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Ecology and Vegetation of Godavari River in Nanded District, Maharashtra

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ABSTRACT:
The distribution pattern of aquatic macrophytes is depending on the water chemistry. This article reveals the aquatic macrophytes diversity in the river Godavari in Nanded district (Maharashtra).The total of 30 macrophytes were recorded during the course of study from different sites in the river. Also, the hydrochemistry of river water was studied at three locations.
Plant density and abundance in season and location wise clearly indicated that amongst the locations and seasons, and season summer showed favourable for plant density, abundance and biomass in both the years suggesting the high and clear sunshine, high atmospheric temperature, less total solids, alkaline pH of water and higher dissolved oxygen demand (D.O.).

Keywords: Aquatic macrophytes, plant density, Godavari

INTRODUCTION:

A multitude for plants, particularly aquatic species totally depends on the water to carry out its vital functions and the river water is integral constituent of aquatic plant life and also the most important natural resource.

The aquatic plants are important component of aquatic ecosystem as they participate in natural purification of water and mainly act as primary producer. Beside, these aquatic macrophytes are important structural and functional components in most ponds, rivers etc. The aquatic macrophyte also provides place for living, reproduction, development and feeding substrate for aquatic animals [1]. The aquatic macrophytes have in recent times assumed importance due to fact they are the main producers releasing oxygen in the aquatic environment [2-5], harvester of excessive nutrients and pollutants out of the water [6-9] hence, in realty without aquatic vegetation most water bodies would be just ‘wet-deserts’ [10].But presently most of the rivers in the country are found polluted because of the industrialization, advancement in agricultural infrastructure etc. The extensive use of fertilizers, pesticides and other chemicals in agriculture is also creating impact on water quality during floods through surface run off in monsoon and leaching, seepage during non-monsoon period.

Therefore, work has been carried out to investigate the ecology of dominant aquatic macrophyte: *Hydrilla verticillata (L.)* in river Godavari at Nanded district.

The river water is the integral constituent of aquatic plant life and one of the most important natural resources. A multitude of life for plant, particularly aquatic species is totally depends on water to carry out its vital functions. The aquatic macrophytes are important component

of aquatic ecosystem, as they participate in natural purification of water and mainly act as primary producer. Besides, these aquatic macrophytes are important structural and functional components in most of ponds, rivers and have a pronounced effect on the ecosystem. Aquatic macrophytes are also known to respond to the quality of water in which they grow and can be used for monitoring the water body [11]. However, human settlement mostly on or near the river banks, increase in industrialisation and exploitation of natural resources for his own benefit. The human being has behaved in a wild manner by creating problem of pollution which is hazardous not only aquatic life but also to his own life [11].As a result tremendous change in aquatic biota and water chemistry of rivers has been found.

Therefore present investigation was under taken in order to record the macrophytes diversity and hydrochemistry of river Godavari in Nanded district.

MATERIAL AND METHODS:

The survey of river Godavari was carried out in order to record the diversity of aquatic macrophytes from different sites of river Godavari during 2000-2001. The plant samples of aquatic macrophytes were uprooted, washed thoroughly, kept in polythene bags separately and brought in the laboratory for the identification. The plants were identified by standard texts [12-14]. The chemical properties of river water were also studied during 2000-2001 and 2001-2002. The water samples were collected at regular intervals from three sites (Viz; Shikarghat, Raher and Kolegaon) and estimated by standard text [15-16].The values given in table are the mean of two year.

The frequency, density and abundance were estimated by rectangular quadrate method of size 25 cm X 25 cm. The ten quadrates of a size 25 cm X 25 cm were laid down at fixed date of every month on selected sites to record the frequency, density and abundance of *Hydrilla verticillata*. The data were collected in triplicates. The frequency (percentage of cover), density and biomass of *Hydrilla verticillata* was calculated by the formula recommended by (Ambasht, 1969).Similarly abundance was calculated by the formula described [17].

The biomass was determined randomly at each location using ten quadrates of size 25 cm X 25cm in three replicates per month. The plant individuals were harvested and washed in running tap water; adhered debris was removed with the help of fine hairbrush. The fresh weight was recorded immediately after harvest followed by plants were dried in an oven at 98 ± 2°C to estimate dry weight. There after biomass was calculated by using the same formula recommended by (Ambasht, 1969).

The water samples were also collected on a same date from all the three locations to record the physico-chemical characteristics. The water samples were analyzed by procedure [15-16].

RESULT AND DISCUSSION:

In the river bed of Godavari showed a diversity of aquatic macrophytes including submerged, free floating and emergent plant species. During the course of study total of 30 aquatic macrophytes were collected belonging to 16 different families. Among these 07 were submerged, 04 were free floating and remaining are emergent. The list of aquatic plants is given in table-1. Out of 30 macrophytes observed the emergent are dominant in the river of Godavari.

The data given in table-2,3and 4 with regards to physico-chemical characteristics of water Godavari River showed considerable variations between the locations. However, most of the parameters studied do not show much more variations.

In respect to hydrogen ion concentration, almost same trend was observed in all the three locations. The pH values were recorded in range between 7.0-8.25.

The hardness values fluctuated in between 92-215 mg/ l, 77.5-176mg/l and 83-192mg/l at location –II, III and I respectively. The lowest hardness was observed at location III and highest was at location II during summer season.

Dissolved oxygen (D.O.) showed seasonal variations in all the location with higher values recorded at location III. Lower dissolved oxygen range was specifically observed during rainy and winter suggesting the less growth of aquatic macrophytes.

Chemical oxygen demand (C.O.D.) showed similar trend in all the location and exhibited maximum in summer. The lowest values were recorded in the month of December during both the years. Calcium exhibited higher value during winter. However, lowest calcium was observed in rainy season during both the year in all the location.

Chlorides was recorded in ranged between 22.04mg/l to 112.58 mg/l with higher at site-II suggesting many brick factories and lowest at site-III.

Percentage cover:

The percentage cover values in *Hydrilla verticillata* varied from 12.0 to 28.0 in September to June but there was a steady rise in it from December to June. Later, it was observed that the free-floating species, usually dominated over submerged species in the polluted regions of Godavari River.

Density:

The density of plant *Hydrilla verticillata* was measured by counting the total number of individuals in 10 quadrates under investigation. The table-1 indicated that there were significant variations in the observations noticed for plant density at different locations per month during two years (2000-2001 and 2001-2002).The observations revealed that values of density ranged between 10.80 and 110.80 plants / m²for first year while it was ranged between 5.20 and 132.30 plants / m² for second year. The highest density was noticed during summer season particularly in the month of May (110.80 plants / m²) during first year and in June (132.30 plants / m²) during second year at location-III. However, the lowest plant density was recorded during winter season particularly in December and November during first and second year respectively.

Abundance:

The abundance of plant was measured by counting the total number of individuals occurred in 10 quadrates studied. The observations noticed on plant abundance clearly revealed that there were significant changes in between the locations and seasons during both the year (2000-2001 and 2001-2002).

The abundance of plant values ranged between 21.33 and 119.00 plants / m², 16.66 and 138.28 plants / m² during first and second year respectively. The maximum values were recorded in summer season particularly in the month of May (119.00 plants / m²) in June (138.28 plants / m²) for first and second year respectively at location-III while minimum values were recorded during winter season particularly in December (21.33 plants / m²) and November (16.66 plants / m²)during first and second year respectively at the location-III(Table 5).

The data recorded on plant density and abundance in season and location wise clearly indicated that amongst the locations and seasons, the location-III and season summer showed favorable for plant density, abundance and biomass in both the years suggesting the high and clear sunshine, high atmospheric temperature, less total solids, alkaline pH of water and higher dissolved oxygen demand(D.O.). The similar results were reported by [18-20].

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Table -1: List of Aquatic Macrophytes in the river Godavari at Nanded (Maharashtra).

Sr. No	Botanical name of aquatic macrophytes	Family	Nature
1	*Polygonum glabrum*	Polygonaceae	Emergent
2	*Ceratophyllum demmersum*	Ceratophyllaceae	Submerged
3	*Ammania baccifera*	Lythraceae	Emergent
4	*Ipomoea carnia*	Convolvulaceae	Emergent
5	*Ipomoea aquatica*	Convolvulaceae	Emergent
6	*Spirodella polyrhiza*	Lemnaceae	Free-floating
7	*Najas indica*	Najadaceae	Submerged
8	*Typha angustata*	Typhaceae	Emergent
9	*cyperus senguinolentus*	Cyperaceae	Emergent
10	*Scirpus articulatus*	Cyperaceae	Emergent
11	*Scirpus littoralis*	Cyperaceae	Emergent
12	*Scirpus roylei*	Cyperaceae	Emergent
13	*Scirpus affinis*	Cyperaceae	Emergent

14	*Scirpus maritimus*	Cyperaceae	Emergent
15	*Scirpus juncoides*	Cyperaceae	Emergent
16	*Fimbrystylis bisumbellata*	Cyperaceae	Emergent
17	*cyperus pseudokilingoides*	Cyperaceae	Emergent
18	*Potomogeton perfoliatus*	Potomogetonaceae	Submerged
19	*Potomogeton pectinatus*	Potomogetonaceae	Submerged
20	*Aponogeton natanus*	Apotomogetonaceae	Emergent
21	*Hydrilla verticillata*	Hydrocharitaceae	Submerged
22	*Vallisnaria natanus*	Hydrocharitaceae	Submerged
23	*Ottelia alismoides*	Hydrocharitaceae	Submerged
24	*Saccharum spontianeum*	Poaceae	Emergent
25	*Pennisetum pedicellatum*	Poaceae	Emergent
26	*Baccopa monnieri*	Scrophulariaceae	Emergent
27	*Tamarix ericoides*	Taccaceae	Emergent
28	*Nelumbo nucifera*	Nelumbonaceae	Free-floating
29	*Nympheae pubescens*	Nymphaceae	Free-floating
30	*Wolffia globosa*	Lemnaceae	Free-floating

Table 2: Hydrochemistry of river Godavari in Nanded district at site-I during 2000- 2002.

Sr. no	Months	Parameters					
		PH	Hardness (mg/l)	D.O. (mg/l)	C.O.D.(mg/l)	Calcium (mg/l)	Chloride (mg/l)
1	Jul	7.6	83	5.22	48	28.45	75.26
2	Aug	7.4	87	4.67	39	25.64	66.03.
3	Sep	7.7	100	4.87	42	24.24	50.41
4	Oct	7.5	124	4.57	73	23.64	47.57
5	Nov	7.1	165	4.43	41	20.83	41.89
6	Dec	7.5	187.5	4.28	41	21.23	36.21
7	Jan	7.3	192	5.52	42	32.46	33.63
8	Feb	7.5	185	6.28	72	37.97	33.37
9	Mar	7.7	110	6.68	76	41.48	35.05
10	Apr	7.7	100	8.54	86	45.28	31.24
11	May	8.1	135	9.89	97	57.20	26.98
12	Jun	7.9	162	7.83	74	44.98	28.37

Table 3: Hydrochemistry of river Godavari in Nanded district at site-II during 2000- 2002.

Sr. no	Months	Parameters					
		PH	Hardness (mg/l)	D.O. (mg/l)	C.O.D. (mg/l)	Calcium (mg/l)	Chloride (mg/l)
1	Jul	7.0	92	5.24	38	26.85	112.55
2	Aug	7.2	107	4.53	33	24.64	106.50
3	Sep	7.5	125	4.23	38	22.54	90.17
4	Oct	7.2	135	4.29	62	22.04	63.19
5	Nov	7.0	181	3.7	33	20.21	43.25
6	Dec	7.2	215	3.52	32	20.31	50.41
7	Jan	7.1	215	5.23	38	25.83	46.15
8	Feb	7.2	215	5.92	66	31.66	47.58
9	Mar	7.2	195	6.44	71	40.78	41.18
10	Apr	7.5	175	7.54	78	43.98	35.05
11	May	7.9	165	8.70	89	47.99	33.37
12	Jun	7.6	187	7.63	66	43.98	50.14

Site-I: Shikarghat, **Site-II:** Raher; **Site-III:** Kolegaon.

Table 4: Hydrochemistry of river Godavari in Nanded at site-III district during 2000- 2002.

Sr. no	Months	Parameters					
		PH	Hardness (mg/l)	D.O. (mg/l)	C.O.D.(mg/l)	Calcium (mg/l)	Chloride (mg/l)
1	Jul	7.6	73	6.33	56	44.48	65.32
2	Aug	7.6	77.5	5.87	54	37.67	56.85
3	Sep	7.6	105	5.62	56	32.86	45.17
4	Oct	7.5	133	5.49	74	29.65	38.34
5	Nov	7.0	154	4.73	55	26.70	33.37
6	Dec	7.1	176	4.72	45	24.84	31.24
7	Jan	7.4	165	5.72	58	43.64	31.95
8	Feb	7.5	160	6.46	85	46.08	29.48
9	Mar	7.7	145	7.57	96	48.19	26.27
10	Apr	7.8	130	9.24	104	50.49	24.85

11	May	8.2	120	10.54	111	67.43	22.04
12	Jun	7.8	134.5	8.66	87	48.89	24.85

Table-5: Location and year wise observations on plant density, abundance and biomass production of *Hydrilla verticillata* (L) in river Godavari at Nanded district.

Months	**Density (plants / m²)**			**Abundance (plants /m²)**			**Biomass(gm / m²)**		
	L-1	**L-2**	**L-3**	**L-1**	**L-2**	**L-3**	**L-1**	**L-2**	**L-3**
2000-2001									
Sep	42.00	3.80	51.96	77.00	60.28	100.00	46.31	23.95	72.50
Oct	24.80	21.87	27.60	73.32	45.33	72.33	43.71	18.11	52.24
Nov	17.60	12.00	2.40	60.00	22.33	47.00	33.33	17.29	45.34
Dec	11.60	10.80	14.00	54.00	21.33	35.99	16.88	13.03	45.12
Jan	66.40	57.20	86.40	82.28	72.80	109.47	51.01	36.00	84.83
Feb	84.40	76.80	97.40	95.50	84.55	118.67	66.79	41.72	92.61
March	99.60	83.20	102.40	105.80	84.56	116.50	103.41	58.99	124.01
April	105.20	94.50	108.30	106.00	87.32	118.80	106.87	99.27	200.21
May	108.00	98.80	110.80	108.40	94.00	119.00	119.68	117.13	215.98
June	61.00	36.35	80.00	93.60	86.66	99.00	33.37	18.96	80.10
2001-2002									
Sep	20.80	23.20	39.03	63.28	42.40	78.45	45.89	40.14	74.79
Oct	10.20	12.00	32.85	62.00	37.66	70.00	44.53	27.11	51.17
Nov	4.80	4.40	15.03	25.33	16.66	44.00	16.83	16.08	37.21
Dec	56.40	12.40	28.46	54.66	29.66	62.66	34.28	30.77	42.81
Jan	64.40	34.80	70.70	91.30	75.00	111.78	70.96	34.24	92.25
Feb	68.80	54.80	76.84	105.42	77.50	118.50	86.87	67.97	94.53
March	74.20	71.90	84.29	120.85	77.71	128.94	143.78	77.79	130.49
April	88.00	84.40	92.26	121.20	81.65	129.20	147.20	111.03	201.78
May	92.00	91.80	94.53	122.80	98.90	132.21	162.41	113.70	212.34
June	93.60	92.80	95.61	126.00	102.19	138.28	173.76	126.30	242.96
SE ±	**0.60**	**0.52**	**0.46**	**1.08**	**4.44**	**1.88**	**1.09**	**1.40**	**1.05**
CD at 5 %	**1.67**	**1.46**	**1.27**	**3.00**	**1.23**	**5.20**	**3.02**	**3.87**	**2.92**