2.8 Parrotfeather

Ryan M. Wersal; Minnesota State University Mankato, Mankato MN; ryan.wersal@mnsu.edu

Myriophyllum aquaticum (Vell.) Verdc is a heterophyllous plant (distinct submersed and emergent leaves on the same plant) in the Haloragaceae (watermilfoil) family
Derived from myrios (Greek: *numberless*), phyllon (Greek: *leaf*) and aquat (Latin: *water*)
"water plant with many leaf divisions"

Introduced from South America to New Jersey in the 1890s
Present throughout the southern US; north to New York; west to Washington state and Idaho

Introduction and spread

Parrotfeather is native to South America and is a member of the Haloragaceae family. The species is closely related to the invasive species Eurasian watermilfoil (Section 2.3) and has been introduced to Southeast Asia, Australia, New Zealand, Japan, South Africa and North America. The earliest specimen recorded in the US was collected in Haddonfield, New Jersey in 1890. Parrotfeather is widespread in the United States, infesting nearly all southern states, Hawaii, and as far north as New York on the east coast and Washington on the west coast.

Parrotfeather is a rooted plant that grows well in the moist soils of shallow wetlands, slow moving streams, irrigation reservoirs, canals, edges of lakes, ponds, sloughs and backwaters. The species tolerates frequent inundation of salt water as long as concentrations remain below 4 parts per thousand and can grow in water depths of up to 10 feet if the water is clear and light penetration is sufficient to support growth and colonization. Once stems reach the surface of the water, the creeping growth habit of parrotfeather can quickly cover large expanses of the water surface. Parrotfeather is not seriously affected by frost; however, a hard freeze may kill emergent shoots in northern latitudes. The species overwinters in submersed form and resumes growth when water temperatures reach 45 °F.

Because parrotfeather is widely adapted, it is frequently used as an ornamental plant in ponds and water gardens. In addition, the species is sold as an "oxygenating" plant for aquariums across the US. The spread of parrotfeather is almost exclusively attributed to humans. For example, in the 1980s aquarium plant growers in the San Francisco Bay area planted parrotfeather in local waterways to have a convenient source of plant material to sell to their customers. Parrotfeather's ease of cultivation and attractiveness as a pond plant are likely the most common means of spread of the species and have aided in its escape and subsequent colonization of natural areas.

Little information exists regarding the spread of parrotfeather by animals. The species does not produce seed, turions or tubers and the leaves are generally unpalatable to most animals. However, parrotfeather is tolerant of dry conditions and may be spread if cattle or other rangeland animals utilize ponds and wetlands infested with the species because fragments may become entangled in fur or lodged in hooves and transferred to other areas. Waterfowl (Section 1.3) or

migratory birds may also aid in spreading parrotfeather if fragments are transported in feathers, although there is no direct evidence of this mode of transport.

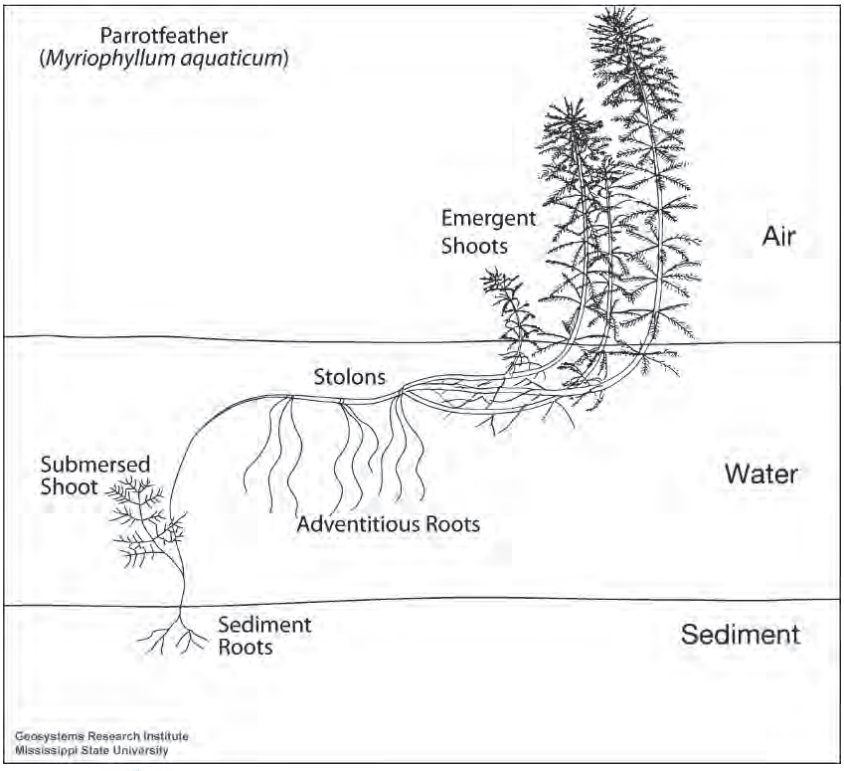
Description of the species

Parrotfeather is an evergreen stolon-forming perennial with sturdy stems that have submersed and emergent portions. The emergent and submersed leaves of parrotfeather differ in appearance from one another, a phenomenon known as heterophylly. Emergent leaves are whorled, stiff, grayish green, feather-like and usually have 20 or more divisions on each leaf. Leaves borne on submersed shoots are reddish orange, thread-like, pectinate and arranged in whorls of four to six at each node. Submersed shoots grow mostly in a vertical manner until they reach the water surface, when growth of the plant changes to the emergent form. Stems initially creep horizontally along the surface of the water with extensive branching at each node; the horizontal growth is followed by vertical growth of new stems. Parrotfeather also produces adventitious roots at each node that are important for nutrient uptake and mat formation since roots from different plants often become entangled. Flowering typically occurs from March to May in the leaf axils of emergent shoots. Parrotfeather is dioecious [plants produce either pistillate ("female") or staminate ("male") flowers], but plants with staminate flowers are not found outside South America and are rare even in native populations of South America. Because seed set requires the presence of both types of flowers, seed production is not known to occur in parrotfeather and the species reproduces exclusively by vegetative means.

Reproduction

Parrotfeather lacks specialized structures such as seeds, tubers, turions and winter buds that often facilitate overwintering in many aquatic plants. Instead, plants survive adverse conditions by switching between the submersed and emergent growth forms. The switching of growth forms is accomplished by reallocation of resources (carbohydrates) throughout the growing season. The majority of starch is stored in the stolons of parrotfeather, making it readily available to both the submersed and emergent leaves.

The submersed form can overwinter in colder water where the emergent form would be killed. Additionally, the emergent form is somewhat tolerant to desiccation and can therefore survive for a period of time in areas that have been de-watered as long as the soil remains moist. The species reproduces solely through the fragmentation of emergent and submersed shoots. Both types of shoots are easily fragmented; once fragmentation occurs, adventitious roots are rapidly formed, which allows the plant to anchor in the sediment and take up nutrients needed for growth.



Problems associated with parrotfeather

Little information exists regarding the direct impact of parrotfeather infestations on fish and wildlife populations. Dense beds of parrotfeather reduce dissolved oxygen in the water column, which may be detrimental to fish populations. Parrotfeather may outcompete more desirable aquatic plant species [e.g., pondweeds (*Potamogeton* sp.)

and coontail (*Ceratophyllum demersum*)] which are readily utilized as a food source by waterfowl. Dense surface mats of emergent growth shade out and eliminate native submersed plants, which also reduces populations of macroinvertebrates that are important to waterfowl as well as for fish (Section 1.2).

The creeping growth of parrotfeather can quickly cover large areas of the water surface, which can impede navigation, stream flow and runoff and can increase the duration and intensity of flooding. Dense growth of parrotfeather in irrigation canals of the western US have limited the water supply needed for crop irrigation. Also, the species infests major river systems and tributaries in a number of developing countries and poses a direct threat to potable water supplies. In addition, dense infestations of parrotfeather offer mosquito adults, eggs and larvae a refuge from predation, which may lead to increases in mosquito-borne diseases that affect wildlife and humans (Section 1.5).

Parrotfeather competition

Parrotfeather is generally not a strong competitor, especially as species richness increases, but it can cause problems in small ponds and ditches where disturbances are frequent. In fact, disturbance is often cited as a primary means for dispersal of parrotfeather, especially when mechanical control (Section 3.5) is utilized. Because parrotfeather relies on fragments for growth, it can re-colonize after a disturbance more quickly than species that must regrow from seeds, tubers or turions. Other aquatic plants with a creeping growth habit (such as alligatorweed) can overtake infestations of parrotfeather and reduce its growth.

Management options

Parrotfeather is often overlooked until it reaches nuisance levels, which allows the species time to become established and expand its range. Although parrotfeather is not considered a widespread nuisance, control of the species after it has invaded an area is difficult regardless of the method used. The most effective means to avoid infestations is to prohibit the sale of parrotfeather by the water garden and aquaculture industries and to ensure plant fragments don't hitchhike on boat trailers, as these are the primary means of spread in the US.

Several methods – including chemical (Section 3.7.1), mechanical and biological control (Section 3.6) – have been evaluated with mixed results. Chemical and mechanical methods can provide short to medium term control of parrotfeather. Herbicides are used most often and results are dependent upon herbicide choice. The use of mechanical methods has received less attention, but their use may encourage fragmentation, regrowth and further spread of parrotfeather. There are currently no effective biological control agents available in the US.

Foliar applications of herbicides – including 2,4-D, imazapyr and triclopyr – have resulted in consistent control of parrotfeather. Glyphosate and diquat are generally not recommended because only emergent shoots are killed and plants often regrow at greater densities. Foliar applications of carfentrazone-ethyl and flumioxazin will not control parrotfeather in the long term; however, these herbicides can be combined with 2,4-D to provide excellent control of small infestations of parrotfeather. The effectiveness of herbicides applied to the water column has not been studied as extensively as foliar applications. However, of those herbicides tested as submersed treatments, only triclopyr and the butoxyethyl ester formulation of 2,4-D have provided good control of parrotfeather. The effectiveness of herbicide treatments is site-specific and is influenced by

environmental conditions at the time of application. In addition, multiple applications are often necessary to completely control parrotfeather. Overall, the auxin class of herbicides usually offers the best results when controlling parrotfeather.

Mechanical harvesting methods such as raking, chaining (long chains of sharp blades pulled by tractors) or hand pulling can provide temporary control of small infestations of parrotfeather. However, these approaches are very labor intensive as dense mats are heavy and difficult to remove from the water. Also, harvested plants have little utility as a mulch or animal forage and must be taken to a landfill. Parrotfeather is often tolerant of mechanical disturbance; in fact, the repeated use of mechanical control methods actually favors the formation of new infestations of parrotfeather because numerous fragments are produced during harvesting operations. As a result, care must be taken to remove all plant parts (emergent shoots, submersed shoots, root crowns and fragments) after mechanical harvesting to reduce the risk of re-infestation.

Cultural methods (Section 3.4) such as drawdown and dredging might provide effective control of parrotfeather in some areas, provided the drawdown is maintained long enough to completely dry the soil since parrotfeather can survive in moist soil. Winter drawdowns in the southern US would likely not be effective because the rainfall that occurs during this time is usually sufficient to keep soil moist enough for parrotfeather survival. Dense mats of parrotfeather also serve as an insulator against cold weather and water loss, which keeps sediments and root crowns moist and viable. Winter drawdowns in the northern US may be effective if the upper 6 to 8 inches of the soil freezes and causes death of the root crown. Summer drawdowns can provide a measure of control if sediments dry to the point of cracking, which should dry plant mats and root crowns and result in plant death. However, if a large amount of biomass is present it may prolong the drying process by trapping moisture underneath the thick mat. The moisture will be enough to keep parrotfeather alive until more favorable growing conditions return. Dredging can be used to control parrotfeather infestations, but the technique is expensive and control is short-lived because it is difficult to ensure removal of all plant fragments and root crowns.

Summary

Since its introduction in 1890, parrotfeather has spread down the East Coast, across the southern US and along the West Coast as far north as Washington and Idaho. Having both submersed and emergent growth forms allows parrotfeather to invade a wide range of habitats and may give this species an advantage over other aquatic plants, especially during times of adverse environmental conditions such as droughts or floods. Although parrotfeather does not share the rapid invasion characteristics associated with other noxious species such as Eurasian watermilfoil and hydrilla, it can quickly colonize and overtake a variety of habitats in a short period of time. Parrotfeather is often overlooked until it becomes firmly established; once this occurs, parrotfeather has shown great resiliency towards many of the current management techniques. Parrotfeather is not included in the Federal Noxious Weed list. As a result, buying, selling and transporting this species is not restricted in most states. Parrotfeather is widely sold in the water garden industry and is one of the most popular plants sold for this purpose. The continued sale and transportation of this species is responsible for most of its spread and will further exacerbate future nuisance problems associated with parrotfeather.

Photo and illustration credits

Page 55: Emergent growth form of parrotfeather. Ryan Wersal, Minnesota State University Mankato
Page 56 upper: Flowers in the leaf axils of parrotfeather. Ryan Wersal, Minnesota State University Mankato
Page 56 lower: Line drawing of parrotfeather growth. Geosystems Research Institute, Mississippi State University
Page 57: Population of parrotfeather (note reddish-orange leaves on submersed form). Ryan Wersal, Minnesota State University Mankato