

REVISION OF THE AMETHYST-THROATED SUNANGEL (*HELIANGELUS AMETHYSTICOLLIS*): A NEW SUBSPECIES FROM SOUTHERN PERU

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Resumen. – El Angel del Sol de Cuello Blanco (*Heliangelus amethysticollis*) es un colibrí que habita los altos Andes desde el Sur de Ecuador hasta el norte de Bolivia. Actualmente, son reconocidas tres subespecies (nominal, *laticlavus*, *decolor*). El presente estudio es una revisión de la biogeografía y la variación geográfica de *H. amethysticollis*. Aunque la variación intraespecífica, particularmente en morfometría, es sutil en comparación a otros troquílidos andinos, con base en caracteres de coloración se encuentra evidencia de una población distinta al sur del Perú, que no ha sido previamente reconocida. Se ha denominado subsecuentemente como *Heliangelus amethysticollis apurimacensis* ssp. nov. Recientes patrones biogeográficos y morfológicos sugieren que la diversidad entre los miembros del grupo *H. amethysticollis* surgió en tiempos geohistóricos recientes, como consecuencia de eventos de aislamiento en cadenas montañosas particulares de la zona norte y central de los Andes.

Abstract. – The Amethyst-throated Sunangel (*Heliangelus amethysticollis*) is a high Andean hummingbird ranging from southern Ecuador to northern Bolivia. Currently, three subspecies are recognized (nominative, *laticlavus*, *decolor*). The present study reviews the biogeography and geographic variation of *H. amethysticollis*. Although the intraspecific variation, particularly in morphometry, is rather subtle compared to other Andean trochilids, based on colour characters there is evidence for a previously unrecognized distinct form in southern Peru. It is named subsequently as *Heliangelus amethysticollis apurimacensis* ssp. nov. The recent biogeographic and morphological patterns suggest that diversities among members of the *H. amethysticollis* group emerged in recent geohistoric times, supported by isolation events in particular mountain ranges of the northern and central Andes. *Accepted 3 November 2009.*

Key words: Amethyst-throated Sunangel, *Heliangelus amethysticollis*, *Heliangelus amethysticollis apurimacensis* ssp. nov., Trochilidae, Peru, Andes.

INTRODUCTION

According to Schuchmann (1999), the genus *Heliangelus* (Trochilidae) comprises nine medium-sized members inhabiting the high Andes from Venezuela to Bolivia. Among them, the Amethyst-throated Sunangel *Heliangelus amethysticollis* d'Orbigny & Lafresnaye, 1838 has one of the most extended ranges in the northern and central Andes. The

taxonomy of this species has been controversial in the past as some authors regarded the Longuemare's Sunangel (*H. clarisse*) to be conspecific (e.g., Zimmer 1951, Fjeldså & Krabbe 1992). However, other reviewers such as Todd (1942) and, more recently, Schuchmann (1999), Ridgely & Greenfield (2001), and Hilty (2003) separated *H. clarisse* from the *H. amethysticollis* complex due to incongruent morphological patterns (i.e., colour combina-

tion of frontlet, throat patch, and underparts). Currently, three subspecies of the Amethyst-throated Sunangel are recognized: a) ssp. *lati-clavius* Salvin (southern Ecuador to north-western Peru); ssp. *decolor* Zimmer (north- to south-eastern Peru); and ssp. *amethysticollis* d'Orbigny & Lafresnaye (southern Peru to northern-central Bolivia).

Recent studies of widespread Neotropical hummingbird genera have demonstrated the lack of sufficient modern biogeographical analyses for many Andean taxa (e.g., Schuchmann *et al.* 2000, 2001; Weller & Schuchmann 2004). Concerning increased collecting efforts by field parties mainly undertaken in southern Ecuador and Peru since the mid 1970's, there has been a filling of former - and sometimes artificial - distributional gaps for a number of trochilids formerly known from very local ranges, including *Helianthus* (e.g., resulting in the discovery of *H. regalis*; Fitzpatrick *et al.* 1979). Moreover, individual variation is a common phenomenon in trochilids and may impede both the recognition of geographic variation and taxonomic classification (for *Helianthus*, see, e.g., Zimmer 1951, Bond 1954, Graves 1993, Kirchman *et al.* 2009).

In this study, I review taxonomy, range information, biogeographical and morphological patterns, and body mass data of the Amethyst-throated Sunangel based on a survey of the genus *Helianthus*. This includes the characterization of a population from southern Peru subsequently described as a distinctive new subspecies.

MATERIAL AND METHODS

Altogether I analyzed a total of 181 skin specimens of the Amethyst-throated Sunangel housed in various bird collections of research museums (see Acknowledgments), following widely the methods applied in earlier biogeographical-taxonomic studies on Trochilidae (e.g., Schuchmann *et al.* 2001).

Exact names, coordinates, and altitudes of collecting sites were either obtained from specimen labels or traced using ornithological gazetteers (Stephens & Traylor 1983, Paynter 1992, 1993).

Undated specimens were excluded from further analysis. If provided on the label, data on sex and body mass were included in the subsequent analysis unless the sexual identity of the concerning specimen was in doubt.

Selected morphometric traits (length of bill, wing, rectrix 1 and 5) were measured with a digital caliper. In order to test for geographical variation, characters of subpopulations were statistically compared with student's *t*-test, based on ANOVA (via MS Excel 2003). Since immature birds differ partly in their biometric data from adults (e.g., in tail) they were not included in these analyses.

Plumage variation was studied under natural light conditions. Colours are derived from subjective impressions (i.e. iridescent plumage parts) or using a colour guide (non-iridescent parts; Smithe 1975).

RESULTS

Distribution and taxonomy. The northernmost distributional limits of the Amethyst-throated Sunangel are in Morona-Santiago (Cordillera de Cutucú; Ridgely & Greenfield 2001), southern central Ecuador. However, the first description of the northern subspecies *lati-clavius* (Salvin, 1891) indicates "Intag," a site located on the western slope in Imbabura province, northern Ecuador. The uncertainty of that old (Buckley) record and the fact that the species has never been found there despite extensive collecting induced Zimmer (1951) to correct the type locality to "Jima" (= Gima, prov. Azuay; Paynter 1993). Nevertheless the taxon is uncommon to local throughout southern Ecuador, being found more numerous only in the Loja-Zamora area and in Cordillera de Condor (Ridgely &

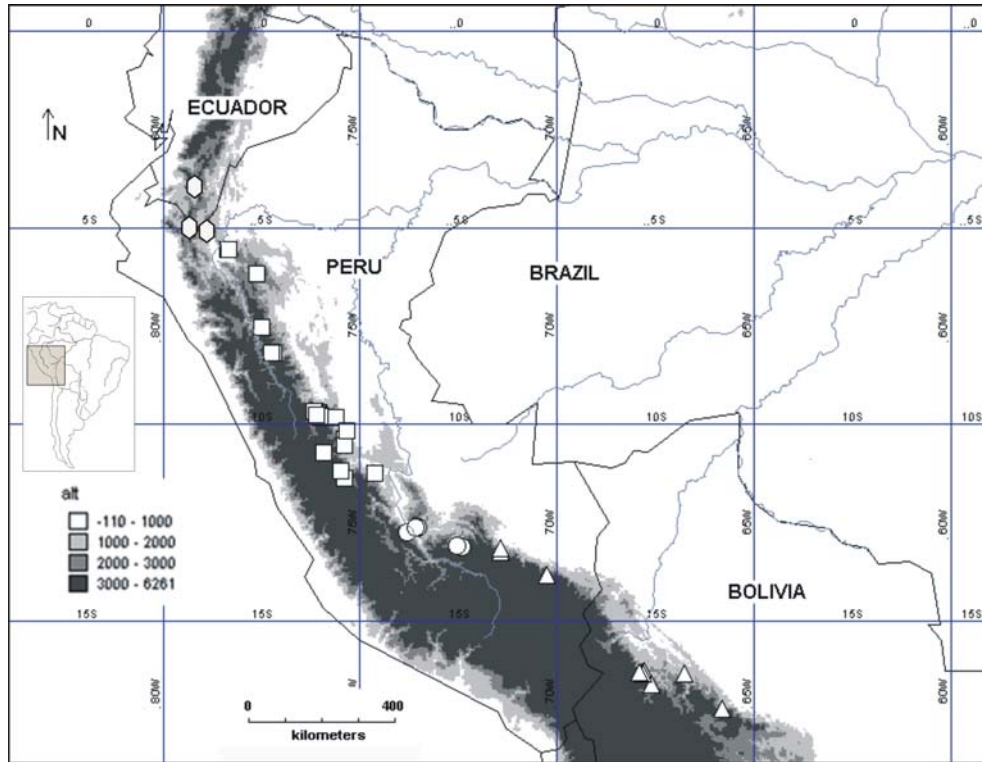


FIG. 1. Geographical distribution of all subspecies of the Amethyst-throated Sunangel (*Heliangelus amethysticollis*) examined. Hexagons indicate range of *H. a. laticlavus*; squares - *H. a. decolor*; circles - *H. a. apurimacensis* ssp. nov.; triangles - *H. a. amethysticollis*.

Greenfield 2001). The Peruvian range of *H. a. laticlavus* covers the Cerro Chinguela, Piura, northwest of the Marañon depression. Based on a very narrow species concept, Simon (1921) excluded *laticlavus* from the *H. amethysticollis* complex as a separate taxon.

The subspecies *H. a. decolor* was separated from *H. a. laticlavus* by Zimmer (1951) based on differences in the coloration of frontlet, throat, and belly. Conversely to the latter, it occurs along the eastern slope of the Peruvian Andes, reaching its northern range limits east of the rio Marañon in the Cordillera de Colan. Of all congeners, *decolor* has the widest distribution (cf. Fig. 1) ranging from depto. Amazonas southward probably to

depto. Apurímac (Fjeldsá & Krabbe 1992). Southward the taxon's distribution is flanked by that of *H. a. amethysticollis*. The range of the nominotypical form has been recently indicated to extend from depto. Cuzco, southern Peru to depto. Cochabamba, Bolivia (Fjeldsá & Krabbe 1992). Contrary, Zimmer (1951), however, suggested that Peruvian species' records may refer to *H. a. decolor*. This study confirms that *H. a. amethysticollis* is present in Peru at least in two departamentos, Cuzco and Puno (specimen records, see Appendix).

Diagnosis and plumage variation. The Amethyst-throated Sunangel can be discriminated from

TABLE 1. Biometric characters (mm) and body mass (g) for all subspecies of *Helianthus amethysticollis* (incl. *ssp. nov.), listed from north to south; given are mean \pm s.d., range, and sample size (in brackets).

Taxon/sex	Bill length	Wing length	Rectrix 1 length	Rectrix 5 length	Body mass
<i>H. a. latianus</i>					
Males	19.01 \pm 0.54	66.74 \pm 0.87	38.89 \pm 0.95	44.66 \pm 1.02	5.64 \pm 1.23
	18.1–19.6 (8)	64.5–67.1 (7)	37.5–40.0 (8)	43.2–46.3 (7)	3.8–7.7 (7)
Females	18.86 \pm 0.78	59.76 \pm 3.18	36.72 \pm 1.30	39.64 \pm 2.12	4.84 \pm 0.26
	18.0–19.6 (5)	57.2–64.5 (5)	35.1–38.1 (5)	38.0–43.2 (5)	4.6–5.2 (4)
<i>H. a. decolor</i>					
Males	18.65 \pm 0.81	66.40 \pm 1.56	41.45 \pm 1.36	45.27 \pm 1.62	5.78 \pm 0.51
	16.6–21.0 (62)	62.0–70.0 (62)	38.2–45.4 (61)	40.5–49.0 (61)	5.0–7.4 (43)
Females	18.87 \pm 0.88	59.92 \pm 1.67	37.89 \pm 1.39	39.61 \pm 1.54	4.78 \pm 0.50
	17.1–20.5 (40)	55.9–63.3 (40)	35.0–40.7 (41)	36.8–42.5 (37)	4.0–6.0 (31)
<i>H. a. apurimacensis</i> *					
Males	19.27 \pm 0.71	66.52 \pm 1.09	41.35 \pm 1.27	44.40 \pm 1.10	5.0, 6.0 (2)
	18.3–20.3 (6)	65.5–68.2 (5)	39.8–43.2 (6)	43.2–46.0 (5)	
Females	19.90 \pm 1.02	61.00 \pm 0.97	37.92 \pm 1.29	37.90 \pm 0.94	4.9, 5.0 (2)
	18.6–21.1 (5)	59.7–62.3	36.1–39.1 (5)	36.5–38.8	
<i>H. a. amethysticollis</i>					
Males	19.15 \pm 0.85	64.64 \pm 1.84	40.89 \pm 1.26	43.39 \pm 1.45	5.58 \pm 0.60
	17.4–20.8 (35)	61.4–68.5 (35)	38.3–44.2 (37)	41.1–46.3 (33)	4.8–7.0 (25)
Females	19.42 \pm 0.54	59.78 \pm 1.21	37.92 \pm 1.25	38.36 \pm 1.12	4.75 \pm 0.47
	18.6–20.3 (13)	58.2–61.6 (13)	35.6–39.4 (12)	36.3–40.2 (13)	4.3–5.4 (10)

near-related congeners, such as Longuemare's Sunangel and the Gorgeted Sunangel (*H. strophianus*), by a combination of the following characters: (1) glittering frontlet enlarged; (2) male throat patch rather purplish-violet; and (3) reduced greenish underparts (with whitish to buffish breast and abdomen). Of all morphological traits, I found the coloration of the frontlet to be the most variable character, even at the subspecific level, although some tendencies can be validated for each taxon (see also Zimmer 1951). Nominotypical males have on average the frontlet strongly iridescent turquoise to golden green, while those of *decolor* are more golden to golden bronze-green (Table 1). However, some of the latter match nearly those of *latianus*, being more bluish green (c. Turquoise Blue, 65 or Emerald, 163 \times Cyan, 164), especially those from the northern portion of the range (depto. Amazonas, San Mar-

tín, La Libertad; e.g., LSUMZ 87499, MHNJP 4922, 18532–36). In females and immatures generally the frontlet is less well pronounced and glittering as well as slightly darker (i.e., more bluish rather than turquoise) than in males.

Males of all subspecies exhibit a glittering purplish throat. I confirm Zimmer's (1951) statement that the coloration is fairly uniform throughout the range of *H. amethysticollis*, but that the patch is narrowed to some extent in *decolor*: Females of all subspecies have basically a brownish throat (c. Sepia, 119), but some individuals (likely mature birds), exhibit either some single feathers or even an indefinitely closed patch of purple to violet colour (e.g., *H. a. decolor*, LSUMZ 91844).

Another major diagnostic character indicating clinal variation is the coloration of the breast and lower belly. The breast is cinnamon-buff (c. Cinnamon, 39 \times Warm Buff,

118) in nominotypical birds but whitish-buff in *decolor* and almost whitish in *laticlavius*. Additionally, the latter has extended green on the centre of belly, becoming more greyish-brown towards the abdomen (c. Light Drab, 119C), while the greenish parts are reduced in both other taxa with buff-greyish in *decolor* (c. Drab-Gray, 119D) but strongly cinnamon-buff in *amethysticollis*. Zimmer (1951) described an adult male from Molinopampa, Amazonas with intermediate characters between all three forms in upperparts and ventral coloration, suggesting a different form. However, this study could not confirm constant differences in specimens from the northern Peruvian range occupied by *decolor*, e.g., from Cordillera de Colán.

Taking into account the current geographical variation in major plumage characters, I found a population from the eastern slope of the southern Peruvian Andes to be distinctive from all other conspecific populations. Subsequently it is introduced as a new taxon named as

Helianthus amethysticollis apurimacensis, **ssp. nov.**

Diagnosis. Differs from *decolor* (more turquoise golden) and *laticlavius* (more turquoise blue) by turquoise green frontlet (in males glittering), by the broader throat patch; breast whitish-buff, belly centre and abdomen pale buff, intermediate between *H. decolor* (lighter) and *H. a. amethysticollis* (darker).

Type. AMNH no. 820750, adult male; Yuraccyacu (c. 12°45'S, 73°48'W), Depto. Ayacucho, Peru, 2600 m a.s.l.; mistnetted on 22 July 1970 by J. S. Weske and J. P. O'Neill in understory of very mossy cloud forest; testes 2.5 mm, no fat, iris dark brown, feet brownish-gray.

Description. Bill blackish, medium-long, straight, 18.3 mm; frontlet sharply defined, glittering Turquoise Green (64); upperparts shining dark golden green, slightly more

bronzy at rump, flanks, and uppertail coverts; wings dark purplish-brown; gorget light purple with Bluish Violet (172B reflections towards chin; chest band Pale Horn Color (92), laterally becoming Warm Buff (118); upper belly and flanks dark golden green, the former centrally horn-coloured; belly centre Tawny-Olive (223D); undertail coverts with dark brown (Hair Brown, 119A) centres and greyish-buff fringes; innermost rectrices (R1) greyish-green with dark tips, R2 purplish-black, R3–5 becoming blue-black with narrow greyish tips, widest in R5.

Cotype. AMNH no. 820,456, adult female; Cordillera Vilcabamba (12°37'S, 73°33'W), Depto. Cuzco, Peru, 2640 m a.s.l.; collected by J. S. Weske and J. P. O'Neill in elfin forest along mountain ridge; little fat, ovary 2 mm.

Description. Bill blackish, medium-long, straight, 17.8 mm. Differs from male by indefinite shining golden turquoise green frontlet, slightly extended towards crown; bronze-green upperparts; blackish-brown (c. Sepia, 119) throat with few purple-violet spots, laterally blackish- to bronze-green, and central lower throat feathers fringed Raw Sienna (136); broader breast band, Pale Pinkish Buff (121D); extended bronze-green on upper belly.

Etymology. The name refers to the Apurimac valley where the type locality and the focal range of the new subspecies are situated.

Range. Occurs around the upper Apurimac valley and in the upper Urubamba valley, e.g., on both slopes of Cordillera Vilcabamba, in deptos. Ayacucho and Cuzco, southeastern Peru, at altitudes between ca. 2200–3400 m a.s.l.

Individual variation. A male from Cordillera Vilcabamba (AMNH 820419) differs from the

type by the extended greenish plumage on belly. One female from the same area (AMNH 820749) has central gorget spots being Bluish Violet (172B) instead of purplish but lacks the brownish (Sienna) fringes as the cotype; moreover, the lower throat discs are deep bronze-green. Another female (820,749) from Yuraccyacu (AMNH 820749) has the throat completely Raw Sienna (136) with pale fringes, lacking any purplish or violet-blue discs, and exhibits a rather glittering turquoise green frontlet. An immature male (FMNH 166521) from the eastern slope of Cordillera Vilcabamba has a weakly pronounced, rather golden green frontlet, a darker, more violet tone on throat, and broad whitish tips in the rectrices, which could be accounted for its incomplete plumage.

Biometrics and body mass. The Amethyst-throated Sunangel is a medium-sized member of the genus (Table 1); for example, it is larger than *H. micraster* but smaller than *H. viola* (unpubl. data). Compared to other trochilids with similar range extensions (e.g., *Lesbia gouldii*; Weller & Schuchmann 2004), overall variation is minor resulting in weak or even absent intraspecific differences. For example, there is no significant variation in bill length among taxa and sexes, respectively, with means in males ranging from 18.65 mm (*decolor*) to 19.25 mm (*apurimacensis*). In males, the average wing length is slightly smaller in non-typical birds (64.64 mm) than in all other taxa. More obvious differences exist in the tail length since males of *H. a. laticlavus* have significantly shorter innermost rectrices (R1: 38.89 mm) compared with all other conspecifics ($P < 0.001$ vs *amethysticollis*, *decolor*; $P < 0.01$ vs *apurimacensis*). However, due to the unbiased sample sizes of the taxa I was able to examine, the statistic analysis included only 13 specimens from *H. a. laticlavus* and 12 specimens from *H. a. apurimacensis*.

Except for bill length, females of all sub-

species are markedly smaller than males in all morphological traits (Table 1). For example, males of *H. a. laticlavus* exceed the females by c. 7 mm in wing length and by c. 5 mm in R5 length. Due to only moderately prolonged outer rectrices in females, their tail bifurcation is less pronounced than in males ($P < 0.001$).

For the first time, this study summarizes body masses for all members of *H. amethysticollis* (Table 1). Generally, *laticlavus*, *decolor*, and *amethysticollis* show strong individual (especially in males of taxa) rather than intraspecific variation. Average body mass for males is 5–6 g; females are lighter by c. 0.8–1.0 g. Although only two specimens of each sex could be included for *H. a. apurimacensis*, their values indicate a similar tendency as in the other forms.

DISCUSSION

Biogeographic and morphological patterns in Andean trochilids often reflect recent geohistorical changes, resulting in the establishment of locally distinct populations (e.g., Schuchmann *et al.* 2000, 2001, Weller & Schuchmann 2004). In this context, the rate of diversification seems to increase for taxa from higher altitudes and is most prominent in habitats close to or above the tree line (e.g., in metal-tails *Metallura*; Garcia-Moreno *et al.* 1999, Heindl & Schuchmann 1998). Such speciation events have been partly explained by the repeated and rapid change of concerned habitats due to climatic or even man-made causes (Fjelds  1992, 1995; Fjelds  & Mayer 1996).

Members of the sunangel genus *Helianthus* inhabit the medium and upper zones of subtropical to temperate cloud and elfin forests mostly at altitudes between c. 2000–3000 m a.s.l. (Schuchmann 1999; see also Appendix). These ecological requirements may explain why some members, such as Amethyst-throated Sunangel, are fairly widespread but show only minor geographical

variation when compared to hummingbirds found in climatically more extreme habitats (e.g., *Metallura*, *Chalcostigma*; Schuchmann & Heindl 1997, Heindl & Schuchmann 1998, Garcia-Moreno *et al.* 1999). The geographical and morphological patterns observed in the Amethyst-throated Sunangel are nearly paralleled by some trochilid taxa with a similar geographical and altitudinal distribution, namely *Lesbia nuna/gouldii* and particularly *Coeligena violifer* (Schuchmann & Züchner 1997). This fact could reflect that these taxa share in part the same evolutionary centres. According to the morphology of the new taxon that is closer to the nominotypical form than to *H. a. decolor*, *H. a. apurimacensis* may have emerged from an ancestral population including the precursor of *H. a. amethysticollis*, once distributed along the eastern slope of the central Andes from southern Peru to northern Bolivia. Subsequently, *apurimacensis* likely became isolated from the northern central populations (present *decolor*) and the southern birds (present *amethysticollis*) in the central mountains of present Cuzco, namely in Cordillera Vilcabamba. This scenario is consistent with findings for other avian taxa, e.g., the hummingbirds *Coeligena torquata eisenmanni* and *C. violifer albicaudata* supporting the hypothesis that the Apurimac drainage (Vuilleumier 1969, Weske 1985, Schuchmann & Züchner 1997) and possibly also the Urubamba valley served as dispersal barriers during more arid geo-historical periods. As indicated for *Coeligena violifer albicaudata* (Schuchmann & Züchner 1997), radiations following (sub-) speciation events could have dissolved the initial barrier effect of the Apurimac under more suitable ecological conditions (i.e., lowering of cloud forest zone). Therefore the single record of *H. a. apurimacensis* from Ayacucho (cf. Fig. 1) may result from post-glacial dispersal across the Apurimac valley. However, the lack of records mainly in the southern range of *H. a. apurimacensis* may simply reflect

collecting gaps, and further studies may show a more widespread distribution around the headwaters of Rio Apurimac and its tributaries.

Recent phylogenetic studies based on mtDNA and nuclear data have placed the Amethyst-throated Sunangel within the Andean clade of “Coquettes” including the sister taxa *H. viola*, *H. exortis*, and *H. micraster* (McGuire *et al.* 2007, 2009; Kirchman *et al.* 2009). However, these studies lacked other congeners, such as Longuemare’s Sunangel *H. clarisse* and the Merida Sunangel *H. spencei* which have been traditionally placed in close relationship (or even as conspecifics) to the Amethyst-throated Sunangel (Zimmer 1951, Fjeldså & Krabbe 1992, Schuchmann 1999). In view of the subtle but obvious differences among subspecies of the latter taxon as well as the more clearly defined species limits in other congeners (e.g., *H. exortis* vs *H. micraster*; cf. McGuire *et al.* 2007), I suggest to maintain *H. amethysticollis*, *H. clarisse*, and *H. spencei* as separate allospecies based on the combination of throat, breast, and frontlet colour characters.

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APPENDIX. Localities and coordinates for skin specimens of all subspecies (*ssp. nov.) of the Amethyst-throated Sunangel examined (cf. Methods). Coordinates were either obtained from labels or ornithological gazetteers; n. loc. = not located.

Taxon	Locality	Departamento, country	Altitude (a.s.l.)	Coordinates (°S/°W)
<i>laticlavus</i>	“near Loja”	Loja(?), Ecuador	-	c. 0400/7913
	Batan, Zapalache-Carmen trail	Cajamarca, Peru	2250 m	c. 0502/7921
	Machete, Zapalache-Carmen trail	Cajamarca, Peru	2050 m	c. 0502/7921
	ridge above San José de Lourdes	Cajamarca, Peru	2450 m	0504/7854
<i>decolor</i>	SE of La Peca, Cordillera de Colón	Amazonas, Peru	8200–8700 ft	n. loc.
	E of La Peca	Amazonas, Peru	8150–9800 ft	c. 0534/7822
	16 km E Molinopampa	Amazonas, Peru	2400 m	c. 0611/7737
	Puerto del Monte, 26 km NE Pataz	San Martín, Peru	3090–3250 m	c. 0732/7729
	Pajatén, 40 km E Pataz	San Martín, Peru	2800 m	n. loc.
	Cumpang, above Utcubamba, on trail to Ongón Mashua	La Libertad, Peru	2975 m	c. 0812/7710
		La Libertad, Peru	3150–3350 m	0812/7714

APPENDIX. Continuation.

Taxon	Locality	Departamento- country	Altitude (a.s.l.)	Coordinates (°S/°W)	
<i>decolor</i>	Carretera Central, E slope Cordillera Carpish	Huánuco, Peru	2250–2400 m	c. 0940/7609	
	Bosque Unchog, pass between Churubamba- Hacienda Paty	Huánuco, Peru	3600 m	c. 0941/7607	
	Bosque Cutirragra, S of Huaylaspampa	Huánuco, Peru	2775 m	n. loc. (S of 0942/7602)	
	Bosque Huaylaspampa	Huánuco, Peru	8300 ft	n. loc.	
	Bosque Taprag	Huánuco, Peru	3350 m	c. 0943/7604	
	Huancapata, Panao	Huánuco, Peru	2745–3000 m	c. 0950/7600	
	Playa Pampa, 8 km NW Cushi, trail to Chaglla	Huánuco, Peru	2440 m	c. 0951/7537	
	2 km NW Punta de Saria, Pozuzo-Chaglla trail	Huánuco, Peru	3100 m	n. loc.	
	Cumbre de Ollón, 12 km E Oxapampa	Pasco, Peru	2500 m	n. loc., E of 1033/7524	
	Cabecera del Rio San Alberto, PN Yanachaga- Chemellén	Pasco, Peru	2600 m	n. loc., c. 1023/7524	
	Rumicruz	Pasco, Peru	2960 m	1044/7555	
	Vía Satipo, Chanchuleo, 8 km SE Calabaza	Junín, Peru	3080 m	n. loc. (SE 1116/7437)	
	Pampa Huasi, 12 km SE Calabaza	Junín, Peru	-	n. loc. (SE 1116/7437)	
	Maraynioc	Pasco, Peru	3300 m	1112/7528	
	Utcuyacu	Junín, Peru	1465 m	1122/7524	
	<i>apurimacensis</i> *	Cordillera Wilcabamba	Cuzco, Peru	2640–2830 m	1237/7333
		Yuraccyacu	Ayacucho, Peru	2600 m	1245/7348
Cedrobamba, Machu Picchu		Cuzco, Peru	3660 m	1305/7233	
<i>amethysticollis</i>	San Luis	Cuzco, Peru	2745 m	1306/7225	
	Pillahuata	Cuzco, Peru	2500–3000 m	1308/7125	
	Huaisampillo	Cuzco, Peru	3050 m	1314/7126	
	1 km below Marcapata	Cuzco, Peru	2750 m	1330/7055	
	Carabaja	Puno, Peru	-	c. 1350/7015	
	Sacramento Alto, 8 km N Chuspipata	La Paz, Bolivia	2575 m	c. 1616/6747	
	4.5 km WNW Chuspipata	La Paz, Bolivia	3300 m	c. 1617/6748	
	1 km S Chuspipata	La Paz, Bolivia	3050 m	c. 1618/6750	
	Cerro Sillutincara	La Paz, Bolivia	-	c. 1617/6754	
	Yungas de Cochabamba	Cochabamba, Bolivia	2000 m	1620/6645	
	Limbo	Cochabamba, Bolivia	2200 m	n. loc.	
	Chaco, Yungas	La Paz, Bolivia	-	1620/6748	
Camino Lambate	La Paz, Bolivia	2600 m	1637/6736		
Incachaca	Cochabamba, Bolivia	2700 m	1714/6549		