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The Nest and Eggs of the White-tipped Quetzal (*Pharomachrus fulgidus*) from the Sierra Nevada de Santa Marta, Northern Colombia

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ABSTRACT.—We provide the first detailed descriptions of the nest cavity and eggs of the White-tailed Quetzal (*Pharomachrus fulgidus*) from the montane forest of the SW slope of the Sierra Nevada de Santa Marta, northern Colombia. We found two active cavities (both >2.5 m high) in isolated tree snags of non-native Mexican weeping pine (*Pinus patula*). One cavity contained two unmarked, pale turquoise eggs at the bare base. The nest cavity and eggs of the *P. fulgidus* resemble those of other high elevation species of quetzals. Breeding occurs in the first half of the Julian calendar during the end of the dry season. Additional information about the breeding biology of this group of birds is warranted. *Received 3 February 2014. Accepted 17 September 2014.*

Key words: cavity-nesting birds, montane forest, reproductive biology, South America, Trogonidae.

The nesting biology of Neotropical quetzals (genus *Pharomachrus* and *Euptilotis*) is poorly understood (Collar 2001), with exception for the Resplendent Quetzal (*Pharomachrus mocinno*), an iconic and endangered quetzal of Central America which has been well studied (Skutch 1944, Bowes and Allen 1969, Wheelwright 1983, Siegfried et al. 2010). Quetzals are secondary cavity-nesting birds that sometimes use their beaks to excavate holes in decaying bark or rotten trunks: a pair of birds is capable of removing several inches in depth of decayed wood, either to enlarge a woodpecker hole or to fashion a new nest (Bowes and Allen 1969). When unable to find previously hollowed out cavities, the Resplendent Quetzal appears to excavate a new nest cavity in soft, decaying wood, in the same manner as other trogons (Skutch 1944). It has been suggested that excavation could play a vital role in reproduction by stimulating ovulation (Bowes and Allen 1969), as a pair of Resplendent Quetzals were observed excavating a hole in a rotten tree as part of a copulatory behavior (Wheelwright 1983), but the importance of excavation on reproduction has never been tested.

In Colombia and South America, detailed descriptions of nest and eggs are available for very few of the quetzal species. One description was made 135 years ago of the eggs of the Golden-headed Quetzal (*Pharomachrus auriceps*, collected by T. K. Salmon) from the State of

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FIG. 1. General view of the tree snag where the first cavity was found (A) and cavity entrance (B) with a male entering the cavity-nest. Photos by PCPR.

Antioquia, Colombia (Sclater and Salvin 1879). More recently the nest and eggs of the Pavonine Quetzal (*Pharomachrus pavoninus*) from southeast Peru (Lebbin 2007) were described, but complete descriptions about the cavity (nest) and eggs of any of the *Pharomachrus* species for Colombia are lacking. Here we provide additional information about the nest cavity, and the first descriptions of the eggs of the White-tipped Quetzal (*Pharomachrus fulgidus*), a range-restricted species inhabiting montane forest in northern Colombia and Venezuela (Hilty and Brown 1986, Collar 2001). Our observations and descriptions were made at the ''Cuchilla de San Lorenzo'' on the SW slope of Sierra Nevada de Santa Marta (SNSM) in northern Colombia.

FIG. 2. Interior view of the first cavity and two turquoise eggs lying at the bottom of the cavity. Photos by PCPR.

RESULTS

Between the 14–16 April 2012, we found two active nest-cavities of *Pharomachrus fulgidus* at 2,265 m asl, beside the road from Minca town to the SNSM National Park cabins (11° 06 N, 74° 03 W). Descriptions of the vegetation and area are detailed in Cleef et al. (1984) and Caro et al. (2013). Both cavities were found in dead snags of a non-native pine tree (Mexican weeping pine, *Pinus patula,* Schiede ex Schltdl. and Cham.).

The first cavity was found on 14 April on the left side of the SNSM National Park cabin entry. We located a dead snag ~3 m tall beneath a line of bushy-tree fence, surrounded by natural forest, gardens, and isolated trees. We examined the nest on 16 April: the nest entrance was oriented 161° S, and the lower part of the cavity was 2.45 m above the ground. The cavity entrance was square-shaped, 12 cm high, and 10 cm wide (Fig. 1A, B). The cavity was 17 cm deep, 14 cm wide, and 13.5 cm long, measured from the base of the entrance. At the bottom of the cavity, we found 2 pale turquoise eggs with no obvious markings; no plant material was holding or under the eggs (Fig. 2). The first egg was 34.5 mm long × 28.0 mm wide; the second egg was 37.7 mm long × 28.1 mm wide (Table 1). Both eggs weighed 16 g as measured using a 100 g Pesola scale. The male and female were seen attending the nest continuously, and when we got close to the nest the adults flew to near-by branches, and started calling but never left the nest unattended. We documented activity every day from 14–20 April, with eggs still unhatched the last day.

On 16 April, we discovered the second cavity by knocking on the main trunk of a dead tree, very close to a dirt road at the edge of a pine plantation. A female flushed immediately off the nest after our knocking. This second cavity was located ~100 m from the first cavity. Because of the 4 m high entrance to the cavity, we were not able to check the status of this nest. However, a female was seen leaving the cavity on 18 April at 1307 hrs Colombia Time (COT), and again at 0900 hrs on 20 April 2012.

DISCUSSION

Our observations represent the first detailed descriptions and images of the nest cavity and eggs of the White-tipped Quetzal (*Pharomachrus fulgidus*) in Colombia and northern South America. Our observations of breeding condition adults match the timing (Jan–Apr) of previous reports in the San Lorenzo area in SNSM (Carriker 1922 and Hilty and Brown 1986). This period corresponds to the end of the dry season, as the rainy season in the north coast of Colombia starts mainly at the end of April or the beginning of May (Cleef et al. 1984). In Colombia, other species of *Pharomachrus* are also reproductively active in the first half of the year (Hilty and Brown 1986).

The nest cavity, clutch size, and eggs of the White-tipped Quetzal resemble those of the

TABLE 1. Comparative measurements of eggs and body masses of three species of Neotropical quetzals.

	Pavonine (Lebbin 2007)	Resplendent (Wheelwright 1983)	White-tailed (Present study)
Egg size (length × width)	31.5 × 27.6	38.9 × 32.4	34.5 × 28.1
	32.4 × 28.1	34.9 × 41	37.7 × 28.1
Egg mass (g)	8.5–13.5	15.0–18.9	16
	$n = 2$	$n = 4$	$n = 2$
Mean body size (g).	163	202	160
Dunning 2001	$n = 11$	$n = 20$	$n = 1$
Color	Pale blue with small brown buff speckles	Light Blue	Turquoise

Pavonine Queztal and Resplendent Quetzal, while the eggs also resemble those of the Golden-headed Quetzal (Sclater and Salvin 1879, Skutch 1944, Johnsgard 2000, Lebbin 2007). As in other quetzals, the White-tipped Quetzal female laid two turquoise eggs with a clutch size characteristic of Trogonidae (Wheelwright 1983). However, we found subtle differences between highland quetzals and lowland quetzals with regard to egg size and colors. The eggs of the Pavonine Quetzal, a lowland-distributed taxa, are smaller and have small brown buff speckles compared to the light blue and larger eggs of the Resplendent and White-tipped quetzals which live in higher elevations. Few data are available in the literature with regard to quetzals' reproduction (Table 1), but when comparing information we found some qualitative variation in color, which could be related to differences in abundance or the type of predators between lowland and highland regions. Moreover, eggs appear to be larger at higher elevations where temperature is lower, which we speculate may be an example of Bergman's rule: in colder habitats bigger objects lose less energy as heat (James 1970).

The information about the tree species that quetzals use for nesting is rather limited (Collar 2001). Our observations suggest the White-tipped Quetzal is using non-native tree plantations and isolated trees for nesting and reproduction. Plantations of *Pinus patula* in SNSM were introduced 50–60 years ago. It is possible that historical deforestation in this area, now a protected national park, has forced this cavity-nesting species to use non-native trees for reproductive activities. Finally, it is possible that strong competition for cavities (with woodpeckers, forest-raptors, toucans, and woodcreepers) or innate nesting plasticity is allowing this species to use this novel resource.

Data from additional nests across the range of this species are necessary to investigate how rainfall or seasonality may influence the timing of breeding. We encourage other ornithologists, naturalists, and field biologists to add to the limited amount of information regarding the reproductive biology of this group of birds.

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