GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Salvinia molesta***

Salvinia molesta 简体中文 正體中文 **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Pteridophyta	Filicopsida	Hydropteridales	Salviniaceae

Common name foug&#65533;re d&#65533;eau (French, Burkina Faso), koi kandy (English), African pyle (English), aquarium watermoss (English, United States), salvinia (English), giant salvinia (English, United States), giant salvinia (English), water fern (English), water spangles (English), kariba weed (English), African payal (English)

Synonym *Salvinia auriculata* , Aubl.

Similar species *Salvinia biloba, Salvinia herzogii, Salvinia auriculata*

Summary Salvinia molesta is a floating aquatic fern that thrives in slow-moving, nutrient-rich, warm, freshwater. A rapidly growing competitive plant, it is dispersed long distances within a waterbody (via water currents) and between waterbodies (via animals and contaminated equipment, boats or vehicles). Salvinia molesta is cultivated by aquarium or pond owners and it is sometimes released by flooding, or by intentional dumping. Salvinia molesta may form dense vegetation mats that reduce water-flow and lower the light and oxygen levels in the water. This stagnant dark environment negatively affects the biodiversity and abundance of freshwater species, including fish and submerged aquatic plants. Salvinia molesta can alter wetland ecosystems and cause wetland loss and also poses a severe threat to socio-economic activities dependent on open, flowing and/or high quality waterbodies, including hydro-electricity generation, fishing and boat transport.

view this species on IUCN Red List

Species Description

Salvinia molesta is a free floating aquatic fern. It produces a horizontal rhizome (that lies below the water surface) and two types of frond (buoyant and submerged). The mature plant produces egg-shaped spore sacs containing infertile spores. It lacks true roots but its submerged fronds function as roots. Its fronds are in whorls of three (two floating and one submerged). The floating fronds are positioned in an opposite orientation to each other and are round to oblong in shape. On their upper surface they have rows of cylindrical papillae. Each papilla has four hairs at its distal end (each consisting of a single row of cells) that are joined together at their tips to form what looks like an inverted egg-beater. The cage-like structure of the end hairs is an effective air trap giving the plant buoyancy in the water. The papillae, end hairs and upper surface of the plant are water repellent in comparison to the under surface of the leaf, which attracts water. It is this difference in water attraction that maintains the correct orientation of the plant on the water surface. The fronds are light to medium green, often with brownish edges in mature plants, and with a distinctive fold in the center. The plant exhibits great morphological variation depending on the conditions of habitat (such as space and nutrient availability), and ranges from a slender floating specimen with leaves less than 1.5cm wide to one with leaves up to 6cm wide (Pieterse *et al* 2003; Kay and Hoyle 1999; Mitchell D. Pers. Comm. 2005; ARMCANZ ANZECC 2000).

Lifecycle Stages
Depending on the climate *Salvinia molesta* may be either a perennial or an annual. In non-tropical regions it may function as an annual but it will still produce significant growth during the summer period. In nutrient rich waters it may reach a density of 30 000 small plants per m² and under ideal growth conditions it can double its biomass in two days. The plant passes through three identifiable growth stages, the development of which are determined by environmental conditions). The growth of single ramets (plantlets) is known as the primary growth stage and the growth of a linear chain of ramets is known as the secondary growth stage. Finally, the formation of a compact vegetative cluster is known as the tertiary phase (ARMCANZ ANZECC 2000; ARMCANZ ANZECC 2000; WAPMS 2003; Jacono 1999). A good illustration showing the growth stages can be viewed at: *Salvinia molesta. Giant salvinia.* U.S. Geological Survey.

Uses
Floating aquatic weeds have been used for mulch, compost, fodder, paper making, handcrafts and bio-gas generation (Howard and Harley, 1998). Annual gains from successful biological control of salvinia worldwide have been estimated to be approximately $US 150 million. The main impediment to the commercial use of floating aquatic weeds such as salvinia is their high water content, which is often up to 90% of the harvest wet weight. Thus a large proportion of the harvest is water, while only a small proportion is actually plant matter. The high growth rate of aquatic weeds may lead to an optimistic evaluation of their commercial use but the commerical benefits are negligable in comparison to their known wide-ranging negative socio-economic and environmental impact (Julien Center and Tipping 2002; Mitchell D. Pers. Comm. 2005).

Habitat Description
Salvinia molesta prefers tropical, sub-tropical or warm temperate areas of the world and grows best in still or slow-moving water bodies including ditches, ponds, lakes, slow rivers and canals. In standing water it forms stable floating mats. It grows optimally at a water temperature of between 20°C and 30°C. Buds are killed when exposed for more than two hours to temperatures below -3°C or above 43°C. Salvinia is able to tolerate salinity levels one tenth that of seawater, allowing the weed to adapt to a wide range of benthic environments. Its growth rate decreases by 25% at a salinity level of 0.3%. Growth is greatly stimulated by an increase in nutrient levels. As a consequence the weed is particularly fast-growing in areas where the hydrological regime has been altered by humans, encouraging an increase in nutrient levels (for example by increased runoff or fertiliser leaching) (WAPMS 2003; Mitchell D. Pers. Comm. 2005; ARMCANZ ANZECC 2000; Howard and Harley 1998).

Reproduction
Salvinia molesta produces egg-shaped, slender-tipped sporocarps that develop in elongated chains along the submersed fronds. Sporocarps contain numerous sporangia (which are usually empty or contain only a few deformed spore remnants). Because the plant is pentaploid (contains five sets of chromosomes) it can not produce viable spores (due to an unequal division of chromosomes during meiosis). As a consequence *S. molesta* is sterile and can only reproduce asexually. The plant propagates by vegetative growth and sporadic fragmentation, resulting in small vegetative propagules that are dispersed by water currents (Jacono 2003).

General Impacts
For details on impacts of this species please see *general impacts*

Management Info
Proliferation of aquatic weeds is often indicative of increased nutrient levels in watersheds and wetlands. This may mean several species of floating aquatic weeds may be waiting to replace S. molesta. Following salvinia removal continuous monitoring of infestation sites to detect aquatic plant succession is necessary. Sustainable management of the whole ecosystem, decreasing the nutrient level and improving sewage drainage and effluent treatment is likely to reduce the biomass of floating plants such as S. molesta (Howard and Harley 1998; Chikwenhere and Keswani 1997; Room and Fernando 1992; McFarland et al. 2003).
For details on management of this species, please see *management information*

Pathway
Floating aquatic weeds, including salvinia, may be spread on contaminated barges or log rafts (Howard and Harley, 1998).The attraction of *S. molesta* as an ornamental plant and as one of particular botanical interest has led to its spread to a far greater extent through intercontinental transport in aquarium and landscaping trades. Its introduction to North America,*S. molesta* is a popular aquarium plant throughout Australia (despite being banned) and continues to be kept in ponds and fish tanks in all States. It is sold through market gardens, pet shops, landscapers, with supplies coming from both wild harvesIt is believed that *S. molesta* was first introduced into Sri Lanka into the Botony Department of the University of Colombo in 1943 (Williams, 1956, in Room and Fernando, 1992). Apparently a botanist at the University of Dakar (the capital of Senegal) was also responsible for encouraging the spread of the weed into the Sengal river (Pieterse *et al*, 2003).

Principal source: Room and Fernando, 1992. Weed Invasions Countered by Biological Control: *Salvinia molesta* and *Eichhornia crassipes* in Sri Lanka.
Giant Salvinia *Salvinia molesta*., 2004. Western Aquatic Plant Management Authority

Compiler: National Biological Information Infrastructure (NBII), Comit&#65533; fran&#65533;ais de l'UICN (IUCN French Committee) & IUCN SSC Invasive Species Specialist Group (ISSG)
Updates with support from the Overseas Territories Environmental Programme (OTEP) project XOT603, a joint project with the Cayman Islands Government - Department of Environment

Review: Under Revision
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Pubblication date: 2010-10-04

ALIEN RANGE

[8] AUSTRALIA
[1] BERMUDA
[1] BURKINA FASO
[1] CUBA
[1] FRANCE
[1] GHANA
[2] INDONESIA
[1] JAPAN
[1] MADAGASCAR
[1] MAURITIUS
[1] MEXICO
[1] NEW CALEDONIA
[1] PAPUA NEW GUINEA
[1] PORTUGAL
[1] SENEGAL
[1] SOUTH AFRICA
[1] SWAZILAND
[1] THAILAND
[1] UGANDA
[1] VANUATU
[2] ZIMBABWE
[1] BANGLADESH
[1] BOTSWANA
[1] COTE D'IVOIRE
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[2] FRENCH POLYNESIA
[1] INDIA
[1] ITALY
[1] KENYA
[1] MALAYSIA
[1] MAYOTTE
[1] NAMIBIA
[1] NEW ZEALAND
[1] PHILIPPINES
[1] REUNION
[1] SINGAPORE
[2] SRI LANKA
[1] TANZANIA, UNITED REPUBLIC OF
[1] TRINIDAD AND TOBAGO
[12] UNITED STATES
[1] ZAMBIA

Red List assessed species 4: VU = 1; NT = 1; LC = 2;

Fulica alai **VU**
Himantopus mexicanus knudseni **LC**
Mesophoyx intermedia **LC**
Oxyura maccoa **NT**

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Invasive species - Plants is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Plantas [Accessed 30 July 2008]
Spanish:
La lista de especies del Sistema de informaci&#65533;n sobre especies invasoras de m&#65533;xico cuenta actualmente con informaci&#65533;n aceca de nombre cient&#65533;fico, familia, grupo y nombre com&#65533;n, as&#65533; como h&#65533;bitat, estado de la invasi&#65533;n en M&#65533;xico, rutas de introducci&#65533;n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p&#65533;gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci&#65533;n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci&#65533;n novedades, para conocer los cambios.
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