El Hornero
Volumen 39 · Número 1 · Agosto 2024

Comunicaciones Breves

doi: 10.56178/eh.v39i1.1473

VER NOTA ONLINE →

THE NEST AND EGGS OF THE RUFOUS-SHAFTED WOODSTAR *Chaetocercus jourdanii andinus*, WITH A REVIEW ON THE BREEDING DATA FOR THE GENUS

El nido y los huevos del Colibrí de Jourdan *Chaetocercus jourdanii andinus*, con una revisión de los datos reproductivos del género

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ABSTRACT: Egg collections represent a critical, though underutilized, source of sensitive biological data about a substantial proportion of avian taxa, and can help expand our knowledge of avian natural history and general biology. The breeding biology of the genus *Chaetocercus* remains considerably poorly studied, in particular of the Rufous-shafted Woodstar (*Chaetocercus jourdanii)*. In this short note, we provide descriptions of the egg and nest of the Rufous-shafted Woodstar, based on the examination of eggs and nests preserved in the Western Foundation of Zoology (WFVZ) and Natural History Museum of Berlin (ZMB), respectively. The nest is typical for the genus *Chaetocercus*, which is a tiny cup composed predominantly of fine plant fibres and evenly covered externally with lichens. Eggs were collected in February and April, and clutches consisted of two uniform white eggs measuring, on average, 12.58 ± 0.18 mm × 7.74 ± 0.29 mm (n = 7). In addition, we provide a brief literature review about the basic breeding habits for the congeneric species, where we expand the information available for the closely related Gorgeted Woodstar (*C. heliodor*) by using additional nests from the ZMB collection.

KEYWORDS: *Chaetocercus, egg collection, hummingbird, Salomón Briceño Gabaldón, Venezuela*

RESUMEN: Las colecciones de huevos representan una fuente crítica, aunque subutilizada, de datos biológicos sensibles sobre una proporción sustancial de taxones de aves, y pueden ayudar a ampliar nuestro conocimiento de la historia natural y la biología general de las aves. La biología reproductiva del género *Chaetocercus* sigue estando considerablemente poco estudiada, en particular del Colibrí de Jourdan (*Chaetocercus jourdanii*). En esta nota, proporcionamos descripciones del huevo y el nido del Colibrí de Jourdan en base al examen de los huevos y nidos conservados en la Fundación Occidental de Zoología (WFVZ) y el Museo de Historia Natural de Berlín (ZMB), respectivamente. El nido es típico del género *Chaetocercus*, una pequeña copa compuesta predominantemente de finas fibras vegetales y cubierta uniformemente por fuera con líquenes. Los huevos se recolectaron en febrero y abril, y las nidadas consistieron en dos huevos blancos uniformes que midieron, en promedio, 12.58 ± 0.18 mm × 7.74 ± 0.29 mm (n = 7). Además, proporcionamos una breve revisión de la literatura sobre los hábitos reproductivos básicos de las especies congenéricas, donde ampliamos la información disponible para el Colibrí de Heliodoro (*C. heliodor*), especial estrechamente relacionada, mediante el uso de nidos adicionales de la colección del Museo de Historia Natural de Berlín.

PALABRAS CLAVE: *Chaetocercus, colección de huevos, picaflor, Salomón Briceño Gabaldón, Venezuela*

Recibido: 10 de octubre 2023 · Aceptado: 7 de febrero 2024 · Editor Asociado: David Canal

Egg collections represent an important repository of natural history data and were widely utilized in numerous publications, contributing inter alia to a better understanding of avian breeding biology through the documentation of egg morphology, probable clutch size, and often include details about seasonality, breeding habits, or nest characteristics along investigating broader and more complex ecological hypotheses (Marini et al. 2020).

Private egg collectors, which in particular were active during the past two centuries, acquired a tremendous amount of nest and egg sets, often of poorly known taxa of which no information about the breeding biology was previously present in the literature (Schönwetter 1960-1992). Several significant private egg collections are preserved in museum collections, often remaining an underused resource of biodiversity information for scientific publications (Marini et al. 2020). Among the largest and most significant private egg collections was owned by Adolph Nehrkorn at the beginning of the 20th century, which posthumously was donated by Nehrkorn to the Natural History Museum of Berlin (ZMB). While Nehrkorn published a detailed catalogue of his egg collection (two volumes), listing all represented taxa in his collection, including the average egg size (Nehrkorn 1910, 1914), no information was provided regarding the concrete collection locality, clutch size, and egg morphology in his catalogue. Some of these data were subsequently added later in the Handbook of Oology (Schönwetter 1960-1992). In addition, Nehrkorn also obtained a substantial number of nests, which were associated with the egg sets within his collection or were shared with other egg collectors, of which little remains known.

The breeding biology of the genus *Chaetocercus* remains considerably poorly studied, with eggs described only for three (*Chaetocercus berlepschi, C. bombus, C. heliodor*), and nest for four (aforementioned taxa plus *C. mulsant*) out of the six extant taxa (Juiña et al. 2010, Greeney & Juiña 2020, Züchner et al. 2020, Marcuk & de Boer 2021). In contrast, the information about breeding biology for the other three representatives (*C. astreans, C. jourdanii, C. mulsant)* remains virtually unknown (Juiña et al. 2010, Züchner et al. 2020, Züchner & Kirwan 2020, Marcuk & de Boer 2021). Systematic field studies about the breeding behavior are only available for the threatened Esmeraldas Woodstar (*C. berlepschi*), whereas for the Gorgeted (*C. heliodor*) and Little Woodstar (*C. bombus*) only a qualitative description of the nest and eggs is currently present (Greeney & Juiña 2020, Marcuk & de Boer 2021). The nest of White-bellied Woodstar (*C. mulsant)* was only briefly described (Züchner et al. 2020). Information about the breeding biology of the Rufous-shafted Woodstar (*C. jourdanii*) is very limited, mentioning only a record of two juveniles in November in Norte de Satander, Colombia (Hilty & Brown 1986). The nest of *C. jourdanii* remains undescribed, although measurements for the eggs are documented (Oates & Reid 1903, Schönwetter 1966).

The Rufous-shafted Woodstar (*Chaetocercus jourdanii*) is a striking, tiny hummingbird that inhabits the edges of montane forest or scrub lands (Züchner & Kirwan 2020). It is frequently observed in coffee plantations, and is infrequently reported from sub-páramo shrublands (Fjeldså & Krabbe 1990, Züchner & Kirwan 2020). The species occurs between 900-3000 masl, although records above 2500 m require further confirmation and have been questioned by several authors (Hilty 2003, Züchner & Kirwan 2020). The nominate subspecies is confined to northeastern Venezuela (mountains of Sucre and northern Monagas, Fig. 1) and Trinidad (Hilty & Brown 1986, Fjeldså & Krabbe 1990, Hilty 2003, Züchner & Kirwan 2020). Two additional subspecies are currently recognized: *andinus* is found in the Sierra de Perijá of western Venezuela and in the Andes of Venezuela (Lara to Táchira) and northeastern Colombia, while subspecies *rosae* is restricted to the highlands of northern Venezuela from Falcón to Miranda (Hilty & Brown 1986, Fjeldså & Krabbe 1990, Hilty 2003, Züchner & Kirwan 2020, Fig. 1).

Males of the three subspecies differ in the coloration of their gorgets; crimson-rose in *rosae*, predominantly less rose in *andinus*, and striking violet in nominate *jourdanii* (Fig. 1, Züchner & Kirwan 2020). Across its range, *C. jourdanii* is reported to be local and rare, but is not currently considered threatened (Fjeldså & Krabbe 1990, Züchner et al. 2020, Birdlife International 2024).

In this short communication, we provide unpublished details about two overlooked breeding records of the species based on egg and nest specimens preserved in the Western Foundation of Zoology (WFVZ) and Natural History Museum of Berlin (ZMB), including information on clutch size, seasonality, and the first formal description of the nest and eggs. In addition, we summarize and review the available information about the breeding records for the genus, expanding information available for the Gorgeted Woodstar (*C. heliodor*) by providing novel information about the nests and egg sets preserved in the ZMB and Halle Natural History Museum (MLUH).

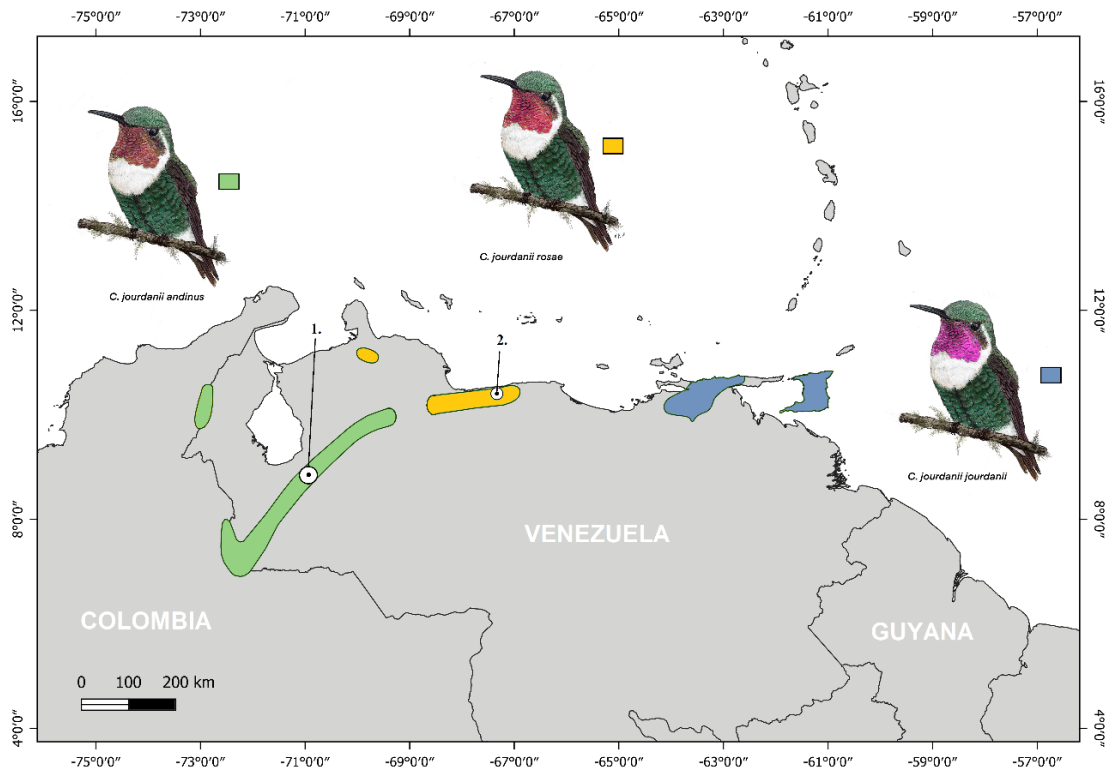

Figure 1. Geographic distributions of the three subspecies of *Chaetocercus jourdanii*, including the approximate localities of the breeding records mentioned in the results. Illustrations by VM. Modified after Birdlife Distribution Map Data 2022.02 and eBird records (eBird 2023). Green (■) distribution range for *Chaetocercus jourdanii andinus*, yellow (■) distribution range for *Chaetocercus jourdanii rosae*, blue (■) distribution range for nominate form *Chaetocercus jourdanii jourdanii*. **1.** Approximate location of both egg records in Mérida, Venezuela (18.02.1904 and 30.04.1909, collected by Salomón Briceño Gabaldón and sons), **2.** Pico Codazzi, Aragua, Venezuela (29.09.2013, 10°24'20''N, 67°19'54''E, Lorenzo Calcaño ML178012131).

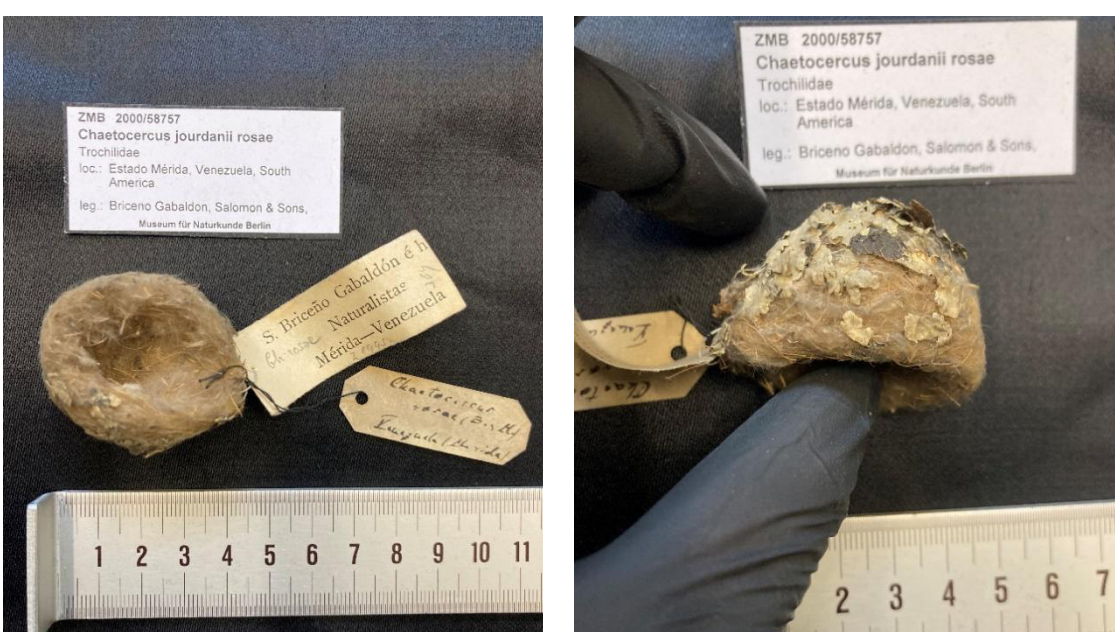

Figure 2. Nest of the Rufous-shafted Woodstar (*Chaetocercus jourdanii andinus*) in the Adolph Nehrkorn collection deposited in the Natural History Museum of Berlin. **Left)** nest (catalogue number ZMB 2000/58757) originally collected by Salomón Briceño Gabaldón and sons on 18.02.1902 in Mérida, Venezuela. **Right)** lateral view of aforementioned nest. Note that the labels incorrectly assign the specimens to subspecies *rosae*, as the locality indicates that the nest and egg belong to *andinus*.

RESULTS

We examined two egg sets and one nest collected by S. B. Gabaldón and sons in Mérida, Venezuela, during the first decade of the 20th century. An egg set deposited in the WFVZ (catalogue number# EN-141881) was collected on April 30, 1909 on Mount Nevador. A second egg set (ZMB 2000/76189) and an associated nest are preserved in the Nehrkorn collection at the ZMB (ZMB 2000/58757) and were obtained on February 18, 1904 in Mérida (Fig. 1). While these specimens were previously assigned to the form *rosae*, their approximate collecting localities both lie within the range of *andinus*. Subspecies *andinus* was formerly described only in 1949 (Phelps & Phelps 1949), three decades after the two egg sets in question were collected, explaining the incorrect taxonomic assignments.

Nest. The nest is a tiny cup, characteristic of the genus, internally made predominantly of soft plant material, evenly interspersed with tiny fibres and seeds (Asteraceae), and externally covered with lichens. Most of the lichen chips are now dried and distorted or have fallen off, and it seems likely that the external layer of the nest was covered more evenly than the present condition of the nest suggests (see Fig. 2 right and left). The nest had the following linear measurements (taken by a digital calliper): external diameter 42.6 × 35.4 mm, internal diameter 27.5 × 23.5 mm, wall thickness 7.7-8.7 mm, height 26.8 mm, depth 16.3 mm. Another nest is preserved in the Natural History Museum of Tring and was collected on July 18, 1906 (NHMUK N/227.1) in Mérida by S. B. Gabaldón. In addition, a female was photographed sitting in a nest in Aragua (ssp. *rosae*) on September 29, 2013 (Photo: Lorenzo Calcaño).

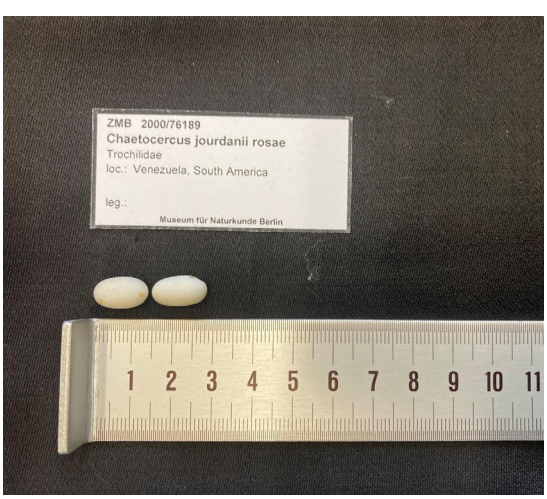

Figure 3. Eggs of the Rufous-shafted Woodstar (*Chaetocercus jourdanii andinus*) in the Adolph Nehrkorn collection at the ZMB (catalogue number ZMB 2000/76189).

Eggs. Like the eggs of congeners and related species, the eggs of *C. jourdanii* are uniformly white and elongated ovate in shape. Mean measurements: 12.58 ± 0.18 × 7.74 ± 0.29 mm (12.4-12.9 x 7.4-8.3; *n* = 7; including the measurements of the egg sets in Oates & Reid 1903, Schönwetter 1966, R. Corado pers. comm., see Fig. 3). The clutch size in all egg sets was two (*n* = 3), except for the single egg mentioned by Oates & Reid (1903), where no further information about the egg set is given and no information is deposited in the NMHUK database. While the egg originated from Venezuela, no concrete locality data are provided, and it is thus not assignable to subspecies.

Additionally, in the ZMB collection two additional egg sets (*n* = 2 with two eggs ZMB 2000/76191 and in MLUH in Germany collection number 2096, *n* = 1 with a single egg ZMB 2000/77784) and two associated nests (04.05.1904, ZMB 2000/58696 and ZMB 2000/58756, date unknown, the nest associated with the two eggs in MLUH on March 26, 1905; measurements were not included here), of *C. heliodor*, all from Mérida, and collected by Salomón Briceño Gabaldón & sons, were identified. Their measurements have been incorporated into the data presented in Tables 1 and 2, which resemble the information provided previously by Marcuk & de Boer (2021).

DISCUSSION

This note expands the limited data available about the breeding biology of this poorly known species by adding novel details about the breeding seasonality, clutch size, nest characteristics, and egg morphology. Data about the reproductive biology of *Chaetocercus* spp. remains, however, very limited (Tables 1 and 2), with detailed data is absent for the most of the genus. The exception is the globally threatened Esmeraldas Woodstar (*C. berlepschi*), where the breeding biology and parental behavior were reported in more detail (Juiña et al. 2010).

The nest and eggs of *C. bombus* and *C. heliodor* remained undescribed until very recently (Greeney & Juiña 2020, Marcuk & de Boer 2021). In the *Chaetocercus* taxa, where the nest is qualitatively described, the nest is a characteristic tiny cup (Juiña et al. 2010, Greeney & Juiña 2020, Marcuk & de Boer 2021), which is internally composed either of plant fibres (Asteraceae, *C. bombus*), cottony fibres of *Ochroma pyramidale*

Table 1. Overview of the breeding data and egg morphology for the genus *Chaetocercus*
a – this study., b – Juiña et al. 2010, c – Greeney & Juiña 2020, d – Hilty & Brown 1986, e – Marcuk & de Boer 2021, f - Züchner & Kirwan 2020, g – A. Hill undat, h – Oates & Reid 1903
cl – clutch, juv - juveniles
* Two additional clutches from the ZMB (Natural History Museum of Berlin), and one likely measured by Schönwetter from MLUH (Halle Natural History Museum) (collection number 2096, Mérida, Venezuela, two eggs and nest, collected on March 26, 1905)
** del Hoyo et al. 1999

Common name	Scientific name	Body size (in cm)**	Seasonality	Clutch size	Egg morphology	Egg size (mm)
Rufous-shafted Woodstar	*C. jourdanii*	6-8	2 juv in Nov, eggs on Feb 18 and Apr 30. Another nest on Jul 18 and Sep 29	2	white, elongated ovate	12.58 ± 0.18 × 7.74 ± 0.29 (n = 7)[a,f,h]
Esmeraldas Woodstar	*C. berlepschi*	c. 6-7	Dec-Jun	2	white	NA[b]
Gorgeted Woodstar	*C. heliodor*	5.8-6.4	Cl in Mar-Apr and Sep	2	white, elongated oval	13.09 ± 0.55 × 8.46 ± 0.39 (n = 8)[a,e*]
Little Woodstar	*C. bombus*	6-7	Two nests, one in Jul, 1997 and other with eggs in May, 2005	2	white	11.6 × 7.8[b,c,g]
White-bellied Woodstar	*C. mulsant*	8.5	Incubating female on nest in Sep and another nest in Aug	?	NA	NA[d,e]
Santa Marta Woodstar	*C. astreans*	7	NA	?	NA	NA

Table 2. Comparison of the nest dimensions between congeneric species of the genus *Chaetocercus* (all dimensions are given in mm; Mean ± SD)
a – this study., b – Juiña et al. 2010, c – Greeney & Juiña 2020, d – Marcuk & de Boer 2021, e - A. Hill undat

Taxa	External diameter	Internal diameter	Wall thickness	Height	Depth
C. jourdanii (n = 1)[a]	42.6 × 35.4	27.5 × 23.5	7.7-8.7	26.8	16.3
C. heliodor (n = 3)[a,d]	38.40 ± 1.92 × 34.63 ± 3.01 (36.1-40.8 × 31.3-38.6)	25.23 ± 0.26 × 22.70 ± 0.77 (25.0-25.6 × 21.8-23.7)	7.4-8.6 (n = 2)	31.3 ± 5.66 (23.3-35.6)	19.0 ± 1.08 (17.5-20)
C. berlepschi (n = 6)[b]	32.2 ± 2.8 × 33.9 ± 3.7	21.8 ± 3.4 × 21.7 ± 2.6		35.9 ± 3.7	20.4 ± 0.84
C. bombus (n = 2)[c,e]	36.4	23.3 × 19.9 and 16.5		34.6-35.0	15.7-16.8

(Malvaceae) and seeds of Asteraceae (*C. berlepschi*) or soft plant material (*C. heliodor, C. jourdanii*) (Juiña et al. 2010, Greeney & Juiña 2020, Marcuk & de Boer 2021, this study). Externally, the nest is either decorated with an external layer of leaden-coloured leaves, like in the case of the Little Woodstar (Greeney & Juiña 2020) or decorated by lichens (this study, Marcuk & de Boer 2021). The nest of the Little Woodstar was found c. 80 cm above the ground in an Asteraceae (Greeney & Juiña 2020), whereas nests of *C. berlepschi* were situated 7 ± 3.99 m above the ground all in a bifurcation of a small tree or bush (Juiña et al. 2010). The photographed female on a nest of the form *rosae* indicates that the nest is also placed in a bifurcation of a small tree. The biometric nest characteristics of Rufous-shafted Woodstar and its congeners are given in the Table above (Tab. 2)

Information about food provisioning and nestling development is only published for Esmeraldas Woodstar (*C. berlepschi*) (Juiña et al. 2010), while there are no data concerning the incubation and nestling

periods for any member of the genus.

According to Kiff et al. (1985) only two egg sets for *C. heliodor* and one egg set for *C. jourdanii* are present in the museums of North America, which were covered in the current study and by Marcuk & de Boer 2021, highlighting the limited information available for both species. Neither the eggs nor the nest of the Santa Marta (*C. astreans*) and White-bellied Woodstar (*C. mulsant*) are formerly described. A photograph (Photo Santiago David-Rivera) of a nest of *C. mulsant* from San Cristobal, Medellín (Colombia), however, suggests that the species builds a cup-shaped nest composed of fine plant material and decorated externally with lichens, similar to its congeners. Indeed, it is likely that both, the Santa Marta and White-bellied Woodstar, build a cup-shaped nest and have clutches consisting of two white eggs, as is the norm for the family Trochilidae (Winkler et al. 2020).

ACKNOWLEDGEMENTS

We are indebted to René Corado, who send us the information of the egg set preserved at Western Foundation of Vertebrate Zoology and allowing us to use the pictures. In addition, we would like to thank the comments from the three anonymous reviewers, which significantly improved the quality of the manuscript.

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