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# A Comparative Analysis of Life Form Composition and Biological Spectrum of Macrophytes in Sitajhari River and Dalua Beel of Kishanganj District, Bihar

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*Abstract:*The present paper deals with the study of phytoclimate analysis of two selected wetlands(Sitajhari river and Dalua beel)of Kishanganj district,Bihar with the help of the Raunkiaer life form and biological spectrum. A total of 19 macrophytes species belonging to 16 families have been enlisted which were further classified according to growth form(Cook, 1996) and life form(Raunkiaer, 1934). Among 19 species only 4 life form classes were recognized.These are Therophytes(63.15%), Hemicryptophy-tes(15.78%),Hydrophytes (10.52%) and Chamaephytes(10.52%).Phytoclimate of the study area is Therophytic.The entirestudy depicts the presence of various biotic factors, floristic composition and microenvironment of the study areas.

*Index Terms*- Phytoclimate, Biological spectrum, Floristic composition, Biotic factors, Microenvironment.

## I. INTRODUCTION

Wetlands can be considered as ecotone, as it represents the vegetation of varieties of plants community of both the terrestrial and wetland ecosystem. The land is inundated with shallow water and predominantly supports hydrophytes[1].Aquatic hydrophytes are mainly aquatic angiosperms that are large enough to see with our naked eyes. Existance of plants in particular region is determined by climate of that region.The concept of life form of the species comprising of vegetation and the classification of vegetation has been done on the basis of physiognomy[2-3].Life form can be consider as the most significant ecological attribute as it is the indicator of certain ecological conditionin which plants are adopted[4-6]. It helps to understand micro and macroclimate along with different anthropogenic activities of particular area[7]. Characterization of life form also enables to analyze the inter action of plants-climate (phytoclimate), on the basis of location of reproductive organ from the soil surface as well as the cope of ability of macrophytes from disturbed stressful environment[8].

Raunkiaer (1934) classified perennial plants according to their life form on the basis of their resistance organ or perennating bud relative to the soil surface, as it is the most important criteria to understand the phytoclimate[9]. He classified plants into five categories such as Phanerophytes(Ph), Chamaephytes(Ch), Hemicryptophytes(Hcp), Geophytes(G), and Therophytes(Th). As life form is the direct indicator of phytoclimate so composition of the life form helps to distinguish different types of phytoclimate. phanerophytic(tropics), therophytic(desert), hemicrytophytic(cold temperate zone). Biological spectrum is the enumeration of percentage representation of life-form of the flora in a wide range of particular geographical area comprising of floristic community. It reveals the stratum of community pattern, biotic interaction, as well as all other prevailing climatic factors which has remarkable impact on plants.

So, the significance of the ongoing research is relative analysis of normal spectrum of macrophytes with the Raunkiaer's constructed biological spectrum which would be the important tool to understand the vegetation, floristic composition, climatic condition along with the overall health status index of specific ecosystem. Besides this it also enables to renovate and strengthen the floral community of that ecosystem[10]. Therefore, the present research intended to find out life form composition of documented macrophytes from Sitajhari river and Dalua beel of Kishanganj district, Bihar.

## II. MATERIALS AND METHODS

**Study area:**

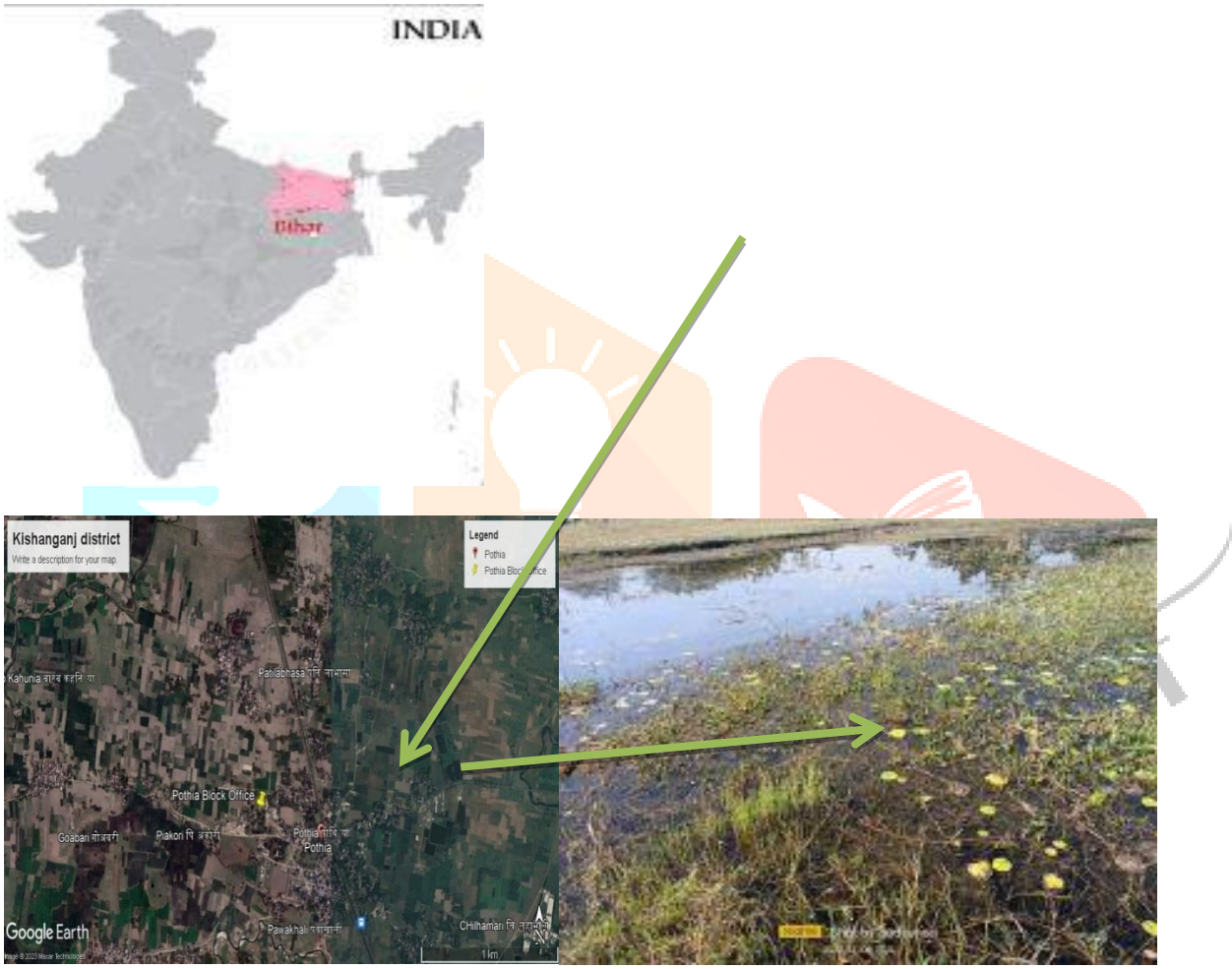
The two selected study areas, Sitajhari river and Dalua beel are located at Kishanganj District in Bihar. The district lies between 25°20' N to 26° 30' N latitude and 87◦ 70' E to 88 °19' N longitudes which covers the total area of 1884 sq. km. The district is surrounded by Purnia in the south-west, Uttar Dinajpur of West Bengal on the east, Araria in the west, and Darjeeling district of West Bengal and Nepal on the north. Kishanganj is only one subdivision in this district. Donk, Kankai, Mahananda and Ratua are the major rivers of the district.

**Sitajhari River:**

At Ratua mouza of Pothia block in the Kishanganj district of Bihar there is a natural and perennial wetland which is locally known as Sitajhari river by the native people. It is located at 88.09° E longitude and 26.25° N latitude. The total area covered by the wetland is 9 acres. Neighbouring villages are Yadavtola, Dhumdangi, Borodangi, Poliatoli etc.

**Dalua Beel:**

At Pothia block of Sitalpur mouza there is a manmade, perennial wetland. Locally it is known as Dalua beel and it covers the area of about 6.2 acres. It is located at 88.08° E longitude and 26.24° N latitude.Neighbouring villages of the wetland are Maria, Sarkaribasti, Nayabasti and Sitalpur. Water of the Wetland is used for the irrigation of about 62 acres of agricultural fields.




Few glimpses of study site(Sitajhaririver) including satellite view.

## III. METHODOLOGY

For preparing the documentation of life form composition and biological spectrum analysis of macrophytes extensive field survey was conducted from November 2021-May 2023. Macrophytes were collected from two selected wetlands and detailed study of floristic vegetation, habit, habitat, height, nature of perennial buds relative to the soil surface, occurrences season etc. were done in the field. Collected macrophytes were then worked out in the laboratory with the help of standard taxonomic literatures [11-35]and to check their valid scientific names **POWO**(Plants Of the World Online, 2023)[**36] and WFO**(World Flora Online,2023) [**37]** were used, then preserved in the form of herbarium specimens at Taxonomy of Angiosperms and Biosystematics laboratory of SKBU, Purulia. Different plant species were classified according to Raunkiaer's life form system modified by Ellenberg and Muller-Dombois(1967) [38] and Muller-Dombois and Ellenberg(1974) [39].Growth form of the collected macrophytes have also been classified according to Cook(1996). Life-form of the species were calculated in the form of percentage for constructing the biological spectrum, then it is compared with Raunkiaer's normal spectrum for the analysis of phytoclimate.

$$\textbf{\% Life-form} = \frac{\textbf{Number of species in any life form}}{\textbf{Total number of species in all life form}} \textbf{ x 100}$$

## IV. RESULTS AND DISCUSSION

A total of 19 macrophytes species were recorded from the two selected study sites belonging to 16 angiosperms families. Onagraceae, Convolvulaceae, and Asteraceae all three showed their dominance(11 %) over the rest of the 13 families(Fabaceae, Alismataceae, Cyperaceae, Hydrocharitaceae, Acanthaceae, Marsileaceae, Menyanthaceae, Pontederiaceae, Potamogetonaceae, Poaceae, Lythraceae, Linderniaceae, Lentibulariaceae) contribute the same number of macrophytes i.e 1 species each. Macrophytes were classified (Table 1) according to their growth form (Cook, 1996) and life form (Raunkiaer, 1934). Only four types of life form were recognized among the 19 macrophytes species. These are Therophytes(12), Hemicryptophytes(3), Hydrophytes(2), and Chamaephytes(2), represented in Table 2. Therophytes showed dominance (63.15%) followed by Hemicryptophytes (16%), Chamaephytes(11%), and Hydrophytes(10%). Maximum number of species(12) belonged to Therophytes, some of them are *Ludwigia adscendens*, *Ludwigia perennis*, *Acmella uliginosa*, *Eclipta prostrata*etc.Therophytes are plants which complete their life cycle in favourable season and maintain their dormancy during unfavourable condition. Lowest percentage of life form were exhibited by hydrophytes which contribute only 2 species such as *Nymphoides hydrophylla* and *Pontederia crassipes.*Relative assessment of biological spectrum of macrophytes and Raunkiaer's normal spectrum have been represented in Table 2.It revealed the major deviation of biological spectrum of macrophytes from the normal spectrum of Raunkiaer.highest deviation shown by Therophytes(50.15).

**Table 1.** Macrophytes associated with Sitajhari river and Dalua beel.

| Sl. No. | Scientific Names of the plant | Family | Life form (LF) | Growth form (GF) | $W_1$ | $W_2$ |
|---|---|---|---|---|---|---|
| 1 | *Acmella uliginosa*(Sw.) Cass. | Asteraceae | TH | Hel | | + |
| 2 | *Aeschynomene aspera* L. | Fabaceae | TH | Hel | + | + |
| 3 | *Albidella oligococca*(F.Muell.) Lehtonen | Alismataceae | TH | Hyp | + | |
| 4 | *Cyperus esculentus* L. | Cyperaceae | TH | Hel | | + |
| 5 | *Eclipta prostrata*(L.)L. | Asteraceae | TH | Hel | | + |
| 6 | *Hydrilla verticillata* (L.f.)Royle | Hydrocharitaceae | HCP | Vit | + | |
| 7 | *Hygrophila auriculata*(Schumach.) Heine | Acanthaceae | TH | Ple | + | |
| 8 | *Ipomoea aquatica* Forssk. | Convolvulaceae | HCP | Hyp | + | |
| 9 | *Ipomoea quamoclit* L. | Convolvulaceae | HCP | Hyp | + | |
| 10 | *Ludwigia adscendens*(L.)H.Hara | Onagraceae | TH | Hyp | + | |
| 11 | *Ludwigia perennis* L. | Onagraceae | TH | Hel | | + |
| 12 | *Marsilea quadrifolia* L. | Marsileaceae | TH | Ple | + | + |
| 13 | *Nymphoides hydrophylla*(Lour.) Kuntze | Menyanthaceae | HY | Eph | + | |
| 14 | *Pontederia crassipes* Mart. | Pontederiaceae | HY | Ple | + | |
| 15 | *Potamogeton crispus* L. | Potamogetonaceae | CP | Vit | + | |
| 16 | *Sporobolus indicus*(L.)R.Br. | Poaceae | TH | Ple | + | + |
| 17 | *Trapa natans* L. | Lythraceae | TH | Ten | + | |
| 18 | *Torenia crustacea*(L.)Cham.& Schltdl. | Linderniaceae | TH | Hel | | + |
| 19 | *Utricularia aurea* Lour. | Lentibulariace | CP | Pla | + | |

**LF(**Life form): **CP**=Chamaephytes, **HCP**=Hemicryptophytes, **HY**=Hydrophytes, **TH** =Therophytes. **GF** (Growth form): **Eph**= Ephydate, **Hel**=Helophyte, **Hyp**= Hyperhydrate, **Pla** = Plankton, **Ple** = Pleustophyte, **Ten** =Tenagophyte, **Vit** = Vittate. **W1: Sitajhari river, W2: Dalua beel.**

**Table 2.**Biological spectrum of macrophytes of Sitajhari river and Dalua beel, compared with Raunkiaer;s normal spectrum and their deviation.

| Life form | No. of taxa | % of taxa | Raunkiaer normal spectrum | Deviation |
|---|---|---|---|---|
| Chamaephytes | 2 | 10.52 | 9 | 1.52 |
| Hemicryptophytes | 3 | 15.78 | 26 | -10.22 |
| Hydrophytes | 2 | 10.52 | 2 | 8.52 |
| Therophytes | 12 | 63.15 | 13 | 50.15 |

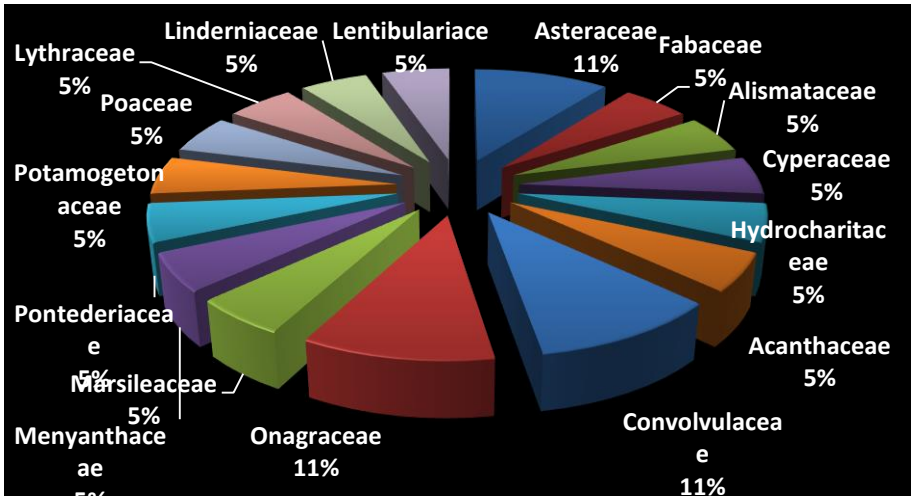



**Figure 1.** Familywise distribution of collected macrophytes.

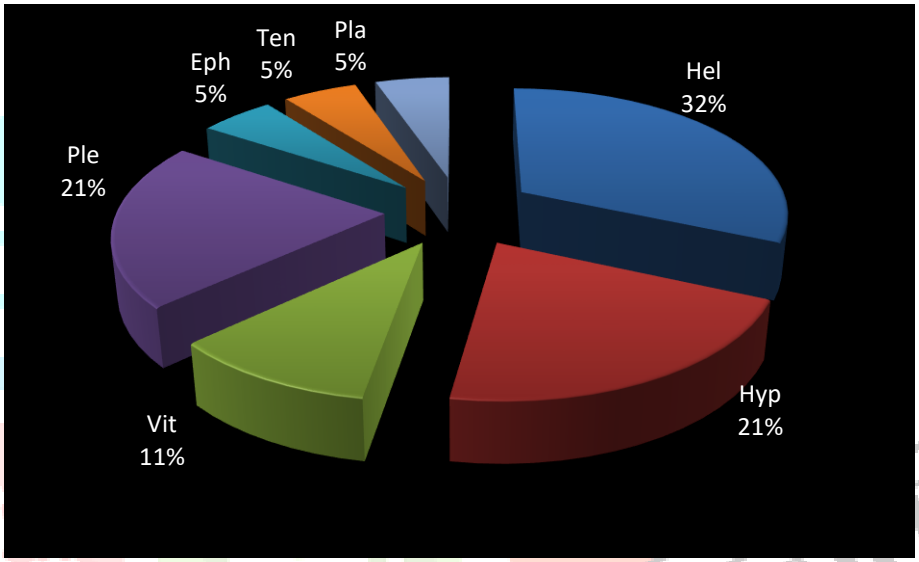



**Figure 2.** Distribution of growth form of collected macrophytes.

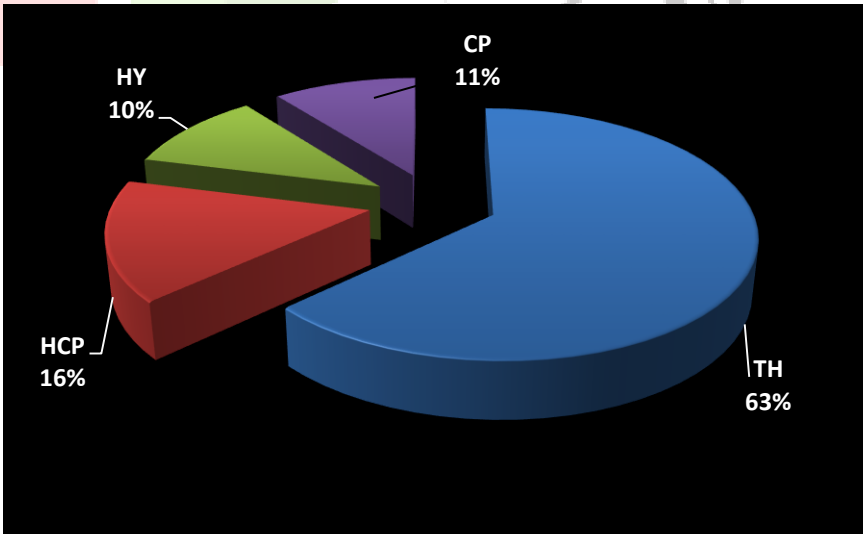



**Figure 3.** Biological spectrum of collected macrophytes.

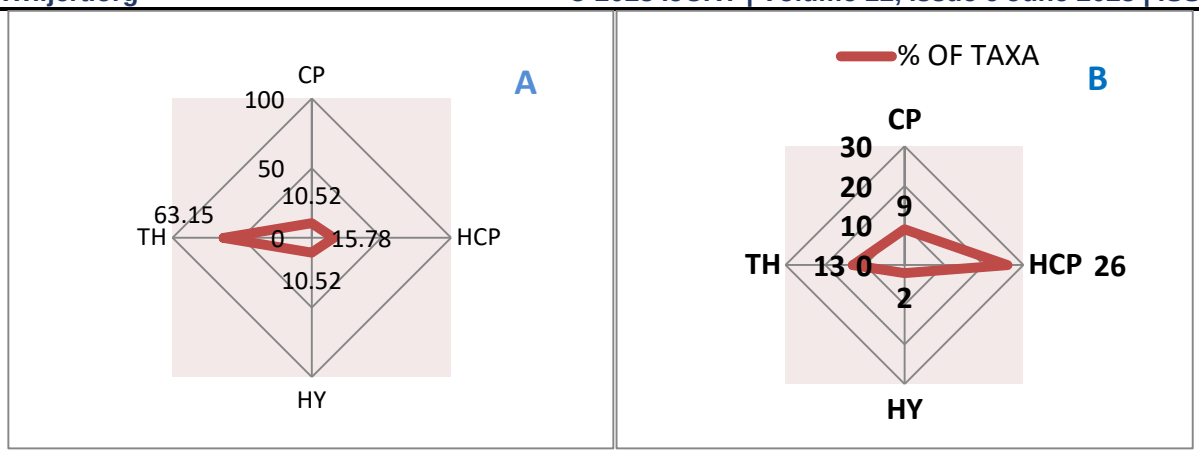



**Figure 4.** Comparison of (A)biological spectrum of collected macrophytes with the (B) Raunkiaer normal spectrum.

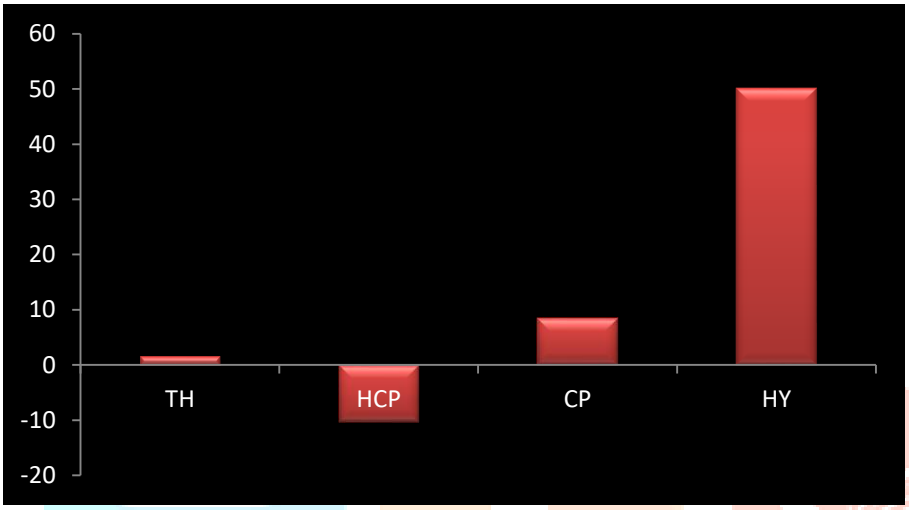



**Figure 5.** Deviation of biological spectrum from normal Raunkiaer spectrum.

## V. CONCLUSION

Comparative analysis of biological spectrum of research area, and Raunkiaer's normal spectrum revealed the higher percentage of Therophytes(63.15%) which concluded that the area is the characteristic of subtropics and phytoclimate is Therophytic. Prevalence of Therophytes, is the consequences of presence of numerous factors such as deforestation, over exploitation, over grazing and many other anthropogenic activities. The significance of the present study is the current condition of phytoclimate of the research area and further studies regarding disturbances on native vegetation will help to infer the microenvironment of that particular area as well as it also enables to increase social awareness for the conservation and protection of biodiversity in their native places due to the rapid increase of biotic and abiotic interference.

## VI. ACKNOWLEDGEMENT

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## REFERENCES

1. Purohit,M.K.and Singh,S.(2020).Analysis of physico-chemical and biological parameters of different water bodies of Doon Valley. *International Journal of Creative Research Thoughts*,**(8 )7:** 5767-5771.

2. Bujarbarua, P.(2018).Study of the life form and the biological spectrum of Umananda river Island, Guwahati, Assam,India - a tool for characterization of the phytoclimate. *Journal of Emerging Technologies and Innovative Research*,**5(5)**:804-806.

3. Manan,F.,Khan ,S.M.Muhammad,Z.,Ahmad, Z.,Abdullah,A.,Rahman, A.,Han, H.,Ariza-Montes,A.Contreras,N.and Rapo so, A.(2022).Floristic composition, biological spectrum, and phytogeographic distribution of the Bin Dara Dir, in the western boundary of Pakistan. *Frontiers in Forests and Global Change*,**5**:1-16.

4. Sharma,J.,Raina,A.K. and Sharma,S.(2014).Lifeform classification and biological spectrum of Lamberi Forest Range, Rajouri, J&K,India. *International Journal of Current Microbiology and Applied Sciences*,**3(11)**:234-239.

5. Sen,U.K.and Bhakat, R. K.(2021).Quantitative evaluation of biological spectrum and phonological pattern of vegetation of a sacred grove of West Midnapore District,Eastern India,*Asian Journal of Forestry*,**5(2):**83-100.

6.Bazarragchaa,B.,Kim,H.S.,Batdelger,G.,Batkhuu, M.,Lee,S.M.,Yang,S.,Peak,W.K.and Lee,J.(2022). Forest vegetation structure of the Bodg Khan Mountain: A strictly protected area in Mongolia. *Journal of Asia-Pacific Biodiversity*, **15**:267-279.

7. Gupta,A.and Haobijam, S.(2021).Life form analysis of weeds from paddy agroecosystem at Imphal East, Manipur, North – Eastern India. *Ecology Environment & Conservation*, **27**:13-19.

8. Irl,S.D.H.,Obermeier,A.,Beierkuhnlein,C.and Steinbauer,J.(2020).Climate controls plant life-form patterns on a high-elevation oceanic island. *Journal of Biogeography*, 1-13.

9. Gazal ,S.and Raina,A.K.(2015).Life form composition and biological spectrum of Ramnagar Wildlife Sanctuary,J&K, India. *International Journal of Science and Research*, **4(4):**161-164.

10.Patel, A.K. (2021). Study of biological spectrum and life form of Kankupura area of Visnagar taluka, dist. Mehsana (north Gujarat). *International Journal of Creative Research Thoughts*, **9(10)**:512-516.
11.Batdelger,G.,Batkhuu, M.,Janchiv, A.,Lee,S. M.,Kim,H.S.,Vang, S.,Peak,W.,Kim,D.H.and Lee, J.(2022).Floristic composi-tionand biological spectrum of the Bogdkhan mountain, Mongolia,Badamtsetseg Bazarragchaa. *Bangladesh Journal of Plant Taxonomy*, **29(2)**:241-268.
12. Cook,C.D. K.(1996). *Aquatic and wetland plants of India*. Oxford University Press, New York.
13. Nikolić,L.,Čobanović,K. and Nićin,S.(2011).Relationship between plant life forms and ecological indices in a lacustrine ecosystem.*Central European Journal of Biology*, **6(2)**:275-282.
14. Reddy,S.C.,Krishna,P.H.,Meena,S.L.,Bhardwaj,R.and Sharma,K.C.(2011).Composition of life forms and biological spectrum along climatic gradient in Rajasthan, India.*International Journal of Environmental Sciences*,**1(7)**:1632-1639.
15. Mary,K.V.(2014).A survey of useful aquatic macrophytes, and its biological spectrum in Kurandikulam, Melasankarankuzhi, Kanyakumari district,Tamil Nadu, India.*Kongunadu Research Journal*, **1(1)**:57-64.
16. Choung ,Y., Min, B.M.,Lee,K.S.,Cho,K.,Joo,K.Y.,Hyun,J.,Na, H.R.,Oh,H.K.,Nam,G.,Kim,J.,Cho,S.,Lee,J.Jung,S.and Lee, J.(2021). Categorized wetland preference and life forms of the vascular plants in the Korean, Peninsula.*Journal of Ecology and Environment*,**45(8)**:1-6.
17.Rodrigo,M.A.(2021). Wetland restoration with hydrophytes: A review.*Plants*,**10**:1-26.
18. Sen,S.K.(2021).Aquatic floristic composition of Chhattishgrh. *Intrenational Journal of Innovative Life Sciences*,**1(1):**32-38.
19. Agbogidi,O.M.,Nwabueze,A. A.,Edema,N. E.,Erhenhi, A.H. and Obi-Iyeke,E.G.(2022).Diversityand life forms of aquatic macrophytes in relation to physicochemical parameters of river Ethiope in Delta State, Nigeria.*Annals of Plant Sciences*, **11(04)**:5040-5050.
20. Ahmed, M. and Dhiman, M.(2022).Vascular macrophytic flora of Peer panjal hiamalya of Jammu, Jammu and Kashmir, India. *Indian Journal of Plant Sciences*,**11**: 52-57.
21. Chowdhury,M. and Chowdhury, A.(2022).*Wetland Flora of West Bengal*, Bluerose Publishers,Pvt.Ltd.
22. Deka,U.,Borthakur,U. and Phukan, S. (2022).Ecological productivity studies of dominant aquatic macrophytes in Kapla Beel,Assam North East India. *Ecology Environment & Conservation*, **28**:178-184.
23. Haque,M.and Sinha,S.N.(2022).Species diversity and distribution of macrophytes in Chupisar wetland ecosystem, West Bengal, India.*International Journal of Research Publication and Reviews*,**3(9)**:1626-1629.
24. Patil,P.S.(2022).Diversity of aquatic weeds in Washim region of Maharashtra,India. *International Journal of Creative Research Thoughts*,**10(02)**:343-347.
25. Shelekar,A.L.,Yewale,R.M. and Bhagat,V.B.(2022).Macrophyte diversity of Mandwa lake neardharni (Melghat) tahsil, district Amravati(M.S.),India.*Journal of Emerging Tehnologies and Innovative Research*,**9(5)**:468-472.
26. Awo ,M.E.,Tabot,P.T.,Kenko,D.and Fonge,B.A.(2023).Occurrence and nutrient retention ofaquatic macrophytes in roadside streams in the Mount cameroon region.*GCS Biological and Pharmaceutical Sciences*, **22(01)**:25-37.
27. Bhanja, A., Singh,N.,Mandal, B.and Payra, P.(2023).Diversity of aquatic macrophytes in four Blocks of Purba Medinipur District,West Bengal ,India. *Indian Journal of Pure & Applied Biosciences*,**11(1**):1-8.
28. Edo,G.I.,Nwosu,L.C.,Samuel P.O.,Akpoghelie,P.O.,Onoharigho,F.O.,Emakpor,P.O.,Emakpor,O.L.,Kpoghelie,E.O.,Ugbune,U . and Agbo,J.J..(2023).Assessment of the physicochemical water quality parameters and distribution of aquatic macrophytes present in Goenyeli Dam, Nicosia district, North Cyprus. *Journal of Analytical &Pharmaceutical Research*, **12(1)**:19–24.
29 . Mjelde,M.,Thrane,J.-E.and Demars,B.O.L.(2023).High aquatic macrophyte diversity in Norwegian lakes north of the Arctic Circle.*Freshwater Biology*, **68**:509–522.
30. Mukherjee, S.and Mandal,S.K.(2023).Quantitative analysis of aquatic and associated macrophytes in selected wetlands of North Dinajpur District,West Bengal. *International Journal of Scientific Research in Science,Engineering and Technology*, **10(3)**:205-212.
31. Paradiya,P.D.,Chauhan,B.N. and Kumbhani, N.R.(2023).Floristic diversity of Vrundavan Education campus-Ganeshpura, Kadi Taluko,Mehsana district,Gujrat, *International Journal of Creative Research Thoughts* ,***11*(2)**: 489-493.
32. Patel, K.N.and Patel, P.K.(2023).A taxonomic account on the monocotyledonous Plants from Khanpur Taluka of Mahisagar District,Gujarat,India. *Annals of Plant Sciences*,**12(05)**:5855-5863.
33.Radhanpuri, F.(2023).A review on wetland plant diversity of Gujarat. *International Association of Biologicals and Computa-tional Digest* , **2(1)**:1-6.
34.Troia,A.(2023).Macrophytes in inland waters: From knowledge to management. *Plants*, **12**:582-584.
35. Vukov,D.,Ilić,M.,Ćuk,M. and Igić,R.(2023).Environmental driverse of functional structure and diversity of vascular macrophyte assemblages in altered waterbodies in Serbia.*Diversity*, **15**:1-15.
36. POWO.(2023).“Plants of the World Online Facilitated by the Royal Botanic Gardens, Kew Published on the internet; http://www.plantsoftheworldonline.org/Retrived 10th June 2023”.
37.WFO:World Flora Online.Published on the Internate; http:// www.worldfloraonline. org. 10th June,(2023).
38. Mueller- Dombois,D. and Ellenberg,H.(1974).*Aims and methods of vegetation ecology*. John wiley and sons, New York.
39.Ellenberg,H.and Mueller-Dombois,D.(1967). A key to Raunkiaer plant life-forms with revised subdivisions. *Ber Geobot Inst Eidg Tech Hochsch Stift Rubel*, **37**:56-73.