Plant Propagation Protocol for *Rotala ramosior*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/RORA.pdf

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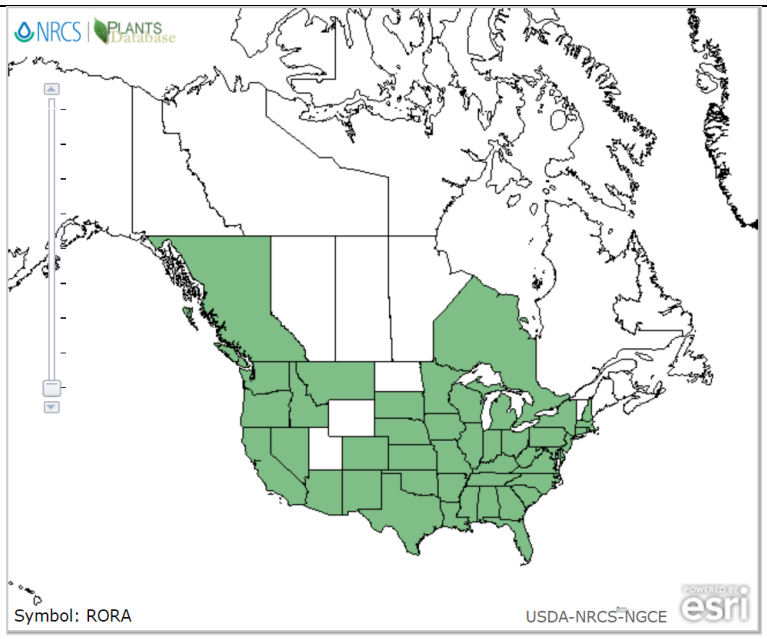
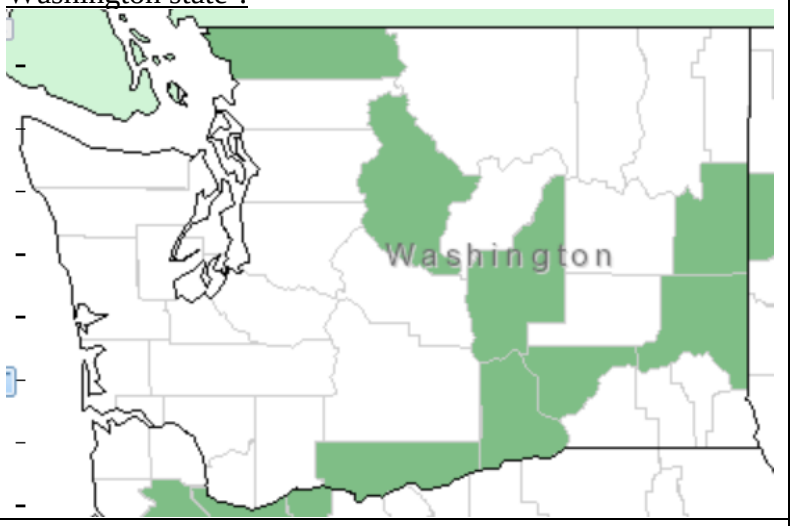
TAXONOMY	
Plant Family	
Scientific Name	Lythraceae
Common Name	Loosestrife Family
Species Scientific Name	
Scientific Name	*Rotala ramosior* (L.) Koehne
Varieties	
Sub-species	
Cultivar	
Common Synonym(s)	*Rotala catholica* (Cham. & Schltdl.) van Leeuwen *Rotala dentifera* (A. Gray) Koehne *Rotala ramosior* (L.) Koehne var. *interior* Fernald & Grisc. *Rotala ramosior* (L.) Koehne var. *typica* Fernald & Grisc[1].
Common Name(s)	Lowland Rotala, Lowland Toothcup[2]
Species Code (as per USDA Plants database)	RORA
GENERAL INFORMATION	
Geographical range	Continental U.S. (excluding North Dakota, Utah, and Wyoming), B.C. and Ontario, Canada[1]; Mexico, and the West Indies[2]. In Washington state, the species is native to Chelan, Grant, Klickitat, Benton, Spokane, Whatcom, Franklin, and Whitman counties[1]. See maps below for distribution in North America and Washington state. <u>North America[1]:</u>

	 Washington state[1]: 
Ecological distribution	Regions of medium to high water content; damp places with silt or fine sands, swampy areas, mudflats, lake/pond margins, and riparian areas[2]. Obligate wetland indicator status[1].
Climate and elevation range	Elevation: 60-690 m (200-2260 ft)[2] Climate: Requires moderate to high moisture levels and fluctuates with rainfall and surface water levels. Often found in regions of full sun[3].
Local habitat and abundance	Seasonally wet areas with moderate to high water fluctuation (often periodic flooding), where water levels influence year-to-year abundance. The species is intolerant of shade and tends to be reduced in density and health with reduced light levels (often induced by competition)[4].

	While global population size is unknown, *R. ramosior* is ranked globally secure (G5), and nationally secure (N5) in the United States[5]. But this species is listed as endangered in Connecticut, Massachusetts, and Rhode Island; threatened in Minnesota and New York; rare is Pennsylvania; and sensitive in Washington State[1]. Associated species: *Salix exigua* (narrowleaf willow), *Ammania robusta* (grand redstem), *Juncus* spp. (rushes), *Eleocharis acicularis* (needle spike-rush), *Limosella acaulis* (southern mudwort), *Lindernia dubia* (yellowseed false pimpernel, and C*yperus acuminatus* (tapertip flatsedge)[2].
Plant strategy type / successional stage	*R. ramosior* lives in wet regions often prone to flooding—river banks, ponds, swamps—and can grow while submerged, indicating a high water tolerance[4]. However, the species is ill-adapted to compete with other species and tends to occupy shorelines or regions of natural water fluctuations in which few other species colonize,[6] which demonstrates moderate early successional characteristics.
Plant characteristics	Annual Forb/ herb[1] with simple or branched, erect prostrate stems up to 10 cm high[7]. Leaves are opposite and blades lanceolate to oblanceolate (tapers gradually to a short petiole)[2]. Flowers June to August. The flowers are sessile in the axils of the upper leaves, with a 4-lobed calyx forming a bell-shape, and white (or pink) petals about 1mm long[7].Fruit is 3- or 4-valved globose capsule about 3mm across[7]. The species population reproduces sexually resulting in large quantities of seed. The majority of seeds are dormant and reach maturity in autumn where they tend break dormancy in flooded conditions (fall/winter)[4]. Population seed dispersal occurs through passive movement—wind water, and animal transport—where subpopulations and sites are dependent on a seed bank[4]. Flowers are entomophilous (insect-pollinated), but primarily self-pollinated[6]. No symbiotic or parasitic relationships are known[6].

PROPAGATION DETAILS	
Ecotype	
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	Seeds
Time to Grow	"Medium"[8]
Target Specifications	Target height of 4-16 inches[9]
Propagule Collection Instructions	Seeds are contained within the fruit after seed production has occurred and should be collected once fruit has been allowed to dry on the plant[10]. Notes: Mature fruits develop into 3 mm long, roundish seed capsules that become green or red (hundreds of seeds per individual plant). Seed production occurs in September[11]
Propagule Processing/Propagule Characteristics	Seeds size: 0.3-1 x 02.-0.4 mm[12] Naturally, seeds are long-lived (>10 years) in the soil seed bank, however outside of the soil, seeds quickly lose viability—up to 50% becoming non-viable within a year[6].
Pre-Planting Propagule Treatments	Seeds naturally break dormancy during flood conditions in the temperatures of fall/winter[4]. Prior to dormancy treatments, seeds should be removed from the dried (or fresh) fruit and cleansed to help prevent bacterial and fungal infestation. Soaking seeds in running water for 24-48 hours[13] is often sufficient. *R. ramosior* have an optimal dormancy break temperature regime of 20˚C (day) and 10˚C (night)[4] for the length of one season. However, Brown University found that highest germination rates occur when seeds are subject to 21 days of cold, moist stratification followed by long warm day length[6]. Therefore, a combination of cold, most stratification followed by the optimal dormancy break temperature regime over a long day length is recommended.
Growing Area Preparation / Annual Practices for Perennial Crops	Naturally, this species performs well in riparian mimicking situations—moist to wet conditions, with sandy and thin (0-5 cm[11]) media. *R. ramosior* requires exposed soil, sand, or gravel to germinate and can be inhibited by soil surface layers, even leaf litter[6]. Therefore, use of shorter containers filled with a mixture of sand/gravel and soil is

	recommended, where seeds are sown thinly since those sown at a depth greater than 1mm rarely germinate[6]. pH 6.5-7.5 is optimal for this species[8].
Establishment Phase Details	*R. ramosior* often experiences large fluctuations in annual seed germination and growth, which are likely dependent on the timing and amount of seasonal rainfall and water levels. After water levels recede—summer—soils become exposed and seeds readily germinate[4]. Summer germination indicates that seeds require light and high temperatures to germinate successfully. Below are two examples of summer-like conditions, and their germination rates that were used in the University of Kentucky's study. 99% germination: Day temps 35˚C, night temps of 20 ˚C 32% germination: Day temps 25˚C, night temps of 15 ˚C[6]
Length of Establishment Phase	
Active Growth Phase	Grown easily under bright lighting and kept in a controlled aquarium—wet/moist—environment[4].
Length of Active Growth Phase	
Hardening Phase	
Length of Hardening Phase	
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	In nature, germination occurs under flooded conditions, and flowering/seed production occur as the water level recedes and the region dries[11]. Therefore, timing of outplanting should align with the species' natural life cycle—full grown non-flowing plants should be outplanted prior to a significant reduction in water levels or before early July[11].
Other Comments	
INFORMATION SOURCES	
References	See endnotes below
Other Sources Consulted	See consultation list below
Protocol Author	Jordan Drugge
Date Protocol Created or Updated	06/03/18

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