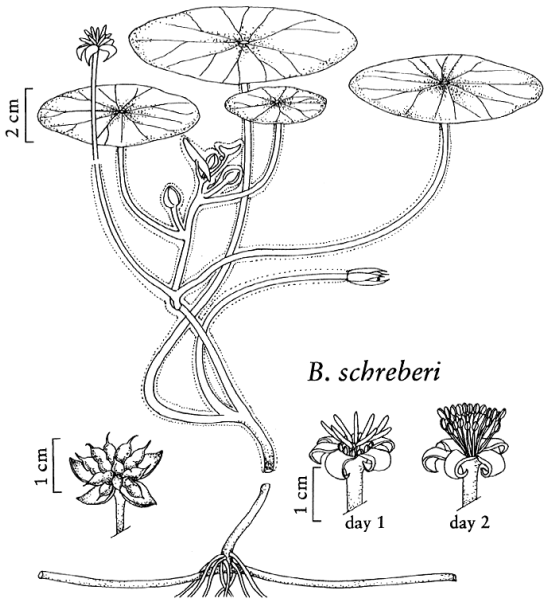
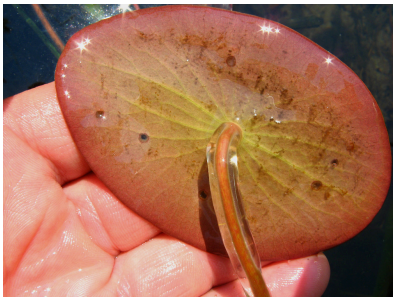
Plant Propagation Protocol for *Brasenia schreberi*

ESRM 412 – Native Plant Production

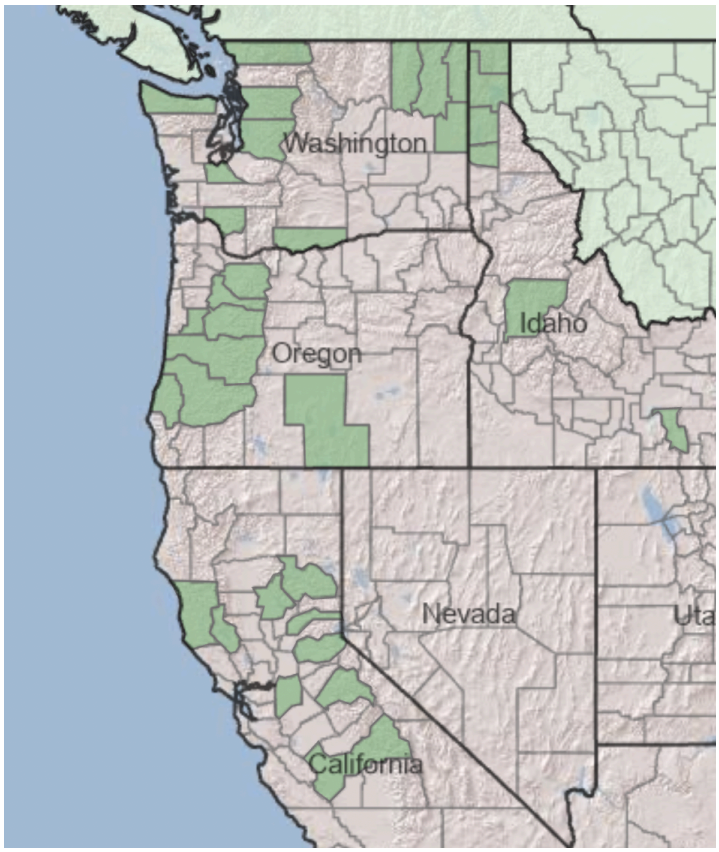
URL: https://courses.washington.edu/esrm412/protocols/2024/BRSC.pdf





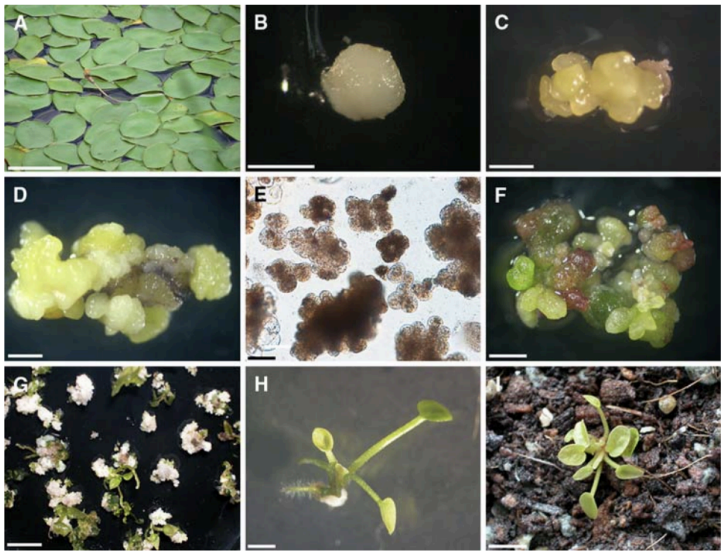
Botanical drawing [3] and field images[6] of B. schreberi

TAXONOMY	
Plant Family	
Scientific Name	Cabombaceae Rich. ex A. Rich
Common Name	Water-Shield
Species Scientific Name	
Scientific Name	*Brasenia schreberi* JF. Gmel. [4]
Varieties	N/A
Sub-species	“
Cultivar	“
Common Synonym(s)	“
Common Name(s)	Watershield, Water Target, Purple Wen-dock, Junsai (Japan), chúncài 莼菜 (China)

Species Code (as per USDA Plants database)	BRSC
GENERAL INFORMATION	
Geographical range	  Distribution maps of *B. schreberi* in the US and CA (state-level) as well as Washington, Oregon, Idaho and California (county-level) [4]

	widely distributed in tropical and temperate regions of East Asia, West Indies, Australia, South Africa, as well as North and Central America.[10] Within the Pacific Northwest, [8]
Ecological distribution	This plant thrives in calm waters of ponds, lakes, marshes, and canals. It prefers water less than 1.5m deep with a stable level and a thick sediment layer (Sunlight becomes insufficient at greater depths, preventing winter bud germination). *B. schreberi* requires high-quality water with near-neutral pH, low conductivity, and low turbidity for optimal growth. Its tissues generally prefer temperatures above 15C and can't survive heavy freezes, limiting its presence in higher-elevation lakes.[9]
Climate and elevation range	Large distributions all across North American lowlands, from Sea level to 7150 ft elevation[9] USDA zones 3-10 [7]
Local habitat and abundance	
Plant strategy type / successional stage	perennial, aquatic, floating-leaved macrophyte adapted to aquatic environments with specified adaptation of mucilage coating the plant tissue underwater that has anti-algal and antibacterial compounds[3]
Plant characteristics	*B. schreberi* is an aquatic plant that has long, thin creeping stems and rhizomes that are covered in a gel-like substance, except for the top surface of the leaves. The stems of this plant are submerged underwater and are also long and thin. The leaves float on the water's surface and are elliptical in shape, grow from near the top of the stem, measure between 3-12 cm in length and 4-10 cm in width, and they are attached to stalks that are 5-40 cm long. The flowers are purplish in color and measure 2-3 cm across. They have 3 to 4 sepals and petals each, which are narrowly oblong. The stamens, which produce pollen, are numerous and purplish. The plant also has between 5 to 15 ovaries. The flowers grow on long stalks that arise from the leaf axils. The fruits are leathery and narrowly egg-shaped and ripen underwater. As they decay, they release one or two seeds.[8]

	Field Identification Video: https://youtu.be/A5M_hQnR40U?si=kO_p01MHwcXLi2-x [5]
PROPAGATION DETAILS: zygotic-embryo-derived embryogenic cell suspension culture method as described by Oh et. al. (2008)[11]	
Ecotype	Korea (no further specification on location provided)
Propagation Goal	plants
Propagation Method	tissue culture
Product Type	plants in container (plug)
Time to Grow	approximately 10+ weeks
Target Specifications	small viable plants with sprouts and leaves
Propagule Collection Instructions	Collect mature seeds in October
Propagule Processing/Propagule Characteristics	sterilize seeds in 70% ethanol for 1 min, followed by a 0.4% sodium hypochlorite solution for 20 min. Rinse the seeds four times with sterile distilled water and store at 4°C.[11]
Pre-Planting Propagule Treatments	Dissect the seeds to collect embryonic tissue and culture it on 25ml half-strength MS basal medium (pH of all media was 5.8) in plastic Petri dishes (87x19mm) at 25°C in the dark. After 4 weeks, examine explants for evidence of white nodular structures and pale-yellow callus (growth)[11] cell suspension culture: Disintegrate the initial pale-yellow callus and transfer to a flask containing a half-strength MS liquid medium with 0.3 mg l-1 2,4-D. Maintain the culture on a gyratory shaker at 25°C in the dark. Subculture at 2- to 3-week intervals.[11]
Growing Area Preparation / Annual Practices for Perennial Crops	Dissect surface-sterilized seeds and place zygotic embryos on half-strength MS medium [11] Zygotic embryos form pale-yellow globular structures and white friable callus at a frequency of 80% when cultured on half-strength MS medium supplemented with 0.3 mg l-1 2,4-D.[11]
Establishment Phase Details	~4 weeks
Length of Establishment Phase	~2 weeks
Active Growth Phase	Plate cell aggregates onto a half-strength MS basal medium supplemented with activated charcoal and/or benzylaminopurine (BA). The highest rate of plantlet development recorded was 55% when plantlets were cultured on a half-strength MS medium supplemented with 3 mg l-1 zeatin. Additionally, The highest frequency of rooting is 48.3% and 45% when cultured on half-strength MS

	medium supplemented with 0.1 mg l-1 IAA and NAA, respectively.[11] Collect cell aggregates from 2-week-old cell suspension cultures and rinse with liquid half-strength MS basal medium. Plate the aggregates onto a half-strength MS basal medium. After 4 weeks of culture in the light (30 lmol m-2 s-1 from cool-white fluorescent lamps with a 16-h photoperiod), count the number of green regenerated plantlets.
Length of Active Growth Phase	~4 weeks
Fig. 1 Plant regeneration from embryogenic cell suspension cultures of *Brasenia schreberi* via somatic embryogenesis. **a** Wild plants, **b** cultivation of embryonic tissue from seed, **c** globular structure formation from zygotic embryo, **d** proliferation of embryogenic callus, **e** establishment of embryogenic cell suspension cultures, **f** numerous somatic embryo formation from suspension cultured cell aggregates, **g** plantlets development from somatic embryos, **h** rooting of plantlets, **i** successful soil transfer of regenerated plants. *Bars* **a** 10 cm; **b**, **c**, **d**, **f**, **h** 1 mm; **e** 200 μm; **g** 5 mm; **i** 1 cm 11	
Hardening Phase	N/A
Length of Hardening Phase	“
Harvesting, Storage and Shipping	water can be added to pots and increased as the size of plantlets increases in the greenhouse[1]
Length of Storage	plants should be outplanted as soon as possible for maximum viability
Guidelines for Outplanting / Performance on Typical Sites	no information found on outplanting specifics, but once established rhizomes are quite vigorous and can cover large areas of the water they inhabit and generally begin flowering the following growing period
Other Comments	in East Asia, young buds are harvested as a traditional vegetable as the mucilage of *B. schreberi* has strong antioxidant capacity, with a multitude of reported health benefits [10] Like many aquatic plants, seed viability is extremely low when dried out, so if trying to grow from seed it is essential to either sow immediately when ripe or store

	in water to grow in the spring[1] as such, not much information is available for seed production of *B. schreberi*
PROPAGATION DETAILS: VEGETATIVE	
Ecotype	
Propagation Goal	plants, propagule (daughter plants)
Propagation Method	Vegetative division of rhizome
Product Type	Propagule (divisions), bareroots
Stock Type	
Time to Grow	0, should be outplanted immediately to reduce drying out[1]
Target Specifications	healthy root rhizome with stem and leave(s) attached
Propagule Collection Instructions	cleanly divide rhizome between nodes in spring, the beginning of the growing season 1',[2]
Guidelines for Outplanting / Performance on Typical Sites	see above, plant rhizome in rich soil in lime-free water at depths of 1.5-1.8meters[1,2]
Other Comments	
INFORMATION SOURCES	
References	1. PFAF. (2024). Brasenia schreberi WaterShield PFAF Plant Database. Retrieved from PFAF Plant Database. 2. Adams, F. S. (1969). Winterbud Production And Function In Brasenia Schreberi. Rhodora, 71(787), 417–433. https://www.jstor.org/stable/23311753 3. U.S. Forest Service. (2024). Watershield. Retrieved from U.S. Forest Service. 4. USDA Plants Database. (2014). Brasenia schreberi J.F. Gmel. watershield watershield. Retrieved from USDA Plants Database. 5. Center for Aquatic and Invasive Plants, University of Florida, IFAS. (2024). Brasenia schreberi Watershield. Retrieved from University of Florida, IFAS. 6. Go Botany, Native Plant Trust. (2024). Brasenia schreberi (water-shield). Retrieved from Go Botany. 7. Washington State Noxious Weed Control Board. (2021). Printable Noxious Weed List - Garden Wise. Retrieved from Washington State Noxious Weed Control Board.

	8. MacKinnon, A., Pojar, J., & Alaback, P.(2004). Plants of the Pacific Northwest coast : Washington, Oregon, British Columbia & Alaska (Rev.). Lone Pine Pub. pp. 348 9. CNPS Rare Plant Inventory, *B. schreberi*. (2021). Supplementary rare plant files. Retrieved from CNPS Rare Plant Inventory. 10. Iris Publishers. (2021). Watershield (Brasenia schreberi J. F. Gmel.), from Popular Vegetable to Endangered Species. Retrieved from Iris Publishers. 11. Oh, M. J., Na, H. R., Choi, H., Liu, J. R., & Kim, S. W. (2008/04). High-Frequency Plant Regeneration From Zygotic-Embryo-Derived Embryogenic Cell Suspension Cultures Of Watershield (Brasenia Schreberi). Plant Biotechnology Reports, 2(1), 87-92. https://doi.org/10.1007/s11816-008-0047-6
Other Sources Consulted	N/A
Protocol Author	Ailia Schmid
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