

Feeding of nestlings of the Amazonian Motmot (*Momotus momota*) in southern Goiás, Brazil

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ABSTRACT: In this study, the provisioning of nestlings by a monogamous pair of *Momotus momota*, living in the urban area of Morrinhos, Goiás, Brazil, was studied. The male and female fed the nestlings throughout the day, but with greater intensity during sunrise. One of them devoted twice as much effort than his mate to this activity. Food items offered to the nestlings were usually insects, small vertebrates, fruits, and other invertebrates.

KEY-WORDS: Parental care, daily activity, nestlings, diet, urban environment.

Reproductive effort is defined as part of the energy spent during a period of time in the life of an organism that is devoted to reproduction (Hirshfield & Tinkle 1975). In birds, this energy can be allocated to sex-specific activities such as egg-laying in females, mating rituals in males, and activities that can be shared by both sexes, such as nest building, incubation, and feeding and defending young. The degree of parental investment in performing these tasks depends on the mating system, with greater dedication expected of males in parental care in social and/or genetic monogamous reproductive systems of tropical birds (Stutchbury & Morton 2001). Motmotidae comprises a monophyletic group of six genera and ten species of Neotropical birds recognized by simple song, bright plumage, lack of sexual dimorphism (Snow 2001), and monogamy (Murphy *et al.* 2010). These birds dig tunnels through earth banks to incubate between two to six white eggs (Snow 2001), feeding mainly on insects, small vertebrates and fruits (Orejuela 1980, Remsen *et al.* 1993). *Momotus momota* is a large motmot with a wide distribution in South America, inhabiting forests near watercourses for nesting (Melo & Piratelli 1999). Few studies have been conducted on reproduction and provisioning of nestling motmots in Brazil (Alves *et al.* 1999, Piratelli *et al.* 2000).

This study was conducted in an urban area of Morrinhos (17°73'42"S, 49°09'94"W), southern Goiás, Brazil. More than half of the municipal area was occupied by pastures, leaving only 17% native vegetation, mainly

of the Cerrado biome (Martins *et al.* 2009). The local climate is characterized by a cool period from May to August (20.85 ± 1.10°C, mean ± SD), and a hot period from September to April (24.33 ± 0.81°C). Rainfall is high from November to March (241.07 ± 32.50 mm), low from May to August (9.57 ± 1.44 mm), and intermediate in April, September and October (77.34 ± 13.46 mm) (Pesquero *et al.* 2012).

We estimated the dedication of a *M. momota* pair during the feeding of three nestlings for six alternate days between October 19 and November 8, 2008, from 6:15 am to 7:15 pm (DST), totaling 84 h of observation. The birds dug a 2.46 m long nest on the bank of a cistern in the backyard of a residence. The number of nestlings and the length of the nest were measured using a 3 m probe attached to a netbook (Figure 1). Observations began after the incubation period, when parents entered the nest only to deliver food to the nestlings. Binoculars (7 × 25 mm) were used to recognize parents and food types when parents perched on a wall before entering the nest at a maximum distance of 5 m from the observer. Timepoints in which parents entered the nest to feed the nestlings were recorded for parental dedication analysis.

Several times a day, parents entered the nest to feed the nestlings, preferably during the first three hours after sunrise, corresponding to a 4.14 ± 0.71 / hour (mean ± SE) encounter rate of food compared with 3.02 ± 0.23 / h during other periods of the day (t = 1.95, df = 69, P = 0.054) (Figure 2). The reason for the non-significant

outcome should be the delayed onset of observations (6:15 am) in relation to sunrise (5:44 am to 5:34 am), underestimating foraging activity in the early morning.

Although sexes were not recognized, parents were morphologically distinguished from each other by the presence or absence of a spot on the chest. The spotted bird fed the nestlings twice as much as the mate (Figure 2). It was present for 67 of the 84 h of observation, compared to 46 h of the mate's activity ($\chi^2 = 11.92$, $P < 0.001$); entered the nest to feed the nestlings 150 times, while his mate entered only 80 times ($\chi^2 = 21.30$, $P < 0.00001$); and its rate of food delivery per hour was twice as much as the mate's (2.10 ± 0.17 and 1.01 ± 0.15 , respectively, $t = -4.78$, $df = 140$, $P < 0.00001$).

The nestlings' diet was mainly composed of insects, including slugs, snails, worms, millipedes, woodlice, spiders, dragonflies, cockroaches, grasshoppers, mantes, frogs, lizards, and small fruits (Figure 3A). The most common insects were Lepidoptera (40% young and 60% adults), Coleoptera, and Orthoptera (Figure 3B).

The dedication of parents to feeding activity decreased as the lifetime of nestlings progressed (Figure 4), but this relationship was not significant ($r_s = -0.77$, $t = -2.42$, $P = 0.07$). On November 9 and 10, 2008 three nestlings left the nest. They had a single pectoral spot, 24.6 ± 0.6 cm mean length, and 95.37 ± 6.59 g mean weight (mean \pm SE).

The occurrence of *M. momota* is expected for the central region of Brazil, but the pair observed during this study had distinctive specific stains (Stiles 2009), such as a greenish breast, ocher abdomen, violet posterior region of the crown, and the absence of an ocher stain close to the neck. Interestingly, there are no records regarding adult motmots without a pectoral spot, or records on the relationship of this trait with sexual dimorphism.



FIGURE 1. Probe attached to a netbook used to visualize the *Momotus momota* nestlings.

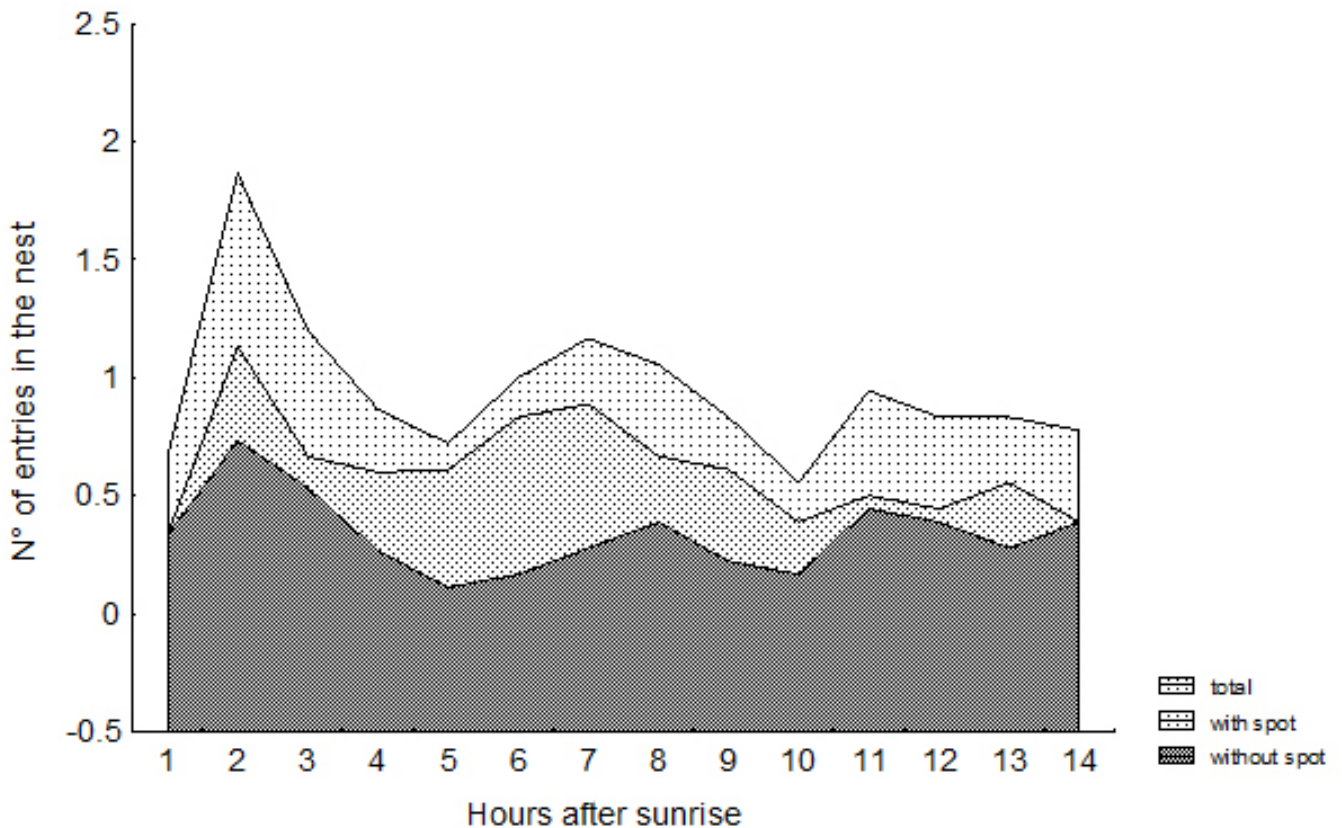


FIGURE 2. Average number of feeding visits to the nest carried out by a pair of *Momotus momota* throughout the day.

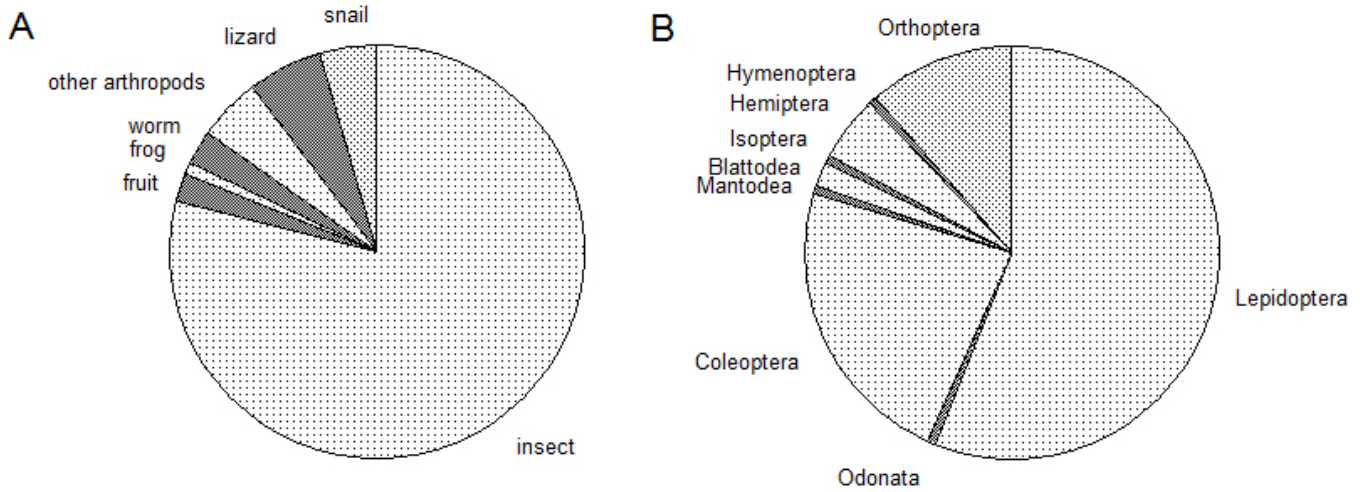


FIGURE 3. Kinds of food brought into the nest by the couple of *Momotus momota*. A) All foods. B) Insects.

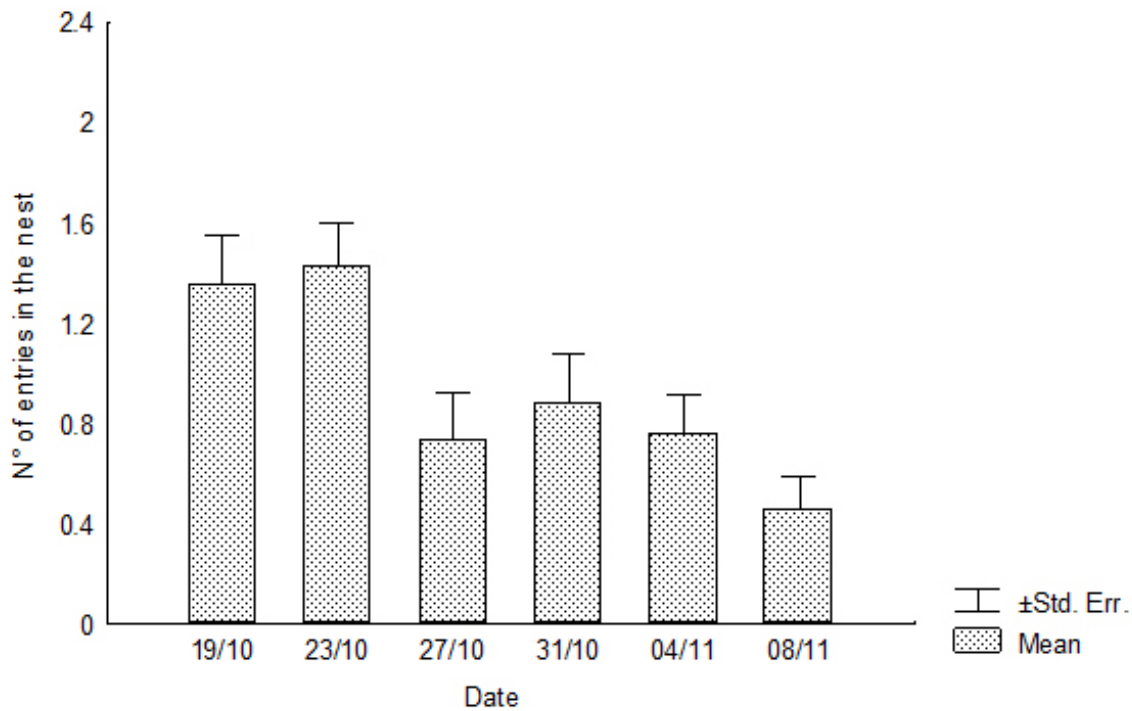


FIGURE 4. Average number of feeding visits to the nest carried out by a pair of *Momotus momota* throughout the days.

The breeding observed here occurred in the rainy season, similar to other studies on motmot birds (Skutch 1971, Alves *et al.* 1999, Piratelli *et al.* 2000). In seasonal climates, the rainy season favors the growth and reproduction of arthropods, which is very common in the diet of motmots (Alves *et al.* 1999, Melo & Piratelli 1999). The nestlings' diet was composed predominantly of insects, small vertebrates and fruits, similar to the omnivorous diet of adult birds (Orejuela 1980, Remsem *et al.* 1993, Piratelli & Pereira 2002). Unlike forest environments where the insects most commonly offered to the nestlings of *Electron platyrhynchum* (Skutch 1971) are cicadas, Lepidoptera was the most offered insect to

nestlings during the six days of observation in an urban area. However, the rate of food delivery to nestlings was not constant over time. This can indicate paternal encouragement for nestlings to leave the nest.

The prevalence of adult activity during the first hours of the day was described for *M. momota* and *Eumomota superciliosa* (Sandbach 1837) (Orejuela 1980, Melo & Piratelli 1999), and the authors attribute them to satiety and physiological limitation. Both sexes fed the nestlings as expected for monogamous birds of tropical climate (Stutchbury & Morton 2001), yet one individual devoted more time than the mate to this activity. Although Skutch (1947) did not recognize the sex of the parents, he reported

that *E. superciliosa* presented unequal division of labor in digging nest tunnels. Males and females of *Baryphengus ruficapillus* (Vieillot 1818) have also presented unequal dedication during the provisioning of nestlings (Alves *et al.* 1999); and observations of the species made by Orejuela (1977) suggest that motmot females are more devoted to parental care.

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