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Conservation Implications of the Reproductive Biology of the Endangered Vine *Ipomoea microdactyla* Griseb. (Convolvulaceae)

Abstract

Empirical evience showing habitat fragmentation results in population genetic consequences for plants is rapidly accumulating. The effects have been variable, most often negative but also positive. Habitat fragmentation followed by reductions in population size generally leads to decreasing genetic variation, both allelic richness and heterozygosity of individuals. The danger to the fragmented populations may be reductions in the fitness of individuals and in the immediate viability of these populations. The purpose of my study is to gauge the relationship between genetics and demography for this imperiled species. *Ipomoea microdactyla* Griseb. (Convolvulaceae) is an hermaphroditic perennial vine. In the United States, it occurs only in the pine rockland habitat of Miami-Dade County, Florida; it also occurs in Cuba and the Bahamas. This species is Florida State listed as endangered and has populations at 12 conservation areas in the county, including Everglades National Park. Presently, there is less than 2 % of the original pine rockland habitat left, outside of the large block protected in Everglades National Park. The goal of my project is to conduct a population viability analysis (PVA) to determine which factors are important for the continued persistence of this species in Florida. The first part of my research will be a breeding system experiment to gauge self-compatibility/self-incompatibility. This entails a protocol of hand pollinations at several levels: the individual, within populations, and among populations. The second part of my project will be a multi-year demographic study at many of the conservation areas. The final component will be a population genetic study (using microsatellite genetic markers) to determine the spatial pattern of genetic variation and then to incorporate this into the PVA. Preliminary results from the breeding system experiment suggest this species is self-incompatible and unable to set fruit without a pollen vector. This implies potentially severeAllee effects for these low-density populations.

Introduction

- Habitat loss and fragmentation is the main threat to the persistence of endangered plant species
- Management of endangered plant species requires knowledge of factors affecting extinction risk, e.g. small population size, disturbance regime, genetic impoverishment, pollinator limitation, exotic species impacts
- PVA (population viability analysis) is a tool that allows the quantitative assessment of extinction risk
- PVA allows the user to test the effect of varying vital rates (growth, fecundity and survival) on population persistence
- PVA enables the user to offer the conservation-oriented application of the results to guide land stewards in making the appropriate management decisions

Scientific Approach

This research is composed of 3 interdisciplinary studies:

1. Reproductive Biology
   - A breeding system experiment to gauge the degree of self-compatibility / self-incompatibility
   - Protocol of hand pollinations at several levels: the individual, within and between populations
   - Seed germination experiment with resulting seeds to evaluate genotypic differences
2. PVA (population viability analysis)
   - Perform a 3 year demographic, multi-site study
   - Incorporate results of seed and seedling outplanting experiments into the PVA
3. Population Genetic Study
   - Obtain DNA samples of the tagged individuals from the demographic study
   - Utilize microsatellite genetic markers developed for close relative sweet potato, *Ipomoea batatas*
   - Incorporate results into the PVA

Study Species

***Ipomoea microdactyla* Griseb. – 'Man-in-the-ground'**

Figure 1. Experimental plant in greenhouse

Figure 2. Closeup of flower with pollen

Figure 3. Underground tuber

- Hermaphroditic, perennial woody vine with underground tubers
- Scarlet red flowers visited by butterflies, bees and hummingbirds?
- Blooms during the rainy season from May through early October
- Plants dormant during the dry season from December through February
- Occurs in hyper-fragmented pine rockland habitat in Miami-Dade County (< 2 % remaining outside ENP)

Figure 4. Global distribution of *I. microdactyla* in Miami-Dade County FL. (USA), the Bahamas, Turks and Caicos and Cuba

Study Area

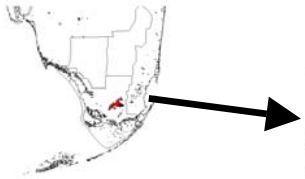

Figure 5. southern Florida

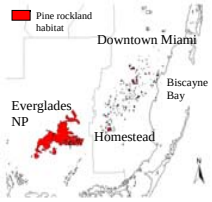

Figure 6. Miami-Dade County, Florida

Figure 7. Pine rockland habitat

Preliminary Results

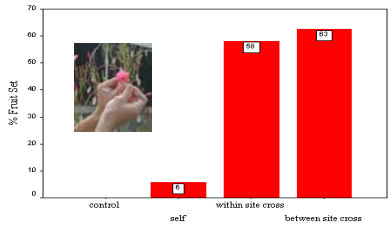

Figure 8. Percent fruit set for 4 hand pollination treatments

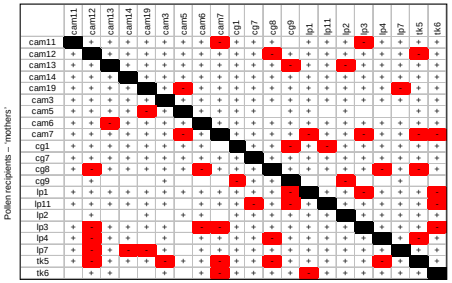

Figure 9. Matrix of cross compatibility for the 21 individuals used in the breeding system experiment (+ signifies compatibility, - signifies incompatibility)

Impact

- Globally imperiled habitat (pine rockland) with nearly 10 % of the plant species endemic
- Few studies conducted in this plant species-rich habitat
- Conservation-oriented application of results may be beneficial for other co-occurring threatened species
- Management of the remaining habitat in southern Florida shared by Federal, State and County agencies
- First PVA conducted on the plant life-form of a perennial vine
- Genetic data rarely incorporated into PVA's

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