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## ***A review on Eichhornia crassipes (water hyacinth): A water weed can be managed by using it for human welfare***

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**Abstract:** Water hyacinth (*Eichhornia crassipes*) is a free floating freshwater plant considered one of the world's worst water weeds. It gets spread throughout Southeast Asia, the south-eastern United States, central and western Africa, and Central America. It is found throughout India blocking rivers, sewages, water reservoirs. Threat from this plant is that it forms large, dense mats that degrade water quality and clog waterways. These dense mats prevent air and light diffusion, altering and even killing native plant and animal communities. Water hyacinth can be a problem economically as it negatively affects fisheries, slows down or prevents water traffic, impedes irrigation, reduces the water supply, obstructs water ways, and slows hydropower generation. All the efforts of scientists and technocrats all over the world to eliminate these weeds by chemical and biological means have met with little success. Water hyacinth is used to treat waste water from dairies, tanneries, sugar factories, pulp and paper industries, palm oil mills, distilleries, etc. The water hyacinth have been found to have potential of use as phytoremediator plant, paper, organic fertilizer, biogas production, human food, fiber, animal fodder. In this review the distribution, botanical description, impact and the utilization of *Eichhornia* are presented to bring attention towards management of this weed by constructive approach which will be beneficial for human beings as well as for environment instead of a chemical approach of its control.

**Keywords:** Water hyacinth, impacts, utilization of water hyacinth

## INTRODUCTION

Water hyacinth (*Eichhornia crassipes*) is a free floating freshwater plant of the family Pontederiaceae that is considered one of the world's worst water weeds, invading lakes, ponds, canals, and rivers. It is called the world's worst aquatic weed due to its ability to rapidly cover whole waterways<sup>1</sup>. Water hyacinth has invaded freshwater systems in over 56 countries on five continents; it got spread throughout Southeast Asia, the south-eastern United States, central and western Africa, and Central America<sup>2</sup>. It was introduced into many countries from Amazon basin that is its native range, during late 19th and early 20th centuries, where it spread and degraded aquatic ecosystems. It is found throughout India blocking rivers, sewages, water reservoirs etc. Its growth rate is highest among the any plant known, and populations can double in as little as 12 days<sup>3, 4</sup>. Water hyacinth grows in still or slow-flowing fresh water in tropical and temperate climates. Optimum growth occurs at temperatures of between 28°C and 30°C, and requires abundant nitrogen, phosphorus and potassium. This plant can tolerate a wide range of growth conditions<sup>5</sup>. They range from clean waters that are poor in major nutrients such as rivers and reservoirs to highly polluted waters with large amounts of nutrients and organic matter, as is the case in sewage lagoons. In addition such waters may receive a variety of organic and inorganic industrial effluents containing heavy metals<sup>4</sup>. But it is rapidly killed by sea strength salinity and will not grow in brackish water<sup>5</sup>. Economic importance of *Eichhornia* may be accelerated from the fact that they may pollute drinking water when they die and decay. Besides providing convenient breeding sites for mosquito, snails and other animals of medical and veterinary importance, they may also invade large areas impeding the free movement and use of water in irrigation systems and in fish culture. Threat from this plant is that it forms large, dense mats that degrade water quality and clog waterways. These dense mats prevent air and light diffusion, altering and even killing native plant and animal communities<sup>6</sup>.

## BOTANICAL DESCRIPTION

Water hyacinth is a free-floating aquatic herb. Thick, waxy leaves are entire, and form in rosettes that reach up to 3 feet above water surface. Leaf blades are round to kidney-shaped and are 1.5-5 inches across. Water hyacinth has striking inflated petioles that enable it to float on the water surface. Feathery, blue-black to dark purple roots are dense near the root crown and heavily branched. Flowers are showy; clusters of 8-15 form in 1.5-6 inch panicles. Flowers are light purple with 6 petals, 2-3 inches in diameter. Fruit is a 3-celled capsule that contains up to 450 seeds. New plants develop vegetative, as new rosettes form on floating stolons. Clonal daughter plants are often produced by stolons along the surface of the water. Colonies of floating plants often develop. Seeds are 1 to 1.5 mm long and roughly egg-shaped, with ridges from end to end. They are long-lived and may survive in mud for up to 20 years. Seeds have also remained viable over very long periods in dry soil<sup>1,5</sup>.

## IMPACT

After forming a mat over water surface water hyacinth blocks large amount of sunlight, oxygen exchange, circulation of nutrients in pond or water body due to seasonal changes and air current, disturbs food web and affects the life of fauna present in water body and due to its presence the biological diversity of the invaded area is greatly reduced<sup>2</sup>. Water hyacinth can be a problem economically as it negatively affects fisheries, slows down or even prevents water traffic, impedes irrigation, reduces water supply, obstructs water ways, and slows hydropower generation<sup>2, 4</sup>. The most commonly documented effects are lower phytoplankton productivity and dissolved oxygen concentrations beneath mats. Furthermore, it is destroying natural wetlands, changing the temperature,

pH and oxygen levels of water, eliminating native aquatic plants, increasing water loss through transpiration (greater than evaporation from an open water body) thus changing a water body into a land by adding dead and decay matter and by water evaporation, reducing water quality from decomposing plants<sup>5-7</sup>.

Water hyacinth will rapidly take over an entire waterway. Under favourable conditions it can double its mass every 5 days, forming new plants on the ends of stolons. It also grows from seed which can remain viable for 20 years or longer<sup>5</sup>.

Water hyacinth causes reduction on productivity of a lake's phytoplankton since the weed mats shade out any photoautotrophs (both phytoplankton and also submerged macrophytes) beneath them. The calming of the water by the floating mats reduces upwelling of nutrients from the sediments by wind action, making them less available to phytoplankton in the photic zone, and large aggregations of *Eichhorniacrassipes* rapidly remove nitrogen and phosphorus from the water column, out competing the phytoplankton for these vital nutrients. Exploitative competition among aquatic plants occurs for limiting resources, e.g. light, nutrients and suitable substrates<sup>7,8</sup>.

## UTILIZATION

Water hyacinth can be used for human welfare. Such as for making useful materials, in industrial waste water treatment etc. Its tremendous application in wastewater treatment is already proved. Water hyacinth is used to treat waste water from dairies, tanneries, sugar factories, pulp and paper industries, palm oil mills, distilleries, etc. All the efforts of scientists and technocrats all over the world to eliminate these weeds by chemical and biological means have met with little success. So, we can move to a better approach which is evident from many researches. The water hyacinth have been found to have potential for use as phytoremediation, paper, organic fertilizer, biogas production, human food, fibre, animal fodder. The root of the plant will be absorb the metal pollutant that contain in the wastewater and enhance the quality of the water<sup>4,9</sup>.

Phytoremediation using water hyacinth, for removing heavy metals and other pollutants is a newly developed environmental protection technique. The water hyacinth growing prolific in wastewater can efficiently accumulate heavy metals. Water hyacinth also absorbs organic contaminants, and nutrients from the water column. In California, water hyacinth leaf tissue was found to have the same mercury concentration as the sediment beneath, suggesting that plant harvesting could help mediate mercury contamination if disposed of properly<sup>10-14</sup>.

Water hyacinth harvests have been put into valuable uses in several countries. Methods of converting the plant material into valuable products have emerged. Apart from its ornamental value, the plant has been found useful as a source of animal feed, as a source of fertilizers for use in agriculture, a source of biomass energy, a source of raw materials for building, handcraft making, paper and boards. In addition the plant has been found to be useful as a filter worth of solving man created problems of pollution in water bodies<sup>15-17</sup>.

Water hyacinth can be used on the land either as a green manure or as compost. As a green manure it can be either ploughed into the ground or used as mulch. The compost increases soil fertility and crop yield and generally improves the quality of the soil. In developing countries where mineral fertilizer is expensive, it is an elegant solution to the problem of water hyacinth proliferation and also poor soil quality. In Sri Lanka water hyacinth is mixed with organic municipal waste, ash and soil, composted and sold to local farmers and market gardeners<sup>4</sup>.

Conversion of other organic matter, usually animal or human waste in biogas, is a well-established small and medium scale technology in a number of developing countries, notably in China and India. Studies have been carried out, primarily in India with quantities of up to 4000 l of gas per tonne of semi dried water hyacinth being produced<sup>1,18</sup> with a methane content of up to 64%.

## CONCLUSION

As water hyacinth is so plentiful and people have been trying to remove the plant from many water ways, spending billions of dollars in doing so, Instead of wasting money and time on controlling the spread and its eradiction by using chemical, mechanical and biological ways we can follow a productive approach and can use this plant for human welfare. Although all efforts must be made to control these plants where they are nuisance from natural ecosystems, research efforts must be stepped up to tap these recourses for human welfare. Finally, more research is needed on alternatives for the sustainable management of this worldwide invader; this includes economic incentives for removal, spread prevention, or utilization projects that create goods from water hyacinth.

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