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FLOWER DESTRUCTION AND NECTAR DEPLETION BY AVIAN NECTAR ROBBERS ON A TROPICAL TREE, *CORDIA SEBESTENA*

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Abstract.—Visitors to the blossoms of a scarlet cordia tree (*Cordia sebestena* L.) were observed on St. John, U.S. Virgin Islands. The blossoms were visited by birds 191 times during 5.3 h of observation. Two species of hummingbirds fed exclusively from the open ends of blossoms, possibly effecting pollination in the process. *Coereba flaveola* and *Tiaris bicolor* removed nectar by piercing the base of the corolla and drinking the nectar, but without pollination. *Loxigilla noctis* also extracted nectar without pollinating the flower. It plucked the corolla, grasped the base in its bill, and tilted the corolla upward as if drinking from a bottle. Nectar depletion and corolla plucking may have a major impact on the reproductive success of scarlet cordia.

DESTRUCCIÓN DE FLORES Y DEPLECIÓN DE NECTAR POR PÁJAROS LADRONES DE NECTAR DEL ÁRBOL TROPICAL *CORDIA SEBESTENA*

Sinopsis.—En St. John, Islas Virgenes Estadounidenses, se estudiaron los visitantes a los capullos de *Cordia sebestena* L. En 5.3 h de observación, los capullos fueron visitados por aves en 191 ocasiones. Dos especies de zumbadores, *Eulampis holosericeus* y *Orthorhynchus cristatus*, se alimentan exclusivamente desde la parte abierta de la flor y durante el proceso probablemente polinizan. *Coereba flaveola* y *Tiaris bicolor* obtienen nectar perforando la base de la corola y bebiendo nectar sin polinizar la planta. *Loxigilla noctis* también obtiene el nectar de la planta sin polinizarla. Este arranca la corolla, luego toma la base en su pico, y la eleva hacia arriba, como si estuviera bibiendo de una botella. Las aves que agotan el nectar y extraen la corola de la planta, muy bien podrian tener impacto negativo en el éxito reproductivo de *C. sebestena*.

Bird-pollinated flowers are subjected to heavy selection pressure from nectar-robbing birds and insects (McDade and Kinsman 1980, Roubik 1982, Roubik et al. 1985). Nectar robbers not only deplete nectar supplies, but may also damage floral parts. We observed two types of nectar robbing on scarlet cordia (*Cordia sebestena* L.; family Boraginaceae): one relatively nondestructive type that resulted primarily in nectar depletion, and another type, to our knowledge not previously described, that resulted in destruction of the flower.

Scarlet cordia is a small tree of coastal habitats in the West Indies

(Johnston 1949). The blossoms have many characteristics associated with hummingbird pollination (Faegri and van der Pijl 1979): bright reddish-orange corolla and calyx; a long corolla tube (averaging 32 mm) with basal nectaries; and flower clusters that protrude horizontally or hang down obliquely. Percival (1974) observed Streamertail Hummingbirds (*Trochilus polytmus*) feeding at scarlet cordia blossoms in Jamaica. The blossoms also have adaptations associated with prevention of nectar-robbing (Kodric-Brown et al. 1984): the petals are completely fused, and the fused sepal tube firmly encases the base of the corolla, forming an additional barrier to protect the nectar.

All visitors to the blossoms of an 8-m tall scarlet cordia were recorded during a total of 5.3 h at Little Lameshur Bay, Virgin Islands National Park, St. John, U.S. Virgin Islands on 29–30 May 1986. Observations were made between 06:10 and 10:00 on both days, and between 16:30 and 18:30 on 29 May. Frequent additional brief observations from 27–31 May indicated very little nectar-feeding at the tree by either birds or insects at midday (10:00–16:30), a pattern that is typical of some hummingbird-pollinated plants (Brown et al. 1981).

Birds were frequent visitors to cordia blossoms, but only one insect was observed taking nectar from a blossom (Table 1). Of 191 blossoms visited by birds, 44% were robbed (i.e., nectar was taken without touching the reproductive structures of the flower) and 56% were fed upon legitimately (i.e., nectar taken by dipping the bill into the corolla, touching the anthers and stigmas in the process and potentially effecting pollination).

Two species of hummingbirds (Green-throated Carib, *Eulampis holosericeus*, and Antillean Crested Hummingbird, *Orthorhynchus cristatus*) accounted for almost all of the legitimate feeding (Table 1). Bananaquits (*Coereba flaveola*) were the most frequent nectar robbers (Table 1). They

TABLE 1. Feeding techniques used by birds feeding on the nectar of a *Cordia sebestena* tree during a total of 5.3 h of observation.

Species	Legitimate feeding (number of blossoms)	Nectar robbing (number of blossoms)	
		Flower piercing	Corolla plucking
Green-throated Carib *Eulampis holosericeus*	97	0	0
Antillean Crested Hummingbird *Orthorhynchus cristatus*	7	0	0
Bananaquit *Coereba flaveola*	3	41	0
Black-faced Grassquit *Tiaris bicolor*	0	16	0
Lesser Antillean Bullfinch *Loxigilla noctis*	0	0	27
Carpenter bee *Xylocopa* sp.	1	0	0

pierced the sepals and the base of the corolla, creating an oval slit into which they inserted their bills to feed on nectar. In most cases they appeared to use holes that were already present, as did the Black-faced Grassquits (*Tiaris bicolor*) that visited the tree. There were 4 aggressive encounters between Bananaquits, and they chased Grassquits away from the tree twice. No aggression was observed between Bananaquits and hummingbirds; in fact, Bananaquits and Green-throated Caribs sometimes fed peacefully at the same flower cluster. Also, Lesser Antillean Bullfinches (*Loxigilla noctis*) and Bananaquits fed close together without aggression.

A survey of the lower half of the tree revealed that 34% of the intact flowers had been pierced. Nectar levels (measured by extracting nectar at the base of the corolla with a 1 cc syringe at 09:45) were lower in pierced flowers than in unpierced flowers. The means and 95% confidence intervals are as follows: pierced—12 ± 8 μl; unpierced—24 ± 12 μl. This difference was not significant ($t = 1.8$, df = 74, $P = 0.08$).

Lesser Antillean Bullfinches may have a disproportionate effect on the reproductive rate of the tree because they destroy flowers when robbing nectar (Table 1). Bullfinches reached the nectar by grasping the corolla at the base and plucking it out of the calyx (Fig. 1). They sometimes fed on nectar while pressing the corolla down against a branch with a foot. More often they grasped the narrow, basal end of the corolla in the bill

FIGURE 1. Nectar-feeding behavior of Lesser Antillean Bullfinch (*Loxigilla noctis*) on a *Cordia sebestena* tree. (a) The bullfinch plucks the corolla out of the fused sepal tube. (b) The corolla is then held against a branch with the foot while the base of the corolla is grasped in the bill. (c) Nectar is extracted by tilting the corolla up to a vertical position. Illustration by Julie Zickefoose.

and released the foot holding the corolla. The head was then tilted back, raising the corolla vertically as it was grasped in the partially open bill, as if the bird were drinking from a bottle. The corolla was then dropped. In the lower half of the tree 34% of the calyces had no corolla, but we do not know how many of these had been removed by bullfinches. The removal of the corolla probably prevents pollination, but the pistils were not damaged so fruit development might occur if the flower had already been pollinated. Various species of birds have been recorded eating flowers (Riley and Smith 1986) and two species of icterids in Mexico often knocked off corollas while searching for insects or nectar in *Ceiba acuminata* flowers (Baker et al. 1971), but we know of no other reports of birds plucking and drinking nectar from corollas. Previously, Lesser Antillean Bullfinches have been described as feeding primarily on fruit (Raffaele and Roby 1977, Adolph and Roughgarden 1983).

C. sebestena apparently is an introduced tree to St. John (Little and Wadsworth 1964), and the Green-throated Carib and Lesser Antillean Bullfinch have only recently colonized the island (Lack 1976, Raffaele and Roby 1977). *C. sebestena* and the five species of birds that visited it occur together on many islands in the Lesser Antilles (Johnston 1949, Bond 1974), however, so interactions among these species may have occurred frequently during their evolution. Our preliminary results suggest that nectar-robbing birds may have an important impact on reproduction in scarlet cordia.

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