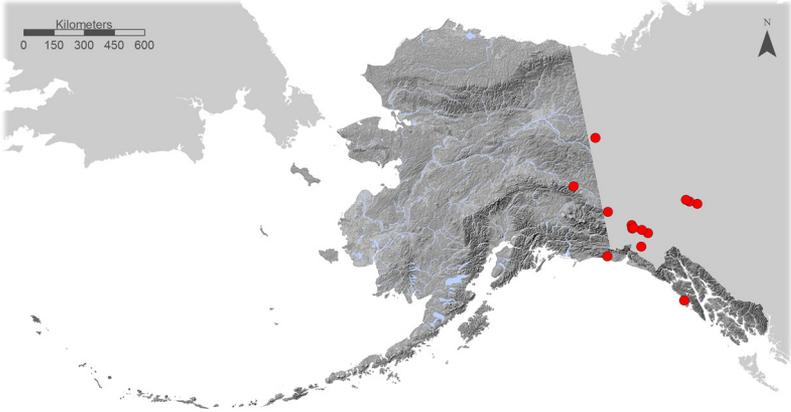


**Global Distribution:** Northwestern and northeastern North America with large gap between the two ranges.<sup>51</sup>

**Alaska Distribution:** Coastal Rainforests, Intermontane Boreal.

**Ecoregions Occupied:** Gulf of Alaska Coast, Alexander Archipelago, Tanana-Kuskokwim Lowlands.

**Conservation Status:** S1 G3; USFS Sensitive.



**Description**<sup>51, 52, 53, 54, 56</sup>

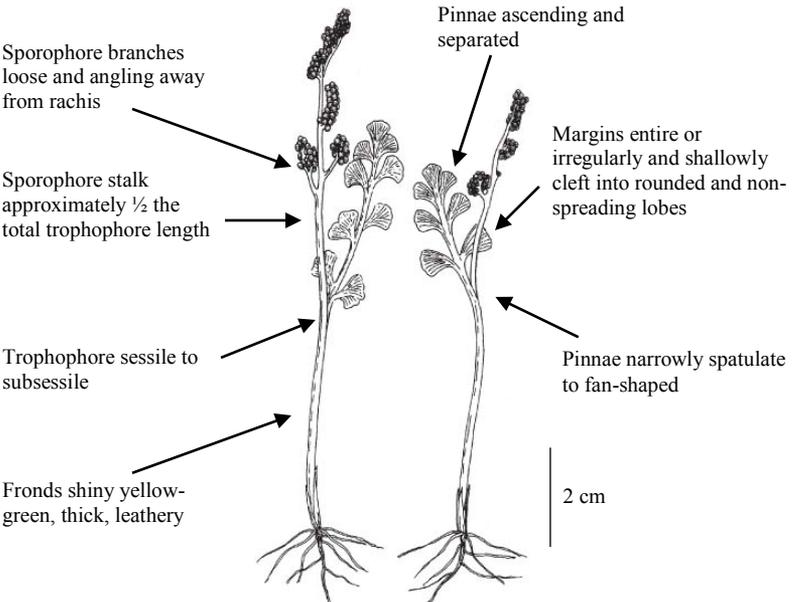


Illustration by Jane Lee Ling, courtesy of Province of British Columbia

*Botrychium spathulatum*

**General:** Frond divided into dissimilar vegetative blade (trophophore) and spore-bearing segment (sporophore); perennial, 1 to 10 cm tall; some atypical forms with irregularly cleft pinnae occur in Alaska, such as the plants from Kruzof Island in the Alexander Archipelago.<sup>57</sup>

**Trophophore:** Stalk 0 to 1 mm long; blade shiny yellow-green, thick, leathery, up to 8 cm long and 2.5 cm wide, once pinnately divided; pinnae in up to 8 pairs, ascending, separated, spatulate to fan-shaped, rounded, margins entire or irregularly and shallowly cleft into rounded and non-spreading lobes, prominently veined; 1<sup>st</sup> (lowest) and 2<sup>nd</sup> pinnae pairs approximately equal in size and shape; distance between 1<sup>st</sup> and 2<sup>nd</sup> pairs up to slightly more than distance between 2<sup>nd</sup> and 3<sup>rd</sup> pairs.

**Sporophore:** Sporophore stalk approximately ½ the total length of the trophophore; once or twice pinnately-divided, branches loose and angling away from rachis.



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## Ecology

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- Elevation:** Known from near sea level to approximately 480 m in Alaska; 0 to 2,000 m elsewhere in North America.<sup>56</sup>
- Landform:** Coasts, stabilized coastal dunes, upper beaches, riparian forests.
- Soil Type:** Sand, gravel; *Botrychium* gametophytes require mycorrhizae to grow beyond a 2- to 3-cell stage and reproduce, and sporophytes require mycorrhizae to develop enough to produce above ground leaves.<sup>55</sup>
- Moisture regime:** Mesic.
- Slope:** Flat to gentle.
- Aspect:** No particular aspect.
- Vegetation type:** Sparsely vegetated, early seral, boreal forest.
- Associated species:** *Botrychium* spp., *Conioselinum pacificum*, *Dodecatheon pulchellum*, *Festuca rubra*, *Leymus mollis*.
- Longevity:** Long-lived perennial with a persistent rhizome that produces one leaf per year;<sup>55</sup> when collecting, remove only the above-ground portion with a knife.<sup>55</sup>
- Phenology:** Leaves appear late spring through summer;<sup>52</sup> rhizomes of *Botrychium* species can remain dormant and produce no above ground growth for one to three years.<sup>55</sup>
- Population estimate:** There are three known occurrences in Alaska; above ground populations of *Botrychium* species are usually small and scattered;<sup>55</sup> below ground populations of gametophytes and juvenile sporophytes at various developmental stages can occur at higher densities.<sup>55</sup>

**Reproductive biology:** Spores of *Botrychium* species filter into soil and germinate in darkness;<sup>55</sup> self-fertilization is dominant, gametophyte density below ground often exceeds juvenile sporophyte density;<sup>55</sup> mortality rate of juvenile sporophytes is high;<sup>55</sup> sporophytes grow for several years below ground before the apex of the rhizome produces a leaf that emerges above ground;<sup>55</sup> sporophytes of *Botrychium spathulatum* possibly reproduce vegetatively by gemmae.<sup>55</sup>

**Herbivory:** Above ground leaves of *Botrychium* species often regrow from rhizomes one to several years after disturbances such as herbivory or fire with no decrease in plant vigor.<sup>55</sup>

**Similar Species**<sup>51, 52, 53, 54</sup>

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Several other *Botrychium* species that occur in Alaska can be easily confused with *Botrychium spathulatum*, and distinguishing characteristics are often difficult to recognize. The table below shows morphological traits that distinguish *Botrychium* species that occur in Alaska with basal pinnae that span less than 120°.

Species	Trophophore	Basal Pinnae	Pinnae Margins	Sporophore
<i>Botrychium spathulatum</i>	Sessile, shiny yellow-green	Spatulate to fan-shaped, blade spanning arc less than 90°	Entire or irregularly and shallowly cleft into rounded and non-spreading lobes; junction of lower margin with outer margin rounded	Sporophore stalk approximately 1/2 total trophophore length
<i>Botrychium ascendens</i>	Sessile or stalk up to 30% of total trophophore length, yellow-green	Fan-shaped, blade spanning arc less than 90°	Coarsely toothed, if divided into segments then symmetrically cleft into 2 to 4 spreading lobes; junction of lower margin with outer margin sharp-angled	Sporophore stalk approximately 1/2 total trophophore length
<i>Botrychium minganense</i>	Stalk usually up to 20% of total trophophore length, rarely sessile; dull green	Narrowly fan-shaped to oblong, blade spanning arc less than 120°	Entire to symmetrically and shallowly 3- to 5-lobed	Sporophore stalk 1/2 or more the total trophophore length
<i>Botrychium campestre</i> var. <i>lineare</i>	Sessile or stalk up to 1 cm long; pale green	Linear, blade spanning arc less than 45°	Commonly bifid with spreading and linear lobes	Sporophore stalk 1/3 or less the total length of the trophophore
<i>Botrychium montanum</i>	Stalk 0.3 to 1.5 cm long; dull green, glaucous	Pinnae poorly developed, often confluent	Trophophore blade often appearing to have 2 to 4 angular lobes at tip	Not branched below the upper 2/3