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; Glaucospira sp.: syn. Spirulina abreviata Lemm. ex Kleb. and Lemm., G. agilissima Lag., G. laxissima G.S.West syn.: Spirulina tenuior Lag., Glaucospira sp. Syn.: Spirulina corakiana Playf., Glaucospira sp.syn.: Spirulina 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.

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 epipelic 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 Epipelic algae: For capturing a motile epipelic algae as described by Spackova, et al. [15] mud samples were collected at the edge of the pond regularly from January to July012 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 to0.6mm mesh size nuber25 [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: OscillatoriophycideaOrder: 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
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 epipelic 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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Jan</th>
<th>Feb</th>
<th>Mach</th>
<th>April</th>
<th>May</th>
<th>Jun</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature (°C)</td>
<td>19</td>
<td>21.5</td>
<td>21</td>
<td>28</td>
<td>32</td>
<td>34.00</td>
<td>25.91</td>
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<tr>
<td>Water temperature(°C)</td>
<td>19.5</td>
<td>15.5</td>
<td>20.2</td>
<td>32</td>
<td>21.4</td>
<td>26.5</td>
<td>22.5</td>
</tr>
<tr>
<td>pH</td>
<td>7.78</td>
<td>7.38</td>
<td>8.27</td>
<td>7.8</td>
<td>7.82</td>
<td>7.80</td>
<td>7.69</td>
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<tr>
<td>EC μs.cm⁻¹</td>
<td>975</td>
<td>892</td>
<td>966</td>
<td>780</td>
<td>795</td>
<td>790</td>
<td>866.33</td>
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<tr>
<td>TDS mg.l⁻¹</td>
<td>610.2</td>
<td>551.1</td>
<td>456.5</td>
<td>398.9</td>
<td>551.4</td>
<td>652.0</td>
<td>536.68</td>
</tr>
<tr>
<td>Turbidity NTU</td>
<td>5.1</td>
<td>7.3</td>
<td>6.2</td>
<td>4.9</td>
<td>3.2</td>
<td>3.1</td>
<td>4.966</td>
</tr>
<tr>
<td>T. Alkalinity mg.l⁻¹</td>
<td>270.7</td>
<td>6370</td>
<td>252.2</td>
<td>225.2</td>
<td>514.8</td>
<td>150.7</td>
<td>297.2</td>
</tr>
<tr>
<td>T. Acidity mg.l⁻¹</td>
<td>25.1</td>
<td>116</td>
<td>12.4</td>
<td>18.1</td>
<td>21.2</td>
<td>22.3</td>
<td>35.85</td>
</tr>
<tr>
<td>T. hardness mg.l⁻¹</td>
<td>204.6</td>
<td>202.2</td>
<td>230.2</td>
<td>222.1</td>
<td>240.9</td>
<td>241.5</td>
<td>223.58</td>
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<tr>
<td>Ca²⁺ mg.l⁻¹</td>
<td>89.4</td>
<td>79.2</td>
<td>80.4</td>
<td>75.5</td>
<td>92.4</td>
<td>98.7</td>
<td>85.93</td>
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<tr>
<td>Mg²⁺ mg.l⁻¹</td>
<td>15.4</td>
<td>14.2</td>
<td>12.3</td>
<td>15.9</td>
<td>16.4</td>
<td>16.2</td>
<td>15.06</td>
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<tr>
<td>NO₃ mg.l⁻¹</td>
<td>2.5</td>
<td>2.1</td>
<td>2.7</td>
<td>2.6</td>
<td>4.1</td>
<td>5.2</td>
<td>3.2</td>
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<tr>
<td>SO₄ mg.l⁻¹</td>
<td>24.6</td>
<td>20.0</td>
<td>25.2</td>
<td>38.7</td>
<td>56.2</td>
<td>80.2</td>
<td>40.81</td>
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<tr>
<td>PO₄ mg.l⁻¹</td>
<td>0.482</td>
<td>0.330</td>
<td>0.428</td>
<td>0.512</td>
<td>0.622</td>
<td>0.601</td>
<td>0.495</td>
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<td>Cl⁻ mg.l⁻¹</td>
<td>132.3</td>
<td>133.5</td>
<td>154.3</td>
<td>148</td>
<td>162</td>
<td>141.1</td>
<td>145.2</td>
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<tr>
<td>BOD₅ mg.l⁻¹</td>
<td>0.2</td>
<td>2.1</td>
<td>2.2</td>
<td>2.2</td>
<td>3.2</td>
<td>1.2</td>
<td>1.85</td>
</tr>
<tr>
<td>DO mg.l⁻¹</td>
<td>1.6</td>
<td>5.6</td>
<td>5.5</td>
<td>2.6</td>
<td>2.5</td>
<td>0.5</td>
<td>3.05</td>
</tr>
</tbody>
</table>
Species description

Glaucospira sp.1. (Komárek, 1992 syn; Spirulina abbreviata Lummermann ex Klebahn and Lammeranann, 1985. (Pl.1.Figs.1a +b). Trichome pale blue green, 2-2.5 μm wide slightly screw like coiled 22-30μm long, coils 7, 5-7μm long, coils 2-3μm 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). 12μm [Fig-Anon 3 and Komarek and Anagnostidis, 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 1.2-2.2μm wide, trichome 56μm long, coils 4-8μm height (long) the distance between coils 20-10μm long septa not visible (Komarek and Anagnostidis, 2005, P.146, Fig.169b).

Glaucospira laxissima. after Smith from Kondratera (1968) = G. Laxissima (Komarek, 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 Litis, 1970 (Pl. 2Ffig.1)]. Trichome pale blue green, screw –like coils 0.5-0.7 μm wide, Trichome 65μm long, coils 10μm height (long), distance between trichomes 20-22μm long fast mobility, cell content homogenous cosmopolitans, apical, cell rounded obtuse (Komarek 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 1.5μm wide, coils 8μm height (long), distance between trichomes 10-12μm. (Komarek and Anagnostidis, 2005; P.140, Fig.163) Glaucospira sp.4. syn.: Spirulina stagnicola Drouet, 1970 = Glaucospira stagnicola (Pl.2, Fig.3). Trichome pale blue green 1.5μm wide, trichome 38μm long, coils 10μm height (long), distance between trichomes 14μm, cell homogenous in contents, loosely screw like coils, apical cell rounded. (Komarek and Anagnostidis, 2005; P.142, Fig.164) Glaucospira sp.5 syn.: Spirulina subtillissima var. brevis Croasadal 1948 (Pl.3, Figs.1a+b). Trichomes very loosely coiled 0.8μm wide, 22μm long, apical cell rounded coils 1.8μm wide. (Komarek and Anagnostidis, 2005; Fig.165, P.145). Fig 2a+b). Trichomes 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. magna 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 trichomes 10 μm. (Komárek 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 trichomes 12 μm. Martens et Pankow 1972. (Pl.3, Fig.2).

References:


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

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الخلاصة:
أخذت عينات منتظمة لمدة سنة من كانون الثاني إلى تموز 2012 من البرك الصغيرة، والضحلة والدائمة والراكدة والبرك ذات تراكيز عالية من الكلوريد (132-162 ملغم/لتر) بالقرب من نهر الزاب الكبير في قضاء كوير-أربيل. وتم قياس بعض العوامل الفيزيائية والكيمائية بالإضافة إلى دراسة الطحالب الموجودة في منطقة الطحالب الدراسة. تراوح قيم درجة الحرارة المسجلة من 7.38-8.27م° و 9.18-11.5م° و 313-199 ميكروسمين/سم للنترات و1.88-1.93 ملغم/لتر للفوسفات و33.1-31.3 ملغم/لتر للكبريتات. وسجلت الطحلب الأخضر المزرق Glauccospira Lagerheim, 1982 كاضافة جديدة لاول مرة الى قائمة الطحالب المسجلة في العراق. وتم تصويرها في الدراسة الحالية وهي:


1396