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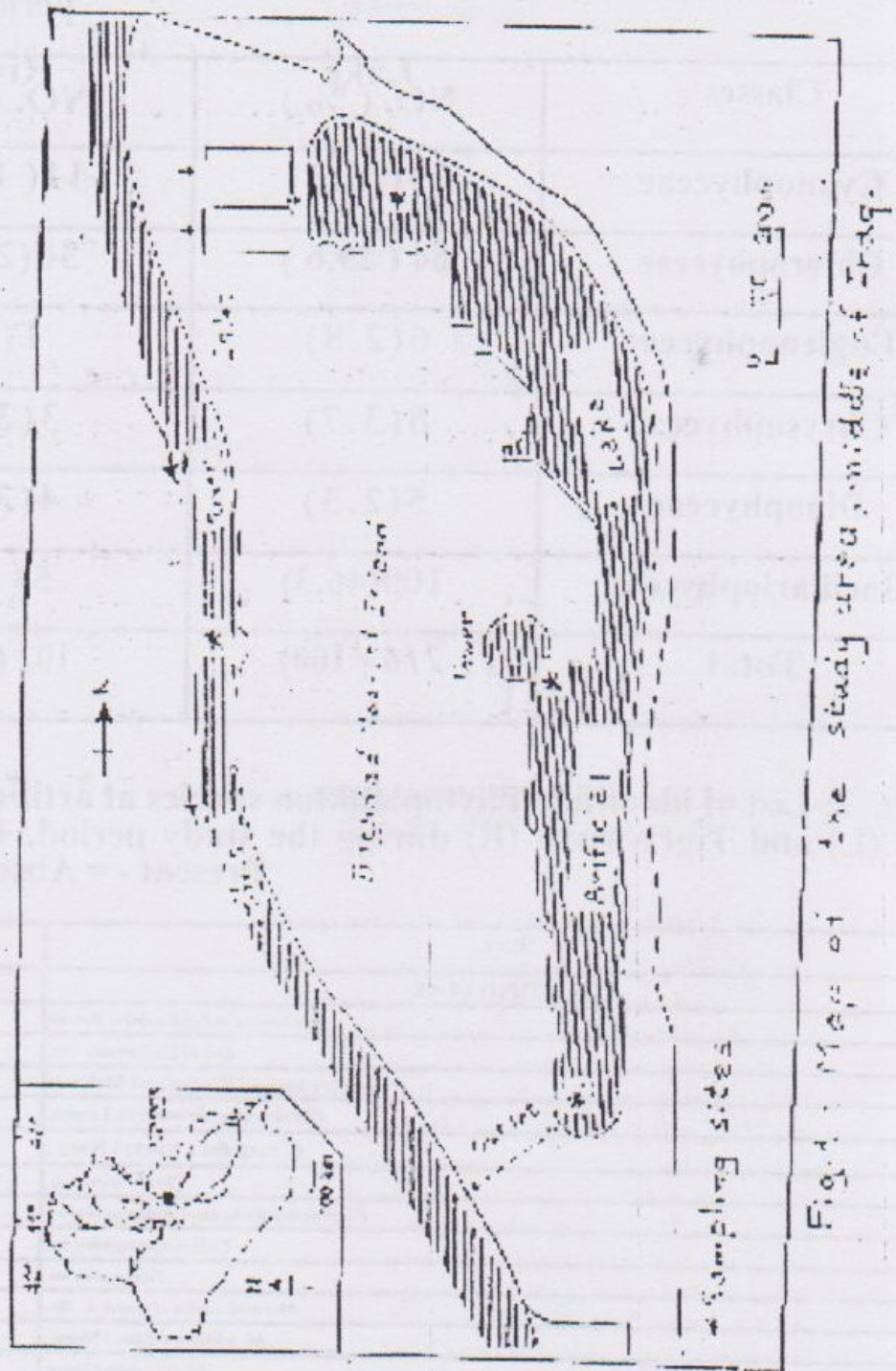




Table 1: Number of species (NO.) and percentage (%) from the total identified phytoplankton of the different classes in artificial lake, and Tigris river during the study period.

Classes	Lake NO. ( % )	River NO. ( % )
Cyanophyceae	33(15.3)	11( 10.8)
Chlorophyceae	64 ( 29.6 )	30(29.4)
Euglenophyceae	6(2.8)	1(1)
Chrysophyceae	8(3.7)	3(3.8)
Dinophyceae	5(2.3)	4(3.9)
Bacillariophyceae	100(46.3)	53 (52)
Total	216 ( 100)	102 ( 100)

Table 2: List of identified Phytoplankton species at artificial lake (L) and Tigris river (R) during the study period. + = Present - = Absence

Taxa	L	R
CYANOPHYCEAE		
<i>Anabaena subcylindrica</i> Rorae	+	+
<i>Aphanizomenon</i> sn.	+	-
<i>Calothrix baronii</i> Brenet and Flahault	+	-
<i>Chroococcus limneticus</i> Lemm.	+	+
<i>C. turgidus</i> ( Kuetz ) Naeg .	+	-
<i>Chroococcus</i> sn.	+	+
<i>Coelosphaerium kuetsingiana</i> Naeg.	+	+
<i>Cylindrocapsa</i> sn.	+	-
<i>Gleocarya</i> sn.	+	-
<i>Merismopedia elegans</i> A. Re	+	-
<i>M. planica</i> ( Ehr. ) Naeg .	+	+
<i>M. truncata</i> Mev.	+	-
<i>M. tenuissima</i>	+	-
<i>Merismopedia</i> sn.	+	-
<i>Microcystis aeruginosa</i> Kütz.	+	-
<i>M. flocculans</i> ( Witr. ) Kirch .	+	-
<i>M. marginata</i>	+	-
<i>Nodularia</i> sn.	+	+
<i>Nostoc</i> sn.	+	+
<i>Nostocoidiscus luteus</i>	+	-
<i>Oscillatoria wardii</i> Com .	+	+



<i>O. Curviceps</i> Agardh.	+	+
<i>O. Linnetica</i> Lemm.	+	-
<i>O. atoria princeps</i> Vau. et Com	+	-
<i>O. rubes cens</i> de Candolt	+	-
<i>O. subbrevis</i> Schm.	+	+
<i>Oscillatoria</i> sp.	+	-
<i>Phormidium</i> sp.	+	-
<i>Pseudoanahaena</i> sp.	+	-
<i>Spirulina laxa</i> G.M. Smith	+	-
<i>S. major</i> Kutez.	+	+
<i>S. princeps</i> West and West	+	-
<i>S. subalsa</i> Oer. et Gom.	+	-
CHLOROPHYCEAE		
<i>Ankistrodesmus convolutus</i> Cor.	+	+
<i>A. falcatus</i> G.S. West	+	+
<i>Botryococcus braunii</i> Kuetz.	+	-
<i>Cerasterias irregular</i>	+	-
<i>C. slaurasleroides</i> West and West	+	-
<i>Chlorella vulgaris</i> Beiger	+	-
<i>C. ellipsoidae</i>	+	-
<i>Closterium acerosum</i> (Schr.) Ehr.	-	+
<i>C. acutinn</i>	+	+
<i>C. costatum</i>	+	+
<i>C. granular</i>	+	+
<i>Closterium</i> sp.	+	-
<i>Closteriopsis longissima</i> Lemm.	+	-
<i>Coelastrum aslroides</i>	+	-
<i>C. microporum</i> Naeg.	+	-
<i>C. reticulatum</i> (Dang.) Senn	+	+
<i>C. sphaericum</i> Naeg.	+	-
<i>Cosmarion gran alium</i> de Breh.	+	-
<i>C quadratus</i>	+	+
<i>Cosmarium</i> sp.	+	-
<i>Ducyllococcus in'itsionum</i>	+	-
<i>Dictyosphaerium pulchellum</i> Wood	+	-
<i>Gleocystis</i> sp.	+	-
<i>Kirchneriella obesa</i> (G.S. West) Schm.	-	+
<i>Lagerhemia ciliata</i> (Lagerli.) chod.	+	-
<i>L. cilriformis</i> (Snow) G.M. Smith	+	-
<i>L. longiseta</i>	+	-



<i>Ulothrix</i> sp.	+	+
<b>EUCLEINOPHYCEAE</b>		
<i>Euglena acus</i> Ehr.	+	+
<i>E. convululus</i> Korsh.	+	-
<i>E. polymorpha</i> Dang.	+	-
<i>E. proximum</i> Dang.	+	-
<i>E. tripteris</i> ( Duj. ) Klebs	+	-
<i>Phacus candalus</i> Hueb.	+	-
<b>CHRYSTOPHYCEAE</b>		
<i>Dinobryon cylindricum</i> Imhof	+	-
<i>D. divergens</i> Imhof.	+	-
<i>D. sertularia</i> Ehr.	+	+
<i>Draparnaldiopsis salishensis</i>	+	-
<i>Golenkenia radiata</i>	+	+
<i>Golenkenopsis</i> sp.	+	-
<i>Malamonas acroides</i>	+	+
<i>M. caudata</i>	+	-
<b>DIINOPHYCEAE</b>		
<i>Ceratium hirudinella</i> (I.;B. Mull.) Bergh	+	+
<i>Ceratium</i> sp.	+	-
<i>Glenodinium</i> sp.	+	+
<i>Gymnodinium</i> sp.	+	+
<i>Peridinium</i> sp.	+	+
<b>BACILLARIOPHYCEAE</b>		
" Pennales "		
<i>Achnanthes biasolettiana</i>	+	+
<i>A. minutissima</i> Kuetz	+	+
<i>Achnanthes</i> sp.	+	-
<i>Amphiprora alata</i> Kuetz	+	+
<i>A. costata</i>	+	-
<i>Amphora ovalis</i> Kuetz	+	+
<i>A. robusta</i> Gerg.	+	-
<i>Anomoeoneis exilis</i> ( Kuetz. ) Cl.	+	+
<i>Bacillaria paxillifera</i> ( Mull. ) Hendey	+	+
<i>Bacillaria</i> sp.	+	-



<i>Caloneis alpestris</i>	+	-
<i>C. lenidula</i>	+	-
<i>Caloneis</i> sp.	+	-
<i>Cocconeis nediculus</i> Ehr.	+	+
<i>Culticentulei</i> var. <i>evoluta</i> (Ehr.) Cl.	+	+
<i>C. ovalis</i>	+	+
<i>Cymatolura elliptica</i> (Breb.) W. Smith	+	-
<i>C. solea</i> (Breb.) W. Smith	+	-
<i>C. solea</i> var. <i>regular</i>	+	-
<i>Cymbella affinis</i> Kütz.	+	+
<i>C. microcephala</i> Grun.	+	+
<i>C. naviculiformis</i> Auerwald	+	+
<i>C. cistula</i> (Hemm.) Grun.	+	-
<i>C. cymbiformis</i> (Ag.) Kuetz.	-	+
<i>C. gracilis</i>	-	+
<i>C. lanceolata</i> (Ehr.) VanHeurck	+	+
<i>C. microcephala</i> Grun.	+	+
<i>C. naviculiformis</i> Auerwald	+	+
<i>C. tumida</i> (Breb.) Vanheurck	-	+
<i>C. turrida</i>	+	-
<i>C. ventricosa</i> Kuetz.	+	+
<i>Diatoma elongatum</i> (Lynce.) Ag.	+	+
<i>D. vulgare</i> Rorv	+	-
<i>Diloneis ovalis</i> (Hilse) Cl.	+	+
<i>D. pseudovalis</i> (Hust.) Hust. Patric	+	-
<i>Eunotia</i> sp.	+	-
<i>Fragillaria acus</i> Kütz.	+	-
<i>F. acus</i> var. <i>amoussianii</i> Grun.	+	+
<i>F. construens</i> (Ehr.) Grun.	-	+
<i>F. tenara</i>	+	-
<i>F. tubulata</i> (C. A. A. C.) Kuetz.	+	-
<i>F. ulna</i> (Nitsch.) Ehr.	+	-
<i>F. ulna</i> var. <i>bicens</i> Kuetz.	+	+
<i>F. vaucheriae</i> (Kütz.) Peters	+	-
<i>Fragillaria</i> sp.	+	+
<i>Gomphonema acuminata</i> Kütz.	+	-
<i>G. constrictum</i> var. <i>canitata</i> (Ehr.) C.	+	-
<i>G. intricatum</i> Kütz.	+	+
<i>G. lanceolatum</i> Ehr.	-	+
<i>G. parvulum</i> (Kütz.) Grun.	-	+
<i>G. subaequalatum</i> Ehr.	-	+
<i>G. subtile</i>	+	-
<i>G. ventricosum</i>	+	+
<i>Gomphonema</i> sp.	+	+
<i>Gyrosigma acuminatum</i> (Kuetz.) Rabh.	+	-
<i>G. alternatum</i> (Kuetz.) Rabh.	+	+
<i>G. kützingeri</i> (Grun.) Cl.	+	-
<i>G. neisonis</i> (Grun.) Gust.	+	-
<i>G. scutelloroides</i> (Kütz.) Rabh.	+	+
<i>G. stenocephalum</i> (W. Smith) Cl.	+	+
<i>G. striatellum</i>	+	-
<i>G. tenuirostre</i> (C. Grun.) Cl.	+	-
<i>Hantzschia amphioxys</i> (Ehr.) Grun.	+	+



<i>Mastogloia elentica</i> (C. A. A. C) Cl.	+	-
<i>M. smithi</i> Thvva.	+	-
<i>Mastogloia</i> sp.	+	-
<i>Navicula onglia</i> Ralfs	+	+
<i>N. atomus</i> (Kütz.) Grun.	+	-
<i>N. cryptocephala</i> Kütz.	+	-
<i>Navicula cryptocephala</i> var. <i>intermedia</i> Grun.	+	+
<i>N. cryptocephala</i> var. <i>minuta</i> Boy.	+	-
<i>N. parva</i> (Mench.) Cl.	+	-
<i>N. radiora</i> Kütz.	+	-
<i>N. fas en la</i> Ehr.	+	-
<i>N. viridis</i> Kütz.	+	-
<i>Navicula</i> sp.	+	+
<i>Nitzschia acicularis</i> W. Smith	+	-
<i>N. acuminata</i> (W. Sm.) Grun.	-	+
<i>N. amphibia</i> Grun.	+	-
<i>N. apiculata</i> (Greg.) Grun.	+	-
<i>N. fasciculata</i> Grun.	+	-
<i>N. filiformis</i> (W. Sm.) Must.	+	-
<i>N. frustulum</i> var. <i>perminula</i> Grun.	+	-
<i>N. palae</i> (Kütz.) W. Smith	+	+
<i>N. sigma</i> (Kütz.) VV. Smith	+	-
<i>N. sigmoidae</i> (Ehr.) VV. Smith	+	-
<i>N. tryblionella</i> var. <i>victoriae</i> Grun.	+	+
<i>Nitzschia</i> sp.	+	+
<i>Pinularia</i> sp.	+	-
<i>Rhoicosphenia curvata</i> (Kütz.) Grun.	-	+
<i>Rhopaloidia gihha</i> (Ehr.) O. Mull.	+	-
<i>Surirella capronii</i> deBreb.	+	+
<i>S. ovalis</i> deBreb.	+	+
<i>S. ovata</i> Kütz.	-	+
<i>S. robusta</i> Ehr.	-	+
<i>Surirella</i> sp.	+	+
"Centrales"		
<i>Aulacosira granulata</i> (Ehr.) Ralfs.	+	+
<i>A. granulata</i> var. <i>angustissima</i>	+	-
<i>A. italica</i> (Ehr.) Kütz.	+	+
<i>A. varians</i> (Agard.) Simo.	+	-
<i>Atheya zachariasii</i> J. Brun.	+	-



<i>Chaetocerus mulerie</i>	+	+
<i>Coscinodiscus sp.</i>	+	-
<i>Cyclotella comta</i> ( Ehr.) kuetz.	+	-
<i>C. meneghiana</i> Kuetz.	+	-
<i>C. kuetzing'uuia</i> Thu.	+	+
<i>C. ocellata</i> Pan.	+	+
<i>C. stelligera</i> Cl. et Grun.	+	-
<i>Rhizosolenia longiseta</i> Zach.	+	-
<i>Stephanodiscus astrae</i> ( Ehr.) Grun.	+	+



## On the phytoplankton populations in artificial lake and Tigris river, middle of Iraq

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### Abstract

Phytoplankton were collected from artificial lake and Tigris river nearby, middle of Iraq, for the period between August 1998 to April 1999. A total of 230 algal taxa were identified. Out of that 216 taxa were identified in the lake and 102 taxa in the river. Diatoms was the dominant group in both studied area (47.8%), followed by greens (29.5%) and blue greens (14.3%). Species belong to Pennales were six times more than those belong to Centrales in both areas. Several genera were represented by more than 3% of the total identified species at both areas, namely *Nitzschia*, *Cymbella*, *Scenedesmus*, *Pediastrum* and *Gomphonema*.

### Introduction

It is well known that phytoplankton are considered to be the primary producer in the aquatic environments, both lotic and lentic waters. Their productivity and diversity depend on several factors mainly light, temperature, pH and nutrients.



In Iraq, several works were already published on the algal composition of lotic water such as Shatt al-Arab estuary (Al-Saadi et al. 1979), Garmat All river (Al-Saadi et al. 1996), Euphrates river (Al-Saadi et al. 2000a) and Saria stream (Al-Saadi et al. 2000b), as well as lentic water such as marsh area (Pankow et al. 1979, Al-Saadi and Al-Lami 1992, Al-Mousawi et al. 1994) and Qadisia lake (Kassim et al. 1999). Whereas, there is no single work deals with the comparison of algal composition between lotic and lentic environment in Iraq. Therefore, the present investigation is the first attempt to give such comparison.

#### Materials and Methods

Hydro-Bios plankton net of 20 $\mu$ m mesh size was used to collect phytoplankton twice a month for the period between August 1998 to April 1999. The collection was made from artificial lake near Baghdad city at three different locations and from Tigris river nearby (Fig. 1), samples were fixed with Lugol's solution.

Identification of non-diatom algal species was confirmed by several references (Smith 1950, Desikachary 1959, Fritsch 1965, Prescott 1979, Bold and Wynne 1985). Whereas, the diatoms were confirmed by other references (Hustedt 1930, Cleve-Euler 1952, 1953, 1955, Patric and Reimer 1975, German 1981).



## Result and Discussion

The limnological comparative characters of both studied areas were already given (Ismail and Al-Saadi 2000). Both artificial lake and Tigris river nearby have fresh water, well areated, alkaline and very hard. Higher turbidity was recorded in the river. Also, the comparison in the algal quantity between the same two studied areas was reported (Ismail and Saadalla 1997). They indicated that the lake showed higher counts of algal biomass and diatoms was the dominant group in the total cell number at both areas.

A total of 230 algal taxa was identified in the studied area. Out of that 216 taxa was identified in the lake, while only 102 taxa in the river (Table 1). Diatoms was the dominant group in number of species which represent 110 taxa (47.8%), followed by green algae (68 taxa and 29.5%) and blue greens (33 taxa and 14.3%). Such sequence of dominancy was illustrated in other Iraqi aquatic areas, both lotic and lentic waters, such as Tigris river (Maulood et al. 1994), Garmat Ali river (Al-Saadi et al. 1996), Saddam river (Sulaiman and Kamel 1999), Euphrates river (Al-Saadi et al., 2000a), marsh areas (Al-Mousawi et al. 1994) and Qadisia lake (Kassim et al., 1999).

Diatoms were also dominated in their species number at both lakes (46.3%) and river (53%), followed by greens 24.6% and 29.4%, and blue greens 15.3% and 10.8% in both areas respectively. Species belong to Pennales prevail in both areas (87 taxa and 46 taxa), compared with Centrales (13 taxa and 7 taxa) in lake and river respectively (Tables 1 and 2).



Similar results was found in almost all studied Iraqi aquatic areas (see the above references). few species belong to other groups were also identified, namely Euglenophyceae, Chrysophyceae and Dinophyceae at both areas (Table 1 and 2).

Although the percentage of diatoms and green algae in respect to the total identified species was almost similar at both studied areas, but the number of species was doubled in the lake in comparison to the river. This was also the case in the total species number (Table 1). Such case was expected since the lake environment has relatively stable water body and better habitat for algal growth and diversity (Goldman and Home 1983, Wetzel 1983).

The total cell number of phytoplankton In the lake was also higher than the river as indicated by Ismail and Saadalla (1997).

Most of the identified species in the river were benthic in their origin which may be removed by the effect of water current. Whereas, in the lake most of them were planktonic. Such case is well known elsewhere (Wetzel 1983).

A total of 89 taxa was common between the two studied areas (Table 1), and indicated that most of the identified species in the river were also found in the lake (Table 2). These common species were equal to 87.3% from the total identified species in the river.

Few genera were represented by higher number of species (more than 3% of the total identified species), in the lake (Table 2), such as *Nitzschia* (11 species), *Navicula* (10 species),



*Cymbella* (9 species), *Scenedesmus* and *Gyrosigma* (8 species each), and *Oscillatoria*, *Pediastrum* and *Gomphonema* (7 species each). These genera were also represented by several species in other lentic water in Iraq, such as Burket Baghdad in the marsh area in which *Navicula* was represented by 13 species, *Oscillatoria* by 10 species and *Gomphonema* by 6 species (Pankow et al. 1979). Also, in Al-Hammar marsh, *Nitzschia* was represented by 19 species, *Navicula* by 7 species and *Scenedesmus* by 4 species (Al-Saadi and Al-Lami 1992). In Qadisia lake, *Nitzschia* was represented by 21 species, *Cymbella* by 10 species, *Navicula* and *Pediastrum* by 5 species each (Kassim et al. 1999).

Whereas, in the river *Cymbella* was represented by 10 species, *Scenedesmus* by 6 species, *Pediastrum* and *Gomphonema* by 5 species each and *Nitzschia* by 4 species (Table 2). These genera were also reported representing by several species in other Iraqi lotic water, such as Shatt al-Arab in which *Nitzschia* was represented by 17 species (Al-Saadi et al. 1979). In Saddam river *Nitzschia* was represented by 14 species and *Cymbella* by 4 species (Sulaiman and Kainel 1999). In Euphrates river, *Nitzschia* was represented by 19 species, *Cymbella* by 13 species, *Scenedesmus* by 7 species and *Pediastrum* by 4 species (Al-Saadi et al. 2000a). Meanwhile, in Saria stream, *Nitzschia* and *Cymbella* were represented by 9 species each (Al-Saadi et al. 2000b).

From the above, *Nitzschia*, *Cymbella*, *Scenedesmus*, *Pediastrum* and *Gomphonema* species were represented by more than 3% from the total identified taxa (Table 2). In the



meantime, the variations in the number of species belong to one genus may be related to different environmental characters. This needs further investigations.



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