

BIRD USE OF *CECROPIA* (CECROPIACEAE) AND NEARBY TREES IN ESPIRITO SANTO STATE, BRAZIL

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Skutch (1945) called Neotropical light-loving *Cecropia* “the most hospitable tree,” as it provides food and shelter for animals from ants to mammals. Birds eating cecropia catkins were later studied by Eisenmann (1961), Leck (1972a, b), Trejo Pérez (1976), Silva (1980), Sazima *et al.* (1981), Snow (1981), Wheelwright *et al.* (1984), and Marcondes-Machado & Argel-de-Oliveira (1988).

Here we report on visits of 40 species of birds in cecropias and adjoining trees, with 18 species feeding on catkins, at one site in the Atlantic Forest of Espírito Santo, Brazil. Nearby plants can be visited as much as the cecropias themselves and may benefit from resulting insectivory; concentrations of birds occur at dawn, midday and well before dusk; one frugivore, *Euphonia violacea*, may use vocal mimicry to call other species in for “protection in numbers” against predation.

The study area is a gallery woodland, one of several scattered areas of recovering natural vegetation in eucalyptus plantations, now protected and studied by Aracruz Celulose S. A.: “Área 231”, at 18°31’ S, 39°44’ W, in the lowlands northeast of São Mateus, northern Espírito Santo. We watched birds on 30–31 January and 3 February 1993, for a total of 28 h and 21 min. Two cecropia clumps 2.5–8 m tall were separated by two Leguminosae trees 8 and 12 m tall, next to a dirt road that ran north-south with a pond just west, amidst plantations of introduced pine to the south and eucalyptus to the north.

Birds foraging in cecropias

The most common species were (Table 1) *Dacnis cayana* (at least one pair, plus a mottled young male that sometimes joined them), *Euphonia violacea* (one or two males, singing at times; at times a loosely associated pair), *Tangara mexicana* (at least one group of 3–4 birds, occasionally single or paired birds), and *Thraupis sayaca* (pair or lone bird visiting every 20–40 min). *Tyrannus melancholicus*, feeding a large young bird with insects or pieces of catkin, was frequent in the afternoon. Single *Turdus leucomelas*, usually wary, fed now and then, while single (once with a grown young) *Saltator maximus* fed 8 times up to 11:00; there were 8 visits of *Tangara cayana*. Not included in Table 1 are two species (*Leptopogon amaurocephalus*, *Megarynchus pitangua*) that were catching insects. Three of the 18 that ate cecropias (the kingbird, *Myiozetetes similis*, and *Elania flavogaster*) also caught insects, for a total of 5. The number of species feeding on catkins was similar to the 17 registered by Marcondes-Machado & Argel-de-Oliveira (1988) at three separate sites in São Paulo state, with 5 species being the same (*Pitangus sulphuratus*, *D. cayana*, *Tangara selodon*, *T. sayaca*, and *Ramphocelus bresilius*).

Fig. 1 shows hours of visits, birds feeding on insects, and numbers of birds per group. Visits of all species considered together were most frequent at dawn, 11:00–14:00, and 16:00–17:00, suggesting the “three meals a day” pattern previously detected in swifts feeding young (Oniki

TABLE 1. Number of cecropia food visits alone (= 1 species present) or in mixed flocks.

| | Visits with given number of species present | | | | | | Total |
|-------------------------------|---|----|----|---|---|---|-------|
| | 2 | 3 | 4 | 5 | 6 | 8 | |
| <i>Dacnis cayana</i> | 27 | 6 | | | | | 51 |
| <i>Tangara mexicana</i> | 17 | 8 | | | | | 48 |
| <i>Euphonia violacea</i> | 7 | 9 | | | | | 31 |
| <i>Thraupis sayaca</i> | 7 | 9 | | | | | 29 |
| <i>Turdus leucomelas</i> | 5 | 1 | | | | | 14 |
| <i>Tyrannus melancholicus</i> | 5 | 1 | | | | | 10 |
| <i>Salinator maximus</i> | 2 | 3 | | | | 1 | 9 |
| <i>Tangara cayana</i> | | 4 | 2 | | | | 8 |
| <i>Myiozetetes similis</i> | 1 | 1 | 1 | | | | 6 |
| <i>Elaenia flavogaster</i> | 2 | 1 | | | | | 4 |
| <i>Ramphocelus bresilius</i> | | | | | | 1 | 4 |
| <i>Cyanerpes cyaneus</i> | | | | | | 1 | 4 |
| <i>Pitangus sulphuratus</i> | | | | | | | 3 |
| <i>Celeus flavescens</i> | | | | | | | 1 |
| <i>Megarynchus pitangua</i> | | | | | | | 1 |
| <i>Parula pitiayumi</i> | | | | | | | 1 |
| <i>Tangara seledon</i> | | | | | | | 1 |
| <i>Turdus fumigatus</i> | 1 | | | | | | 1 |
| Visits | 67 | 29 | 15 | 4 | 3 | | |

et al. 1992). There was a precipitous drop in use one hour before dark, though there was still plenty of light for feeding. Insect eaters, mainly *T. melancholicus*, used the cecropias mainly at midday, when the trees were in sunlight. The first visitors of the day were more often isolated birds, later visitors more often pairs or larger groups (dotted line in Fig. 1).

Birds visiting cecropias

Twenty-four species of birds visited the cecropias without feeding, including 10 species never seen to feed there (*Columbina minuta*, *Columbina talpacoti*, *Piaya cayana*, *Crotophaga major*, *Crotophaga ani*, *Ceryle torquata* (with nest nearby), *Satrappa icterophrys*, *Mniodynastes maculatus*, *Vireo olivaceus*, and *Volatinia jacarina*). With the 20 species noted above, this means that we found 30 species in cecropias, a number similar to 31 found at the three sites in São Paulo (Marcondes-Machado & Argel-de-Oliveira 1988). Visitors often stopped briefly when passing the tree at dawn or sat on it in the sunny afternoon. They were often alone (Fig. 2) or associated only with other species. Few birds visited after 17:00, despite plenty of light, and rather few visited from 7:00 to 11:00 even though many birds fed. *T. melancholicus* may have watched for food in certain brief visits. *E. flavogaster* sang or stopped while

passing between song perches, and it and other species (notably *Columbina* spp.) were sunning in the tree.

Birds visiting legume trees

Thirty-one species visited the adjoining legume trees. The commonest species were *D. cayana*, *T. mexicana*, *E. violacea*, *T. melancholicus* and singing *E. flavogaster*. Feeding on insects was registered 5 times for *D. cayana*, twice for *T. melancholicus*, and once each for *Xenops rutilans*, *S. maximus*, and *R. bresilius*; *Amazilia versicolor* visited epiphyte flowers.

Singing was noted for 11 species: *V. olivaceus*, *T. mexicana*, *V. jacarina*, *E. violacea*, *Camptostoma obsoletum*, *T. melancholicus* (2), *E. flavogaster* (3), *Sporophila caerulescens* (3), *Sporophila nigricollis*, *M. similis*, and *S. maximus*. Preening was recorded for *D. cayana*, *V. olivaceus*, *T. mexicana*, and *S. icterophrys*. Other birds recorded were an unidentified hummingbird, *Eupetomena macroura*, *Melanerpes candidus*, *Tolmomyias flaviventris*, and *Thryothorus genibarbis*.

The main activity, however, was birds briefly visiting the legumes before and after entering the cecropias: 35 cases (61 birds, 1.74 per group) of birds that flew to the cecropias and 75 (130 birds, 1.73 per group) of birds that came from the cecropias (209 total visits and 301 individuals were

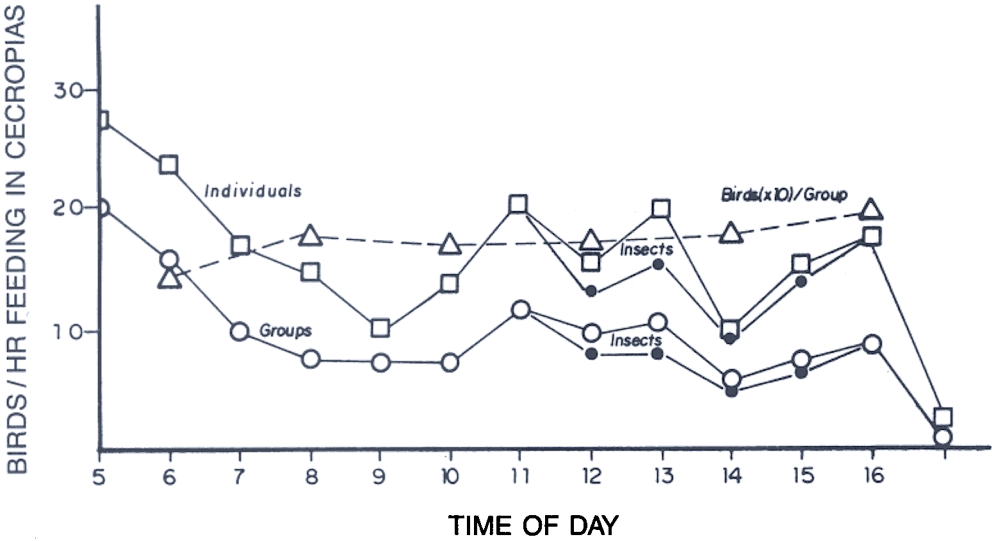


FIG. 1. Individuals or groups (one or more birds) feeding in cecropias, per hour of observation, at different hours of day (insect eaters shown separately); number ($\times 10$) of birds per group at different two-hour intervals. "Individuals" gives the total of all birds, including ones present in groups of two or more.

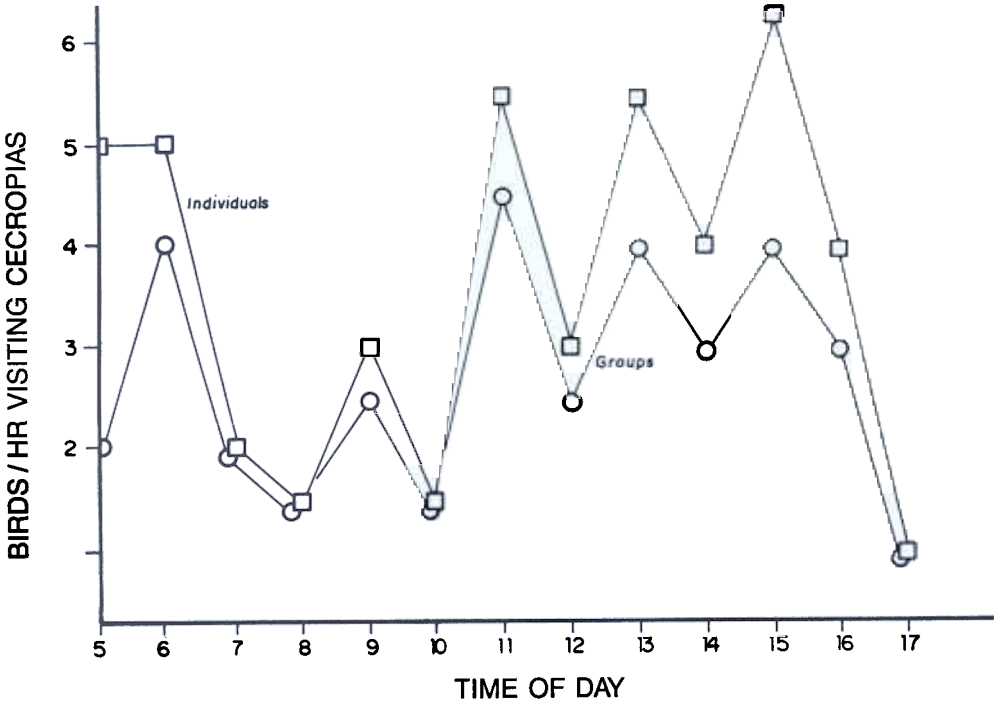


FIG. 2. Individuals or groups (one or more birds) visiting cecropias, without feeding, per hour observed at different times of day.

recorded in the legumes, 1.44 birds per visit). In 6 cases for *D. cayana*, 2 for *T. mexicana*, and 1 each for *T. sayaca* and *T. leucomelas*, the bird(s) stopped in the legumes both before and after a cecropia visit. The legume-cecropia movement never occurred at dawn or dusk (Fig. 3), the birds going directly to the cecropias at these hours if they went at all. Fewer birds did the cecropia-legume or legume-cecropia moves at 8–10 am, hours of lower general activity in the cecropias. Before 10:00, most of the few birds flying from legume to cecropias were alone (Fig. 3). The average number of birds/visit also increased after 10:00 for cecropia-legume movements (not shown).

Mixed flocks

Table 1 shows feeding visits alone or in mixed flocks. *D. cayana* pairs often visited alone, rather in line with the totals at the bottom of the table, as did large *T. leucomelas* and aggressive *T. melancholicus*; but *T. leucomelas* also tended to visit within groups of 4 or more species. *T. mexicana*, *E. violacea*, *T. sayaca*, *S. maximus*, *T. cayana*, *M. similis*, *R. carbo*, and *C. cyaneus* tended not to visit alone. Mixed groups were significantly more common 5–7 am, when 11 of 16 visits were of mixed groups, compared to 42 of 106 later in the day ($\text{Chi}^2 = 4.8, P < 0.05$).

Table 2 shows that certain species consistently were among the first to arrive when

several species formed a mixed flock feeding in the cecropias. In the table, two species that arrived together are both registered as "1.5" or "2.5" or "3.5"; when four arrived together (once), all were registered as "2.5" and, when three together (twice), all as "2" or "3" (mean of $1 + 2 + 3$, or of $2 + 3 + 4$). *Euphonia violacea* was most likely to be the first bird in a group. *E. violacea* often sang, imitating other species as recorded by other workers since the 16th century (Fernão Cardim, *vide* Santos 1948). Several flycatchers that rarely fed on cecropias, such as *M. pitangua*, *P. sulphuratus*, and *E. flavogaster*, sometimes arrived noisily and were joined by other birds. The two most frequent visitors, *D. cayana* and *T. mexicana*, were not so often first, but tended to be early in the groups. Birds that tended to arrive after other birds were already present were *T. sayaca*, *S. maximus*, *T. leucomelas*, and especially *R. bresilius*. The three latter species were obviously wary when visiting, and often appeared but fled without eating.

DISCUSSION

We found cecropias to be an important food source, as recorded by other workers (see first paragraph). The principal species were nine-primaried oscines and thrushes, birds that regularly eat small insects and fruits (Snow 1981). Several Tyrannidae also used the catkins, notably

TABLE 2. Frequency of arrival order in cecropia feeding groups.

| | Arrival order | | | | | | | | | | \bar{x} | |
|-------------------------------|---------------|----|-----|---|-----|---|---|---|---|---|-----------|------|
| | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 5 | 6 | 7 | 8 | | |
| <i>Dacnis cayana</i> | 5 | 8 | 3 | 2 | 5 | 1 | | | | | 1.93 | |
| <i>Tangara mexicana</i> | 3 | 14 | 7 | 2 | 2 | | 2 | | | | 1.97 | |
| <i>Euphonia violacea</i> | 9 | 11 | 2 | 1 | 1 | 1 | | | | | 1.56 | |
| <i>Thraupis sayaca</i> | 4 | 7 | 2 | | 8 | | 1 | | 1 | | 2.28 | |
| <i>Turdus leucomelas</i> | | 1 | 2 | 1 | 2 | 2 | 1 | | | | 2.78 | |
| <i>Tyrannus melancholicus</i> | | 1 | 2 | | 1 | | | | | | 2.12 | |
| <i>Saltator maximus</i> | 1 | 3 | 2 | | | | | | 1 | | 2.36 | |
| <i>Tangara cayana</i> | | 2 | 2 | 1 | 1 | 1 | 1 | | | | 2.5 | |
| <i>Myiozetetes similis</i> | | 1 | 2 | | 1 | | 1 | | | | 2.92 | |
| <i>Elaenia flavogaster</i> | | 1 | 1 | | | | | | | | 1.75 | |
| <i>Ramphocelus bresilius</i> | 1 | | 1 | | | | 1 | | 1 | | 3.5 | |
| <i>Cyanerpes cyaneus</i> | | | 2 | | | | | | | 1 | 4.0 | |
| <i>Pitangus sulphuratus</i> | | 1 | 1 | | | | | | | | 1.75 | |
| <i>Celeus flavescens</i> | | | | | | | 1 | | | | 5.0 | |
| <i>Megarynchus pitangua</i> | 1 | | | | | | | | | | 1.0 | |
| <i>Tangara seledon</i> | | | 1 | | | | | | | | 2.0 | |
| Total (n = 150) | 24 | 50 | 30 | 7 | 21 | 4 | 5 | 5 | 2 | 1 | 1 | 2.17 |

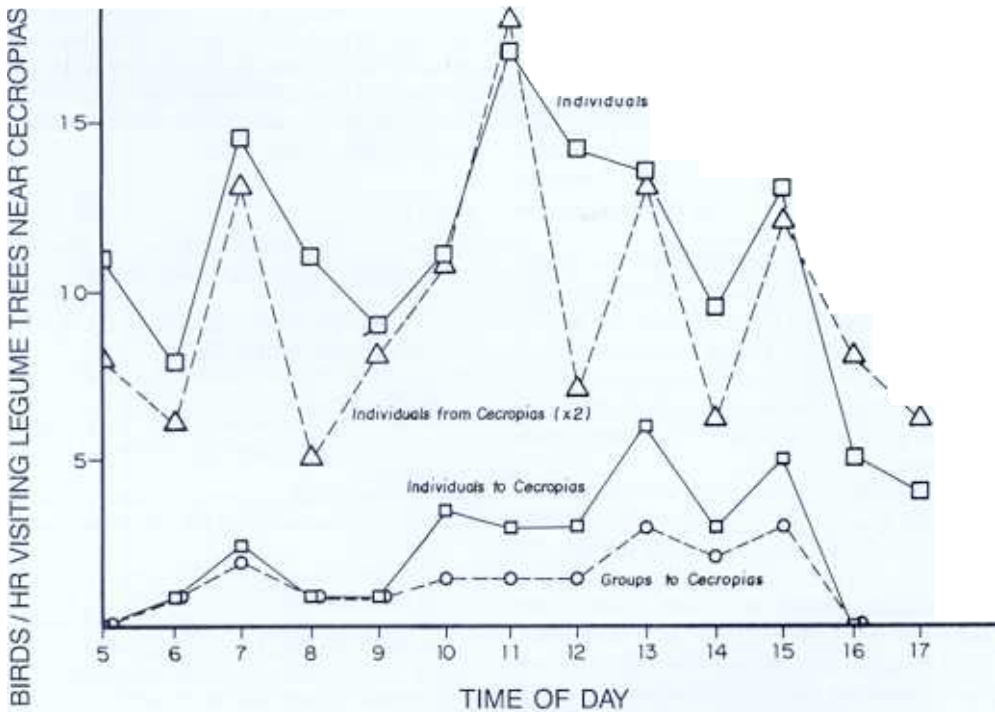


FIG. 3. Individuals or groups (one or more birds) visiting legume trees and going to cecropias at different times of day; individuals ($\times 2$) from cecropias to legumes compared to total number of individuals visiting the legume trees (all records per hour observed).

a *Tyrannus melancholicus* with a hungry young. One woodpecker (*Cealeus flavescens*), a known fruit eater, also visited.

Movement of birds in the cecropias and to or from nearby legume trees seemed to attract passing birds, forming a center of activity at this forest-edge site. Other areas along this gallery woodland were not so actively visited (we studied birds for several hundred meters down-creek).

Activity peaks at dawn, midday and mid-afternoon followed a "three meals a day" pattern, although detailed study of individual species is needed. This pattern may occur more widely than among humans and may follow patterns of energy or food needs: high after and before the night, plus a peak at an intermediate time. Swifts (Oniki *et al.* 1992) give young "dinner" late in the day, whereas cecropia birds avoided feeding for at least an hour at dusk. This early "dinner" may have been necessary because owls, bats or

other nocturnal predators might locate birds that went to roost late. The dawn peak of activity was quite early, as soon as it was light, so birds were not avoiding hours when the sun was low.

Tendencies to visit alone at dawn (Fig. 1) might reflect priorities among individuals of pairs and families, some preferring to sit in sunny sites or sleep longer and others to get some food. Alternatively, the pattern might reflect the necessity to group more later in the day, when strong sunlight could help hunting hawks or other diurnal predators.

Interspecific groups were frequent early in the day, in contrast to pairs and families. In part, this offset the tendency for intraspecific groups to be smaller at dawn. To some extent, the mixed flocks at dawn were the accidental result of scattered birds of several species arriving in a "rush hour". However, we noted busy periods and recesses, with few birds present for several minutes in a row, even at peaks of activity measured on an hourly basis.

In particular, we noted that there was little fighting among birds here (6 intraspecific attacks; 11 interspecific, including 4 by *T. leucomelas* and 3 by *T. sayaca*) and that there seemed more tendencies to form mixed flocks, several species moving in only when other birds were feeding. *Dacnis cayana* and large flycatchers seemed to visit at any hour, but most species tended to group with others.

The grouping of species might be due to mixed flocks, formed away from Cecropias, moving in now and then. However we did not notice mixed flocks of these species away from the Cecropias in this plantation area. Our impression was that species were moving in separately, as soon as other birds were in the legumes or Cecropias.

One of the most interesting cases involved *E. violacea*, which was imitating voices of other birds in and near the Cecropias. It was also the species that tended to arrive first in the Cecropias (Table 2), suggesting that it may imitate other species in order to call them to fruiting trees. Even though it is supplanted now and then (once by *T. leucomelas*, once by *T. mexicana*), it might gain protection from predators attracted to the trees by having other species about to give the alarm or distract the predators.

Formation of an interspecific flock, especially at fruiting trees where a species might otherwise have to wait alone for others to arrive, could be a major reason for vocal mimicry in this species, in *Icterus cayanensis* (Fraga 1987) and in related *Euphonia lanirostris* (Morton 1976, Remsen 1976).

We were impressed by the repeated and rapid visits of birds to the trees, fleeing to digest food elsewhere as if wary of hawks that might wait near a busy fruit tree. As Howe (1979) suggested, the Cecropias might produce large fruit crops to attract large numbers of birds, thus attracting hawks, and forcing the fearful small birds to carry seeds away rather than sit digesting fruits in the tree. Neighboring trees might gain from the birds (insectivory, fertilization by feces).

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