Tumbling For Seed Cleaning And Conditioning[1]

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ABSTRACT

Small rock tumblers can be used to clean and condition seeds both in an aqueous and a dry mode. During the process, grit and gravel remove fruit pulp and abrade seed coats. Wet tumbling of seed aids imbibition, leaches water-soluble germination inhibitors, and may partially substitute for cold stratification for some shrub seed lots.

Key Words:

Oleaceae, *Forestiera pubescens* var. *pubescens*, New Mexico olive, Plantanaceae, *Platanus wrightii*, Arizona sycamore, Grossulariaceae, *Ribes aureum, Ribes cereum*, Solanaceae, *Lycium torreyii*, wolfberry, Cornaceae, *Cornus sericea* ssp. *sericea*, redosier dogwood

Nomenclature:

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Introduction

At the Los Lunas Plant Materials Center in New Mexico, we use small, hobby-size rock tumblers to accomplish a number of seed cleaning and seed conditioning treatments. The principal application of the tumbler has been maceration of dried or hydrated fruit pulp. We commonly use it to remove pulp from dried New Mexico olive (*Forestiera pubescens* Nutt. var. *pubescens* [Oleaceae]) fruits. The fruits collected in late summer or fall after the pulp has dehydrate and adheres tenaciously to seeds. A wet tumbling procedure employing pea gravel/crushed stone and water in a rubber lined tumbler vessel allows the rehydration of the pulp an slow abrasion of pulp from seeds. The amount of water is minimized so that the gravel and fruit makes a slurry. This method is not quick, but the tumbler can be run overnight and check the following day. After a course of tumbling, the contents dumped into a sieve and the pulp is washed off, leaving clean seeds. The tumbling process is repeated until clean seeds achieved (Figure 1).

Figure 1: The pulp of naturally dehydrated fruits (top) of New Mexico olive can be removed using a rock tumbler, leaving extremely clean seeds (bottom).

Another cleaning application involves removal of fine hairs attached to achenes of Arizona sycamore (*Platanus wrightii* S. Wats. [Platanaceae]). The dry fruiting heads are crushed under water to partially liberate the achenes while preventing and fine hairs from becoming airborne (Figure 2). A slurry achenes with pea gravel is tumbled and the hairs detach time and can be separated using sieves and strong sprays of water. In addition, the wet tumbling thoroughly imbibes seeds and may leach out water soluble germination inhibitors. After cleaning and imbibition, seeds are typically cold stratified.

Dry tumbling to scarify legume seeds has been investigated, (Bonner and others 1974; Dreesen and Harrington 1997). The rationale for dry tumbling is to avoid seed destruction that can readily occur with sulfuric acid, boiling water, and high energy impact mechanical scarification treatments. Dry tumbling is a slow process taking several days to a week, but we often use it when we have small seed lots we do not want to risk with other scarification treatments. The procedure uses carborundum grit (sold by rock tumbler dealers), pea gravel, and seeds. After tumbling, scarified seeds are separated from the grit and gravel with sieves. The grit can also be reused by washing the seed coat debris through a fine sieve or by floating off the debris and then drying the grit. Different size grits are available and we typically use fairly coarse material. Coarse grit size is still much smaller than most legume seeds, allowing the easy sieve separation of grit, seeds, and gravel.

Wet tumbling can be used for scarification if an abrasive (typically pea gravel) is incorporated in the seed and water slurry (Dreesen and others 2002). The force imparted to the grit by the tumbling gravel facilitates abrasion. Although this treatment method may result in some seed coat degradation, other effects may be more important, such as assuring com- plete imbibition in well-aerated water and the leaching of water soluble germination inhibitors in the seed coat. A typical treatment would involve wet tumbling for several days to a week with daily changes of water.

Figure 2: At the Los Lunas Plant Materials Center, dry fruiting heads of Arizona sycamore, seen lower left, are crushed under water in a large pan. The hairs agglomerate into balls (gray sieve in foreground). A slurry of achenes and pea gravel are tumbled in the rock tumbler to dislodge the hairs. Finally, the achenes, hairs, and pea gravel are separated with soil sieves with the cleaned achenes visible in the brass sieve (background).

For a few species, wet tumbling may partially substitute for a cold stratification requirement. Two currant species (*Ribes aureum* Pursh and *R. cereum* Dougl. [Grossulariaceael]) and wolfberry (*Lycium torrey*ii Gray [Solanaceae]) generally require 2 to 3 m of cold stratification to achieve acceptable germination. Wet tumbling followed by 1 to 2 wk of storage in a warm moist environment has resulted in germination without cold stratification. The dry seeds of another important riparian species, redosier dogwood (*Cornus sericea* L. ssp. *sericea* [Cornaceae]), generally require 1 h scarification in concentrated sulfuric acid and then 2 to 3 mo of cold stratification for acceptable germination. Using fresh fruit with hydrated pulp, rapid germination has been achieved by wet tumbling the fruit with 1 to 2 cm (0.5 to 0.75 in) gravel. Most of the pulp is removed in the first day of tumbling and separated by screening and float/sink manipulations in water. After pulp removal, seeds are wet tumbled for several more days with daily water changes. The imbibed seed is then stored in a warm moist environment; germination starts in about 7 to 10 d and continues for several weeks. Although a limited number of species have been tested with wet tumbling for seed conditioning, additional species may benefit from this treatment.

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