Germination and Field Survival of White-Topped Pitcher Plant Seeds

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Abstract: A study was initiated to determine longevity of white-topped pitcher plant (*Sarracenia leucophylla*, Raf.) seeds in the field and in cold storage. Thirty seed pods were harvested in August 2009 from plants located in Alabama 38 miles from the Gulf Coast. Of the 10,000+ seeds extracted from the pods, some were buried outside in screen-wire bags and harvested throughout the year. In addition, 100 seeds were immediately placed in the growth chamber to test for viability, while others were (1) stratified for 60 days in the walk-in cooler immediately after collection, (2) stratified for 4-6-8 weeks after being stored for 7 months, (3) placed in a vial and left at room temperature for one year, (4) scattered on the surface of two pots and left outside all winter, and (5) stored dry in the walk-in cooler. Seeds placed immediately in the growth chamber without any period of cold stratification did not germinate, while those cold stratified for 4 weeks averaged 21% germination. Seeds stored 7 months and then stratified for 4, 6, or 8 weeks averaged 75%, 78%, and 72% germination respectively. Seeds scattered on the surface of two pots and left outdoors averaged 50% germination the following spring. Seeds in the buried screen-wire bags began germinating inside the bags in June 2010. Seeds were still viable after one year in the buried bags and after one year when stored as dry samples in the cooler.

Introduction

White-topped pitcher plants (*Sarracenia leucophylla* Raf.) are native to the Gulf Coast region of the United States. The plants are found in Alabama, Florida, Georgia, Mississippi, and North Carolina, with populations in Florida and Georgia listed as endangered. White-topped pitcher plant is a wetland indicator species found in bogs and wet pine savannahs. The plants are insectivorous, trapping and digesting insects to obtain nutrients which may be low or lacking in the poor soils in which they grow. They are threatened by wetland draining for agriculture and development, invasive species, and also by illegal harvesting. Like longleaf pine, they thrive under a naturally occurring fire regime and require plentiful sunlight.

Methods

Thirty seed pods were harvested in August 2009 from a stand of white-topped pitcher plants, located in Alabama 38 miles from the Gulf Coast. Pods were sealed in plastic bags and shipped overnight to Auburn, AL. Seeds were immediately harvested from brown pods. Green pods were allowed to mature, and the seeds were extracted when the pods showed signs of splitting open. All pods had opened and all of the seeds were removed from them within eight days of harvest. The following tests were conducted:

Laboratory Studies

(1) One hundred seeds were scattered into a clear-lidded plastic box lined with paper moistened with distilled water. Seeds were sprayed with Spectracide® Immunox all-purpose fungicide (7

oz per gallon) and placed in a growth chamber set at a uniform 30°C. After 4 weeks, with no sign of germination, the growth chamber setting was changed to 30°C with light for 16h and 25°C, no light, for 8h (hereafter referred to as the standard temperature regime). The seeds were tested under this temperature regime for another 4 weeks.

(2) One hundred seeds were rolled into a moist paper towel, sealed inside a plastic bag, and placed in the cold storage room at 5°C. The bag was removed from the cold room after 60 days, and the seeds were scattered into a clear-lidded plastic box, sprayed with the fungicide, and placed in the growth chamber set at the standard temperature regime.

(3) After storage for 7 months at 5°C, 12 lots of 100 seeds each were placed on paper towels moistened with distilled water and sprayed with fungicide. The 12 towels were then rolled up, sealed in a plastic bag, and stored at 5°C. Four rolls were removed after 4-6-and 8 weeks of moist stratification and placed in the growth chamber set at the standard temperature regime to determine if length of stratification affected germination of stored seeds.

(4) Seeds were placed in storage at 5°C. Every six months, a vial containing 400 seeds will be removed from storage and tested for viability.

5) Four replications of 100 seeds were stored at room temperature and tested for viability after 1 year.

Field Studies

1) One hundred seeds were soaked in 10% bleach for 1 minute, rinsed 3 times with distilled water, and divided into 2 lots of 50 seeds each. Two 1-liter plastic pots were lined in the bottom with longleaf pine needles and filled with a 50-50 mix of coconut husk and sand. Seeds were sprinkled on the top of this layer and then thoroughly sprayed with the fungicide. Nets were tented over the pots which were then placed in a tray filled with rain water.

(2) One hundred seeds were placed in each of 56 2x3-inch screen-wire bags that were sewn with clear plastic thread. Three plastic tubs measuring 20 inches x 26 inches were filled with a 50/50 sand/ peat moss mixture. The screen-wire bags were divided into three lots and placed in a single layer on top of the sand/peat moss mixture, then covered with a layer of fine sand. The tubs were kept moist by a rainwater irrigation system (Figure 1).

Bags were harvested from the field after 3, 7, 10, 11 and 12 months. Viability of the seeds was tested in the growth chamber set at the standard temperature regime. Ungerminated seeds from the 11 and 12 month samples were stained with tetrazolium chloride (TZ) to determine if they were still potentially viable. Bags will continue to be harvested and tested at intervals throughout the next year until viability or sample bags are depleted.

RESULTS AND DISCUSSION

Laboratory Studies

White-topped pitcher plant seeds harvested from pods and placed immediately in the growth chamber did not germinate. However, 21% of the seeds that were moist stratified at 5°C for 60 days produced plants.

Dry seeds stored at 5°C for 7 months and placed immediately in the growth chamber without a period of moist stratification did not germinate. Seeds that were stratified for 4 weeks averaged 75% germination. The sample stratified for 6 weeks averaged 78% germination, and the 8 week stratified sample averaged 72% germination.

Seeds stored at 5°C for one year averaged 75.5% germination. Some pitcher plant seeds remained viable after being stored at room temperature for one year, although germination averaged only 2.5%.

Field Studies

No germination was recorded in the tented pots through April 6, 2010. Two weeks later, however, 47% of the seeds had germinated, averaging 23 per pot. Three more seeds later produced plants, raising total germination to 50%. No germination occurred after June 2010.

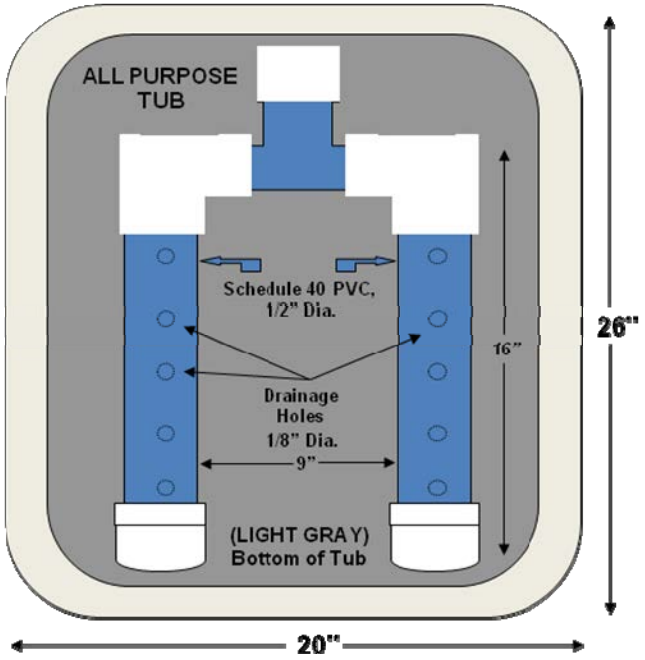
After 3 months in the field, four bags of the seeds buried in the tubs were uncovered and brought into the lab. No germination occurred in the field; however, laboratory germination was 66%. A second seed sample was collected from the field after 7 months, instead of 6, because of mechanical difficulties with the growth chamber. There was no evidence of germination in the field. After 4 weeks in the germinator, average germination was only 16%. The third seed sample from the field study was harvested after 10 months. Germination occurred in the field, with 126 of the 400 seeds (31.5%) already producing plants. An additional 70 seeds germinated in the laboratory, raising total germination to 49%.

By the time the 11 and 12 month samples were harvested, seeds had decayed to the extent that it was impossible to tell which had germinated and produced plants; they could only be counted as 'empty'. Empty seeds from the 11 month sample averaged over 50%. While only 2% of the remaining seeds germinated in the laboratory, staining with TZ indicated that 56% of the remaining seeds were potentially viable. In the one year sample, 50% of the seeds harvested from the bags were empty and 8% germinated in the laboratory. Of the remaining 193 ungerminated seeds, however, only 3% stained positive with TZ.

Conclusions

It is evident from these studies that, despite the southern location of the seed source, some cold stratification is necessary to stimulate germination of white-topped pitcher plant seeds and that some seeds buried for at least one year retain viability. While many of the seeds remaining after 1 year in the field and 4 weeks in the germinator appeared firm and white, they did not react to the TZ stain. We will continue to harvest seeds from the field and will periodically test viability of seeds kept in cold storage. It is unknown how germination from these controlled studies in the laboratory translates to long-term survival in the field.

Figure 1. Diagram of the planting tub watering system used in the outdoor field study. Water flows from a rainwater catchment basin into the PVC connector pipe at the top of the diagram. This system waters the tubs from the bottom, eliminating upper layer soil disturbance while keeping the soil surrounding the buried bags moist throughout the year.



Recommended Resources

International Carnivorous Plant Society, http://www.carnivorousplants.org

The Meadowview Biological Research Station, http://www.pitcherplant.org

McPherson, S. 2007. Pitcher Plants of the Americas. The McDonald and Woodward Publ. Co., Blacksburg, VA. 320 p.

Schnell, D.E. Carnivorous Plants of the United States and Canada. John F. Blair, Publisher, Winston-Salem, NC. 125 p.