

Chapter 10

The role of "Water hyacinth" *Eichhornia crassipes*, (Mart.) Solms. in the natural ecosystem of India: A review

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ABSTRACT:-Water hyacinth (*Eichhornia Crassipes* (Mart.) Solms.) is a fast-growing aquatic plant that has gained significant attention due to its profound impact on aquatic ecosystems worldwide. This abstract focuses on the role of water hyacinths in the natural ecosystems of India. The plant's aggressive growth, coupled with its ability to form dense mats on the water surface, has led to

ecological disruptions in various water bodies across the country. This study examines the ecological implications of water hyacinth invasion in Indian water ecosystems, including lakes, ponds, rivers, and wetlands. It investigates the plant's influence on water quality, biodiversity, nutrient cycling, and overall ecosystem stability. Additionally, the abstract sheds light on the socio-economic consequences of water hyacinth proliferation, considering its effects on fishing, irrigation, navigation, and recreational activities. The abstract further delves into potential management strategies employed to mitigate the negative impacts of water hyacinth. These strategies may involve mechanical removal, biological control using natural enemies, chemical interventions, and innovative uses of harvested water hyacinth biomass. The abstract also touches upon the challenges associated with managing water hyacinth due to its rapid growth, adaptability, and potential for recolonization.

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WATER HYACINTH: IT'S ECOSYSTEM IN INDIA

India is a unique country on the world map in that it has a combination of all types of climates, soils, and other required factors for the growth of all types of vegetation existing in the world. Naturally, plants from any part of the world to this country thrive here well and are naturalized. Such plants, being 'exotic', are vigorous and overpower the plants with which they grow. These plants are water plants and land plants. Some of these plants are very important from destructive and constructive points of view. Here we are considering the most important plant "water hyacinth" whose eradication has become a burning problem before scientists. In this context, a certain conclusion arrived at by earlier scientists, including^{1,2} was that the only effective means of controlling this 'weed' was its mechanical collection and destruction. Although, there are many water plants water hyacinth, *Eichhornia crassipes* (Mart) Solms., or *Pontederia crassipes* Mart. Fam: "Pontederiaceae" is one which is most controversial, often said as an "obnoxious weed". If we trace the genesis of this plant, there are different views on its origin. Lawrence (1963)³ wrote in his book: "*Eichhornia* is tropical American extending north probably to Florida and also in tropical Africa to Madagascar". This view is based on the work of Alexander (1937)⁴. In the Science Reporter December 1983⁵, it is mentioned that water hyacinth a Brazilian plant, was introduced for the first time at Narayanganj in West Bengal in 1914 through ships. Based on the work of Bose (1945)⁶, Gay (1958)⁷, Davies (1959)⁸, Gay and Berry (1959)⁹, Sharma (1971)¹⁰ reported (Curr. Sci.) that *Eichhornia crassipes*, (water hyacinth) is an outstanding example in South-East Asia, the Nile and the Congo basins, where from an ornamental plant was introduced in India less than a century ago. Jha (1965)¹¹ says that *Eichhornia crassipes* is an exotic species for us. This, of course, has originated from Brazil and has reached towards States and spread to some parts of Africa as pointed out by many investigators referred to above. Besides, reaching Narayanganj first by ship, one possible way of its reaching India is from some rivers of the States (USA), by crossing the Atlantic, reaching the Mediterranean seas through the English Channel along with warm water current (a congenial Medium for its sprouting) and finally coming to the Indian Ocean through the Red Sea

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and thus reaching the ultimate goal-the western sea shore of Deccan. From there, probably by human beings (ornamental point of view) or/ by certain animals, these plants may have reached some rivers and then spread to the most remote water ecosystems of this country. Thus, this plant entered this country from the eastern the Bay of Bengal, and from the western sea coast of Deccan. This plant may have entered this country as an ornamental one but the temperature and environment as a whole are so congenial to it that it spread vigorously, particularly where it could get sufficient rainfall. It has a vegetative propagation when the tillers/or offsets reproduce many folds forming the mats within a very short period. It can very well be said that the spread of the plants is explosive and now wherever a part of this mat was flown with water and got stuck there it formed its own ecosystem by virtue of its rapid growth, commonly found in small ditches and shallow ponds in the countryside.

These water hyacinth plants with their broad leaves give shelter to the fish in summer under the scorching rays of the Sun. Due to the presence of some macrophytes along with water hyacinth sometimes, oxygen in water depletes. It is to be noted here that these hydro floras (plants and the fishes) are found in such 'aquatic ecosystems' where water is slightly acidic to almost neutral, (pH 6-6.9) in general. However, in alkaline water, this water hyacinth has also been found growing well where the city garbage is thrown. This, after getting rotten releases



Figure 1: Dense mat of *Ecchornia* in a pond. (source:https://commons.wikimedia.org/wiki/File:Common_Water_Hyacinth_Flower.jpg)

nitrogenous substances for which this water hyacinth has a great affinity. As such, *Eichhornia crassipes*, without hesitation, can be said to be a nitrophilous plant. It is a fact that water hyacinth has covered a vast area of water in the country where water is fresh, slightly acidic, and has an optimum tropical temperature in alkaline water as discussed above. Finding such a situation most congenial, water hyacinth grows luxuriantly. As it covers a large area of water and does not allow other crops to grow, it has been declared an obnoxious weed. Such widely distributed water hyacinth plant can very well be identified by its pinkish-violet roots due to the presence of anthocyanin; stems rooting at nodes; leaves radical and speculate; and petioles swollen into green bladders. Flowers violet-blue in spike inflorescence, tepals forming a distinct tube below, and stamens curved with glandular-hairy filaments¹². The utilization of water hyacinth plants as a fertilizer in the form of compost as indicated by Sharma (1971)¹⁰ does not appear to be fruitful. My own experience was that when the mature plants were transformed into green manure and that was applied in the field millions of young water hyacinth plants (seedlings) came up in the field. These fields are low-lying and are well drained. In this area, those young seedlings became a problem for years until they were not completely picked up by the laborers. It is a fact that nobody can completely take out seeds from the plants while preparing compost or green manure. The only alternative is to burn the plant into ashes and to spread the ashes in whatever form may be.

Gay (1958)⁷ has remarked that *Eichhornia crassipes* reproduce by tillers in no time and thereby propagation is explosive. He further says, "It flowers abundantly but the part played by such reproduction was not assessed". Sharma (1971)¹⁰ has also pointed out that seeds of water hyacinth are dormant at least for one year and are viable for several years. Sarvendra Kumar (2019)¹³ worked on the use of *Eichhornia* extract as liquid fertilizer for aquaculture ponds, similarly, B. Prasad and Deblina Maiti (2016)¹⁴ studied on metal uptake potential of *Eichhornia crassipes* growing in ponds from mining and non-mining. Mukherjee, Pathak, and Kumar (2019)¹⁵ worked on detailed Studies on morphotaxonomy and anatomical features of *Eichhornia crassipes* with regards to its spread and distribution in Jharkhand, Verma and Pandey (2008)¹⁶ worked on aquatic weeds which are a serious problem for water bodies

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in Jharkhand, a great deal of *Eichhornia* was given in their work, Mukherjee and Kumar (2017)¹⁷, reported about the invasive aquatic and semi-aquatic plant species including *Eichhornia crassipes* in Santhal Pargana, and found that these plants are responsible for the loss of native aquatic biodiversity. Mukherjee P. (2019)¹⁸ in his D.Sc. research entitled "The floristic studies of aquatic and semi-aquatic angiosperms of major water bodies of Jharkhand with special reference to their economic importance." Explained in detail the various uses and harm of *Eichhornia crassipes*, a method of compost preparation from *Eichhornia crassipes* was also developed in his work. The Use of *Eichhornia Crassipes* is dealt with by Hemkant Jha and Bijay Singh (2015)¹⁹ and (2017)²⁰ they explained that Water Hyacinth (*Eichhornia Crassipes* (Mart.) Solms. – An Invasive and valuable Aquatic Weed as well as explain it as a boon for mankind. Ateesh and Kisku (2022)²¹ Documented Several Applications of Water hyacinths. Ranjan, Rajesh, and Mishra (2021)²² worked on invasive species of Vinoba Bhave University Campus (Jharkhand.), mentioning that *Eichhornia crassipes* are one of the important invasive species. After reviewing all works and based on my own observations, one can connect the germination and expansion of this 'water hyacinth' plant in the following manner: -

The innumerable seeds on the margin of the rivers, the tanks, the streams, and the ditches, etc. germinate especially in the months of June-July in the young seedling forms. These seedlings getting the congenial environment discussed so far develop in young plants and then the tillers or the offsets sprout profusely.

Now, these tillers or offsets when broken by animals, wind, or the current of water, are flown from one place to another, and when they are stuck anywhere the plant again reproduces explosively and forms a big mat of its own ecosystem. The seeds falling from these floating plants on the bottom of the water do not germinate due to the non-availability of sufficient oxygen. According to my own experience and observations, it is pointed out that the *Eichhornia* plants are very important as far as their medicinal and economic values are concerned. The soft parts (young leaves and shoots) of the whole plant are very useful for a person suffering from the free discharge of urine. The thick paste of such young parts of the water hyacinth plant brings a very cooling effect when it is applied to the lower part of the belly. It promotes

free urination. The author further clarifies that the small fruit of the *Eichhornia* flowers contains innumerable minute seeds resulting in countless seedlings after germination. The explosive expansion of this plant described by various workers including myself presents a very beautiful sight in the rivers, streams, trenches, ditches, etc. when the plants flower during the months of February to October. During this period the slightly light blue-violet flowers in spikes (the largest tepal having deep blue colour with a central yellow patch) present a very attractive sight for the insects helping in pollination, and the bees are also attracted. It has been observed that certain trees growing on highlands beside the water hyacinth ecosystems, sometimes bear beehives and thereby the honey is procured. The author further says that it would not be out of place to mention here that the blue-violet colour which 'the flowers here contain is the most advanced character taxonomically'. This 'blue colour' is due to the presence of Phycocyanin', and the centrally beautifying 'yellow patch' is due to the presence of the Xanthophyll pigment". Dhar (1962)²³ suggested that the manure formed in combination with the soil and the basic slag would be effective in fixing the atmospheric nitrogen. I do not agree with this; the view that if such plants with their inflorescences were taken up in the preparation of manure, the seeds would again be a menace in the low-lying fields. It is here, therefore, suggested that before bringing the water hyacinth plants into action all the inflorescences should completely be chopped off, removed, and burnt. Then, in that case, only the 'water hyacinth' plant can serve as a successful manure.

As regards the food value of this plant (water hyacinth), various workers have made numerous experiments and used this plant as food for pigs' cattle, etc. This plant has not been found palatable to cattle because of the presence of high potash and chlorine content (Chatterjee and Hye, 1938)²⁴. Hossain (1959)²⁵ reports that this plant when used as food causes 'diarrhoea' to cattle. As reported in Anonymous (1951)²⁶, the feeding of water hyacinth to buffaloes increases the milk considerably but it is watery, and the butter obtained is without taste and flavour Loosli *et al.* (1954)²⁷ wrote that *Eichhornia* contains only 0.4% digestible proteins and 4.7% total digestible nutrients, and therefore its use, unless mixed with other nutrients, is not recommended. From a review of the views and data of various workers above, it appears that

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Eichhornia crassipes used as food to the cattle is harmful and injurious; it should therefore, never be used as cattle food. There are many ways to get commercial benefits from this water hyacinth plant.

The water hyacinth, however, can be used as green food in poultry as it contains a high amount of carotene, a lower amount of protein' and intermediate 'fibrous content' (Smetanas, 1967)²⁸ are of the view that if this water hyacinth plant is fermented for 2 to 3 days, it is a good food for fish. This is because of the fact that under this process protein content considerably. Sharma (1971)¹⁰ says that as reported in (Ark, Sobairi, 1959) the water hyacinth ashes mixed with superphosphate or bone-meal with sulphuric acid in the ratio of (5:1), if applied to a pond at 100 lb/acre/week would cause an intense development of plankton, especially 'zooplanktons'. The author thinks that such a development of plankton with special emphasis on zooplanktons after application of the fertilizer in a fishpond as indicated above should disturb the users, as plankton includes phytoplankton and zooplankton; the herbivorous fishes eat up phytoplankton; the omnivorous and carnivorous fishes eat up phytoplankton and zooplanktons. A question arises as to what type of pond should be fertilized with a fertilizer prepared. Thus, I think such a fertilizer may be used for omnivorous and carnivorous fishes, which are generally found in freshwater shallow ponds or in the water hyacinth ecosystem.

In the whole survey of water hyacinth plants used as food for animals, it has been found that water hyacinth serves as a suitable food in poultry and for pigs only. Based on the information from various workers and on my own observations I find that the water hyacinth plant has spread very explosively on the larger part of the water surface on this earth where it has a congenial environment. Its eradication by any means whether by applying chemicals or by man's labour appears to be a madman's job. To indulge in this direction either with chemicals or with man's labour would involve heavy expenses without a matching return. Further, in both ways, the water hyacinth ecosystems would be fully disturbed and as a result, there would be an unparalleled loss.

CONCLUSION

It would be wiser to tackle the situation in such a way that the so-called 'Obnoxious weed' would be proved a 'boon' for the welfare of human society. This has been very clearly discussed in detail from

different angles and from all points of view. Naturally, the onus is on us as to how wisely we utilize this otherwise dreadful plant.

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