

FORAGING ECOLOGY OF THREE SYMPATRIC TURACOS IN A MONTANE FOREST IN RWANDA

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ABSTRACT.—We studied the foraging ecology of three sympatric turacos (Great Blue Turaco [*Corythaeola cristata*], Ruwenzori Turaco [*Musophaga johnstoni*], and Black-billed Turaco [*Tauraco schuettii*]) in a tropical montane forest in Rwanda between November 1991 and December 1992. All three species fed primarily on fruit. Whereas Black-billed Turacos were strictly frugivorous, Great Blue and Ruwenzori turacos were partially folivorous; leaves constituted 25% and 6.3% of their overall diets, respectively. The overall dietary diversity was highest for Great Blue Turacos and lowest for Black-billed Turacos. Most fruits eaten by turacos came from trees. Although most leaves eaten by Great Blue Turacos also came from trees, leaves eaten by Ruwenzori Turacos mainly came from lianas and epiphytes. For the Ruwenzori and Black-billed turacos, the two territorial species, monthly dietary diversity increased with increasing fruit abundance in the environment, but this relationship did not hold for Great Blue Turacos. During periods of fruit scarcity, all three species depended more heavily on their most frequently used foods; this trend was particularly evident in the two territorial species. Like most frugivores, these turacos probably were generalists that exploited a great variety of fruit sources. Received 24 June 1996, accepted 24 January 1997.

TURACOS (FAMILY MUSOPHAGIDAE) are large birds endemic to woodland and forested habitats of sub-Saharan Africa and are considered to be principally frugivorous (Brosset and Fry 1988). Given their large body size and potentially frugivorous habits, forest turacos may be important seed dispersers in African tropical forests. However, the ecology of most turacos is poorly known (Dowsett-Lemaire 1983, 1990; Candy 1984; Brosset and Erard 1986; Brosset and Fry 1988). Here, we examine the foraging ecology of three sympatric turacos in a tropical montane forest in Rwanda.

Three species of turacos occur in the Nyungwe Forest Reserve, Rwanda. The Great Blue Turaco (*Corythaeola cristata*) exists throughout the entire elevational range of the forest (1,760 to 2,950 m; Dowsett-Lemaire 1990). The Ruwenzori Turaco (*Musophaga johnstoni*) is common between 2,000 and 2,920 m and may descend to 1,800 m in some wetter areas (J.-P. Vande Weghe pers. comm., C. Sun pers. obs.). The Black-billed Turaco (*Tauraco schuettii*) is found up to 2,500 m but is more abundant at lower elevations and reaches the lowest limit of the forest (Dowsett-Lemaire 1990, C. Sun pers. obs.). In this paper we compare the foraging

ecology of these turacos between 2,000 and 2,500 m, where they coexist. Specifically, we address the following: (1) What is the diet composition for each species of turaco? (2) What is the dietary response of each species to temporal changes in resource abundance in the environment?

METHODS

Study site and birds.—The Nyungwe Natural Forest Reserve is a 950-km² montane forest located in southwestern Rwanda, Africa (ca. 2°35'S, 29°15'E). The general topography of the forest is highly dissected, with steep slopes and few level areas. The study site encompasses an area of approximately 3.5 km² and ranges from 1,950 to 2,500 m in elevation. Extensive trail systems within the study site provide access to the home ranges of all focal birds studied.

The Great Blue Turaco weighs approximately 1,000 g and is the largest species in the family. The Great Blue Turaco lives in social groups of 6 to 20 individuals (Brosset and Fry 1988, C. Sun pers. obs.). Fifteen birds formed the focal group that we studied. Ruwenzori and Black-billed turacos each weigh about 250 g. Individuals of both species live in pairs that defend year-round territories (Brosset and Fry 1988, C. Sun unpubl. data).

Between November 1991 and December 1992, C.S. followed focal groups of turacos monthly and recorded their activities, movements, and diets. Each species was followed for two to five days each month, during which data were collected for 25 to 40 h. On

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serving several birds simultaneously necessitated that we record data quickly and consistently, and we could not predict at the outset whether a feeding would be an extended feeding bout or a short incident. Our procedure represented the best compromise between neglecting and overestimating the importance of food types eaten at these incidents.

Because the daily overall number of food types eaten by a group or pair of turacos usually was small, and the food types eaten at feeding incidents usually were not different from those eaten during continuous feeding, our sampling scheme was unlikely to have missed recording the rare food types.

Estimating fruit abundance.—To document temporal changes in community-wide fruit abundance, we conducted monthly surveys on the phenology of 568 reproductively mature trees of 49 species. As part of a study of seed dispersal by frugivores, we focused on tree species that produced fleshy fruits. Although we did not sample all tree species at the study site, our sample included most of the common species (see Sun et al. 1996). During phenology surveys, the percentage of the crown covered with fruits in each tree was estimated and assigned a score between 0 and 4 (0 = 0%, 1 = 1–25%, 2 = 26–50%, 3 = 51–75%, 4 = 76–100%).

To determine the relative abundance and size distributions of tree species, we classified and mapped different habitats in the study site and then placed five to seven 0.1-ha sampling plots within each habitat type. The locations of plots were selected by stratified random sampling. All trees in each plot with dbh ≥ 10 cm were identified to species and their dbh measured. All habitats were mapped on topographic maps and digitized to calculate their relative areas. The density of each tree species in the study site was derived from the sum of the tree density in each habitat multiplied by the proportion of each habitat in the study site.

Evidence suggests that the reproductive capacity of a tree is approximately proportional to its dbh. McDiarmid et al. (1977) found a linear positive relationship between fruit number and dbh in one Neotropical species, and Peters et al. (1988) found that fruit-crop size was proportional to dbh to the 1.2 power in 22 species from the West Indies. To account for the different abundance and size distributions of adult trees among species, we multiplied the mean fruiting scores from each species by the product of the average dbh and the density of adult trees for that species before integrating fruit abundance of different species. The fruit abundance index (F_m) in month m was calculated as:

$$F_m = \sum_i S_{mi} \times DBH_i \times D_i, \quad (1)$$

where S_{mi} is the mean fruiting score of species i in month m , DBH_i is the average dbh (cm) of reproductively mature trees for species i , and D_i is the density

(number per ha) of reproductively mature trees of species i . For community-wide fruit abundance indices, i includes all species of trees sampled in the phenology survey. Because animals use only a subset of resources in their environment, community-wide fruit abundance indices may be a poor measure of the quantity of resources actually available to a particular species. Therefore, we calculated fruit abundance indices specific to each turaco species, including only plant species actually consumed by the birds. Unless indicated otherwise, all fruit abundance indices applied in the following analyses are the indices specific for each turaco species.

Data analyses.—We used the Simpson index (D), the reciprocal of Simpson's original formula (Simpson 1949), to describe dietary diversity of each turaco species:

$$D = \frac{1}{\sum_i p_i^2}, \quad (2)$$

where p_i is the proportion of food type i in the total of food types consumed during the period of interest. The Simpson index (and its derivatives) is sensitive to changes in the common food types, whereas the more widely used Shannon index is more sensitive to changes in rare food types (Peet 1974). Due to the limited monthly sampling effort on each focal group of birds, the variation among months in observed use of the rarely used food types was more susceptible to sampling errors than was that of the commonly used food types. We chose the Simpson index to minimize the influence on diet diversity indices of the rarely used food types and to emphasize changes in the commonly used food types.

Variation in monthly dietary diversity could simply be due to differences in sampling effort or in the quantity of data recorded between months (Fleming 1986). To examine this possible confounding effect, we examined the correlation between monthly total food scores and monthly dietary diversity for each species; none of the correlations was significant.

We used the simplified Morisita index (C_H ; Horn 1966) to assess dietary overlap between species or between months within species:

$$C_H = \frac{2 \sum_i p_{ij} p_{ik}}{\sum_i p_{ij}^2 + \sum_i p_{ik}^2}, \quad (3)$$

where p_{ij} and p_{ik} represent the proportion of food type i in the diet of bird species (or month) j and k , respectively. Morisita's overlap index has nearly zero bias at all sample sizes (Smith and Zaret 1982). However, we recorded resource use as scores for each food type, not as the number of individuals as required by Morisita's index. In this situation, the simplified Morisita's index, which uses the percentage values and is almost identical to the original Morisita

TABLE 1. Overall diet composition (%) and the number of plant species eaten by three species of turacos.

Fruits	Flowers	Leaves	Galls ^a	Total species
Great Blue Turaco (11,290)^b				
73.3 (16) ^c	0.9 (4)	25.0 (18)	0.9 (1)	28
Ruwenzori Turaco (2,842)				
91.9 (19)	1.7 (1)	6.3 (10)	0.2 (1)	25
Black-billed Turaco (1,554)				
100 (12)	—	—	—	12

^a Turacos were seen eating galls from *Syzygium parvifolium* trees.

^b Numbers in parentheses denote the total number food scores on which results were based.

^c Numbers in parentheses denote the number of plant species included in each food category.

index (Krebs 1989:384), is the appropriate measure of overlap.

RESULTS

Turaco diets.—Fruit was the major component in the diet of all three turaco species (Table 1, Appendix). The Black-billed Turaco was strictly frugivorous. The other two species also ate leaves, with the Great Blue Turaco being the most folivorous (Table 1). The temporal patterns of leaf use by Ruwenzori and Great Blue turacos differed (Fig. 2). Leaves constituted more than 25% of the diet of Ruwenzori Turacos in November and December 1991, but became unimportant thereafter. In contrast, leaves always constituted at least 9% of the monthly diet of Great Blue Turacos. Moreover, the monthly percentage of leaves in the diet of Great Blue Turacos was negatively correlated with fruit abundance ($r_s = -0.464, P < 0.05, n = 14$), indicating that Great Blue Turacos increased their use of leaves as fruits became scarce.

Overall, the majority of fruit eaten by turacos came from trees, with an additional 5 to 12% from strangler figs (*Ficus oreodryadum*). However, a relatively high percentage of fruits eaten by the Ruwenzori Turaco came from lianas (Fig. 3A). Of the leaves eaten by the Great Blue Turaco, roughly half (51.2%) came from trees and the rest from lianas and epiphytes (Fig. 3B). In contrast, only a small proportion (2.3%) of the leaves eaten by the Ruwenzori Turaco came from trees, and the majority (92.9%) came from lianas and epiphytes. In summary, non-

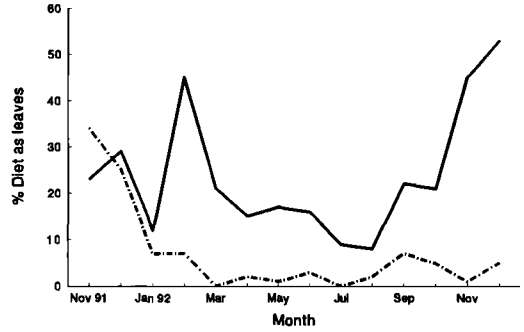


FIG. 2. Percentages of leaves in monthly diet of Great Blue (solid line) and Ruwenzori (dashed line) turacos.

tree plants were particularly important food sources for Ruwenzori Turacos at certain times of the year; in November-December 1991, leaves (mainly of lianas and epiphytes) constituted about 25% of their diet, whereas between May and July 1992 liana fruits accounted for nearly half of their diet (Figs. 2 and 4).

Fruit abundance and dietary diversity.—Fruit abundance fluctuated widely through time,

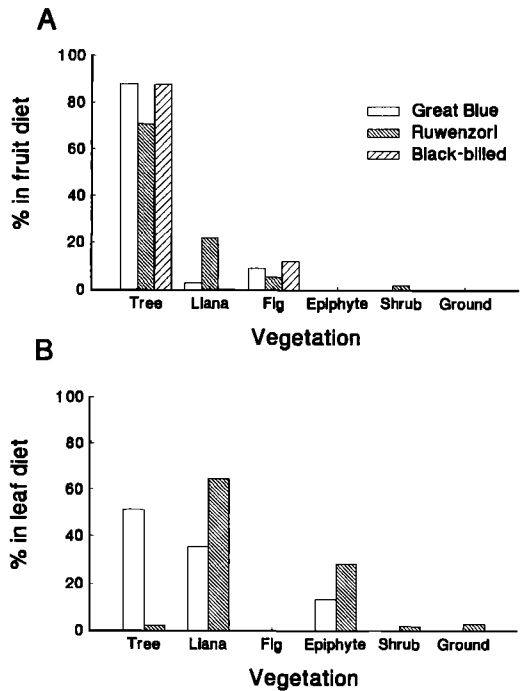


FIG. 3. Fruit and leaf sources in diets of turacos. (A) shows the fruit and (B) shows the leaf sources from plants of different growth forms.

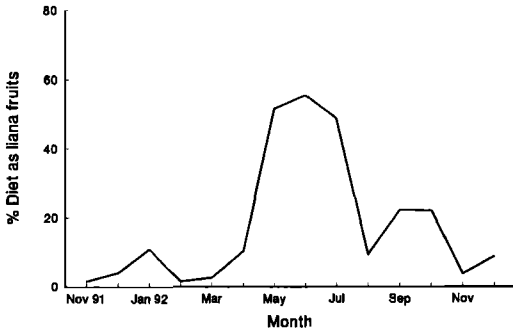


FIG. 4. Monthly percentages of liana fruits in the diet of Ruwenzori Turacos.

with a peak between May and July 1992 (Fig. 5). The community-wide fruit abundance indices were positively correlated with fruit abundance indices for Great Blue and Black-billed turacos (Great Blue: $r_s = 0.697$, $P < 0.01$; Black-billed: $r_s = 0.604$, $P < 0.05$, $n = 14$), but not for Ruwenzori Turacos ($r_s = 0.015$, $P > 0.05$, $n = 14$). Of all species sampled in the phenology study, 13 species of fruits were consumed by at least one species of turaco. For these 13 fruit species, the monthly fruit abundance was positively correlated with monthly fruit diversity (described by Simpson's index; $r_s = 0.477$, $P < 0.05$, $n = 14$), suggesting that both quantity and diversity of fruits increased during the period of fruit abundance.

Dietary diversity overall was highest for the Great Blue Turaco and lowest for the Black-billed Turaco (Table 2). Monthly dietary diversity for Black-billed Turacos was significantly lower than those for the other species, but no difference was found between Great Blue and Ruwenzori turacos (Table 2). The monthly dietary diversity indices were positively corre-

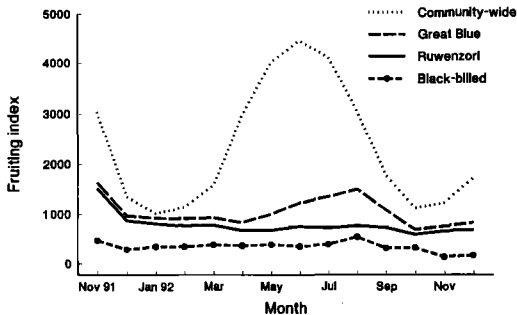


FIG. 5. Seasonal patterns of community-wide and turaco species-specific fruit abundance indices.

TABLE 2. Dietary diversity (overall and monthly mean), correlation between monthly dietary diversity and fruit abundance (r_s), and between-month dietary overlap for three species of turacos. Values in columns 2 and 4 are $\bar{x} \pm SD$.

Overall diversity	Monthly mean diversity ^a	r_s	Between-month dietary overlap ^b
Great Blue Turaco			
8.82	3.02 \pm 1.22	-0.257	0.67 \pm 0.33
Ruwenzori Turaco			
5.81	3.41 \pm 0.72	0.587*	0.71 \pm 0.28
Black-billed Turaco			
2.10	1.97 \pm 1.00 ^c	0.550*	0.83 \pm 0.22

* $P < 0.05$.

^a $n = 14$ months for each species.

^b Between-month dietary overlap did not differ among species (Mann-Whitney U -tests, all $P_s > 0.05$).

^c Monthly dietary diversity of Black-billed Turaco significantly different from that of the other two species (Kruskal-Wallis test, $P < 0.003$).

lated with fruit abundance for Ruwenzori and Black-billed turacos, but no such relationship was found for Great Blue Turacos (Table 2). When monthly food types were ranked by their importance (percentages) in the diet, the combined percentages of the two highest-ranked food types in the diets increased with decreasing fruit abundance for all turaco species. This negative correlation was significant for Ruwenzori and Black-billed turacos, but not for Great Blue Turacos (Table 3). These results suggested two trends: (1) as fruits became abundant, turacos tended to diversify the food types they used; and (2) as fruits became scarce, turacos became increasingly dependent on the most frequently used food types. Both trends were

TABLE 3. Mean monthly percentage of the two highest-ranked food types in the diet of three species of turacos, and the correlation (r_s) between the summed percentage of the two highest-ranked food types and fruit abundance in the environment ($n = 14$ months for each species of turaco).

Species	% of highest-ranked food types in diet	r_s
Great Blue Turaco	74.0%	-0.380
Ruwenzori Turaco	70.7%	-0.528*
Black-billed Turaco	71.6% ^a	-0.603*

* $P < 0.05$.

^a Value represents the first-ranked food item only for Black-billed Turaco.

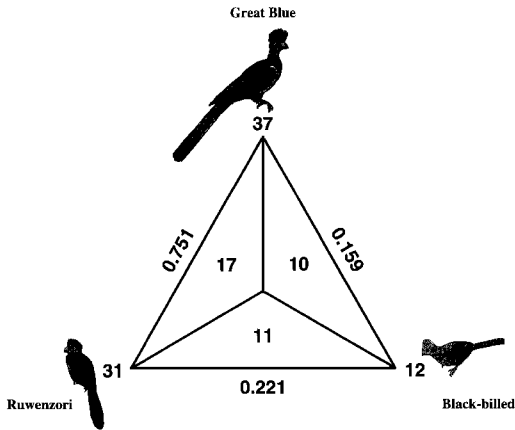


FIG. 6. Dietary overlap among turacos. Numbers within triangles indicate the number of food types shared by each species-pair; the 10 food types shared by Great Blue and Black-billed turacos also were shared by all three species of turaco. The number next to each bird diagram indicates the total number of food types used by that species. Numbers parallel to the side of the triangle indicate dietary overlap between species-pairs. Bird diagrams are based on plates by Martin Woodcock in Fry et al. (1988).

evident in Ruwenzori and Black-billed turacos, the two territorial species.

Intra- and interspecific dietary overlap.—The indices of between-month dietary overlap did not differ among species (Table 2). The between-month dietary overlap was not correlated with fruit abundance for any of the turaco species. Among all species, the Black-billed Turaco shared the highest percentage of its overall food types with other species. However, when the percentage of each food type in the diet was considered, Great Blue and Ruwenzori turacos had the highest dietary overlap among all species-pair combinations (Fig. 6).

DISCUSSION

Frugivory and folivory.—Although fruit was the major component in the diet of each turaco species, Great Blue and Ruwenzori turacos also ate leaves. Because leaves contain lower concentrations of lipids and soluble carbohydrates than fruits and often are loaded with secondary compounds, they are probably poor food sources for frugivores (Milton 1981, Cork and Foley 1991). The Great Blue Turaco, being the largest of the three species, was the most folivorous. Our result is consistent with findings

in mammalian herbivores that the quality of foods consumed often decreases with increasing body size (Geist 1974, Demment and Van Soest 1985, Gordon and Illius 1996).

Leaves appeared consistently in the diet of Great Blue Turacos (>9% in all monthly diets), regardless of fruit abundance. In addition, the negative correlation between fruit abundance and leaf consumption by Great Blue Turacos indicates that leaves were eaten more often when fruits were scarce. Leaves may be essential as well as partial substitutes for fruits in this turaco. The Ruwenzori Turaco consumed more leaves in November-December 1991, and again in December 1993 (Fig. 2; H. Krauter pers. comm.), when *Syzygium parvifolium* fruits also were important in the diet (C. Sun unpubl. data, H. Krauter pers. comm.). Thus, when certain kinds of fruits are predominant in the diet, Ruwenzori Turacos may eat leaves to balance their nutritional intake.

Dietary diversity among species.—Although the territorial Black-billed and Ruwenzori turacos are similar in body size and home range size (Brosset and Fry 1988, C. Sun unpubl. data), dietary diversity of Black-billed Turacos was much lower than that of Ruwenzori Turacos (Table 2). This could have resulted from the smaller mean monthly sample size for the former (1.6 pairs) versus the latter (2.2 pairs). However, Black-billed Turacos foraged less often than Ruwenzori Turacos (8.5 vs. 14.6 % of daily activity budget; C. Sun unpubl. data). Thus, the difference in dietary diversity between the two species probably reflected a true difference in their biology.

The high overall dietary diversity of Great Blue Turacos likely was due to the presence of leaves in its diet. Although the focal group of Great Blue Turacos that we studied had a home range 50 times the size of an average territory for the other two species (C. Sun unpubl. data), these birds did not feed on a greater diversity of fruits (Table 1). Given that fruits in tropical forests are patchily distributed in space and time, only a limited number (and hence diversity) of fruit patches (e.g. trees of a few species in heavy fruit) may be large enough to accommodate an entire foraging group or flock of frugivores at any given time (Diamond 1975, Chapman 1990, Fleming 1992). Although a large home range might ensure the availability of some food resources at all times, it does not

necessarily guarantee more diverse food resources at any given time.

Fruit abundance and dietary diversity.—Fruit abundance and monthly dietary diversity were positively correlated for Ruwenzori and Black-billed turacos (Table 2). Turacos probably are similar to most frugivores, being generalists and capable of exploiting a great variety of fruit sources (Herrera 1984, Moermond and Denslow 1985, Wheelwright 1985, Fleming 1986). Because Ruwenzori and Black-billed turacos were territorial year-round and foraged almost exclusively within their territories (C. Sun unpubl. data), the diversity of foods they ate may well have been limited by the availability of fruits in their territories. When fruits are abundant, turacos may exploit the whole range of fruit resources available in their territories, increasing their dietary diversity. In contrast, during periods of fruit scarcity, turacos may have to live on the few reliable food sources that are available year-round (i.e. top-ranked food types), as supported by the significant negative correlation between overall fruit abundance and the proportion of top-ranked food types in the diets of Ruwenzori and Black-billed turacos (Table 3).

Interspecific aggression.—Although trees were the major sources of fruits for all three turacos, a significant proportion of fruits eaten by Ruwenzori Turacos from May to July came from lianas (Fig. 4). The territories of Ruwenzori Turacos usually had complex vegetation structure and often abounded with epiphytes and lianas. In contrast, the vegetation within Black-billed Turaco territories was relatively simple structurally and frequently lacked lianas (C. Sun unpubl. data). Areas with abundant lianas might provide a higher diversity of fruits and thus be favored by both of the territorial species. However, the Ruwenzori Turaco was the dominant species during interspecific interactions (C. Sun unpubl. data). Thus, Black-billed Turacos might not be able to settle in their preferred habitats in the presence of Ruwenzori Turacos.

Focal pairs of Ruwenzori Turacos often chased and fought with Great Blue Turacos that trespassed within their territories. Similarly, members of the focal group of Great Blue Turacos often were chased by Ruwenzori Turacos when they foraged in fruiting trees or traveled through the forest (C. Sun pers. obs.). Interspecific aggression usually underlies resource

competition (MacArthur 1972). However, our results were derived from small sample sizes and thus are not appropriate for examining interspecific competition. A long-term study that incorporates larger sample sizes and extends into elevations beyond which all three species coexist will provide opportunities to further examine species interactions and mechanisms underlying the different elevational distributions of these three turacos.

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APPENDIX. The relative importance of each food type (% in diet) for three species of turacos. Food types are listed in descending order based on their relative importance in the diet of Great Blue Turacos.

Species	Food part ^a	Great Blue Turaco	Ruwenzori Turaco	Black-billed Turaco	Growth form
<i>Balthasarea schliebenii</i>	FR	19.14	35.10	1.03	Tree
<i>Syzygium parvifolium</i>	FR	19.07	12.88	5.47	Tree
<i>Ilex mitis</i>	FR	12.90	3.10	4.05	Tree
<i>Olinia rochetiana</i>	FR	8.92	2.50	1.54	Tree
<i>Maytenus acuminata</i>	LV	7.81	<0.1	— ^b	Tree
<i>Ficus oreodryadum</i>	FR	6.62	4.93	11.90	Fig
<i>Embelia schimperi</i>	LV	3.96	2.92	—	Liana
<i>Phragmanthera rufescens</i>	LV	3.29	—	—	Epiphyte
<i>Ekebergia capensis</i>	FR	2.80	7.64	67.31	Tree
<i>Dalbergia lactea</i>	LV	2.35	—	—	Liana
<i>Psychotria mahonii</i>	LV	2.21	—	—	Tree
<i>Ocotea michelsonii</i>	LV	1.50	—	—	Tree
<i>Salacia erecta</i>	LV	1.29	1.02	—	Liana
<i>Schefflera goetzenii</i>	FR	1.07	8.01	0.39	Liana
<i>Schefflera goetzenii</i>	LV	1.00	<0.1	—	Liana
<i>Canthium</i> spp. A	FR	0.93	—	—	Liana
<i>Syzygium parvifolium</i>	Gall	0.89	0.21	—	Tree
<i>Strombosia scheffleri</i>	FR	0.70	—	I	Tree
<i>Canthium</i> spp. A	FL	0.70	—	—	Liana
<i>Bersama abyssinica</i>	LV	0.60	—	—	Tree
<i>Podocarpus milanjanus</i>	FR	0.43	0.99	<0.1	Tree
<i>Ekebergia capensis</i>	LV	0.40	—	—	Tree
<i>Prunus africana</i>	FR	0.35	<0.1	6.11	Tree
<i>Embelia schimperi</i>	FR	0.25	11.81	—	Liana
<i>Canthium</i> spp. A	LV	0.23	—	—	Liana
<i>Syzygium parvifolium</i>	LV	0.15	—	—	Tree
<i>Parinari excelsa</i>	FL	0.10	—	—	Tree
<i>Olea hochstetteri</i>	FR	<0.1	0.70	0.84	Tree
<i>Rapanea melanophloeios</i>	FR	<0.1	0.70	—	Tree
<i>Alangium chinense</i>	FR	<0.1	—	I	Tree
<i>Beilschmiedia troupinii</i>	FR	<0.1	—	—	Tree
<i>Symphonia globulifera</i>	FL	<0.1	—	—	Tree
<i>Olinia rochetiana</i>	FL	<0.1	—	—	Tree
<i>Olinia rochetiana</i>	LV	<0.1	—	—	Tree
<i>Sericanthe leonardii</i>	LV	<0.1	—	—	Tree
<i>Allophylus</i> spp.	LV	<0.1	—	—	Liana
Aquatic plants	LV	<0.1	—	—	Ground ^c
<i>Galiniera coffeoides</i>	FR	—	1.88	—	Shrub
<i>Carapa grandiflora</i>	FL	—	1.65	I	Tree
Orchids	LV	—	1.16	—	Epiphyte
<i>Sericanthe leonardii</i>	FR	I	0.84	—	Tree
Lichens or mosses	LV	—	0.33	—	Epiphyte
<i>Maesa lanceolata</i>	FR	I	0.28	1.09	Tree
<i>Tapinanthus</i> spp.	LV	—	0.28	—	Epiphyte
<i>Psychotria mahonii</i>	FR	I	0.18	—	Tree
<i>Galiniera coffeoides</i>	LV	—	0.12	—	Shrub
Ferns	LV	—	0.11	—	Ground ^c
<i>Salacia erecta</i>	FR	I	0.11	—	Liana
<i>Casearia russorica</i>	FR	—	<0.1	I	Tree
<i>Allophylus</i> spp.	FR	—	<0.1	—	Liana
<i>Sericostachys scandens</i>	LV	—	<0.1	—	Ground ^c
<i>Tricalysia niammiamensis</i>	FR	—	—	0.13	Tree
<i>Memecylon waliklense</i>	FR	I	I	—	Tree
<i>Ixora burundensis</i>	FR	—	—	I	Shrub
<i>Bridelia brideliifolia</i>	FR	—	—	I	Tree
<i>Harungana montana</i>	FR	—	—	I	Tree
Total no. food types ^d		37	31	12	

^a FR, Fruits; FL, flowers; LV, leaves.

^b —, food type not eaten; I, food type observed eaten during incidental observations but not during systematic sampling.

^c Plants such as forbs, herbs, or creeping lianas that grow near ground level.

^d Not including food types observed eaten only during incidental observations.