

INTERSPECIFIC PARENTAL CARE BY A RUFIOUS-COLLARED SPARROW (*ZONOTRICHIA CAPENSIS*) AT A NEST OF THE PALE-BREADED THRUSH (*TURDUS LEUCOMELAS*) PARASITIZED BY A COWBIRD (*MOLOTHRUS BONARIENSIS*)

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ABSTRACT · Interspecific parental care (IPC) in birds, when one individual helps to rear the offspring of another species, is rare outside the context of brood parasitism. Reports of IPC addressed to non-brood-parasitic bird species are mostly anecdotal, and in some cases have been explained as a non-adaptive response to the begging calls of interspecific nestlings in the vicinity of the helper's own nest. Here, we report a case study of a Rufous-collared Sparrow (*Zonotrichia capensis*) feeding three nestlings in a Pale-breasted Thrush (*Turdus leucomelas*) nest, including one Shiny Cowbird (*Molothrus bonariensis*) nestling. The combined feeding rate of the nest owners was not significantly different from that of the helper, which fed all nestlings and removed their fecal sacs. To our knowledge, this is the first IPC case reported for South America, and we hypothesize that parasite begging sounds are one of the proximate causes of this behavior.

RESUMO · Cuidado parental interespecífico por um tico-tico (*Zonotrichia capensis*) em um ninho de sabiá-barranco (*Turdus leucomelas*) parasitado por um chopim (*Molothrus bonariensis*)

Cuidado parental interespecífico (IPC) em aves, quando um indivíduo ajuda a criar filhotes de outra espécie, é raro fora do contexto de parasitismo de ninhada. Registros de IPC direcionado a espécies de aves que não são parasitas de ninhada são geralmente anedóticos, e em alguns casos têm sido explicados como uma resposta não adaptativa às vocalizações dos filhotes de outras espécies na vizinhança do ninho do ajudante. Nesse estudo, registramos um estudo de caso de um tico-tico (*Zonotrichia capensis*) alimentando três ninhegos em um ninho de sabiá-barranco (*Turdus leucomelas*), incluindo um ninhego de chopim (*Molothrus bonariensis*). A taxa de alimentação combinada dos parentais não diferiu significativamente daquela do ajudante, que alimentou todos os ninhegos e removeu seus sacos fecais. Ao nosso conhecimento, este é o primeiro IPC registrado na América do Sul, e nós hipotetizamos que os chamados do parasita estão entre as causas próximas deste comportamento.

KEY WORDS: Adoption · Behavior · Brood parasitism · Helper · Misdirected parental care**INTRODUCTION**

In birds, alloparental behavior occurs when the offspring is reared by individuals other than their parents. Although helpers are usually conspecifics, there are a number of (mostly anecdotal) accounts in the literature of non-brood-parasitic nestlings being fed by heterospecific adults in the wild, a behavior known as interspecific or misdirected parental care (hereafter IPC; Skutch 1961, Shy 1982). In passerines, IPC has been occasionally reported (e.g., Petrassi et al. 1998, Dolenc 2002, Robinson et al. 2005, Schaeffer et al. 2009, Suzuki & Tsuchiya 2010, Halley & Heckscher 2013), and its proximate and ultimate causes are not well known.

Because there is no clear benefit conferred to the heterospecific helper, IPC is widely thought to be a reproductive error, and therefore non-adaptive (Riedman 1982, Shy 1982, Merila 1994; but see Halley & Heckscher 2013). For this reason, researchers have proposed proximate causes that may contribute to such behaviour (e.g., the heterospecific helper is not paired, adopts orphaned chicks, or is nesting in proximity and drawn to the begging calls of the heterospecific nestlings, among other non-mutually exclusive hypotheses; see Shy 1982).

Here, we report a case of a Rufous-collared Sparrow (*Zonotrichia capensis*, hereafter sparrow) feeding the offspring of Pale-breasted Thrushes (*Turdus leucomelas*, hereafter thrushes), that also contained one parasitic

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Table 1. Frequency of visits to a Pale-breasted Thrush (*Turdus leucomelas*) nest by both thrush parents summed, and by a heterospecific helper, a Rufous-collared Sparrow (*Zonotrichia capensis*) at the Federal University of São Carlos, São Paulo state, Brazil. The number of aggressive behaviors between the thrushes and the sparrow, and the relative contribution of the sparrow to the total number of food deliveries, are shown across the time of focal observation.

Date	Hour		Nest visits		Aggressive behaviors	Sparrow contribution
	Start	End	Sparrow	Thrushes		
23 Oct	07:10	07:50	5	7	9	41.67%
23 Oct	07:51	08:30	4	10	0	28.57%
23 Oct	08:31	09:10	9	8	7	52.94%
23 Oct	15:12	15:52	2	5	0	28.57%
23 Oct	15:53	16:32	8	4	2	66.67%
23 Oct	16:33	17:12	4	4	0	50.00%
24 Oct	07:18	07:58	4	7	1	36.36%
24 Oct	07:59	08:38	3	6	1	33.33%

Shiny Cowbird (*Molothrus bonariensis*, hereafter cowbird) nestling.

METHODS

We conducted our observations at the campus of the Federal University of São Carlos, an urban but relatively green area, in São Paulo state, southern Brazil. The thrush nest was built on an edifice of the university library (21°58'58"S, 47°52'58"W), 3.5 m above the ground, and close to the ceiling. Pale-breasted Thrushes are medium-sized, omnivorous passerines (ca. 22 cm in length) that inhabit a variety of environments including riparian forests and urban areas (Ridgely & Tudor 1994, Sick 2001). The nest was also attended by a Rufous-collared Sparrow, a small granivorous passerine (ca. 15 cm in length) that inhabits grasslands, open woodlands, and urban areas (Sick 2001, Carro & Fernández 2013). Both species, among dozens of others in the study area, are hosts of the brood parasitic Shiny Cowbird (Lowther 2011).

We detected the sparrow delivering food to the thrush brood on 21 October 2014, when the nest contained three well-feathered nestlings, of which one was a cowbird. We observed the nest for a total of 320 min on 23 October 2014 (07:10–09:10 h and 15:12–17:12 h) and 24 October 2014 (07:18–08:38 h), and compared the number of visits for each adult species along each 40-min interval, defined according Sturges' rule (Sturges 1926). During these observations, we also quantified the frequency of aggressive behaviors by thrushes against the sparrow. For this purpose, we considered an aggressive behavior when one of the thrushes flew towards the sparrow, expelling it from his perch. We carried out additional observations every 2–3 days between 25 October 2014 and 7 November 2014 in order to check if both species continued to feed the cowbird fledgling (see below the fate of the brood). Both sparrow and thrush are sexually monomorphic species, and we

were not able to determine the sex of each adult. However, we never saw more than one sparrow at the same time in the vicinity of the nest during all observation periods. Thus, we assume that there was only one sparrow feeding at this nest. Feeding-rate data were not normally distributed (Anderson-Darling test, $P = 0.009$), so we compared the ranked median contributions of the sparrow and the average contribution for both thrushes combined with a non-parametric Mann-Whitney U -test adjusted for ties ($\alpha = 0.05$). We conducted analyses using the software R (R Core Team 2011).

RESULTS

The sparrow visited the nest 7.31 ± 3.62 (mean \pm SD) times per hour, while each thrush visited the nest 4.78 ± 1.55 times per hour (Table 1). The median feeding rate of the sparrow was not significantly different compared to the combined median rate of the nest owners (Mann-Whitney U -test adjusted for ties, $U = 47.5$, $W = 83.5$, $P = 0.110$). All three adults, including the sparrow, performed the same tasks, removing fecal sacs from the nest and feeding all the nestlings (Figure 1).

We witnessed aggressive behaviors by the thrushes against the sparrow 20 times (Table 1). The owners chased the helper from the nest 12 times, and from nearby perches 8 times, preventing it from delivering food to the offspring. Sometimes, the sparrow waited for several minutes near the nest with arthropods in its bill, while the thrushes fed the nestlings. After the thrushes left the nest vicinity, the sparrow delivered its food item to the brood. We observed a difference in the type of food brought to the nest by parents (fruits, mainly mulberry) and the sparrow (small arthropods).

The cowbird left the nest on 23 October 2014, between morning and evening observations, and both thrush nestlings remained in the nest. The sparrow continued visiting the nest, 6.30 ± 3.42 times per



Figure 1. An adult Pale-breasted Thrush (*Turdus leucomelas*) feeding the Shiny Cowbird (*Molothrus bonariensis*) nestling (A), and the helper (*Zonotrichia capensis*) removing a fecal sac (B), feeding the parasite (C) and the owner's nestlings (D). Pictures taken at Federal University of São Carlos, São Paulo state, Brazil on 21 (A), 22 (B and C) and 24 October 2014 (D) by AFB.

hour after the cowbird fledged, feeding the thrush nestlings and removing fecal sacs. The sparrow also continued to feed the cowbird fledgling, which remained in the area, a few meters away from the nest.

The thrush nestlings were predated before fledging, on the morning of 24 October 2014, at 08:32 h, by a Roadside Hawk (*Rupornis magnirostris*), after the parents attempted to expel the predator during two minutes. During additional observations every two–three days after this date, both thrushes and the sparrow were seen feeding the cowbird until 3 November 2014, but feeding rates were not quantified.

DISCUSSION

There are reports of *Turdus* sp. and other members of the family Turdidae involved in cases of IPC (e.g., Govoni et al. 2009, Kristin 2009, Schaeffer et al. 2009, Halley & Heckscher 2013), but this is to our knowledge the first report of a Pale-breasted Thrush nest attended by a heterospecific adult. No record of cooperative or polygamous parental care was documented in a study of the nesting biology of the Pale-breasted Thrush (Davanço et al. 2013), but video cameras were not used and some nests were attended by non-banded birds, which may have precluded the recruitment and the detection of intraspecific helpers (e.g., Goetz et al. 2003, Halley &

Heckscher 2016). Nevertheless, the “sexual solicitation hypothesis” proposed by Halley & Heckscher (2013), in which a female inadvertently recruits one phylogenetically close-related heterospecific male instead of a conspecific helper, is unlikely to explain our observations because the Pale-breasted Thrush and the Rufous-collared Sparrow are phylogenetically distant (Jønsson & Fjeldså 2006).

In some reported cases of IPC, interspecific helpers visit the nest sporadically (Kristin 2009, Heber 2013). However, in our study the number of visits did not differ among helper and owners, similarly to previous reports (Yoerg & O’Halloran 1991, Schaeffer et al. 2009, Halley & Heckscher 2013). Aggressive behaviors by the owners did not dissuade the heterospecific helper, as documented in some other IPC cases (e.g., Yoerg & O’Halloran 1991, Masuda 2011; but see Halley & Heckscher 2013, Heber 2013). The difference we observed about the type of food offered by parents and by the helper was also reported in other IPC studies (Farmer et al. 2008, Kristin 2009).

Our observation may have been a hormonal byproduct of the loss of the sparrow’s own offspring, as suggested as an explanation for the appropriation by one Eared Dove (*Zenaida auriculata*) of the nestlings of Creamy-bellied Thrush (*Turdus amaurochalinus*) (Segura et al. 2016). However, we did not find any inactive sparrow nest near the thrush nest. Although the nesting history of the concerning sparrow individual is unknown, Rufous-collared Sparrow

ests are frequently parasitized by Shiny Cowbirds in our study site (AFB unpubl. data), and elsewhere in southeastern Brazil and other South American countries (Sick 2001). Thus, it is possible that the sparrow had fed cowbird nestlings before, and its attention was drawn to the nest due to familiarity with its vocalizations (see Shy 1982), but we have no data to support this hypothesis. A similar approach has been used to explain IPC by an Eastern Towhee (*Pipilo erythrophthalmus*) at a nest of Wood Thrush (*Hylocichla mustelina*) that contained a parasitic Brown-headed Cowbird nestling (*Molothrus ater*), in an area where both species are regularly parasitized (Schaeffer et al. 2009).

Long duration IPC reports as documented here (≥ 14 days) are not common in the literature, being detected through the fledgling stage in only 10% of the reports listed the review by Shy (1982). Over a prolonged period, the intensification of parental activity at a nest may increase the risk of nest predation (Skutch 1949, Francisco 2006, but see Segura & Reboreda 2012). Increasing activity at nests attended by heterospecific adults may be disadvantageous for the nest owners if an increase in predation risk outweighs the benefit of augmented parental support (Yoerg & O'Halloran 1991).

To our knowledge, this study is the first report of IPC in South America, the first involving these bird species, and the first where the helper was detected feeding two heterospecific species at the same time in different stages (as fledglings and nestlings). Similar to Schaeffer et al. (2009), we hypothesize that the occurrence of a brood-parasitic nestling in the attended nest, a species known to parasitize both helper and nest owners, may have been among the main proximate causes of the IPC we observed.

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