

## *Botrychium yaaxudakeit*

**Family:** Ophioglossaceae  
**Genus:** *Botrychium*  
**Species:** *Botrychium yaaxudakeit* Stensvold & Farrar  
**Common Name:** Giant Moonwort, Yakutat Moonwort  
**Ploidy:** Tetraploid



**Published description:** Rhizomes erect, unbranched, their apex 2–4 (ave. 5) cm below the soil surface, bearing 5–24 (ave. 13) fleshy roots; gemmae absent. Above-ground plants 8–25 (ave. 18) cm tall, with a common stalk 1–5 (ave. 2.5) cm long. Trophophores green, leathery; stalks 0–0.5 cm long; blades 1.75–11 (ave. 7) cm long, 1.25–6 (ave. 4) cm wide at the base, oblong to ovate, once pinnate. Pinna pairs 4–7, angled toward the apex, strongly overlapping one another, the anterior portion overlapping the rachis. Basal pinnae 7–30 (ave. 18) mm long, 9–32 (ave. 20) mm wide, short-stalked, fan-shaped, spanning an arc of 180° to 250°, usually symmetrical; basiscopic inner margin strongly recurved; outer pinna margins entire to undulate, occasionally denticulate or occasionally shallowly cleft with angular sinuses; veins dichotomous, 3–5 major veins entering the pinna base, 90–120 veins ending at the margins. Sporophores 8–18 (ave. 14) cm long; sporophore stalks 5–9 (ave. 7) cm long and longer at maturity than the length of the trophophore; sporangia-bearing portion erect, 1–2 pinnate, broadly lanceolate to narrowly ovate in outline, the branches 6–8, basal branches ascending and not twisted. Spores 43–48 (ave. 45) μm in longest diameter, released earlier or at about the same time as those of *B. lunaria*. Apparently tetraploid. (Stensvold, Farrar and Johnson-Groh 2002)

## Taxonomy

*Botrychium yaaxudakeit* was described in 2002 by Stensvold, Farrar and Johnson-Groh, based on plants from coastal Alaska. In its type locality *B. yaaxudakeit* grows with *B. neolunaria* and had previously been considered to be that species.

## Identification

*Botrychium yaaxudakeit*, *B. lunaria* var. *lunaria*, *B. neolunaria*, *B. lunaria* var. *crenulatum* and *B. tunux* are the only moonwort species in which the span of the outer margin of the basal pinnae equals or exceeds 150°, i.e., a half-moon shape. *B. yaaxudakeit*, in its northern range differs from *B. lunaria*, *B. tunux* and *B. neolunaria* in its darker green, more lustrous and firmer textured trophophore, pinnae that overlap one another and the rachis, and basal pinnae that are usually stalked and have a strongly recurved lower side margin. Pinna veins of *B. yaaxudakeit* tend to be fewer and coarser than those of the other taxa. These characters plus a sporophore stalk much longer at maturity than the length of the trophophore also distinguish *B. yaaxudakeit* from *B. tunux*.

Plants in the southernmost part of its range (Montana, Oregon and California) are much smaller and are more difficult to distinguish morphologically from *B. neolunaria* and *B. lunaria* var. *crenulatum*. Questionable specimens can be distinguished from all diploids of the *B. lunaria* complex by their larger spores averaging 45 µm in longest diameter. Spores of *B. neolunaria* average 36 µm and those of *B. tunux* average 40 µm. Spores of *B. lunaria* var. *crenulatum* are equally as large as those of *B. yaaxudakeit*, but the spreading pinnae with crenulate margins are distinctive to *B. lunaria* var. *crenulatum*.

## Distribution

*Botrychium yaaxudakeit* has been recorded from southeast Alaska, southwestern Yukon, northwestern British Columbia, northwestern Montana, northeastern Oregon and east Central California. Considering the disjunctive southern records, it seems likely that *B. yaaxudakeit* will ultimately be found elsewhere in the Mountains of western North America.

## Habitat

In its coastal habitats *B. yaaxudakeit* grows on beach sand deposits sparsely to densely vegetated by bryophytes and herbaceous plants. In inland locations it occurs in grassy riverine meadows and mountain talus slopes and roadsides. In California *B. yaaxudakeit* is known from sites at the head of Virginia Canyon in Yosemite National Park. Here it grows under shrubby vegetation (*Potentilla* and *Salix*) among talus boulders at 10,000 feet.

## Population Genetics

As in most allotetraploid *Botrychium* species, *B. yaaxudakeit* expresses fixed heterozygosity that is largely invariable from plant to plant and from population to population. The only variability observed is the failure in some population, at some gene loci, to express the alleles it has inherited from both parents, presumably as a result of gene silencing.

## Phylogenetic Relationships

*Botrychium yaaxudakeit* is the allotetraploid result of hybridization between *B. lunaria* var *lunaria* and *B. neolunaria*. The ranges of these two diploid species overlap in Alaska and sterile hybrids between the two have been detected. Considering the migration of *B. yaaxudakeit* to its southern occurrences (far beyond the current range of *B. lunaria* var *lunaria*), the hybridization resulting in *B. yaaxudakeit* likely occurred in the far distant past.

## Additional images of *Botrychium yaaxudakeit*:

