



ISSN: 2320-8090

Available online at <http://www.journalijcst.com>

International Journal of Current Science and Technology
Vol.5, Issue, 5, pp. 413-418, May, 2017

IJCST

RESEARCH ARTICLE

SURVEY OF AQUATIC MACROPHYTE DIVERSITY OF MOHABALA LAKE FROM BHADRAWATI TAHSIL OF CHANDRAPUR DISTRICT, STATE MAHARASHTRA (INDIA)

Umakant B .Deshmukh^{1*}, Eanguwar Srinivas Reddy² and Omprakash S. Rathor³

¹Department of Botany, Janata Mahavidyalay, Chandrapur, Maharashtra, India.442401

²Department of Botany, Baliram Patil Arts, Commerce and Science Collage, Kinwat, District, Nanded, Maharashtra, India

³Ex. Principal and Reader in Botany N.E.S. Science College, Nanded. Maharashtra, India

ARTICLE INFO

Article History:

Received 13th February, 2017

Received in revised form 25th

March, 2017

Accepted 6th April, 2017

Published online 28th May, 2017

Key words:

Aquatic macrophyte, Mohabala lake, Bhadrawati Tahsil, Chandrapur.

ABSTRACT

In present survey total 57 aquatic macrophytes documented belonging to 32 families and 46 genera and they belonging to different groups like Angiosperms, Pteridophytes and Algae from Mohabala lake of Bhadrawati Tahsil of Chandrapur district. Angiosperms contributes 54 species (95.08%) followed by Pteridophytes contributes 02 species (3.27%) namely *Azolla pinnata* R.Br. *Marsilea quadrifolia* L. and Algae contributes single species (1.63%) *Chara globularis* J.I.Thuiller. Monocots contributes 20 species (35%) belonging to 11 families and dicots contributes 34 species (60%) belonging to 18 families. Angiosperm macrophytes shows dominance over Pteridophytes and Algae in Mohabala Lake of Bhadrawati Tahsil. Dicots showing dominance over monocots. Emergent macrophytes contributes 41 species (72%) and showing the dominance over floating macrophytes are 10 species (17 %) and submerged macrophyte 6 species (11%). Herbaceous macrophytes dominating and represents 51 species (89%), followed by creepers represents only 03 species (5%), under shrubs only 02 species (4%) and shrubs only one species (2%). These aquatic macrophytes play important role to improve the quality of water.

Copyright © 2017 Umakant B.Deshmukh et al., This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Aquatic macrophytes occur permanently or seasonally in aquatic or wet environment. They includes a diverse group of organisms including some freshwater macroalgae, liverworts, mosses, ferns, and angiosperms, and that occur in seasonally or wet environments (Lacoul and Freedman, 2006; Chambers et al., 2008). Sculthorpe, (1985) classified these macrophyte on the basis of their life form into four forms namely free-floating, floating-leaved, submerged, and emergent.

Aquatic macrophytes forms links between the water, sediment, and atmosphere in various aquatic ecosystems like lakes, rivers and reservoirs. They function as primary producers and also involved in various processes like transpiration, sedimentation, materials transformation, mineral cycling, bio mineralization and release of biogenic trace gases into the atmosphere of aquatic ecosystem (Carpenter and Lodge, 1986).

Aquatic macrophytes are the major component of freshwater ecosystem because they provides better nourishment to the aquatic organisms in the form of food, nutrients and also provided habitat for to maintain and enhance the biodiversity of aquatic ecosystem (Agostinho et al.2007, Theel et al.2008).

*Corresponding author: Umakant B .Deshmukh

Department of Botany, Janata Mahavidyalay, Chandrapur, Maharashtra, India.442401

Aquatic macrophytes used as bio indicator as they respond to the changes in quality of water, minerals and other organic components. They are used as indicator for monitoring the change in aquatic ecosystem. They also accumulate various heavy metals presents in aquatic ecosystem. (Devlin,1967). Submerged macrophytes are the generators of oxygen in the aquatic system. In controlled growth situations, either naturally or by human interference, aquatic plants can purify water, but if uncontrolled growth takes place, they can reach the levels of pests and are frequently regarded as aquatic weeds. Aquatic macrophytes can reduce biological oxygen demand, and these plants are now exploited for bio filtration of organic waste in the waste water treatment systems (Ghosh, 2005).

Many researchers carried out studies on aquatic macrophytes from India and Maharashtra (Subrahmanyam, 1962; Bhaskar and Razi, 1973; Kachroo, 1984; Majid,1986; Lavania et al.1990;Cook,1996; Baruah and Baruah, 2000; Dutta et al.2002; Maliya and Singh, 2004; Ambasht, 2005 ; Kiran et al., 2006; Dhore et al., 2012; Dhore and Lachure, 2014;Kumar and Pal,2015) and many more. Reports on aquatic macrophyte from Chandrapur districts also carried out by some researchers from this region (Khinchi et al.,2008; Wadhve et al., 2010; Harney et al.,2013; Sitre, 2013; Sitre et al., 2014 ; Harney, 2014; Deshmukh et al. 2016, 2016b; Shende et al, 2016; Dhamgaye et al, 2016 and Reddy and Chaturvedi, 2016) .

Mahajan and Harney (2016a, 2016b, and 2016c) reported 56 species of birds; they studied the diversity of rotifers and also reported the diversity of Chlorophyceae from Mohabala Lake. As

there are no previous reported studies on aquatic macrophyte of Mohabala lake of Bhadrawati tahsil from Chandrapur district and aquatic macrophytes having various significance in aquatic ecosystem therefore the present investigation was undertaken to record the diversity of macrophytes in Mohabala lake of Bhadrawati tahsil from Chandrapur district.

MATERIAL AND METHOD

Study Area

Chandrapur city is known as “Black Gold” city because of large number of coal mines present around this city. Chandrapur city is located on the bank of Erai River towards the eastern edge of Maharashtra state in Nagpur division and forms the eastern part of Vidarbha region of Maharashtra state. Chandrapur district is one of the 11th district of Vidarbha region.

Chandrapur district lies between 19° 30' and 20° 45' north latitudes and 78° 46' and 80° 00' east longitudes. This district is bounded on east by Gadchiroli district, on south by Andhra Pradesh state, on west by Yawatmal district and on north by Gondia, Bhandara, Nagpur and Wardha districts. Wainganga river forms the eastern boundary and Wardha river forms the Western boundary. This district falls in parts of the Survey of India Toposheet No. 55H, 55L, 56E and 56I covering an area of 10920 Sq.Km.(CGWB,2013). Mohabala Lake is one of the important fresh water lake situated 25 Km North of Chandrapur and 125 Km South East from Nagpur within Bhadrawati tahsil in Chandrapur district of Maharashtra state. It is situated about at about 211 m above the mean sea level.

Table No 1 Aquatic Macrophyte biodiversity of Mohabala Lake from Bhadrawati tahsil of Chandrapur District

S.N	Family name	Botanical name	Habit	Life Form
01	Acanthaceae	<i>Hygrophila schulli</i> (Harm.) M.R.and S.M.Almeida	Herb	Emergent
02	Alismataceae *	<i>Sagittaria obtusifolia</i> L.	Herb	Emergent
03	Alismataceae *	<i>Sagittaria sagittifolia</i> L.	Herb	Emergent
04	Amaranthaceae	<i>Alternanthera philoxeroides</i> (Mar)Griesp.	Herb	Emergent
05	Amaranthaceae	<i>Alternanthera sessilis</i> (L.)R. Br. ex	Herb	Emergent
06	Aponogetanaceae *	<i>Aponogeton natans</i> (L.) Engler and Krause	Herb	Anchored floating
07	Araceae *	<i>Pistia stratiotes</i> L.	Herb	Free floating
08	Asteraceae	<i>Eclipta prostrata</i> (L.) L.	Herb	Emergent
09	Asteraceae	<i>Grangea maderaspatana</i> (L.) Poir.	Herb	Emergent
10	Asteraceae	<i>Parthenium hysterophorus</i> L.	Herb	Emergent
11	Asteraceae	<i>Sphaeranthus indicus</i> L.	Creeper	Emergent
12	Asteraceae	<i>Xanthium strumarium</i> L.	Herb	Emergent
13	Boraginaceae	<i>Coldenia procumbens</i> L.	Creeper	Emergent
14	Boraginaceae	<i>Heliotropium indicum</i> L.	Herb	Emergent
15	Boraginaceae	<i>Heliotropium supinum</i> L.	Herb	Emergent
16	Ceratophyllaceae	<i>Ceratophyllum demersum</i> L.	Herb	Submerged
17	Characeae +	<i>Chara globularis</i> J.I.Thuiller	Herb	Submerged
19	Commelinaceae *	<i>Commelina hasskarlii</i> C. Comm. Cyrt.	Herb	Emergent
18	Commelinaceae*	<i>Commelina benghalensis</i> L.	Herb	Emergent
20	Commelinaceae*	<i>Murdannia nudiflora</i> (L.) Brenan	Herb	Emergent
21	Convolvulaceae	<i>Ipomoea aquatica</i> Forsk.	Herb	Anchored Floating
22	Convolvulaceae	<i>Ipomoea carnea</i> Jacq.Subsp <i>fiatulososa</i> (Mart.ex Choisy)D.F.Austin.	Shrub	Emergent
23	Cyperaceae *	<i>Cyperus difformis</i> L.	Herb	Emergent
24	Cyperaceae *	<i>Cyperus rotundus</i> L.	Herb	Emergent
25	Cyperaceae *	<i>Eleocharis geniculata</i> (L.) R&S.	Herb	Emergent
26	Cyperaceae*	<i>Eleocharis capitata</i> R. Br.	Herb	Emergent
27	Cyperaceae*	<i>Scirpus articulatus</i> L.	Herb	Emergent
28	Euphorbiaceae	<i>Chrozophora rotleri</i> (Geisel.) A. Juss. ex. Spr	Herb	Emergent
29	Fabaceae	<i>Aeschynomene aspera</i> L.	Under Shrub	Emergent
30	Fabaceae	<i>Aeschynomene indica</i> L.	Under Shrub	Emergent
31	Hydrocharitaceae *	<i>Hydrilla verticillata</i> (L. f.) Royle	Herb	Submerged
32	Hydrocharitaceae *	<i>Vallisneria spiralis</i> L.	Herb	Submerged
33	Hydrocharitaceae*	<i>Ottelia alismoides</i> (L.) Pers	Herb	Submerged
34	Lemnaceae *	<i>Lemna minor</i> L.	Herb	Free floating
35	Lythraceae	<i>Ammannia baccifera</i> L.	Herb	Emergent
36	Lythraceae	<i>Rotala indica</i> Blatt. & Halb.	Herb	Emergent
37	Malvaceae	<i>Urena lobata</i> L.	Herb	Emergent
38	Marsileaceae †	<i>Marsilea quadrifolia</i> L.	Herb	Emergent
39	Menyanthaceae	<i>Nymphoides cristata</i> (Roxb.)Kuntz	Herb	Anchored Floating
40	Menyanthaceae	<i>Nymphoides indica</i> (L.) Kuntze	Herb	Anchored floating
41	Molluginaceae	<i>Glimmus lotoides</i> L.	Creeper	Emergent
42	Molluginaceae	<i>Mollugo pentaphylla</i> L.	Herb	Emergent
43	Najadaceae*	<i>Najas minor</i> L.	Herb	Submerged
44	Nymphaeaceae	<i>Nymphaea nouchali</i> Burm. f.	Herb	Anchored Floating
45	Nymphaeaceae	<i>Nymphaea pubescence</i> Willd.	Herb	Anchored Floating
46	Onagraceae	<i>Ludwigia adscendens</i> (L.) H. Hara	Herb	Anchored Floating
47	Onagraceae	<i>Ludwigia perennis</i> L.	Herb	Emergent
48	Oxalidaceae	<i>Oxalis corniculata</i> L.	Herb	Emergent
49	Poaceae *	<i>Coix aquatica</i> Roxb.	Herb	Emergent
50	Poaceae *	<i>Cynodon dactylon</i> (L.) Pers.	Herb	Emergent
51	Polygonaceae	<i>Polygonum glabrum</i> Willd.	Herb	Emergent
52	Portulacaceae	<i>Trianthema portulacastrum</i> Linn.	Herb	Emergent
53	Salviniaceae †	<i>Azolla pinnata</i> R.Br.	Herb	Free floating
54	Scrophulariaceae	<i>Bacopa monnieri</i> (L.) Wettst.	Herb	Emergent
55	Scrophulariaceae	<i>Limnophila sessiliflora</i> L.	Herb	Emergent
56	Typhaceae *	<i>Typha angustata</i> Bory and Chaub.	Herb	Emergent
57	Verbenaceae	<i>Phyla nodiflora</i> (L.) Greene.	Herb	Emergent

*: Monocot, †: Pteridophytes, +: Algae

It is at 20° 06' 35.67" N latitude and 79° 07' 7.33" E longitude. (Mahajan and Harney, 2016).

Collection of Macrophytes and Identification

For enumeration of an aquatic macrophytes diversity from Mohabala lake of Bhadrawati tahsil from Chandrapur district various survey arranged periodically during the period of December 2015 to April 2017. Various aquatic macrophyte collected and by following usual laboratory procedures herbarium sheets prepared. All collected aquatic macrophyte species correctly indentified using pertinent literature and flora Cook (1996), Gupta (2001) and Yadav and Sardesai (2002).

Herbarium sheet deposited in the herbarium of PG Dept of Botany, Janata Mahavidyalaya, Chandrapur for further studies. These collected macrophytes plants species were classified on the basis of their habitat and life form.

RESULT AND DISCUSSION

In present survey total 57 aquatic macrophytes collected belonging to 32 families and 46 genera of Mohabala lake from Bhadrawati tahsil of Chandrapur district (Table No.01). Collected 57 macrophytes are classified according to various habitats in three types of life forms namely Floating, Submerged and Emergent of Mohabala lake from Bhadrawati tahsil of Chandrapur district (Fig.No.01).

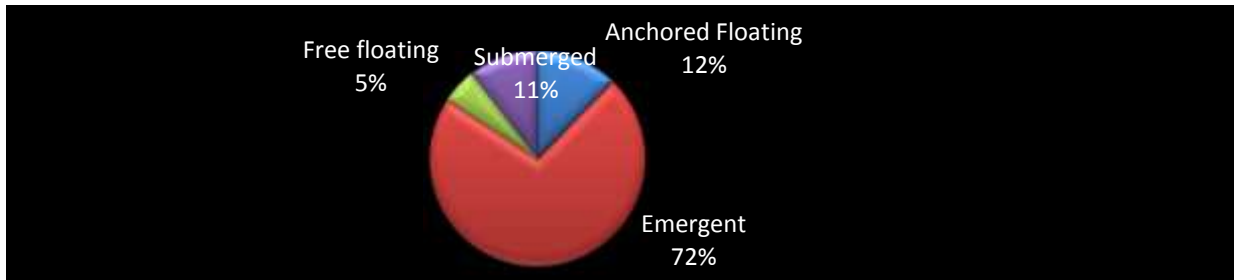


Fig 1 Graph showing life form of aquatic macrophyte diversity of Mohabala lake of from Bhadrawati tahsil of Chandrapur district.

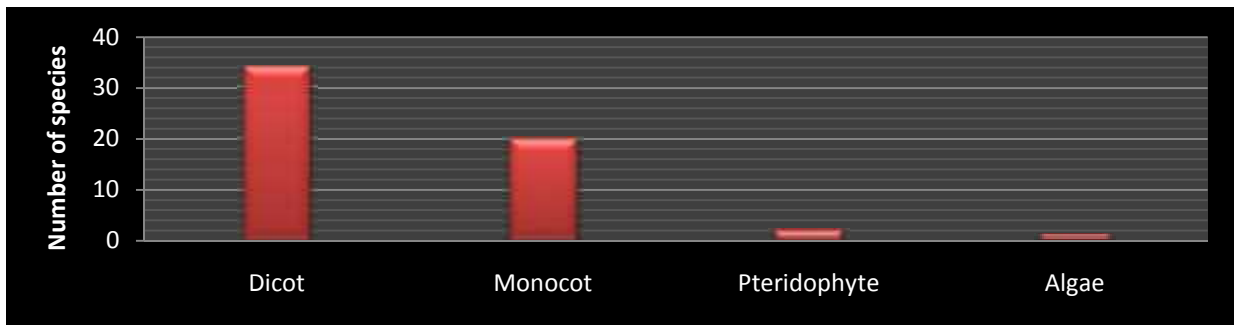


Fig 2 Graph showing different groups of aquatic macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district.

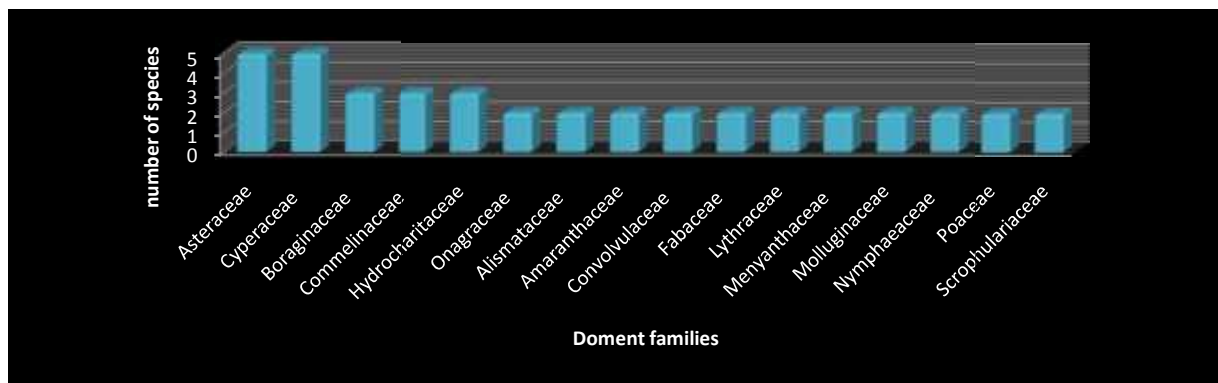


Fig 3 Graph showing 16 domient families of aquatic macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district

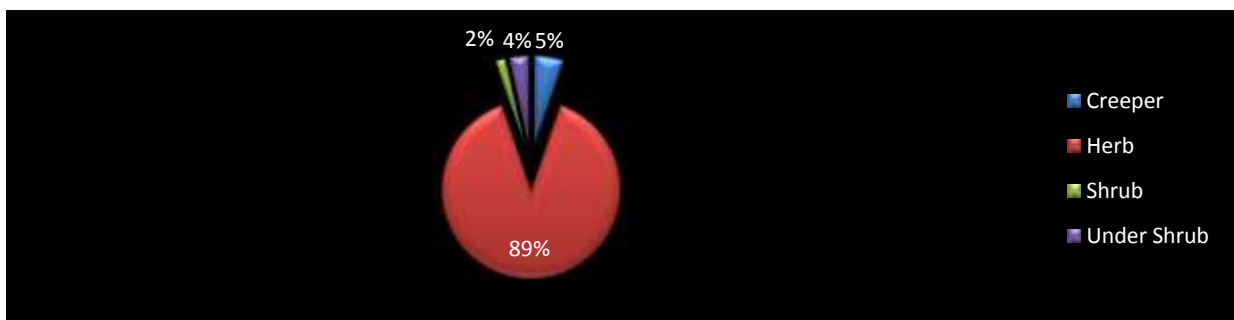


Fig 4 Graph showing Habit of aquatic macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district

In present survey out of 57 macrophytes recorded floating macrophyte represented by only 10 species (17 %). Three species namely *Lemna minor* L.(Lemnaceae), *Azolla pinnata* R.Br. (Salviniaceae) and *Pistia stratiotes* L.(Araceae) not fixed to the soil at bottom are free floating macrophyte (5%). *Aponogeton natans*(L.) Engler and Krause (Aponogetanaceae), *Nymphaea nouchali* Burm. f. and *Nymphaea pubescence* Willd.(Nymphaeaceae) *Ludwigia adscendens* (L.) H. Hara (Onagraceae), *Ipomoea aquatica* Forsk, (Convolvulaceae) *Nymphoides indica* (L.) Kuntze, and *Nymphoides cristata*(Roxb.) Kuntz (Menyanthaceae) anchored down to soil and these are anchored floating macrophytes (12%). They contributes 16.39% of total macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district.

Out of 57 aquatic macrophytes 41 macrophytes from 21 families grow in shallow water and existing near the wet environment and they forms life form as emergent macrophytes. They are namely *Hygrophila schulli* (Harm.) M.R.and S.M.Almeida, *Sagittaria obtusifolia* L., *Sagittaria sagittifolia* L., *Alternanthera philoxeroides* (Mar)Griesp., *Alternanthera sessilis* (L.)R. Br. Ex,*Eclipta prostrata* (L.) L.,*Grangea maderaspatana* (L.) ,Poir.,*Parthenium hysterophorus* L., *Sphaeranthus indicus* L.,*Xanthium strumarium* L., *Coldenia procumbens* L., *Heliotropium indicum* L, *Heliotropium supinum* L.,*Commelina benghalensis* L.,*Commelina hasskarlii* C. Comm. Cyrt., *Ipomoea carnea* Jacq.Subsp *fistulosa* (Mart.ex Choisy)D.F.Austin.,*Cyperus difformis* L.,*Cyperus rotundus* L.,*Eleocharis geniculata* (L.) R&S.,*Eleocharis capitata* R. Br.,*Scirpus articulatus* L., *Chrozophora rotleri* (Geisel.) A. Juss. ex. Spr,*Aeschynomene aspera* L.,*Aeschynomene indica* L.,*Ammannia baccifera* L., *Rotala indica* Blatt. & Halb.,*Urena lobata* L.,*Marsilea quadrifolia* L., *Glennus lotoides* L.,*Mollugo pentaphylla* L.,*Ludwigia perennis* L.,*Coix aquatica* Roxb.,*Cynodon dactylon* (L.) Pers.,*Polygonum glabrum* Willd., *Trianthema portulacastrum* Linn., *Bacopa monnieri* (L.) Wettst., *Limnophila sessiliflora* L. *Phyla nodiflora* (L.) Greene., *Murdannia nudiflora* (L.) Brenan., *Oxalis corniculata* L.,and *Typha angustata* Bory and Chaub. Emergent Macrophyte contributes 72% of total macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district and they dominating over the floating (17%)and submerged macrophytes(11%).

Six macrophyte species namely *Ceratophyllum demersum* L.(Ceratophyllaceae), *Chara globularis* J. L.Thullier(Characeae). *Hydrilla verticillata* (L. f.) Royle, *Ottelia alismoides* (L.) Pers. and *Vallisneria spiralis* L.(Hydrocharitaceae) *Najas minor* L.(Najdaceae) are submerged macrophytes as they grow, germinate , and reproduce beneath the water surface . They contributes 11% of total macrophytes of Mohabala lake from Bhadrawati tahsil of Chandrapur district.

In present survey 57 aquatic macrophyte diversity recorded from different groups like Angiosperms contributes 54 species (95.08%) followed by Pteridophytes contributes two species namely *Azolla pinnata* R.Br. *Marsilea quadrifolia* L.(3.27%) and Algae contributes single species *Chara globularis* J.I.Thuiller (1.63%). Dicots contributes 34 species (60%) belonging to 18 families and showing dominance over monocots. Monocots contributes 20 species (35%) belonging to 11 families. Angiosperms shows dominance over Pteridophytes and Algae in Mohabala Lake of Bhadrawati Tahsil (Fig.No.02). 41 species of macrophytes contributed by

16 families and remaining 16 species of macrophytes contributed by 16 different families of different groups from angiosperms, Pteridophytes and from Algae (Fig No.03).

Out of 57 collected phytoplanktons *Alternanthera philoxeroides* (Mar) Griesp., *Alternanthera sessilis* (L.)R. Br. ex, *Oxalis corniculata* L., *Parthenium hysterophorus* L., *Pistia stratiotes* L. *Typha angustata* Bory and Chaub., *Urena lobata* L., *Xanthium strumarium* L. these 08 species are reported as invasive alien angiosperms to this region (Deshmukh *et al*,2012,2015).

Herbaceous macrophytes dominating from Mohabala lake of Bhadrawati tahsil from Chandrapur district and represents 51 species (89%),(Fig. 03) followed by Creepers represents only 03 species (5%), under shrubs only 02 (4%) species *Aeschynomene aspera* L. *Aeschynomene indica* L.(Fabaceae) and shrubs only one species (2%) *Ipomoea carnea* Jacq.Subsp *fistulosa* (Mart.ex Choisy)D.F.Austin..(Convolvulaceae) (Fig. 04)..

Aquatic macrophytes have different route to uptake heavy metals, for instance in the case of free floating and emergent plants, is through the roots, however, the upper inside of plants might able to remove metals, but there is no enough data, which needs to study further in the future. Whereas in submerged both roots and leaves take part in removing heavy metals and nutrients. These bunches of aquatic plants could be applied as an effective, economical and ecological alternative to accelerate the removal and degradation of agro-industrial wastewater polluted with metals, nutrients and other common pollutants. As a matter of fact, the majority aquatic macrophytes are naturally occurring and easily adapted for their surroundings environment. Aquatic macrophytes have a remarkable capability to remove excessive nutrients load form the water otherwise cause eutrophication of the water body. They have also been used to mitigate heavy metals, toxic organics, suspended solids and bacteria from agricultural outcome, landfill, acid-mine drainage and urban storm water runoff. In addition, the aquatic plants, indirectly helping some materials to sediment and suspend them through slowing the water current and thus affecting metal retention in water bodies (Barznji, 2014).

CONCLUSION

In present survey total 57 aquatic macrophytes documented from Mohabala Lake of Bhadrawati Tahsil from Chandrapur district, belonging to different groups like Angiosperms, Pteridophytes and Algae. Various macrophytes having the potential to remove the contamination of water and to improve the water quality by absorbing heavy metals from water. It is important to enlist the aquatic macrophyte biodiversity for to monitor water quality and environment and also for the conservation of biodiversity of this Lake.

Acknowledgement

The authors thankful to Dr.M.Subhash, Principal Janata Mahavidyalaya,Chandrapur and Dr. Ashokbhai Jiwatode, Secretary of Chanda Shikshan Prasark Mandal Chandrapur, for providing facilities and cooperation.

References

1. Agostinho, A.A., Pelicice, F.M., Petry, A.C., Gomes, LC. and Julio Jr., H.F.: Fish diversity in the upper Parana River basin: habitats, fisheries, management and

- conservation. *Aquatic Ecosystem Health & Management*, 10(2), pp. 174-186. (2007)
2. Ambasht, R. S.: Macrophytes limnology in the Indian subcontinent. Ukaaz Publication, Hyderabad: 58 - 174. (2005).
 3. Baruah P.P. and Baruah C.K.: Study of the hydrophytic flora of Kaziranga National Park, Assam, India. *Annals of Forestry*; 8(2): 170-178. (2000)
 4. Barznji Dana Ahmed Mohammed: Role of aquatic plants in improving water quality. *Unique Journal of Pharmaceutical and Biological Sciences*, 02(05), pp.12-16.(2014)
 5. Bhaskar, V. and Raji, B.A.: *Hydrophytes and marsh plants of Mysore city*. Prasaranga, University of Mysore, Mysore, India. (1973)
 6. Carpenter, S. R., Lodge, D. M.: Effects of submersed macrophytes on ecosystem processes. *Aquatic Bot.* 26: 341-370. (1986)
 7. CGWB: Government of India, Ministry of Water Resources, Central Ground Water Board. (2013)
 8. Chambers P.A. P.Lacoul, K.J. Murphy and Thomaz S.M.: Global diversity of aquatic macrophytes in freshwater. *Hydrobiologia*, vol., 595, no. 1, p. 9-26. (2008)
 9. Cook C. D. K: *Aquatic and Wetland Plants of India*. Oxford Uni.Press. (1996)
 10. Deshmukh U.B., Shende M.B. and Rathor O.S., Invasive Alien Angiosperms of Chandrapur District of Maharashtra (India), *Bionano Frontier*, 5(2-II), 100-103 (2012)
 11. Deshmukh U.B., Shende M.B. and Rathor O.S., Invasive Alien Angiospermic plants from Chamorshi Tahsil of Gadchiroli District of Maharashtra, India, *International Research Journal of Biological Sciences* Vol. 4(12), 40-45, (2015)
 12. Deshmukh, U.B., M. B. Shende, Rathor O.S.: Aquatic macrophytes biodiversity assessment from Asolamendha reservoir of Chandrapur district, Maharashtra State (India). *International Journal of Applied Research*; 2(1):pp. 293-298.(2016a)
 13. Deshmukh, U.B., M. B. Shende, Gedam, Y.B. Preliminary survey of phytoplankton diversity of Mul lake From Mul Taluka of Chandrapur District, Maharashtra State (India). *Janata Multidisciplinary Research Journals Journal*. 1, (1), PP.1-8.(2016b)
 14. Devlin R.M.: Plant Physiology. Reinhold, New York, pp. 564.(1967)
 15. Dhamgaye M.M., M.B. Shende, Y.B. Gedam Deshmukh U.B. Survey of phytoplankton diversity of Sakharwahi Lake from Chandrapur District, Maharashtra State (India). *Int. Jour. of Res. in Bios. Agri. and Tech.* Special Issue: 33-37 (2016).
 16. Dhore M., Dhore M. and Dabhadkar D.: Environmental impact of macrophytes on some fresh water bodies in washim district, Maharashtra state, India. *International Journal of Scientific and Research Publication* 2 (1) 2250-3153. (2012)
 17. Dhore M.M. and, Lachure P.S.: Survey of Aquatic Macrophyte diversity in Yavatmal District, Maharashtra, India, *Int. J. of Life Sciences*, 2(3): 273-275. (2014)
 18. Dutta S.A, Desai N., Almeida S.M, Das A.P. Aquatic Macrophytes of Apalchand Reserve in Jalpaiguri district of Wst Bengal., In Perspective of Plant Biodiversity, (Ed. Das A P) Dehradun. (2002)
 19. Ghosh S.K.: *Illustrated Aquatic and Wetland Plants in Harmony with Mankind*, Standard Literature, Kolkata. (2005)
 20. Gupta O.P.: *Weedy Aquatic Plants: their Utility, Menace and Management Agrobios* Jodhpur, India, pp 273. (2001)
 21. Harney N.V., Dhamani A.A., Andrew R.J.: Biodiversity of macrophytes of three water bodies near Bhadrawati, District- Chandrapur (M.S.), India. *International Journal of Scientific Research*, 2(9): 437- 439. (2013)
 22. Harney N.V.: Macrophytes Biodiversity of Dudhala Lake of Bhadrawati, District- Chandrapur (M.S.), India. *Asian Journal of Multidisciplinary Studies*, Vol 2, Issue 4. pp.69-72. (2014)
 23. Kachroo, P.: *Aquatic Biology in India*. Bishen Singh Mahendra Pal Singh, Dehra Dun. (1984)
 24. Khinchi P.J., Telkhede P.M. Dahegaonkar N.R. and Zade S.B.: Study on macrophytes in Ramala Lake, Dist Chandrapur (M.S.). *Environment Conservation Journal*. Vol.9.No.3. pp37-39. (2008)
 25. Kiran, B.R., Patel A.N., Kumar Vijaya and Puttaiah E.T.: Aquatic macrophytes in fish culture ponds at Bhadra fish farm, Karnataka. *J. Aqua. Biol.* 21(2): 27-30. (2006).
 26. Kumar Jitendra and Amit Pal : Macrophytic Diversity in Different Aquatic System of Bundelkhand Region, Uttar Pradesh, India. *International Journal of Scientific Research in Environmental Sciences*, 3(10), pp. 0350-0356. (2015)
 27. Lacoul P. and B. Freedman: Environmental influences on aquatic plants in freshwater ecosystems. *Environ. rev.*, Vol. 14, no. 2, p. 89-136. (2006)
 28. Lavania G.S., Paliwal, S.C. and Gopal B.: *Aquatic Vegetation of Indian Subcontinent*: In E. Gopal (Ed.) Ecology and Management of the Aquatic Vegetation of the Indian Subcontinent. Dordrecht: Kluwer Academy Publishers. (1990)
 29. Mahajan V.S. and Harney N.V.: Avifaunal diversity of Mohabala lake near Bhadrawati, District - Chandrapur (MS), India. *Online International Interdisciplinary Research Journal*. Vol-VI, Special Issue. pp.75-83. (2016a)
 30. Mahajan V.S. and Harney N.V.: Diversity of Rotifers in Mohabala Lake of Bhadrawati, District Chandrapur, (M.S.), India. *Asian Journal of Multidisciplinary Studies*. Vol. 4, Issue 2, pp.80-85. (2016b)
 31. Mahajan, V. S., Harney, N. V: Diversity of Chlorophyceae in Mohabala Lake of Bhadrawati, District Chandrapur (M.s.), India. *International Journal of Scientific Reseach* Vol.5.No.3. pp.336-338. (2016c)
 32. Majid, F.Z.: *Aquatic Weeds –Utility and Development*, Agro Botanical Publishers, India. (1986)
 33. Maliya S.D. and Singh S.M.: Diversity of aquatic & wetland macrophytes vegetation of Uttar Pradesh (India). *Journal of Economic & Taxonomic Botany* 28(4) 935-975. (2004)
 34. Reddy Mallesh B. and A. Chaturvedi: Study of aquatic and associated macrophytes from the major rivers of the Chandrapur District, Maharashtra. *International Journal of Science, Environment and Technology*, Vol. 5, No 6, pp. 3774 -3782 (2016)

35. Sculthorpe, C.D.: *The biology of aquatic vascular plants*. Königstein-West Germany: Koeltz Scientific Books. 597.(1985)
36. Shende M.B., U.B.Deshmukh , Mithun S.Shende and Butale A.J.Aquatic macrophytes diversity of Mul Lake from Mul Taluka of Chandrapur District, Maharashtra State (India). *Int.Jour. of Res.in Bios.Agri. and Tech.* Special Issue: 140-145 (2016).
37. Sitre S.R., Arvjen Lushaj, Elisabeta Susaj, Bashkim Mal Lushaj, Ismail Gokhan: Aquatic Weed Diversity of a Freshwater Pond in Chandrapur District of Maharashtra State. *Online International Interdisciplinary Research Journal*, 4(5):43-46. (2014)
38. Sitre, S. R.: Assessment of macrophyte biodiversity of a freshwater reservoir of Bhadrawati tehsil in Chandrapur district. *Online International Interdisciplinary Research Journal*. Vol III (III): pp. 78-81. (2013)
39. Subrahmanyam K: *Aquatic Angiosperm.*, Botanical Monograph 3. CSIR Publ., New Delhi. (1962)
40. Theel, H.J. and Dibble, E.D.: An experimental simulation of an exotic aquatic macrophyte invasive and its influence on foraging behavior of bluegill. *Journal of Freshwater Ecology*, 23(1), pp. 79-89. (2008).
41. Wadhawe N.S., NasareP.N, HarneyN.V.and SitreS.R.: ' Biodiversity of Macrophytes in Ghodpeth reservoir at Bhadrawati Tehsil Chandrapur district Maharashtra State. *Bioinfolet*. Vol.7.Issue; 1,pp.46-47. (2010)
42. Yadav S.R. and Sardesai M.M.: Flora of Kolhapur District. Shivaji University, Kolhapur. (2002)

