

# A new mimetic species of *Periplacis* (Lepidoptera: Riodinidae: Nymphidiini) from the eastern Andes of Ecuador

Jason P. W. Hall<sup>1</sup> and David H. Ahrenholz<sup>2</sup>

1. Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0127, USA.

2. 493 Pierce Road, Landrum, SC 29356, USA.

Date of issue online: 19 June 2020

Zoobank Registered: urn:lsid:zoobank.org:pub:186CF1D5-9ED2-448A-AC4B-33BE558CFE35

Electronic copies (ISSN 2575-9256) in PDF format at: <http://journals.fcla.edu/tropolep>; <https://zenodo.org>; archived by the Institutional Repository at the University of Florida (IR@UF), <http://ufdc.ufl.edu/ufir>; DOI: 10.5281/zenodo.3877487

Supplementary Materials: DOI: 10.5281/zenodo.3877452

© The author(s). This is an open access article distributed under the Creative Commons license CC BY-NC 4.0 (<https://creativecommons.org/licenses/by-nc/4.0/>).

**Abstract:** A new riodinid species in the tribe Nymphidiini, *Periplacis perisama* Hall, Ahrenholz & Aldas n. sp., is described from lower montane forest in the eastern Andes of Ecuador. An updated phylogenetic analysis for the genus suggests that the new taxon is sister to the Transandean species *P. laobotas* (Hewitson, 1875). These two species form the *laobotas* group, defined by the presence of setose eyes and a proximally isolated pale postdiscal band on the dorsal forewing of males. *Periplacis perisama* is externally dissimilar to all other members of the genus, and bears an apparently mimetic resemblance to several sympatric species of Nymphalidae, most notably in the genus *Perisama* Doubleday, 1849.

**Key words:** cloud forest, mimicry, species description, taxonomy

---

## INTRODUCTION

The Neotropical riodinid genus *Periplacis* Geyer, 1837 (Nymphidiini) was recently revised by Hall (2018), who recognized 15 described species in five species groups. In recent decades, most of these species have been treated under the junior synonym *Menander* Hemming, 1939, which was itself a replacement name for the junior homonym *Tharops* Hübner, [1819] (e.g., Stichel, 1930-31; Callaghan & Lamas, 2004). Most *Periplacis* species are externally characterized by having spectacular, often metallic, blue to green iridescence on the dorsal wings, as well as an unusually large thorax, which reflects their very rapid flight capabilities. All *Periplacis* species are unique in the Nymphidiini in possessing concealed androconial scales on male abdominal tergites six and/or seven. The genus is widely distributed in predominantly lowland habitats from southern Mexico to Argentina, with a center of diversity in the Amazon basin. Although a few species are reasonably common, such as *P. menander* (Stoll, 1780) and *P. hebrus* (Cramer, 1775), the majority of them are uncommon to rare. Males perch in open sunny microhabitats, most frequently near streams, resting on top of leaves with their wings outspread and their abdomens often raised and extended to reveal the aforementioned androconial scales. Most of the foodplant records for the genus are from the largely hemiepiphytic family Marcgraviaceae, and the myrmecophilous caterpillars are notable for having a variably broad and flattened “turtle”-like carapace. In this paper, we describe a highly distinctive and apparently mimetic new species of *Periplacis* from lower

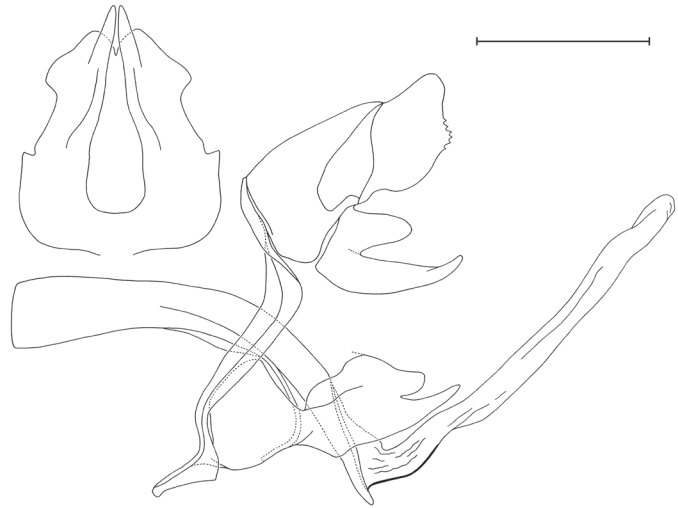
montane forest in the eastern Andes of Ecuador. The species was examined and mentioned by Hall (2018), but its discovery came too late for ready inclusion in that work.

## MATERIALS AND METHODS

Morphology was studied using standard techniques, with the dissection methods used following those outlined in Hall (2018). The terminology for male genital structures follows Klots (1956), Eliot (1973), and Harvey (1987). *Periplacis* material was studied by the first author in 42 institutional and private collections worldwide (as listed in Hall, 2018). A phylogenetic analysis for the genus *Periplacis* was conducted using the morphological data set presented in Hall (2018) updated to include the new species. *Pseudolivendula hemileuca* (Bates, 1868) was again used as the outgroup taxon, as that genus was identified from morphology as being the closest relative to *Periplacis* (*Pseudolivendula* Hall, 2018, and relatives have yet to be included in molecular analyses (e.g., Espeland *et al.*, 2015; Seraphim *et al.*, 2018)), and that species is phenotypically similar. The character matrix was edited using MacClade Version 3.05 (Maddison & Maddison, 1995), and the maximum parsimony analysis was performed using PAUP Version 4.0b10 (Swofford, 2002). A heuristic search was performed with tree bisection-reconnection (TBR) branch swapping and 500 random-addition-sequence replicates, with all characters equally weighted and unordered. Branch support strength was estimated by means of 1000 bootstrap replicates in PAUP using the aforementioned heuristic search parameters.



**Fig. 1.** Holotype male of *Periplacis perisama* n. sp. (dorsal surface on left, ventral surface on right), Río Cashurco, 1300 m, E. Ecuador (USNM).



**Fig. 2.** Male genitalia of *Periplacis perisama* n. sp. in lateral view, with ventral view of valve complex (at top left). Scale bar = 1 mm.

## SPECIES DESCRIPTION

### *Periplacis perisama* Hall, Ahrenholz & Aldas, new species (Figs. 1-3)

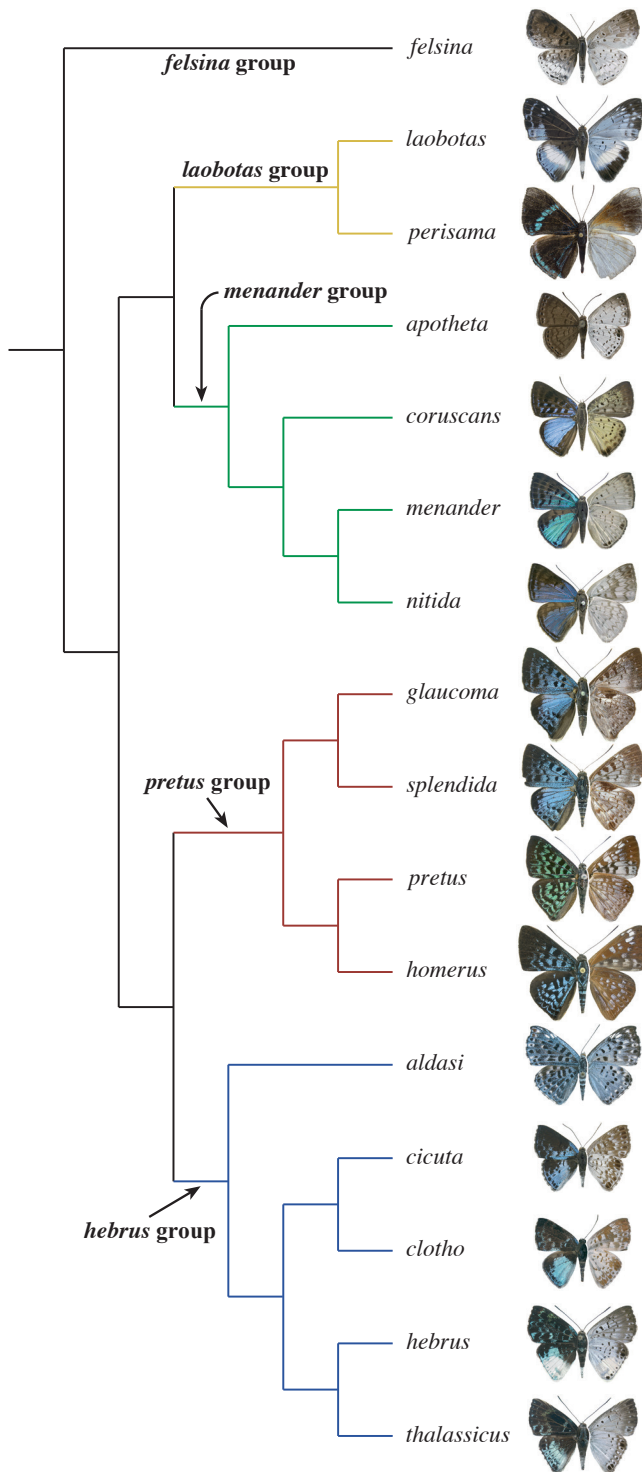
**Description:** MALE: Forewing length 20 mm. *Wings:* see Fig. 1; turquoise markings on dorsal wings more iridescent than figure suggests. *Head:* Eyes brown and setose, with white marginal scaling; frons black, with white scaling laterally and a horizontal white bar ventrally; dorsal surface of labial palpi black, ventral surface black with scattered white scales, second and third segments relatively elongate; antennal length approximately 60% of forewing length, segments black with dirty whitish scaling at ventral base, nudum along inner ventral margin discontinuous, clubs black, tips brown. *Body:* Dorsal surface of thorax black, ventral surface white; dorsal surface of abdomen black, ventral surface white; concealed abdominal androconial scales present in a continuous patch at anterodorsal margin of tergites six and seven; all legs white. *Genitalia:* see Fig. 2; ductus ejaculatorius enters anterior tip of aedeagus directly anteriorly; everted vesica exits posterior tip of aedeagus slightly to right, cornutus a very thin and narrow sclerotized bar at ventral base of vesica; eighth tergite rectangular; eighth sternite rectangular, gradually narrowing posteriorly, with a very slight medial indentation at posterior margin. FEMALE: Unknown.

**Types:** HOLOTYPE male: ECUADOR: *Tungurahua*, Río Cashurco, 4 km. E. of Río Negro, 1°25.4'S, 78°10.5'W, 1300 m, March 2010 (I. Aldas) (National Museum of Natural History, Smithsonian Institution, Washington, DC, USA).

**Etymology:** This species is named after the nymphalid genus *Perisama* Doubleday, 1849, which contains several sympatric taxa that bear a remarkable resemblance to the new *Periplacis* species.

**Systematic placement and diagnosis:** The new species described herein can unequivocally be placed in the genus *Periplacis* due to its possession of concealed androconial scales at the anterior margin of male abdominal tergites six and seven, and male genital valvae with a very long, tapering, and slightly upwardly curved posterior process, a rounded and posteriorly elongate “brow” above the posterior process, and an anterior “elbow” at the ventral margin of the posterior process. Hall’s (2018) revision of *Periplacis* recognized 15 described species in five species groups, based on a phylogenetic analysis of 66 morphological characters (wing shape and pattern [22],

body [7], male genitalia [20], and female genitalia [17]). To determine the phylogenetic placement of *P. perisama*, a new analysis was conducted, with the character matrix from Hall (2018) updated in three ways (see Supplementary Materials). Firstly, two new characters were added, with character 67 being the absence (0) or presence (1) of a proximally isolated pale postdiscal band extending between the anal and costal margins of the dorsal forewing of males, and character 68 being the absence (0) or presence (1) of setose eyes. For both characters, *P. laobotas* (Hewitson, 1875) and *P. perisama* were coded with state (1) and all other species with state (0). Secondly, the original 66 characters were coded for *P. perisama*, with the character states being the same as those for *P. laobotas* with the following exceptions: character state (1) instead of (0) for characters 3, 33, and 35, and character state (?) for characters 9-15, 28-29, and 50-66 (mostly reflecting the lack of a known female for *P. perisama*). Thirdly, character 24 was updated from being the presence (0) or absence (1) of pale rings around the abdomen of males to that of both sexes, resulting in a character state change for *P. laobotas* from (0) to (1) (reflecting the presence of a dorsally brown abdomen in the female rather than the autapomorphic dorsal white medial band in the male) and for *P. thalassicus* (Brévignon & Gallard, 1992) from (0) to (?) (reflecting the lack of a known female for this species). The phylogenetic signal from the observed character variation seems to be better reflected in this character definition, which results in character 24 changing from being a synapomorphy for the *menander* group in the original analysis to one for the *laobotas* + *menander* groups, stabilizing this cladogram node. The heuristic search generated a single most parsimonious cladogram with a length of 105 steps, a consistency index (CI) of 0.75, and a retention index (RI) of 0.86 (compared to length 100 steps, CI 0.77 and RI 0.87 in the original analysis). This cladogram (Fig. 3) places *P. perisama* as the sister species to *P. laobotas* in a bitypic *laobotas* group. As discussed in detail in Hall (2018: 594), the correct phylogenetic placement of *P. laobotas* and the now expanded *laobotas* group is hindered by the unusually large phenotypic gaps between the basal



**Fig. 3.** Phylogeny of *Periplacis* based on an updated analysis of the data matrix in Hall (2018) that included *P. perisama* n. sp. and two additional characters. Single most parsimonious cladogram (length 105 steps, consistency index 0.75, and retention index 0.86) resulting from the heuristic analysis of 68 morphological characters (wing shape and pattern [23], body [8], male genitalia [20], and female genitalia [17]) with *Pseudolivendula hemileuca* as the outgroup taxon. The five species groups are indicated and color coded.

*Periplacis* taxa, including the closely related *P. apotheta*, and the numerous autapomorphies and apparent character reversals they exhibit. As a result of these factors, branch support in the form of bootstrap values is very weak for both the *laobotas*

group (57) and the *laobotas* group + *menander* group clade (47). However, two unique universal synapomorphies support the monophyly of the *laobotas* group (the above-described characters 67 and 68), and three support the *laobotas* group + *menander* group (the above-described character 24, as well as 29 [an eighth female abdominal tergite with a heavily sclerotized posterior projection, which is expected to occur in *P. perisama*] and 30 [male genitalia with serrations at the ventral posterior corner of the uncus]). Characters 29, 30, and 68 are particularly strong morphological synapomorphies, and there is no good character support for alternative plausible phylogenetic hypotheses, such as the *laobotas* group being sister to all three of the derived species groups (i.e., the *menander*, *pretus*, and *hebrus* groups).

*Periplacis perisama* is externally unlike any of its congeners, possessing a highly derived wing pattern that appears to be the result of mimetic convergence on a pattern shared by many, predominantly biblidine, nymphalids (see Biology section below). The dorsal male wing pattern of *P. perisama*, consisting primarily of a turquoise postdiscal band across the middle of the forewing and a medially divided turquoise band along the distal margin of the hindwing, is approximated only by that of its Transandean sister species *P. laobotas* (see Fig. 3). However, *P. laobotas* has pale blue patterning and visible dark basal and postdiscal spots on both dorsal wings, a postdiscal blue band on the dorsal forewing that is more vertically oriented, becomes white at the costal margin, and is distally fused with a more prominent submarginal band, and a distal band on the dorsal hindwing that is much broader, continuous, and has a broad white postdiscal band proximally. The male of *P. laobotas* also has narrower and more elongate wings, a white band across the dorsum of the abdomen, and a dissimilar blue, white, and black ventral surface. The ventral male wing pattern of *P. perisama* is unique in the genus in having a forewing that is rufous brown basally and black distally with no visible dark spots and a large white patch in the apex, and a hindwing that is almost entirely white with faint rufous-brown postdiscal spots. No other riordinid shares a similar wing pattern to that of *P. perisama*. The unrelated *Chalodeta theodora* (C. & R. Felder, 1862), a lowland member of the Riordinini, has somewhat similar metallic green bands on the dorsal wings, but is a tiny species, with a falcate forewing apex, a prominent white hindwing fringe, and uniformly dark and spotted ventral wings. The male genitalia of *P. perisama* share a serrated ventral posterior corner to the uncus with those of *P. laobotas* and the four *menander* group species, and a thin, narrow, and smooth sclerotized cornutal bar at the ventral base of the everted aedeagal vesica with those of *P. laobotas*. A similar cornutal bar is present in the three derived members of the *menander* group as well as the five *hebrus* group species, but all eight of these species except *P. menander* (Stoll, 1780) have a spiny instead of smooth cornutal bar, and, although the cornutal bar in *P. menander* is smooth, it is more similar in shape to those of its *menander* group relatives, being thicker and broader. The valvae of *P. perisama* are more similar in shape to those of the derived majority of *Periplacis* species rather than those of *P. laobotas*, which have valvae that are more similar to those of its other close relatives *P. felsina* (Hewitson, 1863) and *P. apotheta* (Bates, 1868), with

shorter posterior tips and a relatively smooth ventral margin (the aforementioned characters 33 and 35, respectively). The phylogenetic analysis suggests that these two valve characters are homoplasious, with long posterior tips and an anterior “elbow” at the ventral margin of the posterior process having either been independently derived in three different lineages or independently lost in *P. laobotas* and *P. apotheta*.

**Biology:** This species has only been recorded from a single lower montane forest locality at 1300 m. The unique holotype male was encountered perching on top of a leaf with its wings spread open, on low sunlit vegetation overhanging a small stream. Unfortunately, this perching area was subsequently scoured of vegetation by flash flooding, a not uncommon phenomenon in the Pastaza valley, hindering further study of the species. *Periplacis perisama* is only the second known species in the genus that seems likely to be exclusively associated with montane habitats. The other, *P. aldasi*, a powdery blue member of the *hebrus* group known to occur from 600 to 1300 m between southern Colombia and southern Ecuador (a small southerly range extension since Hall, 2018), was itself only relatively recently described (Hall & Willmott, 1995), with the holotype coincidentally collected by the same collector as the new species described here, the eponymous Ismael Aldas.

*Periplacis aldasi* is a very scarce species, known from fewer than 30 specimens and only ten localities (seven locality clusters), but *P. perisama* appears to be even rarer. This paper's authors have never personally encountered the species alive despite thirty years of intensive collecting in Ecuador, and no specimens are known in the world's collections (as listed in Hall, 2018). A factor that may be causing *P. perisama* to be overlooked by many collectors, and contributing to its perceived rarity, is its potentially mimetic resemblance to several sympatric species of Nymphalidae, all of which share iridescent greenish bands postdiscally on the dorsal forewing and distally on the dorsal hindwing. These nymphalids belong to the genera *Perisama*, including both sexes of *P. alicia* (Hewitson, 1868), *P. bomplandii* (Guérin-Méneville, [1844]), *P. dorbignyi* (Guérin-Méneville, [1844]), and *P. lebasii* (Guérin-Méneville, [1844]), *Mesotaenia* Kirby, 1871, namely both sexes of *M. vaninka* (Hewitson, [1855]), *Diaethria* Billberg, 1820, including both sexes of *D. clymena* (Cramer, 1775) and *D. neglecta* (Salvin, 1869) (Biblidinae), and *Doxocopa* Hübner, [1819], namely the female of *D. zunilda felderi* (Godman & Salvin, 1884) (Apaturinae). The males of these nymphalids are most frequently encountered puddling on the ground, with their wings closed. However, when perching, they rest on top of streamside vegetation with their wings open, and the most similar *Perisama* species, in particular, would probably be indistinguishable from the new *Periplacis* species at even a modest distance. Although the ventral wings of *P. perisama* may lack the more prominent and elaborate patterns of black spots and lines on the hindwings of the biblidine nymphalids, the pattern is otherwise rather similar. Given the dorsal wing pattern convergence exhibited by butterflies from unrelated suprageneric groups, as well as the high degree of wing pattern divergence exhibited by *P. perisama* with respect to its congeners, it seems likely that the wing pattern of *P. perisama*

is mimetic. The models in this mimicry system would seem to be a number of day-flying moths, which are common flying and puddling in the same streamside habitats.

**Distribution:** *Periplacis perisama* is currently known only from the type locality in the east Ecuadorian Andes.

#### ACKNOWLEDGMENTS

JPWH thanks all those museum curators in Europe and the Americas who gave access to the riordinid collections in their care (see list in Hall, 2018); and the National Science Foundation (DEB #0103746 and #0639977) for financial support of museum and field research; JPWH and DA thank Ismael Aldas for his industrious collecting efforts throughout Ecuador over the decades in support of our inventory goals; the Instituto Nacional de Biodiversidad (formerly Museo Ecuatoriano de Ciencias Naturales) (most recently Santiago Villamarín and Sofia Nogales) and Ministerio del Ambiente for arranging the necessary permits for research in Ecuador; and two anonymous reviewers for helpful comments on the manuscript.

#### LITERATURE CITED

- Callaghan, C. J., Lamas, G. 2004. Riordinidae, pp. 141-170. In: Lamas, G. (Ed.), *Checklist: Part 4A. Hesperioidea - Papilionoidea*. In: Heppner, J. B. (Ed.), *Atlas of Neotropical Lepidoptera*. Gainesville, Scientific Publishers.
- Eliot, J. N. 1973. The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. *Bulletin of the British Museum of Natural History (Entomology)* 28: 373-506.
- Espeland, M., Hall, J. P. W., DeVries, P. J., Lees, D. C., Cornwall, M., Hsu, Y.-F., Wu, L.-W., Campbell, D. L., Talavera, G., Vila, R., Salzman, S., Ruehr, S., Lohman, D. J., Pierce, N. E. 2015. Ancient Neotropical origin and recent recolonisation: Phylogeny, biogeography and diversification of the Riordinidae (Lepidoptera: Papilionoidea). *Molecular Phylogenetics and Evolution* 93: 296-306.
- Hall, J. P. W. 2018. *A Monograph of the Nymphidiina (Lepidoptera: Riordinidae: Nymphidiini): Phylogeny, Taxonomy, Biology, and Biogeography*. Washington, The Entomological Society of Washington. 990 pp.
- Hall, J. P. W., Willmott, K. R. 1995. Five new species and a new genus of riordinid from the cloud forests of eastern Ecuador (Lepidoptera: Riordinidae). *Tropical Lepidoptera* 6(2): 131-135.
- Harvey, D. J. 1987. *The Higher Classification of the Riordinidae (Lepidoptera)*. Ph.D. Thesis. Austin, University of Texas.
- Klots, A. B. 1956. Lepidoptera, pp. 97-110. In: Tuxen, S. L. (Ed.), *Taxonomists' Glossary of Genitalia in Insects*. Copenhagen, Munksgaard.
- Maddison, W. P., Maddison, D. R. 1995. *MacClade: Analysis of Phylogeny and Character Evolution. Version 3.05*. Computer program distributed by Sinauer Associates, Sunderland, MA.
- Seraphim, N., Kaminski, L. A., DeVries, P. J., Penz, C., Callaghan, C., Wahlberg, N., Silva-Brandão, K. L., Freitas, A. V. L. 2018. Molecular phylogeny and higher systematics of the metalmark butterflies (Lepidoptera: Riordinidae). *Systematic Entomology* 43(2): 407-425.
- Stichel, H. F. E. J. 1930-31. Riordinidae, pp. 1-795. In: Strand, E. (Ed.), *Lepidopterorum Catalogus*. Volumes 38-41. Berlin, W. Junk.
- Swofford, D. L. 2002. *PAUP: Phylogenetic Analysis Using Parsimony (and Other Methods). Version 4.0b10*. Computer program distributed by Sinauer Associates, Sunderland, MA.

**Supplementary Material available online:**

DOI: 10.5281/zenodo.3877452