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Beneficial Uses of Jalkumbhi (*PISTIA STRATIOTES)* for Animals, Human Life and Ecosystem

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Abstract: ***Animals and plants are part of our ecosystem and provide some benefits to each other. Jalkumbhi (Pistia stratiotes) is an important ornamental aquatic macrophyte planta is also known as water lettuce. The study is focused on uses of Pistia stratiotes for animals, human and fresh water ecosystem. There are various medical uses of this plant, this plant being utilized as famine food as well as beneficial for animals and ecosystem. It serves as a food source for many aquatic invertebrates. This plant plays an important role in purification of waste water. It is used for phytoremediation and determine the effectiveness as the remediation tool for the treatment of domestic wastewater. Effect of Pistia stratiotes to purify domestic waste water and remove impacts of effluents on corresponding water ecology were found to be satisfactory in various regions of India. This is best suitable technology for the removal of pollutants which destroy the flora and fauna of our environment by contaminating them and entering the food chain. Pistia stratiotes is beneficial for animals and freshwater ecosystem. Water lettuce is among the world's most productive freshwater plant.***

Keywords: Jalkumbhi, *Pistia startiotes*, Famine food, Phyto remedy

1. Introduction

Jalkumbhi, Pistia stratiotes (common name: Water lettuce) is free floating plant that is capable of forming dense mats on the surface of lakes, ponds, river and other fresh water bodies in India. *Jalkumbhi, Pistia stratiotes* is also known as water cabbage. It can be used as medicine of many diseases in India[3] and Africa. The people of Nigeria used the ash of the plant as a substitute for salt due to its high concentration of potassium chloride, a mineral salt. The leaf of water lettuce is infused in water to create an eye wash to treat conjunctivitis in some regions of Africa. Water lettuce is also considered an alternative for poultry feed in Indonesia due to its high content of crude protein. Water lettuce is used for wastewater treatment and best native plant source for phytoremediation in India. Domestic wastewater is producing in a huge quantity in India. Disposal of domestic wastewater in to fresh water bodies is constantly adding nutrients in to water where it is posing a serious threat to the water quality. When toxic substances enter lakes, streams, rivers and other water bodies, they get dissolved or lie suspended in water and get deposited, and mainly responsible for increase in the concentration of nitrogen and phosphorus. The presence of nitrogen in wastewater is undesirable, because of ammonical form of nitrogen which is toxic to fish and many other aquatic organisms. It is also an oxygen-consuming compound, which can deplete the dissolved oxygen in water. This results in the deterioration of water quality, which affects the aquatic ecosystem and created problem to organisms and human. This is big problem for many years in some areas of India. In such a condition there is an urgent need of a low-cost technology. Phyto remedy treatment using Water lettuce is best treatment in this condition[6]. This native plant can grow well and survive better in local conditions. The treatment of domestic wastewater by Phyto remedy using *Pistia stratiotes* can be adopted in various regions of India.

1.1 Jalkumbhi

Jalkumbhi is an aquatic plant, floating in lakes, streams and stagnant water throughout India. It forms danse mat on the water surface. Gray-green, leaves of *Pistia stratiotes* are about 10-20 cm long, widest at the apex, spongy near the base, with dense white hairs, 7-15 prominent parallel veins, and arranged in rosettes .Stem arise from leaf axis, up to 70 cm long, and entangle and covered with fine root hairs , dense, and hang unbranched about 50 cm below the water .*Pistia stratiotes* is free floating plant that is capable of forming dense mats on the surface of lakes, ponds, river and other fresh water bodies. this species is autotrophic. It is an ornamental plant for garden ponds and aquarium. Water lettuce is among the world's most productive freshwater aquatic plants.

1.2 Beneficial uses of Jalkumbhi, *Pistia stratiotes*:

1.2.1 Nutritive value

Water lettuce is high in vitamin A, C and K and it has anti-inflammatory properties, it contains beta -carotene, iron, calcium and magnesium. These nutrients help boost the immune system and could help lower the risk of heart disease. The plant also contains calcium and magnesium, which are minerals important for strong bones. Calcium also helps lower blood pressure and reduces the risk of developing kidney stones. The minerals in water cabbage could help prevent osteoporosis. Eating water cabbage could also help prevent cancer. Vitamin A could help slow down the growth of cancerous cells. Water cabbage also contains some protein. Protein is an important part of a healthy diet, and it can help build muscle and reduce the risk of getting type 2 diabetes. Water cabbage is low in calories and fat. It is also rich in fibre which means it could help promote a healthy digestive system. It could also help lower cholesterol levels and reduce the risk of heart disease. Jalkumbhi contains

certain nutrients that are important for a healthy metabolism. All of these combined make water cabbage a very nutritious and healthy food.

1.2.2 Famine food

It was found that P*istia sretiotes* can be utilized as famine food[1,2]. The efficacy of artificial feed in promoting maximum growth in a fresh water culture system depends upon the quality, quantity and feeding strategies employed. In Singapore and Southern China, *Pistia stratiotes* is commonly grown or collected as animal feed for ducks and pigs. Water lettuce is also considered an alternative for poultry feed in Indonesia due to its high content of crude protein. The leaves and stems contain 92.9% moisture,1.4% protein,0.3%fat,2.6%carbohydrate 0.2% calcium,0.06% phosphorus,0.9%fibres. Pistia stratiotes is rich in calcium oxalate crystals that are litters in taste. Nevertheless, there are records of the plant being utilized as famine food in India. Besides of balance nutrients, feed should be palatable and economically viable.

1.3 Medical Uses of Jalkumbhi

There are various medical uses of this plant, the powdered leaf is applied to skin infection and syphilitic eruption. Ash of leaves is used in treating infections of ringworm. It is antifungal and extraction of the leaves of water lettuce reduce degranulation in allergic reactions. A large number of medicinal properties are attributed to the plant. Leaves of this plant are used in eczema, leprosy, ulcers, piles and syphilis. This plant is considered as antiseptic, anti-tubercular and anti-dysenteric. It is useful in Tridosha fever and diseases of blood.

1.4 Jalkumbhi as Phyto remedial tool for waste water treatment

Water lettuce can absorb and accumulate toxic heavy metals[4,5]. The roots and leaves of the plant, *Pistia stratiotes* have been found as hyper-accumulator, absorb excess nutrients and heavy metals, Zinc, chromium etc., in contaminated waters. *Pistia stratiotes* can be grown in water gardens and can reduce harmful algal blooms (Fig.2). It can uptake of Phosphorus and ammonia nitrogen. The plant is able to control the growth of algae by restricting light penetration in the water column.

1.5 Biogas production

P. stratiotes, an aquatic weed, was investigated as a substrate for biogas production in batch digestion. An inoculum was necessary to obtain biogas production from the weed. It has been found that with *Pistia* only, production of carbon dioxide alone was high during the first 5 days of digestion but began to level off thereafter. With inoculated *Pistia*, a high rate of biogas production was sustained for nearly 10 days and the average methane content was 58–68%. The digesters charged with *Pistia* alone had significant concentrations of propionic, butyric, isobutyric, valeric, and isovaleric acids. These acids were not present in detectable concentrations, in the digesters running with inoculated *Pistia*, except during the first 4 days of the digestion when propionic acid was formed. When an inoculum was added to a "soured" digester the performance of the latter improved.

Figure 1 : Jalkumbhi

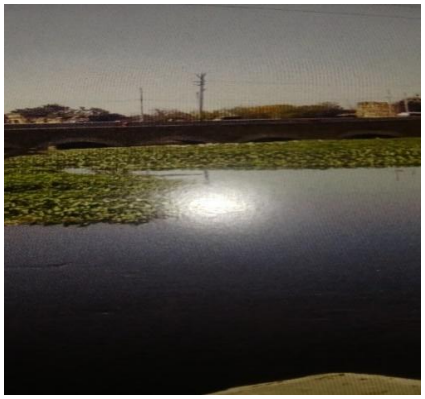

Figure 2: Jalkumbhi

Table 1: Compound from Jalkumbhi

Sr.no	Compound	Nature of compound	Function
1.	n-Hexadecanoic acid	Palmitic acid ester	Antioxidant,hypocholestrolemic,anti androgenic,antipsychotic,hemolytic
2.	Hexadecanoic acid	Palmitic acid ester	Antioxidant,hemolytic,hypocholesterolemic flavor,antiandrogenic
3.	Diisooctylphthalate	Plasticizer	Antimicrobial,antifouling
4.	Stigmasterol	Steroid	Antioxidant,hypoglycemic,thyroid inhibitory properties,precursor of progesterone,antimicrobial,anticancer,anti arthritic,antiasthama,anti inflammetry,diuretic
5.	L-Glutamine	Amino acid	Building block of protein

2. Discussion

Jalkumbhi**,** *Pistia stratiotes* is beneficial for animals and freshwater ecosystem. Water lettuce is among the world's most productive freshwater plant. Now this plant is established as native plant of India. The plant has short span maturation time of about 90 days and easy to grow in local conditions. The large number of medicinal properties are attributed to this plant. Water lettuce has good nutritive profile, contain 19.86% crude protein and 16.39% crude fiber,

Pistia stratiotes is rich in calcium oxalate crystals that are litter in taste. Jalkumbhi can be incorporated in animal feed to provide all the protein, crude fat and minerals at very low cost. *Pistia statiotes* is effective tool for wastewater treatment. The study of phytoremediation for wastewater treatment in fresh water ecosystem, using *Pistia stratiotes* show that there is vast reduction in concentration of wastewater pollutants. BOD was reduced; this shows that *Pistia stratiotes* having a capability to remediate the heavy metals from wastewater. Phytoremediation technique can be well established but there is a need for more research work and planning. Watter lettuce should be planted in fresh waterbodies where it may control pollution.

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