FRUGIVORY BY THE WHITE-BEARDED MANAKIN (*Manacus manacus*, PIPRIDAE) IN THE RESTINGA ATLANTIC FOREST ECOSYSTEM

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INTRODUÇÃO

In tropical forests, most woody plants rely on frugivores to disperse their seeds (Gentry 1982). The number of fruit species consumed, the patterns of fruit removal, and the seed treatment given by a frugivore may influence seed dispersal effectiveness, and, ultimately, plant recruitment (Schupp *et al*. 2010). Manakins (Pipridae) are small frugivorous passerines abundant in the understory of primary and secondary neotropical forests (Blake and Loiselle, 2002). Manakins have broad diets, eating whole a great variety of small fruits, thus potentially exerting important role as seed dispersers (Snow, 1962). In restinga forests from southeastern Brazil, an Atlantic forest ecosystem heavily impacted by urbanization (Sampaio, 2005), the White-bearded Manakin *Manacus manacus* (Linnaeus, 1766) is one of the most common understory passerines. Therefore, this species may consume and disperse a great variety of seeds contributing for the dynamics and structure of restinga vegetation.

OBJETIVOS

We investigated the fruit diet of *M. manacus* in well-preserved patches of restinga forests in the southern portion of São Paulo state. More specifically, we assessed: (1) how many plant species have fruits eaten by *M. manacus*, (2) the ripeness and biometrics of these fruits, and (3) the fruit removal maneuvers and fruit handling techniques used by *M. manacus.*

MATERIAL E MÉTODOS

The study was conducted in lowland forests in the southern of São Paulo state, southeastern Brazil. Study areas are still covered in great part with restinga, a structurally simple vegetation composed by halophytic herbs and shrubs close to the sea, and more complex vegetation in lowland and lower mountain forests as one moved further into the continent (Sampaio, 2005). Secondary forests with high abundance of fruits are the preferred habitat of M. manacus (Snow, 1962). The frugivorous diet of M. manacus was accessed conducting direct observation of its foraging behavior, collecting seeds from feces and regurgitations of mist-netted individuals from April 2009 to March 2011, and collecting seeds in 21 courts used by resident males in five lek areas from March 2010 to February 2011. The foraging behavior of M. manacus was characterized considering the height of the fruits eaten, the foraging maneuvers, and the fruit handling behavior (fruits swallowed whole or peacemeal). We recorded only the first feeding event of individuals to quantify the species' foraging behavior. Fruit type, ripeness, length and width

(measured with a digital caliper), and number of seeds were accessed in the field. We evaluated the degree of completeness of the fruit sampling in the diet of M. manacus by plotting accumulation curves of plant species consumed according to each of the methods employed to sample diet. The monthly frequency of feeding events on ripe and unripe fruits by *M. manacus* was compared using Wilcoxon test. We employed Bioestat 5.0 for all analyses. Significance was accepted at $P \leq 0.05$.

RESULTADOS

Manacus manacus consumed 58 species of fruits from 30 different plant families. Myrtaceae (10 spp.), Melastomataceae (5 spp.), and Rubiaceae (4 spp.) were the most consumed plant families. Species accumulation curves revealed that new species might be added to our sampling. Fruits were taken at 3.5 ± 1.9 m height and 1.5 ± 1.6 m below the forest canopy using mainly sally-strike and glean maneuvers. Most of the fruits were berries ranging from 3.1 to 17 mm in diameter and containing from 1 to 86 seeds. Fruits up to 12 mm in diameter were swallowed whole. Ripe and unripe fruits were equally consumed ($Z = 0.62$, $df = 24$, $P = 0.53$).

DISCUSSÃO

Our results corroborated data from other studies that showed a great variety of fruits consumed by manakin species in the understory of neotropical forests. We recorded 58 species of plants consumed by M. manacus and more plant species will likely be added if we continued sampling. Manakins have a wide gape in relation to their body size, which allows them to swallow whole fruits that cannot be swallowed by larger birds such as some tanagers (Snow, 1962). In our study, M. manacus had no difficult to swallow fruits up to 12 mm width; fruits up to 16 mm width (e.g., Coussarea paniculata M. Vahl Standl.) were swallowed by this species in Trinidad (Snow, 1962). Manacus manacus was also recorded consuming all types of available fruits, including unripe ones. Because their high metabolic rate, studies indicated that some manakins (including *Manacus* spp.) evolved behavioral and physiological adaptations such as rapid passage of fruits (and seeds) through their guts, high assimilation of nonstructural carbohydrates, selective regurgitation, and rapid elimination of bulky seeds that allow them to ingest a high rate of fruits compared with larger birds (see Worthington, 1989).

CONCLUSÃO

M. manacus ate a great number of small fruit species. Given the high abundance of this species, its rapid processing of fruits, and the fact that most of the fruits were swallowed whole, *M. manacus* should be an important seed disperser in restinga, an ecosystem constantly threatened by urban expansion.

REFERÊNCIAS BIBLIOGRÁFICAS

BLAKE, J. G. & B. A. LOISELLE. 2002. Manakins (Pipridae) in second-growth and old-growth forests: Patterns of habitat use, movement, and survival. Auk 119:132-148.

GENTRY, A. H. 1982. Patterns of neotropical plant-species diversity. Evolutionary Biology 15:1-85.

SAMPAIO, D. 2005. Restinga. Pp. 25-30 in: D. Sampaio, V. C., Souza, A. A., Oliveira, J., Paula-Souza & R. R. Rodrigues, R. R. (eds). Árvores da restinga: guia de identificação. Neotrópica, São Paulo.

SCHUPP, E. W., JORDANO, P. & J. MARIA GOMEZ. 2010. Seed dispersal effectiveness revisited: a conceptual review. New Phytologist 188:333-353.

SNOW, D. 1962. A field study of the Black and White Manakin, Manacus manacus, in Trinidad. Zoologica. 47:65-104.

WORTHINGTON, A. H. 1989. Adaptations for avian frugivory: assimilation efficiency and gut transit-time of Manacus vitellinus and Pipra mentalis. Oecologia 80:381-389.

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