E-ISSN: 2583-9667
Indexed Journal
Peer Reviewed Journal
https://multiresearchjournal.theviews.in

Received: 01-04-2024
Accepted: 06-05-2024

INTERNATIONAL JOURNAL OF ADVANCE RESEARCH IN MULTIDISCIPLINARY

Volume 2; Issue 3; 2024; Page No. 546-549

To identify the flora species present in the gulf of Kutch region, including coastal areas, mangroves, and intertidal zones

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Abstract

This study presents a comprehensive survey and analysis of the flora in the Gulf of Kutch, an ecologically diverse and economically significant region situated along the western coast of India. The Gulf of Kutch harbors a rich variety of plant species, including mangroves, seagrasses, and marine algae, which play crucial roles in supporting marine ecosystems, coastal livelihoods, and biodiversity conservation efforts. Through extensive field surveys, literature reviews, and data analysis, this research investigates the biodiversity, distribution patterns, and bio-prospects of flora in the Gulf of Kutch. The study employs a multi-disciplinary approach, integrating botanical, ecological, and socio-economic perspectives to assess the ecological significance and socio-economic implications of the region's flora. Key findings include the identification of diverse plant species, their habitat preferences, and their ecological functions within the Gulf of Kutch ecosystem. Additionally, the study examines the bio-prospects of Gulf of Kutch flora, including their potential applications in pharmaceuticals, biotechnology, food security, and ecosystem restoration.

Keywords: Biodiversity, Conservation, Flora, Pharmaceuticals, Biotechnology

1. Introduction

The Gulf of Kutch, situated along the northwestern coast of India, is a region of immense ecological significance, boasting a rich diversity of flora that contributes to the region's unique marine ecosystem. The flora of the Gulf of Kutch encompasses a wide range of plant species, including mangroves, seagrasses, and marine algae, which play vital roles in supporting biodiversity, coastal livelihoods, and ecosystem services. Understanding the distribution, abundance, and bio-prospects of these plant species is essential for effective conservation and sustainable management of the Gulf of Kutch's coastal resources.

This study aims to conduct a comprehensive survey and analysis of the flora in the Gulf of Kutch, focusing on the identification, characterization, and assessment of their bio-prospects. By integrating botanical surveys, ecological analyses, and socio-economic assessments, this research seeks to unravel the ecological significance and socio-economic implications of the region's botanical resources.

The Gulf of Kutch is renowned for its diverse mangrove forests, which serve as critical habitats for numerous plant and animal species, act as natural barriers against coastal erosion and storm surges, and provide valuable ecosystem services such as carbon sequestration and nutrient cycling. Additionally, seagrasses and marine algae found in the Gulf of Kutch play crucial roles in stabilizing coastal sediments, supporting marine biodiversity, and sustaining fisheries productivity.

Despite their ecological importance, the flora of the Gulf of Kutch faces various threats, including habitat degradation, pollution, overexploitation, and climate change. Understanding the distribution patterns, ecological functions, and bio-prospects of Gulf of Kutch flora is essential for devising effective conservation strategies, promoting sustainable utilization, and enhancing the resilience of coastal ecosystems to environmental stressors.

Through this study, we aim to shed light on the ecological significance and socio-economic potential of the flora in the Gulf of Kutch. By conducting a systematic survey and analysis of plant species, we seek to provide valuable insights into their biodiversity, distribution patterns, and bio-prospects. The findings of this research will contribute to the scientific understanding of coastal ecosystems, inform conservation policies and management practices, and pave

the way for harnessing the bio-economic opportunities offered by the flora in the Gulf of Kutch.

2. Review of Literature

The 1990s revision of the World Heritage discourse has brought in an encompassing term 'cultural landscapes', along with the introduction of another important aspect, intangible cultural heritage. There have also been other discourses taking shape such as the biodiversity conservation, cultural diversity, sustainable development and so on. Contemporary heritage discourse has evolved to emphasize a holistic concept of heritage and seeks to bridge the gaps between different dichotomized categorizations such as nature and culture, tangible and intangible. An attempt to critique the approaches of cultural landscapes as well as biodiversity and cultural diversity, for limiting the notion to either the cultural or the natural domain, has been made. It is hoped that by pointing out common interests and similar work within different disciplines the concept of cultural landscape can be expanded. The specific case examined is the heritage ecosystem of Kutch region of Western India.

Rai (2016) [10] We document two new forms of the bennetitalean genus Williamsonia, Williamsonia sp. A and Williamsonia sp. B, along with other fossil flora, such as horsetails and conifers, wood logs, flowers, and seeds (Carpolithes sp.) from the Middle Oxfordian Kanthkot Ammonite Beds (KAB), Washtawa Formation, exposed in the Waged region of the Kachchh Basin, western India. This is the oldest and the only record of the genus Williamsonia from the marine Upper Jurassic rocks of India, as most of the records of this genus are from the early Cretaceous of India. The studied horizon with plant fossils is rich in datable Middle Oxfordian ammonites and calcareous nannofossils.

Pardeshi (2020) [9] Rann is largest saline and Marshy tracts in the entire world usually have low rain fall and sparse vegetation. However, it forms its own unique ecosystem which supports unique biodiversity of flora and fauna. Similarly, Kachchh Biosphere Reserve (KBR) is mainly composed of two major ecosystems called Great Rann of Kachchh (GRK) and Little Rann of Kachchh (LRK) covering area of 12,454 km2, the reserve mainly it covers Kachchh Desert Sanctuary (in GRK) and Wild Ass Sanctuary (in LRK). A reserve also covers part of finest grassland of Asia called "Banni". Not many researches are available about the scientific information of KBR.

Patel (2021) [8] Floral diversity of higher plants was undertaken in the Kachchh district of Gujarat state during 2007-10. The study reveals that in spite of the arid region, Kachchh district supports total 988 higher plant species (including one gymnosperm) of belonging to 118 families and 503 of 805 dicots and 183 monocots. Herbs were the most dominant life form of recorded species represented by 457 species (46.25%). Poaceous family of Monocotyledons recorded as dominant family with maximum of 104 species. Among the 988 plant species, in which a total 21 threatened plants were recorded.

3. Objectives of the study

1. To identify and document the flora species present in the Gulf of Kutch region, including coastal areas, mangroves, and intertidal zones
2. Analyze the bioactive compounds present in the identified flora species through phytochemical screening and biochemical analysis

4. Research Methodology

Coastal landscapes and their typical ecosystems are highly dynamic and fragile which are characterized by steep environmental gradients and controlled by geomorphological, physical and biological processes. Despite several constraints, coastal areas are highly diversified offering a wide range of floral diversity. Apparently, the coastal flora is more influenced by the geological setting and climate of the region. Specificity of the flora along the coastline is attributed to the presence of sand dunes, rocky coasts, mud flats, marshlands and intertidal and tidal zone areas. In addition, coastal areas form a unique ecosystem owing to combined influence of both fresh and saline water. This interaction causes the coastal landforms to support large diversity of flora and fauna which are crucial to the ecosystem. Coastal vegetation provides habitats, food and fodder for fauna as well as protection from the wave action. Coastal sand is continually being eroded and deposited on the shore by wave action. Therefore, the role of vegetation in dune fixation is critical since, they serve as wind trappers, sand binders and dune stabilizers. Apart from natural events, coastal areas are subjected to constant anthropogenic pressure which disturbs the coastal ecosystem. Therefore, it is a subject of prime importance to study the coastal areas in their natural state.

5. Study area

Devbhoomi Dwarka district of India is located on the southern coast of the GoK, in Gujarat state. It extends between 21.42° to 22.58°N Latitude and 68.58° to 70.40° E Longitude. Coastal areas of the district are distributed in three Talukas which are Okhamandal, Kalyanpur and Khambhaliya. Nine Islands *viz.*, Ajad, Beyt Dwarka, Bhaidar, Dabdaba, Dhani, Gadu, Leffa, Kalubhar and Panero have been covered in this district. The soil of Devbhoomi Dwarka district is calcareous and alkaline in nature with grain size varying from silty loam to clay. The district receives average rainfall of 596 mm.

6. Field Data collection

The present work is based on the survey of vegetation occurring in coastal areas and its 9 islands of Devbhoomi Dwarka district during 2011-2015. The area was surveyed on foot and random sampling method was followed. In the coastal area, line transects of 500 m were laid perpendicular to HTL (High Tide Line to landward side) by using 5km×5km grid laid over land use/land cover maps. Distance of 5 km between two subsequent line intersects was maintained using Global Positioning System (GPS).Within each transect, quadrates were laid at an interval of 20 m, 5m ×5m for trees and shrubs and1m×1m for herbs, grasses and climbers. However, to enrich the species inventory the opportunistic coastal area at each site (areas falling out side of the quadrates) were also explored and monsoon data for herbaceous plants were also recorded in the same sampling plots. The coastal areas of Devbhoomi Dwarka District and its Islands were explored by laying a total of 46 transacts

comprising of 915 quadrates (1m×1m size) and 589 quadrates (5m×5m size), respectively. Within each sampling plot the number and name of all the trees, shrubs and herbs were counted and recorded. The plants were collected in the flowering and fruiting stages and were identified by using different available floristic keys. Documentation was done in the form of photographs as well as plant specimen were preserved by preparing herbarium and deposited in the GEER Foundation, Gandhinagar, Gujarat for future reference.

7. Data analysis and Results

Table 1: Floral Richness in coastal areas of Devbhoomi Dwarka district

	Family	Genera	Species
A. Angiosperm			
Dicotyledons	54	144	202
Monocotyledons	6	32	40
B. Gymnosperm	1	1	1
Total	61	177	243

Among 202 dicot species sub-class Polypetalae exhibited the highest no of species (97 species), followed by Gamopetalae (74 species) and Monochlamydeae (31 species). Within Polypetalae, Calyciflorae group was represented with the maximum number of species (52), followed by Thalamiflorae and Disciflorae. Ratio of subclasses, Polypetalae to Gamopetalae to Monochlamydae was 1:0.8:0.3 and in the subclass Polypetalae, ratio of groups Thalamiflorae to Disciflorae to Calyciflorae was 1:0.45:1.58.

During study, it was revealed that Poaceae was the largest family in Monocotyledons represented by 23 species and 20 Genera, whereas Fabaceae was the largest family among Dicotyledons represented by 20 species and 12 Genera. Out of 61 families, only 11 families were represented with more than half of the species recorded and 22 families were represented with single species. The genera *Ipomoea* had the highest number of species *i.e.* 8 followed by *Cassia* and *Euphorbia* genera both represented with 6 species. Among recorded 177 genera, 28 genera were represented by two species and 137 genera were represented with a single species (Annexure 1).

Among 243 recorded species, herbs were represented by the highest number of species (124), followed by trees, shrubs and grasses & sedges represented with 30 species each and climber (29 species).

Among 3 talukas, the highest species diversity was found in Khambaliya taluka (207 species) followed by Okhamandal (192 species) and Kalyanpur (169 species). Among islands, Beyt Dwarka showed the maximum species diversity (166 species) followed by Azad (120 species) and Gadu (118 species). The lowest species diversity was found in Kalubhar island with 24 species. High floral diversity in Beyt Dwarka may be due to its proximity to coast and human interference due to tourist influx as well as fishermen. It was observed that, the islands near to the coast have high floral diversity, which is similar to the adjoining coastal area. Human beings, winds and water current help to disperse the seeds of various species in such islands and after that great struggle for survival of the plant species acclimate to island conditions ensues. Other islands were with less floral diversity and one of the reasons may be isolation and distance from coastal area. It was reported that a total of 127 vascular plants and a species of Gymnosperm recorded from Beyt Dwarka Island. In that study, the dicotyledonous plant included 45 families, 91 genera and 113 species, and the monocotyledonous plant included 3 families, 11 genera and 13 species.

Table 2: Phytosociological attributes of tree and shrub species in coastal areas and its islands of Devbhoomi Dwarka district in GOK

No.	Botanical name	D (ind./ha)	F (%)	A	A/F	RD (%)	RF (%)	RA (%)	IVI
1	*Prosopis juliflora*	373.51	63.50	588.24	9.26	30.19	24.41	7.68	62.28
2	*Capparis decidua*	135.82	26.99	503.14	18.64	10.98	10.38	6.57	27.93
3	*Zizyphus nummularia*	112.73	32.94	342.27	10.39	9.11	12.66	4.47	26.24
4	*Salvadora persica*	112.73	16.13	698.95	43.33	9.11	6.20	9.13	24.44
5	*Euphorbia nivulia*	83.53	26.32	317.42	12.06	6.75	10.12	4.15	21.01
6	*Acacia nilotica*	83.53	18.85	443.24	23.52	6.75	7.25	5.79	19.79
7	*Grewia tanex*	80.14	18.68	429.09	22.98	6.48	7.18	5.60	19.26
8	*Grewia villosa*	76.06	16.81	452.53	26.92	6.15	6.46	5.91	18.52
9	*Commiphora wightii*	59.08	13.58	435.00	32.03	4.77	5.22	5.68	15.68
10	*Cassia auriculata*	58.40	12.56	464.86	37.00	4.72	4.83	6.07	15.62
11	*Calotropis procera*	19.02	3.90	486.96	124.70	1.54	1.50	6.36	9.40
12	*Salvadora oleoides*	17.66	3.57	495.24	138.90	1.43	1.37	6.47	9.27
13	*prosopis cineraria*	8.15	2.04	400.00	196.33	0.66	0.78	5.22	6.67
14	*Cadaba fruiticosa*	5.43	1.36	400.00	294.50	0.44	0.52	5.22	6.19
15	*Ephedra foliata*	4.07	1.02	400.00	392.67	0.33	0.39	5.22	5.94
16	*Mimosa hamata*	4.07	1.02	400.00	392.67	0.33	0.39	5.22	5.94
17	*Acacia senegal*	3.40	0.85	400.00	471.20	0.27	0.33	5.22	5.82
						100.0	100.0	100.0	300.0

D (ind./ha)= Density (Individual/hector), F (%)= Frequency (Percent); A= Abundance, A/F= Abundance/Frequency, RD (%)= Relative Density (Percent), RF(%)= Relative Frequency (Percent), RA (%)= Relative Abundance (Percent), IVI= Important Value Index.

8. Conclusion

A general review of the study region that means coastal parts and as well as Kutch district as a whole, shows that the district has a prominent place in the map of India, not only because of its long international border, but because of the upcoming large industrial houses establishing their base in this part and contributing in making the district "A gateway to North". The status of land use and recent development

undertaken would further illustrate that this will be more than average developed district in the near future, condition being that all-natural disaster like cyclone and earthquake give mercy to this area, because these disasters have wiped out all the development in the past and that is also the important reason that all big houses avoid development in this zone earlier.

This chapter highlighted that, despite many constraints and problems, inflicted by rapidly changing socio-economic setups under market influence, the local people are still a key repository of knowledge about the various uses of plants, majority are in the domain of traditional knowledge system. Nevertheless, it can safely be assumed that the volume of traditional knowledge, documented during this study, can only be a small fraction of the total 'mass' of ethnobotanical knowledge in the region and still lying within uncodified folk knowledge system. At the same time, frequent reports of various uses of many recently invaded exotic plant species like *Prosopis juliflora* also suggests that the knowledge system is quite dynamic and continuously evolving. Documentation, protection and promotion of such knowledge, therefore should be a top priority in the conservation arena.

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