

A new species of *Podanotum* Torres & Johnson, 1996 (Lepidoptera, Lycaenidae) from northern Peru

Una nueva especie de *Podanotum* Torres & Johnson, 1996 (Lepidoptera, Lycaenidae) en el norte de Perú

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Citación

Farfán J, Cerdeña J, Lazo-Rivera A, Huanca-Mamani W, Bálint Z. 2021. A new species of *Podanotum* Torres & Johnson, 1996 (Lepidoptera, Lycaenidae) from northern Peru. *Revista peruana de biología* 28(4): e20968 (Noviembre 2021). doi: <https://dx.doi.org/10.15381/rpb.v28i4.20968>

Presentado: 05/08/2020

Aceptado: 15/10/2021

Publicado online: 26/11/2021

Editor: Diana Silva

Abstract

We describe a new species of the genus *Podanotum* Torres & Johnson, 1996, *Podanotum pajaten* Farfán, Cerdeña & Bálint sp. nov. from northern Peru, associated with the Andean treeline ecotone adjacent to cloud forest and wet grassland at 3200 m above sea level. Description of this new species is based on one female adult and is distinguishable from its congeners by the combination of the following morphological characters: dorsal wing pale blue, forewing discoidal line present on ventral side, hindwing tailed, and ostium bursae distally toothed. *Podanotum pajaten* sp. nov. is separated geographically from the closest spatial species, *P. glorissimum* Bálint & Wojtusiak, 2002, by approximately 100 km to the south, and represents the second species described for Peru. An identification key to all known species of *Podanotum* is provided, stating their distributions by country.

Resumen

Se describe una nueva especie del género *Podanotum* Torres & Johnson, 1996, *Podanotum pajaten* Farfán, Cerdeña & Bálint sp. nov. del norte de Perú, asociada al ecotono andino entre bosque nublado y pastizal húmedo a 3,200 metros de altitud. La descripción de esta nueva especie está basada en una hembra adulta que se distingue de sus congéneres por la combinación de los siguientes caracteres morfológicos: vista dorsal de las alas de color azul pálido, línea postdiscal del ala anterior presente en vista ventral, cola corta en ala posterior, y parte distal del ostium bursae dentada. *Podanotum pajaten* sp. nov. está separada geográficamente de la especie espacialmente más cercana, *P. glorissimum* Bálint & Wojtusiak, 2002, por aproximadamente 100 km hacia el sur, y representa la segunda especie descrita de Perú. Una clave de identificación es presentada para todas las especies conocidas de *Podanotum*, con indicación de los países de ocurrencia.

Keywords:

Andes; cloud forest; Río Abiseo National Park; Eumaeini; new species.

Palabras clave:

Andes; bosque nublado; Parque Nacional Río Abiseo; Eumaeini; nueva especie.

Publicación registrada en Zoobank/ZooBank article registered:

LSIDurn:lsid:zoobank.org:pub:FE6C35CF-2609-410C-9CB5-57737D02DFC3

Acto nomenclatural/nomenclatural act:

Podanotum pajaten Farfán, Cerdeña & Bálint, 2021

LSIDurn:lsid:zoobank.org:act:B8CE9125-0182-4DAB-BD92-D15DC4E16C47

Introduction

The Tropical Andes region is an important centre of South-American biodiversity (Hoorn et al. 2010), containing hotspots for plant and animal biodiversity (Myers et al. 2000, Young et al. 2002, Swenson et al. 2012). In this region, the transition zone between the upper montane forest and wet grasslands (the treeline ecotone) is of particular interest due to its outstanding species and functional diversity (Bader et al. 2007, Ramírez et al. 2009, Hofstede et al. 2014, Peters et al. 2014, Llambí 2015) with high endemism rates for many taxa of Lepidoptera (Willmott et al. 2001, Lamas 2003, Pycrz 2004, Hall 2005, Ignatov et al. 2011, Pycrz et al. 2014, Sublett et al. 2019), including Lycaenidae (e.g. Prieto & Bálint 2007, Prieto & Rodríguez 2012).

In 2016, during an entomological expedition carried out to the high mountains of the Tropical Andes of northern Peru, one female adult of an undetermined Eumaeine species was collected, and provisionally labelled as “Lycaenidae sp.” in the scientific collection of the Museo de Historia Natural, Universidad Nacional de San Agustín de Arequipa (MUSA). Recently, we examined this specimen and consider that it belongs to the genus *Podanotum* Torres & Johnson, 1996 (Lycaenidae: Eumaeini) due to its wing pattern and female genitalia characters. *Podanotum* currently contains eleven described species (Robbins 2004, Bálint & Wojtusiak 2006, Bálint & Attal 2007, Prieto & Rodríguez 2012) distributed from Venezuela to southern Peru, along the upper montane forests of the Tropical Andes (Bálint & Wojtusiak 2006, Lamas et al. 2021).

Torres et al. (1996) enumerated the morphological diagnostic characters of *Podanotum*, including a bipartite habitus with sclerotized terminal element in the female genitalia. Moreover, it was recorded that sexual dimorphism in the genus is limited, male and female phenotypes being very similar to each other (Bálint & Wojtusiak 2006, Bálint & Attal 2007, Prieto & Rodríguez 2012). The single specimen recently collected in Peru represents a hitherto unknown phenotype. Therefore, the aim of this study is to describe formally a new species of *Podanotum*, based on one female specimen collected in northern Peru at 3200 m elevation and to place it amongst congeners with the help of a key to identification.

Material and methods

Material examined. One female specimen of *Podanotum* was examined from the Museo de Historia Natural, Universidad Nacional de San Agustín de Arequipa, Arequipa, Peru (MUSA). Photographs of all type specimens of *Podanotum* taxa were examined from images available in Bálint & Wojtusiak (2002), Prieto & Rodríguez (2012), and Warren et al. (2017).

Morphological analysis. The abdomen was removed from the specimen and soaked in a 10% KOH solution for ten minutes. Subsequently, the abdomen was preliminarily cleaned out of soft tissue in water in order to expose the genitalia, afterwards stained with chlorazol black in

order to identify the soft parts. Water was extracted from the dissected genitalia by using 90% and 95% ethanol solutions. Wing venation and genitalic terminology follows Nicolay (1977) and Klots (1970) respectively. Measurements are in millimetres and were made from photographs of specimen taken next to a scale and magnified on a computer screen. Photographs of adult were taken with a Nikon D610 digital camera through a Nikkor 105 mm f/2.8G AF-S VR Micro lens; photographs of genitalia were taken with a camera Nikon DS-Ri2 through a Nikon SMZ25 stereomicroscope. Images were assembled and edited in Nikon NIS-Elements and Photoshop CS5.1.

Genomic DNA was extracted from abdominal tissue, following the procedures described by Huanca-Mamani et al. (2015). A fragment of the COI gene was amplified by polymerase chain reaction (PCR) with the primers LEP-F1 and LEP R1 (Hebert et al. 2004). PCR reactions were performed in a final volume of 20 µL. Each reaction contained 1 µL of DNA extract, 10 µmoles of each primer, 2.5 mM of each dNTP, 2 mM MgCl₂, 1X PCR buffer (KCl), 1 unit of Taq DNA polymerase (Thermo Scientific) and sterile distilled water. The amplification program was 5 min at 94 °C, 35 cycles of 30 s at 94 °C, 30 s at 47 °C, 1 min at 72 °C, and a final elongation step of 10 min at 72 °C. Three µL of each PCR product was visualized on 1.5% agarose gel stained with gel-red (Biotium). Reactions containing fragments of the expected size were purified and directly sequenced by a commercial facility (Macrogen, South Korea).

The following abbreviations are used:

MUSM—Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru.

MUSA—Museo de Historia Natural, Universidad Nacional de San Agustín de Arequipa, Peru.

DFW—Dorsal forewing

DHW—Dorsal hindwing

VFW—Ventral forewing

VHW—Ventral hindwing

Results

Podanotum pajaten Farfán, Cerdeña & Bálint sp. nov.

Figs 1, 2

Type material. - *Holotype*, female: PERU, LL [La Libertad], Pataz, Parque Nacional Abiseo, Puerta del Monte, 3200 m, 0741/7727 [7°41'S, 77°27'W], 19.v.2016, Leg. J. Farfán (MUSA) [will be deposited in MUSM]. Genbank accession number: OK484465.

Type locality. - Peru, La Libertad, Pataz, Puerta del Monte, 7°41'S, 77°27'W, 3200 m.

Diagnosis. - *Podanotum pajaten* sp. nov. can be distinguished from the other known congeneric species by the following combination of characters: (1) dorsal wing surface pale blue colored (vs. brown color in *P. andrew-*

neildi Bálint, 2001 and *P. melanissimum* Bálint & Wojtusiak, 2006), (2) conspicuous discoidal line on the VFW (vs. absent in the other species except *P. glorissimum*, with metallic green dorsal wing surface and *P. andrewneildi*, with brown dorsal wing surface), (3) hindwing tailed (vs. absent in *P. glorissimum*), and (4) ostium bursae distally toothed (vs. untoothed in *P. glorissimum*).

Description. -

Female (Fig. 1). Forewing length 12.6 mm (n=1).

Head: Primarily black with brown hairs dorsally, brown eyes with white hair-like scales around, hairy palpus with white hair-like scales, antenna striped white and black.

Thorax: Wings dorsally pale blue. DFW with broad blackish border (approx. 1.5 mm in width) to apical and outer margins. Hindwing rounded, DHW dark grayish brown border to outer margins with thin marginal black line, presence of slight tornal lobe and short brown tail.

Fringe on both wings formed of long light brown scales. Wings ventrally dark grayish brown. VFW with discal line, postmedian line terminates posteriorly at vein Cu_2 , and submarginal line terminates posteriorly at vein A_2 , all lines brown. VHW with discal line, postmedian line irregularly terminates posteriorly at vein Cu_2 , and submarginal line with lunular spots (basally reddish brown, distally black scales) all lines reddish brown.

Abdomen: Blackish dorsally and light grey ventrally, with long white hairs.

Female genitalia (Fig. 2): Fluted lamella postvaginalis, ductus bursae distally sclerotized, prominent, toothed, anterior section of ductus bursae large and thin tube weakly sclerotized. Corpus bursae with two very large and shield-like signa, inwardly toothed in lateral view; anal papillae enlarged and elliptic with apophyses about half the size of the ductus bursae length, with the proximal tip bent.

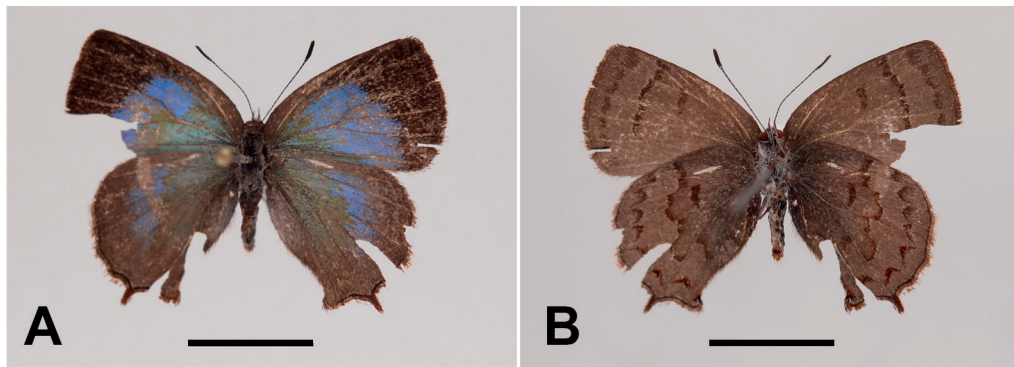


Figure 1. Adult female of *Podanotum pajaten* sp. nov., Holotype. **A.** dorsal view; **B.** ventral view. Scale bar: 10 mm.

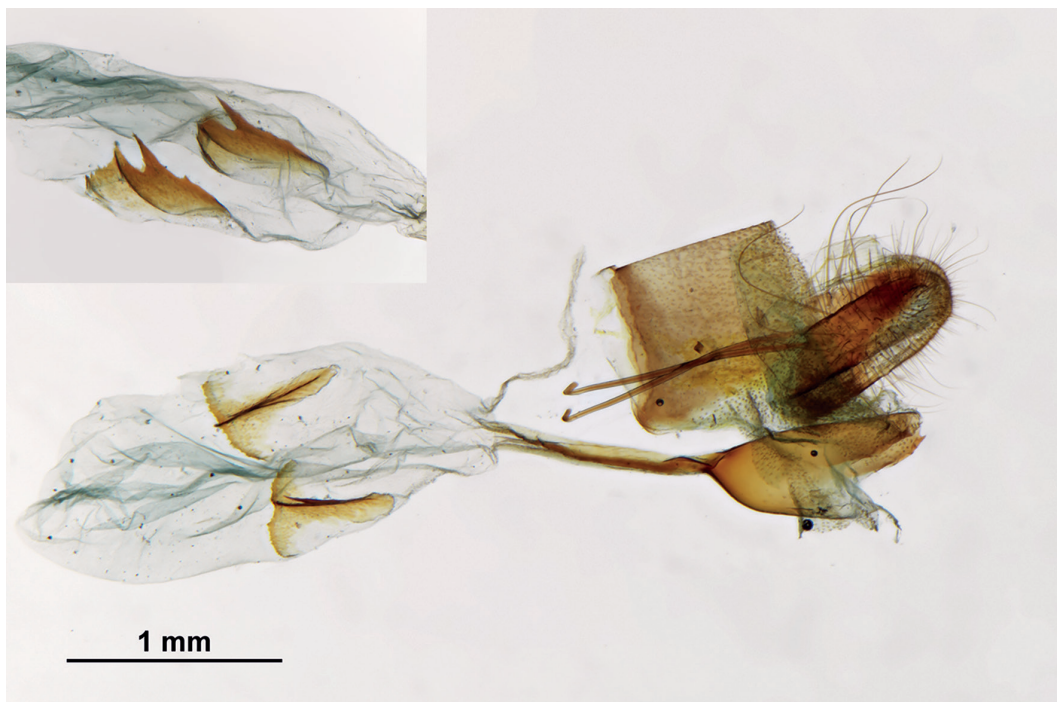


Figure 2. *Podanotum pajaten* sp. nov., female genitalia in lateral view; details of signa on upper left corner. Scale bar: 1 mm.

Male: Unknown.

Distribution: *Podanotum pajaten* is known only from the type locality in Río Abiseo National Park, at the treeline ecotone, approximately 100 km south of the type locality of the closest distributed species, *P. gloriosissimum*.

Etymology: The specific epithet is a masculine noun in apposition, derived from the “Gran Pajatén” archaeological site, which occurs in the Río Abiseo National Park, near where this new species was found.

Host plant: Unknown.

Remarks. - This new species is placed in the genus *Podanotum* (type species: *Podanotum clarissimum* Hall, Willmott & Johnson, 1996, by original designation) by the following combination of diagnostic characters: dorsal wing blue green, VHW with submarginal band of blackish-brown lunules or chevrons, female genitalia with sclerotized terminal element (Torres et al. 1996), and VFW with postmedian line ending posteriorly at vein Cu₂ (Robbins & Busby 2015).

Discussion

According to Prieto & Rodríguez (2012), the wing pattern of *Podanotum* is not geographically variable within species, so we discarded that this new species could be a variation or subspecies of another population of *Podanotum* previously described, and we are convinced that the species status of *P. pajaten* is fully justified; despite the description being based on a single somewhat damaged female specimen, it contains enough characters to differentiate it from other species of the genus, and considering that within the genus there is very little sexual dimorphism, it is probable that the males of *P. pajaten* are very similar to the female described herein.

In the Neotropical butterfly checklist (Robbins 2004) *Podanotum* was placed next to *Penaincisalia* Johnson, 1992 (type species: *Thecla ? culminicola* Staudinger, 1894, by original designation) in the *Micandra* Section of Eumaeini, based on genitalia and wing pattern. In a preliminary phylogenetic analysis with molecular data, *Podanotum* joined with *Rhamma* Johnson, 1992 (type species: *Thecla oxida* Hewitson, 1870) (Qental 2008).

Subsequently, Robbins & Busby (2015) in a phylogenetic analysis with morphological evidence indicate that *Podanotum* is closely related to *Lathecla* Robbins, 2004 (type species: *Thecla latagus* Godman & Savin, 1887). Therefore, further phylogenetic analysis, integrating morphological and molecular characters, is still required to determine the phylogenetic position of *Podanotum*.

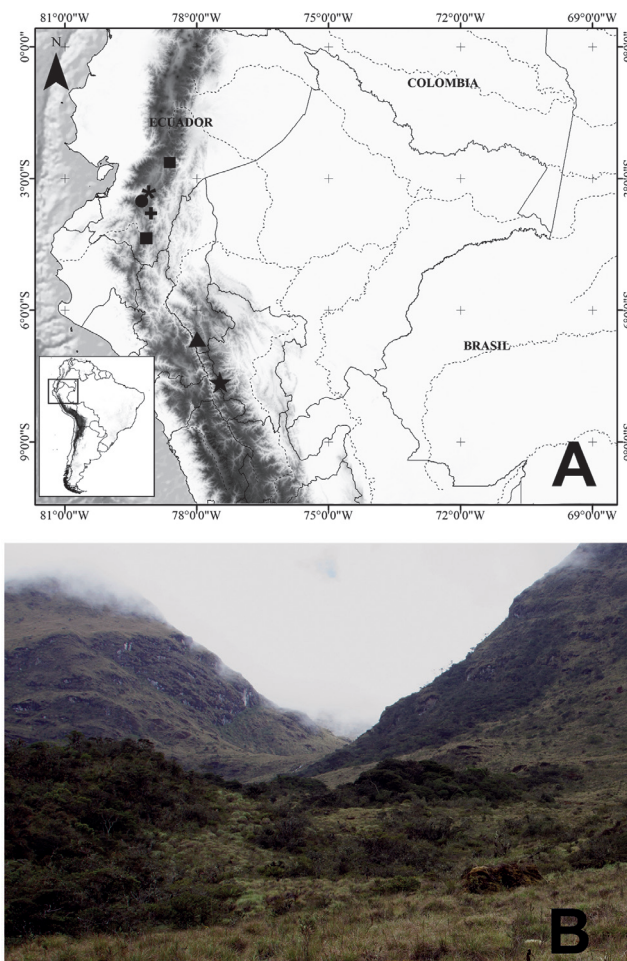


Figure 3. Distribution and habitat of *Podanotum pajaten* sp. nov. **A.** Distribution map of *Podanotum* species in Peru and Ecuador. *P. pajaten* sp. nov. = star, *P. gloriosissimum* = triangle, *P. metallicus* = circle, *P. melanissimum* = asterisk, *P. aquaphilum* = square, *P. magnificentum* = cross; **B.** Type locality of *P. pajaten* sp. nov.

Key to *Podanotum* species with indications of country occurrence

- | | |
|--|---|
| 1_Hindwing Cu ₂ vein terminus with tail | 6 |
| _Hindwing Cu ₂ vein terminus without tail | 2 |
| 2_Dorsal wing surface brown (Ecuador: Loja) | <i>melanissimum</i> Bálint & Wojtusiak, 2006 |
| _Dorsal wing surface blue or green | 3 |
| 3_Dorsal wing surface deep metallic green (Peru: Amazonas) | <i>gloriosissimum</i> Bálint & Wojtusiak, 2002 |
| _Dorsal wing surface light metallic green | 4 |
| 4_Dorsal hind wing surface with wide (> 2mm) black margin (Ecuador: Loja) | <i>clarissimum</i> Hall, Willmott & Johnson, 1996 |
| _Dorsal hindwing surface with narrow (< 1mm) or no black border | 5 |
| 5_Ventral forewing postmedian line consists of scattered spots (Colombia: Antioquia) | <i>pulsar</i> Prieto & Rodríguez, 2012. |
| _Ventral forewing postmedian consists of continuous spots (Colombia: Boyacá) | <i>metallicus</i> Torres & Johnson, 1996 |

6_Dorsal wing surface brown (Venezuela: Mérida)	<i>andrewneildi</i> Bálint, 2001
_Dorsal wing surface blue	7
7_Ventral forewing surface with discoidal line (Peru: La Libertad)	<i>pajaten</i> sp. nov.
_Ventral forewing surface without discoidal line	8
8_Dorsal wing surface deeper blue, hindwing with narrow (>1mm) black border	9
_Dorsal wing surface lighter blue, hindwing with wider (> 2mm) black border	10
9_Ventral forewing postmedian line slightly bent running to inner margin (Ecuador: Zamora-Chinchipec)	<i>aquaphilum</i> Bálint & Attal, 2007
_Ventral forewing postmedian line straight running to tornus (Colombia: Cundinamarca)	<i>salaeides</i> (Draudt, 1919)
10_Ventral forewing submedian and postmedian areas with identical color, postmedian line basally red (Colombia: Caldas)	<i>paramosa</i> (Constantino & Salazar, 1998)
_Ventral forewing postmedian area lighter than submedian, postmedian line basally brown	11
11_Ventral forewing submargin with white limbal pattern (Colombia: Cauca)	<i>vanewrighti</i> (Johnson & Adams, 1993)
_Ventral forewing submargin with brown limbal pattern (Ecuador: Zamora-Chinchipec)	<i>magnificum</i> Bálint & Attal, 2007

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Agradecimientos / Acknowledgments:

We are grateful to the staff of the Río Abiseo National Park for their support during the field trip expedition. Thanks to Dr. Evaristo López (Museo de Historia Natural, Universidad Nacional San Agustín, Arequipa, Perú [MUSA]) for access to the Animal Systematic Laboratory of Universidad Nacional San Agustín de Arequipa (UNSA).

Conflicto de intereses / Competing interests:

The authors declare no conflict of interest.

Rol de los autores / Authors Roles:

JF and JC: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. WHM: Investigation, Writing – original draft, Writing – review & editing.

Fuentes de financiamiento / Funding:

This study has been supported in part by the project of the Universidad Nacional de San Agustín de Arequipa (UNSA) with Contract IBA-001-2019-UNSA.

Aspectos éticos / legales; Ethics / legals:

Authors declare that they did not violate or omit ethical or legal norms in this research.