EXPERIMENTS WITH PITCHER PLANT SEEDS

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ABSTRACT

We initiated a study 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, four replications of 100 seeds each were immediately tested for viability, while others were (1) stratified for 60 days in the walk-in cooler immediately after collection and for 4-6-8 weeks after being stored for 7 months, (2) placed in a vial and left at room temperature for one year, (3) scattered on the surface of two pots and left outside all winter, and (4) 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. Seeds in the buried screen-wire bags began germinating inside the bags in June 2010. After one year in the field, 2% of the seeds from the field study germinated, while those stored in the cold room retained 75% germinability. Seeds stored for one year at room temperature averaged 2.5% germination.

INTRODUCTION

White-topped pitcher plant (*Sarracenia leucophylla* Raf.; Figs. 1, 2) is 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. The 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. They thrive under a naturally occurring fire regime and require plentiful sunlight.

METHODS

Thirty seed pods were harvested from a stand of white-topped pitcher plants, located in Alabama 38 miles from the Gulf Coast, in August 2009. 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 (Fig. 3). All pods had opened and the small seeds (Fig. 4) removed within eight days of harvest. The following tests were immediately conducted:

Laboratory Studies

(1) One hundred seeds were scattered into a clear-lidded plastic box lined with moist paper. Seeds were sprayed with Spectracide® Immunox all-purpose fungicide (7 oz per gallon) and placed in a growth chamber set at a uniform 30ºC. After 4 weeks, with no sign of germination, this was changed to 30ºC with light for 16h and 25ºC, no light, for 8h (hereafter referred to as the standard temperature regime).

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

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

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

5) Four reps 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

FIGURE 1: White-topped pitcher plants with blood-red flowers.

FIGURE 2: Close-up of developing white-topped pitcher plant seed pod.

FIGURE 3: Seed pod and seeds of white-topped pitcher plant

FIGURE 4. White-topped pitcher plant seeds.

FIGURE 5. Pots planted with white-topped pitcher plant seeds in August 2009 and left outdoors through October 2010.

FIGURE 6a. Bags containing white-topped pitcher plant seeds arranged in tubs.

FIGURE 6c. Bags containing white-topped pitcher plant seeds covered with thin layer of sand.

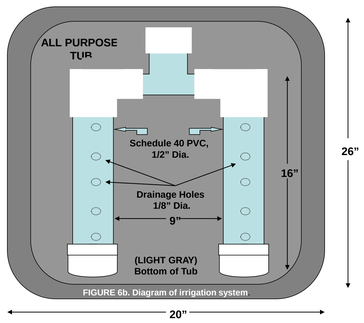

FIGURE 6b. Diagram of irrigation system

FIGURE 7. Laboratory germinated white-topped pitcher plants that have formed small pitchers.

Figure 8. Germinated white-topped pitcher plant seeds in a bag harvested from the field in early June, 2010.

Field Studies cont.

plastic pots were lined in the bottom with 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 (Fig. 5).

(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 6a-c). Bags were harvested and seed viability tested after 3, 7, 10, 11, and 12 months. For these tests, the growth chamber was set at the standard temperature regime. Bags will continue to be harvested and tested at intervals throughout the next year until viability is lost 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 100 seeds that were moist stratified at 5ºC for 60 days produced plants (Fig. 7).

Dry seeds stored at 5ºC 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.

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 (Fig. 8). An additional 70 seeds germinated in the laboratory, raising total germination to 49%.

By the time the 11 and 12 month samples were harvested, vegetative matter in the bags had decayed to the extent where it was impossible to tell which seeds 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 tetrazolium chloride (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 2% germinated in the laboratory. Of the remaining 193 ungerminated seeds, however, only 3% stained positive with TZ. We did find, however, that a field sample harvested in October 2010 had 7.5% germination, and we found newly germinated seeds in our March 2011 sample (March).

After one year, seeds stored at room temperature were cold stratified and placed in the germinator. Only 2.5% of these seeds germinated, while 75.5% of the seeds stored at 5ºC for one year germinated.

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 1.5 years 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 translates to survival in the field.