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A new species of *Argyrophorus* Blanchard from northern Peru and considerations on the value of wing venation as a source of synapomorphies in some temperate Neotropical Satyrinae (Lepidoptera: Nymphalidae)

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Abstract. A new species *Argyrophorus blanchardi* with a new subspecies *A. b. celendini* are described from Cajamarca in northern Peru, extending considerably northwards the known distribution of the entire temperate group of Pronophilini. Two subspecies are identified. Based on a comparative study, venation is questioned as a valid character at the generic level in the *Argyrophorus* complex.

Key words: entomology, taxonomy, Andes, Chile, genitalia, Hypocystini, new species, Patagonia, Pronophilini, puna, venation.

INTRODUCTION

The genus *Argyrophorus* was described by Blanchard for the emblematic, shining silvery *Argyrophorus argenteus* (Blanchard, 1852). Subsequently, several newly described species were placed in *Argyrophorus* (Weymer, 1912). A renewed interest in the systematics of temperate neotropical Satyrinae took place in the nineteen-fifties and sixties (Forster 1964). Overall, as many as 15(!) new genera were described during this period. In some of the most relevant articles Hayward (1953) provided a detailed redescription of *Argyrophorus*, Heimlich (1963) attempted a revision of *Argyrophorus*, focusing on specifying some basic differences between this genus and *Cosmosatyrus*, whereas Herrera (1989a, b, 1992) and Herrera & Howarth (1966) pointed out many inconsistencies, inaccurate genitalia drawings, and mistakes in bibliography in the

paper of Heimlich. There was a great deal of instability in the generic taxonomy of the *Argyrophorus* (Table 1). The validity of the genera raised by Hemlich, Hayward and Herrera has ever since been a source of controversy, especially that several of them were monobasic (D'Abrera 1987). Peña & Ugarte (1992) made a point on this issue: "...confusion has increased with the creation of various genera, sometimes for a single species, which is obviously going too far. Genera have proliferated out of proportion to reality...". In the most recent catalogue of Neotropical butterflies *Argyrophorus* is treated as monobasic (taking into account only the already described species), and all of the genera raised by the above mentioned three authors are validated, however no justification is given (Lamas et al. 2004).

Several of these Chilean-Patagonian genera were described most of all, if not solely, based on the differences of venation pattern. Venation has traditionally been considered as an important character in the higher taxonomy of Lepidoptera and butterflies in particular (De Vries 1987, Kristensen 1999), although often its taxonomic validity was a matter of controversy (Albrecht & Kaila 1997, Hall 2003, Walla 2004). According to Nielsen and Common (1991) the family Nymphalidae is recognized by hindwing with humeral vein usually present, Sc+R1 diverging from Rs near base, and forewing with all branches of R present. The Neotropical tribe Pronophilini, downranked to subtribe Pronophilina (Harvey 1991), is weakly defined and again a venation feature is pointed out as one of its most salient, if not the only qualitative synapomorphy. It is the hindwing m1-m2 cross vein produced basally (Miller 1968; Viloria 2007). Again, this character is not exclusive and does not allow discriminating the Pronophilina form the Holarctic Satyrini.

In 1998 we discovered a new Peruvian species of satyrine related to *Argyrophorus*. We were unable to accommodate in any extant genus because its venation presents exclusive characters. This finding induced us to investigate the taxonomy of the genera of Austral Pronophilina, related to *Argyrophorus* with an emphasis on venation.

Table 1. Genera, whose species were associated in different sources with *Argyrophorus*

Genus	Author(s) and date	Type species
Neomaniola	Hayward, 1949	*Pseudomaniola eurypides*
Pampasatyrus	Hayward, 1953	*Epinephele gyrtone*
Pamperis	Heimlich, 1959	*Pamperis poaoeneis*
Punargenteus	Heimlich, 1963	*Argyrophorus lamna*
Etcheverrius	Herrera, 1965	*Satyrus chiliensis*
Palmaris	Herrera, 1965	*Hipparchia monticolens*
Stuardosatyrus	Herrera & Etcheverry, 1965	*Argyrophorus williamsianus*
Chilanella	Herrera, 1966	*Faunula stelligera*
Pseudocercyonis	Miller & Emmel, 1971	*Epinephele glaucone*

MATERIAL AND METHODS

Field study took place in the department of Cajamarca in June 1998. Collecting was carried out with standard entomological nets. Type material was examined in major public and private European and American collections. Type species of the following genera were examined: *Argyrophorus, Pampasatyrus, Stuardosatyrus*, *Etcheverrius*, *Palmaris*, *Pamperis* and *Punargenteus*. Head morphological characters were examined under an Olympus SZX9 stereomicroscope. Male genitalia were dissected according to standard procedure, preserved in glycerol, and examined, alongside other morphological microstructures, under an Olympus SZX9 stereomicroscope. Wing venation slides were made by soaking in KOH solution, in order to remove the scales from the wing surface, and preserving in euparal. Photographs of adults were made with an Olympus E-500 digital camera. Colour plates were composed using Adobe PhotoShop 8. The following abbreviations and collection codes were used: FW: forewing. HW: hindwing, V: ventral surface, D: dorsal surface. BMNH: Natural History Museum, London, UK (formerly British Museum (Natural History)); MUSM: Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, Peru; MZUJ: Muzeum Zoologiczne Uniwersytetu Jagiellońskiego, Kraków, Poland; PBF: collection of Pierre Boyer, Le Puy Sainte Réparade, France.

SYSTEMATIC OVERVIEW

Based on a preliminary comparative study of adult morphology of nine genera of temperate Pronophilini (Table 1), the genus *Argyrophorus* is redefined as follows:

Argyrophorus Blanchard, stat. rev.

Diagnosis

Head: eyes naked (not covered with setae); antennae short (2/5) to very short (1/3) length of costa, antennal club spoon shaped (except in *A. lamna*), antennae entirely covered with scales (in opposition to other Neotropical temperate Pronophilina) except partly covered in *A. poaoeneis*. Wings: forewing with a blunt or subacute apex and smooth, slightly convex outer margin; hindwing rounded or oval with a smooth outer margin. Venation: HW vein m1-m2 noticeably curved into discal-cell; FW radial veins and m1-m2 vein variable. Colour pattern: generally one prominent ocellus in FWV M1-M2 (however none in *A. poaoeneis*; several smaller ocelli in *A. lamna* and *A. blanchardi*; two ocelli in M1-M2 and M2-M3 and one smaller in Cu1-Cu2 in *A. nilesi* and *A. quies*; HWV ocellar elements as intravenal dots or stripes, never fully developed ocelli (in opposition to *Cosmosatyrus*). Male genitalia: uncus stout to very solid, mostly considerably wider in basal half, the junction of tegumen/uncus noticeable or uncus linked to tegumen by a fine membrane; gnathos short and stout, with the base as wide as base of uncus, or nearly so; valvae roughly rectangular or with a blunt or elongated apical part, without any dorsal process, dorsal surface smooth or slightly irregular, never serrate; aedeagus the length of valvae or slightly shorter, arched and

thin, in most species with lateral spines. Female genitalia not taken into consideration because they were not available for all the taxa for comparison.

Based on the above diagnosis, the new species discovered in northern Peru is placed in the genus *Argyrophorus*. Two subspecies are identified, described as below.

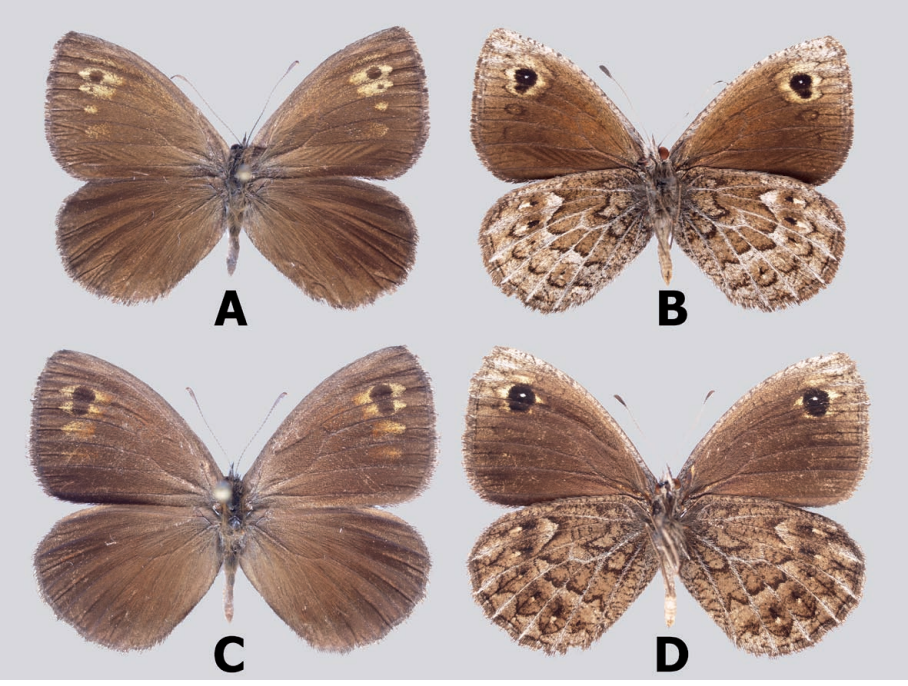
Argyrophorus blanchardi Pyrcz & Wojtusiak, n. sp.

Material examined

HOLOTYPE (male): Peru, Dept. Cajamarca, Cajamarca, Aylambo, S7°14'07''/ W78°29'13'', 3100-3200 m, 16.VI.1998, T. Pyrcz & J. Wojtusiak *leg*., to be deposited in MUSM; PARATYPES (18 males): data same as the holotype, 17 MZUJ, 1 PBF.

Diagnosis

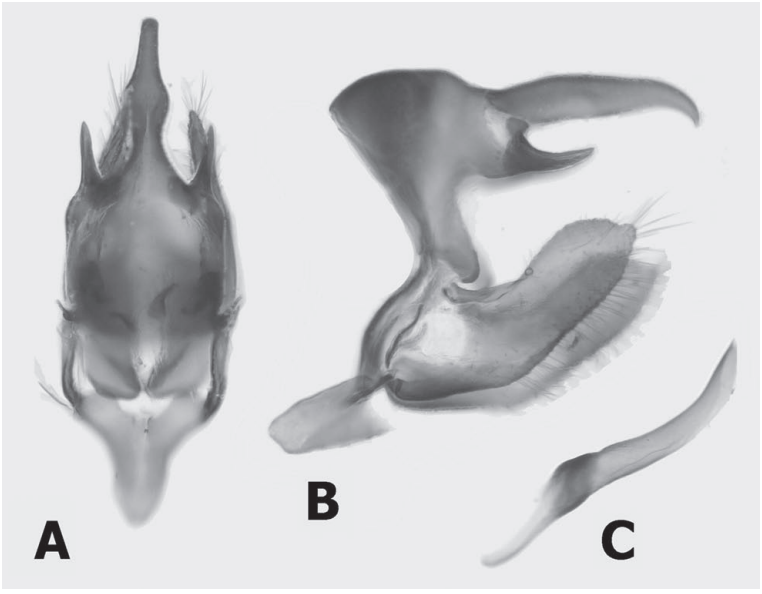
Upperside medium brown with a series of elongated yellow subapical patches, two of them with black pupils, somewhat similar to *A. monticolens*, however the latter is much bigger and, contrary to *A. blanchardi* which has an all dark brown forewing underside, has a wide reddish median patch.



1. Adult male: A and B – *Argyrophorus blanchardi blanchardi*: A – holotype dorsal, B – holotype ventral; C and D – *Argyrophorus blanchardi celendini*: C – holotype dorsal, D – holotype ventral

Description

MALE: *Head*: eyes chocolate brown, naked; palpi twice the length of head, dorsally black, laterally light grey, covered with grey and black hair; antennae to half costa, entirely covered with scales, dorsally brown and steely grey, ventrally snow white, club darker, spoon like, composed of 9-10 segments. *Thorax*: dorsally black, covered with dense, chestnut hair, ventrally blackish gray; legs grey brown. *Abdomen*: dorsally and laterally chestnut, ventrally light gray. *Wings*: FW length 19-22 mm; mean 20.9 mm; n=18; apex blunt, outer margin straight or slightly concave; HW oval with a smooth outer margin; fringes brown, longer on the HW. Venation: FW Sc and R arise independently, R1 arises before branching of M1, R2, R3 and R4 arise from the same stem, approximately the same distance from each other, rs-m1 short but noticeable, m1-m2 curved inside discal cell at straight angle, twice as long as m2-m3, m2-m3 straight. HW humeral vein absent, m1-m2 long and bent inside discal cell, M1 arises three times closer to Rs than to M2. FWD: chestnut, glossy; 4 – 5 diffused, elongate subapical and submarginal patches, varying in color between pale olive yellow and light orange, suffused with chestnut, heavier towards inner and outer margins, the widest in M1-M2 and M2-M3 approximately 4-5 mm, those in M3-Cu1 and Cu1-Cu2 half this width, the patch in R5-M1 apparent only in some examined individuals; two rounded, black subapical spots in the middle of M1-M2 and M2-M3 patches, the former slightly larger. HWD: chestnut, glossy; in one examined individual two faint, elongate, triangular submarginal patches apparent in M1-M2 and M2-M3, of same color as the FW patches. FWV: ground color dark brown with a black sheen; a light yellow submarginal patch,



2. Male genitalia of *Argyrophorus blanchardi blanchardi*: A – dorsal view, B – lateral view, C – aedeagus in lateral view

in some examined individuals extending distally as venal stripes along R5, M2 and M2, enclosing two black ocelli, in some individuals merging together to form a single large ocellus with a white pupil; apical and marginal area from apex to M2 steely grey; a thin, straight brown, marginal line, barely noticeably in some individuals. HWV: ground color steely grey suffused to a different degree with dark brown scales, in most examined individuals forming a darker median band; a series of zigzagging black lines extending from costa to anal margin, postbasal, postmedian and submarginal; a thin, black marginal line parallel to outer margin; all the veins marked with light gray. Male genitalia: Uncus massive, slightly longer than tegumen, straight, gnathi one third the length of uncus, stout at base, conical, transtilla elongated and wide, vinculum angled to tegumen shoulder, saccus wide and intermediate in length, valvae slightly shorter than tegumen+uncus, roughly rectangular with a slightly undulated ampulla, aedeagus straight, the length of valvae, without lateral spines.

FEMALE: The only known female of *A. blanchardi* is a specimen from Chavín de Huantar, which apparently represents a separate subspecies (Lamas 2004). It is not illustrated here. The differences compared to the male of the nominate subspecies are slight and limited to the narrower FW and HW yellow-orangey patches, which may represent rather a subspecific than a gender trait.

Etymology

This species is dedicated to Charles Émile Blanchard, French entomologist, born on March 6, 1819 in Paris, 1819-1900, author of many scientific papers Histoire des insectes, Zoologie agricole, and the chapter dedicated to Zoology in the Historia Fisica y Politica de Chile, where he described the genus *Argyrophorus*.

Remarks

The habitat of this subspecies is dry puna dominated by *Stipa* grassland. Other butterflies collected in the same spot were polyommatine blues, *Nabokovia* Hemming, *Madeleinea* Balint and *Eldoradina* Baletto.

Argyrophorus blanchardi celendini Pyrcz & Wojtusiak, n. ssp.

Material examined

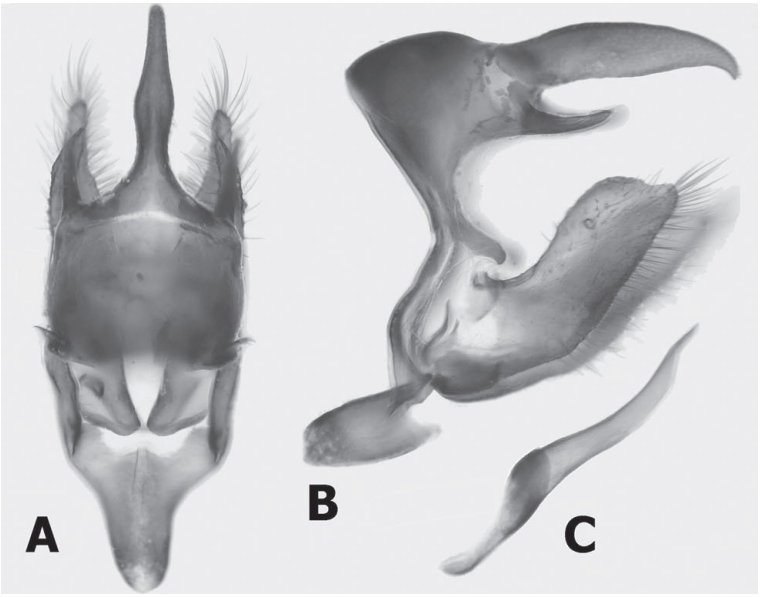
HOLOTYPE (male): Peru, Dept. Cajamarca, Celendín, Sucre, S6º54'2''/ W78º07'36'', 2650-2750 m, 17.VI.1998, T. Pyrcz & J. Wojtusiak *leg*., to be deposited in MUSM; PARATYPES (11 males): same data as the holotype, MZUJ.

Description

This subspecies differs from the nominotypical as follows: consistently bigger - FW length 20-23 mm (mean 22.5 mm; n=12); FWD subapical and submarginal patches slightly shorter, with a prominent orange shade; FWV ground color dark brown, but consistently lighter without any black overcast; HWV ground color medium brown, without any steely gray overcast.

Etymology

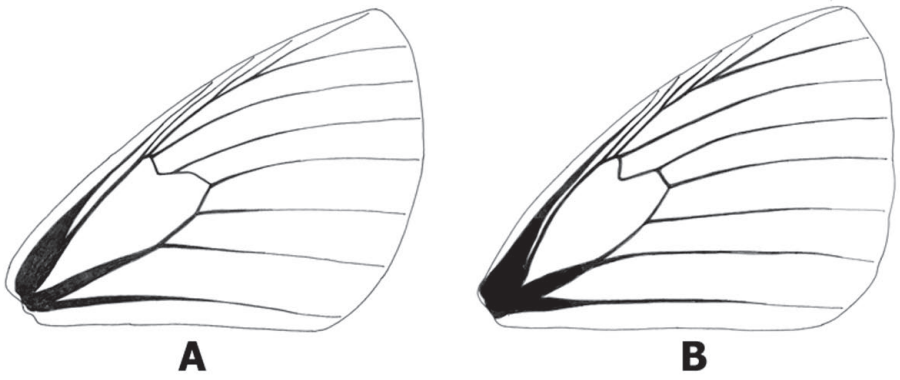
This subspecies is called after the locality of Celendín where it was collected.



3. Male genitalia of *Argyrophorus blanchardi celendini*: A – dorsal view, B – lateral view, C – aedeagus in lateral view

Remarks

The habitat of this subspecies, a shrubby puna (jalca), is consistently more humid than that of the nominate. The species composition of local butterflies fauna is also different. Apart from *A. blanchardi*, we observed or collected *Colias euxanthe* C. & R. Felder, *Colias lesbia* (Fabricius) and *Parapedaliodes parepa* (Hewitson) none of which was present in the type locality of the nominate subspecies.



4. Forewing venation: A – *A. lamna* ssp. 2, B – *A. blanchardi blanchardi*

DISCUSSION

The finding of the new species of *Argyrophorus* extends considerably northwards the known range of the genus. Thus far, the northern known generic distribution limit was the Cordillera Blanca in central Peru where a local subspecies of *A. lamna* is found, some 250 km south. The population of *A. blanchardi* near Cajamarca is also the northernmost known locality for any member of the entire group of Pronophilini Satyrinae, in some sources designated as belonging to the predominantly Australian Hypocystina (Viloria, 2007). Puna grassland has not been sampled further north in the Peruvian department of Cajamarca.

The taxa discussed herein are the foremost exponent of infrageneric and individual variation of the venation pattern. For example, *A. lamna* has only four radial veins, a unique character among the Nymphalidae. Also, *A. argenteus* and other taxa of the group, except *S. williamsianus*, do not have humeral vein, while this is one of the outstanding characters of the Nymphalidae according to Nielsen & Common (1991). *Pamperis poaoeneis* presents a unique venation pattern characterized by the complete anastomosis of Sc and R1, and partial fusion, in basal half, of R2 with Sc+R1. The vein rs-m1 is absent rs-m1, and the veins m1-m2 and 1dc are shaped similarly as in *E. chiliensis* and *P. monticolens*. Its aberrant venation made Miller (1968) doubt about its status within the Satyrinae! Important individual variation can be appreciated in *A. argenteus* and *A. stelligera*. No geographic pattern can be correlated with the changes of venation pattern. For example, the northernmost species (*A. blanchardi*) has the most similar venation pattern to the southernmost (*A. williamsianus*). Also, particular novelties in the venation pattern cannot be correlated with other morphological characters. Reassuming, we argue that this group of species is genetically prone to mutations affecting the expression of veins, particularly forewing radial veins. On the other hand, interestingly, the variation of venation does not affect the expression of HW m1-m2 cross vein, which is noticeably curved inside discal cell - diagnostic for the subtribe Pronophilina.

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APPENDIX - Venation dissections (males)

taxon	locality	prep. number
Argyrophorus blanchardi blanchardi	Aylambo, Cajamarca, Peru	04/13.10.2006
Argyrophorus argenteus	Sosneado, Mendoza, Argentina	02/13.10.2006
Argyrophorus argenteus	Sosneado, Mendoza, Argentina	07/07.08.2006
Argyrophorus (Punargenteus) lamna ssp 1.	via Chavín de Huantar, Ancash, Peru	03/13.10.2006
Argyrophorus (Punargenteus) lamna ssp. 2	Las Vegas, Junín, Peru	01/18.04.2007
Argyrophorus (Etcheverrius) chilensis	Sosneado, Mendoza, Argentina	03/08.08.2006
Pamperis (Argyrophorus) poaoeneis	La Hoya, Esquel, Argentina	01/10.12.2009

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