The Effect of Various Stratification Lengths on Seed Sources of *Ambrosia artemisiifolia* Across Latitudes

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BACKGROUND

Common ragweed seeds are dormant seeds that can persist in the soil while maintaining their seed viability[1]. One of the most crucial environmental conditions for ragweed seeds is stratification, or a period of cold temperatures[3]. Dormancy can be lost through moist cold stratification[4].Stratification is the first process that induces the dormancy and later promotes germination[3].

Ragweed seeds experience different winter lengths across latitudes, thus seed germination may change in response to various stratification lengths[2]. Here, the objective of this study was to evaluate different germination rates of seeds across latitude and assess if there is evidence of geographical patterns of adaptation (Fig 2).

We predict that seeds from northern seed sources will show higher germination rates when exposed to longer stratification. In contrast, the seeds from southern seed sources will show higher germination rates when exposed to shorter stratification.

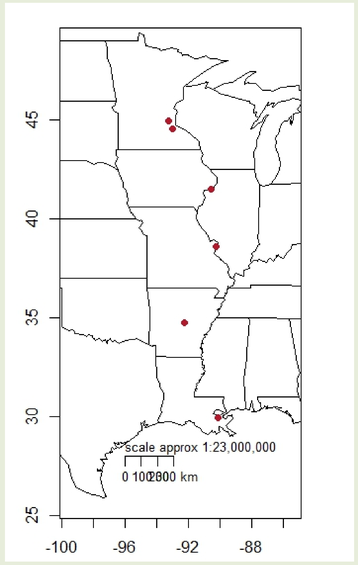

Figure 2. Map of sampling locations. Red points indicate the locations of seed sources across latitudes.

Figure 1. Mature common ragweed plant.

METHODS

Experimental design

6 different seed sources were selected from MN to LA, with 8 genotypes/seed source and 12 seeds/genotype. Four stratification treatments were tested: 0 days, 4 weeks, 8 weeks,12 weeks. Seeds were placed in the moist sand and stratified at 4°C in a dark cold room. After the stratification treatment seeds were placed on moist petri plates in a growth chamber that was set to 22°C 14 h day/ 18°C 10 h night and number of new germinants were recorded for 10 days (Figure 5).

After 10 days, seed viability was determined for seeds that did not germinate using tetrazolium staining; causing seeds from clear to pink or red. We calculated germination rate as number of germinated seeds over number of viable seeds. We compared mean germination rates between seed sources based on latitude.

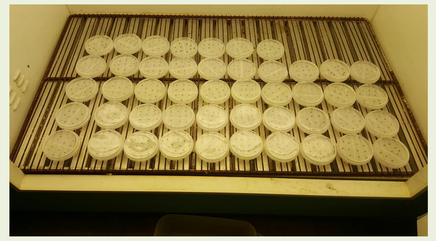

Figure 5. Common ragweed seeds in the growth chamber

RESULTS

Germination rates vary across latitude and in response to stratification treatments

Percent germination rates were significantly different among the seed sources and stratification treatments but no presence of geographical pattern. The effect of longer stratification induced higher germination rates for all seed sources.

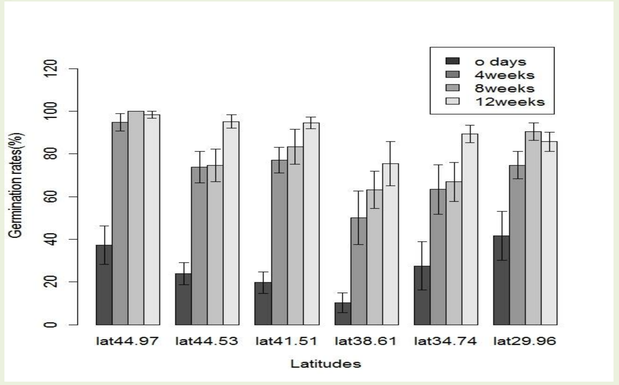

Figure 3. The influence of various stratification lengths on mean germination rates (± SE) of ragweed seeds populations across latitudes (ANOVA; Latitudes $p < 0.0001$, Treatments $p < 0.0001$).

Days to germination vary across latitudes and in response to stratification treatments.

Days to germination was significantly different among the populations and stratifcation treatments but no presence of geogrphical pattern. Overall days to germination decreased as stratification length increased.

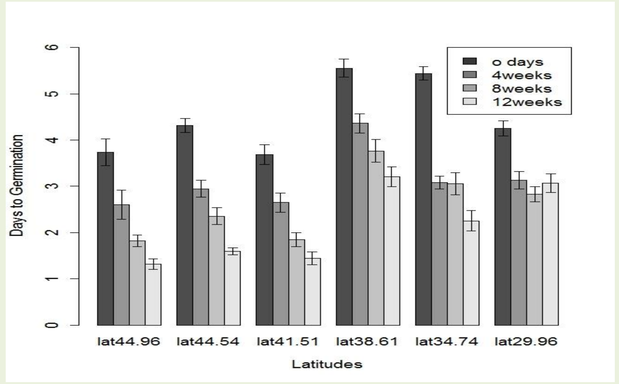

Figure 4. The effect of various stratification lengths on mean days to germinate (± SE) of ragweed seeds populations across latitudes (ANOVA; Latitudes $p < 0.0001$), Treatments $p < 0.0001$).

DISCUSSION

- The effect of longer stratification induced higher germination rates for all seed sources.
- No evidence of predicted geographical patterns of adaptation but U-shaped pattern suggests that central seed sources have lowest germination rates (Fig 3).
- In order to have explicit observation , it would be necessary to conduct second round of experiment.

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