

Diversity of Phytoplanktons in Rice Fields of Davangere Taluk, Karnataka

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Abstract

The diversity of Phytoplankton's in relation to different locality of paddy fields at Davangere taluk, Karnataka has been under taken for the first time in this area. A differential locality has been made during several field trips in 2015. Total 12 taxa with wide range of thallus structure were collected belonging to various orders i.e., *Zygnematales*, *Volvocales*, *Chlorococcales*, *Chladophorales*, *Pennales* etc. Light intensity, light nutrients and abundant water availability appears to be better conditions for algal growth in Paddy Fields. This study reveals that maximum diversity of phytoplankton's present in the rice fields in Bullapura's rice fields than compare to other locality.

Keywords: Algae; Cyanobacteria; Diversity; Morphology; Nature

Introduction

In the year 1939, De [1] was first time introduced blue green algae used as biofertilizer for rice crop. Algalization seems to have little effect on the physical properties of the soil and it may improve soil aggregation [2] and algae fertilizer used as source of nitrogen [3,4]. Rice is an exclusive crop plant of aquatic habitat, largely raised in an anaerobic or partially anaerobic submerged environment. Diversity of rice fields provides favourable environment for the growth of various group of algae with respect to their requirement of light, water, temperature and nutrient availability. The chemical properties which undergo changes on submergence are essentially the complex transformation of various elements. These elements depend on factors like the redox potential, pH, nature and quantity of organic matter, base status of the soil and microbiological activity [5]. Cyanobacteria are an ancient group of unique prokaryotic organisms with the ability to perform mutually compatible functions like nitrogen fixation and photosynthesis. Diversity of blue green is essential to understand the algal dynamics and interaction with other microorganisms and have gained much importance especially after the recognition of their role in the natural environment with their ability to provide an alternate source of energy. The capacity of several cyanobacteria to fix the atmospheric nitrogen is a significant biological process of economic importance [6]. The green algae play the important role acting as primary producer and also increase the fertility of the soil in paddy fields. Algae has been used as cheap sources of animal and plant nutrients, industrial exploitation of variety of value added products has already been initiated, medicinal potential of many of these being exhaustively explored for application. Many algae has been identified as bioindicator of the type and extent of pollution and their involvement in bioremediation of the problem has far reaching implication in protecting the water bodies. Thus, it is essential to study algal community in fluctuating physico-chemical scenario of habitat like paddy fields area to conserve and to maintain the ecosystem. There are many paddy fields that remain unexplored, at various locations of paddy fields in Davangere district of Karnataka. Hence, the present work has been made to study the diversity of cyanobacterial population and their nitrogen fixing potential. Keeping these views in mind an attempt has been made during the year 2015 to survey the distribution of the green algae in certain paddy field in and around Tholahunase area Davangere district, Karnataka which has been recorded for the first time.

Materials and Methods

Study area

The study area has been divided into two different site i.e., Road side paddy field area and Rice fields of various spots around Davangere district (Tholahunase, Kurki, Bullapura, Chandranalli and Turchagatta). The algal sample materials were collected from various waterlogged and moist soil surfaces in wide mouthed bottles. Surface water samples were also taken for the study of various phytoplanktons. The collected specimens were brought to the laboratory, University department of Botany, Davangere University, Davangere carefully preserved in 2% of Lugol's iodine solution. Temporary Mounts of algal specimen were prepared with suitable stains and observed under compound microscope and photomicrographs of dominant forms were also taken by a digital camera.

Collection, preservation and identification of samples

Samples were collected in two different sites of Davangere District. The samplings were done randomly from both soil and water of the paddy fields. The algal samples were preserved in 2% of Lugol's iodine and slides were prepared by staining without Saffranine. Detail studies were made by examining specimens under a compound microscope with SONY (DSC-W510) photomicrographic attachment. The strains were identified based on their morphological features and cell structure following the monograph of Desikachary [7] and Prescott [8].

Results and Discussion

Ankistrodesmus falcatus (Plate-1 and Figure 1A)

Order: Zygnematales

Family: Chlorophyceae: Cells minute, smooth, elongated, more

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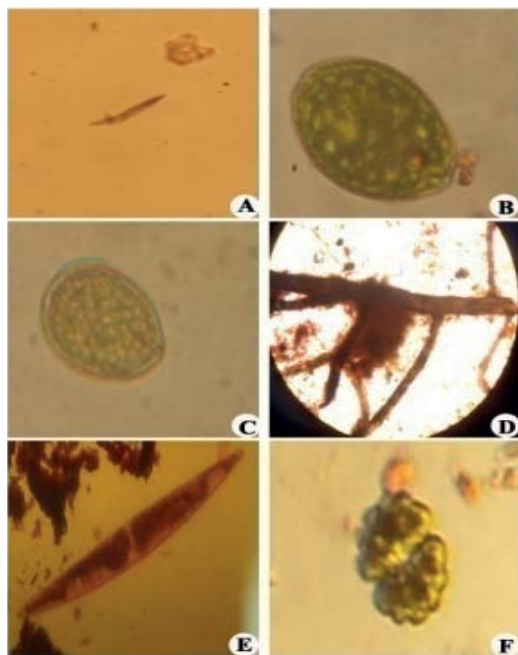


Figure 1: (A): *Ankistrodesmus falcatus*. (B). *Chlamydomonas* sp. (C). *Chlorella vulgaris*. (D). *Cladophora glomerata*. (E). *Closterium acutum*. (F). *Cosmarium contratum*.

or less numerous aggregated, forming fasculi or families, each family resulting from the self-division of a single cell, which commence by the formation of a somewhat oblique septum at the middle, continually rendered more and more oblique form the young cells growing alongside one another longitudinally until they each attain the length of original parent cell.

***Chlamydomonas* sp. (Plate-1 and Figure 1B)**

Order: Volvocales

Family: Chlamydomonadaceae: Plant body is a thallus which consists of a single biflagellated cell. Thallus is unicellular and are motile cell in oval, spherical pear shaped or elongated anterior end is pointed from the basal granules at the anterior end arises flagella of equal length; flagella help in motility and cup shaped chloroplast is present. Vacuoles are present in cytoplasm.

***Chlorella vulgaris* (Plate-1 and Figure 1C)**

Order: Chlorococcales

Family: Chlorellaceae: The plant body small, spherical, green unicells. They are generally found in fresh water of ponds and ditches, in moist soil. Symbiotic association in lichens and in certain invertebrates such as Hydra, Paramecium and Sponges.

***Cladophora glomerata* (Plate – 1 and Figure 1D)**

Order: Chladophorales

Family: Chladophoraceae: The branching filaments are usually coarse and stringy to touch the individual cells are large, multinucleated, cylindrical and placed end to end. The rhizoidal branches grow further and function as stolon-like outgrowths. From these, new upright threads arise at intervals. The stolon thus helps in vegetative

propagation by breaking down in several pieces. Each piece develops upright threads and function as a separate plant.

***Closterium acutum* (Plate – 1 and Figure 1E)**

Order: Zygnematales

Family: Desmidiaceae

The thallus is an elongated cell tapering from the middle towards the ends. Most spores are straight and spindle shaped. A few others have a curved cell which is crescentic in lateral view and may be distinctly lunate or arcuate.

***Cosmarium contratum* (Plate - 1, Figure 1F)**

Order: Zygnematales

Family: Desmidiaceae

It consists of a small, flat cell. The length of the cell is one and a half times greater than the breadth. The unicell has a deep median constriction, the sinus. The sinus divides the cell two distinct symmetrical halves, the semi-cells.

***Euastrum spinulosum* (Plate -2, Figure 2G)**

Order: Zygnematales

Family: Chlorophyceae

They are semi-terrestrial habitats, a good number of desmids occur in planktons. The mucilage envelopes are needle like possesses on the cell wall help in adapting to planktonic life. The cell wall is smooth without pores on never impregnated with iron compounds.

***Navicula* sp. (Plate -2, Figure 2H)**

Order: Pennales

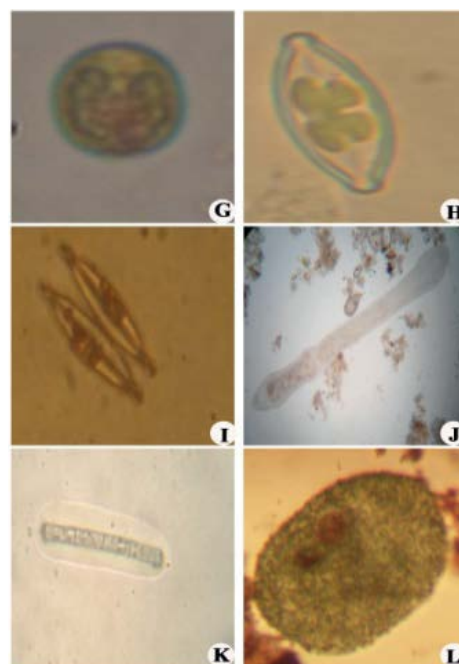


Figure 2: (G): *Euastrum spinulosum*. (H). *Navicula* sp. (I). *Pinnularia viridis*. (J). *Pleurotaenium ehrenbergii*. (K). *Rhizoclonium hieroglyphiarum*. (L). *Vlovox* sp.

Family: Naviculoideae: The striations are arranged in pinnate manner. They appear in two regular rows or series, one on either side of the axial strip. The axial strip may either be a plain area in between and called the **pseudoraphe** or it has a longitudinal slot called the **raphe**. The raphe extends from one end of the valve to the other.

***Pinnularia viridis* (Plate -2 and Figure 2I).**

Order: Pennales

Family: Naviculoideae: *Pinnularia* are elongated elliptical unicellular organisms. Their cell walls are composed chiefly of pectic substances on a rigid silica framework. Their walls are composed of two halves called thecae (or less formally, valves.). The margins of the two thecae are covered by a connecting band called a cingulum and all together are referred to as a frustule, the surface view is called valve view and band view is called girdle view. The outer larger valve is called epitheca and the smaller inner valve is called hypotheca. The cell is covered by a mucilaginous layer.

***Pleurotaenium ehrenbergii* (Plate -2 and Figure 2J)**

Order: Zygnematales

Family: Chlorophyceae: Long, cylindrical, bilaterally symmetrical unicells with blunt ends. Ring-like thickening in the central area where the two semi-cells join. In a good specimen, very delightful to look at due to obvious intracellular activity, especially at the ends. *Pl. ehrenbergii* prefers a more acidic, meso-oligotrophic habitat.

***Rhizoclonium hieroglyphiarum* (Plate -2 and Figure 2K)**

Order: Chladophorales

Family: Chlorophyceae: *Rhizoclonium* consists of unbranched filamentous individuals. The cells are unior plurinucleate and have a single reticulate chloroplast the number of pyrenoids in which depends on the age and size of the cell. The filaments are normally attached to soft or hard substrata or to other algae by means of rhizoids. The life history is normally diplobiontic and isomorphic.

***Vlovox* sp. (Plate -2 and Figure 2L).**

Order: Volvaceales

Family: Volvaceae: The *Vlovox* is a mobile colony of green algae. There are between 500 and 50,000 cells within the colony. These colonies are spherical or oval hollow in nature, and may be larger than a pinhead. The cells within a colony are contained within a gelatinous wall. For movement, each cell contains two flagella, which allows the organism to move through the water. During this present dissertation out of total 12 taxa of Chlorophyceae belonging to 3 Orders where, *Zygnematales* represent 5 genera and 5 species, *Volvales* represent 1 genera with 1 species, *Chladophorales* with 2 genera and 2 species, following Chlorophyceae belongs to 1 order where *Chlorococcales* represent 1 genera 1 species similarly *Desmidiaceae* family belongs to 1 order where *Pennales* represent 2 genera 2 species and *Volvaceae* represent 1 genera 1 species have been found with total 12 genera and 12 species. (Table 1). Locality varies on populations of algae were seen in most of the areas in dissertation. Algae populations were drastically reduced where field flooded with suspended soil particles.

Several reports have indicated a widespread distribution of *Nostoc* and *Anabaena* [9]. The dominating heterocystous nitrogen fixing blue green algal species of *Aluosira*, *Cylindrospermum*, *Nostoc*, *Anabaena*, *Tolypothrix* and *Calothrix* were reported from soils of Cuttack and Orissa [10]. Distributional profiles of cyanobacterial isolates from soils

of West Bengal [11]. Various workers have studied the cyanobacterial flora of rice fields of our country [12-17] and few attempts have also been carried to explore their diversity in the state of Orissa [18,19].

Amit and Sahu [20] reported that the distribution of Chlorophyceae (Green algae) in relation to seasonal variation of paddy fields at Lalgotwa area, Ranchi and first time clearly mentioned this area includes about total 24 chlorophycean taxa with wide range of thallus structure up to various orders i.e., *Chlorococcales*, *Ulotrichales*, *Cladophorales*, *Oedogoniales*, *Zygnematales* etc.

Maheshwari [21] reported that the rich diversity of heterocystous cyanobacteria was recorded from rice fields of Bundi District. And clearly highlighted about 12 species, in Rajasthan includes *Anabaena aequalis* Borge, *A. constricta* (szafer) Geitler, *A. fertilissima* Rao C.B., *A. oryzae* Fritsch, *A. variabilis* Kutzing ex Born et Flah, *A. dolium* Bhardwaj, *Nostoc muscorum* Ag.ex Born.et Flah., *Microchaete*

Sl.No	Name of Taxa	1	2	3	4	5
		Th	K	C	B	Tu
1	<i>Ankistrodesmus falcatus</i>	+	-	-	+	-
	F-ChlorophyceaeO – Zygnematales					
2	<i>Chlamydomonas</i> sp.	+	-	-	-	-
	F-Chlamydomonadaceae					
	O –Volvocales					
3	<i>Chlorella vulgaris</i>	-	+	-		+
	F –Chlorellaceae					
	O –Chlorococcales					
4	<i>Cladophora glomerata</i>	-	-	+	-	-
	F–ChladophoraceaeO – Chladophorales					
5	<i>Closterium acutum</i>	-	-	-	+	-
	F –Desmidiaceae					
	O –Zygnematales					
6	<i>Cosmarium contractum</i>	+	+	-	+	-
	F–DesmidiaceaeO – Zygnematales					
7	<i>Euastrum spinulosum</i>	+	-	-	-	+
	F–Chlorophyceae					
	O –Zygnematales					
8	<i>Navicula</i> sp.	+	+	+	+	+
	F – Naviculoideae					
	O – Pennales					
9	<i>Pinnularia viridis</i>	+	+	-	-	-
	F – Naviculoideae					
	O – Pennales					
10	<i>Pleurotaenium ehrenbergii</i>	-	-	-	+	-
	F–Chlorophyceae					
	O –Zygnematale					
11	<i>Rhizoclonium hieroglyphiarum</i>	-	-	-	+	-
	F–Chlorophyceae					
	O–Chladophorales					
12	<i>Vlovox</i> sp.	-	-	+	-	+
	F–Volvaceae					
	O –Volvales					

[Note: + = present; - = absent; F-Family; O-Order; Th-Tholahunase; K-Kurki; C-Chandranalli; B- Bullapura; Tu-Turchaghatta].

Table 1: Species variation of *Chlorophyceae*, *Chlorellales*, *Chlamydomonadaceae* *Chladophoraceae* *Desmidiaceae* and *Volvaceae*, in different locality.

calothrichoides Hansing, *Microcoleus acutissimus* Gardner., *Oscillatoria princeps* Vaucher ex Gomont, *Oscillatoria proboscidea* Gomont and *Oscillatoria obscura* Bruhl ex Biswas.

Conclusion

The presence of cyanobacteria which fix atmospheric nitrogen in paddy soils and also enhances the soil fertility. So, it is necessary to conserve algal genetic resources of local habitat and to do more systematic work on it which is possible only after understanding the ecology and habitats of various algal forms. The present study concludes that the maximum diversity of phytoplankton's present in the rice fields in Bullapura's rice fields in around Davangere taluk.

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