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SECONDARY NECTAR ROBBING, A PREVIOUSLY UNSUBSTANTIATED FORAGING BEHAVIOR OF THE CINEREOUS CONEBILL (*CONIROSTRUM CINEREUM*)

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Robo segundario de nectar, un comportamiento previamente no confirmado en el Picocono Cinereo (*Conirostrum cinereum*).

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Conebills (genus *Conirostrum*, currently placed in the Thraupidae; Dickinson 2003) are an assemblage of small warbler-like birds, about 10 species, which are distributed in South America and eastern Panama. Six of these species are found in highland Andean forests and shrub zones; four species occur in lowland edge or semi-open habitats (Ridgely & Tudor 1989). Conebills have small conical and pointed bills with which they forage by picking and gleaning insects from leaves, leaf axils, and bud tips. Conebills have been classified either as warblers (Parulidae) (Ridgway 1902, Beecher 1951, Lowery & Monroe 1968) or honeycreepers (Coerebidae) (Meyer de Schauensee 1970, Fjeldså & Krabbe 1990). However, recent DNA analysis supports their recent placement in the family Thraupidae (Burns *et al.* 2002, 2003). Ridgely & Tudor (1989) indicated that the four lowland species of *Conirostrum* were quite distinct from the six montane species, perhaps deserving to be placed in a separate genus *Ateleodacnis* (Cassin, 1864). A Recent taxonomy of conebills can be found in Remsen *et al.* (2006).

Cinereous Conebills (*Conirostrum cinereum*) feed on insects and berries, foraging mostly along middle branches inside vegetation (Fjeldså & Krabbe 1990). Nectar feeding has been reported from two other *Conirostrum,* the White-eared Conebill (*C. leucogenys*) and the Chesnut-vented Conebill (*C. speciosum*) (Sick 1993, Hilty 2002), and has been hypothesized for Cinereus Conebills on the indirect basis of their territorial disputes with flowerpiercers, *Diglossa* sp. (Moynihan 1963, 1979). However, nectar feeding has never actually been substantiated for the species. Cinereous Conebills have been observed probing in the open flowers of flamboyant trees (*Delonix regia,* Caesalpiniaceae) in Lima, Peru, presumably collecting nectar, although insect gleaning cannot be ruled out (Engblom pers. com.). In a study of pollination of *Brachyotum* (Melastomataceae) by Black (*Diglossa humeralis*) and Glossy (*D. lafresnayii*) flowerpiercers, an adult

Cinereous Conebill was mist-netted and found to have 10 or fewer pollen grains of *Brachyotum* on its plumage and/or bill. However, the author made no mention of flower visitation or nectar feeding for the species (Stiles *et al.* 1992).

In this article I describe, secondary nectar robbing in Cinereous Conebill. In another paper (Vogt in prep.), I describe the specifics of the foraging interactions between the Black Flowerpiercer and two hummingbird species, Black-tailed Trainbearer (*Lesbia nuna*) and Tyrian Metaltail (*Metallura tyrianthina*), as secondary nectar robbers.

I observed Cinereous Conebills, mostly paired, on approximately 15 occasions in December 2004, June 2005, December 2005 and January–February 2006 in a large garden in Quito, Ecuador at 2850 m. They were foraging for nectar by using the holes made by Black Flowerpiercers at the base of flower corollas of *Fuchsia hybrida* (Onagraceae), *Abutilon pictum* (Malvaceae) and *Tecomeria capensis* (Bignoniaceae). Cinereous Conebills were observed methodically moving from flower to flower and inserting their bills in the holes that had previously been pierced by Black Flowerpiercers at the base of the flower corollas. Perched on the woody branch near the terminal flower clusters of these plants, conebills would extend their bodies in order to reach the base of the corolla. Occasionally, an individual would grab the flower petiole with the proximal foot and pull the flower closer to its bill. A corolla of *Tecomeria capensis*, an ornamental shrub native to South Africa, was actually split open by the vigorous probing of Cinereous Conebills. The genera *Fuchsia* and *Abutilon* are native to the Andes and may constitute a significant part of the diet of the resident Black Flowerpiercers as I was able to judge by their frequent daily visitations to flowers of these two genera.

Although I did not obtain direct evidence for nectar extraction on the part of Cinereous Conebills, this conclusion is supported, I believe, by the following observations: 1) I thoroughly examined flowers and corolla holes of *Fuchsia hybrida, Abutilon pictum* and *Tecomeria capensis*, but found no evidence of the presence of insects near these holes. 2) I observed Cinereous Conebills feeding on scale insects found on *Hibiscus* (Malvaceae). The behavior was very different from that associated with nectar feeding. The conebills were gleaning insects from the underside of the leaves, and not from flowers. 3) In general, my observations indicated that at least 30 min had elapsed between the last feeding bout by Black Flowerpiercers and that by Cinereous Conebills, which would have allowed for renewed nectar supply available to conebills. 4) I found that feeding bouts of Cinereous Conebills were often interrupted when Black Flowerpiercers vigorously chased them off, therefore suggesting that these two species were in direct competition for nectar resources. Black Flowerpiercers demonstrated similar territorial aggression towards hummingbirds feeding on *Fuchsia* (Moynihan 1979, Vogt in prep)

Diglossa spp. are well-known for their behavior of piercing the base of flowers and extracting nectar without pollinating. Nectar is produced by plants, as a reward for pollinators, and because Flowerpiercers obtain nectar without pollinating they have been referred to as nectar robbers (Inouye 1980, 1983). They possess a distinctive hook at the end of their maxilla, which facilitates the grasping and positioning of the flower in order to perforate the corolla base with the shorter and awl-like mandible (Skutch 1954, Moynihan 1963, Vuilleumier 1969). As I never observed Cinereous Conebills inserting their bill through the natural opening of the flower corolla in normal pollinator fashion, and furthermore, as *Conirostrum* spp. do not have a hook at the tip of their bill, the nectar feeding behavior of Cinereous Conebills is opportunistic and, more specifically, a form of nectar robbing. As this species cannot pierce the corolla and appears to depend on Black Flowerpiercers to make the opening to gain access to the nectar, the feeding behavior fits the definition of secondary nectar robbing (Inouye 1980, 1983; Irwin & Brodie 2001). My observations constitute the first substantiated record of secondary nectar robbing for the Cinereous Conebill.

Nectar feeding has been previously reported for only two of the 10 species of *Conirostrum*. The White-eared Conebill has been reported to sip nectar from *Erythrina* blossoms in Venezuela (Hilty 2002). The Chestnut-vented Conebill comes to sugar-water bottles in Brazil (Sick 1993), and presumably feeds on floral nectar as well. In the closest related monotypic genus *Oreomanes*, the Giant Conebill (*O. fraseri*) gleans aphids and their sugary secretions from under *Gynoxis* leaves (Fjeldså & Krabbe 1990).

Long ago, Moynihan (1963) suspected that, whereas the bill of *C. c. fraseri* is less specialized than that of *Diglossa* spp., it seems to extract nectar by a similar method. "At least I have seen conebills pecking at the base of tubular corollas, apparently inserting their bills, and then found incisions in the corollas after the birds had flown away." In a later publication, Moynihan (1979) characterized conebills as generalists because, with their simple and short bills, they take many arthropods as well as nectar. Moynihan also claimed that conebills are commensals of man and other birds and that Cinereous Conebills (and other species of conebills may extract nectar from the holes made by *Diglossa* spp): "There may be an old predilection for holes, a preadaptation to use them, in the conebill stock" (Moynihan 1979). Another member of the group, lowland *Coereba*, is known to cut occasionally holes in flowers with its only slightly elongated and curved bill (Borrero, 1965). This may be further evidence of a phylogenetic link between conebills and *Diglossas*" (Moynihan 1979, p.79).

Whereas Moynihan (1979) did not substantiate secondary nectar robbing in Cinereous Conebills, his hypothesis, which he based on his observations of conebills probing flowerpiercer holes as well as his description of vigorous territorial disputes between conebills and with *Diglossa*, was indeed correct. As there appear to be no accounts of nectar feeding in *Conirostrum* spp. previous to Moynihan (1963), his hypothesis may have been somehow biased by the then prevailing taxonomy, which placed the *Conirostrum* in the honeycreepers (Coerebidae), a family characterized by various degrees of nectar-feeding (Beecher 1951, Skutch 1954).

Beecher (1951), one of the first authors to recognize the presence of polyphyly in the formerly recognized Coerebidae, claimed that the only feature common to this group was the nectar-feeding habit. He believed that jaw-muscle patterns indicated *Conirostrum* to be a nectar-"adapted" warbler. In view of the fact that *Conirostrum*'s highly developed mandibular adductors are similar to those of *Coereba*, Beecher (1951) hypothesized that *Conirostrum* is a "gaper". In other words the closed bill is apparently plunged into a flower, then opened forcefully to spread the corolla to allow access to nectar. Beecher even stated: "possibly a hole is pecked in the side of a flower and enlarged in this manner."

Although I found no evidence that the Cinereous Conebill is "gaping" or is piercing flower corollas, I find it noteworthy, that Beecher (1951) should have presented anatomical evidence of "preadaptation" for nectar-feeding in *Conirostrum* without actual observations of this kind of behavior in the genus. Records of feeding behavior of *Conirostrum* are scarce (e.g., Sick 1993, Hilty 2002). The four lowland species are difficult to observe due to the fact that they generally feed high in the canopy and furthermore, are rare or local in occurrence (Ridgely & Tudor 1989). In addition, they move about within the canopy, and from tree to tree, quite rapidly (Vuilleumier pers. com.). Hence, what will be required are particular conditions of topography or canopy towers located within known species ranges. These circumstances would facilitate observations of feeding behavior in the lowland species of *Conirostrum* (*Ateleodacnis).* By contrast, Andean *Conirostrum* species are generally common and seen well in the lower canopy and in open shrubby habitats. I hope that my observations will spur further study to obtain direct evidence for nectar feeding in Cinereous Conebills. In addition and importantly, future studies should be aimed at determining the importance of nectar feeding in the energy budget of *Conirostrum*.

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