



RESEARCH PAPER

OPEN ACCESS

Taxonomic studies of family Osscillatoriaceae from Tehsil Landikotal, District Khyber, Khyber Pakhtunkhwa, Pakistan

Haroon Khan¹, Muhammad Irfan^{*2, 3}, Nabeela², Mohammad Kamil², Zakir Ullah², Fazal Wahab², Rashid Khan¹, Syed Inziam Ulhaq⁴, Muhammad Fiaz¹

¹Department of Botany, Hazara University Mansehra, Pakistan

²Department of Botany, Abdulwali Khan University, Mardan, Pakistan

³Department of Botany, University of Swabi- Swabi, Pakistan

⁴Department of Botany, Islamia College, University, Peshawar, Pakistan

Article published December 15, 2018

Key words: Taxonomic, Landikotal, Khyber, Khyber Pakhtunkhwa, Pakistan.

Abstract

Landikotal is an area mostly consists of hilly tracks, mountains and narrow strips of valleys. It is the meeting place of high ranges of mountain such as the Koh-e-Safaid, and outcome of the mighty Hindukush Mountains. The taxonomic studies of family Osscillatoriaceae from tehsil Landikotal, District Khyber, Khyber Pakhtunkhwa, Pakistan was carried out to find out the diversity of family Osscillatoriaceae which contains 2 Genera and 9 Species that includes *Oscillatoria terebriformis*, *Oscillatoria tenuis*, *Oscillatoria splendid*, *Oscillatoria Formosa*, *Oscillatoria prolifica*, *Oscillatoria amoena*, *Oscillatoria saneta*, *Lyngbya kashyapii* and *lyngbya martensian*.

*Corresponding Author: Muhammad Irfan ✉ Mirfan310@yahoo.com

Introduction

District Khyber is on the way across the mountains to the city of Peshawar and consists of three major tehsils including Barra, Jamrud and Landi kotal. Landikotal tehsil consist four major territories viz. Tirah, Khyber, LandiKotal and Shalmans while the Shalmans include Loy Shalman and Kam Shalman. Tehsil LandiKotal has a barren and rocky mountainous landscape. The area is mostly consists of hilly tracks, mountains and narrow strips of valleys. It is the meeting place of high ranges of mountain viz. Koh-e-Safaid and Hindukush Mountains. Amongst these mountains ranges natural water stream are flowing throughout the year. In Pakistan few studies have been conducted in the field of algae viz. studies on fresh water cyanophytes of Karachi, Sindh, Pakistan (Farzana & Niazmuddin, 1979) and other areas of Sindh Province (Shameel & Butt, 1984) and Khyber Pakhtunkhwa Province (Leghari & Arbani, 1984). But little attention has been paid on the study of blue green algae of the Punjab Province and Azad Kashmir. Ghose was the first phycologist to start a systematic study of blue green algae from this area and reported fifty nine species including nine new species and three new varieties (Leghari *et al.*, 2000). Randhawa mainly worked on Chlorophycota and added twenty-three species of blue-green algae to the list of this region (Faridi, 1971). Twenty five species of blue green algae growing in the culture of rice field soils of Kashmir were isolated by (Khan,1957). About ninety five species were reported by Ali and Sandhu in which seventy eight species were recorded for the first time from this area (Ali *et al.*, 1972). Later (Masud-ul-Hasan, 1978) reported some freshwater algae including Cyanophycota which were collected from ponds around Lahore and study of pinnate diatoms from tehsil Landilotal, district Khyber, Khyber Pakhtunkhwa Pakistan were previously reported by (Irfan *et al.*, 2018).

It appeared that vast areas of the north eastern regions of Pakistan were however not studied.

Therefore the current study was undertaken to make a detailed survey of these algae from these areas.

Materials and method

The algal species were collected from fresh water streams of six major locations from tehsil landikotal, district Khyber, Khyber Pakhtunkhwa, Pakistan. The collected specimens were kept in glass bottles and preserved by adding 3% formalin solution. The preserved specimens were then examined under microscope and identified with the help literature (Ghose, 1919).

Results and discussion

A total of 9 species having 2 genera belongs to family Osscillatoriaceae were reported and identified. The taxonomic descriptions of all the species is given below.

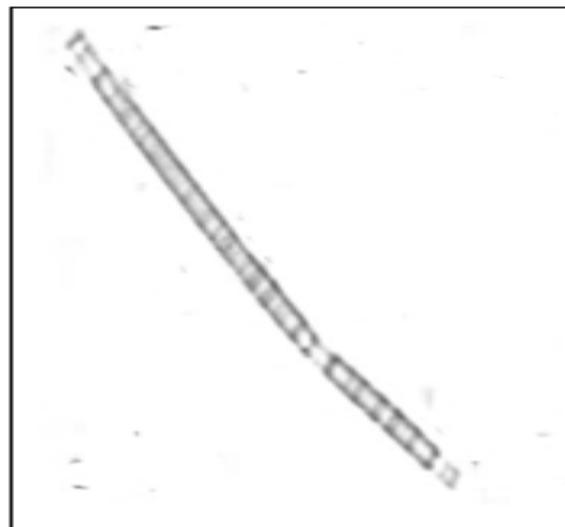


Fig. 1. *Oscillatoria Amoena*.

Key to family

- Filaments unbranched cylindric, sheath generally hyaline usually
- Trichomes*Osscillatoriaceae*

Family Osscillatoriaceae

Taxonomic description

Filaments un branched, cylindrical, straight, curved or twisted, solitary or densely inter wined into floccose masses or epiphytic; sheath firm, generally hyaline but sometimes brownish or with age, often

yellowish lamellose usually extending beyond the trichomes, trichomes solitary sometime appearing otherwise when hormogonia form within tenacious sheath, obtuse or sometime apically attenuate, sometime constricted at cross-wall, cell contents, homogenous, granulose and variously colored.



Fig. 2. *Oscillatoria Saneta*.

Key to genera

Plant irregularly spiral or straight.....*Oscillatoria*
 Trichomes generally single within sheath.....
 Sheath hyaline or yellow brown..... *Lyngbya*

Oscillatoria

Trichomes un branched, cylindrical, without evident sheath or amorphous jelly, solitary or in floccose masses, straight or variously curved and contorted, sometime apically narrowed, terminal cell rounded or calyptrate, cell contents homogenous or granular, color variable; plants often exhibiting oscillating or gliding movement; end cells often obscure in fragment material.

Key to species

End cell capitates.....*Oscillatoria amoena*
 Diameter of cell 10-20 μ*Oscillatoria saneta*

Trichome crooked or spirally twisted at the apex cross wall granular.....*Oscillatoria terebriformis*
 End cell not globular.....*Oscillatoria prolifica*
 End cell almost globular.....*Oscillatoria splendid*
 Cell diameter 2.3-4.3 μ or 4-10 μ.....*Oscillatoria Tenuis*
 End cell conical, end cell capitates, end cell not capitates.....*Oscillatoria Formosa*

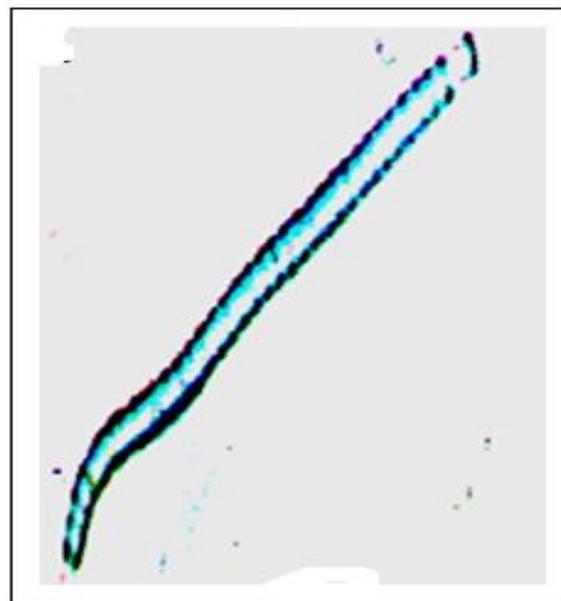


Fig. 3. *Oscillatoria Terebriformis*.

Oscillatoria amoena (kuetzing) Gomont 1892 Fig. 1
 Cell 2.5-5.0 x 2.7 - 4.3 μ granulate in cross wall; trichome vertical, a little constricted at cross wall steadily attenuated at the apex with or without capitates, broadly outwardly -rounded thick calyptras end at cell, spread or form blue green masses.

Distribution

North America, Europe and Asia/

Oscillatoria saneta (kuetzing) Gomant 1892 Fig 2
 Cell 10-20 x2.5-6.0 μ granulate at cross wall with half -rounded, slightly capitate end cell with thick outer membrane, trichomes straight or twisted, slightly constricted at cross-walls, slightly narrowed apically, deep blue-green to dirty olive-green; masses steel-blue, shiny thin, slimy.

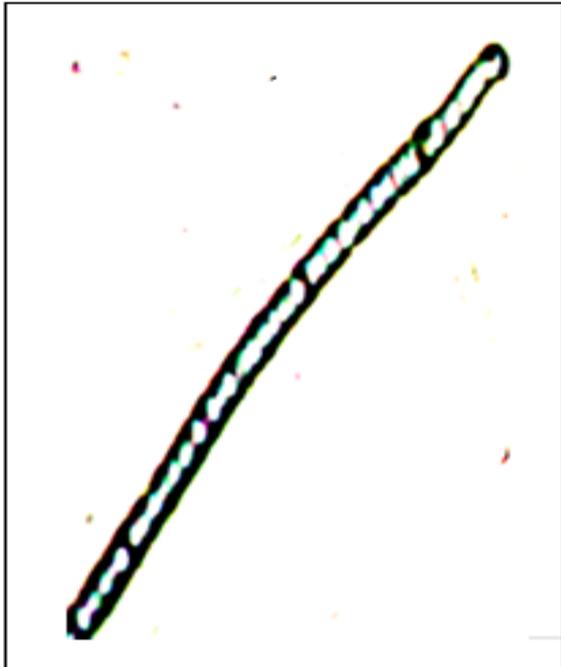


Fig. 4. *Oscillatoria Prolifica*.



Fig. 5. *Oscillatoria Tenuis*.

Distribution

North America, Europe and Asia

Oscillatoria terebriformis C.A.Agardh 1892 Fig. Trichome forming a plant mass, dark steel-blue in color; spirally twisted, especially at the apex, slightly tapering in the apical region.

Apical cell round or pointed, not capitates, and without a calyptras. Cell 4-6 μ in diameter, 2.5-6 long; not constricted at cross wall.

Distribution

Europe, North America, Asia and Australia

Oscillatoria prolifica (Greville) Gomont 1892 Fig. 4 Cell 2-5 x 4-6 μ with pseudo vacuoles ,cross wall granulate; trichomes bent-straight ,not tapered at or near cross walls gradually become narrow at apex ,spread or make red to purple-violet asymmetrical masses; capitates, calyptras present or absent.

Distribution

Europe, North America, Asia and Australia

Oscillatoria tenuis

C.A Agardh 1892 Fig. 5.

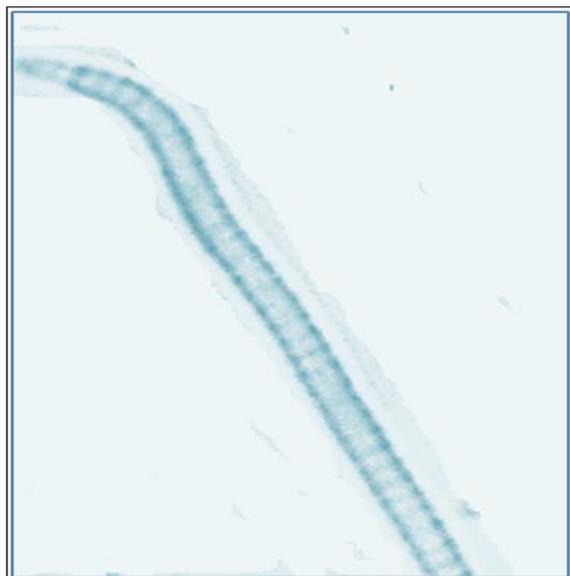


Fig. 6. *Oscillatoria splendida*.

Cell 4-10 x 2.5-5.0 μ with more or less protoplasm granulose, frequently crush at cross wall; trichome are blue or bright green in colored, wall are straight or slightly constricted, gradually curved at the apex , end cell convex and with thick outer membrane, hemispherical, forming thin blue green, oily masses, attached or free floating.

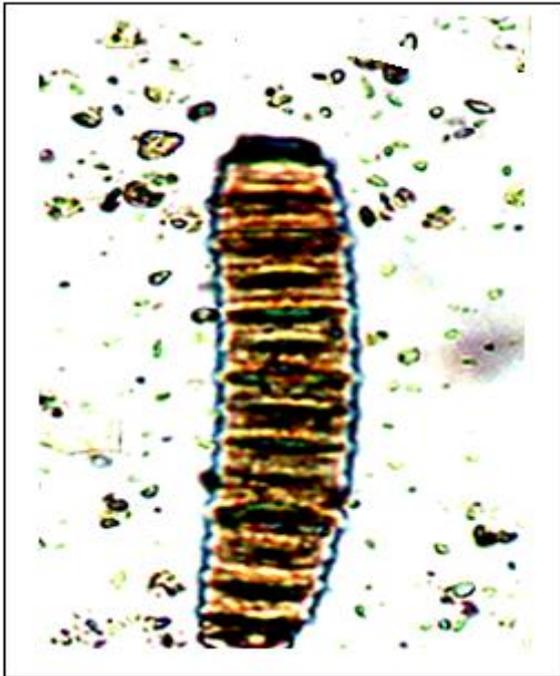


Fig. 7. *Oscillatoria formosa*.

Distribution

Europe, North America, South America, Africa and Asia.

Oscillatoria splendid

Greville.1892-1893 Fig. 6.

Cell 2-3 x 3.9 μ homogenous, blue green; trichome straight or bent, not constricted but somewhat granulate at cross wall gradually tapering at apex (often bent or twisted) and cell capitates, nearly rounded , forming dark blue green thin masses, or scattered.

Distribution

North America, Asia

Oscillatoria formosa Bory 1892 Fig. 7

Cell 4-6 x 2.5 - 5.7 μ sometime slightly granulate near cross wall clear blue- green; trichome are slightly striate or tapered at cross walls, apically tapering bluntly rounded end of cell or it may neither capitates nor calyprate with dark blue to green masses.

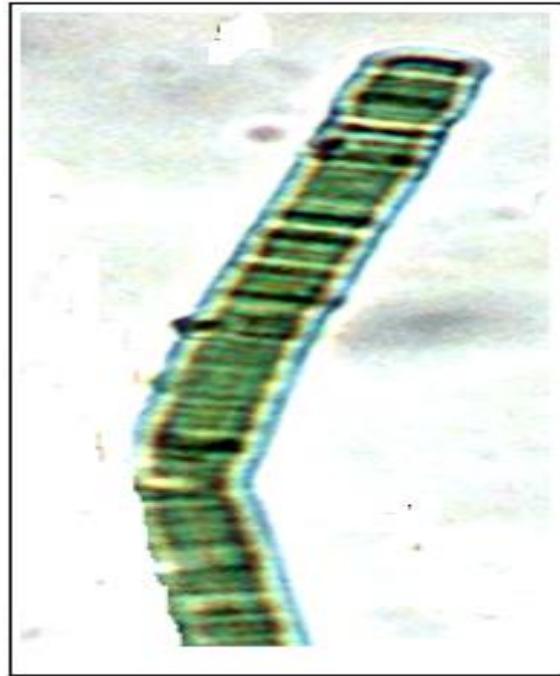


Fig. 8. *Lyngbya martensian*.

Distribution

Caribbean island, South America, Antarctic and sub Antarctic island and Asia.

Lyngbya

Filaments unbranched, cylindrical, straight, curved or twisted, solitary or densely intertwined into floccose masses, or epiphytes; sheath firm generally hyaline but sometime brownish or yellowish with age, often lamellose, usually extending beyond the trichomes; trichomes solitary, obtuse or sometime apically attenuate, sometime apically attenuate, sometime constricted at cross walls, cell contents homogeneous, granulose, variously colored.

Key to species

Sheath firm.....*Lyngbya Kashyaphii*

Filment 6-10 μ in diameter; apical cell rotund; sheath thick.....*Lyngbya Martensian*

Lyngbya martensian Meneghini 1892 Fig. 8 Plant greatly knotted and interwoven to form an extended, dark blue or green mass; trichome 10-20.9 μ in diameter, not narrowing near the apices which are

generally convex; cell about $\frac{1}{4}$ as long as broad, 2.6-2.9 μ length, not constricted at or near cross wall, contents homogeneous excluding for 1 or 2 conspicuous granule near cross wall; sheath firm, fairly broad (1.5-2 μ); filament mostly 6-10 μ (upto 14 μ) in diameter.

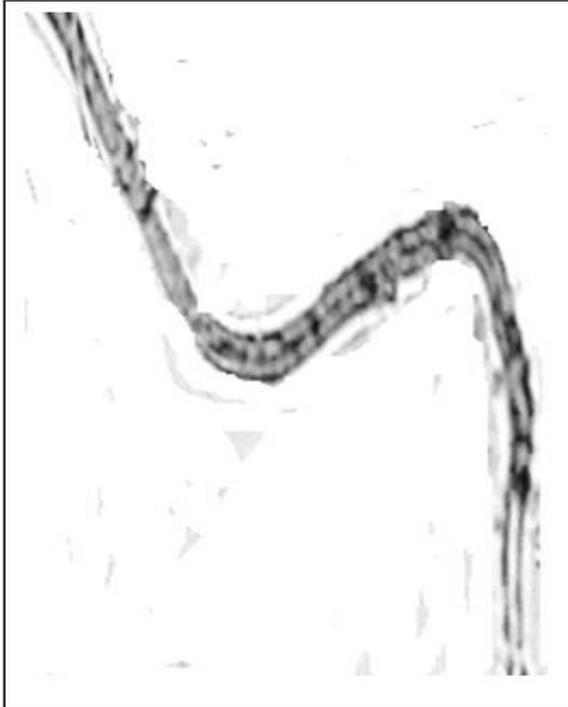


Fig. 9. *Lyngbya kashyapii*.

Distribution

Europe, America, Asia and Antarctic caribbean

Lyngbya kashyapii

Ghose 1893 Fig. 9.

Prolonged Thallus spent purple curved filament with densely intricate; sheath hard, and thick, tedious blue or purple with smooth chitinous trichome 3-4 μ m broad, but not tapered at the cross-wall; cells are quadrate or shorter than broad, cross-wall not granulated, often oblique or curved; cells are not rounded and capitates at end calyptras none.

Distribution

North America, Europe and Asia.

Conclusion

The taxonomic studies of family Oscillatoriaceae from Tehsil Landikotal, District Khyber, Khyber Pakhtunkhwa, Pakistan was carried out to find out the diversity of family Oscillatoriaceae which contains 2 Genera and 9 Species viz. *Oscillatoria terebriformis*, *Oscillatoria tenuis*, *Oscillatoria splendid*, *Oscillatoria Formosa*, *Oscillatoria prolifica*, *Oscillatoria amoena*, *Oscillatoria saneta*, *Lyngbya kashyapii* and *lyngbya martensian*. Keys at generic and specie level were presented. Based on our findings it is concluded that this area need more research to determine the diatoms flora.

Acknowledgement

The authors are thankful to the inhabitants of tehsil Khyber, Khyber Pakhtunkhwa, Pakistan for their moral support.

Author's contribution

HK, MI & N conducted the experiment and MK, ZU & FW carried out the statistical analysis and HU & RK designed the experiment and SIU & MF structured and wrote the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

References

- Ali S, Sandhu GR.** 1972. Blue green algae of the saline soil of the Punjab. *Oikos* **22**, 268-272.
- Faridi MAF.** 1971. The genera of freshwater algae of Pakistan and Kashmir. *Biologia* **17**, 123-142.
- Farzana A, Nizamuddin M.** 1979. Studies on some members of Cyanophyta from Karachi. *Nova Hedw.* **31**, 247-256.
- Ghose SL.** 1919. The Myxophyceae of Lahore. *J. Ind. Bot. Soc.* **1**, 8-13.

Ghose SL. 1924. A systematic and ecological account of the collection of blue-green algae from Lahore and Simla. *J. Linn. Soc. Bot.* **46**, 333-346.

Irfan M, Kan H, Faiz M, Khan R, Ahmad H, Sheikh NY, Khan S, Nabeela, Kamil M, Ilyas M, Ullah S, Ishaq M. 2018. Taxonomic studies of pennate diatoms from Tehsil Landikotal, District Khyber, Khyber Pakhtunkhwa, Pakistan. *International Journal of Biosciences* **13(4)**, 128-138, 2018.

Khan SI. 1957. Cultures of algae of the rice field of Kashmir. *Biologia* **3**, 29-43.

Leghari SM, Arbani SN. 1984. Survey of freshwater algae (Cyanophyceae) in ponds and lakes of lower Sindh. *Sindh. Stud.* **1**, 67-91.

Leghari SM, Jafri SIH, Mahar MA, Lashari KH, Ali SS, Jahangir TM, Shameel M, Butt NI. 1984. On the occurrence of Cyanophyta from Karachi, Pakistan. *Pak. J. Bot.* **16**, 75-79.

Masud-ul-Hasan. 1978. A contribution to the freshwater algae of the Punjab-II. *Biologia* **24**, 81-96.

Masud-ul-Hasan. 1980. A contribution to the freshwater algae of the Punjab-III. *Biologia* **26**, 71-79.