

2.5 Egeria

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Egeria densa Planch.; submersed plant in the Hydrocharitaceae (frog's-bit) family
Derived from *Egeria* (Greek: water nymph) and *densa* (Latin: dense) “densely growing water plant”

Introduced from South America to the northeastern US in the 1890s
Present throughout most of the US except the upper Midwestern states

Introduction and spread

Egeria (*Egeria densa*), sometimes inappropriately referred to as *Elodea densa*, is easily confused with nonnative hydrilla (Section 2.2) and native *Elodea canadensis*. Physical similarities among the three species are responsible for the confusion in proper identification and, by extension, inconsistent naming. The popularity of egeria in home aquariums and ponds and its frequent use in biology classrooms are likely responsible for the widespread distribution of egeria across the US and elsewhere. *Egeria* has many common names (including anacharis and Brazilian elodea) and is commonly referred to as “oxygen weed” on many internet sites, where the species is

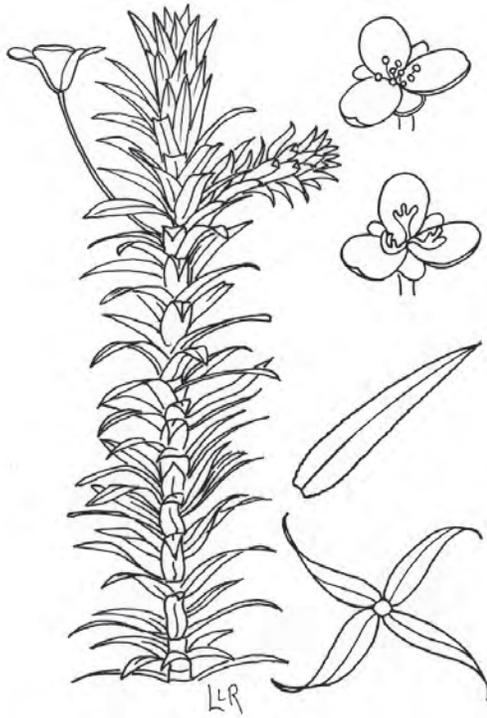


touted for its ease of growth and ability to increase dissolved oxygen in freshwater aquariums and ponds. Many aquarists fail to consider the downsides of the plant's rapid growth rate and its effect on early-morning dissolved oxygen levels.

Plants release oxygen during the day; however, plants respire (take up oxygen) at night and cause the lowest oxygen levels to occur in the early morning. Fish kills can occur if plant density is high enough and dissolved oxygen levels become depleted overnight due to plant respiration. Like many aquatic weeds, egeria was most likely brought to the US through the aquarium trade and the species was probably first introduced to natural waterways as a result of aquarium dumping and flooding of ornamental ponds. Some states now list *Egeria densa* as a noxious weed, which may slow commercial sales and introduction to new waterbodies. The current spread of egeria is due primarily to recreational activities such as boating, fishing and the use of personal watercraft. Similar to hydrilla and other aquatic weeds, initial infestations of egeria are often found near public boat ramps, providing further evidence for this means of spread.

Description of the species

Egeria is a rooted submersed monocot that grows in a variety of fresh water bodies, including flowing and standing water. Growth of egeria is limited when the species is exposed to extremely warm (above around 90 °F) or cold (below around 40 °F) water for several weeks; however, egeria can withstand low light and low temperatures similar to Eurasian watermilfoil (Section 2.3). The species' limited tolerance for high water temperatures may explain the shift in species dominance from egeria to hydrilla during the summer in some Florida water bodies. *Egeria* has stems that are highly branched and can reach lengths of 25 feet or more due to the species' tolerance of very low light levels. The long stems



from a single rooted plant commonly form a canopy near the water surface that can cover an area of six feet or more, a growth habit that is observed in other canopy-forming submersed weeds. Leaves of egeria are thin, small (1-1/2 inches long and 1/8 inches wide), lance-shaped and have minute teeth along the edges that may be difficult to see without a magnifying glass. Leaves are arranged in whorls around the stem, with each composed of four to six leaves per whorl. Leaf nodes are so densely spaced at the growing tip of the plant that they are indistinguishable, but nodes are more widely spaced near the main stem and on stems lower in the water column. Branches are borne from distinct and rather predictable locations along the stems of egeria. The number of leaves per whorl doubles or even triples (up to 12 leaves per whorl) every 8 to 12 leaf nodes, which has led some to refer to these unique regions as “double nodes”. These double nodes are the only location where branches and flowers are borne along the stems.

Reproduction

Egeria is dioecious, meaning that plants bear only staminate (“male”) or pistillate (“female”) flowers. “Female” plants (with pistillate flowers) are not known to occur outside South America. In rare cases these plants are found, but sexual reproduction and seed set are extremely rare. This has resulted in widespread distribution in the US of “male” plants (with staminate flowers) which likely have little genetic variation. Egeria spreads exclusively from vegetative propagules including stems, branches and root crowns. Branches, roots, flowers and root crowns are formed along plant stems adjacent to double leaf nodes every 8 to 12 leaf whorls. Unlike several other invasive submersed plants, egeria does not produce tubers, turions or rhizomes to facilitate spread or to provide energy storage for overwintering. Instead, egeria relies on stems and root crowns for colonization and survival during inclement conditions. Closely spaced double nodes in stem tips result in the greatest potential for growth in this region, which can make management of the species difficult. Egeria can produce a new plant from each double node along a stem fragment; this, coupled with its rapid growth rate (easily growing up to 1/2 inch per day), allows for the rapid expansion and competitive ability of the species.



Problems associated with egeria

Egeria roots in the sediment at the bottom of the water body and grows completely underwater but forms a dense mat just under the water surface. The result is a thick canopy of vegetation that spreads over large areas and impacts recreation, property values, water quality and ecosystem function.

Dense growth of egeria entangles boat propellers and impedes navigation, which often results in the unintended spread of the species when stem fragments are created after a close encounter with a boat prop. Fragments can float for days or weeks before sinking into the sediment or being stranded along shorelines. These fragments quickly form roots, which results in new colonizations or substantial increases in plant bed size that would not occur naturally. Because

egeria is largely transported by human activities, infestations tend to occur near boat launches, adjacent swimming areas, marinas and boat docks. Thick mats of surface vegetation in these areas are extremely unsightly and even dangerous for users of these facilities.

Water quality may be compromised by thick surface growth of egeria. Dense growth reduces the natural mixing of water by wind and causes an increase in surface water temperature during the summer, which is harmful to fish (Section 1.2) and invertebrates. Thick mats also provide a protected growth platform for filamentous algae (Section 2.18) that are unsightly, cause odors upon decay and can support large mosquito populations (Section 1.5). Reduced wind mixing also restricts the entry of atmospheric gases (i.e., oxygen and carbon dioxide) to the water. Oxygen is necessary for fish and invertebrates, while carbon dioxide is necessary for growth of submersed plants, including algae. Similar to other invasive submersed weeds, dense growth of egeria also causes wide daily fluctuations in pH and other water quality parameters which makes infested waterways inhospitable to many aquatic animals.

Management options

Egeria has been sold as an aquarium plant in the US for more than 50 years, but it has not spread through the country as quickly as other noxious species such as hydrilla and flowering rush (Section 2.17). The first lines of defense to reduce the impacts of egeria are to prevent the introduction of the species to new water bodies and to limit its spread in waters that are already infested. The most efficient and effective preventative measure is to thoroughly remove plant fragments from boat trailers and watercraft before leaving an infested waterbody. In fact, removing all aquatic vegetation reduces the likelihood of spreading other nonnative species such as zebra mussels and other inconspicuous species such as New Zealand mudsnails. The cost of prevention (e.g., through signage, boat inspections, boat washing stations, etc.) is orders of magnitude less than the cost of managing existing populations because once egeria is established it is extremely difficult, and most would argue impossible, to eradicate.

Physical (Section 3.4) and mechanical (Section 3.5) controls for egeria are similar to those for other submersed weeds, largely due to their ability to establish new colonies from stem fragments. As a result, the benefits and drawbacks of various control methods are similar among the species. Hand removal and the use of benthic barriers can be selective; however, these methods are very laborious and time-intensive. Because egeria does not produce tubers or turions, the likelihood of reinfestation after benthic barriers are removed or when hand pulling is completed is reduced, provided both methods are employed with vigilance. Mechanical harvesters can clear large areas for boat navigation; however, harvesters can produce thousands of fragments that can expand the population. Since harvesters essentially mow the upper portions of the plant, the need to remove stem tips after mechanical harvesting cannot be understated; otherwise, stem tips float away and spread the plant to new habitats within a water body. In addition, multiple harvests are usually required during the peak growing season due to the rapid growth rate of egeria.



Water level drawdowns may be used where feasible to control egeria in regulated water bodies (e.g., irrigation canals and reservoirs for power generation or flood control). Egeria may be the submersed aquatic weed most susceptible to drawdown and desiccation because seeds, tubers or turions are not produced to allow for re-growth; however, plant fragments within mounds that maintain adequate moisture are known to be viable after as much as 30 days of dewatered conditions. Plants are particularly vulnerable during winter drawdowns when dry and freezing conditions are present.

The required duration of dewatering depends on various climatic and sediment conditions such as relative humidity, temperature and sediment density (the ability of soil to retain water). Disadvantages to drawdown include lack of specificity (nontarget native plants and wildlife are impacted) and loss of the water for other purposes such as hydropower, irrigation and recreation.

Currently, the only biocontrol agent available in the US for reducing egeria biomass is the sterile grass carp (Section 3.6.2). Grass carp have been stocked following drawdown in some locations, which has led to long-term control. Sterile grass carp effectively control egeria in areas where low water temperature does not limit their feeding; unfortunately, egeria is capable of positive and sustained growth in climates cooler than those required for active grass carp feeding, so effectiveness may be limited under those conditions. Research in California on a leaf-mining fly (*Hydrellia egeriae*) concluded that the host range of *H. egeriae* is too broad for use in the US as it indiscriminately oviposits on both egeria and the native *Elodea canadensis*.

Herbicides commonly used to control egeria include the systemic herbicides fluridone and penoxsulam and the contact herbicides copper, endothall (mono(N,N-dimethylalkylamine salt) and diquat (Section 3.7.1). The list of herbicides that can be used to effectively control egeria is very limited compared to those used to control Eurasian watermilfoil. Egeria is a monocot and is therefore not susceptible to 2,4-D or triclopyr. Egeria is often found in systems with flowing water, which makes the use of slow-acting systemic herbicides challenging because plants require a long exposure time in order for systemic herbicides to provide effective control. The growth of egeria in flowing water systems coupled with a limited number of effective herbicides make egeria a difficult plant to control with herbicides.

Summary

The popularity of egeria in the aquarium trade and in biology classrooms has substantially contributed to its widespread distribution in the US, Europe, Asia, New Zealand, Japan, Chile, Mexico, Canada and Australia. The spread of egeria between water bodies is largely due to trailered boats and other watercraft that transport fragments. Long-lived stem fragments are easily spread by currents and watercraft within infested water bodies. When these fragments come into contact with sediments on the lake bottom or the margins of the water, the fragments form roots, plantlets develop and new colonies of egeria rapidly become established. Egeria tolerates a wide range of water quality characteristics, sediment nutrient levels and light levels and commonly grows in similar habitats favorable to Eurasian watermilfoil. As a result, it is likely that egeria can invade and colonize areas that currently support growth of Eurasian watermilfoil.

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Page 43: Egeria infestation; Toni Pennington, ESA

Page 44 upper: Line drawing; University of Florida Center for Aquatic and Invasive Plants

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