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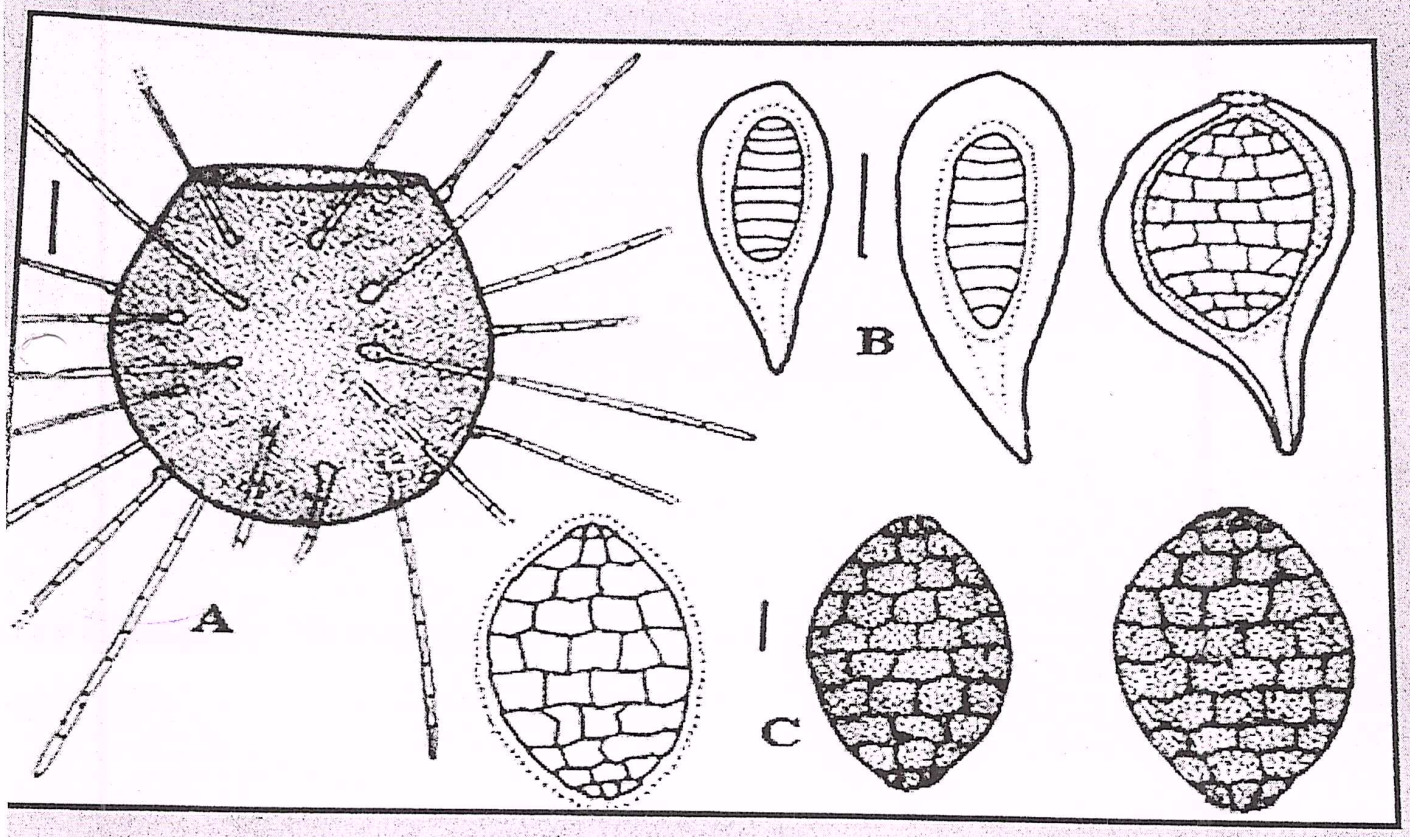

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SOIL CHARACTERISTICS AND ALGAL DIVERSITY OF CULTIVATED FIELDS

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ABSTRACT

Soil algae are an important group of microorganisms that inhabit all terrestrial ecosystems. The nature of soil microalgae depends on soil physical and chemical characteristics. In the present study soil characteristics and soil algae inhabiting in Groundnut and Soybean fields were determined. Total of 115 species belonging to 46 genera of algae had been observed in these two fields. Cyanophyceaen algae showed quite high species diversity. Slightly alkaline pH favoured growth of Cyanophycean members.

Key Words: Soil Algae, Soil characteristics, Groundnut, Soybean, Cyanophyceae

Introduction

In farmlands soil algae and cyanobacteria play an important role as they serve as a sources of nitrogen and carbon for other organisms. They produce and secrete polysaccharides, which in turn promote soil aggregation (Goyal 1997; Zenova *et al.*, 1995). Soil microalgae are responsible for its formation and stability (Metting, 1981). Soil fertility is improved due to organic matter produced by these micro-organisms. The polysaccharides produced by some soil algae increase soil porosity, aggregation, and water-holding capacity (Choudhary *et al.,2007*). Algae adds nitrogen to soil through biological nitrogen fixation (Goyal, 1997). Zancan *et.al*, (2006) studied algal diversity of various agro-ecosystems such as cultivated corn (*Zea mays* L.) field, a vineyard, a pasture and an abandoned field and found several algal species inhabiting therein. Present study was undertaken to find out and identify soil algal flora and to study physico-chemical parameters of Groundnut and Soybean fields near Nagpur city.

Material and methods

The soil samples were collected from Groundnut and Soybean field situated at Kalmeshwar, near Nagpur city. Algal samples growing on moist soil surface were collected in sterilized collection bottles and samples were brought to the laboratory for observation and identification. Different algal species were observed under microscope and identified following relevant literature (Prescott, 1952; Desikachary, 1959; Sarode and Kamat, 1984) and preserved in 4.5% formalin for further study.

Result and discussion

In all 115 species, belonging to 46 genera of algae were enumerated from these two fields. Highest number of species belonging to Cyanophyceae (86) were observed, followed by Chlorophyceae (13), Bacillariophyceae (12), Euglenophyceae (3) and Xanthophyceae (1). Highest number of species belonged to the genus *Oscillatoria* (14), Phormidium (7), Nostoc (7), Anabaena (7), Lyngbya (6), Chroococcus (5), Scytonema (4), Calothrix (4) were pointed out. The results are presented in Tables 1-4.

Species like *Oscillatoria curviceps*, *Phormidium angustissimum*, *Symploca muralis*, *Nostoc commune*, *N.muscorum*, *Anabaena variabilis*, *Aulosira fertilissima*, *Calothrix marchica*, *Chlorococcum humicolo*, *Chlorella vulgaris* and *Navicula anceps*

var.linearis were observed from both fields.

In Groundnut fields 59 species were observed, among them 46 were from Cyanophyceae, 6 from Chlorophyceae, 5 from Bacillariophyceae and one each from Xanthophyceae and Euglenophyceae.

In Soybean fields 69 species were identified belonging to Cyanopheceae (48), Chlorophyceae (10), Euglenophyceae (2) and Bacillariophyceae (9). Not a single species from Xanthophyceae was reported from Soybean field.

The physico-chemical characters of the soil samples collected from both fields of Kalmeshwar has been presented in Tables 1 and 2. The nature of soil algal communities depends on soil properties, climatic conditions .nd vegetation type (Quesada, et al., 1995, 1998).

During rainy season (June to September) soil surface at some places showed dark green to dark brown patches. Dark coloured soil crusts were dominated by filamentous blue green algae, wherein maximum cyanophyceae members were observed (Tables 3 and 4). Among them *Oscillatoria tenuis* and *Scytonema hofmanni* were dominant (Deb, *et.al.* 2013).

Soil pH is an important factor in determining composition of algal communities. Cyanobacteria are unable to survive in acidic conditions (Brock, 1973), while abundant and diverse green algae have been recorded in cid soils (Lukes˘ova´ and Hoffmann, 1995). However, during present study, neutral conditions supported growth of algal communities from all taxonomic groups. It is believed that, Cyanophycean algae represent main component of terrestrial micro-algal vegetation in tropical regions, whereas Chlorophyceae are the dominant forms in emperate regions (Fritsch, 1907; John, 1988). Furthermore, algal cover and species richness s positively and significantly ($p < 0.01$) orrelated with soil pH, amounts of silt and lay, concentrations of HCO_3. Cl, SO_4, Mg, soil rganic carbon and N content (Li, *et. al.*2003)

During present study only thirteen hlorophycean species were recorded. ıkesova and Hoffmann (1995), recorded abundant and diverse green algae in acidic soils, while Lund (1945) reported that diatoms are absent in acidic soils. During present study, as many as, 12 Bacillariophycean species were observed.

It can thus be concluded that many algal species constitute soil flora, and the algal forms present in that flora depends on several factors like location, weather and physico-chemical characters of the soil. The soils of Maharashtra are slightly alkaline, and therefore exhibit different type of algal vegetation.

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Table 1.Physical Analysis of soil from Groundnut and Soybean fields

Sr.	Physical parameter		Groundnut field	Soybean field
1	Mechanical composition	Coarse sand%	15.10	17.70
2		Fine sand%	16.58	12.47
3		Silt %	22.50	25.00
4		Clay %	36.50	36.50
5	Air Dry Moisture		8.69	8.50
6	Max.Water Holding Capacity %		21.72	19.93
7	Apparent Density		1.56	1.55
8	Absolute Specific Gravity		1.93	1.85
9	Pore Space %		36.82	32.61
10	Volume Expansion%		13.71	13.73

Table 2.Chemical composition of soil from Groundnut and Soybean fields

Sr.no.	Chemical parameter	Groundnut field	Soybean field
1	Soil pH	8.3	8.4
2	CaCO3	5.25	7.25
3	EC	0.14	0.14
4	Organic matter	0.620	0.717
5	Total Carbon%	0.36	0.41
6	Total Nitrogen%	0.036	0.041
7	P2O5 Kg/ha	25.0	46.4
8	K2O Kg/ha	276.0	308.0
9	Exchangeable Na per 100gm	1.629	1.656
10	Ca meq	30	23.75
11	Mg meq	3.75	6.50

Table.3 :Summary of the total species of soil algae

Group	Groundnut field	Soybean field
Cyanophyceae	46(23)	48(21)
Chlorophyceae	6(5)	10(10)
Bacillariophyceae	5(4)	9(7)
Xanthophyceae	1(1)	-
Euglenophyceae	1(1)	2(2)
Total	59	69

(Values in parenthesis indicate number of genera)

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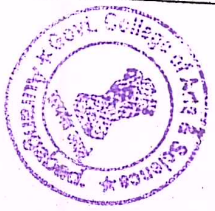
Table. 4. Distribution of Soil algae in Groundnut and soybean field

Sr. No.	Algal taxa	Groundnut field	Soybean field
Cyanophyceae			
1.	*Microcystis elabens*	+	
2.	*Chroococcus gomontii*	+	
3.	*Chroococcus indicus*		+
4	*Chroococcus minor*		+
5	*Chroococcus minutes*		+
6	*Chroococcus texas*		+
7	*Gloeocapsa decorticans*	+	
8	*Gloeocapsa pleurocapsoides*		+
9	*G. polydermatica*	+	
10	*Gloeothece membranacea*		+
11	*Gloeothece rupestris*	+	
12	*Aphanocapsa banaresensis*		+
13	*Aphanocapsa biformis*	+	
14	*Aphanothece nidulans*		+
15	*Aphanothece naegelii*	+	
16	*Synechococcus aeruginosus*	+	
17	*S. cedrorum*	+	
18	*Merismopedia glauca*	+	
19	*Chloroglea fritschii*	+	
20	*Chloroglea microcystiodes*		+
21	*Chroococcidiopsis mysorensis*		+
22	*Oscillatoria acuta*	+	
23	*O. amphibian*		+
24	*O.animalis*	+	
25	*O. amoena*	+	
26	*O. curviceps*	+	+
27	*O. geitleriana*		+
28	*O. jasorvensis*	+	
29	*O.limosa*		+
30	*O. princeps*		+
31	*O.salina*	+	
32	*O.schultzii*		+
33	*O.subbrevis*	+	
34	*O.subbrevis f.crassa*		+
35	*O.vizagapatensis*		+
36	*Phormidium africanum*		+
37	*Phormidium angustissimum*	+	+
38	*P.ambiguum*		+
39	*P. corium*		+
40	*P.bohneri*	+	
41	*P. papyraceum*	+	
42	*p.uncinatum*	+	
43	*Lyngbya aestuariivar.tenuis*		+
44	*L.allorgei*	+	
45	*L.ceylanica*		+
46	*L.digueti*		+
47	*L.martensiana*	+	
48	*L. palmarum*	+	
49	*Symploca muralis*	+	+
50	*Microcoleus acutissima*		+
51	*Microcoleus chthonoplastes*	+	
52	*Anabaenopsis circularis*	+	
53	*Cylindrospermum indicum*	+	
54	*Cylindrospermum licheniformis*		+
56	*C. muscicola var. longispora*		+
55	*Nostoc calcicola*	+	



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56	*C. muscicola var. longispora*		+
55	*Nostoc calcicola*	+	
57	*N.commune*	+	+
58	*N. ellipsosporum*	+	
59	*N. entophytum*		+
60	*N.linckia*		+
61	*N.muscorum*	+	+
62	*N.piscinale*		+
63	*N.punctiformis*		+
64	*Anabeana anomala*	+	
65	*A.doliolum*		+
66	*A.fertilissima*		+
67	*A. iyengarii var. tenuis*	+	
68	*A.oscillarioides var.angustus*		+
69	*A.variabilis*	+	+
70	*A.laxa*	+	
71	*Aulosira fertilissima*	+	+
72	*A. pseudoramosa*	+	
73	*Plectonema notatum*		+
74	*Plectonema hansgirgi*	+	
75	*Camptylonemopsis iyengarii*		+
76	*Scytonema fremyii*		+
77	*Scytonema javanicum*	+	
78	*S.ocellatum var. purpureum*		+
79	*S.schmidtii*	+	
80	*Microchaete calothrichoides*		+
81	*M.uberrima*		+
82	*Calothrix braunii*		+
83	*Calothrix epiphytica*	+	
84	*C.marchica*	+	+
85	*C. membranacea*	+	
86	*Westiellopsis prolifica*	+	

Chlorophyceae			
1	*Chlamydomonas globosa*		+
2	*C. mucicola*	+	
3	*Carteriaklebsii*		+
4	*Chlorococcum humicolo*	+	+
5	*C.vitiosum*	+	
6	*Chlorella vulgaris*	+	+
7	*Tetrardron muticum*		+
8	*Scenedesmus bijugatis*	+	+
9	*Protococus viridis*		+
10	*Oedogonium globosum*		+
11	*Spirogyra maxima*	+	
12	*S. prolifica*		+
13	*Cosmarium granatum*		+
Xanthophyceae			
1	*Vaucheria amphibian*	+	
Euglenophyceae			
1	*Euglena acus var. hyalina*		+
2	*E. gracilis*	+	
3	*Phacus caudatus*		+
Bacillariophyceae			
1	*Cyclotella operculata*	+	+
2	*Fragillaria brevistriata f.elongata*	+	
3	*Synedra affinis*		+
4	*Navicula anceps var.linearis*	+	+
5	*N.clavata*		+
6	*Nitzschia palea*	+	
7	*N.dissipata*	+	
8	*N. mutica*		+
9	*Hantzschia amphioxys*		+
10	*Gomphonema gracile*		+
11	*Nitzschia gracilis*		+
12	*N.intermedia*		+

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