biome which, due to the moderating climatic effects mentioned just above, is quite distinctive and includes numerous plants invading from surrounding localities because of the comfortable localized conditions. This information will hopefully be published in more detail elsewhere. Other butterflies observed in the biotope included *Heoda atacama*, *Eiseliana* aff. *probabila* (Lycaenidae), *Colias vauthieri*, *Tatochila mercedis* (Pieridae), *Vanessa caryae*, *Euptoieta claudia* (Nymphalidae), *Hylephila signata*, *H. fasciolata* (Hesperiidae) and *Cosmosatyrus chilensis* (Satyridae). On sunny and warm days butterfly flight activity started before 1000 hr. and lasted until 1900 hrs. (Chile summer time, sunset is close to 2100 hrs.). Consistent with comments under *Nabokovia faga* just above, it should be noted that both the other lycaenid species mentioned above from the Pichicuy biome are recently described species.

Adult Behavior. Adults of *P. benyamini* occur from mid-August to late February in three full broods followed by a shorter fourth brood typified by lower density. These broods occurs as follows: first generation August-September; second generation October-November; third generation December-January; partial fourth generation in February. The type material of *P. benyamini* represents the first generation and was collected by the author on 17.9.93. During the early generation, hundreds of adults are observable flying about the *Chorizanthe* cushions at the type locality. The males are very territorial, perching on the foodplant, on sand, dry twigs or other plants. They patrol for females, flying at short ranges of about 10 cm. over the ground in search of mates. When not laying eggs, females sit on the ground, either with wings closed or bent at 45° with the hindwings being rubbed together as often seen in lycaenid butterflies. When a female is confronted by a male, she will often begin to fly and is then followed closely by the male, usually less than 1" behind. Quite immediately, the female lands on a flowering head of the foodplant, with the male landing just behind her. The female then proceeds to walk about the flower with the male following behind, vibrating his wings.

(LIST 1, *continued...*).

[*P. benyamini*, **continued**] The female at first proceeds with her activities as if to ignore the male. However, on 1.11.1993 initiation of copulation was observed when a male moved up to the posterior of a female. The female vibrated her hind legs in an up and down fashion, in what appeared to be a repulsive posture (similar to behavior observed in a Chilean skipper, *Hylephila faciolata* Blanchard, Hesperiidae, Benyamini 1995a). Additional copulating pairs were observed on 11.9.94 and, in each of five cases, disturbance of the mating pair resulted in the male flying, carrying the female.

Life History. *Chorizanthe vaginata* Benth. is abundant at the type locality. The egg is layed on the calyx of the flower buds. A female usually deposited up to three eggs (each white and about 0.5 mm. in diameter) on each flower head. Before the larvae emerge, the eggs turns grey. The young larva does not consume the egg shell. It is 1.0 mm. long, light brown to greenish. The 2L larva is 2.0 mm. long, brown with faintly darker markings. From L1-L4, the larvae have rows of distinctive white "hairs": two lateral, two along the mid-subdorsal flanks, and two located dorsally on each side of the middorsal stripe. The head is shiny black and the true legs are flat black. Initial rearing attempts failed at either the L1 or L2 stage, until it was realized that laboratory conditions needed to be altered to more closely resemble those at the biotope. Once a more humid environment was provided in the laboratory rearing proceeded without problems. L3 larvae are completely green, penetrate the calyx from the side and consume the flower buds. The larger L4 and L5 larvae feed on the flowers, consuming the corolla from the top. Consistent with this "external" feeding, colors of the L4 and L5 larvae also change, these instars showing a mix of hues of orange, reddish, or brown with the green ground (photoplate X: 10-13) more closely resembling the colors of the foodplant (photoplate X: 1,2). At this stage the larvae prefer to eat the stamens and stylus, consuming these before the corolla. Most L4 larva (photoplate X: 10) have a reddish brown middorsal line with white margins, subdorsal dark-green dashes, and white side lines; however, some L4 larvae (photoplate X: 11) appear nearly completely orangish white. As noted above, larvae from L1-L4 are distinctly "hairy". However, the fully grown L5 larva (which grows to 6.5-8.5 mm.) is less so; their middorsal stripe and subdorsal dashes are brown or reddish brown, edged marginally with white or yellowish white. In the laboratory, the larvae feed mostly at night. When exposed to direct sunlight, larvae cease feeding and move toward the bottoms of the stems to hide. Diapause occurs in the fully grown L5 stage. Depending on local foodplant availability, hibernation of larvae may occur after the annual second brood (on dry slopes or in gully bottoms) or after the third or fourth broods (in consistently humid areas like near the lagoon or along the bottoms of slopes). Three larvae that began diapause in mid-March 1994 were sprayed with moisture on 12.8.94 and 30.9.94. On 8.10.94 two larvae of this cluster emerged from their silken net, reddish brown in color and about 7 mm. long. On 25.10.94 a parasitic fly (Tachinidae) emerged from one larva and, on 1.11.94, a wasp (Ichneumonidae) from the other. In all, only one larva of ten fourth-brood larvae involved in the initial rearing (10%) survived to the next spring. Entering the prepupa stage, the larvae shrink to 6-7 mm. and their colors fade to reddish-brown or orange. In the laboratory, prepupae descended to the bottom of the rearing vial, or built a loose silken net around themselves (photoplate X: 14). Some of the prepupae constructed silken nets in concert with unidentified moth larvae. The pupae measure 5.0 - 6.0 mm. and, when fresh, range from brown- or reddish-hued green to yellowish-brown and have red dorsal & subdorsal abdominal line (photoplate X: 16). Prior to hatching, the pupa becomes entirely brown. Hatching occurred in Santiago (in shade at external summer temperatures) within 9-10 days. The female figured in photoplate X: 18-22 emerged on 12.11.93 with the entire process of wing expansion and flight occurring in less than one minute. Such a short time certainly minimizes vulnerability during this preflight period. Cannibalism among the larvae was observed on three occassions and, in all three instances, the cannibalizing larvae proved to parasite infested. For instance, on 11.11.93 a prepupa appeared to be "sucked" into a fully grown larva. On 16.11.93 the cannibalizing larva shrunk to 5.5 mm., turned greyish brown and, as it disintegrated, revealed a parasite's cocoon. On 27.11.93 a wasp emerged (Ichneumonidae [Campopleginae, det. Dr. D. Wahl, *Hyposoter* sp., det. Dr. D. Lanfranco], photoplate X: 23). On 5.11.93 a fully grown larva ingested the abdominal sections of a 2L larva whose cephalic area was imbedded in a bud. Two days later the cannibalizing larva shrunk and a wasp cocoon emerged. On 14.3.94 an L5 larva ingested an L4 larva. On 18.3.94 the cannibalizing larva descended to the bottom of the rearing vial. On 21.3.94 a wasp cocoon was revealed and a wasp emerged on 2.4.94. It appears significant that each of these cases of cannibalism also involved parasitism. Two cases of a more than one-year diapause were observed in the parasitic wasps. Parasitized larvae originally collected in 10.93 produced parasite cocoons on 15.11.93 and 25.12.93 but an adult wasp did not emerge until 9.95.

The author also reared *P. benyamini* on *Chorizanthe vaginata* from a second locality, Concon, Valparaíso Region, 10-12.94 and was surprised to find larvae of quite different color pattern in the L5 stage, some with pink stripes and bands similar to larvae of *P. lyrnessa* (see entry 8, below, and photoplate X: 31). The matter was of considerable interest since, in all other aspects, the larvae appeared typical of *P. benyamini*. Larval and adult material from Concon was sent to Zsolt Bálint and positively identified positively as *P. benyamini*. The occurrence of such differences in color pattern among the larvae of *P. benyamini* at different localities supports the notion mentioned previously that there is considerable convergence of larval color with that of the surrounding foodplant. In this case, such convergence also appears to include color parallelisms among different *Pseudolucia* species utilizing the same larval foodplant species.

Myrmecophily. Only a few individuals of a small ant species (*Linepithema* sp.) were noted on the foodplants near the *P. benyamini* larvae and no "milking" was observed. The DNO on *L. benyamini* appears very diminutive, observable as a small dish; accordingly, from the data now available, myrmecophily appears to be of the lowest grade. This is also directly reflected in the percentage of parasites in the larvae (Table 1) which may reach 90% in the fourth generation. This fatality percentage starkly contrasts that in other species of *Pseudolucia* with active myrmecophily (*e.g. P. andina* and *P. avishai*, see Benyamini and Bálint 1995). Effective ant defense in these latter two species reduces fatality to less than 10%. Several possibilities are suggested by these data. First, if the tiny *Linepithema* ant species seen around some *P. benyamini* larvae are in fact ant attendants, this small ant species may simply be an ineffective protector. Second, it is notable that although the extent of vulnerabililty to parasitic wasps in *P. benyamini* is far higher than any other reared Chilean polyommatine, it is still an extremely common butterfly in its biotope during its flight period. Perhaps the small *Linepithema* species are the only ants available in this biotope for a myrmecophilous relationship

(LIST 1, *continued...*).

[*P. benyamini*, **continued**] with this *Pseudolucia* species. Moreover, perhaps the biotope is so generous (with its protractedly mild climate) that a high mortality due to parasitic wasps is actually of little consequence to its overall survival.

8. ***Pseudolucia lyrnessa* (Hewitson, 1874)** (Photoplate X, figs. 24-35, Photoplate XV, figs. 4-5 & Photoplate XVIII).

Habitat. Inhabits central, to south-central, regions of Chile from the Maipo River (Metropolitan Santiago Region) some 450 km. south to Constitución and Concepción (in the Bio-Bio Región) on the Pacific Coast. Depending on availability of foodplants, *P. lyrnessa* has two broods inland, in the Precordillera, and up to three annual broods on the coast. In these two types of biomes (inland & coastal) the species also feeds on foodplants of two different plant families— *Chorizanthe* (Polygonaceae) on the coast and *Montiopsis* (Portulacaceae) inland on sandy soils (this versatility mirroring that reported previously for *P. collina*). Interestingly, as will be discussed latter, the succulent-like plants of the family Portulacaceae are rarely utilized by polyommatines outside of Chile. In mid-September of 1993 and 1994, *P. lyrnessa* was was locally common near San Jose de Maipo, off the southern bank of the Maipo River about 35 km. southeast of Metropolitan Santiago and this was the most frequently used habitat source for rearing experiments.

Life History. Oviposition habits are of particular interest in this species and will be summarized first. Eggs are white and 0.4-0.5 mm. in diameter (photoplate XVII). They are usually laid on the "hairy" whitish colored annual *Montiopsis capitata* (H.& A.) Ford (photoplate X: 24). Numerically, 56% of recorded eggs (n=43) were laid on the flower buds (which are surrounded basally by long "hairs"), 15.5% in "hairy" areas below the leaves, and 6.25% on the less "hairy" trunk below the leaves. The egg laying on the "hairy" structures of the plant is interesting because, on the one hand, these 3-5 mm. long "hairs" serve as an effective protective cover for the immature stages. However, the "hairs" also appear to make oviposition difficult for the adult females. Observations of oviposition indicated that only about 30% of the eggs laid on the flower buds were placed in a position actually ideal for hatching and feeding (e.g. the egg affixed on its side in the lower part of the elongate "hairs" where the larvae can emerge from the side and freely reach the flower bud). The haphazardness of the oviposition behavior, sometimes with care taken to deposit at particular alignments within the long "hairs" close to edge of the flower buds, while othertimes quickly "dropping" eggs here and there, suggests that even of those eggs laid near the flower bud only about 30% are really in an ideal location for hatching and feeding. With this in mind, considering the numbers of eggs laid elsewhere on the plant (under the leaves or down the stem), a very small percentage indeed are in an ideal location for ready hatching and feeding. This kind of oviposition, however, appears less a "risk-sharing" kind of strategy then simply a result of the logistical difficulty females display when trying to oviposit economically on this extremely hairy plant. On 26.11.94, adults of *P. lyrnessa* were observed in Parque Nacional El Morado (eastern Rio Volcan, Metropolitan Region, 1750 -1900 m.). Some individuals were perched on the bare ground. However, one female was observed on a small, hairy, light-green perenial whose large violet flowers would blossom in the afternoons up to some 25 cm. in height (photoplate X: 25). The plant was determined as *Montiopsis gilliesii* (H. & A.) Ford (det. Ing. Agr. Iris Peralta, IADIZA, Mendoza, Argentina). On this *Montiopsis* species, fresh and hatched eggs were found mostly on the flower buds (photoplate X: 26). Interestingly, at this locality, only one *Chorizanthe* sp. plant was observed. Yet, its presence, indicated that even this locality, dominated by the *Montiopsis* foodplant, did have at least some *Chorizanthe* as a secondary foodplant. Since all the observations of the present study were done in a relatively short span of time, it is interesting to query if relative percentages of the two foodplants vary with local conditions from year to year, with concomitant differences in foodplant utilization by the butterflies.

Regarding the immature stages, the freshly emerged larva does not consume the egg shell. After emerging, it penetrates a flower bud and is invisible from outside except for extrusions of violet frass that correspond to the color of the foodplant's flowers (photoplate X: 28). As noted before for Chilean *Pseudolucia*, larvae at different localities evidence some variety of color pattern, depending on the local foodplant. The 2L larvae at El Morado were orange-brown with white markings, with the L3 to L5 larvae (ultimately reaching 7.5-8.0 mm. in length) pinkish white with the first segment dorsum showing an elliptic brown mark (photoplate X: 29). The head was shiny black and the true legs brown. A single L4 larva was green with tiny white spots, a middorsal reddish-pink line, oblique white dashes on its flanks, and white lateral stripes edged on both sides with pink-red margins and white "hairs". At San Jose de Maipo, the L5 larvae (found on 22.10.94 on foodplant flowers), looked slightly different (photoplate X: 30,31,32): larger (to 9 mm. long and 2.5 mm. wide), with tiny white spots over the entire body, short white "hairs" along the margins, a white-margined reddish brown middorsal stripe extending from the second segment, oblique green and white dashes covering subdorsal flank bordered ventrally by a wide pink band, white lateral lines, and the dorsum of the first segment pinkish violet similar to the color of the foodplant flowers. The head was shiny black, the venter of the larva, the prolegs, and true legs all green. Given these differences, the only salient trait of the larvae common to the species at both localities was the reddish to pink middorsal line. Prepupae measured 6.0-6.5 mm. and ranged from dull green or greenish-violet to reddish-brown with faint whitish oblique markings along the side. Pupation takes place inside the foodplant in a loose silken net (photoplate X: 33). It is possible that diapausing larvae also hibernate inside the foodplant. Pupae were 6.0-6.5 mm. long, light greenish brown to violet-brown with yellow-white lateral lines and brown dorsal lines when fresh. Later, the pupae turned completely brown (photoplate X: 34). In the pupae, the adults' colors become visible within 24 hours of emergence. During rearing in December, emergence of adults took place within 9 days after pupation. There was a low instance of parasitism. Only one larva, an L3 larva from San Jose de Maipo measuring 3.5 mm., contained an Ichneumonid wasp. The larvae ceased feeding on 22.10.94 and on 6.11.94 the wasp emerged.

Myrmecophily. The DNO is visible as a brown line. In San Jose de Maipo many *Dorymyrmex agallardoi* Snelling ants were observed on and under the larval foodplants. These are possibly ant species that tends the larvae of *P. lyrnessa*.

9. ***Pseudolucia hazeorum* Bálint & Johnson, 1993** (Photoplate XI, figs. 20-35, 41 & XVIII).

Habitat. This unmistakeable species is known from the Precordillera of the central Mediterranean Zone. It is discontinuously distributed from Alcohuaz, near Vicuña, in the Coquimbo Region to some 750 km. farther south to its type locality in the Parral Mts. (Region de Maule, Talca) and Las Trancas ("Los Trancas" of the original description) near Termas de Chillán in the Bio-Bio Region.

COLOR PHOTOGRAPHIC PLATES VII-XIV

Including Color Figures for Entries in LIST 1

(**Format**: unpaginated, alternating color photoplates and captions; color photos relevant to species treated as well in the general text are also included (as cited in the text); color photos relevant to species treated in other papers of this volume are cross-referenced in a separate caption at the end of each paper of the volume).

Notes: Fig. B, p. 11 (after the color photoplates) locates the biotopes of each species treated in LIST 1 within a schematic of vegetation belts in the western slopes of the Andes of central and northern Chile, drawn in reference to elevation and latitude; additional Figs. A and C (p. 11) relate these areas to plant species diversity, degrees of plant cover, and annual rainfall.

"Photoplate XV", where cited in LIST 1, was printed in black and white as Photoplate III for purposes of the entire volume. As placed among the black and white photoplates herein, it is used to refer to a number of species in various papers of the volume, each cross-referenced in a separate caption at the end of each paper.

LIST 1, continues on p. 9, beginning with "*Pseudolucia hazeorum* (continued)" immediately after the colorplate section and a single page of black and white line drawings (Figs. A-C) which are also cited in LIST 1.

CAPTIONS TO PHOTOPLATE VII

I. Color Photographs for Benyamini and Bálint, **Studies of Life History and Myrmecophily in Certain Chilean Pseudolucia Nabokov (Lepidoptera, Lycaenidae).** UWSP Museum *Report* **No. 51.** Figure 1 was the locality map, p. 4 of the article (captioned on p. 5). Color figures are as follows (all by D. Benyamini); date citations follow format of Benyamini 1995 (*Report* No. 52)— day, month, year.

Fig. 2. Type locality of *P. avishai* Los Pelambres, 2950 m., 2.4.94, long range vista (see electric tower near bottom center of photograph). Site of initial discovery of myrmecophily between ants and two species of *Pseudolucia*, *P. avishai* and *P. andina.*

Fig. 3. *Astragalus monticola* Phil. and surrounding vegetation in Portillo, 3050 m.. Under the stones several *P. andina* L5 caterpillars were found tended by *Dorymyrmex tener* Mayr workers on 1.4. 1994.

Fig. 4. *Camponotus ovaticeps* Spinola worker tending a *P. avishai* L5 caterpillar, 3.4.1994.

Fig. 5. *Dorymyrmex tener* worker tending a *P. avishai* L5 caterpillar, 2.4.1994.

Fig. 6. Adult *P. andina* from El Morado glacier, 2550 m.: above, upperside male; below, upperside female.

Fig. 7. Pupae (left, lateral), 5L larva (right, dorsal) of *P. andina* reared subsequently by Benyamini (see also Benyamini 1995, photoplate XII).

Fig. 8. Adult *P. avishai* from Los Pelambres study area, reared by D. Benyamini from immature stages in Fig. 9.: above, upperside male; below, upperside female.

Fig. 9. Pupae (left, dorsal), 5L larva (right, dorsal) of *P. avishai* reared subsequently by Benyamini (see also Benyamini 1995, photoplate XII).

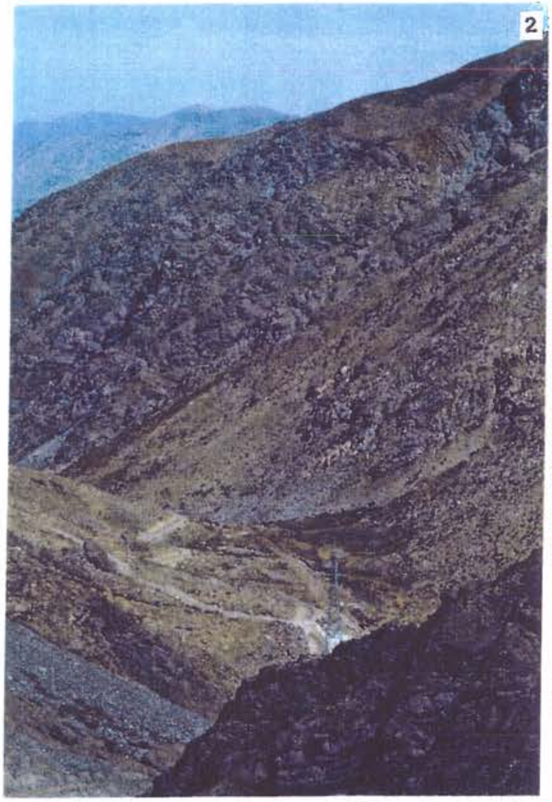
Fig. 10. Parasitic Campopleginae wasp typical of those recorded for both *P. avishai* and *P. benyamini* (Table 1) using *P. andina* as host at Portillo.

II. Additional Color Photographs of Certain Type Specimens of *Pseudolucia.*

Figs. 11,12. Type male of *Lycaena endymion* Blanchard (MNHN ["Museum Paris"]) (= *Pseudolucia sibylla* (Kirby)) (see species groups of *Pseudolucia*, Bálint and Johnson 1995 (UWSP *Report* **No. 45**), Addendum).

Fig. 13,14. Lectotype male of *Lycaena lyrnessa* Hewitson (BMNH) (i.e. *Pseudolucia lyrnessa*, see Bálint and Johnson, 1995, UWSP *Report* **No. 45**, Addendum).

Remaining Color **Photoplates VIII-XIV** Pertain Mainly to Benyamini, **Synopsis of Biological Studies of the Chilean Polyommatini (Lepidoptera, Lycaenidae)**, UWSP Museum *Report* **No. 52**, particularly LIST 1 of that study. These Photoplates are cross-referenced, however, as appropriate, to the other papers of this volume in separate captions at the end of each article.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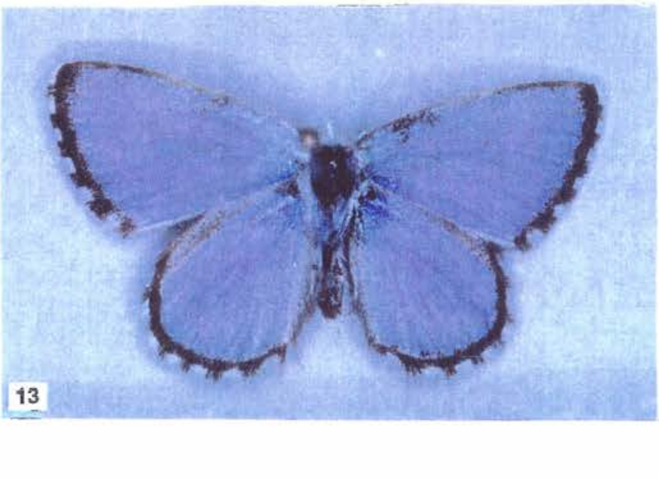
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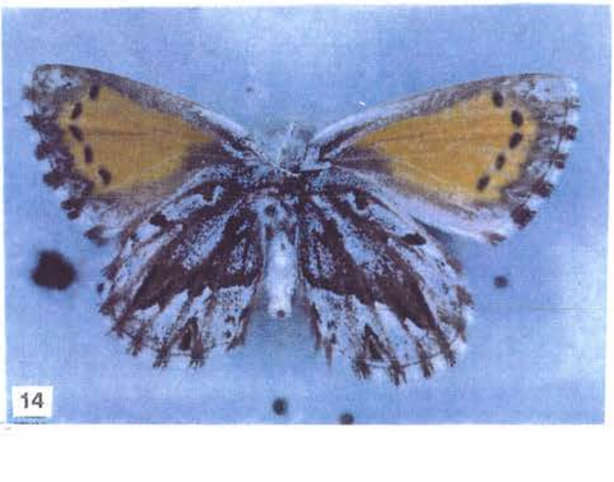
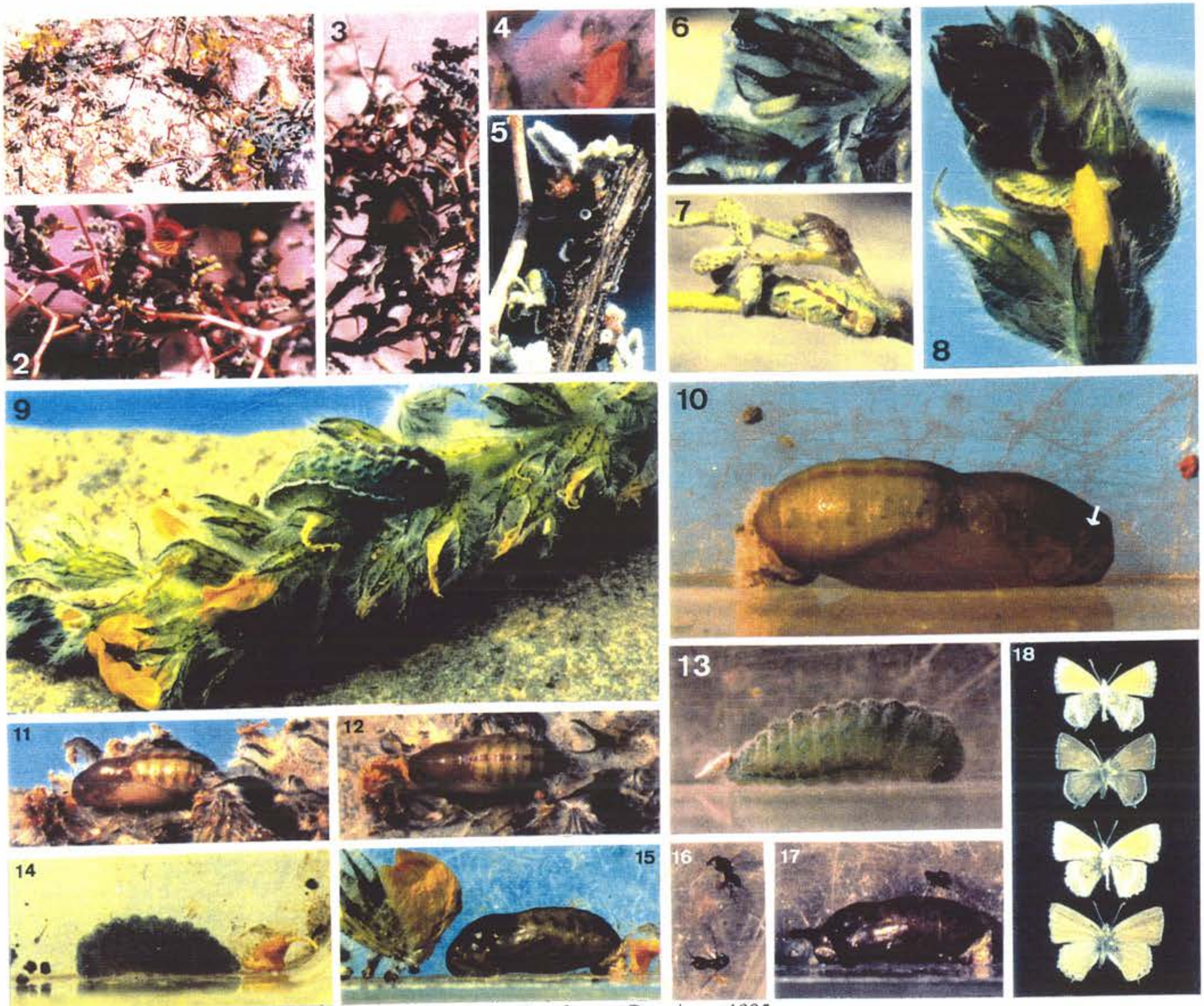

14

PHOTOPLATE VIII



Nabokovia faga Dognin , 1895

Hemiargus ramon Dognin , 1887

Leptotes trigemmatus Butler , 1881

CAPTIONS TO PHOTOPLATE VIII

Nabokovia faga

Fig. 1. The foodplant, *Dalea* cfr. *cylindrica* Hook var. *sulphurea* (Ulbrich) Barneby, near Putre, 3500 m., 16.4.94.
Fig. 2. The foodplant, *Adesmia melanthes* Phil., 10 km. west of Zapahuira, 3000 m., 14.4.94.
Fig. 3. Female ***N. faga*** on ***A. melanthes***, 10 km. W. of Zapahuira, 3000m., 14.4.94, (-x 1.5).
Fig. 4. Egg on ***D. cylindrica***, near Putre, 3500 m., 16.4.94, (-x6).
Fig. 5. Eggs on ***A. melanthes***, 10 km. west of Zapahuira, 3000 m., 14.4.94, (-x3.5).
Fig. 6. Larvae (figs. 6-9), fig. 6, L2 on ***D. cylindrica*** 19.4.94, (-x3.5).
Fig. 7. L4 on ***D. cylindrica*** 22.4.94, (-x3.3).
Fig. 8. L4 on ***D. cylindrica*** 19.4.94, (-x3.3).
Fig. 9. L5 on ***D. cylindrica*** 25.4.94, (-x3).
Fig.10. Pupa; arrow notes "false mouth" that appears to mimic reptilean head, (-x7.5).
Fig.11. Fresh pupa, lateral view, (-x3).
Fig.12. Fresh pupa, dorsal view, (-x3).
Fig.13. Prepupa, (-x4.5).
Fig.14. Parasitized larva, (-x3.5).
Fig.15. Parasitized pupa, (-x3.5).
Fig.16. Parasitic wasps (*Pteromalus* sp?) (-x3.5).
Fig.17. Pupa & parasites, (-x3.5).
Fig.18. Adults, top to bottom, (87%/ 13% reductions):
male underside, ex egg Putre 3500 m. 28.5.94.
male upperside, ex larva Putre 3500 m. 12.5.94.
female underside, Zapahuira 3000 m. 14.4.94.
female upperside, Socoroma 3100 m. 16.4.94.

Hemiargus ramon

Fig.19. Egg on ***Medicago sativa***, Arica 4.2.1994, (-x3.5).
Fig.20. Larva, L5 on ***M. sativa***, Arica 4.2.1994, (-x4.5).
Fig.21. Diapausing [?] pupa, (-x3.8).
Fig.22. Adults, top (t), middle (m) & bottom (b), (70%/ 30% reductions):
t: male/female typical underside - Arica S.L., 4.2.1994.
m: male upperside - Quillagua, 750 m., 2.2.1994.
b: female upperside - Arica S.L., 4.2.1994

Leptotes trigemmatus

Fig.23. Empty egg on the calyx of ***Plumbago capensis*** L. Santiago 700 m., 4.1994, (-x6.5).
Fig.24. Egg (above) and L3 larva (below) on ***P. capensis***, (-x4).
Fig.25. Larva, fully grown L5 on the foodplant with prepupal coloration; note "wasp mark" at left, (-x3).
Fig.26. Larva, fully grown L5 on the foodplant, (-x3).
Fig.27. Pupa with the "dark brown sign" left of larva's "wasp mark", (-x3).
Fig.28. Adults, top (t), middle (m) & bottom (b), (89%/ 11% reductions):
t: male underside - Copiapo 150 m., 6.10.1994.
m: male upperside - ex larva. Santiago, Las Condes 700 m., 15.5.1994.
b: female upperside - ex larva, Santiago, Las Condes 700 m., 24.4.1994.

CAPTIONS TO PHOTOPLATE IX

Pseudolucia vera

Fig. 1. The type locality, 1100 m., with Vn. Longuimay in background, Malleco, (IX) Región de la Araucania, 3.2.1995.

Fig. 2. The foodplant, ***Montiopsis gayana*** (Barn.) Ford, at the type locality, 3.2.1995.

Fig. 3. Male ***P. vera*** perching on the foodplant, place & date as in fig. 1, (-x1.25).

Fig. 4. Male perching on stone with wings open at 45°, data as fig. 1, (-x2).

Fig. 5. Female basking on stone with wings open at 45°, data as fig. 1, (-x1.1).

Fig. 6. Female nectaring on ***Adesmia emerginata*** Clos, data as in fig. 1, (actual size).

Fig. 7. Egg fixed on foodplant, data as in fig. 1, (about actual size).

Fig. 8. Egg on fruit of ***M. gayana***, data as in fig. 1 (-x2.5).

Fig. 9. Larvae (figs. 9-20), fig. 9, L1 larva from the type locality, 4.2.1995, (-x4).

Fig.10. L2 from the type locality, 11.2.1995, (-x4).

Fig.11. L3 from the type locality, 4.2.1995, (-x5).

Fig.12. Dead L5 (note distension around head capsule) on smooth areas of foodplant, 3.2.1995, (x3).

Fig.13. L5 on brightly colored, smooth fruits of foodplant, (-x3).

Fig.14. L5 feeding on "glandular" areas of foodplant at the type locality, 3.2.1995, (-x2).

Fig.15. L5 on ***M. gayana***, data as fig. 14, (-x3.5).

F.16,17. L5, well camouflaged, feeding inside a flower at the type locality, data as in fig. 1, (-x3.5 & -x3, respectively).

Fig.18. Fully grown L5 before entering diapause, at the bottom of the foodplant, 8.2.1995, (-x2.7).

F.19,20. Diapausing larva, 2.1995, (-x2 & -x4.5, respectively).

Fig.21. Pupa on foodplant, 20.2.1995, (-x3.5).

Fig.22. Same as fig. 21, emphasizing the girdle, (-x6).

Fig.23. Pupa about two days before emergence, 15.2.1995, (-x5).

Fig.24. Adults, males left, (enlarged 26%): male upperside - Vn. Longuimay 1100 m., 3.2.1995; male underside - Vn. Longuimay 1100 m., 3.2.1995; female upperside - Vn. Longuimay 1100 m., 3.2.1995; female underside - ex larva Vn. Longuimay 1100 m., 28.2.1995.

Pseudolucia collina

Fig.25. Habitat closeup at Rio La Laguna, 2650 m., Elqui, Coquimbo (IV) Región, 3.12.1994.

Fig.26. Habitat vista at El Chacay, Los Pelambres Valley, 1800 m., Illpel, Coquimbo (IV) Región 7.1.1995.

Fig.27. A foodplant, ***Chorizanthe viridis*** Phil., at Rio la Laguna, data same as fig. 25, (-x0.2).

F.28,29. A foodplant, ***Chorizanthe paniculata*** Benth., at El Chacay, data same as fig. 26.

F.30,31. Eggs and feeding holes on flower buds of ***C. viridis***, data same as fig. 25, (-x6).

Fig.32. Egg on flower bud of *C. paniculata*, data same as fig. 26, (-x9).

Fig.33. Larvae (figs. 33-41), fig. 33, L2 on ***C. paniculata***, 10.12.1994, (-x4).

Fig.34. L3 on ***C. paniculata***, 10.12.1994, (-x5).

F.35,36. L4 on ***C. viridis***, Rio la Laguna, 2650 m., 3.12.1994, (-x5).

F.37,38. L5 at El Chacay, 1800 m., on ***C. paniculata***, 26.12.1994, (-x3).

F.39,40. L5 from Rio la Laguna, 2650 m., on ***C. viridis***, 6.12.1994, (-x4).

Fig.41. L4 hiding at base of *C. viridis* plant, Rio la Laguna, 2650 m., 3.12.1994, (-x4).

Fig.42. Prepupa, Rio la Laguna, 2650 m., 8.12.1994, (-x4.8).

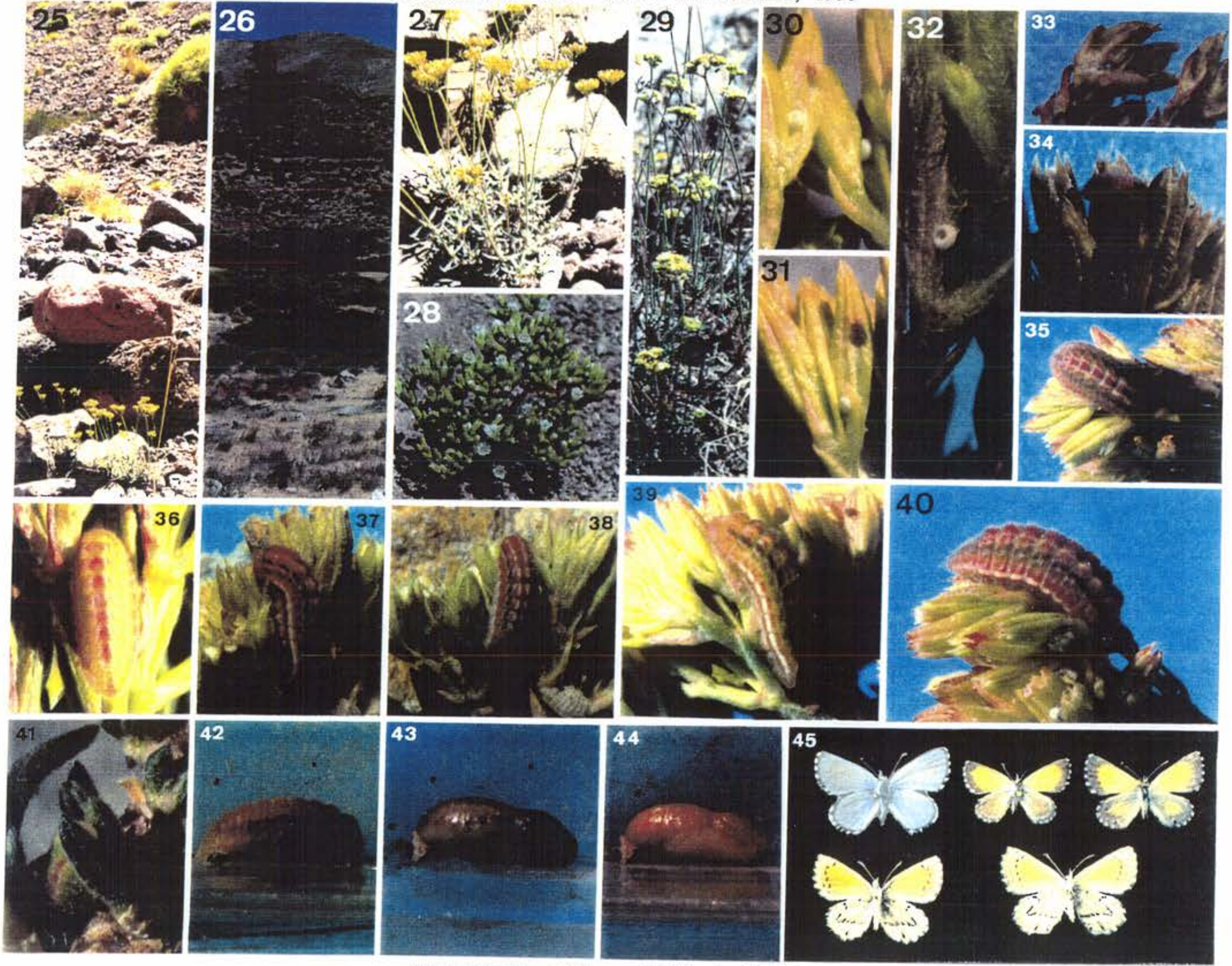
Fig.43. Fresh pupa of fig. 42, 10.12.1994, (-x5).

Fig.44. Same pupa two days before emergence, 17.12.1994, (-x4.6).

Fig.45. Adults, males on left (enlarged by 40%); male upperside - ex larva, Rio la Laguna, 2650 m., Elqui, Coquimbo, 20.12.1994; male underside - 16 km. N.Caren, 1900 m., Illapel, Coquimbo, 25.12.1994; female upperside, center - ex larva, Rio La Laguna, 2650 m., Elqui, Coquimbo, 22.12.1994; female upperside, right, Ex larva, El Chacay, Los Pelambres 1800 m., Illapel, Coquimbo 14.1.1995; female underside - same data as male with underside figured.

PHOTOPLATE IX

Pseudolucia vera Bálint and Johnson, 1993



Pseudolucia collina Philippi, 1860

PHOTOPLATE X

Pseudolucia benyamini Bálint and Johnson, 1995

Pseudolucia lyrnessa Hewitson, 1874

CAPTIONS TO PHOTOPLATE X

Pseudolucia benyamini

Fig. 1. The foodplant, ***Chorizanthe vaginata*** Benth, at the type locality, Pichicuy, sea-level, 25.9.93.

Fig. 2. Same, closeup of plant in fig. 1.

Fig. 3. Male ***P. benyamini***, typical perch, Pichicuy S.L., 13.9.94.

Fig. 4. Female, basking, Pichicuy S.L., 15.9.94.

Fig. 5. Female on foodplant at Concon, 50 m., 24.10.94, (-x1.5).

Fig. 6. Copulating pair, Pichicuy S.L., 25.9.93, (-x2.0).

Fig. 7. Female depositing egg, Pichicuy S.L., 3.10.93, (-x2.5).

Fig. 8. Egg on foodplant, Pichicuy S.L., 25.9.93, (-x12).

Fig. 9. Larvae (figs. 9-13), fig. 9, L2 at Pichicuy S.L., 3.10.93, (-x15).

Fig. 10. L3, Pichicuy S.L., 12.10.93, (-x3.3).

Fig. 11. L4, Pichicuy S.L., 3.10.94, (-x4.3).

Fig. 12. L5, Pichicuy S.L., 24.10.93, (-x3.5).

Fig. 13. L5, Pichicuy S.L., 24.10.94, (-x5).

Fig. 14. Prepupa in silken nest, Pichicuy S.L., 9.11.93, (-x2.8).

Fig. 15. L5 in diapause in silken nest inside foodplant, Pichicuy S.L., 13.3.94, (-x3.5).

Fig. 16. Fresh pupa, Pichicuy S.L., 9.1.93, (-x4).

Fig. 17. Pupa from second generation rearing, Pichicuy S.L., 12.11.93, (-x5).

F.18,21. Female ***P. benyamini*** from second generation rearing, Pichicuy S.L., 12.11.93, (-x4.5).

Fig. 22. Female resting after emergence, Pichicuy S.L., 12.11.93, (-x4.5).

Fig. 23. Emerged parasitic Ichneumonidae (**Campopleginae**) wasp with dead larva, its host, (-x4.5).

Pseudolucia lyrnessa

Fig. 24. A foodplant, ***Montiopsis capitata*** (H. & A.), at San José de Maipo, 800 m., 22.10.94.

Fig. 25. A foodplant, ***Montiopsis gilliesii*** (H. & A.), at Parc Nacional El Morado, 1800 m., 26.11.94.

Fig. 26. Egg on ***M. gilliesii*** Parc Nacional (hereafter, "P.N.") El Morado, 1800 m., 26.11.94, (-x6.5).

Fig. 27. Larvae (figs. 27-32), fig. 27, 2L on ***M. gilliersii***, P.N. El Morado, 1800 m., 2.12.94, (-x4).

Fig. 28. 3L on ***M. gilliersii***, P.N. El Morado, 1800 m., 10.12.94, (-x2.5).

Fig. 29. 4L on ***M. gilliersii***, P.N. El Morado, 1800 m., 30.11.94, (-x3.5).

Fig. 30. 5L on ***M. gilliersii***, San José (hereafter, "S.J.") de Maipo, 800 m., 22.10.94, (-x3.1).

F.31,32. 5L on ***M. gilliersii***, S.J. de Maipo, 800 m., 25.10.94, (-x2.3).

Fig. 33. Pupa with loose silken net, S.J. de Maipo, 800 m., 28.10.94, (-x3.1).

Fig. 34. Pupa on ***M. capitata*** at S.J. de Maipo, 800 m., 28.10.94, (-x3.1).

Fig. 35. Adults, males left, females right (enlarged by 10%): upperside male - ex larva, S.J. de Maipo 800 m., Metropolitan Región, 14.11.1994; underside male - ex larva S.J. de Maipo, 800 m., Metropolitan Región, 13.11.1994; upperside female - ex larva P. N. El Morado, 1850 m., 2.2.1995; underside female - Contitución S.L., Región de Maule, 18.12.1994.

CAPTIONS TO PHOTOPLATE XI

Pseudolucia talia

Fig. 1. Uppermost habitat at Paso del Agua Negra, 4400 m., San Juan, Argentina, 28.1.1995.

Fig. 2. ***Adesmia echinus*** K. Presl., the foodplant above 3650 m., data same as fig. 1, details of foodplant terminus (nearly actual size).

Fig. 3. Male ***P. talia***, well camouflaged, on ***A. echinus***, Paso del Agua Negra, 3650 m., 31.12.1994.

Fig. 4. Eggs on ***A. echinus*** at the type locality, 4350 m., 20.2.1993.

(PHOTOPLATE XI, CAPTIONS, *continued*)

Pseudolucia talia (continued)

F. 5,6. Larvae (figs. 5-12), fig. 5, L3 on ***A. echinus*** and in collection vial, Paso del Agua Negra, 4350 m., 31.1.95, (-x5.5).

F. 7,8. L4 with usual coloration on young growth of ***A. echinus***, data same as for figs. 5 & 6, (-x3.7).

F. 9,10, 11. L4 larva with apparent warning colors on ***A. echinus***; note the black "wasp mark" on the 4th segment; data same as figs. 5 & 6, (-x4.5).

Fig. 12. Fully grown L5 with distinctive colors; note brown marking at honey gland and weakly colored "wasp mark", 19.2.1995, (-x3).

Fig. 13. Diapausing L5/prepupa, 19.2.1995, (-x3.8).

Fig. 14. Pupa, 23.2.1995, (-x4).

Fig. 15. Pupa on ***A. echinus***, 23.2.1995, (-x3.5).

Fig. 16. Parasitic **Ichneumonidae** wasp, genus ***Diadegma***, near dead host larva, 14.4.95, (-x2.5).

Fig. 17. Male ***P. talia***, underside, at Paso del Agua Negra 3650 m., San José, Argentina, 31.12.1994, (actual size).

Fig. 18. Females of ***P. talia*** at Paso del Agua Negra, 3650 m., San Juan, Argentina, 31.12.1994, (reduced 89%/ 11%).

Fig. 19. Male [paratype], upperside, at Paso Agua Negra, 4350 m., 25.12.1993.

Pseudolucia plumbea & Pseudolucia hazeorum

Fig. 20. The biotope of both species at Parque Nacional El Morado, 2000 m., 8.12.1994.

Fig. 21. ***Adesmia gracilis*** Meyen ex Vog. the foodplant of ***P. plumbea*** and ***P. hazeorum***, data same as fig. fig. 1.

Fig. 22. Female basking on ***Haplopappus*** bush, Parque Nacional El Morado, 2000 m., 8.12.1994, (-x0.9).

Fig. 23. Male perching on ***A. gracilis***, data same as in fig. 22, (-x0.5).

Fig. 24. Male perching on ***Haplopappus*** bush, data same as in fig. 22, (-x0.9).

Fig. 25. Egg on calyx of ***A. gracilis*** flower, data same as in fig. 22, (-x12).

Fig. 26. Another view of egg on ***A. gracilis*** calyx, data same as in fig. 25, (-x4).

Fig. 27. Larvae (figs. 27-31), fig. 27, L3 at Parque Nacional El Morado, 2000 m., 10.12.1994, (-x4.5).

Fig. 28. L4, data same as in fig. 22, 17.12.1994, (-x2.5).

Fig. 29. L5, with pronounced "wasp mark" on lower larva; data same as in fig. 22, 18.12.1994, (-x2.5).

F.30,31. L5 of fig. 29, figured separately, (-x2).

Fig. 32. Diapausing L5 larvae, 26.12.1994, (-x4).

Fig. 33. Prepupa in the bottom of plastic vial under leaves and loose silken net, 26.12.1994, (-x2).

Fig. 34. Diapausing L5 larva; with "wasp mark", 23.1.1995, (-x2.4).

Fig. 35. Pupa of fig. 33, 1.1.1995, (-x3.8).

Fig. 36. Adults of ***P. plumbea***, males on left (reduced 9%): male upperside, ex larva P.N. El Morado 2000 m., 1.1.1995; male underside, P.N. El Morado 2100 m., 18.12.1995; female upperside, ex larva P.N. El Morado 2000 m., 1.1.1995; female underside, ex larva P.N. El Morado 2000 m., 8.1.1995.

Fig. 37. Adults of ***P. oligocyanea*** (reduced 20%): paratype males (ex coll. MNHN, Santiago) on left and bottom, all collected in Tumbre, and Antofagasta on Sep.-Oct. 1995 by L.Peña.

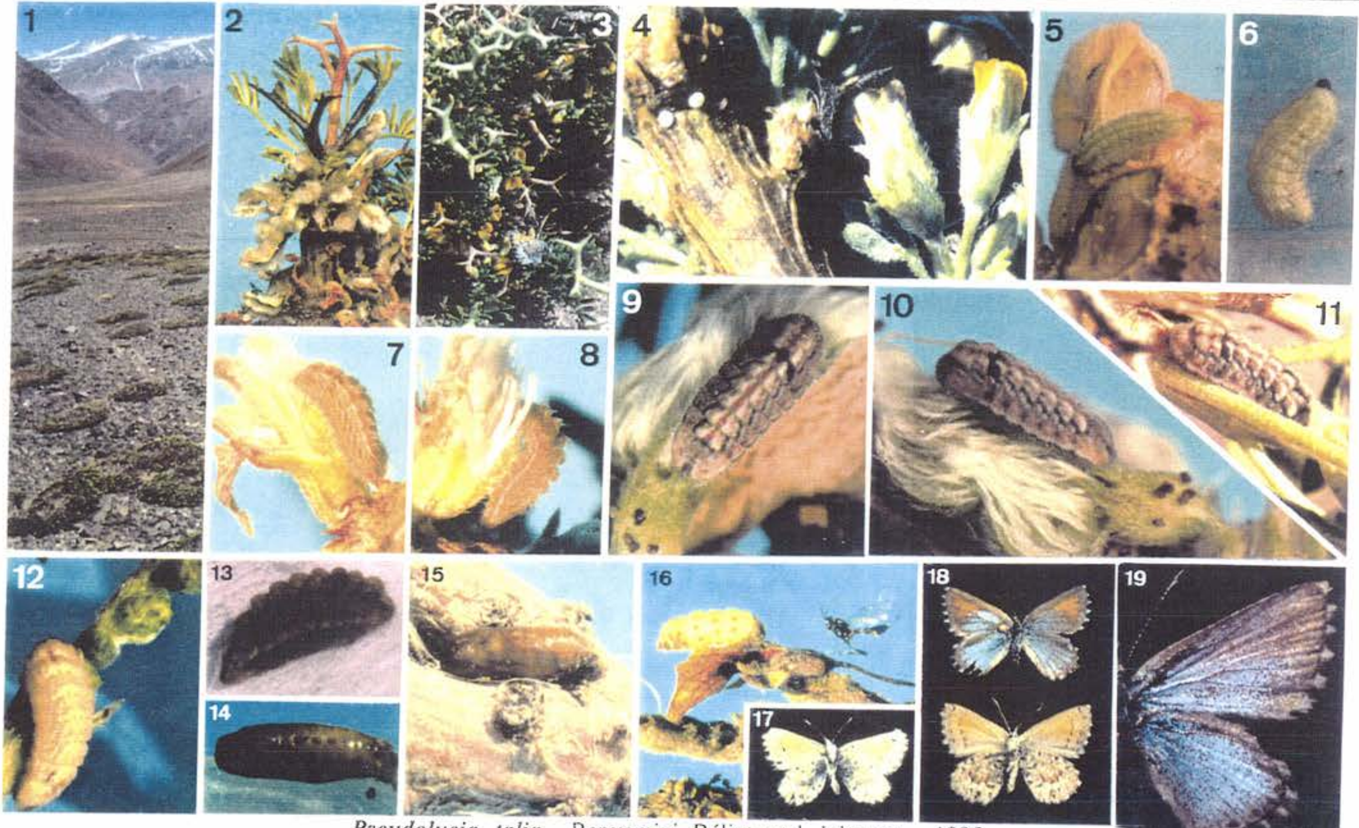
Fig. 38. Adults of ***P. aureliana***: two paratype males at top collected by C. Snyder (AMNH) at 9 km., S. of "Inca del Oro", 1700 m., 4.11.1992; the type locality has since been successfully resampled.

Fig. 39. Adults of ***P. annamaria*** (reduced 19%): females at top, males at bottom; male upperside, Batuco 1850 m., 55 km. S. of Salamanca, Illapel, Coquimbo (IV) Región, 31.10.1993; male underside, and all female views, Cerro la Virgen 2850, 70 km. S. of Salamanca, Coquimbo Reg., 28.11. 1993.

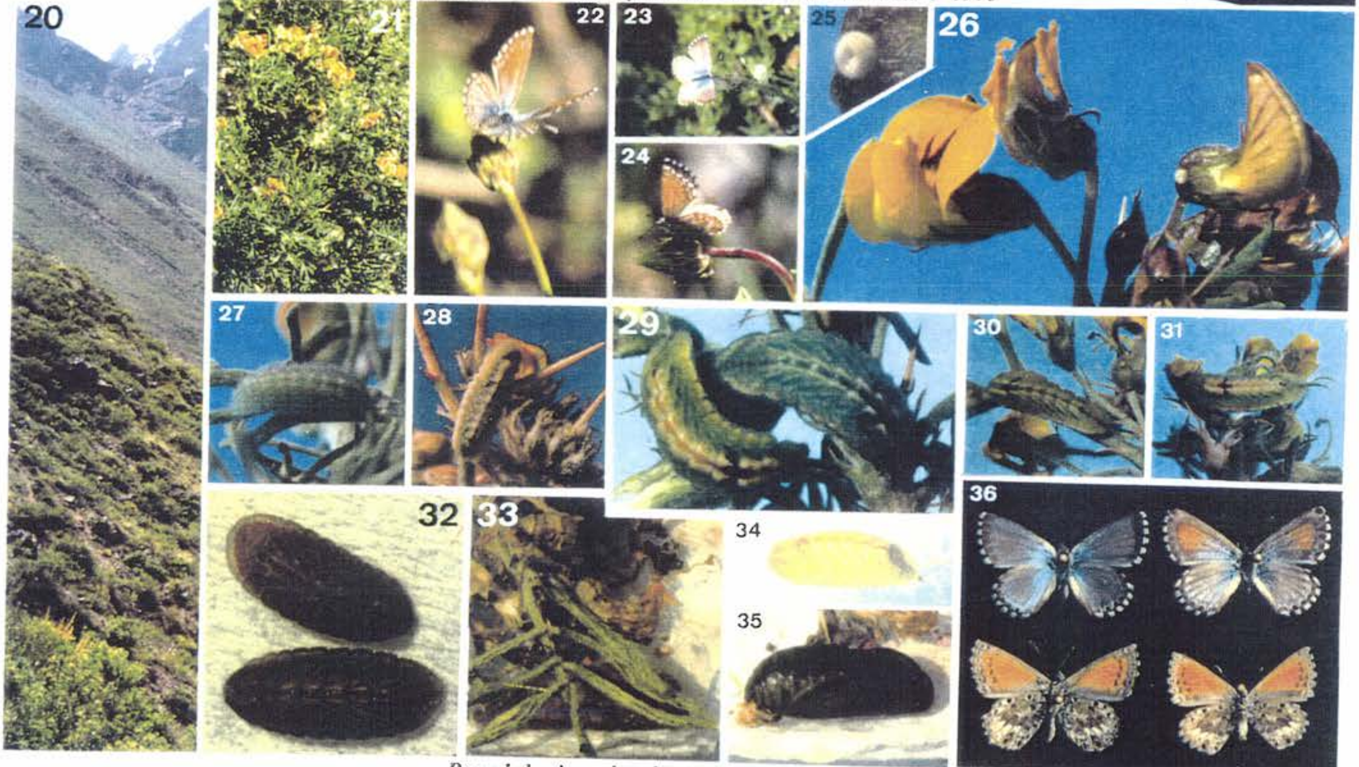
Fig. 40. Adults of ***P. zina*** (enlarged 10%): male at top, Embalse de Yeso, 3300 m., Maipo, Metropolitan Región, 13.11.1993, leg. Peña & Ugarte; female at bottom, same data as male.

Fig. 41. Adults of ***P. hazeorum*** (reduced 18%): males at left; male, upperside and underside, ex larva P.N. El Morado, 2000 m., 10.1.1995; female, upperside and underside, La Disputada, 1400 m., Cord. Santiago, 8.12.1994.

PHOTOPLATE XI



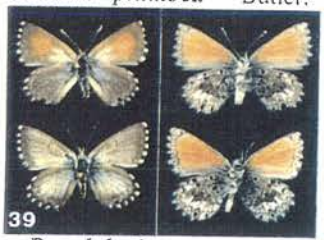
Pseudolucia talia Benyamini, Bálint and Johnson, 1995



Pseudolucia plumbea Butler, 1881

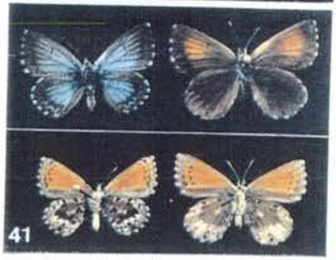
Pseudolucia oligocyanea Ureta, 1956

P. aureliana Bálint & Johnson 1993



Pseudolucia annamaria Bálint and Johnson, 1993

P. zina Benyamini, Bálint & Johnson 1995

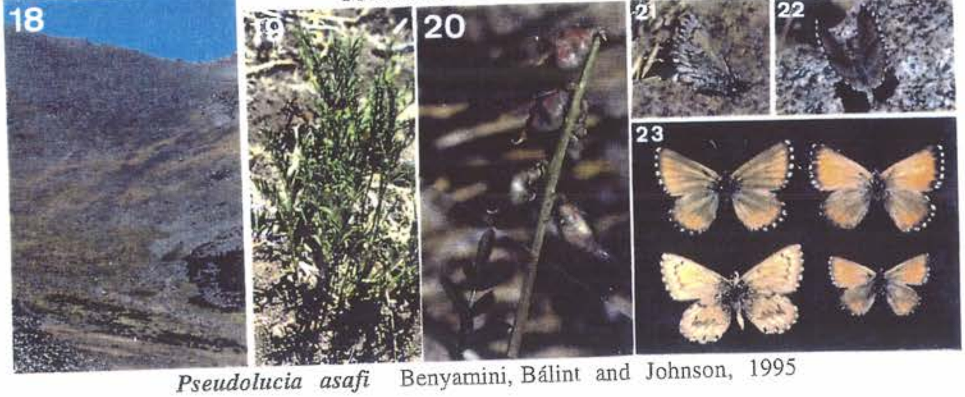


Pseudolucia hazeorum Bálint and Johnson, 1993

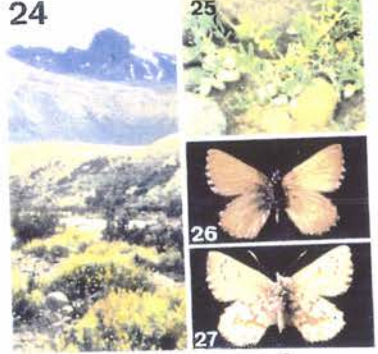
PHOTOPLATE XII

Pseudolucia andina Bartlett - Calvert , 1894

Pseudolucia avishai Benyamini, Bálint and Johnson , 1995



Pseudolucia asafi Benyamini, Bálint and Johnson, 1995



Pseudolucia magallana
Benyamini, Bálint & Johnson 1995

CAPTIONS TO PHOTOPLATE XII

Pseudolucia andina

Fig. 1*. The biotope at Portillo, 3050 m., Valparaíso (V) Región, 22.12.1993.

Fig. 1. A foodplant, ***Astragalus cruckshanksii***, at Portillo, 3050 m., 22.12.1993.

Fig. 2. Egg on calyx of ***Astragalus arnotianus***, another foodplant at Portillo, 3200 m., 3.1.1993, (-x10).

Fig. 3. Larvae (figs. 3-6), fig. 3, L2 feeding on leaf of ***A. arnotianus***; note distension near head capsule, which appears as if "black within a transparent window"; Portillo, 3200 m., 2.12.1993.

Fig. 4. L4 on leaf of ***A. arnotianus*** near pods of foodplant, Portillo 3200 m., 21.2.1993.

Fig. 5. L3, L4 & L5 under stone near ***A. cruckshanksii***, below El Morado glacier, 2550 m., Metropolitan Región, 7.3.1993.

Fig. 6. Fully grown, diapausing, larvae under stone near ***Astragalus looseri***, La Parva (the type locality), 2900 m., Metropolitan Región, 13.3.1994.

Fig. 7. Pupa inside dry pod of *A. arnotianus*, Portillo 3200 m., 7.2.1993.

Fig. 8. Parasitic ichneumonid wasp, **Campopleginae**, near its host larva, Portillo, 3050 m., 3.4.1994.

Fig. 9. Pod of ***A. arnotianus*** showing penetrated larval hole and protective silken web, Portillo, 3200 m.

Fig. 10. Adults of ***P. andina*** (reduced 9%): uppersides, male at top, female at bottom; male, ex larva El Morado glacier, 2550 m., 1.6.1993 (laboratory hatched), female ex larva El Morado glacier, 2550 m., 1.5.1993 (laboratory hatched).

Fig. 11. An early season male, sitting on ground near ***A. arnotianus*** waiting for hatchings of females at Portillo, 3200 m., 28.11.1993; this behavior can be used to locate foodplants.

Pseudolucia avishai

Fig. 12. Egg on the leaf of *Astragalus looseri* Johnst., foodplant at Los Pelambres Velley 2550 m., Illapel, Coquimbo (IV) Región, 22.2.1994, (-x8).

Fig. 13. Larvae (figs. 13-16), fig. 13, L4 on ***A. looseri***, data same as in fig. 12, (-x6).

Fig. 14. Diapausing L5 larva and pupae under stone near ***A. losseri*** & ***A. cruckshanksii*** (H.& A.) Griseb., Los Pelambres Valley, 2950 m., 30.10.1993, (-x3).

Fig. 15. ***Camponotus ovaticeps*** Spinola palpating an L5; note larva's honey gland under ant's thorax; Los Pelambre Valley, 2550 m., 2.4.1994, (-x2.5).

Fig. 16. ***Dorymenex tener*** Mayr palpating an L5, same data as in fig. 15, (-x3).

Fig. 17. Adults of ***P. avishai*** (reduced 7%): uppersides, male at top, female at bottom; male ex diapausing pupa, Los Pelambres, 2950 m., 9.11.1993 (laboratory hatched); female, ex larva, Los Pelambres, 3000 m., 27.3.1994 (laboratory hatched).

Pseudolucia asafi

Fig. 18. The biotope at 20 km. NW Caren, Illapel, Coquimbo (IV) Región. Patches of foodplant, ***Astragalus looseri*** Johnst. are visible as green stripes along center and bottom of photograph, 2800-2900 m., 7.1.1995.

F.19,20. ***Astragalus looseri***, closeup at biotope of fig. 18 (fig. 19, -x10; fig. 20 actual size).

F.21,22. Perching males of ***P. asafi*** on stones and bare ground near the foodplants; data same as in fig. 18 (near actual size).

Fig. 23. Adults of ***P. asafi*** (reduced 20%): males at left, females at right, collected on 7.1.1995 at the type locality, 2500 to 2950 m.

Pseudolucia magallana

Fig. 24. Biotope at type locality, Rio Baguales, 500 m., La Ultima Esperanza, Magallanes XII Región, 2.12.1994.

Fig. 25. The foodplant, *Astragalus patagonicus* (Phil.) Spegazzini, at the type locality, (-x0.16), compared to Chilean peso coin 25 mm. in diameter.

F.26,27. Allotype of ***P. magallana*** (reduced 10%): upper and undersides, data as in fig. 24.

***credits for Photoplate XII*:**
Figs. 1-23,26,27: photographed by D. Benyamini.
Figs. 24 & 25: photographed by Dr. A. M. Shapiro.

CAPTIONS TO PHOTOPLATE XIII

Pseudolucia chilensis

Fig. 1. The biotope along coastal dunes near Constitución; a ring of ***Cuscuta recemosa*** **Mart.** foodplant can be seen at bottom, growing on the weedy species ***Ambrosia chamisson*** (Less.) Greene.
Fig. 2. The biotope at Parc Nacional El Morado, 2000 m., ***Cuscuta micrantha*** Choisy is growing maily on ***Adesmia gracilis***.
Fig. 3. One of the most southern biotopes on the pacific coast; at Laraquet base. Here, ***P. chilensis*** also uses ***A. chamissomis*** as its host. Note the Lupine (***Lupinus arboreus***) in the foreground.
Fig. 4. Close-up of ***C. racemosa*** taken from fig. 1.
Fig. 5. A perching ***P. chilensis*** male at Parc Nacional El Morado Ca., 2000 m.
Fig. 6. Female ***P. chilensis*** basking on ***A. chamissonis*** at the biotope of fig. 1, 2.2.95, (actual size).
Fig. 7. Egg layed on the stem of *Senecio glaber* Less. close to *C. micrantha*, Parc Nacional El Morado, 2000 m., 20.3.95, (-x5).
Fig. 8. Egg layed on the stem of *A. chamissonis* near *C. racemosa* at the biotope of fig. 1, 2.2.95, (-x8).
Fig. 9. First instar larva form Constitución 8.2.1995, (-x5).
Fig. 10. L3 on *C. racemosa*, 16.3.95, (-x3.8).
F.11,12. L4 on *C. racemosa*, 16.3.95, note the well marked honey gland, 12.3.95, (-x2.8 & -x2.2, respectively).
Fig. 13. L5 on *C. racemosa* at Constitución, the first larva of *P. chilensis* located during the study, 12.3.95, (-x2.5).
Fig. 14. Fully grown L5 larva on *C. racemosa* 12.3.95, (-x1.5).
Fig. 15. Prepupa, 20.3.95, (-x2.5).
Fig. 16. Pupa, lateral view, 18.3.95, (-x2.2).
Fig. 17. Pupa, 24 hours before emergence, 20.3.95, (-2.4).
Fig. 18. Pupa inside the leag of ***Haplopappus*** with *C. micrantha* Parc Nacional El Morado, 2000 m., 20.3.95, (-x2.8).
Fig. 19. Diapausing larva inside leaf of *Haplopappus*, Parc Nacional El Morado, 2000 m., 14.4.95, (-x3.8).
Fig. 20. Tachinid fly just emerged nearby empty pupa, 3.6.95, (actual size).
Fig. 21. Adults of ***P. chilensis***, males at left (actual size); male upperside - Pichicuy S.L. Valparaíso (C) Reg., 3.10.93; male underside - Santiago, Metropolitan Reg., 1200 m., 27.3.94; female upperside cta. Totoralillo 60 km. N. La Serena, Coquimbo (IV) Región, 16.8.94.
Fig. 22. ***Pseudolucia parana*** **Bálint 1993** (***Lycaena griqua*** Schaus), Brazil, male underside (actual size).

Pseudolucia lanin

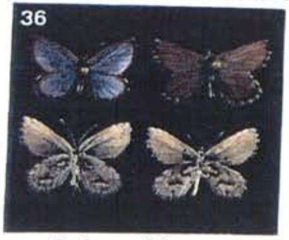
Fig. 23. The foodplant *Adesmia retusa* Griseb., Vn. Antillanca, 1300 m., Osorno (X) Región de los Lagos, 15.2.95.
Fig. 24. Close-up of the foodplant flowers in the biotope of fig. 26, 15.2.95, (about actual size).
Fig. 25. Empty egg on lower surface of a foodplant leaf, 19.2.95, (-x9).
Fig. 26. L3 larva on ***A. retusa***, 23.2.95, (-x3.9).
Fig. 27. L4 larva on the foodplant fruit, 23.2.95. (-x3.3).
Fig. 28. L4 larva with exceptional red markings, 1.3.95, (-x3.6).
F.29,30. Typical L5 larva, very similar to those of ***P. plumbea*** in photoplate IV fig. 29 (R.H.) & fig. 30, 23.2.95, (-x2.5 & -x4.7 respectively).
Fig. 31. Fully grown L5 larva on the foodplant fruit, 20.2.95, (-x4.2).
Fig. 32. Diapausing L5 larva, 12.3.95 (-x3.2).

PHOTOPLATE XIII

Pseudolucia chilensis Blanchard, 1852

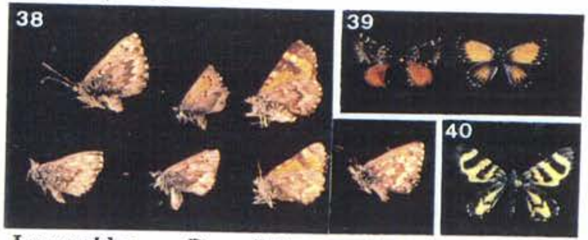
Pseudolucia lanin Bálint and Johnson, 1993

Madeleinea lea
Benyamini, Bálint
& Johnson, 1995



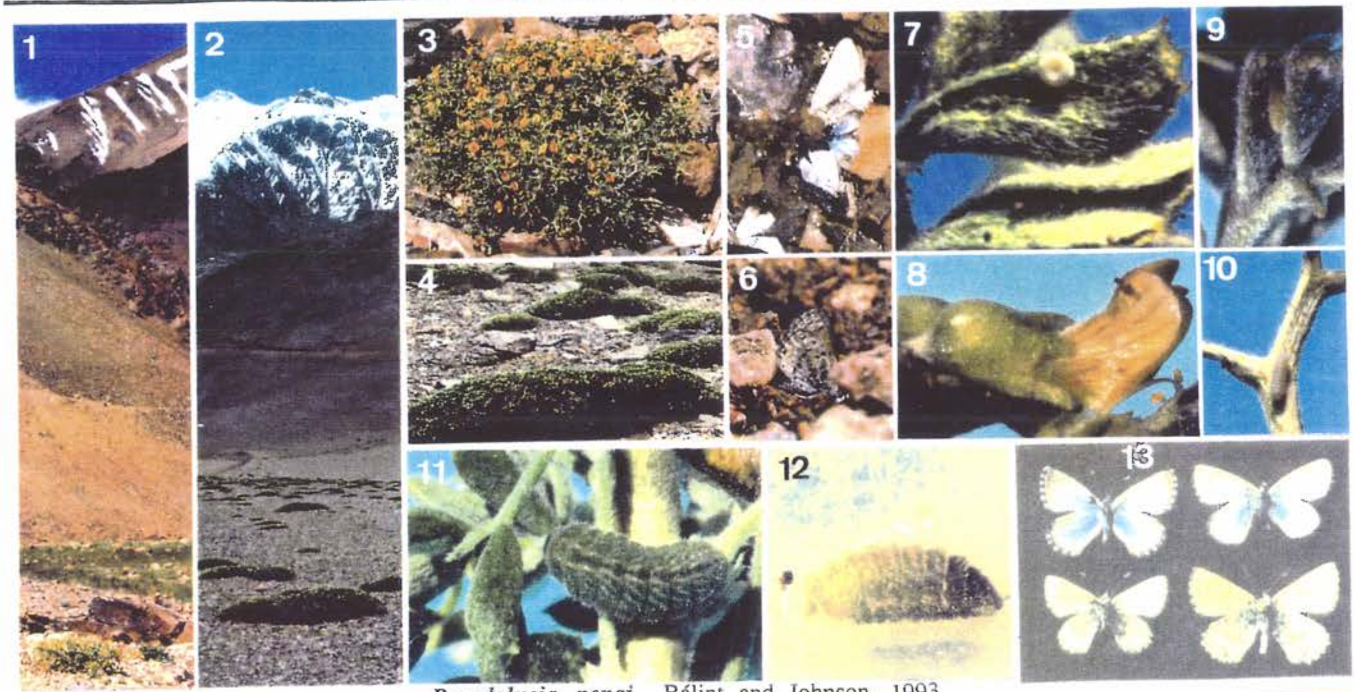
Itylos titicaca
Weymer, 1890

M. moza
Staudinger, 1894

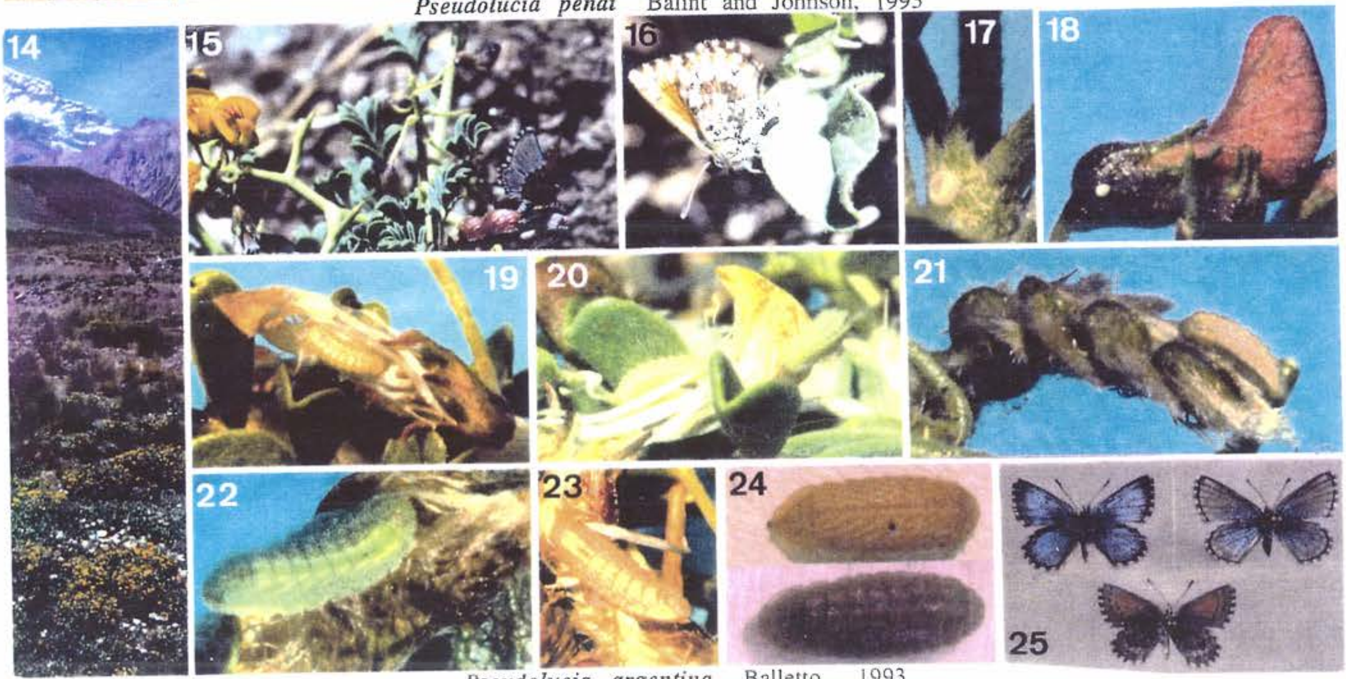


Lycaenidae - Day flying moths mimicry ring

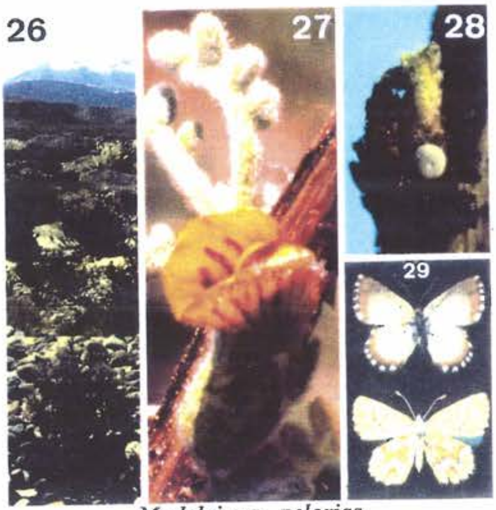
PHOTOPLATE XIV



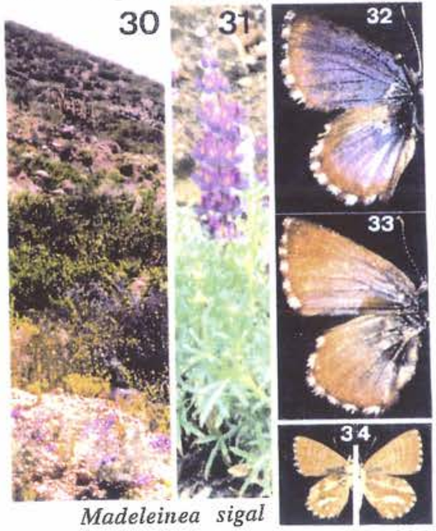
Pseudolucia penai Bálint and Johnson, 1993



Pseudolucia argentina Balletto , 1993



Madeleinea pelorias
Weymer , 1890



Madeleinea sigal
Benyamini, Bálint and Johnson , 1995

Paralycaeides vapa
Staudinger , 1894

(PHOTOPLATE XIII, CAPTIONS, *continued*)

Adults of Various Polyommatine Species

Fig. 33. Adult of ***Pseudolucia lanin***, female paratype (AMNH), upperside, showing confusing blue-gray hue compared to male, from Parc Nacional Lanin, Argentina (near actual size).

Fig. 34. Adult of ***Pseudolucia charlotte***, female, upperside, showing the typical orange patches at center of forewings and blue-gray hue, Puyehue Pass, 1300 m., 28.12.1992, collected by Peña and Ugarte (near actual size).

Fig. 35. Adults of ***Madeleinea lea***, male upperside, left, L. H. Pongo, Cochabamba, Bolivia, 4800 m., 13.2.1994, (-x2); female, upperside at top (-x0.8), underside at bottom, (-x0.9), Tiwanaka, 4000 m., 9.2.1994, L.Paz, Bolivia.

Fig. 36. Adults of ***Itylos titicaca***, upper surface above, males left, females right, Turco, Oruro, Bolivia, 3600 m. (actual size).

Fig. 37. Adults of ***Madeleina moza***, male, upper & underside, Uspallat, Mendoza Prov., Argentina, 1900 m., 26.12.1993, (reduced 17%).

Apparent Warning Color Mimicry Guild of Polyommatini, Day Flying Moths, and Various Eumaeini.

(illustrations re: Table 9 and Figure G of Benyamini 1995, UWSP *Report* No. 52)

Fig. 38. Figs. 38-40, fig. 38, comparative undersides exhibit yellow-brown coloration and the "V-shape" or "sawtooth" ventral hindwing pattern; all collected on the same slope over Baños Morales, Rio Volcan, Maipo, Metropolitan Región on 22.11.1992 between 1750 and 1950. Left to right, females along top, males along bottom: *Pseudolucia andina*; *Pseudolucia lyrnessa*; **Fidoniidae** genus *Heterosia*; outset, bottom right, ***Pseudolucia plumbea*** male (all reduced 29%).

Fig. 39. Uppersides of **Fidomiidae**, genus ***Fidonia*** (left) and female of ***Pseudolucia collina*** (right) collected on Hwy. 5, km. 423, opposite Tongoy, Coquimbo (IV) Región, 100 m., 13.8.1994 (reduced 7%).

Fig. 40. Day flying moth from Rio La Laguna, Elqui, (**Fidomiidae**, genus *Heterosia*), showing V-shape on upper hindwing and strong black and yellow warning colors (reduced 27%). Various Eumaeini are included in Fig. G herein and in Benyamini and Johnson (1995).

CAPTIONS TO PHOTOPLATE XIV

Pseudolucia penai

Fig. 1. The biotope at Rio la Laguna, 3200 m., 3.12.1994, with ***Adesmia aegiceras*** Phil., the foodplant there at lower elevations.

Fig. 2. The upper biotope at Paso del Agua Negra, close to the Argentine border, with the spiny cushion-like ***Adesmia echinus*** K. Presl., 4500 m., 19.1.1995.

Fig. 3. ***Adesmia aegiceras*** at 3200 m., 3.12.1994.

Fig. 4. ***Adesmia echinus*** at 4200 m., 19.1.1995.

Fig. 5. ***Pseudolucia penai*** and some moths found drowned in a small pool after strong winds; data as for fig. 1.

Fig. 6. Male ***P. penai*** mudpuddling in the biotope of fig. 1, 3.12.1994.

Fig. 7. Egg on leaf of *A. aegiceras*, 3200 m., 3.12.1994, (-x10).

Fig. 8. L1 larva feeding on an *A. **echinus*** flower, 4500 m., 22.1.1995, (-x4.1).

F. 9,10. L2 larvae on trunk of *A. aegiceras* 10.12 & 17.12.1994, (-x4 & -x2.2 respectively).

Fig. 11. L5 larva fully grown, Rio la Laguna, 3200 m., 22.1.1995, (-x3).

Fig. 12. Diapausing L5 larva on the bottom of rearing vial, 23.1.1995, (-x4.8).

Fig. 13. Adults of ***P. penai***, males on the left (actual size); male upperside— Rio la Laguna 3200, 12.11.1994; male underside— Rio la Laguna, 4500, 21.1.1995; female upperside— Rio la Laguna 3300 m., 3.12. 1994; female underside— Rio la Laguna, 4500 m., 21.1.1995.

(PHOTOPLATE XIV, CAPTIONS, *continued*)

Pseudolucia argentina

Fig. 14. The biotope at the type locality, Los Horcones, 2750 m., Parc Providencial Aconcagua, Mendoza, Argentina, 1.1.1995

Fig. 15. The foodplant, ***Adesmia aeqiceras***, with an perching adult ***P. argentina*** (probably a female), data same as fig. 14.

Fig. 16. Adult ***P. argentina*** male, perching on edge of ***Convolvulus*** leaf, data same as fig. 14.

Fig. 17. Egg on stem of ***Adesmia aeqiceras***, Los Horcones, 2.1.1995.

Fig. 18. Egg on calyx of flower bud, Los Horcones, 1.1.1995.

Fig. 19. Larvae (figs. 19-24), fig. 19, L2 on flower, Los Horcones, 16.1.1995, (-x3.8).

Fig. 20. L2 & L3, respectively, on flower and leaf, Los Horcones, 16.1.1995, (-x3.8).

Fig. 21. L4 feeding on foodplant, Los Horcones, 22.1.1995, (-x3.3).

Fig. 22. L5 feeding on foodplant, Los Horcones, 22.1.1995, (-x4.3).

Fig. 23. L5 feeding on foodplant, Los Horcones, 29.1.1195, (-x2.8).

Fig. 24. Dispausing L5 on paper bottom of plastic vial 19.2.1995, (-x4.5).

Fig. 25. Adults of ***P. argentina*** (enlarged 5%): upper left, male upperside, Los Horcones, 2750 m., 1.1.1995; upper right, female upperside, Los Horcones, 2750 m., 1.1.1995; bottom center, male underside, Los Horcones, 2750 m., 1.1.1995

Madeleinea pelorias

Fig. 26. The biotope at 10 km., west of Zaphahuira, 3000 m., 5.2.1994, Tarapacá (I) Regiόn with "Nevados de Putre" in the background.

Fig. 27. The foodplant, ***Adesmia melanthes*** Phil., at the locality of fig. 26, 5.2.1994.

Fig. 28. Egg on ***A. melanthes*** stem, same locality, 2.5.1995.

Fig. 29. Adults of ***M. pelorias*** (reduced 7%): top, male upperside, Putre, Tarapacá (I) Regiόn, 3500 m., 4.11.1994; bottom, male underside, 10 km. west of Zapahuira, 3000 m., 3.2.1994

Madeleinea sigal

Fig. 30. The type locality at Putre 3400 m., Tarapacá (I) Regiόn, 5.2.1994.

Fig. 31. Probable foodplant, a ***Lupinus*** sp., at the type locality, 5.2.1994.

Fig. 32. Adult of ***M. sigal*** (enlarged 89%): male upperside, Putre 3400 m., 16.4.1995.

Fig. 33. Adult of ***M. sigal*** (enlarged 89%): female upperside, same data as in fig. 32.

Fig. 34. Underside half-sides of adults (reduced 23%): left, male, data as in fig. 32; right, female, Huaras de Jurasi, (above Putre), 4000 m., 4.11.1994.

Paralycaeides vapa

Fig. 35. Suspected foodplant ***Astragalus garbancillo*** photograped in mid-February, ***P. vapa*** being very abundant around this plant between La Paz and Copacabana, Bolivia, on the Peruvian border (Batallas, Tiquina).

Fig. 36. Freshly emerged adult females of ***P. vapa*** (difficult to see) on 60-70 cm. tall ***Astragalus*** with white-violet flowers, also identified as belonging to the ***A. garbancillo*** group, near Copacabana, Bolivia, 10.2.94.

Fig. 37. Adult ***P. vapa*** perching on ***Astragalus garbancillo***, locality as in fig. 35.

Fig. 38. Adults of ***P. vapa*** (reduced 15%): upper left, male upperside; upper right, female upperside; bottom center, male underside; all from locality of fig. 35, 10.2.94.

(LIST 1, *continued...*)

[*P. hazeorum*, **continued (from page 8)**] It occurs from October, in the warmer central and northern areas of its distribution, to as late as December-January in its southernmost ranges. It has one annual brood (altitudinal range 1000 - 2500 m.) and offers evidence of at least a partial second brood (a freshly emerged female was collected near La Disputada, at 1400 m., east of Santiago, Metropolitan Region, 6.11.93). *Adesmia confusa* Ulib., a yellow flowering species ranging up to 80 cm. tall appears to be the most common foodplant. This species was found growing in upland habitats at Parque Nacional El Morado, from mid-November 1994 (at 1850 m.) to mid-December 1994 (at 2200 m.), and surrounded by many *P. hazeorum* adults on 22.11.92 (at 2000 m.). At slightly lower altitudes, another *Adesmia* species, *A. gracilis* Meyen ex Vog. (photoplate XI: 20,21) was also apparently being utilized, occasionally at locations as close as 30 m. from stands of *A. confusa*. On 8.12.94, while working in the El Morado biotope, female *P. hazeorum* were observed on and around this plant. Similarly, at La Disputada, 1400 m., females were also seen patrolling about the local *Montiopsis* species, *M. capitata* (Hook. & Arn.) Ford and *M. trifidia* (Hook. & Arn.) Ford, Portulacaceae, that may be its second choice foodplants. Such alternative usage would be consistent that what has been observed in other *Pseudolucia* species noted above.

Life History. Observations on this species derive from field observations of several periods of the life cycle and the emergence of adults from field collected L5 larvae and resultant pupae. The eggs are usually laid on the calyx and pedicels of the flower buds (photoplate XI: 25,26). Emergent 1L larva are white or greenish-white with long white "hairs". Immediately after emergence the larvae enter the flower bud to feed; thereafter, all larval instars feed on the flower buds and flowers. On 18.12.94 a fully grown L5 larva (10 mm. long) was observed on the foodplant. It was completely green, covered with tiny white spots, showing a dark-green middorsal stripe, oblique dark green subdorsal dashes, a white lateral line edged ventrally with a thin brown margin and dorsally with yellowish-green. Short "hairs" occurred around the prolegs and along the white lateral line; the head capsule was shiny black and the true legs were green. A distinctive dark green "wasp mark" occurred on the first abdominal segment; the DNO was clearly marked on the seventh segment. This larva was collected and, fortunately, reared to adulthood in the laboratory. On 21.12.94, it descended to the bottom of the rearing vial, shrunk to about 8 mm., became reddish-brown with short yellowish dashes on its flanks and a yellowish lateral line. The "wasp mark" remained clear as late as 27.12.94, appearing red-brown with a greenish tint. On 31.12.94 this larva pupated; the pupa was about 8 mm. long, completely brown and without an apparent girdle. A male adult emerged on 10.1.95 (photoplate XI: 41).

Myrmecophily. The common ant species, *Dorymyrmex tener* Mayr, were widespread on the foodplant and are thus suspected as the attending ant species of the facultative larvae.

10. ***Pseudolucia clarea*** **Bálint & Johnson, 1993** (Photoplate III, figs. 8,9).

Habitat. A local species that was described from the vicinity of Alcohuaz, a small montain village located 38 km. south of Rivadavia and 52 km. by road southeast of Vicuña, Elqui, in the Coquimbo Región. The locality is situated between the Mediterranean Coquimbian semi-desert and the lower Andean Alpine & Puna vegetational belts (Fig. B) on the southeastern slopes of Cerro de la Viga (3584 m.). There appears to be one annual brood, in October and November (the earliest specimen being unrecorded hitherto, a specimen from the L. Peña collection from Hda. Illapel, 2000 - 2300 m. 22.10.58). The author collected *P. clarea* together with *P. annamaria* southwest of Batuco, 44 km. southeast of Salamanca, 11.9.93 and 24.9.95 at 1800-2100 m. This locality is situated on the southern border of the Coquimbo Region at the northern limit of the Valparaíso Región some 200 km. directly south of the type locality. Thus, even though local, the species has an extensive regional distribution.

Life History. On 28.11.93, at 2850 m. on the eastern slopes of Cerro la Virgen, 70 km. southeast of Salamanca, *P. clarea* was observed again with *P. annamaria* flying among *Adesmia*, aff. *glutinosa* Hook. & Arn., a bush growing some 60-80 cm. tall. These bushes were restricted to a narrow vegetational belt about 200 m. below the mountain peak and are thus suspected as the larval foodplant of the species at least at this locality.

11. ***Pseudolucia plumbea*** **(Butler, 1881)** (Photoplate XI, figs. 20-36 & Photoplate XVIII).

Habitat. Clarification of the habitat of this species should be noted in the historical context that old data for this taxon included at least five other *Pseudolucia* species: *P. annamaria*, *P.clarea*, *P. hazeorum*, *P: nympha* and *P. grata* (Bálint and Johnson 1993; Benyamini, Bálint and Johnson 1995). Similarly, in collections viewed by this author since his arrival in Chile, a common "mix" included *P. plumbea* with *P. hazeorum*. The recent work on "*plumbea*-like" taxa has enlighted this problem considerably. Yet, even within true *P. plumbea*, populations are quite various (in both biotope and facies) over a 1000 km. distribution and it is possible that other sibling species are still unaccounted. During studies by the author, *P. plumbea* has been collected, or documented in regional collections, from the following regions: Coquimbo Región (Baños del Toro, 24.11.46; Teatines, 08.01.49; Hda. Illapel, 22.10. 58; Cuesta Espino, 23.10.42); Aconcagua/Valparaíso Region (Valle Piuguenes, 24.25.58; Peñuelas, 14.12. 47); Santiago Metropolitan Región (El Manzano, 28.10.51; Purgatorio Cordillera, 23.12.50; Carretones, 30.11.50, 31.12.50; Lagunillas, 11. 11.5O); Región de Maule (Las Cruces, Cordillera Parral, 10.1958); Bio-Bio Región (Las Cabras, Cordillera Chillán, the recorded type locality, 02.02, 12.12.1901, 10/23.12.54); Región de la Araucania, the southernmost record (Vn. Llaima, Temuco, 12.12.1950; Rio Blanco, 26.12.46). At Parque Nacional El Morado, two other lycaenid species were documented as sympatric and synchronic with *P. plumbea* on bushes of *Adesmia gracilis* Meyen ex Vog.: *Pseudolucia hazeorum* and *Eiseliana bicolor* (Philippi).

Adult Behavior. Collections at Parque Nacional El Morado, Rio El Volcan, some 70 km. southeast of Santiago, Metropolitan Región (photoplate XI: 20) were the source of most material used in rearing. At this locality, males displayed marked territorial behavior, perching on the larval foodplant *A. gracilis* Meyen ex Vog. (photoplate XI: 20,21,23) or adjacent *Haplopappus* bushes (photoplate XI: 24) and darting out to intercept fellow congeners or, on one occasion (at 2000 m.), successfully chasing away a *Yramea* species (Nymphalidae). Females were observed on the same plants (photoplate XI: 22) and also nectaring on the orange flowers of the prostrate *Quinchamalion chilense* Mol. and *Phacelia shrubs*. Mating behavior was seen on one occasion. **[continued, page 12]**

CAPTIONS FOR FIGURES A-C CITED IN LIST 1

(and keys, below, to additional biotope and species photographs within the volume)

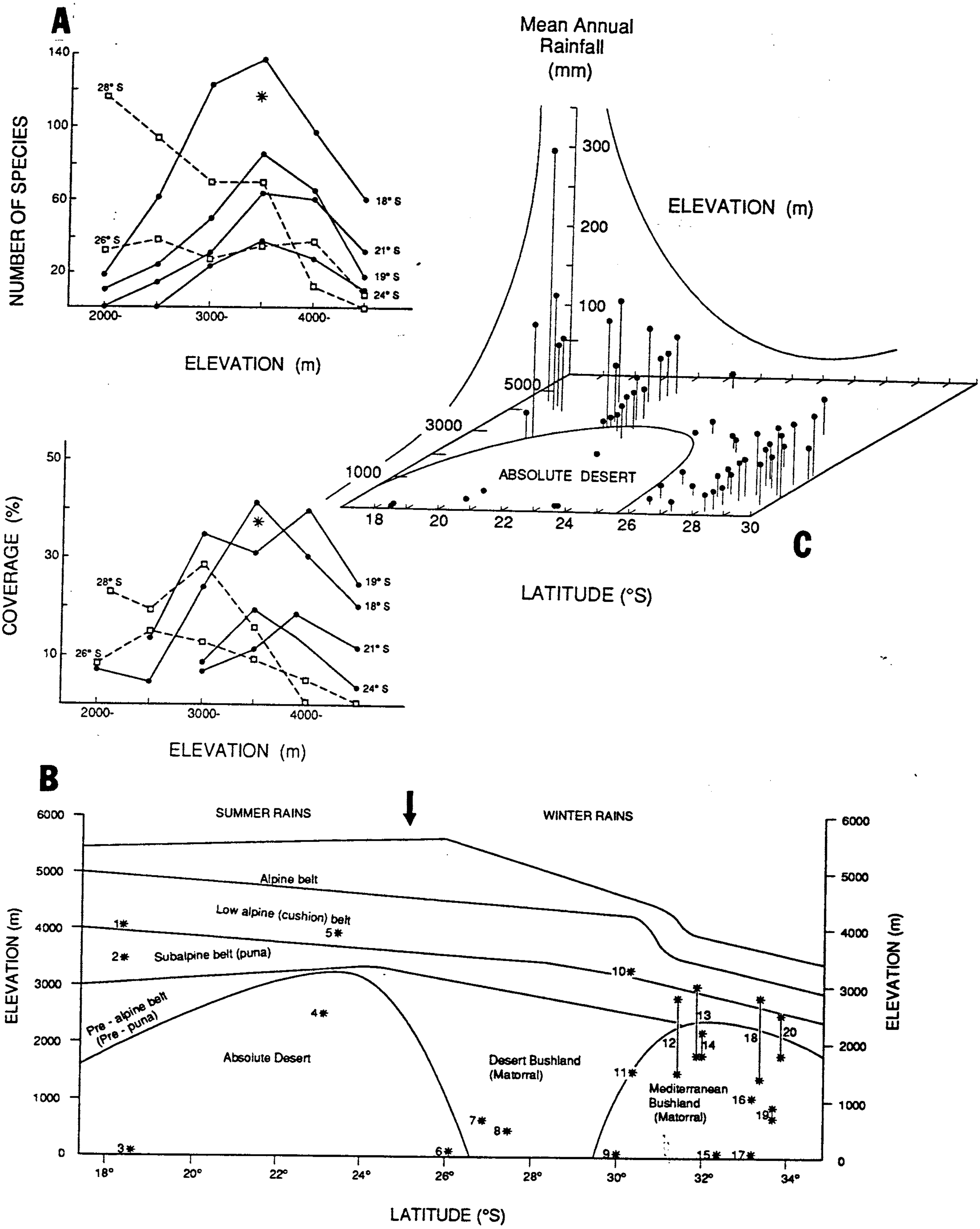
Figure A. Variation in number of species (above) and percentage of plant cover (below) at different elevations in the northern Chilean Andes (modified from Arroyo *et al.* 1988); * marks the biotope locations of *Nabokovia faga*, *Madeleinea sigal* and *M. pelorias* from LIST 1.

Figure B. Vegetation belts of the western slopes of the Andes in central and northern Chile (modified from Villagran *et al.*, 1983) drawn in a schematic against elevation and latitude. Locations of biotopes of various species treated in LIST 1 are keyed below, **1-20**.

1 . Parinacota / Chungara - *I. Titicaca*
2 . Putre - *N. faga, M. pelorias, M. sigal*
3 . Arica - *L. trigemmatus, H. ramon*
4 . San Pedro de Atacama - *L. trigemmatus*
5 . Tumbre - *P. oligocyanea*
6 . P.N. Pan de Azucar - *P. "collina", P. chilensis*
7 . Inca de Oro - *P. aureliana*
8 . Copiapo - *L. trigemmatus, P. chilensis*
9 . La Serena - *N. ada, P. collina, P. chilensis, L. trigemmatus*
10 . Rio la Laguna - *P. sibylla, P. penai, P. collina*
11 . Alcohuaz, Elqui - *P. collina, P. plumbea, P. hazeorum, P. clarea*
P. annamaria, L. trigemmatus, P. scintilla (Guampula)
12 . Caren, "Hda. Illapel" - *P. collina, P. asafi, P. scintilla, P. chilensis*
13 . Los Pelambres, "Hda. Illapel" - *P. avishai, P. collina*
14 . Batuco, "Hda. Illapel" - *P. annamaria, P. collina, P. chilensis, P. clarea, P. plumbea*
15 . Pichicuy - *P. benyamini, P. chilensis*
16 . Cuesta la Dormida - *P. charlotte, P. chilensis*
17 . Valparaiso / Con Con - *P. benyamini, P. chilensis, L. trigemmatus*
18 . Cord. Santiago (La Disputada, Purgatorio, La Parva) - *P. andina, P. plumbea,*
P. hazeorum
19 . San Jose de Maipo / Santiago - *P. lyrnessa, P. chilensis, L. trigemmatus*
20 . Parque Nacional El Morado / Embalse de Yeso - *P. lyrnessa, P. plumbea, P. andina*
P. nympha, P. chilensis

Figure C. Mean annual rainfall versus elevation and latitude in the northern Chilean Andes (modified from Arroyo *et al.* 1988). Three dimensions of this schematic should allow meaningful comparisons to the schematic of Fig. B (for relative spatial locations, see "Absolute Desert" parabola of both schematics, etc.).

Note: Additional (BxW) photographs of the biotopes of *Leptotes trigemmatus* (List 1.5), *Pseudolucia benyamini* (List 1.7), *P. collina* (List 1.6), *P. lyrnessa* (List 1.8), *P. chilensis* (List 1.16), *P. avishai* (List 1.20), *P. oligocyanea* (1.26), *P. annamaria* (1.13), *P. clarea* (1.10), and *P. scintilla* (1.14) are included in Photoplate III (placed sequencially after Photoplate II) earlier in the volume. Additional color photos are also provided of types of *P. lyrnessa* and *P. collina* (Color Photoplate VII), and adults of *Pseudolucia avishai* and *P. andina* as treated in *Report* #51.


A
NUMBER OF SPECIES
140
100
60
20
28° S
26° S
18° S
21° S
19° S
24° S
2000-
3000-
4000-
ELEVATION (m)
COVERAGE (%)
50
30
10
28° S
26° S
19° S
18° S
21° S
24° S
2000-
3000-
4000-
ELEVATION (m)
Mean Annual Rainfall (mm)
300
200
100
ELEVATION (m)
5000
3000
1000
ABSOLUTE DESERT
18
20
22
24
26
28
30
LATITUDE (°S)
C
B
SUMMER RAINS
WINTER RAINS
6000
5000
4000
3000
2000
1000
0
ELEVATION (m)
Alpine belt
Low alpine (cushion) belt
Subalpine belt (puna)
Pre - alpine belt (Pre - puna)
Absolute Desert
Desert Bushland (Matorral)
Mediterranean Bushland (Matorral)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
18°
20°
22°
24°
26°
28°
30°
32°
34°
LATITUDE (°S)

(LIST 1, *continued...*)

[*P. plumbea*, **continued (from page 9)**] On 8.12.94, *P. plumbea* was common from 1900 to 2100 m. at Rio El Volcan. A female, landing on an *A. gracilis* flower bud to lay eggs was followed by a male, who exibited the same kind of behavior noted hitherto for *P. benyamini*— landing closely behind the female and beginning to vibrate its wings. The male followed the female, repeating this behavior until the female flew well into the bush and the male was unable to follow.

Life History. *Pseudolucia plumbea* was reared, together with *P. hazeorum*, on *Adesmia gracilis* Meyen ex Vog. (photoplate XI: 21) from material collected at Parque Nacional El Morado, Rio El Volcan, some 70 km. southeast of Santiago, Metropolitan Región (photoplate XI: 20). The former species has one annual brood along with a partial second brood, extending from mid-October (at 1750 m.) to February (at 2000 m.). At Parque Nacional El Morado, 1800-1850 m. on 26.11.94 worn females were observed on *Adesmia macronata* H. & A. and *A. tomentosa* Meyen that are suspected foodplants for the first generation at the lower elevations (1750-1850 m.). Data reported herein are based on eggs obtained from these females and will be somewhat incomplete since, at this writing, some individuals are still in diapause. The eggs are white, about 0.5 mm. in diameter (photoplate XI: 25,26; photoplate XVIII). Of nineteen eggs laid by an observed female, 42% were laid the calyx, 37% laid on the pedicels, and the rest on the foodplant's stems and leaves. The larvae do not consume the egg shell but feed inside the flower buds. The 1L larvae was 1.0-1.2 mm. long, greenish-white with long white "hairs" (length at least half the body diameter). The head capsule was shiny black, the termini of the true legs also black. All instars observed fed continuously on flowers or flower buds. The L2 and L3 larvae are completely velvetine green with short "hairs", a darker green middorsal stripe with whitish subdorsal margins, faint oblique greenish white subdorsal dashes, and a white lateral line (photoplate XI: 27). In L4 and L5 larvae there was a dark green "wasp mark" on the fourth segment (photoplate XI: 28-31,34) and the above-mentioned oblique marks were more pronounced. Some larvae remained green until the prepupal stage; others, however, showed a reddish-brown middorsal stripe and subdorsal dashes (similar to those in photoplate XI: 29,30). The fully grown L5 larva was 7-10 mm. long with a pronounced dark-green, brown or almost black "wasp mark". The prepupa measured 6.5-8.0 mm. long, exhibited dull translucent green-hued brown and violet colors and faint (almost unnoticable) white lines. In the laboratory the prepupa lay horizontally, under a loose silken net, with a covering of leaves (photoplate XI: 33). On 28.12.94 prepupae began turning dark brown, producing 6.5-7.0 mm. pupae (photoplate XI: 35) and, by 8.1.95, a single female had emerged. Laboratory temperature was 26°(day), 18°(night).

Myrmecophily. The DNO is apparent on the larvae as an elongate, transverse, brown ellipse. In Santiago, the larvae grew successfully without attending ants (indicating that they can be considered facultative). At the collection site, however, most of the *Adesmia* bushes had high concentrations of the common ant, *Dorymyrmex tener* Mayr, workers being black and red, and 6-7 mm. long (photoplate VII: 5). This ant species was observed palpitating the larvae of a *Pseudolucia chilensis* at this same habitat.

12. *Pseudolucia zina* **Benyamini, Bálint & Johnson 1995** (Photoplate XI, fig. 40).

Habitat. This species looks like a reduced *P. plumbea* and was collected by Luis Peña & Alfredo Ugarte near the water reservoir "Embalse de Yeso", north of the Maipo river, south of Santiago in the Metropolitan Region. The author visited the biotope and noted that it is quite similar to that of Parque Nacional El Morado near Baño Morales located about 30 km. away. The collection dates suggest an annual brood with a partial second one depending on local conditions.

Life History. Adults were observed during November-December flying among *Adesmia gracilis* Meyen a Vog. bushes. Consistent with usages noted heretofore for *Pseudolucia*, these *Adesmia* bushes are most likely the larval foodplant.

13. *Pseudolucia annamaria* **Bálint & Johnson 1993** (Photoplate XI, fig. 39 & Photoplate XV).

Habitat. This beautiful species, marked on the male dorsum by a greenish metallic sheen, is known from the Pre-Cordillera strip of the Mediterranean zone at middle elevations. The butterfly is distributed continously from Alcohuaz, south of Vicuña, Coquimbo Region (the type locality) to the Parral Mountains (Talca, Region de Maule) some 650 km. to the south. It begins flying in September (at about 1400 m.) in the warmer biotopes of the north; southward it may not be seen until February. Given these differences in flight period, the species has one to two annual broods. Records from June (1989) from Elqui, Coquimbo Region (leg. G. Castillo) may suggest a third, at least partial, autumn brood. From August until December, 1993, the author collected in the mountains around Salamanca, principlally about 30 km. south of Illapel (Coquimbo Region), using a different field itinerary (on foot) nearly every day. The first specimen of *P. annamaria* (a slightly worn female) was taken on 11.09.1993 near Batuco (51 km. south of Salamanca, 1700 m.). On 31.10. 1993 at the same locality, but at about 1850 m., three males were collected. On 28.11.93, on Cerro la Virgen, some 75 km. south of Salamanca (2850 m.), four fresh females and one fresh male were collected (photoplate XI: 39). In these areas the species was distributed in a typical altitudinal gradient, flying later in the season at higher altitudes. Also in these areas, the species was always associated with *Adesmia* species, which appear to be the obvious foodplant. At the lower elevations cited above, the prostrate species *Adesmia* aff. *exilis* Clos appears to be the foodplant; on Cerro la Virgen, however, *Adesmia* aff. *glutinosa* Hook & Arn., a bush reaching 60-70 cm. in height, is the plant probably utilized. On Cerro la Virgen, adult *P. annamaria* were flying around these *Adesmia* shrubs with some males also perched directly on the plant.

Life History. Given the field data noted above, study of the life history of *P. annamaria* should be possible with any protracted stay in these localities. However, considering that the areas sampled were very remote and reached only after long hikes, time did not allow the securing of immature stages on these initial expeditions.

14. ***Pseudolucia scintilla* Balletto 1993** (Photoplate III, fig. 10).

(synonym *P. kinbote* Bálint & Johnson 1993).

Habitat. This species is only known from a few specimens collected by L. Peña in Guampulla, 30 km. northeast of Ovalle, Coquimbo Region on 2.11.54 and at Hda. Illapel, Coquimbo Region, 2500-2900 m. on 11.11.54. These localities are about 120 km. apart within the Mediterranean shrubland zone (often described as semidesert, mean annual rainfall about 120 mm. [133 mm. at La Serena]). Mr. Peña recalled these localities in detail and, based on his instructions, I visited the area northeast of Caren in late

(LIST 1. *continued...*)

[*P. scintilla*, continued] December, 1994, and early January, 1995. However, I failed to encounter the species. Two possibilities may explain this: since the year had been very dry, either early hatchings occurred (*e.g.* August-September) or, immature stages were still in diapause. The low hills around Guampulla were visited twice while travelling from from Vicuña through Hurtado to Ovalle. On 19.9.92, at Tabaqueros (500 m.), 5 km. southwest of Guampulla, a "desert bloom" was taking place and the area was covered with grasses and flowers. However, this event preceded the description of *P. scintilla* and *P. kinbote* and the author was unaware the butterfly's existence. Exactly one year later, on 19.09.93, knowing of this species, the area was visited again. The region was entirely dry with only a few small yellow annuals in bloom. It is possible that these kinds of unpredictable extremes in climatic conditions may have evolved a varying diapause in *P. scintilla* or even one that is multiannual.

15. *Pseudolucia vera* **Bálint and Johnson, 1993** (Photoplate IX, figs. 1-24).

Habitat. Until recently, this species was known only from a rather limited area of Chile: the vicinity of Volcan Longuimay (type locality), Malacahuello, Las Raices (Tunel), Curacautin, and Ladera Sur (in the Malleco Province), and from northern Parque Nacional Conquillo north to Termas de Pemehue, Parque Nacional Tolhuaca, on the northern slopes of Volcan Tolhuaca (approximately 90 km. northeast of Temuco in the IX Regiόn de la Araucania). In both regions, elevations for collection of the species was 1000-1300 m. Peña & Ugarte (1995) added records from Parque Nacional Nahuelbuta in the Arauco province and the mountains of Ñuble province (both in VIII Regiόn del Bio-Bio). Balint (1995) records a female (in ZSM) from Hda. San Manuel, Talca, Linares Province in the VII Regiόn de Maule. If authentically labelled, this record extends the known distribution of *P. vera* 280 km. north from the type locality. In regions where the species is well known, adults are on the wing from mid-November to at least mid-February; there appear to be two to three annual broods. On 3.2.95, in the southeastern foothills of Volcan Longuimay (1100 m., above the *Araucarias* timber line [photoplate IX: 1]), the species was found to be common and one of the most dominant butterflies of the area. Adults were observed nectaring on *Adesmia emerginata* Clos (photoplate IX: 6) and perching on the bare ground (photoplate II: 3,5). However, after an hour of fieldwork a far less noticeable small shrub, *Montiopsis gayana* (Barn.) Ford (Portulacaceae), with violet or white flowers was found to be the actual larval foodplant (photoplate IX: 2). The males were perching (photoplate IX: 3) and nectaring on the foodplant.

Adult Behavior. At the Volcan Longuimay locality noted just above, courtship flights were observed. The male flew very close (less than 5 cm.) behind the female and only a few cm. above the ground. When the female landed on the ground, the male landed behind her and started to walk toward her on the ground. On one occasion a female landed and immediatley closed her wings. This posture, with the ventral cryptic coloration blending well with the ground, appeared to confuse the male, who began flying about as if to relocate her. Having no success, the male then simply flew away. Similar to other *Pseudolucia*, males of *P. vera* are very territorial with regard to other butterflies. They perch on small stones, edges of the foodplant, short dry branches, or even on bare soil. While sitting they sometimes rub their hindwings together, a behavior also seen in the female. Except for this behavior, both sexes usually sit with their wings open (at 45°); however, when it is windy, they close their wings.

Life History. The eggs are white and about 0.5 mm. in diameter. They are laid on both foodplant morphs (photoplate IX: 7): the ones with blackish-green glandular fruits and violet flowers (photoplate IX: 8) and the one with bright-green, smooth, fruits and pinkish white flowers (photoplate IX: 12). Eggs were laid on the fruits, flower buds (photoplate IX: 8, righthand side) and calyx. On one occasion a female was observed carefully laying an egg inside a calyx, an area that would afford excellent protection from predators. The emerging larvae (photoplate IX: 9) did not consume the egg shell; it was 1 mm. long, olive green with a black head capsule and smooth (with only few "hairs"). Two brown marks existed; one behind the head and the other on the body terminus. The first three instars were completely green (photoplate IX: 9,10,11) growing inside the flower buds and fruits aside their deposits of frass. The first external markings appear in the L3 larvae, with a bright-green lateral line and faint oblique dashes on the flanks. One L2 larva that was showed bright brown "axe blade"-shaped mark on the dorsum just behind the head capsule. The L4 and L5 larvae express two types of morphs, depending on the morph of the foodplant. Larvae on the blackish glandular fruits (photoplate IX: 14,18) are darker: dark green or brownish red, covered with fine white spots; they have a continuous brownish red middorsal line (photoplate IX: 17) or a line of rhomboid marks (photoplate IX: 15,16) with white lateral margins (photoplate IX: 15). On these caterpillars the subdorsal oblique dashes are usually reddish brown or dark green with white dashes in between them and the lateral line white with reddish ventral edges, the line becoming yellowish as a prepupa. Larvae on the brighter *Montiopsis* plants are brighter (photoplate IX: 12,13) with the L5 larva showing two middorsal parallel rows of yellowish marks. The lateral line is more yellowish with ventral reddish margins. On these larvae there are short "hairs" near the head capsule and around the caudal part of the body. The dorsum and the flanks show only very short hairs. The prepupa is 6.5-7 mm. long and either reddish-brown with violet tint or completely green (photoplate IX: 19,20). The pupa is 5.5-6 mm. long and 1.75 mm. wide, smooth and at first translucent green, attached to the foodplant with a gridle. It shows a middorsal brown line, bright brown head area and the eye regions are marked with a brown hemisphere. Before emergence, the pupae turn light brown with a darker brown head and thorax. In February, in Santiago, at 25°C day and 19°C night temperatures, the adults of the third annual brood emerged after 10-13 days. Interestingly, some L5 larvae, 7.5 mm. long and reddish brown with yellowish-red ~~lateral~~ lines, crawled to the bottom of the foodplant (photoplate IX: 18) and under the papers at the bottom of the rearing box; these entered what was apparently the winter diapause. The fact that such larvae were yet again differently marked than those others noted above is worthy of some reflection. Their coloration may tie in somehow with the environmental conditions of winter diapause.

Myrmecophily. The DNO was evident on L4 & L5 larvae and at the roots of the foodplants were large communities of the black and red *Dorymyrmex tener* Mayr ant (5-7 mm. long). Since these ants are now well known for their attendance with other *Pseudolucia*, they are most probably the ant attendant for *P. vera*.

(LIST 1, *continued...*)

16. ***Pseudolucia chilensis* (Blanchard, 1852)** (Photoplate XIII, figs. 1-22, Photoplate III, fig. 4 & Photoplate XVII).

Habitat. This is the most widespread polyommatine in Chile, distributed from the National Park Pan de Azucar on the Atacama Coast (some 1000 km. north of Santiago), to Laraquete (49 km. south of Concepción) and VIII Región del Bio-Bio, nearly 550 km south of Santiago. In the BMNH there is one female labelled "Valdivia" (ex Staudinger, Godman & Salvin Coll. 1909-28), but it is most likely mislabeled. Along the nearly 1500 km. long distribution of *P. chilensis*, it is locally common on the coast, in sandy dunes, and up to at least 2200 m. in the Precordillera de los Andes. It is in these common dune habitats that the foodplant of the species was eventually discovered, a discovery answering many questions about *Pseudolucia* and the probability of a complex mimicry ring based on *P. chilensis*. *Pseudolucia chilensis* is also the most well represented Chilean lycaenid among most collections and, possibly for this reason,was selected by Vladimir Nabokov as the type species for the genus. It appears, however, that this may have been an unfortunate choice because the uniqueness of the species wing pattern, morphology and life history make it "the" prime candidate for splitting off of the rest of the genus.

Adult Behavior. *Pseudolucia chilensis* is usually the first spring lycaenid in the air and sometimes is the only butterfly caught on early season field trips. It remains on the wing from mid-August (in the warmer northern biotopes) and appears in successive broods at least until April. During this period it may have as many as three to four broods along the central coast but, at elevations of around 2000 m., only two. Adult behavior is distinctive from other congeners in that both sexes, but especially the females, sit very quietly on many different plants, or even on the ground, with wings open at 45° (Photoplate XIII: 6). Their distinct lack of movement gives the impression they are "listening" or "waiting for something" (as familiar in birds) since they do not move for minutes at a time. Such poses are so accessible that sometimes females can be touched before they fly away. This sedentary behavior provided some key for discerning possible foodplants, since to discover the species life history females were followed from plant to plant, in each case watching for oviposition or other informative behavior. At Parc Nacional El Morado, 1800-2200 m., all visited plants were recorded and this list initially included mostly Asteraceae but also few Fabaceae, Hydrofyllaceae, Santalaceae and Berberidaceae. The extremely high frequency of perching on Asteraceae (Compositae) caused initial confusion in the search for a foodplant since most experienced lepidopterists know that Asteraceae are seldom used as butterfly foodplants. However, in initial stages of the study the following common perch substrates for *P. chilensis* were collected and examined for immature stages: *Chuquiraga oppositifolia* D. Don, *Haplopappus* sp., *Haplopappus* cfr. *uncinatus* Phil., *Mutisia sinuata* Cav., *Senecio glaber* Less. (Asteraceae), *Berberis empetrifolia* Lam. (Berberidaceae), *Quinchamalium chilense* Mol. (Santalaceae), wild *Medicago sativa* L., *Adesmia gracilis* Meyen ex Vog. (Fabaceae) and *Phacelia secunda* J.F. Gmel. (Hydrofyllaceae). All these plants were kept fresh in the laboratory for prolonged exposure to *P. chilensis* females. Five females and three males nectared in the laboratory on *Senecio*, *Medicago*, *Phacelia* and *Quinchamalium* flowers but produced no behavior suggesting that these were foodplants.

Life History. The behaviors noted above suggested the possibility that *P. chilensis* was an ant obligatory species, unable to lay eggs without the presence of the proper supporting ant. However, *Dorymyrmex tener* Mayr was very common on and around these plants, sometimes with as many as twenty ants on one branch of *Adesmia gracilis*. Thus, ants were added to the laboratory cages and still no oviposition behavior was noted. Fresh flowers were also added on a regular basis; the adult *P. chilensis* remained alive but without any noted oviposition. Considering the behavior of the Palaearctic obligatory lycaenid *Apharitis acamas* Klug (Benyamini 1990, page 13, fig.2), which lays eggs close to the ants nest on the ground, the ground and stones of the rearing cages were also checked thoroughly and no eggs were found. These experiments appeared to leave no further avenues to be explored. However, on 2.2.1995, a female was observed in dunes along the Pacific Coast, 2 km. south of Constitución, (VI) Región de Maule, which perched for over five minutes with wings open at 45° on a leaf of the weedy *Ambrosia chamissonis* (Less.) Greene (Asteraceae). The latter is a typically dominant plant in dune biomes along much of the Chilean Coast. The female *P. chilensis* was rubbing its wingsslowly but then started walking on the plant. This action immediately caught attention because of the usual sedentary habits of the females. It crossed the plant and crawled onto the parasitic *Cuscuta racemosa* Mart. (det. Prof. Luis Faundez, general common name "Dodder") that was growing upon the *A. chamissonis*. There, on the *Cuscuta* flowers it laid an egg. One more egg was layed on the *Cuscuta* plant's filiform stem and two more on a leaf and spiny fruit of the hostplant *A. chamissonis*. On 18.3.1995 at Parc Nacional El Morado, 2200 m., adults of *P. chilensis* were active near the natural soda streams ("Aguas Panimavidas") always not far away from plants with Dodders. In this biome *Cuscuta micrantha* Choisy, a species with elongated fruits, was growing. Generally, these dodders were dry but some edges were still fresh enabling the last generation of *P. chilensis* to still have available foodplant. A search of the biome yielded eggs and larvae on and close to the *C. micrantha*. In late summer and during the winter Dodders are dry and starting growing again in early spring. The activity of *P. chilensis* is fully synchronized with the growing period of this foodplant. In Parc Nacional El Morado there is a clear shift of *P. chilensis* activity upland when Dodders at the lower altitudes become drier and fresher *C. micrantha* is more available at the higher altitudes.

As far as is known, this is the first recorded foodplant usage of poisonous Cuscutaceae/Convolvulaceae plants for Neotropical Lycaenidae. Scott (1989) recorded *Cuscuta* (*gronovii*?) for *Deciduphagus augustinus* (Westwood) (common usage sometimes the homonym *augustus* Kirby and placed historically in "*Callophrys*", or "*Incisalia*"; Johnson 1992, in his European-published revision of Palaearctic "elfins" described *Deciduphagus* as the sister genus of Old World non-Pinaceae feeders of this group [the sister group of pine-feeding New World *Incisalia* being Old World pine-feeders). Fiedler (1991) recorded four species of Lycaenidae for Convolvulacea (Tables 17, 18 [including Afrotropical *Aphnaeus erikssoni* and *Spindasis lohita*]). For North America he noted *D. augustinus*. These lycaenids are all hairstreak or elfin butterflies (Theclinae, Eumaeini). Thus, it is believed that records herein are the first for this group and the Polyommatini.

The eggs, 0.5-0.6 mm. in diameter, are white and laid separately on all parts of thes *Cuscuta* foodplants and nearby parts of this parasite's plant host (Photoplate XIII: 8). In the laboratory the L1 larvae emerged after six days; it was 1.0 mm. long,

(LIST 1, *continued...*)

completely whitish-green, with the first segment whitish and the head smooth brown (Photoplate XIII: 9). It was completely smooth except for six anteriorly directed "hairs" bordering the head capsule and five posteriorly directed "hairs" at the terminus of the abdomen. Along the flank on the second and third thoracic segments were also a number of shorter "hairs". The larvae did not consume the egg shell but began feeding on the fruits and flowers of the *Cuscuta* foodplant. The larvae soon become pale yellow-orange— very close to the color of the foodplant. Such cryptic coloration continues through L2 and L3 larvae (attaining a length of 5 mm.), occasionally with a greenish tint. Pattern details include only a light brown or light green hemispherical marking on the first dorsal segment behind the head capsule and a narrow light brown line along the dorsum that becomes darker near the honey gland. Usually the dorsal nectaring organ (DNO) and the two tentacle organs (TO's) are well marked. The L2 and L3 larvae are also generally smooth, with only a few short white "hairs" around the anterior and posterior termini (Photoplate XIII: 10). Remarkably, the L4 and L5 larvae are quite different, showing a number of color patterns: brownish red with bold cream colored subdorsal lateral lines, oblique brownish red dashes edged with white, or greenish-brown in ground color with cream colored subdorsal lateral lines edged with brownish red or pinkish (or sometimes with wider red-orange margins or a dark brown dorsal line with yellowish white margins). The DNO is always well-marked, appearing "framed" with a rectangular marking breaking the continuity of the dorsal line. The subdorsal oblique dashes are brown with dorsal and ventral creamy white margins (Photoplates XIII: 11,12,13). The L5 larva grows to about 11 mm. long and 4 mm. wide. The colors fade in the prepupa; the oblique white dashes and the lateral lines become brownish and almost unnoticable; the prepupa measures only 8-9 mm. (Photoplate XIII: 15) and pupation occurs under leaves or in a loose silken web amid the *Cuscuta* foodplant (Photoplate XIII: 17). The pupa (about 7.5 mm. long) has a girdle and, when fresh, is light brown with dark brown veins in the wing region and red dashes along the abdomen; it becomes dark brown before emergence (Photoplate XIII: 16,18). The diapausing L5 larvae is entirely brown and positions itself under leaves (Photoplate XIII: 19) or inside a loose silken web amid the foodplant. On one ocassion three larvae from Constitución were observed under one leaf; when the leaf was turned upwards, the larvae descended again to the underside. As noted heretofore for *Pseudolucia andina*, this appears to be a case of communal larval roosting. During the rearing experiments, larvae from various collecting locations, and from different original *Cuscuta* species, readily switched their utilization to other other *Cuscuta* species supplied in the laboratory, irrespective of fruit shape. Larvae collected at Constitución on 12.3.1995 and pupating in early April showed tachinid parasites. On 14.4.1995 two tachinid flies emerged from a total of fifteen wild-collected larvae. This is a 13.3% occurrence of parasitism, somewhat higher more than observed in *P. andina* (6%) and *P. avishai* (11.1%), all species being attended by *Dorymyrmex tener* (see below).

Myrmecophily. Myrmecophily in *P. chilensis* is of the facultative type (Fiedler 1989); in the laboratory the species was reared both with and without ants. The attending ants were studied from two biotopes. In the coastal dunes of Constitución, on 13.2.1995, *Tapinoma antarcticum* Forel and *Brachymyrmex laevis* Emery were collected on *Adesmia chamissonis* near larvae of *P. chilensis*. The smallest of these ants (*B. laevis*) was also associated also with *Heoda atacama* (Lycaenidae, Theclinae) larvae from Cordillera Santiago. Beneath the A. *chamissonis*, near the roots, was also found a yellowish ant, *Solenopsis gayi* Spinola that appeared to be possibly a nocturnal species. In Parque Nacional El Morado ("P. N. El Morado), *Dorymyrmex tener* Mayr was observed on all the *Cuscuta* species as well as their hostplants. Two larvae from P. N. El Morado were brought to the laboratory along with their *Cuscuta* foodplant and two *D. tener* ants that refused to leave them. These ants were introduced to a different larva, from Constitución, that appeared to be signaling to them with its pair of eversible tentacles. In less than a minute the ants began palpitating the larva and "milking" the DNO. On 15.3.1995 an *S. gayi* ant was introduced to a larva previously living with *D. tener*. The *S. gayi* ant showed no interest in the larva and died after two days. To the contrary, however, two *D. tener* ants, one from Constitución and one from P. N. El Morado (each of which had been "milking" larvae at their collection sites) were introduced to the vial with the *P. chilensis* larvae and in less that 30 seconds began fighting until one was killed. This phenomenon was also noted in the *D. tener* ants attending *Pseudolucia andina* larvae at La Parva, Cordillera Santiago (see Benyamini & Bálint, *Report* 51).

18. *Pseudolucia charlotte* Bálint & Johnson, 1993 (Photoplate XIII, fig. 34).

Habitat. Until recently, this species was known only from the Argentine provinces of Mendoza and Neuquén (Bálint and Johnson 1993). But while checking the "*collina*"-like specimens in the National Natural History Museum, Santiago, a male of *P. charlotte* was located from a locality in between that of the coastal *Pseudolucia benyamini* and *Pseudolucia collina* which occur in the lower Precordillera of the Andes. This worn specimen was sent to Dr. Zsolt Bálint who confirmed the identification by both the wing pattern and genitalic dissection (Bálint gen. prep. No.589). The specimen label reads "Chile, Pr. Valparaíso & Santiago, Cuesta La Dormida. INT.BIOL.PROGRAM, 1970-1972. Leg. A.R.Moldenke". Cuesta La Dormida is an unpaved mountain road, often used as a short cut from Tiltil, Chacabuco Province, Metropolitan Reg. (60 km. by road north of Santiago) through Olmue and Sn. Francisco de Limache, Quillota Province, to Concon (some 70 km. to the west along the Pacific coast, Valparaíso V Región). The collection area is on the southern slopes of Cerro del Roble (2222 m.), where Dr. A. M. Shapiro collected the type material of *Eiseliana probabila* and *Heoda shapiroi* (Johnson et al. 1992) and is best defined as belonging to the Cordillera de la Costa. On 21.08.1993, *Heoda shapiroi* was collected at Colliguay, 20 km. south of Cuesta la Dormida and, on 27.8.94, *Colias vautieri* and *Battus archidamas* were found near Quillota about 30 km. to the northwest. A specimen of *P. charlotte* was located in only one other local collection, a male collected by Peña & Ugarte at Puyehue Pass on 28.12.93 (1300 m.). It is marked typical of the species with an orange patch mediad to postmediad on the DFW (Photoplate XIII: 34). The above-mentioned males represent extreme disjunction for the species, nearly 1000 km. within Chile, and at their closest proximity to Argentine populations separated by some 200 km. across the highest part of the Andes. If this type of distribution suggests remnants of an ancestral population, it may go back to periods where Andean uplift in the region only slightly exceeded 1000 m. whereas today the "Continental Divide" is at nearly 3000 m. (at Paso Bermejo). Additional comments on the habitat are included below among more detailed notes concerning adult behavior.

TABLE 1

Kill-ratios of Parasitic Wasps & Flies in Four Annual Broods of the Pacific Coastal Chilean *Pseudolucia benyamini*

Note: The figures are related only to fully grown larvae and ignore caterpillars that died of disease or starvation. Period of experiment: 9.1993-11.1994. All data presented are from the type locality at Pichicuy.

* = After diapause.

BROODS	1st	2nd	3rd	4th
No. OF LARVAE (100%)	*3(100)	21(100)	7(100)	9(100)
No. & % OF PARASITIC WASPS	1(33.3)	9(42.8)	2(28.6)	7(77.7)
No.& % OF PARASITIC FLIES	1(33.3)	1(14.3)	1(14.3)	1(11.1)
TOTAL KILL RATIO IN %	66.6	47.6	42.8	88.8

Comparisons to raw kill-ratios computed from random numbers of larvae reared in the various experiments summarized in LIST 1*:

Pseudolucia andina: 6%; *Pseudolucia avishai*: 11.1%

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*For conditions and numbers see species entries of these species under the subtitle "Life History" in List 1.

***Pseudolucia charlotte*, continued...**

(LIST 1, *continued...*).

Adult Behavior. To further investigate the above-mentioned records of *P. charlotte*, Cuesta la Dormida was visited several times from September to October, 1995. Crossing Paso Bermejo on 19.9.95 (from east to west) a fresh male was collected about 1400 m. north on the road summit in a patch of some dozen or more freshly emerged *Chorizanthe virgata* Benth. plants. Further down the road in Quillota Province, at 1250 m., a larger more mature community of *C. virgata* was located and here seven males and one female of *P. charlotte* were collected. Unfortunately, cold and rainy weather delayed the next visit to this locality to 8.10.95. This was a sunny early spring day and at 1250 m. males were actively flying in the vicinity local *Chorizanthe* plants. The butterflies were nectaring on the yellow flowers of a tiny *Gayophyton* species (Onagraceae). Males at this locality exhibited an obvious territorial behavior, actively engaging a large number of common lizards who were occupying the same area. Unfortunately, the pugnacious activity between the butterflies and lizards made it impossible to get within 70 cm. of the *Pseudolucia* with a camera. At this range one *P. charlotte* actually "attacked" the camera, flying directly towards it and veering off only at the last second. Adults of both sexes were perching on the ground, on small stalks, or on dry stems the previous year's *C. virgata* plants, rubbing their hindwings together or sometimes opening them to 45°. One female was observed on a *Chorizanthe* plant, walking over the surface as if to oviposit. However, this early in the spring the plants had only leaves— and no buds or flowers— and no eggs were laid. At this locality, rains had come late and it appeared possible that the species had emerged too early. To investigate whether an alternative foodplant might be available this early in the season, exploration was made farther west where two males were seen flying over a low vegetation with tiny white flowers. These plants were *Pectocarga linearis* (R. et P.) DC. (Boraginaceae) and were being used as a nectar source. However, also amid these flowers, at 1150 to 1200 m., were individuals of *Montiopsis capitata* (H. & A.) Ford (Portulacaceae). Even this early in the year this plant can have flowers and fully grown fruits. Indeed, after careful search, one unhatched egg was found among the flower buds as well as an L4 larva feeding inside a fruit. Thus, like *Pseudolucia collina* & *P. lyrnessa*, *P. charlotte* also utilizes an early and fast-growing *Montiopsis* as the foodplant for its first and second broods and later switches (in early November) to *Chorizanthe* for its third brood and possible fourth one. Notably, at 1250 m. at this locality, individuals of *Montiopsis capitata* were first seen during the author's second visit. However, this species is so small it is possible it was there during the early spring but simply not noticed.

Life History. The egg is typically lycaenid, colored white, about 0.4-0.5 mm. in diameter, and laid among the hairy flower buds of the foodplant. Given the long distance to collecting localities from the residence of the author, only the egg and later stages of the larvae were able to be studied. The L4 larva is 5 mm. long, pinkish white and covered with tiny white spots all over its body.

(LIST 1, *continued...*).

Along the dorsum and around the lateral areas are white "hairs". There is a continous reddish-pink middorsal stripe, edged with white and interrupted only by brown surrounding the DNO. Along the upper subdorsal area are lines of whitish-pink patches and reddish pink oblique dashes which, on each segment, conjoin into a zig-zag line. Beneath this line is a pink band that with a thin reddish ventral margin. The L5 larva measures up to 8.5 mm.; its DNO and two tentacle organs (TO's) are whitish. The prepupa measures 7 mm. and is dull pink. Prior to pupation in the laboratory, caterpillars crawled beneath the paper lining the bottom of the rearing vial and positioned themselves upside down. Resulting pupae measured 6-6.5 mm. with a tiny girdle; they were light brown when fresh with a middorsal abdominal reddish brown stripe, subdorsal reddish brown markings, greenish brown along the wing case and head capsule, and with a light brown thorax. A few scattered, short, and lighter colored "hairs" occur along the border of the abdomen, the wing cases, the thorax, and the head. At 24°C/17°C day/night temperatures, the pupae hatched after twelve days. Diapause was not observed but, if typical of the genus, should occur in the last instar.

Myrmecophily. At the locality three kinds of ants were noted: a tiny *Brachymyrmex* sp., another species quite near *Dorymyrmex tener*, and a very fast golden-black species (most likely *Camponotus chilensis* Spinola). All were collected on the foodplant. These species may be attendant on *P. charlotte* but, given the remote collecting locality, no further study was possible to document this.

Taxonomic Note. To further investigate the identity of apparently disjunct *P. charlotte* populations in Chile, fresh material from Cuesta la Dormida was forwarded to Zsolt Bálint for study. Bálint opined that this material showed a female configuration like that unique to *Pseudolucia collina*. There are two possibilities: either the only confirmed Chilean population of *P. charlotte* is from the Puyehue Pass, or studies thus far at Cuesta la Dormida have produced two sympatric *Pseudolucia*. Given this information (as noted elsewhere in this paper), disjunct Chilean populations taxonomically near *P. charlotte* probably warrant a complete review as to their specific identity. Also, it is highly probable that additional, yet unstudied, intervening populations of this *Pseudolucia* complex exist. Disovery of these will be important regarding their identity compared to typical Argentine *P. charlotte* and the *P. charlotte*-like populations now known from Chile.

19. *Pseudolucia lanin* Bálint & Johnson, 1993 (Photoplate XIII, fig. 23-33 & Photoplate XVIII).

Habitat. The original description of this species located the type locality as "west" of National Park Nahuel Huapi; it is actually about 100 km. to the north. Additional Chilean material was collected by Nielsen & Karsholt on 10-11.12.81 at Puyehue Pass (1300 m.) and on Volcan Antillanca (1100-1300 m.) (Zs. Bálint pers. comm.). On 15-16.2.95 the author visited the slopes and top of Volcan Antillanca but no adults *Pseudolucia* were seen. Not giving up, search was made for early stages. Empty eggs and fresh larvae were found on the prostrate shrub-like *Adesmia vetusa* Griseb. This is one of the dominant plants on the outer slopes extending down to Refugio Antillanca on the internal flanks of the crater (at 1300 m.). The prostrate species *Adesmia longipes* Phil. grows on the volcanic soils near the summit and also may be a foodplant. The plants inside the crater on which larvae were found were in wind protected areas. Some empty eggs were found further down the slope near Hotel Antillanca. The soil in that area is volcanic ash with very sparse vegetation. Timberline here for the *Notofagus* forest is at about 1100 m.

Taxonomic Note. The immature stages decribed below as *P. lanin* are based on knowledge of the adult population at that locality and have not yet been confirmed by emergent adults (laboratory populations still in diapause at the time of this writing). During visits to the locality two other *Pseudolucia* species were also collected in smaller numbers: *P. tamara*, and the population previously identified as Chiliean *Pseudolucia charlotte* in the entry just above. The larvae described below do not look like those previously associated with *P. charlotte* but could represent *P. tamara*, or, considering the foodplant genus, and nearby distributions, possibly also *P. grata* (see entry 20, below).

Life history. The egg is typically lycaenid, white, and (in 90% of observed cases) laid on the underside of lower leaves just over the ground, perhaps for protective purposes. A few eggs have been seen oviposited on the calyx. The young larva does not consume the egg shell (Photoplate XIII: 25). Larvae feed on flowers and on internal parts of the leaves, leaving thin translucent areas which appear almost like "windows". The L1 larvae is about 1.0 mm. long, greenish white with short white dorsal and lateral "hairs", the latter which remain at least until the L3 stage (Photoplate XIII: 27). The head capsule is shiny black and there is a tiny dorsal brown spot located immediately behind the head. Larvae in all stages are completely green and nearly identical to the color of the fruits of the foodplant. Markings are confined to a darker green to brownish middorsal stripe (edged with white), darker green subdorsal green dashes also edged with white, and a lateral line which is whitish with thin ventral brown margins. The last instar larvae are velvetine green, about 9 mm. long, smooth, and with all the whitish marginal markings much more yellowish (Photoplate XIII: 31); in this instar the dorsal area of the first segment has a unique brown rhomboid mark. The last instar feeds completely on the fruits, opening large holes in the skin and also consuming the seeds. There are a few larvae in the sample which appear different than those described above (Photoplate XIII: 26,27,28), being whitish yellow-green with a dashed red line on the dorsum, oblique red subdorsal dashes, and a dashed red line with yellowish ventral margins. There is little reason to suspect that these represent a different species, since as noted before for several *Pseudolucia* species, the colors of such individuals perfectly match the yellowish red flowers of the foodplant. Diapausing larvae are completely green, turning later to brown and measure about 6 mm. long. In the laboratory, they crawl beneath the papers at the bottom of the rearing vial (Photoplate XIII: 32), in nature possibly below stones.

Myrmecophily. The DNO was readily observed in most of L4-L5 larvae. At the collecting locality in the crater at Volcan Antillaca a *Dorymyrmex* ant (some 5.5-6.5 mm.) slightly darker than *D. tener* was collected; in the foothill localities a 7-8 mm. long, black, *Camponotus*-like ant was collected on the foodplants. These are possibly attendant ants but their precise identifications have not yet been returned by specialists.

(LIST 1, *continued...*).

20. ***Pseudolucia grata*** **(Köhler 1934).**

Habitat. Note that the possibility of this species being represented by material covered in another entry (*P. lanin*, just above) has already been indicated. Search for this species was undertaken by carefully checking available literature and the local Chilean collections for specimens that might suggest explorable localities. In doing this it became clear that this little-known taxon is is most certainly a southern Chilean species, inhabiting the southern chain of volcanos along the Argentine border from Rio Blanco, Curacautin (near Volcan Longuimay, (IX) Region), and Volcan Llaima (3125 m.), 70 km. east of Temuco (in (IX) Region de la Araucania), to at least Volcan Antillanca (1500 m.) and Parque Nacional Puyehue, 90 km. east of Osorno, ((X) Reg. de Los Lagos), more than 150 km. to the south. Peña (1967) mentions "*Itylos plambea grata*" collected at "Chile Chico 24/31-XII-1960". This locality, in (XI) Región de Aisen on the southern shores of Lago General Carrera (Lago Buenos Aires), extends the reported distribution for *P. grata* south by 900 km., very close to the reported occurrences of *P. grata* in the Chubut Province in Argentina. Considering the known occurrences of *P. grata*, it is on the wing from mid-November to the end of December. There are three worn males in the collection of the University of Concepción from "Volcan Llaina, 12.12.1950" possibly collected by M. Rivera. In early February, 1995, Volcan Longuimay was visited with search for *P. grata* in mind. The species was not found although *Pseudolucia vera* was very common at the locality. Proceeding southward to Volcan Llaima in Parque Nacional Conguillio no *Pseudolucia* were observed and it is assumed the season was, this far south, much too late.

Life History. *Adesmia emerginata* Clos. was abundant at all the localities explored for *P. grata* and appears to most probable foodplant of this taxon. Seasonal efforts should be made to study *P. grata*; time available to the present author did not allow rediscovery of the species.

21. ***Pseudolucia andina*** **(Bartlett-Calvert, 1894)** (Photoplate XII, figs. 1-11 & Photoplate XV).

Habitat. From January to March, 1993, the author was studying the biology of *Colias mendozina* Breyer in the Aconcagua Región on both sides of the Chile-Argentina border around Paso Bermejo. From the beginning of this work a competitor lycaenid larvae was eating leaves of the same *Astragalus arnotianus* foodplant. The lycaenid proved to be *Pseudolucia andina*. The species inhabits the Precordillera and lower valleys and slopes of the central Andes near Valparaíso, Metropolitan Santiago and Rancagua Regions, to the El Radal mountains near Talca, in Región del Maule. At its northern limits of distribution, *P. andina* flies from 2100 m. to over 3800 m. but it is known as low as 1700 m. at La Leonora, Rancagua (23.12.1954) and 1100 m. at El Radal (Oct. 1954) at the southern limits of its distribution.

Adult Behavior. Males of *Pseudolucia andina* sit on the ground close to the foodplant or at the edge of foodplant leaves, rubbing their hindwings together. As with most congeners, they are aggressively territorial. On 8.12.94, in Parque Nacional El Morado, near the Lagoon at 2200 m., adults were active near their foodplant (*Astragalus cruckshanksii* (H.& A.) Griseb., see below); a male was seen "intercepting" *Yramea lathonoides* individuals and driving them away from the habitat.

Life History. *Pseudolucia andina* was reared from three different localities and at each of them it used all the available species of *Astragalus*. At Portillo (3050-3800 m.) the females oviposited on *A. arnotianus* (Gill.) Reiche., *A. monticola* Phil. and *A. cruckshanksii* (Photoplate XII: 1A). At La Parva (2800-3000 m.) females oviposited on *A. looseri* Johnst., at Parque Nacional El Morado (2100-2550 m.) on *A. cruckshanksii*. It is noteworthy that the altitude of these three localities decreases successively southward. *Pseudolucia andina* flies in one or two annual broods depending on altitude: between 1100 m. (El Radal, Talca) and 2000 m. (Cord. de Santiago, Lagunillas, Baños Morales) the first brood emerges in early October and has time and available foodplants to produce at least one more generation. At its highest altitudes of occurrence, only one annual brood is produced, the first adults (males, Photoplate XII: 11) appearing in early December (Portillo 3100 m., Aconcagua Reg.; La Parva 2800 m., Metropolitana Reg.; La Leonora, 1700 m., Rancagua, Reg. de Maule). The relatively low temperatures at these elevations enable the larvae to grow slowly and enter dispause as L5 larvae in about two months. It cannot be ruled out that in warm niches within this flight zone, and with the greenhouse effect of rising temperatures, a second brood may also occur at 2600-3800 m. in the Alpine belt. The eggs are typically lycaenid, white or greenish-white, 0.5 mm. in diameter (Photoplate XII: 2) and laid on the stems, leaves and flower buds of the *Astragalus* foodplants (*A. cruckshanksii* at Portillo, La Parva, El Morado [Photoplate XII: 1], *A. arnotianus* at Portillo, Aconcagua, 3050-3800 m., *A. monticola* at Portillo, 3100 m.). On 24.1.93, at 2550 m., below the glacier of El Morado National Park, an isolated *A. cruckshanksii* plant was examined and eight eggs were located deep on an inside stem, only a few centimeters above the ground. Also, at Portillo (3050-3200 m.) a similar situation was noted on *A. cruckshanksii* and the larger species *A. monticola*. This deep penetration of the foodplant for oviposition may result from females hiding from the wind. It is possible that such oviposition may also occur during long periods of rain and cold which often delimit the flight activity of this species. Crawling deep inside the foliage may also give protection to females from the locally common lizards (seen often at Portillo, 4.12.1993) if, indeed, such reptiles find these butterflies palatable. The L1 larva does not consume the egg shell; it is about 1.25 mm. long, green colored with with white hairs and black head capsule. It feeds on the leaves, digging a small hole in the epidermis and through it consuming the mesophyll tissues (Photoplate XII: 3 [note at bottom of *A. annotianus* leaf the small "window" entering hole and, in the middle, of the leaf a 2L larva feeding on the mesophyll]). L1 and L2 feed on leaves; L3 larvae penetrate the pods (Photoplate XII: 4 [observed on *A. arnotianus* and *A. cruckshanksii*) where they reside amid their frass, consuming the seeds and the shell of the fruit. Sometimes they close the entrance hole with a silken net for protection (Photoplate XII: 9). On *A. looseri* (a species with small pods) or on plants where no pods occur, the larvae feed only on leaves and are mostly nocturnal. During the day they descend to lower parts of the foodplant, even to the roots or under the ground. On 20.2.93 at Portillo (3050 m.) many L3, L4 and L5 larvae were found hiding at the bottom of *A. cruckshanksii* plants where they were tightly pressed together (a behavior perhaps offering some protection against tachinid and ichneumonid parasites frequently observed near the foodplants). The later instar larvae are quite large, achieving lengths of 13 mm. and widths of 3.5-4 mm. Some are completely green with a darker green middorsal stripe edged with white and subdorsal dark green oblique dashes with white edges; their head capsules are shiny black with very short blackish "hairs" extending along the abdomen (Photoplate XII: 4). L5 larvae found under stones ranged from reddish to orangish-

Tables 2-4

A Series of Tables Comparing Diversity of Polyommatine Larval Foodplants as now Understood in Chile with that Known from other Comparable Land Areas and Regional Ecologies Worldwide

Table 2. Raw ("unadjusted") data on foodplant diversity measured simply as the number of larval foodplant families and genera utilized in Chile, California, Israel, Europe (west of Ural Mountains), and North America (north of Mexico)*

Table 3. Data adjusted for diversity of foodplant usage as a percentage of total flora (families or genera) in each area

Table 4. Data adjusted for differences in geographic sizes of the areas

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**Rationale for land areas.* California and Israel compare interestingly to Chile because all have Mediterranean climates with neighboring alpine and desert zones; they are also located in similar latitudes. Chile, despite its greater length has most of its Polyommatini populations in the Central Mediterranean zones. California is a northern, Nearctic, bioclimatic "mirror-image" of Chile while Israel is a Palaearctic bioclimatic "mirror-image" of Chile. Comparisons to the larger faunas of surrounding continental areas (Europe west of Urals), North American (north of Mexico) add interesting contexts for the above comparison; such comparison in South America might also include Argentina, but no comparable biological work has been done there.

Data sources: Marticorena, 1990 (Chile); Hickman, 1993 and Scott, 1986 (California); Feinbrun & Danin, 1991 and Benyamini, 1990, 1993 (Israel): Chinery, 1989 and Stace, 1991 (Europe); Scott, 1986 and Edit. Commit. 1994 (North America) as summarized in **Table 5.**

Data summarized herein regarding families and genera of foodplants in use by the Chilean Polyommatini considering the following elements:

n = Total number of Polyommatini species
n1 = Total number of Polyommatini with known foodplant (F.P.)
Ff = Total no. of foodplant families
Fg = Total no. of foodplant genera
S = Area in thousands of square kms
Pf = Total no. of plant families in the zone/country
Pg = Total no. plant genera in the zone/country
Ps = Total no. of plant species in zone/country

Table 2. REGION	**NR. OF POLYOMM. SP.**		**NR. OF FOODPLANTS**		**PLANTS (TOTAL NR.)**			**AREA IN THOUSANDS of sq.kms**
	n	**n1**	**Ff**	**Fg**	**Pf**	**Pg**	**Ps**	
CHILE	29	22	6	11	184	1008	5739	755.6
CALIF.	25	25	29	97	173	1222	5862	495.9
ISRAEL	31	26	18	46	136	853	2780	40.0
EUROPE	71	58	18	37	203	1541	11557	10477.8
N.AMER. (N.OF MEXICO)	31	30	32	103	210	2350	18000	19312.4

Table 3.

The adjustment for diversity of foodplant usage as a percentage of total flora (families or genera) in each area is computed as follows:

$$Rd = \frac{F}{P} \times 100$$

F = No. of foodplants
P = Total flora (higher plants)
Rd = F.P. relative diversity in %

Calculating this ratio separately for plant families (Ff, Pf) and for plant genera (Fg, Pg) results in the following:

RD	ZONE	CHILE	CALIFORNIA	ISRAEL	EUROPE	NORTH AMERICA
$Rdf = \frac{Ff}{Pf} \times 100$		3.26	15.03	13.23	8.86	15.24
$Rdg = \frac{Fg}{Pg} \times 100$		1.09	6.79	5.39	2.40	4.13
$\frac{Rdf}{Rdg}$		2.99	2.21	2.45	3.69	3.69

TABLE ADJUSTED FOR DIVERSITY OF FOODPLANT USAGE AS PERCENTAGE OF TOTAL FLORA

Table 4.

The adjustment for difference in geographic sizes of areas is computed as follows:

$$Sr = \frac{n * F}{S * P} \times 100; \text{ and, since } Rd = \frac{F}{P} \times 100 \quad \text{one then computes } Sr = \frac{n}{S} \times Rd .$$

where : Sr = Species richness
Rd = Relative diversity
n = Number of Polyommatini species
S = Area in thousands of sq. kms.

Calculating this ratio results in the following:

Sr	ZONE	CHILE	CALIFORNIA	ISRAEL	EUROPE	N.AMERICA
$Srf1 = \frac{n}{S} \times Rdf$		0.1035	0.757	8.60	0.049	0.0236
$Srf = \frac{n}{S} \times Rdf$		0.1338	0.757	10.25	0.060	0.0244

TABLE ADJUSTED FOR DIFFERENCES IN GEOGRAPHIC SIZE OF AREAS

OBSERVATIONS—

As further noted in the text, it is apparent from **Table 2** that although the total number polyommatine species in Chile is close to all the other areas (except Europe), Chile shows extremely low numbers of families and genera of foodplants. Thus, the adjustment is made represented in **Table 3**. Considering **Table 3**, one again notes strikingly low figures for polyommatine foodplant diversity in Chile (California and North America showing far higher values). Adjustment in **Table 4** attempts to counter the problem of comparing large geographic areas to smaller ones. Yet, Chile still maintains low values while another much smaller area (Israel) shows twice the diversity of the former. Regarding the Chilean data one must consider the effects of (a) relative montane and austral isolation, (b) relative geologic youth and (c) possibly greater "catastrophic pressures" of the Quaternary glacials, as all contributing to the paucity of foodplant radiation among Chilean Polyommatini. This paucity probably also accounts for the limited southern ranges of polyommatines (compared to certain other butterflies) in the austral regions.

TABLE 5

Baseline Table of Polyommatine Larval Foodplants Utilized Comparing Chile to Other Areas of the World

Updatable Table for Field and Laboratory Workers as of November 1995 Based on Tabulations of the Author.

Sequencial tables numbered 5.1-5.7 and keyed to genera along right hand margin. Numerals inside the Table record the number of butterfly species using particular genera of families as larval foodplants; the "Total" represents the number of plant genera and families being used as larval foodplants. Updatable totals boxes at end of table 5.7 for convenience of active researchers.

Sources are same as Table 1; **Order of Families** is from Cronquist 1981.

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Plants	Countries/Regions	CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Ranunculaceae	Cimicifuga			1	1					1	1
	Aquilegia										?1
Hamamelidaceae	Hamamelis			1	?1					1	?1
Moraceae	Humulus									1	1
Fagaceae	Quercus			1	1					1	1
Aizoaceae	Trianthema			1	1					1	1
	Sesuvium				1						1
Chenopodiaceae	Atriplex			2	2					2	2
	Suaeda				1						1
	Salicornia										1
	Chenopodium				1						1
	Halogeton				1						1
	Salsola				1						1
Amaranthaceae	Amaranthus					1	1				
Portulacaceae	Montiopsis (Calandrinia)	4	4								
Polygonaceae	Polygonum	4		7	1	1	1			8	1
	Oxytheca				1						1
	Eriogonum				7						8
	Chorizanthe		4		1						1
Plumbaginaceae	Plumbago	1	1	2	2	2	1	2		2	2
	Acantholimon						1		1		
	Armeria								1		
	Statice								1		

Table 5.1
Ranunculaceae
Hamamelidaceae
Moraceae
Fagaceae
Aizoaceae
Chenopodiaceae
Amaranthaceae
Portulacaeae
Polygonaceae
Plumbaginaceae

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* calculated as all of North America minus butterfly species and larval foodplants that don't occur in California

** in the Holarctic Realm including *Astracanta*.

Table 5.2
Cistaceae
Capparaceae
Empetraceae
Ericaceae
Diapensiaceae
Primulacaceae
Crassulaceae
Saxifragaceae
Rosaceae (partim)

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Countries/Regions		CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Cistaceae	Cistus							2	2		
	Helianthemum								2		
Capparaceae	Capparis					1	1				
Empetraceae	Empetrum									1	1
Ericaceae	Erica			3				4	4	3	
	Arctostaphylos				1						1
	Ledum				1						2
	Vaccinium				3				1		3
	Kalmia										1
Diapensiaceae	Diapensia									1	1
Primulacaceae	Androsace			1	1			2	2	1	1
	Soldanela								2		
	Dodecatheon				1						1
Crassulaceae	Dudleya			1	1			1		1	1
	Sedum								1		
Saxifragaceae	Saxifraga			1						2	1
	Jamesia				1						1
	Vaccinium										?1
Rosaceae	Rubus			2	1	2	1	2		2	1
	Crataegus						1				
	Adenostoma				1						1
	Chamaebatiaria				1						1

Table 5.3
Rosaceae (partim)
Mimosaceae
Caesalpiniaceae
Fabaceae (Leguminosae)
(partim)

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Countries/Regions		CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Rosaceae (cont.)	Holodiscus				1						1
	Malus				1						1
	Physocarpus				1						1
	Petrophytum				1						1
	Peraphyllum				1						1
	Prunus				1						1
	Spiraea				1						1
	Aruncus										1
	Sanguisorba								2		
Mimosaceace	Mimosa	1		3	1	5				3	1
	Acacia		1		3		3				3
	Prosopis		1		3		3				3
Caesalpiniaceace	Caesalpinia			1		1				2	1
	Cassia (Senna)				1		1				1
Fabaceae (Leguminosae)	Crotalaria	19		15	1	18	1	36		17	2
	Lupinus		1		9		2				10
	Indigofera				1		2				2
	Albizzia				1						1
	Spartium						1				
	Thermopsis				1						1
	Genista						2				
	Oxytropis				4						4
	Tephrosia						2				
	Sarothamnus								1		

Table 5.4
Fabaceae (Leguminosae)
(partim)

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Plants	Countries/Regions	CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Fabaceae(cont.) (Leguminosae)	Colutea						3		2		
	Astragalus**		4		12		6		8		12
	Adesmia		13								
	Tripodion						1				
	Anthyllis								2		
	Lotus				9		3				9
	Dalea		1		2						2
	Ulex								3		
	Coronilla								2		
	Hippocrapis								4		
	Onobrychis						1		8		
	Amorpha				1						1
	Galactia				2						3
	Glycyrrhiza				3						3
	Lysiloma				1						1
	Wisteria				1						1
	Ononis						3				
	Trigonella						1				
	Medicago		2		6		5		4		6
	Melilotus				5		4				5
	Trifolium				4		5		4		4
	Vicia				5		2		3		5
	Erythrina				1						1

Table 5.5
Fabaceae (Leguminosae)
(partim)
Elaeagnaceae
Cornaceae
Aquifoliaceae
Euphorbiaceae
Rhamnaceae
Malpighiaceae

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Plants	Countries/Regions	CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Fabaceae(cont.) (Leguminosae)	Lathyrus				5						5
	Lespedeza				1						1
	Pisum						1				
	Amphicarpa				1						1
	Vigna						1				
	Apios				1						1
	Phaseolus				2		1				3
	Baptisia				1						1
	Desmodium				1						2
	Hedysarum				2						2
	Desmanthus				1						1
	Abrus				1						1
	Macroptilium				1						2
	Psorothamnus				1						1
	Rhynchosia				1						1
	Pithecellobium										2
	Vitaliana								1		
Elaeagnaceae	Hippophae							1	1		
Cornaceae	Cornus			1	1					1	1
Aquifoliaceae	Ilex			1	1			1	1	1	1
Euphorbiaceae	Andrachne					1	1	1	1		
Rhamnaceae	Ziziphus			1		2	2	2	2	1	
	Ceanothus				1						1
Malpighiaceae	Malpighia									1	1

Table 5.6
Sapindaceae
Hippocastanaceae
Aceraceae
Anacardiaceae
Zygophyllaceae
Oxalidaceae
Geraniaceae
Araliaceae
Gentianaceae
Cuscutaceae
Boraginaceae

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Plants / Countries/Regions		CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Sapindaceae	Cardiospermum									1	1
Hippocastanaceae	Aesculus			1	1					1	1
Aceraceae	Acer			1	1	1	1			1	1
Anacardiaceae	Pistacia			1		1	1			1	
	Rhus				1						1
Zygophyllaceae	Tribulus					1	1				
Oxalidaceae	Oxalis							1	1		
Geraniaceae	Geranium					3	2	4	3		
	Erodium						2		3		
Araliaceae	Aralia			1	1	1		1		1	1
	Hedera						1		1		
Gentianaceae	Gentiana							1	1		
Cuscutaceae	Cuscuta	1	1								
Boraginaceae	Heliotropium					2	2	1	1		

Table 5.7
Lamiaceae (Labiatae)
Oleaceae
Rubiaceae
Caprifoliaceae
Asteraceae (Compositae)
TOTALS

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Plants / Countries/Regions		CHILE		CALIF.*		ISRAEL		EUROPE		N.AMER.	
Family	Genus	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen	Fam	Gen
Lamiaceae (Labiatae)	Salvia			1		4	?1	8	1	1	
	Micromeria						1				
	Thymbra						1				
	Majorana						1				
	Origanum						1				
	Cleonia								1		
	Thymus						1		7		
	Collinsonia				1						1
Oleaceae	Ligustrum			1	1					1	1
Rubiaceae	Chiococca									1	1
Caprifoliaceae	Lonicera			1	1			1		1	1
	Viburnum				1						1
	Symphoricarpus								1		
Asteraceae (Compositae)	Verbesina			1	1	1				1	1
	Actinomeris				1						1
	Chrysanthemum				1						1
	Helianthus				1						1
	sp.						1				
TOTAL		6	11	26	83	18	46	18	37	32	97

______________________________ Date
______________________________ Date
______________________________ Date
______________________________ Date
______________________________ Date

TABLE 6

Diversity of Plant Families Utilized as Larval Foodplants in Certain Geographic Regions

Expressed as percentage portions of 100%, that is, percentage of taxa which choose the foodplant family as a larval foodplant.

Sources same as for Table 5.

CHILE	NORTH AMERICA	EUROPE	ISRAEL
Fabaceae -79.1%	Fabaceae -60.0%	Fabaceae -62.1%	Fabaceae -69.2%
Polygonaceae -16.6%	Polygonaceae -26.6%	Labiatae -13.8%	Mimosaceae -19.2%
Portulacaceae-16.6%	Mimosaceae -13.3%	Geraniaceae-6.9%	Labiatae -15.4%
Mimosaceae - 8.3%	Ericaceae -10.0%	Ericaceae -6.9%	Geraniaceae -11.5%
Plumbaginaceae-4.1%	Chenopodiaceae -6.6%	Rosaceae -3.4%	Rhamnaceae -7.7%
Cuscutaceae -4.1%	Saxifragaceae -6.6%	Rhamnaceae -3.4%	Plumbaginaceae7.7%
	Rosaceae -6.6%	Cistaceae -3.4%	Rosaceae -7.7%
	Caesalpiniaceae-6.6%	Primulaceae-3.4%	Boraginaceae -7.7%
	Plumbaginaceae -6.6%	Plumbaginac.3.4%	Amaranthaceae-3.8%
	Ranunculaceae -3.3%	Crassulac. -1.7%	Polygonaceae -3.8%
	Moraceae -3.3%	Elaeaganac.-1.7%	Capparaceae -3.8%
	Fagaceae -3.3%	Aquifoliac.-1.7%	Caesalpiniac.-3.8%
	Aizoaceae -3.3%	Euphorbiac.-1.7%	Euphorbiaceae-3.8%
	Empetraceae -3.3%	Oxalidaceae-1.7%	Aceraceae -3.8%
	Diapensiaceae -3.3%	Araliaceae -1.7%	Anacardiaceae-3.8%
	Primulacaceae -3.3%	Boraginac. -1.7%	Zygophyllac. -3.8%
	Crassulaceae -3.3%		Araliaceae -3.8%
	Cornaceae -3.3%		
	Aquifoliaceae -3.3%		
	Rhamnaceae -3.3%		
	Malpighiaceae -3.3%		
	Sapindaceae -3.3%		
	Hippocastanac. -3.3%		
	Aceraceae -3.3%		
	Anacandiaceae -3.3%		
	Araliaceae -3.3%		
	Oleaceae -3.3%		
	Rubiaceae -3.3%		
	Caprifoliaceae -3.3%		
	Asteraceae -3.3%		

OBSERVATIONS— In the geographic regions enumerated, Fabaceae is the most widely utilized while other usages are quite various; Polygonaceae ranks second in the New World but is totaly absent from Europe (although in Israel one polyommatine species [*Zizeeria karsandra* Moore] utilizes it). Labiatae and Geraniaceae rank high in the Old World but are not utilized in the New World. Mimosaceae shows mixed results, ranking high in Israel and North America, absent (or yet undiscovered) from Europe but utilized by two polyommatine species in Chile. Interestingly, two out of six foodplant families utilized in Chile are recorded here for polyommatine usage for the first time. Portulacaceae was previously recorded for an unspecified species (e.g. Fiedler 1991, Tables 17 and 18 [noted simply as "one species", Table 17]). However, in Chile four species are already known to feed on it. Cuscutaceae (which is represented in Chile by ten species) supports what could be argued as the most common lycaenid species (*Pseudolucia chilensis*), while only one other species of butterfly is known to use it elsewhere. It can be strongly suggested that the Brazilian sister species of *P. chilensis* (*Pseudolucia parana* Bálint) also uses Cuscataceae as its foodplant.

TABLE 7

Diversity of Plant Families and Genera Utilized as Larval Foodplants by Species of Polyommatini Occurring in Chile and Argentina

Including Notes on General Plant Morphotypes, Altitudinal Ranges and Toxicology

Pseudolucia*

*this genus includes 69% of the polyommatine species occurring in Chile and adjacent Argentina

FOODPLANT & ALTITUDINAL RANGE			POLYOMMATINE SPECIES
Fabaceae,	Astragalus 2200-3200m	Agronomically Toxic	P. andina P. avishai P. asafi
	* 0-1300m		* P. sp.n.near andina,
	** 200-500m but in high latitude		** P. magallana ** P. sp.n.near neuqueniensis,
	Adesmia (bush) 1200-2800m		P. annamaria P. clarea P. plumbea P. nympha P. hazeorum P. grata
	*400-1600m		* P. aureliana
	Adesmia, bush, prostrate 1000-1400m		P. lanin
	Adesmia, spiny cusion formation 2750-4500m		P. argentina P. sibylla P. penai P. talia
Polygonaceae,	Chorizanthe 0-2650m		P. collina P. benyamini P. lyrnessa P. charlotte
Portulacaceae,	Montiopsis (Calandrinia) 200-1800m		P. collina P. lyrnessa P. vera P. charlotte
Cuscutaceae,	Cuscuta 0-2300m	Agronomically Toxic	P. chilensis
FAMILY	GENUS and morphotype	**,* identifies certain clustered species, or exceptions	

OBSERVATIONS— The most frequent choice ***Adesmia*** has different morphotypes: at low altitudes (up to 2800 m.) it is in a bushy formation (usually up to 2 m. high). It also has prostrate morphs (like those utilized at Volcan Antillanca [*P. lanin*]). Above 3000 m. in the Puna (Subalpine) and Lower Alpine belts (see Fig. B) it takes on a smaller but spiny, cushion-like formation.

Based on these data a schematic network clustering the various taxa is presented as **Figure F** (p. 32); probable mimicry phenomena based on the agronomically toxic status of some foodplants is explored in **Figure G** (p. 33) and **Table 9** (p. 28).

TABLE 8

Summary of Myrmecophilous Relationships Among Chilean Polyommatini and Ants

The presence of Dorsal Nectaring Organs (DNO's) and Tenticle Organs (TO's) is recorded on species of Polyommatini compared to species of ants documented as myrmecophilous with these lycaenid butterflies. Study of Pore Cupola Organs (PCO's) is also relevant to these studies but can only proceed with further study of the microstructure of the larvae collected in the present studies. As noted in Benyamini and Bálint (*Report* No. 51), more substantial data on polyommatine/ant myrmecophily followed quickly upon the initial discovery of myrmecophily in *Pseudolucia avishai* and *P. andina*. Color Photoplates VII-XIV, as captioned following page 7 of the present *Report* (see below), record the activities of various ant and polyommatine species included in the Table, or the plant clusters in which both ant nests and polyommatine larvae were collected.

SPECIES	DNO	TO'S	ANT SPECIES
H. ramon	+		?
N. faga	+	+	?
L. trigemmatus	+		?
P. collina	+		?
P. benyamini	+		*Linepithema* sp.
P. lyrnessa	+		*Dorymyrmex agallardoi* Snelling
P. hazeorum	+		*Dorymyrmex tener* Mayr
P. plumbea	+		*Dorymyrmex tener* Mayr
P. vera	+		*Dorymyrmex tener* Mayr
P. avishai	+		*Dorymyrmex tener* Mayr *Camponotus ovaticeps* Spinola
P. andina	+		*Dorymyrmex tener* Mayr
P. argentina	+		*Dorymyrmex tener* Mayr
P. talia	+		?
P. chilensis	+		*Dorymyrmex tener* Mayr *Tdapinoma antarcticum* Forel *Soleniosis gayi* Spinola *Brachymyrmex leavis* Enery

Cross-references: *P. avishai*, Photoplate VII, XII; *Nabokovia faga*, Photoplate VIII; List 1 entries and cited photographs: 3 (*N. faga*), 5 (*L. trigemmatus*), 6 (*P. collina*), 7 (*P. benyamini*), 8 (*P. lyrnessa*), 9 (*P. hazeorum*), 11 (*P. plumbea*), 15 (*P. vera*), 18 (*P. grata*), 19 (*P. andina*), 20 (*P. avishai*), 27 (*P. argentina*), 28 (*P. talia*).

Table 9

Patterns of sympatry and synchrony involving the orange-colored, toxic, polyommatine *P. chilensis* and twenty-four other butterfly taxa which share similar wing coloration.

To highlight, in the central Coquimbian, Metropolitan and Valparaíso Regions, *P. chilensis* flies with eighteen species listed in the **Table.** In the northern Atacama and Antofagasta Regions *P. chilensis* flies with *Heoda wagenknechti* (Theclinae) and *Pseudolucia collina* (these northern regions also host several other bright orange *Heoda* and *Eiseliana* (Theclinae) still requiring local documentation of sympatry and synchrony). Elsewhere, in northern to central Chile, *P. chilensis* is sympatric and synchronic with *H. atacama* and *H. shapiroi* and *E. bicolor* and *E. probabila*. At moderate elevations (1000 to 2500 m.) the orange coloration is mixed with blue in *P. plumbea*, *P. zina* and *P. clarea* females and *P. clarea* and *P. charlotte* males. In addition, grey and silver also occur among the colors in *P. andina*, *P. avishai*, and *P. asafi* females and *P. asafi* males. In the southern Regions of Talca (VI), Bio-Bio (VII), Araucania (VIII), Los Lagos (IX) and Aisen (XI) fewer species show the orange coloration but the distributions of apparent mimics are a perfect match with the southern distributional limit of *P. chilensis*. Orange coloration is rarer at high altitudes (over 3000 m., out of the flight range of *P. chilensis*), yet the orange patches in females of *P. talia* (flying at over 3600 m.) could suggest a lowland ancestry for this latter species. In Rio la Laguna, brightly colored moths (genus *Heterusia*) occur with the orange-colored lycaenid species. Accordingly, the information in Figure G suggests that orange-brown, orange-blue, orange-grey/silver and yellow-black patterns form part of a complex mimicry ring based on the usage of toxic *Cuscuta* (Cuscutaceae) plants (which contain selenium).

Species Biotopes (Region)	*Eiseliana bicolor* ♀ & ♂	*Eiseliana probabila* ♀ & ♂	*Heoda wagenknechti* ♀ & ♂	*Heoda atacama* ♀ & ♂	*Heoda shapiroi* ♀ & ♂	*Heoda suprema* ♀ & ♂	*Pseudolucia lyrnessa* ♀	*Pseudolucia vera* ♀	*Pseudolucia collina* ♀	*Pseudolucia benyamini* ♀	*Pseudolucia charlotte* ♀ & (♂)	*Pseudolucia chilensis* ♀	*Pseudolucia asafi* ♀ & ♂	*Pseudolucia avishai* ♀	*Pseudolucia andina* ♀	*Pseudolucia plumbea* ♀	*Pseudolucia zina* ♀	*Pseudolucia hazeorum* ♀	*Pseudolucia grata* ♀	*Pseudolucia annamaria* ♀	*Pseudolucia clarea* ♀ & ♂	*Fidonia* sp. (Day flying moth)	*Heterusia* sp. (Day flying moth)	Satyridae sp.	Total biotope species
Pan de Azucar, Atacama coast. (II - III)			+						+			+													3
Copiapo (III)			+						?			+													3
La Serena, Coquimbo (IV)	?		+	+					+			+										+			5+
Alcohuaz, Coquimbo (IV)	+			?					+			+				+		+		+	+	?	?		7+
Caren, Illapel (IV)	+								+			+	+									?	?	+	5+
Los Pelambres, Illapel (IV)	?								+			+		+								?	?	+	4+
Batuco, Illapel (IV)	+	?							+			+				?				+	?	+	?	+	6+
Pichicuy, Valparaiso (V)	+	+		+						+		+										?	+	+	7+
Cuesta la Dormida, Valp. (V)	+	+		?	+						+	+										+	+	+	8+
Valparaiso, Con Con (V)	+	?		?						+		+										+	+	+	6+
Cord. Santiago (Metrop.)	+	?		+	+		?					+			+	+		+		?		+	+	+	10+
San Jose de Maipo (Metrop.)	+			+	+		+					+										+	+	+	8+
P.N. El Morado (Metrop.)	+				+		+					+			+	+	+	+				?	+	+	9+
Constitucion & Cord. Parral, Talca (VII)	+				+		+					+			+							+	+	+	6+
Las Cabras, Chillan (VIII)					+		+					+				+		+		+		+	+	+	7+
Vn. Lonquimay (IX)								+				?							+					?	2+
Puyehue (X)											+	?							+					+	3+
Chile Chico, Aisen (XI)						+						?							+					+	3+

(4+; meaning more than four)

(LIST 1, *continued...*).

yellow (Photoplate XII: 5) but these get a violet tint before entering the prepupal stage. Diapausing L5 larvae are completely brown (Photoplage XII: 6) and stay under stones on a silken "bed" for six to seven months, roosting together in clumps. On one occasion at La Parva (2975 m.), 27.3.94, sixteen fully grown diapausing larvae were found under a single stone (about 7 cm. across) at the base of an *A. looseri* plant (Photoplate XII: 6). The prepupa has a girdle and is brown and smooth except for a few very short "hairs" bordering the head region; it is 4.5 to as much as 10.0 mm. long and 3.0-4.0 mm. wide. On one occasion, at Portillo (3200 m.) on 03.3.93, one pupa was found inside an empty *A. arnotianus* (Photoplate XII: 7). In the laboratory, at 26° C/15° C, day/night conditions, the adults of second and third generations *P. andina* emerged after 9 days. Parasitism appeared slight among *P. andina* larval populations. From about forty wild-caught larvae at Aconcagua, Portillo, La Parva and El Morado only three had parasites. An ichneumonid parasitic wasp hatched on 3.4.1994 from a dead larva found at Portillo (3050 m.) (Photoplate XII: 8). A tachinid fly (genus *Goniini* or *Eryciini* [det. Dr. H. Shima]) emerged on 26.5.1994 from a larva collected at Portillo (3050 m.) on 1.4.94. Another Tachinid fly emerged on 8.6.1994 from a diapausing larva that was found in La Parva (2975 m.) on 27.3.94. A resultant 6% of parasitism in *P. andina* contrasts 11.1% in *P. avishai* and 40-70% in *P. benyamini* (see Table 1) and may reflect not only effective ant protection but also the combinations of nocturnal feeding (with diurnal hiding) and protection gained from feeding inside the foodplant pods.

Myrmecophily. *Pseudolucia andina* larvae show a DNO at least from the L3 instar and, at all the locations used for rearing-related collections, it was always associated with the widespread myrmecophilous ant *Dorymyrmex tener* Mayr (see also, Benyamini & Bálint, *Report* No. 51).

Taxonomic Note. The rearing experiments surrounding *Pseudolucia andina* have strongly indicated the discovery of two populations which are specifically distinct from *P. andina* and some notes are made about these two populations below. The first produced adults which appear closest to the species *neuqueniensis* Bálint & Johnson, a taxon first described from small samples as a subspecies of *andina* but later seen as a good species in the context of what is now known of the *andina*-Group of *Pseudolucia* (see Bálint and Johnson *Report* 48). The new Chilean entity was actually collected early in the present author's study but its distinction at that time was not apparent. The locality was Chile Chico, Chile, where the very local hairstreak species *Heoda suprema* also occurs. Given the collecting locality, both species are probably *Astragulus* feeders and after full life history is completed it is anticipated that a new *Pseudolucia* species will require description. The second entity is one occurring at very low elevations in the southern Coquimbian Coastal zones and known from quite a number of specimens (one male, Huentelauquen, sea level 5.10.1947; Guampula NE Ovalle, Coquimbo, 500 m., one female; two males, 2.11.1957, in collection Peña/Ugarte; Cordillera de la Costa, Cuesta la Dormida, Chacabuco/San Felipe, Metropolitan Regién, 1300 m., 17.10.95, two males, collected by A. Ugarte; and, at same locality, 1150 m., 7 males and 4 females, collected by D. Benyamini). This is a large, quick flying, orange-brown species which was first observed ovipositing on *Astragalus berterianus* (Moris) Reiche. Its flight period appears to be restricted, with all records limited to October and early November, synchronic and sympatric with the flowering period of at least four species of *Astragalus*: at Huentelauquen, (about 40 km. north of Los Vilos) the large *Astragalus coquimbensis* (H. & A.) Reiche, a bushy species with white flowers and inflated pods; at Cuesta la Dormida, *A. berterianus*, A. aff. *limariensis* Muñoz and *A.* aff. *verticillatus* (Phil.) Reiche (i.d. by Dra. E. Gomez-Sosa) both large *Astragalus* bushes with white, bluish white, or whitish lavender flowers. Again, full elaboration of the life history of this entity will probably indicate the presence of another distinctive species of the *andina*-Group of *Pseudolucia*.

22. *Pseudolucia avishai* Benyamini, Bálint & Johnson, 1995 (Photoplate XII, figs. 12-17, Photoplate III, fig. 6 & Photoplate XV).

Habitat. This is a local species known only from the Los Pelambres Valley which descends from the Argentine border at Paso de Pelambres, (3614 m.) southward some 25 km. to Cuncumen, Hda. Illapel, in the southeast Coquimbo Región. At Los Pelambres, it inhabits the upper part of the valley (3300 m.) from late October, extending to the bottoms (2500 m.) by March. In the uplands, *Astragalus cruckshanksii* (H. & A.) Griseb. is the foodplant but nearer the river bottoms, in more humid and warm biomes, *Astragalus looseri* Johnst. (a species that stays green and flowering for longer periods) is preferred. This foodplant transition allows the species to fly until April in a three broods. This locality has been mentioned in List 1 regarding the effects of local water pollution from the Los Pelambres copper mine. The valley is rich in plants due to restricted usage by livestock herds. The relatively small area harbors 370 different plant species (compared to only 350 plant species in Tierra del Fuego, a land area 100 times larger).

Life History. This species was discovered on 30.10.93 at 1950 m., on a cold and snowy day when only young shoots (10-15 cm.) of *A. looseri* were apparent above the ground. Looking under stones, the author's son, Avishai, found four pupae and one diapausing larva under a stone (20x20x15 cm., Photoplate XII: 14). The diapausing larva was dark brown (about 11.0 mm. long and 4.5 mm. wide), the pupae were brown with white lines along the wing region (8-12 mm. long, 3.5-4 mm. wide). The pupae were connected with a girdle to a silken net which covered the lower surface of the stone. The first adult emerged in Santiago on 4.11.1993 and was obviously an unknown *Pseudolucia* species (described herein in *Report* 48). Study of the life history at the type locality showed the eggs to be white, 0.45 mm. in diameter (Photoplate XV) and usually laid on the leaves of *A. looseri* (Photoplate XII: 12), *A. cruckshanksii*, and *Astragalus* aff. *moyanoi* Speg., but also on the stems (especially in periods of strong winds) and on the flowers. Emerging larvae do not consume the egg shell; they feed on the leaves, opening little holes in the epidermis and then consuming the mesophyll by extending into the leaf. When leaves are the only available diet, the larvae build translucent "windows"; sometimes the entire plant appears riddled with such damage. In the field, the appearance of such plants strongly indicates the presence of larvae and, if not found on the plant, these are often located under stones near or at the base of the plant. The L1 larva is light brown (1.25-1.5 mm. long) with long white "hairs" and black head capsule. After consuming their first leaf-meal they become completely green. Honey glands become apparent in the L2 larvae (usually about 2.5 mm. long). The larvae then grow to the lengths of approximately 12 mm., often both the fruits and flowers on *A. cruckshanksii*. Compared to the larvae of *Pseudolucia andina*, the

(LIST 1, *continued...*).

L5 larva of *P. avishai* (Photoplate XII: 13) appears less reddish and more greenish-brown. The middorsal line is brown with a greenish tint; there are two brown subdorsal oblique dashes on each segment, and a continuous white lateral line. Some L3 instar descend during the day to the base of the plant; all L4-L5 larvae observed stayed at the base of the plant or under stones during the day (for ant protection, see Myrmecophily, below). At Los Pelambres a third brood was evident in early April. No eggs were found during this period, temperatures were low, and foodplants only meagerly available. Thus, it is believed that this third brood is partial, fortuitous, one and most of it ends with diapausing larvae which remain dormant for at least six month until the November spring. Only two parasites emerged from a total of eighteen wild-caught larvae (constituting 11.1% parasitism). This contrasts 40-70% in *P. benyamini* and may indicate the strong protection achieved by myrmecophily (see Table 1). Both parasites were found in larvae that had *Dorymyrmex tener* attendants; one Ichneumonid parasitic wasp emerged on 20.3.94 from an L4 larva collected n 6.3.94 at 2550m. One tachinid fly emerged on 1.5.94 from a pupa that pupated on 10.4.94.

Myrmecophily. Defoliated conditions drew attention on 6.3.94 at Los Pelambres (2550 m.) among a stand of *A. looseri* growing on the edge of a "vega" close to a slope (Photoplate III: 6). Under the first stone examined were five L4 and L5 larvae along with a nest of the reddish black ants (*Dorymyrmex tener* Mayr). Ten meters away, under larger stones, eight L3-L5 larvae (ranging from 6-12 mm. long) were found in the nest of a larger and very aggressive golden-black ant (*Camponotus ovaticeps* Spinola in Gay). The latter is a more local species than a similar looking and more common ant (*Camponotus chilensis* Spinola in Gay) which is also believed to attend lycaenid larvae. *Report* No. 51 more fully describes the initial experiments in the laboratory with *P. avishai* and *Dorymyrmex tener*. In the laboratory the larvae and attending ants were active at night, a behavior corroborating observations in the field indicating consistent diurnal descent of later instar larvae to the base of the plant and under stones occupied by ant nests.

23. *Pseudolucia asafi* Benyamini, Bálint & Johnson, 1995 (Photoplate XII, figs. 18-23).

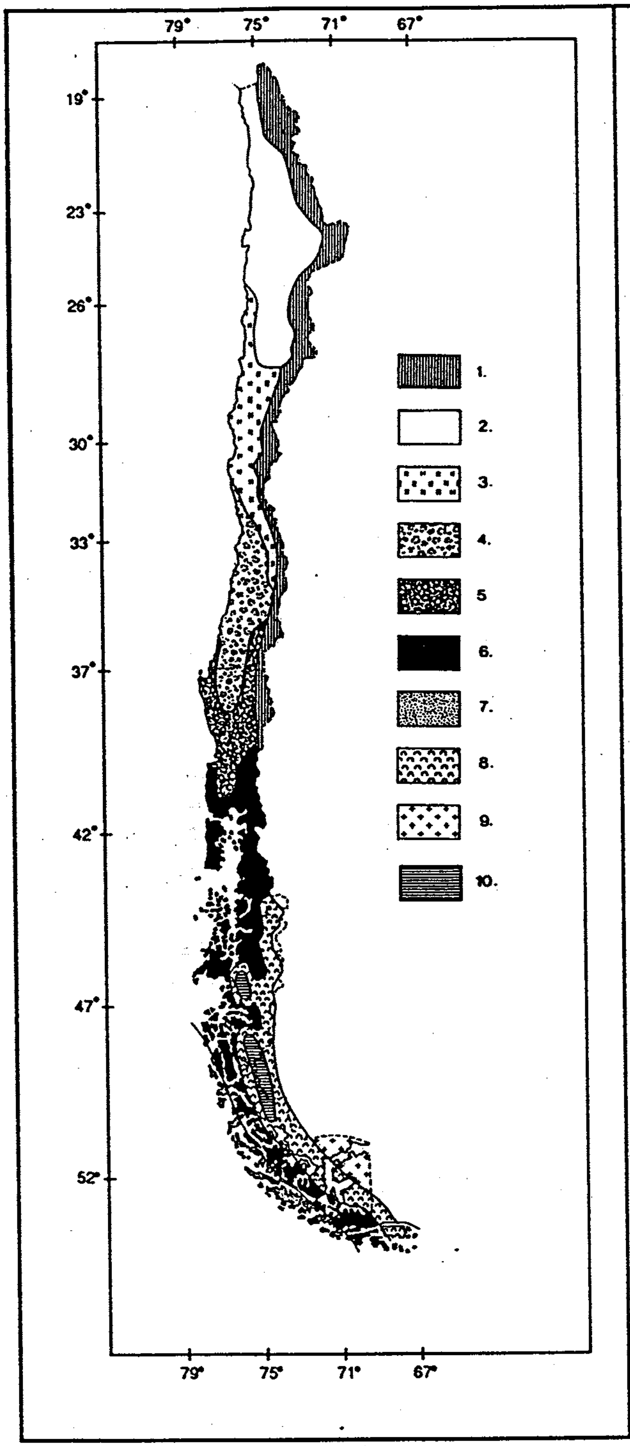
Habitat. During December 1994 and January 1995 I tried to find *Pseudolucia scintilla* Balletto east of Illapel, Chile. Mr. Luis Peña provided rough directions to the area were he had collected the species on 11.11.54. At the time he was riding a horse "some 20 km. northeast of Caren". Arriving at Caren in December, 1994, the area was very dry; the annual rainfall was far below average and the only green vegetation existing was along the Rio Illapel. Given these conditions, this excursion continued northeastward through Sta. Virginia on the private dirt road that ends in a valley locally called "Sespe" about 14 km. northeast of Caren. Foot exploration was made from this point to the highest elevation possible to the northwest (about 2400 m.) and near here, on 25.12.94, *P. chilensis* was collected from 1700-1900 m. and *P. collina* from 1600-2300 m. along with some pronophilines (Nymphalidae, Satyrini). Because of these catches the region was visited again on 7.1.1995 and this time horses were used to explore the area. This allowed ascent of the green mountain "vega" at 2500 m. (Photoplate XII: 18). Initially only a worn *P. collina* male was collected at 2500 m. but then a "*P. andina*"-like blue that seen flying at the edge of the vega close to the eaten remains of *Astragalus* plants. Arriving at about 2800 m., local shephards provided information about a very extensive area of *Astragalus* ("yerba locas" [crazy herbs] in local usage) and pursuing this lead an area of yellow-flowered cushion-like *Adesmia* bushes and an extensive patch of *Astragalus looseri* Johnst. (about 20 x 60 m.) was located up a moderate slope to the northwest. These *A. looseri* were up to 60 cm. tall with violet flowers but only a few fruits. These plants, agriculturally considered poisonous, had been avoided by the goats but showed definite signs of caterpillar defoliation. This was the location where the new species, *Pseudolucia asafi* (see *Report* 53) was disovered. Adults were common on and around this foodplant.

Adult Behavior. Males of *P. asafi* exhibited territorial behavior, flying out at approaching objects from their perches on stones or the foodplant. When sitting, both sexes rubbed their hindwings together. The males were distinctive looking because of their large size (FW 11-13 mm.) and tendency for their forewing patches to be either bright orangish in fresh specimens or nearly whitish in worn ones (Photoplate XII: 23); the females ranged in size from 9-14 mm.

Life History. Only a few empty whitish egg shells were found on the leaves. Also, a single 3L larva was found (2.5 mm. long). It was light green, hairy, and covered with small dark spots. Removed to the laboratory, it fed on the foodplant's leaves and flowers for five days, reached a length of 3.5 mm. but then died (unfortunately before it could be photographed). About ten days later two unidentified small ichneumonid wasps emerged from the remains.

24. *Pseudolucia magellana* Benyamini, Bálint & Johnson, 1995 (Photoplate XII, figs. 24-27).

Habitat. During November-December 1994 my apartment in Santiago was the local homebase for Dr. A. M. Shapiro while he dedicated his enitre summer vacation to work in Chile. Along with lecturing at the University of Valparaíso and attending the annual meeting of the Chilean Entomological Society, Dr. Shapiro accompanied the author on several collecting trips in the surrounding Andes before leaving for his own expedition to the Chilean Magallanes. On this latter expedition, Dr. Shapiro collected a single polyommatine on 2.12.94 far south at Rio Baguales, 500 m. (located about 115 km. by road north of Puerto Natales at 50°S & 72°-23'W to the east of the famous National Park Torres del Paine) (Photoplate XII: 24). The location is in the Province La Ultima Esperanza ("the last hope") in the Chilean XII reg. of the Magallanes (spelling different than the Anglicized "Magellanic Straits"), farther south than any other lycaenid ever captured in Chile. Dr. Shapiro noted the biotope as a "river floodplain with lot's of Astragalus near Rio Baguales". Only one specimen was observed, collected while sitting with slightly open wings on *Astragalus*. The external temperature was about 12°c and three species of *Hypsochila arqyrodice* also observed nearby. Dr. Shapiro's specimen was a large (FW 10.5) and uniquely marked female (Photoplate XII: 26,27), its coloration actually more like that familiar in males of *P. andina*— completely silver-gray although notably brighter. This coloration contrasts the various dorsal orange patches that are common to the females of other members of the *andina*-Group of *Pseudolucia*. The significance of this is further explored in the present paper in the discussion of mimicry. The apparent host *Astragalus* has light green inflated pods (Photoplate XII: 25). It was identified at the Instituto de Botanica Darwinion in Buenos Aires as *A. patagonicus* (Phil.) Spegazzini (S.I. No. 28244, Det. Dra. Edith Gomez-Sosa). Other legumes from the type locality were determined by Prof. Emilio Ulibarri of the same Institute as various



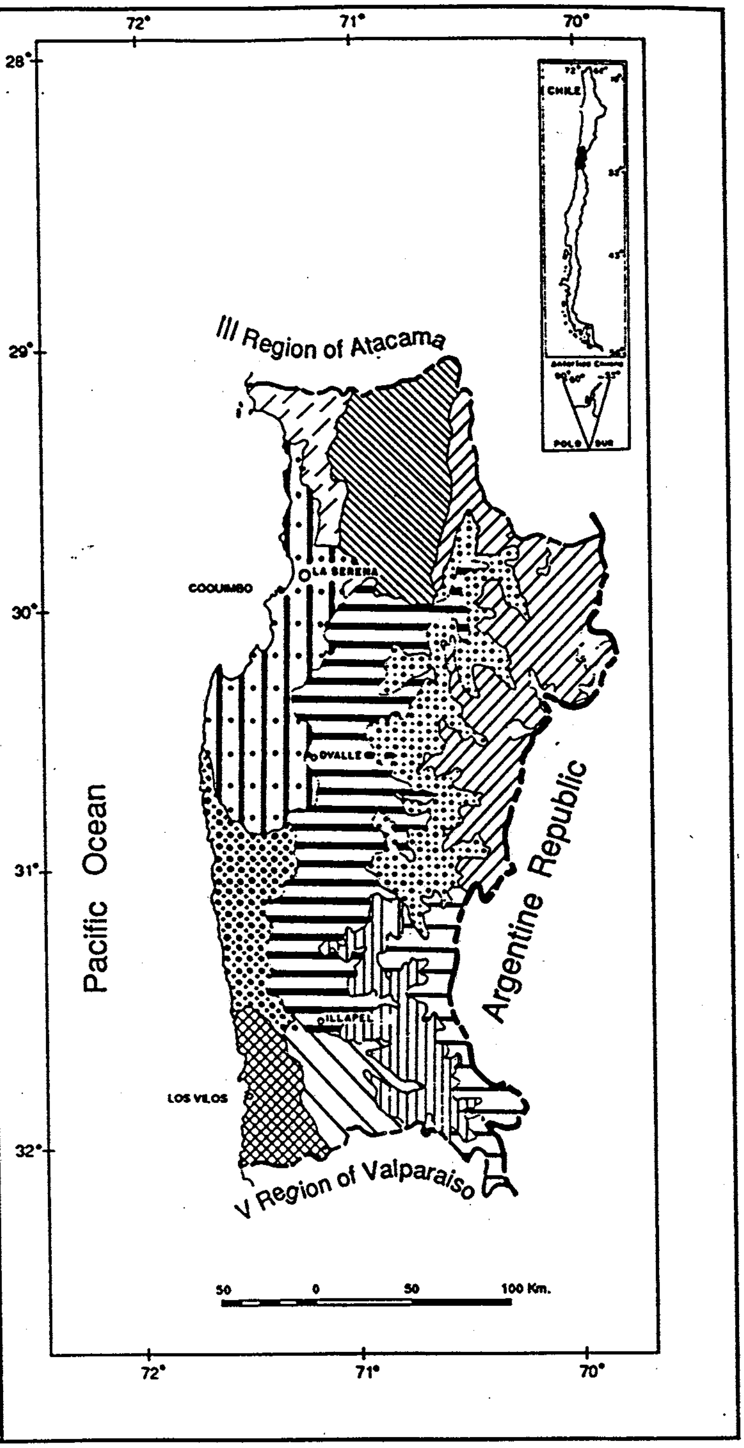


Fig. D Phytogeographical Zones of Chile

1.- Northern High Andean Zone
2.- Atacama Desert
3.- Semidesert
4.- Sclerophyllous Zone
5.- Central (warm) deciduous forest
6.- Evergreen Rainforest (Valdivian Forest)
7.- Tundra
8.- Subantarctic deciduous forest (***Notofagus pumilio***)
9.- Patagonian steppe
10.- Southern High Andean Zone (Glaciers)
Source: Schmithusen 1956

Fig. E The phytogeographical sub zones of the IV Region of Coquimbo

- Coastal Desert of Huasco
- Mountainous blossoming Desert
- Subalpine & Low Alpine belts of Coquimbo
- Scrub belt of the precordillera
- Sclerophyllous Andean Bushland
- Low Alpine belt of Santiago
- Coastal Steppe
- Inland Steppe
- Dense Arboreal Bushland
- Arboreal Bushland
- Spiny Bushland
- High alt. without vegetation

Source: Gajardo 1994

Figure F.

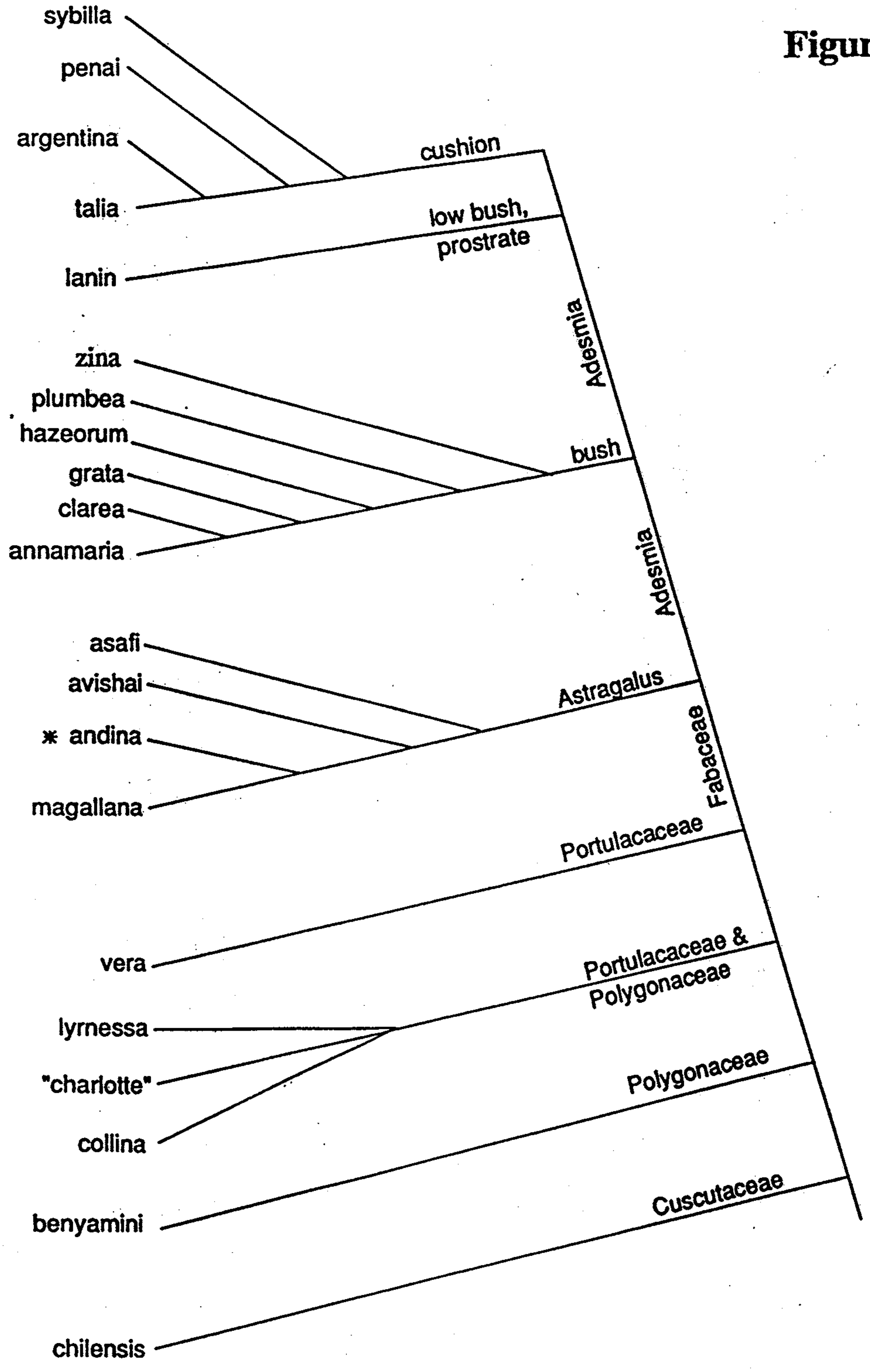


Fig. F Foodplants family tree of Chilean ***Pseudolucia*** Nabokov
⁎– See note in text of ***P. andina*** for two additional species.

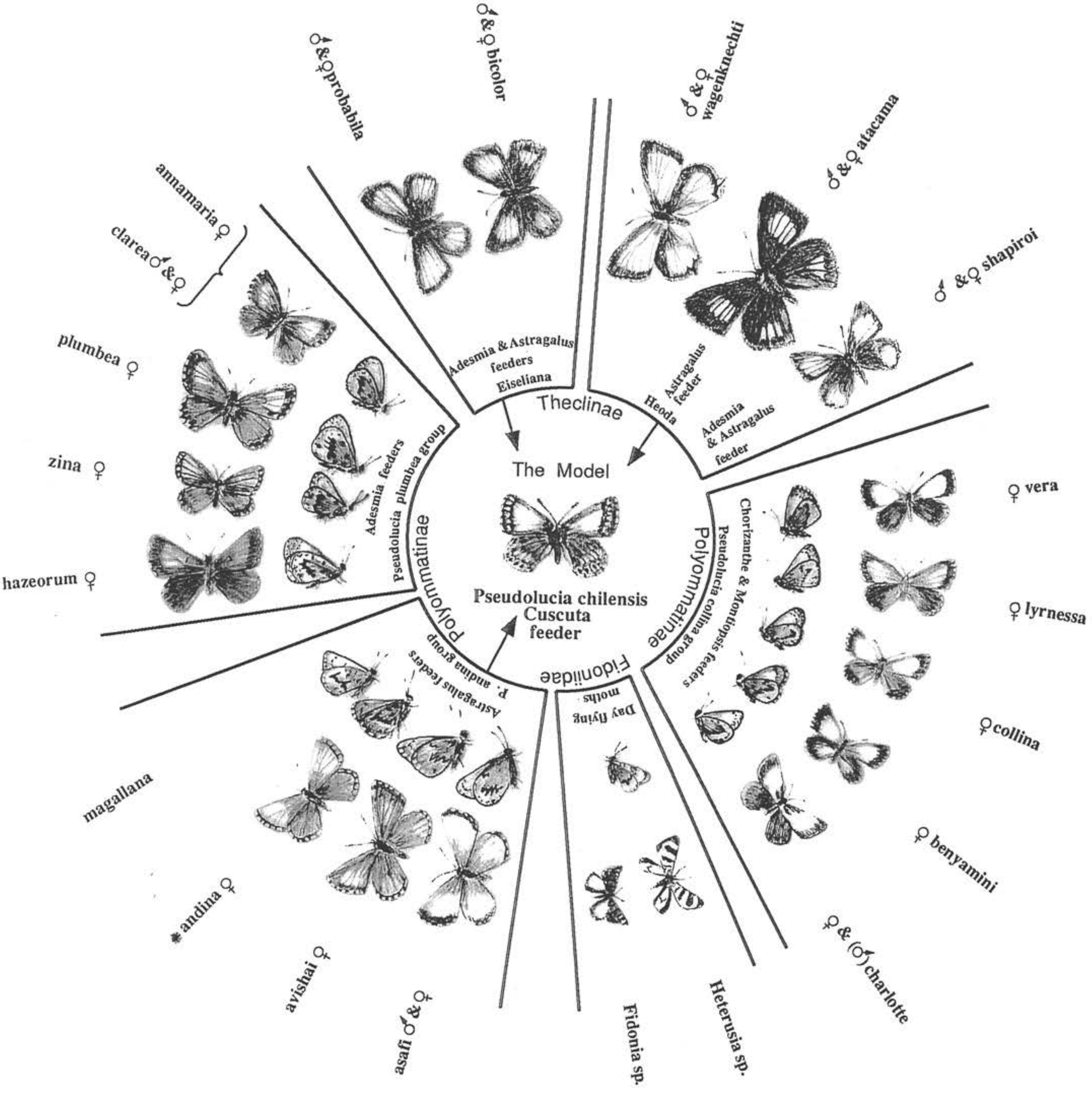


Fig. G. Schematic of mimicry ring including numerous Lycaenidae and day flying moths based on the dorsally orange-patched and ventrally "cryptic with dark (usually V-shaped) ventral hindwing band" apparent in a toxic model ***Pseudolucia chilensis***. Table 9 details patterns of sympatry and synchrony.

Format. External circle represents the dorsal wing surfaces (dark= brown [grey in *andina* Group of *Pseudolucia*] or blue [partial blue in *plumbea* Group of *Pseudolucia*]; white= orange, yellow-orange and red-orange occurring as distinct or suffusive patches). Internal circle represents the ventral wing surfaces (dark= various shades of brown; white= areas of lighter tawny or grey; black= blackish macular patterns including forewing spots and, prominently, V-shaped hindwing patterns). ***Pseudolucia chilensis*** is a *Cuscata* feeder; arrows note *Astragalus* feeders wherein data unpublished by another author also suggest some toxic foodplant elements. All butterflies and moths are approximately life size.

Species	Location of biotopes & records	Typical Distribution
I. titicaca	✢	
H. ramon	+	—+—+—+
N. faga	⧫	—//—//—//
N. ada	◊	
L. trigemmatus	✡	
P. collina	□	————————
P. benyamini	⧄	—··—··—··—
P. lyrnessa	⊟	—×—×—×
P. "charlotte"	▣	════════
P. lanin	⊠	
P. vera	⊞	—·—·—·—·—·—·
P. plumbea	▲	+ + + + + +
P. grata	▽	● ● ● ● ● ●
P. zina	⍋	
P. hazeorum	△	
P. annamaria	◬	
P. clarea	◭	
P. chilensis	○	. . . .
P. scintilla	✳	
P. andina	◘	
P. avishai	◨	
P. asafi	⬓	
P. sp.n. near andina	▚	
P. sp.n. near neuqueniensis	⬒	
P. magallana	▦	
P. sibylla	⊖	
P. penai	⊘	
P. argentina	◒	
P. talia	⊗	
P. aureliana	▬	
P. oligocyanea	▭	
M. ludicra	◕	
M. pelorias	⭘	— — — — — — — —
M. sigal	⊕	× × × × × ×
P. vapa	⌖	

CAPTIONS to MAP FIGURES H-L

(note that due to transliteration problem, there is no Figure I)

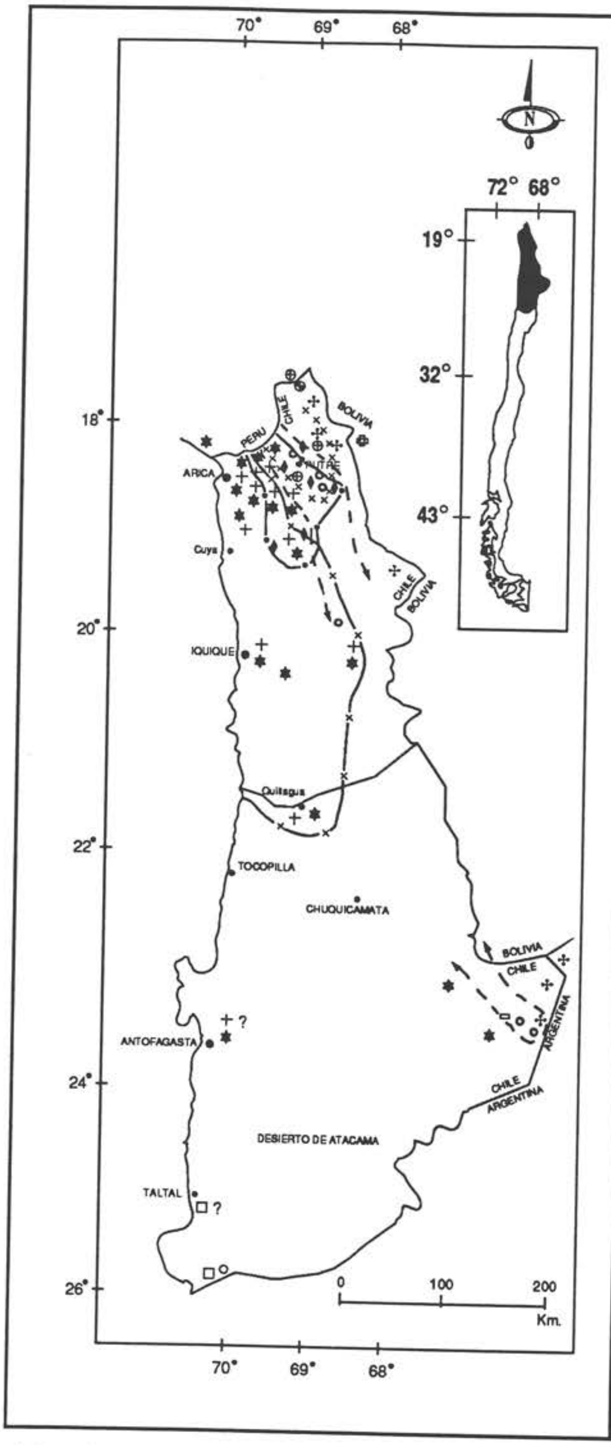


Fig. H Polyommatine distributional Map for Tarapaca & Antofagasta ; Regions I & II.

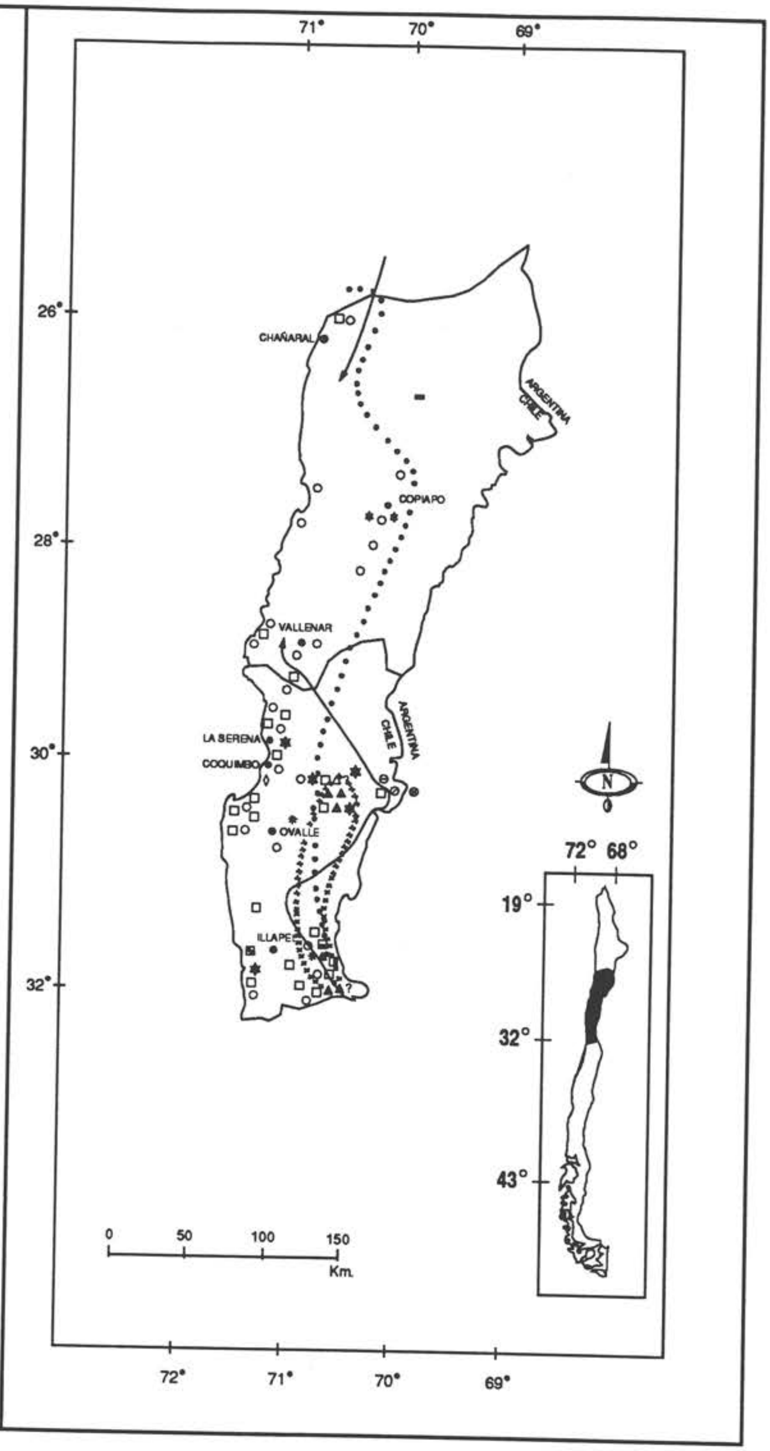


Fig. J Polyommatine distributional Map for Atacama & Coquimbo ; Regions III & IV.

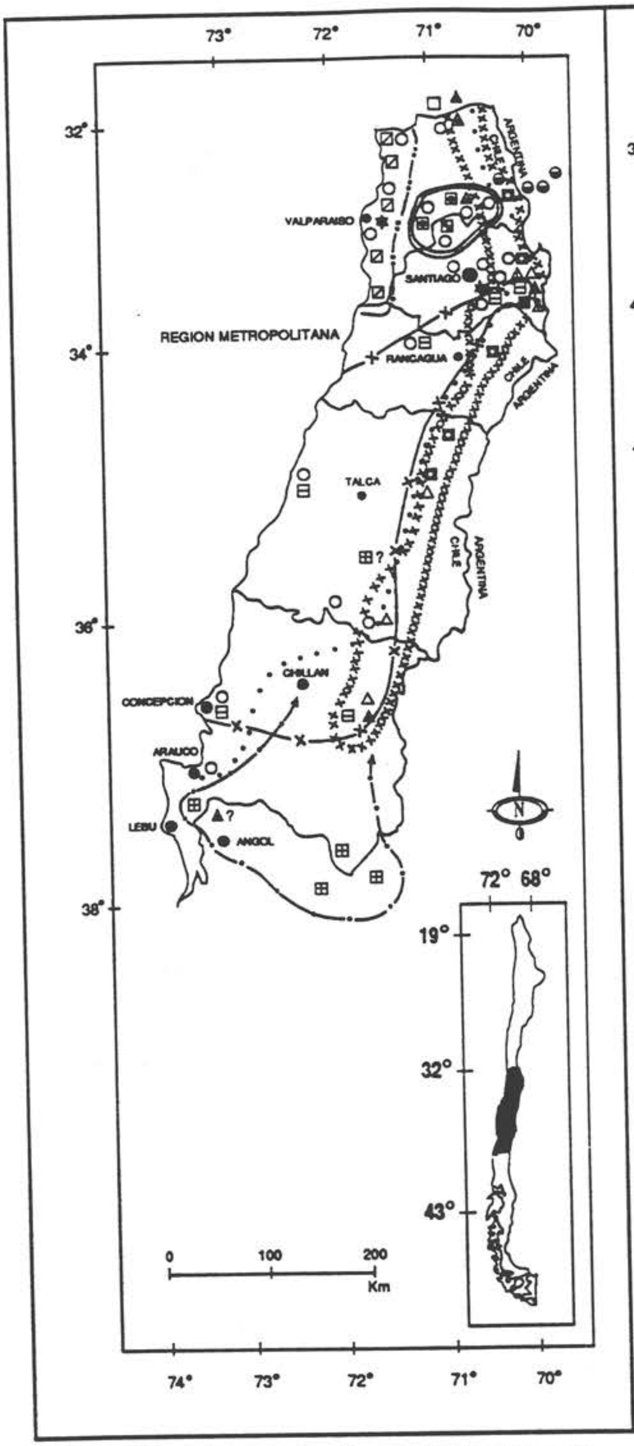


Fig. K Polyommatine Distributional Map for Valparaiso , Metropolitan Santiago , Rancagua , Maule and Bio-Bio; Regions V , VI , VII & VIII .

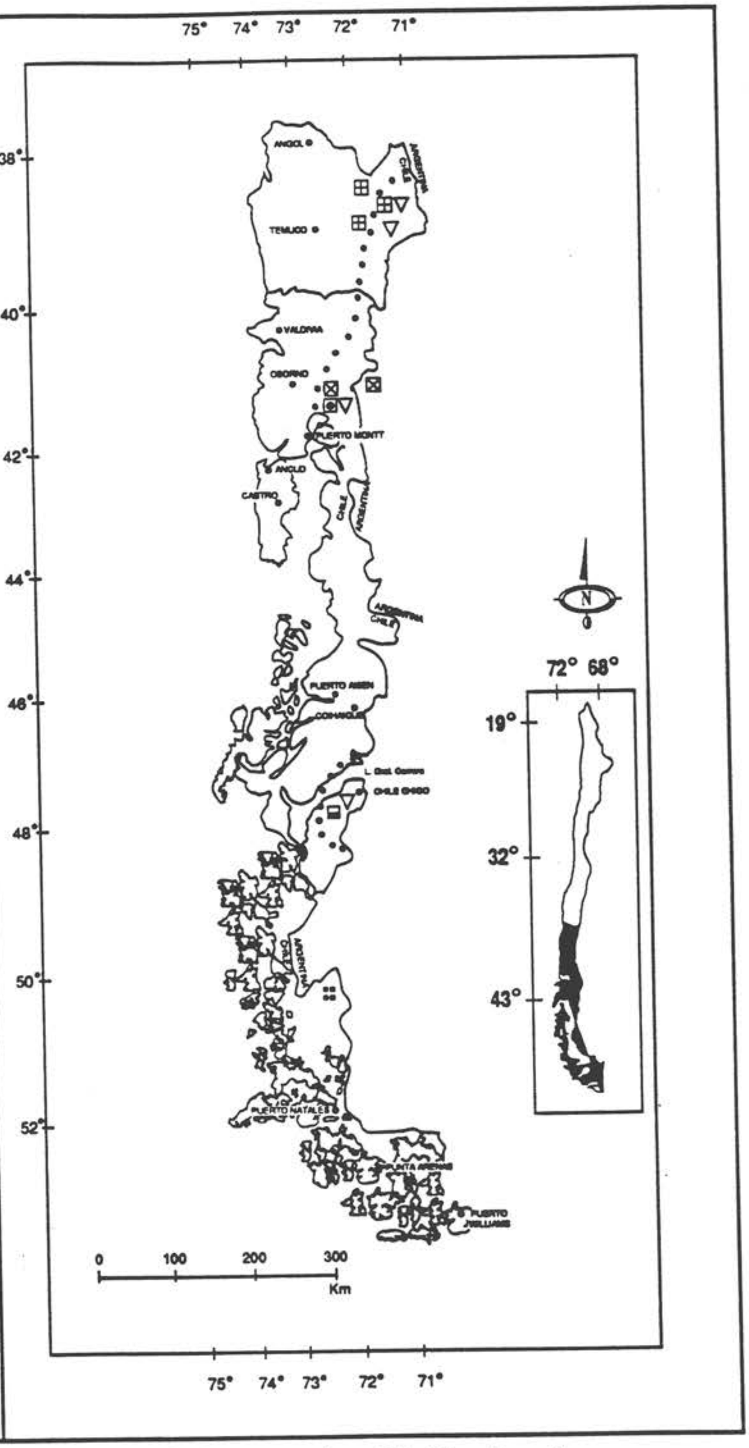


Fig. L Polyommatine Distributional Map for Araucania , Los Lagos , Aisen and Magallanes; Regions IX , X , XI & XII.

TABLE 10

Entomofaunal Regions for Chile Based on the Polyommatini

The Table has several functions. Firstly, Peña (1968) published a "preliminary" division of Chilean "Entomofaunal Regions" based on the Tenebrionidae (Coleoptera). Thus, a review here based on the Polyommatini (Lepidoptera) is of particular interest. There is significant similarity between regions defined by polyommatine endemism and phytogeographical boundaries. Concerning these and tenebrionids there is considerable congruence in the central and northern regions of Chile. However, current paucity of known polyommatine occurrences southward limits comparisons there (see entries 9, 10 and 11 below). Secondly, the Table allows a summary correlation of recognized Chilean ecological "zones", "belts" and "regions" with new data on endemic polyommatine and eumaeine Lycaenidae. (Color Photoplates VII-XIV [in List 1 see after page 8], as well as Photoplate III, picture many of the habitats listed below).

1. **The Northern Low Alpine Belt** (often called "Altiplano"). This belt, with its humid "Bofedales" is the habitat of *Itylos titicaca*, *Paralycaeides vapa*, and occasional *Madeleinea sigal*. It stretches along the Andes from the Peruvian Border at lat. 18°S (over 4000 m.), to the Antofagasta Mountains at lat. 24°S (over 3500 m.).

2. **The Puna Belt.** This belt lies between latitudes 18°S and 20°S (3000 to 4000 m.) and is the habitat of *Nabokovia faga*, *Madeleinea sigal*, *M. pelorias* & *M. ludicra*. Especially narrow, the biome receives "Bolivian Winter" rains in the Chilean Summer, causing a "tropical" period. Consequently, it has two annual "spring" seasons; the first, the normal one, in October-November and the second from February-March after and during the "Bolivian Winter". The biotope has a high plant diversity and coverage (Fig. A) and harbours at least four endemic species of lycaenids (Eumaeini) namely *Heoda* n. sp. (Benyamini and Johnson 1996), *Chlorostrymon larancagua*, *C. kuscheli* and *Abloxurina muela* (see Benyamini and Johnson 1996).

3. **Atacama oasis-like wet "quebradas".** These lie mainly along the east-west evergreen watercourses and are the habitat of *Hemiargus ramon* and *Leptotes trigemmatus* within the absolute Atacama Desert. These "quebradas" harbour three more Theclinae— *Ministrymon azia*, *M. quebradivaga* and *Strymon davara*. Along the Atacama Coast at Pan de Azucar National Park (Lat. 26°S) are the northern distributional limits of *Pseudolucia chilensis* and *P.* "*collina*" together with that of the uniquely marked thecline *Heoda wagenknechti*.

4. **The Circum-Atacama Zone.** This "zone" has a mean annual rainfall of less than 25 mm. and is characterized by *Pseudolucia aureliana*, flying at 1600 m. about 100 km. north of Copiapo. In Rio Copiapo, at about 200 m., *Leptotes trigemmatus* and *Pseudolucia chilensis* also occur; this biotope is similar to zone 3. (the "Atacama Oasis" just above). In Tumbre, in the Antofagasta Mountains (ca. 3500 m.), the biotope of *Pseudolucia oligocyanea* also occurs. *P. aureliana* and *P. oligocyanea* appear to represent dwindling relict faunas that can be considered highly endangered due to the millenial drying of the region.

5. **The Coquimbian Low Alpine Zone.** Two closely related species inhabit the low alpine and alpine environs that charactrerized this zone, extending up to the edge of existing vegetation. *Pseudolucia sibylla* and *P. penai* live on the the spiny cushion-like *Adesmia* along the Chilean edge of the continental divide. On the eastern side of Paso del Agua Negra, in Argentina, similar habitats are occupied by *Pseudolucia talia*, using the same *Adesmia* foodplants. Only a few kilometers along the top of the Andes separate these Chilean and Argentine populations, yet each of their wing markings and morphologies are distinct— strong evidence of the invisible "Cross-Andean Barrier".

6. **Circum-Mediterranean Belts of the Precordillera.** These environs are situated between latitudes 30°S and + 37°S and elevations of 1500 to 2800 m., in the north, to 800 to 1300 m. in the south. These are transitional zones occurring between Mediterranean environs and desert bushland at latitudes 29°30'S to 31°, and between Mediterranean belts and subalpine environs south of latitude 31°S. These belts harbour no less than fourteen species of Polyommatini (45% of the known Chilean fauna) and constitute the richest Chilean habitat for the tribe. Most of the species are found in the Coquimbo, Valparaíso and Metropolitan Santiago Regions. This distribution can be easily understood for the following reasons: (a) the area's mild climate and considerable size appears to have persisted relatively intact since at least the Pleistocene, and (b) this stability is reflected by the occurrence of some 2000 plant species (in the Coquimbian Regi*ó*n) out of about 5500 in all of Chile (a remarkable 36% of the Chilean flora, see Fig. E). These factors appear to account for the high regional endemism among herbivorous insects. Today, however, very local populations of some species (*i.e. P. asafi*, *P. scintilla*, and *P. clarea*) are endangered by heavy livestock grazing and already appear to occur in only scattered, relict, colonies. There are only a few areas, like the remote Los Pelambres Valley (still with few herds of cattle and goats) where populations of *P. avishai*, for instance, still thrive. Ironically, contamination here of local rivers by the Los Pelambres Copper mine is contributing unintentionally to the conservation of this lycaenid as well as isolated populations of the a rare *Hypsochila* near *microdice* (Blanchard) (Benyamini, unpublished and in lit. to A.M. Shapiro).

Table 10 (continued)

7. **Coastal Mediterranean Zone.** This zone is situated between latitudes 29°, 30'S (North of La Serena) to about 38°S (south of Concepción) and appears to be the habitat of the little known *Nabokovia ada*, along with *Pseudolucia benyamini* and *P. chilensis*. South to latitude 34°S, *Pseudolucia lyrnessa* occurs along the coast and "replaces" *P. benyamini* on the same *Chorizanthe vaginata* foodplants (also reach here its southern limit of distribution). Given this latter situation the distinctive wing and morphological characters of the latter two *Pseudolucia* species are of great biogeographic interest.

8. **Central Mediterranean Isolate.** This isolate occurs at Cuesta la Dormida (700 to 1400 m.) on the southern slopes of the Cerro del Roble (2200 m.) (see Fig.B, point 16). Characteristic polyommatines of this zone include *Pseudolucia "charlotte"* (see below under entry 9), a new species near *andina* (see note in the *P. andina* entry of List 1) and *P. chilensis*. Other lycaenids sympatric and synchronic with local polyommatines include *Eiseliana bicolor*, *E. probabila*, *Heoda atacama*, *H. shapiroi* and *Strymon eurytulus*. Accordingly, this habitat harbours eight lycaenid species and is comparable only with the rich Alcohuez-Elqui Valley. The occurrence of *P. "charlotte"* in this enclave (see *P. charlotte* entry, List 1) along *E. probabila* and the n. sp. near *P. andina* suggests this small area is one of high local endemism (perhaps of a relict nature).

9. **Southern Volcanic Zone.** South of latitude 37°S, the Valdivian Forest becomes predominant. It is an area from which no lycaenids are currently known but which is rich in endemic pronophiline Satyrini. However, above timber line, on the slopes and tops of the surrounding mountains and volcanoes, low-lying *Adesmia*, *Astragalus* (Fabaceae) and *Montiopsis* (Portulacaceae) provide a unique habitat for *Pseudolucia grata*, *P. lanin*, true *P. charlotte* (this entity must soon be distinguished from the northern population at Cuesta la Dormida cited just above) and *P. tamara* (Puyehue Pass Chile-Argentina). Also occurring in these uplands is *Pseudolucia vera* in a southward extension to Parque Nacional Nahuelbuta (Lat. 37°45'S) and Linares in the VII Maule Región (Lat. 36'S). The bounderies of this Zone are approximately latitudes 37°S to 41°S (elevations 800 to 1500 m). Along the northern coasts of this region, where domestic activities of "clearing" land and forests have ensued, the eventual intrusion of *Pseudolucia chilensis* can be expected. Today, it already is found at latitude 37°15'S near Arauco, VIII Región de Bio-Bio, and it further expansion appears almost guaranteed.

10. **Chile Chico Zone.** This unique area is situated on the southern shores of the large General Carrera Lake, at latitude 46°30'S, and features a very specialized microclimate. It constitutes a relatively warm corner of Patagonia with more abundance occurrences of *Adesmia* and *Astragalus* foodplants than adjacent regions. Polyommatines occurring in this "zone" include *Pseudolucia grata* (Peña 1968 as "*P. plumbea grata*") and a n. sp. near *P. neuqueniensis*. Present also in this region is the remarkably colorful thecline *Heoda suprema* first disovered in Argentina by Dr. A. M. Shapiro and later in Chile by L. Peña. The occurrence of all of these species marks this specially "warm" enclave as one of potentially significant endemism. On February 11, 1995 the author visited to Pto. Ibañez and Levican, on the northern shore of Lake Grl. Carrera. Although no lycaenids were found it may have been too late in the season. However, discovery of the local foodplant of *Tatochila theodice* Boisduval (the abundant, sticky, *Adesmia boronoides* Hook f. [Benyamini in lit. to Dr. A.M. Shapiro]) occurred on this expedition.

11. **Magallanes Zone.** This area was visited on 2.1.1994 and 20.4.1995 without recording any lycaenid species. However, a local collection of a CONAF "ranger" in Parque Nacional Torres del Paine included pierids, nymphalids, satyrids and hesperiids. Important occurrences of lycaenids here are suggested by Dr. A. M. Shapiro's discovery of *Pseudolucia magellana* about 25 km. east of the ranger residence at Lago Azul. The population of *P. magellana* in La Ultima Esperanza district of the XII Región of the Magallanes in Chile (latitude 50°40'S) marks the known southern limit for polyommatines (and all lycaenids) in South America. However, the paucity of concerted collecting suggests surprises in the future should not be unexpected. Here, the natural habitat of poorly known *Pseudolucia patago* (Mabille) should be queried. It is supposed to inhabit the coasts of the Magellan Straits near Punta Arenas and presents a historical mystery as intriguing as that of the lost *Colias imperialis* Butler of Puerto del Hambre, Magallanes, only 50 km. south of Punta Arenas. The author searched all available Chilean collections for possible specimens of both species but found none. It is assumed that the late Prof. J. Herrera (Santiago), who worked for ten years at the Magallanes University in Punta Arenas also did not collect them. Had he found either of these little known butterflies he certainly would have brought the discovery to the attention of the entomological community.

***Pseudolucia magellana*, continued...** (LIST 1, *continued...*).

Adesmia species: *A. corymbosa* Clos, *A. boronoides* Hook f., *A. villosa* Hook f., *A. lotoides* Hook f., and *A. pumila* Hook f., (S.I. Nos. 28245-28249). As typical of members of the *andina*-Group, *P. magellana* appears to prefer *Astragalus* over the surrounding *Adesmia*. *A. patagonicus* is an ideal foodplant with its large inflated pods, not only to supply food (including the seeds) but protection from both the climate and local parasites. Further study should include examination of stones beneath this *Astragalus* species; these would normally be the location for dispausing larvae.

Taxonomic Note. Note that the published taxonomic name (*Report* No. 53) has preserved the Anglicized "Magellan" (as in "Magellanic Straits"). This was not this author's original intent and, consequently, the common usage of "magallan.." in some Spanish geography has already resulted in some unfortunate different spellings of this species name.

25. ***Pseudolucia sibylla* (Kirby, 1871)** (Photoplate VII, figs. 11, 12).

Habitat. This species was also described from Chile— as "*Lycaena endymion*" by Blanchard (in Gay) 1852 (its description & color fig. appears in Ureta 1949) but was an invalid homonym and later replaced by the name *sibylla*. The types (males only, Photoplate VII: 11,12) were collected in two localities: (1) along Rio La Laguna (3200 m. and up) on the main international road from La Serena (Chile) to San-Juan (Argentina), a locality easily accessible to early collectors; (2) at Baños del Toro located near the El Indio gold mine. These two localities (both consitututing the type locality until a lectotype is designated) are about 25 km. apart ("as the crow flies") in the same lower alpine vegetational belt with the same dominant species of cushion-like *Adesmia*. *Pseudolucia penai* (see entry below) was described from more recent material collected at Rio La Laguna. No lectotype has been designated for *L. endymion* although Bálint (1993) figured a syntype from the MNHN (Paris) (herein Photoplate VII: 11,12) whose label data said only "Coquimbo". *Pseudolucia penai* was described from a specimen that differed both in wing pattern and genitalia from another Peña specimen which Bálint identified in 1993 as typical of true *sibylla* (e.g. *endymion*) (K. Johnson, pers. comm.). Although this distinction was carefully made among the samples available in 1993, considering new specimens and biological data now available, the entire matter may deserve reconsideration along with designation of a lectotype for *L. endymion*. Concerning the latter, it would be helpful to be able to differentiate between syntypes from the two original syntypical localities (particularly if more than one species is involved). Thus, location of additional MNHN syntypes is important.

26. ***Pseudolucia penai* Bálint & Johnson, 1993** (Photoplate XIV, figs.1-13 & Photoplate XV).

Habitat. This species was described from the Rio La Laguna biotopes to which *Pseudolucia sybilla (e.g. Lycaena endymion* Blanchard) is also attributed. It flies in one annual brood from early November in the Puna belt (3000 m.) (Photoplate XIV: 1) to late January in the lower Alpine belt (4500 m.) on the upper edge of the existing vegetation (Photoplate XIV: 2). At this point *P. penai* occurs only 3 km. from the Argentine border. For some reason it does not cross this "invisible barrier" but, instead, is replaced in its usual biotope by a distinctive Argentine species *Pseudolucia talia*. On 3.12.94 the author visited upper Rio La Laguna and collected slopes above the lake. At 3000 m. near a "vega" to the right of the main access road, a few *P. penai* were nectaring on *Phacelia cumingii* (Benth.) A. Gray (Hydrophyllaceae). At 37.5 km from Juntas (3200 m.) a stop was made near shepherd's shelters where a small rivulet enters the Rio La Laguna; *P. penai* was also collected here, mud-puddling near horse droppings (Photoplate XIV: 6). However, a strong wind not only forced the adults to fly very low, some had been blown into the water along with a number of white moths (Photoplate XIV: 5). The foodplant is the cushion-like *Adesmia aeqiceras* Phil. (Photoplate XIV: 3) which are the dominant shrubs in the valley and upland to nearly 4000 m. These offered ample opportunity for rearing related collections.

Adult Behavior. This species can appear in rather large local colonies which move upland as the season matures. For instance, on a second trip to Rio la Laguna on 21.1.95 no adults were observed at 3200 m. (where they had been seen before) although a single fully mature larva was found at this original site. However, at intervals of 4000, 4200, and 4500 m. adults were congregating is larger and larger numbers, as if in a "hilltopping" behavior or, more unique to this case, an altitudinally "upward shift" (or "dispersion"). In these upland movements, adults fly very close to the ground (usually below 5 cm.), against the wind and then back as if in cycles. When they perch they do so on bare soil or on the patches of *Adesmia* they have reached. Here, males exhibit territorial behavior, sitting on the external edges of the plants or plant clusters and dashing out at passers-by. On dried foodplants the male will often occupy the edge of the "hole" created by the "dying back" of these older plants. Such gradually upland movements apparently serve to move the population to fresher vegetation as the uplands become warmer and more hospitable.

Life History. The eggs are typically lycaenid, white or greenish white, and laid under the leaves (5-8 cm. below the the main foliage or canopy of the plant (Photoplate XIV: 7). Above 4000 m., *P. penai* switches later in the season to *Adesmia echinus* K. Presl. (Photoplate XIV: 4) which hybridize in this area with *A. subterranea* Clos. These spiny, low, and cushion-like plants grow up to 4500 m. where they mark the upper vegetational limit and also the upper limit of lycaenid activity. The eggs are laid on the stems, close to the flower buds (much as in the close relative *P. talia* which uses the same foodplant across the divide in Argentina). The female walks on the stems, 8-10 cm. below the foliage canopy; here it is protected and can lay eggs without disturbance. Prior to hatching, the egg becomes gray. The young larvae eat a hole in the egg but do not consume the shell. L1 larva (observed at 4000 m.) were 1.0 mm. long, completely white or greenish-white, and with long "hairs". At 3200 m. 1L larvae were 1.2 mm. in length and brownish-green with the head capsule and true legs black. Two different manners of feeding were observed. At 3200 m. the young larvae opened "windows" in the leaves, consuming the mesophyll and leaving other tissues behind. One larva was observed eating a green stem while the rest of its body was protruding out into the air. At 4500 m. young larvae were seen consuming flower buds and flowers (Photoplate XIV: 8). L2-L3 larvae were mostly green with shorter white "hairs" than in the earlier instars. Some individuals were pinkish white. Fully grown larvae (Photoplate XIV: 11) were 8.5 mm. long, green, and covered with minute white spots; short "hairs" existed only on the periphery. The middorsal line was dark green, widening anteriorly and edged with white. Each segment had two white subdorsal diagonal streaks. The lateral line was narrow and white contrasting a brilliant black head

(LIST 1, ***continued...*****)**

capsule. No DNO was observed. The diapausing L5 prepupa was 6 mm. long and olive green. In the laboratory it made a loose silken net along the bottom wall of the rearing vial (Photoplate XIV: 12) and diapause initiated on 23.1.95 resulted in pupation on 10.11.95. The pupa was 5.0 mm. long, smooth, brown and without a silken girdle. It was connected to the side of the rearing vial by the desicated skin of the last moult and the entire pupae otherwise suspended in the air.

27. ***Pseudolucia aureliana* Bálint & Johnson, 1993** (Photoplate XI, fig. 38).

Habitat. The type locality of this interesting species (described by Bálint & Johnson 1993 from material of an AMNH expedition) was noted as "Atacama Reg., Huasco, 9km S. of Orodel Inca, 4 November 1992, 1600 hr., leg. Calvin Snyder". My first efforts to find the type locality in the vicinity of Huasco failed, but then from Mr. L. Peña I learned that "Orodel Inca" refers locally to Inca de Oro, a small gold miners village that is located 105 km. north northeast of Copiapo, Chile and 107 km. by road from coastal Chañaral (in the Región of Atacama, 26° 42'S & 70°W). Botanically, the area is described as "Matorral Desertico" (Villagran et al. 1981, 1982), a desert shrubland with annual mean rainfall of about .5" (Arroyo et al 1988). This location is only about 100 km. south of the Atacama absolute desert. The original description noted capture of the holotype among "18 inch high sagelike shrubs sporadically blooming along gravelly seasonal washes". From recent visits to the area, which is very dry, it is evident that water sources in this area are mainly from floods. A very similar situation exists in the Negev desert of southern Israel where infrequent annual floods support desert species like *Euchloe falloui*, *E. aeqyptiaca*, *E. charlonia*, *Zegris eupheme* (all Pieridae), and *Melitaea deserticola* (Nymphalidae) and *Plebejus pylaon philyi* (Polyommatini), that are feeding on annuals and perenials that in the driest years bloom only partially. During 1993-1995 there was no rain (and no floods) along the Atacama periphery. The area surrounding Copiapo is vast (covering 100 x 60 kms.). During the months of 8.93, 2.94, 9.94, 9.95, 10.94 and 10.95 the author travelled a wide circuit: from Rio Copiapo to Pto. Viejo on the Pacific coast north along the coast to Bahia Iglesia, Caldera, Chañaral and Parque Nacional Pan de Azucar, and then southeast to Diego de Almagro, Inca de Oro and back to Copiapo. During these visits the only polyommatines collected were *Pseudolucia chilensis* (8.93, Pan de Azucar; 10.94, Pto. Viejo; 10.95, 45 km. S. Inca de Oro) and *Leptotes trigemmatus* (Copiapo and Rio Copiapo, 9,10.94 & 95; Bahia Inglesa, 2.94). Efforts to locate perenials (Fabaceae) that might support an annual brood of *P. aureliana* ended with one clear possibility— *Adesmia argentea* Meyen.— located at 1700 m. at the type locality on 10.9.95. At locations like the type locality, without rain bushes of this species are reduced to about 40 cm. with few flowers or fruits. On 10.9.95, proceeding south on the the road from Inca de Oro 77 km. to Paipote, the gradual descent showed larger and larger stands of *A. argentea* (up to 1.20 m. high) with fully bloomed yellow flowers and fresh fruits. There was also high activity of Diptera, Coleoptera, lizands and birds around this plant, suggesting its wide usage in the desert foodweb at this locality. Thus, one might readily conclude that the plants noted by Calvin Snyder, collector of the holotype (who has told Dr. K. Johnson that such plants were the only things blooming among am otherwise totally desolate habitat) was *A. argentea*. However, search beneath many of these plants did not turn up any diapausing larvae. Considering this, there are two possibilities: either appearance of *P. aureliana* on *A. argentea* coincides with desert rain-related "blooms", or that the foodplant of *P. aureliana* is a different plant, possibly an annual. The possibilities might include a coastal fleshy *Adesmia littoralis* Burk. (with yellow flowers and green pods), the common "Chañar" *Geoffroea decorticans* (H. & A.) Burk., or a facultative species like *Montiopsis* (*Calandrinia*) *discolor* Schraund (Portulacaceae). If the latter were true, *P. aureliana* would not be of the *sibylla-argentina* cluster of *Pseudolucia* (*Adesmia* feeders) but of the *collina-lyrnessa* cluster (Polygonaceae-Portulacaceae feeders). Since the fresh holotype was collected in circumstances well-remembered by Calvin Snyder (he was, in fact, surprised to catch a "blue" in such a "desolate" area [pers. comm. to K. Johnson), one must assume *P. aureliana* is well adapted to its extremely dry cycles that attend its habitat, possibly spending years in pupal diapause and appearing only when there are times of sufficient rain. This is true *Battus archidamas* (Papilionidae) which the author reared from material collected in this desert area near Vallenar and fed with *Aristolochia chilensis*. Of eight pupae, four hatched after a year, two after two years, and the remaining are still in live pupae after three years.

28. ***Pseudolucia oligocyanea* (Ureta, 1956)** (Photoplate XI, fig. 37 & Photoplate III, fig. 7).

Habitat. This species was described by Ureta (1956) as "*Itylos endymion oligocyanea* ssp. n." from some 50 specimens collected by L. Peña at "Tumbre, Cordillera de Antofagasta 3700-4000 m." between 27.9.55 and 7.10.55. Mr. Luis Peña (1964, 1971) published some notes describing these collections from a three week long expedition to the areas were Chile, Argentina and Bolivia abutt. During this period he also discovered *Eiseliana rojasi* (described as "*Thecla rojasi*" by Ureta ["Ureta Rojas"], an action that led bibiographers to think that "Rojas" and "Ureta" (as authors of various publications) were two different people (Bridges 1988). Peña also discovered *Eiseliana flavaria*. Both these latter species are insular members of the clade including the more common Andean "elfin"-like strymoninid *Eiseliana punona* (Clench) (synonym, high Andean Argentine "*Eiseliana koehleri*", the type species of the genus). Among the other rare butterflies of this region discovered at that was the fast flying pierid *Hypsochila penai* (occurring up to 5200 m.). Mr. Peña recalled that *P. oligocyanea* was locally very common at "Tumbre", the vicinity of an Indian village called Talabre (3200 m.) on the Tropic of Capricorn some 190 km. east of Antofagasta across the Salar de Atacama. The area was reached by the author from San Pedro de Atacama, 10 km. south of Toconao by turning left on a narrow dirt road extending up to the Argentinian border en route to Salta. This is the upper part of the Puna and lower part of the Alpine vegetational belts (Fig. B), dominated near Talabre by *Opuntia berteri* a spiny, cushion-like, cactus. Proceeding toward Vn. Lascar and Laguna Lejia, a zone was entered with low bushes similar to the biotopes known for *Madeleinea sigal*, *M. pelorias*, *Heoda* n.sp. [Benyamini and Johnson 1996] and *N. faga* in Tarapacá's Putre-Zapahuira zone (see Benyamini and Johnson 1996). This area is initially dominated by *Baccharis* bushes which rapidly give way to the typical perenial *Stipa* grasses as one nears Laguna Lejia. First visits mid-July 1993 and early February 1994 were unsuccessful (July typically high and nearly freezing, February somewhat warmer but still very dry). A single *P. oligo-*

(LIST 1, *continued...*).

cyanea was observed northeast of Talabre (3300 m.). Reporting this to Mr. Peña, he commented that in the 1950's the area had been much greener and that an overall dry period appeared to have ensued the latter part of this Century. Also, this area is at the southern limit of the "Bolivian Winter region" where the Chilean summer rains are erratic and completely miss the area in some years. Considering this, *P. oligocyanea* should be looked for in the Puna belt which occurs between 3200-3800 m. from below Laguna Verde in the southwest corner of Bolivia, across Talabre and Socaire, to Salar de Talar near the Chile-Argentine border. It is suggested that the peak flight period is in the "second spring" of February-March-April soon after or even overlapping the Bolivian Winter rains. The paratypes were collected from September and October during the much drier "first spring". It is possible that *P. oligocyanea* may remain in diapause for more than a year, unlike most other *Pseudolucia*.

29. ***Pseudolucia argentina*** **Balletto, 1993** (Photoplate XIV, figs. 14-25 & Photoplate XV).
(synonyms *P. sirin* Bálint 1993 & *P. aconcagua* Bálint & Johnson 1993)

Habitat. This species inhabits the Central Cordillera de los Andes in the Aconcagua Región and occurs in one annual generation, from late November in lower Los Horcones, Parque Provincial Aconcagua, Mendoza Reg. Argentina (2750 m.) to mid-February near the international tunnel and on southern slope of Aconcagua above the first climbers camp at Confluenciaca (3500 m.) Unlike *Pseudolucia penai* and *P. talia* which are distinctive species on either side of the Continental Divide (Coquimbo-San Juan), *P. argentina* has been collected on both sides. However, the present author, on ten trips to the "Paso Bermejo" area never found the species flying on the Chilean side in spite of the vast "carpets" of flowering *Adesmia aegiceras* Phil., its foodplant on the Argentine side. Perhaps the "invisible barrier" is crossed by *P. argentina* at some other time of year, or broods on the Chilean side are not coincidental with those in Argentina.

Adult Behavior. On 1.1.95, the author collected on a sunny but windy day at Puente del Inca at the entrance to Qda. Los Horcones (2750 m.). Adult *P. argentina* were observed on their foodplant, and nearby *Convolvulus* and *Tropaeolum* leaves, as well as bare ground. The species preferred small ravines which were protected from the wind. Males were territorial, perching on the foodplant (Photoplate XIV: 15) or nearby *Convolvulus* (Photoplate XIV: 16) intercepting passing congeners or, on one occassion, *Yeramea lathonioides*. Males land first with closed wings, especially in strong wind, then rub their hindwings together; when the wind weakens they open their wings tot 45°. Although females also perch and rub their hindwings together, the behavior of the sexes differs when disturbed— males flying up and away, females dropping into the foodplant or to the ground. The latter behavior in females has also been noted in *P. talia* and *P. penai*.

Life History. Eggs were laid singly on the foodplant (on one occasion two empty eggs were found together). In 47% of cases studied (n=15), oviposition was close to flower buds or flowers (Photoplate XIV: 17), in 33% it was under the leaves, in 13% it was on the calyx (Photoplate XIV: 18), and 7% of the time on the fruit. The 1L larva is whitish green with long white "hairs". It does not eat the egg shell but feeds on the leaves, opening tiny translucent "windows" while eating the mesophyll and leaving the remaining tissues. Eventually, the larvae may burrow completely into a flower. The L2-L3 larvae are green with white "hairs", a green middorsal stripe edged in a dashlike fashion with white, three darker green subdorsal oblique dashes on each segment, and a white lateral line. The mature larvae measure up to 10 mm. and are velvetine green with tiny white spots throughout. There are only a few middorsal "hairs" and a few scattered around the head capsule and posterior terminus. The prepupa is first brown in color with a purplish tint and marked with white dots. In the laboratory it crawled beneath the paper at the bottom of the rearing vial, shortened to 6.5 mm. and entered diapause (lower Photoplate XIV: 24). Other larvae are pinkish white in color (Photoplate XIV: 23), well-camouflaged for feeding on the fruits. In diapause the larvae are orangish brown (upper Photoplate XIV: 24). A larva entering diapause on 1.2.95 pupated on 8.11.95 and on 15.11.95 emerged as a male. Pupae are about 5.5 mm. long, completely brown, smooth, and without a girdle. The pupae connected to the base of the rearing vial through the desicated skin of the last moult. The DNO is marked by a short dark transverse line edged by small white spots.

Myrmecophily. *Dorymyrmex tener* Mayr ants thrive at the base of the foodplant, including those from which larvae and eggs were collected. It is mostly likely that these are the attendant ants.

30. ***Pseudolucia talia*** **Benyamini, Bálint & Johnson, 1995** (Photoplate XI, figs. 1-19 & Photoplates XV, XVII).

Habitat. This species was discovered at Paso del Agua Negra in Argentina along the international road from San Juan to La Serena, Chile. In the region it may well enter Chile. It occurs in one annual generation from December (at 3350 m.) to late January (at 4380 m.). The first three known specimens, two males and one female were collected by the author at 4350 m., on 25.12.93 at 15:30 hrs. near milestone 370. Below, under Adult Behavior, some further comments on these collections are made. At the end of 1994 the pass was closed with ice, so on the 31.12.94 the author made his way on foot from the Argentine side. That day, the first specimen was observed at 3350 m., at the lower growing limit of *Adesmia*, just above the locality where Dr. A.M. Shapiro discovered *Colias flaveola* Blanchard in Argentina. At 3500 m. two individuals of *P. talia* were seen and, at 3650 m., a dry ravine along the left side of the road sheltered a large colony. In this protected environ the species was actively flying and also perching on *Adesmia echinus* K. Presl. (Photoplate XI: 3), on dry *Stipa* grass, on stones, or on the ground. Unlike the other high Andean *Pseudolucia*, *P. sibylla*, *P. penai* and *P. argentina*, the *P. talia* female has an orange patch on the DFW, very similar to that of *P. plumbea*. This makes them very distinctive in the field.

Adult Behavior. On 25.12.93, with a strong wind and 15°C temperatures at Paso del Agua Negra, the first individuals known of this species were flying very low and, with the elevation, collecting them was difficult. If perched on *Adesmia* cushions, or on the ground, neither sex would fly but only fall into the foliage and be untraceable. This behavior was noted for some time and it was observed that, even on open ground, instead of flying the species would simply run back under the spiny cover of the foodplant. The only way individuals could be caught on this day was to force them out of the foodplant cushions with the net handle. On 20.2.

(LIST 1, *continued...*).

1994 the area was visited again but no adults were seen. On 28.1.95 the pass was accessable from the border with Chile (4775 m.). Descending slightly, at 4450 m. one finds the upper limits of *Senecio volkmanii* var. *lejocarpus* Phil. and at 4400 m. the highest occurrence of *A. echinus*. Three male *P. talia* were observed at 4380 m. (Photoplate XI: 1) perching on the edges of the flowering cushions or around the "hole" that is created in these cushions when the plants "die back". Here, contrasting reports above from 25.12.93, adults were extremely active, flying at every movement of surrounding flies or wasps. The latter were flying directly into the *Adesmia* cushions as if to look for prey (possibly the lycaenid larvae). At 4350 m. near this site, flight activity continued until 16:15 hrs. The nectar source (other than the *Adesmia* flowers) was the prostrate *Junelia uniflora* (Phil.) Mold. (Verbenaceae) which as pink and white flowers. *Oxalis hypsophila* Phil. (Oxalidaceae) also occurs at this altitude but *Adesmia* is the dominant plant.

Life History. To date, oviposition has been observed on two different *Adesmia* species: in December (3200-3500 m.) on *A. aegiceras* Phil. and, in December-January (from 3650 m. to 4400 m.) on *A. echinus* Presl. It is suspected that the closely related *A. subterranea* Clos and *A. crassicaulis* Phil. may also be utilized as foodplants. As as has been discussed concerning *Pseudolucia* on the Chilean flank, there is a foodplant transition upland as the season matures, in fact, utilizing the same foodplant species as the latter taxa. The eggs are laid on the stems of *A. echinus* close to the margin between buds and flowers (Photoplate XI: 4). This is about 15-45 mm. below the spiny canopy of the plant. The young larvae do not consume the egg shell. At 3200 m. *A. aegiceras* was found defoliated and with the "windows" typifying polyommatine larval usage. Upon examination, larvae were found feeding on the flower buds, on flowers, and young fruits. In the first two instars the larvae are whitish green, covered with moderately long white "hairs" (Photoplate XI: 5,6). The head capsule is black and the true legs blackish-brown. The middorsal line is dark green with white margins; two oblique green dashes mark the flanks of each segment, with white dashes separating them; the lateral line is white, edged dorsally by a wide pinkish band that continues around the entire larva. This latter trait makes these larvae very distinctive. In the third instar (Photoplate XI: 7,8) the larvae are usually whitish orange or whitish pink and, on the third and fourth segment, there is a bold "wasp mark" which, by its combination of markings on these two segments outline the shape of a wasp with prominent wings. This distinctive mark is somewhat like that in the larvae of *P. plumbea* and *P. hazeorum*. In the 4L and 5L larvae there is an extreme dimorphism. In one, the larvae show what may be warning colors of bold black,white, red, yellow and pink (Photoplate XI: 9,10,11) in which the black "wasp mark" is extremely well marked. This is truly the most remarkable appearance among any Chilean polyommatine larvae. This morph and the others somewhat like it in *P. plumbea* and *P. hazeorum* (with populations no closer than 200 km.) may indicate a common ancestry. The second late instar morph in *P. talia* is a more common one which, instead of suggesting warning coloration, is cryptic. The larvae are almost homogenous whitish-orange, similar to the color of the *Adesmia* fruits. Photoplate XI: 12 shows such a larva photographed on a "wrong" background color, a green *Adesmia* fruit from a different foodplant. The "wasp mark" is almost totally missing and the honey gland only weakly marked. The fully grown larva is 10 mm. long. In the laboratory it crawled into a fold of paper, shrunk to about 6.5 mm. and entered diapause. At February conditions in Santiago, only one larva pupated. The pupa (Photoplate XI: 15) is about 6 mm. long and 1.5 mm. wide and light brown; it pupated at the bottom of the rearing vial in 19°C/24°C day/night conditions. The eyes, wing cases, thorax and abdomen are successively darker, starting about two weeks after pupation. It is interesting that an ichneumonid parasitic wasp (of the genus *Diadegma* [det. Dra. Dolly M. Lanfranco]) emerged from one of the diapausing "cryptic"-colored larvae (Photoplate XI: 16) while no parasites were noted in any of the larvae showing the possible "warning coloration". Unfortunately the only individual pupating at the laborabory died.

Myrmecophily. The DNO is well marked but attendant ants are not known yet.

31. *Madeleinea ludicra* (Weymer, 1890).

Habitat. This species was recorded from the vicinity of Volcan Tacora, on the border of Chile and Perú. The area was visited by the author twice. On 15.04.94 the Visviri area was visited but cold weather, rain, and hail did not allow any butterfly activity. On 05.11.94, a day after the Putre full eclipse, a trip was made to the southern foothills of Volcan Tacora and a climb made to about 4500 m. No Lycaenidae were observed and the only butterflies collected were two species of Pronophilini (Satyrini) and one *Hylephila* sp. (Hesperiidae). Near General Lagos, some 10 km. east of Volcan Tacora, *Phulia nymphula* Blanchard, a species of Pronophilini, and one specimen of the hesperid *Pyrqus limbata* Ersch. were collected. The vegetation on the southern slopes of Volcan Tacora is most interesting. In the foothills the dominants are the perenial *Stipa* grasses but amid these grasses is a shrub belt composed of the dominant *Polylepis tomentella* Wedd. (Rosaceae) which is reduced to no more than 2.5 meters high because of the strong winds. Among the shrubs are *Adesmia melanthes* Phil. (Fabaceae), *Chuquiraga spinosa* ssp. *rotundifolia* (Wedd). Ezcurra, *Parastrephia guadragularis* (Meyen) Cabr., *Baccharis* aff. *santelicis* Phil. and *Chersodoma jodopappa* (Sch. Bip.) Cabr. (all Asteraceae). This vegetational belt is similar to the Puna belt in the Putre-Zapahuira area of Tarapacá (see Benyamini and Johnson 1996) but the plant diversity and coverage are somewhat smaller and the altitudinal occurrence of the *Stipa* quite different. Considering the biome, it is likely that the foodplant of *M. ludicra* and the above-mentioned *Adesmia*. It is suggested that this region be visited in October and March (soon after the Bolivian winter) for best results.

32. *Madeleinea pelorias* (Weymer, 1890) (Photoplate XIV, figs. 26-29 & Photoplate XVII).

Habitat. This species is known from the distinctive Puna belt of northeast Chile in the Putre-Zapahuira zone at 3000-4000 m. (S Latitude circa 18°15'). The collection of L.Peña had one fresh male collected by G. Castillo; the data label read "Alcohuaz, Limari, Dec. 1993". This record, if true is a recent expansion of this species across the Atacama into the Coquimbo Región which is 800 km. to the south of the Cordillera Antofagasta. Other records are from the months of late September (Perú) and, in Chile, November, December, February and April, appearing to represent at least two annual broods. This corresponds to the bi-seasonal springs of the Chilean Puna and the aforementioned upland shift later in the season. The author first encountered this silvery, quick

PHOTOPLATES XV-XVIII

Four pages of scanning electron micrographs showing the eggs of various Neotropical Polyommatini

Format: Left to right (unless otherwise indicated in species labels in cases of additional views [e.g. usually a closer and less close view of the micropyle]): **left**, distance view of the egg on substrate (appropriate measures at bottom right); **center**, surface "lattice" of the egg (appropriate measures at bottom right); **right**, view of the micropyle (additional views provided for some species; appropriate measures at bottom right).

Order of Taxa

Photoplate XV

Pseudolucia chilensis
Pseudolucia andina

Photoplate XVI

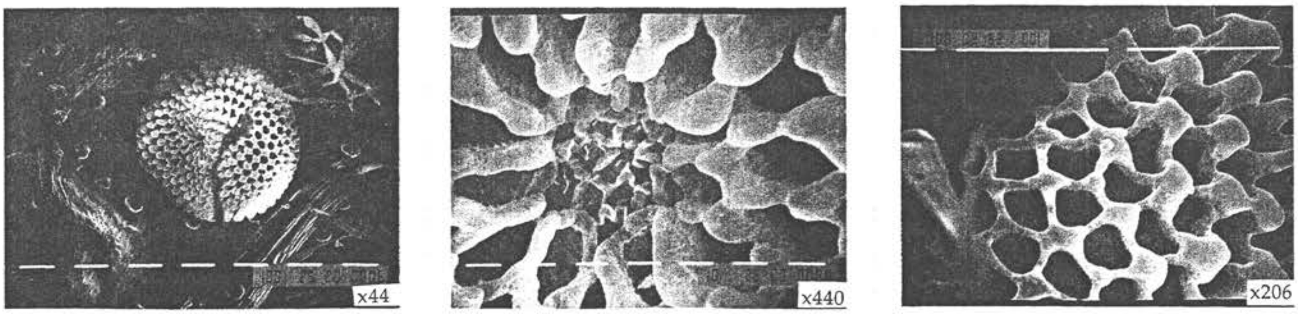
Pseudolucia vera
Madeleinea pelorias
Pseudolucia lanin
Pseudolucia penai
Pseudolucia argentina

Photoplate XVII

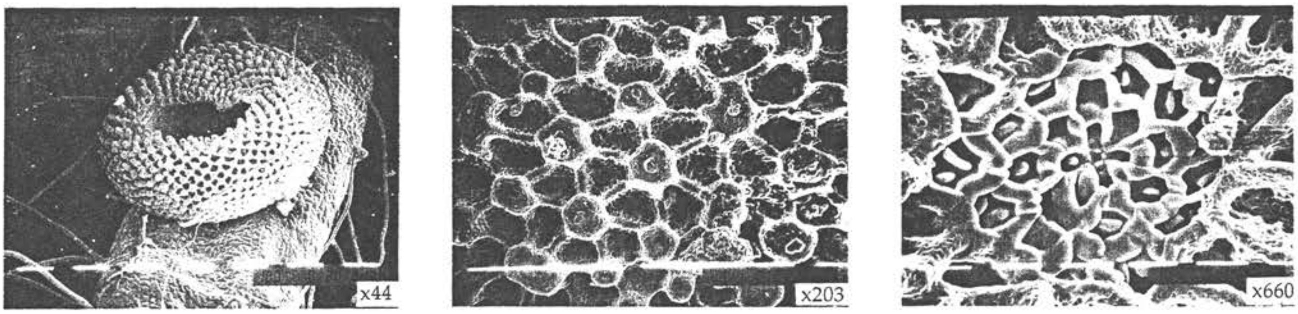
Pseudolucia benyamini
Pseudolucia avishai
Pseudolucia talia (1 & 2)

Photoplate XVIII

Nabokovia faga
Pseudolucia collina
Pseudolucia lyrnessa
Pseudolucia plumbea

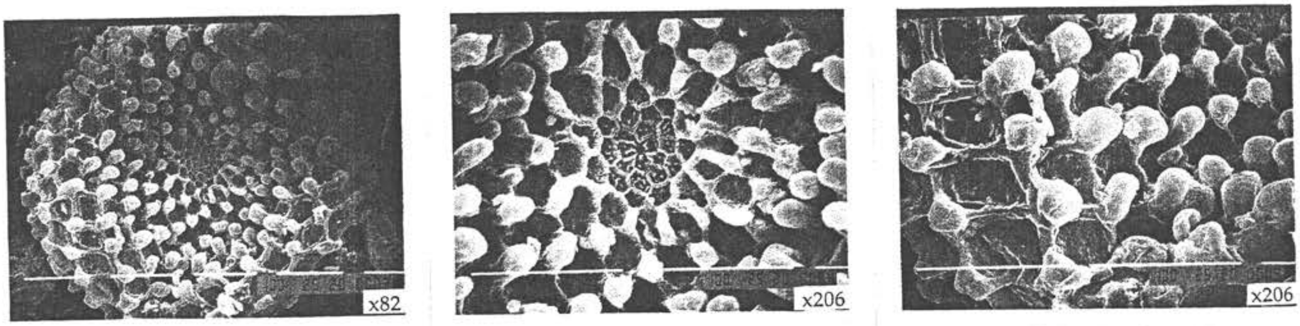


Pseudolucia chilensis ; Parque Nacional El Morado 2100 m, Santiago, Metropolitan Region

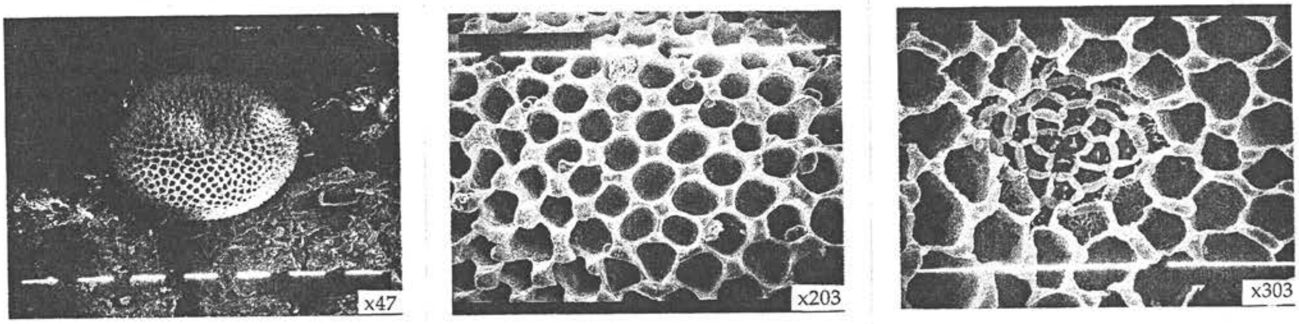


Pseudolucia andina ; Portillo, 3200 m, Los Andes, Valparaíso Region

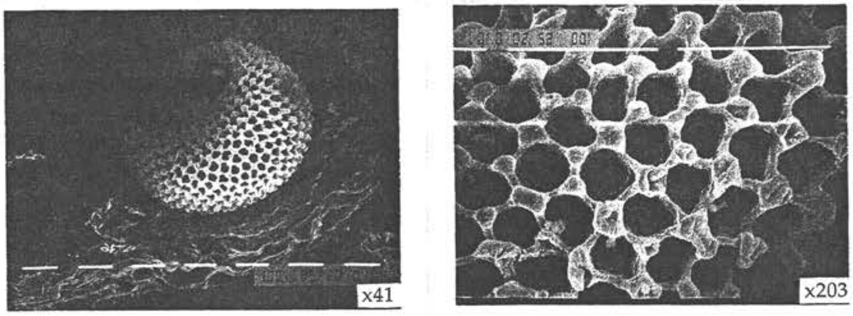
PHOTOPLATE XVI



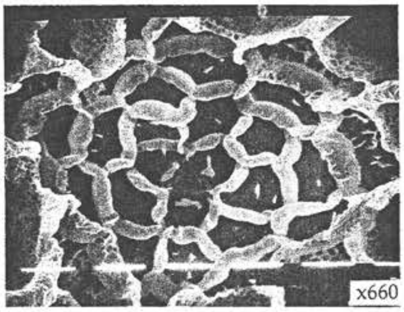
Pseudolucia vera ; Volcán Lonquimay 1100 m, La Araucania Region



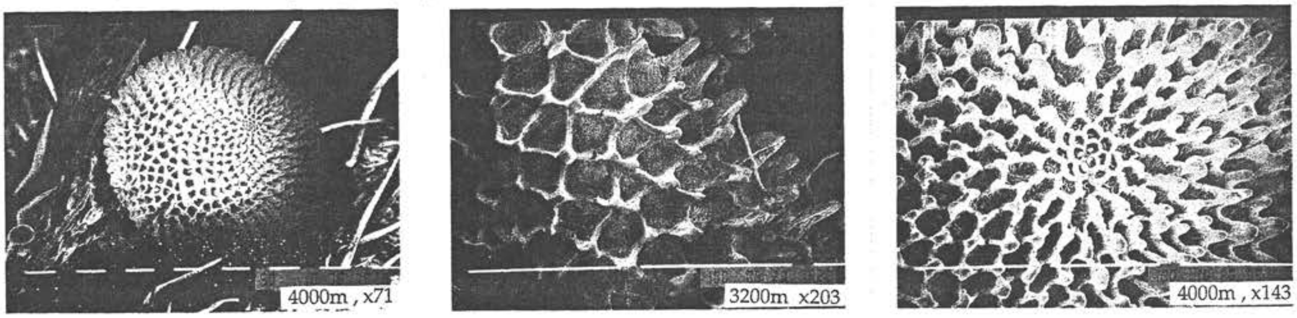
Madeleinea pelorias ; Zapahuira 3000 m , Arica, Tarapacá Region



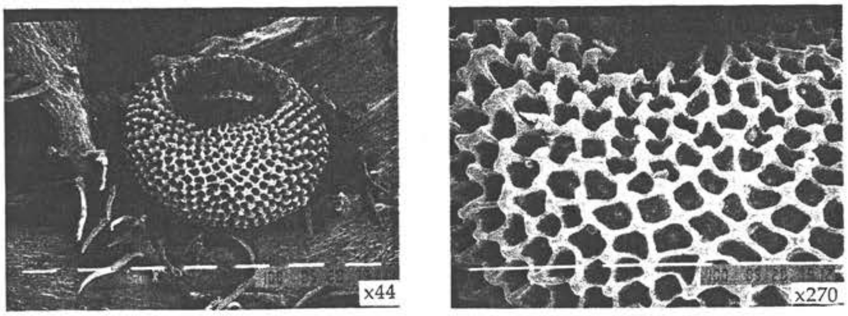
Pseudolucia lanin ; Volcán Antillanca 1300 m, Región de Los Lagos



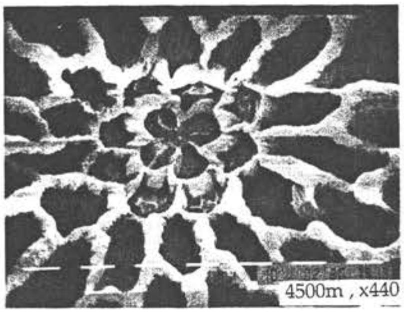
Madeleinea pelorias



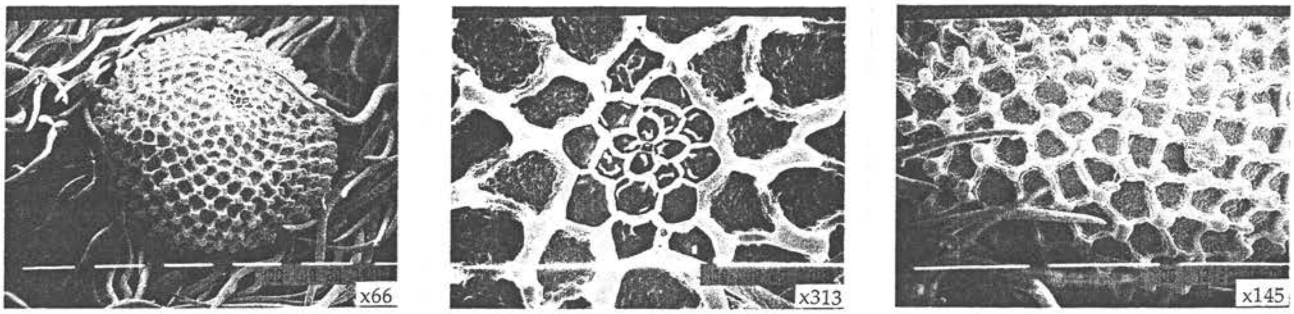
Pseudolucia penai ; Rio La Laguna 3200-4500 m, Elqui, Coquimbo Region



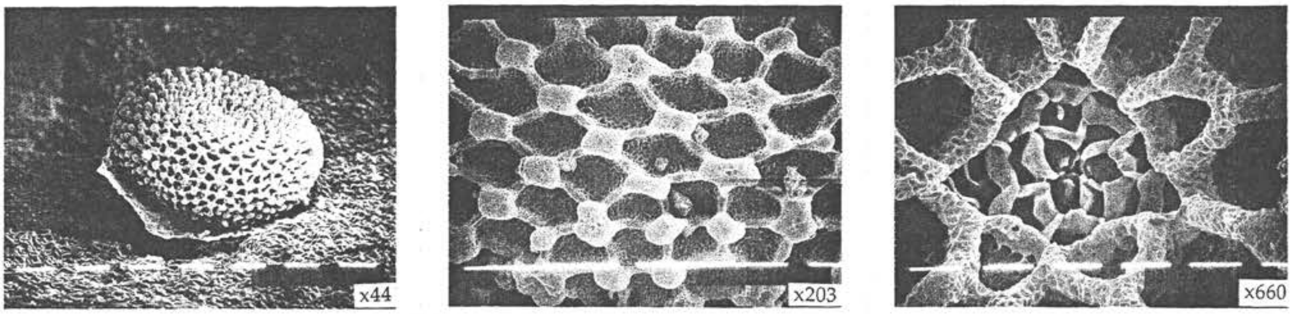
Pseudolucia argentina ; Los Horcones, 2750 m, Aconcagua, Mendoza, Argentina



Pseudolucia penai

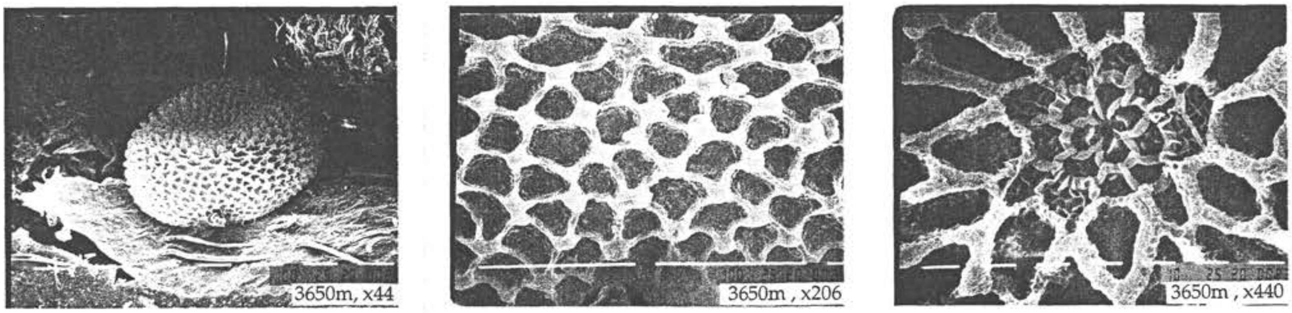


Pseudolucia benyamini ;Con Con (x 66, x 145) & Pichicuy (type locality), both sea level, Valparaíso Region

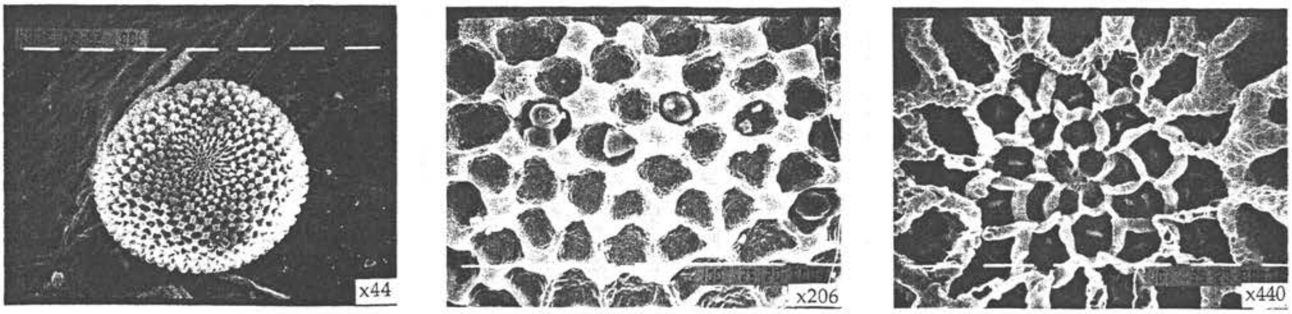


Pseudolucia avishai ; Los Pelambres 2600 m, Illapel, Coquimbo Region

Pseudolucia talia was analyzed from the type locality in relation to the elevational and foodplant usage segregations explored in entry 30 of List 1. Below are comparisons of the eggs from females at these extremes of the biotope.

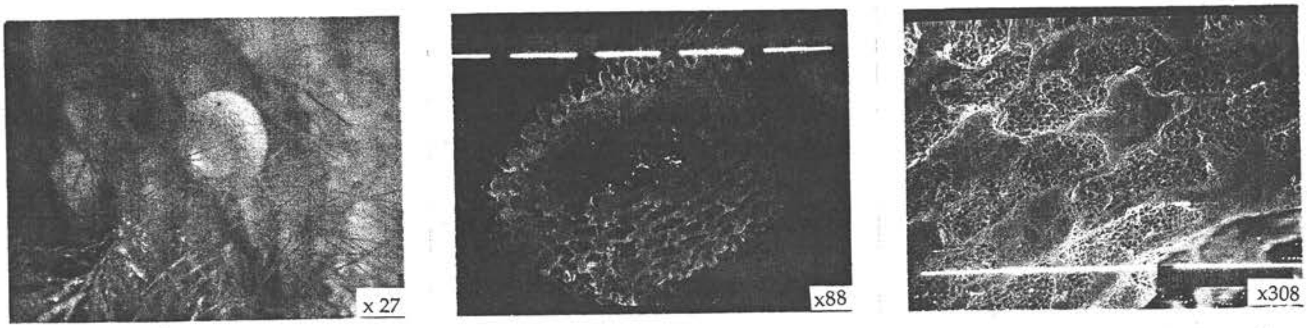


Pseudolucia talia ; Paso del Agua Negra, 3650 m, San Juan, Argentina

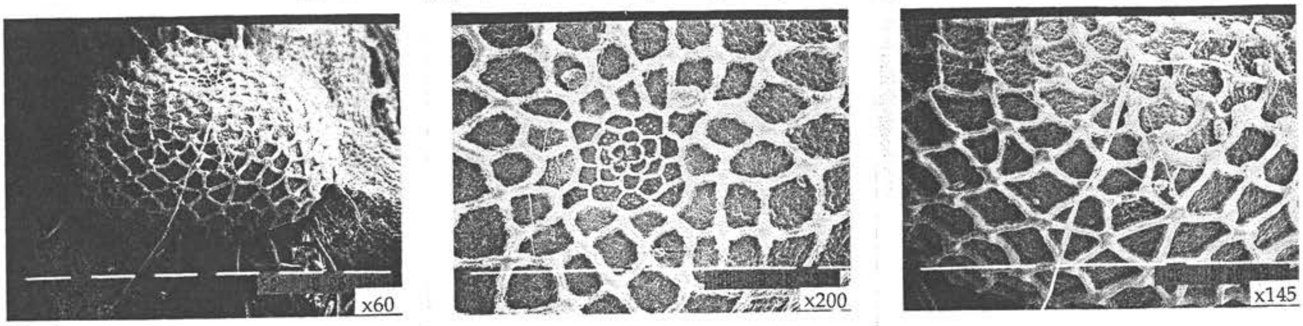


Pseudolucia talia ; Paso del Agua Negra 4350 m (Type locality), San Juan, Argentina

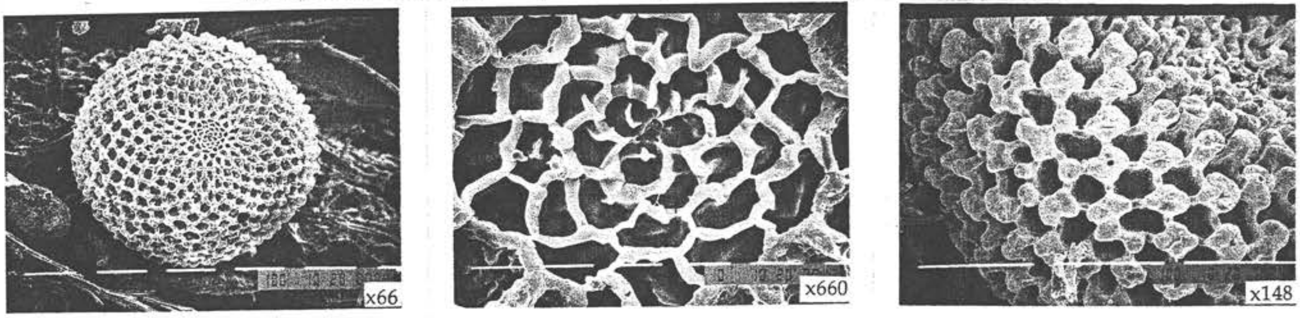
PHOTOPLATE XVIII



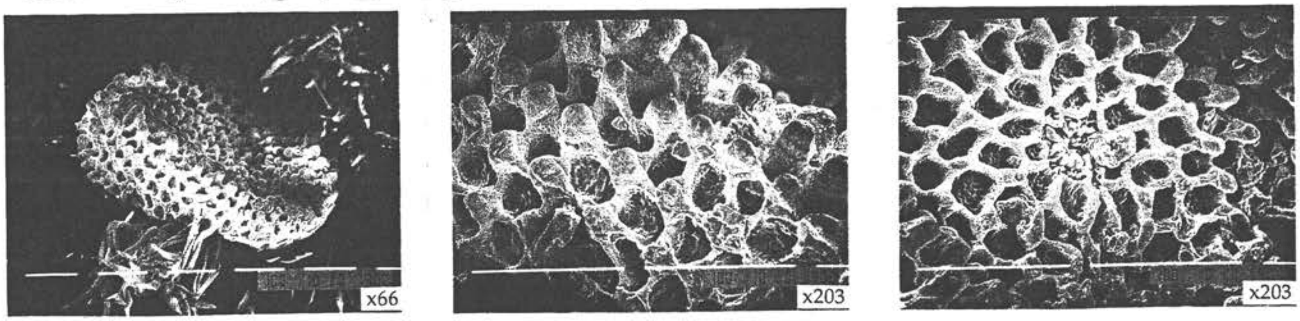
Nabokovia faga ; Putre 3400 m, Arica, Tarapacá Region



Pseudolucia collina ;Juntas, Rio La Laguna 2650 m., Coquimbo Region



Pseudolucia lyrnessa ; San José de Maipo 800 m & Parque Nacional El Morado 1800 m (x 148), Metrop. Region



Pseudolucia plumbea ; Parque Nacional El Morado, 2000 m, Santiago, Metropolitan Region

ERRATA: Due to final publication order of the Photoplates, two citations of Photoplate XV in LIST 1 (*Leptotes trigemmatus*, *Pseudolucia annamaria*) refer to Photoplate III (biotopes); citation of Photoplate XVIII for *Pseudolucia hazeorum* is an inadvertant error originating from an uncorrected typographical error in the Chilean diskette.

Madeleinea pelorias, continued (LIST 1, *continued...*).

flyer on 5.2.94 travelling eastwards from Arica to Chungará (Parque Nacional de Lauca). At about 10 km. before Zapahuíra, at 3000 m., there is a valley to the left of the road (Photoplate XIV: 26) well-marked by large *Baccharis* bushes. *Madeleinea pelorias* was not common but the adults were seen with *Nabokovia faga* around 60-80 cm. tall *Adesmia melanthes* Phil. bushes. The latter to 1.5 m. high in the wetter bottoms of the valley. On this day, the *Adesmia* had buds and flowers (Photoplate XIV: 27) but no fruits. The area 10 km. west of Zapahuira was visited again on 14.4.94 and only one individual of *M. pelorias* was observed; a return trip on 4.11.94 witnessed very dry conditions and no *Madeleinea* adults flying. However, typical of the upland dispersion common to polyommatine populations as the season matures, on 4.11.94 *M. pelorias* was collected near Putre at 3500 m. Also collected here were the newly discovered species *Madeleinea sigal* (see Benyamini, Bálint & Johnson, *Report* 47), *N. faga*, *A. muela*, the pierid *T. zelia*, nymphalids *Vanessa caryae* Hübner and *Junonia vestina livia* Fruhst., and hesperid *Hylephila isonira mima* Evans.

Adult Behavior. Males exhibited typical territorial behavior, perching on the taller *Atriplex imbricata* Moq. branches and flying out at other insects nearby. The flowers of *A. melanthes* and especially those of the weedy *Verbena hispida* R. et P. were used as nectar sources. Other species of butterflies observed at the site were: *Tericolias zelia kuscheli* Ureta and *Tatochila autodice ernestae* Herrera (Pieridae), *Abloxurina muela putreensis* Johnson (Lycaenidae, Theclinae) (these perching almost exclusively on the 1.5-2 m. high *Baccharis petiolata* large bushes) and the hesperiid *Pyrgus bochoris*.

Life History. The eggs are typically lycaenid, white and about 0.5 mm. in diameter. They are laid on the stems of *A. melanthes* close to newly grown buds and shoots (Photoplate XIV: 28). The species was reared while the author was travelling through Bolivia with limited results. The larvae fed on the *A. melanthes* flowers; occasional larvae (e.g. one 3L larvae on 11.2.94) fed on the buds. The 3L larvae weree olive green with a darker dorsal line which widens anteriorly and has white edges; the lateral line is white and but weakly marked. The larva had white dorsal posteriorly directed "hairs" and white hairs along the flanks. Lack of transportable foodplant prohibited further rearing.

33. *Madeleinea sigal* Benyamini, Bálint & Johnson, 1995 (Photoplate XIV, figs. 30-34).

Habitat. This species was discovered by the author on 16.04.94 about 10 km. southwest of Putre (Tarapacá, Chile), 3400 m., near the road to Arica (Photoplate XIV: 30). It was during the annual "second spring" and the day was sunny after a heavy night rain. The species was flying around rapidly but immediately drew notice as a unfamiliar morph, a suspicion confirmed when two females were collected while perching on a 60-80 cm. tall violet *Lupinus* sp. (suspected as the foodplant [Photoplate XIV: 31]). The biome is typical of the Puna habitat (as described in Benyamini and Johnson 1996) with high plant diversity and coverage (see Fig. A). This narrow Puna belt harbors a high butterfly diversity including, in addition to those species cited in the previous entry (32), *Tatochila autodice ernestae* Herrera and *Tericolias zelia kuscheli* Ureta (both Pieridae). Simultaneous with the discovery of *M. sigal*, a new species of Theclinae was also discovered (Benyamini and Johnson 1996). This locale was visited again on 05.11.94 but there was surprisingly little activity. However, on the way to the "Termas" of Huaras de Jurasi (at 3800 m. above Putre), the new *Madeleinea* was collected again on a flat "vega" (called a "Bofedal") typical of the Altiplano and the lower Alpine belt. Other butterflies observed here included *Itylos titicaca* Weymer (Lycaenidae), *Infraphulia ilyodes* Ureta (Pieridae), *Hylephila boulleti* Mabille, and *H. herrerai* (both Hesperiidae). On the same day another male of *M. sigal* was collected near Zapahuira (km. 100 from Arica) by a colleague. As it turned out, *M. sigal* had been collected before. In the collection of Mr. L. Peña was a female collected by him and by A. Ugarte near Parinacota (3300 m.) on 14.02.1994. The specimen had been put aside, however, in "undetermined" material. Once *M. sigal* was recognized as a new species it was also collected elsewhere. Dr. A.M. Shapiro collected one specimen near Parinacota, Chile, on 22.11.94; Dr. Zsolt Bálint and Dr. Gerardo Lamas collected one specimen on the northern slopes of Volcan Tacora on the Peruvian side in early February 1995. These records clearly indicate *M. sigal* has two annual broods (November and April). It is possible that the lower Alpine belt populations of *M. sigal* may also have a different foodplant.

34. *Madeleinea lea* Benyamini, Bálint & Johnson, 1995 (Photoplate XIII: fig. 35).

Habitat. This recently described species (see *Report* 47) was discovered by the author near Tiwanaku, Bolivia (4000 m.). Two fresh females were observed and then collected on 9.2.94. They were flying around *Astragalus* aff. *garbancillo* which is suspected as the foodplant. The type locality is hilly and the specimens were collected on a moderate slope where *Colias weberbaueri* Strand and *Tatochila distincta* Jorgensen were abundant. On 13.2.94 the author crossed the Cordillera Central, travelling to Cochabamba. The rain ceased a few kilometers after Pongo, where the road declines into wide turns. Stopping near a tiny corn field on a slope along the righthand side of the road, the first males of the species were collected while flying rapidly about a small, heavily vegetaged, ravine.

35. *Madeleinea moza* (Staudinger, 1894) (Photoplate XIII, fig. 37).

Habitat. This species was common on 1.1.93 in Uspallata (1900 m.), Mendoza Province, western Argentina, flying in a deserted agricultural area with *Colias lesbia* Fabricius and *Tatochila mercedis vanvolxemii* Capronnier. Both sexes of *M.moza* were flying around *Medicago sativa* L. and yellow flowering *Melilotus albus* Desr. The females seemed to prefer *Medicago*, landing on it with great frequency. This plant is thus suspected as a foodplant although search for eggs led only to location of pierid eggs typical of *C. lesbia*.

36. *Paralycaeides vapa* (Staudinger, 1894) (Photoplate XIV, figs. 35-38).

Habitat. This is the most common lycaenid in the Bolivian Altiplano (4000 m.). In early February, 1994, it was observed in wet meadows ("Bofedales") between Parque Nacional de Lauca in northeast Chile (4500 m. and Oruru in Bolivia (4000 m.). Some

(LIST 1, *concluded...*).

specimens that were collected in Cosapa where it flew with *Itylos titicaca*. This area directly borders Chile so the species can be confidently included in the Chilean fauna. The suspected foodplants, *Atragalus garbancillo* Cav. and *A.* aff. *arequipensis* Vogel (Photoplate XIV: 35) are common in northeastern Chile. In mid-February the species was abundant between La Paz and Copacabana on the Peruvian border (Batallas, Tiquina) flying everywhere with Colias *weberbaueri* Strand, in agricultural areas, and in Tiwanaku with *Madeleinea lea*. The individuals were seen perching on the ground or on plants with wings open at 45° (Photoplate XIV: 37). On 10.2.94, near Copacabana, two freshly emerged females were observed perching on a 60-70 cm. tall *Astragalus* with whitish violet flowers and vivid white edges (Photoplate XIV: 36) identified as belonging to the *A. garbancillo* group. At Copacabana, *M. vapa* was locally common and individuals were often seen in groups of 5-10 perched along single blades of *Stipa* grasses (suggesting a roosting behavior). In mid-February 1994, *M. vapa* was observed in the "Cordillera Central" of Bolivia along the road to Cochabamba. Compared to *I. titicaca* it appeared that *P. vapa* prefers more mesic biotopes. Also, its wide distribution suggests that it probably uses more than one foodplant. For instance, it is often observed in areas where *A. garbancillo* does not occur.

37. ***Leptotes cassius*** **(Cramer 1775)** (Photoplate II).

Habitat. This species have seen reported from Chile (Peña & Ugarte 1994-Mx), repeated in the present volume by Bálint and Johnson (*Report* 44). I have not seen any Chilean specimens in local Chilean collections or in the field. Regarding this widely distributed species, it seems the Andes are an efficient barrier since no records have ever been recorded from the higher Andes or Patagonia. Bálint & Lamas, who collected on the southern Peruvian Coast close to Chile, observed only *Leptotes trigemmatus* there. However, as Johnson and Miller (1992) noted, most of the old records for various xerophytic species entering northern Chile are from the 1800's (*e.g.* mostly from the British Museum and Oxford collections) and the majority attributed to Walker's early expeditions along the "xeric corridor" extending from coastal Ecuador to Arica, Chile. In mid-February 1994 *L. cassius* was collected by the author in agricultural areas and in gardens in southern Bolivia (on *Medicago sativa* L. its foodplant in Tupiza. 2950m, Potosi, Bolivia). It is also well known from xeric lowlands in northern Argentina (K. Johnson, pers. comm.). Thus, if *L. cassius* were to be found in Chile it would most likely represent either a population established along the xeric coastal corridor or, also possibly, an accidental agricultural transplantation.

DISCUSSION

Distributions and Zoogeography

Figures H, J, K & L (pp. 35-36) present the data accumulated in the field and supported by the following collections; National Natural History Museum Santiago de Chile; University of Concepción Dept. of Zoology (ex Wagenknecht Coll.); Metropolitan University, Santiago; the Peña/ Ugarte collection; American Museum of Natural History, The Natural History Museum (London); Field Museum of Natural History (Chicago, ex Peña collection); and the author's personal collection. These data are readily comparable, for overall reference and interest, to phytogeographic zones generally recognized for the region (Figures D and E, p. 31).

Table 10 (p. 37-38) summarizes the known polyommatine distributions into "Entomofaunal Regions" in a fashion comparable to that produced for the Coleoptera by Peña (1968). The data concerning the geography, ecology and climatology of these areas is contained in figures A-C. To a great degree, all the above data serves to amplify and complement the taxonomic data presented on Andean and austral Polyommatini in the various other *Reports* of this volume.

Biology of Chilean and Argentine Polyommatini

To conserve space and provide an evenly organized format, biological data has been summarized for 37 species of Andean and austral Polyommatini in "List 1" (pp. 3-44 [including interspersed colorplates and other, black and white Photoplates]). Each entry includes notes subtitled as Habitat, Adult Behavior, Life History and Myrmecophily as pertinent to available data. Many of the taxa treated therein are the subjects of taxonomic treatments elsewhere in the present volume. Photographs of habitats are included in the various colorplates (Photoplates VIII-XIV) and also as black and white Photoplate III. Ultrastructural accounts of the many larval samples collected in the present study was beyond the scope of this synopsis but it is hoped these data can be eventually elaborated and published. However, electron micrographs have been reproduced for a number of the studied species in Photoplates XV-XVIII.

Several aspects of the larval foodplant profile presented by South American Polyommatini studied to date have been summarized in Tables 2-7. The most pertinent observations are best summarized by stating that although the total number of polyommatine species in Chile is, except for Europe, close to the other areas analyzed, Chile shows extremely low numbers of families and genera of foodplants utilized. Even with adjustment for plant faunal size and geographic size (Tables 3, 4) Chile still shows strikingly low figures for polyommatine foodplant diversity. This may reflect the (a) relative montane and austral isolation of the region, (b) relative geologic youth and/or (c) possibly greater "catastrophic pressures" from the Quaternary glacials. In the Andean and austral regions Fabaceae is the most widely utilized larval foodplant while other usages are quite various; Interestingly, two out of six foodplant families utilized in Chile are recorded for polyommatine usage here for the first time. The usage of Cuscutaceae (documented herein for one of the most common South American polyommatines) has important implications as regards toxicity and mimicry. The same is true for the widespread documented usages of *Astragalus* species (Fabaceae). *Adesmia* is also shown to be a widely utilized genus (Fabaceae).

It is hoped that the present "Synopis" can serve as an underpinning for future work on the many intriguing implications suggested by these data.

Myrmecophily in the Chilean Polyommatini

Summarizing the known data from eighteen Polyommatini for which the entire life cycle is known, it is noted that seventeen species (94.4%) have dorsal nectaring organs (DNO's or honey glands) and it is assummed that all of these are functional. Only in *Pseudolucia penai* were these not apparent and, in this species, there also appeared to be no sign of association with ants. Unusually, four tentacle organs (TOs), two on each side, one behind the other, were noted in the larvae of *Nabokovia faga* compared to the "normal" two in the larvae of *P. chilensis*, *P. " charlotte"* [of List l, entry 18], *P. lanin* and so on. Table 8 summarized the ants species now known to be associated with the larvae of South American Polyommatini. Seven ant species of six different genera are involved and published here for the first time (see also Benyamini and Bálint, *Report* 51). Much work is still needed concerning the species having DNOs and/or TOs and for which the attending ants are still not known. However, it appears that not even one Chilean polyommatine has obligatory relations with ants.

It is interesting to compare these very high myrmecophilous figures to those reported elsewhere; Scott (1986) mentions association with ants for 13 species of the 30 North American Polyommatines ("only" 43.3%). In Europe, Chinery (1989) mentions 33 myrmecophilous species (out of 71 European Polyommatini). Since life histories were recorded for only 44 species, this suggests a total of 75% myrmecophily for the European Region (as defined in Tables 2-5). Benyamini (1990) registered 9 myrmecophilous Polyommatini for Israel. Of the 31 known Isreaeli polyommatine species the entire biology is known for 17, a 52.9% figure for myrmecophily. Considering these figures, the new data from Chile shows the highest rate of myrmecophily. The implications of this, in light of the other data of phytogeography and polyommatine diversity presented herein, are extremely interesting.

Apparent Mimicry Among South American Polyommatini and Other Lepidoptera

The occurrence of patches of dorsal orange among many species of smaller butterflies and moths flying in Andean and austral South American habitats has been generally known for a long time. Many field workers, or museum scientists looking at samples from the former, have suspected some kind of mimicry phenomenon. However, there has never been an underpinning for such a view. Thus, during the author's fieldwork in Chile there was a keen interest concerning this question. Many lycaenids in Chile have such orange, red-orange, or brownish orange markings on the dorsal fore- and/or hindwings, whether the rest of the ground be brown (as in Theclinae) or blue or grayish (in many Polyommatini). Their similar appearance is striking in the field where, in most of the lycaenid habitats up to about 2500 m. one always encounters "orange"-marked taxa. This phenomenon is more outstanding in Chile than in the Holarctic Realm and has caused considerable historical difficulties regarding species identifications. Indeed, knowing what we know today, it can be easily said that many of the undescribed lycaenid species from the high Andes and austral regions were simply overlooked because of the confusing external similarities, particularly prior to any interest in morphological work.

A host of orange and brown Polyommatini with simple "V"-shaped markings on the under surface show quite different basic female genital structures— the bifurcate structure of *P. collina*, the winged structures of the *plumbea*-Group (now with at least a half dozen distinctive species), the tubular structures of the *chilensis*-Group, and so on. The corroboration of the diversity in these groups by study of their life histories (as in the present *Report*) makes such diversity unquestionable. Likewise, in the Theclinae, some members of both *Eiseliana* and *Heoda* have orange upper surface patches (but otherwise differ generically) and have been harbingers of numerous additional species whose life histories are quite different when studied. For instance Johnson, Miller and Herrera predicted the biological reality of *Eiseliana probabila* (e.g. "probable"), a taxon originally collected by Dr. A. M. Shapiro, from differing genitalia and forewing androconial structures and, indeed, its life history is unique (Benyamini, in prep.).

The orange-brown appearance is not limited to the Lycaenidae; it also occurs in day flying moths of the Fidoniidae family (namely of the genus *Fidonia* Treits which are sympatric and synchronic with their look-alike lycaenids), and at least four species of the genus *Heterusia* Hope have orange and black or yellow and black markings. No less interesting is the appearance of reddish yellow patches, spots and other red markings in the Satyrini (Nymphalidae). This phenomenon is pronaunced between latitudes 26°S to 42°S and in Aisen Región around Chile Chico enclave at 47°S. These similar, almost dominant, colors in many biotopes has needed explanation.

A straightforward way to attack this problem has been to analyze in the field synchronous records among different biotopes and see if the inferences drawn from such data correspond with discoveries of toxic plant usage by any of the involved species. Such comparisons comprise Table 9 for eighteeen lycaenids, two genera of day flying moths, and certain Satyrids recorded from eighteen biotopes. The data point to the common occurrence of *P. chilensis* which (it is now no secret, given the data of List 1) feeds on toxic *Cuscuta* parasites of *Colliguaja odorifera* Mol. (Euphorbiaceae). In the northern Atacama and Antofagasta Regions *P. chilensis* flies with *Heoda wagenknechti* and *Pseudolucia col-*

lina. In the Central Coquimbian, Metropolitan and Valparaíso Regions it flys with no less than eighteen species that are listed in Table 9.

Of further interest, at middle elevations of 1000-2500 m. the orange coloration is mixed with blue in the females of *P. plumbea*, *P. zina* and *P. clarea* and the males of *P. clarea* and *P. charlotte*. It is also mixed with grey or silver in the females of *P. andina*, *P. avishai*, and *P. asafi* and in the males of *P. asafi*. In the southern Regions of Talca (VI), Bio-Bio (VII), Araucania (VIII), Los Lagos (IX) and Aisen (XI) it appears that fewer species are involved— decreasing and then ceasing with the southern distributional limit of *P. chilensis*.

Orange coloration rarely appears higher that 3000 m., out of the flight range of *P. chilensis*. The fact that orange-patched *P. talia* females fly above 3600 m. may suggest this species is of a more lowland origin. Also, at Rio la Laguna an orange *Heterusia* sp. flies with *P. penai* and *P. sibylla* that completely lack any orange coloration. Figure G schematically illustrates the diversity of orange-brown, orange-blue, orange-grey/silver and yellow-black species occurring sympatrically and synchronically as indicated in Table 9. In the Theclinae, two genera are involved with both males and females. *Eiseliana* is represented with two species (*E. bicolor* and *E. probabila*). A third species, *E. rojasi*, is completely brown but flies in the high mountains of Antofagasta out of the range of *P. chilensis*. Most *Heoda* species are orange-brown or golden-brown. Three are sympatric and synchronic with *P. chilensis*: *H. wagenknechti*, *H. atacama* and *H. shapiroi*. A new species (Benyamini and Johnson 1996) in the far Northern Tarapacá Región (golden brown) and *H. suprema* of the far Patagonian Aisen Región (red-orange patches) are also out of the range of known *P. chilensis*. It may be that the red-orange of *H. suprema* indicates a northern origin. This would parallel the fact that there are Chilean colonies of the brown *H. nivea*, sympatric with *P. chilensis*, that have no orange. These peripheral dispersions of *H. nivea* and *H. suprema* could postdate the evolution of the warning colors in their lineages.

The idea that *P. chilensis* is the model of a large mimicry ring became clearer with the discovery of its unusual parasitic and poisonous foodplant: the "Dodders". Muñoz *et al.* (1981 and pers. com.) and Horvat *et al.* (1973) verified its poisonous qualities to animals. Moreover, living on poisonous plants the Dodders are enriched by additiional poisonous chemicals (Wink and Whitte, 1993). Navas (1979) mentions the poisonous bush *Colliguaja odorifera* Mol. (Euphorbiaceae) as the host plant for *Cuscuta chilensis* Ker. in the vicinity of Santiago. The wide distribution of *P. chilensis*, its "safe" behavior (e.g. unabashedly flying in the open compared to behaviors of its congeners described hereafter), and its local abundance additionally support its identity as a model at the center of a mimicry ring. One can suggest its "dress" is so effective that the red-orange colors appearing in no some eighteen Chilean Pronophilini are probably also a part of this mimicry ring. In Cuesta la Dormida flies a small satyrid, *Homeonympha boisduvali* Blanchard, with wing span of 12-14 mm. It has large dorsal orange patches on all four wings. Its appearance early in the season (in September) is unusual but can be explained by the synchronous emergence of *P. chilensis* that is then abundant in the area.

Some other examples of satyrids with dorsal orange patches that are synchronous and sympatric with *P. chilensis* are: *Homeonympha vesagus* (Dobleday), *H. humilis* C and R. Felder, *Faunula patagonica* Mabille (in Chile Chico) *F. leucoglene* C. and R. Felder, *Neosatyrus ambiorix* Wallengren, *Neomaenas coenonymphina* Butler, *N. janiriodes* (Blanchard), *N. fractifascia* Butler, *N. inoranta* Elwes, *N. monachus* (Blanchard), *N. servilia* Wallengren, *Auca delessei* Herrera, *A. pales* (Phillipi) and *Nelia nemyroides* (Blanchard).

Additional support to the idea of a mimicry ring comes from lycaenid species that feed on *Astragalus* plants. These plants are locally known in South America as "Hierba Loca" or "crazy herbs [or grass]" and are known to cause death to animals. Williams and Gomes-Sosa (1986, table 1) indicated that *A. cruckshanksii* and *A. arnotianus* have the toxic Nitro compound 3-NPOH (3-nitro-1-propanol). Russell et al. (1991) found the alkaloids indolizidine Swainsonine in *A. pehuenches*. These three species of *Astragalus* are widely distributed in central Chile. The following species were reared by the author on *Astragalus*: *Heoda atacama*, *Pseudolucia andina*, *P. avishai*, *P. asafi* and *P.* sp.n. near *andina*. Other suspected *Astragalus* feeders are *Eiseliana bicolor*, *E. probabila*, *Heoda shapiroi* and *H. suprema*. Their possible role in the mimicry ring is noted in Figure G by arrows pointing to the other documented toxic model, *P. chilensis*. Four look-alike Polyommatine species that appear to participate in the mimicry ring inhabit the same bottoms in the valley of Cuesta la Dormida at 1150 m., Chacabuco-San Felipe Province, Metropolitan Región; here, *Eiseliana bicolor* and *Pseudolucia* sp.n. near *andina* were observed laying eggs on the toxic *Astragalus berterianus* (Moris) Reiche. *Heoda shapiroi* was observed on the flowers and the stems of this *Astragalus* and is suspected as also feeding on this same plant. *Eiseliana probabila* was observed close to and flying about it. The *A. berterianus* is locally common and not consumed by goats, cows or horses. It is important to also note that two other species of *Astragalus* growing at mountain pass— *A.* aff. *limariensis* Muñoz and A. aff. *verticillatus* (Phil.) Reice— are also not consumed by livestock.

Cryptic Defense as Part of the Mimicry Ring

A fascinating phenomenon in the field appears adjunct to the orange warning color phenomenon. It involves the ventral cryptic appearance that the majority of the species included in Figure G also share. The operation of this cryptic pattern in defense became clear in the field in what could be called the "disappearing" behavior, a behavior it appears other austral and Andean field workers have been aware of but for which they have had no explanation. For instance, on 21.8.93 in Coliguay, Curacavi, Valparaíso (V) Region, the author was hopelessly trying to collect *H. shapiroi*. The adults were sitting on the bare soil of a gravel road and are very fast flyers, alert to almost any movement. On several occasions the net was quickly placed over an *H. shapiroi*, only to find, upon examination, that there was "nothing there". The author's sons had accompanied him and they reported, observing this, that the butterfly had, in fact, not flown away. This is when it was discovered that the missing butterfly was laying on its side, motionless, and nearly invisible, amid the gray and brown gravels of the road. Taken in by the motionless an attempt to pick up the insect only resulted in it suddenly darting away. This happened over and over again while collecting this species.

Once the above behavior was noted as possibly what is called, in insect behavioral studies, a "release pattern" (e.g. a certain repetitive behavior that is "released" by certain stimuli) it could be "tested" by "setting up" the conditions to induce it. The sudden attempt to net several other species of lycaenids, all polyommatines, also resulted in this "disappearing" behavior: *Pseudolucia collina*, *P. talia*, *P. argentina*, *P. penai* and *P. sibylla*. Variations on the theme included falling into the spiny cushions of *Adesmia* (among *Adesmia* feeders) and females thus avoiding aggressive males. The identity of this behavior as a distinct "released pattern" comes to mind because it so starkly contrasts the usual behavior of these lycaenids in the field before they are disturbed. Without disturbance (as oft-noted in List 1) most Polyommatini sit at first with closed wings, then rub their hindwings slowly and then, when apparently lacking any "danger" stimulus, finally open the wings to 45°.

Another aspect which must be mentioned concerning the "disappearing" behavior is the success of the ventral pattern in achieving camoflauge once the insect is laying motionless and sideways on the ground. The combination includes cryptic colors (gray, beige, brown, etc.) interrupted by a distinctive "V-shape" or "saw tooth" on the ventral hindwing. This character is shared by five Chilean *Pseudolucia* of the externally "*collina*-like" group (see external resemblance groupings of Bálint and Johnson 1993a): *P. collina*, *P. lyrnessa*, *P. benyamini*, *P. charlotte* and *P. vera*. Across the Andes there are Argentine taxa which also show this ventral patterning. This pattern character is not known in any polyommatine from the Holarctic Realm. Contrasting the round shape of the wing margins, the "ruptive" (term as used in discussions of protective coloration) effect of the "V"-like band, along with the cryptic coloration, is extremely effective. In addition, six members of the *andina*-Group of *Pseudolucia* have a more compressed, modified "V"-like band: *P. andina*, *P. avishai*, *P. asafi*, *P. magellana*, *P.* n.sp. near *neuqueniensis*, and *P.* n.sp. near *andina*. In these species the "V" is less lineal and more obviously comprised of spots. Whitish margins along the "V" also add further distraction to the eye. The day-flying moths of the Fidoniidae (genus *Heterusia*) also carry a "V"-shaped mark (Photoplate XIII: 38, 40) which occurs on both sides of their wings. Although their flight is more "fluttery" than polyommatines, they also perch on the bare ground and there display their cryptic patterns. In the *plumbea*-Group of *Pseudolucia* the "V"-shape is less developed, with only one "stem" of the "V" appearing as a straight dark line (along with some chevron-like "teeth" across the middle of the hindwing). Again, in this group, white margins break the continuity of this "half V" from the surrounding cryptic color.

On 22.11.92 at Parque Nacional El Morado between 1800 and 2000 m. members of all the above groups were observed simultaneously sitting on the ground (Photoplate XIII: 38). The following taxa were included: *P. andina*, *P. collina*, *P. plumbea* and *Heterusia barriosi* Ureta. The *Heterusia* (yellow-brown moths) were flying among the lycaenids and alighting with them on the ground with closed wings.

Also important to this consideration is review of the *Pseudolucia* species either not showing a "V"-shaped and cryptically colored ventral pattern or not sympatric with *P. chilensis*. These are summarized succinctly here: *P. oligocyanea* (flying hundreds of kilometers out of the range of *P. chilensis* and at higher elevations, it has a "V"-mark on the ventral hindwing but lacks any orange coloration; in its biotope (at Tumbre) it was rapid flyer which would fly away with the smallest disturbance); *P. aureliana* (like *P. chilensis* with radial, spotted, ventral pattern; regionally sympatric with *P. chilensis* but a insular desert local which may diapause more than one year); *P. sybilla*, *P. penai* and *P. argentina* (occurring in the Alpine belts and flying above the range of *P. chilensis*; the ventral hindwing in *P. argentina* is a weaker version of that seen in the *plumbea*-Group; *P. sybilla* and *P. penai* have "dappled" brown markings on the venter, comparable only to a diminished version of that in the *plumbea*-Group); *P. talia* (flying above and out of the range of *P. chilensis* and also with ventral appearance like the *plumbea*-Group; orange markings on the dorsal forewings of females may suggest lowland origin; remarkable warning-like color in the larvae make it a species of great interest).

The final observation relevant to the above considerations concerning mimicry is that, of all the *Pseudolucia*, only *P. chilensis* (the apparent model for the dorsal orange coloration) has the typically "spotted" ventral markings characteristic of Holarctic Polyommatini. It does not appear to have any "escape" or "disappearing" behaviors.

Conservation

No treatment concerning the "biology" of a group of organisms is complete without noting if these organisms are in danger. It is remarkable, and perhaps symptomatic of our times, that a group like the Chilean Polyommatini can elaborated in detail for the first time just as it is also discovered that their very habitats are being overrun by the demands of domestic grazing. Particularly in a region like Chile, full of montane and other "remote" areas, the lure of *unrestricted* grazing by cattles, horses, donkeys, sheep, goats, etc. makes even the most "isolated" habitats open to destruction. If any lesson was learned during the discoveries of the microhabitats of many of the lycaenid butterflies described herein it was that the habitats of each of them are on a collision course with unrestricted grazing. Sadly, one of the most noted habitats for collecting Chilean "blues" is where pollution of a local water course has inhibited the effects of grazing!

Better than words is a visit to the Coquimbo Región. Since 1992 only a few milimeters of annual rainfall has caused the vegetation to be dug up by the animals to the roots. Today, in many places, only Cacti, Eucalyptus, Pepper-trees and other plants remnant of habitat destruction exist. Goats and other animals that "short-graze" abound; trucks and new roads have allowed livestock owners to transport their herds to new localities which, hitherto, had escaped such destruction. This process is now pronounced in the highland pastures and slopes over 2000 m. where domestic livestock can be observed in the thousands.

Even the rare *Astragalus nelidae*, the foodplant of the Chilean endemic *Colias flaveola* (Benyamini, personal observation), formerly living at about 4000 m. in Paso del Agua Negra above Rio la Laguna, could not be found and *C. flaveola* is locally close to extiction. The herds eat both the palatable *Astragalus* species that serve as polyommatine foodplants as well as the cushion-like *Adesmia* which is the most prominent larval foodplant.

Visits to the type localities of species described only in the last few years witnessed similar destruction. In September and October, 1995, the Los Horcones type locality of *Pseudolucia argentina* (2750 m., near the entrance to Parque Provincial Aconcagua, Mendoza Province, Argentina) showed no evidence of the foodplant *Adesmia aegiceras* except for root remains where livestock had grazed. The terrible Argentinian Patagonian drought of 1994-1995 can only further contribute to this deteriorating situation.

The fragile biologies of the species treated in the present study should certainly suggest to Chilean and Argentine authorities and conservationists the need to close some areas to grazing. With present policies, even National Parks are open to grazing which is looked upon as both advantageous to the livestock industries and not harmful to the overall beauty of the parks.

In addition, scientific institutions in Chile and Argentina (which might take up the challenge of studying and preserving wildlife) have limited budgets and minimun stuff. They can hardly maintain the existing collections. The Concepción University has a good and healthy approach where Dr. José Artigas and Dr. Andrés Angulo are developing the Wagenknecht collection. The Peña/Ugarte collection in El Portezuelo near Colina/Santiago will be maintainded and developed according to the will of the late Luis Peña. His house, with its library, will serve as a museum for future research (conducted now by Agr. Ing. Alfredo Ugarte and Dr. Pedro Vidal). The national collection of the Santiago Natural History Museum at Quinta Normal is well maintained and preserves considerable old material. Such institutions clearly need larger budgets if they are to expand any activities or become active in habitat protection. The national forests corporation (CONAF), that is responsible for the wildlife in the National Parks, may be a vehicle for responsible expansion of conservation activities. However, until the respective governments take some action to expand both research and conservation, such activities will remain limited to the dedicated professionals and amateurs. However, one can hope that with significant amounts of data, like those contained in the present volume concerning "Neotropical Blues", some effort can be made to educate the governments on the dangers of overgrazing and other forms of habitat destruction.

Dedication and Acknowledgments

On the early morning of September 27, 1995 Luis E. Peña G. passed away at his home near Collina, Santiago, Chile. He had been a gracious host to the author for over two years and, in his later years, had seen the elaboration of many new species from Chile which he had originally discovered but lacked the facilities to taxonomically evaluate. He also came to see his desires for a Chilean butterfly book fulfilled. The author dedicates this article to his memory, with condolences to his family and best wishes to Alfredo Ugarte (his closest friend and collaborator) who is proceeding with "Lucho"'s entomological legacy including the Chilean butterfly book.

Coming to a new country on a different continent Señor Luis Peña ("Lucho") made available his house, time and vast experience. Without this help none of the results reported herein would have been gathered so quickly. Dr. Kurt Johnson of the American Museum of Natural History, New York, graciously coordinated this Chilean work with the

rest of the lepidopterist community. He first introduced me to Dr. Zsolt Bálint of the Hungarian National Museum of Natural History and, from that moment, all the available literature and scientific information was shared in true team work; Zsolt contributed identifications and comparisons with the European collections and types; Kurt disseminated specimens, dissections, and literature and examined and organized much of the field data in a manner which, despite language barriers, made preparation of this manuscript timely. In the field, for over 120,000 combined kilometers and hundreds of driving hours, the author enjoyed the company and help of his family. Lea, his wife, organized logistics for the expeditions; Avishai and Eran hiked and collected with the author; Talia and Sigal, despite young ages, were never uncooperative. Crediting their contributions with patronyms has been the least the author could do in appreciation. Not less important was the advice of scientific specialists. Plants identifications were made by Prof. Luis Faundez of Universidad de Chile Faculty of Forestry and Agronomy and Dra. Melica Muñoz the Manager of the Botanical Dept. at the Museo Nacional de Historia Natural, Santiago, Chile. The difficult Fabaceae genus was identified by the Instituto de Botanica Darwinion at Buenos Aires, Argentina; Dr. Edith Gomez-Sosa examined the *Astragalus* foodplants; Prof. Emilio G. Ulibarri did excellent determinations of the *Adesmia*. *Chorizanthe* (Polygonaceae) were determined by Prof. Otto Zöllner of the Catholic University of Valparaíso. Larval attendant ants were identified by Dr. Roy R. Snellilg of Los Angeles Museum of Natural History, Dr. Stefen Cover of the Museum of Comparative Zoology, Harvard University and Dr. David Smith of the Systematic Entomology Lab. USDA, who handled vast material. Parasitoid Ichneumonidae were identified by Dr. David Wahl of the American Entomological Institute, Gainesville, Florida and Dr. Dolly M. Lanfranco of Universidad Austral, Valdivia, Chile. Dr. Monty Wood of Agriculture Canada commented on the parasitic Tachinidae and Dr. H. Shima of Japan identified some of these to these the genera level. Visiting collections, assistance was provided by Mssrs. Philip Ackery and Campbell R. Smith (BMNH, London). Dr. Andres Angulo, Señoras M. Contreras & M. Rodriguez Garcia of Concepcion University, Chile, kindly prepared a list of all Polyommatini in their collection, including specimens collected by J. Herrera, E. Ureta, and R. Wagenknecht. In Santiago Dr. Ariel Camousseight and Señor Mario Elgueta of the Entomology Section in the Museo Nacional de Historia Natural, Santiago, kindly assisted during visits. Señor Alfredo Ugarte, the close collaborator of Mr. L. Peña, was always realy to help me find collections and localities. Señor Julio Videla and Señor Joaquin Martinez assisted with fine graphics. Additional figures were prepared by Señor Jose Luis Lara Duarte. Mr. Marius Kahana assisted with photographs and Dr. Leonid Shikmanter prepared the SEM micrographs. Lea prepared the intricate and time consuming schematics concerning the *P. chilensis* mimicry ring (Fig. G). Avishai Benyamini typed the manuscript. To all these persons and institutions the author is greatly indebted for their support. Last, for special note, the author benefited immensely from the close collaboration of Dr. Arthur M. Shapiro of the University of California at Davis and Dr. David G. Furth of the Department of Entomology, Smithsonian Institution, Washington. These specialists were always "on call" for any desired request and, during correspondence and meetings, were always willing to give me the good advice I needed. Dr. Shapiro visited Santiago and took particular interest in the work in the field. Laura Duffy and David Grossman of the Environmental Action Committee of the Brooklyn Society for Ethical Culture volunteered their time, through Dr. Johnson, to help with the preparation of the English version of this manuscript.

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Recently Discovered New Species of *Pseudolucia* Nabokov (Lepidoptera, Lycaenidae) from Austral South America

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ABSTRACT

Three recently discovered new species of *Pseudolucia* are described: *P. zina*, *P. asafi* and *P. magellana*, **new species**. *Pseudolucia zina* is a sister species of *P. plumbea* (Butler) and *P. hazeorum* Bálint and Johnson; *P. asafi* is one of several recently discovered sister species of *P. andina* (Bartlett-Calvert); *P. magellana* is an important biogeographic discovery, extending the range of the genus far southward to the Province Magallanes of Chile (biogeographically the Magellanic Interoceanic Biotic Province).

INTRODUCTION

As taxonomic evaluation of Neotropical polyommatine lycaenids has become more thorough, the genus *Pseudolucia* has proven far more diverse than ever suspected. The recognition of only two species at the time of the original description (Nabokov 1945) starkly contrasts some two dozen species known today. *Pseudolucia* was, in fact, so poorly elaborated that an essay concerning the Chilean butterfly fauna published in 1989 failed to even mention the generic name (Etcheverry 1989). Subsequently, however, elaboration of substantial material collected by Chilean lepidopterists L. Peña and J. Herrera resulted in the far larger numbers of taxa now attributed to the genus.

As the current volume concerning Neotropical polyommatines progressed new species of *Pseudolucia* continued to be discovered, particularly as new areas of Chile and Argentina were explored and life history studies initiated. This paper describes three of the most recently discovered new species of *Pseudolucia*. Each derives from the extensive fieldwork of the senior author which, since 1992, has been aimed at collection of life history data on the Chilean Lycaenidae.

METHODS AND MATERIALS

The paper follows methodology and format employed in previous works concerning *Pseudolucia* published by the junior authors (Bálint 1993; Bálint and Johnson 1993). As typical of these publications, a new name is derived from Nabokov's literary work— in this case his novel **The Gift**— suggested to us by Professor Stephen Parker (University of Kansas), editor of the journal **The Nabokovian.**

Taxonomic Descriptions

Pseudolucia zina Benyamini, Bálint and Johnson
NEW SPECIES

Photoplate VI,7; Figs. 1,4,6.

DIAGNOSIS. ***Wings***. Smaller than superficially very close congeners *P. plumbea* and *P. hazeorum*. DFW, DHW in males dull blue contrasting brightly checkered fringes, females also blue but with a succinct orange FW median patch. VHW closest to *P. hazeorum* but with HW band comparatively vague (elements appearing variously more or less pronounced depending on the specimen).

Morphology. Male and female genitalia with elements extremely diminutive, male with lateral genital valvae shape showing high Baird's Angulation and a pronounced terminal rostellum, aedeagus with conspicuously long suprazonal element. Female genitalia showing lateral shape of eighth tergite oblongate with an elongate and thin anteriorly directed apodeme; genital terminalia oviform with central tube large and wide (length equalling 2.5 times maximal diameter).

DESCRIPTION. ***Male***. DFW,DHW ground lustrous ceramic blue (Maerz and Paul 1950:Pl 36/K7), both wings with well marked black marginal border and finely checkered fringe. VFW centrally yellowish to beige, postmedian area spotted (more emphatically toward costa), submargin beige or very light brown. VHW ground mottled gray, medial band comprised of brown and tawny vague spots, limbal area mottled gray with small CuA1 spot in yellowish ground. FW length: 8.0 mm. (holotype), 8.0-9.0 mm. (paratypes, n=3). ***Female***. Similar to male on VHW, DFW and DHW mottled blue but VFW with distinctive suffusive orange medial patch. FW length: 8.0 mm. (allotype), 8.0 mm. (paratype). ***Male Genitalia***. Fig. 4. Genitalia with valvae shape elongate and with greatly produced at Baird's angulation and terminally hooked rostellum; aedeagus with conspicuously long suprazonal element (cca. equal length with subzonal part, Fig. 4). ***Female Tergal Morphology and Genitalia***. Figs. 1,6. *Sipc* of terminal tergite laterally oblongate with long, anteriorly directed, apodeme (Fig. 1). Genitalia with sclerotized terminalia robust and winged; central tube large, wings comparatively small, heavily sclerotized only basally (Fig. 6).

TYPES. Holotype male labelled "Emb. El Yeso, Stgo-Maipo, 13.Nov.'93, leg: L.Peña/A.Ugate", genitalia dissection 571, gen. prep. No. Bálint, deposited in HNHM; allotype female labelled as the holotype, genitalia dissection 572, gen. prep. No. Bálint, deposited in HNHM. *Paratypes*. 1 male and 1 female labelled as the primary type; 1 male labelled as "El Yeso, Cordillera, XII. 1993, leg: Peña/Ugarte"; all the paratypes are deposited in the private collection of Señor Luis Peña (Santiago, Chile).

DISTRIBUTION. ***Spatial***: samples known only from two localities situated in Santiago-Maipo, central Chile. ***Temporal***: the type specimens were collected in November and December.

REMARKS. The etymology for this species was suggested by Professor Stephen Parker, editor of **The Nabo**

kovian who noted (in litt. to Johnson), "In the listing you provided of previous such names, I was struck by the absence of Zina Mertz. Zina is, of course, the heroine of Nabokov's novel **The Gift**. The love shared between Fyodor (the hero) and Zina is unique in Nabokov's fiction. Zina is perhaps the closest Nabokov came to placing his own wife, Vera, into his fictions. In brief, Zina is the most ideal of all Nabokov's female characters." The use of this etymology is particularly fitting since Bálint and Johnson described *Pseudolucia vera* in 1993.

ETYMOLOGY. As noted above in Remarks, taken from the character Zina Mertz in Nabokov's novel, **The Gift**.

Pseudolucia asafi Benyamini, Bálint and Johnson NEW SPECIES

Photoplate VI,8; Figs. 2,5,7.

DIAGNOSIS. **Wings**. A large species (FW length to 13.5 mm.) easily recognized by overall brownish DFW,DHW with extensive basal and median orange suffusion; VHW with very narrow and jagged brown crescents forming a delicate VHW "V"-shaped band. Confusable only with worn *P. avishai* specimens on which DW basal and median suffusion is greyish blue and the VHW "V"-shaped band somewhat wider.

Morphology. Male genitalia with valvae typical of the *andina*-group but aedeagus more robust, with a heavily dentated sagum. Female morphology more similar to sister species *P. andina* but with wider sclerotized terminalia (cca. one-third entire length) and tergal apodeme longer.

DESCRIPTION. ***Male***. DFW, DHW ground ranging from lighter to darker brown with orange suffusion at FW base and submedial area and, on HW, across submedial area; fringe checkered. VFW ground generally tawny to beige, postmedial area marked emphatically with dark spots from cell CuA1 to the costa, each paralleled by brown submarginal crescents; VHW ground beige, marked with jagged brown chevrons reduced in width (compared to sisters *P. andina*, *P. neuqueniensis* and *P. avishai*) comprising medial "V"-like band. Postbasal intercellular spaces marked rather randomly with vestigial spots; limbal area with chevron-shaped markings; marginal cell CuA1 with brown chevron enclosing a large brown spot. FW length: 11.0 mm. (holotype); 11.0 mm. (paratypes). ***Female***. Confusingly similar to male on both DFW, DHW and VFW, VHW but with notably wider wing shape. FW length: 10.5 (allotype). ***Male Genitalia***. Fig. 5. Genitalia with valvae shape typical of the *andina*-group; aedeagus extremely long and slender with conspicuously short suprazonal portion (one-sixth of entire aedeagus length), sagum large but less sclerotized (Fig. 5). ***Female Tergal Morphology and Genitalia***. Figs. 2,7. *Sipc* of terminal tergite robust with a relatively long and pointed process (Fig. 2). Genitalia with elongate sclerotized terminalia (three times maximal width) in lateral view; central tube centrally narrowed with edges slightly curved in the dorso/ventral view but parallel in lateral view (Fig. 7).

TYPES. Holotype male, allotype female, both labelled "Chile, 20 km north of Caren Illapel, Coquimbo, 2800 m, 7.I.1995, leg. D. Benyamini"; gen. prep. No. 592 (holotype), 594 (allotype), Bálint, deposited in HNHM. *Paratypes*. Two males with the data of the primary types, deposited in the private collection of the senior author.

DISTRIBUTION. ***Spatial***: currently known only from the type data. ***Temporal***: currently known only from January.

REMARKS. This species was discovered during rearing experiments concerning *P. andina* and *P. avishai* conducted by the senior author. Detailed life history results of will be published by Benyamini in a separate paper.

ETYMOLOGY. Patronym for Asafi Benyamini, the younger son of the senior author.

Pseudolucia magellana Benyamini, Bálint and Johnson NEW SPECIES

Photoplate VI,9; Figs. 3,8.

DIAGNOSIS. ***Wings***. Like *P. andina*, a relatively small species (FW length 10.5 mm.) compared to sister taxa *P. avishai* and *P. asafi*. VHW with strongly marked jagged brown triangles comprising the submedial band; basal line, submedial spot CuA1 and cells Rs and Sc+R1 coalesce to add an interesting and peculiarly looking wavy pattern.

Morphology. Female most similar to sisters *P. avishai* and *P. asafi* but with genitalia far more robust (very widened throughout, relative to length, making the posterior and anterior triangulate elements visible within the terminalia nearly symmetrical); elongate and pointed tergal apodeme slightly curvate anally.

DESCRIPTION. ***Male***. Unknown. ***Female***. DFW, DHW ground bronze lustre (Maerz and Paul 1950: Pl16/E12) with a grayish shade; fringe checkered. VFW ground tawny, postmedial area marked emphatically with dark spots from cell CuA1 to the costa, each paralleled by brownish submarginal crescents; VHW ground beige, marked with large brown triangles in each cell comprising medial "V"-like band. Basal line, submedian spot cell 2A, cell Rs and Sc+R1 coalescent to form an additional wavy pattern. Postbasal intercellular spaces almost without pattern, only marginal cells CuA1 and CuA2 with brown chevron enclosing a large brown spot. FW length: 10.5 mm. (holotype).

Female Tergal Morphology and Genitalia. Figs. 3,8. *Sipc* of eighth tergite not so robust as in sister taxa and with a pointed and relatively long process which is slightly curvate anally (Fig. 3). Genitalia with sclerotized terminalia very produced, comprised of an oblong tube showing rounded corners in the lateral view. Central tube of terminalia apically widened in ventral view (one-half width of entire tubal length) with edges slightly curved in the dorso/ventral aspect but appearing generally parallel in the lateral view (Fig. 8).

TYPE. Holotype female labelled "Río Baquales, Torres de Puine, Magellanes, Chile, 2.XI.1994", leg. A. M. Shapiro; gen. prep. No. 591, Bálint", deposited in Museo Nacional de Historia Natural, Santiago, Chile.

DISTRIBUTION. ***Spatial***: currently known only from the type data. ***Temporal***: currently known only from November.

REMARKS. As noted in Discussion below, life history notes and/or color photographs of taxa described in the present paper are included in the senior author's contribution concerning the biology of various Chilean Polyommatini. The type specimen of *P. magellana* was collected by Dr. Arthur M. Shapiro (University of California, Davis) and given to the senior author for eventual identification in light of the present project on South American blues. The specimen was of extreme interest because it represented the first record of the genus (or, indeed, any polyommatine) from the southerly Magellanic Interoceanic Biotic Province of Chile (Davis 1986: 17). Its collection suggests it is not unrealistic to expect unique populations of Lycaenidae (both Polyommatini and Eumaeini) in more extreme austral regions of South America. Certainly, the painstaking search for additional lycaenid populations in these southerly regions is encouraged by this discovery. The butterfly fauna recognized from the Magellanic Interoceanic Biotic Province is small indeed, being limited mostly to certain typically austral *Tatochila* and *Colias* (Pieridae), vagile Nymphalidae (*Vanessa*) and certain Hesperiidae (*Hylephila*) and Satyrini (Nymphalidae: *Cosmosatyrus*) (Ureta 1963). The traditional literature for Chile does not include any Lycaenidae from the Magallanes and a major question of Dr. Shapiro in his Lepidoptera-oriented expeditions to the extreme southern areas of Argentina and Chile has been the southward extent of suitable habitat for Lycaenidae (including Polyommatini) (in litt. to Johnson). Johnson, Miller and Herrera (1992) described the new species *Heoda suprema* (Theclinae) (originally discovered by Shapiro) from the Aysen region of Chile, a southerly extreme for that subfamily. Thus, the discovery of *P. magellana* provides a kind of "trumpet call" that extremely austral occurrences in the Polyommatini are not out of the question. What is invited now is more thorough examination of the extent of habitat in these regions that could support populations of Lycaenidae.

ETYMOLOGY. Noun, used in apposition, signifying the region of the type locality (politically, the Province Magallanes in Chile, bioticallly, the Magellanic Interoceanic Biotic Province).

DISCUSSION

The significance of the taxa described herein lies both in the circumstances of their discovery and the sister relationships indicated by each. *Pseudolucia zina*, a clear sister of *P. plumbea* and the recently described *P. hazeorum*, reemphasizes the former confusion surrounding Butler's name prior to (1) clarification vis-a-vis type specimens and (2) demonstration that "V"-shaped ventral hindwing patterns in *Pseudolucia* (both as "lineal V's" and "spot-formed V's") cut across several clades of taxa with very different internal morphologies. Armed with this realization, both the incredible species diversity of *Pseudolucia* and its strong monophyletic underpinning (including diverse structural components) can be appreciated. With the recent discovery of *P. benyamini* Bálint and Johnson (linking the divergent bifurcate female genitalia of *P. collina* (Philippi) with the winged and tubular configurations of the rest of the genus) there can be much less doubt concerning the veracity of species diversity now attributed to the genus *and* its singular ancestry. Considering these new data, only the phylogenetic roots of *P. chilensis* (Blanchard [unfortunately the types species of *Pseudolucia*]) and its Brazilian sister *P. parana* may still be debatable among the species now placed within the genus.

Discovery of *P. asafi* further strengthens the view that another of the old names attributed to *Pseudolucia*, *andina* (Bartlett-Calvert), comprises (like *P. plumbea*) only one of a diverse complex of species in *Pseudolucia*. These members of the "*andina*-group" of *Pseudolucia* share structural innovations of the male valvae so peculiar that even Nabokov (1945) did not include them in the genus. Now that *P. asafi* and other sister species of *P. andina* are known, the peculiarly "closed" valve terminus of *andina sens. strict.* can be understood as only one a *number* of structural configurations in the *andina*-group, *including* terminally hooked structures more typical of the genus.

As noted under Remarks in the description of *P. magellana*, this latter species extends the range of *Pseudolucia* (and indeed the Polyommatini and Lycaenidae) much farther south in austral South America than formerly known. It will be important to see if this occurrence is, in fact, unusual or one of the many "iceberg tips" remaining among the sampling error problems typifying these lesser known families of butterflies. Certainly, with the results of the present volume on Neotropical "blue" butterflies and the publication of Peña's Chilean butterfly book there will be a renewed interest in the southerly extremes and biologies of butterfly populations in Chile and Argentina. To this end, the senior author has included these species in his color-illustrated discussion of various polyommatine life histories in the present volume.

Acknowledgements

The authors again thank Mr. L. Peña (Santiago, Chile) and Dr. Arthur M. Shapiro (University of California, Davis) for their contribution of important polyommatine specimens to this research.

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MORPHOLOGICAL FIGURES

(facing page, 5)

Figs. 1-3. Eighth tergite in certain *Pseudolucia* females. **1.** *P. zina*; **2.** *P. asafi*; **3.** *P. magellana.*

Figs. 4-5. Male genital aedeagus in two *Pseudolucia* taxa. **4.** *P. zina*; **5.** *P. asafi.*

Figs 6-8. Female genital terminalia in certain *Pseudolucia* taxa.

6. *P. zina*, ventral (top) and lateral (below) view; **7.** *P. asafi*, with everted ductus bursae in ventral view (left), without ductus bursae in lateral view (right); **8.** *P. magellana*, with everted ductus bursae in ventral view (left), without ductus bursae in lateral view (right).

ADULT FIGURES

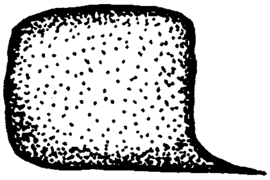
Dorsal and ventral views of males and females of these new species are included in Photoplate VI, as keyed in detail in its facing caption.

Pseudolucia zina **Benyamini, Bálint and Johnson**
Photoplate VI,7 (as therein noted).

Pseudolucia asafi **Benyamini, Bálint and Johnson**
Photoplate VI,8 (as therein noted).

Pseudolucia magellana **Benyamini, Bálint and Johnson**
Photoplate VI,9 (as therein noted).

Certain color aspects of these species are also included in the color plates accompanying the senior author's included contribution concerning the biologies of various Chilean Polyommatini (see captions to color plates therein).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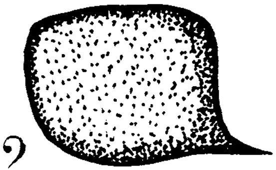
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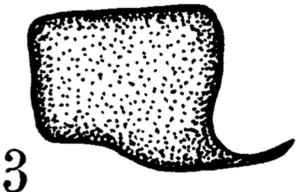
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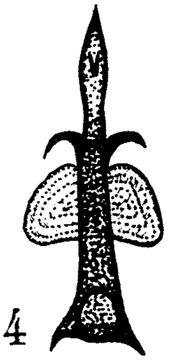
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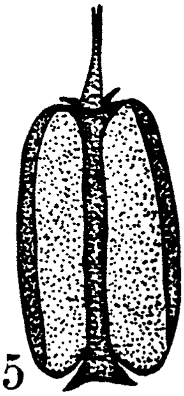
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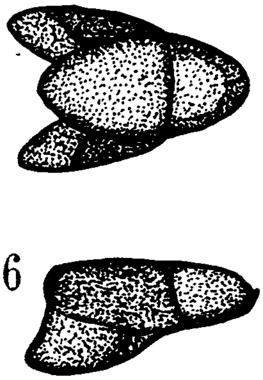
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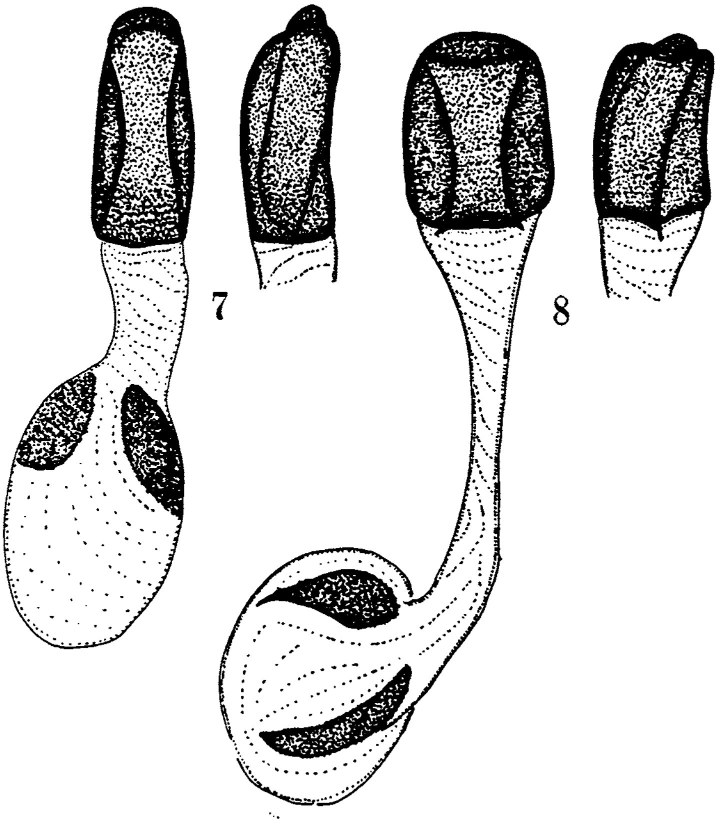

Distinction of *Pseudochrysops*, *Cyclargus*, *Echinargus* and *Hemiargus* in the Neotropical Polyommatini (Lepidoptera, Lycaenidae)

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ABSTRACT

The paper treats a persistent problem in synonymy among certain higher taxa of the Neotropical Polyommatini, particularly concerning members of the Caribbean fauna. Data presented correct the error, initiated by N. D. Riley, in 1975, considering *Cyclargus* Nabokov 1945 a synonym of *Hemiargus* Hübner [1818] (followed by many authors to the present day). Documentation is provided corroborating Nabokov's view of the monophyly of Caribbean *Cyclargus*, *Echinargus* and *Pseudochrysops* (all Nabokov 1945) and, expanding based on new data concerning Neotropical polyommatine diversity, defining a larger clade: *Cyclargus*, *Pseudochrysops* + *Eldoradina* Balletto 1993 (an autochthonous South American genus)/ *Echinargus* + *Nabokovia* Hemming 1960 (an autochthonous South American genus). These genera belong to the POLYOMMATUS SECTION of the Polyommatini (*sensu* Eliot 1973 as redefined, to include new groups, by Bálint and Johnson 1995). *Hemiargus* Hübner, the genus with which *Cyclargus* is often solely synonymized (especially in popular literature), is the sister group of *Itylos* Draudt (1921) and part of the GLAUCOPSYCHE SECTION of the Polyommatini (*sensu* Eliot 1973 as redefined, to include new groups, by Bálint and Johnson 1995).

Nabokov correctly differentiated *Cyclargus* from *Hemiargus* based on a consilience of male morphological features, a view supported by additional characters including those of the females. Riley's view that *Hemiargus* subsumed *Cyclargus* relied on shared catochrysopoid wing patterns and similar (analogous) spatial orientation among certain structures of male genital terminalia. Catochrysopoid wing patterns occur widely among worldwide Polyommatini genera, often with remarkable instances of similar pattern detail, across phylogenetically disparate taxa. Historically emphasized similarities between the male genitalia of *Cyclargus* and *Hemiargus* merely involve (1) analogous spatial orientation of structures at the valve terminus (the "open" terminal mentum and dorsally "free" terminal rostellum stressed as parallelisms by Nabokov) and (2) similarity of overall clasper shape between *Cyclargus*, *Hemiargus* and Holarctic *Plebeius* Kirby 1871 (the latter an archaic focus used by early taxonomists when comparing the Holarctic and Neotropical polyommatine faunas).

At the generic level, Nabokov correctly recognized the monophyly of *Cyclargus*, *Echinargus* and *Pseudochrysops*. He errored only in omitting reference to the larger monophyly of these genera with other Polyommatini of South America, *Nabokovia* Hemming (= *Pseudothecla* Nabokov 1945, unavailable homonym) and *Eldoradina* Balletto (= *Polytheclus* Bálint and Johnson 1993, of which Nabokov had no material). The sister relationship of *Itylos* Draudt and *Hemiargus* was implicit in Nabokov's illustrations but overlooked by him because he attributed the name *Itylos* to the wrong group of butterflies (*Itylos* Draudt had priority; *Itylos sensu* Nabokov, the "*koa* Group" of Polyommatini, became *Madeleinea* Bálint 1993).

Nabokov (1945a) correctly evaluated the species statuses of taxa known to him in *Hemiargus*, *Cyclargus* and *Echinargus*, omitting only certain taxa undiscovered at the time. Accordingly, we resurrect *Cyclargus woodruffi* Comstock and Huntington 1843 and *Cyclargus erembis* Nabokov 1948, both revised status, these having been widely considered, respectively as subspecies of *C. thomasi* (Clench) and *C. ammon* (Lucas) by various authors after Nabokov. We also describe *Cyclargus shuturn* **n. sp.** (the recently reported Jamaican member of the *ammon* Group). We stress the distinctive structural characters in locally endemic Antillean members of *Cyclargus* (such as *woodruffi*, *erembis*, *shuturn*, *kathleena* and *sorpresus* [latter two Johnson and Matusik 1992]) compared to the overall homogeneity of structures in pan-Antillean and mainland *C. thomasi* (where even "subspecific" differences show little coherence). *Cyclargus*'s pattern of local endemics regionally sympatric with widespread common congeners mirrors that seen in Antillean *Leptotes* (Polyommatini) and *Strymon* (Theclinae, Eumaeini), among others. The widespread species in all cases are vagile generalists; numerous of the local endemics are known only from highly specialized biomes. Our taxonomy reflects this pattern of endemism and generalism, not simply taxonomic "splitting". The latter criticism was also leveled by others at Nabokov's detailed seminal work; however, it is clearly superior to generic grades (like *Hemiargus sensu* Riley, used as late as 1992) whose members share no comparable structural features).[1]

INTRODUCTION

Nabokov (1945a), in a seminal study of the taxonomy of Neotropical Polyommatini, distinguished three new genera from *Hemiargus* Hübner 1818: *Cyclargus*, *Echinargus* and *Pseudochrysops*. Members of all these genera occur throughout the Caribbean region and display varieties of the catochrysopoid wing pattern (sensu Nabokov) common to many worldwide Polyommatini. Later, in a popular fieldguide to West Indian butterflies, Riley (1975) synonymized *Cyclargus* with *Hemiargus*. This view was followed by most subsequent authors, even as recently as Opler and Malikul's (1992) fieldguide to eastern North American butterflies.

In a review of polyommatine morphology for studies of taxa occurring on Hispaniola, Johnson and Matusik (1988) were surprised to find that it was impossible to prepare diagnoses for taxa of "*Hemiargus*" (*sensu* Riley) because the species originally included by Nabokov in *Cyclargus* did not

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[1] A lengthy ABSTRACT is necessitated because the present work summarizes results from a number of other works by these, and other, authors and integrates it with the substantially expanded higher classification by Bálint and Johnson 1995.

share any comparable genitalic elements with the rest of *Hemiargus* as defined by Riley. To investigate this diagnostic problem, Johnson and Matusik reviewed Nabokov's text and figures, and surveyed additional polyommatine material, particularly from the Caribbean region.

Two factors were immediately noted:

First, Nabokov's *Cyclargus* and Riley's *Hemiargus* are superficially alike in only two, albeit salient, aspects: they share (a) a similar-looking catochrysopoid wing pattern (see Nabokov 1945a: p. 61, plate 8) and (b) similar spatial orientation among certain elements of the male genital terminalia (see Nabokov 1945a: pp. 56-57, plates 3-4, and Morphological Figures herein).

The wing pattern similarities between *Cyclargus* and *Hemiargus* taxa are not unique among the Polyommatini. The structures that have similar spatial orientation on the terminus of the male clasper ("valve") do not indicate sister relationship. They are, of course, homologous within the context of the entire Tribe Polyommatini but, when considered in context of all the genera of the tribe (as well as with characters of the complete male genital apparatus and female genitalia) indicate subclade monophyly with different phylogenetic subsets of the tribe (as we detail below).

Second, Nabokov's original text clearly differentiated the valve termini of *Hemiargus* and *Cyclargus*. He also discussed the male genital characters shared by *Cyclargus* with *Echinargus* and *Pseudochrysops* and suggested corroborative characters of the females. Nabokov's original work only failed to notice the sister relationship of *Hemiargus* and *Itylos* Draudt (articulated subsequently by Bálint and Johnson 1995), and the monophyly of *Cyclargus*, *Echinargus* and *Pseudochrysops* with various South American polyommatine genera (the latter either poorly represented in Nabokov's material or unknown to him).

The sister relationship of *Itylos* and *Hemiargus* was implicit in Nabokov's drawings (1945a, Plates 1-7) but, because Nabokov applied the name *Itylos* to the wrong group of butterflies [Nabokov's *Itylos* was an invalid usage replaced by *Madeleinea* Bálint 1993], and also perhaps because *Itylos* and *Hemiargus* had very different geographic distributions, Nabokov did not recognize their relationship. Considering *Cyclargus*, *Echinargus* and *Pseudochrysops*, Nabokov was unable, because of sampling error, to recognize their monophyly with certain autochthonous groups now known from South America. The latter groups include *Nabokovia* Hemming (originally named *Pseudothecla* by Nabokov, an unavailable homonym) and *Eldoradina* Balletto 1993 (= *Polytheclus* Bálint and Johnson 1993) a group of high Andean blues Nabokov had not examined, but suggested as distinct in a footnote (Nabokov 1945a: pp. 11-12). Also, unaware of the actual structural diversity of these latter genera, Nabokov was unable to recognize their overall monophyly with other Neotropical members of the POLYOMMATUS SECTION (including his own genus *Pseudolucia* Nabokov 1945).

Considering the actions of Riley (1971, and other subsequently following him) it appears likely that Riley and others may not have read Nabokov's text in detail. This possibility is suggested because certain morphological elements illustrated in Nabokov's plates can be confused on a first, or cursory, reading. Plates 2-7 were keyed in Plate 1 with a long caption which reads much like text. Certain genitalic details were illustrated by Nabokov in isolation, unconnected to contiguous structures. Considering this, we think the most likely misunderstanding was viewing as homologous the "open mentum" and "free rostellum" illustrated for both genera by Nabokov (1945a: plates 2 and 4). The "open mentum" and "free rostellum", at their extremes (in drawings of *H. hanno* from Puerto Rico [Nabokov 1945a: plate 4, herein Fig. 1 (p. 5), D, left] and *C. dominica* from Jamaica [Nabokov 1945a: plate 3, herein Fig. 1 (p. 5) D, right]) appear quite alike. If Riley and others simply scanned these drawings to check for genitalic corroboration of the similar looking catochrysopoid wing patterns, variation in the hooked rostellum of *Hemiargus* and terminally combed rostellum of *Cyclargus* can appear so similar (if one ignores the terminal comb) as to suggest continuous variation. If ones reads the text, however, Nabokov clearly differentiates the kind of rostellum occurring in *Hemiargus* from the kind occurring in *Cyclargus*, *Echinargus* and *Pseudochrysops* (among which the terminal comb is a unique character [autapomorphy] in *Cyclargus* (Fig. 1 [p. 5] D, right; Fig. 2 [p. 6] A-D). Nabokov also emphasized the aedeagal characters supporting his conclusion. Since these would have to be ignored to reach a conclusion of synonymy for *Cyclargus* and *Hemiargus*, it appears Riley based his view on the wing patterns corroborated by valve terminalia.

Consequently, recognizing the differences pointed out by Nabokov in their preparation of descriptions for *Cyclargus kathleena* and *C. sorpresus*, Johnson and Matusik (1992), returned to the original generic nomenclature of Nabokov. Unfortunately, however, due to a change of publication venue for that paper and inherent page constraints, only the taxonomic descriptions from their original paper were published and their detailed figures supporting Nabokov's original view were accompanied only by a short caption and one brief paragraph of discussion.

After 1992, Johnson communicated details of the original work on *C. kathleena* and *C. sorpresus* to various lepidopterists. Since the matter of *Cyclargus* and *Hemiargus* was straightforward, requiring only a reading of Nabokov's original work to establish their nonmonophyly, other recent authors followed this view, also treating *Cyclargus* as a valid genus (Bálint 1993a; Smith, Miller and Miller 1994). However, commentary accompanying these treatments was brief, Bálint's (1993) appearing in a short entry in a synoptic catalogue and those of Smith, Miller and Miller (1994, a recent popular fieldguide to Caribbean region butterflies) simply referring to the original work of Johnson and Matusik.

What has been lacking is publication of detailed supportive material relating to the distinction of *Cyclargus* and *Hemiargus*. Although, Nabokov's treatment was itself thorough in this regard, it has apparently been ignored by others in deference to Riley's reputation among lepidopterists. Moreover, the entire matter is now seen far more clearly in light of new and additional data now available of the diversity of Neotropical Polyommatini (Bálint 1993ab, Balletto 1993, Bálint and Johnson 1992 ab, 1995abc). The impact of these data on higher classification of the Polyommatini has been summarized most recently by Bálint and Johnson in a paper concerning higher categories in the worldwide Polyommatini (Bálint and Johnson 1995d).

RESULTS

Pertinent data are summarized herein in morphological illustrations including the following: (1) monophyly of *Cyclargus*, *Echinargus* and *Pseudochrysops* and certain members of Eliot's (1973) POLYOMMATUS SECTION (latter as revised by Bálint and Johnson, 1995) (herein Fig. 1 [p. 5], A (left), C (left, right), Fig. 2 [p. 6] A-E, Fig. 3 [p.7]); (2) monophyly of *Hemiargus*, *Itylos* and members of the GLAUCOPSYCHE SECTION of Eliot (1973) (herein, Fig. 1 [p. 5], A (right), B); (3) misleading homoplasies among taxa of *Hemiargus* and *Cyclargus* which appear to have influenced Riley's (1973) view of their synonymy (herein Fig. 1 [p. 5], D).

After discussion of these data, a synonymic list of species of *Hemiargus*, *Cyclargus*, *Echinargus* and *Pseudochrysops* in the Neotropical Realm is presented, based on the most current morphological studies accompanying revisionary work on Neotropical Polyommatini. As can be seen, except for taxa discovered subsequent to Nabokov (1945a) this list agrees almost completely with his original work.

DISCUSSION

Riley, in using wing pattern similarity to synonymize *Cyclargus* with *Hemiargus*, failed to recognize that such catophrysopoid patterns also occur in *Echinargus*, and *Pseudochrysops* within the Caribbean and, elsewhere in the farflung Polyommatini, *Chilades* as well as some Asiatic *Plebeius* and Nearctic *Icaricia*. Nabokov, in noting the plasticity of this pattern, pointed out that in its elaborate development in *Cyclargus* even some features of the African genus *Euchrysops* occur as parallelisms.

Concerning the morphology, the Neotropical genera *Itylos*, *Hemiargus*, *Pseudochrysops*, *Cyclargus*, *Nabokovia*, *Echinargus* and the very recently discovered genus *Eldoradina* (=*Polytheclus*) can be excluded from Eliot's characterization of the POLYOMMATUS SECTION based the following characters incompatible with Eliot's original definition of the Section (see also Bálint and Johnson 1993b, 1994ab; Bálint and Johnson 1995d).

(1) male genital valve with conspicuous and long apical process (= "rostellum" *sensu* Nabokov);

(2) female genital ductus bursae (= "henia" *sensu* Nabokov) with limited extensibility (*Cyclargus*, *Pseudochrysops*, *Eldoradina* with only limited eversibility; *Hemiargus* and *Itylos* not eversible).

Of these genera, which do not conform to Eliot's original characterization of the POLYOMMATUS SECTION, *Itylos* and *Hemiargus* form a separate monophyletic group which is the sister of the GLAUCOPSYCHE SECTION; characters defining the *Itylos/Hemiargus* clade, which we defined as the ITYLOS SECTION is our 1995 treatment of higher categories in worldwide Polyommatini include:

(1) male genital valve "quadrate" in shape;

(2) male genital aedeagus extremely robust relative to rest of genital apparatus;

(3) female genital ductus bursae biapical and and not eversible.

MORPHOLOGICAL FIGURES

(pages 5-7)

Figure 1 (pg. 5)— Phylogenetic Unity of *Itylos* and *Hemiargus*, A (right), B.

Phylogenetic Unity of *Cyclargus*, *Echinargus*, *Pseudochrysops* and only certain members of the POLYOMMATUS SECTION (*sensu* Eliot), A (left), C (right and left).

Homoplasies of *Hemiargus* and *Cyclargus*, D.

Figure 2 (pg. 6)— Phylogenetic Unity of *Cyclargus*, A-E.

Figure 3 (pg. 7)— *Cyclargus woodruffi* Status Revised, *Cyclargus erembis* Status Revised, *Cyclargus shuturn* New Species, above.

Continental affinities of POLYOMMATUS SECTION, comparing *Pseudochrysops*, *Echinargus*, *Nabokovia* and *Eldoradina*.

MORPHOLOGICAL FIGURES

Facing Page (5): **Phylogenetic Unity of *Itylos* and *Hemiargus*** (A); **Phylogenetic Unity of *Cyclargus*, *Echinargus*, *Pseudochrysops* and Polyommatus Section** (C) (for latter see also page 7); **Homoplasies of *Hemiargus* and *Cyclargus*** (D); and, **Corroborative Characters of Females** (A).

Overleaf (6): **Phylogenetic Unity of *Cyclargus* Taxa** (A-E).

Facing Page (5)

***Itylos* and *Hemiargus*:** A (right). Bipartite sclerotized female terminalia characteristic of *Itylos* and *Hemiargus*, comprised of clearly overlapping plate-like elements, one extending to posterior and (bifurcate) to the anterior (**1a,b** finely stippled: **a**, shorter in *Hemiargus*, **b**, elongate in *Itylos*) and one located centrally and variously expansive laterally (**2c,d**, not stippled: **c**, shorter in *Hemiargus*, **b**, more laterally expansive in *Itylos*).

B. Lateral view of male valve, *Itylos* (above), *Hemiargus* (below) both from Bolivia (SP= superior process, IP = inferior process, R= rostellum, H= hook-like terminus; M= mentum). Although these structures clearly show the sister group relationship, certain extremes in *Hemiargus* (when the mentum is more lobate and rostellum less hooked [see *hanno*, Puerto Rico, in **D**]) result in misleading similarities between *Hemiargus* and some extremes in *Cyclargus* (see **D**, *C. dominica*) particularly if the terminal hook-like structures of *Hemiargus* are not differentiated from the coxcomb terminus (C) in *Cyclargus* (for additional comment see caption for **D**). C (left): "*hanno*" and "*titicaca*", lateral views of the aedeagus showing their strut-like allulae (SA) (D= distal point or suprazonal sheath, TT = proximal tabs of subzonal sheath).

***Cyclargus* and Sister Groups:** A (left). Singular "cubate" structure of sclerotized female terminalia characteristic of *Cyclargus*, *Pseudochrysops* and *Echinargus* (**1**, cubate structure more typical of *Cyclargus* and *Pseudochrysops* (terminus radically indented in *Pseudochrysops* [stipples defining notch near "1"], terminus finely concave, like the lateral edges, in *Cyclargus* [entire outline of structure excluding "2"]); **2[+1]**, anteriorly elongate configuration of same stucture typical of *Echinargus*.

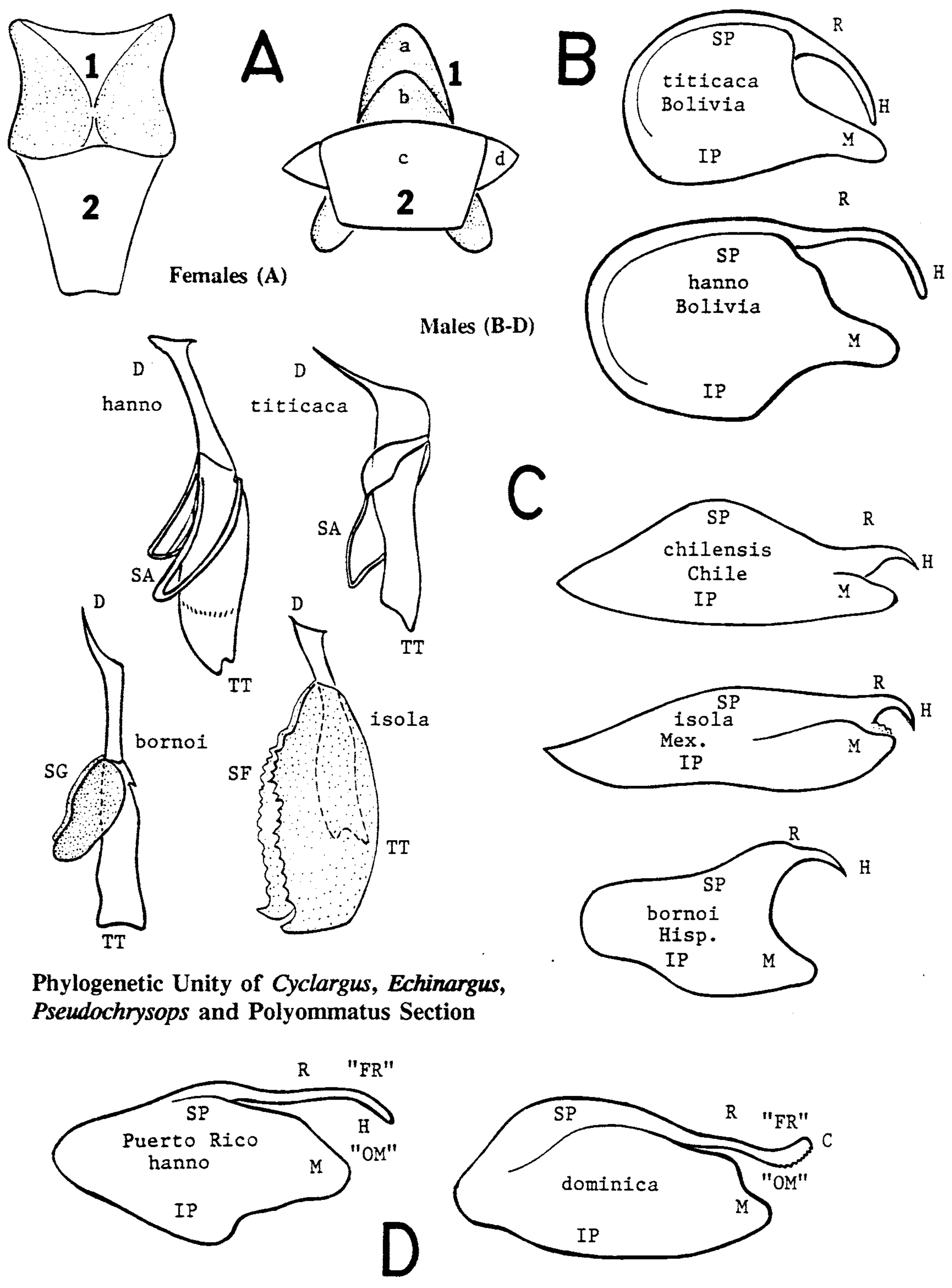
C (right). Lateral view of male valve (for *Cyclargus* see A-C, page 6), top: "reformed" Polyommatus Section, type species of *Pseudolucia*, *P. chilensis*, Chile; middle, *Echinargus isola*, Mexico; below, *Pseudochrysops bornoi*, Hispaniola (structure labels same as in **B**, above). **C**, (left). "*bornoi*" and "*isola*", lateral views of the aedeagus showing the sclerotized sagum typical of group (SG) (other structures same as above in **B**); for *Cyclargus* aedeagus see page 6 **A,B,D,E**.

Homoplasies of *Hemiargus* and *Cyclargus*. D. Selected species showing misleading similarities in spatial orientation of some terminal elements of male valve. Left, *H. hanno*, Puerto Rico, showing "open mentum" (OM) and "free rostellum" (FR) noted by Nabokov; Right, *C. dominica*, Jamaica, indicating similar looking OM and FR. However, as noted by Nabokov, the rostellum of *Hemiargus* is hook-like (H), as in *Itylos*, while that of *Cyclargus* terminates in a unique coxcomb (C), autapomorphic for *Cyclargus* among the clade which includes it and the other Pseudochrysopsina (*sensu* Bálint and Johnson 1995).

Overleaf (6)

Phylogenetic Unity of *Cyclargus*. A-E. Structures of male valvae (noted as "ventral" and "lateral"), terminal coxcomb (C), uncus (U) and falces (F), and aedeagus showing prominent sagum (SG between D and TT) in species further keyed and explained on page 7. **A**, *C. ammon*; **B**, *C. sorpresus* distinguished by Johnson and Matusik (1992); **C**, subspecies of *C. thomasi*, and *C. kathleena* distinguished by Johnson and Matusik (1992); **D**, *C. thomasi*; **E**, *C. kathleena*.

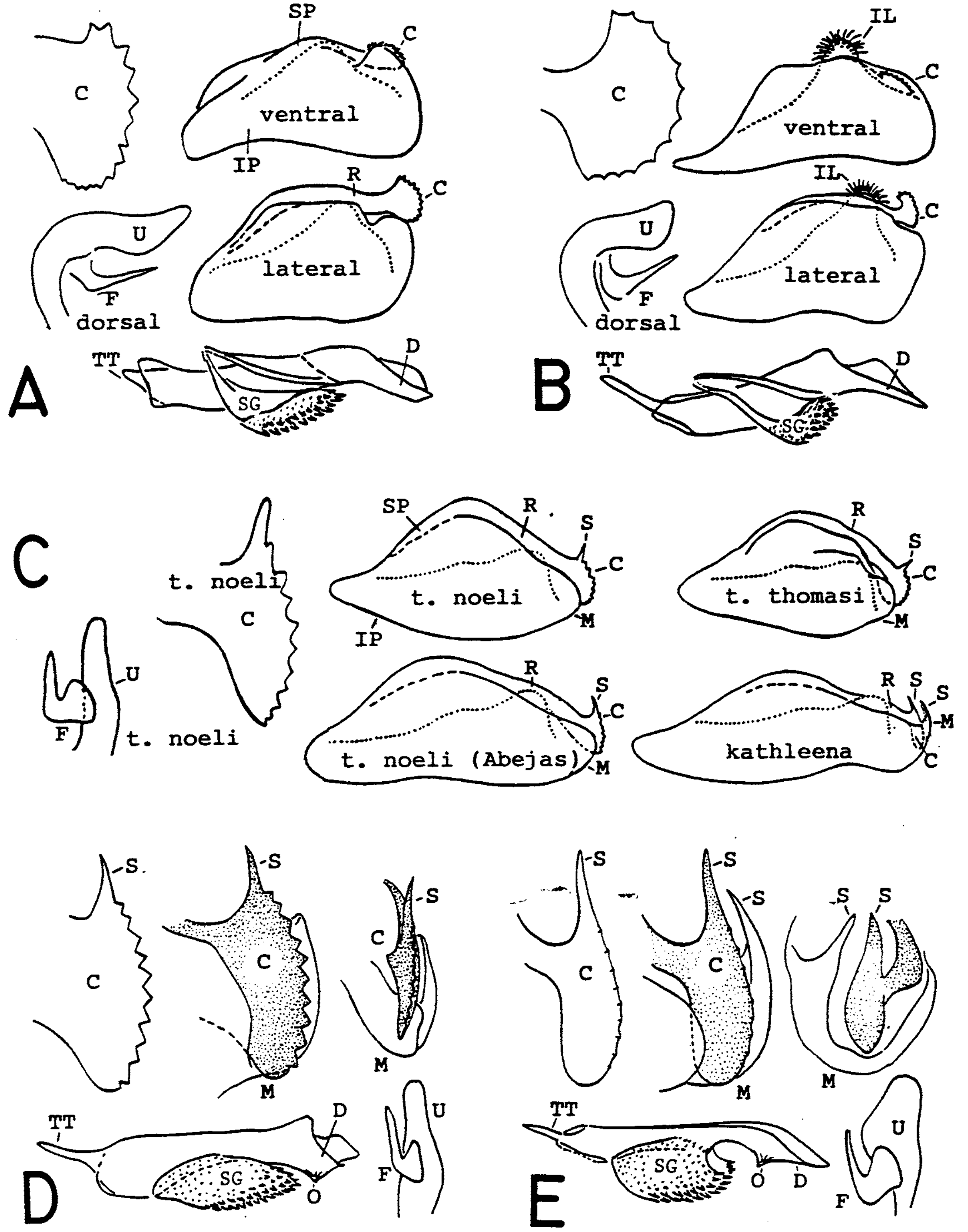
Phylogenetic Unity of *Itylos* and *Hemiargus*

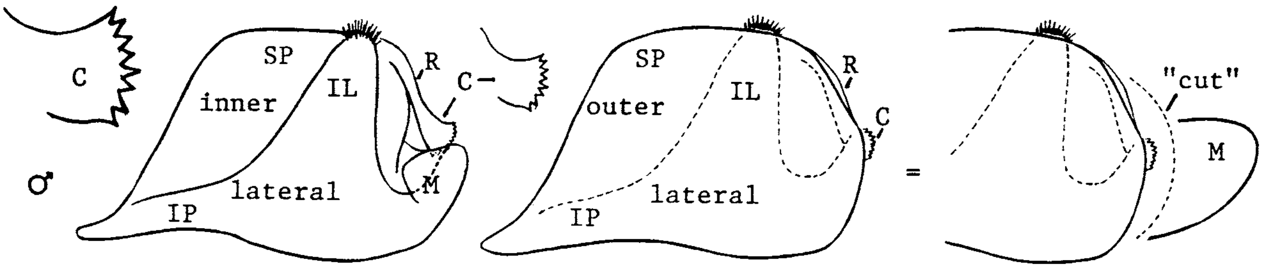


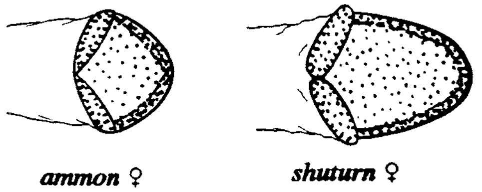
Phylogenetic Unity of *Cyclargus*, *Echinargus*, *Pseudochrysops* and Polyommatus Section

Homoplasies of *Hemiargus* and *Cyclargus*

Phylogenetic Unity of *Cyclargus* Taxa



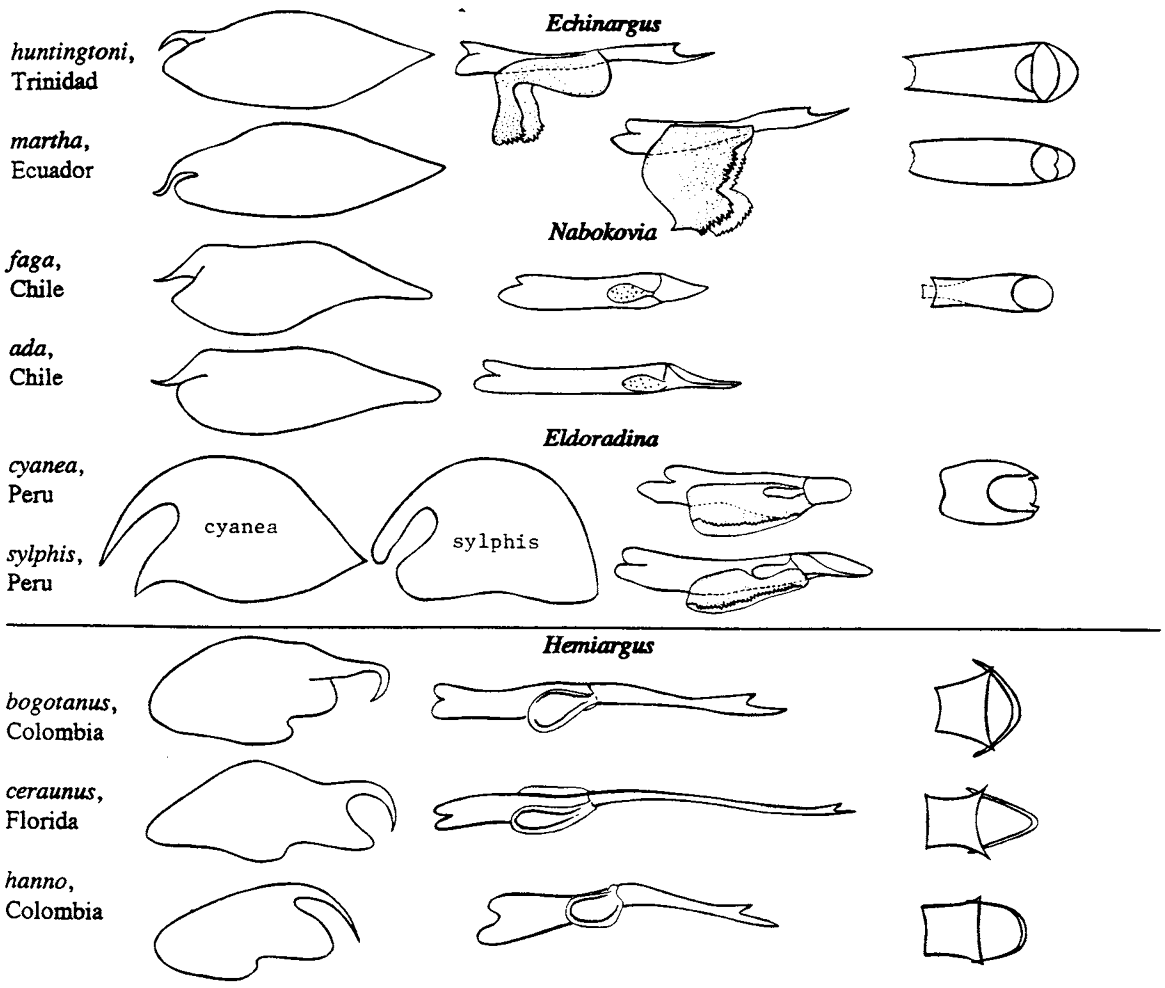




Cyclargus shuturn, **Jamaica**
above: male valvae, *C. shuturn* (far right, mentum unfolded)
below: female sclerotized terminalia (stippled)
(left, *C. ammon*); (right, *C. shuturn*)

ADDITIONAL COMPARATIVE FIGURES

Reformed *Polyommatus* Section



Male: valve (lateral) aedeagus (lateral) Female: sclerotized terminalia

Regarding how the above problems could have happened in a work as highly regarded as Eliot (1973), correspondence with Col. Eliot has been enlightening. In the first place, Eliot used only selected characters of the males. Secondly, Eliot reports that in a work as vast as his survey of the world's Lycaenidae, morphological characterizations of genera were taken strictly from the type species and, if it was not available, any selected species from the NHM. If no representative was available, secondary sources were used. Thus, problems could inevitably develop regarding (1) the characterization of genera which, by common usage, were not monophyletic, (2) genera where the arbitrarily chosen type species was either extremely apotypic of plesiotypic or (3) taxa concerning which secondary source material was inaccurate. Obviously, the only way that such problems "shake out", historically, is for workers to "come along" and examine every taxon of a group, which is what we have done in our work on the New World Polyommatini. As a result, some "diagnostic" characters cited by Eliot actually occur differentially in certain monophyletic groups of the Polyommatini and are thus not taxonomically useful. Further, there was tremendous sampling error in the known diversity of the New World Polyommatini at the time of Eliot's work. Indeed, some of the generic level groups included in the "revised POLYOMMATUS SECTION" by Bálint and Johnson (1995d) were unknown at the time of Eliot's worldwide survey.

Considering the New World Polyommatini, as known today, the following review is pertinent to the present discussion of *Hemiargus* and *Cyclargus* and their actual affinities among the New World polyommatine fauna.

Hemiargus is endemic to Latin America with four historically recognized species. *Hemiargus hanno* is widely distributed in the Caribbean region, Central America and lowland South America; *H. ceraunus* occurs in North America, deeply penetrating into the temperate region. *Hemiargus ramon* is restricted to the western slope of the high Andes. *Hemiargus bogotanus*, another Andean species, is sympatric and synchronic with *H. hanno* in certain mountane habitats of Colombia but otherwise more typical of higher Neotropical elevations (Bálint and Johnson 1995d). The valvae in *Hemiargus* are shorter than the aedeagus and comparable in purely superficial aspects to *Cyclargus*, in that valvae in both genera approach the overall shape of that seen in Holarctic *Plebeius*. Historically, the terminus of the valvae in *Hemiargus* has also been confused with *Cyclargus*, both having the mentum comparatively "open" and the upper process well-developed and "free" (quoted terms being those coined by Nabokov). However, the upper process does not terminate with a prominent "coxcomb" as in Nabokov's *Cyclargus*.

Itylos is entirely high Andean with one widely distributed, and four stenochorous [one still undescribed], species. Species of this genus lack the genital sagum, thus suggesting that both the distribution and the apparent character reversal are apomorphic. *Itylos* represents an autochthonous high Andean lycaenid clade (along with numerous Eumaeini hairstreak lineages demonstrated to date) evolved from the lowland Neotropical fauna, not an ancestry from the north.

Regarding other genera above— *Cyclargus*, *Pseudochrysops*, *Echinargus*, *Nabokovia* and *Eldoradina*, our 1995 treatment of higher categories recognized them as the NABOKOVIA SECTION. In the mentioned paper (Bálint and Johnson 1995d) denoted two infratribes in the NABOKOVIA SECTION: the Nabokovina and Pseudochrysopsina, each with mainland and Caribbean region representatives. The Nabokovina included the genera *Nabokovia* and *Eldoradina* (referred to by us as the "Thecline [Theclinae]-like taxa" [Bálint and Johnson 1993b, 1994a]) which are autochthonous high Andean entities, and the Caribbean and mainland genus *Echinargus*. Very recently the female genital structures of the high Andean entities were able to be studied in more detail (Bálint and Lamas, in prep.). These structures suggest that it is more advisable to consider the NABOKOVIA SECTION as including two sister sections— the NABOKOVIA and PSEUDOCHRYSOPS SECTIONS. The former would contain *Nabokovia* and *Echinargus* and the latter *Pseudochrysops*, *Cyclargus* and *Eldoradina*. The new characters suggesting such a subset division are as follows:

***Echinargus*/ *Nabokovia*:**

(1) female genital ductus bursae eversible, very long and slender with tubular terminalia;

(2) male genital aedeagus slender and blunt with allulae and conspicuous sagum (*Echinargus*) or only extremely produced allulae (*Nabokovia*).

***Cyclargus*/ *Pseudochrysops*/ *Eldoradina*:**

(1) female genital ductus bursae with limited extensibility, terminalia ("fibula") heavily sclerotized and stout ("shovel" or "missile"-shaped).

(2) male genital aedeagus robust and stout with allulae at the zone and with conspicuous sagum.

This more elaborate scheme does not change the overall monophyly of Bálint and Johnson's 1995 NABOKOVIA SECTION; it only adds a perspective concerning sister subsets within it similar to their (1995d) treatment of the ITYLOS SECTION (*Itylos*/ *Hemiargus*) as the sister of the GLAUCOPSYCHE SECTION, not part of it.

Nabokovia is a high Andean endemic composed of two sister species. One is widely distributed, the other recently described and known only from the Coquimbo region of Central Chile (an area well known for its endemic biota) (Bálint and Johnson 1993b, 1994a). A third, undescribed entity, occurs in the Cuzco region of Peru and is in the process of being elaborated (Bálint and Lamas, in prep.).

Echinargus is Transamerican and contains three species. One, *E. isola*, is a well-known species widespread in North and Central America and vagrant as far south as Venezuela (Bálint 1995a). *Echinargus huntingtoni* is widely distributed in the Caribbean region and adjacent coastal areas of Central and South America. A little known high Andean entity, *E. martha*, was historically misinterpreted for many years (cf. Bridges 1988: I.215 and Bálint 1993a: 16). It has since been found to typify high montane Ecuador and Peru. These latter two species, both unacknowledged in Nabokov's (1945a) formal nomenclature, can be easily separated by their wing patterns and morphology from all the known polyommatines of the region, as well as from each other (see Fig. 3). If one considers the eversible, conspicuosly elongate, ductus bursae ("henia") in the *Echinargus* females as an apomorphic character, the NABOKOVIA element of the sister sections noted hitherto (p. 3) appears to be the more apotypic compared to PSEUDOCHRYSOPS.

The apparently older of the NABOKOVIA related sister sections, the PSEUDOCHRYSOPS SECTION (as noted immediately hitherto, p. 3) is best considered to include the *Cyclargus*, *Pseudochrysops* and *Eldoradina*. *Cyclargus* contains eight species, mostly endemic to the Caribbean region, counting the new species and new statuses recognized herein). Only one of these species, *C. thomasi* also occurs in the Florida Keys as well as Central America (Bálint 1995a). The widespread distribution of this latter species, and the rather haphazard geographic variation among its highly vagile populations call attention to the endemicity of the other congeners, many of which are known from either limited geographic regions or restricted ecological niches. It even appears questionable whether subspecies should be formally recognized within *C. thomasi*.

Aside from superficial similarities in the spatial orientation between some terminal structures of *Cyclargus* and *Hemiargus* (Fig. 1D), homologous structures of the valvae in *Cyclargus* most closely approximate those in the *Pseudochrysops* sister group. The shape of the valvae in this latter genus can be deceiving, however, because of a robust shape (with an extremely high Baird's Angulation) and short terminal length (not exceeding that of the aedeagus). Nabokov noted this valval shape as "gaping" (Nabokov 1945a: 13). Indeed, compared to other genera the valvae are very short, at the broadest only .75 as broad as long, with a strong Baird's Angulation. The superior process is abruptly sloped, then recurved distally into a slender horn-like rostellum somewhat inwardly curvate at the terminus and located quite distant from the mentum. The aedeagus is narrow and elongate with the supra- and subzonal elements generally equal and remaining details (subzonal sheath, vesica, allulae, Chapman's process etc.) all showing autapomorphic characters (Nabokov 1945a, plate 2, herein Figs. 1, 3) (an interpretation that could also be given to *Pseudochrysops* unique hairlike tail on the HW). The sagum is only rudimentary. The female has a well developed fibula shaped in three dimensions rather like the kind of icecube produced by trays which place a concavity into each facing surface of the cube (Nabokov 1945a, plate 7, herein Fig. 1A (left).

Pseudochrysops was originally described as monotypic, restricted to Haiti. Additional populations of closely related taxa have since been found on several other Caribbean islands and described as subspecies. However, more material and a more critical biogeographic interpretation (in conext with all the Caribbean Polyommatini) might suggest these best be considered allopatric species. Certainly, in the field populations of *Pseudochrysops bornoi* are as restricted as any of the most local Antillean *Cyclargus* or *Leptotes*. Thus, it is hard to number them among the "vagile" elements of the Antilles' dispersalist fauna. However, we leave this problem for future research.

Eldoradina [=*Polytheclus* Bálint and Johnson 1993 which, for reference purposes regarding character information, was elaborated in much more detail than that of Balletto 1993] is a high Andean endemic genus comprised of two sister species. *Eldoradina cyanea* is known from high elevations of the western Andean region; *E. sylphis*, known from only four specimens, occurs at the edge of the altiplano of south-central Peru (Bálint 1995a).

The high Andean entities of the sister sections NABOKOVIA and PSEUDOCHRYSOPS (*Nabokovia* and *Eldoradina*, respectively) offer yet another example of polyommatine lineages originating from the lowland Neotropics and successfully invading the high upland xeromontane and oreal biomes of South America. Characters also suggest that Caribbean lineages form the oldest elements of the PSEUDOCHRYSOPS set (*Cyclargus*, *Pseudochrysops*) retaining, except for the vagrant species *C. thomasi*, a restricted Antillean distribution. *Echinargus* (of the NABOKOVIA set), on the other hand, is an ecological generalist with the widest range among the groups, well adapted to temperate and tropical lowlands as well as the high Andes. In the latter regions, it is sympatric with the autochthonous genera *Nabokovia* and *Eldoradina*.

The sister group of these diverse Neotropical NABOKOVIA/ PSEUDOCHRYSOPS sections is one that can only be comprehended in light of the most recent data on overall polyommatine diversity in the New World (a view which, because of sampling error, not really possible for categories, the eversible ductus bursae of the female genitalia, and the presence of the heavily sclerotized male genital sagum common throughout the entire Nabokovia Section, suggests that the sister group of this entire Neotropical clade of taxa is the "reformed POLYOMMATUS SECTION", elaborated by us in 1995.

This reformed POLYOMMATUS SECTION includes genera which currently have no Caribbean region representatives and includes two infratribes, the Pseudolucina and Polyommatina.

The infratribe Pseudolucina is composed solely of the diverse genus Pseudolucia (Nabokov 1945a), generally endemic to the southern high Andean region and austral South America but with a vicariant isolate in southeastern Brazil. Our recent investigations documented a vast austral diversity for this genus. Today, relatively small geographic regions support large numbers of sympatric and synchronic species (Bálint and Johnson 1993a, 1995cd; Bálint et al. 1995a) and new species are still frequently discovered.

The sister Infratribe Polyommatina includes one Holarctic genus (*Plebeius*) and two autochthonous Neotropical genera (*Paralycaeides* Nabokov, 1945 and *Madeleinea* Bálint 1993 [the "*Itylos*" of Nabokov 1945a]).

The genus *Plebeius* is widely distributed and very diverse in the Holarctic. The most common North American species weakly extends into the northern part of the Neotropical Realm. *Paralycaeides* is endemic to the high Andean region (Peru, eastern Bolivia, northwestern Argentina and northeastern Chile). Two species groups of four species are recognized. One species (*P. vapa*) is widely distributed, occurring southward to the Catamarca region of Argentina (Bálint 1993a, Bálint and Johnson 1995e).

Madeleinea Bálint is also endemic to the high Andean region (from montane Colombia to the Salta region of Argentina). Three species groups include more than fifteen total species (Bálint 1993a, Bálint and Johnson 1995a, Bálint et al. 1995b) and new species are frequently discovered.

CONCLUSION

When viewed in context of the entire Neotropical Polyommatini, it is clear that *Hemiargus* Hübner and *Cyclargus* Nabokov are not only distinctive but (a) not sister taxa and (b) not members of the same taxonomic SECTION within the tribe. The historical problem involving their frequent synonymy (particularly in popular works) results simply from their similar catochrysopoid wing patterns and similar (analogous) spatial orientation among certain structures of male genital terminalia. Nabobov's original (1945a) treatment was thorough and correct regarding distinction of *Cyclargus* and *Hemiargus*. To draw conclusions otherwise, it appears other workers either ignored or misunderstood Nabokov's morphological data concerning these and other polyommatine genera treated by him in 1945.

Historical loss of the integrity of *Cyclargus* exemplifies was appears to be a frequent need among many collectors and catalogers of butterflies— to condense the number of taxa among given sets of historical names (particularly taxa that look somewhat alike externally). Perhaps the need stems from a desire by older workers to make some "final stroke" regarding the general knowledge of a certain era. Typical of such efforts in the past have been regional or synonymic lists most often characterized by (a) lack of reference to type specimens or morphology and (b) ignorance of the fact that more, not fewer, species actually exist in many groups— both in unsorted museum trays and in the field. Some of the taxonomy in Riley's work on Caribbean region butterflies illustrates this problem. It and similar works actually reflect the sociology of the time more than the true calibre of the taxonomic workers. One is reminded of H. K. Clench's unpublished "checklist" of Neotropical *Cyanophrys* (Theclinae) (mentioned in posthumous work published in Clench 1981) in which Mr. Clench, after having authored many new names in that genus, made a "final" list reducing many to synonymy. In the entire effort neither dissections nor type specimens (other than those in his own collection) were consulted. Similarly, a "final stroke" by Gillham (1956) (interestingly, published in the same journal as Nabokov's Neotropical polyommatine study, and concerning Old World elfin butterflies) synonymized all the old world taxa into the familiar New World genus *Incisalia*. However, the study included less than a quarter of the species now known, identifications based entirely on the common usage (all proving incorrect when types were located), and dissections limited to single males of the erroneously identified taxa (Johnson 1992). Regarding *Cyclargus* and *Hemiargus*, the biogeography of the old era was also a contributing factor. The origin of the Antillean fauna was viewed solely on the basis of waif dispersal; accordingly, all the similar-looking Antillean "blue butterflies" were readily viewed as simply reflections of similar "donor" faunas on the mainland. Antillean representatives might "look a little different" (having been isolated for some "short" time) but there appeared no compelling reason, at the time, to dissect and thus discover the gigantic differences in the structural features. This is an era that is now past. However, it is worth remembering that much of the popular taxonomy of butterflies still reflects that era. One can still pick up Opler and Malikul (1992), certainly viewed as the most authoritative fieldguide to Nearctic butterflies, and find *Cyclargus* as a synonym of *Hemiargus*. It would not be so startling if the genera were a "close call", yet the two do not even belong in the same taxonomic SECTION of the Polyommatini.

TAXONOMIC ENTRIES and SYNONYMIC LIST

Entries are required concerning four revised statuses and one new species established by our review of *Hemiargus* and *Cyclargus* among the Neotropical Polyommatini.

Hemiargus hanno (Stoll, 1790), **revised status**; Fig. 3, p. 7).

The valvae, aedeagus and female genital terminalia are distinct from *H. ceraunus* (see below). Individual subspecies entries for *H. hanno* are included in the subsequent synonymic list.

Hemiargus ceraunus (Fabricius, 1793), **revised status**; Fig. 3, p. 7).

The valvae, aedeagus and female genital terminalia are distinct from *H. hanno* (see above). Individual subspecies entries for *H. hanno* are included in the subsequent synonymic list.

Cyclargus erembis Nabokov 1948, **revised status** (11 Figs., Nabokov 1948; herein, Fig. 3, p. 7).

Cyclargus woodruffi (Comstock and Huntington 1943), **revised status** (Nabokov 1945a, Pl. 3; herein, Fig. 3, p. 7).

Results of our studies of termino-dorsal structures, valvae and aedeagii in male genitalia of *Cyclargus* (see Nabokov 1945a, 1948 and herein Figs. 2,3 p. 6-7) and a review of female genitalia (selected figs. herein, Fig. 3) concur with the original species status decisions of Nabokov 1945a. We should note that L. D. and J. Y. Miller (Allyn Museum of Entomology, Florida Museum of Natural History) (pers. comm. to Johnson after preparation of this paper but before its publication), noted they had come to a similar conclusion about *woodruffi* as a result of their ongoing studies of the Bahamanian fauna. Subsequent to Nabokov (1945a, 1948), *woodruffi* has sometimes been considered a subspecies of *C. thomasi* and *erembis* a subspecies of *C. ammon*. There does not appear to be any morphological coherence in such subspecific assignments. Rather, Nabokov's division of *C. ammon* between Cuban and Cayman Island populations (as subspecies) appears sound (Nabokov 1945a, Pl. 3) with the externally *ammon*-like populations named *erembis*, *sorpresus*, and the new entity below, each distinctive and, in the externally *thomasi*-like populations, *thomasi*, *kathleena* and *woodruffi* each distinctive. In fact, some wing characters of the new Jamaican entity described below actually more resemble the *thomasi* Group than the *ammon* Group.

A New Species of *Cyclargus* from Jamaica

Recently, Iftner, Shuey and Calhoun (1993) reported "*Hemiargus ammon*", a new addition to the Jamaican butterfly fauna. Not surprisingly, given circumstances noted by us above, they used the common usage nomenclature following Riley (1975) *et al.* and placed *ammon* in *Hemiargus*. They also suspected the species might be a recent dispersal addition to the Jamaican fauna, given that it had gone unreported in rather extensive literature on the butterflies of that island. In 1992, Johnson and Matusik had described a distinctive southern Hispaniolan member of the "*ammon* Group": *Cyclargus sorpresus*. This species had some distinctive wing pattern differences from *C. ammon* (historically considered restricted to Cuba and the Cayman Islands). It also showed a unique morphology with, among others characters, the male genital valvae showing a produced, inwardly directed, setate lobe (apparently derived from what appears as a more minor, convex, inner lateral cleft in *C. ammon* [a characteristic state not even mentioned by Nabakov 1945a]). Thus, we were keen to obtain specimens of the Jamaican "*ammon*" and dissect them. Dr. John Shuey (Nature Conservancy, Indianapolis, Indiana) kindly provided specimens for study. Interestingly, morphology of the Jamaican population suggests it is the sister species of the southern Hispaniolan *C. sorpresus*; it also has some wing characteristics more reminiscent of the "*thomasi* Group" of *Cyclargus*. We describe the new Jamaican entity below.

Cyclargus shuturn,
NEW SPECIES

Photoplate VI; Fig. 3.

Hemiargus ammon: Iftner, Shuey and Calhoun 1993, p. 37.

DIAGNOSIS. ***Wings.*** **Forewings**— of all members of the genus, ventral forewing spotbands, distad the medial area, with a distinctive *regularly striped pattern* (wide white postmedial spot-band bordered basally and distally by substantial deep brown medial and submarginal bands, each of the latter also bordered [basally and laterally, respectively] by narrower white). In all congeners (see *e.g.* Smith, Miller and Miller 1994, pl. 13) the costal region of the forewing spotbands is variously irregular from that in the tornal field (in fact, in some species, especially *C. sorpresus*, the postmedial spot-band is incised from the submarginal one by a bold brown costal patch). **Hindwings**— darkening of the medial spot in cell CuA1 and one or two adjacent spots (a) basad in the subdiscal area and (b) costad in the postdiscal area, give a strong "Y"-shaped impression to the hindwing band, framing the dark mediocostal black orb between the "forks" of the "Y" (see Photoplate VI, "*Cyclargus*" entries).

Morphology. The male valve shares with *C. sorpresus* an inwardly directed, terminally setate lobe, top of the being visible above the "horizen" of the Baird's Angulation (in *C. ammon*, their is a convex cleft but it is not apparent above the horizen as a protruding lobe). This lobe, in *C. shuturn*, is narrower than that in *C. sorpresus*. Compared to *C. ammon*, the termino-lateral habitus of the valve appears short and stout in *C. shuturn*, a state caused by a terminal invagination of the mentum (see Remarks). However, when extended, the mentum is actually much longer than in *C. ammon*. The rostellum in *C. shuturn* is reminiscent of *C. dominica* narrow with a steep terminal declination; at the end of this structure the comb is much less hemispherical than in *C. sorpresus* or *C. ammon* and, again, more like *C. dominica*, a dentate crescent (see Remarks). The female is distinct with a produced, "acorn"-shaped, henia.

DESCRIPTION. *Male*. DFW, DHW lustrous purplish-blue with narrow, somewhat black and white checkered, marginal lines; HW with bold black orbs marginad in cells CuA1 and CuA2, the former variously outlined basally with some orange. VFW,VHW ground gray, FW marked with wide and regularly parallel white spotbands (wide white postmedial spot-band bordered basally and distally by substantial, deep brown, medial and submarginal bands, each of the latter also bordered [basally and laterally, respectively] by narrower white); apex of FW discal cell with broad dark slash bordered on both sides by white; HW with markings typical of "*ammon*/ *thomasi*" groups of *Cyclargus*— basal area with three discrete black orbs (typical of "*ammon*" Group ["*thomasi*" Group with four]) and an additional small black orb medial along the anal margin; intercellular areas across wing filled with white, forming full postmedial band offset by white in the discal and adjacent cells and a smaller arc of white intercellular marks along the submargin; costal margin of medial area with pronounced black orb, black orbs marginal in cells CuA1 and CuA2, the former widely outlined with orange basally. Pronouncement of medial spot in cell CuA1 and one or two adjacent spots (a) basad in the subdiscal area and (b) costad in the postdiscal area, give a strong "Y"-shaped impression to the hindwing band, framing the dark mediocostal black orb between the "forks" of the "Y". FW length: 8.5 mm. (holotype). *Female*. DFW divided dark blackish in distal half, lustrous azure in ventral half; margins white and quite checkered with black; DHW with ground divided as of FW, although blue more restricted to cell interspaces; black marginal orbs in cells CuA1 and CuA2 very large, former widely bordered with orange basally; adjacent cell M3 with a small bluish white spot. FW length: 10.5 mm. (allotype). ***Male Genitalia***. Fig. 3. Valvae laterally appearing very short and stout but with terminally invaginated mentum actually quite elongate; inner lateral surface of valve with produced, inwardly directed lobe, slightly setate terminally and exceeding the Baird's Angulation; dorsum of valve with rostellum not greatly free; rather, steeply declined and terminating with a crescent-shaped, marginally dentate, comb. ***Female Genitalia***. Fig. 3. Terminally sclerotized area with posteriorly pronounced "acorn"-shaped henia.

TYPES. Holotype male, JAMAICA, St. Ann's Parish, 5 mi. W. of Ocho Rios, 17 October 1985, leg. J. A. Shuey; allotype male, same data except 19 October. Both deposited AMNH. *Paratypes*. We include here, by reference, all specimens listed in Iftner, Shuey and Calhoun (1993).

DISTRIBUTION. Currently known only from Jamaica and, apparently, the Jamaican vicariant entity of the "*ammon*" Group of *Cyclargus*.

REMARKS. ***General***. As noted in introductory comments, it was inevitable that someone would genitalically examine the specimens of "*Hemiargus ammon*" reported from Jamaica by Iftner, Shuey and Calhoun (1993). With so many recent discoveries concerning butterflies of Jamaican and southern Hispaniolan, reports of "*ammon*" from Jamaica would immediately invite an examination of morphology for comparison with populations in southern Hispaniola and elsewhere in the Antilles. Given the relatively well documented Jamaican butterfly fauna, discovery of "*ammon*" on the island would either reflect extremely recent introduction or something of certain historical and biogeographical interest. Modern workers are less apt to invoke recent introduction as the more probable explanation since the current view of butterfly origins in the Antilles includes a combination of dispersal and ancient tectonic vicariance. All recently discovered new lycaenids in the Antilles (and particularly southern Hispaniola and Jamaica [respectively polyommatines *Leptotes idealus* (Johnson and Matusik 1988), *Cyclargus kathleena* and *C. sorpresus* (Johnson and Matusik 1992) and theclines *Cyanophrys harti* (Turner and J. Y. Miller 1992), *Chlorostrymon orbis* (Johnson and Smith 1993)] represent extremely local species. These were, more than likely, simply not collected before. Thus, one is immediately suspicious of a recent introduction explanation for a newly reported "blue" from Jamaica.

Characters. The characters discussed in our description of *C. shuturn* are mostly self-explanatory. However, we should note that the unfolding of the terminal mentum on the valve was a new innovation of the junior author which appears to have great promise in future studies of the Polyommatinae. We have always been curious why Nabokov never mentioned the convex inner lobe of the valve and suspect it was because only in *C. sorpresus* and *C. shuturn* is it pronounced enough to be a recognizable character. We were thus curious about the nature of the "short, stout" valve termini of *C. sorpresus* and *C. shuturn* relative to *C. ammon* because consistent differences in both the mentum and rostellum of these, and other, *Cyclargus* species would be extremely important in judging whether Antillean island populations, with their distinctive allopatry, most probably represent biologically distinct species. Thus we have included reference to the female genitalia of *C. ammon* and *C. shuturn* even though the female genitalia of *Cyclargus* have not figured greatly in analysis of members of this genus hitherto. Indeed, most of the recently described *Cyclargus* taxa from the Antilles have been represented by small samples from remote and seldom collected areas and nearly all of these specimens have been males.

Taxomonic Procedure. Dr. Shuey was kind enough to forward specimens to us for examination and we informed him, and his colleagues, of our morphological findings numerous months before preparing the present description. We have included this new species in this synoptic review of *Hemiargus* and *Cyclargus* for the sake of completeness, consistent with various treatments of other newly discovered Antillean taxa over the last five years. We trust that this taxonomic recognition of the Jamaican population will further credit the work of its discovers, Iftner, Shuey and Calhoun.

ETYMOLOGY. Our choice of an etymology reflects a combination of our gratitude to Dr. Shuey for his "due diligence" in getting material to us and the unchallengeable worth of recognizing the substantial contribution to Jamaican Lepidopterology made in recent years by Dr. Thomas Turner (Clearwater, Florida). Euphoniously, in the spirit of the name "*ammon*", we have thus formed the name "*shuturn*" from the roots of Shuey and Turner, respectively.

ANNOTATED SYNONYMIC LIST

ITYLOS SECTION

Hemiargus Hübner 1818

H. hanno (Stoll, 1790)
H. ceraunus (Fabricius, 1793)
    syn. *antibubastus* Hübner 1818
    syn. *filenus* (Poey 1832)
    syn. *watsoni* W. Comstock and Huntington 1943

Note: much as in *C. thomasi* (see below), haphazard morphological configurations among and between representatives of these taxa relative to their geographic definitions calls into question their validity as "subspecies". However, for heuristic purposes, such distinction might be made purely on geographic grounds.

H. ramon (Dognin 1887)
H. bogotanus Draudt 1917-1924 [1921]

REFORMED *POLYOMMATUS* SECTION

Cyclargus Nabokov 1945

C. ammon (Lucas 1857)
C. erembis Nabokov 1948

Note: to make room for the description of *C. shuturn* at proof, the line drawings regarding this taxon had to be removed (see Nabokov 1948).

C. thomasi (Clench 1941)
    t. thomasi (nominate ssp.)
    t. bethunebakeri (W. Comstock and Huntington 1943)
    t. bahamensis (Clench 1943)
    t. noeli (W. Comstock and Huntington 1943)
    t. clenchi (L. Miller, Simon and Harvey 1992)

Note: morphology in these taxa illustrates the problems with Antillean allopatry and taxonomic statuses; there is considerable haphazardness among and between representatives of these taxa relative to their geographic definitions which call into question their validity as "subspecies". However, there is more distinction among these than in the synonyms recognized under *ceraunus*. We continue to recognize these subspecies mostly because, contrary to the situation under distinction of *ceraunus* from *hanno*, there is no major change among the "*thomasi*" clade warranted by our work save that of *woodruffi* noted immediately below.

C. woodruffi (W. Comstock and Huntington 1943)

Note: the comment under *C. erembis* pertains here.

C. dominica (Möschler 1886)
C. sorpresus K. Johnson and Matusik 1992
C. kathleena K. Johnson and Matusik 1992
C. shuturn K. Johnson and Bálint 1995

Pseudochrysops Nabokov 1945

P. bornoi (W. Comstock and Huntington 1943)
    b. bornoi (nominate ssp.)
    b. escobioi Schwartz 1987
    b. yateritas D. Smith and Hernandez 1992

Note: we have commented before that eventual detailed elaboration of these populations (rare in the first case and extremely poorly known in the latter two) might suggest species distinction (a consideration of some import regarding the monotypy of this genus). However, the usual contradictions between biological and/or morphological reality and binomial nomenclature pervade this issue and, accordingly, short of any detailed demonstration of species distinction, we continue the traditional treatment here.

Echinargus Nabokov 1945

Note: we have not considered subspecific statuses in *Echinargus* in detail, concentrating on the species relations in the neotropics; thus, we follow common usage here.

E. isola (Reakirt 1866-1867 [1867])
    i. isola (nominate ssp.)
    syn. *nyagora* (Boisduval 1870)
    i. alce (W. H. Edwards [1871])
E. martha (Dognin 1887)
E. huntingtoni Rindge and Comstock 1953
    h. huntingtoni (nominate ssp.)
    h. continentalis (Clench 1965)
    h. hannoides (Clench 1965)

Note: entries above pertain only to taxa of these SECTIONS treated herein; each SECTION contains additional genera (see Bálint and Johnson 1995d).

Note: entries above pertain only to taxa of these SECTIONS treated herein; each SECTION contains additional genera (see Bálint and Johnson 1995d).

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[Note: consistent with the Technical Comment on a frontis, the European convention of including author/publication date in lists of taxa but not considering these formal literature citations is followed here].

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