

Nesting of the Tropical Parula *Parula pitiaiyumi* in eastern Ecuador

Caroline Dingle and Harold F. Greeney

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En base a observaciones hechas en cinco nidos en el noreste de Ecuador entre 2005 y 2007, describimos un nuevo modo de construcción de nidos de *Parula pitiaiyumi*. Incluimos una descripción de los huevos y observaciones del comportamiento y asistencia de los adultos al nido. Descripciones previas hablan del nido de esta especie como un domo, con la entrada al lado, construido dentro de una mata de musgos colgante. Los nidos que encontramos en Ecuador fueron contruidos en el estilo de una copa abierta, similar a los nidos del género *Vireo*, y colgando de musgo pegado a una rama de árbol. Todos los nidos que encontramos tenían dos huevos.

Tropical Parula *Parula pitiaiyumi* ranges broadly from southern Texas through South America to northern Argentina. Throughout its range, it is a fairly common resident of a variety of woodland and forest types, where it often associates with mixed-species flocks⁹. Recent molecular evidence reveals that Tropical Parula is the sister species of the Northern Parula, which breeds throughout North America and winters as far south as Mexico and the Caribbean⁸. Whilst the nest of Northern Parula *P. americana* is relatively well known, there are fewer recorded observations on the nest and breeding behaviour of Tropical Parula. Nests of this species, from Texas, Costa Rica, Trinidad and Argentina, are described as dome-shaped with a side entrance, built into a hollowed-out clump of hanging moss^{1,9,11}. The species account in *The birds of North America* notes that Tropical Parula may also construct open-cup nests, citing personal communication with J. Arvin⁸, but no such description exists in the literature.

Here we provide the first description of open-cup nests built by Tropical Parula, with other observations of nesting behaviour, from north-east Ecuador. We found five nests at the Yanayacu Biological Station and Center for Creative Studies (00°35'S 77°53'W; 2,100 m), prov. Napo, north-east Ecuador. The first nest, discovered on 4 August 2005, contained two almost fully grown nestlings. The nest was discovered by following adults that were foraging in the overgrown pasture behind the station. We found four additional nests and made general observations on breeding behaviour in 2005–07. We collected and described nests after the breeding attempt was terminated and videotaped activity at the August 2005 nest using a tripod-mounted camera, recording a total of 15 hours during the three days prior to fledging.

Nest description

All nests were pendant cups, similar to vireo nests, suspended from horizontal branches of *Alnus*



Figure 1. Nest of the Tropical Parula *Parula pitiaiyumi*, Yanayacu Biological Station, prov. Napo, Ecuador (H. F. Greeney)

acuminata (Betulaceae) trees in the overgrown pasture around Yanayacu station, and were likely all built by the same pair. Nests ranged in height from 3.5–9.0 m above ground ($n=5$, mean 5.5 ± 2.2 m), and were mossy cups of *Usnea* sp. moss, bound together with spider webs and thinly lined with fine, pale, hair-like fibres. Nests were suspended by 3–6 attachment points to naturally growing moss (always including some *Usnea*) dangling below the covering branches. The surrounding moss (not brought by the adults) usually formed a wall on three sides of the cup, and occasionally a partial dome. For most nests there was only a single entrance into the cup, affording the appearance of a

'domed' nest. Observations during the construction of several nests, as well as careful examination of nests removed from their substrate, confirm that only the suspended cup portion was constructed by the birds. The outside measurements of four nests (\pm SD) were 6.8 ± 0.6 cm wide by 7.5 ± 0.4 cm high, with up to 20 cm of *Usnea* moss dangling below the cup (mean 11.8 ± 6.7 cm). Mean inner dimensions of the cup were 4.3 ± 0.3 cm wide by 5.0 ± 0.3 cm deep, measured from the top of the attachment points. Cup depth measured at the entrance point was 3.3 ± 0.2 cm.

Eggs

At three nests clutch size was two eggs, and two other nests held two nestlings, suggesting a regular clutch of two eggs. At two nests eggs were laid on subsequent days, always before 10h00. Mean linear dimensions of five eggs were 16.2 ± 0.6 mm long by 12.4 ± 0.5 mm wide. Fresh weight (within 24 hours of laying) of three eggs was 1.22 ± 0.07 g. Eggs were white with cinnamon flecking, heaviest at the larger end. Whilst a clutch size of two seems standard for South American races, northern races may lay three or even four eggs per clutch¹.

Nestling care

At the August 2005 nest, the first chick fledged at 15h45 on 5 August and the second chick fledged the following morning at 06h38. Whilst both chicks were present, feeding rates ranged from 19 to 44 feeds per hour (9.5–22.0 feeds per hour per chick), with the highest feeding rates during the first two hours after dawn. After the first chick fledged, the parents continued to feed the other chick at a fairly high rate (mean 20–25 feeds per hour). The morning that the second chick fledged, it was fed 19 times between 06h04 and 06h38, at which point it fledged. After the second chick fledged, the parents continued returning to the nest with food for a further 40 minutes.

Over the observation period at the first nest, 30 faecal sacs were produced by the chicks. In almost all cases, they were pushed up to the rim of the nest by the chicks and then removed by the adults, which flew off with them. In the other cases, the adults reached into the nest to retrieve the faecal sacs. No observations were made of the adults consuming the faecal sacs.

General observations on adult behaviour

Only one adult participated in building and incubation. As the second adult, which often accompanied the first to the vicinity of the nest during both stages, was usually singing, we presume that building and incubation was performed by the female. Both adults, however, participated in feeding the nestlings and fledglings. Food brought to the nests usually consisted of

single, small, unidentifiable arthropods. In 2007, one pair built a new nest and laid a second clutch only 12 days after their first was destroyed. Less than one month later this same pair successfully fledged two young from a third nesting attempt.

Seasonality and nesting success

We found single nests under construction in August–September, one nest with incubation underway in May, and nests with chicks in August and October. We observed three separate pairs of adults with dependent fledglings in October. These observations suggest peak breeding during the drier months in our area (August–December), but year-round nesting activity. The only other specific breeding records from Ecuador involved two observations of fledglings in south-west Ecuador in the wet season³ and a nest under construction in June in north-west Ecuador⁶. Best *et al.*² describe the breeding season as February–March in south-west Ecuador.

Of the five nests at Yanayacu, two fledged two young each, and the other three failed. One failed when a wind storm broke both eggs in the nest, a second had the eggs predated by Inca Jays *Cyanocorax yncas*, whilst the reason for failure at the third nest is unknown.

Discussion

The nests of Tropical Parula described here differ markedly from previously published descriptions of a dome-shaped nest with a side entrance, hollowed-out into a clump of moss or epiphytic growth^{5,8}. One previously described nest was mainly of cattle hair, but still built into *Tillandsia* moss¹. Although the nests we observed were indeed sheltered above by mosses and the supporting branch, they were clearly open cups and not domed structures and were not 'carved' from a clump of moss, but rather carefully attached to hanging moss at several points. Previous descriptions indicate that Tropical Parula nests are sparsely lined with materials as varied as horsehair, cottonwood seed down (*Populus deltoides*), 'marsh fibres', plant down or feathers⁸. The nests we found were lined with a fibrous plant material, probably dried grasses from the pasture around the nest tree.

Nests described here appear similar to those of Flame-throated Warbler *Parula gutturalis*, which builds a cup of green mosses and liverworts, lined with fine plant fibres, and usually shielded above by epiphytes⁴. The nest is either placed high in an epiphyte-laden tree (as were the Tropical Parula nests we found), or on a low bank. However, recent studies, which include molecular, morphological and vocal data, suggest that Flame-throated Warbler and Crescent-chested Warbler *P. superciliosa* are only distantly related to *P. pitiaiyumi* and *P. americana*, and may actually comprise a new genus

Oreothlypis, sister to *Vermivora*^{7,10}. Nevertheless, as nests of *P. pitiayumi* and other members of the Parulidae are variously described as cups, domed structures or cups hollowed out in moss, placed in varied situations, from on the ground to high in trees⁴, further detailed observations might prove useful to elucidate taxonomically informative variation.

Possibly, the nest architecture described here is not novel, rather authors of previous nest descriptions^{1,5} from the north of the range have interpreted nest structure differently. However, we are confident that our descriptions of nests in north-east Ecuador are accurate, as we closely examined several. This raises the more interesting possibility that differences in nest architecture may be related to subspecific differences between northern and southern populations. Detailed studies throughout the range would reveal whether there truly is a latitudinal shift in nest type in the species.

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Caroline Dingle

Zoology Department, University of Cambridge, Downing Street, Cambridge CB2 1TP, UK. E-mail: ced45@cam.ac.uk.

Harold F Greeney

Yanayacu Biological Station and Center for Creative Studies, c/o Foch 721 y Amazonas, Quito, Ecuador. E-mail: reummoss@yahoo.com.