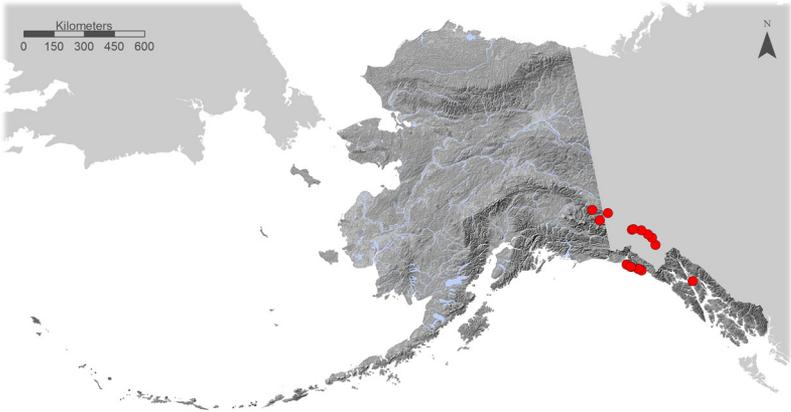


Global Distribution: Patchy throughout western North America.⁵¹

Alaska Distribution: Coastal Mountains Transition, Coastal Rainforests.

Ecoregions Occupied: Kluane Ranges, Gulf of Alaska Coast, Alexander Archipelago.

Conservation Status: S2 G3?; USFS Sensitive.



Description^{51, 57, 58}

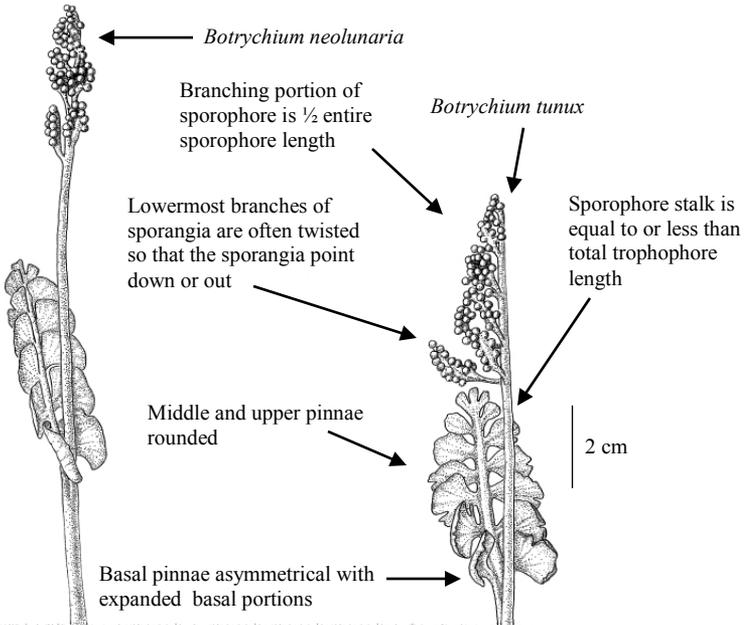


Illustration by Mary Stensvold, courtesy of American Fern Society

Botrychium tunux

General: Frond divided into dissimilar vegetative blade (trophophore) and spore-bearing segment (sporophore); perennial, 6 to 12 cm tall with a common stalk 0 to 3 cm long.

Trophophore: Stalk 0 to 1 cm long; blade yellow-green, leathery, 2.5 to 7 cm long, 2 to 4 cm wide, once pinnately divided; pinnae in 4 to 6 pairs, perpendicular to rachis, separated to slightly overlapping, not overlapping rachis; basal pinnae 7 to 20 mm long, 7 to 18 mm wide, sessile, fan-shaped spanning an arc of 120° to 180°, asymmetrical with expanded basal portions, margins entire or occasionally incised.

Sporophore: Stalk 2.5 to 5 cm long, shorter than or equal to the total trophophore length; 1- to 2-times pinnately-divided at base of sporangial cluster; branching portion of sporophore is ½ the entire sporophore length, branches ascending to spreading; sporangia partially embedded in the branches.



Ecology

- Elevation:** Known from near sea level to 1,020 m in Alaska; up to 3,600 m elsewhere in western North America.⁵¹
- Landform:** Upper beaches, beach meadows, coastal dunes, riparian forests, stream terraces, river bars, alpine slopes in Alexander Archipelago.
- Soil Type:** Sand, silt, rocky soil, unstable scree;⁴⁸ *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.⁵⁵
- Moisture regime:** Mesic.
- Slope:** Flat to gentle.
- Aspect:** No particular aspect.
- Vegetation type:** Sparsely vegetated, forb-graminoid meadows.
- Associated species:** *Achillea millefolium*, *Botrychium minganense*, *B. neolunaria*, *B. yaaxudakeit*, *Castilleja unalascensis*, *Equisetum variegatum*, *Festuca rubra*, *Fragaria chiloensis*, *Gentianella amarelle*, *Leymus mollis*, *Lupinus nootkatensis*, *Moehringia lateriflora*, *Oxytropis campestris*, *Rhinanthus minor* ssp. *minor*.
- Longevity:** Long-lived perennial with a persistent rhizome that produces one leaf per year;⁵⁵ when collecting, remove only the above-ground portion with a knife.⁵⁵
- Phenology:** Rhizomes of *Botrychium* species can remain dormant and produce no above ground growth for one to three years.⁵⁵
- Population estimate:** There are 11 known occurrences in Alaska; above ground populations range from small to approximately 100 individuals;⁵⁹ populations in alpine habitats consist of few scattered individuals;⁶⁰ below ground population of gametophytes and juvenile sporophytes at various developmental stages can occur at significantly higher densities.⁵⁵
- Reproductive biology:** Spores of *Botrychium* species filter into soil and germinate in darkness;⁵⁵ self-fertilization is dominant, gametophyte density below ground often exceeds juvenile sporophyte density;⁵⁵ mortality rate of juvenile sporophytes is high;⁵⁵ sporophytes grow for several years below ground before the apex of the rhizome produces a leaf that emerges above ground;⁵⁵ sporophytes of *Botrychium tunux* do not reproduce vegetatively by gemmae.⁵⁸

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.⁵⁵

Similar Species^{51, 57, 58}

Several other *Botrychium* species that occur in Alaska can be easily confused with *Botrychium tunux*, 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 at least 120°.

Species	Pinnae	Basal Pinnae	Sporophore Stalk	Sporophore
<i>Botrychium tunux</i>	Nearly overlapping to overlapping, not overlapping rachis	Broadly fan-shaped, asymmetrical, blade spanning arc of 120° to 180°	Equal to or less than total trophophore length	Branching portion of sporophore is ½ entire sporophore length
<i>Botrychium neolunaria</i>	Nearly overlapping to overlapping, not overlapping rachis	Broadly fan-shaped, blade spanning arc of 150° to 180°	Greater than total trophophore length	Branching portion of sporophore is ¼ to ⅓ entire sporophore length
<i>Botrychium yaaxudakeit</i>	Strongly overlapping each other and the rachis	Broadly fan-shaped, blade spanning arc greater than 180°	Much greater than total trophophore length	Branching portion of sporophore is ¼ to ⅓ entire sporophore length
<i>Botrychium lunaria</i> var. <i>lunaria</i>	Spreading, well separated	Broadly fan-shaped, blade spanning arc of more than 150°	Approximately equal to total trophophore length	Branching portion of sporophore is ½ entire sporophore length
<i>Botrychium minganense</i>	Spreading to ascending, well separated	Narrowly fan-shaped to oblong, blade spanning arc less than 120°	½ or more the total trophophore length	Branching portion of sporophore is ½ entire sporophore length