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CHANGE IN DIET AND FORAGING BEHAVIOR OF THE ANTILLEAN EUPHONIA IN PUERTO RICO AFTER HURRICANE HUGO

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Abstract.—From 1975 to 1990 the feeding habits of the Antillean Euphonia (*Euphonia musica*) were studied in the Carite Forest located at Cayey, Puerto Rico. The species, usually found in the canopy of mature rain forest, is considered a mistletoe (*Phoradendron* spp.) specialist. The Antillean Euphonia is here reported feeding on eight additional species of plants and on arthropods. After Hurricane Hugo, the species showed foraging and feeding flexibility such as searching and gleaning for insects from the underside of leaves in the mid-canopy and shrub layer of the forest, and eating varied food items. Behavioral changes may have resulted from shortage of its usual food (mistletoe) in the forest canopy as a result of major habitat disturbance following the passage of the hurricane.

CAMBIO EN LA DIETA Y LA CONDUCTA DE FORRAJEO DE *EUPHONIA MUSICA* EN PUERTO RICO DESPUÉS DEL HURACÁN HUGO

Sinopsis.—De 1975 a 1990 se estudiaron los hábitos alimentarios del jilguero (*Euphonia musica*) en el Bosque de Carite localizado en Cayey, Puerto Rico. La especie, típica del docel de bosques pluviales maduros, es considerada un especialista de la fruta de la capitana (*Phoradendron* spp.). En éste trabajo se informa al ave, alimentarse de otras ocho especies de plantas y de artrópodos. Luego del huracán Hugo, el ave mostró gran flexibilidad en sus patrones de forrajeo y alimentación tales como el rebusque de insectos en la parte inferior de hojas de la capa media y arbustiva del bosque, e ingerir variados alimentos. Los cambios en conducta pueden ser el resultado de la escacez de su alimento usual (capitana) en el docel del bosque como resultado de disturbios en el hábitat posterior al paso del huracán.

Euphonias are considered mistletoe (*Phoradendron* spp.) specialists (Danforth 1935, Faaborg 1985, Lack 1976, Skutch 1954, Snow 1981). In Puerto Rico the Antillean Euphonia (*Euphonia musica*) is reported to feed solely on mistletoe (Biaggi 1983, Danforth 1936, Rivera-Cianchini and Mojica 1981, Wetmore 1916). Wetmore (1916), who examined stomach contents of 51 individuals, found exclusively seeds of several species of mistletoe. In a paper apparently overlooked by several authors, Sierra-Bracero (1973) reported ripe bananas (*Musa sapientum*) in the diet of this small tanager.

The Antillean Euphonia is also considered a canopy species in rain forests (Danforth 1936, Dod 1978, Raffaele 1989, Wetmore and Swales 1931, Wunderle et al. 1987, per. obs.); it is usually heard but difficult to observe. Herein, I report the species feeding on different food items, including arthropods, foraging at mid-canopy and shrub layer levels, and using previously undescribed feeding methods, particularly after Hurricane Hugo.

STUDY AREA AND METHODS

The observations were made at the Carite Forest located in southeastern Puerto Rico in the municipality of Cayey (Fig. 1). Carite is classified as a subtropical moist forest with an annual rainfall of 100–200 cm and temperatures between 18 and 24°C (Ewell and Whitmore 1973). The forest is mainly a transitional one, with many ecotones. Some of the forest's native vegetation has been replaced by eucalyptus (*Eucaliptus robustus*) and pine (*Pinus caribaea*). The study area is located at an altitude of 400 m. The forest at this location is a three-stratum formation. It has an open canopy with tree height averaging 17–20 m in the overstory, 7–9 m at mid-canopy level, and 1–3 m in the relatively well developed shrub level. The dominant vegetation at the study area included trees of bulletwood (*Manilkara bidentata*), candlewood (*Dacryodes excelsa*), sierra palm (*Prestoea montana*) and matchwood (*Didimopanax morototoni*). Tree-fall in the study area was minor following Hurricane Hugo. Nevertheless, most canopy trees suffered broken branches and defoliation.

From 1975 to 1988 while conducting a study on the feeding ecology of Puerto Rican tanagers, I made incidental observations on the feeding habits of the euphonia. Observations were made from 0600 to 1800 hours. The sampling technique involved walking along an undetermined path in the study area until a bird was encountered. If the bird was observed foraging, information was recorded on its foraging height, behavior and food being consumed. Food items were collected and taken to the laboratory for identification. Plant taxonomy follows Acevedo-Rodriguez and Woodbury (1985), Little and Wadsworth (1964), Little et al. (1988). Liogier and Martorell (1982) was used for English vernacular names.

RESULTS AND DISCUSSION

During a 13-yr period prior to Hurricane Hugo, I found that the Antillean Euphonia, although feeding mostly on mistletoe (93% of the foraging observations), also includes other fruits in its diet (Table 1).

At Carite, 90% of the euphonias were observed foraging at canopy level, 1% in the mid-canopy and 9% in the shrub layer. In Puerto Rico, euphonias also have been observed feeding 1–2 m above ground in disturbed second-growth forest (J. Wunderle, Jr., pers. comm.), and in xerophytic formations such as the Guánica Forest (pers. obs.).

Also prior to Hugo, the only foraging technique I observed was fruit gleaning. Fruits were plucked while euphonias were perched (98% of observations) or taken as they hovered. Food was mandibulated before being swallowed.

On 14 Oct. 1989, nearly a month after Hurricane Hugo, I visited the Carite Forest and observed such canopy inhabitants as Scaly-naped Pigeon (*Columba squamosa*), Puerto Rican Vireo (*Vireo latimeri*), Stripe-headed Tanager (*Spindalis zena*) and Antillean Euphonia foraging in the middle and lower strata of the forest. Similar behavior had been previously reported in other Puerto Rican species (Pérez-Rivera and Bonilla 1982).

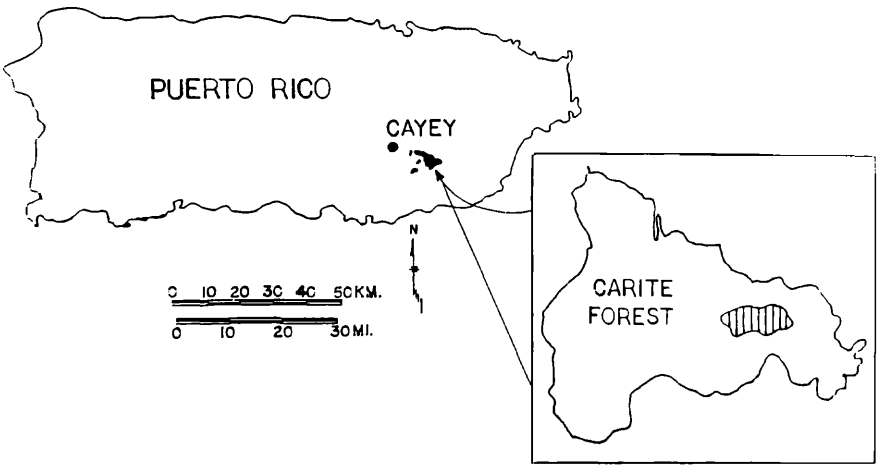

FIGURE 1. Study area (cross-hatched).

But, two Euphonias, apparently a pair (the species is dichromatic), were observed following very quietly (unusual in the species) a small flock of Bananaquits (*Coereba flaveola*) and migratory warblers (*Dendroica caerulescens, D. tigrina* and *Parula americana*) in their search for insects in a pine stand. Later, the foraging flock moves into the middle stratum of the hard-wood forest continuing their search for insects. The male euphonia was observed gleaning from the underside of leaves of a rose-apple tree (*Eugenia jambos*) in a manner similar to that of todies. A female euphonia, in company of a Bananaquit, carefully examined the axils of a bromeliad (*Guzmania* sp.) and ingested two small arthropods. At about noon, I interrupted another pair of euphonias as they were feeding on the fruits of *Rapanea coriacea* in the shrub layer. The two birds moved toward a small clump of flowers of the vine, *Marcgravia sintenissi.* After a brief search, apparently looking for insects, the female ingested parts of a flower.

On 9 Jan. 1990, I again visited the Carite Forest. Although most trees

TABLE 1. Foraging observations of Antillean Euphonia's in Carite Forest prior to Hurricane Hugo.

Plant species	# individuals	Dates
Phoradendron spp.	270	Year-round since 1975
Ficus laevigata	9	Feb., Sep. 1983
Inga fagifolia	1	Aug. 1985
Didimopanax morototoni	1	Feb. 1986
Rapanea coriacea	2	Apr. 1983
Miconia prasina	3	Oct. 1987
Mecranium amigdalinum	2	Sep. 1986
Cassytha filiformis	1	Oct. 1985

had refoliated, some avian canopy species such as the Stripe-headed Tanager and the Antillean Euphonia continued to feed in the lower and middle strata, respectively. From 0730 to 1330 hours, I observed six euphonias foraging but feeding solely on mistletoe (19 obs.), although fruits of *Rapanea* and flowers of *Marcgravia* were available.

Although a mistletoe specialist, the Antillean Euphonia feeds on a variety of fruits and on animal matter as do other species of the genus. Lack (1976) recorded the Jamaican Euphonia (*E. jamaica*) feeding on flowers and invertebrates. Moermond and Denslow (1985) reported *E. violacea* feeding on 19 species of plants.

Insect gleaning from leaf undersides by island avifauna had been previously reported only for the Antillean todies (*Todus* spp.) (Kepler 1977). The dietary and behavioral shifts observed after Hurricane Hugo may have resulted from a shortage of the euphonia's usual food (mistletoe) in the canopy of the forest. My observations after the storm confirmed that the Antillean Euphonia has evolved foraging and feeding plasticity. Craig (1989) has suggested that feeding flexibility, such as that shown in the euphonias at Carite, may be an adaptation of island species to periodic and major habitat disturbances such as hurricanes. Puerto Rico is affected by severe hurricanes about every 10 yr (Wadsworth and Englerth 1959), thus facilitating the evolution of such plasticity in diet and foraging techniques.

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