Frugivory in Puerto Rican *Anolis* lizards and its possible effects on seed dispersal in tropical dry and moist forests on karst

Introduction

Feeding is an important component in consumer-resource interactions of population-community ecology and in energy and nutrient transfers of ecosystems ecology (Bengtsson 1998). Food webs are used to describe the complexity of feeding interactions. The level of omnivory of the members of an ecosystem can influence food web dynamics, interspecific interactions, and trophic structure (Morin and Lawler 1996, Polis and Strong 1996). Omnivory is defined as feeding on more than one trophic level (Pimm and Lawton 1978).

Anolis lizards are the most abundant and conspicuous components of the diurnal community in the Caribbean islands, (Williams 1969). Although considered strict insectivorous, some species add fruits to their diet (Herrel et al. 2002). Given the uncertainty about the trophic ecology of anole lizards, detailed studies about the level of omnivory/frugivory, trophic position, as well as their role as dispersal agents it is necessary to comprehend the role of this group in the dynamic and structure of food webs and in ecosystem function.

We present field observations and preliminary data about omnivory/frugivory of Puerto Rican anole lizards. This data is part of the research being developed to determine their degree of omnivory in Puerto Rico and their possible role as seed dispersers in forests on karst with different ecohydrological dynamics.

Omnivory

The analysis of stable isotopes (^{13}C and ^{15}N) in organisms can be used to indicate the average diet and actual energy links in food webs (Post 2002). The ratio of carbon isotopes ($\delta^{13}C$) changes little as carbon moves through food webs so, $\delta^{13}C$ value of a consumer tissues reflects the $\delta^{13}C$ of their prey, providing information about the original source of carbon (De Niro and Epstein 1978). Meanwhile the ratio of nitrogen isotopes ($\delta^{15}N$) of consumer tissues is enriched by 3-4 ‰ relative to its food providing a measure of the trophic position of the organism (De Niro and Epstein 1981). In general, herbivores are expected to have lower $\delta^{15}N$ values than carnivores, and omnivores should have $\delta^{15}N$ values intermediate between those of herbivores and carnivores (Kelly 2000).

I examined preliminary the trophic position of *A. cristatellus* using isotopic analysis (^{13}C / ^{15}N) and found an omnivory signature when compared with other lizards (Fig. 1). A more extensive sampling of the isotopic variation of *Anolis* lizards is currently being undertaken and will allow us to determine the trophic position and level of omnivory of anole lizards.

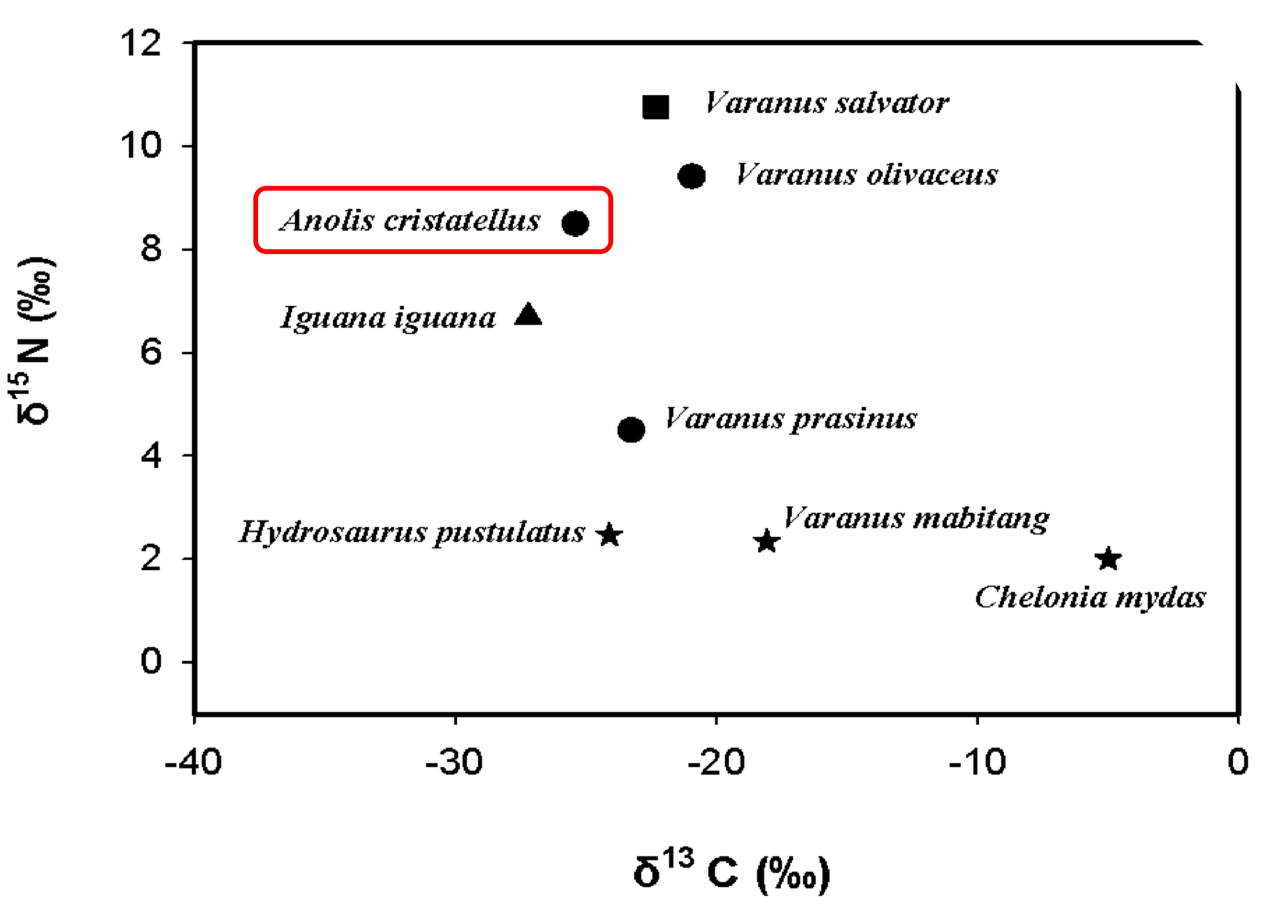

Figure. 1. Comparison of the $\delta^{15}N$ signature of *A. cristatellus* with other reptiles.

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Frugivory

In Puerto Rico the consumption of fruits has been reported for 2 small species of anoles, *A. evermanni* (Reagan 1996, Lister 1981) and *A. monensis* (Schwartz and Henderson 1991), and for the giant species *A. cuvieri* (Pérez-Rivera 1985, Losos 1990). Although there are no published data about frugivory on *A. gundlachi, A. krugi* and *A. stratulus* , we have field observations of these species consuming fleshy fruits (Fig. 2).

A. gundlachi eat the red fruits of palicourea (*Palicourea crocea* (Sw.) Roem. & Schultes), *A. krugi* consume the white fruits of the stinging nettle (*Urera baccifera* (L.) Wedd.), and *A. stratulus* eat red fruit of the wild balsam apple (*Momordica charantia* L.). Further quantitative data on diet of anole lizards will be needed to determine the importance of frugivory on *Anolis* species.

Anolis evermani

Anolis monensis

Anolis cuvieri

Anolis gundlachi

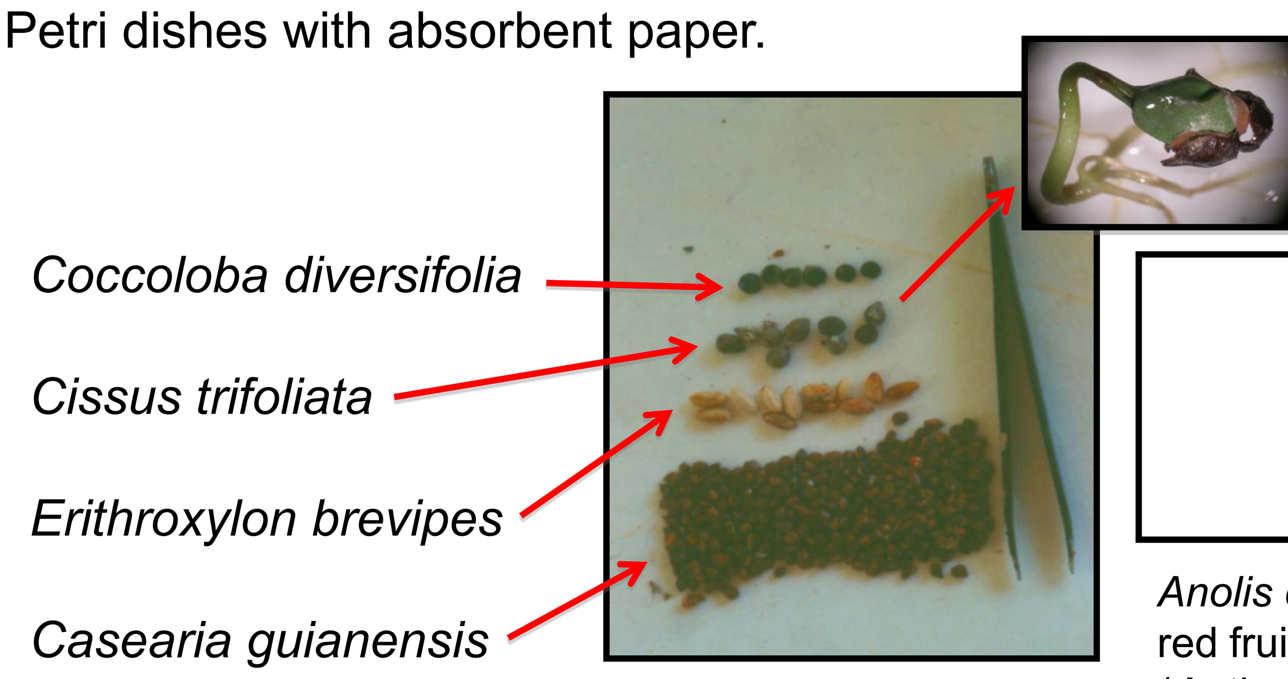
Anolis krugi

Anolis stratulus

Figure 2. Puerto Rican *Anolis* lizards that consume fruits.

Anoles as potential seed dispersers

There is no published data about seed dispersal by anoles lizards, an important phenomenon related to feeding habit that depends, but not only, on the degree of frugivory of a species (Cáceres 2002). Extensive use of fruits, diversity and viability of seeds are three aspects to consider in the evaluation of lizards as a seed disperser. To assess the diversity of fruits and the viability of seeds consumed by the giant anole, *A. cuvieri,* we trapped 15 individuals in the moist karst forest in Dorado, PR. We collected 30 fecal pellets of the trapped animals and determined the ingested items in each pellet. In addition to arthropods and snails, 327 seeds corresponding to 4 species of fleshy fruits from a vine, a shrub and trees were found in the fecal pellets (Fig. 3). All seeds were germinated in Petri dishes with absorbent paper.



Anolis cuvieri consuming red fruits of rat-tail (*Anthurium crenatum)*

Figure 3. Seeds found in fecal pellets of *A. cuvieri*

Conclusion

The preliminary data suggest that *Anolis* lizards are omnivorous and potential seed dispersal agents. Detailed studies will be carried to determine the level of omnivory, trophic position, and role as seed dispersers of *Anolis lizards.* The information gathered in those studies will allow to determine the role of anoles lizards in food webs as well as in the function and dynamics of insular tropical ecosystems.

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Funded by National Science Foundation, HRD #0734826 and University of Puerto Rico, Central Administration and Río Piedras Campus