

Ecological Assessment of Macrophytes of Atiapukur Beel and Ukhalia Beel of South Dinajpur District, West Bengal: An Approach to Multivariate Statistical Analysis

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Abstract—The present research was conducted for the ecological assessment of macrophytes dwelling Atiapukur beel and Ukhalia beel of South Dinajpur district. A total of 11 macrophytes species belonging to 11 families were reported. Ecological classification of macrophytes showed the highest distribution of helophytes (46 %). Hierarchical two-way cluster analysis represented the low similarity and high dissimilarity among the species. The overall assessment also revealed high species richness and low species evenness.

Index Terms—Ecological assessment, Helophytes, Species richness, Species evenness.

I. INTRODUCTION

Wetlands are the building block of any of the ecosystem existing in earth and these ecosystems are the basement of any of the living entity to pursue their lifecycle. Besides this wetlands are the cardle of biodiversity and bio-productivity hotspots. This ecosystem provide numerous ecological services which are directly or indirectly beneficial for biodiversity[1-3]. Macrophytes are the integral element of freshwater ecosystem and plays significant role for structuring and functioning the wetland ecosystem, as well as also have properties for their restoration and conservation. Moreover, macrophytes are considered as bioindicator of overall health of wetland ecosystem [4-5]. Recent one of the most serious global concern is loss of wetlands and wetland's biodiversity which increased dramatically from last two centuries. Due to overexploitation of natural wetland resources, growth of invasive species, eutrophication and various anthropogenic activities, wetlands are facing threat to sustain their existence [6-7]. The main objective of the present research is to

analyse the various ecological parameters affecting the macrophytes distribution inhabiting in Atiapukur beel and Ukhalia beel of South Dinajpur district, along with their details floristic information.

II. MATERIALS AND METHODS

Study site: The selected study area is South Dinajpur district, West Bengal which lies between 26° 35'12" N to 25° 10'55" N latitude and 89° 00'30" E and 87° 48'37" E longitude. The total area covered by the district is 2162 sq. km. The district is enclosed by Bangladesh to the north, east and south and to the west and south west by North Dinajpur and Malda. Purnabhaha, Brahmani, Atreyee and Tangon are the main rivers of the district. The district comprise of two main subdivision: Balurghat and Buniadpur.

Atiapukur Beel: It is located between 88.34° E longitude and 25.54° N latitude. At Sadhupara more of Khushmandi block of South Dinajpur district there is a man made, perennial wetland which covers the area of 5 acres of land. The wetland is under the public ownership and it is jointly owned by Umesh Rai and Baraju Rai.

Ukhalia Beel: It is located between 88.36° E longitude and 25.53° N latitude. This a is man-made, seasonal wetland which is situated at Ukhalia mouza of Khushmandi block of South Dinajpur district. It covers about 5 acres of land. This wetland is under the supervision of public ownership.

Macrophytes collection and identification: Extensive field survey was conducted from November 2021 to October 2023, for the collection of plant specimens and to make the detail floristic database. Collected macrophytes were dried properly and

worked out have been done into the laboratory for the identification. Standard taxonomic literatures were consulted for literatures [8-57]. proper identification besides this POWO (Plants Of the World Online, 2023) [58], WFO (World Flora Online, 2023) [59] and GBIF (Global Biodiversity Information Facility) [60] were also used for checking valid names and comparing the morphophysiological characters of the species. Herbarium sheets of the identified specimen were kept at Taxonomy of Angiosperms and Biosystematics laboratory of SKBU, Purulia. Macrophytes were classified on the basis of growth form according to the Cook (1996) [8].

Cluster analysis: This is a technique for grouping similar observations into a series of clusters based on the observed values of multiple variables. Cluster analysis is similar in concept to discriminant analysis. Here the dendrogram (Two-way cluster) is constructed using the paired group (UPGMA) algorithm and Bray Curtis similarity method, the most efficient clustering algorithm with the help of PAST (Paleontological Statistics) 4.14 software.

Factor analysis: Factor analysis is a multivariate technique that uses the correlation structure amongst observed variables to model a smaller number of unobserved, latent variables known as factors. In order to distinguish the species composition in different wetlands with different species dominance simple CABFAC factor analysis has been done by using PAST 4.14 software.

III. RESULTS AND DISCUSSION

A total of 11 different macrophytes belonging to 11 families, have been documented from Atiapukur beel and Ukhalia beel of South Dinajpur district. Here all the 11 families comprise of single number of plant species. So that there is presence of equally distributed macrophytes (Table 1).

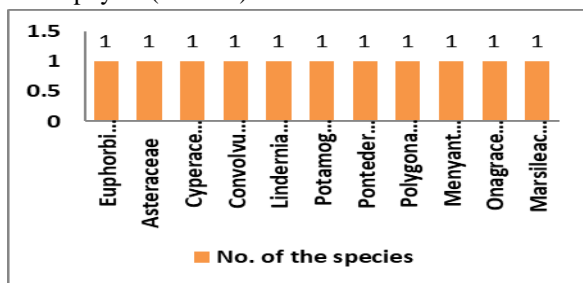


Fig.1. Percentage classification of macrophytes on the basis of family.

Macrophytes were also classified on the basis of growth form according to the Cook(1996) [8]. Pie chart of growth form (Fig. 2) showed the dominance of helophytes (46 %) followed by hyperhydrates (27 %) and pleustophytes (18 %).

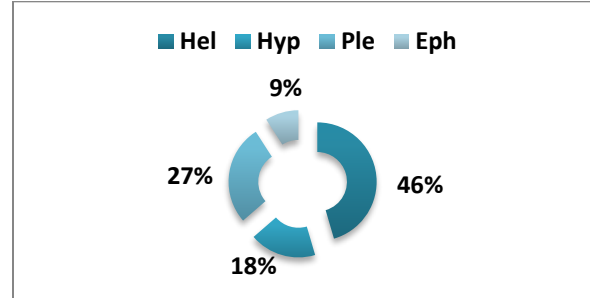


Fig. 2. Percentage distribution of macrophytes on the basis of growth form (Cook, 1996).

Two-way cluster analysis (Fig. 3) was also performed on the basis of Bray-Curtis. Percentage similarity among the species and two selected wetlands, showing the relationship of similarity and distinctness.

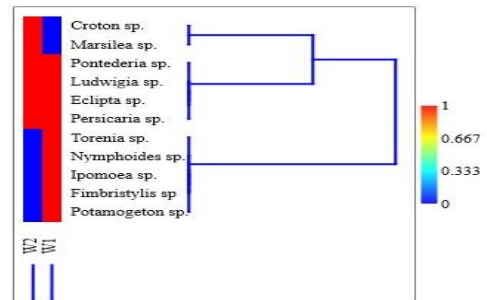


Fig. 3. Bray-Curtis percentage similarity of macrophytes of the two selected wetlands (two-way cluster analysis) by PAST 4.14 software.

Result of statistical classification of species composition in different wetlands was compared by performing CABFAC multivariate factor analysis (Fig. 4). Summarizing these interpretation, Abundance, RA and IVI of all the species accompanied with Density, Frequency and RF were also analysed

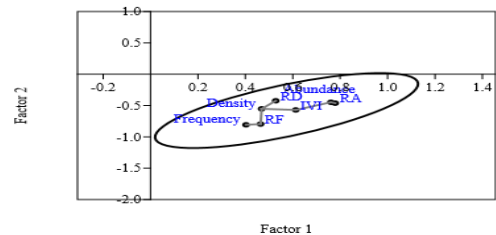


Fig. 4. Multivariate factor analysis with different ecological parameters by PAST 4.14 software.

Table 1. Floristic documentation of macrophytes inhabiting Atiapukur beel and Ukhalia Beel.

Sl. NO.	Scientific Name	Family	Growth form (GF)	Common Name	W	W2
1	<i>Croton bonplandianus</i> Baill.	Euphorbiaceae	Hel	Bon-tulsi		+
2	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Hel	Kesute	+	+
3	<i>Fimbristylis littoralis</i> Gaudich.	Cyperaceae	Hel	Lesser fimbry	+	
4	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	Hyp	Kalmi sak	+	
5	<i>Ludwigia adscendens</i> (L.) H.Hara	Onagraceae	Hyp	Water Primrose	+	+
6	<i>Marsilea quadrifolia</i> L.	Marsileaceae	Ple	Susni sak		+
7	<i>Nymphoides hydrophylla</i> (Lour.) Kuntze	Menyanthaceae	Eph	Panihar	+	
8	<i>Persicaria hydropiper</i> (L.) Delarbre	Polygonaceae	Hel	Water pepper	+	+
9	<i>Pontederia crassipes</i> Mart.	Pontederiaceae	Ple	Kachuripana	+	+
10	<i>Potamogeton crispus</i> L.	Potamogetonaceae	Ple	Kalaypata	+	
11	<i>Torenia crustacea</i> (L.) Cham. & Schtdl.	Linderniaceae	Hel	Malaysian false pimpernel	+	

W1: Atiapukur Beel; W2: Ukhalia Beel; (GF): Eph= Ephydate, Hel = Helophyte, Hyp=Hyperhydrate, Ple= Pleustophyte.

IV. CONCLUSION

The present investigation of assessment of macrophytes by considering some ecological parameters reveal the diversity, distribution, species evenness, and species richness in the two selected wetlands. The database reflecting the high species richness but very low species evenness. Multivariate simple factor analysis with quantitative parameters also reveal the clear diversity, frequency and abundance index of macrophytes. In spite of having high nutrition value, poor vegetation and low species evenness also depicts the overexploitation of natural resources and degradation of wetland biodiversity. For overall conservation and sustainable management of these wetlands influx of contaminate wastage and all other anthropogenic activities should be cut off immediately. It will consequently improve the water body health.

ACKNOWLEDGMENT

Authors extend their heartfelt gratitude to Mrs. Kakali Paul (Housewife) and Najma Khatun (Farmer women) local village dwellers for providing information about the wetlands to collect the preliminary data and for his continuous cooperation during survey.

Conflict of Interest: There is no conflict of interest.

Funding Source: None.

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