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FIRST DESCRIPTION OF THE NEST AND EGGS OF THE SLATY FINCH (*HAPLOSPIZA RUSTICA*) AND OBSERVATIONS ON SONG AND BREEDING BEHAVIOR

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Resumen. – Primera descripción del nido y huevos del Pinzón Plomizo (*Haplospiza rustica*) y observaciones del canto y comportamiento reproductivo. – Describo el nido, huevos y canto del Pinzón Plomizo (*Haplospiza rustica*). Dos nidos fueron colectados durante una masiva producción de semillas de bambú de las cuales los pinzones se estaban alimentando. El primer nido contenía cuatro huevos, y el segundo tres pichones. Los huevos eran blancos pálido, sin marcas. El nido era de forma globular, construido principalmente con musgos y líquenes. Tres diferentes tipos de cantos y un "canto en vuelo" se encontraron en la población, y el canto se comparó con las especies mas cercanamente relacionadas.

Abstract. – The nest, eggs, and male song of the Slaty Finch (*Haplospiza rustica*) are described. Two nests were collected during a massive production of bamboo seeds of which the finches were feeding. The first nest contained four eggs, and the second three nestlings. The eggs were dull white with no markings. The nest was globular in shape, built mainly with mosses and liverworts. Three different song types and a "flight song" were recorded in the population, and the song was compared with the closely related species.
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Key words: Slaty Finch, *Haplospiza rustica*, nest, eggs, male song.

INTRODUCTION

A large number of tropical bird species inhabit forests with understories dominated by bamboo. Some of these birds have been considered to be "bamboo specialists" (Fitzpatrick & Willard 1990, Kratter 1993, Reid *et al.* 2004). Among these specialists, several taxonomic groups are represented, consisting of species with different diets and foraging strategies. Three kinds of specialists exist, including a group that uses bamboo as substrate for foraging for invertebrates e.g., Striated Antbird (*Drymophyla devillei*) (Parker 1982), Bamboo Antshrike (*Cymbilaimus sanctaemariae*) (Pierpont & Fitzpatrick 1983), and Manu Antbird (*Cercomacra manu*) (Fitzpatrick & Willard 1990). A second type eats bamboo sprouts and tender young leaves e.g., the Blue Seedeater (*Amaurospiza concolor*) (Stiles & Skutch 1989) or Plushcap (*Catamblyrhynchus diadema*) (Stiles *et al.* 2000), while a third type feeds on *Chusquea* bamboo seeds e.g., *Haplospiza* spp. (Parker 1982, Olmos 1996) and Peg-billed Finch (*Acanthidops bairdii*) (Stiles & Skutch 1989). In Costa Rica, various uncommon species of montane birds are most commonly found where there is a massive bamboo (*Chusquea* spp.) seeding event, e.g., Maroon-chested Ground-Dove (*Claravis mondetoura*), Barred Parakeet (*Bolborhynchus lineola*), Slaty Finch (*Haplospiza rustica*), and Peg-billed (Stiles & Skutch 1989, Stiles & Rosselli 1998). These last two emberizids are mainly seed-

eaters that show high variation of occurrence in time and space (Stiles & Hespenheide 1972).

Haplospiza is a Neotropical genus consisting of two species: Uniform Finch (*H. unicolor*) and Slaty Finch (A.O.U. 1998). According to Paynter (1970), there is little evidence permitting to consider them as separate species, but Sibley & Monroe (1990) consider them as a superspecies. Uniform Finch is a South American species with a narrow distribution extending from SE Brazil and E Paraguay to NE Argentina (Meyer de Schauensee 1966) whereas Slaty Finch has a patchy distribution from southern Mexico through Central America, and in South America in the Andes from Colombia and Venezuela to northern Bolivia (A.O.U. 1998). Hence, there is no range overlap between the two congeners. The former inhabits from sea level up to 1400 m (Ridgely & Tudor 1989) whereas the latter occupies higher elevations from 1500 m to timberline (Stiles & Skutch 1989). Along its range, the Slaty Finch is considered local and uncommon in montane and premontane habitats, becoming common to abundant when *Chusquea* bamboo is seeding (Wetmore *et al.* 1984, Stiles & Skutch 1989, Howell & Webb 1995; see Stiles & Rosselli 1998 for a description of this phenomenon).

As with many other species of Neotropical birds, the behavior and natural history of this finch are poorly known. Most of the information published so far deals with morphological description, distribution, and behavioral traits (e.g., Wetmore *et al.* 1984). Here I describe the first known eggs and nests of the Slaty Finch, its breeding behavior and the heretofore unknown occurrence of different song types emitted by males.

STUDY AREA AND METHODS

Slaty Finches were studied at the Reserva Forestal de Río Macho, Cartago province (09° 45'N, 83° 54'W), Costa Rica. The site is located between 1800 and 2000 m on the Caribbean slope of the Talamanca Cordillera. Annual rainfall exceeds 3000 mm. Vegetation consists of a mixture of young and old second growth with remnants of old premontane forest. Canopy height ranges around 25 m, with occasional emergent *Quercus* (Fagaceae) trees, and is dominated by *Brunellia* sp. (Brunelliaceae), *Miconia* sp. (Melastomataceae), and several species of Lauraceae. The trunks and branches are heavily covered by diverse epiphytes. The dark, dense understory, includes palms, several species of Rubiaceae, and at the time of these observations, a bamboo species (*Chusquea simpliciflora* Munro) was dominant in the understory. Chusqueas are semelparaous plants (dying-off after mast-flowering, Janzen 1976) ranging from 800–3800 m on elevation. In the Cordillera de Talamanca, numerous species of *Chusquea* occur (Kapelle *et al.* 1995), whose flowering periodicity is variable, with species showing nonflowering periods of c. 30 years (Widmer 1997).

The eggs were weighed and measured with a 10-g Pesola and calipers. Two censuses were carried out to estimate the density of territories (represented by singing males at their perches). By walking at a steady pace along a 1-km transect, I considered every singing male as a territory holder.

Slaty Finch recordings were made using a parabola Telinga Pro II and a Sony TC-D5 Pro II recorder. All sound analysis were generated using the software CANARY version 1.2.1 (Charif *et al.* 1993). Songs were digitized with a sampling rate of 44,100 Hz, filter bandwith of 349.7 Hz and frame length resolution of 512 points. All tapes were deposited at Laboratorio de Bioacústica, Escuela de Biología, Universidad de Costa Rica. Recordings of Uniform Finches were made by J. Minns at Carmo, São Paulo, Brazil (24°13'S, 48°20'W), while Peg-billed Finches were recorded at Providencia de Dota, San José,

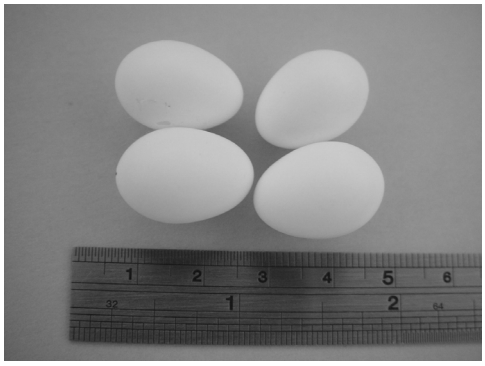

FIG. 1. Eggs of the Slaty Finch (*Haplospiza rustica*), Reserva Forestal de Río Macho, Cartago, Costa Rica, 19 April 2003.

Costa Rica (09°37'N, 83°50'W). For the description of songs, I measured five variables: duration in seconds of the song (ΔT), maximum frequency depicted on the sonogram (MF), minimum frequency depicted on the sonogram (MIF), range between the maximum and minimum frequencies (ΔF), and peak frequency, that frequency at which the highest amplitude occurs (PF) (Charif *et al.* 1993). Furthermore, these variables were used in a discriminant function analysis to analyze the validity of song type classifications. Sonograms depicted on figures were created with Avisoft-SASLab.

RESULTS

On 6 April 2003 I observed several Slaty Finch males at the study site. They were singing and foraging on bamboo seeds. On two occasions I saw a single male carrying a piece of moss in its bill. On the first sighting, after about 2 min of singing with a c. 7-cm long piece of moss in the bill, the male entered a bulky clump of moss, which further observations I found to be a nest. One hour later, the male returned with another piece of material while singing. The nest looked almost completed. On 12 April 2003 the nest was still

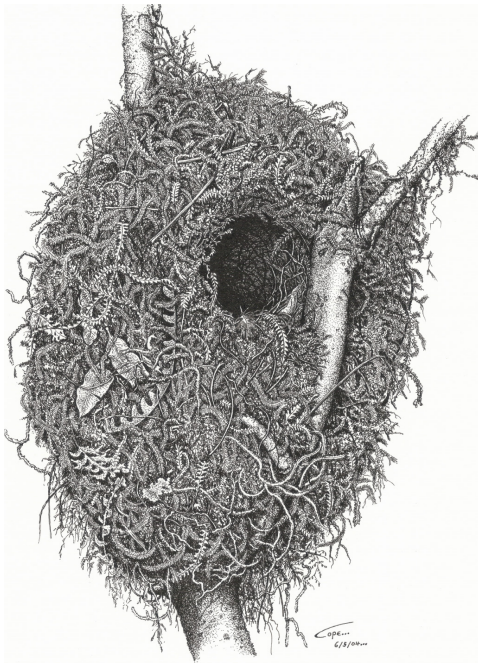

FIG. 2. First Slaty Finch (*Haplospiza rustica*) nest collected, containing four eggs.

empty and a pair was observed foraging about 3 m from the nest, the male was singing and the female producing soft whistles. The nest containing 4 eggs was collected on 19 April. The presumed pair was observed producing soft whistles in the vicinity.

I found a second nest on 12 April. A female flew out of it when I passed nearby. The nest contained three featherless nestlings. Two males were singing less than 20 m from the nest, but no interaction was seen with the female or at the nest. By 19 April the nestlings had feathered wings, and one week later they were gone and I saw no signs of predation. This nest was also collected for further descriptions.

Julio E. Sánchez and E. Carman observed another male carrying nest material into a third nest on 14 April 2003. It was placed at 10 m from the trail and c. 20 m high. On two

TABLE 1. Measurements in mm of two collected nests of the Slaty Finch (*Haplospiza rustica*). HDE corresponds to the maximum horizontal distance from the entrace of the nest to the innermost part of the chamber.

		Nest 1	Nest 2
Nest	Height	260	210
	Width	180	150
	Depth	130	175
Chamber	Entrance height	35	46.5
	Entrance width	41	48.8
	Height	92.5	93.5
	HDE	80	110

further visits on 11 and 18 May 2003, I observed only 1–3 males at the study site. The singing rate of the males was much lower than on previous visits (pers. observ.).

Eggs description. The four eggs were dull white, and slightly transparent (i.e., fresh) (Fig. 1). Measurements (and weight) of the eggs were: 19.0 x 14.6 mm (1.8 g), 20.1 x 14.3 mm (1.8 g), 19.7 x 14.2 mm (2.0 g), and 19.2 x 14.1 mm (2.0 g), respectively. The eggs were deposited at the Museo Nacional de Costa Rica (M.N.C.R. # 452).

Nest description. The two collected nests were located about 3 m high directly above the trail (M.N.C.R. # 301, 302, respectively). They had an elongated but globular shape (Fig. 2). Their measurements are given in Table 1 (see Fig. 3). The second collected nest was older than the first one, with more loose material. Overall both nests were similar in shape and placement. Both were built vertically, with the nest entrance visible from the trail. They were sitting on three-pronged forks with the main trunk (28.0 and 28.8 mm in diameter) giving most of the support to the nests. Nest 1 was built around the trunk and especially around the smaller branch (less than 15 mm diameter). Only the base of the nest was attached to

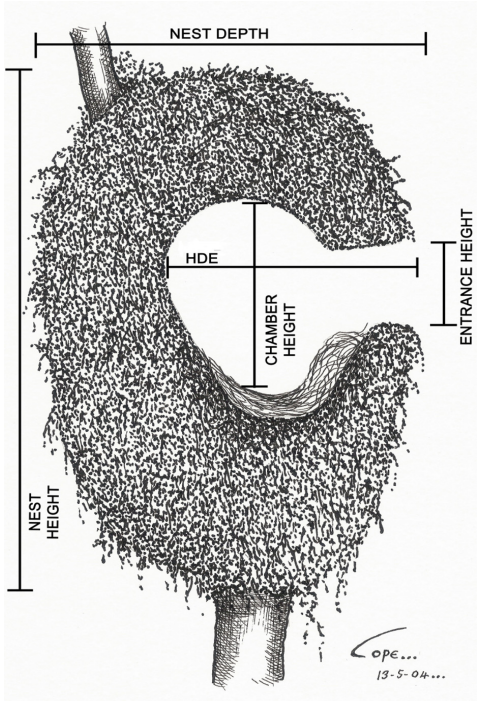

FIG. 3. Side view sketch of nest and nest chamber of the Slaty Finch (*Haplospiza rustica*).

the other branch. Nest 2 was placed between the trunk and the larger branch (21.4 mm diameter), with another branch giving very little support to the nest. The forks supported most of the mass of the nests, but some material was wrapped around the branches. The trunks and branches were partially covered with mosses and other epiphytes; nest 2 had a bromeliad and a fern growing just next to it.

Nesting material consisted of several species of mosses, liverworts, and dead ferns. Almost the entire base of the nest – being almost half the nest – was made of various species of liverworts (*Plagiochila* spp.). Much of the rest of the external structure was formed by other liverworts (mainly *Phyllogonium viscosum* and, in less quantity, *Trichocolea* sp., *Herbertus* sp. and a Meteoreaceae species). The egg chamber was constructed with two

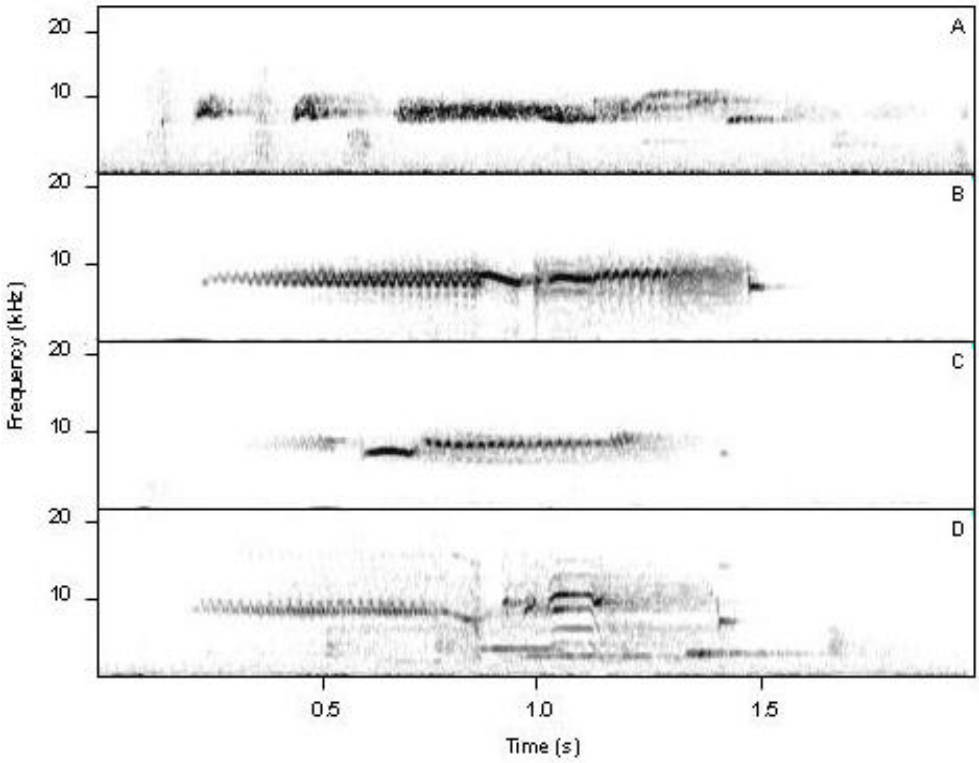

FIG. 4. Sonograms of Slaty Finches (*Haplospiza rustica*): A = Flight song; B = Type I; C = Type II; D-Type III; B-D are static male songs.

moss species (fam. Juqueriaceae) and a less common liverwort (*Trichocolea* sp.), but the bed lined with unidentified thin rootlets.

Breeding behavior. The birds were concentrated in an area of forest dominated by seeding *Chusquea* bamboos, on which they were feeding. Throughout the study, I saw the finches feeding only on bamboo seeds. During two censuses on 12 April, we counted 20 and 26 males singing along a 1-km long transect. Females were difficult to observe, and we heard them utter only soft, high-pitched whistles. By contrast, males sang throughout the day, with diminished song production during the warmer hours. Males sang for several minutes from perches 1 to approximately 18 m high that overlooked more open areas. They often sang while foraging in the understory, when they used lower perches. Most of the perches were horizontal twigs, on live or dead trees. Single males produced one song type, which was repeated continuously, while three song types were found at the study area (Fig. 4B-D). When approached by me or after a long series of songs, the male "escaped" with a fluttering flight (ranging between 10 and 40 m long) while producing a "flight song" (Fig. 4A). The flight song was longer and contained more elements than the static songs.

Among ten males recorded, three different song types were defined, according to strong differences seen in the shape and syntax of individual song elements (Figs 4B–D).

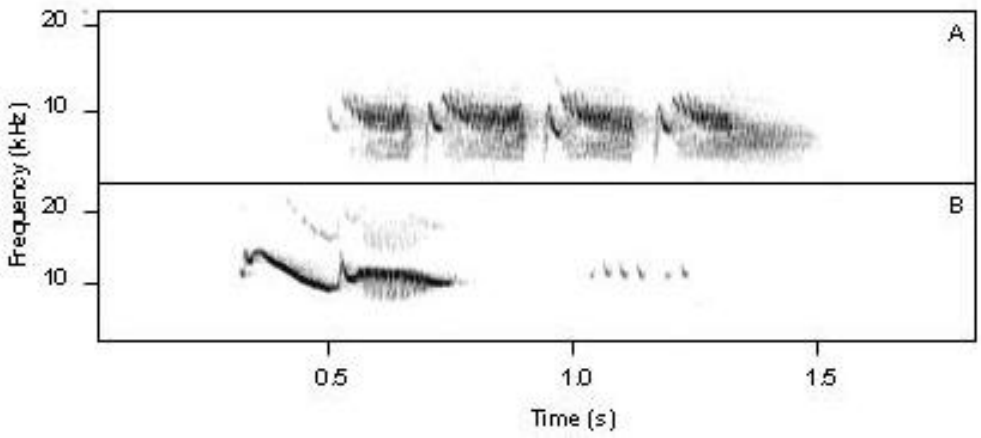

FIG. 5. A = Sonogram of the Peg-billed Finch (*Acanthidops bairdii*) song; B = Sonogram of the Uniform Finch (*Haplospiza unicolor*).

Nine out of ten individuals were classified based on combination of three variables: song duration, peak frequency, and minimum frequency (Wilks' $\lambda = 0.072$, $P < 0.05$), maximum frequency and frequency range were not significantly different. Song type I was the simplest and consisted of an upslurred trill of 1.4 s long. It had a strong modulation in the middle, consisting of a whistle with some harmonics (Fig. 4B). Type II was formed by three sub-elements lasting 1.4 s. These sub-elements were very similar between the two individuals producing this song (Fig. 4C). The beginning of this song was a low, short trill of 2 kHz of ΔF. The second sub-element was an upslurred whistle of 0.5 kHz and lasting 300 ms. The third and last sub-element was much longer, lasting 600 ms, with 2.5 kHz of ΔF. The type III was the most complex song, with 7.2 kHz in ΔF, and was the longest of the three types, lasting 1.5 s. This song started with a trill of half a second at frequencies ranging from 7 to 10 kHz, continued with a short downslurred whistle (100 ms), and ended with a complex series of harmonics longer than 200 ms (Fig. 4D).

Uniform Finch had a song similar to the type I song of the Slaty Finch (Fig. 5A). The Peg-billed Finch's song was very different in syntax and spectrogram shape (Fig. 5B) when compared to both species of *Haplospiza*. A comparison of song variables for one individual of both Uniform (ΔT = 1.07 s, MF = 12.7 kHz, MIF = 5.73 kHz, ΔF = 6.98 kHz, PF = 8.35 kHz) and Peg-billed (ΔT = 0.854 s, MF = 12.6 kHz, MIF = 3.11 kHz, ΔF = 9.52 kHz, PF = 8.96 kHz) finches indicates some similarities in song characteristics among the three species.

DISCUSSION

These observations on Slaty Finches suggest that they are highly dependent on bamboo seeds, and nesting activity corresponded with seeding events (Stiles & Rosselli 1998, this study). Observations of breeding birds by J. Sánchez at the Cerro de la Muerte area, Costa Rica, during two bamboo seeding events about 10 years apart, support this idea, although, the number of individuals at this site were not as high as in the present study. The only observations of Slaty Finches at the study site (in more than 20 visits over the last

6 years) were during this seeding event, indicating that adult finches are following seeding events, which supports the idea that the species is a bamboo specialist. Away from bamboo seeding events, individuals are usually solitary or in small groups, with no evidence of reproduction, on highland pastures where grasses are seeding (Stiles & Hespenheide 1972).

The large amount of food as seen at the study site probably provides suitable conditions for reproduction i.e., food availability hypothesis (Lack 1954). The two clutches observed (containing three nestlings and four eggs), are rather large for a tropical bird (Skutch 1976, Stutchbury & Morton 2001), suggesting good reproductive conditions. Another bamboo specialist, the Peg-billed Finch has equally large clutches during bamboo seeding events (usually 3–4 eggs, J. E. Sánchez unpub.), providing support to Lack's hypothesis.

Nest architecture of the Slaty Finch differs from those of Uniform (Sibley & Monroe 1990, Burns *et al.* 2003) and Peg-billed finches. Both species build open cup nests (Ihering 1902, Sánchez & Hernández 1991). The eggs of Slaty Finch (Fig. 1) also differ from those of Uniform (white-greenish eggs with brown blotches (Ihering 1902) and Peg-billed (light blue with brown blotches) finches (Sánchez & Hernández 1991). White eggs are common among species that lay in caves or within closed nests, and may be advantageous for species laying in dark places e.g., some swallows and thrushes (Skutch 1976).

Observations on nest building suggest that males play a significant role on nest construction. While no females were seen building, my observations do not confirm that nest building is restricted to males. The large globular nest may protect the eggs and nestlings from harmful weather or predators, and might be useful in mate attraction or even as a combination of these, as happens with weaverbirds (Collias & Collias 1984). Both collected nests show a high consistency in the material used and its placement, suggesting some degree of site preference for nest building.

Song analyses revealed three different song types, and a flight song. Individual vocal variability is well known in songbirds (Beer 1970, Falls 1982), especially among oscines, although the reasons for different song types within a single population of a Neotropical species are poorly studied (see Grant & Grant 1996, for an exception). Different vocal types within a population can result from the emission of different vocalizations under different social contexts (Hailman & Ficken 1996), or from the immigration of males from different parental dialect zones (Payne 1996, Grant & Grant 1996). This might be likely in such a nomadic species in which many individuals, formerly dispersed over a presumably large area, concentrate at ephemeral patches of abundant resources for breeding. Because these patches occur locally and unpredictably (Widmer 1997), it seems unlikely that all the same individuals will be found at different patches separated in space and time. It would be extremely interesting to know how such individuals communicate the location of such patches – and presumably recruit others. The high synchrony of breeding in such situations has other implications e.g., extra-pair fertilization might be common, consistent with the high level of male song, social facilitation might occur to enhance synchrony, and sex ratios might be skewed (Stutchbury & Morton 2001).

Several classifications of nine-primaried oscines have considered *Haplospiza* as sister genus of *Acanthidops*, an endemic of Costa Rica-Panamá highlands (Meyer de Schauensee 1966, Sibley & Monroe 1990, Burns *et al.* 2003). Paynter (1970) suggested the genera are inseparable, and some characteristics are shared between the genera (mainly diet and some morphological characters). Although

the static song structures are different, both genera have a rather similar flight song (pers. observ.). Furthermore, Paynter (1970) suggested that there was only weak evidence for considering Slaty and Uniform finches as separate species. The information provided here, however, shows significant differences between them in nest shape, egg color, and song. In addition, the large geographical distance between the current distributions of both species, their different habitats, and the use of different elevation ranges are not in agreement with Paynter's suggestion.

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