Revista Brasileira de Ornitologia 25(4): 269–272.
December 2017

SHORT-COMMUNICATION

Breeding of the Greenish Schiffornis (*Schiffornis virescens*, Tityridae)

Miguel Ângelo Marini[1,2] & Neander Marcel Heming[1]

[1] Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade de Brasília, 70910-900, Brasília, DF, Brazil.
[2] Corresponding author: marini@unb.br

Received on 30 April 2017. Accepted on 23 November 2017.

ABSTRACT: Like several Neotropical bird species, the breeding biology of the seven species of *Schiffornis* (Tityridae) is poorly known. Only three of these species have some aspects of their breeding biology described. This study provides description of two rare unreported clutches of the Greenish Schiffornis (*Schiffornis virescens*) housed for more than a century in the egg collection of Museu de Zoologia (MZUSP). Also, we estimated the nesting period for the species based on several scattered evidences of breeding, and compared the data with other Tityridae. Clutch size is of two or three, and museum eggs measure 2.13 ± 0.13 × 1.65 ± 0.08 cm (n = 4). Egg shape varied from oval to elliptical. The breeding season of the Greenish Schiffornis lasts at least between October and February, a known breeding period of forest birds from its distribution range. The still scarce breeding evidences for *Schiffornis* species and their close relatives call for further field studies, especially when considering the debatable phylogeny of the group.

KEY-WORDS: clutch size, egg measurements, nest, nesting, reproduction.

Our knowledge of the breeding biology of several Neotropical bird species are still lacking or incomplete (Heming *et al*. 2013, Crozariol 2016a). The genus *Schiffornis* (Tityridae) currently presents seven species (Remsen-Jr. *et al*. 2016) with most aspects of their breeding biology still poorly known (Skutch 1969, Sick 1997, Snow 2016). Formerly considered Pipridae, *Schiffornis* is presently included in Tityridae, placed in a clade with *Lanisoma* and *Laniocera* (Prum & Lanyon 1989) in the subfamily Laniisominae (Barber & Rice 2007, Tello *et al*. 2009) or Schiffornithinae (Ohlson *et al*. 2013).

Nearly all our knowledge about the breeding biology of the genus consists on a few nests described from three of the seven species. For other two species, the Foothill Schiffornis (*Schiffornis aenea*) and the Russet-winged Schiffornis (*Schiffornis stenorhyncha*), the breeding biology knowledge are based only on collected birds in breeding condition (del Hoyo *et al*. 2017). There is still no information about the Varzea Schiffonis (*Schiffornis major*) reproductive biology (del Hoyo *et al*. 2017).

The Northern Schiffornis (*Schiffornis veraepacis*) has most of its breeding aspects (egg laying season, nest, clutch, eggs, incubation period, nestling, and provisioning) described in Costa Rica (del Hoyo *et al*. 2017), though it is distributed from south Mexico to west Ecuador. For the Olivaceous Schiffornis (*Schiffornis olivacea*) there are only descriptions of breeding season (based on adult condition), nest, clutch, and eggs from Suriname and Guiana (del Hoyo *et al*. 2017). This species is distributed from southeastern Venezuela, to Guianas and northeastern Brazilian Amazon. The Thrush-like Schiffornis (*Schiffornis turdina*) has nest, clutch, eggs, and incubation and nestling period known from four nests found in Central America (Skutch 1969).

The Greenish Schiffornis (*Schiffornis virescens*) is a resident insectivorous species which inhabits the understory of forests and occurs in central and southeast Brazil, east Paraguay and northeast Argentina (Snow 2016). Sexes have similar greenish plumage and are much alike. The only published report of the Greenish Schiffornis nest was given by Snow (2016): "nest found in Brasília, 19th Dec, a large cup of leaves placed 3 m above ground in upright fork of bush, contained 2 eggs". No additional description or source of information was given. However, this description of the nest differs from most *Schiffornis* nests described so far (reviewed by Crozariol 2016b).

This study reports on two rare clutches housed in the Museu de Zoologia (MZUSP) egg collection, estimates the nesting period for the species based on several evidences of breeding from museums as well as from the literature and the website wikiaves.com.br, and compare all the breeding evidence about the genus.

We visited and searched for eggs in the following egg collections: Western Foundation of Vertebrate Zoology (Camarillo, USA), Natural History Museum (Tring, England), Museum fur Naturkundem (Berlin, Germany), "Nationaal Natuurhistorisch Museum"

(Leiden, Netherlands), Naturhistoriches Museum (Vienna, Austria), National Museums Scotland (Edinburgh, Scotland), Muséum National d'Histoire Naturelle (Paris, France), Natural History Museum - Smithsonian Institution (Washington, USA), Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Buenos Aires, Argentina), Museu de La Plata (La Plata, Argentina), Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (Villa de Leiva, Colombia), and in Brazil, Museu de Zoologia-USP (São Paulo), Museu Nacional (Rio de Janeiro), Museu Paraense Emilio Goeldi (Belém), Coleção Ornitológica Marcelo Bagno (Brasília), Museu de Ciências e Tecnologia da PUCRS and Fundação Zoobotânica do Rio Grande do Sul (Porto Alegre). We also visited the online egg collections of the Field Museum of Natural History (Chicago, USA) and California Academy of Science (San Francisco, USA), and the museum database Arctos Collaborative Collection Management Solution (arctos.database.museum). We measured the eggs of the two clutches found using digital photography (Bridge *et al.* 2007, Troscianko 2014).

We searched for breeding evidence (gonad size) and birds with immature characteristics (fleshy gape or unpneumatized skull, juvenile plumage) on labels and skin specimens at the MZUSP and Natural History Museum. Additionally, we searched the WikiAves website (www.wikiaves.com) on 23–25 March 2016, for photographs of nests, eggs, fledglings and their dates and localities.

We found only two clutches of two eggs each deposited at the MZUSP egg collection. No other Greenish Schiffornis eggs were found elsewhere. The first clutch (eggs 1 and 2 herein) was collected by Ricardo Krone at Itamirim, Iguape, state of São Paulo, Brazil, at an unknown date and labeled as *Scotothorus unicolor* (MZUSP 2675). This clutch was probably collected around (1895–1906), the period that Krone collected another 200 clutches of several bird species, most at Iguape, São Paulo (eggs from MZUSP and NMW). The second clutch (eggs 3 and 4 herein) has no location or date and was labeled as *Heteropelma virescens* (no catalog number). By the condition of the eggs and the data slip, it is also probably from early XX century. Both clutches had light color apparently spotless eggs (though rusted with time) of different sizes and shapes (Table 1). Eggs measured 2.13 ± 0.13 × 1.65 ± 0.08 cm (n = 4). The first clutch had similar eggs but one was narrower, while the second had one egg much smaller (~22%) than the other (n = 4, Table 1).

Table 1. Characteristics of Greenish Schiffornis eggs from MZUSP (eggs 1 and 2 Iguape, SP; eggs 3 and 4 unknown location). Egg length and width were measured in ImageJ (see methods for details).

Egg	Length (cm)	Width (cm)
1	2.23	1.60
2	2.20	1.72
3	2.13	1.71
4	1.94	1.55
Mean	2.13	1.65

The two clutches from MZUSP are in accordance with three additional two-egg clutches for other *Schiffornis* from northern locations. One clutch (MG 426-427) collected by Emile Snethlage at Santo Antônio do Prata, state of Pará, Brazil, on 12 May 1920, had two white eggs. Similarly a clutch (NHM 1952-8-421) collected by T.A.W. Davis at Mahaicony River, Guyana, on 22 April 1934, had two fresh white eggs. Lastly, a clutch of the Northern Schiffornis *Schiffornis veraepacis veraepacis* (MVZ-Berkeley 14376) collected by Prentis T. Burtis at Rio Chalchijapa, Vera Cruz, Mexico, on 3 April 1961, also had two fresh eggs (average size 17.9 × 24.3 mm).

Photos of a nest of the Greenish Schiffornis with three eggs were taken on 18 December 2008 (Table 2) (Wikiaves, WA36059, by A. Bianco). This is in accordance with the three recently described three-egg clutches found in October at Misiones, Argentina (Bodrati & Cockle 2017), but not in accordance with the reports of two eggs from the two MZUSP clutches, the published report by Snow (2016) or the number of eggs reported for Thrush-like Schiffornis (Skutch 1969), Northern Schiffornis, and Olivaceous Schiffornis (del Hoyo *et al.* 2017). The larger clutches from southern locations (Santa Catarina, Brazil and Misiones, Argentina) compared to the northern ones (Skutch 1969, Snow 2016, del Hoyo *et al.* 2017) might be explained by a latitudinal increase in clutch size (Jetz *et al.* 2008, Heming & Marini 2015).

An analysis of 58 skins from MZUSP revealed that a young female with 50% pneumatized skull was caught on 26 November 2011 and a young male with 20% pneumatized skull was caught on 13 March 2012 both at São Paulo state, Brazil. Also, a young male with beak commissure was caught on 17 December 2011 at the state of Minas Gerais, Brazil. Males had developed testes (8 × 11 and 6 × 8 mm) on 16 November 2005 and 25 November 2011, respectively, also at São Paulo state.

When considering all the reproductive evidence we found, the breeding period of the Greenish Schiffornis lasts at least from October to February, a common period of breeding of forest birds in its distribution range in Brazil (Marini & Durães 2001, Marini *et al.* 2007, Repenning & Fontana 2011, Maurício *et al.* 2013, Marques-Santos *et al.* 2015). Also, a photo of a fledgling perched in a branch taken on 29 February 2013 at Caraguatatuba, São Paulo state (WA 585213, by M. Nema) (Table 2), is in agreement with this breeding period. The Northern Schiffornis lays eggs from February to August in several

Table 2. Date, location, stage, collection number, and author name of Greenish Schiffornis egg and fledgling records.

Day	Month	Location	Latitude (S)	Longitude (W)	Stage	WikiAves/ Museum ID	Author
-	-	-	-	-	Eggs	MZUSP no number	-
-	-	Iguape, SP, Brazil	24º	47º	Eggs	MZUSP 2675	R. Krone
3–6	10	San Pedro, Misiones, Argentina	26º	54º	Eggs	-	Bodrati & Cockle (2017)
18	12	Urussanga, SC, Brazil	28º	49º	Eggs	WA36059	A. Bianco
19	12	Brasília, DF, Brazil	15º	47º	Eggs	-	Snow (2016)
29	02	Caraguatatuba, SP, Brazil	23º	45º	Fledgling	WA585213	M. Nema

countries in the Northern Hemisphere (del Hoyo *et al*. 2017). The Olivaceous Schiffornis is suggested to breed from August to September (adults in breeding condition), but a nest with eggs was found in April in Guyana (del Hoyo *et al*. 2017). Adults in breeding condition of Foothill Schiffornis were collected in March and June in east Ecuador and of Russet-winged Schiffornis from January to June in north Colombia (del Hoyo *et al*. 2017).

We found no nests at museums, but the description of nests by Bodrati & Cockle (2017) is similar to the nest in the photo published at Wikiaves, but both differ from the description given by Snow (2016). The nests described by Bodrati & Cockle (2017) are much lower (0.43–0.64 m above ground) and though not inserted in cavities, were laterally protected by petioles of tree ferns. Similarly to Wikiaves reports, a nest of the Thrush-like Schiffornis (NHM 1952-8-421) collected by T.A.W. Davis at Mahaicony River, Guyana, was built in a palm cavity. The Northern Schiffornis eggs collected by Prentis T. Burtis in Mexico (MVZ-Berkeley 14376) were in an open nest built entirely with dried leaves lined with black strands, 1.8 m up in a small palm.

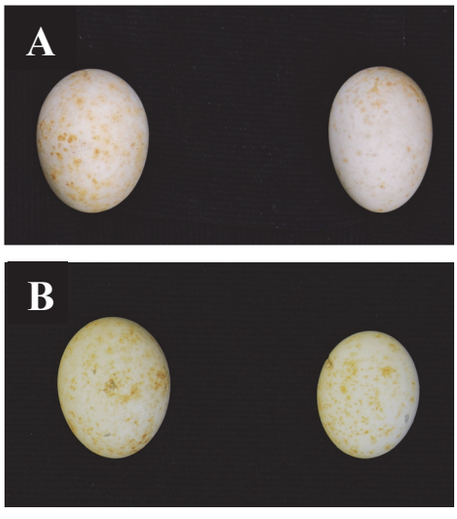

Figure 1. Greenish Schiffornis eggs from (**A**) Itamirim, Iguape, state of São Paulo, Brazil (MZUSP 2675, eggs 1 and 2) and (**B**) unknown location (MZUSP no catalog number, eggs 3 and 4).

Similarly to descriptions of *Schiffornis* nests and eggs, the Cinereous Mourner (*Laniocera hypopyrra*) nest consists of a bulky cup made of dry leaves (Londoño & Cadena 2003). The breeding evidence summarized above (nest type, clutch size and egg color and markings) supports the hypothesis of closer relationship between *Laniocera* and *Schiffornis* (Prum & Lanyon 1989, Barber & Rice 2007, Tello *et al*. 2009, Ohlson *et al*. 2013), and that several of these characteristics are homologous.

Considering all the above, the breeding of the Greenish Schiffornis is similar to that of the Thrush-like Schiffornis and the Northern Schiffornis. The Greenish Schiffornis seems to build its nest in a similar way to the Thrush-like Schiffornis, but at more variable heights (~0.5–3 m, n = 5) than it (~1.1–1.5 m, n = 4). Since clutch size, date and location (one clutch) from the MZUSP records are unknown, it makes difficult further comparisons between these clutches and the other records. The still scarce breeding evidences for *Schiffornis* species and their close relatives (Shrike-like Cotinga *Laniisoma elegans*, Speckled Mourner *Laniocera rufescens* and the Cinereous Mourner) call for further field studies, especially when considering its debatable phylogeny.

ACKNOWLEDGEMENTS

We thank *Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)* and *Fundação de Amparo à Pesquisa do Distrito Federal (FAPDF)*, Brazil, for research funding received by M.Â.M. and N.M.H. and for a fellowship received by M.Â.M. We thank *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)* for a post-doctoral scholarship received by NMH. This research was supported by grants from CNPq and FAPDF. We thank to all museum curators for kindly allowing us to study specimens under their care.

REFERENCES

Barber B.R. & Rice N.H. 2007. Systematics and evolution in the Tityrinae (Passeriformes: Tyrannoidea). *Auk* 124: 1317–1329.

Bodrati A. & Cockle K.L. 2017. Nest, eggs and reproductive biology of Greenish Schiffornis (*Schiffornis virescens*). *Revista Brasileira de Ornitologia* 25: 273–276.

Bridge E.S., Boughton R.K., Aldredge R.A., Harrison T.J.E., Bowman R. & Schoech S.J. 2007. Measuring egg size using digital photography: testing Hoyt's method using Florida Scrub-Jay eggs. *Journal of Field Ornithology* 78: 109–116.

Crozariol M.A. 2016a. Espécies de aves com ninhos não descritos ou pouco conhecidos das famílias Tityridae, Platyrinchidae, Pipritidae, Pipromorphidae e Tyrannidae: um pedido de auxílio aos observadores de aves! *Atualidades Ornitológicas* 189: 18–24.

Crozariol M.A. 2016b. Evolução da forma de nidificação da Superfamília Tyrannoidea (Aves: Passeriformes) com base na fixação, arquitetura e composição dos ninhos, v. 2. Ph.D. Thesis. Rio de Janeiro: Museu Nacional/UFRJ.

del Hoyo J., Elliott A., Sargatal J., Christie D.A. & de Juana E. (eds.). 2017. *Handbook of the birds of the world alive*. Barcelona: Lynx Editions. http://www.hbw.com/ (accesses on 28 April 2017).

Heming N.M., Greeney H.F. & Marini M.Â. 2013. Breeding biology research and data availability for New World flycatchers. *Natureza & Conservação* 11: 54–58.

Heming H.M. & Marini M.Â. 2015. Ecological and environmental factors related to variation in egg size of New World flycatchers. *Journal of Avian Biology* 46: 352–360.

Jetz W., Sekercioglu C.H. & Böhning-Gaese K. 2008. The worldwide variation in avian clutch size across species and space. *PLoS Biology* 6: 2650–2657.

Londoño G.A. & Cadena C.D. 2003. The nest and eggs of the Cinereous Mourner (*Laniocera hypopyrra*). *Wilson Bulletin* 115: 115–118.

Marini M.Â. & Durães R. 2001. Annual patterns of molt and reproductive activity of passerines in south-central Brazil. *Condor* 103: 767–775.

Marini M.Â., Aguilar T.M., Andrade R.D., Leite L.O., Anciães M., Carvalho C.E.A., Duca C., Maldonado-Coelho M., Sebaio F. & Gonçalves J. 2007. Biologia da nidificação de algumas aves do sudeste de Minas Gerais, Brasil. *Revista Brasileira de Ornitologia* 15: 367–376.

Marques-Santos F., Braga T.V., Wischhoff U. & Roper J.J. 2015. Breeding biology of passerines in the subtropical Brazilian Atlantic Forest. *Ornitología Neotropical* 26: 363–374.

Maurício G.N., Bencke G.A., Repenning M., Machado D.B., Dias R.A. & Bugoni L. 2013. Review of the breeding status of birds in Rio Grande do Sul, Brazil. *Iheringia, Série Zoologia* 103: 163–184.

Ohlson J.I., Irestedt M., Ericson P.G.P. & Fjeldså J. 2013. Phylogeny and classification of the New World suboscines (Aves, Passeriformes). *Zootaxa* 3613: 1–35.

Prum R.O. & Lanyon W.E. 1989. Monophyly and phylogeny of the *Schiffornis* group (Tyrannoidea). *Condor* 91: 444–461.

Remsen-Jr. J.V., Areta J.I., Cadena C.D., Jaramillo A., Nores M., Pacheco J.F., Pérez-Emán J., Robbins M.B., Stiles F.G., Stotz D.F. & Zimmer K.J. 2016. *A classification of the bird species of South America*. American Ornithologists' Union. http://www.museum.lsu.edu/~Remsen/SACCBaseline.html

Repenning M. & Fontana C.S. 2011. Seasonality of breeding, moult and fat deposition of birds in subtropical lowlands of southern Brazil. *Emu* 111: 268–280.

Sick H. 1997. *Ornitologia brasileira*. Rio de Janeiro: Editora Nova Fronteira.

Skutch A.F. 1969. *Life histories of Central American birds III: Families Cotingidae, Pipridae, Formicariidae, Furnariidae, Dendrocolaptidae, and Picidae. Berkeley*: Cooper Ornithological Society, Pacific coast avifauna, No. 35.

Snow D. 2016. Greenish Mourner (*Schiffornis virescens*). In: del Hoyo J., Elliott A., Sargatal J., Christie D.A. & de Juana E. (eds.). *Handbook of the birds of the world alive*. Barcelona: Lynx Editions. http://www.hbw.com/ (access on 28 March 2016).

Tello J.G., Moyle R.G., Marchese D.J. & Cracraft J. 2009. Phylogeny and phylogenetic classification of the tyrant flycatchers, cotingas, manakins, and their allies (Aves: Tyrannides). *Cladistics* 25: 429–467.

Troscianko J. 2014. A simple tool for calculating egg shape, volume and surface area from digital images. *Ibis* 156: 874–878.

Associate Editor: Caio G. Machado.