

Article

Reproduction of the Seven-Coloured Tanager (*Tangara fastuosa*) in the Atlantic Forest of North-Eastern Brazil

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Simple Summary

Understanding the breeding biology of a species enables us to understand its population dynamics, allowing us to plan accurate conservation strategies. However, there is a lack of information on the breeding biology of many bird species, especially in the Neotropics. The Seven-coloured Tanager (*Tangara fastuosa*) is a neotropical bird species vulnerable to extinction. Little information is available on its breeding biology. Between 1987 and 2025, we studied 29 nests around the Pedra Talhada Biological Reserve in Quebrangulo, Alagoas, north-eastern Brazil. We recorded the location, shape, size and weight of the nests, as well as the clutch size, egg size and weight, the incubation and nestling periods and nest success rate. Nest success, defined as the proportion of nests where at least one juvenile fledged, was 51.7%, with predation being the main cause of nest failure. Parents, sometimes assisted by nest helpers, fed the nestlings with small fruits, fruit pulp, seeds, and various arthropods. Our records provide new information on the reproduction of this species, which could help protect it against deforestation and capture for the illegal animal trade, both which remain an issue in the study area.

Abstract

The Seven-coloured Tanager *Tangara fastuosa* is a threatened species, with little data available on its reproduction. Between 1987 and 2025, 29 nests were found around the Pedra Talhada Biological Reserve in Quebrangulo, Alagoas, north-eastern Brazil. Nests were cup-shaped, with average external dimensions of 11.0 × 7.3 cm and average internal dimensions of 6.2 × 3.7 cm. They were built at an average height of 5.4 m above ground. Mean clutch size was 2.7 eggs, which measured 20.9 × 15.6 mm, and weighed 2.6 g. Eggs were beige in colour with greenish undertones and were heavily spotted with purple or rusty brown. Average incubation period was 13.8 days, and average nestling period was 15.4 days. Apparent nest success was 51.7%, with predation being the main cause of nest failure. Parents, sometimes assisted by helpers, fed the nestlings with small fruits, fruit pulp, seeds, and various arthropods. Our records provide new information on the reproduction of this species in interior and edge forests. However, forest destruction and capture for the illegal wildlife trade pose a threat to the survival of its populations, both remaining an issue in the study area.

Keywords: reproductive biology; incubation; nestlings; nest success; neotropical bird; avian reproduction; life history



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1. Introduction

Understanding the natural history of birds is crucial for comprehending their reproductive patterns and for implementing effective conservation actions to protect species and their habitats [1–4]. However, information on the reproduction of many species is still lacking, especially in the Neotropical region, which is home to the greatest avifaunal diversity on the planet [3,5–9]. Data on breeding biology is often limited and insufficient, both for threatened and endemic species, as well as for species with a wider geographical distribution [5,6,9].

The genus *Tangara* belongs to the Thraupidae family and comprises 25 species [10]. Early classifications grouped the Seven-coloured Tanager *Tangara fastuosa* (Lesson, 1831) with the Green-headed Tanager (*T. seledon*) and the Paradise Tanager (*T. chilensis*), based on plumage colouration [11]. However, recent phylogenetic analyses show that *T. chilensis* is not closely related to these two species [12]. *T. fastuosa* and *T. seledon* form sister clades, and are closely related to the Brassy-breasted Tanager (*T. desmaresti*), the Red-necked Tanager (*T. cyanocephala*), and the Gilt-edged Tanager (*T. cyanoventris*) [12–14]. These five species inhabit the Brazilian Atlantic Forest, and are likely descended from a single ancestral species that also inhabited this region [12,14].

T. fastuosa is endemic to the Atlantic Forest in north-eastern Brazil, with a geographical distribution restricted to the states of Alagoas, Pernambuco, and Paraíba [15,16]. It inhabits forests, particularly along edges and in clearings, as well as secondary growth forests, orchards, and the backyards of houses near forests [16].

T. fastuosa usually moves in groups of two to four individuals, though occasionally in groups of up to twelve (*pers. obs.*), often alongside other species in mixed flocks [16]. Its diet mainly consists of fruit, but it also feeds on arthropods captured in the tree foliage and on petals from guava and *jambeiro* (Myrtaceae) inflorescences [16,17]. The main fruit sources for this species are *Miconia* sp. (Melastomataceae), *Cecropia* sp. (Cecropiaceae) and *Schefflera morototoni* (Araliaceae) [16,17], but it also consumes cultivated fruits such as guava, banana, papaya and small red peppers (*pers. obs.*). Small fruits are swallowed whole, while larger ones are pecked at [17].

T. fastuosa is classified as vulnerable on both the IUCN Red List of Threatened Species and the Red List of Brazilian Birds [18,19]. This classification is primarily due to population decline and habitat loss and fragmentation, as well as trapping for the illegal wildlife trade [16,18,20].

The breeding season mainly occurs during the dry season, from October to April [17], although nest-building has also been observed in June, August, and September [16]. Both parents build the cup-shaped nest in arboreal bromeliads using radicles, bark, vegetable fibres, and green and dried leaves [15,16]. In captivity, the clutch size is from three to four eggs, which are incubated for 15 to 17 days [17]. There is no information on the nestling period or nest success.

Despite being a vulnerable species with a small distribution area, information on its natural history and reproductive habits is scarce. This study aims to describe the reproductive parameters of *T. fastuosa* observed in the Pedra Talhada Biological Reserve, in Quebrangulo, Alagoas, Brazil, and to expand the existing knowledge on the biology of this understudied species.

2. Materials and Methods

Observations of *Tangara fastuosa* nests were carried around the Pedra Talhada Biological Reserve (09°11'–09°16' S, 36°22'–36°28' W), which is located between the municipalities of Quebrangulo (Alagoas), and Lagoa do Ouro (Pernambuco) in north-eastern Brazil. The reserve covers an area of 4469 ha, with its highest point located at around 880 m above

sea level. It is considered a high-altitude wetland—a submontane rainforest formation that survives thanks to the humid local climate [21]. The relief of the Borborema Plateau maintains these favourable climatic conditions by blocking ocean winds and capturing moisture from the air through condensation, which returns in the form of rainfall. For this reason, the medium-altitude landscapes of the Northeast probably served as a floristic refuge for the forests, enabling them to survive during periods of drought [21].

Nest searches were conducted in the southern part of the forest, around the municipality of Quebrangulo (9°26' S, 36°42' W). Data were obtained sporadically and discontinuously throughout the years between 1987 and 2025, when the area was traversed by trails inside and on the edge of the forest. No systematic or regular sampling was carried out over the months or years. Experienced observers conducted measurements following the same protocol across years.

Once individuals or couples had been identified, their behaviour was observed during the nest-building process, as well as when they approached and left the supposed nesting sites [22]. The found nests were then visited and monitored from a distance, daily or every other day. Parameters such as nest position, height above ground, and supporting plant species were recorded. Nest height was visually estimated by an experienced observer using reference objects or, where possible, measured directly with a tape measure. Where possible, nest dimensions were measured with a tape measure (precision to 0.5 cm), while egg dimensions were measured with a 150 mm calliper (precision to 0.1 mm). Mass was measured using a Pesola spring scale (precision to 0.5 g for nests and 0.1 g for eggs). The clutch size, the incubation and nestling periods, the appearance of the nestlings and parental care behaviours were also noted. Naturalistic observations and photographic records were made from a camouflaged hide located three to six metres away.

The incubation period was defined as the time between the laying of the last egg and the hatching of the first offspring. The nestling period was defined as the time between the hatching of the first offspring and the fledging of the last. The breeding period was defined as the interval between the earliest active nest and the latest fledging date recorded. Predation was defined as the cause of nest failure when the nest was found empty before the expected hatching or fledging date. A nest was considered successful if at least one offspring fledged. Apparent nest success was calculated by dividing the number of successful nests by the total number of nests. As nests were found non-systematically, they were not all found at the beginning of nesting, which could result in the under-detection of early failures and overestimation of nest success [23]. We therefore used the Mayfield method to obtain nest success rates based on the number of exposure days, i.e., the total number of days the nests were monitored [23]. It is calculated as the daily survival rate (p) raised to the power of the period length, with $p = 1 - (\text{failed nests} / \text{number of exposure days})$, for the incubation and nestling periods, respectively. The values for each period are then multiplied to obtain the survival rate for the entire nesting cycle.

We conducted an extensive literature review of the four species closely related to *T. fastuosa* (*T. seledon*, *T. desmaresti*, *T. cyanocephala* and *T. cyanoventris*) in order to compare their respective breeding parameters. We also included our own unpublished data on *T. cyanocephala*, which was collected in the same way and at the same location as our *T. fastuosa* data, between 1986 and 2021. Where sufficient data was available (i.e., our own data on *T. fastuosa* and *T. cyanocephala*), we performed statistical analyses in R (version 4.5.2) [24] using the RStudio software (version 2025.09.2.418) [25]. We compared nest characteristics (nest weight, external and internal diameter, external and internal height) using Student's *t*-test or Mann–Whitney U test, depending on data distribution, which was previously assessed with a Shapiro–Wilk test. We compared egg measurements using linear mixed-effects models (function lmer from package lme4 [26]) for each trait (egg weight, length, and

width). The species were used as fixed effect and the nest identity as random effect, to account for the non-independence of eggs within nests.

3. Results

3.1. Breeding Period

A total of 29 nests were found between 1987 and 2025, in the interior, on the edge of the forest and in backyards bordering the forest. The breeding period extended from January to May.

3.2. Nests

The nests had the shape of tall cups (according to [27]), and were located among the outermost leaves of epiphytic bromeliad rosettes, hidden among the fruits of banana bunches, among the leaves and pseudobulbs of an epiphytic orchid, in the interstices of the branches of a regrown *Erythrina* sp. tree or among the branches of a *Coffea* sp. coffee bush (Figure 1). The pair constructed the nest with thin, flexible leaf petioles, rootlets, dry grass straw, various plant fibres, fragments of banana leaves, and thin fragments of tree bark. The nests had average dimensions of 11.0 cm (± 2.4 , $n = 13$) in external diameter, 6.2 cm (± 0.8 , $n = 13$) in internal diameter, 7.3 cm (± 1.2 , $n = 13$) in external height and 3.7 cm (± 0.6 , $n = 13$) in internal height. They weighed on average 17.5 g (± 4.5 , $n = 11$). They were built between 1.5 m and 15 m above ground level, with an average height of 5.4 m ($n = 29$). Nest were mainly located in semi-closed spaces, such as edges and clearings ($n = 15$), but also in open spaces, such as pastures ($n = 7$), in semi-open spaces, such as capoeira and cerrado environments ($n = 5$), but more rarely in closed spaces, such as forests ($n = 2$).

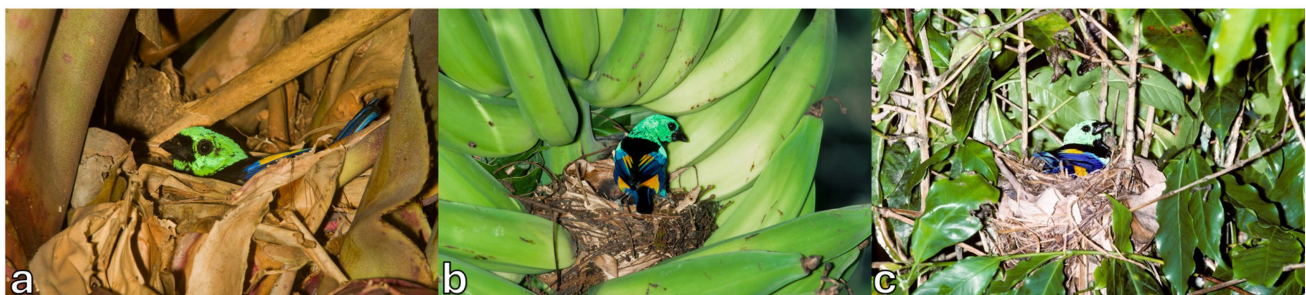


Figure 1. Locations of *Tangara fastuosa* nests: (a) in a bromeliad; (b) in a banana tree; (c) in a coffee tree.

3.3. Eggs and Nestlings

The clutch size was of two to four eggs (mean $\pm$ SD: 2.7 ± 1.1 , $n = 25$). The eggs had an average length of 20.9 mm (± 1.2 , $n = 26$), an average width of 15.6 mm (± 0.9 , $n = 26$) and an average weight of 2.6 g (± 0.3 , $n = 26$). The eggs were shades of beige, with greenish undertones and were heavily stained purple-brown or rusty brown. Sometimes, darker, more concentrated brown spots formed a continuous band around the rhombic pole (Figure 2).

The hatchlings were covered in fine, sparse grey down, that coated their pinkish-grey skin. Their beaks were also grey, with white edges and corners, and their throats were red. As they grew, greenish feathers covered their bodies (Figure 3). When they left the nest, their plumage was greenish, with some dark grey feathers on the head. Over time, they acquired shades of dark green, with bluish and yellow gradations on the wings, and orange feathers grew on their lower backs and rumps.



Figure 2. Eggs of *Tangara fastuosa* in a nest in a bromeliad.



Figure 3. Nestling of *Tangara fastuosa* in a bromeliad nest.

3.4. Incubation and Nestling Period, Nest Success

Of the 29 nests observed, 15 (51.7%) were successful, 11 (37.9%) were predated, one (3.5%) was abandoned, and the fate of two (6.9%) nests is unknown. Of the 12 failed nests, seven failed at the egg stage (six from predation, one from abandonment) and four failed at the nestling stage (predation). The incubation period lasted on average 13.8 days (± 1.3 , $n = 4$) and the nestling period lasted on average 15.4 days (± 0.7 , $n = 11$). The complete nest cycle, from egg laying to fledging, averaged 30 days (± 1 , $n = 3$). The daily survival rate during the incubation period was 0.959, whereas during the nestling period it was 0.984. Therefore, the survival rate for the 13.8-day incubation period was 0.565, and for the 15.4-day mean nestling period it was 0.787. The Mayfield nest success rate was thus 44.4%.

3.5. Parental Care and Feeding

Both parents fed their offspring small fruits (incl. *Miconia* sp.), fruit pulp and seeds, as well as a wide variety of arthropods, such as grasshoppers (Orthoptera), praying mantises (Mantodea), spiders (Araneae) and Hemiptera species (Figure 4). After feeding, the adults would typically remove the nestlings' faecal sacs from the nest. Some helpers were also observed feeding the offspring. This occurred at three nests, with one adult, two adults and one juvenile helper present, respectively (Figure 5). After fledging, the juveniles continued to be fed by their parents for a few more days in the vicinity of the nest.

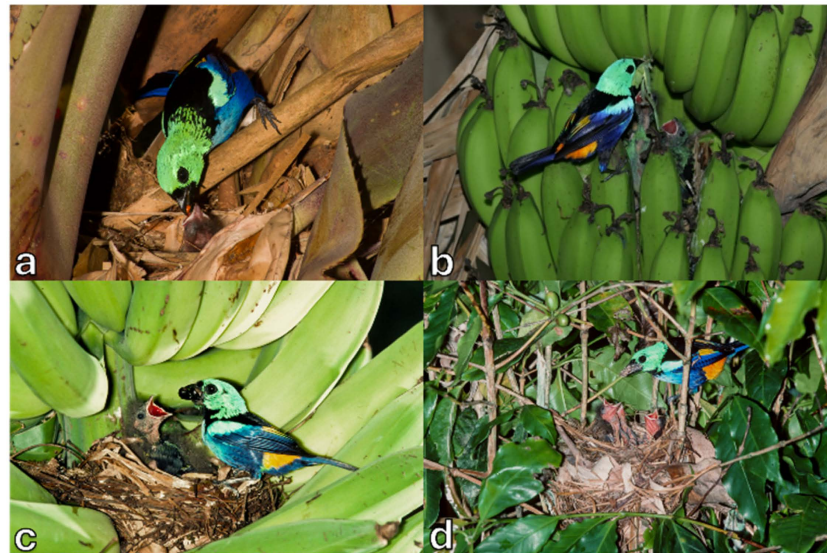


Figure 4. Examples of preys brought to nestlings of *Tangara fastuosa*: (a) a small fruit; (b) Mantodea praying mantis; (c) a dark fruit possibly *Miconia* sp.; (d) a cluster of insects.



Figure 5. Juvenile nest helper of *Tangara fastuosa* feeding nestlings.

3.6. Comparisons with Other Species

When we compared nest parameters between *T. fastuosa* and *T. cyanocephala* (Table 1), we found that nests of *T. fastuosa* were significantly heavier than nests of *T. cyanocephala* (Student's *t*-test: $t_{14.6} = 4.52$, $p < 0.001$, Figure 6a). Similarly, external nest diameter was significantly larger in *T. fastuosa* than in *T. cyanocephala* (Mann–Whitney U test: $W = 228$, $p = 0.02$, Figure 6b). Internal nest diameter was also significantly larger in *T. fastuosa* than in *T. cyanocephala* (Mann–Whitney U test: $W = 249$, $p = 0.002$, Figure 6c), even if the difference was small. No significant differences were found for external or internal nest height (Figure 6d,e). Data for *T. desmaresti* fell within the range of observed values for *T. fastuosa* and *T. cyanocephala* (Figure 6), but were not included in the statistical analyses due to the small sample size ($n = 2$ nests).

Table 1. Nest parameters for *T. fastuosa* and four closely related species. “–” Indicates that no information was found for this parameter in this species. “*” Indicates observations that were made in captivity.

Species	Nest Weight (g)	External Diameter (cm)	External Height (cm)	Internal Diameter (cm)	Internal Height (cm)	Height from Ground (m)
<i>T. fastuosa</i> (this study)	17.5 (± 4.5 , $n = 11$)	11.0 (± 2.4 , $n = 13$)	7.3 (± 1.2 , $n = 13$)	6.2 (± 0.8 , $n = 13$)	3.7 (± 0.6 , $n = 13$)	5.4 (± 3.2 , $n = 29$)
<i>T. fastuosa</i> [15–17]	–	11 ($n = 1$)	7.5 ($n = 1$)	10 ($n = 1$)	7 ($n = 1$)	8–15
<i>T. seledon</i> [11,28]	–	–	–	–	–	1.7–10
<i>T. desmaresti</i> [29]	–	8–9 ($n = 2$)	7 ($n = 2$)	5–5.5 ($n = 2$)	2.5–3.5 ($n = 2$)	2.24–9 ($n = 3$)
<i>T. cyanocephala</i> Studer unpub	10.8 (± 3.0 , $n = 22$)	9.2 (± 1.4 , $n = 24$)	7.1 (± 1.5 , $n = 24$)	5.3 (± 0.6 , $n = 24$)	3.4 (± 0.5 , $n = 24$)	2.8 (± 1.5 , $n = 28$)
<i>T. cyanocephala</i> [11]	–	–	–	–	–	1.8 *

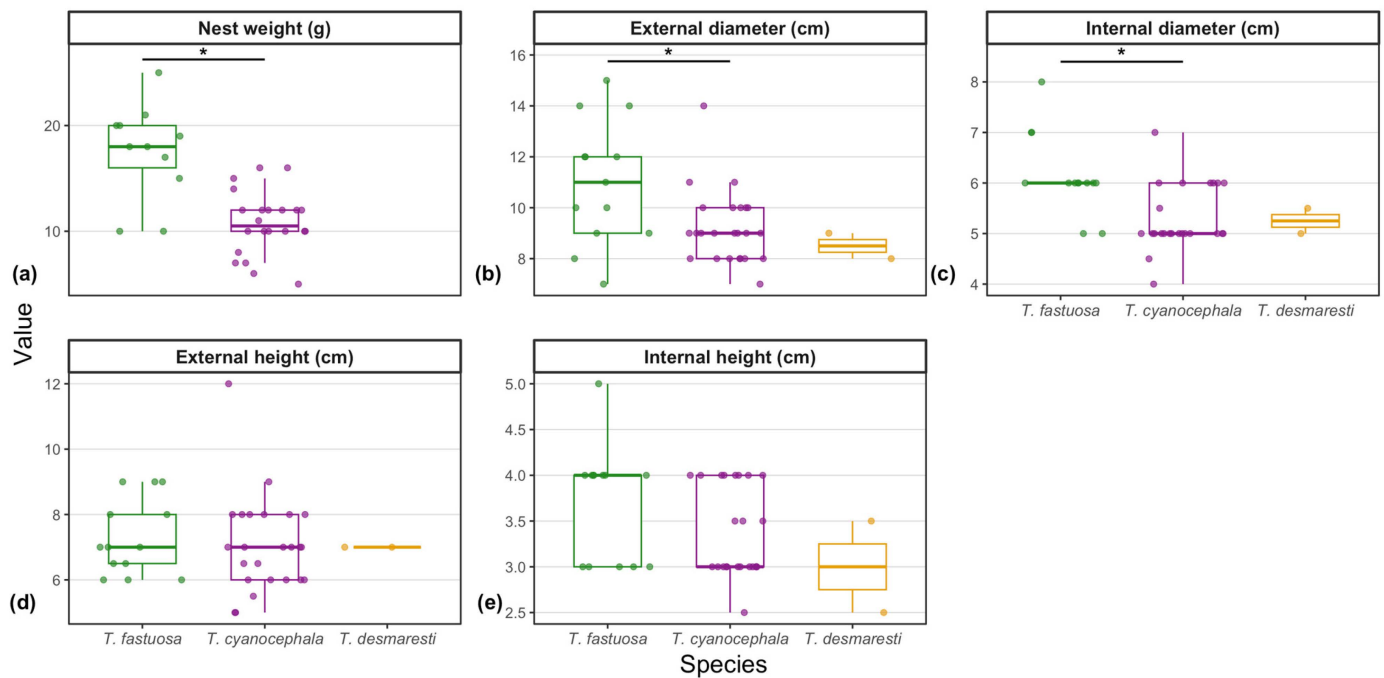


Figure 6. Comparison of nest parameters for the species *Tangara fastuosa*, *T. cyanocephala* and *T. desmaresti*. Boxplots (median and interquartile range) and individual data points are shown for five parameters: (a) nest weight; (b) external diameter; (c) internal diameter; (d) external height; (e) internal height. Asterisks above boxplots indicate significant differences between species based on Student's *t*-test or Mann–Whitney U test.

When we compared egg parameters between *T. fastuosa* and *T. cyanocephala* (Table 2), we found that egg mass differed significantly between species (linear mixed-effects model: $F_{1,20.3} = 29.7$, $p < 0.001$). *T. fastuosa* laid heavier eggs than *T. cyanocephala* (Figure 7a). Similarly, egg length differed significantly between the two species (linear mixed-effects model: $F_{1,21.2} = 18.3$, $p < 0.001$), with *T. fastuosa* laying longer eggs than *T. cyanocephala* (Figure 7b). Egg width also differed significantly (linear mixed-effects model: $F_{1,20.2} = 24.8$, $p < 0.001$), being larger in *T. fastuosa* than in *T. cyanocephala* (Figure 7c).

Table 2. Breeding parameters for *T. fastuosa* and four closely related species. “–” Indicates that no information was found for this parameter in this species. “*” Indicates observations that were made in captivity.

Species	Clutch Size	Egg Size (mm)	Egg Weight (g)	Egg Colour	Incubation Period (Days)	Nestling Period (Days)	Apparent/ Mayfield Nest Success	Breeding Season
<i>T. fastuosa</i> (this study)	2.7 (± 1.1 , $n = 25$)	20.9 (± 1.2 , $n = 26$) $\times$ 15.6 (± 0.9 , $n = 26$)	2.6 (± 0.3 , $n = 26$)	Beige-greenish with purple-brown stains	13.8 (± 1.3 , $n = 4$)	15.4 (± 0.7 , $n = 11$)	51.7%/44.4% ($n = 29$)	Jan–May
<i>T. fastuosa</i> [17]	3–4 *	–	–	–	15–17 *	–	–	Oct–Apr
<i>T. seledon</i> [11,28]	2–3	–	–	Cream-white with brown-grey marks	17 *	30–35 *	–	Oct–Feb
<i>T. desmaresti</i> [11,29]	2/3 *	–	–	White with small light grey spots	12–13	–	–	Jan–Feb
<i>T. cyanocephala</i> Studer unpub.	2.3 (± 0.9 , $n = 24$)	19.8 (± 1.2 , $n = 27$) $\times$ 14.6 (± 0.5 , $n = 27$)	2.1 (± 0.2 , $n = 27$)	Grey-light green with brown, violet and black stains	13 ($n = 1$)	15.2 (± 0.8 , $n = 5$)	21.4%/13.8% ($n = 28$)	Jan–May
<i>T. cyanocephala</i> [11]	3 *	–	–	Cream with brown spots	12–13 *	15 *	–	–
<i>T. cyanoventris</i> [11,30]	2	–	–	–	–	–	–	Oct–Nov

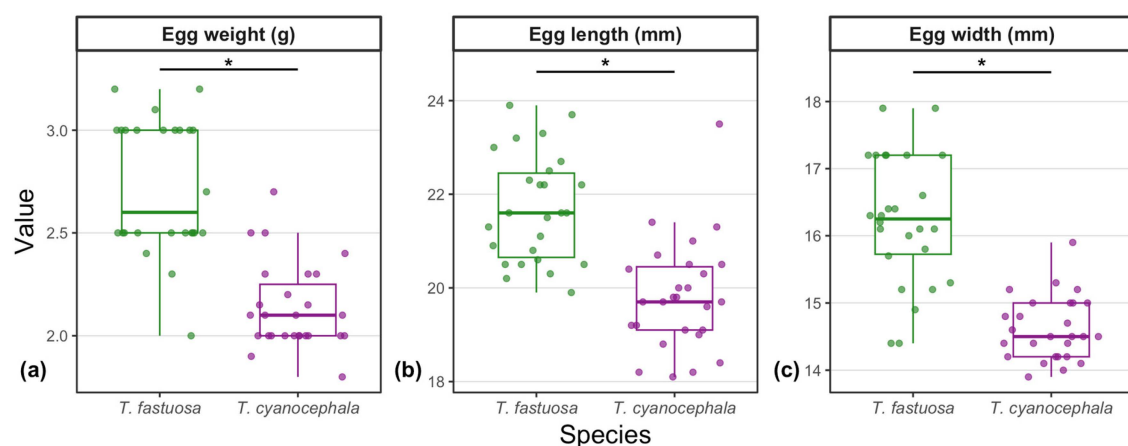


Figure 7. Comparison of egg parameters for the species *Tangara fastuosa* and *T. cyanocephala*. Boxplots (median and interquartile range) and individual data points are shown for three parameters: (a) egg weight; (b) egg length; (c) egg width. Asterisks above boxplots indicate significant differences between species based on linear mixed effect models.

4. Discussion

Our results are based on sporadically collected data, over a 38-year period, with no systematic or regular sampling. This leads to several sources of bias that should be considered when interpreting the results. Nest detection was likely non-random, favouring nests found along trails and nests that were more visible or associated with conspicuous adult behaviour. As a result, nests in dense vegetation, at great heights or in less accessible areas were probably underrepresented [31]. In addition, seasonal bias may be present, with early or late breeding attempts less likely to be recorded, thereby affecting the estimation

of the breeding period. Variation in observer efforts across years introduce temporal heterogeneity, limiting the representativeness of the sample [31]. Taken together, these biases indicate that the dataset likely does not capture the full range of *T. fastuosa* breeding ecology but rather reflects a subset of nesting attempts that were detectable under the observation conditions. Accordingly, our results, as well as comparisons with other species, should be interpreted with caution. Nevertheless, given the scarcity of published information on the breeding biology of *T. fastuosa*, our observations provide valuable baseline data and important insights into its reproductive ecology.

4.1. Breeding Period

We found that the breeding period extended from January to May, which corroborates the findings of Silveira et al. (2003), who observed nests being built in January [16]. In turn, Roda et al. (2011) state that the breeding season of *Tangara fastuosa* is concentrated in the months with the lowest rainfall, which, in the Northeast region of Brazil, runs from October to April [17]. The breeding period for *T. seledon* extends from October to February [11,28]. *T. desmaresti* nests have been found in January and February [29]. The breeding period of *T. cyanocephala* extends from January to May (Studer unpub.). Nests of *T. cyanoventris* have also been found in October and November [11,30]. Thus, we see that the breeding season of *T. fastuosa* and its closely related species extends from October to May, corresponding to the driest months of the year.

4.2. Nests

The tall, cup-shaped nest is a typical feature of *Tangara* nests [11]. Regarding the material used for construction and the locations of breeding sites, our observations were consistent with previous studies on *T. fastuosa*. These studies state that the nest is built using rootlets, plant fibres and dry leaves, and hidden among arboreal bromeliads, between 8 and 15 m above ground [15–17]. Our nests were mainly located in semi-closed spaces, such as edges and clearings, but were also found in other types of environments, such as pastures, capoeira and cerrado, and more rarely, forests. Silveira et al. (2003) also made similar observations, noting that the species inhabits a variety of habitats ranging from the canopy and edges of mature, relatively undisturbed forests to severely degraded secondary forest areas dominated by *Cecropia* sp. and taller trees, interspersed with lianas and vines [16]. Nest height varied considerably in both *T. fastuosa* (1.5–15 m) and closely related species, ranging from 1.7 m to over 10 m height (Table 1). The materials used to build the nests of these species are quite diverse, as they use both plant (e.g., leaves, sticks, grass, moss) and animal (e.g., feathers, spider cocoons, mammal hair) materials [11,15,17,28,29]. These *Tangara* species do not seem to show a pattern in terms of nest height or material; however, they build nests more often in locations concealed by bromeliads or other epiphytes [11,28,29].

Nests of *T. fastuosa* were larger than those of *T. cyanocephala* in terms of both external and internal diameter, and they were also heavier. Comparisons with other species were not possible due to limited available data. This highlights the need for more extensive documentation of *Tangara* nests in order to enable broader intra-specific comparisons.

4.3. Eggs and Nestlings

We found an average clutch size of 2.7 ± 1.1 (range 2–4, $n = 25$) eggs, which is consistent with observations in captivity of three to four eggs being laid [17]. This is also consistent with the few records of closely related *Tangara* species, which report clutch sizes of two to three eggs (Table 2). The eggs of *T. fastuosa*, as well as those of other species, are light in colour and speckled with darker spots (Table 2). Eggs of *T. fastuosa* were larger than those of *T. cyanocephala*, both in length and width, and they were also heavier. Comparisons with other species were not possible due to limited available data. Therefore, *T. fastuosa*

builds larger nests and lays larger eggs than *T. cyanocephala*. This is not surprising, given that *T. fastuosa* is larger and heavier than *T. cyanocephala* [15,32].

4.4. Incubation and Nestling Period, Nest Success

We observed an incubation period of 13.8 ± 1.3 days (range 12–15, $n = 4$), which is slightly shorter than the period of 15 to 17 days observed in captivity [17]. This is comparable to the incubation periods of the other *Tangara* species, observed both in the wild and in captivity, except for *T. seledon*, for which the period was longer (Table 2). However, we only observed the incubation period for four nests, so it is possible that it could last longer. The observed nestling period of 15.4 ± 0.7 days (range 14–16, $n = 11$) is consistent with observations of *T. cyanocephala* in the wild and in captivity. However, it is shorter than the period observed in captivity for *T. seledon* (Table 2).

We observed an apparent nest success rate of 51.7%, and a Mayfield nest success rate of 44.4%. This is higher than the respective rates of 21.4% and 13.8% for *T. cyanocephala*. For both species, predation was the main cause of nest failure. This is not surprising, given the high predation rates found for other tropical bird species [33–41].

4.5. Parental Care and Feeding

We observed parents feeding their offspring fruit and arthropods. Gonzaga & Castiglioni (2006) also made this observation in *T. desmaresti*, noting that the parents brought their offspring spiders, seed agglomerates, winged insects, nymphs (Orthoptera, Homoptera and Ensifera), and caterpillars [29]. Our own observations of *T. cyanocephala* showed that the pair fed the nestlings with fruit and seeds (Studer unpub.). In *T. fastuosa*, we observed both adult and juvenile individuals helping the parents to feed the offspring. In *T. cyanoventris*, offspring from previous broods were seen acting as helpers [30]. In our case, we could not determine whether the helpers were offspring from a previous brood, but this was probably the case, especially for the juvenile one.

5. Conclusions

The breeding parameters of *Tangara fastuosa* observed in the present study are generally similar to those described in the literature, both for the species itself and for its closely related species *T. seledon*, *T. desmaresti*, *T. cyanocephala* and *T. cyanoventris*. However, we found that *T. fastuosa* builds larger nests and lays larger eggs than *T. cyanocephala*, a difference that could be attributed to their size disparity. Nevertheless, information on these five species remains scarce, so the results should be treated with caution. Further research into the breeding biology of these species is required to fully grasp any differences between them. *T. fastuosa* is a forest-dependent species endemic to the Atlantic Forest [15,16]. Its vulnerable status, due to declining populations, habitat loss and fragmentation, and trapping for the illegal wildlife trade, coupled with the degraded state of the Atlantic Forest, demands urgent action to protect the species [16,18,20]. As has been done for the Pedra Talhada Biological Reserve [21], reforestation and restoration actions need to be implemented to enable the connection of isolated fragments and gene flow between populations [16]. Environmental education programmes and continuous monitoring of the species would help to prevent the illegal capture of these birds [16]. Such measures could help to reverse the threat level to the species, but they must be supported and intensified.

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administration, A.S. and M.C.d.S.; funding acquisition, A.S. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: This observational study involved no capture, restraint, marking or experimental manipulation of individuals. Handling of eggs was limited to brief measurements of egg size, and did not involve removal, damage or alteration of the clutch. Fieldwork was conducted in accordance with the accepted ethical standards for avian field research set out in the Ornithological Council's *Guidelines to the Use of Wild Birds in Research* [42], which provide comprehensive recommendations on minimising disturbance and harm in wild bird studies. Brazil's formal regulatory framework for the ethical use of animals in scientific research was established by Law No 11.794 on 8 October 2008, which created the National Council for the Control of Animal Experimentation (CONCEA) and institutional animal ethics committees (CEUAs) [43]. As most of the present study was conducted prior to the enactment of this legislation and the establishment of CONCEA/CEUAs, formal institutional ethical approval and research permits were not required at the beginning of data collection.

Data Availability Statement: The original data presented in the study are openly available in OSF <https://doi.org/10.17605/OSF.IO/HAZ3V> (accessed on 6 March 2026).

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