

**Arcas Swainson, 1832 is revisited:
review of some species-group names,
identification of the sister group and a key for species
(Lepidoptera, Lycaenidae: Eumaeini)**

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Abstract – The sister genus of *Arcas* SWAINSON, 1832 is identified as *Theritas* HÜBNER, 1818 on the basis of the ventral androconial scales in the basal part of the cubital vein of the hind wing. This character is considered to be a synapomorphy of the two genera. Five nominal species are reviewed with the following results: *Arcas alleluia* BÁLINT, 2002 and *A. arcadia* BÁLINT, 2002 are reinstated from synonymy; *A. katia* JOHNSON et SALAZAR, 2002 is considered as junior subjective synonym of *A. delphia* NICOLAY, 1971; *A. lecromi* SALAZAR et COSTANTINO, 1995 and *A. nicolay* SALAZAR et COSTANTINO, 1995 both are considered to be synonyms of *A. splendor* (DRUCE, 1907). The new name *A. gozmanyi* sp. n. is introduced for *A. splendor* NICOLAY, 1971, not DRUCE, 1907. A key for identification of all *Arcas* species recognized is given. With 14 figures.

Key words – Lepidoptera, Lycaenidae, *Arcas*, *Theritas*, androconia.

INTRODUCTION

The genus *Arcas* SWAINSON, 1832 (type species: *Papilio imperialis* CRAMER, 1775), has been reviewed by NICOLAY (1971). Later BROWN (1993) considered “*Arcas*, five rarer species” of Neotropical lycaenids as “good indicators of undisturbed forest systems”. The results of NICOLAY remained stable for more than three decades (BÁLINT 2002), including the concept that the two genera most closely related to *Arcas* are *Atlides* HÜBNER, 1819 (type species: *Papilio halesus* CRAMER, 1777) and *Pseudolycaena* WALLENGREN, 1858 (type species: *Papilio marsyas* LINNAEUS, 1758) (ROBBINS 2004).

Revising voluminous *Arcas* material I discovered that some *Arcas* species concepts of NICOLAY were erroneous. These were plainly reflected in the eumaeine part of the recently published Checklist of Neotropical Butterflies (hereafter CNB), and all the taxa established subsequent to NICOLAY’s work have been synonymized without any supportive text or documentation (ROBBINS 2004).

This paper has the following aims: (1) to identify the sister group of *Arcas*, (2) to revise the previous species concepts and formalize the synonyms plainly introduced in the CNB and (3) to present a revised identification key to *Arcas*.

The results are based on the revision of the material of the following collections: The Natural History Museum, London (BMNH), Naturhistorisches Museum, Wien (NMW) and the Museum National d'Histoire Naturelle, Paris (MNHN). When relevant, the material examined since BÁLINT (2002) is listed. As a closing chapter an identification key to all the species I recognise in *Arcas* is given, with an indication to their range.

THE SISTER GROUP OF ARCAS

In the CNB the genus *Arcas* is placed between two genera: *Atlides* and *Pseudolycaena* in the newly created "*Atlides* Section". The genus *Atlides* is indicated as basal genus of the section. This arrangement should reflect the intention of the compiler: as "the checklist is intended to be phylogenetic" (ROBBINS 2004: xxiv). The *Atlides* section was diagnosed as "the anal lob cleft ... modified from Godman & Salvin". This is an unsatisfactory diagnosis as (1) there is no indication how the CNB cleft concept diverges from that of GODMAN & SALVIN's (1887) and (2) anal lobe cleft identical with that of *Atlides* can be found in numerous other genera placed in various sections by the author of the eumaeine checklist, just to mention three (in brackets with CNB eumaeine section names): *Brangas torfida* (HEWITSON, 1867) d'ABRERA, 1995 (*Brangas* Section); *Panthiades paphlagon* (C. FELDER et R. FELDER, 1865) NICOLAY, 1976 (*Panthiades* Section); *Radissima umbratus* (GEYER, 1832) JOHNSON 1992 (*Paiwarria* Section).

The other difficult point is that placement of *Arcas* in the CNB can be understood in rather different ways, for example, (1) as sister group of *Atlides* with the rest of the Section (*Pseudolycaena* and *Theritas* sensu CNB), (2) as immediate sister group of *Atlides*; or (3) as immediate sister of *Pseudolycaena* (Fig. 1). On the basis of the sole list it is impossible to reconstruct which branching was the real intent of the compiler. However, none of these groupings take into consideration the presence of the androconial pouch in the hind wing ventra of the genera *Arcas* (Fig. 2), *Theritas* (Fig. 3), *Pseudolycaena* (Fig. 4), and *Denivia* JOHNSON, 1992 (Fig. 5) (type species: *Thecla deniva* HEWITSON, 1874; lumped under *Theritas* without any comment in the CBN). Accordingly, the androconial pouch has no phylogenetic importance in reconstructing natural relationships (= phylogeny) or is "homoplastic or difficult to interpret" (ROBBINS 2004: xxiv).

On the contrary, I am of the opinion that the androconium is an important character for lycaenid systematics, and it is not difficult to interpret. Evolving an androconium is most probably costly, therefore its presence suggests presumably the derived state of the taxon, that possesses such characters. For example, "*Thecla*" *teucris* HEWITSON, 1868 and *Lucilda lisus* (STOLL, 1780) are both basal taxa in the generic lineages of *Brangas* and *Denivia*, respectively. This view is in full harmony with HALL & HARVEY (2002a), who express for riordinid butterflies (Riordinidae is considered to be the sister group of Lycaenidae, see e.g. CAMPBELL & PIERCE 2003) that if androconium appeared in a lineage the character was never lost.

On the basis of this character evaluation I consider *Theritas* as a sister genus of *Arcas*, because both genera have identical hind wing ventral androconial pouch, which is situated at the base of the cubital vein (Figs 2–3). I hypothesise that this character is a synapomorphy, and does not appear independently. The monophyly of *Arcas* and *Theritas* is supported by the similarly structured dorsal fore wing androconial clusters and by similar male and female genitalia. The putative sister group of *Arcas*-*Theritas* lineage is *Margaritheclus* BÁLINT, 2002 (type species: *Thecla danaus* C. FELDER et R. FELDER, 1865) on the basis of similar dorsal fore wing scent pad and tubular female genitalia, and because of its large size. I consider large eumaeines primarily plesiomorphic (BÁLINT, *in prep.*).

The ventral androconium of the hind wing has never been mentioned in regard to *Arcas*, but for *Theritas*, *Pseudolycaena* and for "*Thecla hemon*" (= genus *Denivia*) as "a flat but deep pouch line with specialized scales in space 1b on the under surface of the hind wing" by ELIOT (1973: 402). I point out here that hind wing androconia were discovered and documented by GODMAN & SALVIN (1887) far before ELIOT for the taxa *D. hemon* and the representatives of the genus *Brangas* HÜBNER, 1819 (type species: *Papilio caranus* STOLL, 1780) (Fig. 6). However, *Brangas*, *Denivia* and *Pseudolycaena* possess this pouch in different places of their wings (Figs 4–6), and the pouches are differently scaled (BÁLINT, *in*

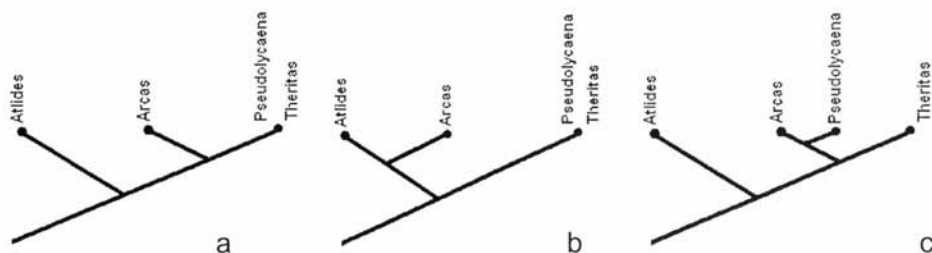
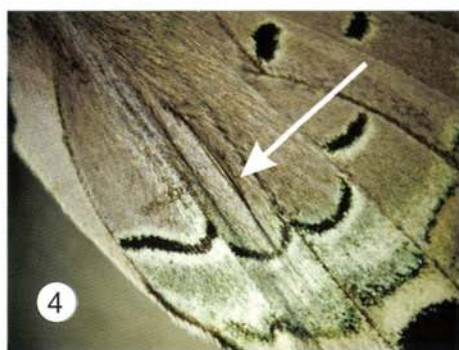


Fig. 1. Possibilities for branching *Arcas* SWAINSON, 1832 in *Atlides* Section according to the Checklist of Neotropical Butterflies (ROBBINS 2004)

prep.). I am of the opinion that *Brangas*, *Denivia* and *Pseudolycaena* evolved independently hind wing ventral androconia, and they represent derived and not basal genera.



Figs 2–6. Eumacine hind wing ventral androconia indicated by arrows: 2 = *Arcas imperialis* (CRAMER, 1775), 3 = *Theritas paupera* (FELDER et FELDER, 1865), 4 = *Pseudolycaena marsyas* (LINNAEUS, 1758), 5 = *Denivia hemon* (CRAMER, 1775), 6 = *Brangas caranus* (STOLL, 1780)

SPECIES ACCOUNTS

Arcas alleluia BÁLINT, 2002, **bona** sp. (Figs 7–10)

Arcas alleluia BÁLINT, 2002: 156, figs 31 (holotype dorsum), 32 (holotype ventrum).

Arcas jivaro SALAZAR et CONSTANTINO; ROBBINS 2004: 119 (synonymy in error).

Material examined – PERU: Jorge Chavez, III.2003., F. König (1 male, NMW); ditto, 1600 m, X.2003. (1 female, NMW).



Figs 7–10. *Arcas alleluia* BÁLINT, 2002 from Jorge Chavez, 1600 m, Peru: 7 = male dorsum, 8 = male ventrum, 9 = female dorsum, 10 = female ventrum

Remarks – In the CNB the species *A. alleluia* was erroneously lumped under *A. nicolayi* SALAZAR et COSTANTINO, 1995 (ROBBINS 2004), which I consider as one of the junior subjective synonyms of *A. splendor* (DRUCE, 1907) NICOLAY, 1971 (see below). The species *A. alleluia* is the only *Arcas* without dorsal fore wing androconia. The female either possesses a faint submedian pattern in the fore wing ventrum or she does not. In this character it is similar to that of *A. delphia* female, which is larger and has a very wide black margin in the dorsal fore wings. Consequently, I reinstate the nominal taxon *alleluia* to its original status.

Arcas arcadia BÁLINT, 2002, **stat. n.**

Arcas (tuneta) arcadia BÁLINT, 2002: 153, figs 17 (holotype dorsum), 18 (holotype ventrum), 19 (paratype female dorsum), 20 (paratype female ventrum).

Arcas tuneta (HEWITSON); ROBBINS 2004: 119 (synonymy in error).

Material examined – BRAZIL: Santa Catharina (1 male, MNHN); Santa Catharina, Blumenau, 1910, Wernicke (1 male, 1 female, MNHN); no precise locality (1 male, 1 female, MNHN).

Remarks – The material listed above displays the same characteristics that have been found to be diagnostic for the representatives of the superspecies *A. tuneta* living in the Atlantic region of South America: (1) wide black marginal border reaching dorsal fore wing androconia, and (2) golden basal scaling along ventral hind wing medial black line. Both semispecies of superspecies *Rekoa zebina* (HEWITSON, 1869) ROBBINS, 1991 were converted into species rank in the CNB without any comment (ROBBINS 2004: 123). Similarly, there is no explanation, why *A. arcadia* has been lumped under *A. tuneta* and why *A. delphia* NICOLAY, 1971 is regarded as distinct species in the CNB. The phenomenon that allopatric species of Amazonian and Atlantic distribution exist is well known in butterflies (HALL & HARVEY 2002b). Therefore, I consider the taxon *arcadia* as an *Arcas* species in accordance with the methodology applied in the CNB and on the basis of the mentioned phylogeographic evidence.

Arcas delphia NICOLAY, 1971

Arcas delphia NICOLAY, 1971: 101, holotype male: COSTA RICA, Guapiles, 850 Ft; Figs 21; BÁLINT 2002: 153, figs 21 (holotype dorsum), 22 (holotype ventrum), 23 (holotype labels).

Arcas katia SALAZAR et JOHNSON in JOHNSON & SALAZAR 2002: 148, figs 1 (holotype dorsum), 2 (holotype ventrum) 3 (genitalia); ROBBINS 2004: 119 (as *A. delphia* new synonym with no support); **syn. n.**

Material examined – COLOMBIA: Bogota (2 males, 1 female, MNHN); Muzo, Ap. Maria (2 males, 1 female, MNHN); Muzo, 4–800 m, coll. Fassl, ex coll. Brabant (1 female, MNHN); Muzo (1 male, MNHN); no precise locality (1 female, MNHN).

Remarks – NICOLAY (1971) indicated a single *A. delphia* record from Colombia (“Victoria, Caldas”, SCHMIDT-MUMM collection, Bogotá). Beside the BMNH specimen originating from the type locality (see BÁLINT 2002), I could find the above listed 5 male and 4 female specimens under the names “Thecla paphia” or “Thecla tuneta” in the MNHN FOURNIER collection.

Arcas katia is considered as junior subjective synonym of *A. delphia* in the CNB without any support (ROBBINS 2004). According to the documentation and description of *A. katia*, the two taxa indeed seem to be synonymous, as their holotypes have an identical tiny fore wing dorsal scent patch “lying completely outside the cell, well beyond transverse line” (= discocellular veins), “longer hind wing” and “much reduced dark margins on the upper hind wing” compared to *tuneta* (NICOLAY 1971). Therefore, I formalise here the synonymy as *Arcas delphia* NICOLAY, 1971 = *Arcas katia* JOHNSON et SALAZAR, 2002, **syn. n.**

Examining *A. delphia* female material, I observed that the fore wing ventrum possesses a faint submedial pattern which appears in most of the specimens I examined as a light band. It is obvious in the “*A. delphia* ? V” figure of d’ABRERA (1995: 1105). This character was omitted by NICOLAY (1971), who gave an illustration of a specimen as *A. delphia* female without this pattern.

It is questionable whether the specimen depicted as *A. delphia* female by NICOLAY (1971: 102, fig. 8c-d) represents indeed *A. delphia* or actually it is the female of the species for which the name “*Thecla splendor*” was misapplied (see below).

Arcas splendor (DRUCE, 1907) NICOLAY, 1971
(Fig. 11)

Thecla splendor DRUCE, 1907: 570, Pl. 31, fig. 4 (holotype dorsum and ventrum).

Arcas splendor (DRUCE); NICOLAY 1971, female: 105, fig. 5b (genitalia), 9c (dorsum), 9d (ventrum); BÁLINT 2002: 154, fig. 24 (holotype dorsum), 25 (holotype ventrum), 26 (holotype labels), 27 (male dorsum), 28 (male ventrum).

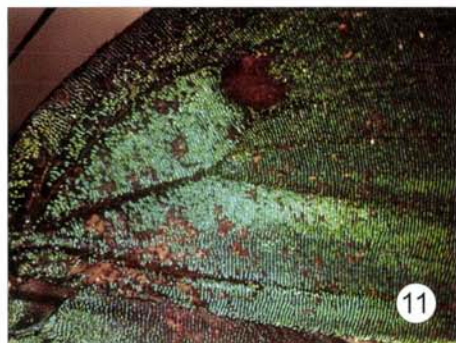
Arcas nicolayi SALAZAR et COSTANTINO 1995a: 125; ROBBINS 2004: 119 (as *A. splendor* new synonym with no support); **syn. n.**

Arcas lecromi SALAZAR et COSTANTINO, 1995b: 461; BÁLINT 2002: 159, fig. 29 (male dorsum), 30 (male ventrum); ROBBINS 2004: 119 (as *A. splendor* new synonym with no support); **syn. n.**

Remarks – The CNB indicates that taxa of *A. lecromi* and *A. nicolayi* are synonyms (ROBBINS 2004). Evidence has not been presented. The holotype of *A. nicolayi* was presented in a figure in the original description. Photographic docu-

mentation of the *A. lecromi* holotype was done subsequent to the original description, in an unsatisfactory manner (c.f. BÁLINT 2002: 155). As the presence of fore wing ventral submedian pattern is indicated for both of the species, I consider them to be synonyms in harmony with the CNB, and formalize here the synonymy: *Arcas lecromi* SALAZAR et COSTANTINO, 1995 = *Arcas nicolayi* SALAZAR et COSTANTINO, 1995. In my opinion, both of these taxa represent “*Thecla splendor*” because they are identical in size, in fore wing dorsal androconia and in ventral fore wing pattern. Consequently, *Thecla splendor* DRUCE, 1907 = *Arcas nicolayi* SALAZAR, CONSTANTINO et JOHNSON, 1995, **syn. n.**

The fore wing androconia of *A. splendor* has never been described. The *splendor* fore wing androconial cluster is situated on the discocellular veins and is of a crescent shape with the medial distal projection outside the discal cell (Fig. 11). The species *splendor* sensu NICOLAY has a distinctively shaped androconial cluster in fore wing dorsum (Fig. 12), a lighter green structural colour and a patternless fore wing ventrum (Figs 13–14). This species has hitherto had no name.



Figs 11–14. 11–12 = Dorsal fore wing androconial clusters: 11 = *Arcas splendor* (DRUCE, 1907), 12 = *A. gozmanyi* sp. n. 13–14 = *Arcas gozmanyi* sp. n., holotype: 13 = dorsum, 14 = ventrum

Arcas gozmanyi sp. n.

(Figs 12–14)

Arcas splendor NICOLAY, 1971 (not DRUCE, 1907), male: 103; Fig. 2D (male genital valvae), (9A (dorsum), 9B (ventrum), 10C (dorsal fore wing androconia); ROBBINS 2004: 129, misidentification.

Type material – Holotype male, University Museum, Oxford (UK), labelled as: (1) “PANAMA: PANAMA [/] Cerro Campana [/] 5–22–1971 [/] H. L. King (white oblong printed label; date handwritten), (2) “Allyn Museum [/] Acc. 1981–11” (white oblong printed label), (3) “Arcas [/] splendour [/] HHDce” (white hand written label), (4) “Exchange [/] from AME/FSM [/] to HEC/OUH [/] no. [/] Acc.3–1985” (pale yellow quadrant printed label). The specimen is in moderate condition: wing apices worn, hind wing CuA2 tails missing. Length of fore wing measured from the base of cubital vein to the vein R3 terminus is 25 mm.

Remarks – NICOLAY (1971) misapplied the name *splendor* to the species as he thought mistakenly that this phenotype represented *splendor* male (see above). He remarked that the range of *A. splendor* was restricted to Central America (Panama and Costa Rica). He was not aware that the type locality of “*Thecla splendor*” is “nr. Bogota” (BÁLINT 2002: fig. 26). This situation is reflected by the CNB (ROBBINS 2004). Another complicated factor is that NICOLAY probably wrongly associated the female phenotype of this Central American species with his *A. delphia* (see above). Consequently, NICOLAY has never described or illustrated either the male of *A. splendor* or the female of *A. delphia*.

Despite its being well described and documented (see above the references given), the Central American species with tear-drop shaped dorsal forewing androconia had so far no applicable name as the species-group name “*Thecla splendor* Druce” was wrongly applied through misidentification. With indication to NICOLAY’s descriptions and the designation of a holotype I give the scientific name to this species *Arcas gozmanyi* sp. n. The species is dedicated to Dr. LÁSZLÓ GOZMÁNY, the widely known Microlepidoptera specialist, former curator of Lepidoptera in the Hungarian Natural History Museum, for the anniversary of his 85th birthday.

KEY TO THE SPECIES OF ARCAS

- | | | |
|---|---------------------------------------|---|
| 1 | Ventral hind wing without median line | 2 |
| – | Ventral hind wing with median line | 3 |

- 2 Ventral hind wing brilliant metallic goldish green densely scattered with black scales (from S Mexico via Mesoamerica, E Andes, Amazon Basin and Guianas to SE Brazil) *A. imperialis* (CRAMER, 1775)
- Ventral hind wing brilliant metallic goldish green densely scattered with black scales, but with a clearly defined carmine basal disc and wide yellow-gold outer margin (SE Brazil) *A. ducalis* (WESTWOOD, 1832)
- 3 Dorsal fore wing without androconia, female dorsal black marking narrow (E Peru) *A. alleluia* BÁLINT, 2002
- Dorsal fore wing with androconia, female dorsal black margin wide 4
- 4 Dorsal fore wing with androconial cluster located well outside cell not touching discocellular veins (Central America via W Colombia to Ecuador) *A. delphia* NICOLAY, 1971
- Dorsal fore wing with discoidal scent pad and postdiscal scent patches basally touching discocellular veins 5
- 5 Ventral hind wing black median displaced distally at vein M3 then curving gently to anal margin (S Mexico via Mesoamerica to NW Colombia) *A. cypria* (GEYER, 1823)
- Ventral hind wing median band with concave angle at CuA2 then running straight to anal margin 6
- 6 Dorsal fore wing with androconial cluster outside the discal cell, smaller species (fore wing length < 20 mm) 7
- Dorsal fore wing with androconial cluster partly in the discal cell, larger species (fore wing length > 20 mm) 8
- 7 Dorsal fore wing ground colour dark green or blue with wide margin reaching discalis (E Andes of Colombia to Peru, Amazon Basin) *A. tuneta* (HEWITSON, 1865)
- Dorsal fore wing ground colour lighter green or blue with narrow margin not reaching discalis (SE Brazil) *A. arcadia* BÁLINT, 2002
- 8 Dorsal fore wing androconial cluster tear-drop shaped and pointed basally in discal cell, very large (> 25 mm) species (Mesoamerica) ***A. gozmanyi* sp. n.**

- Dorsal fore wing androconial cluster not tear drop shaped and not pointed basally in discal cell, not so large (< 25 mm) species 9
- 9 Dorsal fore wing androconial cluster crescent shaped with a medial extension distally, fore wing ventrum with conspicuous black submedian band (Mesoamerica, Colombia) *A. splendor* (DRUCE, 1907)
- Dorsal fore wing androconial cluster circular, fore wing ventrum with no submedian pattern (Ecuador) *A. jivaro* NICOLAY, 1971

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