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Biogeography and Phylogeny of Caribbean Plants—Introduction

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The islands of the West Indies (Bahamas plus the Antilles) comprise 115 islands plus several thousand islets and cays spread across a distance of roughly 3000 km. The largest island, Cuba, is over 2,000 km long, the highest peak, on Hispaniola, is over 3,000 m elevation, and the archipelago extends roughly to within 200 km of mainland North America (Florida), Central America (Yucatan, Mexico), and South America (Venezuela). Vegetation types across the region range from dry scrub thickets to rainforests, and substrates range from limestone to igneous and serpentine soils (Howard 1979). The West Indies hold strikingly high levels of biotic diversity and endemism (Myers et al. 2000). Plants are no exception, with an estimated 2,500 genera of seed plants (over 200 endemic) and 12,000 to 13,000 species of vascular plants [nearly 60 percent endemic (WWF and IUCN 1994–1997; Myers et al. 2000)]. One endemic flowering plant family has been recognized (Goetzeaceae; e.g., Borhidi 1996), but Santiago-Valentin and Olmstead (this issue) provide phylogenetic evidence for its inclusion in the Solanaceae.

The reasons for this rich and unique flora undoubtedly involve the complex geological and environmental history of the region. Various tectonic and climatic events (many of which are still not well understood), changes in the extent of subaerial terrain constituting the islands, and perhaps most importantly, a giant meteor impact and associated flooding across the region 65 million years ago have affected species divergence, disjunction, migration, and extinction in the region over time. Moreover, the West Indies are poised between the two great landmasses of the Western Hemisphere, and the archipelago (particularly the larger islands) may have at various times provided a refugium for once widespread taxa, a conduit for intercontinental migration, a vehicle for adaptive radiation, or any combination of these. The relative importance of major routes of intercontinental migration from, e.g., Mesoamerica, southern Florida, and northern South America likely shifted over time as geological events ensued.

This complex history presents a daunting yet exciting challenge for evolutionary biologists attempting to reconstruct the historical biogeography of the region. Considerable research has addressed Caribbean biogeography from the perspective of various animal groups (e.g., Liebherr 1988; Woods 1989; Crother 1999; Woods and Sergile 2001), spurred to large extent by a vigorous debate on the relative importance of vicariance versus dispersal as an explanation for present-day distribution patterns of Antillean organisms (e.g., Rosen 1975; Guyer and Savage 1986; Hedges et al. 1992; Hedges 1996). Despite extensive activity in documenting the Antillean flora (see bibliography at http://www.nybg.org/bsci/fga/Newsletter/CONTENTS.htm), there has been far less investigation of the historical biogeography of Caribbean plant groups. This emphasis on animal biogeography may benefit from the propensity of some faunal groups toward low vagility, an important feature in organisms used to test vicariance scenarios, versus higher vagility in many plants. Nonetheless, as noted by Lavin and Luckow (1993), data from low-vagility plants can still inform the vicariance/dispersal debate, and studies of plants with higher vagility can inform other issues relating to dispersal, such as the relative importance of various routes of migration both within the Antilles and between the Antilles and mainland areas, and the paleofloristic affinities of Antillean groups.

The recognition of the potential for plants to provide insight into the Caribbean problem, in conjunction with the advent of new molecular and analytical tools, has within the last decade spurred interest in the phylogeny of Caribbean plants (e.g., Zona 1990; Skean 1993; Adams and Jackson 1997; McDowell and Bremer 1998; Judd 2001; Lavin et al. 2001; Moynihan and Watson 2001; Rova et al. 2002; Negrón-Ortiz and Watson 2002, 2003). In response to this interest, we organized a symposium entitled "Biogeography and Phylogeny of Caribbean Plants", sponsored jointly by the American Society of Plant Taxonomists and the Systematics Section of the Botanical Society of America as part of the Botany 2001 meeting in Albuquerque, New Mexico. By bringing together researchers with phylogenetic data on various Antillean plant groups, we hoped to advance our understanding of general biogeographic patterns that underlie the distributions of Caribbean plant taxa, integrate these patterns with the biological processes thought to be involved in their development, and identify groups and methods for future research

into the historical phytogeography of this biodiverse region.

The following seven papers in this issue of *Systematic Botany* are derived from 11 presentations delivered at the symposium. Our symposium served as a fortuitous complement to another held at the New York Botanical Garden the previous year (Zanoni and Buck 2000) that focused more broadly on the flora of the Greater Antilles.

The results from these presentations and papers clearly show that multiple biogeographical scenarios are required to explain the current distribution and biology of the Antillean flora, including an exclusively boreotropical (northern) origin (Lavin et al.), a South American origin (Santiago-Valentin and Olmstead), multiple geographic origins of taxa within larger groups investigated (H. D. Clarke, unpubl. data; Fritsch; S. Graham), and even trans-Pacific long-distance dispersal in one instance (S. A. Kelchner, unpubl. data). Dispersal is the predominant biogeographical scenario invoked for the taxa investigated (e.g., McDowell et al.; Negrón-Ortiz and Watson), but vicariance (or at least ancient divergence) between North America and the Antilles seems to remain viable for legumes (Lavin et al.), *Styrax* in part (Fritsch), and perhaps others. The GAARlandia landspan connecting the Greater Antilles and South America was recognized as a viable means of migration in a number of the studies. This research can provide a basis for further investigation into the biogeography of Antillean plants within a phylogenetic framework, and help quantify the relative influence of various migration routes into and through the Antilles, the influence of vicariance versus dispersal in the taxonomic composition of the Caribbean flora, and the extent to which the Antilles may have served as an area of origin for some plant groups. We are optimistic that, with continued research into the phylogeny of Caribbean groups, a set of general historical patterns consonant with the geological record will eventually emerge.

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