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The Effect of Burning On Seed Germination and Seedling Growth Rates of Sullivant's Milkweed (*Asclepias Sullivantii*) and Common Milkweed (*Asclepias Syriaca*)

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THE EFFECT OF BURNING ON SEED GERMINATION AND SEEDLING GROWTH RATES OF SULLIVANT'S MILKWEED (*ASCLEPIAS SULLIVANTII*) AND COMMON MILKWEED (*ASCLEPIAS SYRIACA*)

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Abstract

Sullivant's milkweed (*Asclepias sullivantii*) (SM) and Common milkweed (*Asclepias syriaca*)(CM) are native Illinois plants that are often used in prairie restoration efforts. Before the seeds can be planted using traditional mechanical planters, the filamentous coma (i.e., silk-like ballooning material) must first be physically removed from each seed, which requires hours of tedious manual labor. A more expedient way to remove the comas is to burn them. However, the impacts of burning on seed germination and seedling growth rates are unknown, which was the purpose of my study. Germination rates from unburned CM seeds (0%) were significantly lower than that from burned CM seeds (20.8%; $X^2_1 = 5.58$, p= 0.02). There was no significant difference in germination rates of unburned (45.8%) and burned SM seeds (45.8%; $X^2_1 = 0$, p=1.0). A two-way ANOVA indicated no significant main effects of treatment (burned or unburned) ($F_{1,24} = 2.2$, p=0.15) or species ($F_{1,24} = 0.28$, p=0.60) on milkweed growth rates. Therefore, burning the coma of milkweed seeds of both species is an effective way of processing before planting.

Introduction

Sullivant's Milkweed (*Asclepias sullivantii*) and Common Milkweed (*Asclepias syriaca*) are native dicot forbs that are found in Illinois prairies. Their seeds typically reach maturity in Illinois in August (Penskar and Higman, 2000 and Stevens, 2006). The fruits of the *Asclepias* species consist of a single follicle that, when the seeds are mature, bursts open and allows the seeds to disperse (Fig 1). The coma, which is the silk-like ballooning material that is attached to the seeds (Fig. 1), aids in wind dispersal (Sacchi, 1987).

Fig. 1 http://www.learner.org/jnorth/images/graphics/monarch/milkweed_0003.jpg

In prairie restoration, seeds from prairie plants are often collected from remnant prairie tracts. When restoring a large prairie, it is more efficient to use a machine planter than to distribute seeds by hand. Before the seeds can be planted using a mechanical planter, they must be processed (Apfelbaum et al., 1997). When processing milkweed seeds, the filamentous comas must be removed, which, when carried out by hand, requires hours of tedious manual labor. An easier and quicker way to remove the comas is by burning them. However, in doing so, the seeds are directly exposed to fire. While prairies are maintained by controlled burning to eliminate invasive species (Solecki, 1997) the effect of directly burning *Asclepias* seeds has not been well studied. Seeds of most plants are usually protected from the heat of the fires because they are buried under the ground in seed banks. In a typical prairie fire, Romo and Gross (2011) found no significant change in temperature of the soil at any depth greater than 1 cm. In some prairie seeds that have evolved to have a thicker seed coat for protection, fire promotes accelerated germination because it breaks down the tough seed coat (Baskin and Baskin, 1998). During a fire, the hottest area is 5-10 cm above the surface of the soil, which has temperatures recorded from 90° C to 516°C. Most seeds that are above the ground are directly burned and are thus killed by the flames. However, whether or not fire has this impact on *all* seeds is unknown (Baskin and Baskin, 1998).

Purpose of the Study

The purpose of my experiment was to test the effect of burning away the filamentous coma on the seed germination rates and seedling growth rates of Sullivant's and Common Milkweed. Because prairie seeds have evolved with fire, I predicted that burning would produce no significant effect on the seed germination rates or seedling growth rates .

Materials and Methods

- Sullivant's Milkweed seeds were collected from the Cayuga prairie patch in Livingston County, Illinois in October 2012 and Common Milkweed seeds were collected from a single plant in McLean County, Illinois in November 2012.
- The experiment was conducted from 27 January 2013 – 16 March 2013.
- Using an 8" square aluminum pan, 20 seeds at a time were burned under a fume hood.
- I randomly selected 24 burned and 24 unburned seeds of each species for the experiment.
- All seeds were stratified at 1.03°C for 3 weeks to break dormancy.
- Seeds were planted in separate containers that were exposed to 15 hours of light per day.
- Each seed container was watered until moist twice a day.
- Seeds were checked for germination and growth of the seedlings was measured daily.
- A chi-squared analysis of seed germination rates based on the treatment (burned or unburned) of each species. A two-way ANOVA was used to determine the difference in seedling growth rates within and between *A. sullivantii* and *A. syriaca*. All analyses were performed using SPSS (ver. 21, IBM, Somers, New York).

Results

- Germination rates from unburned Common Milkweed seeds were significantly lower than that from burned Common Milkweed seeds ($X^2_1 = 5.58$, p= 0.02; Fig. 2). However, there was no significant difference in germination rates of unburned and burned Sullivant's Milkweed seeds ($X^2_1 = 0$, p=1.0; Fig. 2).

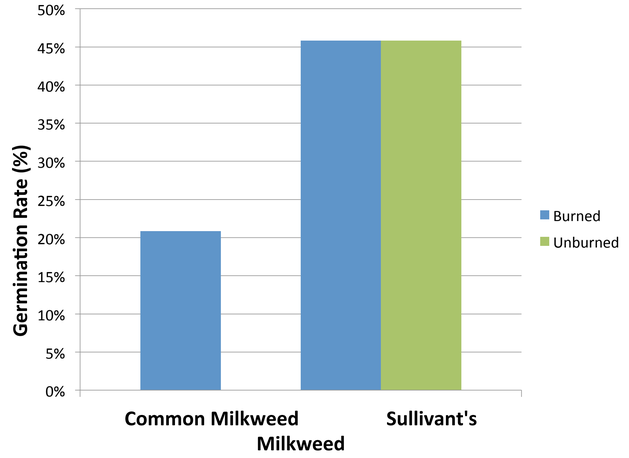

Fig. 2. Milkweed seed germination rate comparing treatments burned and unburned. Unburned Common Milkweed seeds did not germinate.

- There were no significant main effects of treatment (burned or unburned) ($F_{1,24} = 2.2$, p=0.15) or species ($F_{1,24} = 0.28$, p=0.60) on milkweed growth rates (Fig. 3).

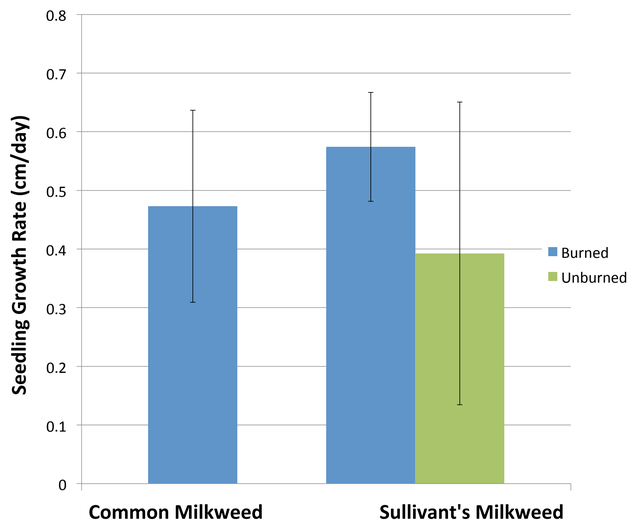

Fig. 3. Average milkweed seedling growth rate ($\bar{X}$±SD cm/day). No Common Milkweed seeds germinated from the unburned treatment.

Discussion and Conclusions

Burning had no effect on the germination rate of Sullivant's Milkweed but did have an effect on the germination rate of Common Milkweed. However, burning did not have an effect on the seedling growth rates of Sullivant's Milkweed (no unburned Common Milkweed seeds germinated). The burned Common Milkweed seeds may have had a higher germination rate than the unburned seeds because prairie plants evolved to be able to live in areas that are prone to wildfires. Bowles et al. (1998) found that *Asclepias meadii* had a higher seedling survivorship and growth rate after burning (Bowles et al., 1998). Seed germination can also vary annually. Glenn-Lewin (1990) found that dicot seedling density in an Iowa tallgrass prairie was greater in nonburned plots compared to burned plots in one year, but not the following year.

Unlike the Sullivant's Milkweed seeds, the Common Milkweed seeds were all collected from a single plant. McLean County, Illinois experienced a drought over the summer of 2012, which could have impacted the viability of the seeds of both species. These factors and the small sample size may have influenced the difference in germination between burned and unburned seeds and the difference in results between species.

The seeds that were burned for this study were directly exposed to fire only for a short period of time (~1-2 seconds). The comas burned quickly, allowing the seeds to escape prolonged intense heat. However, only 20 seeds were burned at a time. If more seed comas were burned at the same time, the heat might have been more intense and the fire may have lasted longer, thus the seeds may have had a greater chance of being damaged.

The results from my experiment suggest that when processing the seeds before planting, it would be more expedient to burn the comas rather than remove them by hand.

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