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Miscellaneous notes on Arcas Swainson, 1832 (Lepidoptera: Lycaenidae, Eumaeini)

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Abstract – *Arcas imperialis* (CRAMER) and *A. tuneta* (HEWITSON) are recorded from Ecuador for the first time. *Papilio imperialis* CRAMER is the senior synonym of *Arcas magnifica* AUSTIN et JOHNSON. *Theritas cypria* GEYER is the senior synonym of *Thecla publica* RÖBER. Western and and southeastern phenotypes of *Arcas tuneta* (HEWITSON) are recognized. The *Arcas tuneta* superspecies concept of BROWN is restricted to these phenotypes recognized as an allopatric semispecies pair. *Thecla tuneta* represents the western phenotype; its lectotype is designated and the type locality is restricted as Amazon, Brazil. The allotype of *Arcas jivaro* NICOLAY proved to be misidentified since it represents *A. (tuneta) tuneta*. *Thecla tuneta* is the senior synonym of *Arcas viriditas* AUSTIN et JOHNSON and *A. marginata* AUSTIN et JOHNSON. The southeastern phenotype as is described *Arcas arcadia* sp. n. (type locality: Santa Catharina, SE Brazil). The holotype specimens of *Arcas delphia* NICOLAY and *Thecla splendor* DRUCE are documented for the first time. *Arcas alleluia* sp. n. is described from NE Peru. With 32 figures.

Key words – Lepidoptera, Lycaenidae, *Arcas*, Brazil, Colombia, Ecuador, Peru.

INTRODUCTION

The genus *Arcas* SWAINSON, 1832 (type species *Papilio imperialis* CRAMER, 1775, by monotypy), a group of magnificent lycaenids, was reviewed by NICOLAY (1971), who recognized seven species, five described between 1775 and 1901 and two described as new by him. Subsequently, further taxa were added, two described by AUSTIN & JOHNSON (1995) and again two by SALAZAR & CONSTANTINO (1995*a*, *b*).

Following the work on Neotropical lycaenid types at The Natural History Museum (London) in the summer of 2000, I studied historical and new material of *Arcas* in various European museums and private collections. From this extensive material, I was able to investigate certain older and some of the new taxa of *Arcas*, resulting in new distributional data, new synonyms, proper documentation of two holotypes, designation of a lectotype and clarification of type localities. In addition, studying the taxonomic status of a long-standing taxon proved that another

one had no applicable scientific name. Furthermore, an undescribed species was found in the unsorted material from Peru.

Beside the material of Hungarian Natural History Museum (HNHM), the *Arcas* material of the following museums or private collections were studied either *in situ* or via loan or electronic media (the curators are in parentheses): The Hope Entomological Collections of The Natural History Museum, Oxford University (HCOU, Mr. DARREN MANN); The Natural History Museum (BMNH, Mrs. KIM GOODGER and Mr. PHILLIP RONALD ACKERY); Naturhistorisches Museum (NMW, Wien, Dr. MARTIN LÖDL); Zoologische Staatssammlung des Bayerischen Staates (ZSM, München, Dr. AXEL HAUSMANN); Mr. ALFRED MOSER (São Leopoldo, Brazil), who transferred the data of his personal collection (MC) and the glossy photos of the holotype of *Arcas delphia* NICOLAY deposited in the National Museum of Natural History (NMNH, Smithsonian Institution, Washington D. C.) and that of the Lepidoptera Collection of Universidade Federal do Paraná (UFPR, Curitiba, Dr. OLAF MIELKE); Mr. JEAN FRANCOIS LE CROM (Bogotá), who sent me images of his rich lycaenid butterfly collection on compact disc; Mr. JULIAN A. SALAZAR-ESCOBAR (Manizales), who sent information and material of his newest *Arcas* findings. Dr. KURT JOHNSON (New York) kindly reviewed the paper and made useful comments. I express my sincere thanks to all of them.

I use standard technics described by NICOLAY (1971) and AUSTIN & JOHNSON (1995).

Arcas imperialis (CRAMER) (Figs 1–6)

Papilio imperialis CRAMER, 1775: 120, Pl. 76, Figs e-f.
Papilio venus FABRICIUS, 1781: 115.
Arcas imperialis (CRAMER): SWAINSON 1832: 88 (new combination); NICOLAY 1971: 95; EMMEL & AUSTIN 1990: 9; LUIS-MARTINEZ *et. al.* 1995: 127; d'ABRERA 1995: 1103, Figs "A. imperialis"; AUSTIN & JOHNSON 1995: 32, Figs 1, 3, 9, 14, 19, 23, 28; SALAZAR & CONSTANTINO 1995*a*: 124; AUSTIN *et al.* 1996: 30; NIELSEN *et al.* 2001: 99.
Thecla imperialis (CRAMER). – HEWITSON 1865: 71 (new combination); GODMAN & SALVIN 1887: 13, Pl. 48, Figs. 15–16.
Eucharia imperialis (CRAMER): BOISDUVAL 1870: 14 (new combination).
Thecla oakesii BUTLER, 1884: 267; NICOLAY 1971: 95 (synonym of *A. imperialis*).
Thecla (*Theritas*) *imperialis* CRAMER: DRAUDT 1919: 746, Pl. 146, row c, Fig. "imperialis".
Arcas magnifica AUSTIN et JOHNSON 1995: 32, Figs 2, 6, 10, 15, 20, 24, 29, **syn. n.**

Material examined. – PANAMA: Chiriqui (ZSM, 1♀). COLOMBIA: Bogotá (HNHM, 4 ♂♂, NMW, 1 ♂), Muzo (ZSM, 7 ♂♂, 4 ♀♀), Riosucio, Caldas (HNHM, 1 ♀). ECUADOR: Napo Province, Jatin Sacha Biological Station (HNHM, 1 ♂). PERU: Chanchamayo (NMW, 4 ♀♀), Pucallpa (NMW, 2 ♂♂, 2 ♀♀), Puerto Maldonado (NMW, 1 ♂), Rodriguez de Mendoza (NMW, 1 ♂), Tingo Maria (NMW, 1 ♀), Ucayali, Contamana (HNHM, 1 ♂); Quinincemil (NMW, 1 ♀). SURINAM no locality (ZSM, 1 ♂). BRAZIL: Amazonas (NMW), 2 ♀♀), Espiritu Santo (NMW, 1♂), Mato Grosso, Diamantino (HNHM, 1 ♂), Minas Pará, Obidos (ZSM, 2 ♂♂); Gerais (ZSM, 1 ♂), Rio (NMW, 6 ♂♂, 1 ♀), Rio Juará, Amazonas, (NMW, 1 ♀), São Paolo, Santos, Cosmopolis (ZSM, 1 ♂), Santa Catharina (ZSM, 1 ♀). Genitalia dissections: Gen. prep. BÁLINT No. 1008 (male, HNHM, Colombia,

Bogotá), No. 1009 (male, HNHM, Colombia, Bogotá), No. 1010 (male, NMW, Peru, Pucallpa), No. 1011 (male, HNHM, Brazil, Mato Grosso).

Remarks – Papilio imperialis was described on the basis of an unknown number of male specimens from Surinam (Fig. 1). I could not find any *imperialis* type material in the BMNH collections. As this species is difficult to confuse with any other butterfly (NICOLAY 1971: 95) and the figures of CRAMER are a good artistic reproduction of the species (Fig. 1), the application of the name is straightforward. NICOLAY thoroughly discussed the species and according to his account, *A. imperialis* is distributed from Mexico (Vera Cruz) to Bolivia, and from French Guiana via the Amazon Basin to southeastern Brazil (Santa Catarina). He mentioned (NICOLAY 1971: 107) that *imperialis* was not recorded from Ecuador. In the HNHM there is a recently collected voucher specimen (Figs 2–3) that confirms its occurrence in Ecuador.

NICOLAY properly placed *Thecla oakesii* in synonymy, considering it to be an individual variation of *Arcas imperialis*. He noted that the coppery or rosy wash on the disc of the hindwing ventrum, which characterizes *Thecla oakesii*, is highly variable and present practically in every region from where he could examine *Arcas imperialis* specimens. The origin of this peculiar "character" is now understood: during the relaxation of dry specimens, the goldish green scales lose their shine and become pink or rusty if humidity precipitates on the surface of the wings. This artificial colour does not disappear when the specimen dries.

Subsequently a closely related taxon, *Arcas magnifica* was described by AUSTIN and JOHNSON (1995: 32) from Rondônia (Brazil), on the basis of the holotype male and two male paratypes (also from the type locality). The describers of the taxon mentioned that superficially *Arcas magnifica* is very close to *A. imperialis*. The diagnosis was based on quantitative androconial characters of the three specimens and genital characters of the short series. I examined the androconial cluster of more than thirty specimens of *Arcas imperialis* (see Material examined) and, in my view, the distal element varies individually in shape and extension. Accordingly, I do not consider it diagnostic (Figs 4–6). I also dissected four male specimens (see Material examined), and my results included ranges of variation consistent with the diagnosis of *Arcas magnificia*. The shape and extension of the genital structures varies; accordingly, a broader, more angulate vinculum and a broad, blunt vincular spur cannot be diagnostic. In addition, in my view, a longer saccus is not a diagnostic character, either. I consider *Arcas imperialis* and *A. magnifica* to be synonyms, consequently *Papilio imperialis* CRAMER, 1775 = *Arcas magnifica* AUSTIN et JOHNSON, 1995.

Arcas cypria (GEYER)
(Figs 7–13)

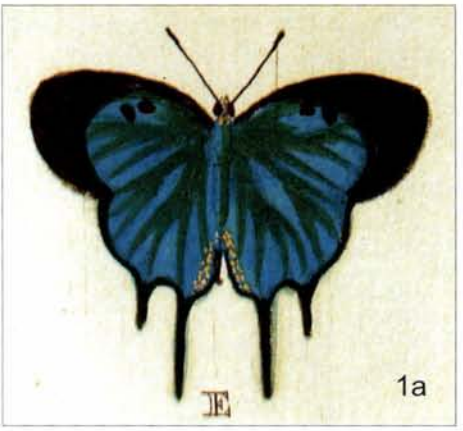
Theritas cypria GEYER, [1837]: 36, Pl. 162, Figs 945–946.
Pseudolycaena paphia FELDER et FELDER, 1865: 234, Pl. 28, Figs 12–13; GODMAN & SALVIN 1887: 2 (synonym of *cypria*).
Thecla cypria (HÜBNER) [sic]: HEWITSON 1865: 71 (new combination); GODMAN & SALVIN 1877: 13, Pl. 48, Figs 12–13.
Thecla (*Theritas*) *cypria paphia* FELDER: DRAUDT 1919: 746, Pl. 146, row d, Fig. "cypria".
Thecla publica RÖBER, 1923: 58; BRIDGES 1988: II.108; BRIDGES 1994: 387; **syn. n.**
Arcas cypria (GEYER): NICOLAY 1971: 101 (new combination), Figs. 1d, 4c, 7e-f, 10d. LUIS-MARTINEZ *et al.* 1995: 127; LLORENTE BOUSQUETS *et al.* 1995: 46; d'ABRERA 1995: 1104–1105, Figs "A. cypria"; SALAZAR & CONSTANTINO 1995*a*: 124.
Arcas cypria publica (RÖBER): d'ABRERA 1995: 1104 (new combination); SALAZAR 2001: 137.

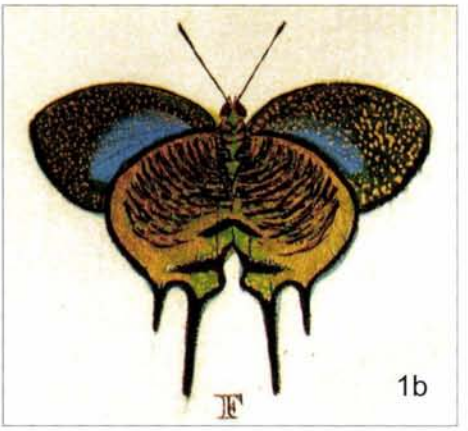
Material examined – Types: *Pseudolycaena paphia*, syntype male (Figs 9–11), BMNH(E) No. 265909, COLOMBIA: Bogotá; syntype male, BMNH(E) No. 265910, COLOMBIA: Bogotá. Non-type material: COLOMBIA: Muzo (ZSM, 3 ♀♀).

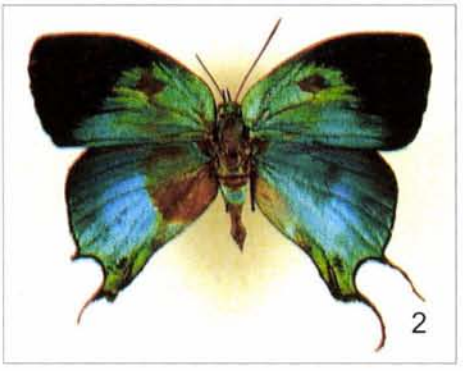
Remarks – *Theritas cypria* was described on the basis of an unknown number of male specimens from "Yucatan". The type material is presumably lost. The species was carefully compared with the original description and figures (Fig. 7), and was promptly redescribed by NICOLAY (1971), who transferred it from *Theritas* to *Arcas*.

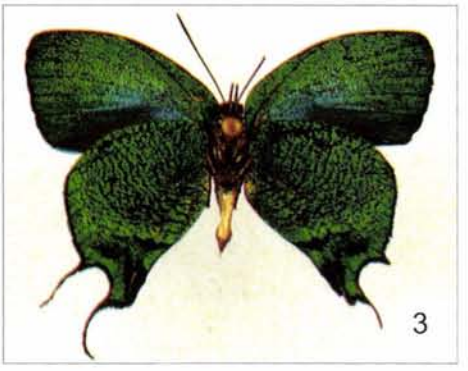
Pseudolycaena paphia was described by the Austrian CAJETAN FELDER and RUDOLF FELDER on the basis of an unknown number of male specimens from "Nova Granada: Bogotá" (= Colombia: Bogotá) purchased from LINDIG. The original description is accompanied by excellent figures of the species (Fig. 8). I have found two original FELDER specimens in the BMNH labelled as "Bogotá, Lindig". They perfectly match the original source (Figs 9–11). Therefore the synonymization of GODMAN and SALVIN, based on the comparison of the figures, and subsequently not altered by NICOLAY (1971: 99), is supported by the type specimens.

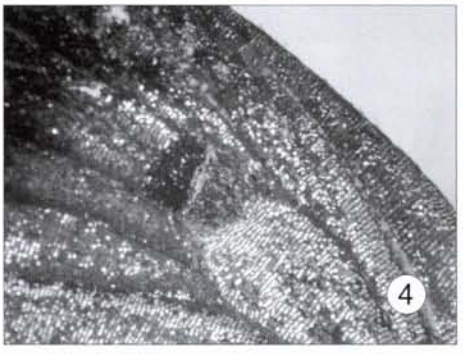
The southern border of distribution of *A. cypria* was given as Magdalena Valley, Elcentro in Colombia (NICOLAY 1971: 100), from where *Thecla publica* was described by RÖBER (1923) on the basis of a single female (= holotype). *Thecla publica* was not mentioned in the paper of NICOLAY (1971). Subsequently *Thecla publica* was listed as a species of "*Thecla* (New World Eumaeini)" by BRIDGES (1988, 1994) and mentioned as a "race" of *Arcas cypria* by D'ABRERA (1995) and SALAZAR (2001). Type specimens of taxa described by RÖBER are deposited at least in five institutions (see LAMAS 1993). The depository of the holotype of *Thecla publica* is unknown; therefore I was not able to locate and study it. However, for me it is obvious from the description that the holotype of *Thecla publica* is

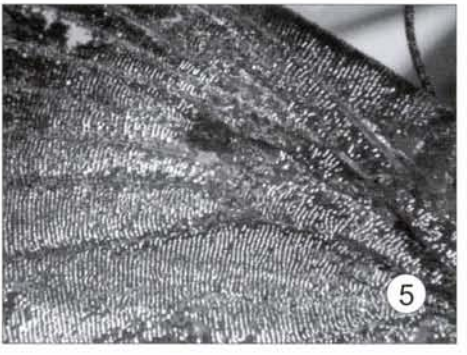








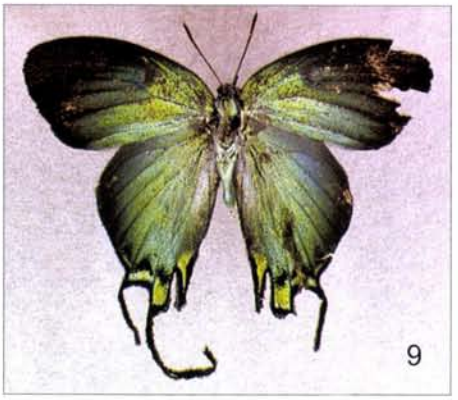


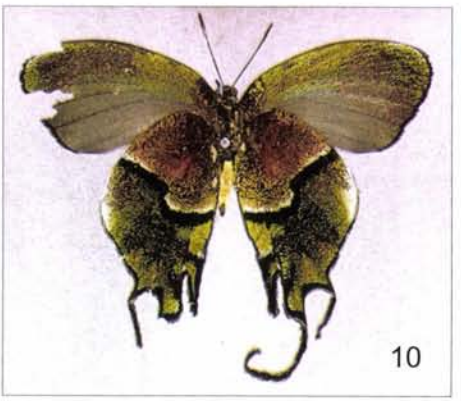


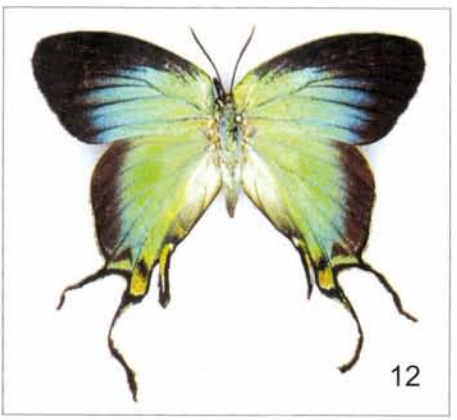
Figs 1–5. 1 = *Papilio imperialis* CRAMER: figures accompanied with the description; 2–3 = *Arcas imperialis* (CRAMER), male, Ecuador (HNHM): 2 = dorsal view, 3 = ventral view; 4–5 = *Arcas imperialis* (CRAMER) androconial clusters of male dorsal forewing: 4 = Colombia, Muzo (HNHM), 5 = Peru, Pucallpa (NMW)

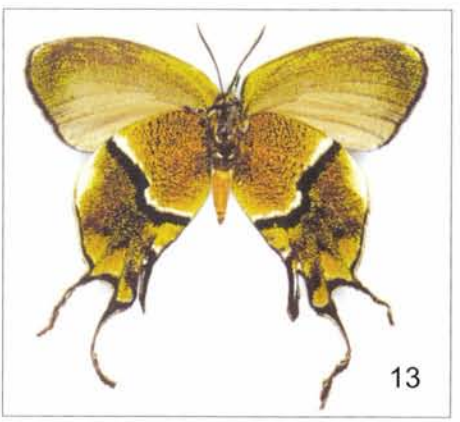
a female specimen of *Arcas cypria*, because it is written: "Die schwarze Mittelbinde der Hinterflügel ist schmäler, unregelmässig begrenzt, in der Mitte breiter als vorn, nicht scharf winkelig, sondern sanft gebogen; die bei *paphia* dieser Binde distal parallel laufende schwarze Binde fehlt der neuen Art, aber diese hat zwei

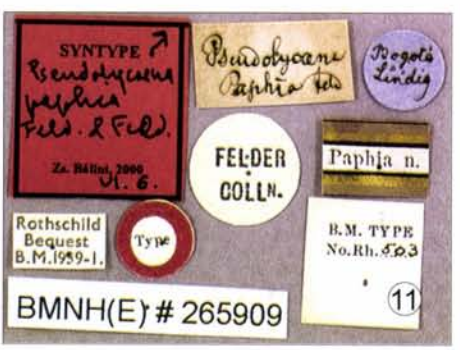
Figs 6–8. 6 = *Arcas imperialis* (CRAMER) androconial cluster of male dorsal forewing: Brazil, Mato Grosso (HNHM); 7 = *Theritas cypria* GEYER: figures accompanied with the description; 8 = *Pseudolycaena paphia* FELDER et FELDER: figures accompanied with the description



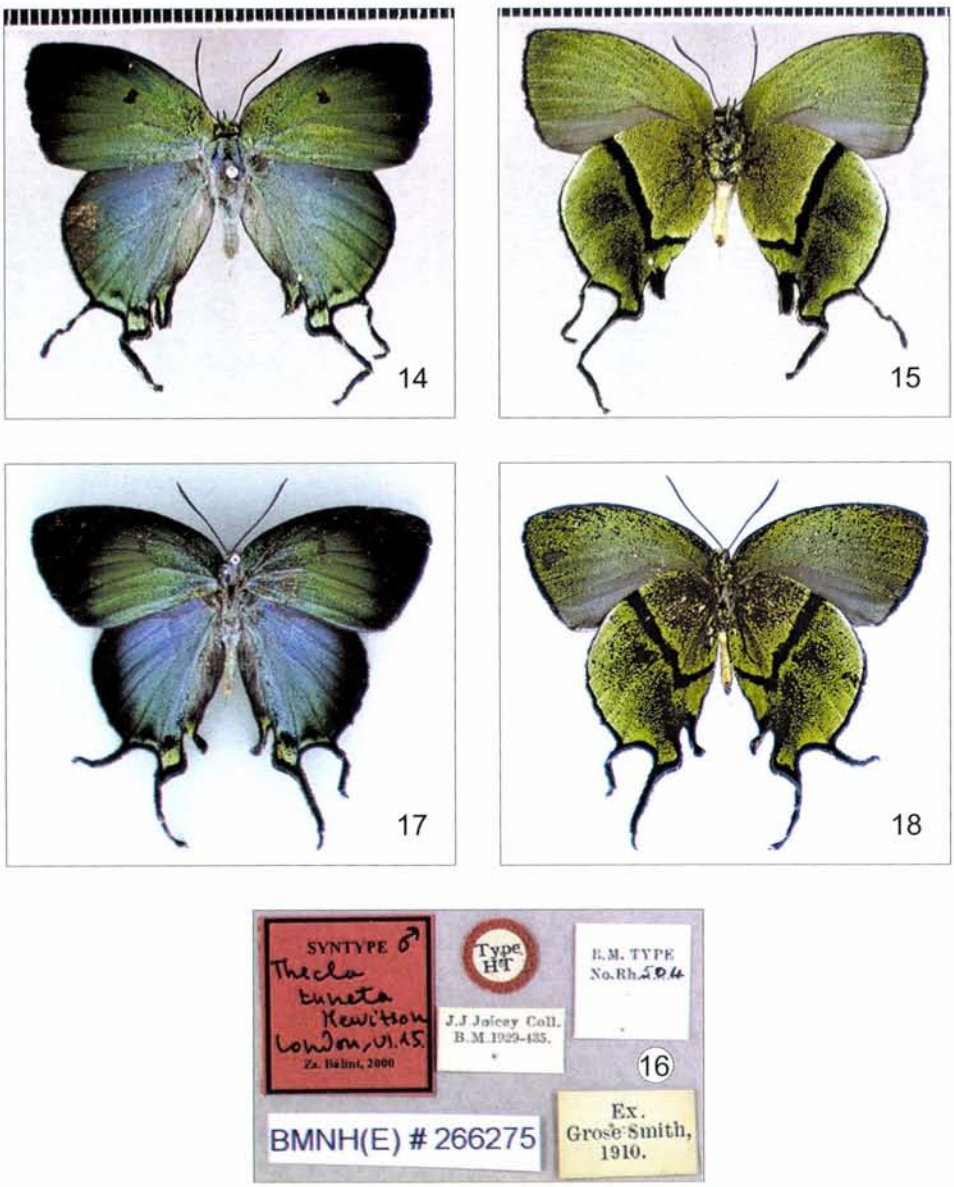








Figs 9–13. 9–11 = *Pseudolycaena paphia* FELDER et FELDER, male, syntype, Colombia (BMNH No. 265909): 9 = dorsal view, 10 = ventral view, 11 = labels; 12–13 = *Arcas cypria* (GEYER), female, Colombia (ZSM): 12 = dorsal view, 13 = ventral view



Figs 14–18. 14–16. *Thecla tuneta* HEWITSON, male, lectotype (BMNH): 14 = dorsal view, 15 = ventral view, 16 = labels (photo courtesy: BMNH); 17–18 = *Arcas arcadia* sp. n.: 17 = male, holotype (BMNH), dorsal view, 18 = ditto, ventral view

schwarze submarginale Kappenflecke." An irregular median band on the hindwing ventrum with a gentle bend and two submarginal patches characterizes *Arcas cypria*. All of these characters are readily visible on the figures accompanying the original description of *Arcas cypria* and on more recent specimens from Colombia (Figs 12–13). I consider *Thecla publica* as a synonym of *Arcas cypria*; consequently *Theritas cypria* GEYER, [1837], female = *Thecla publica* RÖBER, 1923.

The taxon determined as *Thecla paphia* by RÖBER (1923) is most probably *Arcas delphia* which, subsequent to RÖBER, was also recorded from Colombia (see below, cf. SALAZAR & CONSTANTINO 1995*a*: 124, LE CROM collection).

The superspecies *Arcas tuneta* (HEWITSON) (Figs 14–20)

Remarks – BROWN (1993: 148) considered *delphia* and *tuneta* as allopatric taxa of the superspecies *Arcas tuneta*. This view was not supported by any evidence; however, wing pattern and qualitatively identical genital morphology of *Arcas delphia* and *A. tuneta* were stressed by NICOLAY (1971: 101) and fully support BROWN's standpoint. The rarely encountered *Arcas* (*tuneta*) *tuneta* is distributed from Peru to southeastern Brazil according to BROWN (1993: 148), and the distribution of *A.* (*tuneta*) *delphia* is restricted to Mesoamerica. However, *Arcas tuneta* also occurs in Ecuador, and both *A. delphia* and *A. tuneta* have been recorded in Colombia. Moreover, I learned from my colleagues (JOHNSON & SALAZAR, pers. comm.) that an additional member of the group is being described from Rio Abita, Hydric Chocó Province of Colombia (cf. NIELSEN *et al.* 2001: 99). In addition, the western Amazon Basin (Rondônia, Brazil) populations of the complex was very recently reviewed resulting in the descriptions of two sympatric species. After examination of the type specimen of *Thecla tuneta* I believe these are synonyms of *Arcas tuneta*, what was also recorded from the region. The SE Brazilian population, however, proved to be different but, in spite that the population was characterized by NICOLAY, it has no applicable scientific name.

As *Arcas delphia* occurs sympatrically and synchronically with the *A. tuneta* complex (SALAZAR & CONTANTINO 1995*a*, JOHNSON & SALAZAR, pers. comm.) I restrict the superspecies concept to *Arcas tuneta*. The Mesoamerican *Arcas delphia* can be easily separated on the basis of the male androconial cluster and wing markings, which is a general phenomenon amongst the species of the genus. Thus, I see this complex as follows:

Arcas (*tuneta*) *tuneta* (HEWITSON)
(Figs 14–16)

Thecla tuneta HEWITSON 1865: 72, Figs 14–15.
Thecla (*Theritas*) *tuneta* (HEWITSON): DRAUDT 1919: 746, Pl. 146, row d, Fig. "tuneta" and "tuneta U".
Arcas tuneta (HEWITSON): D'ABRERA 1995: 1104–1105, Figs "A. tuneta"; AUSTIN & JOHNSON 1995: 34, Figs 3, 7, 11–12, 21, 25, 30; SALAZAR & CONSTANTINO 1995*a*: 124.
Arcas jivaro NICOLAY: NICOLAY 1971: 105, Figs 5, 11c-d (misidentification).
Arcas marginata AUSTIN et JOHNSON, 1995: 32, Figs 2, 6, 10, 15, 20, 24, 29, **syn. n.**
Arcas viriditas AUSTIN et JOHNSON, 1995: 34, Figs 4, 8, 12, 17, 22, 26, 31, **syn. n.**

Material examined – Type: lectotype male (Figs 14–15), BMNH(E) 266275, BRAZIL: [Amazon], herewith designated. Non-type material: ECUADOR: Archidona (ZSM, 1♀); PERU: Chanchamayo (NMW, 1♀), Huambo (NMW: 1♂), Rodriguez de Mendoza (HNHM, 1♀); Tingo Maria (NMW, 1♂, 1♀). Without locality (NMW, 2♂♂). Genitalia dissections. Gen. prep. Bálint No. 1012 (male, NMW, Peru, Huambo), No. 1013 (male, NMW, Peru, Tingo Maria), No. 1014 (female, NMW, Peru, Tingo Maria), No. 1015 (female, HNHM, Peru, Rodriguez de Mendoza).

Remarks – The taxon *Thecla tuneta* was described as a species of *Thecla* from an unknown number of male specimens deposited in the SAUNDERS collection originating from "South America". DRUCE (1907: 567) wrote that GROSE-SMITH possessed the types of some taxa described by HEWITSON on the basis of specimens deposited in the collection of SAUNDERS. The GROSE-SMITH collection was purchased by JOICEY, whose collection was donated to the BMNH in 1929 (STEARN 1998: 218–219). One *Thecla tuneta* specimen from the GROSE-SMITH collection was segregated by GOODSON (1946) and curated as the type of *Th. tuneta* many decades ago. This specimen most certainly belonged to the specimen(s) seen by HEWITSON.

The place of origin for the species described by HEWITSON is generally indicated, but there is no such indication for his "*Thecla tuneta*". HEWITSON (1865), on eight occasions, named the SAUNDERS collection as the source of type material of his taxa. Brazil is mentioned three times, Mexico and the Amazon mentioned two times each, and Tapajos mentioned once. Since there is no locality label affixed to the "type" specimen, it is impossible to discern more information concerning the type locality of "*Thecla tuneta*". Therefore, I restrict the type locality of *Thecla tuneta* as "Amazon, Brazil", indicating that the specimen originates from the Amazon Basin, as it represents the western phenotype of *Arcas tuneta* sensu lato (see below). KIRBY (1879) indicated the origin of the specimen as Ecuador. There is no evidence what supports KIRBY's indication.

I examined and databased this "type" specimen of *Arcas tuneta* as a syntype of *Thecla tunea* for the Type Catalogue of the Neotropical Eumaeines of the

BMNH (BÁLINT, in prep.) (Figs 14–16). This specimen is hereby designated as lectotype of *Thecla tuneta*, labelled as "Ex Grose-Smith, 1910 \\ J. J. Joicey Coll., B. M. 1929–435. \\ B. M. Type No. Rh. 504. \\ BMNH(E)♂ 266275 \\ Syntype ♂, Thecla tuneta Hewitson, London, VI.15, Zs. Bálint, 2000". The following label will be added to the specimen: "Lectotype ♂, Thecla tuneta Hewitson, designated by Zs. Bálint, Budapest, 2002.IV.8". The designation of the lectotype is necessary because of the nomenclatorial complications caused by the redescription of the species and the subsequent establishment of two nominal taxa described in close relationship with *Arcas tuneta*.

NICOLAY (1971: 100) redescribed *Arcas tuneta* mentioning that the inner and proximal half of the black median line is slightly touched with gold scaling. NICOLAY did not mention that he consulted type material. Subsequently AUSTIN & JOHNSON (1995: 34) applied the name *Arcas tuneta* also for the western Brazilian populations, and described two sympatric taxa with narrow white scaling along the hindwing median band. They have not examined type material, too, considering the previously named taxa unambiguous. According to the works of NICOLAY and AUSTIN & JOHNSON, along with the material I have examined, it is obvious that two *Arcas tuneta* phenotypes exist: the western phenotype with white scaling along the inner part of the hindwing median line and the eastern phenotype with golden scaling along the inner part of the hindwing median line. The western phenotype was documented by AUSTIN & JOHNSON (1995) and the eastern one was redescribed by NICOLAY (1971). In spite of the fact that NICOLAY listed specimens from Peru and Bolivia in his material examined, his descriptions were obviously based on the most voluminous Brazilian material, representing the eastern phenotype as suggested correctly by AUSTIN & JOHNSON (1995: 35). The best distinguishing external character of *Arcas* male specimens, besides wing colouration and pattern, is the shape and extension of androconial cluster situated at the end of the cell of the forewing dorsum. It was demonstrated in the case of *Arcas imperialis*, however, that this character can be extremely variable intraspecifically (see Figs 4–6). The two phenotypes of *Arcas tuneta* cannot be separated on the basis of the androconial cluster of male dorsal forewing, although the eastern phenotype shows a tendency to have a larger quadrate spot. I consider the two phenotypes as a pair of allopatric semispecies. The western semispecies, *Arcas* (*tuneta*) *tuneta*, is distributed along the eastern side of the Andes and the adjacent Amazon Basin, and lives in tropical climatic regions characterized by less marked seasonal fluctuation. The southeastern semispecies, *Arcas* (*tuneta*) *arcadia* sp. n., lives in deciduous Atlantic forests under quite different climatic circumstances, including heavy winter frosts.

Since the lectotype represents the white scaled semispecies, the taxa described by AUSTIN & JOHNSON from Rondônia are junior subjective synonyms of *Arcas tuneta*. I cannot distinguish the holotype of *Arcas viriditas* from the lectotype of *Thecla tuneta*. The distinctively elongate caudal extension of valvae of *Arcas viriditas* contrasts the abruptly truncated terminus of *A. tuneta*, a character based on a sole dissection (AUSTIN & JOHNSON 1995: 35), which appears to be a result of preparational procedure, wherein the valval tip of *A. tuneta* specimen figured was not folded out (cf. NICOLAY 1971: Fig. 2*c* and AUSTIN & JOHSNON 1995: Figs 21–22); consequently *Thecla tuneta* HEWITSON, 1865 = *Arcas viriditas* AUSTIN et JOHNSON, 1995.

The taxon *Arcas marginata* was described on the basis of the single holotype female. Based on the material studied by me, the diagnosis of *A. marginata* appears to be a mixture of female genital character states of *A. tuneta* and *A. viriditas* as far as the postvaginal lamella and ductus bursae are concerned. It is stated that the curvature of the anterior end of the ductus bursae is sharper than on any similar *Arcas*. This character is not diagnostic as the two female *Arcas tuneta* specimens I dissected also show dissimilarity in this respect and an intermediate state between the AUSTIN & JOHNSON's (1995) Figs 25–26 (gen. prep. No. 1015) and 26–27 (gen. prep. No. 1014), respectively. Thus, it appears that the Rondônia samples of AUSTIN & JOHNSON were not adequate for their analysis and I consider *Arcas marginata* to be also synonymous with *Arcas tuneta*; consequently *Thecla tuneta* HEWITSON, 1865 = *Arcas marginata* AUSTIN et JOHNSON, 1995.

The female of *Arcas jivaro* has proved to be misidentified. NICOLAY (1971: 109) mentioned that the *Arcas jivaro* allotype female could not be distinguished from females of *A. tuneta*. This would be an unusual phenomenon amongst *Arcas*, as females of all *Arcas* species are easily separable on the basis of wing markings. I am of the opinion that the allotype female of *Arcas jivaro* represents the female of *A.* (*tuneta*) *tuneta*. The fact that *Arcas tuneta* indeed occurs in Ecuador (see Material examined) and also north to Colombia (SALAZAR & CONSTANTINO 1995*a*: 124), supports this view. Moreover, NICOLAY described the median line as black, etched proximally in white, a crucial character for the western phenotype of *Arcas tuneta* (see above); consequently, in my view, *Arcas jivaro* NICOLAY, 1971 = *Arcas tuneta* (HEWITSON, 1865).

There is no available name for the southeastern semispecies. This is given as *Arcas arcadia* sp. n. below.

Arcas arcadia sp. n.
(Figs 17–20)

Arcas tuneta (HEWITSON): NICOLAY 1971: 100, Figs 2c, 4b, 8e-f, 10e (misidentification).

Types – Holotype male (Figs 17–18), BMNH, labelled as "S. Catharina, Brazil, H. Wernicke \\ Adams Bequest, B.M. 1912–399. \\ Holotype ♂, Arcas arcadia Bálint, London, VIII. 30, Zs. Bálint, 2000 \\ Bálint 9, 28A–59". Length of forewing costa 17.8 mm. The specimen is in perfect condition. Paratypes (all from Brazil). Espirito Santo, ex coll. FRUHSTORFER, ADAMS Bequest (BMNH, 1♂, 2♀♀) (the male is dissected: gen prep. no. 5846); Santa Catharina, Grosse-Smith, JOICEY Bequest (BMNH, 1♀); Brazil, no closer locality (ZSM, 1♂); Santa Catharina (ZSM, 1♀); Joinville, Santa Catharina, Brazil, 200 m, 12. XI. 1991, MIERS leg. (MC, 1♂); Joinville, Santa Catharina, Brazil, 200 m, 21. XI. 1991, MIERS leg. (MC, 1♂); Joinville, Santa Catharina, Brazil, 200 m, 5. II. 1993, MOSER leg. (MC, 1♂). Rio de Janeiro, Petropolis, ex coll GAGARIN (UFPR, 4♂♂,1♀); Santa Catharina, Joinville, coll. FREY (UFPR, 1♂); Santa Catharina, Blumenan (NMW, 1♂); São Paolo, Umuarama, ex coll. GAGARIN (UFPR, 1♂); São Paolo, no exact locality, ex coll. GAGARIN (UFPR, 1♀). Genitalia dissection. Gen. prep. BÁLINT No. 1017 (male, UFPR, Brazil, Joinville).

Diagnosis – Compared to *Arcas tuneta*, the forewing dorsum has wider marginal border: it extends 1/2 length of vein M1 between androconial cluster and apex, whilst the degree of this extension is only 1/6 on *A. tuneta* males (cf. Figs 14–15, 17–18). The hindwing dorsum also possesses 1 to 2 mm wide black marginal border until the vein CuA1, whilst it is faint and generally restricted to the apical area on *tuneta*. The scaling along the black median band of the hindwing ventrum is golden, whilst on *tuneta* it is more whitish. Females (Figs 19–20) can be similarly diagnosed, but the dorsal black margin is more extensive, and hindwing ventral median scaling is more distinctive than on males.

Description – See NICOLAY (1971: 100).

Distribution – Geographic: Brazilian states Rio de Janeiro, Santa Catharina and São Paolo. Altitudinal: specimens were collected at low elevation 200 m above sea level in Santa Catharina. Seasonal: specimens were collected during summer months November and February.

Etymology – The species name refers to *Arcas*, meaning a habitant of the region Arcadia.

Arcas delphia NICOLAY
(Figs 21–23)

Thecla paphia (FELDER et FELDER): RÖBER 1923: 59 (misidentification).
Arcas delphia NICOLAY, 1971: 101, Figs 2a-b, 4a, 8a-d, 10f; d'ABRERA 1995: 1104–1105, Figs "A. delphia".

Material examined – Type: holotype male, NMNH, COSTA RICA: Guapiles, examined (colour glossy photos) (Figs 21–23). Non-type material: COSTA RICA: Guapiles (BMNH, 1♂).

Remarks – I presume from the descriptive text of RÖBER that the "Thecla paphia" specimen he used for comparison with *Th. publica* is misidentified since it actually represents *Arcas delphia*. RÖBER writes that the ventral side of the forewing margin of *paphia* is shiny green and the hindwing median band, after a strong break, runs parallel with the distal margin. The sympatric occurrence of the taxa *Arcas cypria* and *Arcas delphia* was confirmed recently by SALAZAR & CONSTANTINO (1995: 124).

The holotype of *Arcas delphia* has not been figured up to now (cf. NICOLAY 1971). I have a set of colour prints of the holotype specimen and the accompanying labels (courtesy of ALFRED MOSER, São Leopoldo, Brazil). The condition of the specimen is not perfect. It was determined as *Thecla tuneta* by SCHAUS, as the identification label (in his handwriting) indicates, and was dissected in 1946 by WILLIAM D. FIELD, well before NICOLAY's work. This information was not provided by NICOLAY in his original description.

D'ABRERA (1995: 1104) did not find any *Arcas delphia* specimens in the BMNH and figured specimens deposited in NMNH. However, I located subsequently a male in the General Collection of the BMNH misidentified as *Arcas tuneta* (see Material examined).

Arcas splendor DRUCE
(Figs 24–26)

Thecla splendor DRUCE, 1907: 570, Pl. 31, Fig. 4.
Thecla (*Theritas*) *tuneta splendor* DRUCE: DRAUDT 1919: 746, Pl. 146, row d, Fig. "splendor".
Arcas splendor (DRUCE): NICOLAY 1971: 105, Figs 2d, 5b, 9a-d, 10c; D'ABRERA 1995: 1104, 1105, Figs "A. splendor ♂ R", "A. splendor ♀ R" and "A. splendor ♀ V".

Material examined – Type: holotype female, HCUO, COLOMBIA: Bogotá (?), examined (colour glossy photos) (Figs 24–26). Non-type material: COLOMBIA: Bogotá (BMNH, 1♂); no closer locality (BMNH, 2♀♀).

Remarks – The taxon *Thecla splendor* was described on the basis of the holotype female by DRUCE originating from Colombia and deposited in HCUO. NICOLAY (1971) mentioned that he examined the type of *A. splendor* in the BMNH and redescribed the taxon on the basis of material from Panama and Costa Rica. I am of the opinion that the female *Arcas splendor* specimen figured dorsally by D'ABRERA (1995) was the specimen NICOLAY regarded as the holotype of *A.*

splendor but did not figure. This specimen, which I have examined in the BMNH does not possess any label, but D'ABRERA stated that its origin was Colombia. I document here for the first time the holotype of *Thecla splendor* databased as Lepidoptera Type No. 3435 in HCOU (Figs 24–26). The second line of the original locality label was not cited by DRUCE, nor was it mentioned by NICOLAY. This is the line "prob. nr. Bogota" (Fig. 26), which indicates that the specimen probably originated from the environs of Bogotá. Therefore, if the type locality of *splendor* is Bogotá, the following problem emerges.

Recently two large *Arcas* species were discovered in the Colombian Andes with distinctive androconial patches when compared to *Arcas splendor* sensu NICOLAY from Panama. The two Colombian taxa are close in wing colouration and pattern to the holotype of *Thecla splendor*. If *Thecla splendor*'s type locality is Bogotá, most probably one of the recently described *Arcas* species is a junior synonym of *Th. splendor* and, in fact, the male of *A. splendor* was described after its original naming almost ninety years later by SALAZAR & CONSTANTINO – either as *A. nicolayi* (SALAZAR & CONSTANTINO 1995*a*: 125) or *A. lecromi* (SALAZAR & CONSTANTINO 1995*b*: 458). The holotype male of *Arcas nicolayi* originates from Departamento Risaralda, San Antonio del Chamí, 1800 m, from the Pacific side of the Western Cordilleras. The worn male specimen figured by D'ABRERA (1995: 1105) as "A. splendor ♂ R" strongly resembles *Arcas nicolayi* (Figs 27–28). The holotype male of *Arcas lecromi* originates from the Central Cordillera, also from Departamento Risaralda, Río Consota, 1600 m. The holotype was not figured in the original paper but, subsequently, the photos of the male specimens from Caldas, figured as paratype males by SALAZAR & CONSTANTINO (1995*b*: 461, Fig. 1b, d), were reproduced as "holotype male" (dorsum and ventrum of different specimens) in [JOHNSON] (1997, Photoplate XVIII, Figs a-b). The HNHM possesses a male *Arcas* specimen (Figs 29–30) which was sent as *A. lecromi* by JULIAN SALAZAR. This specimen resembles the holotype of *Arcas nicolayi* rather than the types of *A. lecromi*, having a conspicuous median band on the forewing ventrum broken at vein M1 reaching the costa. The paratype male of *Arcas lecromi* figured by SALAZAR & CONSTANTINO (1995*b*: Fig. 1d) has no ventral median band of the forewing in the cells R2, R3 and R5.

If the specimens considered to be *Arcas splendor* by NICOLAY represent a different species, possessing a distinctively tear-shaped male androconial cluster on the forewing dorsum (see NICOLAY 1971: Figs 9 and 10c), this taxon then needs a replacement name because the specimens are not typical *A. splendor*. I could not locate any "splendor" material from Mesoamerica; therefore I cannot solve the problem completely in the present paper.

Obviously *Arcas splendor* represents a group of species or a superspecies similar to *A. tuneta*. This view is confirmed by the distinctive new species described below.

Arcas alleluia sp. n.
(Figs 31–32)

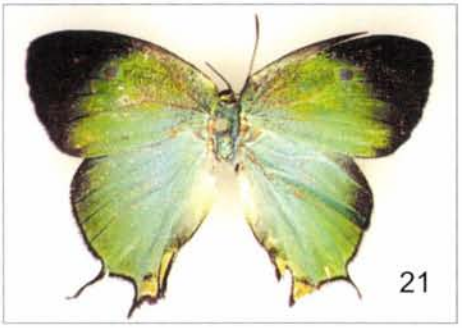
Type – Holotype female, NMW, and labelled as "Rodriguez de Mendoza, N. Peru, 1989.XII., coll. F. König // NMW Neotropische Lycaenidae, König collection, No. 427". Length of forewing costa 17.8 mm. The specimen is in moderate condition. Genitalia dissection gen. prep. BÁLINT No. 1016 (Figs 31–32).

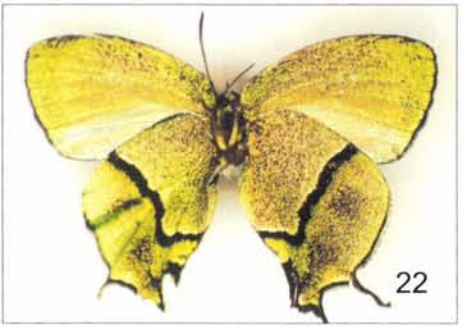
Diagnosis – It is reminiscent of *Arcas splendor* but with faint and narrow (as wide as palpal width) black submarginal band on ventral forewing (which is wider, i.e. as wide as width of eyes on sister taxa *A. nicolay*, *A. lecromi* and *A. splendens*). In contrast to this cluster of taxa, *Arcas delphia* and *A. tuneta* females show dorsally tinted blue with a very faint submarginal band. The hindwing ventrum also resembles to *A. splendor* but with the median band gently bent twice (middle at Cu3), whereas it is bent gently from costa to interspace Cu2 in other *Arcas* species (*A. jivaro, A. nicolay*, *A. lecromi* and *A. splendor*) or straight (*A. tuneta* superspecies). The female is unique amongst all the *Arcas* specimens known to me having a hindwing ventral median band gently bent twice.

Description – Head, thorax and abdomen dorsally luminous azure blue, abdomen ventrally orange coloured; palpi, eyes and legs goldish. Forewing dorsum lustrous azure blue with a vaguely defined wide black margin beginning just proximal to mid-point of costa then curved around outside cell to tornus. Hindwing dorsum lustrous azure blue with a vaguely defined black outer margin, widest below apex, disappearing at Cu4; terminal margin a thin black line from apex to anal lobe; anal lobe and adjacent interspace gold; a dark narrow cap spot across interspace Cu1 and Cu2, fringes narrowly iridescent blue. Forewing ventrum lustrous golden green, tornal area grey; submargin with faint black line from vein M1 to CuA2; terminal line thin, black, fringes basally brown, apically bluish. Hindwing ventrum entirely golden green to median line; submarginal area heavily dusted with black scales beeing more intensive to anal angle; median line black, etched proximally in gold extended from mid costa to just above cleft of anal lobe having slightly waved at vein M2, then narrowed and curved sharply at 90° angle to inner margin; anal lobe black with golden basal margin, outer margin with terminal black fringes very pale blue. Genitalia typical of *Arcas splendor* group.

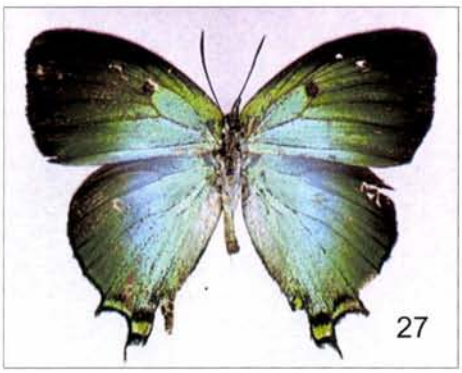
Distribution – Known only from type data.

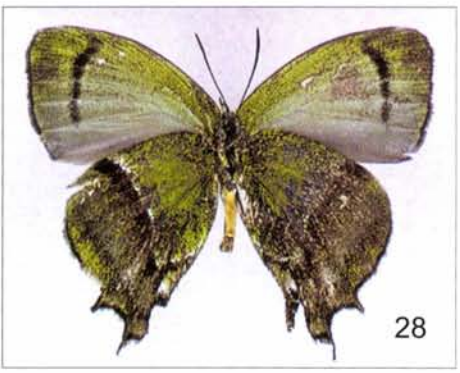
Etymology – From latinized Hebrew, allelu-yah, with the meaning: Praise God.

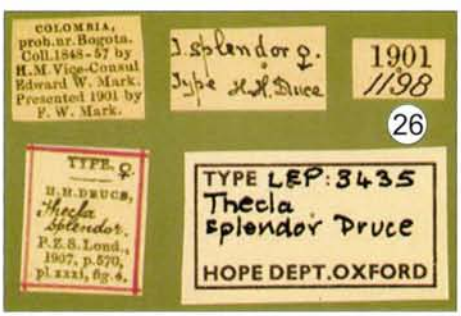




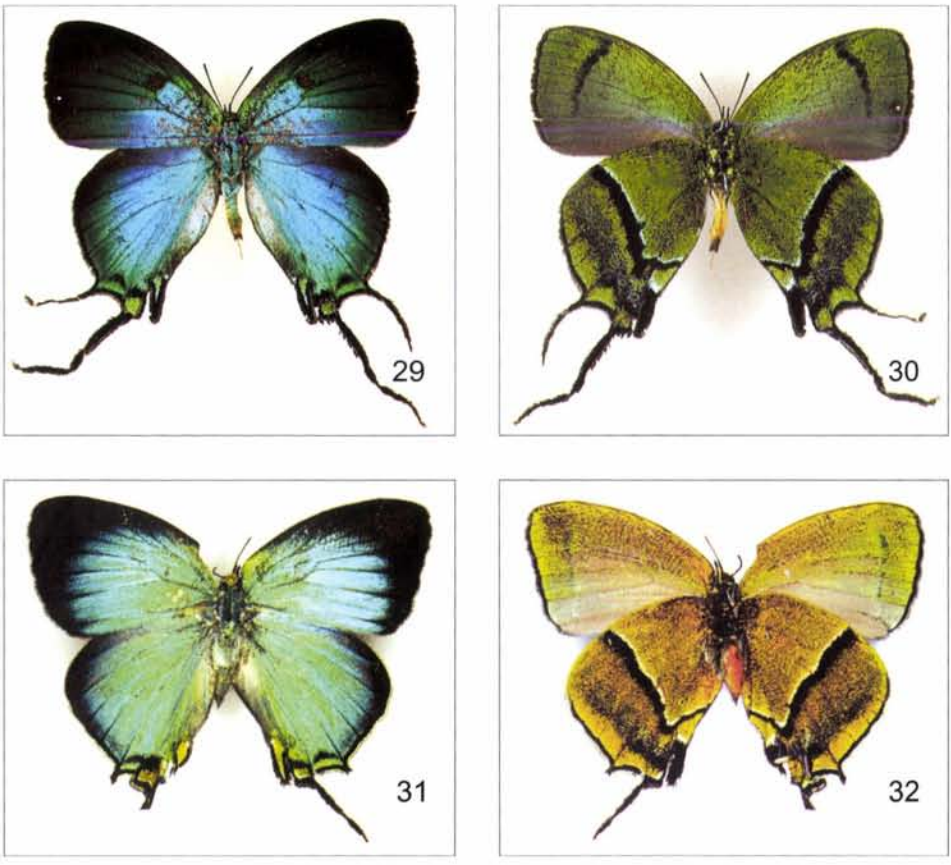
Figs 19–23. 19–20 = *Arcas arcadia* sp. n.: 19 = female, paratype (BMNH), dorsal view, 20 = ditto, ventral view (photo courtesy: BMNH); 21–23 = *Arcas delphia* NICOLAY, male, holotype, Costa Rica (NMNH): 21 = dorsal view, 22 = ventral view, 23 = labels (photo courtesy: A. MOSER)







Figs 24–28. 24–26 = *Thecla splendor* DRUCE, female, holotype (HCUO): 24 = dorsal view, 25 = ventral view, 26 = labels (photo courtesy: HCOU); 27–28 = *Arcas splendor* (DRUCE) sensu d'ABRERA, male Colombia (BMNH No. 146407): 27 = dorsal view, 28 = ventral view (photo courtesy: BMNH)



Figs 29–32. 29–30 = *Arcas lecromi* SALAZAR et CONSTANTINO, male, Colombia (HNHM): 29 = dorsal view, 30 = ventral view; 31–32 = *Arcas alleluia* sp. n, female, holotype (NMW): 31 = dorsal view, 32 = ditto, ventral view

REFERENCES

AUSTIN, G. T., HADDAD, N. M., MÉNDEZ, C., SISK, T. D., MURPHY, D. D., LAUNER, A. E. & EHRLICH, P. R. (1996): Annotated checklist of the butterflies of the Tikal National Park Area of Guatemala. – *Tropical Lepidoptera* **7** (1): 21–37.

AUSTIN, G. T. & JOHNSON, K. (1995): Theclinae of Rondônia, Brazil: Arcas, with descriptions of three new species (Lepidoptera: Lycaenidae). – *Tropical Lepidoptera* **6**: 31–39.

BOISDUVAL, J. B. (1870): *Considérations sur lépidoptères envoyés du Guatemala à M. de l'Orza.* – Oberthür et fils, Rennes, 1 + 100 pp.

BRIDGES, CH. (1988): *Catalogue of Lycaenidae and Riodinidae (Lepidoptera).* – Published by the author, Urbana, Illinois, 788 pp.

BRIDGES, CH. (1994): *Catalogue of the family-group, genus-group, and species-group names of the Riodinidae and Lycaenidae (Lepidoptera) of the World.* – Published by the author, Urbana, Illinois, 1128 pp.

BROWN, K. S, JR. (1993): Selected Neotropical species. – In: NEW, T. R. (ed.): *Conservation Biology of Lycaenidae (Butterflies).* – Occasional Paper of the IUCN Special Survival Comnission No. 8. International Union for Conservation of Nature and Natural Resoruces, Gland, Switzerland, pp. 146–149.

BUTLER, A. G. (1884): On a new species of the theclid genus Theritas from Colombia. – *Annals and Magazine of Natural History (5)* **14**: 267.

CRAMER, P. (1775): *Uitlandsche Kapellen, voorkomende in de drie Waereld-Deelen Asia, Africa en America, by een verzameld en bescreeven.* – S. J. Baalde, Amsteldam; Barthelemy Wild and J. Van Schoonhoven & Comp., Utrecht, xxx + 16 + 132 pp.

D'ABRERA, B. (1995): *Butterflies of the Neotropical Region. Part VII. Lycaenidae.* – Hill House, Victoria, Black Rock, i–xi + 1098–1270 pp.

DRAUDT, M. (1919): Familie: Lycaenidae. – In: SEITZ, A. (ed.): *Die Gross-Schmetterlinge der Erde, Band 5.* Alfred Kernen Verlag, Stuttgart, pp. 744–768.

DRUCE, H. H. CH. J. (1907): On Neotropical Lycaenidae with descriptions of new species. –*Proceedings, Zoological Society of London* **1907** (3): 566–632.

EMMEL, T. C. & AUSTIN, G. T. (1990): The tropical rain forest butterfly fauna of Rondonia, Brazil: Species diversity and conservation. – *Tropical Lepidoptera* **1** (1): 1–12.

FABRICIUS, J. Ch. (1775): *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adjectis synonymis, locis, descriptionibus, observationibus.* – Libraria Korti, Flensburgi et Lipsiae, [i–xxxii]+832 pp.

FELDER, C. VON & FELDER, R. (1865): Rhopalocera. – In: *Reise der österreichischen Fregatte "Novara" um die Erde in den Jahren 1857, 1858, 1859 unter den Behelfen Commodore B. von Wüllerstorf-Urbair. Zoologischer Teil. Zweiter Band. Zweite Abtheilung: Lepidoptera.* – Carl Gerold's Sohn, Wien, 536 pp.

GEYER, C. M. in HÜBNER, J. [1837]: *Zuträge zur Sammlung Exotischer Schmetterlinge. Band 5.* – Jacob Hübner, Augsburg, 52 pp.

GODMAN, F. & SALVIN, O. (1887): *Biologia Centrali-Americana. Insecta. Lepidoptera – Rhopalocera. Volume 2.* – Dulaeu & Co., Bernard Quaritch, London, 112 pp.

GOODSON, F. W. (1946): *List of types of American Theclini in the British Museum.* – Manuscript, 37 pp.

HEWITSON, W. CH. (1865): *Illustrations of diurnal Lepidoptera, Lycaenidae. Vol. 1.* – Van Voorst, London, 228 pp.

KIRBY, W. F. (1879): Catalogue of the collection of diurnal lepidoptera formed by the late William Chapman Hewitson – John van Voorst, London, 246 pp.

KÖNIG, F. (1984): Die Papilionidae Perus, mit besonderer Berücksichtigung des Chanchamayogebites (Lep.: Papilionidae). – *Atalanta, Würzburg* **15**: 124–146.

LAMAS, G. (1993): Lista comentada de los piéridos americanos descritos por J. Röber (Lepidoptera: Pieridae). – *Shilap Revista de Lepidopterologia* **21** (83): 130–155.

LLORENTE BOUSQUETS, J., LUIS MARTÍNEZ, A., VARGAS FERNÁNDEZ, I. & WARREN, D. A. (1995): Lista de las Mariposas del Estate de Jalisco, México. – *Revista de la Sociedad mexicana de Historia natural* **46**: 35–48.

LUIS MARTINEZ, A. VARGAS FERNANDEZ, I. & LLORENTE BOUSQUETS, J. (1995): Sintesis de los Papilionoidea (Lepidoptera: Rhopalocera) del estado de Veracruz. – *Folia entomológica mexicana* **93**: 91–133.

NICOLAY, S. S. (1971): A review of the genus Arcas with descriptions of new species (Lycaenidae, Strymonini). – *Journal of the Lepidopterists' Society* **25**: 87–108.

NIELSEN, G., SALAZAR ESCOBAR, J. A. & VARGAS, I. J. (2001): Reconocimiento de Rhopalocera en algunas taxocenosis de lepidopteros Chocoanos y Amazonicos. – *Boletín Científico Centro de Museos, Museo de Historia Natural, Universidad de Caldas* **5**: 93–107.

RÖBER, J. K. M. (1923): Neue Schmetterlinge. – *Entomologische Mitteilungen* **12**: 57–59.

SALAZAR ESCOBAR, J. A. (2001): Novedades en el Museo de Historia Natural. – *Boletín Científico Centro de Museos, Museo de Historia Natural, Universidad de Caldas* **5**: 136–137.

SALAZAR ESCOBAR, J. A. & CONSTANTINO, L. M. (1995*a*): Sobre algunas especies colombianas del género Arcas Swainson, 1832 y descripción de una nueva (Lepidoptera: Lycaenidae). – *Shilap Revista de Lepidopterologia* **23** (90): 123–128.

SALAZAR ESCOBAR, J. A. & CONSTANTINO, L. M. (1995*b*): Descripción de un nuevo género y dos especies nuevas de lepidópteros de la Cordillera Central de Colombia (Lepidoptera: Lycaenidae). – *Shilap Revista de Lepidopterologia* **23** (92): 457–464.

STEARN, W. T. (1998): *The Natural History Museum at South Kensington*. – The Natural History Museum, London, 414 pp.

SWAINSON, W. (1832): *Zoological illustrations, or original figures and descriptions of new, rare, or interesting animals, selected chiefly from the classes of ornithology, entomology and conchology*. – Baldwin, Cradock, and Joy & W. Wood, London, 136 pp.

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