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SHORT COMMUNICATION

Variations on the nest architecture in the Rufous-fronted Thornbird complex, *Phacellodomus rufifrons* (Aves: Furnariidae)

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Abstract

The Rufous-fronted Thornbird (Furnariidae) is widespread in South America. It has a very characteristic nest, formed by a large cluster of dry sticks, suspended in a tree branch. Exceptionally, some couples build nests that escape this pattern, varying their structure and/or support. Based on field data and online databases, we describe in more detail some of these variations and quantify their occurrence. The data obtained show that atypical nests represent only 1.4% of total nests recorded on databases, but despite the rarity, they are widespread within the complex, both in geographic and taxonomic terms, being probably an ancestral trait of the group. The recurrent use of Cecropia Trees and structures of the electrical network to support atypical nests may be related to some advantage due to the presence of symbiotic ants in these trees and/or the absence of trees suitable for the construction of standard nests. However, current data does not allow explicitly testing such hypotheses.

Keywords Brazil · Cecropia · Nest architecture · Nest placement

Bird nests, like nests of many other animal taxa, may be viewed as extended phenotypes of the individuals (Dawkins 1982), and are thus subject to selective pressures. Not surprisingly, nest architecture has been shown to carry phylogenetic signal in several bird families, such as the ovenbirds and allies (Furnariidae; Zyskowski and Prum 1999). These birds show a wide variety of nest architecture, with oven-shaped, underground or heaps of dry branches, among others, being typical structures of each genus, and thus allowing taxonomic and phylogenetic conclusions to be made (Sick 1997; Zyskowski and Prum 1999). On the other hand, local pressures, such as resource availability, may lead to trait variations on a species' nest. Nevertheless, our understanding on those variations—and how they relate to selective forces—is completely hampered by the scarcity of nest descriptions for most Neotropical bird species (see Tyrannida in Crozariol 2016).

The Rufous-fronted Thornbird (*Phacellodomus rufifrons*) has one of the most distinct and most conspicuous nests among Neotropical birds. This small passerine (16 cm in total length) has a wide distribution in South America and lives in dry forests, thin scrub, Cerrado (savanna), gallery forest, Caatinga, and different types of open areas such as pastures, and always occurs in pairs or small family groups (Sigrist 2006; Winkler et al. 2021). Six subspecies are presently recognized (Winkler et al. 2021), two of which form a quite distinct group that may be best treated as a species, "*P. inornatus*," based on voice, plumage, and most recently, genetic differentiation (Corbett et al. 2020). The characteristic nest of the species is shared among all subspecies, though, and is built with carefully attached small dry sticks, including branches with thorns. The nest can be more than 1 m high and weigh several kg as is continuously built by the same couple, who also maintain it throughout the year as roosting (Thomas 1983; Sick 1997). Nests are typically placed at the end of isolated slender branches which are most commonly dropping-oriented, though eventually the branch can be horizontal or even ascending (Skutch 1969; Thomas 1983; Sick 1997; Carrara and Rodrigues 2001; Rodrigues and Rocha 2003; Santos and Marini 2003; Fig. 1). Simon and Pacheco (2005) have therefore defined such a nest as

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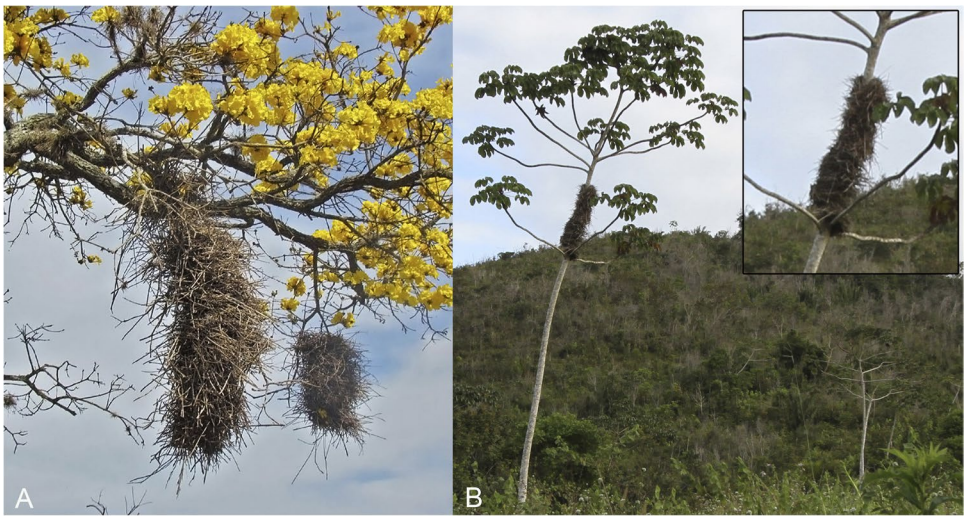

Fig. 1 (**A**) Typical nests of the Rufous-fronted Thornbird *Phacellodomus rufifrons* attached to the tip of thin descending branches (photo: Adriano Campos). (**B**) Atypical nest of the species attached around the main trunk of a Cecropia Tree found in Mata de São João, Bahia, Brazil (photo: Fabio Schunck)

"closed/long/pencile" in their classification system. Exceptionally, *P. r. inornatus* was found to build a nest around the main trunk of a Cecropia Tree (Skutch 1969). The finding of such an unusual nest in the field, but for the nominate subspecies, prompted us to perform a search on online database for other nests which also differ from the species' typical architecture. Here we present a simple description and quantification of the variation found, based on external appearance and nest attachment.

On 21 July 2014, in the municipality of Mata de São João, state of Bahia (12° 27′ 44.6″ S; 38° 15′ 20.2″ W, 104 m a.s.l.), we recorded a nest of *P. rufifrons* with an unusual structure: positioned vertically and around the main trunk just below the crown of a Cecropia Tree (*Cecropia* sp.). The nest was approximately 1 m high and 30 cm of external diameter. The nest bottom was contacting some of the lower branches of the tree as if it was a form of securely fix it to prevent it from slipping (Fig. 1). The tree was about 50 m from a dirt road in a region with anthropogenic and open vegetation formed by patches of isolated low vegetation and sparse trees. No other nests were found nearby and there were no signs of the birds at the site, even after attempting to lure for about 5 min using playback.

Our search in the two largest online platforms for bird images (WikiAves [WA], https://wikiaves.com.br; and eBird/Macaulay Library [ML], https://ebird.org/—as of May 2020) returned 744 images of nests of *P. rufifrons* (625 on WikiAves and 119 on eBird), of which only 10 nests were atypical (Table 1): seven (1.1%) on WikiAves, all from Brazil, and 3 (2.5%) on eBird, 2 of which from other South American countries (Table 1), for an overall ratio of 1.4%. Three of the nests were essentially as the one we found, i.e., built vertically around the main trunk of Cecropia Trees. This type of vertical construction was also documented in Colombia, but in a different tree species, with a slender central trunk. Following the Simon and Pacheco (2005) system, those nests remain as closed/long, but not "pencile;" instead, they are "fork" [-supported] or else "lateral" (in relation to the incubatory chamber, presumably). The other atypical nests were placed on artificial structures: 4 besides electric power poles and supported at the bottom by a steel cable/electric wire (1 with partial view), in a way that seemed to confer great fragility in the face of winds and storms; and 2 nests in the middle of electrical wiring, far from poles. It is likely that these records were in or near urban areas. These nests changed the fixation (cf. Simon and Pacheco 2005) from "pencile" to "base" (most of the nests) and at least one to "lateral," whereas some of them changed the shape from "long" to "irregular." The 10 nests found were within the range of 5 out of the 6 subspecies recognized in the *P. rufifrons* complex. We lacked a record for *P. r. peruvianus* only.

The low ratio of nests built around trunks or over artificial structures that we found in online databases, as well as the near absence of descriptions in the literature (see Skutch 1969 for an exception), suggests that these are indeed atypical variations on the nest architecture of *P. rufifrons*. There is the possibility that the real ratio in nature is even lower, as atypical nests may prompt photographers to document such nest more often than regular nests would do. In any event, we suggest the data on online database work as a good proxy to document the general rarity of atypical nests, even if a little skewed.

Despite being only a small fraction of the nests found on databases (< 1.5%), atypical nest could be found over a wide geographic area and within all but one of the 6 subspecies of the *P. rufifrons* complex. Given the relationship found among the subspecies (Corbett et al. 2020), we consider that the general pattern of nest construction, including its variations, is an ancestral trait shared within the complex, and thus, we expect that similar atypical nests should be found for *P. r. peruvianus* when more data accumulates.

Table 1 Summary data of atypical nests found for Rufous-Fronted Thornbird *Phacellodomus rufifrons* in the field and on online databases. Nests are listed alphabetically according to locality

Media code	Subspecies	Locality	Date (DD/MM/YYYY)	Support structure	Attachment
This study	*rufifrons*	Brazil, Bahia, Mata de São João	21/07/2014	Cecropia Tree	Around the main trunk
WA 2147748	*rufifrons*	Brazil, Bahia, Porto Seguro	23/04/2016	Cecropia Tree	Around the main trunk
WA 993370	*rufifrons*	Brazil, Espírito Santo, Afonso Cláudio	14/06/2013	Cecropia Tree	Around the main trunk
WA 1498020	*rufifrons*	Brazil, Espírito Santo, Vargem Alta	17/10/2014	Electric power poles	Besides the pole? (partially visible)
WA 953550	*specularis*	Brazil, Pernambuco, Belo Jardim	27/04/2013	Electric power poles	Besides the pole/ botton-supported on wire
WA 941885	*specularis*	Brazil, Pernambuco, Correntes	18/04/2013	Electric power poles	Besides the pole/ botton-supported on wire
WA 209629	*specularis*	Brazil, Pernambuco, Gravatá	24/09/2010	Electrical wiring	Supported by wires
ML 219667801	*specularis*	Brazil, Pernambuco, Lagoa dos Gatos	20/11/2009	Cecropia Tree	Around the main trunk
WA 1171096	*sincipitalis*	Brazil, Mato Grosso do Sul, Campo Grande	01/12/2013	Electrical wiring	Supported by wires
ML 233552341	*castilloi*	Colombia, Meta, Villavicencio	11/05/2020	Tree (unidentified)	Around the main trunk
ML 145020801	*inornatus*	Venezuela, Carabobo, carretera a Palmichal	03/04/2011	Eletric power poles	Besides the pole/ botton-supported on wire

We are currently unable to define the reasons behind such atypical nests. Greeney (2008) reported variation in the nest architecture of another species of Furnariidae, Spotted Barbtail (*Premnoplex brunnescens*), and argued that this variation may be related to the availability of resources or even associated with clinal variation in response to climatic conditions (see also Zyskowski and Prum 1999; Botero-Delgadillo et al. 2017). Given the widespread occurrence of atypical nests, we have found for *P. rufifrons*, climatic conditions do not seem to be a likely cause to the variation on nest architecture (placement/perch and kind of nest attachment). However, the lack of environmental and climatic data on the precise localities of the nests precludes us from formally discarding that hypothesis. The nests surrounding Cecropia Trees and poles almost certainly differ in internal structure compared to typical nests, given the proportion of the nest's internal volume occupied by the large trunks or poles. One direct consequence may be a thinner, less isolating wall of the nest, which can affect internal temperature at the incubation chamber and therefore the breeding success of the birds. On the other hand, the nests built on electrical cables look similar, in shape, to the typical nests of the species; thus, this atypical situation may reflect just local availability of favorable trees as nesting sites, perhaps without direct effect on the breeding success.

The three cases of nest construction in Cecropia Trees led us to wonder how the classic interaction between this plant and ants (Davidson 2005) also affects the behavior of the birds. In the dry forest of Central America, some birds choose myrmecophilous Acacias Trees to build their nest (Janzen 1969; Young et al. 1990), apparently benefiting from the presence of aggressive ants, which, according to Janzen (1969), could get used to the pattern of the bird's disturbance within a few days. Nonetheless, *Azteca* spp. ants that are found in Cecropia Trees are less aggressive than ants that colonize Acacias, and a protection against potential nest predators may be less effective, if effective at all. Furthermore, Cecropias commonly attract many other birds looking for food, which could disturb any nesting or roosting bird, and the course, open branch-system of the Cecropias would make them a poor (though not infrequent) place to build a nest (Skutch 1945). How these forces counterbalance each other remains to be tested, and we hope the data presented here for *P. rufifrons* call attention to the existence of variation on nest architecture of the species and foster new hypotheses and studies on the causes and consequences of such variation.

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Data availability The authors confirm that the data supporting the findings of this study are available within the article.

Declarations

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Consent to participate Not applicable

Consent for publication The authors give their consent for the publication of this manuscript in Ornithology Research.

Research involving human participants and/or animals None

Competing interest The authors declare no competing interests.

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