Germination of *Cornus canadensis* Seed

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INTRODUCTION

Cornus canadensis (bunchberry or dwarf cornel) is a Pacific Northwest native perennial that attains a height of 7 to 20+ cm (3 to 9+ in) and spreads by subsurface stems Bunchberry ranges from Greenland across northern Canada to Alaska and as far south as Maryland, South Dakota, New Mexico and California (Dirr 1990; Schopmeyer, 1974). This low-growing, herbaceous plant generally grows best in moist, shady areas but tolerates drier shady areas also. It has few pest problems.

Bunchberry flowers are small, greenish-white terminal clusters, subtended by four showy white bracts borne in a fashion similar to *Cornus florida* and *C. kousa*. The fruits are 1/4 in. scarlet clusters of drupes, ripening in August and continuing to be effective into the winter. Autumn color is light red to crimson.

Propagation has been by digging mats of the material, seed, and more recently, by tissue culture (Dirr and Heuser, 1987; McMillan-Browse, 1979; Bruce Briggs, Briggs Nursery, Olympia, Washington, personal communication) Propagation of bunchberry by seed seems to be the method of choice for the small grower It has been reported that the seed has a double dormancy in this species caused by a physiologically dormant embryo and a hard impenetrable endocarp (Schopmeyer, 1974). The hard seed coat normally delays germination until the second spring after maturity (McMillan-Browse, 1979), but germination may be enhanced by a sulfuric acid treatment followed by cold stratification, or 3 to 5 months warm stratification followed by 3 months of cold (Dirr and Heuser, 1987, McMillan-Browse, 1979).

Seed coat dormancy occurs when the seed coat is impermeable to water or gas exchange, or when the seed coat offers mechanical resistance to seedling emergence. In nature, hard seed coats are normally degraded by microbial decomposition (McMillan-Browse, 1979). Artificially the seed coat may be softened, eliminated, or rendered ineffective by hot water, concentrated sulfuric acid, mechanical scratching, mechanical removal, or warm-moist stratification (microbial decomposition). Warm-moist stratification is also used to mature a rudimentary embryo (Dirr and Heuser, 1987; Hartmann and Kester, 1983). Physiologically dormant embryos may be induced to germinate by cold-moist stratification, or by soaking in a gibberellic acid (GA_3) solution (Hartmann and Kester, 1983).

Growers in Washington have reported difficulty in germinating bunchberry seed even though the seed was considered viable. This research was designed to determine some of the factors affecting bunchberry seed dormancy and to attempt to use these procedures to afford quick, uniform germination in nursery practice

MATERIALS AND METHODS

Seeds of *C. canadensis* were collected from a native stand in the Cascade Mountains about 22 miles east of Enumclaw, Washington on the south side of State Route 410. The seed was separated from the pulp by maceration, floatation, and decantation. The floatation and decantation procedure was repeated many times

because of the mucilaginous nature of the slurry which resulted from the first maceration. The cleaned seed were stored at 4°C until used.

Seeds were separated into 5 replications of 18 seeds each and sown in a sterile, moistened peat-lite mix in 8 5×13×6 cm plastic containers. A 2×4×2 factorial set of treatments in a completely random design was applied as follows: scarification in concentrated sulfuric acid for 0 or 30 min; 24 hour gibberellic acid (GA_3) soak at 0, 100, 500, or 900 ppm, and cold, moist stratification at 2 to 4°C for 60 or 120 days. All treatments were put under mist on 18 July, 1986. The mist was on from 0900 to 1500 every 30 min for 30 sec. Percent germination and mean days to germination were recorded. Germination percentages were arc-sine transformed for statistical analysis. Analysis of variance (ANOVA) was performed on the data (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

ANOVA results for germination percentage and mean days to germination indicated both two and three factor interactions were significant. Because of this, ANOVA was done by factor for each of the three factors in this experiment. When the F-test was significant, a t-test was used to compare GA_3 treatments. In general, treating bunchberry seed with GA_3 enhanced percent germination (Table 1). Within a GA_3 treatment and a cold stratification treatment, sulfuric acid had either no significant effect or decreased germination percentage The difference in germination percentage between the 120 day and 60 day cold with 30 min acid scarification was significant; however, with no acid scarification, the cold treatment difference was significant only in the 100 ppm GA_3 treatment.

Table 1. Effect of cold stratification, sulfuric acid scarification, and gibberellic acid (GA_3) on the germination percentage of bunchberry seed

	60 day cold		120 day cold		0 min acid[y]	30 min acid
	0 min	30 min	0 min	30 min	120-60 cold	120-60 cold
0 GA_3	26 7 a A[z]	0 0 a B	18 8 a A	4 5 a B	- 7 9 NS	4 5*
100 GA_3	21 1 a A	8 9 b A	40 0 b A	50 0 b A	18 9*	41 1**
500 GA_3	35 6 a A	24 4 c A	46 6 b A	45 6 b A	11 0 NS	21 2**
900 GA_3	41 1 a A	26 7 c A	47 8 b A	46 9 b A	6 7 NS	20 2*

[z] Means within columns followed by the same lower case letter are not significantly different at the 5% level, and means between sulfuric acid times within cold periods and GA_3 treatments followed by the same uppercase letter are not significantly different at the 5% level according to F-values and t-tests

[y] In the last 2 columns, the effect of cold treatment within sulfuric acid and GA_3 treatment is presented as the difference between the 120 day cold and the 60 day cold treatment means (120-60 cold) and the significance of the cold treatment is indicated as follows

** = significance at the 1% level, * = significance at the 5% level, NS = not significant

Mean days to germination (Hartmann and Kester, 1983) is an indicator of uniformity of germination. The longer the mean days to germination, the greater will be the size (age) difference between the seedlings. At the 100, 500 and 900 ppm

GA_3 levels in the 120 day cold treatment, sulfuric acid scarification decreased mean days to germination (Table 2).

Table 2. Effect of cold stratification, sulfuric acid scarification, and gibberellic acid (GA_3) on the germination percentage of bunchberry seed.

	60 day cold		120 day cold		0 min acid[y]	30 min acid
	0 min	30 min	0 min	30 min	120-60 cold	120-60 cold
0 GA_3	19 8 a A[z]	0.0 a B	15 8 a A	12 0 a A	- 4 0 NS	12 0*
100 GA_3	18.7 a A	14 2 b A	15.9 a A	12 9 a B	-2 8 NS	-1 3 NS
500 GA_3	16 5 a A	14 0 c A	15 3 a A	6 8 a B	-1 2 NS	-7.2**
900 GA_3	14 9 a A	13 5 c A	13 1 a A	6.0 a B	-1 8 NS	-7 5**

[z] Means within columns followed by the same lower case letter are not significantly different at the 5% level, and means between sulfuric acid times within cold periods and GA_3 treatments followed by the same uppercase letter are not significantly different at the 5% level according to F-values and t-tests

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** = significance at the 1% level, * = significance at the 5% level, NS = not significant

Cornus canadensis seed germination was enhanced by 120 days cold stratification The necessity of using sulfuric acid is questionable; however, it did reduce mean days to germination when used in conjunction with GA_3 and 120 days of cold stratification. *Cornus canadensis* has a physiologically dormant seed, but the role of the seed coat in germination needs further investigation.

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STEVE ADAMSON: Ray — what time of year did you collect your madrone seed and how did you clean the seed?

RAY MALEIKE: The seed was collected in early October We cleaned it in a Waring blender with the blades covered with Tygon tubing. This beat and macerated the pulp so the seeds could come out. By mixing, flotation, and decanting with water we got the pulp off and the seed would sink We would do the same thing with *Cornus canadensis* seed

VOICE: Did you have any problems with the seed germinating during the cleaning process?

RAY MALEIKE: We did not have any seed germination during cleaning, storage, or stratification. We stored the seed in plastic bags at 4°C. The seed would start germinating after about 3 days when they were brought out into warm conditions.

VOICE: What was your medium for growing the madrone seedlings?

RAY MALEIKE: Ground bark with a little sand in it. We just grew them along with the rhododendrons, azaleas, etc. We transplanted the seedlings at the second or third true leaf.

BRUCE BRIGGS: Ray, did you have any problems with fireblight?

RAY MALEIKE: No, we didn't have any problems in the greenhouse with either damping-off or fireblight, but once the plants were out in the field we started seeing some problems there But our soil is a heavy clay loam that does not drain very well, which may partially be the cause of some of these problems.

BRUCE BRIGGS: Question for Rita Hummel Would you comment on blooming in your *Kalmia* plants?

RITA HUMMEL: Some years they bloom heavily as they did this year, but they did not bloom last year in the field. It may be a more or less alternate blooming plant

WILBUR BLUHM: On the Willamette University campus at Salem just south of here they have quite a large planting of *Kalmia* and they have had excellent bloom now two years in a row.