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Review Paper

WATER HYACINTH (Eichhornia Crassipes); From Invasive Weed to Valuble Resource"A Comprehensive Review

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ABSTRACT

Eichhornia crassipes (water hyacinth), a free-floating aquatic plant from the family "Pontederiaceae," is well-known as one of the most invasive weeds impacting freshwater ecosystems globally. Indigenous to the Amazon basin, it has significantly expanded throughout tropical and subtropical areas, including India, where it is commonly known as the "TERROR OF BENGAL" because of its swift growth and harmful ecological effects. The plant creates thick layers on the water's surface, causing diminished oxygen levels, interference with aquatic diversity, and blockage of water movement. In spite of its adverse environmental effects, recent studies emphasize water hyacinth as a valuable bioresource with considerable medicinal potential. The plant contains a variety of phytochemicals, including flavonoids, alkaloids, phenolic compounds, and glycosides, which play a role in its biological effects. Numerous studies have shown its antioxidant, anticancer, anti-inflammatory, antibacterial, and antimicrobial characteristics. Extracts from various plant parts, especially leaves, stems, and roots, have demonstrated significant bioactivity against pathogens and cancer cell lines, indicating its potential use in pharmaceutical and therapeutic applications

INTRODUCTION

Natural plants are the basis of existence on our planet. They are crucial for keeping environmental conditions stable, supporting ecosystems, and offering various resources. Plants hold great importance as they generate oxygen, food, and medicine, which are vital for our survival. Moreover, they help prevent soil erosion and promote sustainability. Plants aid all living organisms, directly or indirectly contributing to a healthy environment; they are primary producers

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that sustain life. Plants play a crucial role in preserving biodiversity. Water Hyacinth, scientifically named "*Eichhornia crassipes"* is a perennial aquatic plant that floats freely and belongs to the family "Pontederiaceae." While it is originally from the Amazon basin, it is now extensively spread across tropical and subtropical areas, including India. It is frequently referred to as the "TERROR OF BENGAL" because of its swift proliferation and detrimental impacts on aquatic ecosystems.

Water hyacinth is notable for its quick vegetative reproduction, enabling it to create dense mats on the water's surface. These mats greatly change aquatic habitats, rendering the species one of the most troublesome invasive weeds globally. Despite its poor reputation, recent research underscores its potential as a valuable bio-resource. Water hyacinth embodies nature's paradox. While its lavender flowers are undeniably attractive, this invasive aquatic plant is among the most productive and harmful species on the planet.



fig .1 Water Hyacinth

BOTANICAL DESCRIPTION :

Water hyacinth, scientifically referred to as "*Eichhornia crassipes"* . It possesses a brief, stoloniferous stem. It creates horizontal runners (stolons) that assist in vegetative reproduction. It consists of internodes that are compact and short. The plant's height typically ranges from 20 to 100 cm based on environmental factors. The leaf measures approximately 5-15cm in length; it is wide and rounded. The stalk measures approximately 10-15cm in length; it is swollen and spongy, while the roots range from 20-80cm long; submerged in water. The plant can proliferate and can span several meters to kilometers across the water's surface. The leaves are simple, shiny, ovate to round, and arranged in a rosette formation. It possesses fibrous and adventitious roots that emerge from the stem's base. It is elongated, feather-like, and ranges from dark purple to black, capable of floating freely in water.It is a free-floating aquatic perennial plant that creates dense mats on the water's Surface in ponds, lakes, and rivers, recognized for its quick vegetative growth. Flowers are vibrant, ranging from lavender to violet hues, and each flower features 6 perianth lobes. One petal displays a unique yellow spot outlined in blue. Flowers possess both male and female reproductive organs and exhibit bilateral symmetry. Reproduction happens both sexually (through seeds) and asexually (through stolons). Vegetative reproduction is the primary method, resulting in swift colonization.



fig.2 Eichhornia Crassipes

CLASSIFICATION OF WATER HYACINTH:

TABLE -1 TAXONOMICAL CLASSIFICATION OF WATER HYACINTH

DOMAIN	EUKARYOTIC
Kingdom	Plantae
Class	monocotyledons
Order	commelinales
Family	Pontederiaceae
Genus	Eichhorina
Species	Eichhorina crassipes

PHARMACOLOGICAL ACTIVITIES :

ANTI-OXIDANT ACTIVITIES:

Hadush Gebrehiwot and et.al., conducted a study on the antioxidant properties of methanolic and ethanolic extracts from water hyacinth leaves. Their research demonstrated that both extracts exhibit significant antioxidant activity, with the methanol extract showing greater effectiveness compared to the standard. The presence of flavonoids and phenolic compounds may account for the plant's antioxidant property.

ANTI-CANCER ACTIVITIES:

The researchers *Zelvisya sayutri,*et.al., demonstrated that water hyacinth leaf extract against MCF-7 type breast cancer cells with invitro methods show that it able to significantly inhibit cancer cell growth, especially at cerain concentration that show cytotoxic effect against MCF-7 cells.

ANTI-INFLAMMATORY ACTIVITIES:

"*Eichhornia crassipes"* were utilized for treating inflammation and wounds, attributed to the plant's phenolic compounds which contribute to its anti-Researchers *Widad Ben Bakrim* and et.al.,discovered that the stems and leaves of inflammatory properties.

ANTI-BACTERIAL ACTIVITIES:

Based on the results of a research article by *Hiba Hazim* and et.al.,they showed their findings utilizing the agar diffusion assay method. The ethanol extract of water hyacinth shows clear antibacterial activity, likely due to the presence of secondary metabolites like alkaloids, flavonoids, and phenols.

ANTI-MICROBIAL ACTIVITIES:

Utilizing the Maceration method, dried powdered plant material was extracted with various non-polar solvents such as petroleum ether, chloroform, and polar solvents like methanol and distilled water, as evaluated by *S. Khalid* et.al., The solvents utilized for extracting various parts of "*Eichhornia crassipes"* (root, stem, and leaf) were employed to investigate their antimicrobial activity and various measurements of inhibition zones against two fungal pathogens and two Gram-negative bacteria.

CONCLUSION

The current investigation into the pharmacological and phytochemical aspects reveals that the leaves, roots, and flowers of "*Eichhornia crassipes"* (Water hyacinth) contain Flavonoids, Alkaloids, Glycosides, Phenolic compounds, Terpenoids, Saponins, and more. These secondary metabolites contribute to various activities such as Anti-oxidant, Anti-inflammatory, Anti-cancer, Anti-microbial, and Anti-bacterial effects. Traditionally, various parts of the"*Eichhornia crassipes"* plant, including leaves, roots, and petioles, have been utilized in folk medicine.

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