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Diversity of Freshwater Macrophytic Vegetation of Kharkai River, Jamshedpur, Jharkhand

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ABSTRACT: ***The present investigation deals, the diversity of macrophytic vegetation of Kharkai River of Jamshedpur. It flows through Adityapur region of Jamshedpur. Macrophytes are an important component of an aquatic ecosystem and play a major role in primary productivity of the aquatic ecosystem. An extensive field survey and plant collection revealed the presence of 62 species of aquatic plants belonging to 50 genera and 32 families in the site. Out of them 12 families, 23 genera and 29 species are monocot, 16 families, 23 genera and 27 species are of dicot and 04 families, 04 genera and 06 species are of pteridophytes. Most identified aquatic species were found to be used for various purposes by the local inhabitants. The use for providing tradition health care was the most abundant causing the wide spread use of most of the plants for medicinal purposes, some species were edible and few species were used as fodder. The present study describes the ecological status including taxonomic structure and richness of the aquatic flora of the Kharkai River. The data recorded from the site shows the predominated species are Fimbristylis dichotoma (L) and Cyperus difformis L. having 100% frequency. It is found that highest density (18.43), (15.1) and abundance (17.86), (17.7) and IVI (Importance value index) 49.11 and 53.1 respectively. The minimum density shows Neptunia oleracea Lour. (2.4), Eurgale ferox Salib (1.6) and abundance (2) and (1.76). The minimum IVI value found 8.08 and 6.06. Terrestrial as well as aquatic biodiversity has great importance for living world. Unfortunately, aquatic ecosystem are destroyed rapidly due to various reasons. Present paper is specially focused on aquatic plants biodiversity for their conservation.***

Keywords: Macrophytes, biodiversity, conservation, medicinal, pteridophytes

1. Introduction

The Macrophytes are larger plants which actively grow continuously or periodically depending upon the available of required amount of water.

Present study deals the diversity of macrophytes vegetation of Kharkai River.

The Kharkai River is a river in eastern India. Kharkai is derived from the Sanskrit word Kharakaya meaning “fast flowing river”. It is one of the major tributaries of the Subarnarekha River. It flows through Adityapur region of Jamshedpur. It arises in Mayurbjanj district, Odisha. On the north slopes of Darbarmela Parbat and the western slopes of Tungru Pahar of the Simplipal Massif.

Human influences and area exploitation of the resources existing in an ecosystem has destroyed its homeostasis and altered the habitat of the native species. This has threated the survival of endemic species making them endangered. Therefore, the present day ecosystem research has advocated the conservation of habitat and the environment for giving all the species to grow undisturbed in their native habited.

2. Materials and Methods

The valley of the lower Kharkai River is quite wide and the soil of that region is very fertile. The soil is rich in alluvial soil. The cultivation of rice is the primary job in this region. The Iron ore is mined in the mountains of the head waters of the Kharkai and there is a steel plant established at Jamshedpur. The elevation 928 m (3,045 ft) Simplipal Massif. It coordinates 22º 4' N 86º 23' E.

The vegetation survey in rehabilitated site was conducted during the month of January (winter season), May-June (summer season) and August-September (rainy season) from the year 2011-2013 to as certain the floristic composition of that sites (Kharkai river) using nested quadrate method 5 quadrates were laid randomly in the area. In each quadrate, the data was recorded for number of species, number of individuals of a species.

This process was repeated time to time in different season. The data obtained was tabulated and analyzed for frequency, density, dominance, importance value index (IVI) and diversity indices.

Importance Value Index

The index has been developed to express the dominance an ecological successes of any species at a given site. It is the sum of all the following:

(i) Relative frequency
(ii) Relative density
(iii) Relative dominance

Diversity Index

Σ Diversity Index is Calculated as H' = pi In pi

Where pi = ni/N

ni = Number of individuals of a species
N = Total number of individuals of all species
In = Natural logarithm (to the base)
H' = Diversity Index

The diversity index is always in positive values. The minus sign in the formula is nullified by the long pi, which is always a minus quantity. The unit of diversity index, Calculated by the formula is pits per individuals.

3. Results and Discussion

The phytosociological study which was undertaken to examine the structure composition indicated that in Kharkai river, *Fimbristylis dichotoma* (L.), *Hydrilla verticillata* (L.f.), *Ammania baccifera* L., *Cyperus difformis* (L.) were still a dominant species among aquatic macrophytes having frequency of 100% and *Potamogeton crispus* L., *Utricularia aurea* Lour., *Azolla pinnata* R. Br. showed lowest frequency of 20%.

Table-1, presents that *Fimbristylis dichotoma* (L.) and *Cyperus difformis* (L.) are dominant species having IVI value of 49.11 and 35.11. It also reveals that highest diversity index with its value -0.312 and -0.265.

The minimum IVI found *Mariscus paniceus* (Rottb.) Vahl. is 8.08 and lowest diversity index is -0.041, followed by *Euryale ferox* Salib. 8.08 and -0.095.

In table-2, the data shows that *Hydrilla verticillata* (L.f.) having highest IVI value is 32.35 and highest diversity index -0.306.

The minimum IVI was found in *Azolla pinnata* R. Br. Is 8.87 and minimum diversity is -0.101.

Table-3 revealed that *Pistia stratiotes* L. having highest IVI value 24.97 and highest diversity -0.213 followed by *Hydrilla verticillata* (L.f.) Royle having IVI is 22.61 and diversity is -0.209.

Eichhornia crassipes (Mart.) Salms. having IVI is 23.3 and diversity is -0.192.

The minimum IVI show *Wolfflia arrhiza* (L.) Harkel is 6.78 and lowest diversity is -0.079.

The examination of table-4 showed that highest IVI having *Ammania baccifera* L. is 48.91 and highest diversity is -0.359.

The minimum IVI was found in *Ipomoea aquatica* Forssk. Is 5.11 and minimum diversity is -0.048.

In the selected water bodies 62 species of aquatic macrophytes belonging to 50 genera and 32 families were the other important group contributing to the productivity of water bodies. Out of them 12 families, 23 genera and 29 species are monocot, 16 families, 23 genera and 27 species are of dicot and 04 families, 04 genera and 06 species are of pteridophytes.

Taxonomic status of aquatic plants of Kharkai river

Plant Type	Family	Genus	Species
Dicotyledon	16	23	27
Monocotyledon	12	23	29
Pteridophytes	04	04	06
Total	32	50	62

Rivers, lakes and streams are very important part of our natural heritage. They have been widely utilized by mankind over the centuries to the extent that very few, if any are now in natural condition. The continuous monitoring of the river's water quality is very essential to determine the state of pollution in our rivers. This information is important to communicate to general public and the Government in order to develop the policies for the conservation of the most important natural freshwater resources. River catchments is frequently a major determine of its water chemistry, in turn, often has important effects on species composition and community structure and consequently on functioning of aquatic ecosystems.

Aquatic plants can provide food and shelter for other organisms that live in and close to the water (Haegard *et. al.*, 2001), and also can provide spatial habitat complexity. Macrophytes contribute to the general fitness and diversity of healthy aquatic ecosystem (Flint and Madsen, 1995) by acting as indicators for water quality and aiding in nutrient cycling (Carpenter and Lodge, 1986).

In the study area, most aquatic plants grow profusely in the tropics and many of them are also used for subsistence of human livelihood supported by several rural families. Most identified plants are used for medicinal purposes. Such as, *Ammania baccifera* L. (Used to remove sputum from the lungs and trachea), *Ceratophyllum demersum* L. (Used in scorpion sting and biliousness), *Marsilea minuta* L. (Fresh root paste is applied on skin diseases), *Fimbristylis dichotoma* (L.) Vahl. (Used for viral fever).

Some plants are edible, such as *Euryale ferox* Salib. (The seeds are eaten raw or rosted), *Ipomoea aquatica* Forssk. (Twigs used as vegetable), *Marsilea quadrifolia* L. (Leaves used for vegetable), *Nelumbo nucifera* Gaertn (Rhizomes and dried petioles are cooked and eaten during the scarcity of food). Some plants are used as fodder, such as *Eichhornia crassipes* (Mart.) Salms. (The plant is used as manure and fodder), *Pistia stratiotes* L. (Used as fodder).

Table 1: Structural Attributes and Diversity Index of the Aquatic Macrophytes of Kharkai River (Winter season)

Sl. No.	Name of the species	Plant type	Frequency %	Relative density	Relative abundance	IVI	Diversity Index
1.	*Fimbristylis dichotoma* (L.)	Monocot	100	18.43	17.86	49.11	-0.312
2.	*Cyperus difformis* (L.)	Monocot	80	13.01	11.85	35.11	-0.265
3.	*Scirpus articubitu* (L.)	Monocot	80	11.49	12.73	34.47	-0.249
4.	*Sacciolepsis interrupta* (Willd.) Stapft.	Monocot	60	8.25	7.46	23.4	-0.206
5.	*Azolla pinnata* R. Br.	Pteridophyta	60	6.51	6.15	20.35	-0.178
6.	*Marsilea quadrifolia* L.	Pteridophyta	60	6.94	5.12	19.75	-0.185
7.	*Nymphoides indicum* (L.) Ktze	Dicot	40	5.43	6	16.56	-0.158
8.	*Crinum defixum* Ker. Gaust	Monocot	40	4.77	4.68	14.58	-0.144
9.	*Rotala indica* (Willd.) Koch	Dicot	40	4.99	4.09	14.21	-0.150
10.	*Najas graminea* Del.	Monocot	40	3.91	4.39	13.43	-0.127

11.	*Eragrostis japonica* Thunb.	Monocot	40	3.47	4.24	12.84	-0.117
12.	*Ceratopteris thalictroides* (L.) Brongn.	Pteridophyta	40	4.34	2.78	12.25	-0.136
13.	*Neptunia oleracea* Lour.	Dicot	20	2.6	2.92	8.08	-0.095
14.	*Pontederia cordata* L.	Monocot	20	1.09	3.22	6.87	-0.049
15.	*Justicia diffusa* Willd.	Dicot	20	2.17	1.61	6.34	-0.083
16.	*Mariscus paniceus* (Rottb.) Vahl.	Monocot	20	0.86	3.08	6.5	-0.041
17.	*Euryale ferox* Salib.	Dicot	20	2.6	2.92	8.08	-0.095

Table 2: Structural Attributes and Diversity Index of the Aquatic Macrophytes of Kharkai River (Summer season)

S. No.	*Name of the species*	*Plant type*	*Frequency %*	*Relative density*	*Relative abundance*	*IVI*	*Diversity Index*
1.	*Hydrilla verticillata* (L.f.)	Monocot	100	17.7	19.78	53.1	-0.306
2.	*Monochoria hastata* Salms. Laub.	Monocot	60	10.55	12.42	32.35	-0.237
3.	*Marsilea minuta* L.	Pteridophyta	60	9.85	10.89	30.12	-0.223
4.	*Marsilea quadrifolia* L.	Pteridophyta	60	9.85	7.98	27.21	-0.228
5.	*Vallisneria natans* L.	Monocot	60	9.15	7.52	26.05	-0.219
6.	*Limnophyton obtusifolium* (L.) Miq.	Dicot	40	7.04	5.37	18.66	-0.187
7.	*Caboma aquatica* Aubl.	Monocot	40	7.04	5.37	18.66	-0.166
8.	*Polypleurum filifalium* (Raman & Joseph) Rao & Hazara	Dicot	40	5.86	5.98	18.09	-0.166
9.	*Neptunia oleracea* Lour.	Dicot	40	5.16	4.76	16.17	-0.153
10.	*Apanogeton natans* (L.) Engl. & Kralis.	Monocot	20	3.52	3.22	9.87	-0.118
11.	*Monochoria vaginalis* (Burm.f.) Prest.	Monocot	20	3.05	3.07	9.25	-0.106
12.	*Spirodella polyrhiza* (L.) Schleid.	Monocot	20	3.05	2.76	8.94	-0.106
13.	*Azolla pinnata* R. Br.	Pteridophyta	20	2.82	2.92	8.87	-0.101
14.	*Scirpus grossus* L.f.	Monocot	20	2.82	2.61	8.56	-0.101
15.	*Potamogeton crispus* L.	Monocot	20	1.88	1.69	6.7	-0.075
16.	*Utricularia aurea* Lour.	Dicot	20	1.88	1.54	6.55	-0.075

Table 3: Structural Attributes and Diversity Index of the Aquatic Macrophytes of Kharkai River (Rainy season)

Sl. No.	Name of the species	Plant type	Frequency %	Relative density	Relative abundance	IVI	Diversity index
1.	*Pistia stratiotes* L.	Monocot	100	8.74	8.77	24.97	-0.213
2.	*Hydrilla verticillata* (L.f.) Royle	Monocot	100	8.46	6.69	22.61	-0.209
3.	*Marsilea minuta* L.	Pteridophyta	100	8.28	7.44	23.18	-0.206
4.	*Eichhornia crassipes* (Mart.) Salms.	Monocot	100	7.36	8.48	23.3	-0.192
5.	*Lemna gibba* L.	Monocot	80	6.62	7.04	18.13	-0.180
6.	*Nymphaea nouchalli* Burm.f.	Dicot	80	5.97	6.46	18.4	-0.168
7.	*Salvinia cuculata* Status.	Pteridophyta	80	5.71	5.83	17.51	-0.163
8.	*Ludwigia perennis* L.	Dicot	80	5.33	5.42	16.72	-0.156
9.	*Dopatrium junceum* (Roxb.) Buch-ham	Dicot	80	5.43	5.25	16.65	-0.158
10.	*Nelumbo nucifera* Gaertn	Dicot	60	5.52	5.13	15.12	-0.160
11.	*Utricularia gibba* L. Sub sp. exoleta (R. Br.) P.	Dicot	60	4.69	4.09	13.25	-0.144
12.	*Sagittaria trifolia* L.	Monocot	60	4.69	5.13	14.29	-0.144
13.	*Colocasia esculenta* (L.) Schott.	Monocot	60	4.04	4.09	12.6	-0.130
14.	*Azolla pinnata* R. Br.	Pteridophyta	60	3.86	4.15	12.48	-0.126
15.	*Rotala indica* (Willd.) Mucll.	Dicot	60	3.68	4.15	12.3	-0.122
16.	*Trapa natans* Var. bispinosh (Roxb.) Makino	Dicot	40	2.75	2.82	8.55	-0.099
17.	*Cyperus iria* L.	Monocot	40	2.29	2.25	7.52	-0.087
18.	*Wolffia arrhiza* (L.) Harkel	Monocot	40	2.02	1.78	6.78	-0.079

Table 4: Structural Attributes and Diversity Index of the Aquatic Macrophytes of Kharkai River (Rainy season)

Sl. No.	Name of the species	Plant type	Frequency %	Relative density	Relative abundance	IVI	Diversity index
1.	*Ammania baccifera* L.	Dicot	100	28.81	19.06	48.91	-0.359
2.	*Cyperus difformis* L.	Monocot	100	19.96	6.81	33.81	-0.322
3.	*Justicia diffusa* Willd.	Dicot	100	2.59	3.86	13.49	-0.095
4.	*Ceratophyllum demersum* L.	Dicot	80	8.23	1.02	14.88	-0.206
5.	*Coldenia procumbens* L.	Dicot	80	5.94	7.43	19.00	-0.168
6.	*Drosera indica* L.	Dicot	80	3.96	6.24	15.83	-0.128
7.	*Polypleurum filifalium* (Raman & Joseph) Rao & Hazara	Dicot	80	2.89	4.14	12.60	-0.103
8.	*Spirodella polyrhiza* (L.) Schleld.	Monocot	80	2.43	3.46	11.52	-0.091
9.	*Paspalum scrobilatum* L.	Monocot	80	2.13	3.91	11.67	-0.082
10.	*Nymphoides indicum* (L.)	Dicot	80	1.67	3.40	10.70	-0.069
11.	*Cyperus haspam* L.	Monocot	60	5.94	8.12	18.28	-0.168
12.	*Acorus calamus* L.	Monocot	60	2.89	7.49	14.60	-0.103
13.	*Ludwigia hyssopifolia* (Don.) Excall.	Dicot	60	2.89	8.00	15.11	-0.103

14.	*Homonia riparia* Lour.	Dicot	60	2.13	2.95	9.3	-0.082
15.	*Fimbristylis dichotoma* (L.) Vahl.	Monocot	60	1.52	4.08	9.82	-0.064
16.	*Hygrophilla difformis* L.	Dicot	60	1.37	4.54	10.13	-0.059
17.	*Scoparia dulsis* L.	Dicot	60	1.37	1.47	7.06	-0.059
18.	*Myriphyllum aquaticum* (Vell.) Verdc.	Dicot	60	0.91	6.98	12.11	-0.043
19.	*Ipomoea aquatica* Forssk.	Dicot	40	1.06	1.24	5.11	-0.048

Figure 1

Figure 2

Photographs showing of Macrophytic Plant of Kharkai River
Plate - I

Figure 3

Figure 4

Photographs showing of Macrophytic Plant of Kharkai River
PLATE – II

4. Conclusion

Further investigation of socio economic systems dependent upon water resources, aquatic biodiversity and other services provided by rivers, is urgently needed especially focusing on the relationships between these resources, human health and well being.

So we conclude that the river is currently the richest and most diverse aquatic flora in general as particularly found in the state. The conservation of biological diversity seeks to maintain the life support system provided by nature in all its variety and the living resources essential for ecologically sustainable development.

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