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Comparative study and chemical analysis of some important macrophytes of Nagchoon pond of Khandwa District, MP, India

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Abstract

Macrophytesare aquatic vascular plants, it also include liverworts, ferns,aquatic mosses, and larger macroalgae. Three types of macrophytes are recognized: free floating, submerged, and emergent .These macrophytes grow in an aquatic ecosystem and it perform numbers of important environmental functions like water purification, ground water level recharge, augment and maintain stream flow, recycling of nutrients and provide habitat for wide variety of flora and fauna. Macrophytes are important components of freshwater ecosystems because they enhance physical structure of habitat and biological complexity, which increase biodiversity within littoral zones. The Nagchoon Pond represented byvarious macrophytic species. The chemical analysis of some important macrophytic species and their observations recorded during both the study year .The chemical parameter like Calcium, Magnesium, Chloride, Nitrate, sulphate, and Phosphate studied for two different phases (Vegetative phase and Flowering phase) for life cycle of macrophytes.

Keywords: Minerals, macrophytes, water, nagchoon, khandwa.

Introduction

Water is the basis of life and universal solvent. Water is one of the most precious commodityrequired for survival of any form of life[1]. There is no doubt that water has the largest collection of anomalous properties. The physiological importance of plants distribution controlled on earth's surface by the availability of water.Macrophytes are important in maintaining nutrient level in the ecosystem of ponds and lake. Different types of macrophytes (figure 1) free floating, submerged emergent, are generally observed in an pond ecosystem.

Macrophytesrespond strongly to the environmental condition within lakes, ponds, wetland and other water body. The chemical environment of many aquatic ecosystem has changed because of pollution ,anthopogenic activity , agriculture waste at an alarming rate. The tolerance limit of aquatic macrophyte linked with the chemical and physical quality of water[2]. Due to variations in the aquatic plant community composition, and large number of individualspecies, provide us a valuable information about anpond ecosystem.

Study Area: Khandwa district is situated south west of the state of Madhya Pradesh. The district is in Indore division of Madhya Pradesh. This district is bounded on the east by the Betul and Hoshangabad. Hoshangabad and Burhanpur of Indore division on south. On the west by West Nimarof Indore division and on the north by Dewas of the Ujjain Division (figure-2).

The district khandwa has 6206.45 Square kilometer in area. This district lies for the most part on the uplands and valleys of the two major rivers, the Narmada and Tapti whichare flowing parallel to each other from east to west through the district. Nagchoon pond is a perineal tropical rainwater reservoir. It is a man made reservoir built by Britisher in 29th March 1897, at cost of Rs. 4 lakh by the rehabilitation of Moghat village. It is situated at a distance of four miles (6.4 K.M.) north- west of Khandwa city on 21°49' 36" N latitude and 76°20' 56' E longitudes surrounded by hills on three sides and an earthen band on one side. This bund makes 2.02 square kilometers area for collection of rain water. The catchment area of the reservoir was 23.30 sq. kilometer and added by local nallaes called baroodnalla and ajanti canal. Now it has been reduced greatly due to natural and anthropogenic activities. The mansoon surface runoff water is the only source of this reservior. It is situated at the height of 324.54 meter above the sea level. The height of the band 12 meter, depth is 5.2 meter, mean depth is 1.2 meter and 5.36 Kilometer long shore line. It is one of the most important source of potable water of Khandwatown. The water is usually carried by gravitation. When the Moghat reservoir runs low, water is pumped sunk well to supply the town. From last few years the Nagchun pond is being utilized as recreational purposes and also land use in the fringe area recreational activity (picnic spot) under custodian of Khandwa municipal corporation. In 2008 Nagchoon pond named as Atalsarover. Since long time near by the increased anthropogenic activities resulted the problem of silt loading.

Material and Methods

Chemical analysis of macrophytes: Triple Acid Extract Method: 1 gm. dry powder of macrophtye addnitric acid, sulphuric acid and per chloeric acid in the ratio of (9:3:1). Digest it, filter the extract and make up to 100 ml. With this

triple acid extract determine the different parameter like calcium, magnesium, chloride, sulphate, phosphate, nitrate (kjedhal method) sodium and potassium.

Nitrate - Nitrogen (Kjedhal method): The nitrate nitrogen content of macrophytic tissue estimated using the kjedhal flask.1 gm of plant tissue is placed in a long neck kejhdal flask 25 ml. concentrated sulphuricacid, potassiumsulphate and copper sulphate added to it. The glass heated gently in an inclined position. The heating is continued until the brown colour of the liquid cleared. At this point all nitrogen converted in to ammonium sulphate. The kejhdal flask cooled and content diluted with distilled water. The solution than transferred in one-liter flask and NaoH solution pour from the side of neck of flask trap and water condenser. The lower end of the condenser dipped in a 25 ml N/10 sulphuric acid solution. The flask heated gently the ammonia librated and distilled in to sulphuric acid than titrated with N/10 alkali using phenolphthalein as indicator.

$$\text{Nitrate-nitrogen mg/lit.} = \frac{(1.4 \times V \times N)}{X}$$

V= volume of Acid used. N= Normality of Acid used. X= weight of plant tissue used.

Results and Discussion

Observations: The Nagchoon Pond represented by different macrophytic species, observations recorded in the table – 1 to 4 (T A E) the chemical analyses of some important macrophytic species. During both study year, two distinct phases (vegetative phase and flowering phase) for the life cycle in each case. Observations recorded in the table - 1 to 4 the variations in chemical composition in macrophytesan account of difference in environmental conditions, nutrient level and different uptake capacities of different species for different chemicals. Consequently, the present study has been designed, to analyses the important macrophytic species.

Calcium: The present study, revealed that the monthly chemical analysis registered in table - 1 to 4. The value of calcium ranged from 4.11 mg/ lit. in *Typhaangustata*to 101.66 mg / lit. in *Hydrillaverticillata* recorded during vegetative phase in the year 2008-09 . During the vegetative phase, the maximum concentration recorded in 101.66 mg / lit. in the *Hydrilla verticillata* in the year 2008-09.While in year 2009-10 maximum concentration recorded in 60.66 mg / lit. in *Vallisneriaspirallis* during vegetative phase and minimum calcium value recorded 4.10mg/lit in *Typha angustata* during flowering phase.

Figure-1
Macrophyte

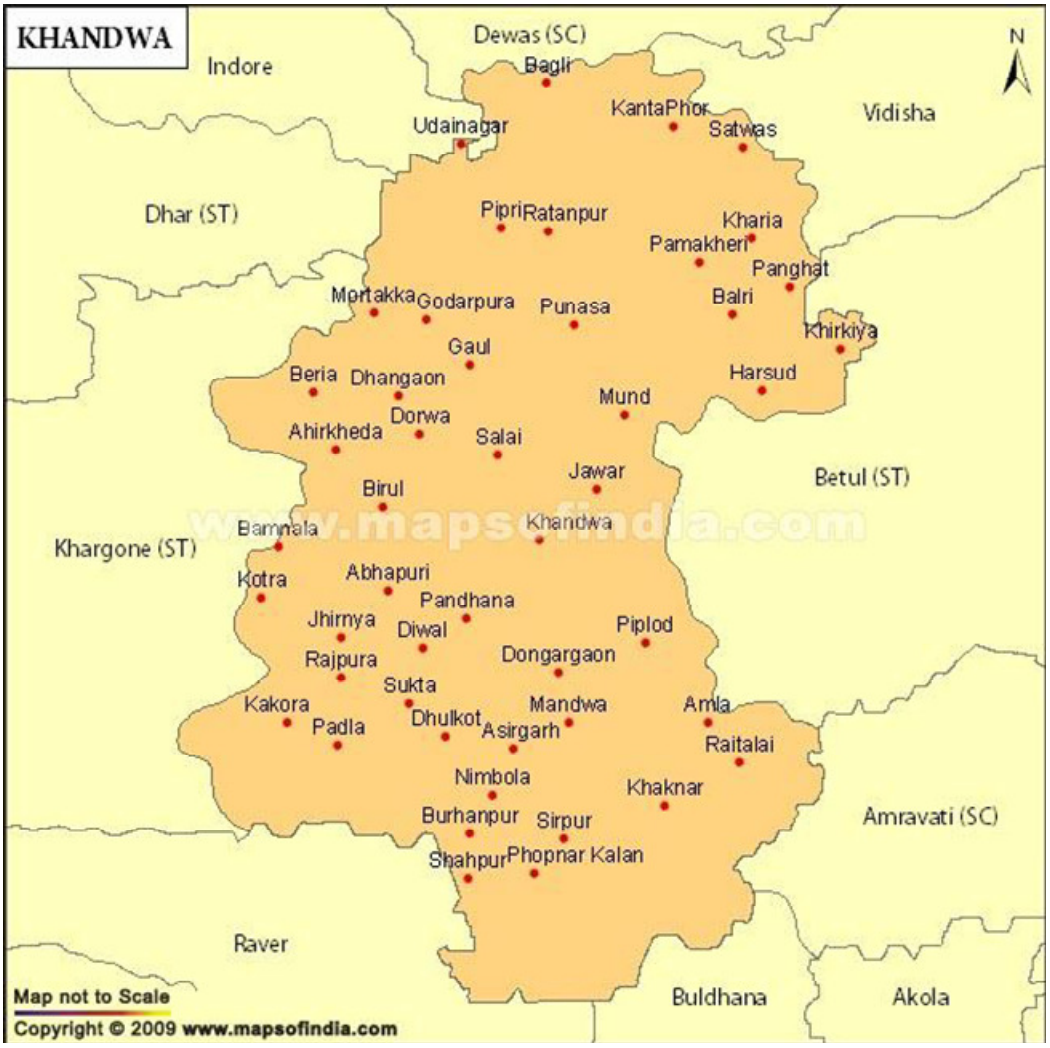

Figure-2
Map of Khandwa

Table-1
Chemical Status (Vegetative phase) 2008-09 mg/ Lit.

Name of Plant species	Calcium	Magnasium	Chloride	Nitrate	Sulphate	Phosphate	Sodium	Potasium
FLOATING ZONE								
Ipomoea aquatica forsk	33.53	19.33	16.70	1.93	2.48	4.56	8.00	4.00
SUBMERGED ZONE								
Hydrilla verticillata L. F. Royle.	101.66	61.20	31.20	0.496	19.63	6.23	7.50	6.50
Ottelia alsimoides L. Pers.	30.74	16.92	17.75	1.22	12.50	6.37	10.5	8.75
Vallisneria spirallis L.	56.33	27.33	29.93	1.33	19.43	8.40	7.66	8.00
EMERGENT ZONE								
Ammannia baccifera L .	18.06	10.25	12.00	2.07	3.43	2.17	11.25	8.00
Bacopa monnieri L .	20.50	10.33	11.33	2.4	3.75	1.73	7.66	7.00
Cyperus iria L.	13.43	10.33	12.43	2.53	3.50	1.80	13.66	12.66
Eleocharis atropurpurea Kunth.	11.36	8.10	11.00	1.50	2.76	2.10	12.66	9.00
Paspalidium geminatum Forsk .	32.00	14.00	11.20	1.00	4.40	1.75	16.00	12.00
Phyla nodiflora L Greene.	15.67	9.36	11.72	2.07	3.07	2.21	7.28	7.28
Scirpus roylei. Nees.	40.33	19.33	11.66	1.86	3.46	1.4	14.33	10.33
Typha angustata L.	4.11	2.90	4.99	2.39	5.95	3.91	13.25	9.00

Table-2
Chemical Status (Flowering Phase) 2008-09 mg/ Lit.

Name of Plant species	Calcium	Magnasium	Chloride	Nitrate	Sulphate	Phosphate	Sodium	Potasium
FLOATING ZONE								
Ipomoea aquatica forsk	29.00	16.25	15.17	1.35	1.45	4.52	7.00	3.25
SUBMERGED ZONE								
Hydrilla verticillata L. F. Royle.	95.20	13.70	23.00	0.37	16.22	5.80	5.25	4.75
Ottelia alsimoides L. Pers.	25.66	16.00	15.75	1.01	14.75	7.52	9.00	7.26
Vallisneria spirallis L.	49.00	23.33	21.33	0.83	15.86	8.46	8.66	11.66
EMERGENT ZONE								
Ammannia baccifera L .	14.00	9.50	10.25	1.67	2.49	2.25	12.00	9.00
Bacopa monnieri L .	14.33	7.00	12.00	2.06	3.10	1.33	7.00	6.33
Cyperus iria L .	12.72	9.55	10.25	1.63	2.72	1.30	11.50	10.76
Eleocharis atropurpurea Kunth.	9.22	3.40	9.60	0.96	1.94	1.06	10	11.66
Paspalidium geminatum Forsk	28.80	12.20	10.20	0.98	7.88	1.78	16.60	11.40
Phyla nodiflora L Greene.	11.00	8.31	11.27	1.20	3.95	1.70	12.00	11.00
Scirpus roylei. Nees.	32.00	17.5	10.00	1.01	2.24	0.93	16.33	12.33
Typha angustata L.	3.64	3.49	3.01	1.70	4.95	4.33	12.35	8.50

Table-3
Chemical Status (Vegetative phase) 2009-10 mg/lit.

Name of Plant species	Calcium	Magnasium	Chloride	Nitrate	Sulphate	Phosphate	Sodium	Potasium
FLOATING ZONE								
Ipomoea aquatica forsk	30.60	15.16	16.70	2.06	3.40	5.03	12.00	5.33
SUBMERGED ZONE								
Hydrilla verticillata L. F. Royle.	40.20	60.50	31.57	1.35	26.41	6.65	11.00	7.50
Ottelia alsimoides L. Pers.	36.05	20.26	33.58	2.51	12.90	6.41	12.66	7.66
Vallisneria spirallis L.	60.66	20.11	32.60	1.13	24.95	7.12	10.75	11.00
EMERGENT ZONE								
Ammannia baccifera L .	16.60	9.34	11.92	2.30	3.88	3.14	11.60	7.60
Bacopa monnieri L .	25.91	11.71	12.13	2.41	8.41	1.88	10.66	12.66
Cyperus iria L.	16.75	12.00	18.52	3.63	11.20	1.56	12.00	12.50
Eleocharis atropurpurea Kunth.	14.70	8.35	11.83	1.77	2.63	1.32	12.00	11.35
Paspalidium geminatum . Forsk	32.60	13.77	12.52	1.62	3.90	2.05	14.25	13.00
Phyla nodiflora L Greene.	25.62	12.07	15.56	2.15	6.46	4.01	7.33	8.00
Scirpus roylei. Nees.	39.46	20.48	12.11	1.42	6.19	1.68	10.33	11.00
Typha angustata L.	11.28	3.71	14.78	2.37	6.14	4.21	13.00	8.40

Table-4
Chemical Status (Flowering Phase) 2009-10 mg/lit.

Name of Plant species	Calcium	Magnasium	Chloride	Nitrate	Sulphate	Phosphate	Sodium	Potasium
FLOATING ZONE								
Ipomoea aquatica forsk.	30.42	13.27	10.90	1.77	2.52	4.52	8.75	3.25
SUBMERGED ZONE								
Hydrilla verticillata L. F. Royle.	31.50	51.52	26.57	0.92	19.33	5.52	10.00	8.00
Ottelia alsimoides L. Pers.	34.75	15.57	35.17	2.11	15.35	7.11	11.33	7.00
Vallisneria spirallis L. .	57.93	18.35	25.45	1.09	21.17	6.01	8.60	9.66
EMERGENT ZONE								
Ammannia baccifera L .	15.40	11.20	9.97	1.27	3.92	2.05	12.00	12.45
Bacopa monnieri L. .	19.16	11.00	11.70	2.09	5.43	1.83	11.37	10.66
Cyperus iria L..	17.99	12.25	16.71	3.08	10.56	1.27	9.75	9.75
Eleocharis atropurpurea Kunth.	11.37	7.30	11.33	0.99	1.84	1.19	10.25	8.00
Paspalidium geminatum .Forsk	28.52	12.00	10.08	1.20	3.38	1.86	14.50	11.40
Phyla nodiflora L Greene.	13.77	9.22	11.81	1.99	3.62	2.50	15.30	13.80
Scirpus roylei. Nees.	38.60	21.02	13.72	1.14	4.36	1.25	13.5	12.50
Typha angustata L.	4.10	3.81	11.84	2.12	5.22	3.32	11.60	7.20

Magnesium: The data table - 1 to 4 suggested that the maximum concentration of magnasium were ranged from 31.20 mg/ lit. in*Hydrilla verticillata* during vegetative phase and minimum concentration value 3.40 mg/ lit. recorded in *Eleocharis atropurpurea* in the flowering phase of the year 2008-09. While, next study year, maximum concentration value 60.50 mg/lit. recorded in the *Hydrilla verticillata* in vegetative phase and minimum concentration value 3.81 mg/ lit. recorded in *Typha angustata* in the flowering phase.

Chloride: It is apparent from the table - 1 to 4 data analyses that during vegetative phase chloride concentration in the some macrophytic species maximum concentration value varied from 31.20 mg/L. *Hydrilla verticillata* and 3.01 mg/L. *Typha angustata* during flowering phase in the year 2008-09 . While, in the next study year 2009-10 ranged from maximum concentration recorded 33.58 mg/ L. in the *Ottelia alsimonoides* during the vegetative phase and minimum concentration recorded 9.97 mg/L in *Ammannia baccifera* in the flowering phase.

Nitrate –Nitrogen: A close look of the data table - 1 to 4 revealed that all species analyzed, the amount of nitrogen higher during vegetative phase. The concentration of nitrate ranged in the study year 2008-09, the maximum concentration value recorded 2.53 mg/L. in the Cyperus *iria* while minimum concentration value recorded 0.37 mg/L in*Hydrillaverticillata* in flowering phase. During next study year 2009-10, maximum concentration value recorded 3.63 mg/ lit. in*Cyperus iria* during vegetative phase. While minimum concentration value recorded 0.92 mg/L in *Hydrilla verticillata* in flowering phase. It is interesting to note that calcium and magnasium value recorded maximum in *Hydrilla verticillata.* While, nitrate recorded minimum in this case.

Sulphate: Data presented in table - 1 to 4 suggested that the ranged varied from maximum concentration 19.63 mg/lit. recorded in *Hydrillaverticillata* during vegetative phase of the year 2008-09. In addition to this, minimum concentration recorded 1.94 mg/L in *Eleocharis atropurpurea* during flowering phase. Similarly, in the next study year 2009-10 the value ranged from 1.84 mg/L in *Eleocharisatropurpurea* in the flowering phase and 26.41 mg/L *Hydrillaverticillata* in the vegetative phase.

Phosphate phosphorus: It is apparent from the data table - 1 to 4 the Phosphate range recorded during both the study year. It is observed from the table the maximum concentration 8.40 mg/ lit, found in the *Vallisneria spirallis* during vegetative phase and 0.95 mg/ lit. in flowering phase of *Scirpusroylei* in the study year 2008-09 while, in the next study year 2009-10 the phosphate value ranged from 1.25 mg/ lit. In *Scirpus roylei* and 7.11 mg/L in *Ottelia alsimoides* in the vegetative phase. It is interesting to note that the concentration of phosphorus almost equal during both the vegetative phase and flowering phase of plant species like *Ipomoea aquatica, Vallisneria spirallis, Ammannia baccifera* and *Paspalidium geminatum* in the year 2008-09. While, in the year 2009-10 the plant species like *Baccopa monnieri*, *Eleocharis atropurpurea* reported almost equal amount during both the phases.

Sodium: It is observed from table - 1 to 4 the value of Sodium ranged from 7.00 mg/L in *Ipomoea aquatica* and *Baccopa monnieri in the* flowering phase and 16.33 mg/ lit. in the *Scirpusroylei* in flowering phase study year 2008-09. In the next study year 2009-10 the value ranged from 7.33 mg/L in *Scirpusroylei* in vegetative phase and 15.30 mg/ lit. in*Phyla nodiflora* recorded in flowering phase . Here, it is interesting to note that plant species like *Ammannia baccifera andPaspalidium geminatum* the concentration of sodium high during flowering phase in 2008-09 while plant species like

Ammannia baccifera Baccopa monnieri and *Typha angustata* recorded higher valueof sodium in the flowering phase in the year 2009-10.

Potassium: The data table-1 to 4 revealed that the concentration of potassium value ranged from 3.25 mg/ lit. in*Ipomoea aquatica* during the flowering phase and 12.66 mg / lit. in *Cyperusiria* in vegetative phase the data recorded during the study period 2008-09. In this study year, it is noted from the table-1 to 4 that in the plant species *Vallisneria spirallis* and *Eleocharis atropurpurea*, concentration of potassium recorded higher in the flowering phase. Similar lily, in the study year 2009-10 the potassium concentration ranged from 3.25 mg/ lit. in *Ipomoea aquatica* in flowering phase and 13.80 mg/ lit. in the plant *Phyla nodiflora* during flowering phase . In study year with respect to potassium, concentration that in the flowering phase more concentration were recorded then the vegetative phase in the plant species like table - 1 to 4 *Hydrillaverticillata, Ammanniabaccifera, Paspalidium geminatum, Phyla nodiflora and Scirpusroylei*.

Discussion

Investigation on the chemical composition of aquatic macrophytes are important since, besides furnishing data on the capacity for nutrient stocking in the biomass of these plants[3]. They also permit the analysis of nutrient availability for the growth[4, 5]. The results of the chemical analysis made on the aquatic macrophytes have been often utilized to estimate nutrient cycling and budgeting in the ecosystem and to compare nutrient value of different species[6] . Some of these studies have reported many variations in the chemical composition within the same species collected from different areas as well as among different species growing in the same environment[7,8].whichhave made ecological studies on the chemical composition of aquatic macrophytes from temperate region, among others. Such research on species of tropical region is rare; exceptions being the work in Lobo reservoir in Brazil[3]. All these studies have recorded in table-5 indicated that variations in chemical composition in aquatic plants are results of differences in environment nutrient levels inpond and different uptake capacity of nutrients of various species. Observations on the concentration of various chemical (in the species analyzed) during vegetative and flowering phase recorded in table- 1 to 4 and The values, obtained for mineral content in the macrophytic species studied very well correspond with those, reported by the other authors[9,10]. Similarly in other aquatic ecosystem in Madhya Pradesh studied[11-14].

Conclusion

A comparative analytical study of concentration of various chemicals during vegetative and flowering phase suggested the following trend in table-5. A zone wise observation showed that the submerged species recorded the high concentration of chemical like calcium, magnesium, chloride, sulphate and phosphate in both phases of submerged plant species and both year of study period. While, the chemicals like nitrate sodium and potassium recorded low concentration in submerged plant species during both year of study period. While, in the emergent zone chemicals like calcium, magnesium, chlorides, sulphate and phosphate recorded in low concentration and high concentration of nitrate sodium and potassium chemicals recorded in plant species.

Table-5
Comparative Chemical Analytical Study

Name of Plant species	Calcium	Magnasium	Chloride	Nitrate	Sulphate	Phosphate	Sodium	Potassium
FLOATING ZONE								
Ipomoea aquatica forsk	More	More	More	More	More	Equal	More	More
SUBMERGED ZONE								
*Hydrilla verticillata*L.F. Royle.	More	More	More	More	More	More	More	More
Ottelia alsimoides L. Pers.	More	More	More	More	------	-------	More	More
Vallisneria spirallis L.	More	More	More	More	More	Equal	-------	-------
EMERGENT ZONE								
Ammannia baccifera L .	More	More	More	More	More	-------	-------	--------
Bacopa monnieri L .	More	More	-------	More	More	More	More	More
Cyperus iria L .	More	More	More	More	More	More	More	More
*Eleocharisatropurpurea*Kunth.	More	More	More	More	More	More	More	--------
*Paspalidiumgeminatum*Forsk .	More	More	More	More	-------	Equal	Equal	More
Phyla nodiflora L Greene.	More	More	Equal	More	--------	More	-------	-------
Scirpus roylei. Nees.	More	More	More	More	More	More	-------	--------
Typha angustata L.	More	-------	More	More	More	-----	More	More

References

1. Singh J.P., Singh S. and Khanna D.R., Water quality status of river Ganga in respect of physico-chemical, microbial characteristics at Anupshahar Dist. Buland, U.P., *Trop.Ecol***.,** **(19)** 178-188 **(2006)**

2. Heegaard E., Birsks H.H., Gibson C.E., Smith S.J. and Murphy S.W., Species environmental relationships of aquatic macrophyte in Northern Ireland, *Aquatic Botany***, (70),** 175-223 **(2001)**

3. Esteves F.A. and R. Barbieri, Dry weight and chemical changes during decomposition of tropical macrophytes in Lobo reservior Sao paulo, Brazil, *Aquatic. Bot,.* **(16)** 285-295 **(1983)**

4. Gerloffa G.C. and Krombholz P.H., Tissue analysis as a measure of nutrient availability for the growth of angiosperm aquatic plants, *Limno.Oceanog-graphy,* **(11),** 529-537 **(1966)**

5. Howard -Williams C., Cycling and retention of nitrogen and phosphorus in wetlands: a theoretic and applied perspective, *Freshwater Biol,.* **(15),** 391-431 **(1985)**

6. Riemer D.N. and Toth S.J., Chemical composition of five species of Nymphaeaceae, *Weed Sci ,* **(18),** 04-6 **(1970)**

7. Allen S.E., Grimshaw H.M., Parikinson J.M. and Quarmby C., Chemical Analysis of Ecological material, John Wiley and Sons Inc.New York, **565 (1974)**

8. Boyd C.E., Chemical analysis of some vascular aquatic plants, *Arch.Hydrobiol,* **(67),** 78-85 **(1970)**

9. Vyas L.N., A study of primary productivity and nutrient cycling in a lake, Ph.D. thesis.Vikram University, Ujjain **(1973)**

10. Singhal P.K., Chemical and productional characters of Lemnids, In: BrijGopal et.al. (eds), Wetlands: Ecology and Management, 97-103 **(1982)**

11. Sankhla S.K., Studies in the Hydrobiology of Baghela Tank, Udaipur(South Rajasthan), Ph. D Thesis, university of Udaipur **(1981)**

12. Giri U., Studies on photosynthesis and primary production of some dominant macrophytes of upper lake Bhopal, Ph,D. Thesis, Barkatullah University, Bhopal **(1994)**

13. Shaikh R., Studies of moist bank community structure and production of Bilawali Talab, Indore, Ph.D. Thesis, D.A.V.V. Indore **(1996)**

14. Shrivastava A., Studies on the macrophytic vegetation of Pipalyapala talab, Indore, Ph.D. Thesis. D.A.V.V. Indore **(1996)**