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SHORT COMMUNICATION

Passeriformes: nest predators and prey in a Neotropical Savannah in Central Brazil

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ABSTRACT. The identification of predators of birds' nests, crucial to a better understanding of predator-prey interactions, remains poorly known. Here we provide evidence that birds, and especially passerines, may depredate birds' nests in the Cerrado (Neotropical Savannah) of Central Brazil. Data was collected primarily in a Conservation Unit (Estação Ecológica de Águas Emendadas) during the breeding season, between 2003 and 2007. We report and discuss details on 14 events of nest predation, 12 of which by passerines, mostly by curl-crested jays – *Cyanocorax cristatellus* (Temminck, 1823). The results of our study suggest that the role of birds as nest predators in the Cerrado has been underestimated and needs to be further investigated.

KEY WORDS. Cerrado; bird; passerine.

Predation is the main cause of nest failure in tropical birds (Oniki 1979, Martin 1996) with predation rates around 80-90% (reviewed in Stutchbury & Morton 2001). The identification of nest predators is helpful in understanding avian life history strategies and can be an aid to devising management and conservation plans. This information is important because nest predation negatively affects avian population sizes (Newton 2003), particularly in fragmented landscapes (Robinson *et al*. 1995, Heske *et al*. 2001).

It has been suggested that mammals, snakes and birds are the most important nest predators in tropical and temperate zones (Robinson & Robinson 2001, Stake *et al*. 2004, Robinson *et al*. 2005). However, most studies that aimed to identify and quantify nest predators and their impact were conducted in the temperate zone, and usually in forests (Weatherhead & Blouin-Demers 2004). Because of the difficulty in recording nest predation events, such studies are usually based on small sample sizes (Weatherhead & Blouin-Demers 2004), are restricted to one or a few prey species (e.g. Renfrew & Ribic 2003), frequently do not include temporal or spatial comparisons (Brown *et al*. 1998), or use indirect inferences (Libsch *et al*. 2008).

Therefore, more information is still needed to determine who the nest predators are and what their relative importance in the tropics is. Herein we describe nest predation events and provide evidence that passerines may be nest predators in an area of the Brazilian Neotropical Savannah (Cerrado). The Cerrado, a threatened biome (Klink & Machado 2005), is a biodiversity hotspot (Mittermeier *et al*. 2004) that includes more than 830 bird species (Silva 1995, Stotz *et al*. 1996) many of which endemic or threatened (review in Marini & Garcia 2005).

This study was carried out at the "Estação Ecológica de Águas Emendadas" (ESECAE), a 10,500 ha reserve in Central Brazil with typical Cerrado vegetation and immersed in a semi–urban landscape. The Brazilian Cerrado biome is composed of woodlands, savannas, grasslands as well as gallery and dry forests (Silva & Felfili 1996). Most of our nest searching was conducted at least 1 km from the edges of the reserve in a 100 ha plot with open low scrub (*cerrado ralo*) to dense savannah (*cerrado típico*; classification after Ribeiro & Walter 1998), but also in a fragmented semi–urban landscape adjacent to ESECAE. This semi–urban landscape was composed by fragmented Cerrado, houses, farms and orchards.

Nest predation was recorded directly during an ongoing, long–term nest monitoring program at ESECAE from August through December during the years of 2003-2007. We made records of nest predation events by chance mostly in the 100

ha plot (N = 14 nests) and once in the semi–urban landscape. Direct observations were conducted from 06:00 a.m. to 6:00 p.m., and were combined with video-monitoring of passerine nests, monitoring of nest contents, observations on parental behavior at nests, following bird groups, or randomly walking in the area. In this study, we report only direct records of nest predation events. Nomenclature follows Cbro (2008).

According to our observations, passerines seem to act as nest predators in our study area. We identified both predators and preys in 13 of the 14 events recorded. The curl–crested jay, *Cyanocorax cristatellus* (Temminck, 1823), was a predator in seven of the 14 events (Tab. I). Three other species of passerines and a Bucconidae – white–eared puffbird, *Nystalus chacuru* (Vieillot, 1816) – were also recorded as predators and seven species of passerines were prey (Tab. I). In one case the interaction was intra–specific – lesser elaenia, *Elaenia chiriquensis* Lawrence, 1865 – as prey and predator. In nine occasions predators were in monospecific groups of at least two individuals (Tab. I). However, only once – white–rumped tanager *Cypsnagra hirundinacea* (Lesson, 1831) as predator (Tab. I) – we observed more than one individual consuming the contents of a nest. There was one instance of a mammal (feral dog) predating on a nest at a height of 56 cm. In the latter case, a single egg was eaten and the nest was only slightly disturbed.

Predation occurred in eight nests during incubation stage and in six during nestling stage. Nestlings were depredated five times by curl–crested jay and once by white–eared puffbird. There were more than one egg or nestling in six depredated nests and only once we observed all nest contents being removed. This provides evidence of partial nest predation in the study area. When eggs where depredated, we found no egg remains three times, egg shells twice and blood remains once (Tab. I). Predation occurred 13 times early in the morning, before 9:00 a.m., and only once in the afternoon (6:00 p.m.) (Tab. I).

This study is apparently the first carried out in a naturally open Neotropical landscape, limiting comparisons. Among 14 previous studies on the nest predators evaluated, only two were conducted in wet forests from the tropical zone (Robinson & Robinson 2001, Robinson *et al.* 2005), while 12 were carried out in temperate regions – 10 in the United States, one in Germany and one in New Zealand (Brown *et al.* 1998, Thompson *et al.* 1999, Farnsworth & Simons 2000, Pietz & Granfors 2000, Morrison & Bolger 2002, Liebezeit & George 2003, Renfrew & Ribic 2003, Sawin *et al.* 2003, Stake & Cimprich 2003, Thompson & Burhans 2003, Schaefer 2004, Stake *et al.* 2004). Five of them took place in open landscapes, but only one in a preserved area.

We recorded mostly passerines predating nests (12 of 14 records), especially the curl–crested jay. In other habitats, the importance of birds in nest predation events is either small or is shared among other taxa. For instance, in a lowland forest, birds, snakes and mammals were recorded as nest predators during nest monitoring (Robinson & Robinson 2001). In the Amazon and the Atlantic forests, both toucans and monkeys were observed predating nests (Feekes 1981, Robinson *et al.* 2005, Duca & Marini 2004). Additionally, in some studies, snakes have been pointed out as the most important predators (Weatherhead & Blouin-Demers 2004, Robinson *et al.* 2005). A study conducted at the edge of ESECAE revealed that birds (beak marks) were the most common predators (> 90% of the marks) of artificial nests baited with plasticine eggs (França & Marini 2009). However, in our study the relative importance of birds and other predators in nest predation events at ESECAE can not be evaluated due to the opportunistic non-systematic way that data was collected. Despite this limitation, our observations allow us to suggest that birds, and especially passerines, may be part of the predator community at ESECAE.

From the 14 studies cited above, 72% reported passerines as nest predators (e.g. Thompson & Burhans 2003, Stake *et al.* 2004). However, in most cases only crows and/or blackbirds (88%) were identified as nest predators (e.g. Farnsworth & Simons 2000, Stake & Cimprich 2003). Blackbirds as predators were represented only by the brown-headed cowbird, *Molothrus ater* (Boddaert, 1783). Some tyrant flycatchers were also mentioned as nest predators (reviewed in Lopes *et al.* 2005), as well as wrens, whose egg destruction behavior seems to be common (Fleischer & Tarr 1995, Rodrigues 2005). Our study is the first to report nest predation by tanagers and is one of a few reporting several species and families of passerines (Tyrannidae, Thraupidae and Corvidae) as nest predators.

Intraspecific predation (reported here for *E. chiriquensis*) does not seem to be a common behavior among birds (Brown *et al.* 1998, Farnsworth & Simons 2000, Robinson & Robinson 2001). Also, it does not happen even in manipulated conditions, when nests are relocated next to other conspecifics (Sawin *et al.* 2003). However, the migratory marsh wren, *Cistothorus palustris* (Wilson, 1810), destroys and eats the contents of nests of conspecifics in order to reduce competition for food around its territory (Poole & Gill 1997). This hypothesis could be tested with *E. chiriquensis*, which is also a migratory species and occurs in our study area in high densities during its breeding season.

Remains of nest predation were not appropriate to allow the identification of nest predators in this study. The strategy of identifying predators using the evidences left in the nest had already been considered inefficient by Marini & Melo (1998). Also, studies using nest video monitoring to compare the predator recorded with the evidences left in the nest confirmed the inefficiency of the method to identify predators (Pietz & Granfors 2000, Thompson & Burhans 2003). Studies with thermistors (temperature sensors) placed in nests allow the record of the time of nest predation events but not the identification of nest predators (Libsch *et al.* 2008).

We suggest that the importance of birds as nest predators in the Cerrado region be further investigated because they may be more frequent predators than previously thought. Further studies aiming this subject may improve our knowledge about the evolution of local bird life histories, and enable the elaboration of more efficient management strategies for tropical birds.

Table I. Predator species, number present during the predation event (present), and items consumed at the nest; prey species, type of item in the nest (egg or nestling), number of items in the nest before and after predation and evidences left by the predator recorded in each predation observed in Brazilian central Cerrado. Sistematic order after Cbro (2008).

Taxa	Predator		Prey				
	Number of individuals		Species	Nest content			Remain
	Present	Consumed		Item	Before	After	
Piciformes							
Bucconidae							
Nystalus chacuru (Vieillot, 1816)	1	1	*E. chiriquensis* Lawrence, 1865	Nestling	3	2	–
Passeriformes							
Tyrannidae							
Elaenia chiriquensis	1	1	*E. chiriquensis*	Egg	2	1	–
Corvidae							
Cyanocorax cristatellus (Temminck, 1823)	> 3	–	*Suiriri suiriri (*Vieillot, 1818)	Egg	⩾1	0	Blood
C. cristatellus	4	–	*Turdus amaurochalinus* Cabanis, 1850	Egg	3	0	None
C. cristatellus	> 3	1	non identified passerine	Nestling	–	–	–
C. cristatellus	4	1	*Tyrannus savana* Vieillot, 1808	Nestling	–	–	–
C. cristatellus	–	1	*Suiriri islerorum* Zimmer, Whittaker & Oren, 2001	Nestling	1	0	None
C. cristatellus	2	1	*Cypsnagra hirundinacea* (Lesson, 1831)	Nestling	1	0	–
C. cristatellus	> 1	1	*E. chiriquensis*	Nestling	2	1	–
Thraupidae							
Neothraupis fasciata (Lichtenstein, 1823)	2	1	*E. chiriquensis*	Egg	⩾1	0	Egg shell
N. fasciata	1	1	*E. chiriquensis*	Egg	2	0	Egg shell*
Cypsnagra hirundinacea	3	1	*E. chiriquensis*	Egg	1	0	Egg shell
C. hirundinacea	2	2	*Mimus saturninus* (Lichtenstein, 1823)	Egg	3	1	–
Mammalia							
Canis domesticus (Linnaeus, 1758)	1	1	*E. chiriquensis*	Egg	1	0	None

* Egg shells that were immediately removed by *E. chiriquensis*.

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