

A new montane *Stalachtis* Hübner species from the Cordillera del Cóndor in southeastern Ecuador (Lepidoptera: Riodinidae: Nymphidiini)

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Abstract: A new riodinid species in the *Stalachtis calliope* (Linnaeus) group (Nymphidiini: Stalachtina), *S. radfordi* n. sp., is described from elevations between 1100 and 2000 m in the Cordillera del Cóndor and its immediate environs in southeastern Ecuador.

Key words: cloud forest; endemism; Neotropics; species description; taxonomy; tepuis.

INTRODUCTION

The remote Cordillera del Cóndor is one of the longest and tallest of the discontinuous chain of sub-Andean ranges that lie between the Andes and the lowland Amazon basin. It extends about 150 km along the border between Ecuador (southern Morona-Santiago and Zamora-Chinchipe) and Peru (Amazonas), and reaches elevations of nearly 3000 m. The geology of the main Andean chain is primarily volcanic and metamorphic, whereas that of the Cordillera del Cóndor and other sub-Andean ranges is primarily sedimentary, consisting of limestones and sandstones, giving the Cóndor range its distinctive flat-topped tepuis (Neill, 2005). Not only is the geology and landscape of the Cordillera del Cóndor similar to that of the older tepuis-laced Guiana shield region of northeastern South America, but a phytogeographic link has also now been discovered, with at least 10 plant genera found to be endemic to the two distant regions (Ulloa & Neill, 2006). The cessation of intermittent but long-running military hostilities between Ecuador and Peru in 1995 finally opened up the Cordillera del Cóndor to biological exploration, and preliminary assessments have found the region to be very biodiverse, with a high incidence of undescribed endemic species in groups ranging from plants to amphibians (e.g., Schulenberg & Awbrey, 1997; Neill, 2005; Ron *et al.*, 2018).

Several new endemic butterfly taxa in the Pieridae and Satyrinae have also been discovered and described from the Cordillera del Cóndor (Lamas, 1997; Pyrcz *et al.*, 2006, in prep.; Radford & Willmott, 2013). This paper describes a new riodinid species in the genus *Stalachtis* Hübner, 1818 (Nymphidiini: Stalachtina), from the Ecuadorian side of the Cóndor range, that was collected by a Cambridge University Lepidoptera Expedition in 2010 led by James Radford (see Radford *et al.*, 2012). *Stalachtis* is an essentially South American genus of large aposematic species. All but one of

the nine described species are confined to lowland habitats and are well represented in collections, having been described in the eighteenth and early nineteenth centuries. The other, *S. halloweenii*, was recently described from a montane tepui in western Guyana (Hall, 2006), and has subsequently been found to occur on two montane tepuis in neighboring eastern Venezuela (Costa *et al.*, 2019). The new *Stalachtis* described here represents a second, unrelated, montane species for the genus that resembles and seems to replace the widespread Amazonian species, *Stalachtis calliope* (Linnaeus, 1758) (Fig. 1), at higher elevations.

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), and the nomenclature for venation follows Comstock & Needham (1898), with cells named for the vein above. *Stalachtis* material was studied in the 27 personally visited institutional and private collections listed in Hall (2018), and the known type specimens were examined for all available names.

SPECIES DESCRIPTION

Stalachtis radfordi Hall & Willmott, new species (Figs. 2-5)

Description: MALE: Forewing length HT 27 mm. *Wings:* see Fig. 2A. *Head:* Eyes dark brown and bare with white marginal scaling; frons black with a white lateral band medially and an isolated white lateral spot dorsally below base of antennae; labial palpi black with very sparse white scaling ventrally and a white patch at outer base of segment two, segments two and three very elongate; antennal length approximately 45% of forewing length, segments black with a narrow nudum section along inner margin, clubs black with a broad inner nudum band and an orange-brown tip. *Body:* Dorsal surface of

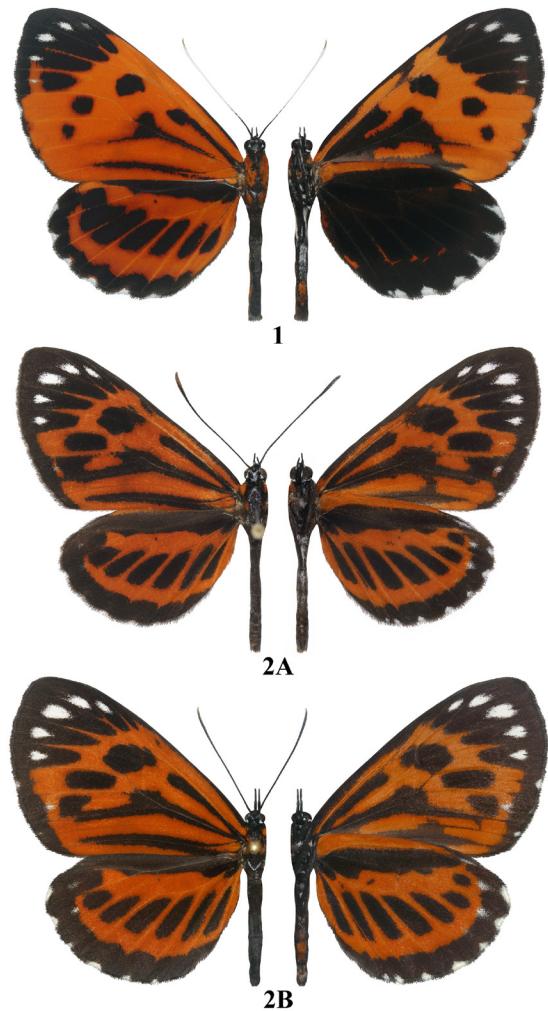
thorax black with orange lateral scaling in anterior two thirds, a narrow white V-shaped mark posteriorly, and a predominantly orange tegula, ventral surface black with white ventrolateral spots and an orange anterolateral patch at base of forewing; dorsal surface of abdomen black, ventral surface black with a narrow white ventral band in anterior two thirds that becomes orange in anterior third and a narrow white lateral band; foreleg black with a white stripe along inner margin of coxa, mid- and hindlegs black. *Genitalia*: see Fig. 3; upper posterior valve process slightly inwardly curved in ventral view with long setae present along basal half of dorsal margin, lower posterior valve process outwardly directed at an approximately 30° angle in ventral view with long setae present around posterior tip; transtilla continuously sclerotized dorsally between bases of upper posterior valve processes with a narrow hooded process extending ventroposteriorly above aedeagus and between rounded inner valve processes; ductus ejaculatorius enters aedeagus anteriorly, vesica exits aedeagus ventrally; narrow tuft of long, posteriorly directed brown setae around outer margin of genital capsule; eighth abdominal tergite approximately rectangular, sternite approximately rectangular with a slightly narrowed and concave posterior margin. **FEMALE**: Forewing length PTs 28-30 mm. *Wings*: see Fig. 2B. *Head*: Differs from male by having slightly more elongate second and third palpal segments, and a slightly larger nudum section on antennal segments. *Body*: Differs from male by having an abdomen with more prominent orange ventral scaling and an additional narrow orange sublateral band between two white bands. *Genitalia*: see Fig. 4; expanded medial section of ductus bursae heavily sclerotized, narrowed posterior section weakly sclerotized, ductus seminalis membranous; sclerotized ostium bursae dorsally curves anteriorly into an invaginated pouch below papillae anales that is membranous ventrally and weakly sclerotized dorsally (perhaps forming a protected resting place for extremely long male genital falces during copulation); papillae anales proportionately small and roundly rectangular; very broad semicircular tuft of long, posteriorly directed brown setae around posterior margin of eighth tergite.

Types: HOLOTYPE male: ECUADOR: *Zamora-Chinchipe*, Cónдор Mirador camp, top of Quimi road, Cordillera del Cónдор, 3°38'29"S 78°23'35"W, 2000 m, 20-28 Aug 2010 (J. Radford, E. Hartley, K. Buckland, and S. Padrón leg.) (to be deposited in Instituto Nacional de Biodiversidad, Quito, Ecuador [INABIO]).

PARATYPES: ECUADOR: *Zamora-Chinchipe*, same data as HT: 1 female (INABIO); 1 female (McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA); 1 female (JPWH collection, Washington, DC, USA).

Etymology: This species is named after James T. Radford, who led the very successful 2010 Cambridge University Lepidoptera Expedition (CULEPEX) to Ecuador's Cordillera del Cónдор, where he and his expedition members discovered this species and collected the type series.

Systematic Placement: The genus *Stalachtis* can be characterized by its members having hindwing veins Rs and M₁ stalked rather than arising separately from the discal cell end, a tuft of long setae around the posterior margin of abdominal segment eight in males and, to a greater extent, females, and extremely long and weakly bent male genital falces (Bates, 1868; Stichel, 1910-11; Harvey, 1987; Hall, 2006), all characters possessed by the new species *S. radfordi*. Hall (2006) proposed three species groups for *Stalachtis* based on wing pattern and male genitalia, the *phlegia* group for *S. phlegia* (Cramer, 1779) and *S. susanna* (Fabricius, 1787) (recently returned to species status by Magaldi *et al.* (2021)); the *calliope* group for *S. calliope* (Linnaeus, 1758), *S. eugenia* (Cramer, 1777) (recently returned to species status by Gallard & Fernandez (2015)), and *S. magdalena* Westwood, 1851; and the *euterpe* group for *S. halloweeni* Hall, 2006, *S. euterpe* (Linnaeus, 1758), *S. phaedusa* (Hübner, [1813]), and *S. lineata* (Guérin-Méneville, [1844]). *Stalachtis radfordi* can be placed in the *calliope* group based on possessing a band of white submarginal spots on the forewing, an entirely checkered black and white hindwing fringe (both characters shared with the *phlegia* group), parallel orange bands



Figs. 1-2. *Stalachtis* adults (dorsal surface on left, ventral surface on right) (1.2 x life size). **1.** *S. calliope* (Linnaeus) male, Rio Nangaritza, Zamora-Chinchipe, E. Ecuador (1050 m). **2A.** *S. radfordi* Hall & Willmott n. sp., HT male, Cónдор Mirador, Zamora-Chinchipe, E. Ecuador (2000 m). **2B.** *S. radfordi* PT female, Cónдор Mirador, Zamora-Chinchipe, E. Ecuador (2000 m).

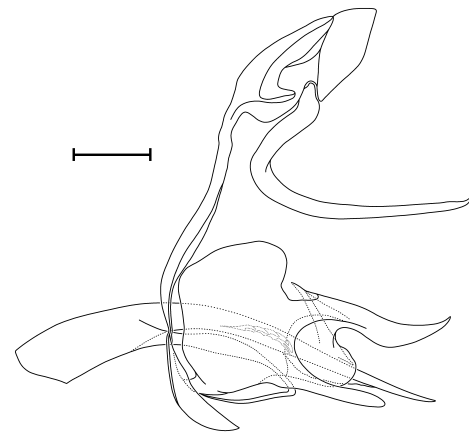


Fig. 3. Male genitalia in lateral view of *S. radfordi* n. sp. HT. Scale bar = 0.5 mm.

across the hindwing, a pair of large, rounded, inner male genital valve processes with a narrow and elongate transtilla process extending ventroposteriorly between them and across the top of the aedeagus (a genital character complex shared with the

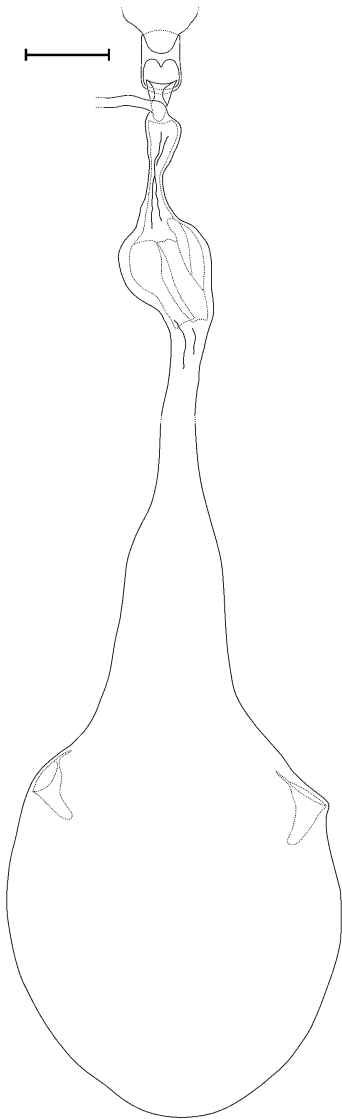


Fig. 4. Female genitalia in dorsal view of *S. radfordi* n. sp. PT. Scale bar = 0.5 mm.

euterpe group), and an upper male genital valve process that is broadest medially (instead of basally in the *phlegia* group and distally in the *euterpe* group).

Diagnosis: Within the *Stalachtis calliope* group, *S. calliope* is widespread throughout Amazonia, whereas the other two described species have more restricted ranges, with *S. eugenia* apparently confined to the lower Amazon of Brazil and the Guianas, and *S. magdalena* to the small Transandean area between eastern Panama and central Colombia. The montane *S. radfordi* is most similar to the apparently elevationally parapatric *S. calliope* (Fig. 1), but both sexes of *S. radfordi* can rapidly be distinguished from those of all other *calliope* group species by having black instead of cream and black antennae, a possible symplesiomorphy shared with *phlegia* and *euterpe* group species. In *S. magdalena*, the antennae are black with cream clubs, and in *S. calliope* and *S. eugenia* the antennae are black in the basal third and cream in the distal two thirds. Both sexes of *S. radfordi* additionally differ from those of *S. calliope* by having less prominent orange scaling on the ventral surface of the abdomen, with an entirely brown instead of at

least partially orange tuft of long setae around the tip of the eighth abdominal segment, darker and more even toned orange-brown instead of orange (males) to orange-yellow (females) wing patterning, slightly more horizontally elongate dark postdiscal spots on the forewing, a broader and more even black margin in the forewing tornus, larger white submarginal spots in the forewing apex, an additional faint white submarginal spot in cell Cu_1 on the dorsal and/or ventral forewing, and additional white submarginal spots in the apex of the dorsal and/or ventral hindwing. The male of *S. radfordi* additionally has a slightly narrower and more pointed wing shape than the male of *S. calliope*. The genitalia of the *calliope* group are rather homogeneous, and the male and female genitalia of *S. radfordi* do not significantly differ from those of *S. calliope*. In addition to all of the wing pattern differences listed above between *S. radfordi* and *S. calliope*, both sexes of *S. eugenia* can additionally be consistently distinguished from those of *S. radfordi* (and *S. calliope*) by having a more proximally positioned dark postdiscal spot in forewing cell Cu_1 , and a relatively smooth and straight instead of rayed distal margin to the orange patch in the forewing apex (Gallard & Fernandez, 2015). *Stalachtis magdalena* is the most distinctive member of the group, with paler orange wing patterning that is reduced to absent distal to the dark postdiscal band on the forewing, and a complete band of enlarged white submarginal spots on the forewing.

Wing pattern variation in the examined specimens of *S. radfordi* is minimal, and limited to whether or not the dark postdiscal spot in forewing cell Cu_1 is connected to the dark scaling proximally along vein Cu_1 , and faint white submarginal spots are visible dorsally as well as ventrally in forewing cell Cu_1 and the hindwing apex.

Biology: This species is known to inhabit montane forest from about 1100 to 2000 m. The type locality at 2000 m is a ridge of stunted elfin forest that forms the border between Ecuador and Peru. At the time that the type series was collected in 2010, a military border encampment at the base of the ridge served as an access point, with a road extending from Quimi (750 m), off the Gualaquiza-Zamora road, up to the camp (1750 m) at the top of the Cordillera del Cóndor. However, the most recent visit by the authors to the area in 2021 revealed large-scale open copper and gold mining activities that had severely degraded the environment at lower elevations (conducted by Ecuacorriente S.A., a company owned by a Chinese conglomerate; see Henderson (2014) for more details). The military camp was found to have been abandoned some years before, and, as a consequence, the road up to it had become badly eroded and was impassable. Both sexes of *S. radfordi* were encountered flying up and over the ridge at about 2 m above the ground during the mid to late afternoon, predominantly from the Peruvian side of the ridge whence the wind was blowing (J. Radford, pers. comm.). A female of *S. radfordi* was also photographed by Andrew Neild atop a low leaf (see Fig. 5) at about 1100 m along the Río Bombuscaro, just to the south of Zamora, located about 60 km away from the type locality in the adjacent main Andean chain. Despite many years of searching for *S. radfordi* in the Cordillera del Cóndor region, we have never encountered this rare and/or localized species, and it is not present in any of



Fig. 5. A female of *S. radfordi* n. sp. from Río Bombuscaro, near Zamora, Zamora-Chinchipec, E. Ecuador (1100 m) (photo by A. Neild).

the institutional or private collections that we have examined (e.g., see list in Hall (2018)). *Stalachtis radfordi* seems to occur at elevations above those occupied by the closely related, widespread lowland Amazonian *S. calliope*, which we have also recorded in Zamora-Chinchipec province, along the Río Nangaritzza at 1050 m (see Fig. 1). Although *Stalachtis* is one of the most well-known groups of aposematic mimetic riordinids (e.g., Seitz, 1916-20; d'Abbrera, 1994; Hall, 2006; Magaldi *et al.*, 2021), there are no sympatric butterflies or moths closely resembling *S. radfordi* at montane elevations in the Cordillera del Cóndor region.

Distribution: *Stalachtis radfordi* has only been found at two localities in Zamora-Chinchipec province in southeastern Ecuador, but its presence at the Ecuador-Peru border indicates that it also occurs in the very remote Peruvian section of the Cordillera del Cóndor (Amazonas). The lack of known specimens from elsewhere in southern Ecuador and northern Peru, despite relatively intensive recent collecting, suggests that the species may be endemic to the broader Cordillera del Cóndor region.

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