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RESEARCH ARTICLE

FILAMENTOUS ALGAL DIVERSITY IN KOLE WETLAND PADDY FIELDS.

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Abstract

The Kole wetlands in Thrissur is one of the significant food production grounds of Kerala which is considered as an unparalleled freshwater ecosystem and is a part of Vembanad-Kole Ramsar site. The name “Kole” refers to the peculiar high yielding type of paddy cultivation practice carried out in this flooded wetland for about six months in a year. The present study is an attempt to screen the filamentous algae in kole paddy fields. Altogether, 28 species of blue-green algae were identified. Green algae were *Mougeotia* species and five filament types of *Spirogyra*. The significant contributions of these algae to soil fertility in terms of the physico-chemical, biological and soil-water relations are well established in terms of soil conditioning and soil bioindicators.

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Introduction:-

The Kole wetland in Thrissur is one of the significant food production grounds of Kerala which is considered as an unparalleled freshwater ecosystem and is a part of Vembanad-Kole Ramsar site. The name “Kole” refers to the peculiar high yielding type of paddy cultivation practice carried out in this flooded wetland for about six months in a year. “Kole” a Malayalam word means good yield or high returns. Kole wetlands are highly productive and the area is quite unique. The entire tract is the result of fluvial estuarine modifications by anthropogenic activities. The area is devoid of any significant relief features and consists of extensive flat land surface interspersed with uplands. The land around the rice fields have steep slopes which are terraced and put under perennials like areca nut and coconut and annuals like banana, yams, etc.

The dry lands of the Kole region adjoining the coastal belt have level topography and are under coconut plantation (MSSRF, 2007). The Kole fields are low-lying tracts located 0.5–1 m below the mean sea level. Eventhough the biodiversity of flora and fauna are well studied in Kole wetland paddy fields like butterflies (Sarath *et al.*, 2017), macrobenthos (Vineetha *et al.*, 2015) there exists limitations of knowledge regarding filamentous algae in Kole lands and the present study is in this background.

Materials and Methods:-

Samples were collected from the Kole paddy fields in Thrissur during October 2011 to January 2012 by taking soil surface layer (0-2cm) using a clean scoop. Samples were collected randomly from different places at each location, and combined together for observing the algae. The algae were also scrapped off any rock, and concrete structure and submerged vegetation, as well as filtered out from stagnant water. The samples were placed in clean polythene bags, and carried to the laboratory where they were processed immediately or after short term storage in dark at 4⁰C.

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The algae present in the samples were observed by following two methods: direct observation and enrichment method.

Identification and classification of algae was carried out based on morpho-taxonomic description with the help of monographs, taxonomic keys and standard publications like Desikachary (1959), Randhawa (1959), Prescott (1962), Gonzalves (1981), Anand and Hopper (1987), Anand (1989), Krishnamurthy (2000), Mahendrapuram and Anand (2008) and Guiry and Guiry (2014).

Results and Discussion:-

Filamentous algae collected from the paddy fields of Kole belonged to blue-green and green algae. There were 28 species of blue-green algae. Green algae were *Mougeotia* species and five filament types of *Spirogyra*. Among these fifteen species of blue-green and two filament types of *Spirogyra* were same as those observed in Kuttanad. These species are *Lyngbya bergi*, *Lyngbya hieronymusii*, *Lyngbya major*, *Oscillatoria splendida*, *Oscillatoria accuminata*, *Oscillatoria princeps*, *Oscillatoria subbrevis*, *Oscillatoria perornata*, *Oscillatoria laete-virens*, *Oscillatoria limnosa*, *Oscillatoria proboscidea*, *Phormidium tenue*, *Phormidium retzii*, *Nostoc commune*, *Anabaena naviculoides*, *Spirogyra* type1, *Spirogyra* type 3.

In the sampling locations of Kole lands the highest number of filamentous algal species was observed in Palakkal followed by Muriyad and Nedupuzha, and the lowest number was at Puzhakkal throughout the cropping season. The occurrence of species in the sampling locations is given in Fig. 1.

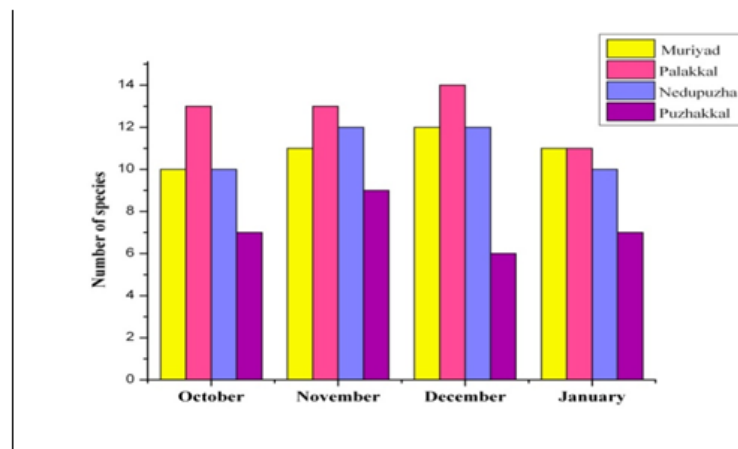


Fig.1:- Species richness in the sampling locations of Kole lands.

The diversity of filamentous algae in the sampling locations of Kole lands were dominated by blue-green algae. The occurrence of filamentous algal species are given in Fig. 2.

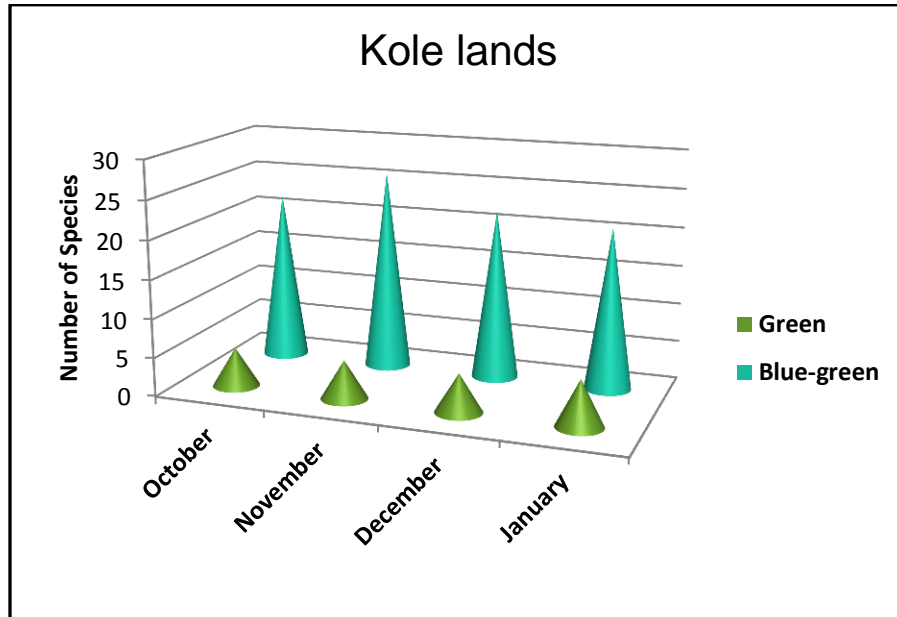


Fig. 2:-The occurrence of filamentous algae in Kole lands

The frequency of distribution of each species in Kole lands and their constancy class is represented in Table 1. According to this *Spirogyra type 3* falls under the constancy class IV i.e. 100% occurrence, and therefore is assumed to be present throughout Kole lands. *Lyngbya bergi* and *Lyngbya palmarum* fall under the constancy class III with 75% occurrence. Twenty two species fall in the consistency class I with 25% occurrence and are the least distributed.

Thirteen species of filamentous algae were observed in Muriyad. *L. bergi*, *L. hieronymusii*, *L. major*, *O. boryana*, *O. subbrevis*, *P. tenue*, *Spirogyra type 3* and *Spirogyra type 5* were present throughout the cropping season. *O. limosa* was present only in the month of December. The highly distributed species in Muriyad was *P. tenue*; *O. limosa* comprised only 2% of the population and this was the least distributed one. Fifteen species of algae were observed at Palakkal. Among these eight species were present throughout the cropping season. They were *L. bergi*, *L. hieronymusii*, *O. splendida*, *O. princeps*, *P. tenue*, *Spirogyra type 1*, *Spirogyra type 3* and *Spirogyra type 5*. *L. bergi* and *P. tenue* were highly distributed in these regions. *Mougeotia sp.* and *L. palmarum* had the least frequency. Thirteen species of algae were obtained from Nedupuzha. *L. palmarum*, *O. raai*, *O. splendida*, *O. princeps*, *O. limosa*, *P. retzii*, *Spirogyra type 3* and *Spirogyra type 7* were present throughout the season. *O. laete-virens*, *C. indicum* were obtained only in the middle of crop season. *S. myochrous* was observed in the month of December and January only.

In Nedupuzha *Spirogyra type 3* and *Spirogyra type 7* showed highest distribution frequency. *O. laete-virens*, *C. indicum* and *S. myochrous* were least distributed. Nine species of algae were observed in this area. Only four species were present throughout the cropping season. They are *L. bergi*, *O. proboscidea*, *Spirogyra type 3* and *Spirogyra type 6*. *H. welwitschii* was observed at the middle of the season whereas *A. naviculoides* was present in the first half period. *Spirogyra type 3* and 6 showed highest distribution frequency in Puzhakkal, whereas *A. naviculoides* and *H. welwitschii* were least distributed. The taxonomic descriptions of the other species are given below.

Lyngbya dendrobia Bruhl et Biswas

Trichome 11-13 µm broad, sheath 2-2.5 µm thick, colourless, trichome 8-10 µm broad, not constricted at the cross-walls, cells 2-3 µm long.

Lyngbya palmarum (Martens) Bruhl et Biswas

Trichome 5-7 µm broad, not constricted at the cross-walls; apices rounded, cells 3-4 µm long.

Oscillatoria raai De Toni, J.

Trichome straight, uniform thickness, without constrictions at the joints, 6-9 µm broad, granules closely arranged on either side of the septa, cells 2-3 µm long, end cells rounded.

Oscillatoria chalybea (Mertens) Gomont

Trichome more or less straight, 8-11 μm broad; bent at the end, slightly attenuated; slightly constricted at the cross walls; cells 3-5 μm long, end cells obtuse.

Oscillatoria boryana Bory ex Gomont

Trichome straight, slightly constricted at the cross-walls, 4-7 μm broad; cells 4-7 μm long; end cell rounded.

Oscillatoria amoena (Kütz.) Gomont

Trichome straight, ends gradually attenuated, 5-8 μm broad; cells 2-3 μm long; end cells capitate, broadly conical with calyptra.

Spirulina subsalsa Oerst. ex Gomont

Trichome 1-2 μm broad, blue-green colour, spirally coiled, spirals very close to each other, 3-4 μm broad.

Phormidium inundatum Kutzing ex Gomont

Trichome blue-green, straight, not constricted at the cross walls; sheath thin; cells 3-4 μm broad, 4-7 μm long, nearly quadrate, granulated at the septa.

Cylindrospermum indicum Rao, C.B., orth. Mut. De Toni

Trichome single with deep constrictions at the joints, 2-4 μm broad, cells almost quadrate, or more or less barrel-shaped, 3-4 μm long, heterocysts spherical, one at each end of the trichome, 2-3 μm broad, spores ellipsoidal, 7-8 μm broad.

Nostoc punctiforme (Kütz.) Hariot

Thallus sub-globose; sheath mucous; trichome 3-4 μm broad, cells barrel-shaped; heterocyst 5-6 μm broad, 6-7 μm long.

Anabaena circinalis Rabenhorst ex Born. et Flah. Var. *crassa* Ghose

Trichome single, loosely coiled, cells nearly spherical, but generally shorter than broad, 5-6 μm broad; heterocysts globose, 7-8 μm broad.

Scytonema myochrous (Dillw.) Ag. ex Born. et Flah.

Thallus brownish black, 35-40 μm broad, sheath yellowish brown, trichome 8-12 μm broad, heterocysts longer than broad.

Hapalosiphon welwitschii W. et G.S. West

Filaments 5-8 μm broad, sheath very close, colourless; cells sub spherical or elongate, as long as broad; lateral branches short, 4-6 μm broad, slightly attenuated at the ends.

Mougeotia C. Agardh

Unbranched uniseriate filaments; cells cylindrical, 8-10 μm broad, 110-115 μm long, chloroplast axial, uncoiled, one per cell, plate like.

Spirogyra Link***Spirogyra*** type 5

Unbranched uniseriate filaments, slimy to touch; cells cylindrical, 14-17 μm broad, 70-75 μm long; chloroplasts two, six to seven turns per cell, ribbon like, coiled, end wall replicate.

Spirogyra type 6

Unbranched uniseriate filaments, slimy to touch; cells cylindrical, 25-27 μm broad, 92-98 μm long; chloroplasts two, three to four turns per cell, ribbon like, coiled, end wall replicate.

Spirogyra type 7

Unbranched uniseriate filaments, slimy to touch; cells cylindrical, 11-14 μm broad, 66-70 μm long; chloroplasts two, three to five turns per cell, ribbon like, coiled, end wall replicate.

Table 1:- Occurrence of filamentous algae in Kole lands.

No.	Species	Muriyad	Palakkal	Nedupuzha	Puzhakkal	%/ Constancy Class
1	<i>Lyngbya</i>					
	1. <i>L. bergi</i>	+	+	-	+	75/III
	2. <i>L. hieronymusii</i>	+	+	-	-	50/II
	3. <i>L. major</i>	+	-	-	-	25/I
	4. <i>L. dendrobia</i>	-	+	-	-	25/I
	5. <i>L. palmarum</i>	-	+	+	+	75/III
2	<i>Oscillatoria</i>					
	6. <i>O. splendida</i>	-	+	+	-	50/II
	7. <i>O. accuminata</i>	-	-	-	+	25/I
	8. <i>O. princeps</i>	-	+	+	-	50/II
	9. <i>O. subbrevis</i>	+	-	-	-	25/I
	10. <i>O. perornata</i>	-	+	+	-	50/II
	11. <i>O. laete-virens</i>	-	-	+	-	25/I
	12. <i>O. limosa</i>	+	-	+	-	50/II
	13. <i>O. proboscidea</i>	-	+	-	+	50/II
	14. <i>O. raoi</i>	+	-	+	-	50/II
	15. <i>O. chalybea</i>	-	+	-	-	25/I
	16. <i>O. boryana</i>	+	-	-	-	25/I
	17. <i>O. amoena</i>	+	-	-	-	25/I
3	<i>Spirulina</i>					
	18. <i>S. subsalsa</i>	-	+	-	-	25/I
4	<i>Phormidium</i>					
	19. <i>P. tenue</i>	+	+	-	-	50/II
	20. <i>P. retzii</i>	-	-	+	-	25/I
	21. <i>P. inundatum</i>	-	-	-	+	25/I
5	<i>Cylindrospermum</i>					
	22. <i>C. indicum</i>	-	-	+	-	25/I
6	<i>Nostoc</i>					
	23. <i>N. punctiforme</i>	-	-	+	-	25/I
	24. <i>N. commune</i>	+	-	-	-	25/I
7	<i>Anabaena</i>					
	25. <i>A. circinalis</i>	+	-	-	-	25/I
	26. <i>A. naviculoides</i>	-	-	-	+	25/I
8	<i>Scytonema</i>					
	27. <i>S. myochrous</i>	-	-	+	-	25/I
9	<i>Hapalosiphon</i>					
	28. <i>H. welwitschii</i>	-	-	-	+	25/I
10	<i>Mougeotia</i>					
	29. <i>Mougeotia sp.</i>	-	+	-	-	25/I
11	<i>Spirogyra</i>					
	30.1 <i>Spirogyra</i> type 1	-	+	-	-	25/I
	30.2 <i>Spirogyra</i> type 3	+	+	+	+	100/IV
	30.3 <i>Spirogyra</i> type 5	+	+	-	-	50/II
	30.4 <i>Spirogyra</i> type 6	-	-	-	+	25/I
	30.5 <i>Spirogyra</i> type 7	-	-	+	-	25/I

Conclusion:-

It is crystal clear that paddy fields in Kole wetlands are unique wet soil habitats suitable for filamentous algae to flourish. The significant contributions of these algae to soil fertility in terms of the physico-chemical, biological and soil-water relations are well established in terms of soil conditioning and soil bioindicators.

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