Dormancy and Germination in *Lonicera involucrata* var. *ledebourii*©

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INTRODUCTION

My name is Anne and I'm from Denmark. I'm in an apprenticeship as a nursery-gardener and at present I work for The Danish Institute of Agricultural Sciences. I'm very honoured to be here today and I would like to thank I.P.P.S. Eastern Region, North America for making this exchange possible. Also, thanks to the Midwest Groundcover people and Peter Orum, and special thanks to Kathy Freeland for looking after me. It has been very beneficial and interesting for me to be here, meeting and talking to people, and listening to all the presentations — I'm very grateful for this opportunity.

I sincerely hope some of you will find the following presentation worth listening to.

BACKGROUND

At the Danish Institute of Agricultural Sciences we have carried out research on dormancy and germination in *Lonicera involucrata* var. *ledebourii*. This species is not native to Denmark but, as you might know, to California in the United States of America.

In Denmark the clones 'Vian' and 'Lebo' have been selected as most suitable for shelter belts. 'Lebo' is the most recently selected clone. Both cultivars are more frost resistant than other tested clones and tolerate shade as well as competition from other plants. In Denmark shelter belts are very important for farmers and nurseries, as there is an almost constant wind blowing through our little country.

Lonicera involucrata var. *ledebourii* is a fast-growing shrub which in 6 years reaches a height and width of approximately 4 m — its maximum height. The leaves are large and dark green, and the foliage dense and plentiful. 'Lebo' was selected from planting stock obtained at the Danish Arboretum. It is too vigorous for private gardens, but superb in the landscape, especially in the lower parts of the shelter belt, which very often becomes bare after some years. *Lonicera xylosteum*, which is native to Denmark, doesn't have the same proportions as *L. involucrata* var. *ledebourii* and is, therefore, not useful for this purpose. *Lonicera xylosteum* is far too upright, lean, and narrow compared to *L. involucrata* var. *ledebourii*.

At present only vegetative propagation is used in production. However, greater genetic variation is called for in shelter belts. There has been some seed propagation research on a few *Lonicera* species, i.e., *L. fragantissima*, *L. japonica* (Korea, Japan, China), *L. maackii*, (China, Japan, Siberia) *L. morrowii* (Japan), and *L. tatarica* (Southern part of Russia). This research indicates that *Lonicera* seeds need various types of stratification which correspond with their dispersal patterns in nature. For example, some species ripen as early as June (*L. morrowii*), whereas others do not ripen until September (*L. maackii*). Most taxa need a cold period to germinate and some may have hard seed coats which would benefit if given a short warm period. According to Baskin et. al. (2000) species of *Lonicera* have under developed embryos

that must elongate before germination. Baskin et. al. (2000) have carried out extensive research on four species (*L. fragantissima*, *L. japonica*, *L. mackii*, and *L. morrowii*) to determine whether they have morphological dormancy (MD) or morphophysiological dormancy (MPD), as well as what kind of MPD they have. They used a 30-day-germination period to distinguish between the two dormancy types — if seeds germinate within 30 days they have MD, if they need more than 30 days they have MPD. However, nothing has apparently been recorded on *L. involucrata* var. *ledebourii*.

We were unsure of the dormancy and germination capacity of *L. involucrata* var. *ledebourii*, and we wanted to find out whether seeds respond better to warm or cold treatment, as well as investigate the length of cold treatment needed. The objective was to determine the optimal germination treatment for seeds of *L. involucrata* var. *ledebourii* in the context of developing a seed source. I must stress that this was a preliminary study, carried out on a limited scale, to provide us with an idea of what to expect.

METHODS

Because we wanted variation, the seeds were harvested from four different seed plants in June 1999. The seed producing plants were grown in a plastic house with open ends. Mature fruits were harvested and the seeds were cleaned and dried. Seeds of *L. involucrata* var. *ledebourii* are small, 2 to 3 mm long and 1.5 mm wide; a sample of 1000 seeds weighed 2.87 g.

To test the general quality of the seeds we carried out a control test with no prior treatment of the seeds. They were moistened in cold running water for 24 h, disinfected on the surface (2% sodium hypochlorite).

In the second test we wanted to examine the effects of the length of cold stratification on the germination of seeds at 15°C/59°F. Seeds were cold treated for 4, 8, 12, and 16 weeks, respectively. Seeds were moistened and disinfected, as mentioned above.

In the third test we treated the seeds with two warm treatments prior to cold stratification, and disinfected the seeds as above. Between the germination period and cut test the seeds were stored at 4°C until the cut test could be carried out.

The temperature we used was lower than those used in previous tests carried out on *Lonicera* seeds (Baskin et. al. 2002)**.** For the germination treatment we selected a temperature of 15°C/59°F. During the germination period we selected the low temperature to control the growth of fungi and also because we were unaware of any potential secondary dormancy problems which we didn't want to trigger (this can happen at high temperatures). Research on other seed types at the Danish Institute of Agricultural Sciences has also shown that embryos grow faster at 15°C/59°F than at 20°C/68°F. There was no sorting of the seeds we used for the test, and a cut test on nontreated, nongerminated seeds showed that only half of the seeds were actually viable. This means that with only 50% viable seeds the relatively low germination percentages shown in the figures are in fact high — our seed source was obviously of low quality, but it's a minor factor for the research itself.

In each test we had four replications of 25 seeds and the results are presented as average in percentages. Based on standard deviations (not shown in Fig. 1) we were not able to conclude 12 weeks cold as being better than 8 weeks cold. However, we can see that a cold treatment affects the germination percentage (Fig. 1). We also showed that after both warm and cold stratification treatments germination

percentage was not improved with added warm stratification (Fig. 2).

Figure 2 shows the accumulated germination over time for the cold-stratified seeds.

Our control test (no cold) shows 25% germination (highest 44, lowest 12) whereas we obtained as high as 41% (12 weeks cold) (highest 56%, lowest 36%) after treatment. Sixteen weeks of cold stratification was found not to be beneficial for germination; both speed and rate of germination went down.

It is clear that germination improves with cold treatment which is important with regards to production. Twelve weeks chilling had the highest gemination percentage (approximately 32%) after 1 week and reached a maximum of 41% at 3 weeks. A common factor noted for all the cold-treated seeds was that the speed of germination generally is better than for the control treatment and the warm-treated seeds.

During our test with warm stratification prior to cold stratification we found that seeds tend to germinate during the period of warm treatment as in the control. Hence, a warm treatment is difficult to use, as some seeds germinate. A solution might be seed priming prior to warm stratification which we did not do.

After the germination period we conducted a cut test on nongerminated seeds to determine whether they were empty, dead, or viable. The cut test for control seeds showed that 4% were empty, 40% were dead, and 31% of the seeds were alive,. If we add the 31% of seeds that were viable but didn't germinate to the 25% that did germinate, we get 56%. Therefore, 56% were viable. The cut test of the stratified seeds showed that the percentage of viable seeds is between 1% and 10%, lowest in the two long periods of cold stratification. Few seeds were empty and 40% to 50%

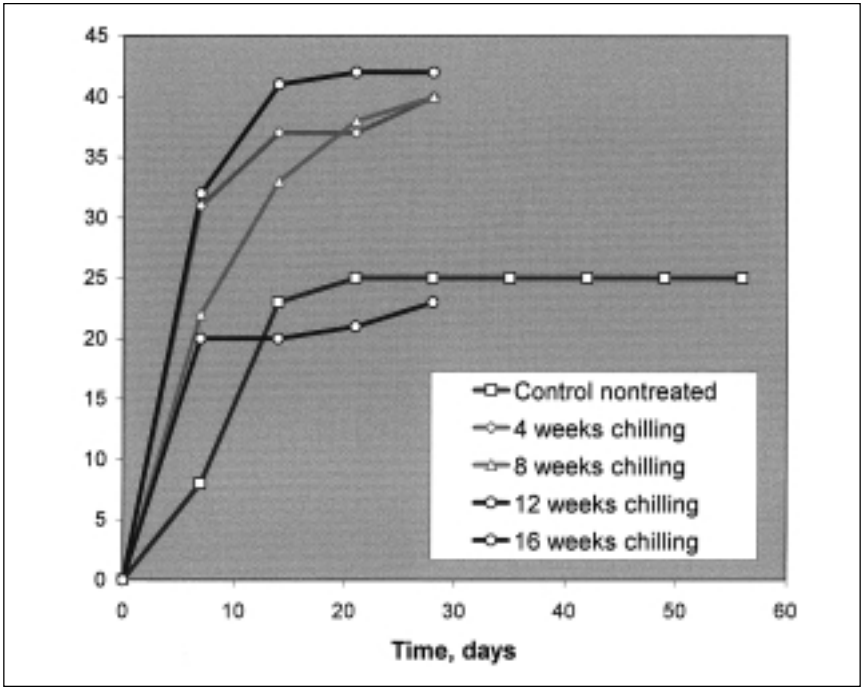

Figure 1. Effect of length of cold stratification on germination of *Lonicera involucrata* var. *ledebourii* seed.

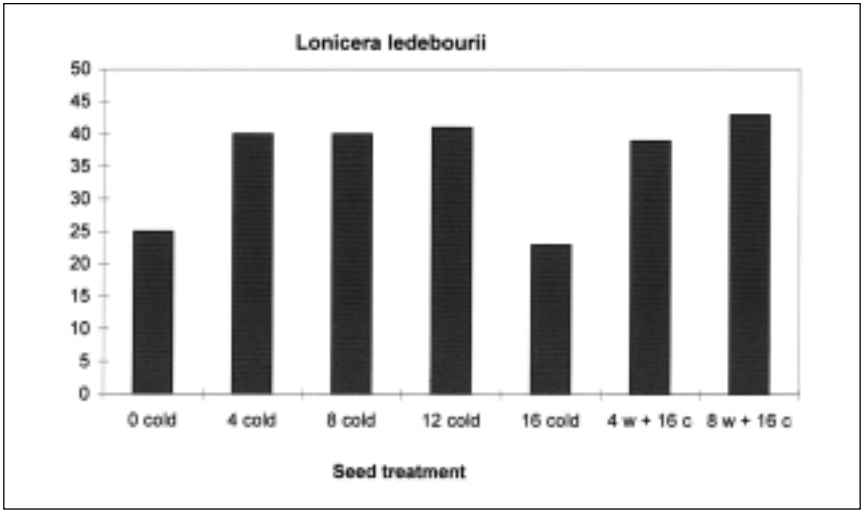

Figure 2. Effect of warm stratification prior to cold stratification on germination of *Lonicera involucrata* var. *ledebourii* seed.

were dead. These results match the control. It seems that close to half of the seeds were unable to germinate. Seeds that were warm stratified had a higher rate of viable but nongerminated seeds. Also, when viewed under a microscope, we could see that the embryo was longer (more elongated) in the seeds that had been warm treated. This showed that embryos do develop during warm stratification but they need a cold period to germinate.

CONCLUSION

We can conclude that cold stratification improves both germination percentage and speed of germination. We have also shown that a cold stratification of 4 to 12 weeks is best for the seeds. Generally, I find that warm stratification is not worth the effort, as it doesn't improve the speed or rate of germination above that of a simple cold stratification.

Before establishing seed production of *L. involucrata* var. *ledebourii* we still need to investigate if this introduced shrub will become invasive. We also need to document the quality of the shrubs in shelter belts. The plant is extremely vigorous and able to disperse by seed. It could spread extensively and become dominant in the Danish landscape. In Denmark we have several invasive species (hogweed, Norway maple) that have been introduced and since become a large problem. It is very important to know exactly how aggressive *L. involucrata* var. *ledebourii* is before releasing it in our environment.

LITERATURE CITED

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