Macroevolution in Microchiroptera: Recoupling morphology and ecology with phylogeny

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ABSTRACT

No family of mammals has undergone a greater adaptive radiation than phyllostomid bats. Phylogeny combined with eco-morphological considerations of trophic structures can help understand this adaptive radiation and the evolution of Microchiroptera. Microchiropteran bats are overwhelmingly insectivorous, and constraints within the morphospace of insectivory have produced a dynamic equilibrium in bat morphologies that has persisted for 60 million years. The ability to eat fruit may be the key synapomorphy that allowed phyllostomids to escape insectivore morphospace and diversify. Although many phyllostomids have changed greatly, others that have maintained insectivory have changed little, which is equally remarkable.

Keywords: bats, craniodental patterns, dental patterns, diet, dilambdodonty, ecology, insectivory, macroevolution, mammals, Microchiroptera, phylogeny, Phyllostomidae.

INTRODUCTION

Adaptive radiations have long fascinated evolutionary biologists. Textbook examples include the cichlid fishes of the African Rift Valley (Liem, 1973) and the Cenozoic bovids (Jernvall et al., 1996). An equal and perhaps more spectacular case is found in the Phyllostomidae, the leaf-nosed bats of the New World. From an ancestral diet of insectivory, descendants today can still be insectivorous, but also carnivorous (consumers of vertebrate prey), nectarivorous and pollinivorous, frugivorous, and sanguinivorous (Fig. 1). This diversification of diet and morphological form within a single family is without parallel in mammals or many vertebrates. How and why this diversification occurred, and how that diversification compares with that of bats in the suborder Microchiroptera, is the subject here. The fossil record is often useful in studying adaptive radiations (Foote, 1996; Jernvall et al., 1996), but fossils of phyllostomids are rare (Dawson and Krishtalka, 1984). Cladistic reconstruction of phylogenies, when coupled with ecological and morphological data, offers an alternative and powerful tool for studying adaptive radiations. Fortunately, knowledge of the phylogeny of phyllostomids has reached a point (Baker et al., 1989; Van Den Bussche, 1992) where my analysis can proceed. Traditionally, cranial and especially dental characteristics have weighed heavily in explaining ancestral–descendant relationships.
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