Germination of Forest Range Species from Southern British Columbia

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Highlight

In the laboratory, seed of 10 out of 25 forest range shrubs and herbs germinated without either scarification or stratification. Stratification was required for 5 species and improved the germination of 10 others. Seventeen species germinated at 1 C after prolonged stratification; this characteristic would enable seedlings to become established ahead of tame grasses seeded in the spring.

Information on germination requirements is available for many of the forest shrubs (USDA, 1948) but little work has been done on most of the forest herbs of the douglasfir zone.

Germination tests conducted under controlled environmental conditions are useful in revealing and separating the various factors involved in breaking seed dormancy and in offering some insight into the germination requirements of plant species. It is recognized, however, that the results obtained in the laboratory cannot be interpreted for field conditions without extensive field testing. Such results do, however, permit the establishment of reasonable hypotheses.

Methods

The seed of 25 species (Table 1) was collected from different sites in the Kamloops area and stored in envelopes at the Research Station until tested. Usually the seed was tested during the winter following collection. Normally seed of fleshy fruits was threshed in a blender shortly after collecting.

Samples of all seed were tested in incubators at 21 C until all germination ceased over a 10-day period. If satisfactory germination percentage was not reached, samples were subjected to scarification or stratification treatments or both. Scarification was accomplished by dipping the seed into concentrated sulphuric acid for varying lengths of time. In the stratification treatments the seed was kept moist at 1 C for 30, 60, 90, 120, and 150 days.

Since temperature is an important environmental factor affecting the initiation and rate of germination, all seed lots were incubated at 1, 4.5, 10, 15, and 21 C. All seed was germinated on standard blue germination blotters saturated with distilled water in 10-cm petri dishes. The incubators used were BOD refrigerators kept at constant temperature (plus or minus 0.5 C about desired temperature). The incubators were unlighted but the seed received light during periods of counting.

In the light-requirement tests with dwarf blueberry (botanical names in Table 1) and huckleberry, light was excluded for 1, 3, 6, 9, 12, 15, 18, 21, and 24 days from the time the seed was moistened.

Normally two replicates of 100 seeds each were used per treatment and each test was repeated three times with different seed lots, generally in different years.

In tests requiring alternating temperatures, combinations of 30, 60, 90, 120, 150, 196 days were used.

Plant nomenclature follows that of Hitchcock et al. (1955).

Results

Seed of 10 of the species germinated without scarification or stratification (Table 1).

Among the species tested, scarification was necessary only for kinnikinnick although it shortened the time required for germination or increased the total in some cases. None of the seed of kinnikinnick could be germinated without scarification. The seed coat of this species was very hard and accepted 7 hours in concentrated sulphuric acid with only slight pitting. Seed of kinnikinnick, bunchberry, and rose that was threshed when harvested in the fall stood up to acid treatment considerably longer than that which was stored in fruit until ready for testing. Scarification of timber milkvetch, lupine, and purple vetch both improved the germination and shortened the period over which the seed germinated. This was particularly noticeable in milkvetch which although it would germinate without scarification did so gradually over a period of three months.

Only 5 species required stratification. For another 10 species stratification for 30 to 120 days either increased the total germination or shortened the total time required. Of the methods used to break seed dormancy the best results were obtained with continuous low-temperature treatments.

Stratification shortened the germination period of milkvetch but was not necessary if the seed was scarified.

Some species required alternations of temperatures to break dormancy. Kinnikinnick after many combinations yielded 34% germination when the seed was moistened and dipped in concentrated sulphuric acid for 7 hours, then kept 90 days at room temperature followed by 90 days at 1 C. Bunchberry germinated after being moistened and receiving 30 days at room temperature followed by 150 days at 1 C. Oregongrape germinated well (74%) after being moistened and kept 30 days at 1 C, 60 days at room temperature, and then 196 days again at 1 C.

Low temperature germination was common. Seventeen species showed upwards of 10% germination at 1 C after 120 to 150 days stratification. Saskatoon serviceberry, milkvetch, oregongrape, white hawkweed, and purple vetch, reached germinations of over 50% during lengthy stratification.

Dwarf blueberry and huckleberry were unusual in that they had to be exposed to light periodically during the entire pre-germination period for germination to take place. Both species required 18 to 21 days to germinate and would not do so unless exposed to at least intermittent light during the entire pre-germination period.

Discussion

One of the most interesting aspects of the results is the number (68%) of species germinating at low temperatures after prolonged stratification. Species that show this characteristic could presumably overwinter under snow and germinate in the early spring before or just after the snow disappears. This would enable the seedlings to become established ahead of tame grasses seeded in the spring. For this reason then fall seeding in the forest seems preferable. There is considerable evidence to indicate

Table 1. Response of 25 forest understory species to scarification and stratification treatments.

Species name		Stratification			Scar.	Low temp. germ'n		Max. germ'n
Common	Botanical	not needed	helpful (days)	needed (days)	not needed	(days)	(%)	(%)
Nodding onion	*Allium cernuum* Roth.	—	120	—	x	150	48	67
Sitka alder	*Alnus sinuata* (Regel) Rydb.	—	30	—	x	—	—	56
Saskatoon serviceberry	*Amelanchier alnifolia* Nutt.	—	—	120	x	120	84	98
Pussytoes	*Antennaria umbrinella* Rydb.	x	—	—	x	150	20	100
Kinnikinnick	*Arctostaphylos uva-ursi* (L.) Spreng.	—	90	—	—	—	—	34
Showy aster	*Aster conspicuus* L.	—	90	—	x	150	10	96
Timber milkvetch	Astragalus miser Dougl. ex Hook var. *serotinus* (Gray) Barneby	—	90	—	x	120	80	98
Pinegrass	*Calamagrostis rubescens* Buckl.	x	—	—	x	—	—	38
Bunchberry	*Cornus canadensis* L.	—	—	x	x	—	—	46
Blue wildrye	*Elymus glaucus* Buckl.	x	—	—	x	60	44	100
Fireweed	*Epilobium angustifolium* L.	—	30	—	x	—	—	38
Strawberry	*Fragaria glauca* (Wats.) Rydb.	x	—	—	x	—	20	78
White hawkweed	*Hieracium albiflorum* Hook.	—	90	—	x	120	50	96
Yellow hawkweed	*Hieracium umbellatum* L.	—	30	—	x	120	40	98
Creamy peavine	*Lathyrus ochroleucus* Hook.	x	—	—	x	120	24	100
Twinflower	*Linnaea borealis* L.	—	60	—	x	—	—	78
Lupine	*Lupinus arcticus* Wats.	x	—	—	x	90	12	94
Oregongrape	*Mahonia repens* (L.) G. Don	—	—	x	x	150	62	74
Yellow rattle	*Rhinanthus kyrollae* Chab.	—	—	60	x	90	22	24
Russet buffaloberry	*Shepherdia canadensis* (L.) Nutt.	—	—	60	x	120	37	68
Whitetop spiraea	*Spiraea betulifolia* Pall.	x	—	—	x	150	10	68
Richardsons needlegrass	*Stipa richardsonii* Link	—	10	—	x	150	27	100
Dwarf blueberry	*Vaccinium caespitosum* Michx.	x	—	—	x	—	—	96
Huckleberry	*Vaccinium membranaceum* Dougl. ex Hook.	x	—	—	x	—	—	80
Percent of total		40	40	20	96	68	—	—

that certain grasses can also germinate under the snow on mountain ranges. Bleak (1959) has reported such results with smooth brome and tall oatgrass and Hull (1960) with intermediate wheatgrass.

Low temperature germination is not uncommon. Dr. Lela V. Barton (personal correspondence, 1960) stated that "there are many seeds which will germinate at low temperatures. Among these are those of alpine forms. Dormant seeds of temperate-zone forms, especially trees and shrubs, will also germinate at the after-ripening temperature of 33 to 41 F if they are kept in a moist medium beyond the time required for dormancy".

Allen (1962) showed that extended stratification lowered the optimum temperature requirements for germination of douglasfir. McArthur and Fraser (1963) report similar results for white spruce and a number of eastern deciduous trees.

In the Kamloops area the soil surface in the douglasfir forest is normally covered with snow from 120 to 150 days. During this period observations made at the time of snow survey sampling for 10 years (end of January, February, and March) indicate that the soil is moist and not normally frozen and that soil temperatures usually vary from −1 to 1 C. These conditions provide suitable stratification and low-temperature germination conditions.

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