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BREEDING BEHAVIOR OF THE BICOLORED ANTVIREO (*DYSITHAMNUS OCCIDENTALIS*)

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Resumen. – Comportamiento de reproducción del Batarito Bicolorado (*Dysithamnus occidentalis*). – Un nido del Batarito Bicolorado (*Dysithamnus occidentalis*) fue filmado durante las horas del día desde un poco antes de la puesta del primer huevo hasta el nacimiento de los pichones. La nidada fue de dos huevos. El intervalo entre la puesta del último huevo y el nacimiento de los pichones fue de 19 días. Ambos sexos participaron en la construcción del nido y la incubación. El macho hizo la mayoría de la incubación. Ambos sexos mantuvieron el nido durante la incubación, al añadir y arreglar materiales adicionales, y removiendo los ectoparásitos. Los adultos quedaron muy ariscos cuando llegaron y salieron del nido, pero fueron muy mansos en presencia de actividades humanas alrededor del nido. La ubicación del nido fue muy parecida a la anteriormente descrita para la especie.

Abstract. – A nest of the Bicolored Antvireo (*Dysithamnus occidentalis*) was videotaped during daylight hours from shortly before laying the first egg until hatching of the nestlings. Clutch size was two. The period from laying of the last egg to its hatch was 19 days. Both sexes participated in incubation. The male performed the majority of incubation duties. Both sexes were seen to maintain the nest during incubation by arranging and adding additional material, and by removing ectoparasites. Adults were very discreet when approaching or exiting the nest but were generally confiding and undisturbed by human activities in the vicinity of the nest. Location of the nest was similar to that previously described for the species. *Accepted 26 January 2004.*

Key words: Egg description, Ecuador, Andes, nest site, incubation, Bicolored Antvireo, *Dysithamnus occidentalis.*

INTRODUCTION

Antvireos (genus *Dysithamnus*; family Thamnophilidae) are a shy group of small, robust, short-tailed antbirds inhabiting the lower growth of humid lowland and lower montane forests (Hilty & Brown 1986, Ridgely & Tudor 1994, Ridgely & Greenfield 2001). The genus contains eight species ranging from Mexico to Bolivia and northern Argentina (Hilty & Brown 1986, Stiles & Skutch 1989, Ridgely & Tudor 1994, Howell & Webb 1995), with four species reported from Ecuador (Ridgely & Greenfield 2001). All described nests for the genus are sparse rootlet cups, sometimes lightly decorated with moss and incorporating small stems and leaves, slung between horizontal forks of small saplings, and placed 0.5–4 m above the ground (Skutch 1969, Lill & ffrench 1970, Wetmore 1972, Willis & Eisenmann 1979, Stiles & Skutch 1989, Skutch 1996, Greeney 2002). Described eggs for the genus are whitish and heavily flecked and blotched with brown, purple, and red (Skutch 1969, Stiles & Skutch 1989). Although the nesting behavior is generally unknown for most species of the genus, both sexes of the Plain Antvireo

(*D. mentalis*) are known to participate in nest building and incubation (Lill & ffrench 1970, Skutch 1996). For most species, however, almost nothing is known about breeding behavior.

The Bicolored Antvireo (*D. occidentalis*) is probably the least known and most range-restricted of the genus, being known from only a few localities in western Colombia and on both Andean slopes in Ecuador (Ridgely & Tudor 1994, Ridgely & Greenfield 2001). BirdLife International (2000) considers it vulnerable, and the scarcity of known localities and collected specimens has led Ridgely & Greenfield (2001) to uphold this highly threatened status. In eastern Ecuador, this species is known from only a few localities (Whitney 1992, Krabbe & Palacio 1999, Ridgely & Greenfield 2001), including Cabañas San Isidro and the Yanayacu Biological Station, where it is found with some regularity (Greeney 2002, M. Lysinger unpubl.).

The taxonomic history of the Bicolored Antvireo is rather convoluted and is summarized in Ridgely & Tudor (1994). It has been called Western Antshrike or Western Antvireo on some occasions, and has been considered as part of the genera *Thamnomanes*, *Thamnophilus*, or *Dysithamnus*. Recent studies, based on behavior and nest construction, however, all agree on its current position in the genus *Dysithamnus* (Whitney 1992 , Ridgely & Greenfield 2001, Greeney 2002).

Only one nest has been described for the species (Greeney 2002); it was found only a few kilometers from the current study site in eastern Ecuador. Brief observations included the *Dysithamnus*-like construction of the nest, the presence of a single nestling in mid-December and fledglings in November, and the attendance of the nestling by both adults (Greeney 2002). In this study, I provide the first description of the eggs, as well as the most complete description of incubation for any species of *Dysithamnus*.

MATERIALS AND METHODS

This study was carried out on the private birding preserve, Cabañas San Isidro. The preserve includes over 1200 ha of undisturbed montane cloud forest interspersed with small pastures, and is located 3 km west of Cosanga, adjacent to the Yanayacu Biological Station & Center for Creative Studies (00°35.949 S, 77°53.403 W) in the Napo province of northeastern Ecuador. For a more complete site description, see Greeney *et al.* (2003).

On 6 November 2002, an empty but seemingly completed nest was discovered in the "Macucaloma" forest patch, extending 2 km west of the Cosanga River. Activity at the nest was monitored with a video camera placed approximately 2 m above and 5 m away from the nest. The camera was situated such that the entire nest, including vegetation within a 50 cm radius, was visible. Although some effort was made to cover the tripod with foliage, the camera was, necessarily, plainly visible from the nest. Adult behavior appeared to be completely unaffected by the camera, and the birds never flushed from the nest during human activity at the camera. The nest was video taped from 05:45 h (EST) to 18:15 h on 10–15, 17, 20, 22, 25, and 28 November. On 21 November, the nest was filmed only until 17:45 h. Videotapes were subsequently watched and transcribed, with all relevant data extracted and summarized. Many of these were saved, and are deposited in the Yanayacu Natural History Video, Sound, and Image Library.

RESULTS

Chronology. The first egg was laid on 9 November. On the 11th at 05:30 h, the nest was unattended and still contained one icy-cold egg. The nest was filmed, and upon checking its contents at 12:00 h I found two eggs. On the

FIG. 1. Nest and eggs of the Bicolored Antvireo (*Dysithamnus occidentalis*).

28th, while filming, I witnessed a 1-m section of epiphyte-laden branch fall 50 cm from the nest. The falling branch hit the nest tree with portions of moss and foliage hitting the nest and the male, who was incubating at the time. On the 29th at 11:45 h, the nest still contained two eggs. One of these was damaged with a dent, approximately 2 mm in diameter, on one side, and radiating cracks around it. It appeared that, when the branch fell the previous day, the egg had been damaged, possibly by hitting against the second egg. When I picked up the undamaged egg, I could feel the baby pecking against the shell from the inside, but could detect no movement or sound from the damaged egg. Nevertheless, at 08:15 h on 30 November, the nest contained two apparently healthy nestlings, but no egg shells. Hatching, therefore, occurred between 12:00 h the day before, and 08:15 h on 30 November. Based on my own observations on hatching times of a variety of species and the observations of Skutch (1996), I feel it is likely that hatching occurred on the morning of 30 November.

Nest description and location. The nest was located at the bottom of a large natural depression oriented roughly perpendicular to a small stream. Viewed from above, the depression was overall T-shaped, with the stream running along the top of the T. At its opening to the stream the depression was approximately 30 m wide but narrowed rap-

idly to only 10–15 m wide at the back where it extended gradually up the slope behind to form the "neck" of the T. The nest was 2.5 m from the stream, which flowed on a 75° azimuth. The base of the nest tree was 0.7 m from the base of the gently sloping bank behind it, running nearly parallel to the stream at this point. Being 1.16 m up in a small *Eugenia* sp. (Myristicaceae) sapling, the nest was situated, horizontally, 2.2 m from the bank. Foliage immediately surrounding the nest was fairly scrubby and dense such that the nest was above most surrounding leaves, yet close to dense vegetation.

The nest itself was a simple cup constructed entirely of black fungal rhizomorphs and was thin-walled enough to allow the contents to be seen from below and through the sides. It was saddled in a Y formed by two horizontal branches, 3–4 mm in diameter. It measured roughly 11 cm in outside diameter, and was 8.5 cm in height. Inside, the cup was 5 cm deep with a diameter of 6.5 cm (Fig. 1).

Eggs. Both eggs were white with heavy dark red-brown streaking and splotching with fine lavender and black flecking. Patterning was heaviest at the larger end (Fig. 1). The first egg measured 22.3 mm by 16.3 and the second one was 21.7 mm by 16.5 mm. On 18 November, seven days after the laying of the last egg, the eggs were held up to a strong light source and embryonic development was clearly visible.

Pre-lay and laying. On 10 November, the day after laying of the first egg (see Chronology), adults spent, in total, only 16.9% of the daylight hours settled onto the egg. No adult spent the previous night on the nest and their first visit to it was at 07:00 h, when both adults arrived together and the female stayed on the nest. The last visit ended at 13:50 h and no adult spent the night on the nest. Of the time on the nest, the majority (61.2%) was by the male, in seven bouts averaging 11.2 min. He visited the nest 10 times and on six occasions brought single strands of fungal rhizomorphs. Twice he visited the nest while the female was present and, on one occasion, gave her a rhizomorph, which she built into the side of the cup. Upon arriving at the nest, the male spent an average of 22.6 s perched on the rim, while peering into the nest or looking around. While sitting on the egg, he spent 2.3% of his time arranging stray rhizomorphs along the rim of the cup, and 1.9% of his time probing and examining the inside of the nest (see Other behaviors), in bouts averaging 23.0 s.

The female visited the nest only twice, arriving the first time with the male and then a second time at 11:00 h. The first time she sat on the egg for 27.8 min, and the second for 21.9 min, for a total of 38.8% of the adults' time on the nest. She was not seen bringing material to the nest, but spent 1.6% of her time arranging rhizomorphs into the cup, and 6.2% of her time inspecting and probing the nest, in bouts averaging 18.6 s.

The following day, the female arrived at the nest for the first time at 08:10 h. She appeared slightly agitated compared to other visits surveyed in this study. She hopped around the rim for a while, got on briefly, then hopped back to the rim. At one point, shortly after the arrival of the female, the male came and left, and the female hopped to the rim as if to follow him, while looking around with sharp movements of the head. She spent a total of 35.5 min on the nest, sitting quietly for long periods, but occasionally looking around. She arranged nest materials twice, and spent 3.9% of her time peering and probing into the nest in four bouts averaging 21.0 s. This was the only period she spent on the nest before I discovered, at 12:00 h, that she had laid a second egg. The time of lay was between 08:10 and 08:45 h.

While the female was on the nest in the

morning, the male arrived four times and stayed for an average of 54.8 s. Once he simply sat and peered at the female and the nest for 35 s. Only once did he arrive bearing a single rhizomorph but, on two other occasions, he pecked repeatedly at rhizomorphs straying out of the rim, between periods of peering at the female and looking around. At 08:20 h, the male got into the nest and appeared to attempt a copulation. He faced the same direction as the female, but she did not lift her tail or respond visibly, and the attempt was likely unsuccessful. The male remained sitting on top of the female for 28 s before leaving the nest. At 08:45 h, the male arrived and the female left. She did not return until 17:45 h. At this time she sat on the eggs for 7 min, then left for 12 min and returned at 18:04 h to spend the night on the nest.

During the morning, while the female was absent, the male sat on the eggs four times, averaging 23.8 min per bout. The male did not bring any further material to the nest, and spent only 0.5% of his time on the nest arranging material. He did, however, occasionally inspect and probe the nest during 2.3% of his time. The longest period the eggs were unattended during daylight hours was for 5.3 h in the afternoon. Thus, after the female laid the second egg, and with the female's bouts later in the day, the eggs were covered, during daylight, for 19.8% of the time.

Post-lay and incubation. On the first four days and the sixth day after laying the last egg, total coverage of the eggs during daylight hours ranged from 24.4% to 54.7%. On days 9–11, 14, and 17, coverage of the eggs ranged from 82.1% to 89.6%. The female was observed spending the night on the nest on all 12 days the nest was filmed. In general, however, for days 1–6, apart from getting off in the morning and getting on in the evening, the female spent only brief periods on the nest in the mid-morning and mid-afternoon. On days 9–11, she generally had an additional bout in the nest around midday. Finally, on days 14 and 17, the female extended the length of her morning bouts and spent more time incubating in the afternoon.

After the laying of the second egg, the male performed 59.1% of the incubation time and, through day 11, maintained between 55.4% and 87.6% of the daily egg coverage. On days 14 and 17, however, the female took over 51.8% and 56.6% of daily incubation, respectively.

Beginning the day after the laying of the second egg, the longest period the eggs were left uncovered was 8 h and 8 min, occurring from 05:50 h to 14:00 h on day 3. The second longest period occurred on day 6, from 05:50 h to 10:30 h, when the eggs were unattended for 4 h and 43 min. Otherwise, up to day 6, periods of egg neglect ranged from 2.0 min to 183.8 min, and averaged 68.2 min. From day 9 to day 17, the eggs were uncovered for periods ranging from 2.0 min to 93.0 min, and averaged only 18 min.

Other behaviors. Throughout the entire incubation period both adults were observed to stand up from the incubating position and peer into the bottom of the nest cup. They then usually engaged in two distinct types of probing or pecking behavior. The first, here referred to as "sharp probing," consisted of pecking or probing into the bottom of the nest by the adult, with a single sharp movement of the head and upper body. Sharp probes ranged from a quick downward movement of the head to a fairly violent thrusting of the head and body, which often resulted in the shaking of the entire nest sapling. The second movement, termed "rapid probing," was a rapid series of head movements that thrust the bill in and out of the nest bottom in a sewing machine-like fashion. This movement caused the entire

bird to vibrate, and often the nest as well, and lasted 0.5–1.5 s. Before, after, and between both types of probing events, the adults would peer intensely into the nest, and I believe they were likely cleaning the nest of parasites. Further evidence for this was their tendency to rapidly open and close their bills slightly after a probe, as if manipulating or eating a small object. On the majority of occasions when the adults stood to peer into the nest as described, both methods of probing were used. Occasionally, however, the adult simply stared into the cup, then settled back to incubate. On several occasions, both adults, using the sharp probe movement, appeared to be chasing something across the bottom of the nest. On one occasion, the female even leapt out of the nest, chasing after something flushed from the nest. Conversely, rapid probes appeared to be directed into a single area for any given probing bout. Based on these observations, I think that sharp probes are used when something is found to peck at, and rapid probes are used either to elicit movements from potential targets, or to perform routine cleaning of the nest. I believe it was most likely the former, as most probing bouts began and ended with rapid probes, with sharp probes in the middle.

On day 6 after the laying of the last egg, an interesting interaction between the sexes occurred. The female was on the nest facing left and had been sitting on the eggs for 35 min. The male hopped up to the rim from the back right, his usual direction of approach. Just as he was about to alight on the rim, the female leapt off the nest and hit him in mid air. Both adults tumbled to the ground grappling and flapping their wings. No vocalizations were heard.

DISCUSSION

The probing behavior seen in the Bicolored Antvireo was described at nests of the Scaled Antpitta (*Gralaria guatimalensis*) in southern Ecuador (Dobbs *et al.* 2003). Subsequently, I observed nearly identical behaviors in finches, warblers, thrushes, and other antpittas (unpubl.). Based on these observations and the data presented here, I believe Dobbs *et al.* (2003) were correct in relating the function of such probing behavior to parasite removal.

Not surprisingly, the incubation rhythms and adult behaviors of the Bicolored Antvireo closely follow the generalizations made by Skutch (1996) for typical antbirds (Thamnophilidae) and antpittas (Formicariidae). The female spent nights on the nest and the male performed most of the daylight hour incubation duties. Diel activity rhythms and their confiding nature around the nest also closely matched Skutch's (1996) generalizations. The apparently aggressive interaction between the adults observed here was nearly identical to interactions I have observed at nests of the Peruvian Antpitta (*Grallaricula peruviana*) and the Ochre-breasted Antpitta (*G. flavirostris*) which show similar covert approaches to the nest. It has never, however, been observed in other open cup-nesting species (Greeney unpubl.). While the significance of this interaction remains unknown, it is likely that it reflects, in some way, the vigilance of the attending adult.

Using methods proposed by Skutch (1945), from the laying of the last egg to the hatching of the last egg, incubation period at this nest lasted 19 days. This is 4 or 5 days longer than for Streak-crowned (*D. striaticeps*) and Plain (*D. mentalis*) antvireos in Costa Rica (Skutch 1945, 1996), but agrees with the majority of reported incubation periods for other antbirds and antpittas (Skutch 1945, Schwartz 1957, Skutch 1996, Holley *et al.* 2001, Dobbs *et al.* 2003, Greeney unpubl.). Given that regular incubation did not begin until at least 7 days after laying of the second egg, these observations could be interpreted

as a true incubation period lasting 11–12 days. Similarly, Dobbs *et al.* (2003) found that the Scaled Antpitta did not begin regular incubation until 3 days after laying of the last egg, changing the incubation period from 20 to 17 days. In this study, however, embryo development had begun before regular incubation was seen. As pointed out nearly 60 years ago by Skutch (1945), only through careful observations will actual physiological incubation periods become known for any species. Additionally, the physiological and ecological reasons why a bird would expose its eggs to predators for longer periods by delaying egg development will only be elucidated through more studies such as this, and that of Dobbs *et al.* (2003).

The nesting situation described here, at the bottom of a streamside depression with nearby banks and foliage providing concealed approaches, is very similar to that previously described for the Bicolored Antvireo (Greeney 2002). Greeney (2002) also noted the adults' concealed approach to the nest from below. The additional observations provided here, of adults using foliage and bank for concealment, strongly suggest the importance of specific topography in nest site selection. Similar nest site selection and associated adult behavior have been observed in both the Peruvian Antpitta (Greeney *et al.* 2004) and the Ochre-breasted Antpitta (Greeney & Gelis unpubl.). I believe, therefore, that nest site selection by the Bicolored Antvireo correlates more to the presence of sheltering banks than proximity to a stream. The fact that most similar depressions in the area are caused by water flow, above or below ground, likely explains nests encountered near streams. Unfortunately, this may have serious conservation consequences, as streams are often highly disturbed by woodcutters using them as a means of accessing forest. Streams adjacent to the study area are frequently cleared, including adjacent vegetation, to allow access by horses (pers. observ.). Additionally, Bicolored Antvireos will likely turn out to feed their nestlings a high percentage of aquatic insects as has been seen in other streamside nesting species in the area such as the Peruvian Antpitta (Greeney *et al.* 2004) and the Slaty-backed Chat Tyrant (*Ochthoeca cinnamomiventris*) (Greeney unpubl.). As aquatic environments and organisms are highly susceptible to disturbance upstream, deforestation, cattle ranching, and other human activities, even outside of protected areas, may adversely affect species such as these. I hope this study encourages others to examine in detail other organisms inhabiting this, and other rapidly dwindling tropical habitats.

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