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SHORT NOTE

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SECONDARY NECTAR ROBBING IN TROCHILIDAE, WITH A FOCUS ON THE VOLCANO HUMMINGBIRD *SELASPHORUS FLAMMULA*

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Abstract · Secondary nectar robbing is poorly studied in hummingbirds. Here, we provide an updated list of hummingbird species reported to be secondary nectar robbers and give the first detailed account of nectar robbing by a Volcano Hummingbird *Selasphorus flammula* that obtained nectar through holes made by a Slaty Flowerpiercer *Diglossa plumbea* in two species of plants with long tubular flowers.

Resumen · Robo secundario de néctar en los Trochilidae, con enfoque en el colibrí volcánico *Selasphorus flammula*
El robo secundario de néctar está poco estudiado en los colibríes. En esta nota, proporcionamos una lista actualizada de las especies de colibríes reportadas como ladrones secundarios de néctar, y brindamos la primera descripción detallada del robo de néctar por parte de un colibrí volcánico *Selasphorus flammula* que obtuvo néctar a través de agujeros hechos por un perforador de flores pizarroso *Diglossa plumbea* en dos especies. de plantas con flores tubulares largas.

Key words: *Costa Rica · Nectar robbing · Neotropical hummingbirds · Slaty Flowerpiercer*

INTRODUCTION

Many species of birds obtain nectar without pollinating the flowers upon which they feed and thus are considered to be nectar robbers (Inouye 1980, Irwin et al. 2010). Primary nectar robbers pierce the base of a flower's corolla with their bills and extract nectar through the holes they create. Flowerpiercers *Diglossa* spp. are the most highly specialized primary nectar robbers among birds (Vuilleumier 1969). Some sunbirds *Chalcomitra* spp. and *Cinnyris* spp. (Rendall 1892, Swynnerton 1916) and the Bananaquit *Coereba flaveola* (McDade & Kinsman 1980, Roubik et al. 1985) also are primary nectar robbers, as are many species of hummingbirds (e.g., Little Hermit *Phaethornis longuemareus;* McDade & Kinsman 1980, Geoffroy's Daggerbill *Schistes geoffroyi*; Boehm 2018, Blue-tailed Emerald *Chlorostilbon mellisugus*; Navarro 1999, Purple-crowned Fairy *Heliothryx barroti*; McDade & Kinsman 1980).

Other hummingbirds are secondary robbers that obtain nectar by inserting their bills into holes made by primary robbers such as bees, flowerpiercers, and other hummingbirds (Irwin et al. 2010). Secondary nectar robbing by hummingbirds is poorly studied (Irwin et al. 2010), and with few exceptions (e.g., Igić et al. 2020), reports are anecdotal. Irwin et al. (2010) listed 17 species of hummingbirds that were reported to be secondary nectar robbers. Here, we update the list of hummingbird species reported to be secondary nectar robbers and provide the first detailed account of secondary nectar robbing by the Volcano Hummingbird *Selasphorus flammula* based on our observations in Costa Rica in 2022.

SECONDARY NECTAR ROBBING UPDATE

We searched primary references published after 2009 and each of the 352 online species accounts for the Trochilidae in *Birds of the world* and found reports of secondary nectar robbing for 34 species of hummingbirds from 26 genera (Table 1). In most of these reports, the primary nectar robbers were thought to have been flowerpiercers, Bananaquits, or other species of hummingbirds. Distinguishing primary from secondary nectar robbing can be difficult (Igić et al. 2020), and few reports contained details

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Table 1. List of the 34 hummingbird species reported to be secondary nectar robbers.

English name	Scientific name	Reference
Sparkling Violetear	*Colibri coruscans*	Pelayo et al. 2011
Lesser Violetear	*Colibri cyanotus*	FG Stiles pers. com.
Orange-throated Sunangel	*Heliangelus mavors*	Pelayo et al. 2011
Amethyst-throated Sunangel	*Heliangelus amethysticollis*	Kjonaas & Rengifo 2006
Royal Sunangel	*Heliangelus regalis*	Seddon et al. 1996
Speckled Hummingbird	*Adelomyia melanogenys*	Snow & Snow 1980
Long-tailed Sylph	*Aglaiocercus kingii*	Snow & Snow 1980
Gray-bellied Comet	*Taphrolesbia griseiventris*	Cuadros 2019
Black-tailed Trainbearer	*Lesbia victoriae*	Igić et al. 2020
Green-tailed Trainbearer	*Lesbia nuna*	Igić et al. 2020
Purple-backed Thornbill	*Ramphomicron microrhynchum*	Züchner et al. 2020
Rufous-capped Thornbill	*Chalcostigma ruficeps*	Heindl & Boesman 2020
Tyrian Metaltail	*Metallura tyrianthina*	Snow & Snow 1980
Coppery Metaltail	*Metallura theresiae*	González & Loiselle 2016
Black-breasted Puffleg	*Eriocnemis nigrivestis*	Bleiweiss & Olalla 1983
Glowing Puffleg	*Eriocnemis vestita*	Snow & Snow 1980
Coppery-bellied Puffleg	*Eriocnemis cupreoventris*	Snow & Snow 1980
Golden-bellied Starfrontlet	*Coeligena bonapartei*	Pelayo et al. 2011
Blue-throated Starfrontlet	*Coeligena helianthea*	Züchner & Boesman 2020
Great Sapphirewing	*Pterophanes cyanopterus*	González & Loiselle 2016
White-booted Racket-tail	*Ocreatus underwoodii*	Snow & Snow 1980, Navarro 1999
Fiery-throated Hummingbird	*Panterpe insignis*	Colwell 1973, Stiles & Boesman 2020
Peruvian Sheartail	*Thaumastura cora*	Clark et al. 2013
Purple-collared Woodstar	*Myrtis fanny*	Marks 2021
Chilean Woodstar	*Eulidia yarrellii*	Estades et al. 2007
Black-chinned Hummingbird	*Archilochus alexandri*	Pfister 1989
Volcano Hummingbird	*Selasphorus flammula*	Stiles & Skutch 1989, this paper
Puerto Rican Emerald	*Riccordia maugaeus*	Fumero-Cabán & Meléndez-Ackerman 2007
Crowned Woodnymph	*Thalurania colombica*	Roubik et al. 1985
Red-billed Streamertail	*Trochilus polytmus*	Lack 1976
Snowy-bellied Hummingbird	*Saucerottia edward*	Roubik et al. 1985
Rufous-tailed Hummingbird	*Amazilia tzacatl*	Snow & Snow 1980
Sapphire-throated Hummingbird	*Chrysuronia coeruleogularis*	Roubik et al. 1985
Violet-bellied Hummingbird	*Chlorestes julie*	Roubik et al. 1985

on how observers determined the robbing was secondary.

All reports of secondary robbing involved species in the subfamily Trochilinae. We also found reports of primary nectar robbing for 26 species of hummingbirds. Several species in the subfamily Phaethornithinae, which includes the hermits — *Ramphodon*, *Glaucis*, *Anopetia*, *Phaethornis*—, sicklebills *Eutoxeres*, and barbthroats *Threnetes*, were reported to be primary nectar robbers, but none was reported to be a secondary robber. Irwin et al. (2010) considered Little Hermits to be primary and secondary nectar robbers, but the reference they cited (McDade & Kinsman 1980) mentioned only primary robbing for that species. Whether any members of the subfamily Phaethornithinae prove to be secondary nectar robbers remains to be determined.

SECONDARY NECTAR ROBBING BY A VOLCANO HUMMINGBIRD

The Volcano Hummingbird is a small trochilid (2.5–2.8 g) with a short bill (mean = 11.7 mm; Ridgway 1911). It occurs in a variety of open and edge habitats in the highlands of Costa Rica and western Panama from 1,800–3,500 m a.s.l. (Garrigues & Dean 2014, Stiles & Kirwan 2020). Reports of nectar robbing by this species are confined to brief statements that it uses holes made by bumblebees or flowerpiercers (Stiles & Skutch 1989, Stiles & Kirwan 2020).

We observed nectar robbing on the grounds of Miriam's Quetzals restaurant in the Talamanca Cordillera, San José Province, Costa Rica (9°35'17"N, 83°47'57"W; 2,620 m a.s.l.), from 13:30–14:25 h on 3 April 2022. Numerous hummingbird feeders, potted flowers, and flowering shrubs and trees were on the deck and grounds behind the restaurant. During the observation period, we saw four species of hummingbirds and estimated their numbers: one Lesser Violetear *Colibri cyanotus*, six Talamanca Hummingbirds *Eugenes spectabilis*, four Fiery-throated Hummingbirds *Panterpe insignis*, and one male Volcano Hummingbird. We also observed a male Slaty Flowerpiercer *Diglossa plumbea* that occasionally foraged for invertebrates in the surrounding trees and repeatedly robbed nectar from two species of flowering plants that grew in a patch next to the deck: Indian shot *Canna indica* and hardy fuchsia *Fuchsia magellanica*. Both plant species had abundant

Figure 1. Male Slaty Flowerpiercer stealing nectar from flowers of *Canna indica* (A) and *Fuchsia magellanica* (B). Photos by HMG (A) and JWC (B).

Figure 2. Male Volcano Hummingbird stealing nectar through flowerpiercer holes in flowers of *Canna indica* (A) and *Fuchsia magellanica* (B). Photos by JWC.

reddish-pink flowers with long tubular corollas (7–8 cm long for *C. indica*; 6–7 cm long for *F. magellanica*).

During the 55-min observation period, the male Slaty Flowerpiercer visited the patch of Indian shots and hardy fuchsias twice. Both times he foraged primarily on the Indian shots, feeding at more than 40 individual flowers each time by piercing and probing holes through the calyx of each flower (Figure 1A). During his second visit, the flowerpiercer also fed on at least eight hardy fuchsia flowers by piercing and probing holes at the base of the corolla (Figure 1B). The male Volcano Hummingbird visited the patch of Indian shots and hardy fuchsias five times. During each visit, he fed by probing holes made by the flowerpiercer at the base of 10–25 Indian shot flowers (Figure 2A); on one visit he also fed by probing holes in at least five hardy fuchsia flowers (Figure 2B). We never saw the Volcano Hummingbird feed at a hummingbird feeder or at any of the other flowers on the grounds, and no hummingbirds other than the Volcano Hummingbird robbed nectar from the Indian shots and hardy fuchsias. We never saw the flowerpiercer and the Volcano Hummingbird foraging in the flower patch at the same time, nor did we see them interacting elsewhere on the grounds. On two occasions, the Volcano Hummingbird inspected the base of an Indian shot flower briefly without feeding and then moved to another flower to feed; in both cases, the flower that he inspected had no flowerpiercer holes, which supports our contention that the hummingbird was a secondary versus a primary nectar robber.

Hummingbirds that rob nectar tend to have short bills and rob flowers with long corollas (Irwin et al. 2010). The Volcano Hummingbird has a much shorter bill than those of the three other hummingbird species that fed on the restaurant grounds. The other species foraged at hummingbird feeders and at several other species of flowers, during which time they often interacted aggressively with one another while attempting to forage. In contrast, the Volcano Hummingbird foraged solely by robbing nectar from two flower species whose corollas were so long that none of the hummingbird species we observed could access nectar through the floral openings. By confining its foraging to nectar robbing in these two species of flowers, the male Volcano Hummingbird escaped aggression from the other hummingbird species on the grounds, at least during the time we were present. Like all hummingbird species that have been reported to rob nectar, the Volcano Hummingbird is a facultative nectar robber that routinely obtains nectar through the floral openings of hummingbird-pollinated flowers (Stiles & Kirwan 2020).

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