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Research Article

BIODIVERSITY ASSESSMENT OF AQUATIC PLANTS IN JHUNJHUNU DISTRICT OF RAJASTHAN, INDIA

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ABSTRACT
In most of fresh water system aquatic plants are important components of food web dynamics. The aquatic plants not only play a crucial role to maintain the composition of aquatic ecosystem but also they have vital role in human welfare. In the present study an account is given of aquatic plants conducted in some fresh water bodies at Jhunjhunu district of Rajasthan, India. A field survey of the study area was carried out to describes the aquatic diversity on the basis of their morphological characteristics. During the study total 15 aquatic angiospermic plant species were identified which belongs to 11 families. Data inventory consists of botanical name, family name, local name, habitats and their description.

Keywords: *Biodiversity, Aquatic Ecosystem, Jhunjhunu, Conservation, Awareness*

INTRODUCTION
Human health and well-being are directly dependent on biodiversity. Terrestrial as well as aquatic biodiversity constitute a valuable natural resources in economic, cultural, aesthetic, scientific and educational terms. Biodiversity includes assemblage of plants, animals and micro-organisms, their genetic variability expressed in varieties and populations, their habitats, ecosystems and natural areas, the mosaic of which gives richness to the natural environment. Biodiversity or biological resources provide food, clothing, housing, medicine and spiritual nourishment to human beings (Kulshrestha, 2005). The majority of aquatic plants are consumed only after they have died and partially decomposed into detritus. Detritus is eaten primarily by aquatic insects, invertebrates and larger crustacean (Madsen, 2009). The potential of aquatic plants as food and feed has been emphasized by several authors (Bhowmik et *al.*, 2013). They are major components of fresh water ecosystems in that they play key functions, contribute to maintain the related biodiversity and supply services to human society. Aquatic plants can form the non-conventional sources of foods, medicines for many diseases. Indeed, they are primary producers that provide habitat, food and refuges for periphyton, invertebrates, fish, amphibians and birds. They also participate to ensuring the clear state of shallow waterbodies through their effect on biogeochemical cycles and on the sediment deposition process (Bornette and Pujalon, 2011). Aquatic habitats are also crucial in providing necessary habitat for feeding, nesting and migrating waterfowl (Havera, 1999).
Fresh water ecosystems are experiencing decline in biodiversity far greater than those in the most affected terrestrial ecosystems. Threats to fresh waters such as pollution of different kinds, unfavourable climatic changes, eutrophication, acidification, and alien species invasion lead to reduction in native hydrophytes diversity (Chambers *et al.*, 2008). Conservation of freshwater biodiversity faces serious challenges because of lack of public awareness about its magnitude and importance (Dudgeon, 2000). Most of the people are more conscious about the conservation of forests but aquatic plants are more or less neglected. Aquatic biodiversity, which is poorly understood in comparison to terrestrial biodiversity and at the same time faces several threatened by invasive species, climatic change, habitat degradation and change in ecosystem conditions. Keeping these facts in mind, the present work is to give importance to aquatic plants and to their conservation.

MATERIALS AND METHODS
The sample of selected plants were collected from different water bodies (Shiv Ganga Canal, BITS Pilani; Birla Talab, BITS Pilani; Fatah Sagar Talab, Baggar; Pannah Sagar Talab, Khetri) of Jhunjhunu district of

Rajasthan. Jhunjhunu district is situated in Western India and located between $27^0$51'0"N Latitude and $75^0$16'12"E Longitude. It is a part of the sub arid region of Thar Desert and the climate of Jhunjhunu district is mainly dry. The summer months are hot while the winter months are cool. In selected water bodies some have fresh water throughout the year and some are drought affecting, yet there will be water at the centre of pond in the muddy form.

During the survey, plants occurring in different water saturated areas were collected, photographed and identified. The plant species were collected in their flowering, fruiting or at their fully mature stage. The field survey was dual in every month. They were preserved according to the conventional herbarium techniques. The species are identified with the help of local inhabitants and also by relevant literatures. Aquatic plants are classified according to their habitat and morphological characteristics.

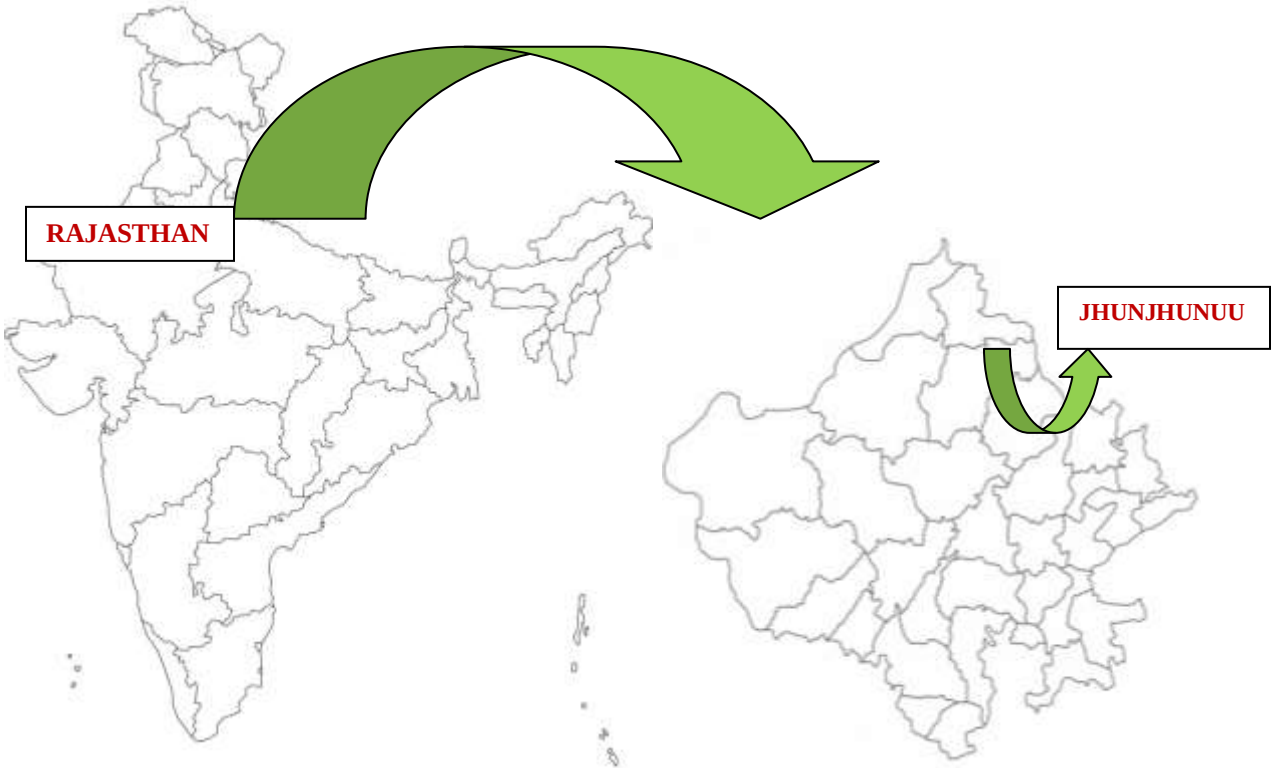

Figure 1: Location Map of Study area in Rajasthan

RESULTS

The present study focuses on an inventory of aquatic angiospermic diversity of Jhunjhunu district of Rajasthan. Selection of the ponds for the collection of plants has been done as per the richness of ponds. After carefully screenings following aquatic angiospermic plants have been recognized. For each species botanical name, local name, family name, descriptions were provided.

The present study recorded 15 species of aquatic plants belonging to 11 family in study area. Families with maximum number of species includes Araceae with four species followed by Hydrocharitaceae (two). Ceratophyllaceae, Convolvulaceae, Nelumbonaceae, Nymphaeceae, Pontederiaceae, Polygonaceae, Potamogetonaceae, Trapaceae and Typhaceae were represented by only one species (Table 1).

Among five morpho-ecological groups, free floating with 40% dominated in the study areas followed by anchored submerged (20%), anchored floating (20%), emergent amphibious (13%) and free submerged with only 6.66% (Fig 2).

Table 1: Aquatic Diversity in Water Bodies of Jhunjhunu District (Raj.)

S.N.	Botanical Name	Local Name	Habitats	Description
1.	*Ceratophyllum demersum* (Ceratophyllaceae)	Jhanjhi	Free submerged	Plants are rootless. Leaves are dark green in color and arranged in whorls on the stem. Spacing between leaf whorls is highly variable.
2.	*Eichornia crassipes* (Pontederiaceae)	Jalkhumbhi	Free floating	Leaves are broad and large. Flowers are violet, blue. Roots are freely feathery, dark fibrous type.
3.	*Hydrilla verticillata* (Hydrocharitaceae)	Kureli	Anchored submerged	Stem is long and branched with oppositely arranged leaves. Leaf is oval shaped with margins toothed.
4.	*Ipomea aquatic* (Convolvulaceae)	Kalama	Anchored floating	Stems are long, hollow, allowing them to float. Leaves vary from sagittate to lanceolate, 5-15 cm long and 2-5 cm broad. Flowers are trumpet shaped.
5.	*Lemna minor* (Araceae)	Pancha	Free floating	Leaves are fronds which may grow singly or in group. Roots may or may not extend from the underside.
6.	*Nelumbo nucifera* (Nelumbonaceae)	Kamal	Anchored floating	It is national flower of India. They have large, round leaves with microscopic hair. Flower are usually found on thick stems rising several centimeters above the leaves.
7.	*Nymphaea nauchii* (Nymphaeaceae)	Poothali	Anchored floating	The leaves are broadly rounded, 25-40 cm across, with a notch at the leaf stem. The flower are 10-15cm diameter. It has blue petel.
8.	*Pistia stratiotes* (Araceae)	Topapana	Free floating	Plants consists of distinct rosettes, light yellow-green leaves. Tufts of long unbranched, fibrous roots. Leaves have definite veins radiating from leaf base towards leaf margin.
9.	*Polygonum spp.* (Polygonaceae)	Gulabi	Emergent amphibious	Erect, rooted herbaceous plant with alternate, oblong leaves. Flowers are small, clustered and generally pink colored. Plant may be emergent in shallow water or completely submersed with only the flowers above the surface.
10.	*Potamogeton crispus* (Potamogetonaceae)	Bihlongoni	Anchored submerged	Leaves are thin, alternately arranged on the stem. Minute teeth visible along entire margin of leaf. Commonly grows early in the spring and dies back during midsummer. Fruits borne in spike above the water surface.
11.	*Spirodela polyrhiza* (Araceae)	Panivaragu	Free floating	Plant has 2 to 3 rounded leaves, which are usually connected. It has several roots beneath each leaf. The under leaf surface of plant is dark red.
12.	*Trapa natans* (Trapaceae)	Singhada	Free floating	Leaves are large, triangular, fan shaped, have toothed edged. Roots are fine, long, many in number. Fruits are nut like.
13.	*Typha spp.* (Typhaceae)	Hangla	Emergent amphibious	Long, slender, grass like stalks up to 10 feet in height. Inhabits wet lowlands and water up to 4 feet deep.
14.	*Vallisneria americana* (Hydrocharitaceae)	Fitagah	Anchored submerged	Roots buried in mud with long, slender, ribbon-like, flaccid leaves. Flower visible late in summer.
15.	*Wolffia spp.* (Araceae)	Thali	Free floating	Smallest flowering plant in world, Plants are rootless. The flower are produced in a depression on the top surface of the plant body.

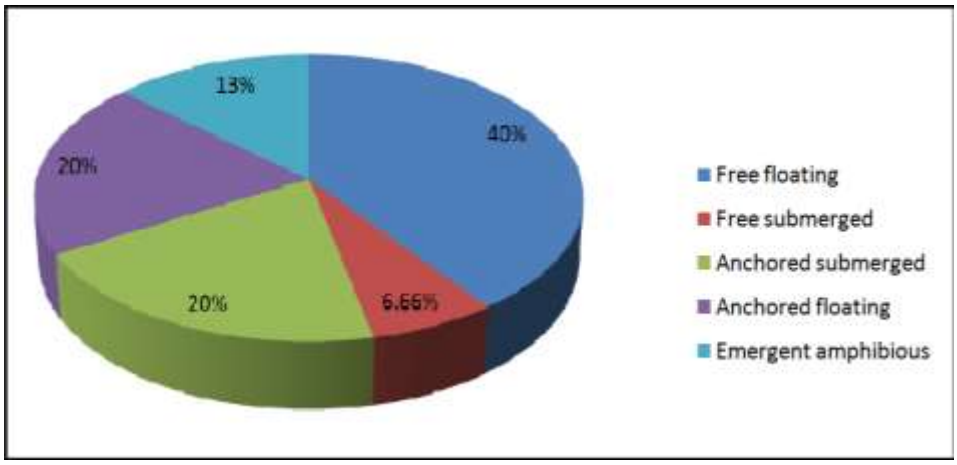

Figure 2: Analysis of data based on habitats showed by the Aquatic Plants

DISCUSSION

Biodiversity has great importance for human survival and economic well-being and for the ecosystem function and stability. The importance of aquatic plant diversity for sustainable life support is an acceptable fact throughout the world.

Although Rajasthan is considered as a desert state but it also has rich aquatic flora and biodiversity. During the present study total 15 species of aquatic plants were recorded and summerised them according to botanical name, family, local name and also by their descripition. Some reports published on the aquatic plants exclusively in Rajasthan state include Ajit Sagar Dam (Nair and Kanodia, 1959); Kota (Gupta, 1966); Bundi district (Maheshwari and Singh, 1974); Ghana Bird Sanctuary (Saxena, 1975); Pareek and Sharma (1988); Pareek A (1996); Jaipur district (Sharma and Kumar, 2012) and Pilani BITS, (Khan and Verma, 2012).

The classification and distribution of aquatic plants in India have been reviewed in past by Agharkar (1923); Deb (1976); Joy (1986); Srivastava *et al* (1987); Jayanath (1988); Fassett (2000); Jain *et al* (2007); Sharma and Saikia (2010); Saini (2010); Pande and Mishra (2011); Dhore *et al* (2012); Chatterjee and Dewanji (2014).

The documentation and proper assessment of aquatic biodiversity is dependent on respective areas and their habitat. Unfortunately, presently aquatic ecosystems are destroyed rapidly due to various reasons. The loss of biodiversity is mainly from habitat destruction, over-harvesting, pollution and inappropriate introduction of exotic plants and animals. The survival of native aquatic species is threatened and hence attention on the aquatic resources. Immediate steps are to be taken for their conservation and sustainable utilization. There is a need for increased legal protection, well designed management practices to conserve the aquatic biodiversity. The measure for conservation of aquatic resources should be taken up on priority by different government and non-government organizations for benefit of humanity.

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