Propagation of Some Underused North American Woody Taxa©

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INTRODUCTION

Ornamental attributes of many native shrubs and small trees have been recognized, but some taxa remain rare in commerce, and little information on propagation is available. Availability of plants for restoration projects also remains limited while the demand for propagules for such projects is on the rise. Many species with horticultural merit also have become rare in the wild, in part due to destruction of their natural habitat for anthropogenic use, and at times because of overcollection of wild plants from natural areas. Such losses prevent horticultural assessment of native plants and increase our reliance on non-native species that do not reflect a region's natural heritage, may become invasive, or may introduce pests and pathogens. Use of native plants in natural and managed landscapes can help contribute to preserving the overall biodiversity and the within-species genetic diversity of indigenous taxa while providing attractive alternatives to the more common, homogeneous landscapes.

Approximately two-thirds of North American woody species exhibit some form of seed dormancy (Schopmeyer, 1974), and inhibitors to germination can develop at various times during seed development (Bradbeer, 1988). Hormones are often used to induce or improve germination among seeds of many plants. On the other hand, hormones (especially, auxins) also induce adventitious rooting of stem cuttings of a number of woody plants. Physiological developmental stage of the cuttings can influence root production in many woody species.

Over the years, we have studied propagation (asexual and sexual) of several woody species native to North America. Herein we present results of our assessment of germination and rooting of stem cuttings of selected taxa: *Leitneria floridana* Chapman, *Rhamnus alnifolia* L'Her, *R. lanceolata* Pursh subsp. *lanceolata*, *R. caroliniana* Walt., yellow-flowered cultivars ('Ivory Chalice' and 'Yellow Lantern') derived from *Magnolia acuminata* L., and *Dirca palustris* L.

MATERIALS AND METHODS

Plants of *L. floridana* form thickets or small trees in standing water, non-tidal or brackish marshes and swamps, wet prairies, and swamp woodlands in disjunct populations in Florida, Georgia, Texas, Arkansas, and Missouri. *Leitneria floridana* has potential in horticultural commerce because of its attractive tropical-looking foliage, patterned bark, and an affinity for poorly drained soils (Koller, 1997).

Drupes were collected from naturally growing plants in Missouri, Arkansas, Texas, and Florida. Pre-germination treatments (fully described in Sharma and Graves, 2004a) included various collection times, excision of the seed from the drupe, various methods of scarification, submersion in hormone solutions, and no treatment.

The genus *Rhamnus* L. (buckthorn) includes several attractive species which are indigenous to North America. *Rhamnus alnifolia* is a simple or slightly forking low, understory shrub, typically distributed in calcareous streambeds, swamps, low woods, and meadows lying to the east of Cascades, from British Columbia east to Quebec and Maine, and south to California, Iowa, Illinois, and West Virginia (Fernald, 1950). Drupes were collected from plants growing in Vilas County and Marinette County in Wisconsin and were subjected to various cold-stratification treatments, a combination of scarification and cold-stratification treatments, or no treatment (Sharma and Graves, 2004b). Softwood cuttings of *R. alnifolia* were treated with indole-3-butyric acid (IBA) or left untreated (Sharma and Graves, 2004b). Another member of the genus, *R. lanceolata*, can grow up to 3 m in a variety of habitats including open wooded slopes, thickets and borders of woods, or on rocky limestone or dolomite glades (Gleason and Cronquist, 1991). Its natural distribution extends from Alabama to Texas, north to central Pennsylvania, West Virginia, Ohio, Indiana, southern Wisconsin, southern Iowa, Nebraska, and south-eastern South Dakota (Fernald, 1950; Kurz, 1997). Drupes were collected from plants growing in a calcareous fen in Kendall County, Illinois. Various cold-stratification and scarification treatments, in addition to an untreated control, were tested to induce germination (Sharma and Graves, 2004b). Plants of *R. caroliniana* form shrubs or small trees that may grow to about 11 m in height (Kurz, 1997). The species is native to the south-eastern and south-central United States, occurring as far north as extreme southern Ohio and central Missouri and south to central Florida and southern Texas. Often found in low areas near water and on elevated ridges and glades (Kurz, 1997), plants exhibit a stratified branching pattern, glossy dark green leaves that become yellow, orange, and red in autumn, and drupes which change color over time (Graves, 2001). Softwood cuttings were used to assess the effects of IBA, juvenility, and position on ortets on adventitious root production (Graves, 2002). Demand for yellow-flowered selections of *Magnolia* has increased consistently, and a large number of hybrids have the native, yellow-flowered *M. acuminata* as one of the parents (Dirr, 1998). Because stem cuttings of *M. acuminata* do not root easily, many of the yellow-flowered hybrids also carry this trait. The effects of IBA and collection date (weeks after budbreak) on the rooting of stem cuttings of 'Ivory Chalice' and 'Yellow Lantern', were tested (Sharma et al., 2006).

Another underutilized North American species is *D. palustris*. Plants are small trees or large shrubs with distinctive leathery bark and light green leaves that emerge very early in spring before most other shrubs leaf out. Leaves turn clear yellow in the autumn offering an effective fall color in the landscape. Plants thrive in moist to wet, shady areas and prefer a deep soil on well-drained slopes in their natural habitat. Small, yellow flowers are borne on leafless stems early in the spring (Dirr, 1998). Seeds were collected in Iowa and treated with combinations of seed excision, hormone treatment, and cold-stratification, or no treatment (Schrader and Graves, 2005).

RESULTS AND DISCUSSION

Leitneria floridana. Provenance differences in seed germination were observed. Removal of the surrounding tissues and a subsequent treatment with 750 mg·L^{-1} GA_3 improved germination of seeds from Florida (32% germination) over all other treatments. Leaching of the whole drupes with warm water and subsequent treatment with GA_3 increased germination to 21% in comparison to control treatment whereby 2% of the seeds germinated. Germination was below 3% among seeds from Missouri and was likely due to the poor condition of the seeds at time of collection. Survival was higher among seedlings originating from leached whole drupes in comparison to those obtained from excised seeds. Green, fleshy drupes from Texas treated with H_2SO_4 and subsequently submerged for 24 h in 1000 mg·L^{-1} GA_3 achieved 48% germination. Green drupes from Arkansas and Missouri showed highest germination (up to 29%) when excised seeds were treated with 750 or 1000 mg·L^{-1} GA_3. This study demonstrated that germination of freshly harvested and stored seeds of *L. floridana* can be improved considerably by using combinations of mechanical and chemical treatments.

***Rhamnus* Species.** Seeds of *R. alnifolia* collected late in summer and stratified for 30 days germinated to 48%, but germination was low (≤ 13%) among cold-stratified seeds collected in mid season. Untreated seeds did not germinate, nor the seeds that were scarified with sulphuric acid or hot water and subsequently stratified. It is conceivable that shorter scarification periods might be more beneficial in causing abrasion of the seed coat without damaging the embryonic tissues. Germination among seeds of *R. lanceolata* was ≤ 5% and occurred only after seeds were stratified for at least 90 days. It is possible that further maturation on the mother plant was required or that the seeds were non-viable at the time of collection. Rooting among softwood cuttings of *R. alnifolia* was 85% within 35 days after application of 3 g·kg^{-1} or 8 g·kg^{-1} IBA in talc. When IBA was applied in solution at 3 and 8 g·L^{-1}, rooting was ≤ 15%. While 75% of the untreated cuttings produced roots, fewer roots formed in the absence of hormones. Position (terminal vs. subtending) of cutting on the donor plant did not affect rooting. We recommend talc-based IBA to induce root formation on terminal or subtending softwood stem cuttings of *R. alnifolia.* Among the stem cuttings of *R. caroliniana*, rooting ≥ 75% resulted when IBA at 3 or 8 g·kg^{-1} was applied unless the cuttings were from terminal positions on mature ortets (stock plants). Juvenile cuttings with IBA at 8 g·kg^{-1} formed the most primary roots and developed root systems with greatest weight. Dry weight of roots on subtending cuttings from juvenile ortets was four times greater (25.6 g) than that of juvenile, terminal cuttings. Fewer than 10% of cuttings not treated with IBA rooted.

***Magnolia* (Cultivars 'Ivory Chalice' and 'Yellow Lantern').** Interaction between collection date and IBA concentration was not detected. Harvest date did not influence rooting of 'Yellow Lantern', which ranged from 44% to 59%. Cuttings of 'Ivory Chalice' collected 7 or 9 weeks after budbreak rooted more frequently (63% and 56%, respectively) than those collected 11 weeks after budbreak (25%). Application of IBA, regardless of the rate (8, 16, or 30 g·kg^{-1} IBA), also improved rooting. To maximize rooting among these two cultivars, terminal cuttings should be collected within 5 to 11 weeks after budbreak and should be treated with 16 or 30 g·kg^{-1} IBA in talc.

Dirca palustris. Cold stratification for 10, 15, and 20 weeks increased emergence of seedlings compared to cold stratification for 0 or 5 weeks. After a cumulative 30 weeks of stratification, 2.9% emergence was recorded, but 53.1% of the ungerminated seeds remained viable (as determined by the tetrazolium viability test). In another experiment, pre-treatment with GA_3 at 500 and 1000 $mg \cdot L^{-1}$ of excised seeds and subsequent 30-day stratification resulted in 36% and 22.7% germination, respectively, over 2.9% germination achieved with control treatment. Application of GA_3 at 50 $mg \cdot L^{-1}$ to excised seeds and subsequent 30-d stratification resulted in up to 68.2% germination among seeds of *D. palustris*. Seed germination in this species appears to be inhibited by dormancy, and removal of the hard endocarp increases germination percentages. Chemical treatment with GA_3 followed by cold-stratification further improves germination.

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