'Bogotá' type specimens of the hummingbird genus *Adelomyia*, with diagnosis of an overlooked subspecies from the East Andes of Colombia

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Summary.—Molecular work has revealed that Speckled Hummingbirds *Adelomyia melanogenys* in the East Andes of dpto. Santander, Colombia, represent a distinct lineage not previously recognised taxonomically. Most specimens from this region differ from others taken in the East Andes by their more extensively rufous and speckled posterior underparts. Sound-recordings and biometrics showed broad overlap for all variables in both populations. Statistically significant but non-diagnosable differences exist in the number of notes in trills of songs, speed of calls and bill length. The type of *Adelomyia melanogenys* (Fraser 1840) is a 'Bogotá' specimen similar to birds from dpto. Cundinamarca, Colombia. *Trochilus sabinae* Bourcier & Mulsant, 1846, is also based on a 'Colombia' specimen. A possible type was identified that resembles the Santander population in its underparts. *Adelomyia simplex* Boucard, 1893, is based on a leucistic 'Bogotá' specimen more consistent with the Cundinamarca population than others. If the Santander population is recognised taxonomically, it is suggested to clarify the type locality for *sabinae* as the west slope of the East Andes in Santander or Boyacá, but molecular work is needed to confirm this. *A. m. inornata* in the southern Andes has a faster call and distinctive plumage, and perhaps merits species rank.

The genus *Adelomyia* is monospecific, comprising the polytypic Speckled Hummingbird *A. melanogenys*, a widespread Andean hummingbird. The following names have been recognised as valid subspecies, with type localities in parentheses: *maculata* Gould, 1861 (Quito), *chlorospila* Gould, 1872 (San Antonio, Peru), *aeneosticta* Simon, 1889 ('Venezuela'; considered by Cory 1918 to be near Mérida), *cervina* Gould, 1872 (Medellín, Central Andes, Colombia), *inornata* Gould, 1846 (Sandillani, Yungas, Bolivia), *connectens* Meyer de Schauensee, 1945 (head of Magdalena Valley at La Candela, dpto. Huila, Colombia) and *debellardiana* Aveledo & Perez 1994 (Venezuelan side of Perijá Mountains) (Dickinson & Remsen 2013). The names *melanogenys* Fraser, 1840, *sabinae* Bourcier & Mulsant, 1846, and *simplex* Boucard, 1893, are all based on 'Bogotá' or 'Colombia' trade specimens, the latter two being generally regarded as synonyms of the first.

Molecular studies have revealed that birds on the west slope of the East Andes in dpto. Santander to northern dpto. Boyacá (hereafter 'Santander–Boyacá population') differ in mtDNA from all other north Andean populations (Chaves & Smith 2011, Chaves *et al*. 2011). Differences are substantial: 5.8% versus other populations in the East Andes with which the Santander–Boyacá population has historically been treated as consubspecific (Chaves & Smith 2011: 7, Table 2). These studies were based on sequences of five specimens at Instituto Alexander von Humboldt, Villa de Leyva, Colombia (IAVH). We studied the sequenced specimens and others from the region, analysed vocal and biometric data, and considered the phenotypic differentiation and names for the Santander–Boyacá population.

Figure 1. Post-1997-collected specimens of (above) main East Andes population and (below) Santander–Boyacá population. Top row: (i) ICN 33152 (El Retiro, Ubalá, dpto. Cundinamarca); (ii) ICN 33951 (Toledo, Parque Nacional Natural Tamá, dpto. Norte de Santander); (iii) ICN 34757 (Santa María, dpto. Boyacá); (iv) ICN 22366 (La Aguadita, dpto. Cundinamarca); (v) ICN 33154 (as i); bottom row: (i) ICN 34816; (ii) ICN 34364; (iii) ICN 36458; (iv) ICN 35820; (v) ICN 34987, details of which appear in Appendix 3 (T. M. Donegan)

Figure 2 (left). ICN 33152 (Cundinamarca) and ICN 35828 (Santander) showing differences in underparts coloration; for details of specimens see Fig. 1 (T. M. Donegan)

Figure 3 (below): IAVH series of the Santander–Boyacá population, from left to right: 10293, 13446, 13463, 10562, 8331, 8336; details of specimens in Appendix 3 (T. M. Donegan)

Methods

Adelomyia songs typically commence with a very fast rising trill, comprising short notes over a broad frequency, followed by stronger, slower notes with thicker maxima and terminal downstrokes, each of progressively lower max. frequency (Fig. 4, hereafter 'song'). The species also gives repeated single, high-pitched *chit* notes over a relatively narrow bandwidth (Fig. 5, hereafter 'call'). Sonograms were produced of songs and calls of the Santander–Boyacá population ($n = 18$ songs from 13 assumed individuals and $n = 7$ calls from seven individuals) and those from elsewhere in the East Andes north of the Andalucía Pass between dptos. Huila and Caquetá near Parque Nacional Natural Serranía de los Picachos ($n = 21$ songs from 11 individuals and $n = 5$ calls from three individuals). Relatively few sound-recordings were available, despite the species' abundance in appropriate habitats, suggesting that it is not a very active songster or is infrequently recorded. For songs, total length and max. frequency were measured for the entire vocalisation. Number of notes, length and speed were then measured separately for the initial trill and later slower notes (Appendix 2). In some recordings, intermediate notes with both broad bandwidth and a longer terminal element occur, making the distinction between the trill and longer notes less obvious. In such recordings, different parts of songs were separated based on the point before where a note with strong terminus and longer gap preceding it first appears. Some songs included only the trill or the longer notes, but not both; these were excluded from analyses. Calls are typically very long and many recordings are only of fragments. As a result, a 3–16-second sample (depending on the length of the recording) was taken. Number of notes and length were measured to permit speed to be calculated. The max. and min. acoustic frequency of a typical note were then measured for each recording, and used to calculate note bandwidth. Short rattle calls are also given while foraging or in contact, or by birds in the hand in alarm, but these were not studied.

Biometric data were collated from mist-net surveys in Colombia reported in Donegan & Dávalos (1999) (West Andes: *cervina* / *ultracervina*), Salaman *et al*. (1999) (East Andes: *melanogenys* / *connectens*) and Donegan *et al*. (2007, 2010) and Villanueva & Huertas (2011) (Santander–Boyacá population). Biometric data for the latter and other East Andes populations (Norte de Santander, Cundinamarca and southern / eastern Boyacá specimens) were compared using specimens at IAvH and were also taken for putative type specimens.

The following statistical tests for diagnosability developed by Donegan (2008, 2012) and Donegan & Avendaño (2008) were applied to the vocal and biometric data.

LEVEL 1: statistically significant differences at $p<0.05$. A Bonferroni correction was applied (songs: eight variables each, $p<0.006$); calls four variables $p<0.013$; biometrics five variables $p<0.010$). An unequal variance (Welch's) *t*-test was used; for song speeds, a two-sample Kolmogorov-Smirnov test was applied as an additional test that must be satisfied for Level 1, to account for the possibility of a non-normal distribution. These calculations assess the statistical significance of differences between means of populations, but do not address diagnosability, as they tolerate considerable overlap.

Further calculations were undertaken to measure inter-population differences in the context of various species and subspecies concepts. In the formulae used below, $\overline{\chi}_1$ and s_1 are the sample mean and sample standard deviation of Population 1; $\overline{\chi}_2$ and s_2 refer to the same parameters in Population 2; and the t value uses a one-sided confidence interval at the percentage specified for the relevant population and variable, with t_1 referring to Population 1 and t_2 referring to Population 2.

LEVEL 2: a '50% / 97.5%' test, following one of Hubbs & Perlmutter's (1942) subspecies concepts, which is passed if sample means are two mean standard deviations or more apart

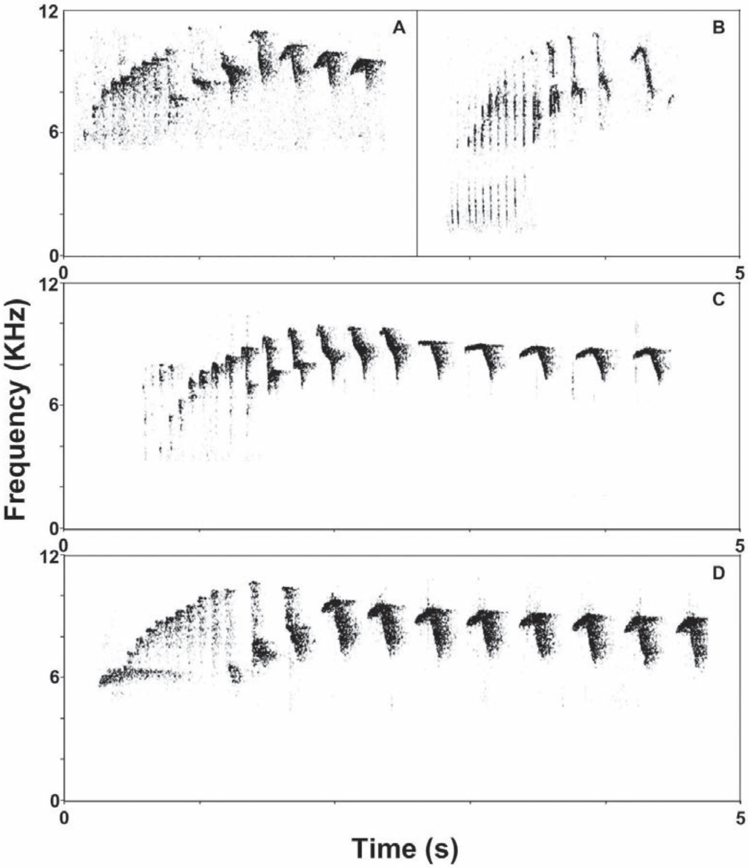


Figure 4. Songs of two Speckled Hummingbird populations in the East Andes of Colombia: Santander–Boyacá population (A–B) and nominate of East Andes (C–D). A: XC64410 (Yariguíes, dpto. Santander). B. XC12688 (north-western dpto. Boyacá). C. XC94059 (dpto. Cundinamarca). D. XC12340 (eastern dpto. Boyacá). For full details of localities and recordists, see Appendix 2.

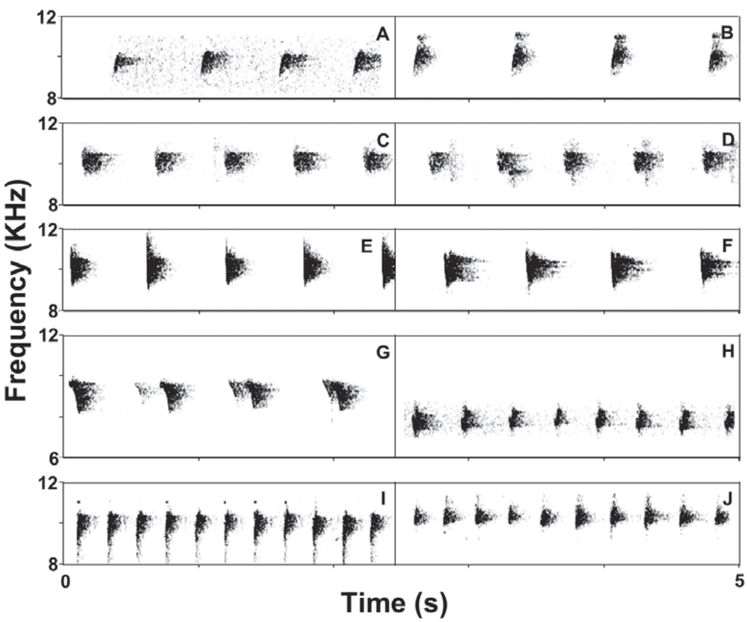


Figure 5. Calls of Speckled Hummingbirds at various Andean localities. Santander–Boyacá population (A–B), East Andes of Colombia (*melanogenys*: C–D), Ecuador (*maculata*: D; and *melanogenys* group: E–F), Peru (*melanogenys* group or *chlorospila*: G; and *chlorospila:* H) and Bolivia (*inornata*: I–J). A. XC246071 (Yariguíes, dpto. Santander: T. M. Donegan). B. XC18358 (north-western dpto. Boyacá: H. van Oosten). C. XC96255 (dpto. Meta: O. Cortés). D. XC89354 (dpto. Meta: O. Cortés). For details of A–D see Appendix 2. E. XC6702 (Tandayapa Valley, Pichincha, Ecuador: N. Athanas). F. XC126906 (Cordillera del Cóndor, Zamora-Chinchipe, Ecuador: L. Ordóñez-Delgado). G. XC5590 (Corral Grande, Zona Reservada Laquipampa, Lambayeque, Peru: W.-P. Vellinga). H. XC63097 (Cock of the Rock Lodge, Manu, Peru: J. Tobias & N. Seddon, response to playback). I. XC1712 (Chillaguatas, Tariquia, Tarija, Bolivia: S. Mayer). J. XC2930 (Carrasco National Park, Cochabamba, Bolivia: A. B. Hennessey)

controlling for sample size, i.e. the sample mean of each population falls outside the range of 97.5% of the other population: $|(\bar{\chi}_1 - \bar{\chi}_2)| > (s_1(t_{1 @ 97.5\%}) + s_2(t_{2 @ 97.5\%}))/2$.

LEVEL 3: The traditional '75% / 99%' test for subspecies (Amadon 1949, Patten & Unitt 2002), modified to control for sample size, which requires both of the following tests to be passed: $|(\bar{\chi}_1 - \bar{\chi}_2)| > s_1(t_{1 @ 99\%}) + s_2(t_{2 @ 75\%})$ and $|(\bar{\chi}_1 - \bar{\chi}_2)| > s_2(t_{2 @ 99\%}) + s_1(t_{1 @ 75\%})$.

LEVEL 4: diagnosability based on recorded values or, for plumage and subjective vocal characters (note shape and change of note shape), subjective diagnosability; the first part of Isler *et al*.'s (1998) diagnosability test.

LEVEL 5: 'Full' diagnosability (where sample means are four mean standard deviations apart at the 97.5% level, controlling for sample size); the second part of Isler *et al*.'s (1998) diagnosability test: $|(\bar{\chi}_1 - \bar{\chi}_2)| > s_1(t_{1 @ 97.5\%}) + s_2(t_{2 @ 97.5\%})$.

The Tobias *et al*. (2010) scoring system was also considered. We do not expressly endorse this system, but use it as a reference point to evaluate taxonomic rank.

We also investigated possible type specimens for three available names in the genus *Adelomyia* based on 'Bogotá' or 'Colombia' type specimens: *Trochilus melanogenys* Fraser, 1840; *Trochilus sabinae* Bourcier & Mulsant, 1846; and *Adelomyia simplex* Boucard, 1893. No subsequent publication concerning the genus discusses any of the types of these names in detail, despite several studies (e.g. Cory 1918, Zimmer 1951, Schuchmann 1999, Chaves & Smith 2011, Chaves *et al*. 2011). Biomap Alliance Participants (2014), who databased all Colombian specimens in public museums worldwide, except IAvH, was used to locate types and other important specimens. We studied all *Adelomyia* in the American Museum of Natural History, New York (AMNH), Natural History Museum, Tring (NHMUK), IAvH, Instituto de Ciencias Naturales, Universidad Nacional, Bogotá (ICN), Universidad Industrial de Santander, Bucaramanga (MHN-UIS), Muséum National d'Histoire Naturelle, Paris (MNHN) and US National Museum, Smithsonian Institution, Washington DC (USNM). We also obtained photographs from the World Museum, Liverpool (LIVCM). This review included examination of many historic 'Bogotá' or 'Colombia' specimens of *A. melanogenys*, at AMNH (n = 39), LIVCM (n = 2), MNHN (n = 6), NHMUK (n = 21) and USNM (n = 8).

Results

Biometric and vocal data are presented in Appendices 1–2. Statistically significant differences were found between the Santander–Boyacá population and the nominate in number of notes (Level 1, p=0.0003) and length (Level 1, p=0.005) of the trill part of the song. For calls, statistically significant differences in speed were found, which passed the first part of the Level 1 test based on Welch's t (p=0.011) but not when a Bonferroni correction is applied, using Kolmogorov-Smirnov (p=0.020). Data are also suggestive of average broader bandwidth for calls in the Santander–Boyacá population, but tests of significance were not met doubtless due to sample size. The difference in call speed is noteworthy given that this varies geographically, with *inornata* of Bolivia, which is sister to all other *Adelomyia* in the molecular phylogeny, being fastest (Fig. 5). Differences in bill length (p=0.05) also narrowly missed the Level 1 test of statistical significance when applying a Bonferroni correction. Bill measurements were considered to vary substantially between other *Adelomyia* populations by Chaves & Smith (2011), who did not study biometrics of the Santander–Boyacá population.

Twelve of the 16 Santander–Boyacá specimens with definite locality data (Appendix 1), including all Yariguíes material, are distinguishable from series collected elsewhere in the

East Andes, in having more extensive rufous (marked with glittering green speckles) on the flanks and belly-sides (Figs. 1–3). Their morphology is described in Appendix 4. West and Central Andes specimens (variously attributed to subspecies *cervina*, *ultracervina*, *connectens* or '*intergrediens*') have a more rufous ground colour to the throat and breast, with less contrasting striations on the throat. Venezuelan specimens (*aeneosticta*) show a yellower shade of glittering green on the ventral surface and a more contrasting and extensively white breast.

Taxonomic rank of the Santander–Boyacá population

Based on molecular studies, the Santander–Boyacá population is a phylogenetic species (Cracraft 1983). It would not meet the requirements for species rank under a comparative Biological Species Concept (*cf*. Helbig *et al*. 2002), given that *Adelomyia* is currently treated as monospecific. Ranking this population as a species would also require splitting *inornata*, *aeneosticta* and *maculata* (with *chlorospila*) to preserve monophyly. Applying Tobias *et al*. (2010), the Santander–Boyacá population would attain 1–2 points for coloration and speckling of its flanks and belly, one point for the number of notes in the trill part of the song and one point for call speed compared to *melanogenys* (total 3–4: less than the required seven for species rank). We suspect that one additional point would be awarded for bill length using a larger sample.

No consensus exists as to if or how avian subspecies should be recognised. Patten (2015) proposed that only a failure to achieve both phenotypic and genotypic distinctiveness should deny subspecies status, implying that distinct lineages such as this one should be recognised even in the absence of phenotypic diagnosability. Under their scoring system, Tobias *et al*. (2010) proposed a benchmark of seven points for species rank, which implies that 3–4 points could be an appropriate score for subspecies rank, especially in a genus where less ancient lineages are recognised taxonomically. In contrast, Remsen's (2010) proposed subspecies concept requires a single diagnosable character, which is lacking for the Santander–Boyacá population, unless molecular characters are considered.

Trochilus melanogenys

In the next three sections, we consider whether any names in *Adelomyia* based on East Andes specimens might apply to the Santander–Boyacá population. The name *melanogenys* was described from a 'Bogotá' specimen by Fraser (1840). Louis Fraser worked at the Zoological Society's Museum in Brewer Street, London. Specimens appear to have flowed regularly from him to the British Museum only from 1846 (E. C. Dickinson *in litt*. 2012). Earlier material—including the *melanogenys* type—would have been accessioned to the Zoological Society of London collection, which is no longer extant. One 'Bogota' specimen we examined (NHMUK 1887.3.22.1561) is annotated: 'Agrees with the type of *A. melanogenys* in the Liverpool Museum comp. 19 Mar 1890 O.S.' [Osbert Salvin]. Of two 'Bogotá' specimens at LIVCM (D1098 and D1098b), one D1098 (Fig. 7) bears a red holotype label and a label of the Mus. Derbianum of Liverpool also annotated 'type'. It was catalogued by Wagstaffe (1978) as the type, but its status has been overlooked in the hummingbird literature. The label is inscribed: '*Trochilus melanogenys* Fraser. Original of W. Fraser's description in the Proc. Zool. Soc. 1840 p. 18. From Sta. Fé de Bogotá' and on the reverse: '1841. Rec'd from Fraser Mar 31. Length 3¾ In. Extend 4¾ In.'.

The type's plumage is consistent with Fraser's (1840) description. In relation to the lower underparts, it reads: 'corpore subtus ex-ochreo-albo; abdominis lateribus rufo lavatis' ['underparts ochre-white; abdominal sides washed reddish']. That the sides (but

Figure 6. An individual of the Santander–Boyacá population of Speckled Hummingbird *A. melanogenys*. Páramo La Floresta, Serranía de los Yariguíes, Zapatoca, dpto. Santander, January 2011 (B. Huertas / Proyecto YARE II)

Figure 7. Type of *Trochilus melanogenys* (Liverpool museum D1098), showing the pale central vent typical of Cundinamarca birds (Clem Fisher & Tony Parker)

not undertail or belly) are washed rufous is a feature of birds from dptos. Cundinamarca and eastern Boyacá. Fraser (1840) gave both total length and wing length as 3¾ inches. It is implausible that an *Adelomyia* would have wing and total length equal: the wing length is presumably in error (*cf*. Appendix 1) and is not stated on the specimen label.

We propose to clarify the type locality of *melanogenys* as the west slope of the East Andes south of dpto. Boyacá or the east slope of the East Andes south of dpto. Norte de Santander, i.e. that part of the East Andes of Colombia within the range of Clade D of Chaves & Smith (2011: Fig. 1b) and Chaves *et al*. (2011: Fig. 5).

Trochilus sabinae

Trochilus sabinae Bourcier & Mulsant, 1846, is based on a specimen from 'Bogotá, dans la Nouvelle-Grenade'. The spelling '*sabinae*' was used in the original description. David & Peterson (2010) endorsed using original spellings for various Bourcier names originally described as unmodified personal names, but *sabinae* was described in this Latinised form.

In the original description, *sabinae* is not distinguished from *melanogenys*, suggesting its authors were either unaware of Fraser's (1840) earlier description or had not made the connection. The description fits a Speckled Hummingbird. Its underparts are described: 'Parties plus postérieures du dessous du corps d'un blanc sale sur la région longitudinalement médiaire, d'un blanc fauve ou d'un fauve pâle sur les côtés, et plus densement et plus visiblement marqué sur ceux-ci que sur celle-là de mouchetures d'un vert semi-doré.' [More posterior parts of the underparts dirty white on the medial line, of a fawn-white or pale fawn on the sides, and more densely and more clearly marked thereon with flecks of semi-golden green.] Measurements (total length 92 mm, bill 16 mm, wings 54 mm, rectrices 38 mm) are given. No illustration accompanies the description and no specimens are cited.

Bourcier & Mulsant's (1846) name was used by Reichenbach (1855) (who omitted *melanogenys*) as *Metallura sabinae*. Bonaparte (1854) placed *sabina* (an incorrect subsequent spelling of *sabinae*), *inornata* and Blossomcrown *Anthocephala floriceps* in a new genus *Adelomyia*. *Trochilus sabinae* was later designated from among these names as the type species of *Adelomyia* by Gray (1855). (Cory 1918 incorrectly stated *melanogenys* to be the type species of this genus.) Gould (1861), Mulsant *et al*. (1866), Mulsant & Verreaux (1877), Elliot (1879), Boucard (1893), Hartert (1900), Cory (1918) and Zimmer (1951) all treated *sabinae* as a junior synonym of *melanogenys*. The genus *Adelisca* Cabanis & Heine, 1860, has as its type species *melanogenys* and is generally treated as a junior synonym of *Adelomyia* Bonaparte, 1854.

Many hummingbird types designated by Bourcier (alone or co-authored with Mulsant, De Lattre or Verreaux) reached Elliot's collection (e.g. Elliot 1879) and were transferred to AMNH, including the supposed types of *Trochilus antoniae* Bourcier & Mulsant, 1846 (=*Threnetes niger*), *Trochilus franciae* Bourcier & Mulsant, 1846 (=*Amazilia franciae*), *Trochilus corallirostris* Bourcier & Mulsant, 1846 (=*Amazilia rutila corallirostris*), *Trochilus viridipallens* Bourcier & Mulsant, 1846 (=*Lampornis viridipallens*) and *Trochilus rosae* Bourcier & Mulsant, 1846 (=*Chaetocercus jourdanii rosae*). Various Bourcier types were examined at AMNH. Most are mounted and have colourful more or less square labels written in red and blue ink denoting their status.

Greenway (1978: 3) considered that some of Bourcier's types lack type specimen labels, which may have been removed. Bourcier's specimens were regularly exchanged with other hummingbird collectors of the time. As an indication of the widespread trade in such specimens at the time, Mulsant *et al*. (1866) includes an advertisement by W. Schlüter for hummingbirds and other specimens, with *A. melanogenys* among the cheapest at 1.5 marks

Figure 8. Possible *Trochilus sabinae* type (MNHN 347), Muséum National d'Histoire Naturelle, Paris (T. M. Donegan)

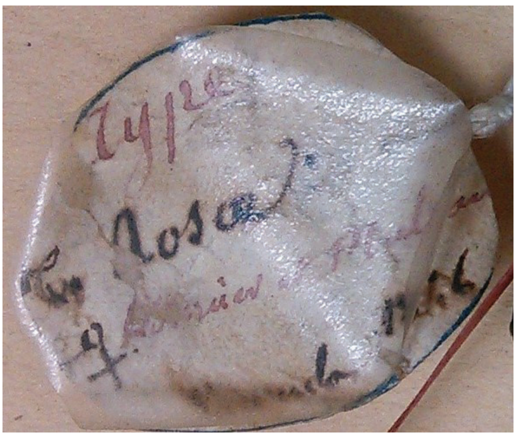
(vs. up to 40 marks for a Red-tailed Comet *Sappho sparganurus* or 160 marks for the most expensive bird-of-paradise). To compound matters, Bourcier sometimes specified 'type' on specimens that were representative of the species but not actual types (Greenway 1978: 5).

The current whereabouts of some of Bourcier's types is a mystery. Deslongchamps (1881) queried whether Elliot (who later deposited specimens at AMNH) certainly obtained the types of *Trochilus grayi*, noting that the Bourcier collection was dispersed at a public sale after his death, and that the Faculty of Sciences of Caen obtained some specimens of this species (along with other Bourcier specimens). It is probable that most of the Caen collection was destroyed during World War II (Greenway 1978: 4). However, Deslongchamps (1881) did not mention any *Adelomyia* in his Caen museum catalogue, so this does not seem a likely repository of the *sabinae* type. Jardine (1852) reported that a collection of Bourcier's, purchased by Dr Edward Wilson of Philadelphia was lost at sea. It is unknown whether this collection included the *sabinae* type.

Among a large collection of *Adelomyia*, MNHN has five specimens each bearing a more or less square label attached with pink string annotated '*G. Adelomyia sabina*', with 'sabina'

Figure 9 (above and left). Dorsal and ventral views of type of *Adelomyia simplex* (MNHN CG1989.398), Muséum National d'Histoire Naturelle, Paris, with close-up of head (T. M. Donegan)

Figure 10 (below). Label on the Bourcier type of *Trochilus rosae*, American Museum of Natural History, New York (T. M. Donegan)



then crossed out for *melanogenys*. None of the other specimens of *melanogenys* studied by us bear labels with the name *sabinae*, 'sabine' or 'sabina'. Two of the MNHN specimens (1896-353, 1896-354) were collected near Caracas, Venezuela, and accessioned from Levraud (French consul in Caracas) in the year specified. They are of subspecies *aeneosticta*, morphologically and by locality. Both specimens post-date the description of *sabinae*. As Levraud presumably donated locally sourced specimens to MNHN, the pink-stringed label was probably attached at MNHN. Two other '~~sabina~~' specimens have similar labels, are unnumbered and lack locality data or additional information.

The final '~~sabina~~' specimen, MNHN 347 (Fig. 8), has an additional handwritten label annotated 'sabine' and another 'P. Mr. Lewy 1850' with 'No. 347'. The 'P' on Lewy specimens has been considered a contraction of 'presented' (e.g. Hellmayr & Conover 1942). MNHN 347 was therefore presented to or by Lewy just four years after the description of *sabinae*.

Unlike the Bourcier types at AMNH, MNHN is unmounted and lacks ornate, colourful labels (*cf*. Fig. 10). We compared the handwriting in the name 'sabine' on the label of MNHN 347 with that on the labels on types of contemporaneously described species, including

Figure 11. Other type specimens of names in genus *Adelomyia*, left to right: (i) *inornata*; (ii) *maculata*; (iii) *cervina*; and (iv) *chlorospila*, all at Natural History Museum, Tring (T. M. Donegan)

Trochilus rosae Bourcier & Mulsant, 1846 (=*Chaetocercus jourdanii rosae*) and *Trochilus franciae* Bourcier & Mulsant, 1846 (=*Amazilia franciae*). Most are written in a calligraphic style that was relatively widespread in the mid 1800s. The original labels of AMNH types are more ornate and written in three different colours for each of the species name, the word 'type' and the authors. However, there are notable similarities. In particular, the 's' is of quite similar shape on the 'rosa' and 'sabine' labels (although one is upper and the other lower case), both are slanted and in both the final letter is embellished by a line at the end, which in the word 'rosa' is upturned (Fig. 10). The name 'franciae' on the original label is written with letters less connected than on the 'sabine' label (writing more slowly or carefully). The lack of a more ornate Bourcier label on MNHN 347 or such careful handwriting could be explained by the name *sabinae* being in synonymy with *melanogenys* and its type specimen then being sold or neglected. Some other supposed AMNH Bourcier types, e.g. *Eriocnemis derbyi*, lack these sorts of labels. Also notable is that the unmodified names 'rosa' and 'sabine' are used on the labels in both cases. This reflects Bourcier & Mulsant's (1846) French vernacular name 'Le C. de Sabine', which continued to be used for *A. melanogenys*, following its synonymy, by Mulsant & Verreaux (1877) as 'L'Adélomye de Sabine'.

Measurements of MNHN 347 are remarkably similar to those of the type in the original description. Bill to skull is 19 mm, but the bill to feathers length is identical to that in the description (16 mm). Wing is 51.5 mm, 2.5 mm shorter than in the description, but 4% shrinkage in wing length can be expected over *c*.165 years (Winker 1993) and differing measuring protocols could also be responsible. Tail is almost identical in reported length at 37.5 mm. The bill is longer than that of the small sample of specimens measured from Santander, but within the range of the larger mist-net sample from this region and also within that for East Andes populations.

The *sabinae* type(s) might be one of the tens of other 'Bogotá' or 'Colombia' specimens in museums, or it could have been sold to a private collector or lost in the collection sold to Wilson. However, for the reasons above, MNHN 347 may be the type of *sabinae*.

MNHN 347 lacks some undertail-coverts and lower belly feathering, probably as a result of preparation and subsequent handling as one of the labels is attached very close to the legs. This makes any identification tentative, but MNHN 347 clearly has buffy feathers in the lower chest to undertail region, with rather large green discs on the sides close to the central belly, resembling Santander–Boyacá specimens most closely in this respect (Fig. 8; *cf*. Figs. 1–3).

The spellings 'sabina', 'sabine' and 'rosa' when used here are solely mentioned to discuss wording on specimen labels and French vernacular names, and are not proposed as emendations or valid subsequent spellings.

Adelomyia simplex

A. simplex was based on a 'Colombia' specimen. Boucard (1893) wrote: 'I have also one specimen with the upperside pale slaty-gray. Tail and wing brownish-gray. All the rectrices excepting the median tipped with buffy white. Underside whitish-gray, spotted with small brown spots on throat and flanks. If it should prove a distinct species, I propose the name of *Adelomya simplex* for it.' (The name *Adelomya* Mulsant & Verreaux, 1866 is an incorrect subsequent spelling of *Adelomyia* Bonaparte, 1854, which was relatively widely used in the 1800s.) The name *simplex* was considered a synonym of *A. melanogenys* by Hartert (1900). This name should not be confused with *Eriopus simplex* Gould, 1849, which is also based on a 'Colombia' trade specimen and which Cory (1918) considered to represent an 'abnormal phase of plumage' of Coppery-bellied Puffleg *Eriocnemis cupreoventris*.

The type of *A. simplex* is at MNHN (CG1989.398: Fig. 9). The specimen bears a 'Museum Boucard' label inscribed '*Adelomya simplex* type of species Columbia [*sic*]'. It had not previously been set aside in the type collection at MNHN but is now. The bill is yellowish below (rather than grey as in *melanogenys*) and more extensively pale, and its legs are also yellow. The bare parts are naturally this colour, not painted. The underside is pale gray, with brown spots from the throat to breast and flanks. The lower belly and undertail are all white. Leucism is rare in *Adelomyia*, though we found a specimen of the nominate subspecies (NHMUK 2002.3.799, 'C.B.XXI.169', 'Columbia') with one all-white rectrix. There was a thriving trade in hummingbirds during the mid 1800s for the millinery business and whilst most specimens were used for such purposes, unusual ones were sold to private collectors.

Biometrics (bill to skull 17.2 mm, wing 55.5 mm, tail 38 mm), supercilium, throat and tail plumage and tail shape (only very slight fork) are broadly consistent with nominate *A. melanogenys*, although tail length is rather long for an old specimen of any population studied here (Appendix 1). Tail and throat to breast pattern (if not coloration) are also consistent with *Adelomyia*. Its subspecific identity should be confirmed genetically. It is presently impossible to refute the null hypothesis that this 'Bogotá' specimen originated from the environs of Bogotá, but we cannot eliminate the possibility it was collected elsewhere using morphology alone.

Other available names in *Adelomyia*, their status and taxonomic rank

Two other names are based on types in the Bonn museum (Schuchmann 1984, van den Elzen 2010, Dickinson & Remsen 2013): *ultracervinus* Kleinschmidt, 1943 (La Cumbre, Valle del Cauca) and *intergrediens* Kleinschmidt, 1943 (Río Toche, Quindío Pass and Cañón del Monte Tolima, 1,700–2,400 m, Colombia: Central Andes). The West Andes population is generally treated as consubspecific with *cervina* of the Central Andes. Specimens are similar in plumage and molecular data show no major distinction between these ranges. We presume that both of Kleinschmidt's (1943) names are junior synonyms of *cervina*, assuming that they are normal *Adelomyia* from the localities stated, but their type specimens should be verified to confirm this.

The names *cervina* and *chlorospila* were afforded species rank by Gould (1887) and some others. Argentine, Bolivian and Peruvian (Cuzco and Puno) populations referable to *inornata* were ranked as a species by Gould (1846, 1861, 1887), Mulsant & Verreaux (1877), Elliot (1879), Hartert (1900) and Cory (1918). However, the genus has been treated as monospecific essentially universally since Peters (1945), e.g. by Zimmer (1951), Schuchmann (1999), Schulenberg *et al*. (2007), Dickinson & Remsen (2013), Remsen *et al.* (2015). The southern populations differ from other *Adelomyia* in having bluish throat feathers, more rufous mantle and rump, and from most populations (but not *chlorospila*) in their buffy tail tip (Fig. 11). They also have a faster paced call than all congeners (Fig. 5). We have not analysed vocal differences statistically, due to the small sample of this type of vocalisation from Peru. Populations referable to *inornata* exceed the Tobias *et al*. (2010) benchmark for species rank, with at least three points for gorget coloration, two for rump and mantle coloration and three for call speed. Chaves & Smith (2011: Fig. 6) considered *inornata* not to differ significantly in biometrics from other populations, but it occupies different climatic and environmental space, resulting in one additional point. A total score of at least nine exceeds the seven suggested for species rank. Chaves & Smith (2011) and Chaves *et al*. (2011) found *inornata* to be sister to all other taxa in the genus. The geographically most proximate and closest-related population, *chlorospila* of Peru, differs by 6.2% in mtDNA (Chaves & Smith 2011: 7, Table 2). Further research into the voice of this population and others in the genus is needed and field work in southern Peru should investigate whether *inornata* is parapatric, sympatric or allopatric with respect to *A. m. chlorospila*, as their ranges abut closely. Because *inornata* was apparently lumped without justification by Peters (1945), it could be argued that the molecular study of Chaves & Smith (2011) together with the data presented here are sufficient to restore it to species rank, as has been proposed for some other hummingbirds (*cf*. Collar & Salaman 2013, Lozano-Jaramillo *et al*. 2014). The next oldest lineage, *chlorospila* of Peru, also differs in morphology from other populations (Fig. 11) but morphological, vocal and molecular data present a complex situation in northern and central Peru, which necessitates further study.

Discussion

Six options exist to deal with the taxonomy of the Santander–Boyacá population, for those who wish to recognise it as a subspecies: (i) establish a neotype for *sabinae* based on the type of *melanogenys*, placing them in objective synonymy, and describe the Santander–Boyacá population as a subspecies; (ii) establish a neotype for *sabinae* using a modern Santander–Boyacá specimen; (iii) treat *sabinae* as a *nomen dubium* and describe the Santander–Boyacá population as a subspecies; (iv) treat *sabinae* as a *nomen dubium* and retain the status quo; (v) ascertain or clarify the type locality of *sabinae* as the immediate Bogotá region, treat *sabinae* as a subjective junior synonym of *melanogenys* and describe the Santander–Boyacá population as a subspecies; or (vi) ascertain or clarify the type locality of *sabinae* as the range of the Santander–Boyacá population.

In our view, any neotype solution involving *sabinae* is not feasible. It is a requirement for doing so that 'no name-bearing type specimen … is believed to be extant'. There are reasons to believe that MNHN 347 may be a type specimen. An application could be made to the Commission that a neotype to be designated, but we do not propose this yet.

Treating *sabinae* as a *nomen dubium* potentially avoids controversy, but leaves the Santander–Boyacá population unnamed, which does not facilitate communication, the ultimate purpose of taxonomy and nomenclature. A description could easily be reversed, in the event that a new name was subsequently demonstrated to be a junior synonym of *sabinae*, but could also be criticised because it can be argued that *sabinae* is not a *nomen dubium* if MNHN 347 is the type specimen.

Under Art. 76 of the Code (ICZN 1999), the type locality of a name is the 'geographical … place of capture, collection or observation of the name-bearing type'. Recommendation 76A refers to 'ascertaining or clarifying' a type locality. This should be based on (1) data accompanying the original material, (2) collector's notes, itineraries or personal communications (3) the original description of the taxon; and (4) 'as a last resort', localities within the known range of the taxon or from which specimens referred to the taxon have been taken. Although *A. melanogenys* is common in forests and mature second growth near Bogotá, it does not occur in Bogotá itself except as a vagrant (ABO 2000). As a result, the locality specified on the label should not be automatically equated with the city; it was more likely taken somewhere else 'dans la Nouvelle-Grenade'. No collector's notes, information in the original description or data accompanying the original material provides more detail as to the locality. It is therefore usual to adopt the 'last resort' approach under Recommendation 76A with respect to 'Bogotá' or 'Nouvelle-Grenade' specimens of resident species. 'Bogotá' and 'Nouvelle-Grenade' (or 'New Grenada' or 'Colombia') are often used indiscriminately and interchangeably on older specimen labels. Because such specimens are trade specimens, the location is the place of purchase, not necessarily the collection locality. Several such types are now considered to have been collected rather far from Bogotá. For example: (i) that of White-rumped Sirystes *Sirystes albocinereus* was probably collected in Amazonia or at much lower elevations on the east slope of the Andes below Bogotá (Hellmayr 1927, Donegan 2013); (ii) at least one of the original types and the neotype of Yellow-breasted Brush Finch *Atlapetes latinuchus* '*simplex*' were probably taken in Nariño, southernmost Colombia, or northern Ecuador (Donegan & Huertas 2006); and (iii) the type of East Andean Antbird *Drymophila caudata* was probably collected in Santander

(Isler *et al*. 2012) or now-deforested parts of Boyacá (Donegan *et al*. 2012). Most 'Bogotá' specimens of *Adelomyia* are typical of the nominate. However, some show more extensively rufous underparts than dpto. Cundinamarca birds, so are here considered referable to the Santander–Boyacá population (Appendix 3) and others (e.g. AMNH 483486, 'Colombie', formerly of the Boucard collection and others at AMNH) clearly belong to *A. m. cervina*, so were collected in the West or Central Andes.

In light of the above, we therefore tentatively clarify the type locality of *sabinae* as dpto. Santander or north dpto. Boyacá on the west slope of the East Andes, i.e. the range of Clade F of Chaves & Smith (2011: Fig. 1b) and Chaves *et al*. (2011: Fig. 5), and that of subspecies *sabinae* in McMullan & Donegan (2014: 131). The main advantage of using the type locality to resolve taxonomy provisionally is that this can easily be re-evaluated if and when further information becomes available. A disadvantage is the lack of certainty compared to a successful application to ICZN to establish a neotype. We appreciate that some authorities may prefer to treat the Santander–Boyacá population as part of the nominate subspecies.

The core range of the Santander–Boyacá population today is in Serranía de los Yariguíes, where *A. melanogenys* was one of the most abundant species mist-netted: 68 different individuals were trapped at nine localities at 1,350–3,000 m elevation during surveys in 2003–11 (Donegan *et al*. 2010). In the Santurbán massif, west slope of the East Andes in Santander, it was also widespread, being found at 12 localities at 1,250–3,400 m (JEA pers. obs.). The distributional limits of the Santander-Boyacá population to the north and east doubtless coincide with the dry río Suárez / Chicamocha canyon and high elevations of the East Andes. Extensive deforestation has occurred on the west slope of the East Andes in Boyacá, making its southern limit more difficult to define. This population also ranges south at least to Alto de Onzaga, Soatá (Fig. 4C) and Arcabuco, Boyacá (Appendix 3). *A. melanogenys* has not been reported in Serranía de las Quinchas (Stiles *et al*. 1999, Stiles & Bohórquez 2002, Laverde *et al*. 2005, Quevedo *et al*. 2006), but surveyed localities may have been too low in elevation. The extensive ICN series of East Andes *Adelomyia* includes the nominate subspecies from east slope localities in dpto. Boyacá (e.g. Garagoa, Pajarito) and west slope specimens from dpto. Cundinamarca (e.g. Fusagasugá) but not further north.

Further molecular studies are required to definitively resolve the taxonomy and nomenclature of *Adelomyia* in the East Andes of Colombia. Three specimens of the Santander–Boyacá population studied by Chaves & Smith (2011) and Chaves *et al*. (2011) had identical haplotypes and two reportedly showed minor differences, but a discrepancy is evident in the sequences at GenBank. When phylogenetic analyses are replicated, one of the five specimens falls within the *aeneosticta* clade (IAVH 8331, tissue JLPV61 accession no. JF89402) (G. Bravo *in litt*. 2015). This issue perhaps led to $n = 4$ being incorrectly mentioned by Chaves & Smith (2011: Fig. 3). This specimen should be re-sampled. Our Yariguíes series at ICN, MNHN 347 and the types of *A. simplex* and *A. melanogenys* should also be sequenced. If molecular work shows that none of the names *sabinae*, *simplex* or *melanogenys* can be related to the Santander–Boyacá population, then description of the Santander–Boyacá population would be warranted.

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Appendix 1: biometric data from mist-net captures and specimens of Speckled Hummingbirds

Data are presented as follows: mean ± standard deviation (lowest recorded value–highest recorded value) (*n* = no. of specimens or individuals).

Taxon	Wing-chord (mm)	Tail (mm)	Total culmen from skull (mm)	Body mass (g)
Mist-net captures				
Santander–Boyacá population Yariguíes	55.42 ± 3.19 (49.0–62.0) (*n*=48)	37.10 ± 3.12 (31.0–42.5) (*n*=45)	17.92 ± 0.96 (15.9–20.0) (*n*=46)	4.09 ± 0.48 (3.0–5.1) (*n*=47)
melanogenys / connectens: Churumbelos, East Andes	54.19 ± 3.54 (47.0–67.0) (*n*=67)	34.06 ± 2.12 (30.9–37.2) (*n*=12)	15.63 ± 0.86 (14.2–17.8) (*n*=16)	4.05 ± 0.38 (3.3–4.8) (*n*=80)
cervina: Tambito, West Andes	59.40 ± 2.70 (55.0–62.0) (*n*=5)	/	16.00 ± 1.73 (15.0–18.0) (*n*=3)	5.4 ± 0.57 (4.7–6.1) (*n*=4)
Specimens				
Santander–Boyacá population All	51.71 ± 2.98 (47.0–56.0) (*n*=7)	33.36 ± 2.39 (30.5–37.0) (*n*=7)	16.57 ± 1.10 (15.0–18.0) (*n*=7)	3.87 ± 0.49 (3.0–4.5) (*n*=6)
Santander–Boyacá population Males	52.25 ± 2.99 (49.0–56.0) (*n*=4)	32.63 ± 2.98 (30.5–37.0) (*n*=4)	17.25 ± 0.87 (16.0–18.0) (*n*=4)	3.85 ± 0.62 (3.0–4.5) (*n*=4)
melanogenys All	50.08 ± 2.72 (46.0–56.0) (*n*=13)	33.00 ± 1.53 (31.0–36.5) (*n*=11)	17.65 ± 1.07 (15.0–19.0) (*n*=13)	3.68 ± 0.52 (3.0–4.9) (*n*=13)
melanogenys Males	51.86 ± 2.12 (50.0–56.0) (*n*=7)	33.43 ± 1.59 (32.0–36.5) (*n*=7)	17.57 ± 1.30 (15.0–19.0) (*n*=7)	3.70 ± 0.34 (3.0–4.0) (*n*=7)

Appendix 2: vocal data

For each population, data are presented as follows: mean ± standard deviation (lowest recorded value–highest recorded value) (*n* = no. of vocalisations analysed). $n_{ai}=x$ in respect of each vocalisation for each population, refers to the assumed no. of individuals sampled.

1. Songs

Taxon	Total song length (seconds)	Max. frequency (kHz)	No. of notes in trill	Length of trill section (seconds)	Speed of trill section (notes/second)
Santander–Boyacá population $n_{ai}=13$	3.62 ± 2.83 (1.49–13.33) (*n*=16)	11.39 ± 0.28 (11.03–11.98) (*n*=18)	12.14 ± 3.57 (7.0–18.0) (*n*=14)	0.94 ± 0.30 (0.46–1.50) (*n*=16)	13.89 ± 2.77 (8.71–17.88) (*n*=14)
melanogenys $n_{ai}=11$	3.04 ± 0.85 (1.38–4.83) (*n*=21)	11.20 ± 0.79 (9.69–12.22) (*n*=21)	7.40 ± 2.74 (2.0–13.0) (*n*=20)	0.65 ± 0.27 (0.17–1.27) (*n*=21)	11.90 ± 2.87 (7.08–18.11) (*n*=20)

Taxon	No. of longer notes	Length of longer notes section (seconds)	Speed of longer notes section (notes/second)
Santander–Boyacá population $n_{ai}=13$	9.28 ± 8.16 (4.0–40.0) (*n*=18)	2.50 ± 2.69 (0.92–12.50) (*n*=18)	4.10 ± 0.86 (2.82–5.46) (*n*=18)
melanogenys $n_{ai}=11$	8.43 ± 2.89 (4.0–16.0) (*n*=21)	2.38 ± 0.81 (0.87–4.05) (*n*=21)	3.60 ± 0.53 (2.76–4.61) (*n*=21)

2. Calls

Taxon	Speed (notes/seconds)	Max. frequency of typical note (kHz)	Min. frequency of typical note (kHz)	Bandwidth of typical note (kHz)
Santander–Boyacá population $n_{ai}=7$	1.56 ± 0.18 (1.26–1.71) (*n*=7)	10.90 ± 0.45 (10.33–11.51) (*n*=7)	9.08 ± 0.35 (8.70–9.65) (*n*=7)	1.82 ± 0.57 (1.33–2.80) (*n*=7)
melanogenys $n_{ai}=3$	1.87 ± 0.16 (1.59–1.98) (*n*=5)	10.70 ± 0.14 (10.56–10.86) (*n*=5)	9.33 ± 0.16 (9.17–9.56) (*n*=5)	1.37 ± 0.25 (1.10–1.69) (*n*=5)

Sound recordings studied

Santander–Boyacá population. Songs. Alto Cantagallos, Serranía de los Yariguíes, San Vicente de Chucurí, dpto. Santander (06°49′N, 73°22′W; 2,400 m) (XC64410, 64412: T. M. Donegan). Reserva Páramo la Floresta, Serranía de los Yariguíes, Zapatoca, dpto. Santander (06°49′N, 73°19′W; 2,800 m) (XC246073–075, 246077–078 and unarchived recordings with original file numbers disc 22 tracks 49–50 and 58–59 and disc 23 track 13: T. M. Donegan). La Aurora, Serranía de los Yariguíes, Galán, dpto. Santander (06°38′N, 73°23′W; 2,700 m) (XC64559: T. M. Donegan). Alto de Onzaga, Soatá, dpto. Boyacá (06°34′N, 72°44′W; 2,500 m) (XC12688: O. Laverde). Calls. RNA Reinita Cielo Azul, Serranía de los Yariguíes, San Vicente de Chucuri, dpto. Santander (06°51′N, 73°23′W; 1,800 m) (XC14023: B. Davis). Rogitama, Reserva Principe de Arcabuco, dpto. Boyacá (05°47′N, 73°26′W; 2,500 m) (XC18358: H. van Oosten). XC246073 (as above). XC264071 (as XC246073). XC64408, 64422 (both, as XC64410). Unarchived recording disc 21 track 93 (as XC264071).

A. m. melanogenys: Songs. Sisavita, Carrizal, Cucutilla, dpto. Norte de Santander (07°26′N, 72°50′W; 2,400 m) (XC117529, 117545: S. Córdoba). Finca Buenos Aires, Vereda Los Alpes, Recetor, dpto. Casanare (05°20′N, 72°46′W; 2,050 m) (XC245571, 245573, 245580, 245604: O. H. Marín Gómez). Finca La Garantía, vereda Brisas del Tonce, Chameza, dpto. Casanare (05°15′N, 72°53′W; 1,500 m) (XC245542: O. H. Marín Gómez). El Secreto, Garagoa, dpto. Boyacá (05°04′N, 73°22′W; 2,000–2,200 m) (XC12340: O. Laverde). Farallones de Medina (or río Gazaunta cuenca alta, Miralindo), Medina, dpto. Cundinamarca (04°35′N, 73°26′W; 2,100 m) (XC94059: O. Cortés; XC117210, 117212, 117213: M. Álvarez Rebolledo). Calls. El Calvario, dpto. Meta (04°22′N, 73°44′W; 2,100 m) (XC96206, 96215, 96241, 96255: O. Cortés). XC89354 (as XC94059).

Appendix 3: specimens attributable to Santander–Boyacá population

ICN, IAvH and MNHN specimens are illustrated in Figs. 1–2, 3 and 8, respectively. Several of the IAvH series are denoted 'A. melanogenys subsp. AMC' on the specimen label. Identification of various specimens as of indeterminate 'subsp.' had been added to some Santander specimen labels by JEA during 2011 when he was curating the collection. A. M. Cuervo, who wrote 'subsp.' on some other specimen labels together with his initials, has confirmed this denotation was intended to indicate that the specimens are representatives of Chaves & Smith's (2011) Santander–Boyacá clade and that he is not working on a separate publication or description (A. M. Cuervo pers. comm. to J. E. Avendaño 2013).

Instituto de Ciencias Naturales, Universidad Nacional, Bogotá, Colombia (ICN 35820), adult male, Cerro La Luchata, east slope of Serranía de los Yariguíes, vereda El Alto, Galán, dpto. Santander (06°37′45.1″N, 73°18′53.2″W; 2,100 m), by JEA & A. Masías, on 17 April 2006.

ICN 34816, adult male, vereda Alto Cantagallos, west slope of Serranía de los Yariguíes, San Vicente de Chucurí, dpto. Santander (06°49′N, 73°22′W, 2,400 m), by TMD, E. Briceño (EB) and B. Huertas (BH) and prepared by TMD, on 8 January 2004 (not 2003 as per the label).

ICN 34364, adult male, El Talismán, west slope of Serranía de los Yariguíes, San Vicente de Chucurí, dpto. Santander (06°85′N, 73°22′W, 2,000 m) by TMD, EB & BH and prepared by BH on 6 January 2003.

ICN 36458, male, Finca El Brasil, vereda Retiro Grande, Bucaramanga, dpto. Santander (06°37′34″N, 73°18′53″W, 2,100 m), by JEA on 17 April 2006.

ICN 34987, female, El Mortiño, km 18 vía Pamplona, Floridablanca, dpto. Santander by G. Alarcón-Nieto on 26 June 2004.

IAvH 8331, male, Reserva Cachalú, Encino, dpto. Santander (06°04′26″N, 73°07′45″W, 2,080 m) by J. L. Parra on 28 August 2006.

IAvH 8335, *idem*, 30 August 2006, 2,100 m, unsexed.

IAvH 8336*, *idem*, 2,080 m, unsexed.

IAvH 10293 male, río Pomeca, Arcabuco, dpto. Boyacá (05°48′80″N, 73°28′97″W), by M. Álvarez & C. I. Bohórquez.

IAvH 10562, male, Costilla de Fara, Cuchilla la Vieja, Inspección de Virolín, Charalá, dpto. Santander (06°06′19″N, 73°13′20″W; 1,750 m), by M. Álvarez, A. M. Umaña, S. Sierra & C. Roa in March 1999.

IAvH 13446, female, Estación Experimental y Demostrativa El Rasgón, Piedecuesta, dpto. Santander, by A.M. Umaña, F. Forero & S. Socorro with JEA on 20 September 2004.

IAvH 13463*, *idem*, male, 21 September 2004.

MHN-UIS 1196, unsexed, Reserva del Acueducto La Plazuela, km 28 via a Pamplona, Tona, dpto. Santander by JEA on 1 August 2002.

USNM 372893*, female, above Virolín, Santander, 7,000 ft. by M. A. Carriker on 17 September 1943.

USNM 410760, male, Hacienda Las Vegas, dpto. Santander, 6,000 ft. by M. A. Carriker on 23 August 1949.

USNM 410762*, *idem*, 24 August 1949.

NHMUK: 2002.3.897, 'Colombia, Bogotá', ex Gould collection.

AMNH 483498, 'Bogota', ex Rothschild collection.

MNHN 347, the possible type of *sabinae*, see text.

* = those specimens not distinguishable in lower underparts coloration from other East Andes specimens. Note: given that some specimens are not distinguishable from the nominate population, other 'Bogotá' or 'Colombia' specimens of more ambiguous underparts coloration doubtless also refer to this population.

Appendix 4: morphology of the Santander population

The following is based on ICN 35820. Colours follow Munsell Color (2000), taken by TMD at ICN in June 2012. Crown, dorsal plumage and wing-coverts darkish glittering green (not coded). Flight feathers and alula dusky (10YR 2/1). Uppertail dusky (as above) but tinged greenish. All tail feathers tipped buffy (10YR 7/4), more extensive on outer feathers. Undertail also becomes buffy (10YR 6/4) towards body, appearing more extensively so on outer feathers. Undertail-coverts cream (10YR 7/2.5). Ground colour of flanks warm orange-rufous (near 5YR 6/6) broadly spotted with glittering green tear-shaped spots. Ground colour of throat, mid-belly, supercilium and small post-ocular spot dirty cream (5YR 8/2). Dense spotting on throat, with glittering green tear-shaped dots arranged in six distinct lines, with dots smaller towards bill. Speckling less intense towards breast. Bill from skull to tip 20 mm, or 14.5 mm (tip to feathers), wing-chord 55 mm, tail 36 mm. Label data: mass: 4.0 g; left testis 2.3 × 2.1 mm; right testis 2.9 × 2.3 mm; iris dark brown; bill black; tarsus dark purple, with white soles to feet; no moult noted. Previously mist-netted, ringed and released on 28 June 2005 (recaptured and released later same day and again on 30 June 2005) by TMD, JEA & BH. (ProAves metal hummingbird ring number N80369 on right tarsus.)

There is some variation in the series. Consistent with female plumage of other subspecies, ICN 34987 is paler glittering green on forecrown but otherwise similar to males. IAvH 13463 has a paler throat than other specimens, with less dense streaking and, unlike other Santander–Boyacá specimens, appears to lack such extensive rufous markings on flanks, being indistinguishable from southern East Andes specimens.