

Parental care of the Black-capped Tanager (*Tangara heinei*) in northeastern Ecuador

CUIDADO PARENTAL DE LA TANGARA CABECINEGRA (*TANGARA HEINEI*) EN EL NORORIENTE DE ECUADOR

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Abstract

The Black-capped Tanager (*Tangara heinei*) is a common resident in the northern Andes; however, the breeding biology of this species remains poorly described. Here we present the first quantitative analysis of incubation behavior and parental care in this species using a videotaped nest in northeastern Ecuador. Our data show biparental care in *T. heinei*, and we also document the contribution of each adult to parental care in this sexually dimorphic species.

Keywords: Andes, breeding biology, incubation behavior, *Tangara heinei*, Thraupidae

Resumen

La Tangara Cabecinegra (*Tangara heinei*) es un residente común de los Andes de Colombia y Ecuador. Sin embargo, la biología reproductiva de esta especie es poco conocida. Presentamos el primer análisis cuantitativo sobre el comportamiento de incubación y el cuidado parental, en base a información obtenida de un nido grabado con video cámara en el nororiente de Ecuador. Los datos obtenidos sugieren que hay cuidado biparental en *T. heinei*; así mismo, documentamos la contribución de cada adulto al cuidado parental en esta especie sexualmente dimórfica.

Palabras claves: Andes, biología reproductiva, comportamiento de incubación, *Tangara heinei*, Thraupidae.

Introduction

The Black-capped Tanager (*Tangara heinei*) is a monotypic species distributed from Venezuela to northern Ecuador (Isler & Isler 1987) and is resident on Andean slopes from 1000-2700 m.a.s.l., where it is often associated with forest disturbance (Isler & Isler 1987, Ridgely & Greenfield 2001). *T. heinei* is also one of the few *Tangara* species that exhibits clear sexual dimorphism (Isler & Isler 1987).

While the nest and eggs of *T. heinei* have been described by multiple authors (Ewert 1975, Greeney & Nunnery 2006, Arcos-Torres & Solano-Ugalde 2007, Greeney *et al.* 2008b), published observations of parental care are few. Ewert (1975) observed a female gathering nesting material and both adults molding material into a nest. More recently, Greeney *et al.* (2008b) observed a *T. heinei* nest where the male did not provide any assistance during construction.

In all *Tangara* species studied, both parents provision

the young with insects and fruits (Isler & Isler 1987, Skutch 1954, 1981). Quantitative behavioral data, however, are rare (but see Skutch 1954, Skutch 1981, Gelis *et al.* 2006, Sheldon & Greeney 2007). Here we present the first quantitative analysis of incubation behavior and parental care in *T. heinei*.

Methods

We made all observations at the Yanayacu Biological Station and Center for Creative Studies (00°35 S, 77°53 W, 2100 m.a.s.l.), located 5 km west of Cosanga, adjacent to Cabañas San Isidro, Napo Province, Ecuador. For more complete descriptions of the study area, see Valencia (1995), Greeney *et al.* (2006), and Guayasamin *et al.* (2006).

We carried out all observations at one focal nest (Fig. 1), found on the morning of 8 February 2007, and located near a heavily traveled footpath. While we consider it unlikely that human activity affected the nest's ultimate fate, human presence did affect some

incubation and brooding behaviors. We videotaped the nest from 9 February to 6 March, placing the camera on a tripod 10 m from the nest. We recorded 133.75 h of video; 79 h during the incubation stage (10-24 February) and 53.75 h during the nestling stage (25 February - 6 March). On 6 March, the female did not brood during a strong rainstorm. The soaked nestlings quickly became

inactive, neither vocalizing nor moving, and, although the adults returned to the nest with food items several times that afternoon, the nestlings died before nightfall. The last 6.5 h of nestling video, documenting the nestlings' death, were omitted from our analysis of feeding behavior.



A.



B.

Figure 1. Two nests of *Tangara heinei* in northeastern Ecuador. A) shows a typical *T. heinei* nest at this site, heavily decorated with lichen on the outside, while B) is a different nest at the same site, constructed with a greater amount of moss. A) is also the nest studied in this paper (Photos: HFG).

Results

Incubation. The female laid eggs on consecutive mornings (10 and 11 February 2007, at 06:28 h and 06:44 h respectively). She incubated briefly on three occasions on 10 February for a total of 41 minutes, but did not spend the night on the nest; regular incubation began on 11 February after she laid the second egg. The female slept on the nest the night of 11 February and all subsequent nights until the nest's failure.

The incubation period lasted 13.5-14 days; during this period the female incubated for 63.2% of the time. Over half of her incubation bouts were affected by human activity, usually people walking along the path near the nest and flushing the female. After removing pre-maturely terminated incubation sessions, the average bout of attendance was 14.7 ± 9.6 m ($n = 121$). Before departing, the female usually sat up in the nest and stretched her wings and legs, especially after longer bouts (>10 m). While preening and stretching, we once observed the female scratch her neck with foot extended over wing.

We quantified the following nest maintenance behaviors during the incubation period, all performed exclusively by the female: bill-probing into the nest, adjusting nest material, and pressing her body into the nest. The female probed her bill into the nest 4.35 times/h ($n = 346$). She also adjusted nest material 0.35 times/h ($n = 28$) and lowered her body into the nest, pressing her breast into the eggs and quivering slightly 0.31 times/h ($n = 25$). The female put her head into the nest, during which we were unable to determine her exact behavior, an additional 2.09 times/h ($n = 166$).

The male occasionally fed the incubating female ($n = 15$, 0.19 times/h). He always perched on a vertical stem above the nest, craning his neck downwards to feed his mate. He generally fed small, unidentifiable items; on at least one occasion he fed mashed fruit to his mate. The female also ate small insects off the nest rim four times during incubation.

Nestling provisioning. The nestlings hatched between 14:16 h on 24 February and 11:05 h on 25 February, after which both adults began to provision the nestlings. The adults fed the nestlings at an overall rate of 5.95 feeds/nestling/h. The female brought food 46.9% of the time ($n = 268$), usually settling down to brood after feeding (brooding after 75.7% of feeds, $n = 203$). The

male brought food 53.1% of the time ($n = 304$), perching on a vertical stem above the nest and leaning down in the same manner as described for mate feeding. He generally fed the nestlings directly (73.4%, $n = 222$), but sometimes passed food to the brooding female (26.6%, $n = 81$). After this, both adults ($n = 49$), the female alone ($n = 29$), or the male alone ($n = 3$) passed food to the nestlings. On two occasions the female ate the male's food without provisioning the nestlings. Feeding rate was not significantly related to time of day or nestling age during this study.

Adults fed both insects and fruit to the nestlings, but their diet could not be fully analyzed, due to the very small size of food items. We were able to identify 67 (11.7%) food items. Nearly all of the identified items were fruit, and included 31 whole berries, delivered singly, and 30 chunks of a pale mush (estimated mean size: 2 cm) probably consisting of mashed cecropia fruit. The adults also fed six unidentified insects (estimated mean size: 1.5 cm) to the nestlings. On 25 February, the presumed day of hatching, adults regurgitated meals to the nestlings.

Nestlings produced fecal sacs in the presence of adults, generally after a meal (mean fecal sac production = 1.79 fecal sacs/nestling/h, $n = 170$). The female disposed of the majority of fecal sacs (72.4%, $n = 123$), eating 76.4% ($n = 94$) at the nest and carrying the rest away. The male carried most of the fecal sacs he disposed of away from the nest (83%, $n = 47$).

Brooding behavior. The female brooded 47.2% of the time (234 bouts, range = 1-34.8 m). Around a quarter of these brooding bouts were affected by human activity, and after removing prematurely-terminated bouts, the average brooding session lasted 7.5 ± 3.4 m ($n = 178$). Brooding rates appeared to be independent of both time of day and nestling age during the course of the study.

We also quantified nest maintenance behaviors during the nestling stage. The female probed her bill into the nests' contents 1.1 times/h ($n = 53$). The other quantified nest maintenance behaviors, adjusting nest material and pressing her body into the nest, were extremely infrequent during the nestling period (<0.05 times/h). Additionally, we observed the female engage in rapid probing 1.7 times/h (average duration = 1.9 ± 0.94 s, $n = 80$). Rapid probing, also called "tremble thrusting," occurs when a bird probes its' bill into the nest's contents in a fast series, reminiscent of the motion of a

sewing machine's needle. Half the rapid probing events occurred in the middle of a brooding bout; the rest occurred either directly after feeding or immediately preceded the female's departure after a brooding bout.

Other observations. On 4 March, the female, while brooding eight-day-old nestlings, displaced an Azara's Spinetail (*Synallaxis azarae*) near the nest. At 15:20 h, a *S. azarae* adult arrived and perched 15 cm below the nest. The brooding female tanager responded by suddenly raising her wings and, while remaining on the nest, jerked her body down towards the intruder. The *S. azarae* promptly left, and apparently did not return. On two occasions, the brooding female slowly sank into the nest cup until she was barely visible above the nest rim. On one of these occasions a group of Green Jays (*Cyanocorax yncas*), presumably a potential nest predator, was audible in the background.

Discussion

Our study included the entire incubation period and first ten days of the nestling period of *T. heinei*, until the nestlings' premature death. The nestling period in other *Tangara* averages 14-16 days (Isler & Isler 1987), suggesting that we observed the majority of the nestling stage.

The *T. heinei* we studied were broadly similar in their breeding biology to the handful of other *Tangara* species for which data are available (Skutch 1954, Skutch 1981, Gelis *et al.* 2006, Sheldon & Greeney 2007). There were, however, several behaviors which differed from other *Tangara*. Additionally, the obvious sexual dimorphism of *T. heinei* allowed us to unambiguously partition the relative contributions of the male and female adults, generally difficult or impossible to do with most *Tangara* species.

We present one of the largest datasets describing incubation in *Tangara* that we are aware of. Although incubation behavior was sometimes affected by human activity, overall percentage of time spent incubating and duration of incubation bouts are similar to Skutch's briefer observations of several *Tangara* spp. in Costa Rica (1954, 1981). We also confirmed that only the female incubates and broods.

There appears to be more variation within *Tangara*, however, in brooding behavior. At the extremes are the Bay-headed Tanager (*Tangara gyrola*) with brooding

bouts of 62-123 m (Skutch 1954), and the Beryl-spangled Tanager (*Tangara nigroviridis*) with average brooding bouts of 1.9 m and daily brooding rates of 0.6 – 6.0 % (Sheldon & Greeney 2007). The *T. heinei* we studied exhibited intermediate levels of brooding; average bouts lasted 7.5 ± 3.4 and daily brooding rates averaged 47.2%. These bout lengths and daily brooding rates are generally similar to several *Tangara* studied by Skutch (1954, 1981). As local weather likely affects these behaviors, and sample sizes are low for all species, it remains to be seen whether these patterns will hold during further studies.

In comparison to the incubation period, during the nestling period the female engaged in much fewer nest maintenance behaviors (for example, bill probing into the nest: 1.1 times/h during nestling period, 4.35 times/h during incubation). This relative inattention to nest maintenance may have been offset by rapid probing, a female behavior we observed only during the nestling stage (1.7 times/h). Although this behavior has now been documented for a large variety of taxa (Haftorn 1994, Greeney *et al.* 2006), its exact function in nest maintenance remains uncertain (Greeney *et al.* 2008a). Nevertheless, the association of rapid probing with the nestling stage in *T. heinei* strongly suggests a nestling-associated function for this behavior in this species, perhaps associated with removing parasites or shaking detritus from the nest.

Although helpers at the nest have been observed in seven *Tangara* species to date (Skutch 1961, Long & Heath 1994, Gelis *et al.* 2006), we observed only two adults provisioning nestlings in our study. Both adults shared nearly equally in provisioning nestlings, similar to previous studies where the adult's sex could be determined (Skutch 1954, Skutch 1981). However, the two adults fed nestlings independent of one another, similarly to *T. gyrola* (Skutch 1954). This contrasts with the more typical *Tangara* pattern, where the pair arrives together to the nest and feeds the nestlings sequentially (Skutch 1954, Skutch 1981, Sheldon & Greeney 2007). Additionally, feeding rates were not correlated with time of day (e.g. were not higher in the morning) as has been reported for other *Tangara* (Skutch 1954, Sheldon & Greeney 2007). We were able to classify 11.7% of food items fed to nestlings; this included 31 berries, 30 bill-fulls of mashed fruit, and six unidentified insects (mean estimated size = 1.5 cm). Identified food items were large, while the majority of food items fed to nestlings were very small. Although this may have created a bias

against observing small insect food items, we suggest that fruits comprise a significant component, and perhaps a majority, of the nestlings' diet in *T. heinei*. In addition, adults clearly regurgitated food to day-one nestlings, a behavior not reported by Skutch (1954, 1981), even during observations of recently hatched nestlings.

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