



AQUATIC FLORISTIC COMPOSITION OF CHHATTISHGARH

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Abstract

Aquatic Macrophytic vegetations and physico-chemical analysis were investigated in urla, Deepak nagar, talpuri and maître bagh ponds of Durg-Bhilai city. Total 13 species were recorded in different seasons & throughout the year. Maximum plant species diversity were recorded in winter while a little less diversity was found in summer & rainy seasons. Luxuriant growth of *Alternanthera philoxeroides* marked the higher NO₃⁻ content of water and Physico-chemical analysis studies in Urla pond revealed that there was a drastic change in Cl⁻ concentration in the water with seasonal changes. With the gradual increase in NO₃⁻ content overall growth of this species also increase gradually. Therefore this species may be considered a good indicators =of NO₃⁻ level of the water.

Keywords: Aquatic macrophytes, floristic composition, Frequency, Density, IVI.

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INTRODUCTION

Fresh water macrophytes play a very important role in aquatic ecosystems by providing food, shelter and variety of habitats for large number of organisms including economically important fishes (Sanchita *et al* 2012, Cook, C. D. K. 1990). Many aquatic plants are also of direct use for man as food (e.g. *Ipomoea aquatica*, *Nelumbonucifera*, *Trapabispinosa* etc.). Study of floristic composition appearing in different seasons in a community is an important parameter of a particular species with the environment and to the other species. The habitat of different species, Ecological amplitude of the species, and the present condition and future trends of the aquatic macrophytic community. Since, species diversity influences the stability and function of the community (Mc Naughton 1967), investigations on species diversity index are quite significant. Majority of the ponds of Durg-Bhilai city in Chhattisgarh in India are biotically disturbed shallow and perennial fresh water bodies. Based on the fact that the floristic component of aquatic biota is dominated by algae in deep waters whereas macrophytes dominate in the shallow waters (Gopal, 1997). Certain macrophytes in the ponds are found useful to man and domestic animals. Since macrophytes are the major contributors of pond productivity, (Prasad *et al* 2002) the present investigations have been focused on the same. Initially nearly 20 bigger fresh water bodies of Durg-Bhilai city were surveyed and finally four distantly located ponds - Urla, Deepak nagar, Talpuri and Maitribaag were selected for further studies.

Study sites :- Durg, the district headquarter of Durg district is situated 21° 10' N latitude and 81° 15' E longitude. Mean sea

level of district is 317 meter and length of Durg district (North-South) is approximately 170 km and breadth (West-East) is approximately 70 k.m. The present studies were carried out during 2008-2010 at four ponds *i.e.* Urla, Deepak nagar, Talpuri, and Maitribaag pond. Urla and Deepak nagar ponds are situated in Durg area while Talpuri & Maitribaag are in Bhilai. Urla & Deepak nagar ponds are totally dependent on rain water. Deepak nagar pond remains almost filled throughout the year due to some internal sources of water. On the other hand as the Urla pond dries up during summer it is filled by sewage & canal water during March-April. Talpuri & Maitribaag ponds are perennial. Maitribaag pond receives continuous supply of water from Maroda Tank - the artificial water reservoir meant to maintain water supply for Bhilai Steel Plant. Correlation between vegetation and water quality of all four ponds.



Fig.1. Sampling location of the studied species

Material and Methods:- Analysis of physico-chemical characteristics were carried out at sampling sites or in the laboratory as per the conditions. Some of the parameters like

temperature, pH, dissolved oxygen, alkalinity, acidity, free carbon di oxide were determined at the sampling sites while determination a remaining parameters like turbidity, total solids, total dissolved solids, conductivity were done in the laboratory in appropriately preserved samples. (APHA 1985, Trivedi and Goel 1980).

Floristic composition of macrophytes

Monthly floristic studies were done in all four lentic bodies (ponds) in Durg- Bhilai city. The macrophytes in the sites were packed in polythene bags and brought to the laboratory. The plant species were identified as per available literature (Biswas et al 1981, Cook 1990, 1996, Das et al 2009, Unni 1971, Subramanayam 1962).

Phytosociological Studies of Macrophytes :-

Monthly Phytosociological studies of macrophytes in various ponds, were under taken in the year during 2009-2010. A metallic frame quadrat (Prasad, Karkun and Sen 2002) of 50 x 50 cm size provide with a dredge was laid at random of 20 places in various pond. Samples were collected in polythene bags and brought to the laboratory. The plant species present in each quadrat were noted, and the individuals of each species were separately counted and circumference measured for the determination of frequency, density, abundance, basal area (dominance) and IVI. Calculations were done using following formulae.

(i) Frequency = $\frac{\text{Total number of quadrates in which a species occurred} \times 100}{\text{Total no. of quadrates studied}}$

(ii) Density = $\frac{\text{Total number of individuals of the species in all quadrates}}{\text{Total number of quadrates studied}}$

(iii) Importance value index (IVI) = Relative frequency + Relative density + Relative dominance.

Urla pond :- Urla pond is situated at 4 k.m. distance from main Railway station of Durg-city. It is located in village Urla. Total area of pond is about 3.879 hectares. In summer season only 10-15% water remains in this body. Main uses of pond water is bathing, washing and domestic uses by village people. This pond is totally eutrophic or shallow water body and provide shelter to many aquatic plant species like – *Alternanthera philloxeroides*, *Nymphaea stellata*, *Nelumbo nucifera*, *Jussiaea repens*, *Utricularia flexuosa*, *Typha angustata*, *Limnophyton obtusifolium*, *Marsilea quadrifoliata*, *Marsilea minuta*, *Nymphaeoides indicum* and *Ipomoea aquatica*. Rain is the only source of water in this pond.



Deepak nagar pond :- Deepak nagar pond is situated near college campus and just about 300 m. from main Railway station of Durg-city. Total area of pond is 2.921 hectare and mainly *Alternanthera philloxeroides*, *Nelumbo nucifera*, *Marsilea quadrifoliata*, *Ipomoea aquatica* and some times *Trapa bispinosa* species occurred in this pond. This pond is eutrophic in nature but continues removal of humus, soil and plant species by municipal corporation.

Talpuripond :- Talpuri pond is situated at about 2.0 k.m. distance from college (research center). This pond is situated between Durg and Bhilai city. Main purpose of this pond water is the irrigation of crop fields in various villages through canals. This pond is totally dependent on natural rain water and a large amount of water is stored in rainy season. Total area of pond is about 13.750 hectare and is divided into two equal parts - upper and lower. This pond is one of the largest pond in this area and observes mostly submerged and fixed floating plant species like- *Aponogeton crispum*, *Hydrilla verticillata*, *Vallisneria spirallis*, *Nymphaea stellata* species etc. 10-15% amount of water remains in summer season. As compared to rainy season.

Maitribaagpond :- Maitribaag pond is totally artificial and is managed by Bhilai Steel Plant, Horticulture department. Main source of water in this pond is the Maroda Tank which is located about 1 km east of this water body. This pond mainly serves for recreation and navigation of tourists. Maitribaag pond is situated in Maitribaag zoological garden and its total area is about 3.998 hectare. This pond houses mostly submerged and free floating plant species like – *Hydrilla verticillata*, *Vallisneria spirallis*, *Blyxa octandra*, *Salvinia natans*, *Potamogeton pectinatus* species etc. In summer season 90% water remains in this tank because of continuous water supply from Maroda tank.

Result and Discussion

The structure of plant communities is affected by the life-history characteristics of component species and their tolerance of environmental conditions associated with disturbance, stress, and competition (Grime (2001). Depending on their growth strategy, aquatic plants may obtain dissolved nutrients

from either or both of the sediment and water column (Barko et al. 1998; Cattaneo et al. 2000). Rooted species can typically obtain nitrogen, phosphorus, calcium, and other key nutrients from sediment, even while absorbing inorganic carbon from the water column. In contrast, non-rooted submerged hydrophytes absorb all of their nutrients from water, while emergent and floating species also have access to atmospheric sources of some nutrients, particularly carbon dioxide. Correlation between vegetation and water quality of all four ponds. *Alternanthera philloxeroides*, found in Urla, Deepak nagar and Talpuri exhibited highest growth in terms of frequency as well as density during rainy season as compared to winter and summer (Ayers 2010). The minimum IVI value of this species was recorded during winter while the IVI value during rainy season increased by 50-100%. In all these three ponds there were a marked increase (30-33%) in NO_3^- content during rainy season as compared to winter. Thus it can be safely concluded that *Alternanthera philloxeroides* responds to the fluctuation in NO_3^- content. Luxuriant growth of *Alternanthera philloxeroides* marked the higher NO_3^- content of water (Xie et al. 2005).

Nelumbo nucifera, another common species recorded in Urla, Deepak nagar and Talpuri shows highest growth during summer as compared to winter & rainy seasons. It was found that Cl-content and total alkalinity of all these three ponds reached their highest level during summer while the level of these two factors were quite low during winter & rainy seasons. It thus seems that Cl-concentration and total alkalinity perhaps play important role in the growth and even flowering of *Nelumbo nucifera*, *Ipomoea aquatica* was also common in Urla, Deepak nagar and Talpuri. Density of this

species was found highest during winter and summer when the NO_3^- content of the pond water was approximate 33% lower as compared to rainy season. Thus it appears that *Ipomoea aquatica* also responded to the level of NO_3^- but the nitrate demand of this species was found lower as compared to *Alternanthera philoxeroides*. Comparatively higher level of NO_3^- tend to suppress growth of *Ipomoea aquatica* while it support *Alternanthera philoxeroides*. Disturbance may play a role in enabling invasive species to penetrate relatively mature communities (Lugo 1994; Nagasaka et al. 2002). For example, measures taken to control invasive *Nymphaea stellata* in Urla Pond resulted in irruptions of other species variety in the newly opened habitat, particularly *Alternanthera philoxeroides* (Schmitz et al. 1993; McCann et al. 1996). In some cases, the ability of invaders to tolerate specific environmental conditions has been important, for example, a tolerance of shading or of low levels of chloride and carbonate (Madsen et al. 2001). Increase in nitrate concentration were responsible for increase frequency of *Alternanthera* species in the aquatic ecosystem. This is further supported by higher frequency of occurrence of macrophytes in the dry season than the wet season that significantly correlated with increase nitrate concentration (Tiseer et al. 2008).

Overall growth of *Marsilea quadrifoliata* was also found to fluctuate during whole year. This species was recorded in Urla and Deepak nagar. When compared, growth of this plant was found to increase by 2 to 4 times during winter and summer in comparison to rainy season. Higher level of NO_3^- during rainy season might be the

factor showing negative effect over the growth and on the other hand higher total alkalinity during winter and summer may be thought to boost up the growth of this species. Out of four above mentioned species overall growth of *Alternanthera philoxeroides* clearly correspond to the NO_3^- content of pond water. With the gradual increase in NO_3^- content overall growth of this species also increase gradually. Therefore this species may be considered a good indicator of NO_3^- level of the water. Similarly Cl^- level of media was well indicated by the growth of *Nelumbo nucifera*. During summer when Cl^- concentration reached to its maximum, the overall growth of *Nelumbo nucifera* also reached to its highest level and the growth declined gradually with the gradual decrease in Cl^- concentration in rainy season followed by winter. An interesting biogeographic observation about aquatic plants is that their frequency of endemism is less than that of terrestrial plants. Even in ancient tropical habitats, there are relatively few endemic species of aquatic plants (i.e., compared with terrestrial plants). This is also concluded from the studied results (Figure 1.) Many species of aquatic plants are widespread, occurring on more than one continent as a result of extensive dispersal by natural vectors (and more recently, by humans). Nevertheless, all species have

particular ranges of environmental tolerance (Paresh *et al.* 2006).

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