

Short Communications

Fruit-eating at *Celtis gomphophylla* (Ulmaceae) by Banded-green Sunbirds *Anthreptes rubritorques* and other species

Compared to other tropical regions, very few studies with a focus on frugivorous bird guilds foraging at fleshy fruiting trees have been carried out in African forests (e.g., Kirika *et al.* 2008). Such information would significantly improve our understanding of the role of avian frugivory in seed dispersal for African tree species. We present observations on fruit-eating bird species at Amani Nature Reserve, East Usambara Mountains, Tanzania. Thirteen of 22 frugivorous bird species occurring in the submontane region of the study area consumed fleshy fruits of *Celtis gomphophylla* (Ulmaceae). Of particular interest, one sunbird species, a member of a guild chiefly known to feed on nectar and invertebrates (Fry *et al.* 2000), was a frequent fruit-eating visitor at this tree species. This observation highlights the lack of sufficient knowledge about frugivory and seed dispersal of African forest trees by birds.

Celtis gomphophylla is a 15-30 m high tree that is typically found at forest edges, disturbed pockets of forest or large open forest gaps (Schulman *et al.* 1998). Its ripe fruits are yellow spherical drupes 5–8 mm in diameter, with a soft, fleshy pulp surrounding a small, hard seed (mean seed size: 6.4 × 5.2 mm, n = 8). In the study area, trees fruited heavily (> 50,000 fruits per tree) from March to July, which is before and during the long rainy season. In late March 2000, we observed birds feeding on fruits of two individual *Celtis gomphophylla* trees, both with approximately 25% of their fruit crops in the ripe stage. These trees were located at the edge of the extensive forest protected within Amani Nature Reserve. Casual observations were made at these trees in late March, and, two focused watches of 237 and 150 minutes were made on 31 March and 8 April 2000. The goal was to document the frugivore assemblage and assess rates of fruit intake by each species. We observed individual birds for 3-minute intervals, changing to a different bird when the interval was up or when the bird moved out of sight. We enumerated the number of fruits consumed per unit time. An additional opportunistic observation of fruit-eating birds was made at another *C. gomphophylla* tree at the forest edge on 25 July 2001.

Thirteen bird species were observed consuming the ripe fruits of *C. gomphophylla* (Table 1). Green-headed Orioles *Oriolus chlorocephalus*, Black-bellied Starlings *Lamprotornis corruscus*, Stripe-cheeked *Andropadus milanjensis* and Shelley's Greenbuls *A. masukuensis* and Yellow White-eye *Zosterops senegalensis* consumed more fruits per unit time than the other species (Table 1).

Table 1. Rate of *Celtis gomphophylla* fruit intake by birds in the East Usambara Mountains

Species	mean # fruits/ min + SE*	n†	primary habitat**
Green-headed Oriole <i>Oriolus chlorocephalus</i>	4 ‡	1	forest interior
Black-bellied Starling <i>Lamprotornis corruscus</i>	2.83 + 0.29	4	forest edge, secondary growth
Stripe-cheeked Greenbul <i>Andropadus milanjensis</i>	2.68 + 0.78 ‡	6	forest interior
Shelley's Greenbul <i>A. masukuensis</i>	2.44 + 0.80	3	forest interior
Yellow White-eye <i>Zosterops senegalensis</i>	1.73 + 0.35 ‡	11	forest interior, secondary growth
Common Bulbul <i>Pyconotus barbatus</i>	1.5 ‡	1	secondary growth, farmland
Little Greenbul <i>A. virens</i>	1.39 + 0.53	3	forest edge, secondary growth
Green Barbet <i>Stactolaema olivacea</i>	1.25 + 0.25 ‡	2	forest interior
Moustached Green Tinkerbird <i>Pogoniulus leucomystax</i>	1.17 + 0.38 ‡	6	forest interior, secondary growth
Banded-green Sunbird <i>Anthreptes rubritorques</i>	0.88 + 0.12 ‡	21	forest edge and interior, farmland
White-eared Barbet <i>Stactolaema leucotis</i>	§		secondary growth, forest edge, farmland
Waller's starling <i>Onychognathus walleri</i>	‡		forest interior, secondary growth
Kenrick's starling <i>Poeoptera kenricki</i>	‡		forest interior, secondary growth

* Rate of fruit intake is the mean number of fruits consumed per minute, pooling data from both tree watches

** Primary habitat is based on observations carried out throughout the study area (NJC, unpublished data)

† n = number of individuals of each bird species for which fruit intake rates were calculated

§ This barbet was not observed consuming fruits during these watches, but was observed doing so on other casual observations at these trees

‡ Species observed feeding on fruits at a different tree at the forest edge on 25 July 2001

Banded-green Sunbirds *Anthreptes rubritorques* consumed the fewest fruits on average, but were far more numerous and regular visitors compared to most of the other species (pers. obs.). In four separate 10-minute bouts of observation at one tree, 16 Banded-green Sunbirds, six Shelley's Greenbuls, six Moustached Green Tinkerbirds *Pogoniulus leucomystax* and 10 Yellow White-eyes were observed, whereas, other species occurred as pairs or singletons. However, it is also likely that the sunbirds were overestimated because individuals remained on the tree for very short periods (< 3-5 minutes), and thus some of the same individuals may have made repeated visits.

Our observations indicate that the fruits of *C. gomphophylla* are consumed by a mix of bird species inhabiting primary and secondary forest, edge

growth and adjacent farmland habitats (Table 1). In 616 hr of observations at 44 trees of the closely related *C. Durandii*, Kirika and his colleagues (2008) recorded 19, 25, and 21 bird species feeding on its fruits in three forests in Uganda and Kenya. We did not record two species (Waller's *Onychognathus walleri* and Kenrick's *Poeoptera kenricki* starlings) during the 387 minutes of focused observations at two trees, but encountered them feeding at the other tree observed opportunistically in 2001 (Table 1). It is therefore likely that other species of fruit-eating birds in the East Usambara Mountains consume fruits of *C. gomphophylla*, but were not recorded during this study because of the comparatively limited time frame of our observations. Also, data for this study were gathered in the mid- to late-afternoon when fruit-eating activity is generally lower than in the morning (e.g., Dowsett-Lemaire 1996). Indeed, seven species found in the East Usambaras (Olive Pigeon *Columba arquatrix*, Tambourine Dove *Turtur tympanistria*, Usambara Thrush *Turdus [olivaceus] roehli*, Cabanis's Greenbul *Phyllastrephus cabanisi*, Violet-backed Starling *Cinnyricinclus leucogaster*, Dark-backed Weaver *Ploceus bicolor*) are known to eat *Celtis* fruits of similar size elsewhere in Africa (Rowan 1983, Urban *et al.* 1986, Dowsett-Lemaire 1988, Urban *et al.* 1997, Kirika *et al.* 2008), but were not observed eating the fruits of *C. gomphophylla* during this study.

Our observations of loose flocks of Banded-green Sunbird regularly visiting and consuming *Celtis* fruits (Figure 1) are of particular interest. This behaviour has been only infrequently reported for other sunbird species in Africa (Dowsett-Lemaire 1996, Fry *et al.* 2000). However, fruit-eating by Banded-green Sunbird may not be uncommon: this species has also been observed consuming similar sized fruits of *Zanthoxylum gillettii*, *Macaranga* and *Rubus* species: (Fry *et al.* 2000, pers. obs.). Furthermore, Dowsett-Lemaire's (1996) observations of 10 sunbird species eating fruits of at least three tree species in the Congo basin suggest that some members of this family may have important seed dispersal roles for tree species with relatively small fruits.



Figure 1. Banded-green Sunbirds *Anthreptes rubritorques* (left: male; right: female) feeding on fruits of *Celtis gomphophylla* (Ulmaceae) in Tanzania. Photo: N.J. Cordeiro

Our observations were that all species swallowed fruits whole and spent relatively short periods feeding in the trees (< 1 to 10 minutes). Therefore, all bird species observed during this study are potential seed dispersers of *C. gomphophylla*. More extensive research will be needed to quantify seed removal rates and determine the relative contributions that these fruit-eating sunbirds, as well as the other species, make toward seed dispersal and forest regeneration in the study area.

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