

# Nest and nestling development of the Sooty-capped Hermit (*Phaethornis augusti*) from Venezuela

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**ABSTRACT:** In order to improve the previous knowledge about the nest and nestling development of the Sooty-capped Hermit (*Phaethornis augusti*) from Venezuela, a nest was followed from February to July 2015. Details of nest structure (shape, materials, dimensions), nest usage, intervals between breeding attempts, hatch time, fledgling period, as well as nestling development data such as body mass, measures, nestling condition on hatching, pterilia development, and when eyes opened were all recorded in detail. The nest had the typical cup-shape structure that hung by a single stout cable of spiders' silk from a single iron nail 1.90 m above the floor, built with moss and spider webbing, inside a shadowy, fresh, and quiet storehouse. Despite appearing to be bulky and heavy, the nest had a mass of only 9.4 g. After four consecutive breedings by a single female, several hitherto unknown parameters were determined, including intervals between breeding attempts (10–21 days), incubation period ( $20 \pm 0$  days), fledgling period ( $26 \pm 0$  days), egg mass ( $0.6 \pm 0$  g); egg lengths ( $14.0 \pm 0.05$  mm), nestling mass at hatching ( $0.65 \pm 0.07$  g), and nestling mass at fledging (6.1 g). Breeding season of Sooty-capped Hermit was better understood: December–July, with scant records between September–November. Sooty-capped Hermit reproductive success (87.5%) was higher than that of other related species which nest in more natural conditions (16.7%). This is probably due to the breeding strategy of nesting within man-made constructions that offer protection from most natural predators.

**KEY-WORDS:** avian development, clutch size, incubation, Trochilidae.

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Sooty-capped Hermit *Phaethornis augusti*, like most members of its genus, is characterized by an olivaceous plumage, strong white facial-lines, and a long, typically white tipped tail. The orange-rufous-colored rump and upper-tail coverts are a distinctive species character (Meyer de Schauensee & Phelps-Jr. 1978). This hermit could be considered an almost endemic species from Venezuela, as its distribution area consist mostly of the montane areas both north and south of the country (0–2500 m a.s.l), with additional records in neighboring NE Colombia, N Brazil, and W Guyana (Snow 1973, Meyer de Schauensee & Phelps-Jr. 1978, Hilty & Brown 1986, Schuchmann 1999, Hilty 2003, Restall *et al.* 2006). It has three recognized races: *P. a. augusti*, typical of the northern mountains of Venezuela, and E Colombia; *P. a. curiosus* of the Santa Marta Mountains, Colombia; and *P. a. incanescens* of the southern mountains of Venezuela, north Brazil, and western Guyana (Meyer de Schauensee & Phelps-Jr. 1978, Schuchmann 1999, Restall *et al.* 2006). There, Sooty-capped Hermit is found in a wide variety of habitats, including undergrowth, edges of dry to moist natural forests, second growth habitats, pasturelands (*Megathyrsus maximus*, Poaceae), and

several agricultural lands, from shade plantation (coffee, cocoa) to others sunny cultures such as banana, orange, and peach (Ginés *et al.* 1951, Meyer de Schauensee & Phelps-Jr. 1978, Hilty 2003, Vereá *et al.* 2009a, 2013). It is regularly recorded in urban and suburban areas frequently entering houses and other buildings searching for small insects, spiders and their silk, which accounts for the common name of *Limpacasa* (House-cleaner). Shadowy, fresh, and quiet locations of these houses or other man-made constructions are often selected for a nesting site. A couple nests on these conditions have been previously described in Venezuela (Gilliard 1959). One nest was described suspended from a strand of woven spider webs in a dark culvert, located under the bridge of a roadway. It hung from a pipe-like structure in the ceiling, where small bats roosted some of them even very close to the nest. A second nest was suspended by a spider silk support, from the ceiling of a concrete pump house with a corrugated asbestos sheet roof. In natural conditions, *Phaethornis* nests have been found attached to the underside of *Heliconia bihai* leaves with strands of spider web, hidden from an observer's view (C. Vereá, pers. obs.). Beside spiders' webs, typical materials found

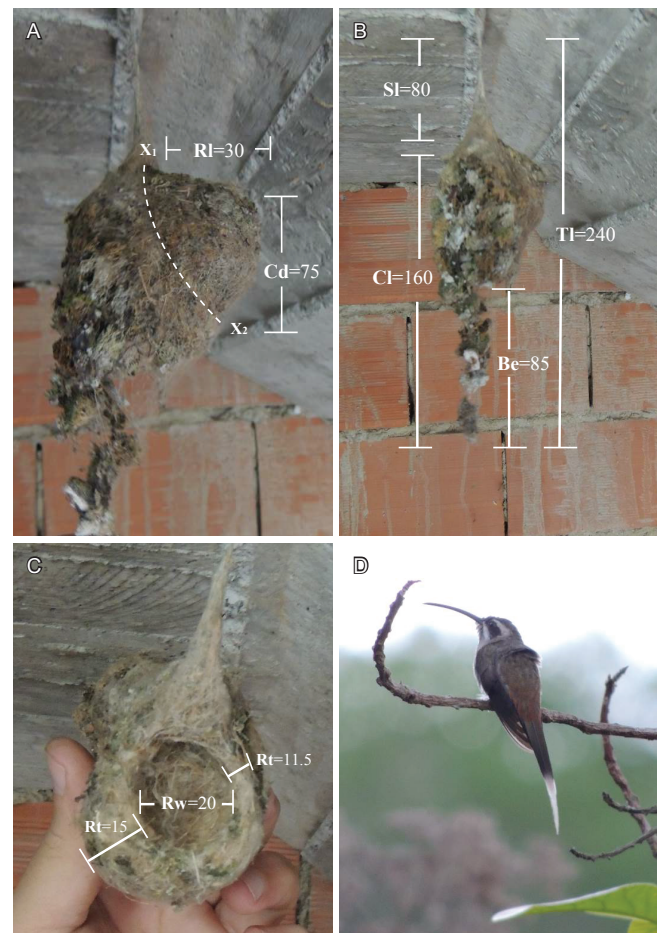
in hermit nests have been moss, rootlets, little stones, and lumps of dry mud (Gilliard 1959, Skutch 1964). The stones and mud are located in the outside walls of the nest, and play an important role as a counterbalance, in order to keep the nest evenly balanced (Gilliard 1959, Hansell 2000).

Some general information about the Sooty-capped Hermit nest structure (shape, dimensions), materials involved, and clutch size is known (Gilliard 1959, Schuchmann 1999). However, information about the nest usage, intervals between breeding attempts, hatch time, fledgling period, nestling development and important data associated to reproductive success are still unknown. This study aims to provide information about these parameters, taken from a Sooty-capped Hermit nest followed from February to July 2015, as well as improve the knowledge on its nest.

Sooty-capped Hermit nest was discovered on 12 February 2015. It held two well developed nestlings that left the nest three days later. The nest was a cup-shape structure build with the most typical materials of moss, spider webbing, and lumps of dry mud. It was hanging by a single stout cable of spider silk from an overhead support (a single iron nail, 1.90 m above the floor), inside a shadowy, fresh, and quiet storehouse located under a stairway, with an open access door toward the exterior garden of a residential house (Figure 1). The opening of the nest faced away from the door and the nest had to be carefully turned around for its contents to be seen. The house is located in the SE suburbs of Caracas, at Los Naranjos farm, El Hatillo County, Miranda state, north Venezuela (10°26'14"N; 66°47'27"W), about 900 m a.s.l. This area used to be an old poultry farm, but is being developed as a residential area. Most of area around the house was covered by pasture (*M. maximus*) and a few fruit trees such as citrus and avocado. A little creek (Quebrada Santa Rosa) runs close the house and nest site (less than 20 m), with a small riparian forest along its edges. Tall trees such as *Erythrina poeppigiana* (Fabaceae), *Bursera simaruba* (Burseraceae), *Hura crepitans* (Euphorbiaceae), and *Cecropia peltata* (Cecropiaceae) emerge above the forest canopy. Shrubbery plants such as *Oyedeaea verbesinoides* (Asteraceae), *Carica papaya* (Caricaceae), and few *Heliconia* (Heliconiaceae) were present. Although the nest resembles that described by Gilliard (1959) the counterbalance section was extended from behind the incubation area of the cup, downward as a long beard (Figure 1A). Thus, counterbalance section had 160 mm long, including 85 mm of "beard" (Figure 1B). Nest dimensions were (mm): total length: 240; support length: 80; counterbalance section length: 160; inner-cup depth: 20; outer-cup depth: 75; cup-rim thickness: 11.5–15.0; cup-rim length: 30; cup-rim wide: 20 (Figure 1A–C). While the studied nest aspect was

bulky and heavy, it only had body mass of 9.4 g. No records of Sooty-capped Hermit nest mass are previously known.

At this time, I thought that Sooty-capped Hermit work had finished. Including Sooty-capped Hermit, other member of the genera has been reported as communal display (lek) birds (Davis 1958, Höglund & Alatalo 1995, Ramjohn *et al.* 2003). Thus, the entire reproduction effort rests on the female: nest construction, eggs laying, incubation, nestling care and feeding. Nonetheless, on 15 March two white eggs were discovered inside the nest. Two nestlings hatched on 20 March and left the nest 26 days later, on 14 April. During the entire period, the female was left strictly undisturbed and only notes about egg laying and nestling departing times were made. Seven days after nestlings left the nest, on 21 April, the female was observed carrying new material to the nest. A single white egg was found in the early morning of 5 May. The next day, a second egg was laid at afternoon time about 36 h later. Skutch (1964) indicated an interval of



**FIGURE 1.** Sooty-capped Hermit (*Phaethornis augusti*) nest structure (A–C): total length (TI); support length (SI); counterbalance-section length (CI); "Beard" section (Be); outer-cup depth (Cd); cup-rims thickness (Rt); cup-rim length (RI); cup-rim wide (Rw). Inner-cup depth (20 mm) no represented. Section X<sub>1</sub>–X<sub>2</sub>: lower cup margin: all arrangement below dotted lines represents the counterbalance-section. All measures in mm. Female Sooty-capped Hermit resting on an avocado twig (D). Photos: C. Vereza.

two days between egg laying in *Phaethornis superciliosus*. After the two previous and successful clutches, detailed notes on the nestlings' development were now taken on a daily basis. An electronic precision balance Acculab EC-211 model, with 0.1 g readability; and a plastic dial caliper Spi 31-415-3 model, with 0.1 mm readability, were used. Notes were taken at 08:00 h every morning recording masses, dimensions and total lengths of bill and tail of both nestlings. Total length was the distance between the bill tip and tail, feathered or not; bill length between the base and the bill tip (culmen); and tail length between the base and tail tip of the two central feathers. Eggs and naked nestling were removed from the nest with a metal spoon, previously sterilized with 100% ethylic alcohol. Once the nestlings were feathered, with eyes open, they were removed by hand. During the last days in the nest, the nestlings became aggressive, and had to be weighed together whilst still inside the nest. To achieve this, the nest with the nestlings still inside was carefully placed on the electronic balance. Once a constant value was recorded, the nest mass (9.4 g) was deducted and the average nestling mass was estimated. Before measurements started, crop condition (empty, occupied) was recorded as it could affect mass accuracy. Notes on particular events of the nestlings' development were recorded, including days when the pteriliae were noticeable, the papillae opened, the eyes opened, and days of mass increase and decrease (Table 1). A photographic sequence of nestling development is shown in Figure 2, including naked, eyes-closed days (Figure 2A–B), pteriliae and papillae development (Figure 2B–E), facial lines and rump color development (Figure 2E–F), and the well-developed nestlings with adult appearance (Figure 2G–H). Previously, the eggs were weighed and measured on the day of laying. Both eggs has mass of 0.6 g each, and were 13.9 and 14.0 mm long respectively (mean = 13.95 mm). Despite *P. augusti* individuals being slightly bigger than *P. superciliosus* (Restall *et al.* 2006), their eggs are shorter. According to Skutch (1964), *P. superciliosus* eggs are 15.9 mm length. No previous data on egg mass of *Phaethornis* are known.

Both eggs hatched on 25 May, after 20 days of incubation; the newly-hatched nestlings had body mass of 0.6 and 0.7 g, respectively. This incubation period was longer than the 17–18 days recorded for *P. superciliosus* (Skutch 1964). When one day old, each nestling oriented itself with its beaks toward the support cable. This position allows them to be located side-by-side in the nest. They have a natural reflex that strongly keeps their toes curled, securing the nestlings to the delicate threads of the nest bottom. They also are able to move backwards toward the edge of the nest to strongly eject excreta. This behavior is known for nestlings of other *Phaethornis* species (Davis 1958, Skutch 1964).

The nestlings were completely naked for the first nine days but the female brooded them for the initial five days only, and only during the afternoon and night time. On day five, nestling pteriliae became noticeable (Table 1), so it probably had a thermal protective effect on nestlings, and female care was no longer necessary. In contrast, Davis (1958) reported no brooding activities on first two or three days in *P. superciliosus*. Skutch (1964) also reports dark skin, sparse down, and tightly closed eyes at hatch time for that species. In the present study of *P. augusti*, the nestlings were naked at time of hatching, had ruddy-colored skin, and the eyes were completely closed until day 10 (Table 1). On day 15, the rump and upper-tail coverts began to turn orange-rufous color (Figure 2E).



**FIGURE 2.** Sooty-capped Hermit (*Phaethornis augusti*) nestling development. Naked, eyes-closed days (A–B); pteriliae become dark (deep lead gray) with feather papillae (contour, wings) acuminate (B); eyes open day (C) and contour papillae just open, showing a brush-like aspect (C–D); white facial-lines and white papillae on tail appears, wing papillae open, brush-like aspect (E); upper jaw still yellow, but base and tip become fuscous colored (E–F); white papillae on tail open, and wing papillae get a rowing-like aspect; tail exceeds nest edge and nestlings resemble the adult except by short tail and lower jaw base pale-orange colored (G–H). Days 3, 8, 11, 12, 13, 16, 20 and 23, from A to H, respectively. Photos: A, G (E. Pescador), others (C. Vereá).

**TABLE 1.** Mass, length measurements (total, bill and tail length), and growth observations on a couple Sooty-capped Hermit (*Phaethornis augusti*) nestlings from Venezuela. Day 1: 25 May 2015; Day 26: 19 June 2015. Particular events on nestling development underlined. Crop condition: E: empty; O: occupied. Individual dashes (-) indicate data not collected.

Day	Observations	Mass (g)	Mean	Total length (mm)	Mean	Bill length (mm)	Mean	Tail length (mm)	Mean	Crop
1	Naked; eyes closed, bill yellow.	0.7–0.6	0.65	28.9–29.0	28.95	2.0–2.1	2.05	-	-	E
2	As above.	1.1–1.1	1.10	29.5–29.8	29.65	2.2–2.4	2.30	-	-	O
3	As above.	1.1–1.2	1.15	30.5–31.0	30.75	3.0–3.1	3.05	-	-	E
4	As above.	1.6–1.6	1.60	35.0–35.1	35.05	5.3–5.5	5.40	-	-	O
5	Pteriliae slightly dark.	2.1–2.3	2.20	37.4–37.8	37.60	5.3–5.5	5.40	-	-	O
6	Pteriliae dark.	2.3–2.5	2.40	38.7–39.1	38.90	5.8–6.0	5.90	-	-	E
7	Pteriliae dark (lead gray) and bump.	2.6–2.9	2.75	39.9–40.2	40.05	6.1–6.2	6.15	-	-	O
8	Pteriliae dark (deep lead gray) with feather papillae (contour, wings) acuminate.	2.8–3.1	2.95	43.0–44.2	43.6	6.3–6.7	6.50	-	-	O
9	Well-developed contour feather papillae: imminent opening.	3.7–3.8	3.75	45.0–47.1	46.05	7.0–7.2	7.10	-	-	O
10	Eyes half-closed; <u>contour papillae open</u> .	3.8–3.9	3.85	45.4–47.5	46.45	7.2–7.6	7.40	-	-	E
11	<u>Eyes open</u> ; contour papillae open, brush-like aspect.	4.0–4.2	4.10	46.3–48.0	47.15	7.4–7.7	7.55	-	-	O
12	Wing papillae enlarged: imminent opening; <u>white facial-lines and white papillae on tail appears</u> .	4.3–4.4	4.35	48.5–49.0	48.75	7.8–7.9	7.85	-	-	E
13	Wing papillae open, brush-like aspect; white facial-lines and white papillae on tail conspicuous; upper jaw yellow, base and tip fuscous.	4.7–4.9	4.80	52.0–54.8	53.40	8.0–8.4	8.20	-	-	E
14	Conspicuous white facial-lines; large white papillae on tail.	5.0–5.0	5.00	53.7–55.0	54.35	8.4–8.5	8.45	-	-	E
15	Conspicuous white facial-lines; white papillae on tail enlarged: imminent opening; <u>rump feathers turned orange fuscous colored</u> .	5.5–5.7	5.60	54.5–55.5	55.00	8.9–9.6	9.25	-	-	E
16	Conspicuous white facial-lines; white papillae on tail open; wing papillae rowing-like aspect; <u>upper jaw yellow, fuscous colored</u> .	5.8–6.1	5.95	60.2–61.5	60.85	9.0–10.0	9.50	7.4–9.1	8.25	O
17	As above.	5.9–6.2	6.05	60.3–63.1	61.70	10.0–11.1	10.55	8.2–10.5	9.35	E
18	Nestling large barely fit in nest; tail reaches the nest edge, resembles adult.	5.9–6.2	6.05	67.0–68.2	67.60	11.5–11.7	11.60	10.0–12.2	11.10	E
19	Nestling large resembles adult; open bills when handled; <u>upper jaw totally black; mass decreased</u> .	5.8–6.0	5.90	68.9–69.7	69.3	11.6–12.0	11.80	12.5–13.7	13.20	E
20	Nestling large, adult aspect; tail exceeds nest edge; difficult nestling re-entry on nest; <u>mass decreased</u> .	5.5–5.7	5.60	70.5–71.7	71.10	12.2–13.0	12.55	13.9–15.1	14.50	E
21	Nestlings too large. Weighed in nest together; <u>mass decreased</u> .	-	5.20	72.5–73.2	72.85	13.7–15.0	14.35	17.8–18.4	18.10	-
22	<u>Mass decreased</u> .	-	5.15	72.9–73.4	73.15	13.7–15.1	14.40	18.3–20.7	19.50	-
23	<u>Mass increased again</u> .	-	5.30	76.7–78.4	77.55	15.3–16.9	16.10	20.9–21.5	21.20	-
24	After weighing, one nestling flew away during handling it to take measures.	-	6.10	-	-	-	-	-	-	-
25	One nestling remain in nest late afternoon (17:30 h).	-	-	-	-	-	-	-	-	-
26	Nest empty (08:00 h).	-	-	-	-	-	-	-	-	-

This important detail means that field ornithologists can then identify the nestlings and fledglings to species with no confusion with other similar species. When the nestlings reached 19 days old, they showed a decrease in mass gain. This coincided with an accelerated rate of tail growth. It could be interpreted as an energy limitation due to the spurt in tail feather growth that necessarily must be completed at fledging as it is an important element in Sooty-capped Hermit flight. On the same day nestlings became aggressive, and opened their beaks when handled. Mass and measurements were then taken with the two birds inside the nest together. Nonetheless, one nestling flew away on day 24 while being measured. The second nestling left the nest two days later, 26 days after hatching. This fledgling period was exactly the same recorded previously. Skutch (1964) indicated a shorter time (22–23 days) for fledgling period of *P. superciliosus*. Nonetheless, from two *P. superciliosus* nests followed by Davis (1958), one matched with Skutch (1964) data; the other was an estimate of at least 18 and possibly as much as 27 days. The last body mass recorded was 6.1 g, similar to the adult mass (mean = 6.0 ± 0.8 g; n = 10) reported by Dunning-Jr. (2008). At time of fledging, the juvenile resembles the adult plumage almost exactly, except for a slightly short tail and lower mandible base pale-orange colored (Figure 2H).

Three days after nestlings left the nest, I saw the female carrying new material to the nest once again. Seven days later, on 29 June, one white egg was laid in the nest, and a second appeared the next day. Both eggs had mass of 0.6 g and measured 14.0 mm in length. Both eggs hatched on 19 July, after 20 days incubation and each nestling had mass 0.7 g. Three days later, one nestling had disappeared. There was no corpse on soil or nearby areas. Similar occurrences have been reported in other *Phaethornis* nests (Skutch 1964). For nestling safety the nest was no longer disturbed. The solitary nestling was raised without incident and left the nest 26 days later, on 13 August. These data represent the evidence of four continuous reproduction cycles in Sooty-capped Hermit. Disarranged plumage and resting behavior at same avocado twig (Figure 1 D) were unmistakable signs that the female involved was always the same. The nest was never visited again once abandoned.

The results add significant data on the nesting of Sooty-capped Hermit, including repeated nest usage (four consecutive periods), intervals between breedings (10–21 days, n = 2), incubation period (20 ± 0 days, n = 2), fledgling period (26 ± 0 days, n = 3), egg mass (0.6 ± 0 g; n = 4), egg length (14.0 ± 0.05 mm; n = 4), nestling mass at hatching (0.65 ± 0.07 g; n = 2), nestling mass at fledging (6.1 g, n = 1), nestling development and other aspects of Sooty-capped Hermit natural history. The primary breeding season previously recorded as the

December–May period (Schäfer & Phelps 1954, Hilty 2003, Vereá *et al.* 2009b), is extended up to July, with sparse additional records between September–November (Vereá *et al.* 2009b). Sooty-capped Hermit studied here had a higher reproductive success rate (87.5%) than other related species (*P. superciliosus*) which nest in more natural conditions (16.7%) (Skutch 1964). It is probable that man-made constructions provide protection from natural predators.

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