Research Article

Fresh water Algae of district Peshawar, Khyber Pakhtunkhwa, Pakistan

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Abstract

Algae are simplest and chlorophyll bearing organism and not differentiated into true leaves, stems and roots. Algae habitat is fresh water. Algae have pivotal role on earth. They are primary producers and form strong food chains mostly in aquatic environment. It constitute important group, so it was desired to work out the freshwater algae of District Peshawar. In the research area total of 13 genera with 51 species of algae found in District Peshawar which belong to Chlorophyta (64%), Cyanophyta (18%), Xanthophyta (2%), Charophyta 6 % and Chrysophyta (10%) were identified and properly key referenced. The frequent genus in term of species was Spirogyra with 11 species (22%), Oscillatoria with 9 species (18%), Chara, Zygnema and Nitzschia have 3 species each 6 %, Cladophora with 7 species (14%), Closterium with 5 specie (10%), Ulotehrix with 4 species (8 %), Rhizoclonium with 2 species (4%), Vachoria, Mougeotia, Ophiocytium and Dinobryon have 1 spp. (2%). The present study will help to know the ecological distribution of fresh water algae in Peshawar.

Keywords: Chlorophyceae; Charophyceae; Cyanophyceae; Chrysophyceae; Xanthophyceae

Introduction

Peshawar surrounded by (Charsadda, Nowshera, Mardan, Swabi and parts of Malakand, Mohamand and Khyber Agencies). Peshawar about (8800 Km). It lies between (710 15/ and 720 47/) East longitudes and (330 40/) and (340 31/) North latitudes. A lot of algae belong to fresh water inhibited in aquatic form and form a diverse group mostly belong to Cyanobacteria form a thick and heavy blooms. The toxic substances which are produced by them may not contain so high concentrations likely to become harmful to human being and livestock. But even in

some cases 'fresh water or brackish water' having one or more spp. of algae. These type of algae form a huge group of algae and they are grouped according to their size and ranged (one micrometer to several. Algae form a huge food chain mostly in lakes. In fresh water algae produced toxin substances which are harmful for aquatic organisms [1]. Peshawar is a 'semiarid climate' with extreme summer and winter seasons. Winters from (November –March). The mean 'maximum temperature in summer is over 40 °C' and the mean 'minimum summer temperature is 25 °C'. The mean 'minimum temperature during winter is 4°C'

and ‘maximum may be upto 18 °C’. Many worker have investigated and extracted algae from fresh water bodies and aquatic area of Pakistan to know the ecological distribution [2-4]. Algae are very important photosynthetic organisms on this earth. Aquatic web foods are formed due to algae which help and support animals. Pakistani phycologist find out fresh water algae from different area of Pakistan [3, 5-7]. The present report is further contribution to the algal flora of Peshawar that will help others to know the ecological distribution of different flora of fresh water algae

Materials and methods

The fresh algae samples were collected from District Peshawar. These samples were collected from different areas of Peshawar five sites were selected for collection of samples. These were Gulbahar, Ring Road Jamel Chock, Pando Payan, Zandai Camp and Hazara Khwani. The samples were collected in different duration of the year from February 2014 to January 2015. These samples were collected from running water, shallow water and standing water. These samples were also collected from the bottom of the stream and also from aquatic plants. These samples were collected with the help of knife and stick in polythene bag. The samples were brought to the laboratory of Bacha Khan University Charsdda in polythene bags. The samples were preserved in 4% formalin in the glass bottles. Slides were prepared and checked with the help of light microscope by different magnification. And Identified [8, 9].

Results and discussion

In present study 51 species belonging to 13 genera and 5 classes were identified from different fresh water habitats of Gulbahar areas. Major class were found to be Chlorophyceae (33 spp) and Class Charophyceae (3 spp) previously this classes

reported by [10] who reported 33 species of Chlorophyta from Peshawar Valley. 41 species of Chlorophyta were listed from Peshawar Valley [11]. The result was strongly supported by [12] studied Forty-two from different fresh water areas of ‘Gujranwala, Jhang, Kasur, Lahore, Sheikhpura, Sialkot and Attock Districts of the Punjab Province and Swat’ of KPK. Our results agree with the findings of [13-16] from India and [11, 17-19]. Class *Cyanophyceae* (9 spp) previously this class investigated by [20]. 30 species of Cyanophyta and our results correlated with the statement that Cyanophyta was the pre dominant in polluted areas. Class *Chrsophyceae* (3 spp) previously this class reported by [21] reported Chrysophyta from fresh water riverian ponds. Same investigation related with our results. Class *Xanthophyceae* (1 spp) previously this class reported [1, 22].

A. Class Cyanophyceae

Key to Species: *Oscillatoria*

1. Apical cell with a flattened calyptras cell 2.5-5 μ in diameter *O. prolifica*
2. Cells with distinctly granular cross walls 3
3. Cells with rows of granules at the cross walls *O. tenuis*
4. Trichomes which are 7.4-10 μ in diameter *O. tenuis* var *natan*
5. Proportions 5.5-6 μ in diameter *O. tenuis* var. *tergestina*.
6. Cells almost colorless, with large, conspicuous alveoli or vacuoles *O. Bornetii*
7. Trichomes hooked at the apex *O. curviceps*
8. Trichomes bent or hooked at the apex cells 7-8 μ in diameter forming a plant mass *O. anguina*
9. Cells not granular at the cross walls *O. subbrevis*
10. Constricted at the cross walls *O. chalybea*.

Figure 1, 2. *Oscillatoria prolifica*, Figure 3. *Oscillatoria tenuis*, Figure 4, *Oscillatoria tenuis* var *natan*, Figure 5. *Oscillatoria tenuis* var *targestina*, Figure 6. *Oscillatoria broneti*, Figure 7. *Oscillatoria curviceps*, Figure 8. *Oscillatoria anguina*, Figure 9. *Oscillatoria subbrevis*, Figure 10. *Oscillatoria chalybea*

B. Class Chlorophyceae

Key to species: *Spirogyra*

11 & 12. Zygosporangia average larger, 38-62 in diameter spore wall irregularly reticulate filament of rather stout cell 40-59 μ in diameter *S. rhizobrachialis*

13. Vegetative cells 23-25 μ in diameter *S. aequinoctialis*

14. Vegetative cells 40 to 44 in diameter up to 240 long Chloroplast 3, making 1-2 turns spores 32 to in diameter *S. fuelleborni*

15. Ovate median spore wall pitted *S. crassa*

16. Spore ellipsoid, 35-44 μ in diameter *S. daedaleoides*

17. Vegetative cells 48-62 μ in diameter *S. condensata*

18. Fertile cells inflated *S. fluviatilis*

19. Vegetative cells 40-50 μ in diameter *S. circumlineata*

20. Median spore wall wrinkled or granular *S. pseudofloridana*

21. 19-30 μ in diameter; fertile cells slightly enlarged *S. Weberi*.

22. Vegetative cells 48-62 μ in diameter *S. circuminata*

23 & 24. Fertile cells cylindric *S. novae-angliae*

Figure 11, 12. *Spirogyra rhizobrachialis*, *Spirogyra condensata*, Figure 13. *Spirogyra aequinoctialis*, Figure 14. *Spirogyra fuelleborni*, Figure 15. *Spirogyra crassa*, Figure 16. *Spirogyra daedaleoides*, Figure 17. *Spirogyra condensata*, Figure 18, 19. *Spirogyra fluviatilis*, Figure 20. *Spirogyra pseudofloridana*, Figure 21. *Spirogyra weberii*, Figure 22. *Spirogyra circuminata*, Figure 23, 24. *Spirogyra novae-angliae*

C. Class Charophyceae**Key to Species: *Chara***

25. Longer than the mature fruit *C. Schweinitzii*

26 & 27. Lateral cortical cell in pairs and more prominent than the primary cell; posterior bracts much shorter than the Oogonium *C. vulgaris*

28. Cortication *C. canescens*

Key to Species: *Cladophora*

29. Vegetative cells 60-120 μ in diameter *C. fracta*

30. Vegetative cells 25-60 μ in diameter *C. fracta*, var *lacutris*

31. Vegetative cells 45-55 μ in diameter *C. oligoclona*

32. Filaments attached vegetative cells 75-100 μ in diameter without bristles like outgrowth *C. glomerata*

33 & 34. Vegetative cells 40-75 μ in diameter *C. crispate*

35. Vegetative cells 75-120 μ in diameter *C. insignis*

36. Arising from below the apex of the cell *C. profunda*

Figure 25. *Chara schweintzii*, Figure 26 & 27. *Chara vulgaris*, Figure 28. *Chara canescens*, Figure. 29. *Cladophora fracta*, Figure. 30. *Cladophora fracta* var *lacutris*, Figure 31. *Cladophora oligoclona*, Figure 32. *Cladophora glomerata*, Figure 33 & 34. *Cladophora crispate*, Figure 35. *Cladophora insignis*, Figure 36. *Cladophora profunda*

D. Class Xanthophyceae**Key to Species: *Vaucheria***

37. Oogonia 60-103 μ in diameter, 85-211 μ long without pedicle from the branch, arising near the base of the antheridia *V. terrestris*

Key to species: *Mougeotia*

38. Vegetative cell 25-33 μ in diameter *M. robusta*

Key to species: *Zygonema*

39. Vegetative cell 17-21 μ in diameter, zoospores in the tube formed *Zygonema synadelphum*

40. Filament form light green vegetative cells 30-40 μ diameter up to 80 μ long median spore wall *Zygonema pectinatum*

41. Vegetative cell 18-20 μ in diameter up to 100 μ long, zoospores in tube, median spore wall brown *Zygonema decussate*

Key to Species: *Ulothrix*

42. Filaments 20 μ or more in diameter, wall thick *U. zonata*

43. Cells 13-16 μ in diameter, 1-2 times longer than wide *U. aequalis*

44. Cells up to 20 μ in diameter, shorter than wide *U. tenuissima*

45. Cells larger, 6-9 μ in diameter *U. variabilis*

Key to Species: Rhizoclonium

46. Filament, freely bunching, crisp, cylindrical, inflated cells, 60-64 μ in diameter and 7 times their diameter in length *Rhizoclonium hookeri*

47. Filament coarse, cell cylindrical but uneven lateral walls and 1.5-2 μ thick, and up to 80 μ long *Rhizoclonium fontanum*

E. Class Chrsophyceae

Key to Species: Dinobryon

48. Swellings at the base of the anterior portion *D. sertularia*

Key to Species: Ophiocytum

49 & 50. Cell smallest, (2.7)-5-10 μ in diameter; spines shortest and sharp *O. capitatum*

Key to Species: Nitzschia

51. Valves 5-7 μ broad *N. palea*

52. Valves linear, 70-180 μ long *N. linearis*

53. Valves margin undulate *Nitzschia sinuata* var. *tabellaria*

Key to Species: Closterium

1. Inner margin straight or straightly convex 1

54. Apices acutely rounded *C. lanceolatum*

55. Apices rounded- truncate *C. acersum*

56. Cells gradually covered from middle to pole *C. acutum*

57. Striation not composed of punctae *C. turgidum*

58. Chromatophore with 1-2 pyrenoids *C. venus*

Figure 37. *Vaucheria terrestris*, Figure 38. *Mougeotia robusta*, Figure 39. *Zygonema synadelphum*, Figure 40. *Zygonema pectinatum*, Figure 41. *Zygnema decussate*, Figure 42. *Ulothrix zonata*, Figure 43. *Ulothrix aequalis*, Figure 44. *Ulothrix tenuissima*, Figure 45. *Ulothrix variabilis*, Figure 46. *Rhizoclonium hookeri*, Figure 47. *Rhizoclonium fontanum*, Figure 48. *Dinobryon sertularia*, Figure 49 & 50. *Ophiocytum capitatum*, Figure 51. *Nitzschia palea* Figure 52. *Nitzschia linearis* Figure 53. *Nitzschia sinuata* var. *tabellaria*

Figure 54. *Closterium lanceolatum*,

Figure 55. *Closterium acerosum*,

Figure 56. *Closterium acutum*

Figure 57. *Closterium turgidum*

Figure 58. *Closterium venus*

Conclusion

Algae in fresh waters have numerous environmental functions and are based upon the recycling of nutrients. Urbanization has led to the pollution of surface water bodies resulting in decline/extinction of some species. On the other hand, some species have increased enormously making water unfit for drinking and recreation. This study only comprises the taxonomic position of algae. It is proposed that a combined i.e. taxonomical and limnological study should be done to understand the biodiversity of alga in fresh water bodies of District Peshawar, Khyber Pakhtunkhwa, Pakistan

Authors' contribution

Conceived and designed the experiments: T Yaseen, M Ali & FM Sarim, Performed the experiments: M Ali, Analyzed the data: M Ali, FM Sarim & T Yaseen Contributed reagents/materials/analysis tools: F Rahim, S Wali & I Ahmad, Wrote the paper: T Yaseen & M Ali.

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