Potential Effects of Interbreeding Among Populations of *Lobelia siphilitica*

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Abstract

A viable method for the conservation of a plant species can involve seed collecting projects that aid in ecosystem restoration. As greater and greater numbers of ecosystems are being restored, it has become increasingly apparent that the potential interaction between the local and restored populations should be understood and documented. *Lobelia siphilitica*, a prairie plant, was chosen for this study to determine the potential effects of interbreeding among naturally occurring populations and those restored using seed obtained from a geographically distinct location. Individuals from the F1, F2 and F3 generations of seed obtained via pollination across three distances (nearest neighbor, within the local populations, and long distance) were grown together in a growth chamber to determine if there were differences in growth rates during early life history. The leaf area of each plant was determined at weekly intervals using a new photo measurement technique. It was found that no significant difference existed between the third generation crosses, suggesting that the growth rates during the seedling stage were not affected by hybridization.

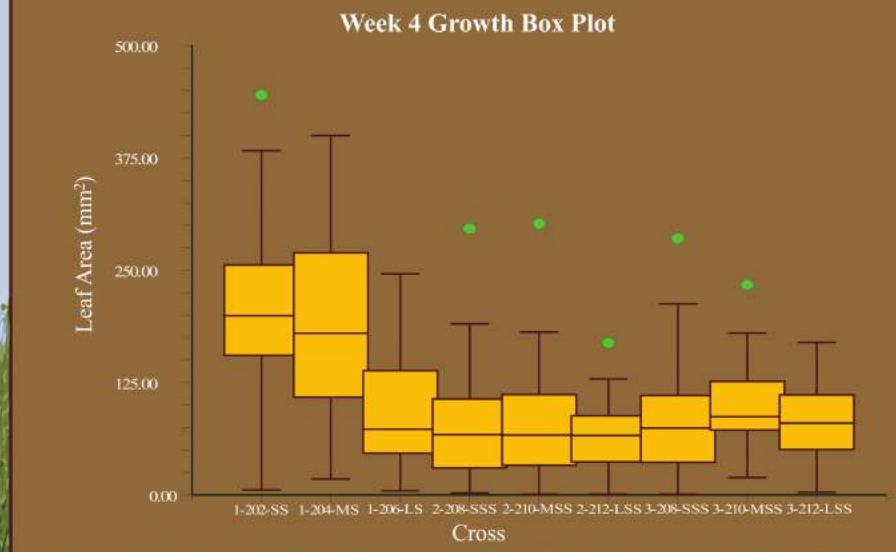
Introduction

Lobelia siphilitica, commonly known as the great blue lobelia, is a perennial that thrives in moisture rich soils and swampland primarily west of the Rocky Mountains in the United States and Canada. Since people and *L. siphilitica* live closely together, it is conceivable that human activities might impact the health of *L. siphilitica* populations. Conservation efforts often times involve moving plants (or collecting seed for restoration) from one area to another to achieve a balance between an expanding human population and the preservation of natural areas. However, it is important to remember that the restored and the local population can potentially hybridize. While first generation after such a crossing event (F1) often display hybrid vigor, by the third generation (F3) this advantage often disappears. It was hypothesized that different distance crosses – that is, crosses from the two different populations, short distance crosses, and medium distance crosses, would show a significant difference from one another in terms of growth rate and leaf area achieved during the early seedling stage.

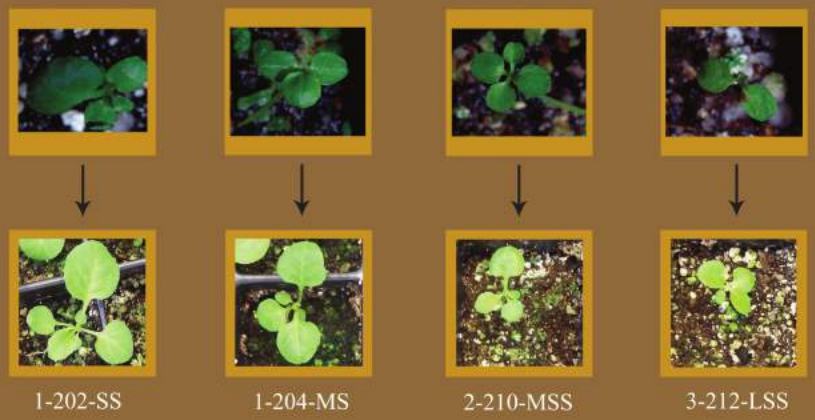
Acknowledgements

Special thanks to Mike Herron for conducting the statistical analysis of the data. In addition, thanks is extended to Frank Rossi for aiding with the experimental design.

Results



According to a Bonferroni multiple comparisons test, there were two groups significantly different from one another. 1-202-SS and 1-204-MS belonged to one group and the other seven crosses belonged to the other. However, there was no significant difference between the different treatments within the groups.



Methods

Nine treatments, consisting of 3 different distance crosses, across 3 generations (F1, F2 and F3) of *L. siphilitica* seeds were first subjected to cold stratification and then germinated and grown in a growth chamber under fluorescent lights at 20°C. Once the seeds had germinated, the seedlings were randomly selected leaving one remaining in each cell to give a total of 48 plants for each of the different treatments. Photos were taken of each of the plants using a Leica camera mounted on a Zeiss microscope and also a Kodak camera. The leaf area of over 2000 specimens was then calculated using Adobe Photoshop to give a pixel count of the selection. Statistical analyses of the data were performed by Mike Herron (AT&T).

Discussion

The purpose of this research was to discover if hybridization between local and transplanted populations of *L. siphilitica* caused any differences in growth rates during early life history. The different letters of each cross stand for the origin of the parent: an S, for example, would refer the progeny of two plants that are a short distance (i.e. no more than a few meters) apart. It was found that no significant difference existed between the leaf area of the third generation crosses. This suggests that the growth rate of the plant will not be altered due to hybridization between the local plant population and the transplanted seed.

Traditionally, digital calipers are used to measure leaf area. However, when large numbers of plants are under study such as with this research, pictures are taken of each plant and a computer program called ImageJ is often used to calculate leaf area. But, this technique also requires either extra sample preparation or image editing (and thus extra time). This method was improved upon by using Adobe Photoshop to give the selection area in pixels. This was then easily converted to square millimeters by comparison to a standard.

While it was found that there was no significant difference between all of the third generation crosses, it is interesting to note that the expected hybrid vigor (in terms of leaf area) was seemingly suppressed in the LS control cross. This is an observation that deserves further exploration. In addition, now that it has been determined that there is no significant difference in leaf area size, further experiments should be conducted to see how each cross would respond to the environment of both parent populations. Also, this study only measured factors that deal with the outer appearance of the plants. Further work should be done to determine if there is any change in plant function. Finally, this research was conducted in a growth chamber that may not realistically represent real world growth conditions. This suggests that the experiment should be repeated in outdoor plant plots.