

An Ecological Observation on Inland water Ecosystem in Erbil –Iraq Kurdistan with particular reference to blue green algae *Glaucospira*

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Abstract:

Regular sampling for six months from January to July 2012 were taken in small, shallow, perennial, standing ponds near the Greater Zab River, Gwer district, Erbil. A variety of physicochemical parameters were determined. Air and water temperature were falling between 15.2 - 34.7 °C and 15.5 and 26.5 °C. The waters are neutral (pH 7.38-8.27), hard, alkaline, salty, high in TDS and EC (892-966µS/cm, and rich in nutrients (NO₃: 2.1-4.1mg/l, PO₄: 0.33-0.62 mg / l , SO₄: 24.7-80.2 mg / l). The attention fixed on a filamentous blue- green algae *Glaucospira* Lagerheim, 1982) which is new to Iraqi flora. It is a filament (trichome), solitary, pale or yellowish blue – green, without sheath, Screw like coiled, motile, some of them are actively motile. In this study nine species were identified, classified and described with their original and hand drawing, photo vis.; *Glaucospira* sp.: syn. *Spirulina abbreviata* Lemm. ex Kleb. and Lemm. , *G. agilissima* Lag., *G. laxissima* G.S.West syn.: *Spirulina laxissima* f. *major* Des., *Glaucospira* sp. syn.: *Spirulina tenuior* Lag., *Glaucospira* sp. Syn.: *Spirulina corakiana* Playf., *Glaucospira* sp. syn.: *Spirulina nodosa* Scham. *Glaucospira* sp. syn.: *Spirulina baltica* Mart., *Glaucospira* sp. Syn.: *Spirulina magnifica* Cop. And *Glaucospira* sp. syn.: *Spirulina subtilissima* Mostly they are from *Spirulina* Turpin ex Gomont.

Key words: *Glaucospira*, blue green algae, Ecosystem

Introduction:

Cyanophyta are ancient group of aquatic photosynthetic organisms on the earth that give rise to land plants [1, 2] and have long time been Known their ability to survive and protect themselves from extreme and external ecological factors [3,4]. Recently more attention paid to cyanophyta due to secondary metabolites [5]. Since last 6 decades more than 2131 taxa of algae were recorded in Iraq [6] and about 1150 taxa in Kurdistan [7]. There were many studies on algal habitats epiphytic as, epipellic, epilithic and periphyton in different fresh water ecosystem reviewed by Aziz [8,9]. Other Studies were to the effect of

ecological factors on algal abundance, distribution, diversity and productivity. [10, 11]. In Iraq as a whole only 15 species of *Spirulina*, and 3 species of *Arthrospira* were recorded [6] of which they regarded to be the mother of *Glaucospira*. In Kurdistan this work is the first in semi saline ponds in plain area south Erbil city. This pond contains a fantastic, interesting and very specific group of algal flora, among them blue-green alga *Glaucospira* sp. The present paper aims to provide information on physicochemical water properties and on the description of this genus and some species of this genus as a new

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records in Iraq, Kurdistan and some species may be new to the world; living as periphyton and epipellic in studied pond [11].

Materials and Methods:

Studied area: As shown in Fig. 1 and 2 it is a small perennial shallow, salty, pond covering an area of 2 hectares, 2-3m depth, located behind Kapran village at the edge of Greater Zab

river locate at the south west of Erbil city by about 70 km. GPS Co-Ordinates 36 10 45 E to 36 03 29 E and a longitude of 45 36 11 to 43 30 29 N, and at an altitude of 385 m.a.s.l., cold in winter, rainfall between 250_400 mm / year, hot and dry in summer. The dominant aquatic plants were *Salix* sp. , *Typha* sp. and *Myriophyllum spicatum* L.



Fig.1: Kapran pond



Fig. 2: Greater Zab pond

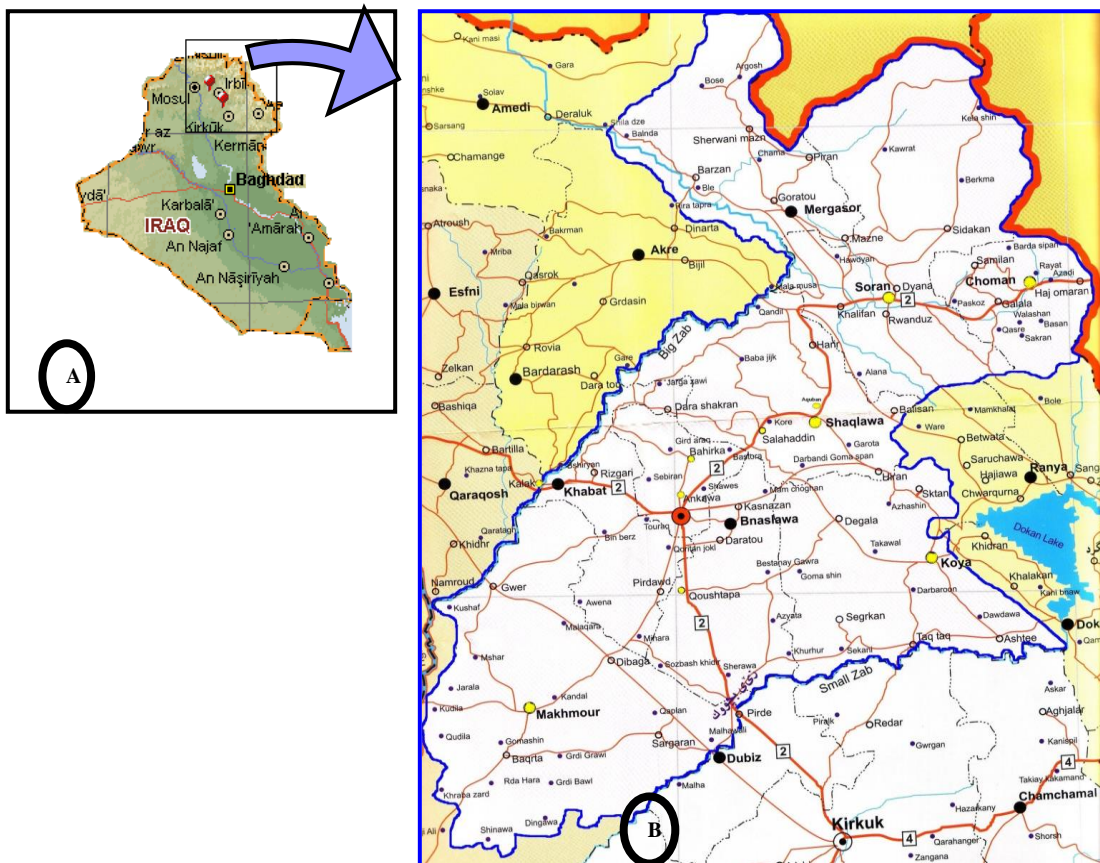


Fig.1: A. Map of Iraq, B. The studied sites in Erbil province.

Water parameters: The water properties of the studied pond were determined according to Golterman, *et al.* [12], APHA [13] and Srivastava [14].

Collection of Epipellic algae: For capturing a motile epipellic algae as described by Spackova, *et al.* [15] mud samples were collected at the edge of the pond regularly from January to July 2012 using a large metal spatula in plastic box 20 x 10 cm. In the laboratory, mixed with water, which added and allowed to stand in the dark for at least 3hrs. The supernatant was removed by suction and tested for any algal presentation. The mud was covered by 4 layers of fine lens tissue, then after 10 slide cover (slips) put on the first 2 layers for non motile algae and other 10 slide put over lens tissue layer for motile algae under room temperature and light intensity. Then an additional water was added to the box to give more time for identification. Olympus microscope at 400X were used for identification of algae.

Collection of periphyton algae: The Phytoplankton algae collected by means of fine bottling silk by plankton net to 0.6mm mesh size number 25 [16]. In return to laboratory after a quick observation and identification, the samples were preserved in Lugol's solution preservative ((10gm iodine crystal + 20ml glacial acetic acid in 200ml of distilled water with a sodium acetate to make solution slightly alkaline), 10 ml of solution added to 100ml of solution added to 100 ml of sample.

Algal identification: Identifications were made for living material by Olympus microscope connected by digital camera and computer. And using [3, 17, 18].

Taxonomy: *Glaucospira* Lagerheim 1892 is a genus of multicellular, filament (trichome),

without sheath, solitary, regularly or irregularly screw, spiral, coiled, cylindrical, attenuated or not attenuated, some of them actively motile (rotation), cross wall not constricted, usually not visible, cells pale or yellowish blue green, cell up to 3µm wide. This genus occurs in extreme conditions, in freshwater or semi _ saline water, up to date less than 10 species were recorded in different part of the world in Cuba, Ecuador, Europe, USA, Africa..... etc.. Living as plankton, epipellic in freshwater or/and saline, and in thermal springs in the USA [18]
Classification: Division: Cyanophyta
Class: Cyanophyceae subclass: Oscillatoriophyceida
Order: Chroococcales Family: Spiralinacea
Genus: Glaucospira sp.

Results and Discussion:

The pond under investigation (Fig.1 and 2) is usually free from ice and snow or land freezing in winter because located in plain areas, may in related old sand wash pond. The growing season in this area started in the beginning of March. The physical and chemical water parameters presented in Table 1. During the studied period water surface temperature ranged from 15.2 to 34.7. pH ranged 7.38 and 7.87, EC ranged from 892-966 µs.cm⁻¹, total dissolved solid was at a level of 852, nutrient NO₃, PO₄ and SO₄ concentration was fall between 2.1 to 2.3., 0.330, 0.622 and 24.7 to 80.2 µg.l⁻¹ respectively, and BOD 2.2 to 5.2mg/l indicated the water of study pond neutral, alkaline, hard rich in EC, TDS. The nutrient status may regard could be of greater Zab river and other water ecosystem of Kurdistan [19]. Chloride concentration was 132.1 to 162. µg.l⁻¹ revealed a salty conditions in comparison with other water bodies (Aziz and Abdulwahid

2012)unpublished.In respect of algal flora, Cyanophyta are a very variable group and particularly in tropical regions and extreme conditions, sometime very specific population occur (Komerak personal communication by email on Jun 2012).and since this area is not covered by a specific ecological and phycological investigations the new records of algae especially Cyanophyta expected [12].

The studied pond was rich in epipellic algal assemblage, Cyanophyta were typical for the summer season that correlated with under temperature [1]. The genus *Glaucospira* has been selected to this study, because it is new to Iraq [6, 7]. In this study nine species record:

- 1.*Glaucospira* sp.1 .syn.: *Spirulina abbreviata* Lemm. ex Kleb 1895 and Lemm 1895
- 2.*G. agilissima* Lag.

3..*Glaucospira* sp.2. syn.: *Spirulina corakiana* Play

4.*G. laxissima* G.S.West syn.: *Spirulina laxissima f.major* Des.

5.*Glaucospira* sp.3. syn.: *Spirulina nodosa* Schem

6. *Glaucospira* sp.4. syn.: *Spirulina stagnicola*

7.*Glaucospira* sp.5. syn.: *Spirulina subtilissima* Quetz.

8.*Glaucospira* sp.6. syn.:*Sirulina magnifica* Cop.

9..*Glaucospira* sp7.. syn.: *Spilurina baltica* Mart.,.

They are reported by [20, 21,22] in detail. The species of serial 1,5,6,7,8 and 9 may be new to the world.

However the water characteristics are as shown in table bellow which is alkaline neutral, hard. rich in chloride, low in acidity and rich in nutrients.

Table (1): Physico –chemical water characteristics of studied ponds in Gwer district

| Parameters | Jan | Feb | Mach | April | May | Jun | Mean |
|-------------------------------------|-------|-------|-------|-------|-------|-------|--------|
| Air temperature (°C) | 19 | 21.5 | 21 | 28 | 32 | 34.00 | 25.91 |
| Water temperature(°C) | 19.5 | 15.5 | 20.2 | 32 | 21.4 | 26.5 | 22.5 |
| pH | 7.78 | 7.38 | 8.27 | 7.8 | 7.82 | 7.80 | 7.69 |
| EC $\mu\text{s.cm}^{-1}$ | 975 | 892 | 966 | 780 | 795 | 790 | 866.33 |
| T D S mg.l^{-1} | 610.2 | 551.1 | 456.5 | 398.9 | 551.4 | 652.0 | 536.68 |
| Turbidity NTU | 5.1 | 7.3 | 6.2 | 4.9 | 3.2 | 3.1 | 4.966 |
| T. Alkalinity mg.l^{-1} | 270.7 | 6370. | 252.2 | 225.2 | 514.8 | 150.7 | 297.2 |
| T. Acidity mg.l^{-1} | 25.1 | 116. | 12.4 | 18.1 | 21.2 | 22.3 | 35.85 |
| T. hardness mg.l^{-1} | 204.6 | 202.2 | 230.2 | 222.1 | 240.9 | 241.5 | 223.58 |
| Ca^{+2} mg.l^{-1} | 89.4 | 79.2 | 80.4 | 75.5 | 92.4 | 98.7 | 85.93 |
| Mg^{+2} mg.l^{-1} | 15.4 | 14.2 | 12.3 | 15.9 | 16.4 | 16.2 | 15.06 |
| NO_3 mg.l^{-1} | 2.5 | 2.1 | 2.7 | 2.6 | 4.1 | 5.2 | 3.2 |
| SO_4 mg.l^{-1} | 24.6. | 20.0 | 25.2 | 38.7 | 56.2 | 80.2 | 40.81 |
| PO_4 mg.l^{-1} | 0.482 | 0.330 | 0.428 | 0.512 | 0.622 | 0.601 | 0.495 |
| Cl^{-1} mg.l^{-1} | 132.3 | 133.5 | 154.3 | 148 | 162 | 141.1 | 145.2 |
| BOD_5 mg.l^{-1} | 0.2 | 2.1 | 2.2 | 2.2 | 3.2 | 1.2 | 1.85 |
| DO mg.l^{-1} | 1.6 | 5.6 | 5.5 | 2.6 | 2.5 | 0.5 | 3.05 |

Species description

Glaucospira sp.1. (Komárek ,1992 syn; *Spirulina abbreviata* Lummermann ex Klebahn and Lammerann,1985. (Pl.1.Figs.1a +b).Trichom pale blue green, 2-2.5 μm wide slightly screw like coiled 22-30 μm long, coils 7, 5-7 μm long , coils 2-3 μm height (long) 5 like screw, attenuated at the ends.(Komárek, 2005 pl.139,fig155,p.140)

Glaucospira agilissima Lagerhiem,1982 syn; *Spirulina agilissima* (Lagerhiem) kirchner in Prant 1900 .(Pl.1,Figs.2a+b). 12 μm [Fig-Anon 3 and Komarek and Anagnostids, 2005,P.1397]

Glaucospira sp.2 Aziz, 2012. Syn.: *Spirulina corkiana* Playfair after Compere,1970 Komarek,1992 (Pl.1.Figs.3a+b).Trichome pale blue irregularly screw like coiled 1.2-2.2 μm wide ,trichome 56 μm long , coils 4-8 μm heigh (long) the distance between coils 20-10 μm long septa not visible (Komerak and Anagnostidis, 2005, P.146,Fig.169b).

Glaucospira laxissima. after Smith from Kondratera (1968) = *G. Laxissima* (Komerak,1989 and Anon 2) syn.: *Spirulina laxissima* G.S. West 1907[syn.:*S.laxissima* f. *major* Desikachary,1959, *S. laxissima* f. *lacustris* Obuchora,1965;*Oscillatoria laxissima* [G. S.West Ltis,1970(Pl. 2Ffig,1). Trichome pale blue green, screw –like coils 0.5-0.7 μm wide, Trichome 65 μm long, coils 10 μm height (long),distance between tunes 20-22mm long fast mobility, cell content homogenous cosmopolitans ,apical, cell rounded obtuse (Komerak and Anagnostidis 2005,and Anon 2,P.140, Fig.160a).

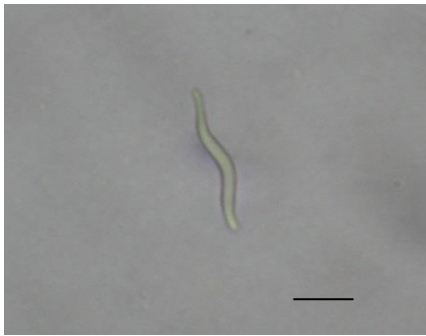
Glaucospira sp.3. syn; *Spirulina nodosa* Schiller ,1956. (Pl.2,Fig.2). Trichome, pale blue green irregularly screw like coiled 1.5 μm wide ,coils 8mm height (long),distance between tunes 10-12 μm .(Komerak and Anagnostidis,2005; P.140,Fig.163)

Glaucospira sp.4. syn.: *Spirulina stgnicola* Drouet,1970 = *Glaucospira stgnicola* (Pl.2, Fig.3). Trichome pale blue green 1.5 μm wide, trichome 38 μm long ,coils 10 μm height (long),distance between tunes 14 μm ,cellc homogenous in contents ,loosely screw like coils, apical cell rounded. .(Komerak and Anagnostidis, 2005; P.142,Fig.164)

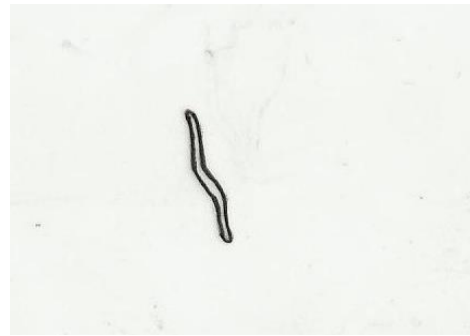
Glaucospira sp5..syn.: *Spirulina subtilissima* var. *brevis* Croasdal 1948 (Pl.3 ,Figs. 1a+b) . Trichomes very loosely coiled 0.8 μm wide, 22 μm long, aical cell rounded coils 1.8 μm wide . (Komárek and Anagnostidis ,2005;Fig165.P.145). Fig 2a+b). Trichome olive blue –green ,trichome solitary 0.9 μm wide, 30 μm

Glaucospira sp.6.syn.:*Spirulina magnifica* (Copeland) Angnostidis (Pl.3,Fig. 2) 2001= *Spirulina cladaria* var. *magnifica* Copeland 1936 = *S.laxissima* Angnostidis1960, (Komárek and Anagnostidis, 2005. Fig 3a-b, P.149).Trichome pale blue green, solitary, free floating, without sheaths, 0.5 μm , wide regularly screw –like coiled, trichome 50 μm , distances between tunes 10 μm . (Komerak and Anagnostidis 2005; P.146,Fig. 157).

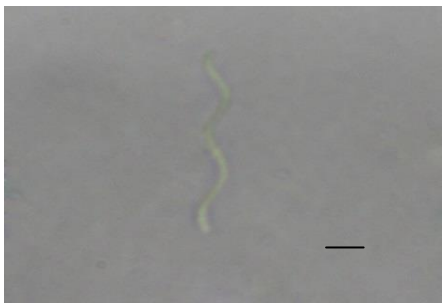
Glaucospira sp.7.syn.:*Spirulina baltica* (Pl. 3, Fig.3) Trichome pale blue green, solitary, free floating, without sheaths, 0.9 μm wide regularly screw –like coiled, trichome 46-48 μm , distances between tunes 12 μm . Martens et Pankow 1972. (Pl.3, Fig.2).



1a



1b



2a



2b

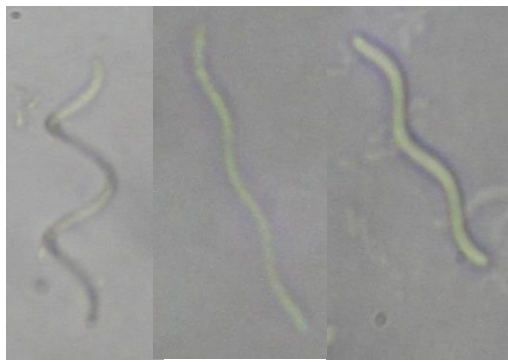


3a

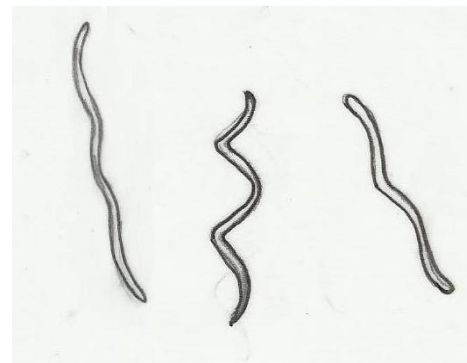


3b

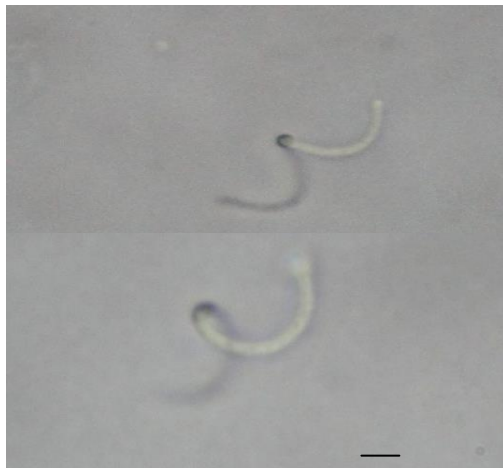
Plate (1) 1-*Glaucospira* sp. Komárek, (1992)=*Glaucospira abbreviate* *Spirulina abbreviata* Lammermann ex Klem & Lemmermann, 1895 2-*Glaucospira agilssimakomerak* 1992=*Spirulina agilissima* (Lagerheim, 1892 in Engler et Prant (1900) 3- *Glaucospira* sp. =*Spirulina corakiana* after Compe, 1970 (40x).



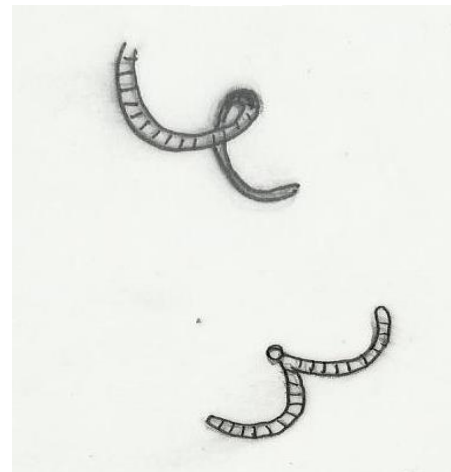
1a



1b



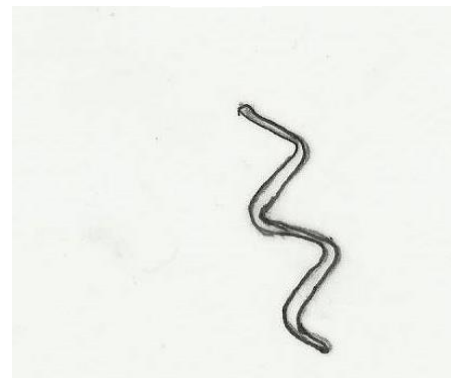
2a



2b

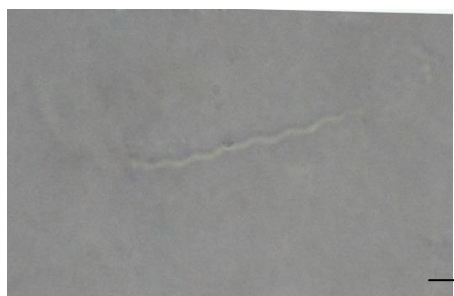


3a

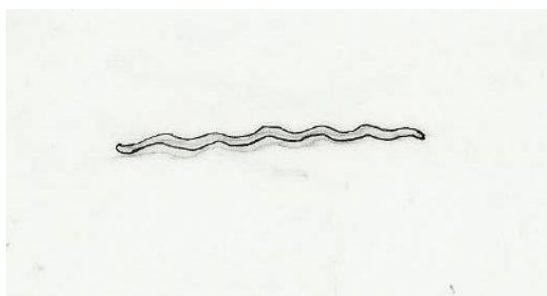


3b

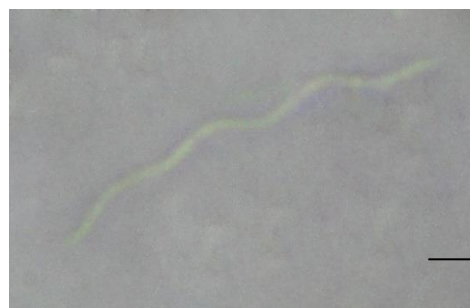
Plate(2).1.*Glaucospira laxissima*. In Komárek,1992=*Spirulina laxissima* after Komárek, 1989=*Glaucospira laxissima*(Aziz, 2012) . 2.*Glaucospira* sp.3.In Komárek =*Spirulina nodosa* Schiller 1950=*Glaucospira nodosa* (Aziz,2012) 3.*Glaucospira* sp.4.=*Spirulina stagnicola* Drouet= *G.Stagnicola* (40x).



1a



2b



2a



2b



3a



3b

Plate (3). 1. *Glaucospira* sp.5. In Komárek, 1992=*Spirulina subtilissima* after Cros 1948=*Glaucospira subtilissima* Aziz, 2012. 2. *Glaucospira* sp.6. In Komárek 1992=*Spirulina magnifica* after Copeland 1936=*Glaucospira magnifica* Aziz, 2012. 3. *Glaucospira* sp.7. In Komárek, 1992 =*Spirulina baltica* after Martena & Panko, 1972=*Glaucospira baltica* Aziz, 2012 (40x).

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المراقبة البيئية للمياه الداخلية في أربيل كردستان -العراق مع إشارة إلى الطحلب الأخضر المزرق. *GlaucoSpira*.

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الخلاصة:

أخذت عينات منتظمة لمدة ستة أشهر من كانون الثاني الى تموز 2012 من البرك الصغيرة، و الضحلة والدائمة والراكدة والبرك ذات تراكيز عالية من الكلوريد (132-162 ملغم/لتر) بالقرب من نهر الزاب الكبريفي قضاء كوير- أربيل. وتم قياس بعض العوامل الفيزيائية والكيميائية بالإضافة الى دراسة الطحالب الموجودة في منطقة الدراسة. تراوحت العوامل المدروسة كمايلي: 15.2-34.7 م° و 15.5-26.5 م° لكل من درجات الحرارة للهواء والماء على التوالي، و 7.38-8.27 لقيم درجة الاس الهيدروجيني و كانت مياه المناطق المدروسة عسرة وقاعدية وذات محتوى عالي من المواد الذائبة الكلية و 892-966 مايكروسمينس/سم للتوصيلية الكهربائية و 2.1-4.1 ملغم/لتر للنترات و 0.33-0.62 ملغم/لتر للفوسفات و 24.7-80.2 ملغم/لتر للكبريتات. وسجلت الطحلب الأخضر المزرق *GlaucoSpira Lagerheim, 1982* كإضافة جديدة لأول مرة الى قائمة الطحالب المسجلة في العراق. ويتميز هذا الطحلب شعري الشكل افرادي و شاحب اللون اصفر مزرق لاحتوي على اغماد وتكون ملفوفة ومتحركة وقسم منها ذات حركة نشطة. كما شخصت تسعة انواع من الطحالب ووصفت وتم تصويرها في الدراسة الحالية وهي :

GlaucoSpira sp.:syn. *Spirulina abbreviata* Lemm. ex Kleb. and Lemm. , *G. agilissima* Lag., *G. laxissima* G.S.West syn.: *Spirulina laxissima f. major* Des., *GlaucoSpira* sp. syn.: *Spirulina tenuior* Lag., *GlaucoSpira* sp. Syn.: *Spirulina corakiana* Playf., *GlaucoSpira* sp.syn.: *Sprulina nodosa* Scham. *GlaucoSpira* sp.syn.: *Spilurina baltica* Mart., *GlaucoSpira* sp. Syn.: *Spirulina magnifica* Cop. And *GlaucoSpira* sp. syn.: *Spirulina subtilissima* Mostly they are from *Spirulina Turpin ex Gomont 189*