

Supplementary Material

This is the supplementary material associated to the following scientific article:

Chaves, Ó.M.; Morales-Cerdas, V.; Calderón, J.; Azofeifa-Rojas, I.; Riba-Hernández, P.; Solano-Rojas, D.; Chaves, C.; Chacón-Madrigo, E.; Melin, A.D. Plant diversity in diet of Costa Rican Primates in contrasting habitats: a meta-analysis. *Diversity* **2023**

Supplemental Data:

Collection Methods Used in Unpublished Studies

Chaves et al. (44) collected data on the diet of three habituated *Alouatta palliata* groups during a 16-month period (Jun 2021-Sept 2022), that included the study period of this meta-analysis (Table 1). In this investigation, ÓMC, VMC, and JC followed the groups 1-2/days per month from dawn to dusk. The behavioral records were collected with the aid of high-definition binoculars (Nikon® Prostaff 5, 10 x 52) via instantaneous scans every 15 min during a 5 min period and, during the inter-scan period, 5-min focal animal samples were collected when some individual was feeding. Riba-Hernández & Stoner [52] and Stoner & Riba-Hernández [55] used the same field methods described in Stoner [56], i.e. 2-min focal animal observations, to study the foraging behavior of three free-ranging groups of *A. palliata*. Finally, in the forest fragment of the Danta Corcovado Lodge, Guadalupe, Península de Osa (N8.62103, W83.47594), Solano-Rojas [74] collected data on the diet of a habituated free-ranging group of *Saimiri o. oerstedii* during a 8-mo period (Dec 2018-July 2019) distributed in 62 sampling days.

The fieldwork in the investigation of Chaves et al. [44] was performed with the approval of the Comité Institucional de Cuidado y Uso de Animales of the Universidad de Costa Rica (Ethic authorization #CICUA-071-2021), the Comisión Institucional de Biodiversidad (authorization #CBio-4-2021), and the Sistema Nacional de Áreas de Conservación, SINAC (permission # ACT-OR-DR-110-2021).

Comparison of alpha-diversity of species in diet using the Shannon-Wiener index

Using a standardized number of study groups per primate species (i.e. 5 study groups), the plant species richness in diet was 217 species for *Ateles geoffroyi* (Shannon index, $H = 2.30$), 183 for *Saimiri*

oerstedii ($H = 2.23$), 145 for *Cebus imitator* ($H = 2.11$), and 66 species in *Alouatta palliata* ($H = 1.80$). Consequently, the Shannon indices differed significantly among primate species (see Table S1).

Table S1. Results of the Shannon-Wiener indexes comparison for the plant dietary diversity for Costa Rican non-human primates using a rarified random number of monkey groups (i.e. 5 groups/primate species).

Comparison ¹	Shannon-Wiener index ²	Hutcheson t-test	d.f.	P-value
<i>Ateles</i> vs <i>Alouatta</i>	2.30 vs 1.80	25.9	169	<0.0001
<i>Ateles</i> vs <i>Cebus</i>	2.30 vs 2.11	10.0	418	<0.0001
<i>Ateles</i> vs <i>Saimiri</i>	2.30 vs 2.23	4.1	472	<0.0001
<i>Saimiri</i> vs <i>Alouatta</i>	2.23 vs 1.80	21.7	181	<0.0001
<i>Saimiri</i> vs <i>Cebus</i>	2.23 vs 2.11	6.1	412	<0.0001
<i>Cebus</i> vs <i>Alouatta</i>	2.11 vs 1.80	14.6	215	<0.0001

¹The species with higher plant diversity in diet is enhanced in bold.

²The Shannon diversity index for each primate species is indicated

Table S2. Animal taxa reported in the diet of Costa Rican primates up to December 2022.

Species/Mspp.	<i>A. palliata</i>	<i>C. imitator</i>	<i>S. oerstedii</i>	Reference
VERTEBRATES				
Mammalia				
Primates				
<i>Cebus imitator</i>		X		Nishikawa et al. [118]
<i>Saimiri oerstedii</i>		X		Chaves [44]
Didelphidae				
<i>Caluromys derbianus</i> (tail)		X		Chaves [44]
Procyonidae				
<i>Nasua narica</i>		X		Fedigan [119]
Rodentia				
<i>Sciurus variegatoides</i>		X		Chaves [44], Fedigan [119]
Chiroptera				
<i>Artibeus watsoni</i>			X	Boinski & Tim [120]
bat Msp1		X	X	Boinski [73], Fedigan [119]

Aves				
bird Msp1		X	X	Boinski [73], Fedigan [119]
various birds		X		Fedigan [119]
bird eggs				Fedigan [119]
Reptilia				
snails		X	X	Boinski [73], Fedigan [119]
lizards		X	X	Boinski [73], Fedigan [119]
<i>Anolis biporcatus</i>		X		Chaves [44]
<i>Ctenosaura similis</i> (tail)		X		Chaves [44]
<i>Iguana iguana</i> (tail)		X		Chaves [44]
Amphibia				
frogs Mspp		X	X	Boinski [73], Melin [121]
INVERTEBRATES				
Arachnida				
spider Msp1		X	X	Boinski [73], Melin [121]
Abranchiata				
Lumbricidae			X	Boinski [73]
Pulmonata				
flatworms			X	Boinski [73]
earthworms			X	Boinski [73]
Insecta				
insect eggs			X	Boinski [73], Melin [121]
Formicidae				
<i>Pseudomyrmex</i> sp.		X		McCabe [68]
<i>Pseudomyrmex flavicornis</i>		X		Freeze [122]
Hemiptera		X	X	Boinski [73], Melin et al. [123]
Homoptera			X	Boinski [73]
Hymenoptera				
ants, Boinski			X	Boinski [73], Melin et al. [123]
wasp, Boinski			X	Boinski [73], Melin et al. [123]
Blattodea				
cockroach Msp1		X	X	Boinski [73], Melin et al. [123]
insect Msp12		X		Boinski [73]
insect Msp13		X		Boinski [73]
Coleoptera				
beetles		X	X	Boinski [73], Melin et al. [123]
Diptera				
flies			X	Boinski [73]
Lepidoptera				

Lepidoptera Msp1		X	X	McCabe [68]
Erebidae				
<i>Coenipeta bibitrix</i> (caterpillar)	X			Azofeifa [34]
Orthoptera				
Orthoptera Msp1		X	X	Boinski [73], Melin et al. [123]
Tettigoniidae				
katydid Msp1		X	X	Boinski [73], Melin et al. [123]
Termitidae				
Termitidae		X	X	Boinski [73], Melin et al. [123]
Vespidae				
<i>Polybia</i> sp			X	Boinski & Tim [120]
Insects no identified				
insects (8 Mspp.)		X		Melin et al. [70]
insects (48 Mspp.)		X		Mosdossy et al. [71]
Total = 13 species + 81 Mspp.	1	71	23	

Table S3. Shared and non-shared plant species in the diet of the four Costa Rican non-human primates in Tropical Dry Forests and Rainy Forests. For this analysis we only considered the studies ≥ 6 months in duration. *Ap* = *Alouatta palliata palliata*, *Ag* = *Ateles geoffroyi*, *Ci* = *Cebus imitator*, *So* = *Saimiri oerstedii*. The data are based in a standardized sample of 4 monkey groups in Tropical Dry Forests and 3 groups in Rainy Forests. **S. oerstedii* do not occurs in Tropical Dry Forest.

Tropical Dry Forests*				Rainy Forests				
Shared plant species in diet				Shared plant species in diet				
	<i>Ap</i>	<i>Ag</i>	<i>Ci</i>		<i>Ap</i>	<i>Ag</i>	<i>Ci</i>	<i>So</i>
<i>Ap</i>	95	41	29	<i>Ap</i>	106	30	15	15
<i>Ag</i>	41	98	44	<i>Ag</i>	30	198	20	21
<i>Ci</i>	29	44	77	<i>Ci</i>	15	20	62	10
				<i>So</i>	15	21	10	107
Non-shared plant species in diet				Non-shared plant species in diet				
	<i>Ap</i>	<i>Ag</i>	<i>Ci</i>		<i>Ap</i>	<i>Ag</i>	<i>Ci</i>	<i>So</i>
<i>Ap</i>	0	57	48	<i>Ap</i>	0	168	47	92
<i>Ag</i>	54	0	33	<i>Ag</i>	76	0	42	86

<i>Ci</i>	66	54	0	<i>Ci</i>	91	178	0	97
				<i>So</i>	91	177	52	0

Table S4. Results of the PERMANOVA assessing the influence seven predictors on the plant species assemblage in diet of Costa Rican primates. Significant effects are enhanced in bold.

Predictor variable	d.f.	Sum of squares	<i>F</i>	R ²	<i>p</i>
Primate species	3	8.2	1.4	0.15	0.002
Habitat type (i.e. TDF and Rainy Forest)	1	3.5	1.8	0.06	0.002
Province	2	5.3	1.4	0.09	0.045
Group size	1	2.6	1.4	0.05	0.052
Study site	10	23.5	1.2	0.42	0.075
Primate species*HLZ	1	2.3	1.2	0.04	0.14
Sampling effort	1	2.2	1.1	0.04	0.24