

Composition and diversity of algae in Paddy fields of Razole Mandal, East Godavari district, Andhra Pradesh

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ABSTRACT

Information was collected on algal diversity in the rice fields of Razole Mandal for the period of two seasons such as Kharif and Rabi from July 2018 to June 2019. Paddy is the semi submerged crop which harbors the growth of many living organisms including the algae, cyanobacteria, methanogens, methylotrophs and others. Algae, especially the blue green ones help to enhance the productivity of the paddy crop. In the present investigation three villages in the Razole Mandal of East Godavari District were selected for collection of algal samples. A total of 62 algal species were identified and belongs to four major classes such as Chlorophyceae (23), Bacillariophyceae (07), Cyanophyceae (27), and Euglenophyceae (05) in all three study sites of the Razole Mandal.

Key- words- Algae, Paddy, Kharif, Rabi, Andhra Pradesh, India.

INTRODUCTION

Godavari districts in Andhra Pradesh are popular for its paddy (*Oryza sativa* L.) cultivation since long back. Due to the continuous water supply to the paddy fields, there is no chance for dry soil. So paddy is always semi submerged crop and harbors variety of biological organisms including algae and other macrophytes. Species of Cyanobacteria played a vital role to enrich the productivity of paddy crops in India (Venkataraman, 1981 and Chowdhary et al, 2011). Some species of Cyanobacteria able to fix the nitrogen in paddy fields (Singh et al, 2014). Data on algal communities in paddy fields was studied by several investigators (Rout and Dey (1999); Rao et al, (2008); Prasanna et al, (2009); Dey et al., 2010; Chowdhary (2011); Bharawaj and Baruah, (2013) ; Borah et al., (2013); Das Gupta and Ahmed, (2013) in different geographical regions of India. Studies on microalgae of Godavari districts are very few (Narasimha Rao, 2009; Bhanu Prakashh et al., 2014). Present investigation aims to deal with the algal communities present in paddy fields of three villages in Razole Mandal of East Godavari district, Andhra Pradesh. Besides identify the other macrophytes

which are present in the paddy plantations along with algae.

Materials and Methods

Three villages namely Mulikipalli, Kunavaram and Kadali of Razole Mandal, East Godavari district, Andhra Pradesh are selected for the present investigation. These study sites lies between longitudes 81° 90' E and latitudes 16°45' N. Paddy fields of Mulikipalli village (selected site) are always with water column of 20-25 cm height and water logging is the common in this site. Study site at Kunavaram is moderate in the water stagnation. While in the third site Kadali, due to the well drained system prevailing in this area, it leads to no stagnation of water.

Surface water blooms and water samples were collected for a period of one year from July 2018 to June 2019. In Kharif season, materials (algal blooms and water samples) were collected in August, September and November months while in Rabi season materials were collected in January, February and March months. Every month water samples were collected randomly at three locations in each village.

In these study sites sufficient water is present up to harvesting the crop. The materials were immediately transferred in to plastic bottles and fixed with 4% formalin. These materials were transported to the laboratory at Botany department of Andhra University and then centrifuged at 1500 rpm for 6 to 10 minutes. Known water sample was taken in a Sedgwick rafer cell and identified the algal forms with help of the standard references of Fritsch (1935), Prescott (1951), Desikachary (1959). Macro algal samples were carefully separated and thin filaments taken for microscopic observation. These macro algae were identified with help of standard keys (Fritsch, 1935; Prescott, 1951).

Results and Discussion

In all three study sites a total of 62 algae, Chlorophyceae (23), Bacillariophyceae (07),

Cyanophyceae (27), and Euglenophyceae (05) were identified, but number of algae in each station (village) was varied. In Mulikipalli, a total of 55 algal species were identified (Table 1), out of these 27 species belongs to Cyanophyceae, 18 belongs to Chlorophyceae, 6 species of Bacillariophyceae and 4 species belongs to Euglenophyceae. Species number was varied in season wise as well as in station wise. In Mulikipalli, in Kharif season a total of 50 algae were reported, out of this, 24 belongs to Cyanophyceae, 16 species of Chlorophyceae, 6 species of Bacillariophyceae and 4 species belongs to Euglenophyceae. In Rabi season, a total of 40 species were reported form the study site. Among these, 21 species of Cyanophyceae, 12 species of Chlorophyceae, 4 belongs to Bacillariophyceae and 3 species of Euglenophyceae (Table.1)..

Table No. 1: List of Algae present in Kharif and Rabi seasons in Mulikipalli village during the study period.

S.No	Name of the alga	Class	Mulikipalli	
			Kharif	Rabi
1	<i>Ankistrodmsmus convolutes</i>	Chlorophyceae	+	+
2	<i>Chalmydomonas globosa</i>	Chlorophyceae	+	+
3	<i>Chlorella vulgaris</i>	Chlorophyceae	+	+
4	<i>Closterium ehrenbergii</i>	Chlorophyceae	+	--
5	<i>Closerium moniliferum</i>	Chlorophyceae	--	+
6	<i>Cosmarium contractum</i>	Chlorophyceae	+	--
7	<i>Cladophora glomerata</i>	Chlorophyceae	+	--
8	<i>Chaetophora elegans</i>	Chlorophyceae	+	+
9	<i>Eudorina pectnalis</i>	Chlorophyceae	--	+
10	<i>Hydrodictyon reticulam</i>	Chlorophyceae	+	--
11	<i>Oedogonium globosum</i>	Chlorophyceae	+	+
12	<i>Pediastrum simplex</i>	Chlorophyceae	+	--
13	<i>Scenedesmus dimophus</i>	Chlorophyceae	+	--

S.No	Name of the alga	Class	Mulikipalli	
			Kharif	Rabi
14	<i>Scenedesmus denticulatus</i>	Chlorophyceae	+	+
15	<i>Spirogyra communis</i>	Chlorophyceae	+	+
16	<i>Tetraspora cylindrica</i>	Chlorophyceae	+	+
17	<i>Ulotrix zonata</i>	Chlorophyceae	+	+
18	<i>Zygnema pectinatum</i>	Chlorophyceae	+	+
19	<i>Cymbella austriaca,</i>	Bacillariophyceae	+	+
20	<i>Navicula bacilloides</i>	Bacillariophyceae	+	--
21	<i>Navicula major,</i>	Bacillariophyceae	+	+
22	<i>Melosira varians</i>	Bacillariophyceae	+	+
23	<i>Synedra affinis</i>	Bacillariophyceae	+	--
24	<i>Fragilaria intermedia</i>	Bacillariophyceae	+	+
25	<i>Anabaena constricta</i>	Cyanophyceae	+	--
26	<i>Anabaena gelatinicola</i>	Cyanophyceae	+	+
27	<i>Anabaena orientalis</i>	Cyanophyceae	+	+
28	<i>Anabaena iyengarii</i>	Cyanophyceae	--	+

Table 2 shows the composition of algae in study site Kunavaram, In Kunavaram, a total of 56 algal species were reported, among these 24 forms belongs to Cyanophyceae, 21 belongs to Chlorophyceae, 6 of Bacillariophyceae and 5 algal forms belongs to Euglenophyceae. In this station also species number was varied in relation to seasons. In Kunavaram, a total of 45 algae were reported in Kharif season, out

of this, 17 species were Cyanophyceae, 19 species of Chlorophyceae, 5 Bacillariophyceae and 4 species belongs to Euglenophyceae. In Rabi season, a total of 40 species were reported from the study site. Among these, 16 species belongs to Cyanophyceae, 14 Chlorophyceae, 5 belongs to Bacillariophyceae and 5 species of Euglenophyceae (Table.2).

Table No. 2: List of Algae present in Kharif and Rabi seasons in Kunavaram village during the study period.

S.No	Name of the alga	Class	Kunavaram	
			Kharif	Rabi
1	<i>Ankistrodismus convolutes</i>	Chlorophyceae	+	+
2	<i>Chalmydomonas globosa</i>	Chlorophyceae	+	--
3	<i>Chlorella vulgaris</i>	Chlorophyceae	+	+
4	<i>Closterium ehrenbergii</i>	Chlorophyceae	+	+
5	<i>Closerium moniliferum</i>	Chlorophyceae	+	--
6	<i>Cosmarium contractum</i>	Chlorophyceae	+	+
7	<i>Cladophora glomerata</i>	Chlorophyceae	--	+
8	<i>Chaetophora elegans</i>	Chlorophyceae	+	+
9	<i>Hydrodictyon reticulam</i>	Chlorophyceae	+	--
10	<i>Oedogonium globosum</i>	Chlorophyceae	+	+
11	<i>Pandorina morum</i>	Chlorophyceae	+	+
12	<i>Pediastrum simplex</i>	Chlorophyceae	+	--
13	<i>Scenedesmus dimorphus</i>	Chlorophyceae	+	+
14	<i>Scenedesmus abundans</i>	Chlorophyceae	+	+
15	<i>Scenedesmus denticulatus</i>	Chlorophyceae	+	--
16	<i>Spirogyra occidentals</i>	Chlorophyceae	--	+
17	<i>Spirogyra communis</i>	Chlorophyceae	+	--
18	<i>Ulotrix zonata</i>	Chlorophyceae	+	+
19	<i>Ulotrix variabilis</i>	Chlorophyceae	+	--
20	<i>Zygnema pectinatum</i>	Chlorophyceae	+	+
21	<i>Zygnema sterile</i>	Chlorophyceae	+	+
22	<i>Cymbella austriaca,</i>	Bacillariophyceae	+	+
23	<i>Navicula cincta</i>	Bacillariophyceae	+	+
24	<i>Navicula bacilloides</i>	Bacillariophyceae	+	--

S.No	Name of the alga	Class	Kunavaram	
			Kharif	Rabi
25	<i>Melosira varians</i>	Bacillariophyceae	--	+
26	<i>Synedra affinis</i>	Bacillariophyceae	+	+
27	<i>Fragilaria intermedia</i>	Bacillariophyceae	+	+
28	<i>Anabaena constricta</i>	Cyanophyceae	+	--
29	<i>Anabaena gelatinicola</i>	Cyanophyceae	+	+
30	<i>Anabaena iyengarii</i>	Cyanophyceae	--	+
31	<i>Anabaena oryzae</i>	Cyanophyceae	+	+
32	<i>Chroococcus varians</i>	Cyanophyceae	+	--
33	<i>Calothrix fusca</i>	Cyanophyceae	--	+
34	<i>Cylendrospermum mucicola</i>	Cyanophyceae	+	+
35	<i>Gloeotrichia indica</i>	Cyanophyceae	+	+
36	<i>Gloeocapsa granosa</i>	Cyanophyceae	+	--
37	<i>Gleotheca rupestris</i>	Cyanophyceae	--	+
38	<i>Lyngbya epiphytica</i>	Cyanophyceae	+	+
39	<i>Lyngbya nigra</i>	Cyanophyceae	+	--
40	<i>Microcystis elegans</i>	Cyanophyceae	--	+
41	<i>Nostoc commune</i>	Cyanophyceae	+	--
42	<i>Nostoc muscorum</i>	Cyanophyceae	+	+
43	<i>Nostoc punctiforme</i>	Cyanophyceae	--	+
44	<i>Oscillatoria chlorine</i>	Cyanophyceae	+	--
45	<i>Oscillatoria cortiana</i>	Cyanophyceae	+	+
46	<i>Oscillatoria proboscidea</i>	Cyanophyceae	--	+
47	<i>Phormodium fragile</i>	Cyanophyceae	+	--
48	<i>Synechococcus cedrorum</i>	Cyanophyceae	+	+

S.No	Name of the alga	Class	Kunavaram	
			Kharif	Rabi
49	<i>Snechocystis aeruginosa</i>	Cyanophyceae	--	+
50	<i>Snechocystis develaki</i>	Cyanophyceae	+	--
51	<i>Spirulina patensis</i>	Cyanophyceae	+	+
52	<i>Euglena fusca,</i>	Euglenophyceae	+	+
53	<i>Euglena viridis</i>	Euglenophyceae	--	+
54	<i>Euglena caudate</i>	Euglenophyceae	+	+
55	<i>Phacus longicauda,</i>	Euglenophyceae	+	+
56	<i>Trachelomonas armata</i>	Euglenophyceae	+	+

Algae present in the Kadali village was presented in Table 3, In Kadali, a total of 51 algae was observed, out of this 18 belongs to Cyanophyceae, 23 algae were Chlorophyceae, 7 species of Bacillariophyceae and 3 belongs to Euglenophyceae. Species composition was varied in Kharif and rabi seasons. In Kharif, a total of 43 algae were reported, out of this, 14 species belongs to Cyanophyceae, 20 forms to Chlorophyceae, 6 species belongs to Bacillariophyceae and 3 species belongs to Euglenophyceae. In Rabi season, a total of 39 algae were observed, among this, 15 species of Cyanophyceae 17 Chlorophyceae, 5 belongs to Bacillariophyceae and 2 species of Euglenophyceae (Table.3).

Results and Discussion

Algae in the paddy fields was investigated by several authors in India (Venkataraman, 1981; Chowdhary et al, 2011; Rout and Dey 1999; Rao et al, 2008; Prasanna et al, 2009; Dey et al., 2010; Chowdhary 2011; Bharawaj and Baruah, 2013; Das Gupta and Ahmed, 2013). In abroad this study has been similarly conducted by several authors such as Okuda and Yamaguchi, 1955; Roger and Reynaud, 1982 Zancarini et al., 2013 and others.

In nature even though atmospheric nitrogen is found in abundance but it is relatively non-available to plants and animals. Crop production therefore depends largely on synthetic nitrogen fertilizers; however it is costly both monetarily as well as energetically. Rice is the staple food of approximately 65% of the world's population and it is widely grown all around the world.

The algal growth in a particular soil type is governed by the seasonal and other ecological conditions of their habitat. The algal fertilizer materials are ecofriendly however unlike the chemical fertilizer they do not bring about spectacular visual changes in crop growth and production. The growth of algae in the paddy field effects the later in several ways. Two main strategies are either by nitrogen fixation or secretion of growth promoting substances or both. Besides vitamins, algae are also responsible for synthesizing auxin-like substances which plays a crucial role in crop growth and vigour.

In the present study only water samples were collected for identification. Variations in composition of algae in three villages were varied may be due to the local environmental features, for instance in Mulikipalli more Cyanophyceae members were

reported than other remaining study sites. In Mulikipalli region, paddy fields are always inundated with water and drainage channels are filled with more aquatic macrophytes, in turn water movement from paddy fields is very minimum and promotes the water logging in the fields. These conditions influence the growth of the more and more Cyanophyceae members than the remaining algal groups. In this study advantage of the Cyanobacteria presence is not established. In contrary in the Kadali study site more number of Chlorophyceae species was reported than

the remaining ones. In this study site, water continuously following from the paddy fields and there is no stagnation of water in the fields which promotes the growth of more Chlorophyceae members than Cyanophyceae and other groups. In study site Kunavaram moderate results were recorded for the composition of algal blooms. Besides the algae, aquatic Pteridophyte *Salvenia*, and hydrophyte *Pistia* and *Nelumbo* were also present in these paddy fields.

Table No. 3: List of Algae present in Kharif and Rabi seasons in Kadali village during the study period.

S.No	Name of the alga	Class	Kadali	
			Kharif	Rabi
1	<i>Ankistrodismus convolutes</i>	Chlorophyceae	+	+
2	<i>Chalmydomonas globosa</i>	Chlorophyceae	+	--
3	<i>Chlorella vulgaris</i>	Chlorophyceae	+	--
4	<i>Closterium ehrenbergii</i>	Chlorophyceae	+	+
5	<i>Closterium moniliferum</i>	Chlorophyceae	+	+
6	<i>Cosmarium contractum</i>	Chlorophyceae	--	+
7	<i>Cladophora glomerata</i>	Chlorophyceae	+	+
8	<i>Chaetophora elegans</i>	Chlorophyceae	+	+
9	<i>Eudorina pectnalis</i>	Chlorophyceae	--	+
10	<i>Hydrodictyon reticulam</i>	Chlorophyceae	+	+
11	<i>Oedogonium globosum</i>	Chlorophyceae	+	--
12	<i>Pandorina morum</i>	Chlorophyceae	+	--
13	<i>Pediastrum simplex</i>	Chlorophyceae	+	--
14	<i>Scenedesmus dimorphus</i>	Chlorophyceae	+	+
15	<i>Scenedesmus abundans</i>	Chlorophyceae	+	+
16	<i>Scenedesmus denticulatus</i>	Chlorophyceae	+	+
17	<i>Spirogyra occidentals</i>	Chlorophyceae	+	+

S.No	Name of the alga	Class	Kadali	
			Kharif	Rabi
18	<i>Spirogyra communis</i>	Chlorophyceae	--	+
19	<i>Tetraspora cylindrica</i>	Chlorophyceae	+	+
20	<i>Ulothrix zonata</i>	Chlorophyceae	+	+
21	<i>Ulothrix variabilis</i>	Chlorophyceae	+	+
22	<i>Zygnema pectinatum</i>	Chlorophyceae	+	+
23	<i>Zygnema sterile</i>	Chlorophyceae	+	--
24	<i>Cymbella austriaca,</i>	Bacillariophyceae	--	+
25	<i>Navicula cincta</i>	Bacillariophyceae	+	+
26	<i>Navicula bacilloides</i>	Bacillariophyceae	+	+
27	<i>Navicula major,</i>	Bacillariophyceae	+	+
28	<i>Melosira varians</i>	Bacillariophyceae	+	--

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