DIET COMPOSITION OF BIRDS ASSOCIATED TO AN URBAN FOREST PATCH IN NORTHERN VENEZUELA

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SUMMARY

Studies about diet composition are of importance to understand the biology and ecological strategies of birds. The present study aims to quantitatively describe the diet of 33 bird species (4 orders and 16 families) that inhabit a semi-deciduous urban forest patch in Caracas, Venezuela, and its variations between dry and rain seasons. One hundred and thirty seven fecal samples were collected from September 2013 to July 2014 using mist nets. The most abundant families in fecal samples were Tyrannidae (45 samples), Thraupidae (18), Thamnophillidae (12), Turdidae (12) and Galbulidae (10). The 63.5% of fecal samples contained only insects, 14.5% fruit and seeds, 12.4% fruits and insects, and 9.5% seeds and insects. The most abundant food items were insects from the Formicidae family and the Coleoptera order, and fruits from the Clusia *genus. Ants were consumed mainly in the dry season, and Coleoptera,* Clusia*, and Diptera during the wet season.* Atalotriccus pilaris *was the most common captured bird, with high prevalence of insects in its feces and occasional fruit consumption.* Formicivora grisea*,* Thamnophilus doliatus *and* Campyloramphus trochilirostris*, among others, were found to be strictly insectivorous; while* Columbina talpacoti, Leptotila verreauxi *and* Tiaris bicolor *were predominantly granivorous.* Thraupis episcopus, T. glaucocolpa, Coereba flaveola, Cychlaris gujanensis, Euphonia trinitatis *and* Saltator coerulescens *had the highest fruit content in their diet. The study is the first work generating information about the diet of birds living in urban habitats in Venezuela. Further research is necessary to understand the processes of adaptation of birds to urban habitats in the neotropics.*

Introduction

Diet studies are necessary for the understanding of the biological and ecological strategies of birds. In Venezuela, few studies about the diet of birds have been carried out, restricted to dry forests and arid zones (Poulin *et al*., 1994, Quilarque *et al*., 2010, Pérez *et al*., 2001). In the neotropics, however, there are abundant studies, mostly based on stomach contents using emetics (Loiselle and Blake, 1990; Pérez *et al*., 2001; Duraes and Marini, 2005; Gaiotti and Pinho, 2013) and on stomach contents of collected birds (Remsen *et al*., 1993; Rosenberg, 1993; Lópes *et al*., 2005). The use of emetics has the disadvantage that they may cause accidental death of the studied specimens, while fecal analysis is a non-invasive method that does not endanger birds. Several studies have demonstrated the convenience of feces' studies to determine feeding guilds in birds (Rouges and Blake, 2001; Piratelli and Pereira, 2002; Carvallo Lima, 2008; Navas, 2009). The disadvantage of this technique is that certain food items may be misrepresented due to differences in digestibility (Voiter *et al*., 2003). Carlisle and Holberton (2006) found that by increasing the number of fecal samples between five and 17, the results obtained are similar to the number of taxa detected in regurgitated samples.

Studies on urban birds are becoming more relevant due to the growth of urban areas and the concomitant increase in anthropic effects on bird biology. In the neotropics, several studies have focused on urban bird communities (Stiles, 1990; Rivera-Gutiérrez, 2006; Villegas and Garitano-Zavala, 2010; Carbó-Ramírez and Zuria, 2011; Reis *et al*., 2012) and many showed that cities retain a considerable diversity of bird species (Clergeau *et al*., 1998; Marzluff *et al*., 2001). However, few explore how urban habitats can affect the diet of birds. The majority of studies are restricted to a single species, mainly Falconiformes and owls (Yalden, 1980; Tatner, 1983; Gavett and Wakeley, 1986; Roth and Lima, 2003; Delgado and Calderón, 2007; Hernández-Muñoz and Mancina, 2011). Several studies have reported that certain bird species tend to consume anthropogenic food (Ottoni *et al*., 2009) such as bread and food scraps (Rollinson *et al*., 2003).

In Venezuela, there is scarce information about urban birds (Caula *et al*. 2003; 2010; Seijas *et al*., 2011; Sanz and Caula, 2014), and none about their diets. Caracas is a city with over five million people and has a great diversity of birds: about 300 species have been recorded that find refuge in many parks and other green areas of city (Aveledo, 1968; Goodwin 1987; Fundación La Salle, 1997; Caula and Levin, 1999; Levin *et al*., 2000; FJBC-SCAV, 2006; SCAV, 2007; Sainz-Borgo and Levin, 2012; Sainz-Borgo, 2012, 2014, 2015).

The aim of this work was to study the diet composition of a bird community associated with an urban patch of semi-deciduous forest, using quantitative analysis of their fecal contents.

Methods

Study area

The study involved two field visits per month, from September 2013 to July 2014, to a 2ha patch of semi-deciduous, seasonal, premontane

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COMPOSICIÓN DE LA DIETA DE LAS AVES ASOCIADAS A UN PARCHE DE BOSQUE URBANO EN EL NORTE DE VENEZUELA

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RESUMEN

El estudio de la composición de la dieta de las aves permite comprender sus estrategias biológicas y ecológicas. El objetivo del presente estudio consistió en realizar una descripción cuantitativa de la dieta de 33 especies de aves (pertenecientes a 4 órdenes y 16 familias) que habitan en un parche de bosque semideciduo urbano en la ciudad de Caracas, Venezuela; y de su variación entre las estaciones de sequía y lluvia. Fueron colectadas 137 muestras de heces desde septiembre 2013 a julio 2014. Las familias más abundantes fueron Tyrannidae (45 muestras), Thraupidae (18), Thamnophillidae (12), Turdidae (12) and Galbulidae (10). Los ítems alimentarios más abundantes fueron hormigas y escarabajos, y frutas del genero Clusia. *Las hormigas fueron consumidas principalmente durante la estación seca, y Coleoptera,* Clusia *y Diptera mayoritariamente durante la estación lluviosa.* Atalotriccus pilaris *fue el ave con mayor cantidad de capturas, encontrándose que consumía mayoritariamente insectos y ocasionalmente frutas. Las especies insectívoras estrictas fueron* Formicivora grisea, Thamnophilus doliatus *y* Campylorhamphus trochilirostris, *entre otras; mientras que* Thraupis episcopus, T. glaucocolpa, Coereba flaveola, Cychlaris gujanensis, Euphonia trinitatis *y* Saltator coerulescens *tuvieron los contenidos más altos de frutas en su dieta. El presente estudio es el primer trabajo en generar información sobre la dieta de aves que viven en ambientes urbanos en Venezuela. Una mayor cantidad de estudios sobre esta línea de investigación son necesarios para entender los procesos de adaptación de las aves en ambientes urbanos del neotropico.*

COMPOSIÇÃO DA DIETA DAS AVES ASSOCIADA A UMA TRECHO DE FLORESTA URBANA NO NORTE DA VENEZUELA

Cristina Sainz-Borgo

RESUMO

Estudos da dieta são de importância para a compreensão da biologia e ecologia de aves. Este estudo é uma descrição quantitativa da dieta de 33 espécies de pássaros (pertencentes a quatro ordens e 16 famílias) que vivem em um trecho de floresta semi-decídua urbana na cidade de Caracas, Venezuela e sua variação ao longo do ano. Foram coletadas 137 amostras fecais de setembro 2013 a julho de 2014. As famílias mais abundantes foram Tyrannidae (45 amostras), Thraupidae (18), Thamnophillidae (12), Turdidae (12) and Galbulidae (10). Os itens alimentares mais abundantes foram formigas e besouros, e frutas do gênero Clusia. *As formigas foram consumidos principalmente durante a estação seca, e Coleoptera, Diptera e Clusia na maior parte durante a estação chuvosa. As espécies com o maior número de sacas era* Atalotriccus pilaris, *sendo consumido principalmente insetos e ocasionalmente frutas. Espécies insectívoras rigorosos foram* Formicivora grisea, Thamnophilus doliatus *e* Campylorhamphus trochilirostris. Thraupis episcopus, T. glaucocolpa, C. flaveola, Cychlaris gujanensis, Euphonia trinitatis *e* Saltator coerulescens *teve o mais alto conteúdo frutas em sua dieta. O presente estudo é o primeiro trabalho na geração de informações sobre a dieta de aves que vivem em habitats urbanos na Venezuela. Mais deste tipo de pesquisa são necessários para entender os processos de adaptação das aves nos habitats urbanos na região neotropical.*

forest located at the Experimental Station Arboretum (Instituto de Biología Experimental, Universidad Central de Venezuela, Caracas, Venezuela, 1100m, 10°30'36"N - 66°53' 92"W), located within a residential zone. The study covered the end of 2013 wet season (September-October), the following dry season (December 2013-April 2014) and the beginning of the 2014 wet season (May-July), with precipitation ranging from 500 to 1000mm per year and an temperature between 19 and 27°C. The vegetation is secondary, consisting of two layers: an upper stratum where trees 8-18m high predominate, while the bottom contains grasses and shrubs, mixed with abundant trees. Tree species are predominantly deciduous, while in the shrub layer there are abundant vines, thorny shrubs and evergreen species (Hokche and Ramírez, 2006). More than 300 plant species of 77 families have been reported, the most abundant families being Asteraceae, Fabaceae, Poaceae, Euphorbiacea, Mimosaceae, Malvaceae and Rubiacea (López and Ramírez, 2004), and xerophilous species of the Cactaceae and Agavaceae families (Ewell *et al*., 1976). The study area is surrounded by residential buildings and vehicular transit took place during collection.

Data collection

Eight mist nets (12×2.8, 36mm mesh) were used along the main path of the study area, placed twice a month from September 2013 to July 2014. The mist nets were opened from 6:30 to 15:30 and checked every 15min. All captured birds were classified according to the South America Classification Committee (SACC) (Remsen *et al*., 2016).

For feces collection, individual birds were placed during 20min in a plastic container (20×30cm) with a mesh at the bottom and topped with black fabric to reduce stress. After that period, the bird was released and feces were collected in a 8ml glass tube containing 4ml of 70% ethanol. The items in the diet were identified to order or family using a stereo-microscope (Wild Heerbrugg-MSA), in the Ornithology Laboratory, Universidad Simón Bolívar, Caracas, Venezuela,. The plant samples were identified using the Lau (2010) data base.

The relative occurrence (Ro) of each category was calculated as number of samples in which the category occurred divided by the total number of samples; while the relative abundance (Ra) of each category was calculated as a number of diet items of each category divided by the total numbers of diet items in the sample,

averaged for all samples (Martini and Duraes, 2005).

Permanova analyses were conducted with the program Primer v5 (Clarke and Gorley, 2006) using the fecal samplings data by bird family, in order to determine if seasonality had some effect on diet. The food items were used as variables and seasons and bird species were considered factors. To check for differences in diet between dry and wet seasons a Chi-square (χ^2) test was used.

Results

From a total of 227 captures, 60% provided useful fecal samples, belonging to 33 species, 4 orders and 16 families (Table I). Bird families having the largest numbers of fecal samples were Tyrannidae (45 samples), Thraupidae (18), Thamnophillidae (12), Turdidae (12) and Galbulidae (10). The more abundant species were *Atalotriccus pilaris* (N=28), *Coereba flaveola* (22), *Galbula ruficauda* (16), *Formicivora grisea* (14), *Turdus nudigenis* (14) and *Camptostoma obsoletum* (13). We have identified 32 different food items (Tables I, II, Figure 1). Of the fecal samples, 63.5% contained only insects, 14.5% fruit and seeds, 12.4% fruits and insects, and 9.5% mostly seeds.

Captures in the wet season were 120 (53%) and in dry season 107 (47%). Richness was greater during the rainy season than the dry season (28 *vs* 21 bird species respectively). The number of fecal samples collected in the two seasons differed: in the wet season 87 feces samples were collected, whereas only 45 samples were obtained in dry season. Food items with the highest values of Ro and Ra were Coleoptera, Formicidae, fruit pulp, Diptera, and seed fragments (Table II). Ants were consumed mainly in the dry season, and Coleoptera, *Clusia,* and Diptera during wet season (Figure 2). Four species (*Columbina talpacoti*, *G. ruficauda*, *F. grisea* and *A. pilaris*) consumed a higher diversity of diet items in the wet season than in the dry one, whereas three species (*Ramphocaenus melanurus*, *Thryophilus rufalbus* and *Saltator coerulescens*) consumed more items in the dry season (Figure 3, Table I).

The Permanova analysis indicated that there was an interaction between the factors (species × season, P=0.013) in Tyrannidae, showing that there are differences in the diet of species between seasons. In the rest of birds evaluated, no interactions were detected (Permanova, Thraupidae: P=0.052, Formicariidae: P=0.517). Significant differences in birds abundance were found between seasons for frugivorous-insectivorous (N wet season=34, N dry season=14, χ^2 P=0.0035) and for insectivorous (N wet season=21, N dry season=25, χ^2 P=0.028). The frugivorous and granivorous-insectivorous did not show differences in abundance in dry and wet seasons (χ^2 P=0.135 and P=0.739 respectively).

Feeding guilds

In insectivorous birds, the most abundant food items were Coleoptera (found in 85 samples), Formicidae (35) and Diptera (30) (Tables II). The most common bird species was *A. pilaris,* which consumed the major variety of food items consisting of eleven different families of insects, as well as *Clusia* and Loranthaceae seeds (Table I). Strict insectivores were *F. grisea*, *R. melanurus, Thamnophilus doliatus, T. rufalbus*, *Grallaricula ferrugineipectus*, *P. squamulatus*, *Synallaxis albescens*, *Campyloramphus trochilirostris*, *Cranioleuca subcristata*, and *Rhodinocihla rosea*.

Samples from *C. subcristata* contained only insects, except in one sample where seed fragments were found during the wet season. In a similar case, one sample of *P. squamulatus* contained a Loranthacea seed.

In one sample from *F. grisea* two individuals of the family Phoridae (Diptera) were found. Several items were registered only once: Araneae, Curculionidae and Blatodea, consumed by *A. pilaris*; Lampyridae by *T. aedon*; Diplopodae, Homoptera, and stones by *F. grisea*; and an ant nymph by *T. doliatus* (Table I).

T. nudigenis, C. flaveola, *Cychlaris gujanensis*, *Euphonia trinitatis* and *Hylophilus flavipes* consumed mostly fruits, and in lesser proportions insects. *A. pilaris*, *C. obsoletum* and *Pitangus sulphuratus* were considered mainly insectivorous with occasional fruits consumed. Strict frugivorous were *Thraupis episcopus*, *T. glaucocolpa, S. coerulescens* and *E. flavogaster.*

Clusia (Clusiaceae) was the most frequently fruit consumed, but seeds of *Clydemia* (Melastomataceae), *Palicourea* (Rubiaceae), and Lauraceae were also commonly found in fecal samples. Non-identified small flowers were found in samples of *C. flaveola, C. fuscatus* and *T. glaucocolpa*. The samples of *E. trinitatis* contained abundant Loranthaceae seeds, which were also consumed by *E. flavogaster*, *C. obsoletum*, *C. fuscatus*, *H. flavipes,* and *A. pilaris*.

In the feces of *C. talpacoti, Tiaris bicolor* and *Cyanocompsa cyanoides* seed fragments and arthopods in smaller proportions were found. In the samples from *Leptotila verreauxi* only seed fragments were found.

Discussion

The bird community in the study area was dominated by insectivores, similar to what has been observed in other neotropical forests (Terborgh *et al*., 1990; Poulin *et al*., 1994; Duraes and Marini, 2005). During the wet season several species, especially insectivorous, consume a greater variety of food items, a fact that has been reported for different birds assemblages (Leck, 1972; Blake and Loiselle, 1991; van Schaik *et al*., 1993; Poulin *et al*., 1994; Williams and Middleton, 2007). Also, a marked seasonality was found in several food items. For example, ant consumption is greater in the dry season, while Coleoptera, Diptera and *Clusia* seeds are

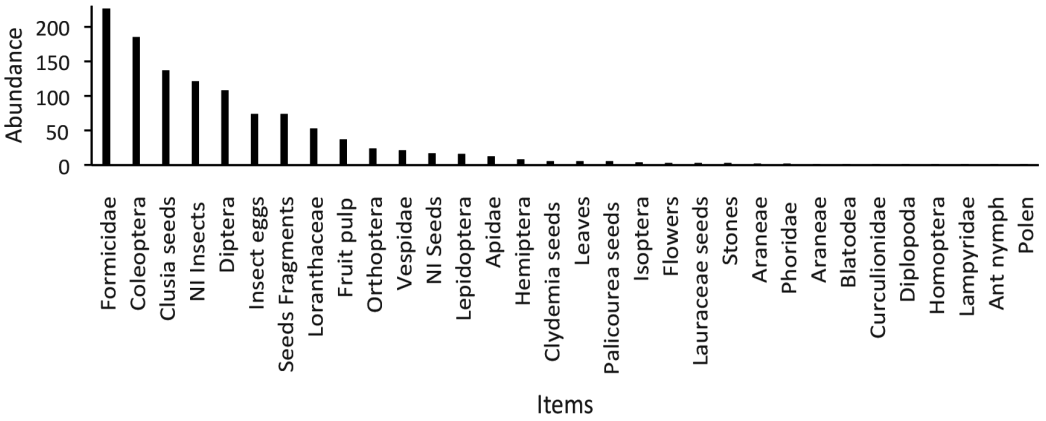

Figure 1. Number of food items contained in the fecal samples from the birds in an urban premontane forest patch in Caracas, Venezuela. (NI: non identified).

TABLE I
BIRDS DIET OF URBAN FOREST PATCH LOCATED AT THE EXPERIMENTAL STATION ARBORETUM, CARACAS, VENEZUELA*

Bird species	Diet items		Nº fecal samples	
	Wet season	Dry season	Wet season	Dry season
Columbidae				
Columbina talpacoti (G)	Nid seed fragments, Leaf fragments, Arthropod fragments	Nid seed fragments	1(4)	1(2)
Leptotila verreauxi (G)	Nid seed fragments		1(1)	0(0)
Trochilidae				
Amazilia tobaci (NI)	Arthropod fragments, Coleoptera		1(5)	0(2)
Picidae				
Picumnus squamulatus (I)	Formicidae, Coleoptera	Formicidae, Loranthaceae seeds	1(1)	2(7)
Galbulidae				
Galbula ruficauda (I)	Coleoptera, Diptera, Insect eggs, Lepidoptera, Orthoptera, Apidae	Coleoptera	9(14)	1(2)
Thamnophilidae				
Thamnophilus doliatus (I)	Orthoptera, Formicidae, ant nymph	Orthoptera, Formicidae, Coleoptera	1(4)	2(2)
Formicivora grisea (I)	Orthoptera, Formicidae, Coleoptera, Hemiptera, Araneae, Diptera	Orthoptera, Coleoptera, Isoptera, Phoridae, Diptera, Insect egg, Hymenoptera, Formicidae	4(11)	5(5)
Grallaridae				
Grallaricula ferrugineipectus (I)	Coleoptera		1(1)	0(0)
Furnariidae				
Cranioleuca subcristata (I)	Coleoptera, Nid seed fragments		2(7)	0(1)
Synallaxis albescens (I)	Coleoptera, Hemiptera		1(1)	0(0)
Campylorhamphus trochilirostris (I)	Formicidae, Coleoptera		3(3)	0(3)
Tyrannidae				
Atalotriccus pilaris (I)	Orthoptera, Lepidoptera, Isoptera, Curculionidae, Araneae, Blatodea, Apidae, insect eggs, Formicidae, *Clusia* seeds, Coleoptera, Diptera,	Coleoptera, Lepidoptera, Hymenoptera, Orthoptera, Formicidae	12(12)	8(16)
Cnemotriccus fuscatus (I)	Coleoptera, Diptera, Hemiptera, Orthoptera, *Clusia* seeds, Loranthaceae seeds, Formicidae, NI seed fragments	Formicidae, Coleoptera, Hymenoptera	7(7)	1(1)
Elaenia flavogaster (F)	Seed fragments, Lorantacea seeds, Palichourea seeds		4(7)	1(7)
Pitangus sulphuratus (FI)		Formicidae, fruit pulp	0(0)	1(1)
Lathrotriccus euleri (I)	Formicidae		1(1)	0(0)
Camptostoma obsoletum (FI)	Coleoptera, Formicidae, Loranthaceae seeds, Diptera, fruit pulp, Nid seed fragments	Formicidae, Coleoptera, insect eggs	9(10)	1(1)
Vireonidae				
Hylophilus flavipes (F)		Loranthaceae seeds, fruit pulp	0(0)	1(1)
Cychlaris gujanensis (F)		*Clusia* seeds, fruit pulp	0(0)	1(1)
Troglodytidae				
Thryophilus rufalbus (I)	Formicidae, Coleoptera	Formicidae, Coleoptera, Diptera	2(3)	1(2)
Troglodytes aedon (I)	Orthoptera, Formicidae, Coleoptera, Lepidoptera, Hemiptera, Apidae, Diptera, Elateroidea	Orthoptera, Formicidae, Coleoptera, Hemiptera, insect eggs, Diptera	2(9)	1(5)
Polioptilidae				
Ramphocaenus melanurus (I)	Orthoptera, Coleoptera, Hymenopter	Orthoptera, Formicidae, Lepidoptera, Apidae, Hymenoptera, insect eggs, Diptera, fruit pulp	1(1)	5(5)
Thraupidae				
Thraupis episcopus (F)		*Clydemia* seed, *Clusia* seeds	0(0)	2(2)

Bird species	Diet items		Nº fecal samples	
	Wet season	Dry season	Wet season	Dry season
Thraupis glaucocolpa (F)	Coleoptera, flowers		1(1)	0(0)
Tiaris bicolor (GI)	Nid seed fragments, Coleoptera	Nid seed fragments	3(5)	3(3)
Coereba flaveola (FI)	Coleoptera, Diptera, Flowers, fruit pulp, *Clusia* seeds, Formicidae, Isoptera, Diptera	Fruit pulp, Coleoptera	5(8)	4(13)
Incertae sedis				
Rhodinocichla rosea (I)	Coleoptera		1(1)	0(0)
Saltator coerulescens (F)	*Clusia* seeds, fruit pulp	Fruit pulp, *Clusia* seeds, Loranthaceae seeds	1(2)	4(5)
Saltator striatipectus (I)	Coleoptera		1(2)	0(4)
Cardinalidae				
Cyanocompsa cyanoides (G)	Coleoptera, Nid seed fragments		2(2)	0(0)
Parulidae				
Parkesia noveboracensis (I)	Formicidae, Coleoptera		1(1)	0(0)
Fringillidae				
Euphonia trinitatis (F)		Loranthaceae seeds	0(0)	1(1)
Turdidae				
Turdus nudigenis (FI)	Formicidae, fruit pulp, Nid seed fragments, *Clusia* seeds	Coleoptera, *Clusia* seeds, fruit pulp, Nid seed fragments, Formicidae, Vespidae	9(9)	3(6)

* Feeding guilds were assigned based on the items found in the feces. G: granivorous, NI: nectarivorous-insectivorous, I: insectivorous, FI: frugivorous-insectivorous. In parenthesis in the columns of fecal samples are the number of total captures (N). Nid: non identified.

TABLE II
NUMBER TOTAL OF FOOD ITEMS, NUMBER OF FECES SAMPLES AND NUMBER OF SPECIES THAT CONSUME EACH ITEM IN A URBAN FOREST PATCH IN CARACAS, VENEZUELA

Food item	Nº total of item	Nº feces samples	Nº bird species	Ro	Ra
Formicidae	226	35	15	0,26	0,2
Coleoptera	185	83	25	0,61	0,16
Clusia seeds	137	16	9	0,12	0,12
NI Insects	121	30	26	0,88	0,03
Diptera	108	30	9	0,22	0,09
Insect eggs	74	13	5	0,09	0,06
Loranthaceae seeds	53	8	7	0,06	0,05
Fruit pulp	37	31	9	0,23	0,03
Orthoptera	24	19	9	0,13	0,02
Lepidoptera	16	10	5	0,07	0,01
Apidae	13	6	4	0,04	0,01
Hymenoptera	11	8	5	0,08	0,01
Hemiptera	8	7	4	0,05	0,01
Vespidae	6	6	3	0,04	0,01
Leaf fragments	6	6	6	0,01	0,01
Clydemia seeds	6	1	1	0,01	0,01
Palicourea seeds	6	2	2	0,01	0
Isoptera	4	4	4	0,01	0
Araneae	3	3	3	0,02	0
Stone	3	1	1	0,02	0
Flowers	3	3	3	0,02	0
Lauraceae	3	1	1	0,01	0
Phoridae (Diptera)	2	1	1	0,01	0
Curculionidae	1	1	1	0,03	0
Blatodea	1	1	1	0,007	0
Ant nymph	1	1	1	0,007	0
Lampyridae	1	1	1	0,007	0
Pollen	1	1	1	0,007	0
Diplopod	1	1	1	0,007	0
Homoptera	1	1	1	0,007	0

NI: non identified, Ro: relative occurrence, and Ra: relative abundance of feeding items found in the feces of birds from the studied forest patch.

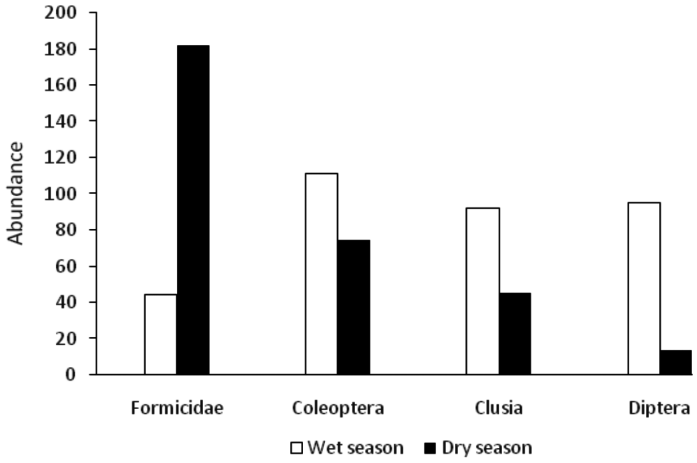

Figure 2. Food item abundance in fecal samples from the birds in the dry and wet seasons in an urban semi-deciduous forest patch in Caracas, Venezuela.

more consumed during the wet season. These results are consistent with previous findings about seasonal changes in arthropod availability on deciduous forests (Wolda, 1978; Wolda and Fisk, 1981), as well as with fluctuations in number of insectivorous birds with changes in food availability (Frith and Frith, 1990). Stouffer and Bierregards (1995) found that in an isolated forest patch the abundance of insectivorous birds tended to decrease. However, the Arboretum Experimental Station is connected to other green areas and parks, constituting an ecological pathway through the city, which allows movements of birds between a continuum of green areas; but probably, the connection between patches is not enough to allow the maintenance of diversity of insectivorous present in pristine areas.

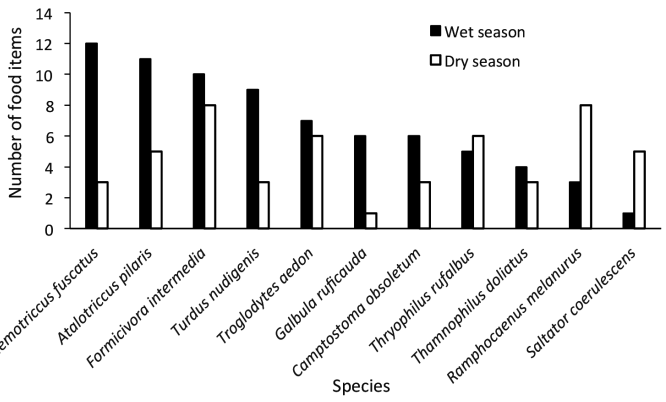

Figure 3. Number of food items consumed by several birds species during the wet and dry seasons at the urban forest patch in Caracas, Venezuela.

Tyrannidae showed the highest diversity in food items. *A. pilaris* contained the highest number of food items in the feces (as previously reported by Poulin *et al.,* 1994), followed by *C. fuscatus* (Gaiotti and Pinho, 2013). For Furnariidae, this study provided the first report of seeds consumption by the specie *C. subcristata*. There are previous reports of other Furnariidae feeding on seeds and fruits (Poulin *et al.*, 1994) but none for this species. The Phoridae consumption by *F. grisea* were probably incidental while it was eating ants, because they are parasitoids of the insects (Porter *et al.,* 1995; Morrison and Gilbert, 1999; Elizalde and Folgarait, 2011). The consumption of insects like Formicidae and Coleoptera in addition to seeds by *C. talpacoti* and *T. bicolor* has been previously reported in other species of these genera (Poulin *et al.*, 1994; Pérez *et al.*, 2001); in the case of ants, they were probably ingested by accident while foraging seeds, or as a protein and fat supplement (Gill, 2006). However, none of these individuals were present in the breeding season, when it has been reported that these species consume proteins.

Frugivorous-insectivorous birds were more abundant in the wet season, as has been reported in other seasonal habitats (Karr, 1976; Blake and Loiselle, 1991). An exception was *P. sulphuratus,* with a single capture in the dry season. Between food items, *Clusia* and Loranthaceae fruit pulp were the most frequently consumed. Frugivorous birds in general tended to consume arthropods, probably as a nutritional supplement (Levey and Martínez Del Rio, 2001).

Leaves were not found in feces of *S. striatipectus* and *S. coerulescens*, in contrast to previous reports (Rodríguez-Ferraro *et al.*, 2007; Chatellenaz, 2008; García-Amado *et al.,* 2011). In this study, *S. coerulescens* consumed only fruit; whereas *S. striatipectus* only consumed Coleoptera. In the literature, occasional consumption of insects has been reported in *S. orenocensis*, but its diet is mostly composed of fruits and leaves (Garcia-Amado *et al.*, 2011). The difference may be related to only one sample obtained of *S. striatipectus*, from which it is difficult to make a generalization of the diet. In the case of *S. coerulescens*, where five samples of feces were obtained, despite it being a mainly folivorous species, the abundance of fruit in the diet probably corresponds to an opportunistic consumption at a time when this resource was abundant.

C. flaveola consumed a wide variety of items, consistent with previous reports (Skutch, 1954; Gross, 1958; Snow and Snow, 1971; Cruz, 1974; Feinsingerp *et al.*, 1985; Poulin *et al.*, 1994). The abundance of Loranthaceae seeds in *E. trinitatis* feces is consistent with numerous reports of *Euphonia* as the principal seed disperser of this family (Restrepo *et al.*, 2002; Ribeiro *et al.*, 2013). Loranthaceae seeds were also found in several Tyrannidae and in *H. flavipes,* as had been previously reported (Guerra and Marini, 2002).

Communities in disturbed habitats tend to be less diverse than in pristine areas, with differences in composition, richness, and abundance, among others. Urban birds are affected by different causes than in a wild habitats (Sanz and Caula, 2014). For example, studies of biodiversity in urban habitats show a gradie nt where biodiversity declines with increased urbanization (Clergeau *et al.*, 2006; McKinney, 2006), where species distribute themselves according to resource-matching (Sutherland, 1983; Morris, 1994). These differences in the availability of resources affect the diet of the species; for example, in the case of the feeding guilds in temperate regions there was an increase in omnivorous abundance in urban areas, but not so in the neotropics (Lim and Sodhi 2004), where there is greater availability of resources throughout the year. In this sense, in order to understand the dynamics of urban birds feeding in the neotropical region, this study is pioneer generating information about the diet of birds living in urban habitats in Venezuela. The birds in our study area probably consume different food items that the same species would have in pristine areas, due to a limited availability of resources. Therefore, this kind of research, as well as long-term studies of bird communities in urban habitats, are necessary in different neotropical localities in order to understand the processes of adaptation of birds to urban habitats.

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