Paraphyly, hybridization, and multiple introductions in the origin and evolution of the endemic Amaranthaceae of the Hawaiian Islands (genera Achyrantes, Charpentiera and Nototrichium)

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INTRODUCTION

The Hawaiian Islands are well known for their endemic plant taxa, many of which provide striking examples of adaptive radiation following their introduction to the islands. Some groups including the Acanthaceae family, lobelias and violas have been well studied, while others have not. Here we describe the native Acanthaceae group, the Acanthaceae from the Oahu Army National Resource Program, Butch Pataky. Results of Parsimony via stepping stone analyses is shown to be clearly indicated by ITS and RPS23 condemnation. A broad group of large shrubs to trees, 12 m high, with a unique morphology, but has been known to have been known to have a Hawaiian origin. The predominant hypothesis suggests a close relationship to the widespread tropic genus Charpentiera, which has been recognized by recent large scale phylogenetic studies (Miller & Borsini, 2005).

Charpentiera is a group of large shrubs to trees, 12 m high, represented by five endemic species, C. densiflora Sohmer, C. blasisca (Hilbert), A. Miller, C. divaricata E. M. Goud., and C. lomentosa Sohmer. The genus also includes a single species, C. austroidea Sohmer in the Austral Islands (Sohmer, 1972). Affinities and origins of Charpentiera have been very difficult to deduce (Sohmer, 1971). The gynodioecious breeding system is rare in the family although its pollen is reminiscent of other core amaranths (Eliasson, 1988). Molecular phylogenetic studies addititionally place it to a basal grade in the family with the genus Ribose (Miller & Borsini, 2005).

Achyrantes are shrubs represented by three endemic and one introduced species. The endemic species, A. cressonii St. John, A. multicaulis A. Gray and A. divaricata E. M. Goud. are all quiescent in the islands. Achyrantes cressonii is extinct and prior to its rediscovery in 1992, and prior to its rediscovery in 1992, it was thought to have gone extinct. A. mutica Sohmer was unexpected and further work is necessary to determine origin and relationships. Charpentiera obovata is a group of large shrubs to trees to 12 m high, with a unique morphology, but has been known to have a Hawaiian origin. The predominant hypothesis suggests a close relationship to the widespread tropic genus Charpentiera, which has been recognized by recent large scale phylogenetic studies (Miller & Borsini, 2005).

RESULTS

A. ITS - Parsimony

B. ITS - ML

CONCLUSION AND FUTURE DIRECTIONS

Our preliminary work has uncovered a complex and dynamic pattern of introduction and subsequent diversification within the Hawaiian Amaranthaceae. The Acanthaceae clade is of particular importance contributing multiple independent introductions. The distinct Nototrichium is one of those introductions which radiated and diversified. This finding is troublesome taxonomically as recognition of Nototrichium results in a paraphyletic Achyrantes. This would need to be examined in the context of revisionary work in Achyrantes. From a standpoint of character evolution the unique characters segregating Nototrichium from Achyrantes lack of pseudostamnodes and ascending flowers and near unique characters (arborescence and 4 merous flowers) appear to be of less taxonomic importance and represent inherent variability within the Achyrantes clade. The basal position of Charpentiera makes determining origin and migration difficult. Its unique morphology and reproductive biology are likely the result of long term isolation and segregation from a new extinct ancestor. The apparent intergeneric gene exchange between Charpentiera and Achyrantes mutica was unexpected and further work will verify this pattern and better understand the mechanism for gene exchange is necessary.

Currently we are surveying additional chloroplast regions to better test these patterns of diversification and provide stronger evidence of phylogenetic relationships.

ACKNOWLEDGEMENTS

We would like to thank Tim Flynn, Kasika Winter, and David Lorance from the National Tropical Botanical Garden, Kelly Welch and Kupu Kawelo from the Oahu Army National Resource Program, Rogue Hils from the Molokai Land Trust, Matt Flynn of the Hawaii Division of Forestry and Wildlife, Hank Cooperman and Alahi Baldevsingh from the University of Hawaii Aquatic Plant Prevention Program, and Kaye Gardner, for useful tips and for providing material for analysis. We would also like to acknowledge the assistance of undergraduate students Kristyn Payne, Amanda Thorton, and Drew Waters for their assistance with this project.

LITERATURE CITED


METHODS

Achyranthes from the Oahu Army National Resource Program, Butch Pataky. Results of Parsimony via stepping stone analyses is shown to be clearly indicated by ITS and RPS23 condemnation. A broad group of large shrubs to trees, 12 m high, with a unique morphology, but has been known to have a Hawaiian origin. The predominant hypothesis suggests a close relationship to the widespread tropic genus Charpentiera, which has been recognized by recent large scale phylogenetic studies (Miller & Borsini, 2005).

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