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Photo: Josh LaPergola

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Mortality of an adult Antillean Palm Swift (*Tachornis phoenicobia*) associated with *Philornis* sp. parasitism in the Sierra De Bahoruco, Dominican Republic

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Cover Page: Adult Antillean Palm Swift (*Tachornis phoenicobia*) captured near Jarabacoa, Dominican Republic, on 25 June 2017 by Josh LaPergola. This bird was caught incidentally while targeting Hispaniolan Woodpeckers (*Melanerpes striatus*) and Palmchats (*Dulus dominicus*) for focal studies on these enigmatic endemic species. Photo by Josh LaPergola.

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Abstract

The ecological importance of avian myiasis caused by fly (Diptera) larvae, especially in the genus *Philornis*, remains poorly understood. One major gap in our knowledge is which bird species experience such parasitism. We present here the first report of *Philornis* parasitism on an adult Antillean Palm Swift (*Tachornis phoenicobia*) from the Dominican Republic, representing the first documented record of *Philornis* parasitism of a swift species (Apodidae). The host bird was found dead shortly after being observed alive with clear evidence of myiasis, and we suggest the bird's death was due to the detected fly larvae. We also propose that this parasite-associated adult mortality implicates *Philornis* as another potential factor contributing to observed aerial insectivore declines, and highlights the pressing need for more comprehensive studies investigating the occurrence of parasitism in other Caribbean avian species.

Keywords

aerial insectivores, Antillean Palm Swift, *Philornis*, Sierra de Bahoruco, *Tachornis phoenicobia*

Resumen

Mortalidad de un *Tachornis phoenicobia* adulto asociado on el parasitismo por *Philornis* sp. en la Sierra de Bahoruco, Republica Dominicana • La importancia ecológica de la miasis en aves causada por las larvas de moscas del género *Philornis* ha sido poco estudiada en el pasado. Un vacío importante en nuestro conocimiento es la distribución taxonómica de las especies hospederas. Reportamos el primer registro de parasitismo por la mosca del género *Philornis* en un individuo de *Tachornis phoenicobia* de República Dominicana, lo que representa el primer registro documentado de parasitismo por *Philornis* en una especie de vencejo (Apodidae). El hospedero fue un espécimen adulto encontrado muerto poco después de haber sido observado vivo con claras evidencias de parasitismo por *Philornis*, por lo que atribuimos su muerte a las larvas de mosca detectadas. Sugerimos que la mortalidad de aves adultas inducida por parasitismo de *Philornis* sea considerada como otro factor potencial que contribuye a la disminución de los insectívoros aéreos y destacamos la necesidad urgente de estudios más completos que investiguen la aparición de parasitismo en otras especies de aves del Caribe.

Palabras clave

insectívoros aéreos, *Philornis*, Sierra de Bahoruco, *Tachornis phoenicobia*

Résumé

Mortalité d'un Martinet petit-rollé (*Tachornis phoenicobia*) adulte associée au parasitisme par *Philornis* sp. dans la Sierra de Bahoruco en République dominicaine • L'importance écologique de la myiase aviaire causée par des larves de mouches (diptères), notamment du genre *Philornis*, reste mal connue. Une lacune importante dans nos connaissances est de savoir quelles espèces d'oiseaux sont affectées par ce type de parasitisme. Nous présentons ici la première mention de parasitisme d'un Martinet petit-rollé (*Tachornis phoenicobia*) adulte par *Philornis* en République dominicaine, ce qui constitue la première mention documentée de parasitisme d'une espèce de martinet (Apodidae) par cette mouche. L'oiseau hôte a été retrouvé mort peu de temps après avoir été observé vivant avec des preuves évidentes de myiase, et nous attribuons donc la mort de l'oiseau aux larves de

mouche détectées. Nous suggérons également que la mortalité à l'âge adulte induite par le parasitisme par *Philornis* soit considérée comme un autre facteur pouvant contribuer au déclin observé des insectivores aériens, et nous soulignons le besoin urgent d'études plus complètes sur l'occurrence du parasitisme chez d'autres espèces d'oiseaux de la Caraïbe.

Mots clés
insectivores aériens, Martinet petit-rollé, *Philornis*, Sierra de Bahoruco, *Tachornis phoenicobia*

An important question in avian parasitology is how many species—and which—act as hosts for a given species or clade of parasites. This question is especially relevant for the study of avian myiasis, defined as "the infestation of healthy or necrotic tissue of living vertebrate animals by dipteran larva" (Little 2009:546). For the Neotropics, a growing literature suggests that myiasis caused by larvae of the fly genus *Philornis* (Diptera: Muscidae) is an ecologically important phenomenon (Couri 1999, Teixeira 1999, Dudaniec and Kleindorfer 2006). Unfortunately, the biology of these flies and which hosts they choose remains poorly understood. *Philornis* comprises ~50 recognized species restricted to parts of the southern United States and the New World tropics, including the West Indies (Dodge 1955, Skidmore 1985, Carvalho *et al.* 2005, Couri *et al.* 2009). Of the described species, 28 have larvae with known habits, including three species that are free-living coprophagous commensals that subsist on bird feces in nests. The remaining sufficiently known *Philornis* species have larvae that are either free-living (2 species) or subcutaneous (23 species) hematophagous parasites primarily on nestling and occasionally on adult birds (Couri 1999, Teixeira 1999, reviewed in Common *et al.* 2019). At least some *Philornis* species (e.g., *P. downsi* and *P. seguyi*) can have substantial negative effects on host reproductive success and nestling survival (Arendt 1985a, 1985b, Young 1993, Dudaniec *et al.* 2007, Rabuffetti and Reboreda 2007, Segura and Reboreda 2011), but large gaps remain in understanding the general impacts and host specificity of these parasitic species.

While parasitism in Caribbean birds remains insufficiently studied in general (Latta 2012; but see Latta and Ricklefs 2010), one notable exception has been work on *Philornis* parasitism in Puerto Rico (Arendt 1985a, 1985b, Snyder *et al.* 1987). However, on the neighboring island of Hispaniola, especially within the Dominican Republic, *Philornis* has a long yet incomplete history. The first described species of this genus, *P. pici* (originally named *Aricia pici*), was collected on, and derived its name from, an adult Hispaniolan Woodpecker (*Melanerpes striatus*) (Macquart 1853, Pont 2012). On Hispaniola, *Philornis* is currently known to parasitize the following resident breeding species: Ridgway's Hawk (*Buteo ridgwayi*; Woolaver *et al.* 2015, Hayes *et al.* 2019), Hispaniolan Trogon (*Priotelus roseigaster*; S. Guerrero pers. comm.), Hispaniolan Woodpecker (Macquart 1853, LaPergola 2021), White-necked Crow (*Corvus leucognaphalus*; Wiley 2006), Red-legged Thrush (*Turdus plumbeus*; Quiroga *et al.* 2020), Eastern Chat-Tanager (*Calyptophilus frugivorus*; Quiroga *et al.* 2020), Black-crowned Palm-Tanager (*Phaenicophilus palmarum*; Quiroga *et al.* 2020), and Palmchat (*Dulus dominicus*; Teixeirra 1999, JBL unpubl. data). Meanwhile, no signs of parasitism from *Philornis* have been found in Black-capped Petrels (*Pterodroma hasitata*, E. Rupp pers. comm.) nor in the well-studied Hispaniolan Golden Swallow (*Tachycineta euchrysea sclateri*; Proctor 2016), despite other *Tachycineta* swallows being parasitized by *Philornis* elsewhere (Stager *et al.* 2012).

Philornis utilizes a wide diversity of host bird families and orders, but one group for which the incidence of *Philornis* remains uncertain is the swift family, Apodidae. The two previous accounts of *Philornis* associated with an apodid species of which we are aware must be treated skeptically regarding the identity of the reported parasites. The first record is from Sick (1958), who observed two empty dipteran cocoons in old nests of the Lesser Swallow-tailed Swift (*Panyptila cayennensis*) in Brazil. Sick suggested these cocoons belonged to *Philornis angustifrons*, a species with subcutaneous larvae, but never provided specific evidence (e.g., descriptions of cocoon morphology) to support this claim. Furthermore, Sick never documented nestling or adult Lesser Swallow-tailed Swifts with current or recent myiasis. The second account by Marín (1999) reported "5 botfly larvae on the nape, upper back, chest, underwing, and anal area" on one of two Black Swift (*Cypseloides niger*) nestlings in Costa Rica, but provided no taxonomic assignment nor any descriptions of the larvae. To the best of our knowledge, though, *Philornis* is the only dipteran genus present in Costa Rica known to parasitize birds. Lowther and Collins (2002; revised in Gunn *et al.* 2021) cited Marín's observation of the "botfly" larvae as belonging to *Philornis*, but they provided no justification for this taxonomic assignment. Subsequent references (Wiggins 2004, Di Iorio and Turienzo 2009) perpetuated Lowther and Collins' (2002) reporting. Thus, the incidence of *Philornis* in Apodidae has so far been questionable at best.

Here we describe the first documented record of *Philornis* in the swift family Apodidae as provided by a case of *Philornis* parasitizing an adult Antillean Palm Swift (*Tachornis phoenicobia*; hereafter ANPS) in the Dominican Republic. ANPS is a breeding resident known exclusively to the Greater Antilles, including the islands of Hispaniola, Jamaica, Cuba, and the Isle of Pines (Raffaele *et al.* 1998). Vagrants have been observed in western Puerto Rico on rare occasion (1969, 2008, and 2011), but there have been no breeding colonies established (Kepler 1971, eBird 2015, A.L. Morales pers. comm.). ANPS is currently considered a species of Least Concern with a stable population trend (BirdLife International 2016), yet its natural history and breeding biology remain poorly known (Raffaele *et al.* 1998, Kirwan *et al.* 2019, Damaj 2020). This paucity of data is more striking given that the foraging and nesting behaviors of the species are conspicuous where it is common. The species nests colonially, constructing nests on the undersides of hanging (usually dead) fronds of *Roystonea* and *Sabal* palm trees (Raffaele *et al.* 1998, Kirwan *et al.* 2019, Damaj 2020); within dead fronds that have been harvested and used for thatched roofs (CJP and JBL pers. obs.); and less

frequently in seaside caves (Kirwan *et al.* 2002). The swift's colonial nesting habits might increase its susceptibility to *Philornis*, as increased risk of parasitism is considered a major cost of group living, especially in avian species (Hoogland and Sherman 1976, Brown and Brown 1996). However, the available literature pertaining to ANPS natural history (Gosse 1847, Verrill and Verrill 1909, Bond 1928, Wetmore and Swales 1931, Wetmore and Lincoln 1933, Barbour 1943, Raffaele *et al.* 1998, Chantler 1999, Chantler and Driessens 2000, Kirwan *et al.* 2002, Kirwan *et al.* 2019, Damaj 2020) does not mention *Philornis* parasitizing the species. We use a combination of morphological evidence and distribution records to support our identification of the larva as belonging to *Philornis*. Our observations suggest that more work is needed on *Philornis* generally and on the breeding biology of ANPS specifically, as our findings would constitute a new bird family being exploited by this genus of parasitic fly. We also suggest that avian myiasis might be a potentially relevant addition to the amalgam of factors contributing to the aerial insectivore population declines observed throughout much of North America (Nebel *et al.* 2010, Spiller and Dettmers 2019).

Methods

Study Site.—Rabo de Gato (18°19'04"N, 71°34'31"W; Fig. 1) is a trail system located near the village of Puerto Escondido at ~400 m above sea level (asl) on the north slope of the Sierra de Bahoruco, above the town of Duverge, Provincia de Independencia, Dominican Republic. The area is known for its abundance of freshwater springs that support extensive agricultural activity, generating streams with narrow riparian habitat and dry thorn forest on one side and plantations of vegetables and avocados on the other. Tall fig (*Ficus*) trees are common along the landscape's walking trails. ANPS are regularly observed foraging in the Rabo de Gato area year-round, but no confirmed observations of nesting colonies exist for the area.

On 16 July 2015 at 1800, KJW observed an ANPS (Fig. 2A–C) falling from the sky at Villa Barrancolí, the basecamp for the Rabo de Gato trail. Still alive, the swift was retrieved from the ground, briefly visually inspected, and photographed by KJW before being placed upon a nearby low-hanging branch to recuperate. Although the individual made some weak attempts to fly, it was found dead shortly afterwards on the ground (at 1900). The specimen, with embedded parasites (see below), was immediately frozen and ultimately deposited at the Museo Nacional de Historia Natural (MNHN) in Santo Domingo (MNHNSD. 24. 1092). We collected all morphometric measurements and documentation of the ANPS specimen and associated parasites post-mortem.

Measurements.—We made all ANPS measurements with a wing ruler (flat wing, wing chord, and tail length), digital calipers (exposed culmen, culmen at nares, bill width, and bill depth), or manual calipers (tarsus). We scored fat and feather wear based on standard ornithological metrics using the numeric scales pre-

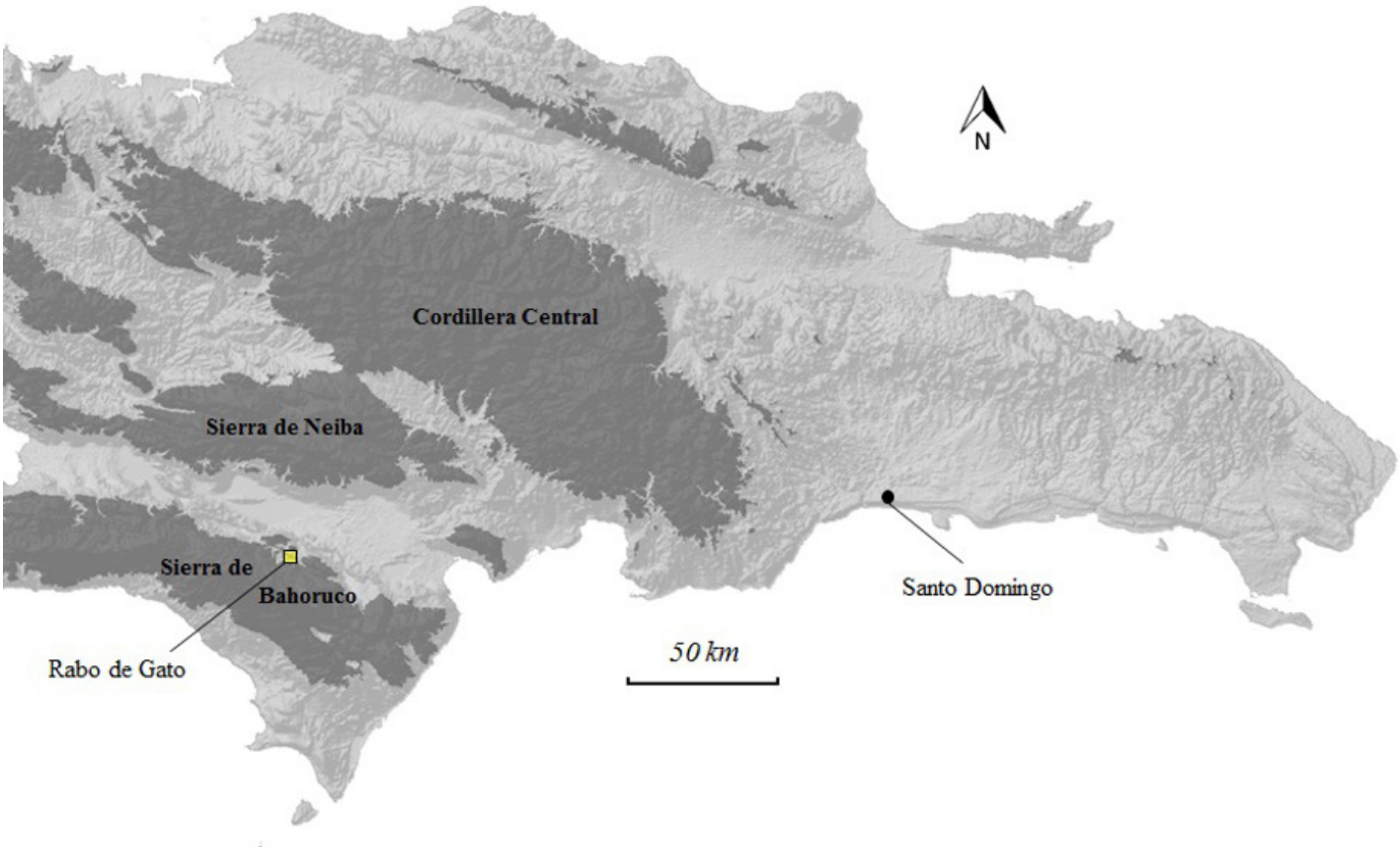

Fig. 1. Map of eastern Hispaniola, Greater Antilles, depicting the location of Rabo de Gato on the northern slopes of the Sierra de Bahoruco. Darker shading denotes elevations > 475 m asl.

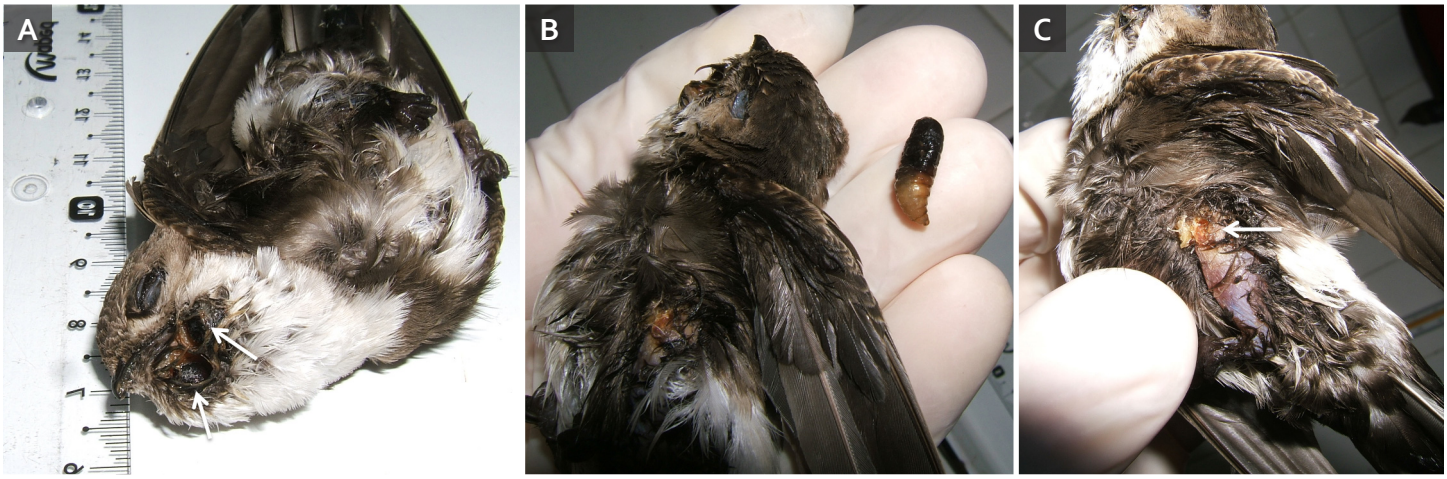

Fig. 2. Photos depicting *Philornis* wounds on the collected Antillean Palm Swift, *Tachornis phoenicobia* (A–C). (A) Two botfly wounds are visible on the throat (indicated by white arrows). The wound closest to the left eye contained the larva (B), shown with the swift specimen for scale. (C) The swift's knee exhibited two old larval wounds (the more laterally located wound is indicated by a white arrow), one of which is more medially located and thus more difficult to see in the photo.

sented by Ralph *et al.* (1993). In this reference, fat class ranges from 0–7, with a score of 0 indicating no visible accumulated fat and 7 indicating "very large fat pads of furculum and abdomen" (Ralph *et al.* 1993:20). Similarly, feather wear ranges from 0–5, with a score of 0 indicating no visible wear on the outer four or five primaries and 5 indicating "excessive wear" (Ralph *et al.* 1993:20). We used ImageJ version 1.46r (Abràmoff *et al.* 2004) to estimate measurements of the extracted larva from a digital photo that had a metric ruler in frame for reference.

Exemplar Larva for Comparison.—As part of a separate study on the breeding biology of the endemic Hispaniolan Woodpecker (*Melanerpes striatus*; LaPergola 2021, LaPergola and Riehl 2022) near Jarabacoa, Provincia de La Vega, JBL collected a *Philornis* larva from a nestling woodpecker on 28 April 2014. This larva fell out of a wound on the nestling woodpecker during processing and was opportunistically collected and photographed. We include a photograph of this larva to allow visual comparison with the larva extracted from the ANPS specimen.

Results

Characteristics of Host Bird.—A close analysis of the plumage of the ANPS individual, along with comparison against other ANPS specimens in the MNHN ornithological collection, suggested that it was an adult. The specimen had dark brown plumage of the wings, crown, nape, back, and tail, and dull white plumage on the chin, throat, and chest (Fig. 2A–C). In contrast to adults, juvenile ANPSs have paler brown plumage, especially along the sides and undertail coverts, and buffy (instead of white) throat and breast (see Raffaele *et al.* 1998 and Damaj 2020 for description). The specimen also had rounded rectrices. In comparison, juvenile ANPS specimens in the MNHN collection had more pointed rectrices. These differences in the shape of rectrices are commonly used to age North American swifts (e.g., *Cypseloides niger*, *Chaetura pelagica*, and *Ch. vaux*i; Pyle 1997).

The individual had the following measurements and attributes: wing chord, 102 mm; flat wing, 104 mm; weight, 8.0 g; tail length, 37 mm; exposed culmen, 5.46 mm; culmen at nares, 2.73 mm; bill width, 2.4 mm; bill depth, 3.2 mm; and tarsus, 4.9 mm. The specimen had a fat score of 2 and feather wear of 0. The bird exhibited symmetrical molt in the wings with left primary 1 ~90% replaced and right primary 1 growing. Additionally, the individual had an internal fracture at the bottom of the ribcage and a broken neck, injuries likely sustained when the bird fell from the sky and impacted the ground.

Parasites.—Brief visual inspection of the live bird on 16 July 2015 revealed evidence of ectoparasite-induced wounds on the throat. After field collection, the specimen was temporarily frozen and stored until a more detailed visual inspection was carried out on 24 July 2015, which revealed ≥ 4 wounds that we ascribed to *Philornis* myiasis (Fig. 2A–C).

Two older (empty) wounds were present on the left leg (one on the knee and one immediately adjacent to the knee but more medially positioned; Fig. 2B, C). Two wounds were present on the throat, both containing larvae (Fig. 2A). We removed an intact larva (Fig. 2B, Fig. 3A, B, D–F) from the left-most wound and preserved it in an alcohol solution. This larva is archived with the ANPS specimen in the ornithological collection at MNHN under the same catalog number (MNHNSD. 24. 1092).

The collected larva (Fig. 2B, Fig. 3A, B, D–F) was discolored relative to typical live *Philornis* larvae (Fig. 3C), likely a result of tissue damage caused by the freezing process. We estimated the length and width of the larva as 16.1 mm and 6.5 mm, respectively. The larva was thus large and similar in size to *Philornis* larvae parasitizing Hispaniolan Woodpecker nestlings (JBL pers. obs.). We were unable to assign the specimen to species.

We posit that the larvae belonged to a species of *Philornis*. The only other dipteran family known to regularly infest birds in the Americas is Calliphoridae (genera *Trypocalliphora* and *Protocalliphora*), which we exclude as a possible taxonomic assignment based on the following evidence. (1) *Trypocalliphora* and *Protocalliphora* are Holarctic in distribution, and as far as is known, there are no records from Hispaniola, let alone the Greater Antilles, for either genus. (2) The only calliphorid species known to

exhibit obligate subcutaneous parasitism is *T. braueri*, which is thought to be "widespread throughout North America" (Whitworth 2003:1022). However, the closest geographic record to Hispaniola is from northern Georgia, United States, with most other records from farther north (Sabrosky *et al.* 1989), reducing the probability of the present specimens being extra-limital *T. braueri*. Furthermore, the empty wounds observed on the swift were consistent in appearance to those caused by subcutaneous *Philornis* larvae infesting Hispaniolan Woodpeckers. (3) The present larval specimen lacks a prothoracic fringe, described as "a band of long spines on the anterior margin of the prothoracic segment" (Whitworth 2003:1001–1002). Nearly all North American *Protocalliphora* larvae are recognized by the presence of a prothoracic fringe, which aids in attachment to avian hosts (Whitworth 2003, T.L. Whitworth pers. comm.), whereas *Philornis* larvae lack this morphological feature (Skidmore 1985, Couri 1999). *Trypocalliphora braueri* also lacks a prothoracic fringe (Rognes 1984, Whitworth 2003), but as mentioned above, this species' current known geographic distribution excludes Hispaniola. (4) The larval specimens examined here lacked cuticular spines (Fig. 3E–F), which are a common feature of some, though not all, *Protocalliphora* larvae. (5) The third stage larva of *T. braueri*, the only likely contender for alternative identification, range in length from 6–12 mm and width up to 6 mm (Rognes 1984). The measured length of our larva (16.1 mm) either further excludes *T. braueri* as a possibility or would otherwise represent a new maximum length record *T. braueri* larva at ~34% greater than the previously recorded maximum length. (6) The posterior spiracles (Fig. 3E) are very close together, which is typical for *Philornis* (Dodge and Aitken 1968, Skidmore 1985, Bulgarella *et al.* 2015) but not for *Protocalliphora* nor *Trypocalliphora*, which typically have more widely spaced posterior spiracles (Sabrosky *et al.* 1989, Iwasa and Hori 1990). (7) Lastly, the spiracular slits appear horseshoe-shaped (Fig. 3E), which is typical of other muscid flies (e.g., Bulgarella *et al.* 2015, M. Bertone pers. comm). In contrast, calliphorid larva typically have more linear and parallel spiracular slits (Rognes 1984, Whitworth 2003, M. Bertone pers. comm.). Unfortunately, we were unable to obtain a clearer photograph of the spiracular slits when the specimen was of fresher condition.

Fig. 3. Photos depicting the putative *Philornis* larva (A, B, D-F) extracted from the Antillean Palm Swift, and (C) a *Philornis* larva extracted from a Hispaniolan Woodpecker, *Melanerpes striatus*, for comparison. (A) The larva shown within minutes of extraction from the dead palm swift, also pictured. Note the contrast in colors between the anterior and posterior regions of the larva. (B) Larva with metric ruler for scale. This photo, taken shortly after (A), shows discoloration has spread across the whole specimen. The extracted, dead larva is shown with a ruler for scale. (C) The live *Philornis* larva, on a metric wing ruler, exhibits the typical coloration in contrast to that of the dead larva (B, D–F). (D) Higher resolution photo of the larva in ventral aspect. (E) Larva in posterior aspect showing the posterior spiracles. (F) Larva in anterior aspect showing the head, thorax, and first few abdominal segments. Photographs A–C by Joshua B. LaPergola, and photographs D–F by Eladio M. Fernández.

Discussion

Based on the morphological evidence and distribution records, our observations provide the first unequivocal case of *Philornis* parasitizing a swift species. Although we were unable to identify the *Philornis* specimen to species, we suggest it was likely *P. pici*. Host specificity of different *Philornis* species varies and is incompletely known (Löwenberg-Neto 2008). On Hispaniola, *P. pici* is known to impact at least two other resident bird species, Hispaniolan Woodpecker (Macquart 1853) and Ridgway's Hawk (Hayes *et al.* 2019), and until recently, this species was the only *Philornis* documented on Hispaniola (Carvalho *et al.* 2005). Other *Philornis* spp. also infest distantly related avian species on the same island (Dodge and Aitken 1968), lending some credibility to the *P. pici* hypothesis. For example, on Santa Cruz island in the Galápagos, the introduced *P. downsi* infests species representing at least two different orders and three families (Passeriformes: Thraupidae and Parulidae, and Cuculiformes: Cuculidae; Fessl *et al.* 2001). However, M.A. Quiroga (pers. comm.) recently identified *P. porteri* also parasitizing Ridgway's Hawk, and other yet to be documented or even described species might also be present on Hispaniola. More clearly delineating *Philornis* species boundaries and these species' geographic ranges will be important for future conservation work since larvae can negatively impact threatened and endangered species.

The documentation of *Philornis* parasitizing an adult ANPS highlights the need for a more in-depth study on the breeding biology and natural history of this poorly known swift species.

Of special importance will be confirming *Philornis* parasitism of ANPS nestlings. *Philornis* typically targets nestlings, where the static environment would conceivably be more conducive for locating and infecting hosts. Although records of *Philornis* larva infesting adult birds are increasingly recognized and reported (Quiroga *et al.* 2020, LaPergola 2021), evidence thus far supports the hypothesis that adult infestation is incidental. For example, in the comparatively less aerial Hispaniolan Woodpecker, *Philornis* parasites were only slightly more likely to occur on nestlings than on adult birds, but the parasite loads of nestlings were ~3.5 times greater on average than those of adult woodpeckers (LaPergola 2021). On Puerto Rico, Pearly-eyed Thrasher (*Margarops fuscatus*) nestlings were far more likely than adults to be infested with *P. deceptivus* larvae (Arendt 1985b). These patterns suggest that *Philornis* almost certainly also infests nestling ANPS. We suggest that monitoring ANPS nests for *Philornis* would therefore be fruitful and important for understanding the impact of such parasitism on ANPS breeding success (see references in Dudaniec and Kleindorfer 2006 for examples of relevant studies). Other important details of ANPS natural history, such as duration of incubation and nestling periods and factors affecting breeding success, remain poorly documented or wholly unknown (Chantler 1999).

That the parasitized bird we documented was an adult raises additional questions about *Philornis* and its relationship with ANPS. Specifically, how does *Philornis* infest adult birds and how does that infestation impact adult survival? The aerial foraging habits of swifts might make *Philornis* targeting adults less feasible and less successful as a strategy. The most likely route to infestation would be when an adult remains in contact with an infested nest for a prolonged period of time, such as during incubation or brooding (Quiroga *et al.* 2020, LaPergola 2021). The incubation behavior of ANPS is unknown, but in at least some swift species, both parents incubate and brood young (Steeves *et al.* 2020, Gunn *et al.* 2021), so the specimen here might have been infested while brooding or roosting with young. Of great importance, too, is the coincidence of *Philornis* parasitism and mortality that we observed. The ANPS specimen had ≥ 4 *Philornis* wounds, including two still containing larvae. Extrapolating from the mean mass for third instar *P. pici* larvae (mean ± SD = 0.130 ± 0.083 g, N = 189; M.A. Quiroga, pers. comm.) suggests that this bird carried a combined mass of ~0.52 g of ectoparasites, corresponding to ~6.5% of the swift's total mass (8 g). For such a small bird completely dependent on flying to acquire nutrition, these relatively large *Philornis* larvae (Fig. 2B) might have dramatically impacted survival by increasing metabolic demands directly or indirectly. Future work should consider the prevalence of *Philornis* infestation among adult ANPS and the degree to which such parasitism reduces adult survival more generally in this species.

Although ANPS is currently considered a species of Least Concern, it belongs to the aerial insectivore guild, a group of birds facing an uncertain future. Aerial insectivores, including the flycatchers, swifts, swallows, potoos, and nightjars, specialize on airborne insects (aerial plankton) for food, and over the last three decades, their populations have shown noticeable declines throughout much of North America (Nebel *et al.* 2010, Spiller and Dettmers 2019). Unfortunately, population trends of aerial insectivores in the Caribbean are mostly unknown. Improving knowledge of Caribbean aerial insectivores for conservation and monitoring will require identifying nesting localities, which for ANPS remain poorly documented. In this case, the exact origin for our focal individual remains uncertain despite common sightings of the species in the Rabo de Gato area. Many tall royal palms (*Roystonea* sp.) and Hispaniolan palmetto (*Sabal domingensis*) occur in nearby open fields (I. Mota pers. comm.). Because ANPS nest in *S. domingensis* at other localities in the Dominican Republic (e.g., La Vega province; JBL pers. obs.), we suspect that the collected individual came from from an unidentified local breeding colony.

Regarding aerial insectivore declines in North America, many researchers hypothesize that the underlying problems are large-scale decreases in food abundance and changes in food availability (Nebel *et al.* 2010, Nocera *et al.* 2012, Pomfret *et al.* 2012, Robillard *et al.* 2013, Spiller and Dettmers 2019). Others have shown that considerable changes have been made to the guild's various nesting and foraging habitats in the past decade (Evans *et al.* 2007, Grüebler *et al.* 2010, McCracken 2013, Spiller and Dettmers 2019). To our knowledge, no studies have looked at the holistic impact of parasitism across the guild. Our findings of *Philornis* larvae parasitizing an adult ANPS introduce parasitism by *Philornis* and other flies (e.g., *Protocalliphora*) as yet another potentially important variable that should be considered within the current amalgam of causes contributing to aerial insectivore decline.

The full scale of *Philornis* parasitism and its impacts on wild bird populations remains unclear, and we need a greater understanding of the ecological importance of this genus, including a more complete picture of its taxonomic and geographic spread. We urge other researchers to document and report cases of *Philornis* parasitism in their work, and just as important, to report when *Philornis* is not observed. Noting the absence of *Philornis* in previously documented host species, habitats, and localities will be especially important. Even old wounds from subcutaneous fly larvae can be externally visible for some time after infection (e.g., see LaPergola 2021), thus we suggest that it would be valuable to review museum collections for any evidence of *Philornis* in other adult specimens of Neotropical bird species. To avoid specimen damage, such data could be gleaned from less invasive methods, such as through x-ray micro-computed tomography, which has successfully visualized internal parasites as small as 40 µm (Martín-Vega *et al.* 2018). Because infections of adult birds tend to be less common (but see LaPergola 2021), conducting inspections for *Philornis* pupae on nestlings or by examining collected nests would be most useful. Indeed, as the need to know more about *Philornis* biology increases, inspecting museum collections more broadly could be very informative.

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