Asian Jr. of Microbiol. Biotech. Env. Sc. Vol. 26, No. (2) : 2024 : 284-289

ISSN-0972-3005

DOI No.: http://doi.org/10.53550/AJMBES.2024.v26i02.018

FLORISTIC DIVERSITY OF AQUATIC PLANTS FROM THE INDUSTRIAL BELTS OF THE JAJPUR DISTRICT OF ODISHA, INDIA

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(Received 6 March, 2023; Accepted 30 April, 2024)

***Key words**: Aquatic plants, Bio-resources, Conservation, Livelihood, Phytodiversity*

Abstract – A comprehensive study was undertaken to assess the aquatic flora in the Jajpur district of Odisha. The survey was conducted within different water habitats within the industrial belts of Jajpur district from 2021 to 2023, aimed at documenting the diverse aquatic habitats in this region. Extensive and intensive studies were carried out to identify and catalog the aquatic plants, with voucher specimens collected and herbaria prepared using established protocols. The research revealed a total of 84 species of aquatic and wetland plants belonging to 55 genera and 31 families. These included 44 marsh species, 18 amphibious species, 3 submerged species, as well as 10 free-floating and 9 fixed-floating species. These plants not only meet the essential needs of the local community but also play a crucial role in maintaining the ecological balance of the area. Further research will be vital in preserving these valuable bio-resources for future generations.

INTRODUCTION

Aquatic ecosystems represent a valuable gift from nature, consisting of habitats that are permanently or temporarily saturated with water. These ecosystems experience an increase in water levels during the rainy season, often leading to floods caused by heavy rainfall. The health of aquatic ecosystems is determined by their biodiversity, which includes plants that have adapted to living in waterlogged environments, known as aquatic or wetland plants. These plants are crucial as they act as producers within aquatic ecosystems, supporting a variety of life forms. Aquatic ecosystems provide a myriad of benefits such as food, fodder, fuel, medicine, and water detoxification, making them essential for sustaining life. In the Jajpur district of Odisha, freshwater ecosystems and aquatic plants are found due to the diverse topology, hydrological cycle, and physico-chemical characteristics of the soil and water. Unfortunately, many native aquatic plants in this region have experienced a significant decline due to various factors. It is imperative to conduct an assessment of the aquatic plant diversity in this area and raise awareness among local communities about the importance of conserving this valuable aquatic resource for future generations.

Various researchers have conducted studies on aquatic and wetland flora in different regions of India (Adhiswar and Choudhary, 2013; Cook, 1996; Jain *et al*., 2007; Agharkar, 1923). Additionally, some researchers have identified aquatic and wetland plants in various parts of Odisha (Pattnaik and Pattnaik, 1956; Panda and Das, 1995; Panda *et al*., 2011; Panda and Mishra, 2011; Das, 1990; Subhadarsini *et al*., 2016, Mishra *et al*., 2016; Mandal *et al*., 2017; Sahoo and Nayak, 2022). However, there is a lack of information on aquatic plants specifically in the Jajpur district of Odisha. In light of this, an extensive floristic study was conducted in the Jajpur district to document the diversity of aquatic plants present in the industrial area of the district.

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MATERIALS AND METHOD

The survey on floristic diversity was conducted in the Jajpur district, located in the state of Odisha, spans an area of 2899 square kilometers. The district is situated between 85° 40'E to 86° 44' E longitude and 20° 30'N to 21° 10' N latitude. Within the Jajpur district, there are 10 CD blocks including Jajpur, Dasarathapur, Bari, Binjharpur, Korei, Dharmasala, Sukinda, Danagadi, Rasulpur, and Barchana (Figure 1). Notably, the Danagadi and Sukinda blocks are well-known for their mineral-based industries. Over the years, the district has seen a significant rise in industrial activities and mining operations. Two key mining areas in the district are Sukinda and Daitari, where mineral reserves such as chromite, iron ore, nickel ore, quartzite, and pyroxenite can be found. The district also hosts major mineral-based industries like Tata Steel, Visa Steel, Jindal Steel, Nilachal Ispat Nigam Ltd., and Mesco Steel. Additionally, the important rivers that flow through the Jajpur district include Brahmani, Baitarani, and their tributaries. The diverse aquatic and wetland habitats in the area consist of rivers, canals, ponds, tanks, ditches, marshes, swamps, and flood plains.

Several field trips have been conducted throughout the years 2021-2023 to different wetlands and aquatic habitats in the Jajpur district to collect plant specimens. The steps like identification, processing, drying, and herbaria preparation of the specimens were carried out by following standard methods (Haines, 1925; Saxena and Brahmam, 1994). All the voucher specimens of the plant species found have been deposited in the herbarium of N.C. Autonomous College, Jajpur. Furthermore, the plants were categorized according to their specific habitats.

RESULTS AND DISCUSSION

The present study revealed that there were 84 different plant species documented, belonging to 55 genera and 31 families. Specifically, the monocot flora consisted of 46 species from 31 genera and 11 families, while the dicot flora consisted of 30 species from 19 genera and 15 families. Additionally, there were 8 Pteridophytes species from 5 genera and 5 families (Figure 2). The ratio of monocot to dicot species was 1.53, the genus ratio was 1.63, and the family ratio was 0.73 (Table 1). These findings align

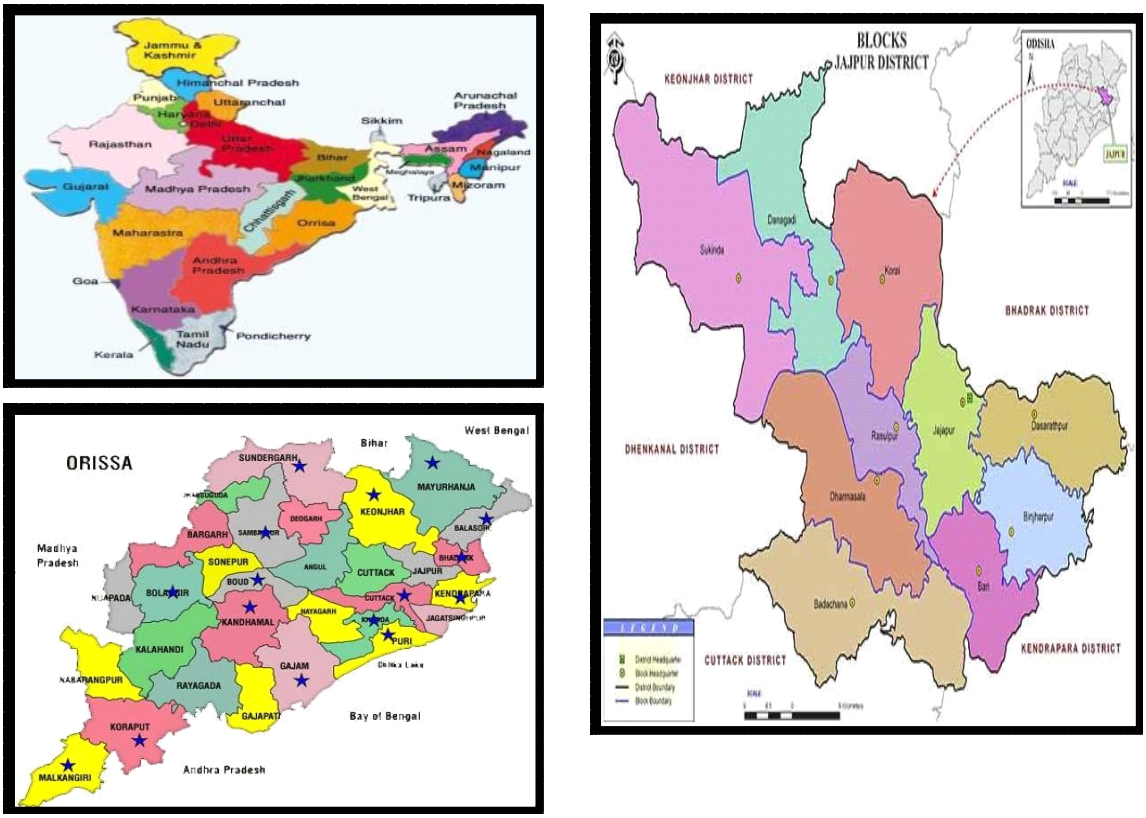

Fig. 1. Map showing the location of the study site

with a previous study by Dalasingh *et al*. (2019), who identified 60 hydrophyte species in the Puri district of Odisha. Monocots were represented by 33 species from 19 genera and 9 families, dicots were represented by 24 species from 17 genera and 14 families, and pteridophytes were represented by 3 species from 3 genera and 2 families. Another study by Behera and Satpathy (2021) revealed 211 hydrophyte species, including 200 angiosperms, 10 pteridophytes, and one alga in the Khorda district of Odisha. Monocots were the most abundant with 110 species from 85 genera and 16 families, while dicots contributed 90 species from 41 genera and 37 families across 10 different localities.

During work, we observed that the family Poaceae (19 species) was the most dominant family which was followed by the family Cyperaceae (13 species). Other prominent families included Asteraceae with 9 species, and both Araceae as well as Nymphaceae with 4 species each. Families like Pontederiaceae, Commelinaceae, Fabaceae, Scrophulariaceae, Rubiaceae, Euphorbiaceae, Onagraceae, and Polygonaceae had 3 species each. Additionally, Lemnaceae, Hydrocharitaceae, Amaranthaceae, Lythraceae, Molluginaceae, Boraginaceae, Convolvulaceae, Salviniaceae, Marsileaceae, and Azolaceae had 2 species each. Furthermore, there were 21 families represented by a single species each (Table 2). These findings are similar to those of Behera and Satpathy (2021) who revealed that the family Poaceae was the dominant one represented by 42 species followed by Cyperaceae with 34 species, Scrophulariaceae with 11 species, Asteraceae with 10 species, Hydrocharitaceae and Commelinaceae each with 6 species, Fabaceae with 5 species, Alismataceae, Nymphaeaceae, Polygonaceae and Onagraceae having 4 species each in the Khorda district of Odisha.Contrastingly, Dalasingh *et al*. (2019) reported that Cyperaceae with 17 species was the most dominant in the Puri district of Odisha.

A total of seventy-three different plant species were documented in marshy habitats, representing 52% of the total. This was the highest among all habitat groups, with amphibious species coming in at 21%, free-floating at 12%, fixed-floating at 11%, and submerged at 4% (Figure 3). These findings align with a study by Subhadarsini *et al.* (2016) who found a total of 102 plant species in Bhubaneswar, Odisha. Among these species, 8 species were classified as submerged hydrophytes, 9 as free-floating, 9 as fixed-floating, 21 as amphibious hydrophytes, and 55 as marshy hydrophytes. Similarly, Panda *et al.* (2018) identified a total of 244 macrophyte species in Ansupa Lake, Odisha, with 182 semi-aquatic and 62 obligatory aquatic species. Of these, 35% were submerged, 15% were free-floating, 31% were rooted floating, and 19% were marshy plant species. Dalasingh *et al*. (2019) reported 35 marshy, 8 amphibious, 6 submerged, 6

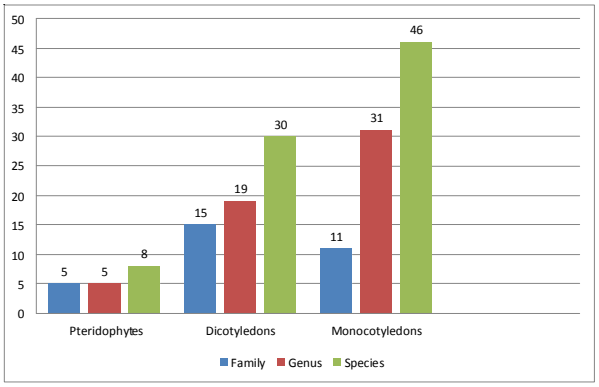

Fig. 2. Distribution of Plants division-wise in the Industrial Belts of the Jajpur District of Odisha, India

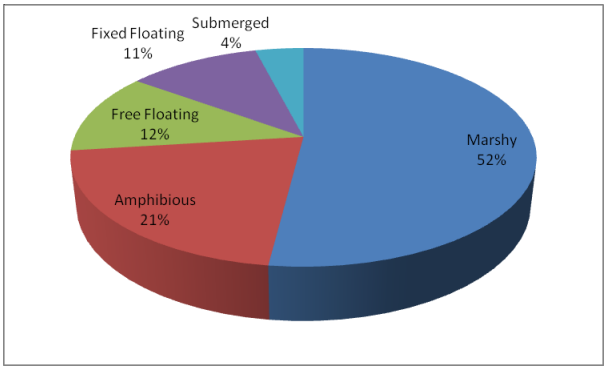

Fig. 3. Distribution of Plants habitat-wise in the Industrial Belts of the Jajpur District of Odisha, India

Table 1. Floral Statistics in the Industrial Belts of the Jajpur District of Odisha, India

Taxa	Monocots	Dicots		Total no. of Angiosperms	Pteridophytes	Grand Total
Species	46	30	1.53	76	08	84
Genera	31	19	1.63	40	05	55
Families	11	15	0.73	26	05	31

Table 2. List of aquatic plants in the Industrial Belts of the Jajpur District of Odisha, India

Sl.No.	Name of the plant	Family	Local Name	Habitat
1	*Aeschynomene aspera* L.	Fabaceae	Solo	Amphibious
2	*Aeschynomene indica* L.	Fabaceae	Sola	Amphibious
3	*Alternanthera philoxeroides* (Mart) Griseb	Amaranthaceae		Amphibious
4	*Alternanthera sessilis* (L.) R.Br. ex Dc.	Amaranthaceae	Madaranga	Amphibious
5	*Aponogeton natans* (L.) Engl. & Krause	Aponogetonaceae	Ghechu	Submerged
6	*Alocasia macrorrhizos* (L.) G.Don.	Araceae	Mana saru	Amphibious
7	*Azolla microphylla* Kaulf.	Azollaceae	Chuni dala	Free-floating
8	*Azolla pinnata* R.Br.	Azollaceae	Chuni dala	Free-floating
9	*Brachiaria distachya* (L.) Stapf	Poaceae	—	Marshy
10	*Centella asiatica* (L.) Urban	Apiaceae	Thalakudi	Marshy
11	*Centipeda minima* (L.) A. Braun & Asch.	Asteraceae	Nakachinka	Marshy
12	*Chrysopogon aciculatus* (Retz.) Trin.	Poaceae	Guguchia	Marshy
13	*Commelina benghalensis* L.	Commelinaceae	Kanasiri	Marshy
14	*Commelina erecta* L.	Commelinaceae	Konisir	Marshy
15	*Commelina diffusa* Burm.f.	Commelinaceae	Kansira	Marshy
16	*Coix lacryma-jobi* L.	Poaceae	Gargara	Marshy
17	*Colocasia esculenta* (L.) Schott	Araceae	Saru	Amphibious
18	*Crinum defixum* Ker-Gawl.	Amaryllidaceae	Pani kenduri	Marshy
19	*Cyperus articulatus* L.	Cyperaceae	—	Marshy
20	*Cyperus brevifolius* (Rottb.) Hassk.	Cyperaceae	—	Marshy
21	*Cyperus difformis* L.	Cyperaceae	Swonli	Marshy
22	*Cyperus distans* L.f.	Cyperaceae	—	Marshy
23	*Cyperus imbricatus* Retz.	Cyperaceae	—	Marshy
24	*Cyperus iria* L.	Cyperaceae	Swanti	Marshy
25	*Cyperus rotundus* L.	Cyperaceae	Mutha	Marshy
26	*Cyperus triceps* Endl.	Cyperaceae	—	Marshy
27	*Echinochloa colona* (L.) Link	Poaceae	Swanghasa	Marshy
28	*Echinochloa crusgalli* (L.) P. Beauv.	Poaceae	Bialisuan	Marshy
29	*Eclipta prostrata* (L.) L.	Asteraceae	Bhrungaraj	Marshy
30	*Eichhornia crassipes* (Mart.) Solms-Laub.	Pontederiaceae	Bilatidala	Free floating
31	*Enydra fluctuans* Lour.	Asteraceae	Hidimicha	Amphibious
32	*Eragrostis ciliaris* (L.) R.Br.	Poaceae	—	Marshy
33	*Eragrostis viscosa* (Retz.) Trin.	Poaceae	—	Marshy
34	*Fimbristylis argentea* (Rottb.) Vahl	Cyperaceae	—	Marshy
35	*Fimbristylis miliacea* (L.) Vahl	Cyperaceae	—	Marshy
36	*Fimbristylis littoralis* Gaudich	Cyperaceae	—	Marshy
37	*Hygrophila auriculata* (Schum.) Heine	Acanthaceae	Koilekha	Amphibious
38	*Hydrilla verticillata* (L.f.) Royle	Hydrocharitaceae	Chingudiadala	Submerged
39	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kalamasaga	Fixed floating
40	*Ipomoea carnea* Jacq.	Convolvulaceae	Amari	Amphibious
41	*Lemna perpusilla* Torrey	Lemnaceae	—	Free Floating
42	*Limnophila indica* (L.) Druce	Scrophulariaceae	Keralata	Amphibious
43	*Lippia javanica* (Burm.f.) Spreng.	Verbenaceae	Naguari	Marshy
44	*Ludwigia adscendens* (L.) Hara	Onagraceae	Jagal	Fixed floating
45	*Ludwigia octovalvis* (Jacq.) Raven	Onagraceae	Panilabanga	Fixed floating
46	*Ludwigia perennis* L.	Onagraceae	Latkera	Marshy
47	*Ludwigia peploides* (Kunth) P.H.R.	Onagraceae	—	Marshy
48	*Lygodium palmatum* (Bernh.) Sw.	Lygodiaceae	—	Marshy
49	*Marsilea minuta* L.	Marsileaceae	Sunusunia	Amphibious
50	*Marsilea quadrifolia* L.	Marsileaceae	—	Amphibious
51	*Monochoria hastata* Solms-Laub.	Pontederiaceae	Nir Tamara	Amphibious
52	*Monochoria vaginalis* (Burm.f.) C. Presl	Pontederiaceae	Kajalapatia	Amphibious
53	*Nelumbo nucifera* Gaertn.	Nymphaceae	Padma	Fixed floating
54	*Nymphaea nouchali* Burm.f.	Nymphaceae	Nilakain	Fixed floating

Table 2. *Continued ...*

Sl.No.	Name of the plant	Family	Local Name	Habitat
55	*Nymphaea pubescens* Willd.	Nymphaceae	Dhalakain	Fixed floating
56	*Nymphaea pubescens* Willd.	Nymphaceae	Nalikain	Fixed floating
57	*Nymphoides hydrophylla* (Lour.) Kuntze	Menyanthaceae	Chandra-malla	Fixed floating
58	*Nymphoides indica* (L.) Kuntze	Menyanthaceae	Chandra-malla	Fixed floating
59	*Oryza rufipogon* Griff.	Poaceae	Balunga	Marshy
60	*Oryza sativa* L.	Poaceae	Dhana	Marshy
61	*Ottelia alismoides* (L.) Pers.	Hydrocharitaceae	Pani Kundri	Submerged
62	*Oxalis corniculata* L.	Oxalidaceae	Ambiliti	Marshy
63	*Oxystelma esculenta* (L.f.)R.Br.	Asclepiadaceae	Dudhialata	Marshy
64	*Panicum repens* L.	Poaceae	Pani dala	Marshy
65	*Paspalidium flavidum* (Retz.) A.Camus	Poaceae	Bilainangi	Marshy
66	*Paspalum vaginatum* Sw.	Poaceae	—	Marshy
67	*Polygonum glabrum* Willd**.**	Polygonaceae	Bihagni	Amphibious
68	*Polygonum hydropiper* L.var. *flaccidum* Steward	Polygonaceae	Pani maricha	Amphibious
69	*Polygonum plebeium* R.Br.	Polygonaceae	Muthisaga	Amphibious
70	*Pistia stratiotes* L.	Araceae	Borajhanji	Free-floating
71	*Pteris cretica* L.	Pteridaceae	—	Marshy
72	*Sacciolepis indica* (L.) Chase	Poaceae	—	Marshy
73	*Saccharum spontaneum* L.	Poaceae	Kasatandi	Marshy
74	*Salvinia cucullata* Roxb.ex Bory	Salviniaceae	—	Free Floating
75	*Salvinia molesta* D.Mitch	Salviniaceae	—	Free-floating
76	*Scoparia dulcis* L.	Scrophulariaceae	Chirarita	Marshy
77	*Scirpus articulatus* L.	Cyperaceae	Gaichara	Marshy
78	*Scirpus grossus* L.f.	Cyperaceae	Santara	Marshy
79	*Spirodela polyrhiza* (L.) Schleid.	Lemnaceae	—	Free-floating
80	*Tonningia axillaris* (L.) Kuntze.	Commelinaceae	—	Marshy
81	*Trapa natans* L. var.*bispinosa* (Roxb.) Makino	Trapaceae	Pani singada	Free Floating
82	*Typha angustata* Bory & Chaub.	Typhaceae	Hangla	Amphibious
83	*Vetiveria zizanioides* (L.) Nash	Poaceae	Bena	Marshy
84	*Wolffia globosa* (Roxb.) Hartog & Plas	Araceae	—	Free-floating

free floating, and 5 fixed floating species in the Puri district of Odisha. In the Khorda district of Odisha, Behera and Satpathy (2021) found a diverse range of marshy hydrophytes with 131 species, followed by 38 species of amphibious hydrophytes, 11 species of free-floating, 15 species of submerged, and 9 species of fixed floating hydrophytes.

CONCLUSION

The industrial belt of Jajpur district is enriched with aquatic flora which fulfill the basic needs of the local people while maintaining the ecological balance of this area. Marshy species were the most dominant ones followed by amphibious, submerged, free-floating, and fixed free-floating species. Unfortunately, the water sources in this area have been depleting rapidly due to the rampant growth of mines and industries, posing a serious threat to these valuable bio resources. Factors such as overexploitation, the introduction of invasive alien species, and various development projects have further exacerbated the decline in aquatic biodiversity. Both the residents and the government must take immediate and effective measures to preserve and conserve these plant resources. By doing so, not only will the livelihoods of the local community be enhanced, but it will also contribute to the conservation of biodiversity in the region.

ACKNOWLEDGMENTS

The authors of the present study are highly grateful to the local people for their kindness in providing necessary information during the investigation. The authors are also grateful to the Principal, N.C. Autonomous College, Jajpur, Odisha for the provision of required laboratory facilities to carry out and accomplish this work.

Conflict of Interest: None

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