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Research Article

A Contribution to Algal Flora in Baghdad Area, Iraq

F.M. Hassan[1], J.J. Toma[2*], A.M. Ismail[1], J.S. Alhassany[1], R.A.M. Hadi[1] and B.K. Maulood[2]

[1]College of Science for Women, University of Baghdad, Baghdad, Iraq.*
[2]College of Science, University of Salahaddin, Hawler, Kurdistan Region of Iraq, Iraq.

Abstract: This study contains the description of twenty-five algal species, twenty genera, nineteen families, nine orders and six classes that were identified in the Baghdad Area during the period from 2007 till 2009, and based on the study two new records will be added to the Algal Flora list of Iraq.

Keywords: Algae, Limnology, Baghdad, Iraq.

1. Introduction

Most of the limnological studies in Iraq have dealt with various quantitative and qualitative aspects of different Iraqi aquatic systems (Maulood *et al*., 1994; Hassan *et al*., 2010a,b; Hadi & Al-Zubaidi, 2001) However, a great deal of effort was spent on identifying microalgae in qualitative analyses of phytoplankton populations and quantitative calculations of phytoplankton biomass.

Algal species composition was the main point of interest in some investigations; pioneer limnologists in Iraq made taxonomic and morphological studies on different groups of algae in different aquatic systems (Hinton & Maulood, 1979a, b, 1980, 1982, 1983a and 1983b; Antoine, 1983; Hadi *et al*., 1984; Al-Saboonchi & Al-Saad, 1988; and Al-Handal 1989). Unfortunately such a huge water system didn't attract enough attention by scientists of algae in the area till the establishment of various universities when the first attempt of gathering the varies scattered publication of algae in the area done by Hinton and Maulood (1983), when they listed firstchecklist of algae where ten years later the second checklist published by Maulood *et al*., (1993), and the third checklist published by Maulood & Toma (2004). This study will try to contribute to the previous work done to classify the algal flora in the Baghdad area.

2. Material and Methods

Twenty-two different types of samples were collected from small streams, stagnant water, failed septic tanks, fountains and wet soil of different sectors of Baghdad city during 2007, 2008 and 2009. The collection of algae carried out by phytoplankton net sample, scraped from rocks, soil surface by using a spatula or dull knife, and a wide-mouthed collection jar.

The samples were preserved by either Lugol's solution (10gm pure Iodine, 20gm Potassium Iodide is dissolved in 20ml glacial acetic acid) or formalin 4%.

3. Result and Discussion

The identifications of algae were done under an Olympus microscope, the diameter of each examined taxon was measured in microns (μm).

Twenty-five species, twenty genus, nineteen families, nine orders within six classes of algae were identified in this study, two new records were added to the list of algal flora in Baghdad based on the newest checklist of the algae flora in Iraq by Maulood & Toma, 2004.

All the identified algae was arranged systematically (following Prescott, 1982). The identification references were listed beside each taxon.

*Corresponding author:
E-mail: janan_toma@yahoo.com.

- **Division: Cyanophyta**
- **Class: Cyanophyceae**
- **Order: Nostocales**
- **Family: Nostocaceae**
- **Genus: *Anabaena***
- **Species: *Anabaena inaequalis* (Kütz.) Bornet & Flahault (Pl. 1, Fig. 1) (Prescott, 1982, 516, Pl. 116, Figs. 9, 10)**

Plate 1. CLASS I: Cyanophyceae: Fig. 1. *Anabaena inaequalis.*
(Scale represents 20µm unless otherwise mentioned)

Trichomes straight or slightly twisted, lying parallel and enclosed by a definite sticky sheath, 5µm wide; forming gelatinous strands, entangled among other algae and adherent (sometimes floating free). Cells short barrel-shaped 5µm in diameters. Heterocysts ovate, 6µm in diameter, 7.5µm long. Akinete is cylindrical, scattered, with wall often golden-brown when mature; 12µm in diameters, 20-25µm long. This taxon was described in Desikachary as *Anabaena laxa*. Collected from the artificial lake behind the University of Baghdad. It was founded as a mass of the blue-green and erectly on the concrete base of the lake.

- **Division: Cyanophyta**
- **Class: Cyanophyceae**
- **Order: Chroococcales**
- **Family: Synechococcaceae**
- **Genus: *Johannesbaptistia***
- **Species: *Johannesbaptistia pellucida* (Dickie) Taylor *et al*., Drouet (Pl. 1, Fig.2) (Desikachary, 1959, 165, Pl. 32, Figs. 14 - 19; Wehr & Sheath, 2003, 80, Fig. 6A).**

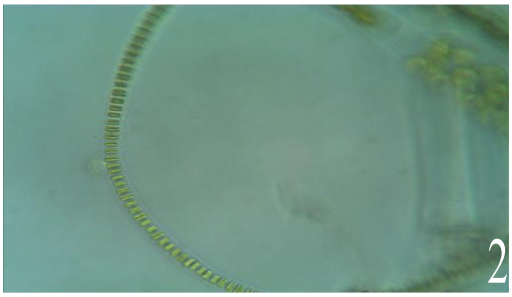

Plate 1. CLASS I: Cyanophyceae: Fig. 2. *Johannesbaptistia pellucida*.
(Scale represents 20µm unless otherwise mentioned)

Filamentous blue-green or pale gray-blue or olivaceous, straight or curved, about 8µm broad; cells discoid or sphaerico-discoid, round at the apices of the filaments, arranged in a single series, in a cylindrical hyaline mucilage, cells 5µm broad and 2.5µm long. It collected from the artificial brook of the University of Baghdad. It was found entangled with *Spirogyra* and *Oedogonium*.

- **Division: Cyanophyta**
- **Class: Cyanophyceae**
- **Order: Chroococcales**
- **Family: Chroococcaceae**
- **Genus: *Chroococcus***
- **Species: *Chroococcus turgidus* (Kütz.) Nägeli (Pl. 1, Fig. 3) (Desikachary, 1959, 101, Pl. 26, Fig. 6; Prescott, 1982, 450, Pl. 100, Fig. 19).**

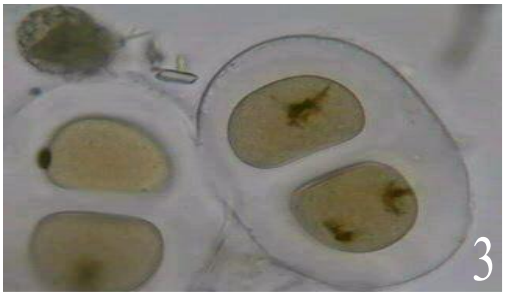

Plate 1. CLASS I: Cyanophyceae: Fig. 3. *Chroococcus turgidus*.
(Scale represents 20µm unless otherwise mentioned)

A free-floating colony of 2-4 ovoid or hemispherical cells inclosed by a very wide (usually), hyaline and lamellate colonial sheath; cells bright blue-green, contents sometimes coarsely granular, enclosed by individual sheaths, 12µm in diameter without sheath, 15µm wide including sheath. It collected from the artificial brook of the University of Baghdad.

- **Species: *Chroococcus limneticus* (Lemmermann) (Pl. 1, Fig. 4) (Desikachary, 1959, 107, Pl. 26, Fig. 2; Prescott, 1982, 448, Pl. 100, Figs. 4-5)**

Plate 1. CLASS I: Cyanophyceae: Fig. 4. *Chroococcus limneticus*.
(Scale represents 20µm unless otherwise mentioned)

A free-floating, spherical or ovate colony of 4 spherical cells rather closely and evenly arranged, sometimes in groups of 2-4 cells as a result of rapid cell division; individual cell sheath usually indistinct and confluent with the hyaline, mucilaginous colonial granular; cells 10.4µm in diameter, without sheath, with sheath 15µm in diameter. It collected from the artificial brook of the University of Baghdad.

- **Division: Cyanophyta**
- **Class: Cyanophyceae**
- **Order: Chroococcales**
- **Family: Merismopediaceae**
- **Genus: *Merismopedia***
- **Species: *Merismopedia tenuissima* Lemmermann (Pl. 1, Fig. 5). (Desikachary, 1959, 154, Pl. 29, Fig. 7; Pl. 30, Fig. 8, 9; Prescott, 1982, 459, Pl. 102, Fig. 10)**

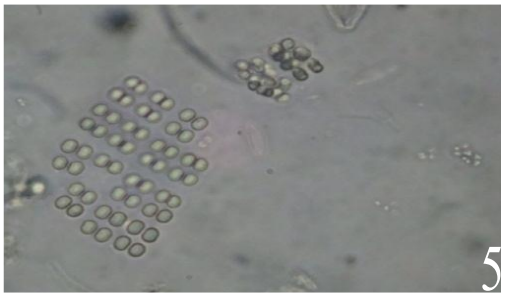

Plate 1. CLASS I: Cyanophyceae: Fig. 5. *Merismopedia tenuissima.*
(Scale represents 20µm unless otherwise mentioned)

Small rectangular plats of usually 16 minutes ovate cells which are closely spaced within a wide gelatinous sheath; cells 2.5µm in diameter, cell contents pale blue-green or gray-green, homogenous; colony 15.6-17µm in diameter.

- **Division: Cyanophyta**
- **Class: Cyanophyceae**
- **Order: Oscillatoriales**
- **Family: Oscillatoriaceae**
- **Genus: *Oscillatoria***
- **Species: *Oscillatoria princeps* Vaucher (Pl. 1, Fig. 6) (Desikachary, 1959, 210, Pl. 37, Figs. 1, 10, 11, 13, 14; Prescott, 1982, 489, Pl. 110, Fig. 1).**

Trichomes blue-green, more or less brownish, violet or reddish, mostly forming a thallus, mostly straight, not constricted at the cross-walls, 20-30 micron broad, blue-green to dirty green, slightly or briefly attenuated at the apices and bent; cells 5-6µm long; end cells flatly rounded, slightly capitates without or with slightly thickened membrane. It collected from the artificial brook of the University of Baghdad.

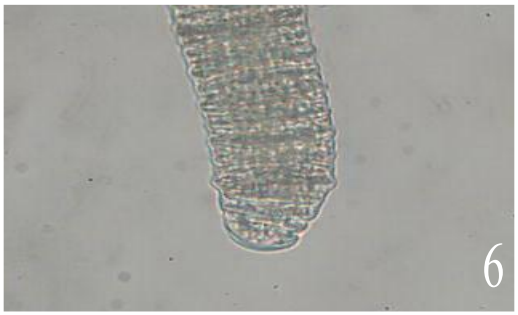

Plate 1. CLASS I: Cyanophyceae: Fig. 6. *Oscillatoria princeps.*
(Scale represents 20µm unless otherwise mentioned)

- **Division: Chlorophyta**
- **Class: Chlorophyceae**
- **Order: Oedogoniales**
- **Family: Oedogoniaceae**
- **Genus: *Oedogonium***
- **Species: *Oedogonium cardiacum* (Hass.) Wittrock (Pl. 2, Fig. 7a, b) (Prescott, 1982, 168, Pl. 29, Figs. 7, 8)**

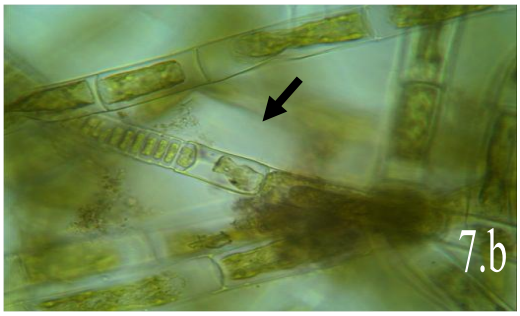

Plate 2. CLASS II: Chlorophyceae: Figs. 7. a,b. *Oedogonium cardiacum.*
(Scale represents 50µm unless otherwise mentioned)

Macrandrous; dioecious. Vegetative cells cylindrical rather stout, 18µm in diameter, 78-90µm long. Oogonia solitary; globose; opening by supramedian pore 50µm in diameter, 75-80µm long. Oospores are 60µm long, 45-50µm in diameter, while antheridia 18µm in diameter, 8µm long. It collected from the artificial brook of the University of Baghdad, attached to Chara.

- **Genus: *Oedogonium***
- ***Species: *Oedogonium lautumniarum* Wittrock (Pl. 2, Fig. 8) (Prescott, 1982, 172) (*New record in Iraq according to Maulood and Toma, 2004)**

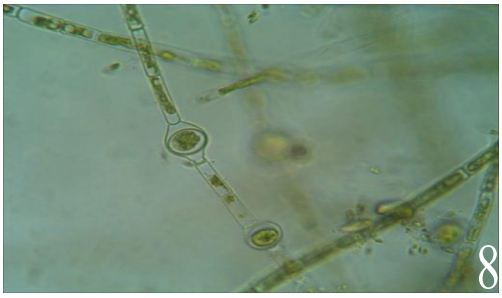

Plate 2. CLASS II: Chlorophyceae: Fig. 8. *Oedogonium lautumniarum.*
(Scale represents 20µm unless otherwise mentioned)

Macrandrous; dioecious. Vegetative cells cylindrical, 18µm in diameter, 50–70µm in long. Oogonia are solitary; sub ovoid-globose; opening by a sup pore; supramedian 42µm in diameter, 38-42µm long. Oospore subglobose; filling the oogonium; wall smooth; 37µm in diameter. It collected from the artificial brook of the University of Baghdad, attached to *Chara*.

- **Division: Chlorophyta**
- **Class: Ulvophyceae**
- **Order: Cladophorales**
- **Family: Cladophoraceae**
- **Genus: *Cladophora***
- **Species: *Cladophora glomerata* (L.) Kützing (Pl. 2, Fig. 9. a, b)**
  (Prescott, 1982, 138, Pls. 20, 21, Figs. 8-9 and 1, 2 respectively)

Attached, fluffy or streaming Arbuscular thalli, usually in flowing water. Filaments successively and regularly branched, the branches usually crowded in the upper limits. Cell's very lightly attenuated toward the apices of the branches, which are bluntly pointed. The main axis is 90-100µm in diameter, 4-5 times the diameter in length; cells in the branches 40-50µm in diameter, 6 times the diameter in length. It collected from the artificial brook of the University of Baghdad.

Plate 2. CLASS II: Chlorophyceae: Figs. 9. a,b. *Cladophora glomerata.*
(Scale represents 50µm unless otherwise mentioned)

- **Division: Chlorophyta**
- **Class: Zygnematophyceae**
- **Order: Zygnematales**
- **Family: Zygnemataceae**
- **Genus: *Spirogyra***
- **Species: *Spirogyra nitida* (Dill.) Link (Pl. 2, Fig. 10)**
  (Prescott, 1982, 318, Pl. 73, Fig. 10)

Plate 2. CLASS II: Chlorophyceae: Fig. 10. *Spirogyra nitida*.
(Scale represents 20µm unless otherwise mentioned)

Filaments of rather stout cells, 60–70µm in diameters, 100µm long, with plane end walls; chloroplast 3, making 1/2 turns. Conjugations are by tuber from both gametangia; fertile cells cylindrical. Zygospore ellipsoid, with sharply rounded pole median spore wall smooth and brown, 50-60µm in diameter, 80-85µm long. It's Tychoplankton and collected from the artificial brook of University of Baghdad.

- **Division: Chlorophyta**
- **Class: Zygnematophyceae**
- **Order: Zygnematales**
- **Family: Desmidiaceae**
- **Genus: *Cosmarium***
- **Species: *Cosmarium botrytis Meneghini* (Pl. 2, Fig. 11)**
  (Nurul-Islam & Haroon, 1985, 882, Pl. 3 Figs. 46, 47; Al-Handal, 1995, 94, Pl. 3, Fig. 24).

Length: 37-62µm; mid region diameter 35-50µm; wide at isthmus; 10-27µm. It's collected from Al-Iskan district, Baghdad.

Plate 2. CLASS II: Chlorophyceae: Fig. 11. *Cosmarium botrytis*.
(Scale represents 20µm unless otherwise mentioned)

- **Division: Chlorophyta**
- **Class: Zygnematophyceae**
- **Order: Zygnematales**
- **Family: Desmidiaceae**
- **Genus: *Cosmarium***
- **Species: *Cosmarium leave* Rabenhorst (Pl. 2, Fig. 12)**
  (Nurul-Islam & Zaman, 1975, 52, Pl. 5, Fig. 80, 81, 85, 86; Felisberto & Rodrigues, 2004, 9, Pl. 1, Fig. 8)

Plate 2. CLASS II: Chlorophyceae: Fig. 12. *Cosmarium leave*.
(Scale represents 20µm unless otherwise mentioned)

Cells 1.2-1.6 times longer than wide, 13-18µm width, 18-29µm length, 4.5-7.5µm at isthmus; constriction deep, sinus closed and narrow; semi-cells variable in outline, mostly angular, pyramidal rounded basal angles and rounded to slightly truncate in apex; semi-cells semicircular in lateral view to wall variable, mostly finely punctuate, chloroplast with one pyrenoid. It's collected from the fountain of 14th Ramadan Street.

- **Division: Chlorophyta**
- **Class: Zygnematophyceae**
- **Order: Zygnematales**
- **Family: Zygnemataceae**
- **Genus: *Mougeotia***
- **Species: *Mougeotia viridis* (Kütz.) Wittrock B. (Pl. 2, Fig. 13. a, b)**
  (Prescott, 1982, 306, Pl. 71, Figs. 8 - 10)

Filaments are slender, becoming geniculate in conjugation; cells 7.5µm in diameter, 30-75µm long; chloroplast a broad plate extending the full length of the cell to 4-6 pyrenoids. Zygospores formed in the tube, dividing both gametangia; quadrate, the sides concave, corners retuse; medium spore wall smooth & colorless; 25-27µm in diameter. It collected from pelves in the front of the Baghdad University.

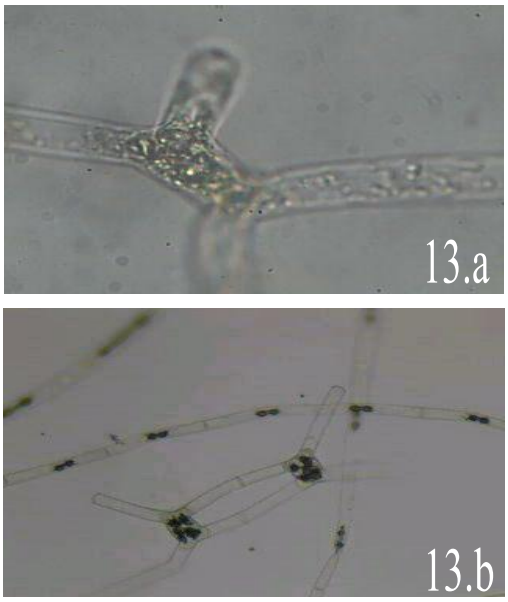

Plate 2.CLASS II: Chlorophyceae: Figs. 13a,b. *Mougeotia viridis.*
(Scale represents 50µm unless otherwise mentioned)

- **Genus: *Hydrodictyon***
- **Species: *Hydrodictyon reticulatum* (L.) Lagerheim (Pl. 2, fig. 14)**
  (Prescott, 1982, 219, Pl. 47, Fig. 1)

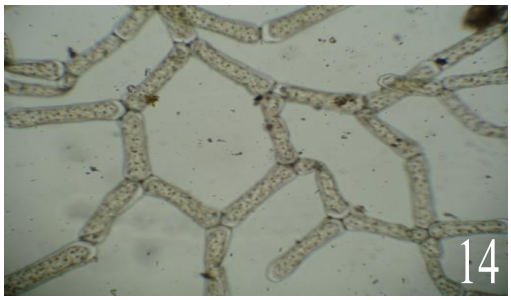

Plate 2. CLASS II: Chlorophyceae: Fig. 14. *Hydrodictyon*.
(Scale represents 50µm unless otherwise mentioned).

A colony is a macroscopic, saclike network consisting of numerous cells that; each cell adjacent to two other at end walls to form four or five or six-sided meshes, organized into a network. The chloroplast in young cells is a parietal plate that has one pyrenoid; later becoming reticulum covering the entire wall containing many pyrenoids. Light yellow-green color in the plant mass. Cells up to 200µm in diameter, as much as 1cm long when fully enlarged, forming a net up to 20cm in length. It collected from the artificial brook of the University of Baghdad.

- **Division: Chlorophyta**
- **Class: Zygnematophyceae**
- **Order: Zygnematales**
- **Family: Closteriaceae**
- **Genus: *Closterium***
- **Species: *Closterium lanceolatum* Kützing (Pl. 2, Fig. 15)**
  (Al-Handel, 1995, Pl. 2, Fig. 18; Opute, 2000, 137, Pl. 3, Fig. 8)

Plate 2. CLASS II: Chlorophyceae: Fig. 15. *Closterium lanceolatum*.
(Scale represents 50µm unless otherwise mentioned).

Cell body slightly curved inner-side nearly straight; cell wall smooth, transparent; chloroplast with 5-10 laminae; 8-10 pyrenoids in each semi-cell; 250-430µm long, 30-37µm wide. It's collected from Al-Iskan district, Baghdad. Length 300-430µm, mid-region diameter 30–37µm; many parallel striations.

- **Division: Chlorophyta**
- **Class: Chlorophyceae**
- **Order: Chlorococcales**
- **Family: Scenedesmaceae**
- **Genus: *Coelastrum***
- **Species: *Coelastrum microporum* Nägeli (Pl. 2, Fig. 16)**
  (Prescott, 1982, 230, Pl. 53.Fig. 3).

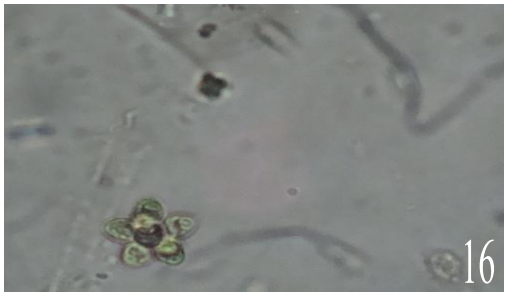

Plate 2. CLASS II: Chlorophyceae: Fig. 16. *Coelastrum microporum*.
(Scale represents 20µm unless otherwise mentioned).

Coenobium spherical composed of 10 - sheathed ovoid cells, with the narrow end outwardly direction; Cells interconnected by very short, scarcely discernible gelatinous processes, leaving small intercellular space; Cells 10.4µm in diameter including the sheath; Colony 15µm in diameter.

- **Division: Chlorophyta**
- **Class: Chlorophyceae**
- **Order: Chlorococcales**
- **Family: Hydrodictyaceae**
- **Genus: *Pediastrum***
- **Species: *Pediastrum boryanum* (Turp.) Meneghini (Pl. 2, Fig. 17)**
  (Prescott, 1982, 222, Pl. 47, Fig. 9; Pl. 48, Figs. 1, 3)

Plate 2. CLASS II: Chlorophyceae: Fig. 17. *Pediastrum boryanum.*
(Scale represents 20µm unless otherwise mentioned)

Colony entire cells 5-6 sides with smooth or granular walls, peripheral cells with outer margins extended 2 blunt-tipped processes, the cells up to 12.5µm in diameter, 20µm long; 36 celled colonies 87.5µm wide. It collected from a pool in the University of Baghdad. Brook of the Baghdad University.

- **Division: Chlorophyta**
- **Class: Chlorophyceae**
- **Order: Chlorococcales**
- **Family: Scenedesmaceae**
- **Genus: *Scenedesmus***
- **Species: *Scenedesmus quadricauda* (Turp.) de Brébisson (Pl. 2, Fig. 18)**
  (Prescott, 1982, 280, Pl. 64, Fig. 2)

Plate 2. CLASS II: Chlorophyceae: Figs. 18. *Scenedesmus quadricauda.*
(Scale represents 20µm unless otherwise mentioned)

Colony is consisting of 4 oblong-cylindrical cells usually in one series; outer cells with a long curved spine at each pole; inner cells without spines or with papillae at the apices; cell 5µm in diameter, 15µm long. It collected from Brook of Baghdad University.

- **Division: Chlorophyta**
- **Class: Chlorophyceae**
- **Order: Chlorococcales**
- **Family: Scenedesmaceae**
- **Genus: *Scenedesmus***
- **Species: *Scenedesmus bijuga* (Turp.) Lagerheim (Pl. 2, Fig. 19)**
  (Prescott, 1982, 279, Pl. 63, Figs. 2, 7)

Plate 2. CLASS II: Chlorophyceae: Fig. 19. *Scenedesmus bijuga.*
(Scale represents 20µm unless otherwise mentioned)

Colony composed of 2-8 cells in a single (rarely alternate) flat series; cells ovate or oblong, without teeth or spines; cells 5.5-7.5µm in diameter, 7.5-12.5µm long. It collected from the artificial brook of the University of Baghdad, attached to *Phragmites*.

- **Division: Euglenophyta**
- **Class: Euglenophyceae**
- **Order: Euglenales**
- **Family: Euglenaceae**
- **Genus: *Phacus***
- ***Species: *Phacus curvicauda* Svirenko (Pl. 2, Fig. 20)**
  (Prescott, 1982, 399, Pls. 85, 88; Figs. 14, 21)
  (*New record in Iraq according to Maulood &Toma, 2004).

Plate 2. CLASS III: Euglenophyceae: Fig. 20. *Phacus curvicauda*.
(Scale represents 20µm unless otherwise mentioned).

Cells broadly ovoid in outline, slightly spiral in the posterior part, which is extended into a caudus that curves obliquely to the left (when viewed from the ventral side); anterior end broadly rounded; periplast longitudinally finely striated (or smooth); paramylon bodies 2 large discs; chloroplast numerous ovoid bodies; cells 27µm in diameter, 35µm long. It collected from contaminated water at the University of Baghdad.

- **Division: Chrysophyta**
- **Class: Bacillariophyceae (Diatoms)**
- **Order: Pennales**
- **Genus: *Gomphonema***
- **Species: *Gomphonema acuminatum* Ehrenberg (Pl. 3, Fig. 21)**
  (Hustedt, 1930, 372, Fig. 688; Foged, 1977, 66, Pl. XL, Fig. 9, 10; Germain, 1981, 301, Pl. 111, Figs. 2, 3).
  L. 26-36.4µm; W. 7.2–9.36µm; striae 12-15 in 10µm.

Plate 3. Class IV: Class: Bacillariophyceae (Order: Pennales)
Fig. 21.*Gomphonema acuminatum*.
(Scale represents 20µm unless otherwise mentioned)

- **Division: Chrysophyta**
- **Class: Bacillariophyceae (Diatoms)**
- **Order: Pennales**
- **Family: Cocconeidaceae**
- **Genus: *Cocconeis***
- **Species: *Cocconeis placentula* var. Euglypta (Ehr.) Cleve (Pl. 3, Fig. 22)**
  (Hustedt, 1930, 190, Fig. 261; Patrick & Reimer, 1966, 241, Pl.15, Figs. 8; Pl. 9, Fig. 158; Lawson & Rushforth, 1975, 21, Pl.11, Fig. 1; Czarnecki & Blinn, 1977, 24, Pl. 6, Fig. 2; Hadi *et al*., 1984, 526, Pl. 3, Fig. 45).
  L. 17.68µm; W. 9.36µm; striae 19-20 in 10µm (Pseudoraphe valve).

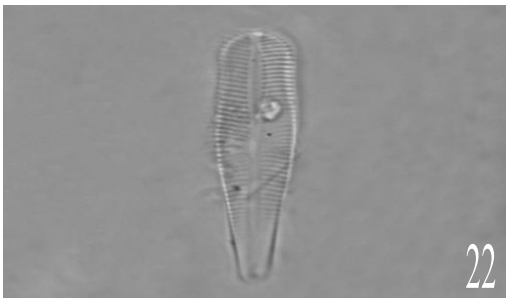

Plate 3. Class IV: Class: Bacillariophyceae (Order: Pennales)
Fig. 22. *Cocconeis placentula* var. *euglypta*.
(Scale represents 20µm unless otherwise mentioned)

- **Division: Chrysophyta**
- **Class: Bacillariophyceae (Diatoms)**
- **Order: Pennales**
- **Family: Fragilariaceae**
- **Genus: *Synedra***
- **Species: *Synedra ulna* (Nitz.) Ehrenberg (Pl. 3, Fig. 23)**
  (Hustedt, 1930, 154, Fig. 166; Patrick & Reimer, 1966, 148, Pl. 7, Figs. 1-2; Germain, 1981, 76, Pl. 24, Figs. 1-6; Pl. 168, Fig. 8, Hadi *et al*., 1984, 324, Pl. 1, Figs. 1- 6; Pl. 8)
  L. 145-230µm; W. 4.65-7.2µm; 9-10 striae in 10µm.

Plate 3. Class IV: Class: Bacillariophyceae (Order: Pennales)
Fig. 23. *Synedra ulna*.
(Scale represents 50µm unless otherwise mentioned)

- **Division: Chrysophyta**
- **Class:Bacillariophyceae (Diatoms)**
- **Order: Pennales**
- **Family: Rhoicosphenaceae**
- **Genus: *Rhoicosphenia***
- **Species: *Rhoicosphenia curvata* (Kütz.) Grunow (Pl. 3, Fig. 24)**
  (Hustedt, 1930, 211, Fig. 311; Patrick & Reimer, 1966, 282, Pl. 20, Figs. 1-5; Germain, 1981, 118, Pl. 44, Fig. 21, Pl. 168, Fig. 13; Hadi *et al*., 1984, 528, Pl. 3, Fig. 53; Pl. 9, Fig. 159;).
  L. 31.24-42.64µm; W. 6.24-8.32µm; striae 14 in 10µm.

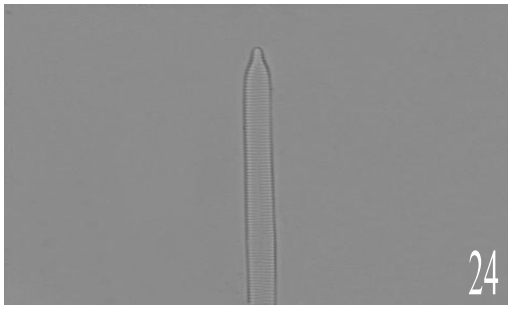

Plate 3. Class IV: Class: Bacillariophyceae (Order: Pennales)
Fig. 24. *Rhoicosphenia curvata*.
(Scale represents 20µm unless otherwise mentioned)

- **Division: Chrysophyta**
- **Class: Bacillariophyceae (Diatoms)**
- **Order: Pennales**
- **Family: Bacillariaceae**
- **Genus: *Nitzschia***
- **Species: *Nitzschia amphibian* Grunow (Pl. 3, Fig. 25)**
  (Hustedt, 1930, 414, Fig. 793; Lawson and Rushforth, 1975, 53, Pl. 38, Figs. 3, 8-9; Czarnecki and Blinn, 1977, 64, Pl. 16, Fig. 4; Czarnecki and Blinn, 1978, 108, Pl. 23, Fig. 9; Foged, 1978, 103, Pl. 46, Fig. 11-13; Germain, 1981, 358, Pl. 135, Figs. 32-37; Al-Zubaidi, 1985,121, Pl. 6, Figs. 115).
  L. 17.6-27.04µm; W. 4.06-5.1µm; striae 16-19 in 10µm. Keel punctae 8-9 in 10µm.

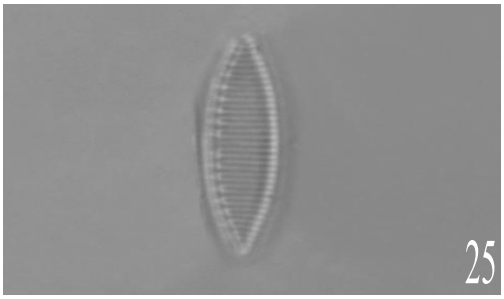

Plate 3. Class IV: Class: Bacillariophyceae (Order: Pennales)
Fig. 25. *Nitzschia amphibian.*
(Scale represents 20µm unless otherwise mentioned)

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