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Evaluation of Seed Treatments for Improved Germination of Starry Rosinweed (*Silphium asteriscus*)

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Starry rosinweed (*Silphium asteriscus*) is a native wildflower of Florida's pine flatwoods. This herbaceous perennial reaches 3 to 5 ft and bears yellow ray florets from May through September. Starry rosinweed is gaining popularity as a landscape plant, but there is little information available that describes methods for propagating this species by either sexual or asexual means. The objective of this study was to determine the effect of pretreatments on germination of *S. asteriscus* seeds. Seeds were collected in Sept. and Oct. 2008 and stored in polyethylene bags or moist stratified in potting media for 30 days at 39 °F. Subsequently, seeds that were stored in polyethylene bags at 39 °F were either water-soaked for 24 hours before planting or left dry. Before sowing, half of the seeds from each of the three previously described treatment combinations were cleaned by removing the pericarp to produce a total of six different treatment combinations that could affect seed germination. A second set of seeds was collected that were described as the fresh (not stored) sample. These seeds were either water-soaked or left dry. At planting time, half the seeds from each of these two treatments were cleaned by removing the pericarp. This resulted in four additional treatment combinations using fresh seed. All 10 treatment combinations were sown under greenhouse conditions (average temperature 73 °F). Separate and combined effects of storage, cleaning, and soaking were examined in an analysis that excluded seeds that were stratified. A second analysis looked at the combined effects of stratification and cleaning and excluded fresh seeds. The treatment that had the largest effect on percent germination and time to germinate was stratification. Mean time to germinate was 4.3 days for seed that received the moist-stratification treatment and a germination percentage of 93% was observed at 2 weeks. The time for seed to germinate was substantially slower and germination percentages were lower for all other treatment combinations that did not include stratification. Soaking and cleaning had some effect on germination rate. Storage and soaking affected the time for seeds to germinate when effects of stratification were excluded.

The genus *Silphium* is a taxonomically complex group of plants with about 33 described species (Small, 1933). The U.S. Department of Agriculture recognizes 19 of these species as present in the United States (Kartesz, 2000) with a natural distribution extending from the Dakotas to west-central Texas, east to central Florida, and north to Virginia (Settle, 1967). The species *Silphium asteriscus* L., commonly known as starry rosinweed, is an herbaceous perennial plant that can reach 3 to 5 ft tall (Osorio, 2001). Rosinweed is a common herb in pine flatwoods (Fig. 1). Leaves have toothed margins and are alternately arranged. Upper leaves are sessile and lower leaves are stalked. Leaves and stems are rough to the touch (Taylor, 1998). Flowers are heads of yellow disk florets and toothed ray florets (Fig. 2) that occur in summer and autumn but can be also found flowering nearly year-round in southern Florida (Osorio, 2001). The fruit is a light brown achene that contains a single, flattened seed that is winged, notched, and hairy at the inner face (Taylor, 1992).

Even though it is reported that rosinweed can be propagated by seed (Osorio, 2001), little information is available describing specific methods. According to Anderson (2003), seeds of cup plant (*S. perfoliatum*) should be sown as they ripen. If harvested during fall, seeds require a 90-d stratification period followed by

Fig. 1. Rosinweed is a common herb in pine flatwoods. Leaves have toothed margins and are alternately arranged. Upper leaves are sessile and lower leaves are stalked. Leaves and stems are rough to the touch.

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Fig. 2. Rosinweed flowers are heads of yellow disk florets and toothed ray florets that occur in summer and autumn but can be also found flowering nearly year-round in southern Florida.

a period of 4 to 8 weeks at 32 to 39 °F, before germination at 60 °F (Anderson, 2003). Seed of the compass plant *(S. lanciniatum)* and the prairie rosinweed (*S. terebinthinaceum*) should be placed in moist stratification for 150 d, and then germinated at 64 to 70 °F (Baskin and Baskin, 2002). The objective of this study was to determine if pre-sowing treatments improved the germination of *S. asteriscus* (starry rosinweed).

Materials and Methods

On 22 Sept. 2008, 160 seeds were collected and stored in polyethylene bags for 30 d at 39 ºF. An additional 80 seeds were collected and stratified in wetted potting substrate (Fafard 2 Mix, Conrad Fafard, Inc., Agawam, MA) under the same conditions. These bags were placed in a refrigerator in the dark. After 30 d, 80 of the stored (non-stratified) seeds were water-soaked for 24 h before planting. Before sowing, half of the seeds from each treatment combination were cleaned. The preplant cleaning treatment was made by removing part of the outer layer (pericarp) of the seed by hand as a scarification-like method to facilitate the exposure of the seed to the environment once sown. A second set of 160 seeds was collected on 22 Oct. 2008, 30 d after the first harvest of which 80 were water-soaked for 24 h before planting and 80 were not. At planting time, 40 of each the water-soaked and non-water-soaked seeds were cleaned (Fig. 3).

On 23 Oct. 2008, ten seeds were planted per treatment in 50-plug plastic trays. Treatments were randomized using two trays per block and a 10-plug row for each treatment. Trays were filled with the same potting substrate as above and placed in a greenhouse under intermittent mist for 10 s every 30 min. Temperatures in the greenhouse during the months of Oct. and Nov. 2008 averaged 73 °F. One seed was placed in each hole as deep as the diameter of the seed. Date of first emergence was recorded for each treatment as well as the number of seedlings which emerged per treatment each week for 6 weeks after planting. Percent emergence at the end of the experiment was analyzed with PROC GENMOD in SAS. Days to emergence were analyzed using PROC GLM in SAS. There were two separate analyses for each data set. One excluded seeds that were stratified. This

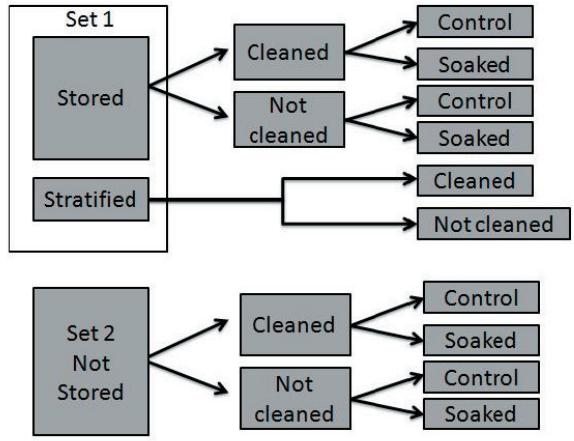

Fig. 3. Illustration of the treatments performed on seeds of *Silphium asteriscus*.

analysis looked at the effects of storage, cleaning and soaking as well as interactions between these treatments on germination. The second analysis excluded fresh seeds and looked at combinations of storage treatments (stratification, cold storage with soaking or cold storage without soaking), cleaning, and interactions between these treatments.

Results and Discussion

No effect on germination was observed whether the seeds were stored for 30 d at 39 °F before sowing or sowed fresh after harvest. Exposure of seed to the environment by cleaning (i.e., removing the pericarp) did not improve seed germination (Table 1). Soaking seed for 24 h before planting showed a positive effect on germination when compared to seed that did not receive the treatment (Table 1). Fresh seeds germinated earlier than stored seeds and those that were cleaned germinated earlier (Table 1). There were no significant ($P>0.05$) interactions between the storage, cleaning, and soaking in analyses examining the effects of these treatments on percent germination or days to germination. Cleaning did not have an effect on the germination of stored seed. However, stratification and water-soaking had a significant effect (Table 2). Of the two treatments, stratification most enhanced germination of *S. asteriscus* seeds (Table 2). This is consistent with the literature on germination of other *Silphium* species. Stratification also decreased the days to germination

Table 1. Mean percent germination and days to emergence for seeds of starry rosinweed (*Silphium asteriscus*) that were stored or not stored and subsequently subjected to combinations of cleaning and soaking treatments.

Treatment	Seed emergence (%)	Days to emergence
Storage treatment		
Not stored (control)	71.69 a[z]	20.0 b
Stored	62.27 a	23.1 a
Cleaning treatment		
Cleaned	68.71 a	19.9 b
Not cleaned (control)	65.56 a	23.2 a
Soaking treatment		
Soaked	72.84 a	20.6 a
Not soaked (control)	60.91 b	22.5 a

[z]Means within a column followed by the same letter are not significantly different ($P>0.05$).

Table 2. Mean percent germination and days to emergence for seeds of starry rosinweed (*Silphium asteriscus*) that were stored or stratified and subsequently subjected to combinations of cleaning and soaking treatments.

Treatment	Seed emergence (%)	Days to emergence
Germination treatment		
Stratified	94.54 a	4.3 a
Stored (soaked)	71.85 b	21.8 b
Stored (not soaked)	51.26 c	24.3 b
Cleaning treatment		
Cleaned	74.48 a	16.0 a
Not cleaned (control)	81.58 a	17.7 a

[z]Means within a column followed by the same letter are not significantly different ($P>0.05$).

compared with the rest of the treatments. First emergence in most of the stratified treatments was observed at about 4 d after sowing. Stratification also increased uniformity since more than 95% emergence was reached in about two weeks. The rest of the treatments did not germinate until three weeks after sowing and total germination rates were ultimately lower than those of stratified seeds. There was no significant interaction ($P>0.05$) between the cleaning and storage treatments for either percent germination or days to germination.

In commercial plant production it is important to have a high percentage of germination, as well as uniformity, in a short period of time. Seeds of *S. asteriscus* that were stratified in moistened potting substrate for 30 d at 39 °F, whether cleaned or not, resulted in faster and higher percentages of germination (Table 2). In all the other treatments, seeds germinated more slowly and more erratically over a longer period of time.

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