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# The role of morphological traits in mutualistic interactions among plants and vertebrates in the Galápagos

Sandra Hervias-Parejo<sup>\*1</sup>, Ruben Heleno<sup>2</sup>, Manuel Nogales<sup>3</sup>, Jens Olesen<sup>4</sup>, Pablo Vargas<sup>5</sup>, and Anna Traveset<sup>1</sup>

<sup>1</sup>Mediterranean Institute for Advanced Studies (IMEDEA) – C/ Miquel Marquès, 21 - 07190 Esporles - Illes Balears, Spain

<sup>2</sup>University of Coimbra – Department of Life Sciences, Centre for Functional Ecology, PO Box 3046, Coimbra 3001-455, Portugal

<sup>3</sup>Department of Agrobiology and the Environment (IPNA) – Avda. Astrofísico Francisco Sánchez, 3 38206 - San Cristóbal de La Laguna Santa Cruz de Tenerife - Islas Canarias, Spain

<sup>4</sup>Aarhus University – Department of Bioscience - Genetics, Ecology and Evolution Ny Munkegade 116 building 1540, 227 8000 Aarhus C, Denmark

<sup>5</sup>Real Jardín Botánico (rjb) – Plaza de Murillo, 2. Madrid E-28014, Spain

## Abstract

Frugivory in lizards is often assumed to be constrained by body size; only large individuals are considered capable of consuming fruits, with the potential of acting as seed dispersers. We studied the entire radiation of lava lizards (*Microlophus* spp.) in the Galapagos to investigate whether frugivory is related to body size and explore the effect of seed ingestion on seedling emergence. Our results showed that fruit consumption was common regardless of body size, and that lizards are important seed dispersers throughout the year and across the whole archipelago. On the other hand, relying on floral morphology to assess pollination systems has been shown to underestimate the ecological service that novel mutualisms can provide. Although vertebrates with opportunistic food habits are common on islands, little is known about how effective they are as pollinators. We thus investigated whether native insectivorous and frugivorous birds act as pollinators by means of pollinator exclusion experiments, and then tested if birds show any preference for specific floral traits. Galápagos passerines are not specialized flower-visitors, either in feeding habits or in terms of morphology, but bird-flower visitation seems to be very common across the entire archipelago. Non-metric multidimensional scaling (NMDS) was used to evaluate the distribution of 16 flower morphology and nectar traits values along two main dimensions and measure the similarity between 26 native plants visited mostly by birds versus those by insects. We confirmed the pollination effectiveness of opportunistic birds. Quantitatively, birds were not important pollinators compared to insects. However, qualitative components of fitness improved when both birds and insects visited the flowers. We further reported two main flower types: entomophilous species, which are as expected to be mostly visited by insects, and a second group mostly visited by opportunistic birds that display mixed floral traits not fitting the classical ornithophilous syndrome. Flower shape, corolla size and nectar volume seem to be important for bird visitation in the plant community of the Galápagos. Our study underscores

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\*Speaker

the importance of co-adaptation and floral diversification in non-specialized plant-visitor interactions.

**Keywords:** floral diversification, frugivory and seed dispersal, *Microlophus* spp., native Galápagos birds, pollination effectiveness