Iraqi Journal of Science, 2025, Vol. 66, No. 12, pp: 5424- 5432
DOI: 10.24996/ijs.2025.66.12.13

ISSN: 0067-2904

Algal Flora in some Springs of Shawre Valley, Ranya, Kurdistan Region – Iraq

Alwan Qader Ahmed[1,2], Sara Abdulkhaleq Yaseen[3], Abdulmunem Dherar Abdullah Aljoborey[4]*

[1]*Department of Medical Laboratory Science, College of Science, Knowledge University, Erbil 44001, Iraq*
[2]*Pharmacy Techniques Department, Medical Technical Institute - Kirkuk, Northern Technical University, Iraq*
[3]*Scientific Research Center, Salahaddin University, Erbil, Iraq*
[4*] *Ministry of Iraqi Environment, Directorate of Environmental Protection and Improvement in the Northern Region, Nineveh Environment Directorate*

Received: 11/9/2023 Accepted: 16/12/2024 Published: 30/12/2025

Abstract

This study aims to assess the diversity of algal flora from some spring water in Shawre Valley. The non-diatom algal composition of four selected spring sites studied was situated at Shawre Valley within Ranya district Sulaymaniyah governorate every month from September 2022 to April 2023. A total of 79 algal species were identified from 6 divisions. The majority of them belong to Chlorophyta, with 35 species (44.30%), followed by Cyanophyta, with 32 species (40.51%) Euglenophyta with 5 species (6.33%), Xanthophyta with 4 species occupied (5.06%), Rhodophyta with 2 species (2.53%) and Charophyta with only one species occupied (1.26%). The most representative genus was *Oscillatoria*, with 6 taxa identified, each of *Calothrix* and *Oedogonium* with 4 species, *Merismopedia*, *Scenedesmus*, *Ulothrix*, *Spirogyra*, *Cosmarium* and *Tribonema* with 3 species were dominant.

Keywords: Non-diatom, algae, spring water, Shawre Valley, Ranya, Iraq.

فلورا الطحالب في بعض ينابيع وادي شاور ، رانيا ، إقليم كوردستان – العراق

ئەلوەن قادر احمد[2,1], سارة عبدالخالق ياسين[3], عبدالمنعم ضرار عبدالله الجبوري[4] *

[1]قسم علوم المختبرات الطبية, كلية العلوم, جامعة نولج, اربيل العراق
[2]قسم تقنيات الصيدلة، المعهد التقني الطبي – كركوك، الجامعة التقنية الشمالية، العراق
[3]مركز البحوث العلمية, جامعة صلاح الدين, اربيل, العراق
[4]وزارة البيئة العراقية، مديرية حماية وتحسين البيئة في المنطقة الشمالية، مديرية بيئة نينوى

الخلاصة

تهدف هذه الدراسة إلى تقييم تنوع الطحالب في بعض ينابيع المياه لوادي شاور. تمت اخذ عينات الطحالب غير الدايتومية لأربعة مواقع نبع مختارة في وادي شور داخل منطقة رانية في محافظة السليمانية بواقع كل شهر من ايلول 2022 إلى نيسان 2023. تم تحديد 79 نوعًا من الطحالب من 6 أقسام. تنتمي معظمها إلى الطحالب الخضراء 35 نوعًا (44.30٪) ، تليها الطحالب الخضر المزرقة 32 نوعًا

*Email: dr.abdulmunem89@gmail.com

(40.51٪), و 5 أنواع (6.33٪) لليوغلينات ، ثم 4 أنواع (5.06٪) للطحالب الذهبية ، وايضاً نوعين (2.53٪) للطحالب الحمراء و نوع واحد فقط (1.26٪) للطحالب الكارية. وكان الجنس الأكثر تمثيلا هو *Oscillatoria* بعدد 6 أصناف ، وكل من *Calothrix* و *Oedogonium* باربعة أنواع ، بعدهم *Merismopedia* و *Scenedesmus* و *Ulothrix* و *Spirogyra* و *Cosmarium* و *Tribonema* و الثلاثة أنواع الاخيرة كانت المهيمنة.

1. Introduction

Springs can be found all across landscapes and are a valuable supply of freshwater for people all over the globe [1, 2]. The point at which water emerges from an aquifer on the surface of the ground is known as a spring. This is the moment in the hydrological cycle at which water from the subsurface emerges to the surface of the earth and then flows into a stream [3]. The springs in the valley are of remarkable importance and have been frequently modified for recreational and drinking water purposes, and are responsible for forming and maintaining the perenniality of streams, rivers, and lakes. They are often used as sources for supplying human activities. Water sources are important for maintaining the hydrological cycle balance, as they allow the passage of the groundwater stored in the water table to the earth's surface. In addition, the water that flows from springs to the earth's surface is essential for biological and metabolic processes, ensuring the maintenance of biodiversity [4,5].

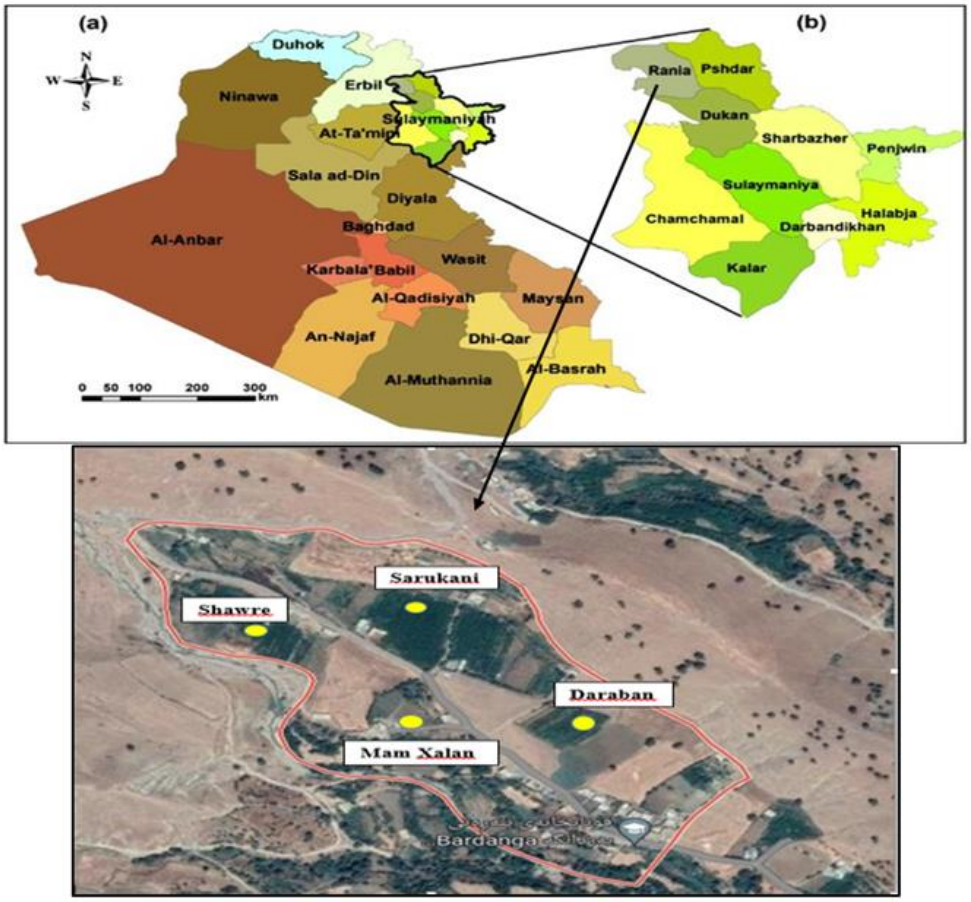
Algae are a crucial part of aquatic ecosystems, including springs, streams, rivers, and ponds, because they reflect the health of their environment through their distribution, abundance, and productivity [6]. Algae are basic thalloid, green, photosynthetic organisms that are typically found in water, but they can also be found in a variety of other moist environments, including arid sands, hot boiling springs, snow, and ice. They are regarded as the primary producers at the base of the aquatic food chain and also serve as a source of oxygen for aquatic life that is consuming excess carbon dioxide from the environment [7].

More recently, several studies have been carried out on the algal flora of Iraq and the Kurdistan region, and some of them regarding new records of Iraqi algal flora. Toma *et al.* conducted a study on the algal diversity in the springs and streams from Shaqlawa district, Erbil province and reported 116 species [8], Jaffer *et al*. studied non-diatom phytoplankton in East Al- Hammar Marshand and identified 135 species [9], Al Mousawi *et al*. performed a study on diatoms of the coral reef in Iraqi territorial waters and they documented 46 taxa [10]. Finally, Al Alwaeli carried out a study of the algal flora of the Shatt al-Arab River, south of Iraq [11]. The algal diversity of Shawre Valley has not been studied yet; therefore, the present study is developed to investigate the algal flora of some springs at Shawre Valley and to provide an algal database of this area.

2. Materials and Methods

2.1 Description of the study sites

The studied sites are located in Ranya district, Sulaymaniyah governorate, in the southern Kurdistan region. Its geographical coordinates are around 36°15'14"N latitude and 44°52'59"E longitude. The depicted location, as seen in Figure 1, is situated in the northwestern region of Sulaymaniyah city. The elevation of the location is about 615 meters above mean sea level (MSL). The distance between Ranya and the city center of Sulaymaniyah is estimated to be roughly 104 km [12]. The climate of Ranya belongs to the Mediterranean system, which is characterized by cold and rainy winters and hot and dry summers [13]. Ranya is



(c)

Figure 1: (a) Map of Iraq, (b) Sulaymania governorate (c) Studied sites from (Google Earth, 2022).

(a)

(b)

(c)

(d)

Figure 2: Study sites (a) Site 1: Daraban spring (b) Site 2: Mam Xalan spring, (c) Site 3: Sarukani spring, (d) Site 4: Shawre spring.

geographically next to Serkepkan in the northwestern direction and to Sengeser in the northeastern direction. The Kewaresh mountain range serves as a geographical barrier, delineating the separation between the regions of Ranya and Pshdr. The Dukan Dam is located in the southern region of Ranya. Chwarkurna and Hajiawa cities are adjacent municipalities situated in close proximity to one another, namely in the western region. Shawre Valley is about 18 km away from Ranya city, and it is located in the north east of Ranya. A total of four spring sites were selected in Shawre Valley (also known as Bardanga) in the Ranya district as follows: Daraban (Site 1), Mam Xalan (Site 2), Sarukani (Site 3) and Shawre (Site 4).

2.2 Algal collection, preservation and identification

Non-diatom algae and epilithic algae were scraped from the rock surface site with a spatula, forceps, and a knife and squeezed on leaves. A plankton net is used to collect planktonic forms, which have pore sizes of 25 micrometers. The collected samples were added to clean, sterilized, non-reactive plastic bottles of 50 ml capacity and preserved with 0.35 ml Lugol's solution [14, 15]. Identification of algal forms was made with the help of standard keys using a monograph and relevant available literature [16 - 22]. Water temperature was measured in situ using a precise glass mercury thermometer with 0.1 C increments. A portable pH-meter was used to test pH immediately in situ using the electrometric approach (PH- meter HI 912, Hanna instruments), and Winkler's titration method was used to measure the amount of dissolved oxygen.

3. Result and Discussion

In the present study, 79 taxa of algae were recorded from the studied springs at Shawre Valley (Table 1), represented by six divisions, 12 orders, 43 genera, and 79 species. Chlorophyta was predominant, accounting for 35 species, most of which belong to Zygnematales. Two genera of Chlorophyta had equal representation, *Oedogonium* and *Spirogyra*, with four taxa recorded in each. Followed by Cyanophyta in importance by 32 species (40.51%), and the most representative genus was *Oscillatoria*, with 6 taxa identified. The dominancy of Chlorophyta over Cyanophyta was also observed by [23 - 25]. Euglenophyta was the third group after Chlorophyta and Cyanophyta in a number of identified species with 5 species occupied (6.33%), Xanthophyta with 4 species occupied (5.06%), during the studied period only 2 genera (*Audonella* and *Batrachospermum*) each with 1 species from the division of Rhodophyta can be seen. Charophyta with only one species occupied (1.26%) as shown in Table 2.

Table 1: The percentage of the studied algal divisions.

Division	No. of genera	No. of species	Percentage %
Cyanophyta	15	32	40.51
Chlorophyte	20	35	44.30
Euglenophyta	3	5	6.33
Xanthophyta	2	4	5.06
Rhodophyta	2	2	2.53
Charophyta	1	1	1.26
Total	43	79	100

Ten common algae were found in all sites, including *Chroococcus minor*, *Chroococcus minutus*, *Merismopedia punctatae*, *Pseudoanabaena galeata*, *Oscillatoria brevis*, *Spirolina major*, *Scenedesmus arcuatus*, *Cladophora glomerata*, *Spirogyra varians*, *Chara vulgaris*. The majority of these identified species were noted at site 2, with 58 species, while site 4 had the lowest number of species. Algae are distributed in almost all types of habitats [26]. And Biological communities exhibit spatial and temporal variations. The extent of variety is contingent upon the physical and chemical attributes of the environment, its temporal stability, and the biotic interactions present [27].

The average water temperature during the study periods was recorded as 16.4°C, 17.3°C, 15°C and 12.2°C respectively, in sites 1,2,3 and 4. Similarly, the average pH of the water was 8.2, 7.9, 7.7 and 7.6, respectively. The average dissolved oxygen (DO) of water was recorded as 10.4 mg/l, 5.6 mg/l, 4.5 mg/l and 6.8 mg/l, respectively.

Table 2: List of algal species identified in the studied sites.

List of algal taxa	Site 1	Site 2	Site 3	Site 4
Division: Cyanophyta				
Class: Cyanophyceae				
Order: Chroococales				
Aphanocapsa delicatissima West and West.		+		+
Aphanocapsa litoralis Hansgirg.	+	+		
Gloeocapsa sanguinea (Ag.) Kuetzing		+		
Gloeocapsa aerogenosa (Garm) Keutzing.		+	+	
Chroococcus minor (Kuetz.) Naeg.	+	+	+	+
Chroococcus minutus (Kuetz.) Naeg.	+	+	+	+
Chroococcus turgidus (Kuetz.) Naeg.	+	+	+	
Merismopedia glauca (Ehr.) Naeg.	+	+	+	+
Merismopedia punctata Meyen.	+	+	+	+
Merismopedia tenuissima Lemm.		+	+	+
Aphanothece saxicola Naegeli.				+
Order: Oscillatoriales				
Glaucosira sp. Kuetz.			+	
Microcoleus amoenus(Gomont) Strunecky, Komárek & J.R. Johansen				
Oscillatoria limosa (Ag.) Gomont.			+	
Oscillatoria sancta Kützing ex Gomont	+			+
Oscillatoria curviceps Agardh.	+		+	+
Oscillatoria agardii Gomont.		+		
Oscillatoria chlorina Kuetz.	+	+		
Oscillatoria brevis (Ktz.) Gomont.	+	+	+	+
phormidium breve Kuetz. ex Gomont.	+	+		
Phormidium favosum (Bory) Gomont.	+	+		
Pseudoanabaena galeata Bocher.	+	+	+	+
Pseudoanabaena limnetica (Lemmermann) Komarek.	+	+	+	
Spirulina major (Kuetz.) ex Gomont.	+	+	+	+
Spirulina princeps West and west.		+	+	

Homoeothrix juliana (Born. et Flah.)		+		+
Calothrix breviarticulata West and West.		+		+
Calothrix fusca (Ktz.) Bornet and Flahault.		+		+
Calothrix braunii Born and Flahault.	+	+		+
Calothrix parietina Thuret.	+	+		+
Dictothrix sp.		+		
Cytonema sp. C. Agardh ex Bornet and Flahault.				+
Division: Chlorophyta				
Order: Chlorococcales				
Coelastrum microporum Naeg.			+	
Coelastrum astroideum De Notaris.	+			
Pandorina morum (O.F.Muller) Bory.		+		
Chlamydomonas globosa J. W. Snow.			+	
Planktospaeria gelatinosa G.M.Smtih.			+	
Pediastrum integrum Naeg.	+	+	+	
Chlorella vulgaris Beijerinck.			+	
Monoraphidium contortum Thuret.	+	+	+	
Oocyst solitoria Wittr.			+	
Scenedesmus arcuatus Meyen.	+	+	+	+
Scenedesmus bijugatus (Turp)Ktz.	+	+	+	
Scenedesmus obtusus Meyen.	+	+	+	
Order: Ulotrichales				
Ulothrix cylindricum Prescott.	+	+	+	
Ulothrix tenussima Ktz.	+	+	+	
Ulothrix zonata (Weber and Mohr.)Kutz			+	
Microspora willeana Lager.			+	
Geminella interrupta (Turp.) Lager.		+	+	+
Order: Cladophorales				
Cladophora glomerata (Linn.) Kuetz.	+	+	+	+
Order: Oedogoniales				
Bulbochaete nanna Wittr.		+	+	
Oedogonuim gracilis (Wittr.)Tiff.	+	+		
Oedogonium mexicanum Wittr.	+		+	
Oedogonium automnale Wittr.	+	+	+	
Oedogonium crispum (Hass.) Kuetz.	+	+	+	
Order: Zygnematales				
Mougeotia calcarea (Cleve)Wittr.	+	+	+	
Mougeotia scalaris Hassall.	+	+	+	
Spirogyra articulata Traseau.	+	+	+	
Spirogyra varians (Hassall) Kuetz.	+	+	+	+
Spirogyra inflata (Vauch.) Kuetz.	+	+	+	
Spirogyra sp.	+			
Zygnema sterile Transeau.	+	+	+	

Closterium lunula (Muell) Nitzsch.			+	
Closerium moniliferum (Bory) Ehr.	+	+	+	
Cosmarium leave Rabeunh.	+	+		
Cosmarium botrytis Ralfs.			+	
Cosmarium granatum de Brebisson.	+	+	+	
Division: Euglenophyta				
Order: Euglenales				
Euglena proxima P.A. Dangeread.	+	+		
Euglena garacilis G. A.Klebs.			+	
Lepocinclis fusiformis (G.J.Carter) Lemm.		+	+	
Lepocinclis ovum (Ehrenberg) Lemm.		+	+	
Phacus orbicularis Huebuer.	+			
Division: Xanthophyta (Tribophyta)				
Class: Xanthophyceae				
Order: Tribonematales				
Tribonema minus (G.A.Klebs) Hazen.	+	+	+	
Tribonema viride Pascher.	+	+	+	
Tribonema ultriculosum (Kuetz.) Hazen.			+	
Characiopsis acuta (A. Braun) Borzi.	+	+	+	
Division: Rhodophyta				
Order: Acrochaetiales				
Audonella hermannii (Roth) Duby in de.	+	+		
Order: Batrachospermales				
Batrachospermum moniliforme Roth.	+	+		
Division: Charophyta				
Order: Charales				
Chara vulgaris Linnaeus.	+	+	+	+
	49	**58**	**53**	**23**

4. Conclusion

This study was carried out to determine the composition of non-diatom algal flora, which will serve as a baseline for comparison of new collections within the Ranya districts and other regions. The algal flora of the studied springs is rich and diverse; a total of 79 taxa were identified, and it was remarkable that the chlorophyte and cyanophyte were the most abundant groups in all the studied sites. Sampling site 2 was the richest in algal species, followed by sites 3, 1, 4.

Conflict of Interest: There is no conflict of interests to declare.

References

[1] S. U. Bhat, S. Mushtaq, U. Qayoom and I. Sabha, "Water Quality Scenario of Kashmir Himalayan Springs—a Case Study of Baramulla District, Kashmir Valley" *Water Air Soil Pollution*, vol. 231, no. 454. https://doi.org/10.1007/s11270-020-04796-4, 2020.

[2] A. Hameed, S. U. Bhat, T. Jindal, I. Sabha and S. H. Lone, "Water Quality Monitoring of Some Freshwater Springs in Hazratbal Tehsil, Srinagar, Kashmir Himalaya" *Journal of Himalayan Ecology And Sustainable Development.*,13. ISSN 0973-7502, 2018.

[3] K. E. Chukwu, "Water Supply Systems and Environmental Health" *Workshop on environment, sanitation and human existence*, UNTH, pp. 16–21,1999.

[4] S. U. Bhat, A. U. Nisa, I. Sabha and N. C. Mondal, "Spring Water Quality Assessment of Anantnag District of Kashmir Himalaya: towards understanding the looming threats to spring ecosystem services" *Applied Water Science*, vol. 12, no. 180. https://doi.org/10.1007/s13201-022-01691-7, 2022.

[5] M. S. Jung and J. A. Silva "Bioindicators for Monitoring Spring Water" *Ibero-American Journal of Environmental Sciences, , v.14, n.4,p.38-47, 2023.*

[6] R. L.Stevenson, M. L. Bothwell and Lowe, R. L. *Algal Ecology Freshwater Benthic Ecosystems. Academic Press.* New York, 1996.

[7] G. Shrestha and S. K. Rai, "Algal flora of Rajarani Lake, Dhankuta and their Seasonal Distribution," *Our Nature*, vol. 15, no. (1-2), pp. 44-54. ISSN: 1991-2951 (Print) *Our Nature* ISSN: 2091-2781. http://nepjol.info/index.php/ON, 2017.

[8] J. J. Toma and F. H. Aziz, "Algal Study in the Springs and Streams from Shaqlawa District, Erbil Province, Iraq II- Zygnematales," *Iraqi Journal of Science*, vol. 63, no. 4, pp. 1438-1452, 2022.

[9] E. M. Jaffer, N. J. Al-Mousawi, and I. J. M. Al-Shawi, "A Qualitative Study of Non-diatom Phytoplankton in East Al- Hammar Marsh," *Egyptian Journal of Aquatic Biology & Fisheries* Zoology Department, Faculty of Science, Ain Shams University, Cairo, Egypt. ISSN 1110 – 6131 Vol. 26, no. 4, pp. 449 – 468, 2022.

[10] N. J. M. Al-Mousawi and J. M. Al-Zewar, "Observation of the Algal Flora (Phytoplankton) of the Coral Reef in Iraqi Territorial Waters," *Ecology, Environment and Conservation.* vol. 27, no. 4, pp. 187-192, EM International ISSN 0971–765X, 2021.

[11] A. A. A. Alwaeli and A. M. Athbi, "New Records of Ten Species of phytoplankton from the Shatt al Arab River, South of Iraq," *Annals of the Romanian Society for Cell Biology*, vol. 25 no. 6, pp. 9061 – 9073, 2021.

[12] G. B. Bapeer, R. K. Muhammad, K. A. Nadr, L. Khodakarami and N. Al-Ansari, "Geotechnical Properties of Soil in Ranya and Arbat Area, Sulaimaniya, Kurdistan Region, Iraq," *Journal of Earth Sciences and Geotechnical Engineering*, vol. 10, no. 5, pp. 35–48, 2020.

[13] S. H. Khdir and K. T. Saeed, "Landfill Site Selection Using GIS and (AHP): Case Study of Ranya City," *Academic Journal of Nawroz University*, vol. 10, no. 4, pp. 39–49, 2021.

[14] A. D. Bony, "Phytoplankton," *Edward Arnold Publisher*. London, U. K. 1975.

[15] H. Bold and M. Wynne, "Introduction to the Algae: Structure and Reproduction," 2nd edition, *Princeton, New Jersey, Prentice Hall,* 1985.

[16] G. M. Smith, "The Freshwater Algae of United States," *McGraw-Hill Book Com. London*, U.K. 1950.

[17] T. Desikachary, "Cyanophyta. Indian Council of Agricultural Research, Monographs on Algae," New Delhi, India, 1959.

[18] G. W. Prescott, "How to Know the Freshwater Algae," *W. M.C. Brown Co publisher,* 1975.

[19] G. W. Prescott, "Algae of the Western Great Lakes Area," *W. M.C Brown Company,* 1968.

[20] J. Komarek and K. Anagnostidis, "Cyanoprokaryota. 2nd part: Oscillatoriales," *Elsevier, München*. Germany 1-759, 2005.

[21] J. D. Wehr, and R. G. Sheath, "Freshwater Algae of North America Ecology and Classification," *Academic press*, Amsterdam, 2003.

[22] D. M. John, B. A. Whitton and A. J. Brook, "The Freshwater Algal Flora of the British Isles," *2ed edition printed in Cambridge University Press,* 2011.

[23] F. H. Aziz, and S. A. Yasin, "Twenty-five new records of algae in eight artificial fish ponds in Erbil," *Zanco journal of pure and applied sciences,* vol. 31, no. 4, p p.153-166, 2019.

[24] S. J. Abdulwahid, "Algal Flora on some Springs within Sherwan Mazn Subdistrict, Erbil-Kurdistan Region of Iraq," *Journal of advanced laboratory research in bio.* vol. 3, no. 5, 2012.

[25] J. J. Toma, "Weekly and Spatial Variation of Physico-Chemicals Variables and Algal Composition in Kasnazan Impoundment, Erbil, Iraq," *Journal of Babylon University,* vol. 10, no. 3, 2004.

[26] K. R. Mohanapriya and D. Geetharamani, "Fresh Water Microalgal Diversity of Noyyal River at Tamil Nadu State," *India Journal of Algal Biomass Utilization.* vol. 5, no. 4, pp. 12-20, 2014.

[27] J. Bengtsson, S. R. Baillie and J. Awton, "Community Variability Increases with Time," *OIKOS,* vol. 78 , no. 2, pp. 249- 256, 1997.