Tapegrass, Eelgrass, or Wild Celery (*Vallisneria americana* Michaux): A Native Aquatic and Wetland Plant[1]

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Introduction

Tapegrass and wild celery are the common names of *Vallisneria americana* Michaux (Figure 1). It is sometimes referred to as eelgrass, which can be confused with some seagrass species with the same common name. It is native to Florida and is considered a key species in aquatic ecosystems due to its ability to provide sediment stability, water clarity, and food and habitat for aquatic organisms such as fish and invertebrates and large mammals such as manatees. Tapegrass can be used as an aquarium plant in fish tanks, and for restoration of lakes, estuaries, and natural areas. This fact sheet describes the main features of tapegrass and summarizes important habitat requirements for its growth and restoration. This document aims to inform and educate the general public and assist academic and Extension faculty in advising regulators and stakeholders.

Classification

Common Names

Tapegrass, eelgrass, vallisneria, wild celery, water celery, eelweed, duck celery, and flumine-Mississippi

Family

Hydrocharitaceae (frog's-bit)

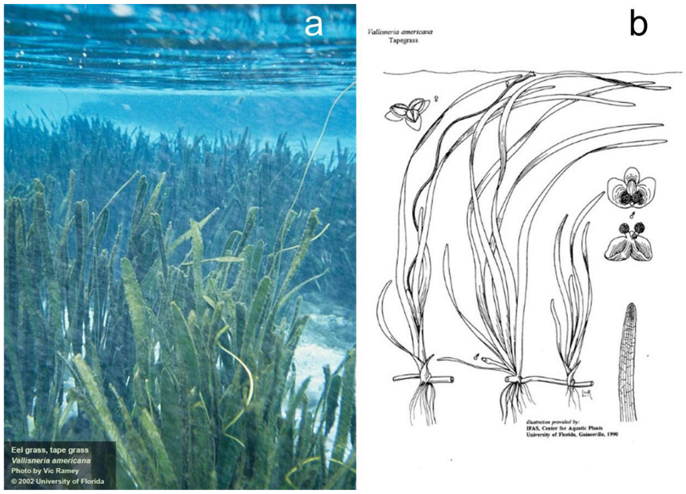

Figure 1. Tapegrass, *Vallisneria americana*. a) Tapegrass underwater meadow. b) Illustrations of male and female plants.
Credits: UF/IFAS

Scientific Name

Vallisneria americana Michaux

Synonyms

Vallisneria spiralis var. *americana*; *Vallisneria neotropicalis*

Related Species

Vallisneria anhuiensis X.S.Shen

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Vallisneria annua S.W.L.Jacobs & K.A.Frank

Vallisneria australis S.W.L.Jacobs & Les

Vallisneria caulescens F.M.Bailey & F.Muell.

Vallisneria erecta S.W.L.Jacobs

Vallisneria longipedunculata

Vallisneria nana R.Br.

Vallisneria natans (Lour.) H.Hara

Vallisneria rubra (Rendle) Les & S.W.L.Jacobs

Vallisneria spinulosa S.Z.Yan

Vallisneria spiralis L.

Vallisneria triptera S.W.L.Jacobs & K.A.Frank

Identification and Reproduction

Tapegrass is a submersed aquatic plant that completes its entire life cycle under water, except during pollination when the female flower reaches the water surface (McFarland 2006). Leaves grow in clusters (rosettes) and vary in color from green to brownish-red; they can grow up to 6 feet long and up to 1 inch wide (Figure 2a). Leaves are flat and thin with toothed margins (Figures 2a and 2b) and rounded tips, although some varieties have curved leaves. Notice that the leaves lack stomata (Figure 2c).

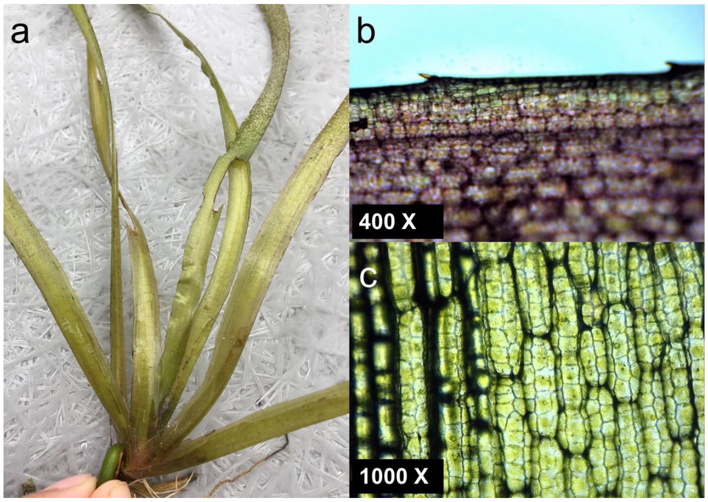

Figure 2. a) Tapegrass (*Vallisneria americana*) leaves grow in clusters (rosettes). b) Leaves under 400x magnification. c) Leaves under 1000x magnification. Notice that tapegrass leaves are thin and flat with toothed margins and lack stomata.
Credits: Mohsen Tootoonchi, UF/IFAS

Tapegrass reproduces asexually (via runners or stolons and winter buds) and sexually (via seeds). Asexual reproduction is common among tapegrass varieties found in southern US locations such as Florida. Reproduction by runners allows tapegrass to easily populate an area (Figure 3a). Varieties that grow in northern climates can produce both runners and winter buds (Figure 3b). Winter buds, also referred to as tubers or turions, store energy and help the plant survive during the winter (McFarland 2006).

Figure 3. a) Tapegrass (*Vallisneria americana*) from the southern region can produce runners. b) Northern tapegrass can produce both runners and winter buds.
Credits: a) Mohsen Tootoonchi, UF/IFAS. b) Drawn by Mohsen Tootoonchi (UF/IFAS) from an image on the Maryland Department of Natural Resources Bay Grass Identification Key (http://dnr.maryland.gov/waters/bay/Pages/sav/key.aspx?savname=Wild%20Celery)

Sexual reproduction is more complicated because tapegrass is dioecious, meaning each plant has either female (pistillate) or male (staminate) flowers. Female flowers are held by a long, coiled peduncle (flower stalk), which uncoils to lift the flower to the water surface. This structure can be used to easily identify tapegrass in the field (Kosuge et al. 2013) (Figure 4a). Male flowers are tiny and produced in a capsule hidden among the leaves at the base of the plant (Figure 4b).

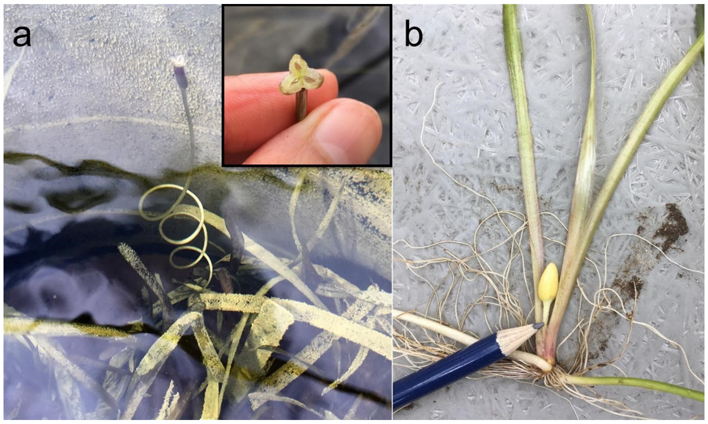

Figure 4. a) Tapegrass (*Vallisneria americana*) female (pistillate) flower reaching the water surface for pollination. b) Male (staminate) flower capsule.
Credits: Mohsen Tootoonchi, UF/IFAS

For sexual reproduction to occur, male flowers are released from their capsule and float to the surface of the water. Each flower expands on the water surface and drops into an open female flower to fertilize it. After the female flower is fertilized, the peduncle twists and coils to pull the flower back under the water (Figure 5a), where it makes banana-like seedpods that carry hundreds of tiny seeds about 1/16 of an inch in size (1.6 mm; Figure 5b).

Figure 5. a) Tapegrass (*Vallisneria americana*) staminate flower on the male plant on the left, and seedpod on the female plant on the right. b) Seedpods carry hundreds of tiny seeds, which are about 1.6 mm or 1⁄16 of an inch in size.
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Habitat and Services

Vallisneria species are found in many parts of the world, from Asia to Europe, Australia, Africa, and North America (Les et al. 2008). They prefer clear and shallow waters and grow well in lakes, rivers, springs, canals, and estuaries. Estuaries are areas where ocean water mixes with fresh water from rivers and lakes. Tapegrass is an important estuary plant because it can tolerate both fresh and brackish water (Tootoonchi and Gettys 2019). In its native environment, tapegrass provides many benefits to the ecosystem, such as filtering water by sequestering and capturing carbon (blue carbon), and capturing excess nutrients. It is a source of food and habitat for many species of fish and invertebrates.

Tapegrass is commonly used for restoration and revegetation of lakes and estuaries, mainly through planting of seeds or transplanting of adult tapegrass. Tapegrass seeds can stay viable for years when salinity level is below 10 parts per thousand (ppt). The ideal conditions for seed germination are temperatures above 72°F (22°C) and salinity level below 1 ppt with an oxygen level around 8 mg/L or ppm. Sediment can also play a role in seed germination. Seeds tend to germinate faster in sediment with less than 3% organic matter content and more than 40% sand (Jarvis and Moore 2008). Mature tapegrass is more resilient to disturbance; therefore, transplanting mature individuals has a higher success rate than planting tapegrass seeds (Gettys and Haller 2012; Gettys et al. 2012). Another problem with using seeds in restoration efforts occurs when seeds are collected from a limited number of fruits. This could lead to a population consisting of full and half-siblings, which subsequently could increase inbreeding. Seeds should be collected from different locations to increase genetic diversity and minimize genetic drift (Lloyd et al. 2012). It is also suggested that tapegrass transplants should be selected from local varieties to maintain allelic composition; however, local varieties are not always available and may not be well-suited to the targeted ecosystem (Gettys and Haller 2013).

Despite large-scale plantings in Florida, tapegrass populations have decreased dramatically over the years in some areas due to periodic hypersalinity in estuaries and intense grazing by turtles, manatees, and other aquatic wildlife (Buzzelli et al. 2017). Therefore, when tapegrass is planted, it is sometimes temporarily covered with exclosures (cages or fences) to protect plants from large herbivores and grazers so that tapegrass mats can establish and revegetate under water (Moore and Jarvis 2007).

Resilience to Environmental Stressors

Although they have several ways of reproducing, tapegrass populations have decreased over the years (Buzzelli et al. 2017). Tapegrass can survive many environmental stressors, such as flooding, low fertility, high water flow, and movement from waves. However, sunlight, temperature, and salinity are among the most important stressors for tapegrass.

Tapegrass is submersed in water, so its metabolism, photosynthesis, and growth depend on the water temperature. Tapegrass can survive temperatures between 55°F and 100°F (13°C–38°C) and grows best around 82°F (28°C) (Bartleson et al. 2014). This makes it a great plant for lakes and streams where winter temperature does not fall below 55°F (13°C). In lower temperatures, some varieties develop a winter bud structure to survive the cold (Figure 3b). Sunlight is necessary for photosynthesis; tapegrass has a Crassulacean acid metabolism (CAM) photosynthesis pathway similar to those of desert plants (terrestrial plants from arid regions). This type of photosynthesis enables them to survive extreme carbon and light limitation and to grow very well under high light exposure (Keeley 1998; French and Moore 2003).

Altered freshwater flow along with sea level rise allows more seawater to move inland (Qiu and Wan 2013) and change the salinity regime in these systems. Seawater has a salinity level of 35 ppt, while lakes and springs are between 0 and 1 ppt. Less freshwater flow into these systems translates to a higher salinity level and can harm aquatic plants sensitive to salt. Salinity is a very important stressor for plants in estuaries or areas with seasonal influxes of salt water. Tapegrass has been shown to grow best at salinity levels below 5 ppt, but it can tolerate a maximum of approximately 10 to 12 ppt (Doering et al. 2002). In estuaries, salinity levels may increase during the dry season and exceed the salt tolerance threshold for tapegrass, which could kill the plants within 2 to 4 weeks (Kraemer et al. 1999). Increased salinity, together with vertebrate (e.g., manatees, turtles, fish) and invertebrate (e.g., insects, snails) grazing, can reduce tapegrass populations. However, tapegrass can recover when salinity decreases during the wet season. Salt tolerance may vary among tapegrass populations (Boustany et al. 2010). Because of this, researchers in Florida and many other parts of the country are working on finding more salt-tolerant varieties to restore and reestablish vegetation in aquatic ecosystems.

Plants can cause problems when they establish outside their native habitat. In Canada, New Zealand, and the Netherlands, tapegrass is not native and is potentially invasive. Reports from these regions show that tapegrass can form dense patches that restrict recreational activities as well as water movement (Catling et al. 1994). It can cause flooding and reduce the aesthetic appeal of a body of water. An overabundance of tapegrass in any body of water may require control and management regardless of its native or non-native status. Several mechanical, biological, and chemical methods are available to control tapegrass. For control methods, refer to EDIS document SS-AGR-44, *Efficacy of Herbicide Active Ingredients Against Aquatic Weeds* (https://edis.ifas.ufl.edu/ag262).

Human Influence

Human activity has altered water flow into lakes, wetlands, and estuaries (Baron et al. 2002). Storing freshwater behind dams for agriculture and urban use can have drastic effects on the salinity regime of an aquatic ecosystem. Such alterations in freshwater flow have been shown to suppress tapegrass population to such an extent that they are completely absent from some streams (Buzzelli et al. 2017; Havens 2017). In addition, excess nutrients from both agricultural and urban areas have increased algal growth, reduced water clarity, and significantly decreased tapegrass growth and productivity (Koch 2001). Tapegrass provides food and habitat for many aquatic organisms that live in estuaries and coasts. These areas are important for fishing, tourism, and recreation; together with residential areas, they provide more than 28 million jobs for our nation. Commercial and recreational fishing alone contribute $13 billion annually to Florida's economy (Lorenzen et al. 2017). Therefore, failure to protect tapegrass populations may put both the environment and the Florida economy at risk. Restoration of freshwater flows are essential for tapegrass to flourish. A healthy vegetation assemblage can provide resilience to marine and coastal ecosystems and protect the environment against natural disasters. Tapegrass is a key species in aquatic ecosystems, and because of its growth and survival abilities, it is a great asset in the restoration of coasts and estuaries.

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