

NESTING OF DARK-BILLED CUCKOO (*Coccyzus melacoryphus*) ON ISABELA ISLAND, GALAPAGOS, ECUADOR

ANIDACIÓN DEL CUCLILLO CANELA (*Coccyzus melacoryphus*)
EN LA ISLA ISABELA, GALÁPAGOS, ECUADOR

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ABSTRACT: We present new data and reviewed the information available on the breeding biology of the Dark-billed Cuckoo (*Coccyzus melacoryphus*), a widespread South American species. We collected opportunistic observations from three nests in a mangrove forest on Isabela Island, Galapagos Archipelago, Ecuador. The nests were built in forks of White Mangrove (*Laguncularia racemosa*) branches 5 to 9 m above the ground. They were low/cup-shaped, with intertwined branches on the outside and leaves, stipules, and strips of stem bark in the inner cup. The clutch size was three eggs, which were light green and sub-elliptical in shape. The nestling period lasted between 7 and 8 days. We observed biparental care during incubation and brooding. In addition, we documented the parasitism of the Avian Vampire Fly (*Philornis downsi*) on Dark-billed Cuckoo chicks.

KEYWORDS: *Avian Vampire Fly, breeding behavior, breeding biology, Cuculidae, nesting, Philornis downsi*

RESUMEN: Presentamos nueva información y revisamos la existente sobre la biología reproductiva del Cuclillo Canela (*Coccyzus melacoryphus*), una especie ampliamente extendida en Sudamérica. Recogimos información de manera oportunista de tres nidos, en manglares de la Isla Isabela, en el Archipiélago de Galápagos, Ecuador. Los nidos estaban colocados sobre horquetas de ramas de Mangle Blanco (*Laguncularia racemosa*), entre 5 y 9 m de altura sobre el suelo. Los nidos tenían forma de copa baja, con ramas entrelazadas en la parte externa, y hojas, estípulas y corteza de tallos en el sitio de alojamiento de los huevos y polluelos. El tamaño de puesta fue de tres huevos, los cuales fueron de color verde pálido y de forma subelíptica. Observamos cuidado biparental durante los periodos de incubación y empollamiento. El periodo de empollamiento y cría duró entre 7 y 8 días. Además, documentamos parasitismo de la Mosca Vampiro Aviar (*Philornis downsi*) en los polluelos del Cuclillo Canela.

PALABRAS CLAVE: *anidación, biología reproductiva, comportamiento reproductivo, Cuculidae, Mosca Vampiro Aviar, Philornis downsi*

The Dark-billed Cuckoo (*Coccyzus melacoryphus*) is a member of the Cuculidae family with a wide distribution in South America, from Venezuela to Argentina (Damon 2020). There are migratory and resident populations in continental Ecuador and the Galapagos

Archipelago, although their movements are poorly understood (Freile and Restall 2018, Brinkhuizen and Nilsson 2020). It occupies a variety of habitats with preference for areas with abundant trees and compact scrub (Brinkhuizen and Nilsson 2020, Damon 2020).

Its diet consists almost exclusively of terrestrial arthropods (Damon 2020).

The breeding biology of the Dark-billed Cuckoo is well documented in Argentina (Dabbene 1926, Smyth 1928, de la Peña 1983, 2013, Payne 1997, Babarskas et al. 2003, Di Giacomo 2005, Salvador 2011), Brazil (Paixão et al. 2021, Paixão and Pichorim 2023), and to a lesser extent in Colombia (Payne 1997). These publications provide details on nests, eggs and nestlings (Table 1). In Ecuador, the only breeding records are from the Galapagos Archipelago and most are occasional observations without follow-up. These data include a description of two nests on San Cristobal Island and one nest on Isabela Island from more than 100 years ago (Gifford 1919), and a detailed description of four nests in the arid zone of Santa Cruz Island found 33 years ago (Ervin 1989). The Galapagos archipelago records include descriptions of nests and eggs, providing little information on nestlings (Gifford 1919, Ervin 1989) (Table 1).

This study aims to increase knowledge of the reproductive biology of the Dark-billed Cuckoo. We present detailed descriptions of nests, eggs, development of the nestlings, and adult behavior during breeding. In addition, we report a new record of Avian Vampire Fly (*Philornis downsi*) parasitism in Dark-billed Cuckoo nests. This information is based on opportunistic observations of three nests in a mangrove forest on Isabela Island, Galapagos Archipelago, Ecuador.

METHODS

Dark-billed Cuckoo nesting observations were made in a mangrove forest at Playa Tortuga Negra (0°14'S, 91°23'W), on the northwest coast of Isabela Island. This mangrove forest is 20 ha, consisting of three mangrove species: White Mangrove (*Laguncularia racemosa*), Red Mangrove (*Rhizophora mangle*), and Black Mangrove (*Avicennia germinans*) (Dvorak et al. 2000). Nesting observations were made opportunistically while monitoring the reproductive success of the Mangrove Finch (*Camarhynchus heliobates*) from February 18 to April 22, 2022.

We made direct observations of three Dark-billed Cuckoo nests using binoculars (Nikon 10x42) from a distance of no less than 7 m. We obtained 13.5 h of observations: Nest 1: 7 h 4 min, once during the incubation period and four times during the nestling period; Nest 2: 5 h 5 min, four times during the incubation period; and Nest 3: 1 h 21 min, twice during the incubation period. Observations were carried out at different times of the day between 6:25 and 17:52 h, and ranged from 17 min to 2 h 21 min in duration. We documented incubation bouts, some adult incubation behavior, and some adult chick feeding behavior.

Additionally, we monitored Nest 1 through indirect observations with a trail camera (Reolink with an internal recharging solar panel battery) from March 18 to March 29, 2022. The camera, covered in camouflage tape to reduce its visibility, was located 1.5 m from the nest on a branch in an adjacent mangrove tree. The camera was active day and night (24 hours), set on motion-detect video mode, recording for 30 s when triggered. It was deployed one day before the eggs hatched, so it documented adult behavior during the nestling period until fledging. The camera recorded at least one video per day, totaling 139 videos recorded between 6:43 and 15:48 h. These videos showed the nestlings' plumage development, and adult and nestling behavior.

We estimated the height above ground of the three nests when the tide was low, using the height of a person as a reference. Nests were collected after confirming that they had been abandoned by fledglings and adults, with 40 min monitoring for two consecutive days. Nest 1 was collected two days after the fledglings left the nest, and Nest 2 was collected eight days after the adults abandoned the nest. We took the following measurements from Nests 1 and 2 with a metal ruler: external diameter, internal diameter, cup depth, and nest height. We also described the materials of Nests 1 and 2 and looked for the presence of Avian Vampire Fly pupae. This fly is introduced to the Galapagos Archipelago and its larvae parasitize nestlings, resulting in many negative impacts on terrestrial birds (Fessler et al. 2001, 2018, Fessler and Tebbich 2002, McNew and Clayton 2018). We took length and width measurements of the infertile eggs with electronic calipers accurate to 0.02 mm: 1 egg in Nest 1 and 2 eggs in Nest 2. Data collection followed the protocols of Cadena-Ortiz (2018) and Fierro-Calderón et al. (2021). For nest shape, we followed Simon and Pacheco (2005), for egg shape Baicich and Harrison (1997), and for color Smithe (1975).

RESULTS

Copulation

On March 17 and April 5, 2022, we observed two pairs of Dark-billed Cuckoos copulating in the understory layer of the mangrove. One individual swooped towards a branch, and another individual approached. The first one situated itself on top of the second bird, which turned its body in a lateral position. They raised their tails and copulated for approximately 15 s. Subsequently, the individual that was in a lateral position flew away, then the other ruffled its feathers briefly and flew away. These observations were made about 300 m from the nests described in this article, so we don't know if these pairs are the ones in our study or others.

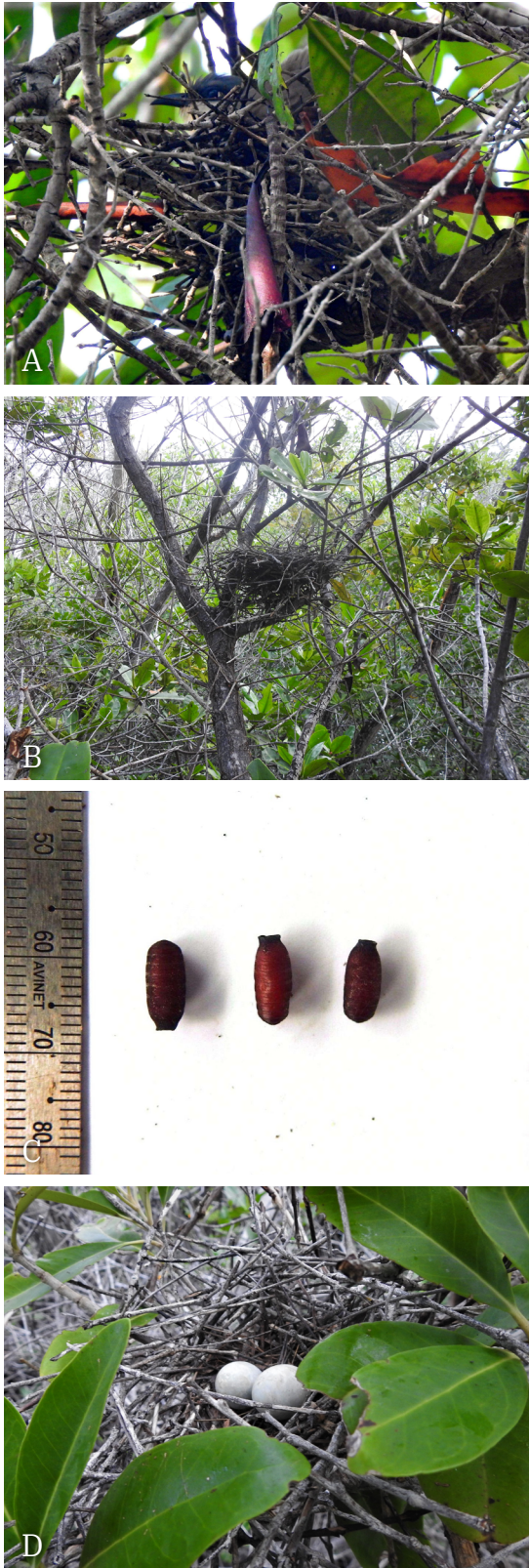


Figure 1. A) Dark-billed Cuckoo (*Coccyzus melacoryphus*) in Nest 3. B) Location of Nest 1 in a mangrove swamp. C) Pupae of the Avian Vampire Fly (*Philornis downsi*) found in Nest 1. D) Unhatched infertile eggs of Nest 2.

We located Nest 1 on March 14, 2022, with three eggs and incubating adults observed. We located Nest 2 on March 21, 2022, when an adult was observed incubating. We located Nest 3 on March 22, 2022, when we observed an adult incubating (Fig. 1A). We could not access Nests 2 and 3 to view their contents so the number of eggs in these nests was not determined at the time, we identified incubation because we saw the adults sitting on the nest for at least 20 continuous minutes. We only documented chicks hatch in Nest 1. The adults abandoned Nest 2 during incubation, and we did not observe the outcome of Nest 3.

Nest description and placement

The three nests were located in forks of White Mangrove branches in the understory layer, 5, 7, and 9 m above the ground (Fig. 1B). The nests were low/cup-shaped, and small, so that the cloacal region and tail of the adults protruded from the edges of the nests. The dimensions of Nests 1 and 2 were: an external diameter of 16 and 13.2 cm, an internal diameter of 7.3 and 6.9 cm, a cup depth of 2.2 and 1.7 cm, and a nest height of 6.5 and 7 cm (Table 1). The outer layer of Nests 1 and 2 were constructed with White Mangrove branches of different lengths and thicknesses, most ending in small forks, while the inner cups were composed mainly of leaves, stipules, and bark from Red Mangrove stems. They also had smaller quantities of roots, tendrils, and some thinner branches of unidentified plants. In addition, only in Nest 1, when we dissected the nest materials, we found three pupae of the Avian Vampire Fly (Fig. 1C), identified by the presence of a frothy cocoon and their typical endings (Fessl et al. 2006).

Eggs and incubation

In Nests 1 and 2, eggs were short sub-elliptical in shape, and light green in color with no markings (Fig. 1D). The egg from Nest 1 measured: 3.4 x 2.5 cm, and eggs from Nest 2 measured: 3.1 x 2.6 cm, and 3.3 x 2.6 cm (Table 1). The clutch size in Nest 1 was three eggs, while Nest 2 contained two eggs and shells, so we were not able to determine clutch size.

In all three nests, we observed both adults incubating the eggs. The incubation bouts varied, with the shortest lasting 4 min and the longest lasting 1 h 6 min (mean= 25.92 min, SD= 21.55, n= 13). The time that adults left the eggs unattended in the nest lasted between 1 and 17 min (mean= 4.35 min, SD= 4.28, n= 17). When an adult left its nest, another individual arrived, or the same individual returned, and continued to incubate. Only on two occasions were two adults found in a nest simultaneously (n= 13 bouts) for a few seconds. At times when the adults were incubating, they moved within the nest to one side or the other by at least 2 or 3 cm, keeping the eggs beneath

them. Although we did not count how many times they performed these behaviors, they were frequent and occurred in all three nests.

When the adults approached the nest to resume incubation they perched on low branches approximately 1 m below the nest, then began to climb slowly, jumping from branch to branch, turning their head side to side while climbing. On three occasions, we observed an adult arrive with nest materials for the outer layer and the inner cup, and after adding them, it resumed incubation.

Nestlings and nestling attendance

In Nest 1, through the trail camera video images, we documented the full development of the nestlings after hatching to fledging. The first chick hatched on March 19, 2022. It had gray nessoptiles on its head and back, and the black eye stripe was already evident. The second chick was observed on March 20. On March 22, we observed both chicks with pin feathers on their wings and backs. On March 26, the chicks had their first feathers, which were brown on their wings and beige on their breasts. Their heads kept the gray pin feathers and the black eye stripe. Their tails were short, about a quarter of the size of the tail of an adult. Their wing feathers were also short.

On March 26, one of the chicks left the nest, possibly the first to hatch. This chick remained in the nest for seven days from hatching until fledging. On March 27, the other chick was still in the nest. It perched several times on the edge of the nest and flapped its wings constantly. On March 28, the second chick fledged, having remained in the nest for eight days since hatching. This chick had more developed plumage and fewer pin feathers than the previous one.

In addition, from reviewing the camera videos we observed both adults directly provisioning the chicks, but only in 2 of 14 observations were both adults found in the nest at the same time. For the first days after hatching, the adults did not deliver whole prey to the nestlings, they crushed the prey and held it in the chicks' beaks for several seconds. The first time an adult delivered whole prey to a chick was when the chick was six days old, one day before it fledged. The chicks begged for food, opening their beaks and flapping their wings, creating sounds similar to bees buzzing. When a chick was seven days old and was alone in the nest, it began to make its first calls, which increased in volume and syllables, until it fledged the following day. The adults were brooding the chicks throughout their time in the nest and an adult was sitting inside the nest next to its chick only hours before the chick fledged the nest. In addition to the video recordings, on four occasions in the field we observed an adult arriving with crickets (*Nesoecia cooksoni*) for the chicks.

DISCUSSION

Our records and previous records of Dark-billed Cuckoo nesting in the Galapagos Islands (Gifford 1919, Ervin 1989) show a breeding period between January and May. These months coincide with the rainy season and the breeding of Galapagos land birds, due to the availability of resources (Grant 1986). In Brazil, nesting of this species is also related to the rainy season; between January and June (Paixão et al. 2021). In Argentina, between October and February (de la Peña 1983, 2013), and in Colombia with one record in October (Payne 1997). It is important to consider that all records from Galapagos are occasional, so the breeding period could be longer.

The Dark-billed Cuckoo's nests described in this paper were low/cup-shaped (Fig. 1B), following the classification of Simon and Pacheco (2005), although other studies have described them as a simple platform shape (de la Peña 1983, 2013, Di Giacomo 2005, Paixão et al. 2021).

Nest dimensions described so far, and data from this study, show slight variations in the following measurements: internal diameter, cup depth and nest height (1.6, 0.5 and 0.25 cm, respectively), while the external diameter measurement varied up to 6 cm (Gifford 1919, de la Peña 1983, Ervin 1989, Paixão et al. 2021). Meanwhile, the height of the nests from the ground varied quite a bit between 0.17 and 9 m (Gifford 1919, Dabbene 1926, de la Peña 1983, Ervin 1989, Di Giacomo 2005, Salvador 2011, Paixão et al. 2021). All three nests in this study were located higher than even the nests described on San Cristobal (maximum height= 3.6 m) and Santa Cruz Islands (maximum height= 3.5 m) (Gifford 1919, Ervin 1989). This variation is probably due to the difference in vegetation composition of the sites where nests were found, with notably taller vegetation at our study site. The average height of the forest at Playa Tortuga Negra was evaluated at 12 m (Dvorak et al. 2000) with a maximum canopy height of 25 m (authors pers. obs.).

The materials used to construct the nests were also different, also due to the composition of the surrounding vegetation. We found differences between the materials of the outer and inner cups of the nests, as reported from some nests in Argentina (de la Peña 1983, 2013, Di Giacomo 2005). The nests of many bird species differ in the materials used for the outer and inner cups, and there are many hypotheses that describe the possible reasons for this feature (Lovette and Fitzpatrick 2016), perhaps it provides more protection for the eggs and chicks.

We observed three Avian Vampire Fly pupae in a Dark-billed Cuckoo nest, indicating that the larva fed on the nestlings. Despite this, the chicks survived and fledged successfully. This is the second reported

case of parasitism in Dark-billed Cuckoo. It has been previously documented in the humid zone of Santa Cruz Island, where 1 of 2 nests reviewed had five Avian Vampire Fly pupae (Fessler et al. 2001, Fessler and Tebbich 2002). With so few records, much remains unknown about the interactions between the Dark-billed Cuckoo and Avian Vampire Flies, which currently threaten 75% of Galapagos land birds species (Fessler et al. 2018). We want to emphasize the small number of pupae found in the two nests reported so far, with only 5 and 3 pupae; on the contrary, the Mangrove Finch, which nests in the same forest, shows very high levels of parasitism (Cunninghame et al. 2015).

The coloration of the eggs has been described as various shades of light blue to light green, while the shape has also been described as elliptical (Smyth 1928, de la Peña 1983, 2013, Ervin 1989, Di Giacomo 2005, Paixão et al. 2021). The clutch size was within the range of previous records ranging from 1 to 6 eggs (Gifford 1919, de la Peña 1983, 2013, Ervin 1989, Di Giacomo 2005, Salvador 2011, Paixão et al. 2021). Although it is assumed that nests with 1 or 2 eggs were found during laying as incomplete clutches. The most common clutch size ranges from 3 and 5 eggs (Paixão et al. 2021).

We report a nestling period of 7 to 8 days, which is the shortest report published to date for the species, as other authors report a nestling period of up to 15 days (de la Peña 2013), although 10 days is the most common (Di Giacomo 2005, Salvador 2011, Paixão et al. 2021). The nestlings of their congeners also fledge the nest after a short nestling period, with Yellow-billed Cuckoo (*Coccyzus americanus*) between 7 and 9 days and Black-billed Cuckoo (*C. erythrophthalmus*) between 6 and 7 days (Hughes 2020a, 2020b), which could suggest that rapid development is an ancestral trait in the family (Riehl 2021). However, it should also be investigated whether the nestling period of Dark-billed Cuckoo is shorter in the Galapagos Islands than on the mainland.

Much remains to be explored about the reproductive biology of the Dark-billed Cuckoo, for example: the factors driving different local and regional nesting adaptations, comparisons between island and mainland nesting, and interactions with other organisms, including invasive species. We therefore encourage the continuation of studies on the species, as they provide a basis for further research.

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LITERATURE CITED

- BABARSKAS M, PEREIRA J AND HAENE E (2003) Aves de la Reserva Natural Otamendi. Pp. 47-113 in: PEREIRA J AND HAENE E (eds). Fauna de Otamendi, Inventario de los animales vertebrados de la Reserva natural Otamendi (Pdo. Campana, Provincia de Buenos Aires, República Argentina). *Temas de Naturaleza y Conservación – Monografía de Aves Argentinas N° 3*
- BAICICH PJ AND HARRISON CJ (1997) *A guide to the nests, eggs, and nestling of North American birds. Second edition*. San Diego (USA): Academic Press
- BRINKHUIZEN DM AND NILSSON J (2020) *Birds and mammals of the Galapagos*. Barcelona: Lynx Edicions
- CADENA-ORTIZ H (2018) Sugerencias para la toma de datos en eventos de biología reproductiva de aves. *Avances en Ciencias e Ingenierías* 10(16):24-35. <https://doi.org/10.18272/aci.v10i1.297>
- CUNNINGHAME F, SWITZER R, PARKS B, YOUNG G, CARRIÓN A, MEDRANDA P AND SEVILLA C (2015) Conserving the critically endangered mangrove finch: Head-starting to increase population size. Pp. 151-157 in: Galapagos Report 2013-2014. GNP, GREG, CDF and GC. Puerto Ayora, Galapagos, Ecuador
- DABBENE R (1926) Nidificación del cucúlido *Coccyzus melanocoryphus* Vieill. *El Hornero* 3:420-422
- DAMON A (2020) Dark-billed Cuckoo (*Coccyzus melanocoryphus*) in: SCHULENBERG TS, editor (2020), *Birds of the World* (web application). Cornell Lab of Ornithology, Ithaca, New York. Available: <https://doi.org/10.2173/bow.dabcuc1.01>
- DI GIACOMO AG (2005) Aves de la Reserva El Bagual. Pp. 201- 465 in: DI GIACOMO AG AND KRAPOVIC-KAS SF (eds). Historia natural y paisaje de la Reserva El Bagual, provincia de Formosa, Argentina. Inventario de los vertebrados y de la flora vascular de un área protegida del Chaco Húmedo. *Temas de Naturaleza y Conservación – Monografía de Aves Argentinas N° 4*
- DVORAK M, TEBBICH S, FESSLER B AND VARGAS H (2000) Distribution, numbers and habitat of the Mangrove Finch (*Cactospiza heliobates*) on Isabela, Galápagos Islands. Results of surveys in 1997 and 1998. A report to the German Ornithological

- Society and the Charles Darwin Research Station. Vienna. BirdLife Österreich DO-G
- ERVIN S (1989) The nesting of the Dark-billed Cuckoo in the Galapagos. *Noticias de Galápagos* 48:8-10
- FESSL B, COURI MS AND TEBBICH S (2001) *Philornis downsi* Dodge & Aitken, new to the Galapagos Islands (Diptera, Muscidae). *Studia Dipterologica* 8:317-322
- FESSL B, HEIMPEL GE AND CAUSTON CE (2018) Invasion of an Avian Nest Parasite, *Philornis downsi*, to the Galapagos Islands: Colonization History, Adaptations to Novel Ecosystems, and Conservation Challenges. Chapter 9. Pp. 213–266 in: PARKER PG (ed). Disease Ecology: Galapagos Birds and their Parasites. Disease Ecology. https://doi.org/10.1007/978-3-319-65909-1_9
- FESSL B, SINCLAIR BJ AND KLEINDORFER S (2006) The life-cycle of *Philornis downsi* (Diptera: Muscidae) parasitizing Darwin's finches and its impacts on nestling survival. *Parasitology* 133:739-747. <https://doi.org/10.1017/S0031182006001089>
- FESSL B AND TEBBICH S (2002) *Philornis downsi* - a recently discovered parasite on the Galápagos archipelago - a threat to Darwin's finches? *Ibis* 144:445-451. <https://doi.org/10.1046/j.1474-919X.2002.00076.x>
- FIERRO-CALDERÓN K, LOAIZA-MUÑOZ M, SÁNCHEZ-MARTÍNEZ MA, OCAMPO D, DAVID S, GREENEY HF AND LONDOÑO GA (2021) Methods for collecting data about the breeding biology of Neotropical birds. *Journal of Field Ornithology* 92(4):315-341. <https://doi.org/10.1111/jfo.12383>
- FREILE J AND RESTALL R (2018) Birds of Ecuador. London (UK): Helm Field Guides
- GIFFORD EW (1919) Field notes on the land birds of the Galapagos Islands and of Cocos Island, Costa Rica. *Proceedings of the California Academy of Sciences* Fourth Series 2:189-258
- GRANT PR (1986) Ecology and evolution of Darwin's finches. Pp. 213-266 in: FESSL B, HEIMPEL GE AND CAUSTON CE (eds) Invasion of an Avian Nest Parasite, *Philornis downsi*, to the Galapagos Islands: Colonization History, Adaptations to Novel Ecosystems, and Conservation Challenges. *Disease Ecology*
- HUGHES JM (2020a) Black-billed Cuckoo (*Coccyzus erythrophthalmus*). In: RODEWALD PG (ed). Birds of the World (web application). Cornell Lab of Ornithology, Ithaca, New York. Available: <https://doi.org/10.2173/bow.bkbcuc.01>
- HUGHES JM (2020b) Yellow-billed Cuckoo (*Coccyzus americanus*). In: RODEWALD PG (ed). Birds of the World (web application). Cornell Lab of Ornithology, Ithaca, New York. Available: <https://doi.org/10.2173/bow.yebcuc.01>
- LOVETTE IJ AND FITZPATRICK JW (2016) The Cornell Lab of Ornithology Handbook of Bird Biology. Third Edition. West Susse (UK): Cornell University
- MCNEW SM AND CLAYTON DH (2018) Alien invasion: Biology of *Philornis* flies Highlighting *Philornis downsi*, an introduced parasite of Galápagos birds. *Annual Review of Entomology* 63:369–387. <https://doi.org/10.1146/annurev-ento-020117-043103>
- PAIXÃO VHF, MACARIO P AND PICHORIM M (2021) Breeding biology of the Dark-billed Cuckoo *Coccyzus melacoryphus* (Aves: Cuculidae) in a semi-arid Neotropical region. *Ornithology Research* 29:68–75
- PAIXÃO VHF AND PICHORIM M (2023) Factors influencing the daily nest survival of the Dark-billed Cuckoo (*Coccyzus melacoryphus*). *The Wilson Journal of Ornithology* 134(4):604-611. <https://doi.org/10.1676/21-00044>
- PAYNE RB (1997) Cuco de pico oscuro. Pp. 597 in: SCHULENBERG TS (ed). Birds of the World (web application). Cornell Lab of Ornithology, Ithaca, New York. Available: <https://doi.org/10.2173/bow.dabcuc1.01>
- DE LA PEÑA MR (1983) Notas sobre observaciones de nidificación de aves en la Provincia de Santa Fe. *El Hornero* 129-131
- DE LA PEÑA MR (2013) *Nidos y reproducción de las aves argentinas*. Santa Fe (AR): Ediciones Biológica. Serie Naturaleza, Conservación y Sociedad N° 8
- RIEHL C (2021) Evolutionary origins of cooperative and communal breeding: lessons from the cropagine cuckoos. *Ethology* 127:827-836. <https://doi.org/10.1111/eth.13149>
- SALVADOR SA (2011) Biología reproductiva de la familia Cuculidae en el departamento Gral. San Martín, Córdoba, Argentina. *Historia Natural* 3:101-112
- SIMON JE AND PACHECO S (2005) On the standardization of nest descriptions of Neotropical birds. *Revista Brasileira de Ornitologia* 13(2):143–154
- SMITHE FB (1975) *Naturalist's color guide*. New York (USA): American Museum of Natural History
- SMYTH CH (1928) Descripción de una colección de huevos de aves argentinas. *El Hornero* 4(2):125-152

Table 1. Published information on Dark-billed Cuckoo (*Coccyzus melacoryphus*) nesting, including our data, three nests in a mangrove forest on Isabela Island, Galapagos Archipelago, Ecuador. Information is sorted by publication and locality, and then by the information described on nests, eggs and nestlings, and Avian Vampire Fly (*Phitornis downsi*) parasitism. Nests: (1) shape, (2) measurements: centimeter (cm); external diameter, internal diameter, cup depth, nest height, and meter (m); height from ground; (3) materials: outer and inner cups, and (4) tree supporting the nest. Eggs: (1) shape, (2) color, (3) measurements: centimeter (cm) and grammes (g); length x width, weight; (4) clutch size, (5) parental care, and (6) incubation period. Chicks: (1) chick development, (2) parental care, and (3) nestling period.

Bibliographical reference	Nest location	Date	Breeding events	Nests	Eggs	Chicks	Presence of <i>Phitornis downsi</i>
Gifford 1919	Wreck Bay, San Cristobal Island, Galapagos, Ecuador	January 21 (n=2), 27 (n=1), March 28 (n=1), 1919	Two nests, one incubating eggs and the other unknown. In addition, a female collected with an egg in the oviduct.	Measurements: external diameter 15.2 (n=1); and height from ground 3.6 and 2.4 (n=2). Materials: twigs and moss (n=2). One nest was in a <i>Psidium galapageium</i> bush.	Clutch size: 1 and 3 (n=2).		
Gifford 1919	Tagus Cove Mountain, Isabela Island, Galapagos, Ecuador	March 28, 1919	One nest.	Materials: dry twigs with some grass stems for lining.	Clutch size: 1		
Ervin 1989	Vicinity of Charles Darwin Research Station, Santa Cruz Island, Galapagos, Ecuador	February 2 (n=1), 6 (n=1), 26 (n=1), March 10 (n=1), March 24 (n=1), 1987	Four nests. Two incubating eggs and the others unknown. In addition, 2 adults feeding a fledgling (n=1).	Measurements: external diameter 9 (n=1), internal diameter 5.5 (n=1), and height from ground 2.5 (n=2), 3 (n=1), and 3.5 (n=1). Materials: small sticks and twigs (n=1). The nests were in Acacia tree (n=2), <i>Laguncularia racemosa</i> (n=1), and <i>Lantana pedunculata</i> (n=1).	Color: bluish-white (n=1). Measurements (5 eggs of 1 nest): 2.91 x 2.36, 9.1. Clutch size: 4 (n=1), 5 (n=1), 6 (n=1). Egg laying and hatching were asynchronous (n=2).	Chicks had their eyes open one day after hatching. The chicks were weighed four times.	
Fessl et al. 2001 and Fessl and Tebbich 2002	Humid Scalesia forest, Santa Cruz Island, Galapagos, Ecuador		Two nests.				One nest had five pupae.
pers. obs. Jimmy Navas 2022	Humid zone of Wolf Volcan, Isabela Island, Galapagos, Ecuador	May 19, 2022	An adult feeding a fledgling.				

Bibliographical reference	Nest location	Date	Breeding events	Nests	Eggs	Chicks	Presence of <i>Philornis downsi</i>
This study	Playa Tortuga Negra, Isabela Island, Galapagos, Ecuador	March 14, 17, 21, 22, April 5, 2022	Three nests. In addition, two pairs copulating.	Shape: low cup (n=3). Measurements (n=2): external diameter 1.6 and 1.7, internal diameter 7.3 and 6.9, cup depth 2.2 and 1.7, nest height 6.5 and 7, and height from ground 5, 7 and 9 (n=3). Materials (n=3): outer nest branches of <i>Laguncularia racemosa</i> , inner nest leaves, stipules, and bark from <i>Rhizophora</i> mangrove stems. The nests were in <i>Laguncularia racemosa</i> (n=3).	Shape: short sub-elliptical. Color: light green. Measurements (3 eggs of 2 nests): 3.4 x 2.5, 3.1 x 2.6, and 3.3 x 2.6. Clutch size (n=1): 3. Egg hatching was asynchronous (n=1). Biparental care.	Description of chick development from hatching to nest abandonment. The nestling period was 7 to 8 days—biparental care.	One nest had three pupae.
Payne 1997	Colombia	October 1997	Nesting record.				
Payne 1997	Argentina	Between October and December. 1997	Nesting record.				
Salvador 2011	Departamento General San Martín, Córdoba, Argentina	Between November and February.	19 nests.	Measurements (n=19): height from the ground between 1.1 to 3.8 (mean= 2.4 m, SD= 0.87). The nests were in <i>Celtis spinosa</i> (n=6), <i>Geoffroea decorticans</i> (n=5), <i>Schinus molle</i> (n=4), <i>Jodina rambifolia</i> (n=2), <i>Arundo donax</i> (n=1), <i>Condalia microphylla</i> (n=1).	Measurements (42 eggs): 2.29 (SD= 0.59) x 3 (SD= 1.37), 9.2 (SD= 0.88). Clutch size: from 2 to 4 (mean= 3.3 m, SD= 0.59). The incubation period was 1.2 to 1.4 days.	They hatched with half-open eyes. The skin was blackish, with white messoptiles on the back, wings, head, and flanks. Beak gray, commissures cream, the interior of the mouth pale red. Tarsus dark gray. When fledglings left the nest they were feathered with coloration similar to adults, with shorter tails. Weights were 43 and 47 (mean= 44.8 g, SD= 1.33). Diet: the nestlings were fed with caterpillars of Lepidoptera and Tettigonidae. The nestling period was 9 to 11 days—biparental care.	Two nestlings had 4 and 6 fly larvae (<i>Philornis</i> sp.).
Dabbene 1926	Los Talas, Buenos Aires, Argentina	February 12, 1926	One nest.	Measurements (n=1): height from ground 1.5. Materials: twigs. The nest was in Alamo tree.			Two.

Bibliographical reference	Nest location	Date	Breeding events	Nests	Eggs	Chicks	Presence of <i>Phylornis downsi</i>
Di Giacomo 2005	Reserva El Ba- gual, Formosa, Argentina	Between October and January.	15 nests.	Shape: simple platform. Measurements (n= 15): height from the ground between 1.3 and 3.5. Materials: outer nest herbaceous stems and lianas, inner nest lichens (<i>Usnea</i> <i>sulcata</i>), tendrils, and petioles of <i>Prosopis</i> sp. The nests were in <i>Schinus molle</i> , <i>Erythroxylum microphyllum</i> and <i>Celtis iguanaea</i> .	Color: pale greenish blue. Measurements (13 eggs): 2.86 x 2.22, 7.3. Clutch size: between 2 and 5.	The nestling period was 9 to 10 days.	
Babarskas et al. 2003	Reserva Natural Olamendi, Campana, Buenos Aires, Argentina	Between November and December.	Two nests, one with eggs.				
Smyth 1928	Santa Elena, Argentina		Eggs from a nest deposited in a collection.		Shape: elliptical. Color: pale greenish blue. Measurements (5 eggs): 3.02 x 2.37.		
Paixão et al. 2021	Seridó Ecolog- ical Station, Serra Negra do Norte, Rio Grande do Norte state, Brazil	Between March 1 and May 8, 2017, and February 8 and June 10, 2018	63 nests.	Shape: single platform. Mea- surements (n=8): external diameter 1.355 (SD= 1.84), internal diameter 6.65 (SD= 2.02), cup depth 2.43 (SD= 0.75), nest height 6.06 (SD= 0.63), and height from the ground between 0.17 and 4.41 (mean= 1.61 m, SD= 0.88). Materials: dry twigs, generally without forks; no internal lining. Nests were mainly on <i>Aspidosperma pyriforme</i> (46%).	Shape: short sub-elliptical. Color: light green. Measure- ments: 2.84 (SD= 1.5, n= 24) x 2.21 (SD= 1.5, n= 24), 9.7 (SD= 0.9, n= 18). Clutch size: be- tween 1 and 6. The incubation period was 10 days.	Number: 2.6 (SD= 0.96, n= 25). The nestling period was 10 days (n= 1).	
de la Peña 1983	Santa Fe, Argentina	Between November and December.	Three nests.	Shape: single platform. Mea- surements (n= 3): external diameter 1.1, cup depth 2, nest height 6.5, and height from the ground between 1.5 and 3.5. Materials: outer nest with lianas and inner nest with leaf veins, lichens, and mosses.	Color: green. Measurements (7 eggs): 2.98 x 2.26. Clutch size: between 3 and 4.		

Bibliographical reference	Nest location	Date	Breeding events	Nests	Eggs	Chicks	Presence of <i>Phylornis downsi</i>
de la Peña 2013	Humboldt, Esperanza, Santa Fe, El Laurel, Grutly, Villa Roda, Colastiné; Argentina	December 1, 11, 23, 1976; December 11, 15, 1977; January 2, 1979; January 20, 1983; January 27, October 25, 1990; January 2, 5, November 26, 1991; December 16, 1994; December 24, 1995; February 9, 1996; January 29, 1997; November 30, December 28, 1998; December 21, 2001; December 14, 2002; February 3, December 3, 9, 25, 2004; January 5, 2005; December 6, 2007; November 8, 2012.	28 nests.	Shape: platform. Measurements (n= 28): external diameter between 11 and 15, cup depth between 0.5 and 1, nest height between 4 and 8, and height from the ground between 1 and 4. Materials: outer nest with sticks and inner nest with leaf veins and lichens. Nest construction lasted between 6 and 8 days.	Shape: elliptical and ovoid. Color: light green. Measurements (18 eggs): 2.98 x 2.3, weight (10 eggs): 8.1. Clutch size: between 1 and 6, but the most common were 2 and 3, with 9 and 10 nests, respectively. The incubation period was between 20 and 21 days. Egg laying was asynchronous.	Partial description of nestling plumage. Chicks were measured and weighed five times. The nestling period was between 13 and 15 days.	