Seed germination studies of *Vitex agnus-castus*©

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INTRODUCTION

Vitex agnus-castus, also known as the chaste tree, is a plant that is grown for its ornamental qualities such as its delicate-textured, aromatic foliage and spikes of lavender flowers that bloom mid- to late-season and attract butterflies. It is also a plant that deer will not eat. *Vitex* is a shrub that grows 5 to15 ft tall with a spread of 15-20 ft and is winter-hardy to USDA Zone 7. The leaf of this deciduous plant is palmately compound, lanceolate shaped with pinnate venation and is bluish-green to green in color (Gilman and Watson, 1994). The *Vitex* plant was recently applauded by the nursery industry as a useful landscape plant, however, there are breeding opportunities to improve the ornamental value of this plant (Dirr, 2015). *Vitex* would benefit from additional breeding in order to develop new characteristics such as a more compact growth habit and additional flower colors.

The long-term goal of this research is to breed and improve *Vitex agnus-castus*. However, the first part is to understand the seed physiology of this plant. The objective of this research was to determine if there are dormancy requirements for the successful germination of seeds from *Vitex agnus-castus* (Bewley and Black, 1982).

MATERIALS AND METHODS

Several experiments were designed to investigate if there are exogenous or endogenous dormancy requirements for the germination of *Vitex agnus-castus* seeds. Five experiments were designed to examine stratification, scarification, scarification + stratification, gibberellic acid treatment, and scarification + gibberellic acid.

1) For stratification, 20 seeds per replication were wrapped in moist paper towels and placed in plastic bags. The bags of seeds were placed in a refrigerator (4°C) for either 4 or 8 weeks. After their treatment, seeds were removed, sown in germination medium in the greenhouse, and evaluated for percent germination.
2) For scarification, 20 seeds per replication were soaked in concentrated sulfuric acid for either 1 or 2 h. After scarification, the seeds were rinsed thoroughly with distilled water to stop the scarification process. The seeds were then sown in germination mix and placed in the greenhouse until germination.
3) For seeds that might have double dormancy, there was an experiment that examined both scarification and stratification. For each replication, 20 seeds were scarified as described in 2 above then they were wrapped in moist paper towels and placed in plastic bags. The plastic bags were placed in the refrigerator (4°C) for either 4 weeks or 8 weeks before the seeds were sown in germination mix and placed in the greenhouse for germination evaluation.
4) For the gibberellic acid test, 25 seeds per replication were soaked in different concentrations of gibberellic acid (GA_3) for 24 h. The concentration tested were 250 ppm, 500 ppm, and 1000 ppm. There were two controls in the experiment: one control was distilled water and another was 19% ethanol. After 24 h, the seeds were sown in germination mix and placed in the greenhouse to germinate.
5) The final experiment tested the effects of both gibberellic acid and scarification on seed germination. For this experiment, 20 seeds per treatment were scarified with concentrated sulfuric acid for different scarification times of 15, 30 and 60 min. After scarification, the seeds were soaked in gibberellic acid (GA_3) with a concentration of 5000 ppm for 24 h before the seeds were sown in germination mix and placed in the greenhouse.

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RESULTS

The best seed germination from the stratification and scarification experiments was 30% for the seeds that were stratified for 4 weeks (Figure 1). The second best germination rate was 20% for seeds that were scarified for 1 hour followed by either 4 weeks or 8 weeks of stratification. The worst treatment, with no germination, was scarification for 2 h followed by 4 weeks of stratification. The second worst treatment for germination was the scarification for 2 hours (Figure 1).

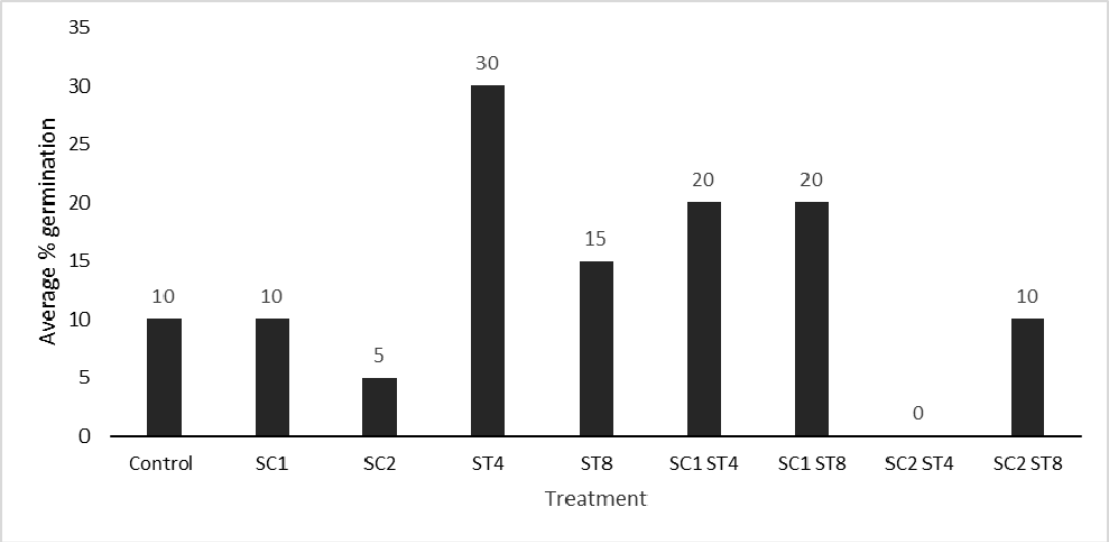

Figure 1. Comparison of different seed treatments to assess dormancy requirements for *Vitex agnus castus*. Seeds with no pretreatment before sowing (control) were compared to those that had been scarified for 1 h (SC1), scarified for 2 h (SC2), stratified for 4 weeks (ST4), stratified for 8 weeks (ST8), scarified for 1 h followed by 4 week stratification (SC1 ST4), scarified for 1 h followed by stratification for 8 weeks (SC1 ST8), scarified for 2 h followed by 4 weeks stratification (SC2 ST4), and scarified for 2 h followed by 8 weeks of stratification (SC2 ST8).

The application of gibberellic acid to *Vitex* seeds did not improve germination when compared to the control seeds (Figure 2). Seeds that were treated with 250 ppm and 500 ppm GA_3 had no better germination percentage than the control seeds. Seeds that were treated with ethanol or 1000 ppm GA_3, did not germinate.

Seed scarification combined with gibberellic acid treatments had some interesting results. The best germination of *Vitex* seeds was obtained during this experiment, however the treatments were not significantly different from the control seeds (Figure 3).

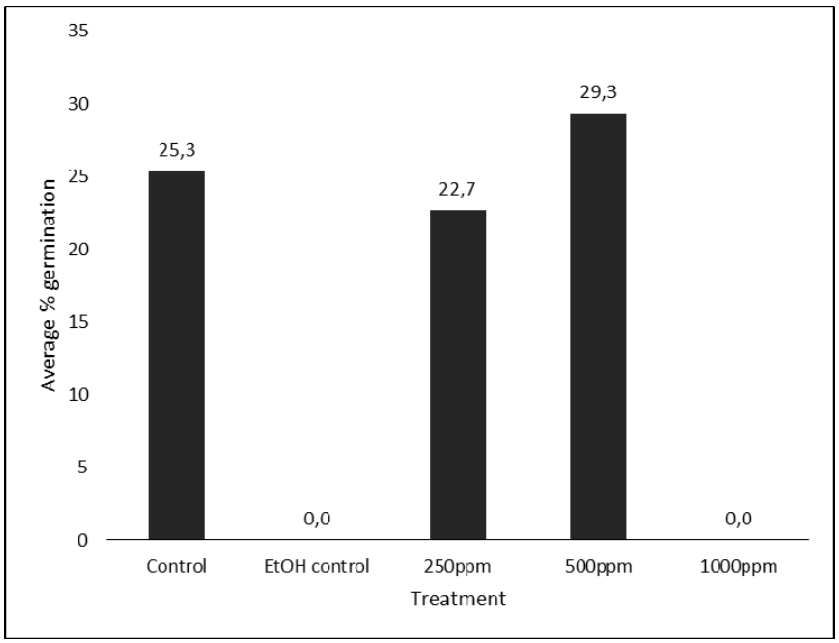

Figure 2. Effect of different rates of gibberellic acid (GA_3) or ethanol on the percent germination of *Vitex agnus-castus* seeds.

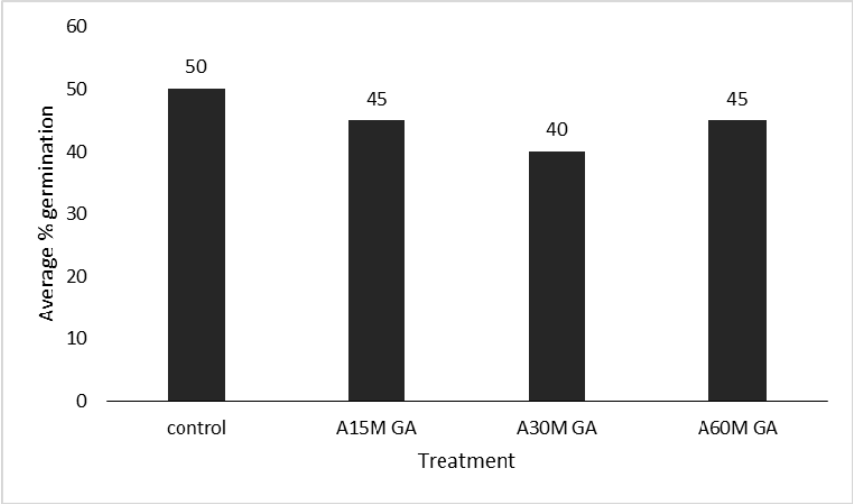

Figure 3. Average percent germination of *Vitex agnus-castus* seeds when soaked in 5000 ppm gibberellic acid (GA_3) followed by scarification for 0 minutes (control), 15 minutes (A15M GA), 30 minutes (A30M GA), and 60 minutes (A60M GA).

SUMMARY

There are many factors that affect seed germination and this research demonstrated that there is more to learn before the factors that are necessary for uniform and reliable seed germination of *Vitex agnus-castus* are fully understood.

These experiments demonstrated that the factors that affect seed germination of *Vitex* are unclear and complex. The seeds responded to scarification, stratification, and gibberellic acid treatments. This suggests that there might be a dormancy factor that plays a role in the germination of their seeds. However, the greatest average percent germination of all treatments was only 50%. When all of the different treatments (Figures 1-3) were compared, it appears that some conclusions can be made: (1) scarification of the seeds for 2 h is too long, (2) treating seeds with ethanol or 1000 ppm GA_3 is not beneficial, (3) there

may be a benefit to treating the seeds with GA_3, and (4) stratification may also be beneficial for enhancing germination.

Because no treatment produced superior and consistent seed germination, no definite and final protocol for treatments of *Vitex agnus-castus* seeds can be outlined. Although there were two sources of fresh seeds that were used for these experiments, it is assumed that the seeds did not have a high level of viability. It is possible that the flowers on *Vitex* plants do not produce large numbers of viable seeds.

Literature cited

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