

ALGAE IN DRY SOILS OF N.W.F.P., PAKISTAN*

GHAZALA ANJUM AND M.A.F. FARIDI

*Department of Botany,
University of Peshawar, Peshawar, Pakistan.*

Abstract

A total of 34 genera and 78 species of algae have been reported from dry lands of Peshawar, Kohat, Bannu and D.I. Khan districts upto a depth of 15 cm. This includes 18 genera and 51 species in Cyanophyceae, 13 genera and 24 species in Chlorophyceae and 3 genera with 3 species in Xanthophyceae. Algal number decreased with increasing depth. Five genera and 14 species were recorded as possible nitrogen-fixers.

Introduction

Soil algae survive in the subsoil darkness, retain vitality in long drought periods, colonize unfavourable substrates are pioneers in succession on denuded areas controlling soil erosion, serve as a storage of energy, fix nitrogen and live in symbiotic relationship with bacteria (Shields *et. al.*, 1957; Shtina, 1969; Ali *et. al.*, 1978; Anjum *et. al.*, 1982; Anjum & Faridi, 1982 a, b). Algae have been isolated from arid soils with low rain-fall. (Chantachat & Bold, 1962). Shahwar (1977) reported 15 genera and 19 species from arid fields of Peshawar. The present report describes the algal flora of dry lands from different parts of N.W.F.P., Pakistan.

Materials and Methods

Soils from dry lands were sampled at a depth of 2, 5, 10 and 15 cm depth from different localities of N.W.F.P. Five g of air dried soil sample was cultured in sterilized 125 Erlenmeyer flask containing 50 ml of sterilized nutrient solution. Media used were, 1N BBM and 3N BBM (Bold, 1942). Flasks were sealed and kept under 16 h photoperiod at room temperature (25-30°C). After 2 weeks algal growth, the plants were transferred to another flask of the same capacity with 50 ml nutrient solution. Plants were identified with the help of available literature (Prescott, 1951; Desikachary, 1959; Smith & Bold, 1966; Archibald & Bold, 1970).

Results and Discussion

A total of 34 genera and 78 species were recorded upto a depth of 15 cm from various parts of N.W.F.P. Cyanophyceae with 18 genera and 51 species was a well represented group followed by Chlorophyceae with 13 genera and 24 species, while Xanthophyceae having 3 genera and 3 species was the least represented group (Table 1).

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Table 1: Algae recorded from dry soils of N.W.F.P.

S.No.	Species	Soil depth (cm)			
		2	5	10	15
1	CYANOPHYCAE				
1	<i>Anabaena aphanizomenoides</i> Forti	+	-	-	-
2	<i>A. fertilissima</i> Rao, C.B.	-	+	-	-
3	<i>A. orientalis</i> Dixit	+	-	-	-
4	<i>A. oryzae</i> Fritsch	+	-	-	-
5	<i>A. sphaerica</i> Born. et Flah.	-	-	-	-
6	<i>A. spiroides</i> Kleb.	+	-	-	-
7	<i>A. variabilis</i> Kg. ex Born. et Flah.	-	+	-	-
8	<i>Aphanotheca gelatinosa</i> (Henn.) Lemm.	-	-	-	+
9	<i>A. microscopica</i> Naeg.	-	+	-	-
10	<i>A. sexicola</i> Naeg.	-	+	-	-
11	<i>Aulosira aenigmatica</i> Fremy	+	+	-	-
12	<i>Chlorogloea microcystoides</i> Geitler	-	-	-	+
13	<i>Chroococcus cohaerens</i> (Breb.) Naeg.	-	-	-	+
14	<i>C. dispersus</i> (Keissler) Lemm.	-	-	-	+
15	<i>C. limneticus</i> var. <i>subsalsus</i> Lemm.	-	-	-	-
16	<i>C. minor</i> (Kg.) Naeg.	-	-	-	+
17	<i>Gloeocapsa crepidinum</i>	-	-	+	-
18	<i>Hydrocoleum oligotrichum</i> A. Br.	-	-	-	-
19	<i>Lyngbya polysiphoniae</i> Fremy	+	-	-	-
20	<i>Merismopedia punctata</i> Meyen	-	-	-	+
21	<i>Microcoleus lacustris</i> (Rabenh.) Farlow	-	-	-	-
22	<i>Microcystis aeruginosa</i> Kg.	+	+	+	-
23	<i>M. flos-aquae</i> (Wittr.) Kichner	-	+	-	-
24	<i>M. pulverea</i> (Wood) Forti	-	-	-	-
25	<i>Nostoc paludosum</i> Kg. ex Born. et Flah.	+	-	-	-
26	<i>N. punctiforme</i> Kg. (Hariot)	+	-	+	-
27	<i>N. sphaericum</i> Vaucher ex Born. et Flah.	-	-	-	-
28	<i>N. spongiaeforme</i> Ag. ex Born. et Flah.	-	-	+	-
29	<i>Oscillatoria agardhii</i> Gomont	-	-	-	-
30	<i>O. animalis</i> Ag.	-	-	+	-
31	<i>O. foreau</i> Fremy	-	-	-	-
32	<i>Oscillatoria formosa</i> Bory	-	-	+	-
33	<i>O. lutea</i> Ag.	+	-	-	-
34	<i>O. rubescens</i> DC.	+	-	-	-
35	<i>O. subbrevis</i> Schmidle	-	-	+	-

36	<i>O. terebriformis</i> Ag.	+	+	+	-
37	<i>Phormidium abronema</i> Skuja	-	-	-	+
38	<i>P. bohneri</i> Schmidle	-	+	-	-
39	<i>P. corium</i> (Ag.) Gomont	+	-	-	-
40	<i>P. foveolarum</i> (Mont.) Gomont	+	-	-	-
41	<i>P. fragile</i> (Menegh.) Gomont	-	-	+	-
42	<i>P. jadinianum</i> Gomont	-	-	-	+
43	<i>P. jenkelianum</i> Schmidle	+	+	-	-
44	<i>P. papyraceum</i> (Ag.) Gomont	-	+	-	-
45	<i>P. purpurascens</i> (Kg.) Gomont	+	-	-	-
46	<i>P. tenue</i> (Menegh.) Gomont	+	+	-	-
47	<i>Plectonema notatum</i> Schmidle	-	-	-	+
48	<i>Rivularia dura</i> Roth ex Born. et Flah.	+	-	-	-
49	<i>Scytonema javanicum</i> (Kg.) Born. et Flah	-	+	-	-
50	<i>S. millei</i> Born. ex Born. et Flah.	-	-	-	-
51	<i>Spirulina massartii</i> (Kuff.) Geitler	-	+	-	-

CHLOROPHYCEAE

52	<i>Bracteacoccus medinucleatus</i> Bisch off & Bold	+	-	-	-
53	<i>B. minor</i> (Chodat) Petrova	-	-	+	-
54	<i>Chlamydomonas globosa</i> Snow	-	-	-	-
55	<i>C. pseudopetryi</i> Pascher	-	-	-	+
56	<i>C. snowii</i> Printz	+	-	-	-
57	<i>Chlorococcum acidum</i> Archibald & Bold	-	-	-	-
58	<i>C. echinozygotum</i> Starr	-	-	-	+
59	<i>C. lacustre</i> Archibald & Bold	+	-	-	-
60	<i>C. microstigmatum</i> Archibald & Bold	-	-	+	-
61	<i>C. minutum</i> Starr	-	+	-	-
62	<i>C. oviforme</i> Archibald & Bold	-	-	+	-
63	<i>C. referingens</i> Archibald & Bold	+	+	-	-
64	<i>Eremosphaera eremosphaeria</i> Smith & Bold	+	-	-	-
65	<i>E. viridis</i> De Bary	-	+	-	-
66	<i>Gloeocystis ampla</i> (Kg.) Lagerh.	+	+	+	+
67	<i>Oocystis parva</i> West & West	-	-	+	-
68	<i>Palmellococcus protothecoides</i> Chodat	-	-	-	+
69	<i>Planktosphaeria texensis</i> Bisch off & Bold	+	-	-	-
70	<i>Protococcus viridis</i> Ag.	+	+	-	-
71	<i>Spondylosium pygmaeum</i> (Cooke) West	-	-	-	-
72	<i>Spongiochloris spongiosa</i> Starr	-	-	+	-

73	<i>Ulothrix idiospora</i> G.S. West	—	+	—	—
74	<i>U. variabilis</i> Kg.	+	—	—	—
XANTHOPHYCEAE					
75	<i>Gloeobotrys limneticus</i> (G.M. Smith) Pascher	+	—	—	—
76	<i>Heterococcus longicellularis</i> Pitschmann	+	+	—	—
77	<i>Monallantus brevicylindrus</i> Pascher	—	+	—	—
Total		30	23	16	14

+ = Present — = Absent

Among Cyanophyceae, *Phormidium* (10 spp.), followed by *Oscillatoria* (8 spp.) and *Anabaena* (7 spp.) were common genera, while *Chroococcus* (4 spp.), *Nostoc* (4 spp.), *Aphanothece* (3 spp.), and *Microcystis* (3 spp.) were intermediate in position. The least represented genera were *Scytonema* (2 spp.), *Aulosira* (1 sp.), *Hydrocoleum* (1 sp.), *Lyngbya* (1 sp.), *Merismopedia* (1 sp.), *Microcoleus* (1 sp.), *Plectonema* (1 sp.), *Rivularia* (1 sp.) and *Spirulina* (1 sp.). Among Chlorophyceae, *Chlorococcum* (7 spp.) was the most frequent genus followed by *Chlamydomonas* (3 spp.), *Bracteacoccus* (2 spp.), *Eremosphaera* (2 spp.) and *Ulothrix* (2 spp.). *Chlorosarcinopsis* (1 sp.), *Gloeocystis* (1 sp.), *Oocystis* (1 sp.), *Planktosphaeria* (1 sp.), *Palmellococcus* (1 sp.), and *Spongiochloris* (1 sp.) were recorded as least represented genera. At increasing depth, the number and kind of algae gradually decreased (Table 1). From 30 species observed at 2 cm depth 23 species were recorded at 5 cm and 14 species at 15 cm depth. Durrell (1959) also observed a gradual decrease in the number of algae with increasing soil depth.

Species recorded as possible nitrogen-fixers were, *Anabaena aphanizomenoides*, *A. fertilissima*, *A. orientalis*, *A. oryzae*, *A. sphaerica*, *A. spiroides*, *A. variabilis*, *Aulosira aenigmatica*, *Nostoc paludosum*, *N. punctiforme*, *N. sphaericum*, *N. spongiaeforme*, *Rivularia dura*, *Scytonema javanicum* and *S. millei*.

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