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RESEARCH ARTICLE

A PRELIMINARY INVESTIGATION ON BIODIVERSITY OF DESMIDS IN WETLANDS OF KORATAGERE IN THE STATE OF KARNATAKA

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Abstract

Desmids are regarded as clean water algae and also as indicator organisms. Enumeration of Desmids diversity is one of the important criterion's in assessing the suitability of water for potable purposes. Contemporary work was carried out with a goal to understand the diversity, monthly occurrence and seasonality of Desmids with respect to Physico-chemical parameters in four wetlands of Koratagere in the state of Karnataka. 4 genera and 13 species of Desmids were identified from the water samples collected from all the four wetlands. Seasonal dynamics of Desmids showed that, the maximum density was recorded during rainy in three wetlands except in Gokulakatte wetland where, it was recorded during summer. Much variation was observed with regard to minimum density. Poor diversity and low density of Desmids indicated that, water in these wetlands as such is not directly used for potable purposes. It is high time to introduce remedial measures to keep wetlands away from reaching eutrophic condition.

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Introduction:-

This contemporary study focused on the diversity of Desmids in wetlands. Desmids commonly called Desmidales placed under the class Charophyta, a division of green algae (Gontcharov et.al., 2003). Further, Desmids are coccoid pocessing striking morphology characterised by two symmetrical halves belong to the family Desmidaceae under the order Zygnematales (Kanetsuna, 2002). These are advanced green algae present in benthic periphyton populations along with other planktonic communities and contribute to the dynamics of food chain (Coesel and Krienitz, 2007). Desmids due to their often appealing appearance are regarded as geographically best studied group of green algae (Peter and Lothar, 2008). Desmids are sensitive organisms more commonly seen in oligotrophic lakes and ponds (Gerrath, 1993). Eutrophic conditions of water bodies do not support the growth of Desmids (Charles, 1955; Gayatri et.al., 2011) hence; Desmids are regarded as useful water quality indicator organisms. Insufficient knowledge on ecology and distribution of Desmids in addition to taxonomic barriers is a big challenge to protect microscopic organisms (Wilbraham, 2020). Quantitative dynamics of Desmids could also be used as pollution indicator (Neustupa and Woodard, 2020). Wetlands selected for the present studies are lacking behind in micro floral investigation therefore contemporary study related to diversity of Desmids was carried out.

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Materials and Methods:-

Figure 1:- Map of Tumkur district showing Koratagere in the state of Karnataka

Koratagere in the district of Tumkur lies in South-east of Karnataka (Figure-1) in Peninsular India between $13^{0}44^{I}$ North latitude and $77^{0}16^{I}$ East Longitude. Four wetlands in and around Koratagere town of Tumkur district in the state of Karnataka were selected for this contemporary study (Figure- 2). Two litres of surface water samples were collected from each wetland (Figure 3 to 6) on monthly basis for the estimation of physico-chemical parameters following the methods of APHA, 2005. For the enumeration of Desmids water samples were collected simultaneously from all the wetlands using plankton net of size 40 µm connected to a wide mouthed bottle. Collected water samples were preserved in 4% formalin. Morphological characters were derived using light microscope with 10X40 magnification and diagrams were drawn using camera lucida. Desmids were identified up to the level of species using keys and literature such as Prescott (1976), Turner (1978), West and West (1912). Identified Desmids were tabulated in table-1 and quatitative enumeration of Desmids was carried out following Rao's (1953) method. Monthly and seasonal occurrence of Desmids was depicted in table-2 and 3 respectively.

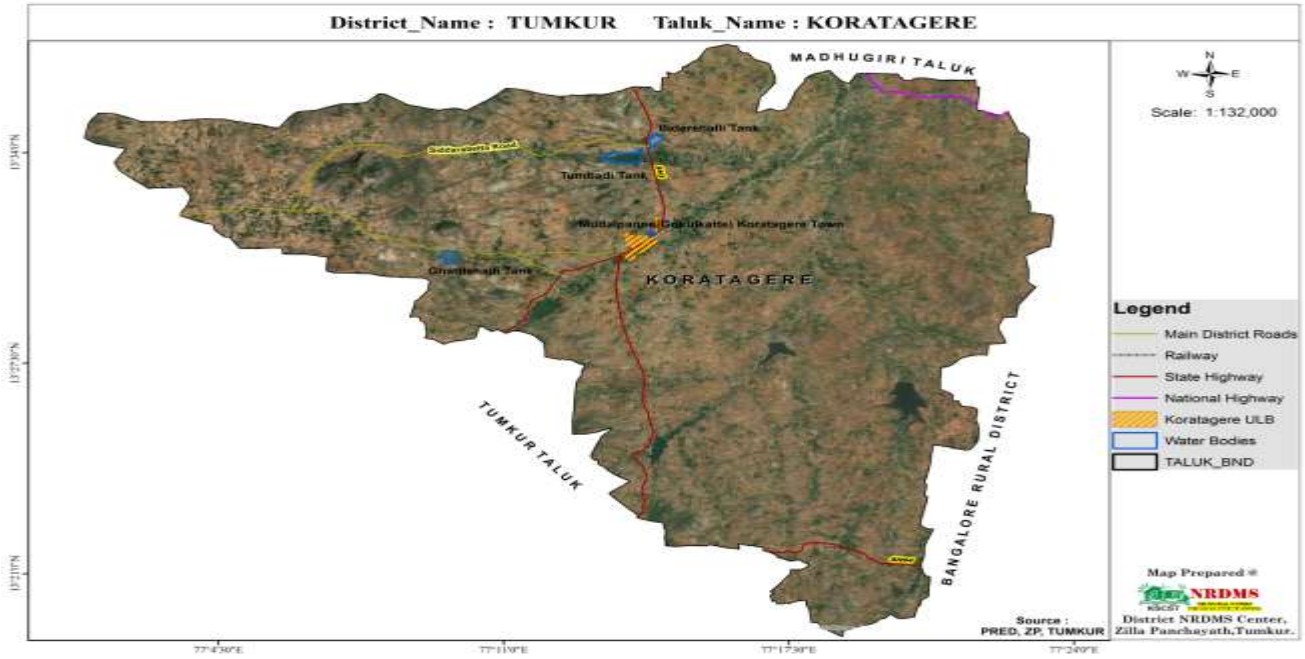

Figure 2:- IRS Map of koratagere showing the wetlands studied.
Source: NRDMS, Zilla panchayat, Tumkur.

Figure 3:- Gattlagollahalli wetland.

Figure 4:- Gokulakatte wetland.

Figure 5:- Tumbadi wetland.

Figure 6:- Birdenahalli wetland

Results and Discussion:-

Table 1:- Diversity and distribution of Desmids in wetlands of koratagere.

Sl No	Desmids	Gattla Gollahalli	Gokula katte	Tumbadi	Birdena Halli
1	Closterium ascicullariae	_	_	++	_
2	Closterium lanceolatum Kutz.	+	_	++	++
3	Closterium acerosum	+	_	+	_
4	Closterium lunula	_	_	_	+
5	Closterium dinae Her.	++	+	++	+
6	Cosmarium melanosporum	_	_	+	+
7	Cosmarium granatum Breb.	+	+	+	++
8	Cosmarium protuberans	_	_	_	+
9	Cosmarium lundelli West & West	+	+	_	_
10	Cosmarium reniforme (Ralfs) Arch	+	_	+	+
11	Euastrum serratum	_	_	++	_
12	Euastrum ansatum (Ehrenb) Ralf	+	_	++	+
13	Staurastrum gracile	_	_	+	_

+++	++	+	-
100 to 500 Org / L	50 to 100 Org / L	1 to 50 Org / L	Absent

Table 2:- Monthly occurrence of Desmids in wetlands of koratagere (Org / l).

Sl. No.	Months	Wetlands			
		Gattlagolla halli	Gokulakatte	Tumbadi	Birdenahalli
1	Jan'2021	57	13	34	53
2	Feb'2021	52	10	28	59
3	Mar'2021	69	8	38	86
4	Apr'2021	65	13	27	60
5	May'2021	52	10	22	65
6	Jun'2021	42	14	10	51
7	Jul'2021	51	18	17	39
8	Aug'2021	31	9	10	56
9	Sep'2021	44	6	15	68
10	Oct'2021	31	11	11	63
11	Nov'2021	46	8	16	50
12	Dec'2021	39	11	12	71

Table 3:- Seasonal variations (org / l) and Relative density of Desmids in wetlands of Koratagere.

Wetlands	Seasons			Relative Density
	Rainy	Summer	Winter	
Gattlagollahalli	61.1	47.3	47.1	25%
Gokulakatte	10.7	12.3	10.2	10.71%
Tumbadi	30.5	17.3	19.7	35.71%
Birdenahalli	69	56.2	58.1	28.51%

Table 4:- Descriptive Statistics of Physico-chemical parameters of the Wetlands of Koratagere

Parameters	Gattlagolla halli		Gokalakatte		Tumbadi		Birdenahalli	
	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation
P1	31.17	3.13	32.29	2.911	32.04	2.18	30.50	2.27
P2	28.83	2.40800	30.04	3.14100	29.88	1.70200	28.29	1.65400
P3	6.93	0.43200	6.97	0.19220	6.91	0.38820	7.05	0.26700
P4	3.59	0.66590	6.00	1.30540	3.48	0.36740	5.37	1.03070
P5	47.33	9.66200	32.76	14.5650	47.46	8.79200	48.65	11.05100
P6	2.78	0.49400	1.27	0.21450	2.64	0.76600	2.42	0.22710
P7	56.25	10.80000	28.66	7.96300	43.46	10.85500	36.08	5.507000
P8	45.29	7.86000	26.59	7.26800	33.71	11.05900	33.72	5.14200
P9	219.50	91.46800	149.67	57.9060	195.17	74.49600	145.79	48.82000
P10	196.26	121.3865	112.92	34.7111	202.74	111.7419	90.83	25.48771
P11	72.63	41.48290	53.78	20.3016	82.55	50.65320	54.00	17.72585
P12	1.85	0.77570	1.15	0.25220	2.54	0.73950	1.03	0.25110
P13	0.10	0.01880	0.19	0.28	0.29	0.31	0.10	0.17630

P1-Air temperature, P2-Water temperature, P3-Ph, P4-Dissolved oxygen, P5-Free CO_2, P6-BOD, P7-Calcium, P8-Magnesium, P9-Total hardness, P10-Sulphate, P11-Chloride, P12-Phosphate, P13- Nitrate

Desmids are sensitive organisms, act as water quality indicators. Luxuriant growth and abundant distribution of Desmids in wetlands indicate the oligotrophic nature of wetlands. Hence Desmids are often referred to as clean water algae. Several workers worked on ecology and distribution of Desmids to quote a few of them: Komal et.al. (2021), Choudhary et.al., (2021), Jyothi et.al.,(1989), Peter and Lother (2008), Kiran (2016).

A total of 13 species under 4 genera were identified from all the four wetlands (Table-1). *Closterium ascicularie*, *Closterium lanceolatum* Kutz. *Closterium dinae* Her. *Cosmarium granatum*, *Euastrum serratum* and *Euastrum ansatum* (Ehrenb) Ralf appeared in good numbers in the range of 50 to 100 org /l. Zafar (1967), Pandey and Pandey (1980) were of the opinion that, water temperature in the range of 20-30^o C favours the growth of Desmids. Mean value of water temperature recorded during present studies in all the four wetlands was found to be in the range of 28.29 to 30.04^o C and with regard to species diversity 13 species were recorded having moderate monthly occurrence (Table-1). It is also evident from table-5 that temperature of water remained positively correlated to the population of Desmids in two wetlands out of four hence we are in partial agreement with the findings of the above researchers. Similar observations were made by Murulidhar and Murthy (2015). Zafar (1967) reported dense population of Desmids in moderately alkaline pH, in contrary to this we have recorded acidic pH in three wetlands except in Birdenahalli wetland where it was neutral (Table-4) and density of Desmids is found to be comparatively less (Table-2). Rao (1955) has not derived any relationship with pH with Desmids the same is true to present investigation (Table-5) which remained in contradiction with findings of Murulidhar and Murthy (2015). Present study witnessed negative bearing of dissolved oxygen and carbon dioxide on density and periodicity of Desmids (Table-5). Biological oxygen demand in Gattlagollahalli wetland showed positive correlation with Desmids at significant level whereas negative correlations were observed between them in Birdenahalli wetland (Table-5). Mitra (1982), Rajkumar (1984) and Venkateswarulu (1986) noticed the importance of calcium in growth and multiplication of Desmids, whereas in present investigation both calcium and magnesium remained as independent variables (Table-5) and similar observations were made by Munawar (1970). Parameters such as chloride and nitrate in present investigation also remained as independent variables (Table-5). Though calcium and magnesium remained as independent variables the behaviour of total hardness with Desmids is peculiar where, they remained

negatively correlated to each other (Table-5). Further, Venkateswarulu (1986), Seenayya (1971) were of the opinion that low concentration of phosphate trigger the abundance of Desmids where we have also arrived at similar conclusion in three wetlands out of four and positive correlations were seen in Gattlagollahalli wetland (Table-5). We are in partial agreement with Murulidhar and Murthy (2015) where, they established significant positive cancelations of sulphate and nitrate with population of Desmids.

Desmids exhibited seasonal variation in the wetlands studied. Seasonal maxima is more during rainy in three wetlands out of four investigated and minimum concentrations were recorded during winter in two wetlands and summer in the other two wetlands (Table-3).

Periodicity of Desmids

Total of 13 species under 4 genera were observed and identified (Table -1). With regard to relative density Tumbadi wetland stood first with 35.71% fallowed by Birdenahalli wetland (28.57%), Gattlagollahalli wetland (25%) and Gokulakatte wetland (10.71%).

Table 5:- Karl- Pearson's correlation coefficient between physico-chemical parameters and Desmids.

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**
Gattlagollahalli	0.333	.500*	-0.15	-.490*	-0.37	.633**	0.399	0.18	-0.051	0.24	0.346	.488*	-0.017
Gokulakatte	0.262	.449*	-0.37	-0.378	-0.27	-0.23	-0.067	-0.232	-.535**	.528**	0.348	0.233	0.133
Tumbadi	0.398	0.17	0.345	0.112	-0.29	-0.15	-0.322	-0.358	-.511**	0.176	-0.04	0.192	0.395
Birdenahalli	0.08	0.04	0.01	-0.27	-.513*	-.430*	-0.19	-0.273	-0.193	0.125	0.1	-0.17	0.04

P1- Air temperature, P2- Water temperature,P3- Ph, P4- Dissolved oxygen, P5- Free CO_2, P6-BOD, P7-Calcium, P8-Magnesium, P9-Total Hardness, P10-Sulphate, P11-Chloride, P12-Phosphate, P13- Nitrate

Tumbadi wetland with a total of 10 species were identified under 4 genera and ranked first among the four wetlands with respect to species diversity. Seasonally, Desmids reached their peak with 30.5 org /l during rainy and recorded low with 17.3 org / l during summer (Table-3).With regard to periodicity and abundance, Closterium ascicullariae, Closterium lanceolatrum, Euastrum serratum and Euastrum ansatum were abundant reaching up to 100 org / l (Table-1). Birdenahalli wetland accumulated eight species under three genera and ranked second with 28.57%. Seasonal maxima of desmids observed in rainy with 69 org / l and minimum of 56.2 was observed during summer. With respect to diversity Closterium lanceolatum and Cosmarium granatum reached up to 100 org / l where as the remaining species were lees abundant with less than 50 org/ l (Table-1). Gattlagolla halli wetland harboured seven species under three genera and ranked third with 25% as for as relative abundance with respect to other wetlands is considered. Seasonally maximum density observed during rainy and that of minimum is observed during winter (Table-3). With regard to diversity and distribution except for Closterium dinae all other species appeared very sparsely less than 50 org / l. Gokulakatte wetland with three monogeneric species stood at last position with 10.71% having less than 50 org / l.

Conclusion:-

This Contemporary work is the first of its kind in the wetlands of Koratagere of Tumkur district. Poor diversity and low density of Desmids is attributed to the habitat of these wetlands where they do not receive directly any type of pollutants. The genus Closterium has been included in Pollution index of algal genera (Palmer, 1969) and in the present work we have noticed fairly high species diversity of Closterium with five species added to this appearance of taxon such as Closterium acerosum which is tolerant to high nutrients is an indication of deterioration of quality of water in two of the wetlands studied.

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