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ECONOMICALY SIGNIFICANT AQUATIC PLANTS OF JALPAIGURI DISTRICT, WEST BENGAL, INDIA

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Aquatic angiosperms are actual substantial customs of plant life and are indispensable component of the fresh water biome. Aquatic plants are very remarkable forms of plant life and are essential component of the aquatic ecosystem. A variety of products and significant beneficial services are offered by these groups of organisms to the human society and ecosystem. They play imperative role in the life of human beings as food, fodder, medicine, etc. In spite of that, the knowledge of correct utilization of aquatic plants is lacking among common people and in order to make them aware, steps are to be introduced. In this survey an attempt has been made to categorize aquatic plants and their utilization by the local inhabitants of Jalpaiguri district, West Bengal, India.

Keywords: wetland, aquatic plants, utilization, angiosperms

ЭКОНОМИЧЕСКИ ЗНАЧИМЫЕ ВОДНЫЕ РАСТЕНИЯ РАЙОНА ДЖАЛПАЙГУРИ, ЗАПАДНАЯ БЕНГАЛИЯ, ИНДИЯ

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Водные покрытосеменные растения являются существенной частью растительной жизни и незаменимым компонентом биома пресной воды. Водные растения являются очень замечательными формами растительной жизни и являются важным компонентом водной экосистемы. Эти группы организмов предлагают человеческому обществу и экосистеме разнообразные продукты и значительные полезные услуги. Они играют важнейшую роль в жизни человека как пища, корм, лекарство и т.д. Несмотря на это, знания о правильном использовании водных растений у простых людей отсутствуют, и для того, чтобы они осознали это, необходимо предпринять определенные шаги. В этом обзоре была предпринята попытка классифицировать водные растения и их использование местными жителями района Джалпайгури, Западная Бенгалия, Индия.

Ключевые слова: водно-болотные угодья, водные растения, использование, покрытосеменные растения

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INTRODUCTION

Plant which is normally found to grow in association with stagnant or slow running water whose level is at or above the surface of the soil is known as aquatic plant [Arber, 1963; Sculthorpe, 1967; Cook, 1974]. Aquatic angiosperms represent a considerable part of the world's flora. About 79 families and 380 genera contain aquatic species [Cook, 1992]. The Indian wetlands support 20 percent of total Biodiversity of the country [Deepa and Ramachandra, 1999]. As their anatomical, morphological, reproductive and physiological peculiarities, the aquatic plants attract a special interest from biologists [Perveen, 1999]. Aquatic macrophytes have multi beneficial role to serve humans well over the centuries, by providing food, medicines, fodders, manures and building materials and also play a crucial role to maintain the healthy ecosystems. Economical point of view it provides multifaceted economic activities such as, attracts tourists of different types. They serve as primary oxygen producers through photosynthesis and provide substrate & shelter for algae and many invertebrates and also help stabilize river and stream banks [Kaufman, 1989]. Macrophytes are natural purifier of the wastewater. They perform it through the uptake of dissolve nutrients. They play an important role against eutrophication in water bodies (ponds, lakes etc.). Yet rapid shrinking of wetlands persists due to non-judicious use of wetland by the inhabitants of the place. People thrive on different types of resources from the wetland without considering its ecological balance. The water bodies along the important roads are being converted into garages & shopping malls eliminating entirely the existence of aquatic vegetation. In the name of development & beautification wetlands are filling heavily at random. Thus it has become a great concern for the existence of wetland ecosystems. To check the above situation we need to transmit the knowledge to the people about the enormous economic possibilities of wetland and its vegetation. The sub-Himalayan location of Jalpaiguri district blessed with huge number of flowing rivers or streams and wetland systems with varied sizes and water bodies of this district houses very rich and stable biodiversity with all possible evolving nature [Chowdhury and Chowdhury. 2016]. That is why the attempt has been given to investigate the economic importance of aquatic plants available in the wetlands of Jalpaiguri district, West Bengal, India.

MATERIALS & METHODS

Study area

The work was mainly done at two important wetlands of the Jalpaiguri district of West Bengal, India (Figure 1). These two wetlands are Gajoldoba wetland ($26^{o}76'$ N, $88^{o}59'$ E) & Domohoni wetland ($26^{o}56'$ N, $88^{o}76'$ E). The distance of Gajoldoba wetland & Domohoni wetland is 40 km & 12 km respectively from Jalpaiguri Town. The mean elevation of the land is 75-100 meter from sea level. Both the wetland situated at the right bank of the river Teesta. In summer the temperature ranges from $28^{o}C$ to $37^{o}C$. In winter it ranges from $5^{o}C$ to $15^{o}C$. The average rainfall is about 3500 mm. The average humidity remains 80-90%. The landscape of the district is called Terai & Dooars.

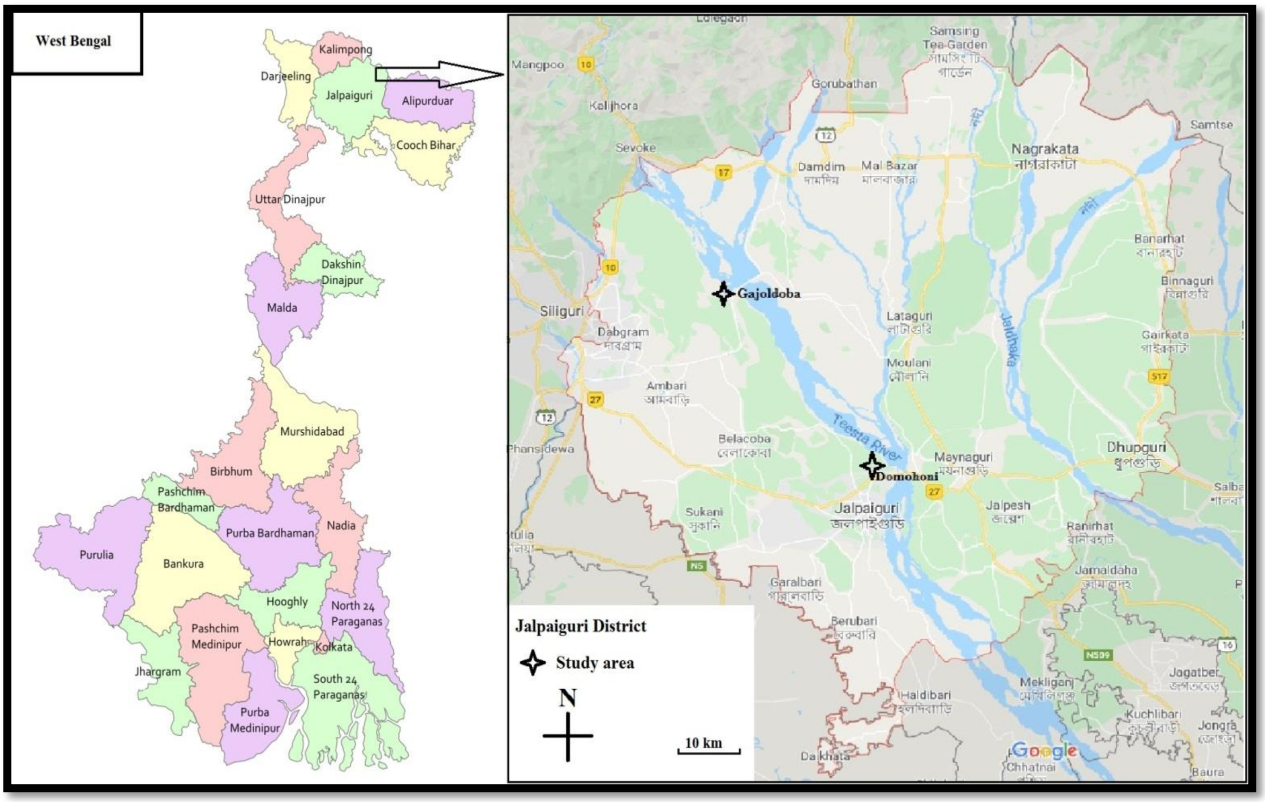

Fig. 1. Map of study area (Gajoldoba & Domohoni wetland, Jalpaiguri, West Bengal, India

Methodology

The authors surveyed the study areas several times in three different pre-dominant season from 2015-2019. The collected plant specimens have been brought under herbarium sheet strictly following the proper herbarium making techniques [Jain & Rao 1977; Chowdhury, 2009]. To identify the collected plant specimens, different taxonomic literatures [Hooker 1886; Prain 1908; Grierson & Long 1983] were consulted and also matched with pre-identified herbarium specimens of some reputed herbaria [CAL, NBU, ASSAM]. The herbarium specimens were deposited in the herbarium of North Bengal University, Taxonomy of Angiosperms and Biosystematics Laboratory [NBU].The inhabitants of the area informed lucidly about the economic importance of the plants, moreover some information has been collected from different literature [Kiran *et al.*, 2007; Chowdhury and Das, 2007, 2014; Chowdhury, 2013, 2014; Das *et al.*, 2016; Sarkar *et al.*, 2017; Sakthinathan 2018; Paul *et al.*, 2019]

RESULTS & DISCUSSIONS

A total of 60 species of plants having 49 genera and 33 families are collected from the selected study area. These plants have been shown alphabetically in Table 1 according to their family, micro-habitat, parts used, ailments and other uses.

Table 1. Economically significant aquatic plants of Jalpaiguri district

Sl. no.	Scientific name [Family]	Micro-Habitat *	Parts used	Ailments	Other uses
1	*Acmella calva* (DC.) R. K. Jansen [Asteraceae]	WH	Leaves, flower, root	Toothache, mouth ulcer, skin disease, dysentery	Vegetable
2	*Acorus calamus* L. [Acoraceae]	WH	Leaves, rhizome	Indigestion	Perfume, flavour, candy
3	*Alternanthera philoxeroides* (Mart.) Griseb. [Amaranthaceae]	WH	Whole plant	-	Fodder
4	*Alternanthera sessilis* (L.) R. Br. e*x* DC. [Amaranthaceae]	WH	Whole plant	Blood impurity, night blindness, snake bite	Vegetable
5	*Aponogeton natans* (L.) Engl. & K. Krause [Aponogetonaceae]	RSH	Leaves, seeds, young shoots	Indigestion	Vegetable
6	*Bacopa monnieri* (L.) Wettst. [Plantaginaceae]	WH	Whole plant	Heart disease, constipation, bronchitis, asthenia, nervous problem, skin disesses, epilepsy, ulcer, leprosy, cold, cough.	Vegetable
7	*Centella asiatica* (L.) Urb. [Apiaceae]	WH	Leaves	Puerperal diarrhoea, colic pain, indigestion, liver problem, bone fracture, madness, gastric, stomach ache due to mestruation, vomiting of child	-

8	*Ceratophyllum demersum* L. [Ceratophyllaceae]	SFH	Leaves	Heart disease, fever, bile problem	-
9	*Coix lacryma-jobi* L. [Poaceae]	WH	Fruits, seeds, leaves	Inflammation, urinary problem, menstruation problem	-
10	*Colocasia esculenta* (L.) Schott [Araceae]	WH	Leaves, seeds, young shoots	Constipation, cracked feet	Vegetable
11	*Commelina diffusa* Burm. *f.* [Commelinaceae]	WH	Whole plant	Dysentery, boils	-
12	*Corchorus capsularis* L. [Malvaceae]	REH	Leaves	Tendency of miscarriage	Fiber
13	*Cynodon dactylon* (L.) Pers. [Poaceae]	WH	Whole plant	Bleeding from nasal path, tuberculosis, tendency of miscarriage, fistula, bone fracture, cut, wounds	-
14	*Cyperus iria* L. [Cyperaceae]	WH	Whole plant	-	Paper, fiber, fuel, food
15	*Cyperus difformis* L. [Cyperaceae]	WH	Whole plant	-	Paper, fiber, fuel, food
16	*Cyperus rotundus* L. [Cyperaceae]	WH	Whole plant	Leucorrhea, weakness, loss of appetite, Indigestion, Liver problem, Bone fracture, Pyorrhoea, Septic, Gangrene, Dysentery	-
17	*Dentella repens* (L.) J.R.Frost. & G.Forst. [Rubiaceae]	WH	Leaves	Blood impurity, low eyesight	-
18	*Drosera burmanni* Vahl [Droseraceae]	WH	Leaves	Stomach ache	-
19	*Eclipta prostrata* (L.) L. [Asteraceae]	WH	Whole plant	Hair fall, gray hair, skin disease, asthma	-
20	*Eichhornia crassipes* (Mart.) Solms [Pontederiaceae]	FFH	Leaves, petiole, flower	Lack of antioxidant	Green manure, vegetable
21	*Enydra fluctuans* DC. [Asteraceae]	WH	Leaves	Constipation, inflammation, liver disease, skin disease, gonorrhea, paralysis, epilepsy, indigestion	Vegetable
22	*Eriocaulon setacoum* L. [Eriocaulaceae]	REH	Whole plant	-	Ornamental
23	*Grangea maderaspatana* (L.) Poir. [Asteraceae]	WH	Leaves	Stomach ache, asthma, cut, wounds	-
24	*Hydrilla verticillata* (L.F.) Royle [Hydrocharitaceae]	RSH	Leaves	Wounds, boils	Biogas, fish feed

25	*Hydrocotyle sibthorpioides* Lam. [Araliaceae]	WH	Leaves	Colic pain, Indigestion, Liver problem, Madness, Gastric, Stomach ache due to mestruation	-
26	*Hydrolea zeylanica* (L.) Vahl [Hydroleaceae]	WH	Leaves	Ulcers	-
27	*Hygrophila auriculata* (Schumach.) Heine [Acanthaceae]	WH	Whole plant	Anaemia, jaundice, rheumatism, leucorrhea, weakness, loss of appetite, madness	Vegetable
28	*Hypericum japonicum* Thunb. [Hypericaceae]	WH	Leaves, roots	Asthma, dysentery, liver disease, appendicitis, boils	-
29	*Ipomoea aquatica* Forssk. [Convolvulaceae]	RSH	Leaves, Shoot	Blood impurity	Vegetable
30	*Limnophila sessiliflora* (Vahl) Blume [Plantaginaceae]	RSH	Whole plant	-	Ornamental
31	*Monochoria hastata* (L.) Solms [Pontederiaceae]	REH	Leaves, stalk	Madness, boils	-
32	*Monochoria vaginalis* (Burm.*f.*) C. Presl [Pontederiaceae]	REH	Leaves, stalk	-	Organic manure, fodder
33	*Murdannia nudiflora* (L.)Brenan [Commelinaceae]	WH	Whole plant	Leprosy, headache, asthma, piles, jaundice	-
34	*Nasturtium officinale* R.Br. [Brassicaceae]	REH	Whole plant	-	Vegetable
35	*Nelumbo nucifera* Gaertn. [Nelumbonaceae]	RHF	Whole plant	Heart disease, liver disease, vomiting, diarrhoea, bone fracture, skin disease, ring worms, piles,	Vegetable, bread making, ornamental plant
36	*Nymphaea nouchali* Burm.*f.* [Nymphaeaceae]	RHF	Whole plant	Diarrhoea, dysentery, dyspepsia, goiter, burn wounds, menstrual problem, heart disease, scabies	-
37	*Nymphaea pubescens* Willd. [Nymphaeaceae]	RHF	Root	-	Veterinary medicine
38	*Nymphaea rubra* Roxb. *ex* Andrews [Nymphaeaceae]	RHF	Stem, leaves	-	Vegetable
39	*Nymphoides indica* (L.) Kuntze [Menyanthaceae]	RHF	Leaves	Jaundice, dysentery, fever, headache	-

40	*Oenanthe javanica* (Blume) DC. [Apiaceae]	WH	Leaves	Jaundice, hepatitis, tumours	-
41	*Oldenlandia corymbosa* L. [Rubiaceae]	WH	Whole plant	Blood impurity	-
42	*Oryza sativa* L. [Poaceae]	REH	Grains	Tendency of miscarriage, Irregular menstruation, Leucorrhoea, Small ovary problem	Food & fodder
43	*Ottelia alismoides* (L.) Pers. [Hydrocharitaceae]	RHF	Tender leaves, petiole, fruit	Fever, haemorrhoids, tuberculosis	Vegetable, fruit
44	*Pistia stratiotes* L. [Araceae]	FFH	Leaves, root	Eczema, leprosy, ulcers, piles, syphilis, constipation	-
45	*Pogostemon cablin* (Blanco) Benth. [Lamiaceae]	WH	Whole plant	Menstruation problem	Insectiside
46	*Persicaria barbata* (L.) H.Hara [Polygonaceae]	REH	Leaves, young shoots	Pneumonia, fever, colic pain	Vegetable
47	*Persicaria chinensis* (L.) H.Gross	REH	Leaves	Dysentery, sore throat	-
48	*Persicaria glabra* (Willd.) M.Gómez [Polygonaceae]	REH	Plant juice, rootstock, leaves	Cough, fever, asthma, pneumonia, jaundice	-
49	*Persicaria hydropiper* (L.) Delarbre [Polygonaceae]	REH	Whole plant	Cut, wounds, inflammation, urinary disease, fungal infection, toothache, epilepsy, gangrene, rheumatism	-
50	*Polygonum plebeium* R.Br. [Polygonaceae]	REH	Leaves, root	Pneumonia, hairfall	Vegetable
51	*Polygonum pubescens* Blume [Polygonaceae]	REH	Leaves	Hydrophobia	Fishing
52	*Polygonum viscosum* Buch.-Ham. *ex* D. Don [Polygonaceae]	REH	Shoot	Nervous problem, AIDS, ovarian cancer	-
53	*Potamogeton octandrus* Poir.	RSH	Leaves	-	Fish feed, duck feed
54	*Ranunculus sceleratus* L.	WH	Leaves, stem, seeds and root	Diarrhoea, dysentery, ringworm, kidney disease	Vegetable
55	*Rumex dentatus* L. [Polygonaceae]	REH	Whole plant	wrinkles, skin disease	-
56	*Sagittaria sagittifolia* L. [Alismataceae]	REH	Leaves, tuber	Skin disease, birth control	-

57	*Spirodela polyrhiza* (L.) Schleid. [Araceae]	FFH	Leaves	Urinary disease, wounds, cuts	Compost manure, duck weed, animal feed, purifying wastw water
58	*Trapa natans* L. [Lythraceae]	RHF	Fruits, leaves	Fever, leprosy, inflammataion	Fruits, sweet dishes, vegetables
59	*Typha latifolia* L. [Typhaceae]	REH	Fruits, seeds, stem	-	Food & fodder, edible oil, vegetable, paper industry
60	*Vallisneria spiralis* L. [Hydrocharitaceae]	RHF	Whole plant	-	Fish feed, Aquarium plant

* Abbreviation used FFH = Free Floating Hydrophytes; RHF = Rooted Hydrophytes with Floating leaves; SFH = Submerged Floating Hydrophytes; RSH = Rooted Submerged Hydrophytes; REH = Rooted Emergent Hydrophytes; WH = Wetland Hydrophytes

Depending upon the primary data it can be stated that the characteristics of the study area possess 6 groups of micro-habitat of plants and their percentage level has been shown through a pie chart (Figure 2). 27 species belong to wetland hydrophytes, highest in rank. The lowest in rank is

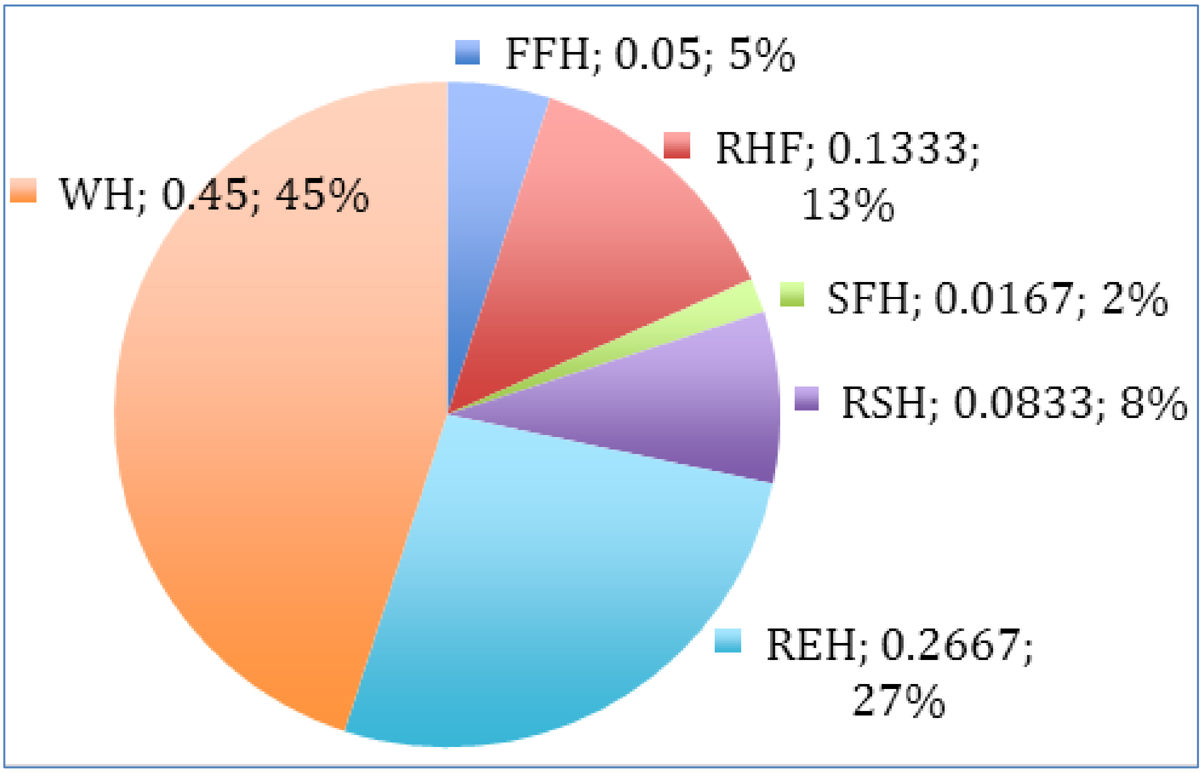

Fig. 2. Pie chart of the micro-habitat of the studied plants (%)

a single species fall under submerged floating hydrophytes group. Among the available plant family Polygonaceae is dominant (8 species) followed by Asteraceae (4 species). Out of 60 species 48 species are having medicinal properties, which are used to treat various diseases. Highest numbers of species (8 species) are applied to treat dysentery. Besides 6 species for skin disease, 6 species for indigestion, 5 species for asthma and 5 species for heart disease are being used as traditional medicine. Other 34 plant species shown in the table 1 are used as food, fodder, manure, water purifier, in perfume, fiber & paper industries and as ornamental plants.

CONCLUSION

It has been noticed during the time of filed study that most of the inhabitants of the study area failed to identify the plants by its name though some of them have the idea about the medicinal effect of those plants. Local name of the plants vary from place to place even within the same district. Most of the elderly people already forgot the use of this plant in different ailment. They always refer to a few senior inhabitants of the area for identification. Urbanization effected the survival of these plant species as they are viewed as a jungle to them. Medicines prepared from these plants have less or no side effect [Lata *et al.*, 2010]. Through this study an attempt has been made to aware the inhabitants of that area about the importance of these plant species and encourages them to protect this 'gift of nature'. The success of this tiny endeavor rests upon the eternal existence of those species, which brings relief from various diseases. More intensive studies need to be conducted on phytochemical analysis.

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