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RESEARCH ARTICLE

RICHNESS AND DISTRIBUTION OF MACROPHYTES IN DHARIAHUR BEEL, ISLAMPUR, NORTH DINAJPUR DISTRICT, WEST BENGAL: AN APPROACH TO PHYTOECOLOGICAL STUDIES WITH MULTIVARIATE ANALYSIS

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ABSTRACT

The present research dealing with the analysis of overall distribution, and macrophytic species richness of Dhariahur beel of North Dinajpur district along with the phytoecological studies. A total of 15 macrophytic species belonging to 13 families were recorded. Among these Amaranthaceae and Cyperaceae showed the highest distribution (13%). Therophytes showed the highest dominance (11 species) on the basis of Raunkiaer life form (1934). Helophytes showed highest dominance according to the Cook's growth form (1996). Multivariate factor analysis have been performed to understand the relationship among the ecological factors.

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INTRODUCTION

The term macrophytes refer to large aquatic plants that are enough to be seen with our unaided eyes, and have several intrinsic properties that enable them to become an indispensable components of wetlands (1). Macrophytes play significant role to stabilise the wetland ecosystem by providing shelter for many fishes, and other macroinvertebrates, apart from this good condition of water body health through physical filtration, reduction of soil erosion, nutrient cycling and increase the level of dissolved oxygen (2, 3, 4).

The role of macrophytes are also effected by different environmental factors such as water level fluctuation, light exposure, organic matter content etc. which also facilitate the changes in water chemistry as well as overall ecosystem functioning. Whereas phytoecological study help to analyse the relationship between plants and their physical and biotic environment (5, 6). The present research aims to make an inventory of macrophytes along with different quantitative parameters which may be an important prerequisite for assessment of overall species richness and distribution inhabiting Dhariahur beel of Islampur.

MATERIALS AND METHODS

Study site: The selected study area is North Dinajpur district which lies between 25.11° N to 26.49° N latitude and between 87.49° E to 90.00° E longitude. The district covers the total area of about 3142 sq. km. Kulik, Mahananda, Nagar etc are the main rivers of this district. The district is divided into two subdivision i. e. Raiganj and Islampur. Selected wetland i. e Dhariahur beel belongs to Islampur subdivision of North Dinajpur district.

Dhariahur Beel: This is a manmade, perennial wetland which is situated in 88.29° E longitude and 26.30° N latitude. The total area covered by the wetland is about 5 acres. It is located at Mushidkha mouza of Islampur block in North Dinajpur District. The wetland is under public ownership.

MACROPHYTES COLLECTION AND IDENTIFICATION: For preparing the inventory of macrophytes extensive field survey was conducted from November 2021-January 2024. Macrophytes were collected from Dhariahur beel for the detailed study of morphometric characters, overall distribution, as well as species richness. Collected macrophytes were worked out in the laboratory with the help of

standard taxonomic literatures (7-37) and to check their valid scientific names **POWO** (Plants Of the World Online, 2024)[38] and **WFO** (World Flora Online, 2024)[39] were used. Then specimens were 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 (1934) system (40). Growth form of the collected macrophytes have also been classified according to Cook (1996) [7].

CALCULATION OF QUANTITATIVE CHARACTERS

Random quadrats were (2m x 2m) laid in different zones of the wetland, in a stratified manner. Four sites were chosen at each corner in which quadrats were laid.

Measuring of quantitative characters:

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all the quadrats}}{\text{Total number of quadrats in which the species occurs.}}$$

$$\text{Frequency (\%)} = \frac{\text{No.of quadrats in which the species occurs}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$$

$$\text{A/F Ratio} = \frac{\text{Abundance of a species}}{\text{Frequency of the same species}}$$

Importance Value Index (IVI) = Relative Frequency (%) + Relative Density (%) + Relative Abundance (%).

Data interpretation with statistics: The statistical analysis is carried out by using PAST (Paleontological Statistics) 4.14 software, and the different statistical tools like Box-plot and Factor analysis (CABFAC) are used for interpretation of the key findings. Multivariate Factor analysis is done for analysing quantitative characters such as, frequency, density, abundance, A/F ratio and IVI of the aquatic macrophytes between different study sites of the Dhariahur beel. Box Plots have been used to represent the distribution of the different macrophytic species inhabiting Dhariahur beel.

Box-plot Analysis: Descriptive statistics and box-plots have been used to compare different sets of data by using PAST (Paleontological Statistics) 4.14 software. Species were compared habitat-wise and seasonal species richness of plants, by using box-plot to display the set of data distribution in terms of quartiles.

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.

RESULTS AND DISCUSSION

A total of 15 different macrophytes belonging to 13 families have been recorded from Dhariahur beel, for making an inventory of macrophytes along with their detailed morphometric study. Among 13 families, Cyperaceae and Amaranthaceae showed the highest dominance (13%) over the rest of the families. Pontederiaceae, Araceae, Commelinaceae, Polygonaceae, Onagraceae, Juncaceae, Convolvulaceae these all showed the equal distribution that is 7% followed by Poaceae, Asteraceae and Alismataceae. Macrophytes were also classified according to the life-form (Raunkiaer, 1934) where therophytes showed highest no. (11) followed by HCP (2) HY and CH (both comprise 1 species). On the basis of growth(according to the Cook, 1996), Helophytes showed highest distribution (5 species) followed by Pleustophytes (4 species) Hyp and Vit (3 sp. Each).

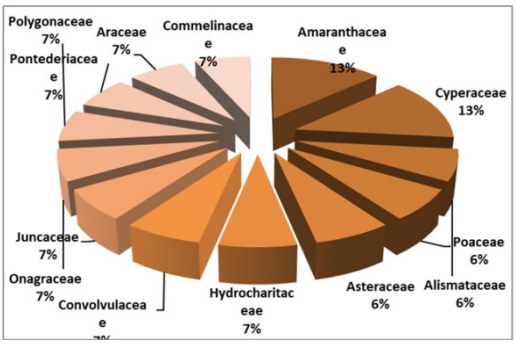

Fig. 1. Frequency of family occurrence recorded from the beel

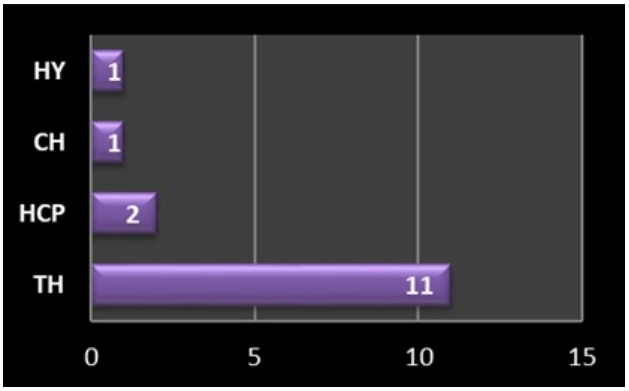

Fig. 2. Distribution of life-forms recorded from the Beel

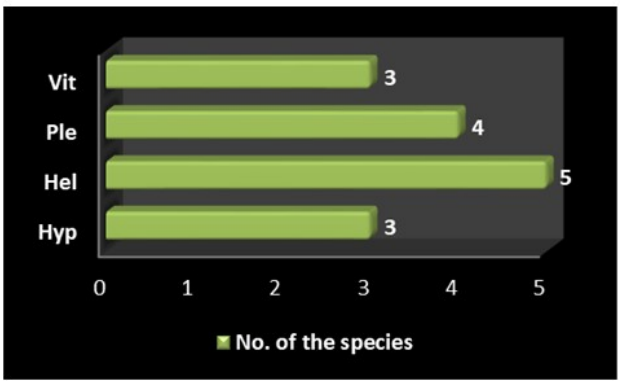

Fig 3. Distribution of growth-forms recorded from the Beel

Box-plot analysis have been done on the basis of frequency, abundance, density, A/F ratio and IVI in between the 4 different sites of the wetland to compare the dataset found at different time intervals during extensive field survey. Minimum, maximum and mean values of the frequency, density, abundance, A/F ratio, and IVI of each species inhabiting the wetland are shown through the box-plot.

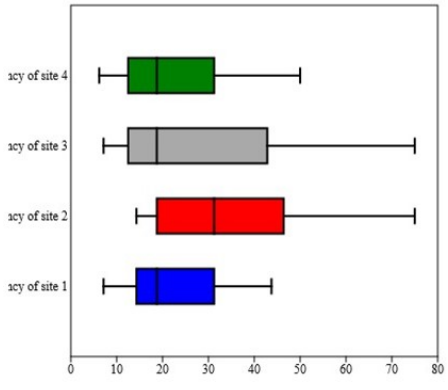

Fig 4. Box-plot of frequency of the species

Table 1. Documentation of macrophytes of Dhariahur Beel along with morphometric characters

Sl. No.	Scientific Names	Family	Life form (LF)	Growth form (GF)	Site 1	Site 2	Site 3	Site 4
1	*Albidella oligococca* (F. Muell.) Lehtonen	Alismataceae	TH	Hyp		+	+	
2	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	TH	Hyp	+		+	+
3	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	TH	Hel	+	+		+
4	*Carex riparia* Curtis	Cyperaceae	TH	Hel	+			+
5	*Colocasia esculenta* (L.)Schott	Araceae	TH	Ple	+	+	+	+
6	*Commelina caroliniana* Walter	Commelinaceae	HCP	Vit	+		+	
7	*Cyperus brevifolius (*Rottb.) Hassk.	Cyperaceae	TH	Hel	+	+		+
8	*Eclipta prostrata* (L.)L.	Asteraceae	CH	Hel	+	+		+
9	*Hydrilla verticillata* (L.f.) Royle	Hydrocharitaceae	TH	Vit	+		+	+
10	*Ipomoea aquatica* Forssk.	Convolvulaceae	HCP	Hyp	+	+	+	+
11	*Juncus prismatocarpus* R.Br.	Juncaceae	TH	Ple		+		+
12	*Ludwigia perennis* L.	Onagraceae	TH	Hel	+	+	+	
13	*Panicum dichotomiflorum* Michx.	Poaceae	TH	Ple	+		+	
14	*Persicaria minor* (Huds.)Opiz	Polygonaceae	TH	Vit		+	+	+
15	*Pontederia crassipes* Mart.	Pontederiaceae	HY	Ple	+	+	+	+

LF: CH = Chamaephytes, HCP = Hemicryptophytes, HY= Hydrophytes, TH= Therophytes. GF: Hel = Helophyte, Hyp = Hyperhydrate, Ple =Pleustophyte, Vit = Vittate.

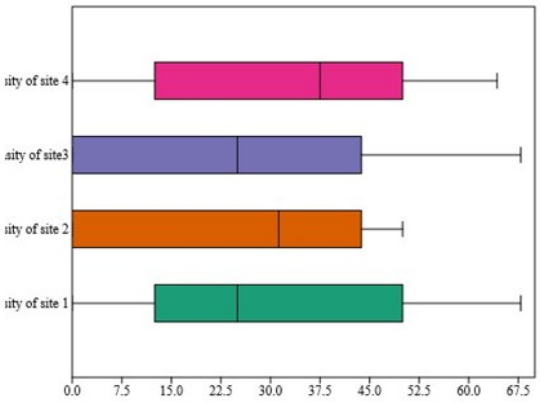

Fig 5. Box-plot of density of the species

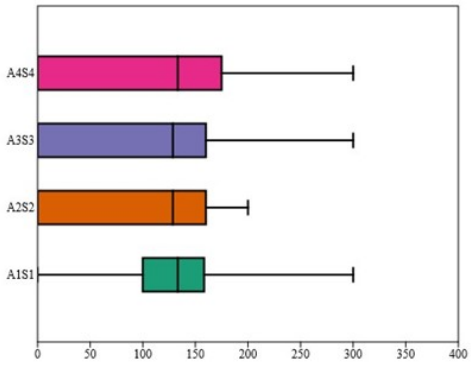

Fig 6. Box-plot of abundance of the species

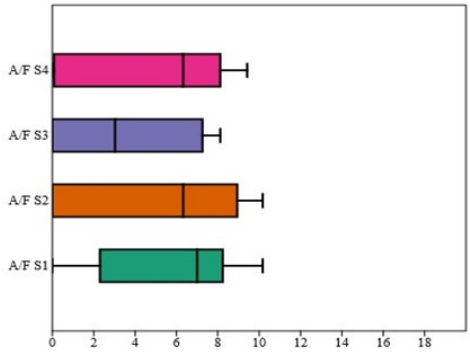

Fig 7. Box-plot of A/F ratio of the species

CABFAC multivariate factor analysis was performed to classify the quantitative parameters statistically, as well as to compare the relationship between the parameters. Data interpretation shown on the basis of frequency, density, abundance, A/F and IVI.

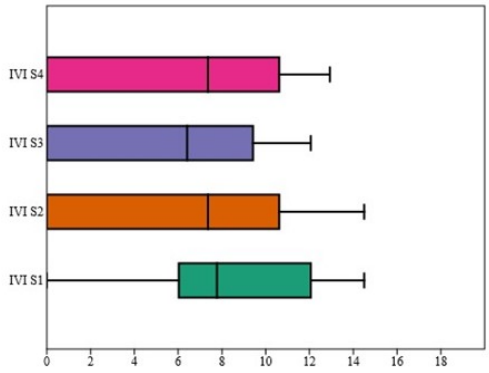

Fig 8. Box-plot of IVI of the species

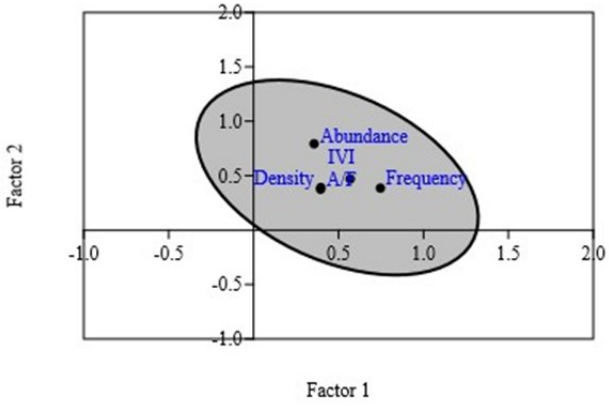

Fig. 9. Factor analysis of quantitative variables by PAST 4.14 software

CONCLUSION

The present investigation reveal the detailed analysis of vegetation composition, richness, distribution to fulfil the approach of overall phytoecological studies of macrophytic species, inhabiting Dhariahur beel. The database reflecting the high distribution and richness of species specifically at 2 sites of the studied wetland. That clearly indicating the wetland comprise of rich floral diversity at particular zone.

Whereas other sites with poor macrophytic vegetation indicate that, it is facing some anthropogenic pressure as well as invasiveness of certain species like *Pontederia crassipes*, which inhibit the growth of other macrophytic species. For the protection of the loss of native species of the wetland, influx of contaminate wastage and anthropogenic activities should be eradicated immediately. It will improve the overall water body health.

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RERERENCES

1. 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.
2. Mukherjee, S. and Mandal, S. K. 2023a. 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.
3. Radhanpuri, F. 2023. A review on wetland plant diversity of Gujarat. International Association of Biologicals and Computational Digest, 2(1), 1-6.
4. Paradiya, P. D., Chauhan, B. N. and Kumbhani, N. R. 2023. Floristic diversity of Vrundavan Education campus-Ganeshpura, Kadi Taluko, Mehsana district, Gujrata, International Journal of Creative Research Thoughts, *1*1(2), 489-493.
5. Mukherjee, S. and Mandal, S. K. 2023b. Ascertainment of phytoclimate with the aid of life form, growth form and leaf size spectra of macrophytes in Jolohari beel and Nehali beel, North Dinajpur district, West Bengal. Journal of Emerging Technologies and Innovative Research, 10(7),157-162.
6. Mandal, S. K. and Mukherjee, S. 2023a. A comparative analysis of life form composition and biological spectrum of macrophytes in Sitajhari river and Dalua beel of Kishanganj district, Bihar.. International Journal of Creative Research Thoughts, 11(6), 85-90.
7. Cook, C. D. K. 1996. *Aquatic and wetland plants of India*. Oxford University Press, New York.
8. Mandal, S. K. and Mukherjee, A. 2016. Inventory of wetlands in Puruliya District, West Bengal and their characterization as natural resources. Indian Journal of Applied Research, 6(11), 649-653.
9. Mandal, S. K. and Mukherjee, A. 2017. Documentation of some rare species of macrophytes associated with wetlands in Purulia District, West Bengal. Indian Journal of Scientific Research 16(1), 73-82.
10. Mandal, S. K. and Mondal, S. 2019. Documentation of several drought tolerance Angiosperms associated with walls in Purulia District, West Bengal. World Journal of Environmental Biosciences, 9(2), 57-61.
11. Mandal, S. K., Mukherjee, S. and Patra, S. 2022a. Diversity of angiosperms and their conservation status in Susunia hill and adjacent regions, Bankura District, West Bengal, India. Ecology, Environment & Conservation, 28, 326-333.
12. Mandal, S. K.., Sahis, A., Maity S. and Mukherjee, S. 2022b. Diversity of angiosperms and their conservation status in Biharinath Hill, Bankura, West Bengal, India. Journal of Scientific Enquiry, 2(2), 92-100.
13. Mandal, S. K. and Mukherjee, S. 2023b. A phytosociological assessment on aquatic macrophytes diversity in two selected wetlands of Kishanganj District, Bihar. Annals of Plant Sciences, 12(08),5917-5925.
14. Mandal, S. K. and Mukherjee, S. 2023c. Comparative analysis of similarity and dissimilarity indices of macrophytes in Aarali beel and Mainapir beel, North Dinajpur District, West Bengal. International Journal of Research and Analytical Reviews, 10(3), 25-30.
15. Mandal, S. K. and Mukherjee, S. 2023d. Floristic analysis of macrophytes in Bheur Canal of North Dinajpur District, West Bengal. International Journal of All Research Education and Scientific Methods. 11(11), 277-283.
16. Mandal, S. K. and Mukherjee, S. 2023e. Ecological assessment of macrophytes of Atia Pukur beel and Ukhalia beel of South Dinajpur District, West Bengal: An approach to multivariate statistical analysis. International Journal of Innovative Research in Technology. 10(6), 231-236.
17. Mukherjee, S. and Mandal, S. K. 2023c. Quantification of floristic diversity and current status of macrophytes in Katarmoni beel, a sacred wetland, Kishanganj district, Bihar. International Journal of Scientific Research in Biological Sciences, 10(3), 95-99.
18. Mukherjee, S. and Mandal, S. K. 2023d. Macrophytes diversity in wetlands of North Dinajpur District, West Bengal, India. Indian Journal of Ecology. 50(4), 1019-1023.
19. Mukherjee, S. and Mandal, S. K. 2023e. Macrophytes of two sacred wetlands, Shibnagar beel and Sonamati beel of Islampur, North Dinajpur District, West Bengal: An approach to phytosociological analysis. International Journal of Applied Research. 9(10), 68-74.
20. Mukherjee, S. and Mandal, S. K. 2023f. Diversity and distribution of macrophytes in Madhya Kachnar beel and Poktar beel of North Dinajpur District, West Bengal: A study on quantitative analysis of bioindicator. International Journal of Novel Research and Development. 8(12), 747-755.
21. Bamania,,S. and Sharma, V. K. 2023. Distribution of hydrophytes in Panchana Dam, District Karauli, Rajasthan, India. Ecology, Environment & Conservation, 29, 229-235.
22. Basar, M. H. and Rahman, A. H. M. M. 2023. Aquatic vascular flora at Sadar Upazila of Chapai Nawabganj District, Bangladesh. Discovery, 59, 1-10.
23. 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.
24. Buenano, B. B. and Zueva, N. V. 2023. Macrophytes as indicators of the ecological status of Valaam island small lakes system. Geography, Environment, Sustainability, 1(16), 103-110.
25. Maitry, A., Chandrakar, S., Shukla, A. and Chandra, A. 2023. Quantitative assessment of macrophytes diversity and their status in wetlands of Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh (India). International Journal of Agricultural and Applied Sciences, 4(2), 120-127.
26. Meena, R. S. and Rathore, N. 2023. Floristic diversity in the wetlands of Karauli district, Rajasthan, India: a survey of panchana dam. International Journal of Education, Modern Management, Applied Science & Social Science, 05(1), 71-74.
27. 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.
28. Ojdanic, N.; Germ, M., Andlovic, M., Cernela, D., Zelnik, I. 2023. Distribution of aquatic macrophytes in the Littoral of Lake Bohinj (Slovenia). Diversity, *15*, 1-15.
29. Onochie, P. and Amarie, E. 2023. Macrophytic vegetation of river Ethiope at Umuaja Ukwani local Government area of Delta State, Nigeria. Engineering Proceedings, 37, 1-5.
30. Saket, R. and Singh, A. R. 2023. Ecological studies of tree vegetation of Jiyavan forest of Singrauli District (M.P.) India. International Journal of Applied Research. 9(10), 134-138.
31. Shailaja, A. and Aruna, M. 2023. Diversity of aquatic macrophytes in Nagaram pond and Dubbak pond of Siddipet district Telangana. International Journal of Novel Research and Development. 8(12), 492-498.

32. Singh, R. G. and Singh, A. R. 2023. Floristic composition, life-forms and biological spectrum of Bagdara forest in Sidhi District, Madhya Pradesh, India. International Journal of Applied Research. 9(10), 126-131.
33. Syed, S. V. and Sonule, M. D. 2023. Diversity of hydrophytic plants from Shri Shivaji College Campus Parbhani. Journal of Emerging Technologyies and Innovative Research, 10(08), 759-763.
34. Tamang, V. B., Shukla, G and Chakravarty, S. 2023. Quantitative assessment of floristic diversity in large Cardamom based traditional agroforestry system across altitudinal gradient in Darjeeling Himalaya, India. Indian Journal of ecology, 50(4), 905-917.
35. Thrupthi, G. N. and Deviprasad, A. G. 2023. Aquatic plant diversity of lakes in Somwarapete taluk , Kodagu, Karnataka. Asian Journal of Environment & Ecology, 20(03), 1-10.
36. Vukov, D., Ilic´, M., C uk, M., Igic, R. 2023. Environmental drivers of functional structure and diversity of vascular macrophyte assemblages in altered waterbodies in Serbia. Diversity, 15, 1-14.
37. Zhou, J., Li, Y., Lyu, T., Yu, H., Meng, J., Song , W., Kang ,Y., Yu, D. and Wang , Z. 2023. Environmental determinants of aquatic plant diversity differ between growth forms and range sizes. Ecological Indicators, 157, 1-9.
38. POWO. 2024. "Plants of the World Online Facilitated by the Royal Botanic Gardens, Kew Published on the internet; http://www.plantsoftheworldonline.org/Retrived 12th January 2024".
39. WFO. 2024. World Flora Online. Published on the Internate; http:// www.worldfloraonline. org. 12th January, (2024).
40. Raunkiaer, C. 1934. *The life form of plants and statistical plant geography*. Clarendon Press. Oxford.

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