International Journal of
Science Inventions Today
www.ijsit.com
ISSN 2319-5436
Research Article

STUDY OF AQUATIC MACROPHYTES AND PHYSICO-CHEMICAL PROPERTIES OF WATER FROM KENDUA BEEL, BAGERHAT, BANGLADESH

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ABSTRACT

The present study was carried out to document the aquatic macrophytes of Kendua Beel at Fakirhat upazila in Bagerhat, Bangladesh. The survey was carried out during March, 2021 to August, 2021. The study on aquatic macrophytes in Kendua Beel was documented with 18 species belonging 15 families, in which 18 species were aquatic plants. All the plants were categorized under submerged, emergent, floating, floating creeper and free floating. Out of 15 families reported, dominant families were Convolvulaceae, Lemnaceae and Marsileaceae. The collected water samples were analyzed for different physico-chemical parameters *viz*. pH (7.17 ± 0.53), electric conductivity (1.46 ± 0.71 mS/cm), temperature (28.08 ± 0.23 ºC), dissolved oxygen (0.86 ± 0.31 mg/L), salinity (526.4 ± 109.2 ppm), water depth (3.18 ± 0.69 cm), transparency (82.11 ± 12.95 cm) and phosphate (679 ± 82.4 µg/L).

Keywords: Kendua beel, Aquatic macrophytes, Limnology, Physico-chemical parameters.

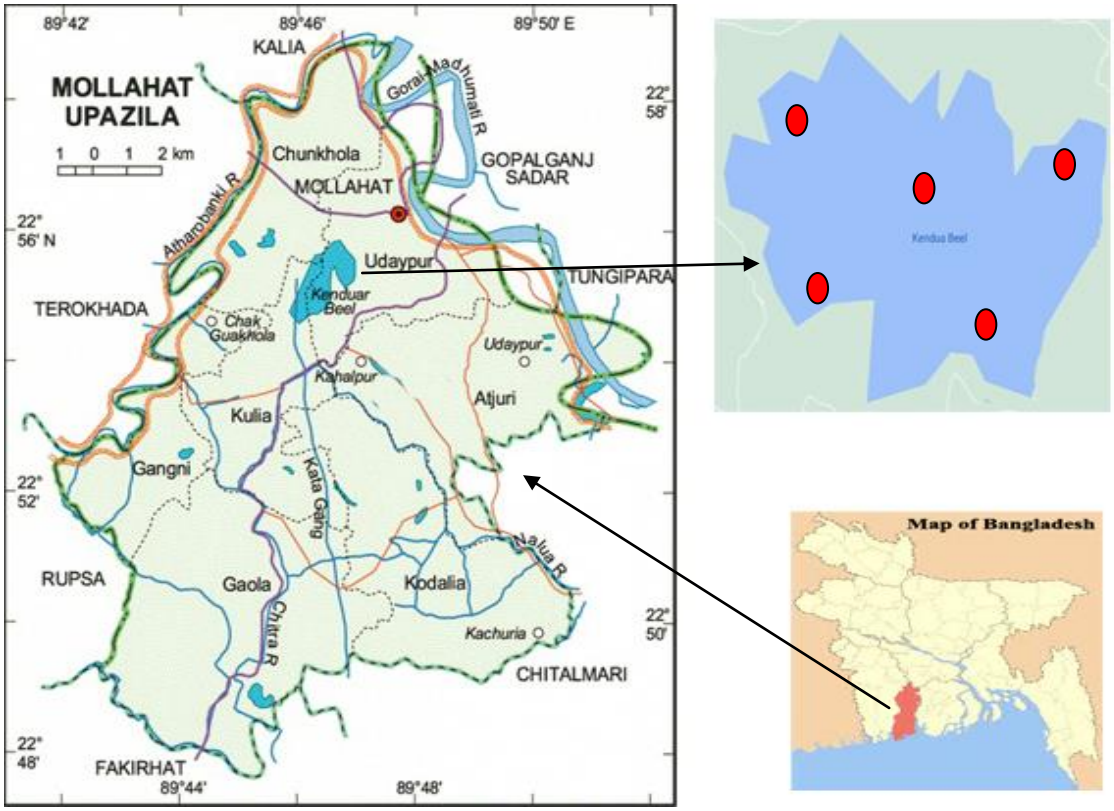
INTRODUCTION

Beel is a large surface waterbody that accumulates surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh[1]. Lakes function a very important life network by serving to in recharging of aquifers and regulation hydrological regimes. Restoration and recharge water level is feasible because of the lakes, that the lakes play a very important role in our lives[2]. The lakes conjointly act as natural traps for sediments and nutrients, there by helps to manage water quality and alluviation of the watercourse systems from the geographical area. The degradation of the lake is because of encroachment and eutrophication hundreds and silt[3]. Wetlands are one in all the crucial natural resources. Wetlands are hierarchal third among the foremost productive system on earth. they're valuable sources, sinks and transformers of a large number of chemical, biological and genetic material and square measure thought of the 'Kidneys of the Earth' for the cleansing perform they perform through biogeochemical cycles. The whole space of wetlands in India is 15.26 million hectares that is around 4.63% of the geographical region of the country[4]. Aquatic plants act with and influence the hydrological, morphological and physico-chemical environments, and act with a good vary of different organisms, from microbes to vertebrates[5]. Ground plants retain the requisites like carbon and methane series balance of the environment and therefore maintaining greenhouse equilibrium. Submerged plants are the generators of gas within the aquatic system. In controlled growth things, either naturally or by human interference, aquatic plants will purify water, however if uncontrolled growth takes place, they'll reach the amount of pests and square measure of times considered aquatic weeds. Aquatic plants will cut back biological gas demand, and these plants square measure currently exploited for bio filtration of organic waste within the waste water treatment systems[6]. Several terrestrial weeds are found within the ecotone region of wetlands that possess many healthful properties[7]. The quality of water generally refers to the composition of water present at the optimum level for stable growth of plants and animals. Aquatic organisms need a healthy environment to live and adequate nutrients for their growth; the productivity depends on the physicochemical characteristics of the water body[8]. In the present study Kendua beel was surveyed for the diversity of aquatic macrophytes for the assessment of biotic potential, which contributes to overall estimation of the basic nature and general economic potential of the water body. A long side analysis of water quality in relation to physicochemical parameters was performed.

MATERIALS AND METHODS

Study Area:

The area of the beel is regarding two hundred acres which is 45.2 km far from Bagerhat town, Bangladesh (Figure 1). The study was conducted at Kendua Beel area Fakirhat, Bagerhat throughout March, 2021 to August, 2021. The position of Kendua Beel is located at latitude $22^0$49'48"N and longitude $88^0$42'54"E.



= Sampling Site

Figure 1: Map of study area

Collection of plant materials:

Sampling of the aquatic plants from Kendua Beel was done during the monsoon period, once in every month from March, 2021 to August, 2021. Samples of aquatic plants were collected in a plastic bag and labelled, with local names, place and date of sampling. Collected samples were packed in bags neatly and brought to the laboratory for further identification. The identification of aquatic plants was done with the help of standard books, monographs and also with the help of available literatures particularly "Encyclopedia of Flora and Fauna of Bangladesh[9-10]".

Collection of water sample for physico-chemical analysis:

During water quality investigation, 5 sampling sites were outlined and samples were collected in the morning hours between 9 am to 11am. For lake water sample collection, a closed bottle was dipped in the lake at a depth of 0.7 to 0.9 m, and then the bottle was opened inside and was closed again to bring it out at the surface. Chemical parameters were determined by using standard methods immediately after taking them into laboratory[11]. The collected water samples were analyzed for different physico-chemical parameters (Table 1) *viz*. pH, Electric Conductivity (EC), temperature, salinity, Total Dissolved Solids (TDS), water depth, transparency, Dissolved Oxygen (DO) and phosphate.

The water depth was measured employing a rope alongside a medium sized stone tied at one end of

it and a meter tape. Water temperature was recorded with the assistance of a centigrade thermometer. The conductivity was measured with the assistance of "Pocket Multiparameter" and recorded (HANNA Instruments, Romania; model: DiST4, HI98304). Transparency of sites was recorded with the assistance of secchi disc. pH of water was analyzed with the assistance of pH scale meter "Pocket Multiparameter" (HANNA Instruments, Romania; model: HI98108). Dissolved oxygen of the water body was analyzed with the assistance of portable DO30 Dissolved oxygen meter and the amount of phosphate was measured by following the method of Hasan *et al*[12].

RESULTS AND DISCUSSION

Diversity of aquatic macrophytes:

The study on aquatic macrophytes in Kendua Beel was documented with 18 species of aquatic macrophytes belonging to 15 families. (Table 1). Out of 18 macrophytes, 4 species belong to free floating and 3 species of floating creeper, 6 species belongs to emergent, 3 species of submerged and were only two species of floating.

Scientific Name	Family	Local name	Life form	References
Actinoscirpus grossus (L.f.) Goetgh. & D.A. Simpson	Cyperaceae	Kasari	Emergent	Siddiqui *et al.*, 2007[10]
Alternanthera philoxeroides (Mart.) Griseb.	Amaranthaceae	Helencha	Emergent	Ahmed *et al.*, 2008[9]
Azolla pinnata R. Br.	Marsileaceae	Lal khudipana	Free floating	Siddiqui *et al.*, 2007[10]
Ceratophyllum demersum L.	Ceratophyllaceae	Sheola	Submerged	Ahmed *et al.*, 2008[9]
Ceratopteris pteridoides (Hook.) Hiern.	Parkeriaceae	Pani Dhekia	Free floating	Siddiqui *et al.*, 2007[10]
Enhydra fluctuans Lour.	Asteraceae	Harhacha	Emergent	Ahmed *et al.*, 2008[9]
Ipomoea aquatica Forssk.	Convolvulaceae	Kalmi Shak	Floating creeper	Ahmed *et al.*, 2008[9]
Ipomoea fistulosa Mart. *ex* Choisy	Convolvulaceae	Dhol kolmi	Floating creeper	Ahmed *et al.*, 2008[9]
Lemna perpusilla Torrey	Lemnaceae	Khudipana	Free floating	Siddiqui *et al.*, 2007[10]
Lemna trisulca L.	Lemnaceae	Kutipana	Submerged	Siddiqui *et al.*, 2007[10]

Ludwigia adscendens (L.) Hara	Onagraceae	Mulsi	Floating	Ahmed *et al.*, 2009[9]
Marsilea minuta (L.) Mant.	Marsileaceae	Susni shak	Floating creeper	Siddiqui *et al.*, 2007[10]
Ottelia alismoides (L.) Pers.	Hydrocharitaceae	Kuchkolai	Submerged	Siddiqui *et al.*, 2007[10]
Phragmites karka (Retz.) Trin. *ex* Steud.	Poaceae	Dharma	Emergent	Ahmed *et al.*, 2008[9]
Pistia stratiotes K.	Araceae	Topapana	Floating	Siddiqui *et al.*, 2007[10]
Salvinia molesta Mitch.	Salviniaceae	Pani Dhekia	Free floating	Siddiqui *et al.*, 2007[10]
Sesbania sesban (L.) Merr.	Fabaceae	Jyonti	Emergent	Ahmed *et al.*, 2009[9]
Typha elephantina Roxb.	Typhaceae	Hogla	Emergent	Ahmed *et al.*, 2008[9]

Table 1: Aquatic macrophytes of the study site recorded during the study period

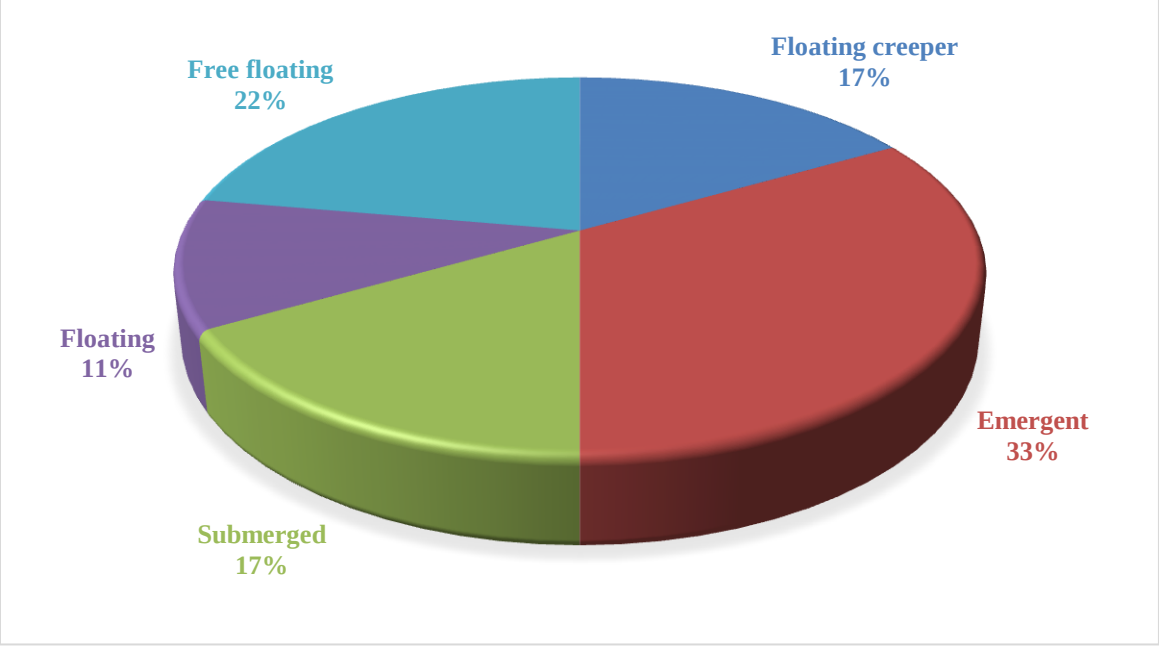


Figure 2: Life form of aquatic macrophytes

All the plants were categorized under submerged 17%, emergent 33%, floating 11%, free floating 22% and floating creeper 17% (Figure 2). Submerged plants represented by 3 species viz. *Lemna trisulca*, Ceratophyllum *demersum*, *Ottelia alismoides*, Followed by emergent anchored with 6 species *viz*. *Enhydra fluctuans*, *Alternanthera philoxeroides*, *Phragmites karka*, *Sesbania sesban*, *Actinoscirpus grossus*, *Typha elephantina*. Free Floating plants were *Pistia stratiotes*, *Ludwigia adscendens*. Out of 15 families reported, dominant families were Convolvulaceae, Lemnaceae and Marsileaceae with 2 species each. And the rest 12 families *i.e.* Salviniaceae, Parkeriaceae, Araceae, Asteraceae, Amaranthaceae, Poaceae, Onagraceae, Fabaceae, Ceratophyllaceae, Cyperaceae, Hydrocharitaceae, Typhaceae were represented by single species.

Species diversity at different stations has showed in Table 2. *Ipomoea aquatica, Lemna perpusilla,* Ceratopteris *pteridoides* and *Azolla pinnata* were found to be grown in all the stations. *Azolla pinnata* is a common aquatic fern in tropical regions. The upper surfaces of this plant leaves are totally water repellent and, if completely submerged, these plants quickly refloat with the right side up[13]. Vegetative reproduction is by fragmentation of the fronds. Sexual reproduction leads to the formation of spores that are released into the water. *Azolla* is heterosporous, a clear adaptation to an aquatic environment.

Scientific Name	**Station-1**	**Station -2**	**Station -3**	**Station -4**	**Station -5**
Actinoscirpus grossus	–	+	–	–	–
Alternanthera philoxeroides	–	+	+	–	–
Azolla pinnata	+	+	+	+	+
Ceratophyllum demersum	–	–	+	–	–
Ceratopteris pteridoides	+	+	+	+	+
Enhydra fluctuans	+	–	–	–	–
Ipomoea aquatica	+	+	+	+	+
Ipomoea fistulosa	+	+	–	–	–
Lemna perpusilla	+	+	+	+	+
Lemna trisulca	–	+	+	–	+
Ludwigia adscendens	–	–	–	–	+
Marsilea minuta	+	+	–	+	+
Ottelia alismoides	+	–	–	–	–
Phragmites karka	–	–	+	+	+
Pistia stratiotes	–	–	–	+	+
Salvinia molesta	–	+	+	–	–
Sesbania sesban	+	+	–	–	–
Typha elephantina	–	+	+	–	–

+ = present, – = absent

Table 2: Species diversity in Kendua beel by different study sites

L. perpusilla is among the smallest of the *Lemna* species, reaching a diameter of only 1.5-4.0 mm[14]. Each of the obovate or suborbicular thalli are slightly convex on both surfaces. Roots of *L. minor* can reach a length of up to 15 cm, whereas those of *L. perpusilla* can grow up to 35 cm in length[15]. Each plant produces 3-7 seeds. During the growing season, each seed produces a seed-bearing plant in 3 days. A water temperature of 21-23°C, and a light intensity of approximately 1600 lux at the water level are optimum conditions for reproduction of *L. minor*. Nutrients, such as phosphate, can stimulate the growth of *L. minor*. Wind action can cause the duckweed to accumulate in mats, sometimes up to 1 m thick although the plant tends to prefer quiet, slow-moving, and sheltered waters[16]. *I. aquatica* is a sprawling vine, annual or perennial, creeping on mud or floating on water; stems terete, branched, hollow and succulent when floating, otherwise solid and firm, up to 3 m long, to 1 cm in diameter. *I. aquatica* occurs in moist, marshy, or inundated localities, in shallow pools, ditches, or wet rice fields, from sea level to 1000 m. It forms dense masses and is easily propagated from cuttings[17]. *Ceratopteris* species are aquatic pteridophytic ferns, generally found in tropical regions. They require a warm climate and lots of water.

Physico-chemical analysis of water samples:

The temperature of the water samples was taken on the spot in the morning. Among the samples taken from the different place's temperature ranged from 28.08 ± 0.23°C. The pH value of the water samples was tested and recorded as 7.17 ± 0.53 that is almost neutral. The results reflect that the mean conductivity was 1.456 ± 0.71mS/cm. Other parameters like TDS, salinity, water depth, transparency, DO and phosphate showed 473.4 ± 91.58 ppm, 526.4 ± 109.2 ppm, 109.7 ± 34.65cm, 82.11 ± 12.95 cm, 0.862 ± 0.31 and 679 ± 82.40 respectively (Table 3). Macrophytes though providing a food and shelter for aquatic animals, may also increase diurnal variability of ecologically important physico-chemical variables and inhibit mixing process that might improve habitat quality[18]. Physico-chemical parameter study is very important to get exact idea about the quality of water. And we have compared results of different physico-chemical parameter values with standard values[19].

Parameters	Station-1	Station -2	Station -3	Station -4	Station -5	Mean	± SD
Temperature (°C)	28.2	28	28.4	27.8	28	28.08	0.23
EC (mS/cm)	0.91	1.2	2.48	1.89	0.8	1.456	0.71
TDS (ppm)	423	566	400	580	398	473.4	91.58
pH	6.81	7.06	8.1	7	6.9	7.174	0.53
Salinity (ppm)	490	710	420	522	490	526.4	109.20
Water depth (m)	2.61	3.73	3.25	3.96	2.36	3.18	0.69
Transparency (cm)	98.98	84.2	88.02	74.02	65.33	82.11	12.95
DO (mg/L)	0.44	1.22	1.09	0.88	0.68	0.862	0.31
Phosphate (µg/L)	794	666	580	722	633	679	82.40

Table 3: Water quality parameters in different sampling sites throughout the period of study

CONCLUSION

Based on the above results, it can be concluded that the study site showed good diversity of aquatic macrophytes. However during the present study it has been found that, due to natural and anthropogenic activities along with the negligence of concerned government authorities, the process of gradual degradation of the wetland has been started. Therefore proper conservation measures should be taken for the conservation and existence of this important wetland.

REFERENCES

1. Banglapedia, National Encyclopedia of Bangladesh, 1st Ed, Dhaka, Bangladesh: Asiatic Society of Bangladesh, 2004.
2. Aher DN, Kele VD, Malwade KD, Shelke MD, Lake Water Quality Indexing To Identify Suitable Sites for Household Utility: A Case Study on Jambhulwadi Lake, Pune (MS), International Journal of Engineering Research and Applications, 2016, 6(5): 16-21.
3. Khare KC, Jadha MS, Water quality assessment of Katraj Lake, Pune (Maharashtra, India): A case study, In: 12th World Lake Conference, Jaipur, India, 2008, 292-299.
4. Swamy J, Chandramohan K, Bhadraiah B, An inventory of aquatic and wetland plants of Pocharam Lake, Medak district, Telangana, India, Asian Journal of Plant Science and Research, 2016, 6(3): 87-91.
5. O'Hare MT, Aguiar FC, Asaeda T, Bakker ES, Chambers PA et al., Plants in aquatic ecosystems: current trends and future directions, Hydrobiologia, 2018, 812: 1-11.
6. Ghosh SK, Illustrated Aquatic and Wetland Plants in Harmony with Mankind, Kolkata, India: Standard Literature, 2005.
7. Deka U, Sarma SK, Present status of aquatic macrophytes of the wetlands of Nalbari district of Assam, India, Asian Journal of Plant Science and Research, 2014, 4(3): 67-75.
8. Agbaire PO, Obi CG, Seasonal Variation of some physico-chemical properties of River Ethiope water in Abraka, Nigeria, Journal of Applied Sciences and Environmental Management, 2009, 13: 55-57.
9. Ahmed ZU, Hassan MA, Begum ZNT, Khondker M, Kabir SMH, Ahmad M, Ahmed ATA, Rahman AKA, Haque EU, Encyclopedia of flora and fauna of Bangladesh, Angiosperms: Dicotyledons (Balsaminaceae - Euphorbiaceae), Vol. 6-12, Dhaka, Bangladesh: Asiatic Society of Bangladesh, 2008-2009.
10. Siddiqui KU, Islam MA, Ahmed ZU, Begum ZNT, Hasan MA et al., Encyclopedia of flora and fauna of Bangladesh (Bryophytes, Pyeridophytes, Gymnosperms), Vol. 5, Dhaka, Bangladesh: Asiatic Society of Bangladesh, 2007.
11. Nagamani C, Saraswathidevi C, Shalini A, Physico-chemical analysis of water samples, International Journal of Scientific and Engineering Research, 2015, 6(1): 2149-2155.
12. Hasan MM, Islam MT, Laskar MAR, Sultana T, Distribution and diversity of aquatic macrophytes and the assessment of physico-chemical parameters of Dakatia beel in Khulna disrtict, Bangladesh, Asian Journal of Medical and Biological Research, 2021, 7(2): 118-125.

13. Croft JR, The aquatic Pteridophytes of New Guinea, Australian National Herbarium, Centre for Plant Biodiversity Research, 1986.
14. Sculthorpe CD, The Biology of Aquatic Vascular Plants. London, UK: Edward Arnold Publications Limited, 1967.
15. eFloras.org, Flora of North America. St Louis, Missouri: Missouri Botanical Garden and Cambridge, Massachusetts: Harvard University Herbaria, Cambridge, MA, 2013, Website http://www.efloras.org/ [accessed on 23 August 2021].
16. Ghavzan JN, Gunale VR, Mahaja DM, Shirke DR, Effects of environmental factors on ecology and distribution of aquatic macrophytes, Asian Journal of Plant Sciences, 2006, 5(5): 871-880.
17. https://www.cabi.org/isc/datasheet/28781
18. Ramesh I, Kiran BR, Aquatic macrophytic diversity in unused fish culture ponds at Bhadra Reservoir project, Karnataka, India, International Journal of Applied Research, 2015, 1(6): 227-229.
19. Patil PN, Sawant DV, Deshmukh RN, Physico-chemical parameters for testing of water – A review. International Journal of Environmental Sciences, 2012, 3 (2): 1194-1207.