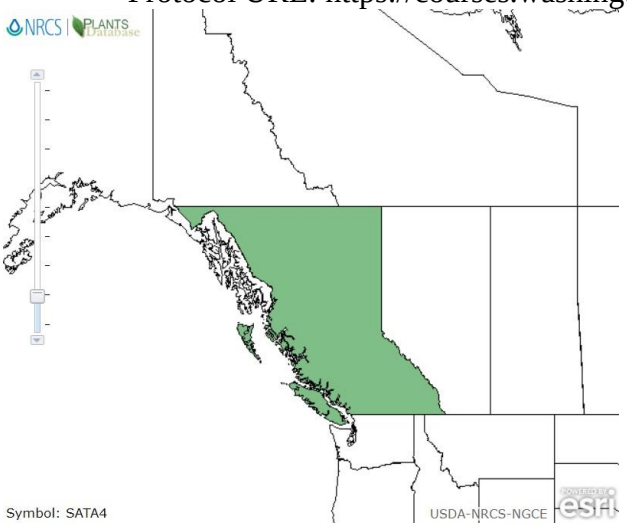
Plant Propagation Protocol for *Saxifraga taylori*

ESRM 412 – Native Plant Production

Protocol URL: https://courses.washington.edu/esrm412/protocols/SATA4.pdf



Distribution in the Pacific Northwest

Map by USDA NRCS PLANTS Database[1]

Photos graphs by Carita Burgman, sourced from https://inaturalist.ca/taxa/168475-Saxifraga-taylorii/browse_photos

TAXONOMY	
Plant Family	
Scientific Name	*Saxifraga taylori*
Common Name	Taylor's Saxifrage
Species Scientific Name	
Scientific Name	*Saxifraga taylorii* Calder & Savile

Varieties	N/A
Sub-species	N/A
Cultivar	N/A
Common Synonym(s)	*Saxifraga taylorii*
Common Name(s)	N/A
Species Code (as per USDA Plants database)	SATA4
GENERAL INFORMATION	
Geographical range	See map above for distribution in North America. Found exclusively in British Columbia, Canada, endemic to the Queen Charlotte Islands[2] and Northwest Vancouver Island[3]
Ecological distribution	Found on moist, talus slopes and rock outcrops above the tree line in areas with late snow[2,3]
Climate and elevation range	Alpine and subalpine. Typically found at elevations greater than 1500 ft, although can be found closer to sea level along the Western coast of Canada[2,3]
Local habitat and abundance	Grows on unstable rocky slopes in moist conditions at high elevations while not avoiding the exposed conditions of the uppermost slopes. Endemic to B. C., Canada, it is a rare species[2,3].
Plant strategy type / successional stage	Pioneer colonizer on unstable rocky slopes, often forming a mat, with vegetative offsets sprawling from the mother plant[2]. As with other alpine saxifrage species, vegetative reproduction is favored over sexual reproduction because the short, cold growing season limits the success of new individuals. Clonal reproduction also allows for continued survival if one or more of the ramets perishes[10].
Plant characteristics	Perennial forb[1] growing from a single taproot growing to be 12-16 cm tall. Flowers are saucer-shaped with 10 stamen and white, widely spaced petals 5-6.5 mm long with rounded tips. Spreading vegetative offsets or ramets sprawl loosely over the rocky surfaces where this species grows. Leaves are basal, alternate, 8-12 mm long, tricuspidate with three lobes at the tip, translucent margins, and bristle-like hairs. Fruits are capsules 4 to 6 mm long, with tiny black seeds 0.5 mm long, described to be "pimpled" in texture[2,3,4]. No information was found regarding flowering time for *S. taylori*, however Ogilvie[10] defines the growing season for alpine saxifrages as June to August and found for a closely related species that individual ramets will produce a flower bud at the end of their

	second season which blooms at the beginning of their third season. *S. taylori* is closely related to *S. vespertina, S. bronchialis, S. austromontana, S. tricuspidata,* and *S. funstonii*, but distinguished with larger flowers and unspotted petals. The genus *Saxifraga* is very diverse with inconsistent taxonomical organization by different experts. *S. taylori* has been placed in the broad sect *Trachyphyllum*, the more specific sect *Bronchiales* by Tkach *et* al., and alternatively categorized in a sect Coastal Cascadia alone with *S. vespertina* by DeChaine *et al* [6,9]. Little information on the propagation of *S. taylori* has exists to date, so techniques applied for some closely related species have been utilized in drafting this protocol.
PROPAGATION DETAILS: FROM SEED – DIRECT SOWING Adapted from protocol by Luna *et al.* for *Saxifraga bronchialis*[4], closely related to *S. taylori*	
Ecotype	Exposed rocky slope at 4600 ft elevation
Propagation Goal	Plants
Propagation Method	Direct Sowing - Seed
Product Type	Container (plug)
Stock Type	160 ml conetainer
Time to Grow	2 years
Target Specifications	At least 2 cm tall with tight cushion of basal leaves and a firm root plug
Propagule Collection Instructions	Collect capsules in fall when fruits have turned brown and split open. Put capsules in paper bags and store in a well-aerated drying shed.
Propagule Processing/Propagule Characteristics	Rub capsules by hand to remove seeds.
Pre-Planting Propagule Treatments	For *Saxifraga oppositifolia*, Deno[8] found that germination to be enhanced by applying gibberellic acid-3 (GA-3) to seeds before planting. He placed seeds in 70°F in the dark and found 85 to 90% germination in the third week, but emphasizes that further investigation should be conducted regarding this strategy. For *S. tricuspidata,* closely related to *S. taylori*[6], Deno observed germination in the second week in 70°F after three months of stratification in 40°F. In the protocol by Luna *et al.*, seeds are stratified after sowing in growing media and germination percentage

	is not reported under these conditions. As an alternative method, follow the protocol adapted from Densmore below for *Saxifraga tricuspidata* for seed germination in Petri dishes, which yielded a 100% germination rate in controlled environment growth chambers.
Growing Area Preparation / Annual Practices for Perennial Crops	Sow plants in late fall in an outdoor nursery in 160 ml conetainers in a seeding mix with a 6:1:1 ratio of sphagnum peat moss, perlite, and vermiculite. Apply 2 grams of slow-release macronutrient fertilizer (Osmocote with 13N:13P2O5:13K2O) and 0.2 grams of micronutrient fertilizer (Micromax with 12%S, 0.1%B, 0.5%Cu, 12%Fe, 2.5%Mn, 0.05%Mo, 1%Zn) per container. Seeds will then undergo 5 months of outdoor cold-moist stratification followed by 4 months of warm stratification while in the growing media.
Establishment Phase Details	Provide ample moisture before wintering. A Rainbird autonomous irrigation system was used in this protocol to saturate the growing media each day. The first emergence was observed in late summer.
Length of Establishment Phase	9 months from sowing to germination with an establishment phase of 4 weeks as defined by Luna *et al*.
Active Growth Phase	Take caution not to overwater seedlings after establishment.
Length of Active Growth Phase	8 weeks after initial emergence and 10 weeks the following year.
Hardening Phase	Slowly reduce the volume of water applied during the fall and cease watering during the winter.
Length of Hardening Phase	4 weeks
Harvesting, Storage and Shipping	Seedlings can be harvested from the conetainers in September of the second year after sowing when a firm root plug has developed. At this point, seedlings can be outplanted or transplanted into larger containers and stored in the outdoor nursery during the winter months
Length of Storage	5 months in nursery
Guidelines for Outplanting / Performance on Typical Sites	Not noted by Luna *et al*.
Other Comments	N/A
PROPAGATION DETAILS: FROM SEED IN PETRI DISH Adapted from protocol by Densmore for *Saxifraga tricuspidata*[4], closely related to *S. taylori*	
Ecotype	South-facing open, dry slope at 1190 m elevation
Propagation Goal	Plants
Propagation Method	Seed – in Petri dish
Product Type	Germinated seed

Stock Type	Bareroot
Time to Grow	2 years
Target Specifications	N/A
Propagule Collection Instructions	Collect seeds in late August to early September when capsules open.
Propagule Processing/Propagule Characteristics	Dry seeds for 24 to 48 hours at 20 to 22°C and freeze at -19°C for storage. Length of storage is not specified by Densmore.
Pre-Planting Propagule Treatments	Densmore found the highest germination percentage for unstratified seeds with a long-day photoperiod (22 hours light, 2 hours darkness). If facilities allow for photoperiod specificity as such, do not stratify seeds. Stratified seeds germinated at a higher percentage under a short-day photoperiod (13 hours light, 11 hours darkness), so seeds should be stratified if the long-day photoperiod conditions cannot be achieved. In this case, place seeds in cold stratification at 2 to 5°C for 88 to 93 days with a photoperiod of no more than 13 hours of daylight.
Growing Area Preparation / Annual Practices for Perennial Crops	Place 50 seeds in 10 cm plastic Petri dishes with tissue paper moistened with distilled water. Place in controlled environment growth chambers with fluorescent light tubes to manipulate temperature and photoperiod.
Establishment Phase Details	For unstratified seeds, set the photoperiod at 22 hours light and 2 hours darkness and set the temperature at 20°C (100% germination in Densmore's study). For stratified seeds, aim for a photoperiod of 13 hours of light and 11 hours of darkness and set temperature at 15°C (yielded 96% germination).
Length of Establishment Phase	21 to 24 days
Active Growth Phase	This study only monitored seed germination and does not include recommendations for post-germination care. If the petri dish method is preferred, follow the above instructions and then transplant germinated seeds into containers and follow the rest of the protocol adapted from Luna *et al.* for container seedlings.
Length of Active Growth Phase	See above.
Hardening Phase	See above.
Length of Hardening Phase	See above.
Harvesting, Storage and Shipping	See above.
Length of Storage	See above.
Guidelines for Outplanting / Performance on Typical Sites	Not noted by Luna *et al.* or Densmore.
Other Comments	N/A
PROPAGATION DETAILS: VEGETATIVE	

Adapted from protocol by Hagen for *Saxifraga oppositifolia*[7], found in a similar habitat to *S. taylori*	
Ecotype	High arctic, permafrost region on unstable gravel, riverside
Propagation Goal	Plants
Propagation Method	Vegetative
Product Type	Container
Stock Type	Container
Time to Grow	2 months if outplanting after initial rooting in fall, or 8 months after further establishment in spring.
Target Specifications	Not noted by Hagen
Propagule Collection Instructions	Collect in August from ten or more mother plants. Luna *et al.* advise collecting in spring or late summer. Make cuttings of 5 cm long from the outermost 10 cm of nonflowering[4] shoots, either sprawling or primary. Wrap propagules in wetted moss and place in plastic bags for transportation.
Propagule Processing/Propagule Characteristics	5 cm long
Pre-Planting Propagule Treatments	Do not store, plant no later than a few days after collection.
Growing Area Preparation / Annual Practices for Perennial Crops	Strike cuttings in 4x4 cm peat pots. Use a rooting media of peat soil with a 2:1 ratio of perlite.
Establishment Phase Details	N/A
Length of Establishment Phase	N/A
Active Growth Phase	House in greenhouse with fogging system which emits a steady supply of water vapor. Allow for natural light to penetrate the greenhouse with no artificial light source. Through the winter months, keep the temperature low between 0 to 4°C. From February to March, gradually increase the temperature to up to 22°C. These conditions yielded 90% rooting for *S. oppositifolia* by April. A supplement for this advanced system could be a polyethylene tent filled with saturated moist air, however this technique resulted in only 18% rooting for this species.
Length of Active Growth Phase	Initial rooting was observed two months after collection.
Hardening Phase	Keep greenhouse at between 0 and 4°C during the winter months. Rooting will be limited in the winter months during the cold winter months and continue in Spring and temperatures are raised.
Length of Hardening Phase	Not noted by Hagen.
Harvesting, Storage and Shipping	Plants can be harvested and outplanted either immediately after initial rooting 2 months after striking

	(November) or one can continue growing propagules in the greenhouse until spring and outplant in April, after further elongation and rooting has occurred.
Length of Storage	Not noted by Hagen.
Guidelines for Outplanting / Performance on Typical Sites	Not noted by Hagen.
Other Comments	N/A
INFORMATION SOURCES	
References	See list below
Other Sources Consulted	See list below
Protocol Author	Abigail Lovell
Date Protocol Created or Updated	05/27/20

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