

FLOWER EATING BY EMERALD TOUCANETS IN COSTA RICA<sup>1</sup>

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Although many tropical birds visit flowers while foraging (e.g., Snow and Snow 1971), few instances of birds consuming flower parts other than nectar or pollen have been reported. Skutch (1944) mentions observations of a Prong-billed Barbet (*Dicrorhynchus frantzii*) and saltators eating flowers. Parrots also apparently eat flowers in some tropical areas (Feinsinger et al. 1979, Janson et al. 1981). Here we report three observations of flower eating made at Monteverde, Costa Rica (10°18'N, 84°48'W) during a study of the foraging behavior of Emerald Toucanets (*Aulacorhynchus prasinus*), an abundant frugivorous bird of the tropical lower montane forest.

(1) *Erythrina lanceolata* (Leguminosae). During dry season in midmorning on 7 January 1985, we observed a male and female Emerald Toucanet (distinguished by bill size and shape [Riley 1986]) land in an *Erythrina* tree, a common legume found in montane regions of Honduras, Nicaragua, Costa Rica, and Panama (e.g., Krukoff and Barneby 1974). Both birds immediately began eating the red flowers, sitting in one spot and reaching to grab flowers from nearby branches. We focused our attention on the male, who ate 13 flowers in 2.3 minutes from his initial perch. He moved 1 m and consumed 15 more flowers in the next 7.6 minutes. While feeding, he became noticeably larger. The female ate fewer flowers and stopped foraging after about 6 min. The birds left together after about 10 min in the tree.

Close inspection of the tree in which the toucanets ate flowers revealed that the birds had consumed only corollas, leaving stamens and pistils exposed. Therefore, toucanets may not have affected seed set if pollination had already occurred; birds searching for nectar occasionally remove corollas from flowers without affecting seed set (Baker et al. 1971, Guillardmod et al. 1979). We removed corollas from several *Erythrina* flowers and found that they separated easily from the remainder of the flower. In addition, some nectar came off within the corolla; both corolla and nectar were palatable to us. We measured 30 corollas which averaged  $40.6 \pm 9.2$  (SD) mm long by  $8.0 \pm 1.4$  mm wide and weighed  $0.28 \pm 0.09$  g, which suggested that the male we observed had eaten about 8 g of flowers. Wheelwright (pers. comm.), who has also observed toucanets eating flowers of this species, reported that a flock of toucanets can apparently strip an entire tree in a matter of minutes.

All 110 species of the genus *Erythrina* are pollinated either by hummingbirds or by perching passerines (e.g., Toledo 1974). Based on plant morphology and nectar characteristics, *E. lanceolata* is classified as a hummingbird-pollinated species, offering a "sucrose-rich" nectar (Baker and Baker 1982). It would appear unlikely, however, that toucanets commonly pollinate *Erythrina* flowers, since they usually come in contact with only the outside of the corolla.

(2) *Saurauia* spp. (Dilleniaceae). During the wet season

in late afternoon on 3 July 1985, Riley observed one adult (sex unknown) and four juvenile (based on bill size and color) toucanets feeding on the flat white flowers with bright yellow stamens of a *Saurauia* tree. She focused her attention on a juvenile. This bird ate two whole flowers, moved about 5 cm, and ate another whole flower. After she had observed them for 18 sec, the group left the tree. Thirty of these flowers averaged  $11.3 \pm 3.3$  mm in diameter and  $0.31 \pm 0.10$  g in mass.

(3) *McClenia* spp. (Ericaceae). During dry season in late morning on 23 March 1985, Riley observed an adult male toucanet as he ate one whole orange tubular flower of this common epiphyte. The nectar of this flower also tasted sweet and palatable to her. Thirty of these flowers averaged  $22.3 \pm 1.1$  mm long,  $5.0 \pm 0.4$  mm wide, and  $0.15 \pm 0.04$  g in mass.

Emerald Toucanets have the most varied diet of all fruit-eating birds studied in Costa Rican lower montane forests, feeding on fruits of at least 113 different plants at Monteverde (Wheelwright et al. 1984, Riley 1986). Toucanets have also been reported to consume flowers in captivity (Todd et al. 1973). Flower eating is consistent with the idea that frugivorous birds might include a variety of brightly colored food items in their diets (see Herrera 1985). Our observations were made during periods when ripe fruits were readily available, so this is not simply a case of toucanets switching to alternative foods during a shortage of ripe fruit.

All reports to date of flower eating by birds from the neotropics concern frugivorous species. Although we have been unable to find data on chemical composition of flowers, flowers in general probably supply a high-energy mixture of lipids, proteins, and carbohydrates, particularly if the entire flower is consumed. If this is true, it is curious that flower eating by frugivorous birds in the tropics has not been reported more often.

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## SPEED OF FLAPPING FLIGHT OF MERLINS AND PEREGRINE FALCONS<sup>1</sup>

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**Key words:** *Flight; speed; Falco peregrinus; Falco columbarius; migration; flapping flight.*

Flapping flight speed data were obtained for four Merlins (*Falco columbarius*) and six Peregrine Falcons (*Falco peregrinus*) while they were being radio tracked during a migration study. The study involved over 16,000 km of observations of 29 birds and provided copious data on average speed in mixed or unknown flight modes. Merlins and peregrines usually soared during migration and seldom flew steadily on a straight path when hunting (Cochran 1975:33). This behavior severely limited opportunities for measuring speed of flapping flight. The data presented were obtained by a variety of radiotelemetric techniques (Cochran 1972, 1985) and were selected for periods when (1) the flight path was known to be approximately straight, (2) continuous telemetric and intermittent visual observation confirmed a flapping mode of flight, and (3) the birds were in approximately level flight below about 100-m altitude, where winds were measured and taken into account.

Our fastest peregrine speeds (Table 1) were less than most lower limits of speed ranges reported in the literature: 63 to 290 km/hr (Dorst 1974:34), 241 to 322 km/hr (Bent 1938:59-60), and a 100-km/hr groundspeed in level flight (Meinertzhagen 1955). Of course, speeds reported in dives (400 km/hr, Newton 1985) and in airplane chases (287 km/hr, Storer 1952), are not comparable to those of the peregrines we observed in unstressed level flight. The fastest Merlin airspeed, 48 km/hr, is the same as that reported by Bond (1936). We found no other references to Merlin flight speed. Both the mean and the maximum peregrine airspeeds exceed those of the Merlin, but the difference of means was not significant ( $P > 0.05$ ,  $t = 0.83$ ,  $df = 8$ ). In addition to flapping flight speeds, horizontal gliding air-

speeds of one peregrine, in 12-min and 10-min straight tracks, were 64 and 62 km/hr, respectively.

In general, flight speeds reported in the literature have emphasized maximum capabilities; for the peregrine, claimed by some to be the fastest bird in the world, reports may sometimes have been exaggerated. Although maximum speed capabilities of Merlins and peregrines are certainly higher than we show, our data on flight speeds are more typical and probably represent speed ranges providing good aerodynamic efficiency.

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TABLE 1. Average speeds of Merlins and peregrines in flapping flight on straight migratory flights, measured to the nearest 0.5 km/hr.

Species/age/sex <sup>a</sup>	Duration <sup>b</sup> (min)	Groundspeed (km/hr)	Airspeed (km/hr)
Merlin/I/m	20	48.5	48.5
Merlin/I/m	28.5	30	30.5
Merlin/A/f	30.5	74	44
Merlin/I/f	40.5	30	34
		Mean = 45.6	39.3
Peregrine/A/f	55 <sup>c</sup>	50	49
Peregrine/I/f	83	49.5	36.5
Peregrine/I/f	9	53	53.5
Peregrine/I/m	9	36.5	36.5
Peregrine/I/m	17	70	50.5
Peregrine/I/m	129.5 <sup>c</sup>	35	36
		Mean = 48.8	43.7

<sup>a</sup> A = adult, I = immature, f = female, m = male.

<sup>b</sup> Time interval over which speed was calculated.

<sup>c</sup> Flights in strong cross winds.

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