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Consumption of vegetable matter by Furnarioidea

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RESUMO. **Consumo de material vegetal por Furnarioidea.** O presente trabalho avalia o consumo de material vegetal pelos Furnarioidea e testa a hipótese de que esta superfamília é exclusivamente insetívora. Para tal, foram compiladas análises de conteúdo estomacal disponíveis na literatura, bem como as informações contidas na etiqueta de espécimes de museu. Foram contabilizadas 1428 análises de conteúdo estomacal, das quais apenas 45 (3,1%) apresentaram evidências do consumo de material vegetal. Nenhuma família ou subfamília mostrou evidências do consumo regular de frutos e/ou sementes. Uma extensa revisão bibliográfica revelou o consumo de material vegetal por apenas 50 espécies de Furnarioidea, cerca de 8% do total de espécies registrado para a superfamília. Foram registradas 19 espécies de plantas, pertencentes a 14 famílias, na dieta do grupo. Portanto, o baixo consumo de material vegetal apresentado por cada família, o pequeno número de espécies de aves registradas alimentando-se de frutos e sementes, associado à pequena diversidade de espécies vegetais, corrobora a hipótese de que as espécies do grupo são insetívoras.
Palavras-chave: Furnarioidea, dieta, frugivoria, guildas-alimentares, Neotrópico.

Key words: Furnarioidea, diet, frugivory, feeding-guilds, Neotropic.

The Superfamily Furnarioidea (Furnariidae, Dendrocolaptidae, Thamnophilidae, Formicariidae, Conopophagidae and Rhinocryptidae) is generally considered as a wholly insectivorous group (Sick 1997, p. 521), even though many of it's species eat fruits or seeds occasionally. Poulin *et al.* (1994a) found fleshy fruits in 11% of the 28 stomach contents of *Thamnophilus doliatus* (Thamnophilidae) analyzed. For *Conopophaga lineata* (Conopophagidae), Lopes *et al.* (unpubl. data) registered fruits or seeds in 11% of the 44 analyses of stomach contents they compiled.

The frequency with which some species consume fruits may be still more surprisingly. For example, Sick (1997) observed seeds of *Myrsine* sp. (Myrsinaceae) in all seven stomach contents of *Schizoeca moreirae* (Furnariinae) analyzed by him. Pineschi (1990) found seeds on the feces of one individual, and also observed *S. moreirae* feeding 17 times on the fruits of three different species of *Myrsine.*

Despite these observations being relatively common, until now no study has estimated the frequency that vegetable matter is ingested. So, this study proposes to evaluate the frequency of consumption of fruits and seeds by members of the Furnarioidea Superfamily.

METHODS

We compiled the results of many studies on diet of Neotropical birds based on the analysis of stomach contents (Marelli 1919; Aravena 1928; Zotta 1932, 1936, 1940; Moojen *et al.* 1941; Hempel 1949; Olrog 1956; Schubart *et al.* 1965; Nacinovic e Schloemp 1992; Ribeiro 2001; Lopes, Fernandes and Marini, unpubl. data). We also accessed the information contained on the labels of museum specimens deposited on the Field Museum of Natural History, in Chicago (The Field Museum 2003). After that, we registered the number of individuals studied in each group, as well as the number of stomach contents in which we found seeds, fruits or other evidences of consumption of vegetable matter. To avoid overestimating this consumption, we did not register the cases in which the material could have been accidentally ingested during capture of prey, such as the grass fragments registered by Marelli (1919, pg. 224) in a sample of *Coryphistera alaudina* (Furnariidae). Here, we also present a synthesis of many reports of consumption of vegetable matter by Furnarioidea, resulting from the analysis of stomach contents and field observations.

Due to differences between the methodologies employed in each study considered, as well as to the fact that we did not control the number of species and sample size of each group, or even locality and season of collection, we do not perform any statistical analyses of the data.

We did not include in this work studies of the diet of single species to avoid biasing the analysis. The taxonomy of species follows Sibley and Monroe (1990). We also adopted subsequent modifications on the taxonomy of some species as proposed by Isler *et al.* (1997), and Zimmer and Whittaker (2000).

RESULTS AND DISCUSSION

We compiled the analysis of 1,428 stomach contents, of which 45 (3.1%) included some vegetable matter (table 1). The consumption of fruits and seeds by Furnarioidea revealed to be extremely low, being observed in a percentage ranging between 1.5 to 6.6% of the samples (table 1). No family or subfamily presented evidence of frequent consumption of fruits or seeds.

Table 2 presents a synthesis of the vegetable items exploited by 50 species of Furnarioidea, which represents 8.8% of the 565 species catalogued on this Superfamily (Sibley and Monroe 1990). After the analysis of the stomach contents and a review of more than 50 studies of frugivory, only 19 species of plants from 14 families have been registered in the diet of Furnarioidea (table 2). As an example of the small number of plant species which fruits are consumed by Furnarioidea, Snow (1962) reported 105 plant species, from 27 families in the diet of *Manacus manacus*, a highly frugivorous species of Piprinae. Therefore, the low consumption of vegetable matter presented by each family, the small number of bird species registered feeding on fruits and/or seeds, plus the small diversity of plant species ingested, corroborates the observation of Sick (1997) that this group is composed exclusively by insectivorous species.

Some species presented great flexibility in diet, such as *Thamnophilus doliatus* (Thamnophilidae). In a study conducted in Venezuela along an aridity gradient, this species was classified as an insectivorous in the more humid areas and as a frugivorous-insectivorous in the drier areas, where it ingested a large amount of fruit (Poulin *et al.* 1994b). An extreme report of diet flexibility is presented by Hundley and Mason (1965), who witnessed *T. doliatus* ingesting sugar inside a hotel in Tobago, after the passage of a hurricane.

After observing the systematic ingestion of *Myrsine* spp. fruits by *Schizoeca moreirae*, Sick (1997) suggested that these fruits might be a food supply during periods of shortage, such as during the winter. Because fruits, as opposed to seeds or insects, are generally poor in proteins and lipids, and may be high in carbohydrates (Moermond and Denslow 1985), their consumption by insectivorous species may provide an energetic supply during times of resource scarcity.

We tested this hypothesis, using the South American studies with sampling date available, and calculated the percentage of stomachs containing vegetable matter along the different seasons of year (figure 1). The consumption of vegetable matter was highest during the South American autumn and winter, a period between the end of March and the end of September. During this same period, Janson and Emmons (1990) observed the lowest availability of insects in a tropical forest in Peru. Interestingly, during the spring, when Janson and Emmons (1990) registered a high peak in the abundance of insects, we observed a strong decrease in the consumption of vegetable matter. Intermediate values were observed in both studies during the summer. Such an inverse correlation between insect availability and vegetable matter consumption corroborates the diet supplementation hypothesis proposed by Sick (1997).

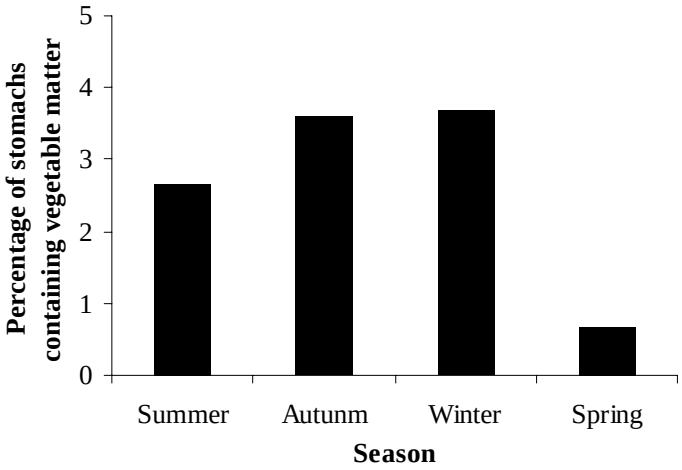

Figure 1. Seasonal variation on the consumption of vegetable matter by South American Furnarioidea. Data derived from 1,251 stomach contents analysis.

Another interesting case of opportunism and flexibility on the diet is that of *Furnarius rufus*, which commonly consumes food remains disposed by students on the *campus* of Universidade de Brasília and even a mixture of flour and water used as bait by fishers on the Três Marias dam, in the city of São José dos Buritis, Minas Gerais state (L. E. L. pers. obs.).

Table 2 registers the consumption of *Myrsine* fruits by eight species of Furnarioidea. Pineschi (1990) also reported the consumption of these fruits by 104 species of birds. Because these fruits are small, abundant, easily accessible, and rich in carbohydrates (Moermond and Denslow 1985, Pineschi 1990, Francisco e Galetti 2001), characteristics attributed by Moermond and Denslow (1985) to fruits that provide a readily accessible supply of energy, it is not surprising that so many species opportunistically feed on them.

Therefore, we can conclude that the members of Furnarioidea are, as a whole, strictly insectivorous species,

Table 1. Frequency of consumption of vegetable matter by Furnarioidea.

	Thamnophilidae	Furnariinae	Dendrocolaptinae	Formicariidae	Conopophagidae	Rhynocriptidae	**Total**
Number of stomach contents	624	399	265	30	76	34	**1428**
Stomachs containing vegetable matter	17	17	4	1	5	1	**45**
Percentage of occurrence (%)	2.7	4.3	1.5	3.3	6.6	2.9	**3.1**

Table 2. Consumption of vegetable matter by species of Funarioidea. “Seed” present in stomach contents may refer to the intentional predation of dry seeds by the bird or to seeds ingested incidentally along with the fleshy fruits that contained them.

Taxa	Resource exploited	Reference
Thamnophilidae		
Biatas nigropectus	Seed	Collar *et al.* 1992
Cercomacra nigricans	Vegetable matter	Wetmore 1972
Cymbilaimus lineatus	Fruit	Schubart *et al.* 1965
Drymophila devillei	Seed	The Field Museum 2003
Dysithamnus mentalis	Fruit of *Myrsine coriacea*, seed	Pineschi 1990, Ribeiro 2001
Dysithamnus stictothorax	Fruit of *Myrsine coriacea*	Pineschi 1990
Dysithamnus xanthopterus	Fruit of *Myrsine villosissima*	Pineschi 1990
Formicivora grisea	Seed, fruit	Poulin *et al.* 1994b
Herpsilochmus rufimarginatus	Fruit of *Myrsine coriacea*	Pineschi 1990
Microrhopias quixensis	Vegetable matter	The Field Museum 2003
Myrmeciza exsul	Seed	Wetmore 1972
Myrmornis torquata	Seed	Wetmore 1972
Sakesphorus bernardi	Fruit	The Field Museum 2003
Taraba major	Seed, fruit	Schubart *et al.* 1965, The Field Museum 2003
Thamnophilus aethiops	Seed	The Field Museum 2003
Thamnophilus atrinucha	Seed	The Field Museum 2003
Thamnophilus bridgesi	Fruit	Skutch 1969
Thamnophilus caerulescens	Seed, fruits of *Cabralea canjerana*, and *Myrsine coriacea*	Zotta 1936, Pineschi 1990, Motta-Júnior 1991, Ribeiro 2001
Thamnophilus doliatus	Seed, fruits of *Trichilia pallida*, and *Palicourea rigida*, sugar	Hundley and Mason 1965, Schubart *et al.* 1965, Wetmore 1972, Poulin *et al.* 1994a, b, Gondim 2001, Wütherich *et al.* 2001, The Field Museum 2003
Thamnophilus pelzelni	Seed of *Solanum* sp.	Lopes *et al.* unpubl. data
Thamnophilus ruficapillus	Seed, fruits of *Myrsine coriacea*, *M. gardneriana*, and *Trema micrantha*	Voss e Sander 1980, Pineschi 1990
Furnariinae		
Anumbius annumbi	Seed, vegetable matter	Marelli 1919, Zotta 1936
Cinclodes excelsior	Seed	Fjeldså and Krabbe 1990
Cinclodes fuscus	Seed, vegetable matter	Zotta 1936
Cranioleuca erythrops	Müllerian bodies of *Cecropia*	Stiles and Skutch 1989
Furnarius leucopus	Seed	Lopes *et al.* unpubl. data
Furnarius rufus	Seed, fruits of *Vitex megapotamica*, *Psidium guajava*, and *Citrus aurantium*	Zotta 1940, Moojen *et al.* 1941, Voss e Sander 1980, 1981
Geositta punensis	Seed	The Field Museum 2003
Lochmias nematura	Seed	Lopes *et al.* unpubl. data
Phacellodomus rufifrons	Fruit of Loranthaceae	Sick 1997
Pseudoseisura cristata	Vegetable matter	Schubart *et al.* 1965
Pseudoseisura lophotes	Seed	Marelli 1919
Schizoeca moreirae	Fruits of *Myrsine gardneriana*, *M. coriacea*, and *M. villosissima*	Pineschi 1990
Synallaxis brachyura	Seed	The Field Museum 2003
Synallaxis erythrothorax	Fruit	Skutch 1969
Synallaxis ruficapilla	Seed of *Paspalum* sp.	Lopes *et al.* unpubl. data
Synallaxis zimmeri	Seed	Collar *et al.* 1992
Dendrocolaptinae		
Dendrocincla fuliginosa	Seed of *Vochysia* sp.	Kuhlmann e Kühn 1947, The Field Museum 2003
Glyphorynchus spirurus	Seed	Wetmore 1972

Table 2. Cont'd

Taxa	Resource exploited	Reference
Lepidocolaptes souleyetii	Seed	Poulin *et al.* 1994b
Sittasomus griseicapillus	Seed	Schubart *et al.* 1965
Xiphorhynchus erythropygius	Seed, fruit of Melastomataceae	Wetmore 1972
Xiphorhynchus guttatus	Seed	The Field Museum 2003
Xiphorhynchus picus	Seed	Poulin *et al.* 1994b, The Field Museum 2003
Formicariidae		
Chamaeza campanisona	Fruit of *Phytolacca dodecandra*	Sick 1997
Chamaeza ruficauda	Seed of *Zea mays*, and *Solanum* sp.	Santos 1979, Nacinovic e Schloemp 1992
Formicarius analis	Seed, fruit of *Oxalis* sp., and Rubiaceae	Wetmore 1972, Stiles and Skutch 1989
Grallaria sp.	Seed of *Zea mays*	Sick 1997
Conopophagidae		
Conopophaga lineata	Seed, fruit of *Myrsine coriacea*, and *Coccocypselum* sp.	Willis *et al.* 1983, Pineschi 1990, Ribeiro 2001, Lopes *et al.* unpubl. data
Rhinocryptidae		
Melanopareia elegans	Seed, vegetable matter	The Field Museum 2003

consuming occasionally a small amount of fruits and seeds. Nevertheless, there are probably some exceptions to this rule, as for example, *Schizoeca moreirae*, which probably does not fit in this feeding guild.

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