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SHORT NOTE

NESTING BIOLOGY OF THE OCHRE-BREASTED TANAGER (*CHLOROTHRAUPIS STOLZMANNI*) IN TATAMÁ NATIONAL NATURAL PARK, COLOMBIA

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ABSTRACT · Information on the nesting of the Ochre-breasted Tanager (*Chlorothraupis stolzmanni*) is limited, only brief nest and egg descriptions are available. This study was based on two nests monitored between February and June 2014, in Tatamá National Park, Colombia. Both nests consisted of a bulky and deep cup and were placed on epiphytes that grew on tree branches or on tree ferns. Two white eggs with reddish-brown spots concentrated at the larger end were found in each nest. The parents spent 68.8 ± 15.4% of their daytime incubating, and conducted 4.6 ± 0.5 off-bout trips per day (N = 8 days) that lasted 44.6 ± 5.1 min (N = 36 off-bouts). Overall, our results showed that *C. stolzmanni* had a small clutch size and low nest attentiveness typical of related species and other tropical passerines. However, further studies are needed to better understand factors that might contribute to similarities and differences in the nesting behavior among *Chlorothraupis* species.

RESUMEN · Biología de anidación del Guayabero Ocre (*Chlorothraupis stolzmanni*) en el Parque Nacional Natural Tatamá, Colombia
La información acerca del anidamiento Guayabero Ocre (*Chlorothraupis stolzmanni*) es limitada, sólo existe una breve descripción del nido y los huevos. Este estudio está basado en dos nidos monitoreados entre febrero a junio durante 2014, dentro del Parque Nacional Natural Tatamá, Colombia. Estos nidos fueron copas voluminosas y profundas construidas entre epífitas que crecen sobre ramas de árboles y helechos arborescentes. En cada nido se encontraron dos huevos blancos con manchas color marrón rojizo, concentradas hacia el extremo más ancho. Durante la incubación, los padres realizaron 4,6 ± 0,5 (N = 8 días) viajes fuera del nido, los cuales tardaron 44,6 ± 5,1 min (N = 36 viajes). El porcentaje de atención al nido fue de 68,8 ± 15,4%. En general, nuestros resultados mostraron que *C. stolzmanni* presenta un pequeño tamaño de nidada y una baja atención al nido, típico de sus especies cercanas y otros passeriformes tropicales. Sin embargo, son necesarios más estudios que ayuden a comprender mejor los factores que contribuyen a las similitudes y diferencias del comportamiento de anidación entre las especies del genero *Chlorothraupis*.

KEY WORDS: Behavior · Breeding biology · Cardinalidae · Cerro Montezuma · *Chlorothraupis stolzmanni* · Eggs · Incubation · Nest

INTRODUCTION

Historically, the genus *Chlorothraupis* was considered a member of the family Thraupidae; however, recent genetic data indicate this genus belongs to the family Cardinalidae alongside the genus *Habia* (Klicka et al. 2007). *Chlorothraupis* includes three species: Carmiol's Tanager (*C. carmioli*), Lemon-spectacled Tanager (*C. olivaceus*), and Ochre-breasted Tanager (*C. stolzmanni*), which inhabit wet valleys and densely foliated stream edges in the humid foothills of Central America, Colombia, Ecuador, Peru, and Bolivia (Isler & Isler 1987, Hilty 2011). These birds forage in groups of up to 10–15 birds through the understory and mid-levels, and regularly join mixed foraging flocks (Hilty & Brown 1986, Isler & Isler 1999). Despite being noisy and widespread species, their natural history is poorly known, especially their breeding biology (Isler & Isler 1999, Hilty 2011). *Chlorothraupis* nests are bulky, open cup-like structures located in the forest interior, mostly in close proximity to streams. The clutch size is two white eggs with maroon to light brown speckles, concentrated at the larger end (Huber 1932, Hilty & Brown 1986, Isler & Isler 1999, Hilty 2011, Martínez & Rechberger 2011, Valdez-Juarez & Londoño 2016).

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Nesting characteristics have been described only for two of the three *Chlorothraupis* species, and these descriptions were mainly restricted to nests and eggs (Hilty & Brown 1986, Isler & Isler 1999, Hilty 2011). Detailed breeding biology data are only available for the Carmiol's Tanager (Huber 1932, Martínez & Rechberger 2011, Valdez-Juarez & Londoño 2016), including information about parental care, incubation, nestling development, and nestling period (Valdez-Juarez & Londoño 2016). In contrast, nesting information for the Ochre-breasted Tanager (*C. stolzmanni*) is limited to basic descriptions of nest shape and egg coloration (Hilty & Brown 1986), without any morphological measurements or nesting behavior information. Here, we provide detailed description and morphological measurements of the nest, eggs, and incubation rhythm of *C. stolzmanni* based on two nests found in Tatamá National Park, Colombia. We compare our results with previous nesting behavior information reported for other *Chlorothraupis* species and related species within the same clade (i.e., *Habia* spp.).

METHODS

Study area. Our study was conducted at Cerro Montezuma (05°13'59.5"N, 76°05'25.7"W), Tatamá National Park, Colombia, on the western slope of the western Andes. The nests were found between 1390 and 1450 m a.s.l.. The vegetation in this area is a typical Andean cloud forest with dense epiphytic cover, a canopy height of 25 m, mean daily temperature of 19.2 ± 1.7°C (Rangel 1993); the annual rainfall during the year of the study was 2199 mm (dry months are January and July averaging 84.5 mm, and wet months are May and November averaging 294.0 mm; Caicedo-Argüelles & Londoño in prep.).

Nest searching. We searched for active nests in the two breeding seasons (February to July) of 2014 and 2015. Nests were located primarily by systematic searching, but also by observing parental behavior. When an active nest was located, we measured eggs and nest with a caliper to the nearest 0.1 mm, and weighed them using a digital scale to the nearest 0.05 g (FlipScale F2, My Weigh, Phoenix, Arizona, USA). Whenever possible, the nests were collected once they became inactive, to weigh their different layers and describe their components.

Incubation behavior. We monitored incubation behavior through two thermocouples connected to a U12 four-channel hobo data logger (Onset Computer Corporation, http://www.onsetcomp.com) that was programmed to record temperature every minute. One thermocouple was placed directly under the eggs to record nest temperature, and a second thermocouple was placed outside the nest (approximately 20 cm away from the nest) to record ambient temperature. To interpret incubation rhythm we quantified thermal changes recorded by the thermocouple located inside the nest and contrasted them with ambient temperature fluctuations. Incubation rhythm quantification was done following the algorithm of Cooper & Miles (2005), which detects the intervals when the temperatures decrease or increase monotonically. Additionally, we placed a motion camera trap (Reconyx PC–800; http://www.reconyx.com) between 0.8 and 1 m away from the nests to monitor incubation behavior, and possible predation events. Cameras were programmed to take one photo every minute and 10 photos when any movement occurred at a nest. Values are presented as means ± 1 SD.

RESULTS

We located and monitored two nests of *C. stolzmanni*, and both nests were depredated during the incubation stage. The first nest was found on 8 March 2014 with two developed eggs and was predated two days later, in the afternoon (15:52 h), by a Crimson-rumped Toucanet (*Aulacorhynchus haematopygus*). The second nest was found in construction on 8 April 2014, and one fresh egg was found inside the nest eight days later (16 April 2014); the clutch was completed two days later (18 April 2014). This nest was predated on 5 May 2014 at around 02:03 h by an unknown predator.

Nest and egg descriptions. Nests were bulky and deep cups located within fern leaves, moss, and other epiphytes that grew on tree branches and tree ferns (Figure 1A). The two nests were placed at 1.8 and 4.7 m above ground, located inside the forest and on the edge of a small stream. We carefully analyzed the nest layers and describe their components from a single nest. It had three distinctive layers, an outer layer that weighed 14.79 g and consisted exclusively of moss. The middle layer weighed 8.36 g and was composed of green fern leaves (80%), brown fern leaves (17%), and small sticks (3%). The inner layer weighed 4.47 g, and consisted of dead brown fern leaves (80%) and brown fungal rhizomorphs (20%).

The first nest was 143.8 mm long, 138.7 mm wide, and 94.5 mm high, on the outside. Internal dimensions were 73.5 x 67.8 mm, with a depth of 41.0 mm and a wall thickness of 27.5 mm. The second nest measured 103.0 x 88.5 mm in its interior, with a depth of 45.5 mm and a wall thickness of 41.0 mm. On the outside, the cup was 222.9 mm long, 129.7 mm wide, and 101.4 mm high.

The clutch size was two white eggs with reddish-brown spots concentrated at the larger end (Figures 1B, 1C). Egg dimensions were 27.5 ± 0.7 mm x 18.1 ± 0.4 mm (N = 4 eggs), with a mean fresh mass (no embryonic development observed) of 4.57 ± 0.1 g (N = 2 eggs).

Incubation behavior. We monitored incubation behavior during two days (48 h) for the first nest and

Figure 1. Nest and eggs of the Ochre-breasted Tanager (*Chlorothraupis stolzmanni*) found in 2014 at Tatamá National Park, Colombia. (A) Nest location, (B) bulky shallow nest cup with eggs, and (C) a close-up of the eggs. Photographs by Manuel A. Sánchez-Martínez (A, B) and Richard Aracil (C).

six days (144 h) for the second nest. Although we monitored the second nest during 17 days we only recorded incubation behavior during six days because the incubating bird broke the thermocouple tip located inside the nest. On average, daytime incubation bouts lasted for 95.6 ± 14.5 min (range = 5.0–433.0 min; N=37 on-bouts), resulting on a daytime nest attentiveness of 68.8 ± 15.4% (range = 57.5–84.6%) (Fig. 2A). Incubating birds conducted 4.6 ± 0.5 off-bouts trips per day (range = 4–5 off-bouts; N = 8 days) (Figure 2B) that lasted 44.6 ± 5.1 min (range = 6.0–137.0 min; N = 36 off-bouts) (Figure 2B). Overall, the nest temperature was 30.3 ± 0.1°C (range = 17.5–37.4°C; N = 37 on-bouts) during daytime on-bouts, but it decreased to 23.4 ± 0.1°C (range = 17.1–37.3°C; N = 36 off-bouts) during off-bouts. Ambient temperature around the nest was 19.2 ± 1.2°C (N = 8 days). Overall, the incubating bird conducted continuous nocturnal incubation that started at 17:43 ± 00:11 h (range = 17:28–17:55 h) and lasted until 05:59 ± 00:05 h (range = 05:55–06:07 h). However, in the second nest, the incubating bird left the nest on two occasions during nocturnal incubation. The first one occurred four nights before the nest was depredated (1 May 2014), the bird left the nest at 00:41 h and returned at 02:52 h (Figure 2C), and the second one occurred two nights before nest predation (2 May 2014) when the bird left the nest at 22:36 h and returned at 05:42h (Figure 2C).

DISCUSSION

Our study presents an array of new breeding features for *C. stolzmanni* and provides comparative nesting traits for species of the genus *Chlorothraupis*. For example, the bulky cup-nests of *C. stolzmanni* are similar to those reported for this species in other locations (Hilty & Brown 1986) and those built by congeners and the closely related genus *Habia* (Huber 1932, Willis 1961, Hilty & Brown 1986). The use of green and dry leaves, green moss, twigs, rootlets, and inner layer of dark fungal rhizomorphs closely matched the materials reported for *C. carmioli* nests (Huber 1932, Valdez-Juarez & Londoño 2016); however, the latter species does not commonly use green moss as nesting material in southeastern Peru (Valdez-Juarez & Londoño 2016).

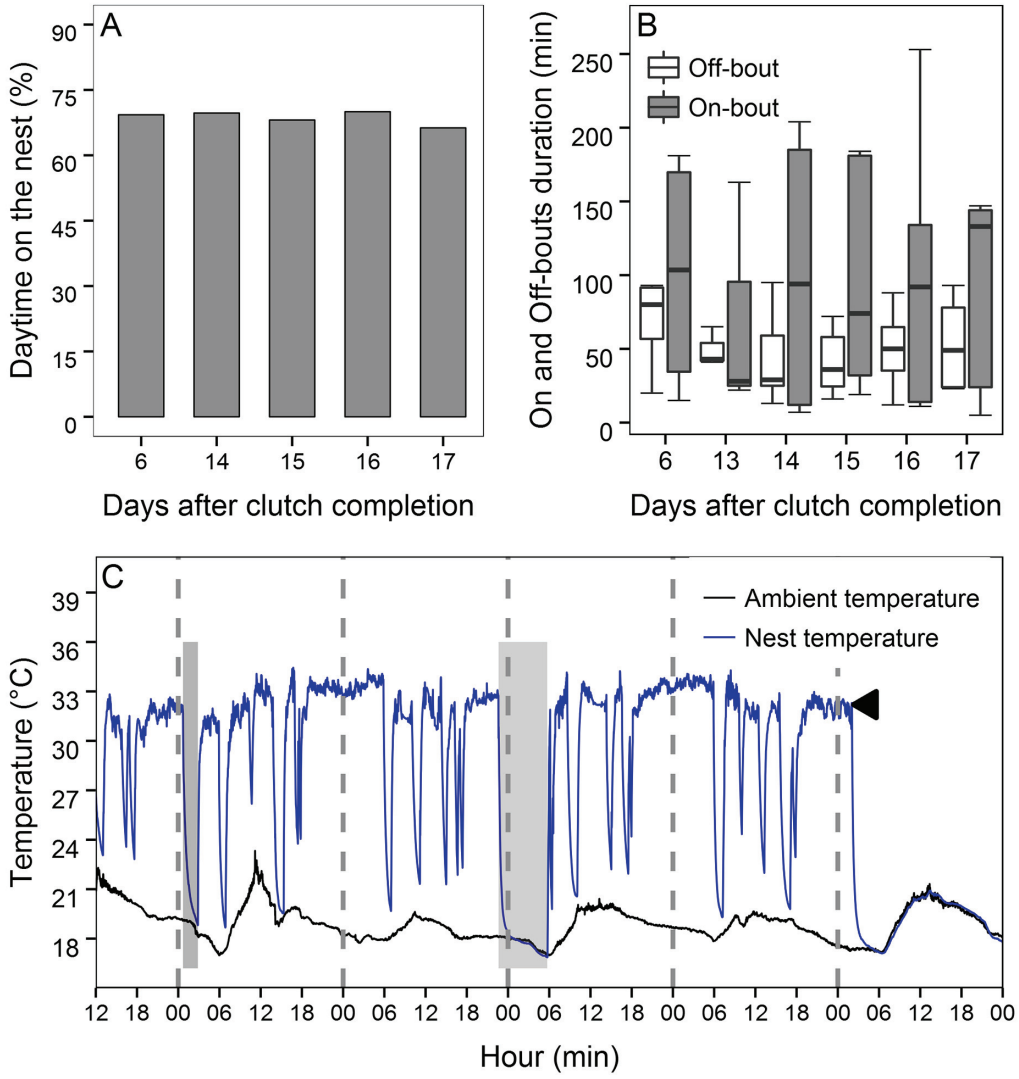

Figure 2. Daytime incubation behaviors of the Ochre-breasted Tanager (*Chlorothraupis stolzmanni*) based on one nest monitored during six 24-hour periods in 2014 at Tatamá National Park, Colombia. (A) Percent of daytime on the nest, (B) duration of on- and off-bouts, and (C) incubation rhythm throughout six consecutive days (30 April to 5 May 2014); gray-shaded areas indicate unusual off-bouts during nocturnal incubation, and black triangle indicates the precise time of nest predation.

Our results show that *C. stolzmanni* had small clutch size and low nest attentiveness typical of congeneric species and other tropical birds (Jetz et al. 2008, Goulding & Martin 2010, Ruggera & Martin 2010, Boyce et al. 2015). Two-egg clutches are consistent with clutch size reported for *C. carmioli* (Huber 1932, Valdez-Juarez & Londoño 2016), but different from clutch size reported for some *Habia* members (2–4 eggs; Isler & Isler 1999), which is quite unusual in tropical passerines (Boyce et al. 2015). Likewise, egg coloration is similar to the one reported by Hilty & Brown (1986) and matches previous descriptions for *C. carmioli* (Huber 1932, Valdez-Juarez & Londoño 2016). However, according to Valdez-Juarez & Londoño (2016) egg coloration can vary widely within *C. carmioli,* from immaculate white to heavily speckled. Thus, a larger sample size including other *Chlorothraupis* species is needed to evaluate variation in egg coloration.

Nest attentiveness in *C. stolzmanni* at our study site was 5.5% higher than reported for *C. carmioli* in southeastern Peru (63.3%) (Valdez-Juarez & Londoño 2016). However, nest attentiveness in both species is relatively low compared to other Neotropical forest Cardinalidae, including Red-crowned Ant-Tanager (*Habia rubica:* 61.4–78%) (Willis 1961, Skutch 1962), Red-throated Ant-Tanager (*Habia fuscicauda:* 69.7–72.1) (Willis 1961), and Blue-black Grosbeak (*Cyanocompsa cyanoides:* 75–95%) (Skutch 1962). In addition, although we could not determine the sex of the incubating bird, due to a lack of obvious sexual dimorphism in *C. stolzmanni*, we believe that incubation is conducted exclusively by the female, based on previous studies on species of this genus (Valdez-Juarez & Londoño 2016) and on low nest attentiveness (< 85%) (Deeming 2002); but further studies are needed. The night incubation recesses observed are unusual (Martin & Schwabl 2008); we speculate that these

nocturnal departures from the nest are caused by unsuccessful nest predation attempts, which can be more common than previously thought (Sánchez-Martínez & Londoño 2016).

Altogether, this study presents important new data concerning the breeding biology of *C. stolzmanni*, which significantly improve our knowledge on the natural history of this species. Such published information, even if anecdotal, may help to generate robust data sets in order to unravel avian nesting strategies or patterns throughout the Neotropics, and might be crucial to the understanding of species' basic requirements and, consequently, to achieve better conservation and management decisions (Robinson et al. 2000, Lebbin et al. 2007, Marini et al. 2012, Tewksbury et al. 2014). Since for members of *Chlorothraupis*, as for many Neotropical birds, large aspects of the breeding biology remain unknown, more fieldwork is needed to fill these gaps (Marini et al. 2012).

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