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Notes on the nesting behavior of the Half-collared Gnatwren (*Microbates cinereiventris*) in southeastern Peru

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ABSTRACT.—*Microbates cinereiventris* is a polytypic and widely distributed species. Its reproductive behavior is only known based on the description of a single nest. Here, we present the first description of the eggs and nest of the subspecies *M. cinereiventris peruvianus* and the first description of the nestlings, feeding, and incubation behavior for the species. *M. cinereiventris peruvianus* has an open nest, primarily made of dry plant fibers and green moss. Nest attentiveness was $92.31 \pm 0.20\%$, and a total of eight trips were recorded during the last 2 days of incubation. Nestlings hatched naked, were fed 1.58 ± 0.89 times per hour by both parents, and grew at a rate of 0.83 g per day during the first 5 days. *M. cinereiventris* share nesting characteristics with closely related species (*M. collaris* and *Ramphocaenus melanurus*). Received 26 September 2012. Accepted 20 March 2013.

Key words: Half-Collared Gnatwren, *Microbates cinereiventris*, nesting behavior, southeastern Peru.

Microbates cinereiventris is a widely distributed species in the Neotropics from Costa Rica to southeastern Peru and western Bolivia, mostly below 750 m (Hilty and Brown 1986, Atwood and Lerman 2006). In the southernmost part of its range, *M. cinereiventris* has a patchy distribution and is considered uncommon by Schulenberg et al. (2007). This species inhabits the understory of primary and secondary forests, and occasionally the forest edge, feeding mainly on ants and other small insects and spiders (Hilty and Brown 1986, Atwood and Lerman 2006, Schulenberg et al. 2007).

A poorly known Neotropical genus, *Microbates* is composed of two allopatric and polytypic species (Olson 1980, Atwood and Lerman 2006). This genus and *Ramphocaenus* form a group with unclear relationships within the passerines (Rand and Traylor 1953, Kiff 1977). They have been considered within several families including Sylviidae (Rand and Traylor 1953), Troglodytidae (Sibley and Ahlquist 1991, Johanson et al. 2008), and Polioptilidae (Remsen et al. 2013). General aspects of their natural history are poorly known (Atwood and Lerman 2006). Although the nest and eggs of the Half-collared

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FIG. 1. Nest location (A) and nest architecture (B–D) of *Microbates cinereiventris peruvianus*.

Gnatwren (*Microbates cinereiventris*) have been described based on one nest found in Costa Rica (Kiff 1977), nothing is known about nesting behavior and nestling development. Our main objective is to provide the first description of the nesting behavior of *M. cinereiventris* and nestling development, and in particular incubation and feeding behavior.

METHODS

Our observations and descriptions are based on a single nest of *M. cinereiventris peruvianus* (*sensu* Olson 1980) found in a lowland forest with canopy height of approximately 35 m. This forest was located at the Pantiacolla Lodge, adjacent to the Alto Madre de Dios River, in the department of Madre de Dios, southeastern Peru ($12^{\circ}39'26.9''\text{S}$, $71^{\circ}15'05.7''\text{W}$; 449 m). To document incubation behavior, we used two thermocouples attached to a HOBO–U12 data logger device with an accuracy of $\pm 0.36^{\circ}\text{C}$ (Onset Computer Corporation, Bourne, Massachusetts, USA), which was set to record temperatures every minute. One of the thermocouples was placed under the eggs to record nest temperature, and the second thermocouple was placed 20 cm from the nest to record ambient

temperature. We analyzed incubation behavior following Cooper and Mills (2005), using data from 32 consecutive hours during the last 2 days of the incubation stage. After hatching, we installed a Reconyx PC–85 camera (Rapid Fire Professional Color IR) for 3 consecutive days (80 hrs). The camera was set to take one picture every minute and eight consecutive pictures every time movement occurred between the camera and the nest (0.5 m apart). Nest, eggs, and nestlings were measured to the nearest 0.01 mm with a caliper and weighed to the nearest 0.05 g with a digital pocket scale. Mean values are presented as means \pm SD.

OBSERVATIONS

Nest and Location.—On 12 November 2010, we found a nest of *M. cinereiventris* in a *terra firme* forest in a relatively open understory area. It was placed within the leaves of a palm (*Geonoma* sp.) at 0.45 m above ground (Fig. 1A). The nest was a bulky open cup with inner diameter of 51.7×51.5 mm and 45.2 mm in depth, outer diameter of 83.3×108.2 mm and a height of 56.7 mm. Additionally, the nest had hanging moss at the bottom that was 65.8 mm in length. The nest mass

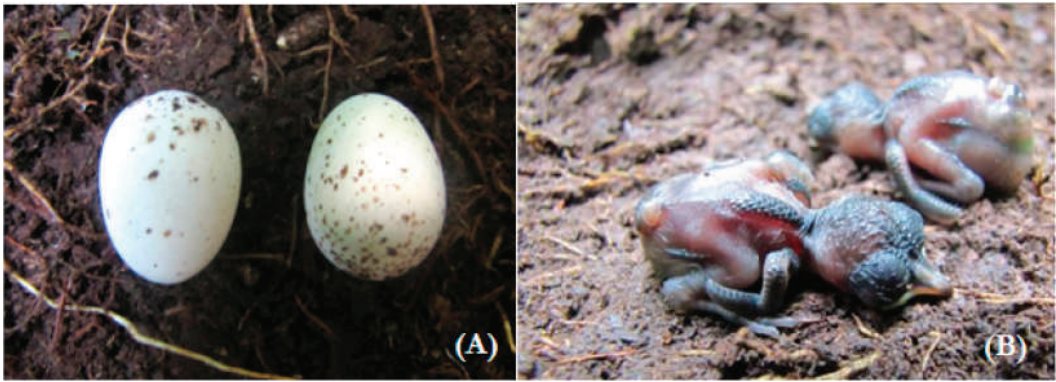


FIG. 2. Eggs (A) and nestlings (B) of *Microbates cinereiventris peruvianus*.

was 16.8 g and it was composed of three layers (Fig. 1). The outer layer (9.2 g) was composed of abundant green moss (4.8 g), palm dry leaves (0.4 g), and other plant materials (e.g., 4.0 g; sticks, rachises, and fibers) (Fig. 1B). The middle layer (4.9 g) was composed of dry angiosperm leaves (0.4 g), green moss (0.8 g), dry palm leaves (0.5 g), and other plant materials (3.2 g) (Fig. 1C). The inner layer (1.9 g) was composed of two types of fine plant fibers (0.1 and 1.8 g, respectively) (Fig. 1D).

Eggs and Nestlings.—The nest at the time of discovery contained two eggs with well-developed embryos. The eggs were white with a few reddish-brown and dark brown spots mainly at the broader end (Fig. 2A). They measured 19.1×13.8 mm and 18.3×13.8 mm and weighed 1.74 g and 1.64 g, respectively. The eggs hatched late in the afternoon of 16 November, according to thermal data on the nest. The following morning, the nestlings weighed 1.6 and 1.5 g, their wings measured 5.5 and 5.0 mm in length, and their tarsi were 7.5 and 7.0 mm in length, respectively. The nestlings were completely naked with dark brown skin and their eyes were closed, their gapes were light yellow and pinfeathers were just beginning to be visible in all tracts except on the head (Fig. 2B). On 20 November (fourth day after hatching), the nestlings started to open their eyes, and head pinfeathers started to appear; the primary pinfeathers measured 3 mm, having already broken through the skin but without breaking sheaths. The nestlings grew at a rate of 0.83 and 0.82 g per day, with wings growing at a rate of 1.83 and 1.60 mm, and tarsi growing at a rate of 1.67 and 1.30 mm respectively, until 21 November (fifth day after hatching) when they were depredated by an unknown predator (the

batteries in the camera failed and no photograph was taken).

Two days prior to egg hatching, nest attentiveness was $92.31 \pm 0.20\%$ and the incubating parent(s) conducted four trips per day. On average, the parents spent 110.43 ± 93.71 mins incubating (min-max = 5–30 mins) and 8.62 ± 11.14 mins foraging (min-max = 1–35 mins). The night bout lasted 1,008 mins starting at 1257 hrs on the first day and finishing at 0546 hrs on the second day. Nest temperature was 29.97 ± 1.79 (min-max = 24.24–35.96 °C) and ambient nest microclimate was 24.90 ± 2.36 (min-max = 21.29–30.82 °C). The parent(s) spent all night brooding during our nestling observations (710 ± 24.58 ; min-max = 695–739 mins). Nestlings were fed by both parents 20.1 ± 13.1 (min-max = 5–30 trips/day) at a feeding rate of 1.58 ± 0.89 trips/hr, with larvae or worms (17.31%; $0.5\text{--}1.5 \times$ bill size), insects (9.61%; $1.5 \times$ bill size), and unidentified items (73.08%; $<0.5 \times$ bill size). We observed seven feeding events while an adult was brooding. In 42.8% of the occasions, the brooding parent ate the item, and in the other 57.2% the brooding parent delivered the food to the nestlings. We recorded fecal sac consumption on five occasions and only one removal event.

DISCUSSION

We describe, for the first time, the nestlings, incubation, and feeding behavior of *Microbates cinereiventris*, and the nest of *M. c. peruvianus*. Our nest was similar to the one described by Kiff (1977) for *M. c. semitorquatus*. The clutch size, eggs, nestlings, nest, and nest site of *M. cinereiventris* are similar to *M. collaris* (Oniki

and Willis 1979) and *Ramphocaenus melanurus* (Eisenmann 1953, Skutch 1960). Gnatwrens attached their nests at broadleaf palms or shrubs in the understory less than 1 m off ground. They lay two white eggs with a few reddish-brown and dark brown spots, and their nestlings have yellow or orange-yellow gapes and are completely devoid of natal down at birth (Skutch 1960, Oniki and Willis 1979). However, as suggested by Kiff (1977), materials in the outer walls of the nest in *M. cinereiventris* could differ from other Gnatwrens. In Costa Rica, Skutch (1960) found a nest of *R. melanurus* with an outer layer of green moss in a path of Selaginella, unlike the nest described by Eisenmann (1953) of the same species in Panama, which had an outer layer of dry hanging leaves. Similarly, the only nest of *M. collaris* (Oniki and Willis 1979:101) to be described was said to be “a well concealed nest [that] looked like a pile of debris” without any green moss like *M. cinereiventris*. This variation of nest material used in the outermost layer has also been reported in the gnatcatchers (*Polioptila* spp.), which use different lichens in the outer layer of their nests depending on the habitat, even when comparing conspecific pairs (Chamberlin 1901).

As other members of Polioptilidae (*sensu* Remsen et al. 2013), both sexes of *M. cinereiventris* share activities while nesting, including nest construction (Kiff 1977), caring for the nestlings, and probably incubation. Our observed feeding rate (1.58 times/hr) was much lower compared to *Polioptila plumbea* (12.3 times/hr; Skutch 1960) and *R. melanurus* (4.5 times/hr; Skutch 1960). Our low feeding rates could result from only having observations during the early stage of the nestling period. Alternatively, altricial nestlings that lack substantial feather growth probably require less food and more brooding than they do later as they develop (e.g., O’Conner 1984, Rosa and Murphy 1994, Sockman 1998).

Nesting behavioral data support a close relationship between *Microbates* and *Ramphocaenus*, but as noted by other authors (Kiff 1977, Oniki and Willis 1979), these data failed to clarify the relative position of the Gnatwrens within the oscines. There are some traits of nesting biology like eggs, nestlings, and incubation rhythm, that suggest a close relation between *Microbates*–*Ramphocaenus* and *Polioptila* spp. Nevertheless, there are some remarkable similarities of nesting biology between *Microbates*, *Ramphocaenus* and some Old World genera of Sylviidae (*sensu lato*)

(see Skutch 1960) and some shared differences with Troglodytidae, especially in nest architecture, that make it difficult to identify patterns and understand behavioral discrepancies. These birds could be reflecting ecological convergence and niche partitioning, both processes difficult to confirm and interpret without any integrative approach involving detailed data and analysis.

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