

Connect to Protect Network: Home Gardening Data Provides Insight in Survivorship of Pine Rockland Species

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INTRODUCTION

With more than 90% of its original range destroyed, pine rockland is an increasingly rare ecosystem found only in southern Florida and the Bahamas (Florida Natural Areas Inventory 2010, Maschinski and Powell 2012). Miami-Dade’s remaining pine rockland fragments are home to 49 rare plants, 18 of which are restricted to this community alone (Florida Natural Areas Inventory 2010). As such, conservation efforts to protect these plants have become a priority for those interested in preserving Florida’s natural ecosystems. Fairchild Tropical Botanic Garden’s Connect to Protect Network has partnered with Miami-Dade residents for nearly a decade to preserve and connect fragments of critically-imperiled pine rockland and to educate participants about the importance of conserving natural plant communities. By providing land owners with plant species native to this ecosystem, CTPN creates stepping stones between habitats, increasing the likelihood of seed dispersal across fragments and survivorship (Maschinski and Powell 2012). CTPN members have provided feedback on the health and phenology of their plants, allowing FTBG staff to analyze their results and interpret survivorship as it pertains to conservation of pine rockland species.

DATA

We received data on 323 individual plants from 73 distinct pine rockland species, recorded at different intervals between 2007 and 2016. Participating citizen scientists included homeowners, teachers, and students of public and private schools.

METHODS

As the data was collected by CTPN members at different times and for unequal intervals, our analysis only considers whether the plant was alive at the time of data recording and if the plant flowered. Of the 73 species, we considered those with at least 10 individual plants for analysis on survival and phenology. Seven species fit these criteria: *A. berteroi*, *C. americana*, *D. carthagenensis* var. *floridana*, *L. involucrata*, *P. walteri*, *T. angustissima* var. *corallicola*, and *Z. pumila* (Table 15). Data was entered as provided by CTPN members. Occasional discrepancies were noted. For example, in species with small, inconspicuous flowers such as *Crossopetalum ilicifolium*, members occasionally recorded fruits but not flowers.

Table 15: Summary of survivorship and phenology data of species with ten or more individuals. Highlighted are those species with greater than 80% survival.

Species Name	Individuals	Survived	Flowered	Fruited
<i>Angadenia berteroi</i>	22	50%	19%	0%
<i>Callicarpa americana</i>	13	92%	77%	85%
<i>Dalea carthagenensis</i> var. <i>floridana</i>	10	0%	100%	100%
<i>Lantana involucrata</i>	11	100%	73%	27%
<i>Physalis walteri</i>	11	82%	64%	27%
<i>Tephrosia angustissima</i> var. <i>corallicola</i>	55	85%	69%	53%
<i>Zamia pumila</i>	10	70%	10%	10%

FINDINGS AND POSSIBLE INTERPRETATIONS

Angadenia berteroi - *A. berteroi* is an evergreen, perennial herb in the Apocynaceae family. This low survival and flowering percentages of this species are somewhat surprising as habitat fragmentation has been shown to have a less severe effect on this species as compared to other threatened pine rockland plants (Barrios Roque, Koptur, and Sah 2016). It is possible that conditions of some of the 10 gardens from which data was collected for this species were not suitable; *A. berteroi* requires calcareous soil, which may not have been available in members' gardens (Florida Native Plant Society). Further, high leaf litter can have a negative effect on reproduction (Barrios Roque, Koptur, and Sah 2016). If gardens were not regularly cleared of litter, it may have prevented flowering and fruiting of the plants. This may be especially likely for individuals planted at schools that were left unattended over the summer months.



Florida Native Plant Society

Callicarpa americana - *C. americana* is a perennial shrub in the verbenaceae family (Verbenaceae). This species saw the second best survival as well as the greatest percentage of flowering individuals of those species that displayed more than 80% long-term survivorship. This is typical, as *C. americana* is more adaptable than other pine rockland species, and indeed enjoys a range far outside south Florida. This species survives in a wide range of soil acidities and textures, as well as light availabilities (United States Department of Agriculture). What is interesting to note, however is that Connect to Protect Members report an average fruiting period of around 6 months at the time of data collection, implying that the actual average may indeed be higher. Further, members were reporting fruiting throughout the year, as opposed to its reported summer-to-fall fruiting period (United States Department of Agriculture).



James Hodges, copyright, 2009

What should be noted however is that a higher percentage of fruiting plants was reported than flowering plants. This is may be the result of when data was collected by members. It seems that the flowering period for *C. americana* is significantly shorter in this sample set than the average fruiting period (an average of 2.7 months among those who reported, those not being strictly consecutive), so without careful monitoring observers may have missed the flowering period.

Dalea carthagenensis - *D. carthagenensis* is a perennial shrub in the pea family (Fabaceae). All individuals of this species considered in this project came from the same garden. In their first year, they all survived, flowered, and fruited and seemed healthy, according to the reporting member. During the fall of their second year however, all plants died in a span of four months. This may be due to the plant's strict substrate requirement of limestone with little to no leaf litter, as this is unlikely to occur in a home garden (Hodges, Maschinski, Possley, and Powell 2014).



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Lantana involucrata - *L. involucrata* is a perennial shrub in the verbena family (Verbanaceae). This species saw an impressive 100% survival rate at the time of data collection. Its success is likely due to its adaptability to different soil substrates. This species tolerates limestone as well as sandy soils, with or without humus, making it more fit to survive in a variety of substrates than species with stricter soil requirements (Institute for Regional Conservation). *L. involucrata* also can tolerate a moderate range of nutrient availabilities, as well as being highly drought tolerant and requiring no supplemental watering after establishment (Institute for Regional Conservation). This high survival did not necessarily translate to high fecundity. *L. involucrata* flowers year-round in the wild, but members reported an average of only 2.3 months flowering in CTPN gardens, with only 27% of individuals producing fruit (Institute for Regional Conservation).



Keith A. Bradley, Institute for Regional Conservation

Physalis walteri - *P. walteri* is a perennial herb in the potato family (Solanaceae). This species displayed a moderate survival rate of 82%. Its success is likely due to its adaptability to environments outside of pine rocklands, being found naturally as far north as Maryland and as far west as Louisiana (United States Department of Agriculture). Much like, *L. involucrata*, this species flowers all year in the wild, but averaged 2.8 flowering months in CTPN gardens, with only 27% of individuals producing fruit. It is possibly that the high nutrient content found in most home garden soils inhibited reproduction in *P. walteri*, which is adapted to low nutrient availability (Institute for Regional Conservation). Other possible explanations for reduced reproductive activity may include lack of light availability or overwatering.



United States Department of Agriculture

Tephrosia angustissima* var. *corallicola - *T. angustissima* var. *corallicola* is a leggy perennial herb in the pea family (Fabaceae). Displaying 85% survival and a moderate flowering rate, *T. angustissima* var. *corallicola* likely owes its success to its weedy tendencies in a home garden setting (Gann 2015). Though only 53% percent of individual plants produced fruit, this species is easily recruited from seed in disturbed areas, meaning that those that produced fruit are likely to have produced offspring (Gann 2015).



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With 55 individual plants, this species was more closely analyzed than others as there was more data to work with. For further analysis those plants with at least a full year's worth of data were considered. It was found that plants averaged 5.25 months in flower with a standard error of 0.30339. Flowering peaked during July, August, and September (Figure 36).

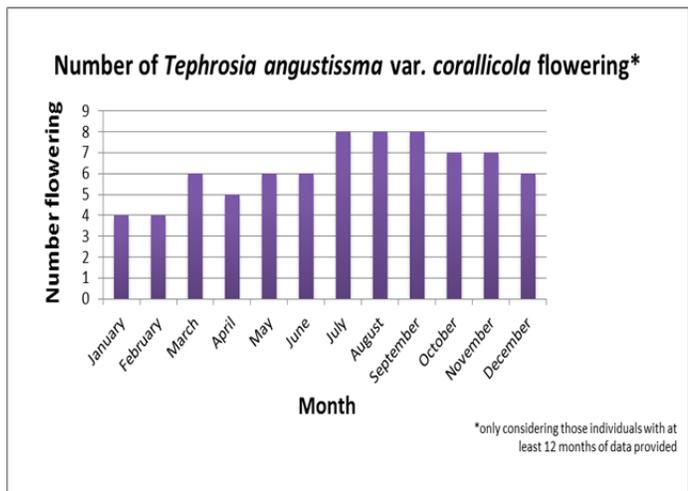


Figure 36 Phenology data for *T. angustissima* var. *corallicola*

T. angustissima var. *corallicola* is an exceedingly rare taxon in the United States, with less than 1000 known individuals in the wild (Gann 2015). While little is known about its phenology in the wild, this study may indicate year-long blooming with peak flowering in late summer.

Zamia pumila - *Z. pumila* is an evergreen shrub in the cycad family (Zamiaceae). This species likely was less successful than others due to its specialization to pinelands and hammocks. These environments are relatively nutrient poor, and individuals planted in home gardens were likely not placed in such a habitat. It is interesting to note however that the only one that produced cones was said to be in full sun with intermediate moisture, and was the only individual in such an environment. This may be further evidence of specialization to pinelands and hammocks.



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OUTCOMES AND FUTURE APPLICATIONS

Through this study FTBG staff was able to analyze the fitness of pine rockland species in home gardens and found possible explanations and interpretations of survivorship and phenology. This data can be used to better narrow the scope of the Connect to Protect Network and provide future members with plants more likely to survive in home gardens, and thus better connecting and reestablishing pine rocklands across Miami-Dade County. Had the provided data been more detailed, more rigorous study on the phenology of pine rockland species could have provided insight as to how to better encourage reproduction and seedling recruitment in gardens and in the wild, particularly for endangered species. Should a similar study be performed in the future, it may be helpful to the analyst to ensure that all participants are provided with the same data collection sheet, as well as given specific instructions on how to fill them out. Further, the relevance of statistical tests would be greatly increased if participants were given a set timeframe in which to collect data, as without this no real analysis can be done. If these improvements could be made, future analyses of Connect to Protect Network data could become key in understanding pine rockland restoration.

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