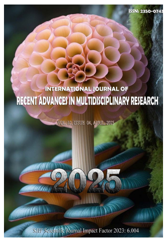
ISSN: 2350-0743

International Journal of Recent Advances in Multidisciplinary Research

Vol. 12, Issue 04, pp.11042-11048, April, 2025



RESEARCH ARTICLE

SURVEY OF EMERGENT AQUATIC MACROPHYTES IN THE DISTRICT OF DHARASHIV OF MAHARASHTRA

Jadhav, S.L.[1] and Babare, M.G.[2]

[1]Indian Institute of Food Science and Technology, Chhatrapati Sambhajinagar, M.S., India
[2]Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar, M.S., India

ARTICLE INFO

Article History
Received 30th January, 2025
Received in revised form
17th February, 2025
Accepted 26th March, 2025
Published online 19th April, 2025

Keywords:

Aquatic vegetation, Lake Administration, Wetland Ecosystems, Emergent, Submerged, and Floating Macrophytes, Biodiversity and Water Resources.

Corresponding author: Jadhav, S.L.

ABSTRACT

Aquatic macrophyte plants are found globally and exhibit a variety of growth forms along with adaptable physiological and metabolic processes that respond to changes in environmental conditions. The majority of macrophyte species are cosmopolitan, and closely related species often replace one another in the aquatic ecosystems across different regions of the world. Macrophytic vegetation encompasses both deep-water and shallow-water species, as well as those that thrive in water in emergent, submerged, or floating forms. While some species are exclusively aquatic, others can grow and reproduce in environments that are periodically flooded. A comprehensive survey was conducted to assess the presence of emergent macrophytes in the waterways of the Dharashiv district in Maharashtra, and the findings were documented. The survey results reveal that a total of species from 27 families were recorded in. The Cyperaceae family was the most prevalent, comprising 39 species, followed by the Poaceae family with 10 species, Nymphaceae with 7 species, and Convolvulaceae with 4 species. Additionally, there were 2 species each from 7 emergent macrophyte families, along with one species from 14 other families. This study offers essential baseline data on the diversity of emergent macrophytes, their comparative status, variability, and distribution within the region.

Citation: Jadhav, S.L. and Babare, M.G. 2025. *"*Survey of emergent aquatic macrophytes in the District of Dharashiv of Maharashtra.*", International Journal of Recent Advances in Multidisciplinary Research,* 12, (04), 11042-11048.

INTRODUCTION

Aquatic plants are vital components of aquatic ecosystems, serving as a source of food and habitat for fish, wildlife, and various aquatic organisms. The influx of sewage and the release of industrial effluents contribute to eutrophication, which adversely impacts aquatic communities. Seasonal variations significantly influence the diversity of aquatic plants. Establishing baseline data is essential for assessing these impacts and maintaining the health of aquatic environments. Aquatic macrophytes are found globally, with most species exhibiting a cosmopolitan distribution. Additionally, groups of closely related species often replace one another in the aquatic ecosystems of different regions around the world (Santamaria, 2002; Zang et al., 2019). Aquatic macrophytes exhibit a variety of growth forms and demonstrate flexibility in their physiological and metabolic processes as they respond to alterations in environmental conditions. This group of vegetation encompasses both deep-water and shallow-water species, as well as those that thrive in water in emergent, submerged, or floating forms. Emergent

macrophyte species are capable of growing and reproducing in environments that are periodically flooded. They can adjust to fluctuations in water levels and can also inhabit temporary water bodies, such as floodplains, seasonal springs, and ponds (Cook, 1999; Jackson et al., 2009). The current investigation focuses on a collection of emergent macrophyte species, characterized by their vegetative structures that rise above the water's surface and exhibit distinct morphological and physiological traits. Aquatic macrophytes have developed a variety of adaptive mechanisms at morphological, physiological, and biochemical levels, allowing them to thrive in diverse freshwater, brackish, and marine environments. These macrophytes play a crucial role in aquatic food webs and fulfill numerous ecological functions within aquatic ecosystems. Key functions include the synthesis and storage of organic compounds, oxygen production, absorption and accumulation of chemical elements, water filtration, detoxification of pollutants, and the release of biologically active substances that facilitate interspecies communication. Additionally, they provide food, shelter, and foraging grounds for aquatic organisms, while also influencing the hydrological dynamics of water bodies. A diverse range of macrophyte species is utilized in various human activities, such as bioindication of water quality, phytoremediation of contaminated water bodies, and wastewater treatment. Nonetheless, human-induced factors such as surface water pollution, eutrophication, and global warming have contributed to a decline in macrophyte diversity across many freshwater and marine ecosystems (Tang et al., 2017). Consequently, effective management of aquatic and wetland ecosystems, including ongoing monitoring and control, is essential for the successful conservation of habitats and the preservation of macrophyte species diversity. This study aims to establish baseline data on emergent macrophytes in the Dharashiv district of Maharashtra. Macrophytes play a crucial role in aquatic ecosystems, serving as a food source for aquatic invertebrates and effectively accumulating heavy metals (Chung and Jeng, 1974). Numerous aquatic plants exhibit significant potential for phytoremediation (bioremediation) of polluted or contaminated wastewater, owing to their inherent ability to efficiently eliminate toxic substances (Nirmal Kumar et al., 2008; Tang et al., 2017). The survey of emergent macrophytes in the Dharashiv district aims to investigate these plants further for their potential in wastewater phytoremediation, thereby expanding the current research conducted by the authors. The findings from this study provide foundational information regarding the diversity of emergent macrophytes in the Dharashiv district of Maharashtra for the first time. This data will be instrumental in the preservation, management, and regulation of aquatic plant species.

MATERIALS AND METHODS

Study area: The State of Maharashtra is categorized into four primary regions: Konkan, Western Maharashtra, Marathwada, and Vidarbha. Notably, the Marathwada region is recognized for its low rainfall and is often subjected to drought conditions. As a result, this area typically faces drought every six to ten years; for instance, the year 2012 was officially designated as a drought year for Marathwada. Dharashiv district, situated in the southern part of the Marathwada region, is one of the eight districts that comprise this area. Dharashiv, previously known as Osmanabad, is an administrative district located in the Marathwada Region of Maharashtra State. It is positioned in the southern part of the state, adjacent to Andhra Pradesh, and is situated between the latitudes of 17°37’ and 18°42’ north and longitudes of 75°16’ and 76°47’ east.

The district encompasses a total area of 7,569 square kilometers and is represented in parts of the Survey of India degree sheets 47 N & O and 58B & 56C. The elevation of the district is approximately 600 meters above sea level. Dharashiv district is bordered to the southwest by Solapur district, to the northwest by Ahilyanagar (formerly Ahmednagar) and Beed districts, to the east by Latur district, and to the south by Bidar and Gulbarga districts of Karnataka State. The district encompasses a total geographical area of 7,512.40 square kilometers, ranking 24th in size among the districts of Maharashtra. Of this area, 248 square kilometers is classified as urban (3.21% of the total), while 7,321 square kilometers is designated as rural (96.79% of the total). The district extends 280 kilometers from east to west and 240 kilometers from north to south. Situated on the Deccan plateau, it has an average elevation of 600 meters above sea level. A significant portion of the district is characterized by the Balaghat Ranges, interspersed with areas of low-lying plains (District Gazetteer of Osmanabad, 1972). The renowned Tulja Bhavani temple is located in the Tuljapur block of this district. The administrative center is situated in Dharashiv city. For effective governance, the district is segmented into eight blocks: Osmanabad (or Dharashiv), Tuljapur, Omerga, and Lohara in the Dharashiv subdivision, and Kalamb, Bhum, Paranda, and Washi in the Bhum subdivision. The district comprises eight towns/blocks and 728 villages. The district is situated within the Deccan Plateau, referred to locally as the Balaghat Plateau, characterized by a southwest and southward slope. Its diverse topography includes hills, plains, and undulating areas adjacent to riverbanks. The district is part of the Godavari River basin, which accounts for approximately 45%, and the Krishna River basin, which constitutes about 55%. The Balaghat Plateau features low-lying hills that act as a water divide between the Krishna and Godavari basins. Numerous tributaries of the Godavari River originate from this plateau.

The northern section of the district is primarily drained by the Godavari River, while the southern section is served by the tributaries of the Krishna River. The Manjra River flows eastward, draining the northern region, while the Terna River, along with its tributary, the Bhogavathi River, drains the eastern area. Notable rivers in the region include the Terna, Tawarja, and tributaries of the Sina, Godavari, Bori, and Harni rivers. The Sina River flows south-southeast before merging with the Bhima River, a tributary of the Krishna River, draining the western part of the district. The Bori River traverses the Tuljapur block and joins the Sina River further south in the Solapur district. Based on the geomorphological characteristics and drainage patterns, the district is categorized into 41 watersheds. A significant portion of Osmanabad district falls under the moderately dissected plateau (MDP) at 84% and the highly dissected plateau at 10%, depending on the degree of weathering and soil cover thickness. In brief, Dharashiv district is a part of the Godavari Basin and the Manjra Sub-basin, with the main rivers flowing through the area being Manjra, Sina, Tirna, Bori, Benitura, and Banganga.

Climate And Rainfall: Climate determines the agricultural land use and agricultural patterns of any region. It consists of temperature, rainfall, humidity, sunshine, fog, frost snow, hailstorms, winds and air pressure. All these elements of weather and climate, individually and collectively, determine the agricultural patterns of a region (Husain M, 2002). The district's climate is marked by hot summers and a general aridity throughout the year, with the exception of the southwest monsoon season, which occurs from June to September. October and November represent the post-monsoon period. The winter season begins in late November, leading to a rapid decline in temperatures. December is the coldest month, with an average minimum temperature of 8.5°C during winter. Starting in early March, daily temperatures rise consistently, peaking in May, which is the hottest month, with an average maximum temperature of 42.5°C. The arrival of the southwest monsoon in the second week of June brings a significant drop in temperature. Dharashiv district is situated in the rain shadow region of the Sahyadri Mountains, resulting in considerable unpredictability regarding the onset and conclusion of the rainy season. Overall, the district experiences limited rainfall, characterized by significant fluctuations in annual precipitation from year to year. The rainfall pattern exhibits two distinct peaks, occurring in June-July and September-October. September experiences the highest levels of rainfall, primarily due to the retreating monsoon and cyclonic activity. Additionally, at times, easterly winds towards the end of the monsoon season contribute to precipitation in the area. Approximately 81.54 percent of the total annual rainfall is recorded during the four-month period from June to September. In April and May, sporadic thundershowers may occur, which can adversely affect horticultural crops. These rainfall characteristics have resulted in semi-arid conditions within the region, limiting both surface and groundwater availability. Consequently, the area faces challenges related to insufficient water resources, which adversely impacts the overall agricultural landscape. The northwestern region of the district receives annual rainfall ranging from 650 to 800 mm, particularly in the Paranda and Bhum blocks.

In the northern area, specifically in the Washi and Kalamb blocks, rainfall is observed between 750 to 800 mm per year. The central part of the district experiences heavy rainfall, with amounts between 800 to 850 mm annually in the Osmanabad and Tuljapur blocks. The southern and southwestern regions, including parts of Tuljapur and Lohara blocks, receive rainfall between 750 to 800 mm per year. Conversely, the southeastern part, particularly in Omerga and parts of Lohara blocks, receives less than 750 mm of rainfall annually. The number of rainy days typically ranges from 40 to 45, with common dry spells lasting between 2 to 10 weeks. It is also common for the southwest monsoon to have a delayed onset and an early withdrawal. The remainder of the district falls within the Central Plateau assured rainfall zone, characterized by annual rainfall of 700 to 900 mm.

The climatic conditions in Dharashiv district range from highly arid to dry sub-humid. Data indicates that approximately seven months of the year experience severe arid conditions, with March exhibiting an exceptionally high arid index value (TMI = -98.51). Additionally, six other months also reflect high arid and dry climatic conditions, underscoring the district's susceptibility to drought. The situation is exacerbated by inadequate irrigation facilities and poor water management in Maharashtra, leaving many districts in the southeastern and central regions of the state at risk of drought.

Survey Methodology: Aquatic macrophytes were systematically collected from the designated study area in Dharashiv district across three distinct seasons: rainy, winter, and summer. Seasonal surveys, involving multiple visits, were conducted to gather data on both emergent littoral and submerged vegetation, as outlined by Narayana and Somashekar (2002). The surveys focused on aquatic plants, particularly emergent macrophytes, over a four-year period from June 2018 to December 2022. During this timeframe, regular excursions were undertaken at short intervals to collect plant samples from various locations and facilitate their identification. A sufficient number of field excursions were carried out to ensure comprehensive sampling and accurate recording of macrophyte species. The Aquatic Plant Sampling Protocols established by Parsons (2001) guided the sampling process. Samples of aquatic macrophytes were collected manually from the littoral zone and the exposed marginal areas of the sampling sites. Given that most of these species are herbaceous, care was taken to uproot them gently. After collection, the plants were rinsed to remove excess mud and subsequently pressed between newspapers or placed in polythene bags, depending on the availability and requirements in the field. These specimens were then promptly prepared for identification. The methodology employed was consistent with the approaches used in the recent research published by Narasimha and Benarjee (2016).

The collected plant specimens were identified and verified against regional floras and relevant literature (Adoni, 1985; Cook, 1996; Garad et al., 2015; Gupta, 2001; Henry et al., 1989; Jain and Rao, 1976; Subramanyam, 1962; Yadav and Sardesai, 2002), as well as regional checklists for hydrophytes from various credible sources, supplemented by the expertise of botanists when available for confirmation.

RESULTS

Most of the unmanaged aquatic macrophytes may become nuisance and growing profusely. Therefore, with multiple interests, the investigations were carried out for more than Four consecutive years from June 2018 to December 2022.

Table 1. List of Emergent Macrophytes observed in major water bodies, their vicinities and wetlands in study region of Dharashiv District

Sr. No.	Scientific Name (Family)	Common Name
1.	*Aeschynomene aspera* (Fabaceae)	Pith plant
2.	*Aeschynomene indica* (Fabaceae)	Indian jointvetch
3.	*Alisma plantago* (Alismataceae)	Water plantain
4.	*Aiternanthera sessils* (Amaranthaceae)	Joy weed
5.	*Alternanthera philoxeroides* (Amaranthaceae)	Alligator weed
6.	*Ammania baccifera* (Lythraceae)	Red stem
7.	*Aponogeton natanus* (Apotomogetonaceae)	Celon ulvaceus
8.	*Arundo donax* (Poaceae)	Gaint reed
9.	*Bacopa monnieri* (Scrophulariaceae)	Water hyssop
10.	*Canna Indica L. or Canna edulis* (Cannaceae)	Kardal/ Indian shot
11.	*Cabomba aquatica* (Nymphaeaceae)	Aquarium plant
12.	*Chrozophora rottleri* (Ephorbiaceae)	Suryavarti
13.	*Coix aquatic* (Poaceae)	Adlay millet
14.	*Colocasia chamissonis* (Araceae)	Swamp taro
15.	*Colocasia esculenta* (Araceae)	Taro/ Elephant grass
16.	*Commelina benghalensis* (Commelinaceae)	Benghal dayflower
17.	*Commelina hasskarlii* (Commelinaceae)	Kamalini
18.	*Cynodon dictylon* (Poaceae)	Bermuda grass
19.	*Cyprus alopecuroide (*Cyperaceae)	Foxtail flat sedge
20.	*Cyperus difformis (*Cyperaceae)	Dila
21.	*Cyperus esculentus (*Cyperaceae)	Sedge
22.	*Cyperus exaltatus (*Cyperaceae)	Gaint sedge
23.	*Cyperus iria (*Cyperaceae)	Rice flatsedge
24.	*Cyperus longus (*Cyperaceae)	Sweet cyperus
25.	*Cyperus Pseudokyllingoides (*Cyperaceae)	Plant form
26.	*Cyperus rotundus (*Cyperaceae)	Nagarmotha
27.	*Cyperus sanguinolentus (*Cyperaceae)	Purple glume sedge
28.	*Cyperus scariosus* (Cyperaceae)	Cypriol
29.	*Cyperus squarrosus* (Cyperaceae)	Awned cyperus
30.	*Cyperus Senguinolentus (*Cyperaceae)	Flat sedge
31.	*Cyperus stoloniferus* (Cyperaceae)	Nut grass
32.	*Echinochloa colona* (Poaceae)	Marsh grass
33.	*Echinochloa stagnina* (Poaceae)	Banti (Marathi)
34.	*Eclipta prostate* (Asteraceae)	Ink plant
35.	*Eleocharis capitata* (Cyperaceae)	Knoblike spikerush

Continue …..

36.	*Eleocharis dulcis (tuberosa)* (Cyperaceae)	Chinese water chestnut
37.	*Eleocharis geniculata* (Cyperaceae)	Spikerush
38.	*Eleocharis plantagenera* (Cyperaceae)	Sedge
39.	*Euryale ferox* (Nymphaceae)	Water Lily
40.	*Fimbristylis alboviridis* (Cyperaceae)	Fimbristyle
41.	*Fimbrystyalis bisumbellata* (Cyperaceae)	Double umbel fimbri
42.	*Fimbrystylis complanata* (Cyperaceae)	Fimbry sedge
43.	*Fimbristylis dichotoma* (Cyperaceae)	Graminoid Fimbry
44.	*Fimbristylis ferruginea* (Cyperaceae)	Common ditch fimbry
45.	*Fimbristylis microcarya* (Cyperaceae)	Fringe rush
46.	*Fimbristylis polytrichoides* (Cyperaceae)	Rusty sedge
47.	*Fimbristylis schoenoides* (Cyperaceae)	Ditch fimbry
48.	*Fuirena cilaris* (Cyperaceae)	Vendranamalona
49.	*Fuirena trilobites* (Cyperaceae)	Three lobed umbrella sedge
50.	*Fuirena wallichiana* (Cyperaceae)	Umbrella grass
51.	*Heliotropium supinum* (Boraginaceae)	Dwarf Heliotrope
52.	*Hygroryza aristata* (Gramineae)	Swimming Grass
53.	*Hygrophila schulis* (Acanthaceae)	Barleria
54.	*Ipomoea aquatic* (Convolvulaceae)	Swamp Cabbage
55.	*Ipomoea Carnea* (Convolvulaceae)	Alpvardhini
56.	*Ipomoea indica* (Convolvulaceae)	Mornig Glorry
57.	*Ipomoea fistulosa* (Convolvulaceae)	Beshram
58.	*Leersia hexandra* (Gramineae)	Rice cut-grass
59.	*Limnophila heterophilla* (Plantaginaceae)	Asian marshweed
60.	*Limnophila sessiliflora L.* (Plantaginaceae)	Asian marshweed
61.	*Marsilea quadrifolia* (Marsileaceae)	Water shamrock
62.	*Monochoria hastata* (Pontederiaceae)	Arrow Leaf pondweed
63.	*Nasturtium officinale* (Brassicaceae)	Watercress
64.	*Nelumbo nucifera* (speciosa) (Nelumbonaceae)	Sacred Lotus
65.	*Nuphar luteum (*Nymphaceae)	Yellow water lily
66.	*Nymphaea lotus* (Nymphaceae)	Tiger lotus
67.	*Nymphaea stellata* (Nymphaceae)	Indian Blue water lily
68.	*Nymphaea lotu* (Nymphaceae)	Egiptian Lily (as per color)
69.	*Nymphaea nouchali* (Nymphaceae)	Star lotus
70.	*Panicum repens* (Gramineae)	Torpedo grass
71.	*Pennisetum pedicellatum* (Poaceae)	Deenanath grass
72.	*Polygonum glabrum* willd L. (Polygonaceae)	Knotweed
73.	*Polygonum hydropiper* (Polygonaceae)	Smart weed
74.	*Phragmites australis* (Poaceae)	Common reed
75.	*Phragmites karka* (Poaceae)	Perennial reed
76.	*Pycreus flvidus* (Cyperaceae)	Yellow flatsedge
77.	*Pycreus pumilus* (Cyperaceae)	Dwarf sedge
78.	*Saccharum spontianeum* (Poaceae)	Wild sugarcane
79.	*Sagittaria latifolia* (Alismataceae)	Broadleaf arrowhead
80.	*Pennisetum pedicellatum* (Poaceae)	Deenanath grass
81.	*Scirpus acutus* (Cyperaceae)	Hardstem bulrush
82.	*Scirpus affinis* (Cyperaceae)	Club rush
83.	*Scirpus articulatus* (Cyperaceae)	Poppangorai
84.	*Scirpus debilis* (Cyperaceae)	Weakstalk bulrush
85.	*Scirpus juncoides* (Cyperaceae)	Vivacious sedge
86.	*Scirpus littoralis* (Cyperaceae)	Baranagar motha
87.	*Scirpus mucronatus* (Cyperaceae)	Ricefield bulrush
88.	*Scirpus maritimus* (Cyperaceae)	Bayonet grass / saltmarsh
89.	*Scirpus roylei* (Cyperaceae)	Nees
90.	*Tamarix ericoides* (Taccaceae)	Sharni/Jhao
91.	*Typha angustata* (Typhaceae)	Ram Ban / Pan Kanis
92.	*Typha latifolia* (Typhaceae)	Bulrudh / Cattail/ Reed-mace
93.	*Typha angustifolia L.* (Typhaceae)	Elephant Grass
94.	*Typha domingensis* (Typhaceae)	Southern cattail

Table 2. Total emergent macrophyte species observed, categorized by family, during the survey conducted in the Dharshiv District study area

Sr. No.	Family of emergent macrophyte	Number of Species
1	Acanthaceae	1
2	Alismataceae	2
3	Amaranthaceae	2
5	Apotomogetonaceae	1
6	Araceae	2
7	Asteraceae	1
8	Boraginaceae	1
9	Brassicaceae	1
10	Cannaceae	1
11	Commelinaceae	2
12	Convolvulaceae	4
13	Cyperaceae	39
14	Ephorbiaceae	1
11	Fabaceae	2
12	Gramineae	3
14	Juncaceae	1
15	Lythraceae	1
16	Marsileaceae	1
17	Nelumbonaceae	1
18	Nymphaeaceae	6
20	Plantaginaceae	2
21	Poaceae	10
22	Polygonaceae	2
23	Pontederiaceae	1
24	Scrophulariaceae	1
26	Taccaceae	1
27	Typhaceae	4
Total number of observed species in 27 families		95 species

During this period of investigations, the macrophytes of the major water bodies and the nearby marshlands and wetlands were visited, observed and existences of emergent macrophytes and their presence or absence were recorded after their collections and scientific confirmations. The areas around the water bodies studied were occupied by many wild species of weeds forming as the ecotone species of the wetlands and terrestrial regions. But, these species were not included in the present investigations, except occurred and observed at the sampling stations. The sampling locations in major water bodies like rivers, their tributaries and the wetland regions showed a wide diversity of emergent macrophytes plant species. Total 95 emergent macrophyte species from 27 families were recorded during the course of study period of these years from littoral and sub littoral zones of the selective sampling stations in the water bodies in the Dharashiv district. This prepared list is representative emergent macrophytes, but not exhaustive. The summary of emergent macrophytes recorded from Dharashiv district is presented in Table 1.

DISCUSSION

Aquatic plants play a role in aquatic ecosystems as they serve as good source of food to different organisms including mankind and animals. Therefore, the study on aquatic macrophytes is important to understand functioning of aquatic ecosystem. Current research on aquatic macrophytes is crucial for comprehending the dynamics of aquatic ecosystems.

This research may also assist in addressing eutrophication issues and facilitate the implementation of phytoremediation technologies. The selected macrophytes are particularly suited to the climatic conditions of the Marathwada region, and specifically the Dharashiv district, as supported by findings from other studies (Jadhav and Babare, 2025). The breakdown of emergent macrophytes by family is detailed in Table 2. The data reveals that the Cyperaceae family is the most prevalent in Dharashiv district, with a total of 39 species.

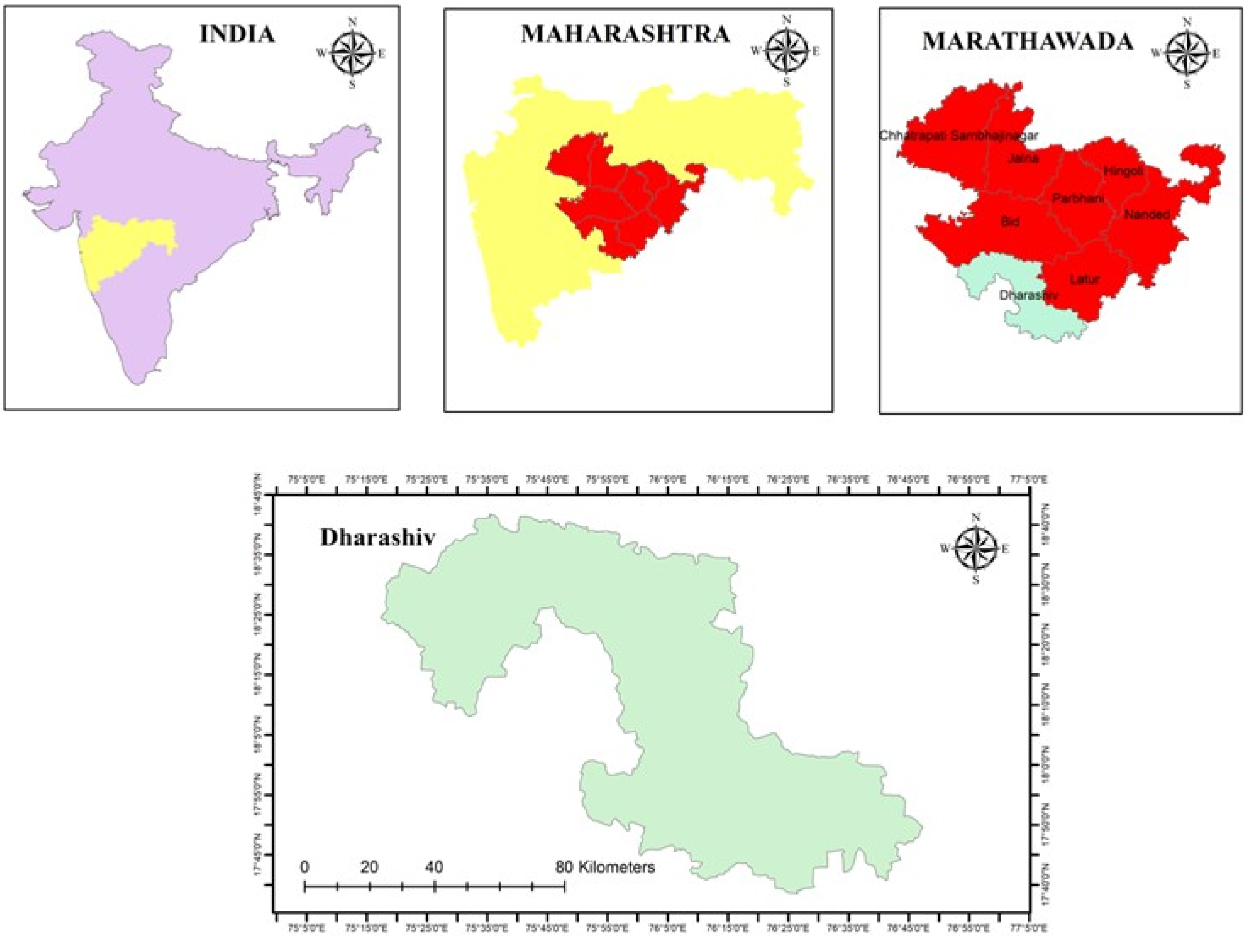


Fig. 1. Map indicating location of Chatrapati Sambhajinagar district of the study area

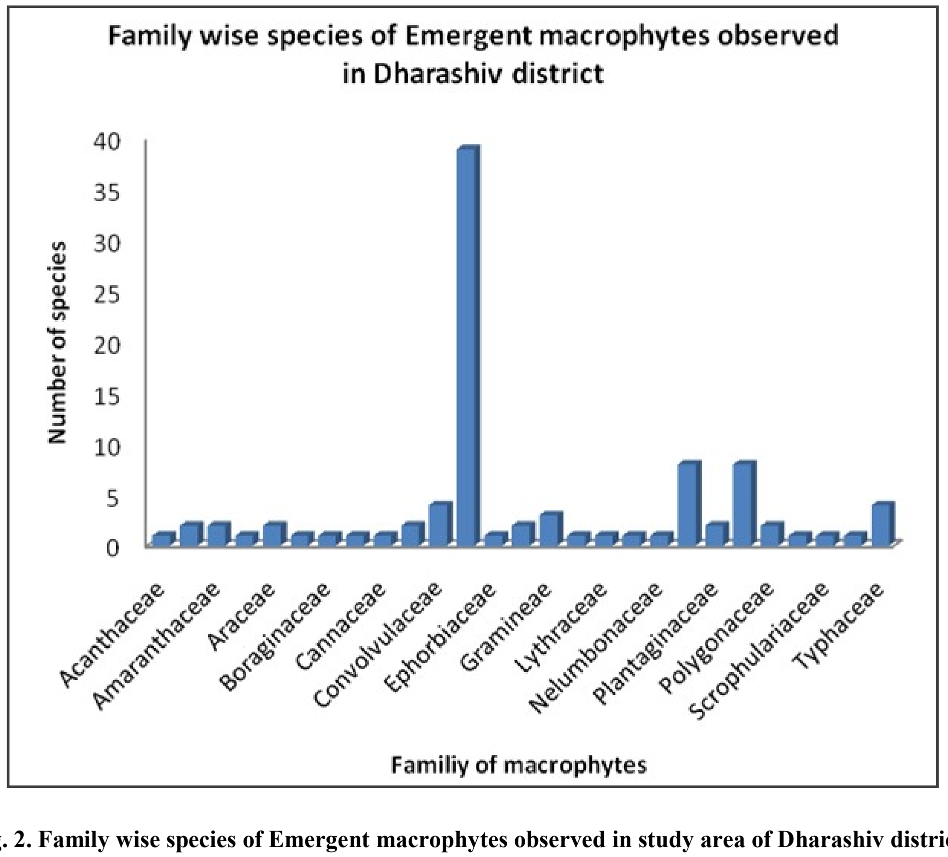


Fig. 2. Family wise species of Emergent macrophytes observed in study area of Dharashiv district.

Following this, the Poaceae family comprises 10 species, while the Nymphaceae family includes 7 species, and the Convolvulaceae family has 4 species. Additionally, two species were identified from each of the emergent macrophyte families of Alismataceae, Amaranthaceae, Araceae, Commelinaceae, Fabaceae, Plantaginaceae, and Polygonaceae during this study. Furthermore, one species each from the families Acanthaceae, Apotomogetonaceae, Asteraceae, Boraginaceae, Brassicaceae, Cannaceae, Euphorbiaceae, Juncaceae, Lythraceae, Marsileaceae, Nelumbonaceae, Pontederiaceae, Scrophulariaceae, and Taccaceae was also recorded (Figure 2). In total, 27 families of macrophyte species were observed in the Dharashiv district within the Marathwada region of Maharashtra. The survey of emergent macrophyte vegetation reveals that the Cypereaceae family predominates in the region. Comparable findings have been documented in the Chhatrapati Sambhajinagar district (Jadhav and Babare, 2025). Analyzing diversity indices in these districts will enhance our understanding of their ecological status and functional characteristics. This research on emergent macrophytes can establish a new baseline for the diversity of these aquatic plants in the significant water bodies of the Dharashiv district. The study encompassed the primary water bodies, river systems, marshlands, and wetlands within the district. The data gathered in this research will be instrumental in managing plant growth, mitigating eutrophication, restoring aquatic ecosystems, and regulating plant species in Dharashiv district, thereby facilitating their effective use in pollution control through phytoremediation techniques. The occurrences and distribution of emergent macrophyte species in the study area exhibit a similar level of diversity and play a crucial role in regulating the climatic conditions of the Dharashiv district in the Marathwada region of Maharashtra. These emergent macrophytes are structurally simpler, as their more complex growth occurs above the water surface, which is often inaccessible to various aquatic organisms. Consequently, it is generally hypothesized that these species create a uniform habitat. The root structure of emergent macrophytes affects the movement of solutes in the subsurface. It is also believed that these plants fulfill similar roles across multiple trophic levels within ecosystems; however, there is currently no scientific data to support this assertion. As noted by Stahr and Kaemingk (2017), targeted scientific research is necessary to investigate the role of emergent macrophytes in shaping littoral habitats.

CONCLUSION

A total of species from 27 families were recorded in the Dharashiv district of the Marathwada region in Maharashtra. The Cyperaceae family was the most prevalent, comprising 39 species, followed by the Poaceae family with 10 species, Nymphaceae with 7 species, and Convolvulaceae with 4 species. Additionally, there were 2 species each from 7 emergent macrophyte families, along with one species from 14 other families. This study offers essential baseline data on the diversity of emergent macrophytes, their comparative status, variability, and distribution within the region. The findings are valuable for the management and control of aquatic plant species diversity. Such research is instrumental in assessing the health and degradation of water bodies, ensuring their sustainability as aquatic ecosystems. The information gathered can aid in regulating the growth of macrophytes in the studied water bodies, mitigating eutrophication, and facilitating the eco-restoration of these environments by addressing pollution issues through the strategic use of native and locally adapted macrophytes in phytoremediation efforts.

REFERENCES

Subramanyam K., 1962, Aquatic angiosperms. Botanical Monograph (3), CSIR, New Delhi.

Yadav S. R. and Sardesai M.M., 2002, Flora of Kolhapur District, Shivaji University, Kolhapur.

Parsons Jenifer, 2001, Aquatic Plant Sampling Protocols, Environmental Assessment Program Olympia, Washington 98504-7710, Pub. No. 01-03-017.

Narasimha Ramulu K and Benarjee G, 2016, Diversity and distribution of macrophytes in Nagaramtank of Warangal district, Telangana state, International Journal of Fisheries and Aquatic Studies, 4(1), pp. 270-275.

Adoni AD., 1985, Work book on limnology Prathibha Publication, C-10, 6 Gouri Nagar, Sagar-470003.

Cook CDK., 1996, Aquatic Plant Book, Edition-2nd, SPB Academic Publishing,New York.

Garad, K. U., R. D. Gore and S. P. Gaikwad, (2015), A Synoptic Account of Flora of Solapur District, Maharashtra (India), Biodiversity Data Journal 3(3): e4282, DOI: 10.3897/BDJ.3. e4282.

Gupta O.P., 2001, Weedy Aquatic Plants: their Utility, Menace and Management. Agrobios Jodhpur, India, pp 273.

Henry AN, Chitra V and Balakrishnan NP., 1989, Flora of Tamil Nadu, India. Botanical Survey of India, Southern Circle, Coimbatore, 1(3), pp. 1-171.

Jain S.K. and Rao R.R., 1976, A Hand book of Field and Herbarium Methods, Today and Tomorrow, New Delhi.

District Gazetteer of Osmanabad (1972), Gazetteer Department, Government of Maharashtra. Pp-31.

Hussain M., 2002, Systematc Agricultural Geography, Rawat Publication, Jaipur pp 92.

Narayana J. and Somashekar R. K., 2002, Macrophytic diversity in relation to water quality in the River Cauvery, as detailed in the book "Ecology and Conservation of Lakes, Reservoirs, and Rivers," published by ABD Publishers in Jaipur, India.

Santamaría L., 2002, Why are most aquatic plants widely distributed? Dispersal, clonal growth and small-scale heterogeneity in a stressful environment. Acta Oecologica, 23:137–154.

Tang Y., Harpenslager S.F., van Kempen M.M.L., Verbaarschot E.J.H., Loeffen L.M.J.M., Roelofs J.G.M., Smolders A.J.P., Lamers L.P.M. 2017, Aquatic macrophytes can be used for wastewater polishing but not for purification in constructed wetlands. Biogeosciences, 14: 755–766.

Zhang M., Molinos J.G., Su G., Zhang H., Xu J. 2019, Spatially structured environmental variation plays a prominent role on the biodiversity of freshwater macrophytes across China. Frontiers in Plant Science, 10: 161.

Cook C.D.K. 1999, The number and kinds of embryobearing plants which have become aquatic: a survey. Perspectives in Plant Ecology, Evolution and Systematics, 2(1): 79–102.

Jackson M.B., Ishizawa K., Ito O. 2009, Evolution and mechanisms of plant tolerance to flooding stress. Annals of Botany, 103: 137–142.

Nirmal Kumar JI, Hiren Soni, Rita N Kumar and Ira Bhatt., 2008, Macrophytes in Phytoremediation of Heavy Metal Contaminated Water and Sediments in Pariyej Community Reserve, Gujarat, India, Turkish Journal of Fisheries and Aquatic Sciences, 8, pp.193-200.

Chung I. H. and Jeng S. S. (1974) reported on heavy metal pollution in the Ta-Tu River in the "Bulletin of the Institute of Zoology, Academy of Science," volume 13, pages 69-73.

****