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Study of *Oscillatoria* Vauch. genus (Cyanobacteria) from Tajan River (Mazandaran Province of Iran)

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Oscillatoria **is an important genus of Cyanobacteria that exist in many freshwater environments, soils and also hot springs. In this study, the ecological diversity of** ***Oscillatoria*** **species from the Tajan River basin (Mazandaran Province of Iran) has performed in nine stations based on routine experimental procedures and distinguished in department of Botany, Physiology and Plant Genetics of Tajikistan academy of Sciences from October to December of 2014. Based on the results, among samples from nine stations, 14 species (mostly stations 2, 5 and 9) identified that most of them were β-mesosaprobe and β-mesosaprobe indicators. for stations 2 and 5 both condition of α & β-mesosaprobe considered. Results also showed, five species including,** ***O. agardhii, O. amoena, O. amphibian, O. anguina*** **&** ***O. boryana*** **that were α-mesosaprobe and six species were β-mesosaprobe including,** ***O. brevis, O. chalybea, O. formosa, O. splendida, O. tenuis,*** **and** ***O. terebriformis*****.**

Key words: Cyanobacteria, *Oscillatoria* diversity, Saprobic index, Tajan River, Iran.

Cyanobacteria (or Cyanophyta - Blue green algae) are belong to procaryote group and distributed not only in many freshwater reservoirs, including hot springs, remaining volcanoes, but also in different soils. They are main important elements for produce oxygen in the atmosphere and have been played eminent features in the human life for many years. Creation of many of Proterozoic oil deposits and as well as the main producers of nitrogen fertilizers in the production of rice and beans attributed to their biological activity (Allnutt, 1996; Desikachary and Cyanophyta, 1959).

Among cyanobacteria, *Oscillatoria* genus are part of filamentous ones that filaments have some disc-shaped cells that may has lengths of more than 1 cm. in this genus ability of gliding motility and lake of heterocysts and akinetes are not formed. The species of *Oscillatoria* usually seen in all aquatic reservoirs and form dark green features on the water and also wet rocks and soils. There is interesting species called *O. limnetica* growing in conditions without oxygen and can perform anoxygenic photosynthesis using hydrogen sulphide as the electron donor instead of water (Dey et al., 2010; Ebadi et al., 2012; Canadian Council of Ministers of the Environment, 1992; Carmichael and Schwartz, 1984; Soil & Water Conservation Society of Metro Halifax, 1993;).

According to above issues and also potential for produce toxic populations, in this study diversity of *Oscillatoria* species studied in Tajan River as the main water source for agricultural usage in the Sari city (Mazandaran Province of Iran).

MATERIALS AND METHODS

The ecological diversity of *Oscillatoria* species from the Tajan River basin (Mazandaran

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Province of Iran) has performed in nine stations along with 40 Km of Tajan River. All samples collected from surface and deep water. 20 cc of each sample kept in special tube that contained 2% formalin for fixation. All samples studied and distinguished in department of Botany, Physiology and Plant Genetics of Tajikistan academy of Sciences from October to December of 2014.

RESULTS AND DISCUSSION

Based on the results, among 90 samples tube, 14 species of Oscillatoria genus (mostly stations 2, 5 & 9) identified that shown as below:

***Oscillatoria agardhii* Gomont 1892**

Thread-like or with trichomal form's species. Trichom 5.7 µ width, cellular 3.5-4 µ length. In plankton (β-mesosaprobe*)*.

***O. amoena* Gomont 1892**

Thread-like or with trichomal form's species. Trichom 5 µ width, cellular 4.1 µ length. In plankton.

***O. amphibia* C.Agardh ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 2.8-5.0 µ width, cellular 3.8-9 µ length. In benthos, sometimes in plankton.

***O. anguina* Bory ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 4-6 µ width. In benthos, sometimes in plankton.

***O. boryana* Bory ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 5.9-6.2 µ width, cellular 4-6.2 µ length. In benthos, sometimes in plankton.

***O. brevis* Kützing ex Gomont 1892**

Thread-like or with trichomal form's species. Cellular 3 µ length, 5-6 µ width. In benthos, sometimes in plankton (α-mesosaprobe*)*.

***O. chalybea* Mertens ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 7.7-11.2 µ, cellular 2.8-4.3 µ length. In benthos, sometimes in plankton.

***O. formosa* Bory ex Gomont 1892**

Thread-like or with trichomal form's species. Cellular 3 µ length 6 µ width. In benthos, sometimes in plankton (α-mesosaprobe*)*.

***O. limnetica* Lemmermann 1900**

Thread-like or with trichomal form's species. Trichom 3.6 µ width, cellular 7.2 µ length. In benthos, sometimes in plankton (oligo-betasaprobe*)*.

***O. limosa* C.Agardh ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 11.4-15 µ width, cellular 3 µ length. In benthos, rare (α-β-mesosaprobe*)*.

***O. putrida* Schmidle 1901**

Thread-like or with trichomal form's species. Cellular 8-12 µ length, 2-3 µ width. In benthos, rare (polysaprobe*)*.

Table 1. List of Oscillatoria species, belonging to indicators of Tajan River water quality

Oscillatoria species	Number of stations	Indicators value S	X	O	β	α	p	G	S
Oscillatoria agardhii Gomont 1892	2	β			8	2		4	2,2
O. amoena Gomont 1892	6	β			8	2		4	2,2
O. amphibia C.Agardh ex Gomont 1892	7	β		3	6	1		3	1,75
O. anguina Bory ex Gomont 1892	5	β			8	2		4	2,2
O. boryana Bory ex Gomont 1892	8	β			8	2		4	2,2
O. brevis Kützing ex Gomont 1892	3	α				10		5	3,0
O. chalybea Mertens ex Gomont 1892	2	α				10		5	
O. formosa Bory ex Gomont 1892	2	α				9	1	5	3,1
O. limnetica Lemmermann 1900	3	α-β		6	4			3	1,4
O. limosa C.Agardh ex Gomont 1892	9	α-β		1	5	4		2	2,35
O. putrida Schmidle 1901	9	p				2	8	4	3,8
O. splendida Greville ex Gomont 1892	5	α				10		5	3,0
O. tenuis C.Agardh ex Gomont 1892	9	α			2	7	1	3	1,85
O. terebriformis C.Agardh ex Gomont 1892	5	α			1	9		5	2,9

S: Indicators of pollution; X: xenosaprobic; O: oligosaprobic; β: beta-mesosaprobe; α: alpha- mesosaprobic; p: polysaprobic; G: Indication strength; S: Saprobic index.

***O. splendida* Greville ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom 2.8 µ width, cellular 8.6 µ length. In benthos, sometimes in plankton.

***O. tenuis* C.Agardh ex Gomont 1892**

Thread-like or with trichomal form's species. Cellular 2.5-5.0 µ length, 5.5-12 µ width. Between other planktonic algae (α-mesosaprobe).

***O. terebriformis* C.Agardh ex Gomont 1892**

Thread-like or with trichomal form's species. Trichom in top look-like spiral, cellular 6 µ length and width. In benthos, sometimes in periphyton (α-mesosaprobe).

From Ecological characters (Table 1) it is found that most of them are α-mesosaprobe and also β-mesosaprobe, this means that *Oscillatoria* found in both fresh and also polluted places in this study. Industrial and also agricultural activities in Tajan river basin and application of fertilizers made increase the organic materials in the water and soil and increased the populations of *Oscillatoria* species. Among 14 species of *Oscillatoria* genus, five species including, *O. agardhii, O. amoena, O. amphibian, O. anguina & O. boryana* were β-mesosaprobe and six species were α-mesosaprobe that included, *O. brevis, O. chalybea, O. formosa, O. splendida, O. tenuis*, and *O. terebriformis*. Among other species one showed oligo-betasaprobe (*O. limnetica*), and one species was α-β-mesosaprobe (*O. limosa*).

According to ecological examination and also diversity of the species in nine stations, it is noted that the increasing of the pollutant materials in the water and also soils, have been been increased in recent years for human activities and this resulted to increase in Cyanobacteria populations and also diversity (especially *Oscillatoria* species). This can be one environmental alarm for people who live in this area and also contributed organizations that are responsible for human health and food (Canadian Council of Ministers of the Environment, 1992; Carmichael and Schwartz, 1984; Soil & Water Conservation Society of Metro Halifax, 1993; Wedepohl et al., 1990; Wedepohl et al., 1990; Kumar Rai and Kumar Misra, 2010; Watanabe and Komarek, 1994; Yacubson, 1980). For example there is the same ecological situation and abundance of the cyanobacteria populations in Chashme Ali Basin (Semnan Province of Iran) which considered as a tourism location (Ebadi et al., 2012). More studies are in progress by the authors for finding the new species and also relation of all ecological indexes in Tajan River basin with diversity of Cyanobacteria.

CONCLUSION

With respect to outstanding characters of Cyanobaceria especially *Oscillatoria* species such as occurrence in many places and also environmental considerations, it is needed to perform more studied about other aspects about mechanism of population spread and cytochemical and biotechnological characteristics among Cyanobacteria Genus specially *Oscillatoria*. High tolerance of different environmental conditions can be beneficial index for this genus and more researches are needed about contributed mechanism.

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REFERENCES

1. Allnutt T.F.C., Cyanobacterial (Blue Green Algae) Biotechnology: past present and future. *J. Sci. Ind. Res.*, 1996; **55**: 693-714.
2. Desikachary T.V., Cyanophyta, I. C. A. R. Monographs on Algae. Indian Council of Agric. Res. New Delhi, India, 1959; pp. 686.
3. Dey H.S., Tayung K., Bastia A.K., Occurrence of nitrogen-fixing cyanobacteria in local rice fields of Orissa, India. *Ecoprint*, 2010; **17**: 77-85.
4. Ebadi A.G., Hisoriev H., Afshari H., and Janbaz Ghobadi G., Additional materials for Algae of the Iran (Case study: Cheshmeh Ali of Damghan). *Annal. Biol. Res.*, 2012; **3**(6): 2994-2998.
5. Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines, 1992; Environment Canada.
6. Carmichael, W.W., and Schwartz, L.D., Preventing Livestock Deaths from Blue-Green Algae Poisoning. U.S. Dept. of Ag., *Farmer's Bull.*, 1984; **2275**: 1-11.
7. Soil & Water Conservation Society of Metro Halifax,Synopsis titled "Phytoplankton" (of fresh waters), 1993; p.11.

8. Wedepohl, R.E., Knauer, D.R., Wolbert, G.B., Olem, H., Garrison, P.J., and Kepford, K., Monitoring Lake and Reservoir Restoration. 1990; EPA 440/4-90-007, Prep. by N. Am. Lake Manage. Soc. for U.S.E.P.A. 142 pp.
9. Kumar Rai, S., and P. Kumar Misra, Freshwater Cyanophyceae from EastNepal, *Bangladesh J. Plant Taxon*., 2010; **17**(2): 121-139.
10. Watanabe, M. and Komarek, J., Several Cyanoprokaryotes from Sagarmatha National Park, Nepal Himalayas. *Bull. Natn. Sci. Mus., Ser. B, Tokyo*., 1994; **20**(1): 1-31.
11. Yacubson, S., The phytoplankton of some fresh water bodies from Zulia State (Venezuela). *Nova Hedwigia*, 1980; **33**: 279-339.