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New Breeding Information on the Pinto's Spinetail *Synallaxis infuscata* in the Atlantic Rainforest of Northeastern Brazil

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Simple Summary

Information on bird breeding biology is important, because it enables us to better understand a species, make comparisons with related species, and implement accurate conservation strategies. In this study, our aim was to describe the breeding habits of the Pinto's Spinetail (*Synallaxis infuscata*), an endangered Neotropical bird about which little was previously known. Between 1986 and 2018, we observed 33 nests and recorded their measurements, as well as the number and size of the eggs in each nest. Apparent nest success, defined as the proportion of nests where at least one juvenile fledged, was 27.3%. Nests mainly failed due to predation, accounting for 81% of failed nests. The breeding information we found was similar to that found for other Spinetails. Our study provides important information on the breeding of this species, which could help to protect it more efficiently.

Abstract

Information on the breeding of the Pinto's Spinetail *Synallaxis infuscata*, an endangered Brazilian Furnariid, is scarce. This study aims to complement it, by looking at nest and clutch parameters, breeding period, and nest success. Once nests were found, they were closely monitored from a hide. Between 1986 and 2018, 33 nests were found in the Pedra Talhada Forest near Quebrangulo. Nests were found year-round, except in middle of the dry season. Nests were of the closed/retort type, weighing 552.1 g, and measuring 37.6 x 28.8 cm, with a side arm of 30.6 x 4.9 cm., on average. The clutch size averaged 2.10 eggs, which measured 22.25 x 17.18 mm and weighed 3.17 g. They were white and had an oval to pointed-oval shape. Mean incubation period was 21.5 days, and mean nestling period 14.71 days. The apparent nest success was 27.3%, while Mayfield's was 21.8%. Predation was the main cause of nest failure, accounting for 81% of cases. The breeding data we collected on *S. infuscata* falls within the range of observations of a comprehensive analysis on other *Synallaxis* species. This breeding information is important for conservation, as rates of nest loss are a key factor in evaluating population viability.

Keywords: nest success; neotropical bird; avian reproduction; life history

1. Introduction

Life history studies are important because they help us understand population dynamics and they allow us to make useful comparisons between species [1]. For example, slower life history traits are exhibited by tropical birds than by birds in temperate regions, with greater investment in survival than reproduction being favoured [2]. In terms of reproduction, longer breeding seasons are experienced by tropical birds [3,4], which are associated with a higher number of clutches and a high re-nesting potential [1,5–7]. Moreover, smaller clutch sizes [8–11], lengthier incubation and nestling periods [1,10,12–16], and extended post-fledging care [17–19] are typical of these species. In terms of species survival, they exhibit reduced mortality [20,21], as well as lower basal and metabolic rates [22–24] and low thermogenic heat production [23]. They also show later sexual maturation [12,18]

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and delayed senescence [25,26]. Data on the life histories of birds is useful for planning accurate conservation strategies [27–29] and inferring phylogenies [30,31]. However, such data remain scarce for a large number of Neotropical bird species [1].

The *Synallaxis* genus [32] is part of the Furnariidae family and comprises 37 species from the Neotropics [33]. The Pinto's Spinetail *Synallaxis infuscata* was initially described as a subspecies of *Synallaxis ruficapilla* [34], but Vaurie, 1980 [35], described it as a distinct species, a classification that has been followed by subsequent authors [36]. Recent morphological and molecular studies indicate that *S. infuscata* is closely related to a group consisting of the species *S. ruficapilla*, *S. whitneyi*, *S. macconnelli*, *S. cabanisi* and *S. moesta* [37–40]. However, the precise position of *S. infuscata* within this group remains to be clarified. Morphological and whole-genome sequencing analyses reveal that *S. infuscata* is more closely related to *S. ruficapilla* and *S. whitneyi* ([38-40], even if Stopiglia [40] consider *S. whitneyi* to be part of *S. ruficapilla*), but a mitochondrial analysis suggests that *S. infuscata* is more closely related to *S. moesta* [37].

S. infuscata is endemic to the north-east of Brazil, in the states of Alagoas and Pernambuco [41]. This species is typically found in tropical lowland evergreen forests and thrives in woodland edges, scrubby forest and early second growth, at altitudes of up to 500 meters [41]. It is classified as endangered on the IUCN Red List, as well as the Red List of Brazilian Birds, due to its small, fragmented and declining habitat and decreasing population trend [42,43]. Indeed, this species is confined to the Pernambuco Endemism Centre [44], a region that has been significantly impacted by deforestation, with only 12.1% of the initial vegetation remaining [45]. *S. infuscata* is an arthropod-consuming species that forages for prey in low-lying vegetation, such as foliage, dead leaves and small branches, at ground level. It forages either alone or in pairs [46]. There is no sexual dimorphism in this species [41].

The available literature on the breeding biology of *S. infuscata* is extremely limited, the only description refers to a personal communication made by the author Anita Studer to the editors of the Handbook of the Birds of the World [41]. This study therefore aims to describe key aspects of the breeding biology of this species, including nest form, clutch and egg size, breeding period, and nest success.

2. Materials and Methods

The study was conducted in and around the Pedra Talhada Biological Reserve (09°11′-09°16′ S, 36°22′-36°28′ W), which is located in the states of Alagoas and Pernambuco, Brazil [47]. The area is characterised by significantly higher humidity levels in comparison to the surrounding lowland regions [47]. The mean annual precipitation recorded between 1912 and 1990 was 1628 mm [47]. The rainy season generally extends from April to August, though can vary from year to year. The area's vegetation is characterised by diverse woodlands on both flatland and slopes, as well as rocky terrain. These woodlands include evergreen and deciduous trees reaching up to 35 metres in height. Open vegetation can be found in a variety of settings, including rocky outcrops, clearings, and marshes. [47]. The forest's pristine vegetation has been extensively logged, and today it is surrounded by private cattle ranches.

Nests were located either by observing adult behaviour or by chance [48]. Once an active nest had been located, it was visited every three to four days, or every other day near hatching or fledging. In instances where the precise date of hatching or fledging could not be ascertained, it was recorded as the median date of the two most recent visits [49]. Observations were made from a concealed position, situated between six and eight metres away from the nest, using binoculars. Photographic and video recordings were also made each time activity around the nest was observed.

The eggs were weighted using a Pesola Spring scale with a 0.5 g accuracy, and their width and length were measured using a calliper with 1 mm accuracy. The nest dimensions were measured with a ruler with a precision of 0.5 cm and the mass was measured with a spring scale with a precision of 0.1 g. The nest was accessed to take these measurements after the fledglings had left, in order to minimise disturbance.

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The incubation period was defined as the time between the complete laying of the clutch and the hatching date of the first chick. The nestling period was defined as the time between the hatching of the last egg and the fledging of the first offspring. The breeding season was determined as the period from the earliest date that an active nest was found to the latest date of fledging across all nests found. It was determined that predation was the cause of nest failure when eggs or nestlings disappeared before the expected date of hatching or fledging, respectively. A nest was considered successful if at least one nestling fledged. The Mayfield method was used to calculate nest success [50].

3. Results

Between 1986 and 2018, 33 nests of Synallaxis infuscata were found in the Pedra Talhada Forest near Quebrangulo. Nests were found year-round, with the exception of December and January, which correspond to the middle of the dry season. The highest number of nests were recorded in April and October, just before and after the rainy season.

The nests were of the closed/retort type [51], generally taller than wide, with an average weight of 552.1 g (± 205.2, n = 14), height of 37.6 cm (± 8.9, n = 15) and width of 28.8 cm (± 12.4, n = 17), respectively. A side arm housed a corridor that provided access to the interior of the nest. The average length of this side arm was 30.6 cm (± 4.4, n = 7), with an internal diameter of 4.9 cm (± 3.4, n = 4). The incubation chamber itself measured 10.9 cm (± 7.6, n = 12) and was lined with a cluster of woolly green leaves (Asteraceae) glued together with webs and spider nests, which gave it the appearance of a thick piece of felt. The nests are usually well concealed under tangles of vines and bromeliads, at an average height of 2.16 metres (±1.14, n = 33) above ground level. Nests were constructed using a variety of materials, including smooth and thorny sticks, dry and green leaves, other vegetation, snake skins and spider webs both internally and externally, with an addition of dry grass, plant fibres and small pieces of wood on the outside (Figure 1). Nests were predominantly located in bushes (n = 21), with some also being found in lianas (n = 5), piles of leaves/branches (n = 2), and trees (n = 4). The nests were primarily located in forested areas (n = 25), but also in semi-open spaces (n = 2), such as edges and clearings, and in semi-closed spaces (n = 6), such as capoeira and cerrado.

Figure 1. Nest of *Synallaxis infuscata* (Anita Studer, June 2018).

The clutch size was 2.10 eggs (± 0.76, n=30). The eggs had an average length of 22.25 mm (± 0.9, n = 63) and an average width of 17.18 mm (± 0.7, n = 63). Their average weight was 3.17 g (± 0.4, n = 63). Eggs are white in colour and have an oval to pointed-oval shape (Figure 2). Hatchlings are characterised by greyish skin on their heads and pink skin on their bodies, as well as yellow colouring on the corners of their beaks, black eyes and brown legs. At 12 days old, it is already possible to see brown plumage on the upper part of the nestlings' bodies and small grey wings, although their bellies remain bare and purplish. At this age, the first change in the nestlings' beaks become visible, which

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darken in colour with a white outline. The legs exhibit a pale yellowish-pink colour, with white nails on the toes.

Figure 2. A white egg of *Synallaxis infuscata* in the nest (Anita Studer, May 2017).

Of the 33 nests observed, nine (27.3%) were successful, 21 (63.6%) failed and the fate of three (9.1%) nests is unknown. Predation was the main cause of nest failure, accounting for 81% of cases (Table 1). Nests failed more frequently during the egg stage (66.7%) than during the nestling stage (33.3%, Table 1). The incubation period was 21.5 days (± 2.12, n = 2), and the mean nestling period was 14.71 days (± 0.76, n = 7). The complete nest cycle length was 36 days (± 2.83, n = 2). The daily survival rate during the incubation period was 0.956, whereas during the nestling period it was 0.963. Therefore, the survival rate for the mean incubation period of 21.5 days was 0.382, and for the mean nestling period of 14.71 days it was 0.570. The Mayfield nest success rate was thus 21.8%.

Table 1. Causes and periods of nest failure for 21 *Synallaxis infuscata* nests. The percentages represent the proportion of failed nests.

	Predation	**Abandonment**	**Human**	**Total**
Egg	11 (52.4%)	2 (9.5%)	1 (4.8 %)	14 (66.7%)
Nestling	6 (28.6%)	0	1 (4.7%)	7 (33.3%)
Total	17 (81%)	2 (9.5%)	2 (9.5%)	21

We observed two pairs that took up to 60 days to complete their nests. During the egg incubation and chick feeding phases, *S. infuscata* adults continue to collect leaves that they incorporate into the external structure of the nest, and sometimes also into the internal structure. Pairs commonly renovate and reuse their first nest. Sometimes, they build a second one nearby, often reusing material from the original structure. It is important to note that the pair does not lay a second clutch in locations that are distant from the nest of the first clutch. Both adults were observed feeding the nestlings with dragonflies, beetles, caterpillars, worms and frog tadpoles (Figure 3). Parents fed 4-day-old nestlings eight times over a 100-minute interval, while 7-day-old nestlings were fed six times during the same time period. Both parents were also observed to remove the faecal sacs.

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Figure 3. An adult *Synallaxis infuscata* bringing a prey to the nestlings (Anita Studer, March 1992).

4. Discussion

Synallaxis infuscata breeds throughout the year, with the exception of the driest months of December and January. This pattern of year-round breeding has also been observed in other bird species in the Pedra Talhada Biological Reserve, with either a break at the peak of the dry season, or at the peak of the rainy season [52,53].

The closed/retort form of the nest of *S. infuscata* is typical of *Synallaxis* nests [54–60]. On average, nests of S. infuscata were heavier (552.1 g ± 205.2, n = 14) than one measured nest of the closely related *S. moesta* (292 g, [56]), but lighter than one measured nest of closely related *S. ruficapilla* (4210 g, [60]). They also weighed less than the mean for *Synallaxis* species (1407.8 g, n = 8, Table A1). *S. infuscata* nests had an average height of 37.6 cm (± 8.9, n = 15) and width of 28.8 cm (± 28.8, n = 17), which is higher but thinner than the *Synallaxis* mean (35.86 cm (n = 21) x 34.33 cm (n = 24), Table A1). The nest arm of *S. infuscata* was 30.6 cm (± 4.4, n = 7) long and 4.9 cm (± 3.4, n = 4) wide. The tunnel is thinner than the ones of *S. moesta* (30 x 15 cm, [56]) and *S. ruficapilla* (23-40 x 14-16 cm, [60]), but of similar length. It is longer and thinner than the mean of *Synallaxis* nests (26.32 cm long (n = 16) and 7.13 cm wide (n = 11), Table A1). The incubation chamber of *S. infuscata* nests measured 10.9 cm (± 7.6, n = 12), which is similar to *S. moesta* (12.5 cm, [56]) and *S. ruficapilla* (10.5-12 cm, [60]) nests, but smaller than the mean of *Synallaxis* nests (15.54 cm, n = 17, Table A1). Nest material of *S. infuscata*, which consist of a mix of vegetal (sticks, leaves, grass, wood) and animal (snake skin, spider webs) materials, is also similar to what has been found in other *Synallaxis* species (Table A1). *S. albescens* and *S. moesta* also had man-made materials (e. g. pieces of canvas, plastic, candy wrappers) in their nests [56,58]. Nests of *S. infuscata* were mainly found being close to the ground (2.16 m ±1.14, n = 33), which is similar to the mean of *Synallaxis* species (2.01 m, n= 28, Table A1).

The clutch size of *S. infuscata* was 2.10 (± 0.76, n=30). This is similar to clutch size of *S. moesta* (2, n=1, [56]) and *S. ruficapilla* (2-3 eggs, n=4, [60, Studer, *unpub.*]). This is slightly below the mean clutch size for *Synallaxis* species (2.77, n = 29, Table A2). The eggs of *S. infuscata* measured on average 22.25 mm (± 0.9, n = 63) x 17.18 mm (± 0.7, n = 63). They are similar to eggs of *S. moesta* (24.1 x 16.5 mm, n = 1, [56]) and *S. ruficapilla* (21.1 x 16.2 mm, n = 7, [60]). They are larger than the average size for *Synallaxis* species (20.42 x 15.91 mm, n = 17, Table A2). The average weight of *S. infuscata* eggs was 3.17 g (± 0.4, n = 63), which is similar to weight of *S. moesta* (3.3 g, n = 1, [56]) and *S. ruficapilla* (3.1 g, n=2, [60]). They are heavier than the mean egg weight for *Synallaxis* (2.63 g, n = 15, Table A2). Eggs of *S. infuscata* are white with an oval to pointed-oval shape, which is similar to eggs of *S. albilora*, *S. azarae*, *S. moesta* and *S. ruficapilla* [56,59–61]. Eggs of *S. candei*, however, vary from turquoise blue to light-green tones [55]. Eggs of *S. albescens* and *S. frontalis* vary from white to greenish-white [58,62–64, Studer *unpub.*], and eggs of *S. erythrothorax* are white to pale blue. Eggs of *S. subpudica* are white with a few brown spots [41].

Nestlings of *S. infuscata* have a pink skin, brown plumage and yellow beaks, which turn darker when they get older. Their appearance is similar to nestlings of *S. moesta*, which have pink skin, dark

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grey plumage and bill in the yellow tones [56], and to *S. candei* nestling, which have orange flesh-coloured skin, greyish plumage and yellow bill [55].

The incubation and nestling periods of *S. infuscata* were 21.5 days (± 2.12, n = 2) and 14.71 days (± 0.76, n = 7), respectively. The incubation period is longer than what has been observed for most *Synallaxis* species and the general mean (18.38 days, n = 13, Table A2), except for *S. subpudica* (25 days, n = 1, [41]). Nestling period, however, is in the lower range of what has been observed for *Synallaxis* species and is slightly under the general mean (15.74 days, n = 14, Table A2).

The apparent success rate of *S. infuscata* was 27.3%, and the Mayfield's one was 21.8%. This result aligns closely with the 25% success rate documented for *S. albescens* [58]. Predation was the main cause of nest failure (81% of failed nests), as has been found for *S. albescens* (91.7% of failed nests [58]) and for several other tropical bird species [52,53,65–69]. Nests of *S. infuscata* experienced higher failure rates during the egg stage (66.7%) compared to the nestling stage (33.3%), while *S. albescens* demonstrated a different pattern, with 45% of eggs were depredated during egg stage, and 55% during nestling stage [58]. Some authors have hypothesised that predation rates may be higher during the nestling period, due to the presence of parents around the nest and the begging of the offspring, which may attract predators [70–72]. However, the present study did not find such results. The selection of a particular nest site also exerts an influence on the predation rate [71]. Indeed, when considering nests located in areas easily accessible to predators, the predation rate is higher during the incubation period. Furthermore, as *S. infuscata* reuse their nests, predators may already be aware of the nest's location and be able to predate the eggs more rapidly. It could also be explained by the fact that the incubation period was longer than the nestling period, thus there is more time for predation during the incubation [73].

Overall, the breeding data we collected on *S. infuscata* falls within the range of observations made on other *Synallaxis* species (Table A1, Table A2). The majority of the data are closely similar to those of the two closely related species *S. ruficapilla* and *S. moesta* [56,60, Studer, *unpub*.]. However, we were unable to find breeding information for the other closely related species *S. whitneyi*, *S. macconnelli* and *S. cabanisi*. Our analysis indicates that the available information on the breeding biology of *Synallaxis* species is still fragmented. There is a lack of information on the breeding biology of several species, and for those for which information is available, it is often incomplete. Further studies are required on the breeding biology of *Synallaxis* species, in order to obtain a comprehensive set of data. This could help to clarify phylogenetic uncertainties, such as those surrounding *S. infuscata*, and contribute to the better protection of these species. Indeed, information on breeding biology and particularly nest success is important for conservation, as rates of nest loss are a key factor in evaluating population viability [28].

Conservation aspects are of particular importance for *S. infuscata*, which is an endangered species [42]. It is endemic to the Atlantic Forest of the Pernambuco Endemism Centre [44], a region that has been heavily degraded [45]. *S. infuscata* has been identified as endangered, primarily due to its exclusive presence within this disturbed geographical area [42,46]. Consequently, priority must be given to the protection and conservation of the remaining Atlantic Forest patches. Anita Studer has followed this initiative by establishing the Pedra Talhada Biological Reserve in 1984 (Presidential Decree n°98.524 of 13 December 1984). This National Reserve, spanning 4,469 hectares, is home to a rich biodiversity, supporting over 2,100 species, including *S. infuscata* [47]. Initiatives of this kind are essential for ensuring the protection of both this species and others in the Atlantic Forest.

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Appendix A

Appendix A.1

Table A1. Nest parameters for different *Synallaxis* species. "–" Indicates that the information was not found within the mentioned reference.

Species	Nest weight (g)	Nest height (cm)	Nest width (cm)	Nest arm length (cm)	Nest arm diameter (cm)	Height of incubation chamber (cm)	Nest height from ground (m)	Nest materials
S. infuscata (this study)	552.1 ± 205.2 (n = 14)	37.6 ± 8.9 (n = 15)	28.8 ± 12.4 (n = 17)	30.6 ± 4.4 (n = 7)	4.9 ± 3.4 (n = 4)	10.9 ± 7.6 (n = 12)	2.16 ±1.14 (n = 33)	Smooth and thorny sticks, dry and green leaves, snake skins and spider webs both internally and externally, with an addition of dry grass, plant fibres and small pieces of wood on the outside
S. albescens [58]	–	16 (n = 7)	17 (n = 6)	11 (n=7)	–	–	0.3 ± 0.2 (n = 30)	Sticks, inner chamber lined with soft plant material, snake skin, human-made materials (pieces of canvas, plastic tape, candy wrappers)
S. albescens [63]	–	34.5 ± 1.3 (n = 11)	18.3 ± 0.6 (n = 10)	23.6 ± 1.3 (n = 9)	8.5 ± 0.3 (n = 8)	–	1.6-2.4	Thorny sticks, mainly from carob and chañar trees; a base of plant debris on which a cup of soft materials is built.
S. albescens [62]	–	–	–	–	–	–	0.6-9.1	Twigs, egg chamber floored with pad of plant-down, snakeskin in entrance passage
S. albigularis [41]	–	–	40-50	–	–	–	1-2	–

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S. albilora [59]	1243 ± 244.6 (n=5)	29 ± 3.7	11 ± 5.5 (n=5)	26 ± 4.5	0.8 (n=5)	24 ± 4.2 (n = 5)	1.5 ± 0.48 (n = 64)	Sticks, bark chips, thorns, green leaves
S. azarae [41]	–	–	–	30-40	–	–	–	Sticks, interior chamber lined with soft plant material, snake skin
S. brachyura [41]	–	20-40	40-50	30-40	–	–	0.5-5	Twigs and sticks, often thorny, reptile skins, floor of chamber lined with pad of soft green or pubescent leaves, spider webs, snake and lizard skin
S. candei [55]	–	70-75	35-48 (n=2)	30	5-6	10-13	1.3-2.5 (n = 6)	Dry spinescent or thorny twigs and sticks, bark, green leaves, cactus thorns, shed lizards, snake skin
S. cinerascens [54]	–	–	–	25	–	12.5	On ground	Small sticks
S. cinerascens [74]	3740-3930 (n = 2)	–	28-30 (n = 2)	24-28 (n = 2)	4.5-5 (n = 2)	8-9 (n = 2)	On ground	Dry sticks, bark, wood chips, fresh leaves
S. cinnamomea [41]	–	40	25	15	–	–	3	Thick twigs and dead leaves
S. erythrothorax [57]	–	47.7 (n = 1)	25.4 (n=1)	–	–	–	1.20 (n = 1)	Twigs
S. erythrothorax [75]	–	48	73	35	–	12	0.76-9.14	Sticks, grass, fine twigs, bark, weed stalks, dry cecropia petioles, broad leaf base of shell-flowers, heliconias, large herbs, *Solanum* foliage, reptile skin
S. frontalis [64]	–	–	–	–	–	–	0.7-2.5 (n = 46)	Made of sticks and lined with soft plant debris
S. frontalis [Studer, *unpub.*]	350 (n = 1)	25-50 (n=2)	25 (n = 1)	–	–	17-18 (n = 2)	2.63 ± 2.39 (n = 17)	Internal: smooth sticks, dry and green leaves, feathers, snake skins, spider webs, animal hair and wool External: smooth and thorny sticks, green leaves, snake skins, animal hair and wool, bark
S. gujanensis [41]	–	25	65	–	–	25	1-2	–

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S. gujanensis [Studer, *unpub.*]	470 (n = 1)	23 (n = 1)	33 (n = 1)	–	8 (n = 1)	5 (n = 1)	1.3-1.8 (n = 2)	Smooth sticks, dry leaves, bark
S. hypospodia [Studer, *unpub.*]	310 (n = 1)	28 (n = 1)	28 (n = 1)	–	6 (n = 1)	25 (n = 1)	0.65 (n = 1)	Dry and green leaves, spider webs, feathers, snake skins
S. kollari [76]	–	–	20	–	–	10	1.5	Twigs. Incomplete
S. moesta [56]	292	–	–	30	15	12.5	–	Sticks, vine tendrils, dead dicotyledon leaves, palm leaf strips, skeletonized leaves, bark strips, snake skin Lining made of dried green leaves, plastic, mushroom fragments, orthopteran wings, spider egg sacs and lepidopteran cocoon silk.
S. ruficapilla [60]	4210	–	–	23-40	14-16	10.5-12	1-2.5	Dry leaves and sticks, wood bark, lizard skin. Lining consists of soft leaves, moss, lizard skin.
S. ruficapilla [Studer, *unpub.*]	–	–	–	–	–	–	3.30	–
S. scutata [41]	–	35-60	45-65	20-25	–	10	On ground	Twigs, roots, dead leaves
S. scutata [*Studer, unpub.*]	–	37 (n = 1)	57 (n = 1)	–	6 (n = 1)	42	–	Internal: dry and green leaves, spider webs External: smooth and thorny sticks, dry leaves
S. spixi [54]	–	20	–	–	–	–	0.6	Small sticks
S. spixi [41]	–	25-30	20-30	25	–	–	1-2	Sticks, usually thorny, snake and lizard skin, occasionally wire, bark, leaves, mosses, hair
S. stictothorax [77]	–	15-40 (mean = 27.2)	24-55 (mean = 35.8)	–	–	5.5-7.5 (mean = 6.6)	2-12 (mean = 5.8)	Spiny sticks, inside lined with feathers and soft seed down
S. subpudica [41]	–	50-60	30-40	–	–	–	2	Sticks, nest-chamber lined with moss and twigs
S. tithys [78]	–	40 (n=1)	30 (n = 1)	–	–	–	–	–
S. tithys [41]	–	30	30	–	–	–	3-7	Sticks

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S. zimmeri [79]	–	–	26	20	4	20	3.5-4.2 (n = 3)	Thorny twigs and sticks, with spines. Inside of chamber lined with old leaf veins
Mean	1407.8	35.86	34.33	26.32	7.13	15.54	2.01	–
N	8	21	24	16	11	17	28	–

Appendix A.2

Table A2. Breeding parameters for different *Synallaxis* species. "–" Indicates that the information was not found within the mentioned reference.

Species	Clutch size	Egg size (mm)	Egg weight (g)	Egg colour	Incubation period (days)	Nestling period (days)	Breeding season
S. infuscata *(this study)*	2.10 ± 0.76 (n = 30)	22.25 ± 0.9 (n = 63) x 17.18 ± 0.7 (n = 63).	3.17 ± 0.4 (n = 63)	white	21.5 ± 2.12 (n = 2)	14.71 ± 0.76 (n = 7)	Feb.-Nov.
S. albescens [58]	2.6 ± 0.6 (n = 16)	19.7 ± 0.1 x 14.4 ± 0.1 (n = 2)	1.8 ± 0.2 (n = 2)	white	18.1 ± 0.6 (n = 5)	13.6 ± 2.9 (n = 4)	Sep.-Jan.
S. albescens [63]	2.7 ± 0.3 (n = 3)	–	–	white-greenish	–	–	Nov.-Jan.
S. albescens [62]	2-3	20.5 x 15.5 (n = 6)	–	white	18	16	Dec.-Sep.
S. albescens [80]	2.3	–	2.31	–	–	–	–
S. albescens [64]	3.8 ± 0.63	18.83 ± 0.73 x 14.68 ± 0.41 (n = 89)	2.3 ± 0.17 (n = 64)	Greenish-white	16-18	14-18	Oct.-Mar.
S. albigularis [41]	–	–	–	–	–	–	Jun.-Jul.
S. albilora [59]	3.35 ± 0.4 (n = 20)	20.5 x 16.4	2.8 ± 0.2	white	15.3 ± 0.7 (n = 8)	13.6 ± 1.1 (n = 5)	Aug.-Dec.
S. azarae [41]	2-4	–	–	–	–	–	Throughout year in Colombia, Feb.-Apr. in Ecuador, Oct.-Nov. in Argentina.
S. azarae [61]	2 (n = 2)	–	–	white	–	–	Mar.-Apr.
S. brachyura [41]	2-3	–	–	–	18-19	17	Jan.-Feb. and Apr.-Oct. in Costa Rica
S. brachyura [80]	2.5	–	2.90	–	18.5	17.0	–
S. brachyura [81]	–	21.5 x 17.0 (n = 6)	–	–	18 (n=2)	14-15 (n = 2)	–
S. candei [55]	3-4	20.0 ± 0.7 x 15.9 + 0.5 (n = 7)	2.5 ± 0.1 (n = 7)	turquoise blue to light-green tones	–	–	Oct.-Dec.
S. cinerascens [54]	–	–	–	–	–	–	Sep.
S. cinerascens [74]	–	–	–	–	–	–	Nov.

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S. cinnamomea [41]	3	–	–	–	–	–	Mar.-Aug. in Tobago
S. erythorthorax [75]	2-4	21.8-19.8 x 17.5-16.7 (n = 19)	–	White to pale blue	17-18	–	Aug.-Sep.
S. erythrothorax [80]	3.0	–	2.94	–	17.5	16	–
S. erythrothorax [81]	–	21.1 x 16.7 (n = 19)	–	–	17 (n = 4)	14-15 (n = 1)	–
S. frontalis [64]	3.4 ± 0.49 (n = 46)	19.71 ± 0.86 x 15.16 ± 0.52 (n = 58)	2.6 ± 0.23 (n = 49)	Greenish-white	16-18	15-16	Oct.-Mar.
S. frontalis [82, Studer, *unpub.*]	2.93 ± 1.33 (n = 17)	19.56 ± 2.04 x 15.46 ± 0.91 (n = 14)	2.05 ± 0.53 (n = 14)	white	–	18-20 (n=2)	Apr.-May in Alagoas and Sep.-Mar. in Minas Gerais, Brazil
S. frontalis [54]	–	–	–	–	–	–	Nov.
S. gujanensis [41]	2-3	–	–	–	–	–	Jan., Mar., May-Sep. and Dec. in Suriname
S. gujanensis [Studer, *unpub.*]	3 (n = 1)	20.43 ± 0.59 x 17.57 ± 0.25 (n = 3)	2.90 ± 0.1 (n =3)	–	–	–	Dec.
S. gujanensis [83]	2-3	–	–	–	–	–	–
S. hypospodia [82]	2 (n = 1)	20.1-20.5 x 15.3-15.5 (n = 2)	2.3-2.5 (n = 2)	–	–	–	Feb.
S. moesta [56]	2 (n = 1)	24.1 x 16.5 (n = 1)	3.3 (n = 1)	white	–	–	Feb.
S. ruficapilla [60]	2-3 (n = 3)	21.1 x 16.2 (n = 7)	3.1 (n = 2)	white	–	–	Nov.-Jan.
S. ruficapilla [Studer, *unpub.*]	3 (n = 1)	–	–	–	–	–	Oct.
S. ruficapilla [54]	–	–	–	–	–	–	Oct.-Nov.
S. rutilans [41]	3-4	–	–	–	–	–	–
S. scutata [41]	2-3	–	–	–	–	–	Apr. in Brazil, Nov. in Argentina
S. scutata [Studer, *unpub.*]	2-3	20.24 ±1.40 x 15.82 ± 0.53 (n = 5)	2.42 ± 0.34	–	–	14	Nov.-Dec. in Maranhão and Jun.-Jul. in Alagoas, Brazil
S. spixi [54]	–	–	–	–	–	–	Feb.
S. spixi [41]	3-5	–	–	–	–	–	Nov.-Jan. in Argentina
S. stictothorax [77]	3-4 (mean = 3.2)	16.5 x 13.5	–	White with a few brown spots	25	16-22	Feb.-Mar.
S. tithys [41]	–	–	–	–	–	–	Jan.-Apr.
S. zimmeri [79]	2	–	–	–	–	–	May

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Mean	2.77	20.42 x 15.91	2.63	–	18.38	15.74	–
N	29	17	15	–	13	14	–

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