

Seed Vigor and Population Size of *Lesquerella ludoviciana* as affected by Colony

by

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Abstract. *Lesquerella ludoviciana* (Nutt.) S. Wats. is an endangered sand prairie plant in Illinois, found in Mason County in three colonies which differ greatly. The North Colony—Lower Bowl is the largest colony (3248 m²) with a plant density of 8.6 plants/m². The North Colony—Upper Bowl (1025 m²) has the lowest plant density with 1.8 plants/m². The South Colony has the smallest area (270 m²) with a density of 4.8 plants/m². Diversity of plant species within colonies increases as density of *L. ludoviciana* decreases. Since flowers bloom first at the bottom of the stalk, seed maturity varies with position upon the stalk. Objectives were to determine the effects of colony on seed vigor and population size. Seed was collected on June 1 and June 16, 2000, and on May 14 and June 6, 2001. Seed was grouped by colony, by date, and by position (early or late) on the flower stalk for the first collection date. Seed was germinated on moist filter paper in petri dishes at 25°C in 24hr light. Germinated seeds were counted every 2-4 days. Population size was quantified on May 14, 2001. For 2000 seed, no consistent differences occurred between colonies or maturity levels. For 2001, May 14 seed did not germinate. This lack of germination shows that seed maturity plays a role in germination since May 14 seed was less mature than June 6 seed, which did germinate. For June 6, seed germination for the South Colony was lower than for North Colonies. North Colony—Lower Bowl was the largest colony based on numbers of seedlings, vegetative plants, reproductive plants, area, and total fruit production.

Introduction

Lesquerella ludoviciana (Nutt.) S. Wats. (silvery bladderpod) is a sand prairie plant that is endangered in Illinois (Herkert, 1991). *L. ludoviciana* arises from a basal rosette, with spatulate leaves that are stellate pubescent. It is only found in three colonies in the Henry Allan Gleason Nature Preserve in Mason County. The colonies are located within former “blow out” areas in the sand prairie. These colonies: North Colony- Upper Bowl; North Colony – Lower Bowl, and South Colony, vary in area and in density of silvery bladderpod and other plants. As the density of other plants within the colony increases, the density of *L. ludoviciana* decreases (Ebinger and McClain, Unpublished). The North Colony – Lower Bowl is the largest colony (3248 m²) and has a bladderpod density of 8.6 plants/m². The North Colony – Upper Bowl has an area of 1025 m² and a bladderpod density of 1.8 plants/m². The South Colony has the smallest area (270 m²) with a bladderpod density of 4.8 plants/m². In 2000 it was estimated the North Colony – Upper Bowl contained 100 reproductive plants and around 6,030 seeds; the North Colony – Lower Bowl contained 3,570 reproductive plants and around 396,000 seeds; the South Colony contained 380 reproductive plants and about 38,000 seeds. Whether colony differences in seed vigor exist are unknown.

L. ludoviciana blooms in late spring with seed production occurring in early summer. It has typical Brassicaceae yellow flowers. The inflorescence is a raceme whose stem elongates while flowering. Thus flowers and seeds at the bottom of the stalk mature

earlier and are shed before seed at the top of the stalk. When seeds become mature enough to exhibit high vigor is not entirely clear.

Objectives

The overall goal is to understand the germination strategy of *Lesquerella ludoviciana* to improve management decisions for its maintenance in Illinois. Specific objectives were to compare colonies (three within Henry Allan Gleason Nature Preserve) relative to seed vigor and population size.

Procedures

Silvery bladderpod seed was collected from all three colonies (North Colony-Upper, North Colony-Lower, and South Colony) in Mason County, IL on June 1 and June 16, 2000 and on May 14 and June 6, 2001. Seed was divided into early maturing (lower half of the flower stalk) and late maturing (upper half of the flower stalk) seed for the first collection dates. For the second collection dates, only late maturing seeds were still present on flower stalks. Then seed was grouped by maturity, colony, and collection date.

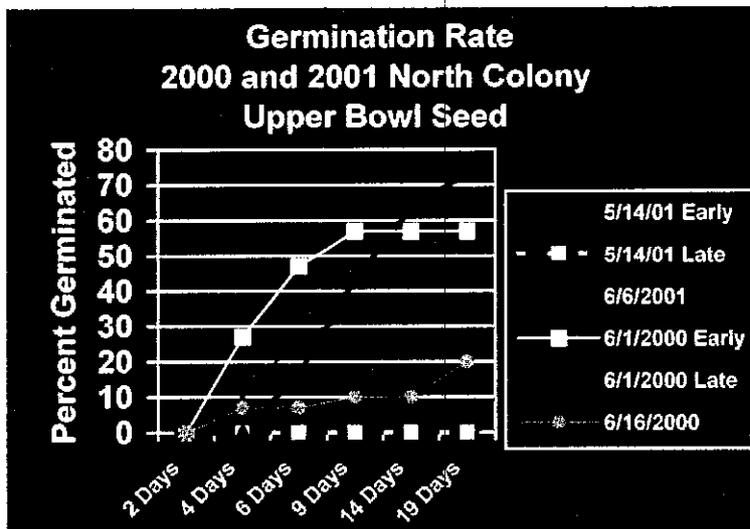
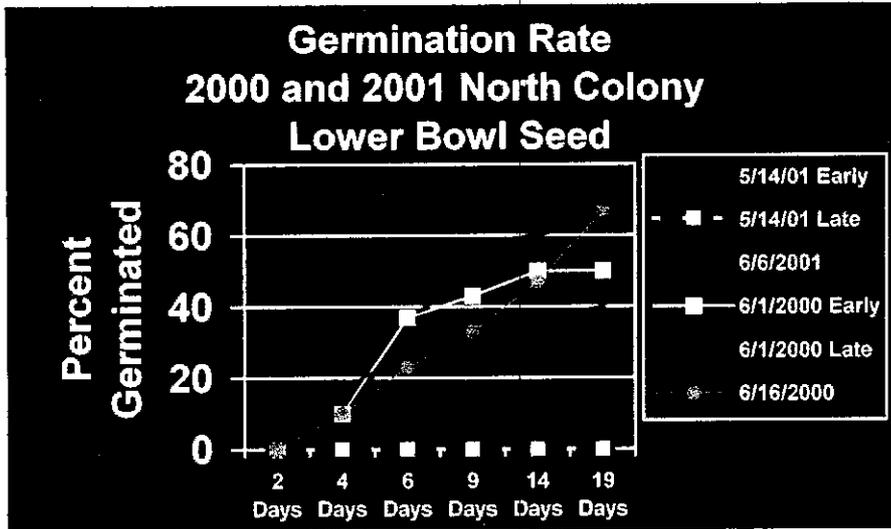
Thirty seeds from each group were germinated in October and November of each year. Germinations were conducted in plastic petri dishes. Ten seeds were placed on two sheets of Whatman #1 filter paper moistened with 5 ml of deionized water. Petri dishes were placed then in clear plastic Rubbermaid® boxes. Prior to imbibition, seeds were dusted with Thiram (50% active ingredient, tetramethylthiuram disulfide) for fungal control. They were germinated at 25°C in 24 hours of light at 4.5 mmol/m²/sec. Every 2-3 days, the number of germinated seeds were counted. A seed was considered germinated when the radicle was evident.

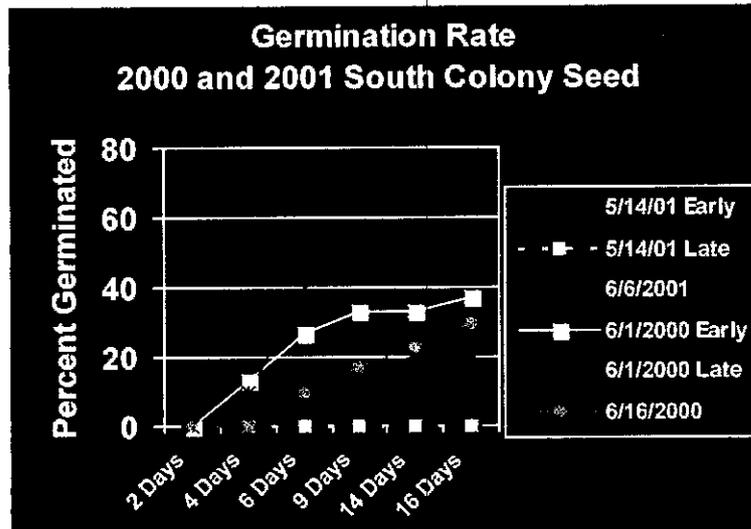
For each colony, a 45-meter transect was sampled at 1 meter intervals using a 0.25 m² quadrat for numbers of seedlings (≤ 6 leaves), vegetative plants, and reproductive plants of *Lesquerella ludoviciana*. These counts were made on May 14, June 6, and July 24, 2001. In addition, area of each population, number of flowerstalks per rosette (on 50 rosettes), and number fruit/flowerstalk (on 50 flowerstalks) were measured.

Data were analyzed using analysis of variance followed by mean separation using Duncan's multiple range test at $p=0.05$. Microsoft Excel was used for statistics, and to determine means and standard deviations for each seed group.

Results

The following figures indicate maturity effects on germination in three colonies.





Germination of 2000 Seed by Maturity and Colony

| | 6/6/2000 Early | 6/6/2000 Late | 6/16/2000 |
|----------------------------|----------------|---------------|-----------|
| North Colony Lower Bowl | 50 ± 26 | 40 ± 16 | 67 ± 21 |
| North Colony Upper Bowl | 57 ± 15 | 33 ± 32 | 20 ± 10 |
| South Colony | 37 ± 12 | 53 ± 25 | 30 ± 20 |

Germination of 2001 Seed by Maturity and Colony

| | 5/14/2001 Early | 5/14/2001 Late | 6/6/2001 |
|----------------------------|-----------------|----------------|----------|
| North Colony Lower Bowl | 0 ± 0 | 0 ± 0 | 67 ± 12 |
| North Colony Upper Bowl | 0 ± 0 | 0 ± 0 | 73 ± 6 |
| South Colony | 0 ± 0 | 0 ± 0 | 20 ± 10 |

Density (number/m²) of *Lesquerella ludoviciana* plants at different developmental stages in three colonies at Henry Allan Gleason Nature Preserve on May 14, 2001.

| Colony | Seedlings | Vegetative | Reproductive |
|----------------------------|-----------|------------|--------------|
| North Colony Lower Bowl | 1.1 | 3.2 | 1.7 |
| North Colony Upper Bowl | 0.0 | 0.1 | 0.6 |
| South Colony | 0.0 | 0.4 | 0.9 |

Density (number/m²) of *Lesquerella ludoviciana* plants at different developmental stages in three colonies at Henry Allan Gleason Nature Preserve on June 6, 2001.

| Colony | Seedlings | Vegetative | Reproductive |
|----------------------------|-----------|------------|--------------|
| North Colony Lower Bowl | 1.1 | 3.8 | 2.1 |
| North Colony Upper Bowl | 0.5 | 1.3 | 0.3 |
| South Colony | 0.0 | 1.4 | 1.1 |

Density (number/m²) of *Lesquerella ludoviciana* plants at different developmental stages in three colonies at Henry Allan Gleason Nature Preserve on July 24, 2001.

| Colony | Seedlings | Vegetative | Reproductive |
|----------------------------|-----------|------------|--------------|
| North Colony Lower Bowl | 1.2 | 2.8 | 0.8 |
| North Colony Upper Bowl | 0.1 | 0.4 | 0.0 |
| South Colony | 0.0 | 0.6 | 0.7 |

Population size and reproductive potential of *Lesquerella ludoviciana* plants at different developmental stages in three colonies at Henry Allan Gleason Nature Preserve on May 14, 2001.

| Colony | Reproductive Plants (#/m ²) | Area (m ²) | Total Number Reproductive Plants | Number Flowerstalks Per Rosette | Number Fruit Per Flowerstalk | Total Number Fruit |
|-------------------------|---|------------------------|----------------------------------|---------------------------------|------------------------------|--------------------|
| North Colony Lower Bowl | 1.7 | 3180 | 5406 | 4.6 | 20.5 | 509,786 |
| North Colony Upper Bowl | 0.6 | 666 | 400 | 2.4 | 16.6 | 15,936 |
| South Colony | 0.9 | 270 | 243 | 4.3 | 18.0 | 18,808 |

Summary

Recommendations for future seed collections would be:

- 1) Collect from the North Colony – Lower Bowl as it produced the most seed whose germination is comparable to or higher than the other colonies, and it contains many more plants and fruits than the other colonies.
- 2) Seed should be harvested mid-June for best germination.
- 3) Holes were observed in some fruits that might be insect damage.
- 4) In 2001, no insects were observed visiting flowers during our visits to the site.

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Literature Cited

- Ebinger, J., and W. McClain. 1999. *Lesquerella*. Unpublished.
- Herkert, J.R. (ed.) 1991. Endangered and Threatened Species of Illinois: Status and Distribution, Volume 1-Plants. Illinois Endangered Species Protection Board, Springfield, Illinois. 158



