



Thirty-Eight New Records for Algal Species of Iraq's Marshes

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Abstract

Mesopotamian marshes in Iraq occupy a vast network of wetland at southern region. This study contains the description of many algal species that were identified in the marshes of Iraq, and based on the study thirty-eights new records will be added to the Algal Flora list of Iraq. Samples were collected at (10) stations, situated on Hammar, Chebaish and Hawizeh marshes in Iraq in May 2014. Thirty-eight new records for algal species of marshes were determined. Among these algal species, there were 6 Chlorophyta, 7 Cyanophyta, 1 Chrysophyta, 15 Bacillariophyta, 7 Euglenophyta and 2 Pyrrophyta. The dominating of species depended on water salinity, pH, and electrical conductivity in addition to biomass of identified algae.

Keywords

Algal, Marshes, New Records, Biomass, Chlorophyta, Cyanophyta, Chrysophyta

Subject Areas: Biodiversity

1. Introduction

Iraqi southern marshes from a large triangular region are bounded by three major southern cities: Nasiriyah to the west, Amarah to the northeast, and Basrah to the south. Such specific wetlands of the southern part of Iraq play a vital role in the maintenance of biodiversity in the middle east primarily because of their large size, the richness of their aquatic vegetation and their isolation from other comparable system [1]. The southern marshes of Iraq are the natural areas for appropriate growth and reproduction of algae, also once famous for their biodiversity and cultural richness. The Tigris and Euphrates have created about 15,000 km² of wetlands known as Mesopotamian marshes in Iraq. These wetlands comprise a complex of interconnected shallow freshwater lakes and marshlands, which are considered the most extensive wetland ecosystem in the middle east [2]. The Mesopotamians marshes of Iraq have been all destroyed by the year 2000. Earlier assessments suggested that poor water quality, the presence of toxic materials, and high saline soil conditions in the drained marshes would pre-

vent their ecological restoration and doom the reestablishment of the marsh Arab culture of fishing and agriculture. However the high volume of good quality water entering the marshes from Tigris and Euphrates Rivers, a result of two record years of snowpack melt in Turkey and Iran, allowed 39% of the former marshes to be reflooded by September 2005 [3]. Research into algal diversity in marshes still remains at initial stage and knowledge of regional algal diversity is far from exhaustive; the algal communities of the natural marshes of Iraq are better known but still sporadically studied. [4] has discussed the water chemistry and ecology of marshes and listed 100 species at Shatt Al-Arab and Gulf areas. Algal species were listed from several parts: [5] listed 289 species, [6] listed 96 species, [7] listed 128 species, [8] listed 164 species, [9] listed 275 species, [10] listed 120 species and [11] listed 75 species. In Iraq few studies dealt with morphology and taxonomy of phytoplankton at marshes of Iraq [12] [13]. Present work aimed to study the systematic account for algae and to add new records species of algae for the first time in marshes of Iraq.

2. Materials and Methods

Samples had been brought from 10 stations at Hammar, Hawizah and Chebaish marshes (Al-eiz, Al-kasrrah, Um Al-Nia'aj, Abo-athbah, the right of impoundment, Ouda, Baghdadia, north Abo-zarraq, Alkarmashia river and Kamessia canal). For the quantitative study subsurface water samples (1 liter) were collected from each station. One liter of each sample was taken in a measuring cylinder mixed with 2 ml of Lugol's iodine solution (as preservative), allowed to sediment for 10 days and was then concentrated to 100 ml. The same steps were repeated for one week to sediment the last 100 ml to 10 ml [14]. A drop of preservational material was placed on a clean coverslip dried and cleaned with hot concentrated Nitric acid, followed by use of the microtransect method for counting diatoms (Bacillariophyceae), where as for the other species the haemocytometer method was used [15]. Detailed studies were made under a compound microscope with camera and microns (μm) were used to describe the diameter (L: length and W: width) of each examined taxon and photographs were taken also [12]. Identified taxa were checked with the checklist of [16]-[20] and determined as new taxa for southern marshes of Iraq. Taxonomy of algal species controlled with [21]-[24].

Physical analysis

Total dissolved solid, electrical conductivity, and pH were measured by using pH-EC-TDS meter (HANNA Instruments). The expression of results were $\mu\text{S}/\text{cm}$ for conductivity, salinity were measured using [25].

Description of the Study Area

- Al-Hammar marshes are a large complex of wetlands in Iraq that are part of the Tigris-Euphrates system along Mesopotamian which also encompass the Hawizah and central marshes. The Hammar marsh formerly covered area of 2800 km² of permanent wetland tending to over 4500 km² in certain season. The Hammar marshes stretched between Nasiriyah and Basrah and were located south of the Euphrates River which formed their principal source.
- The Al-Hawizah marshes are a complex of marshes that straddle the Iraq and Iran border. The marshes are fed by two branches of the Tigris River (the Al-Musharrah and Al-Kahla) in Iraq and Karkheh River in Iran. The Hawizah marsh is critical to the survival of the central and Hammar marshes which also make up the Mesopotamian marshes because they are a refuge for species that may recolonize or reproduce into the other marshland.
- Al-Chebaish marshes are located east of Nasiriyah in Iraq and they are extension to Abu-zark and Hammar marshes and fed by Tigris and Euphrates Rivers (**Figure 1**).

3. Results

The variables of physical parameters pH, electrical conductivity, TDS and salinity are given in **Table 1**.

A total number of new records for algal flora of southern marshes of Iraq are 38 (6 Chlorophyta, 8 Cyanophyta, 16 Chrysophyta, 7 Euglenophyta, 1 Pyrrophyta). Taxa are listed below:

1-Division: Euglenophyta.

Class: Euglenophyceae.

Order: Euglenales.

Familia: Euglenaceae.

Genus: Trachelomonas.

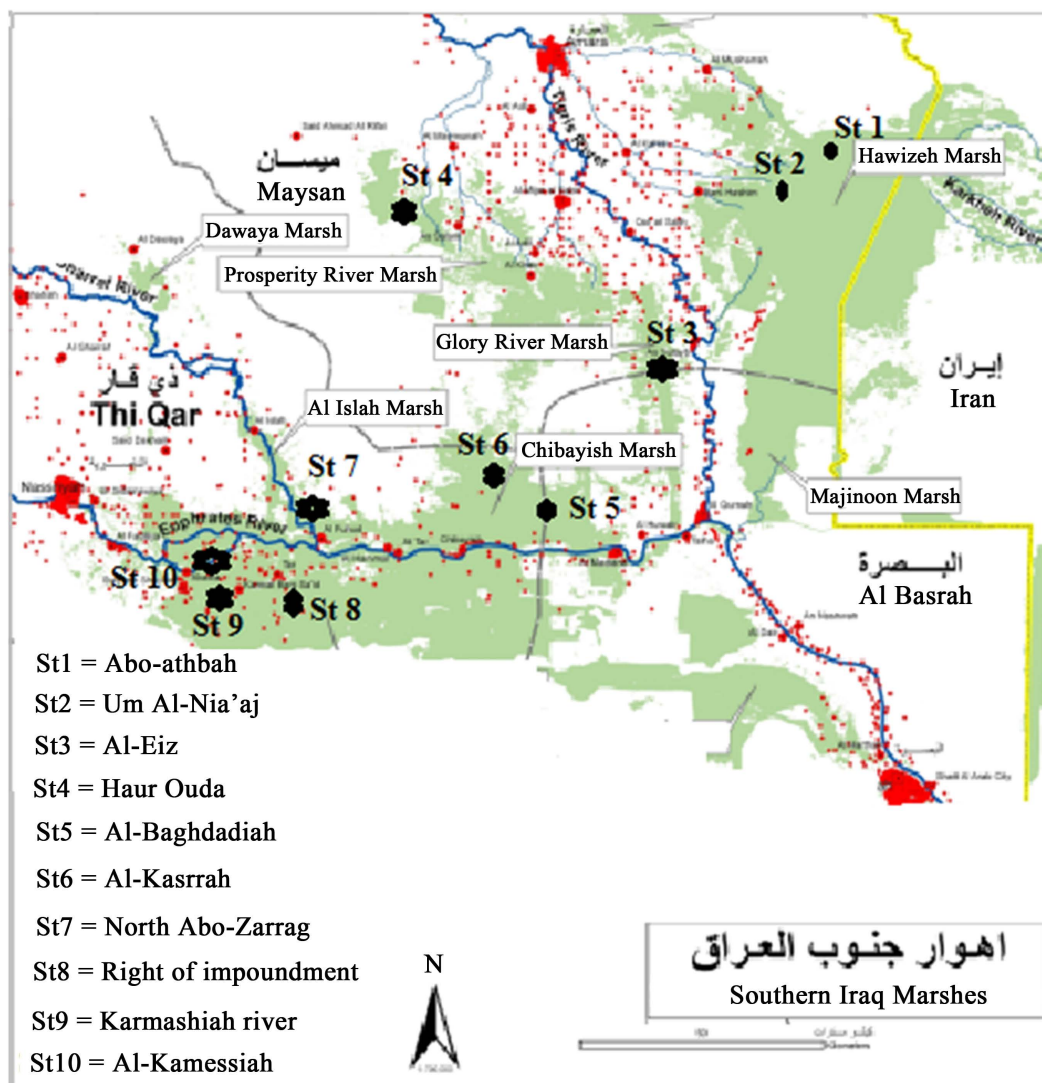


Figure 1. Map of study sites of the southern marshes of Iraq.

Table 1. Some physical parameters for the study locations.

Stations	Parameters	Sal. %	Electrical conductivity $\mu\text{S}/\text{cm}$	TDS mg/l	pH
St1-Abo-athbah		1.2	2.51	1322	7.72
St2-Um Al-Nia'aj		0.4	1206	638	7.94
St3-Al-Eiz		0.4	1325	691	7.88
St4-Haur Ouda		2.7	5.14	-	7.71
St5-Al-Baghdadiah		2.9	5.5	-	7.37
St6-Al-Kasrrah		2.3	4.44	-	7.81
St7-North Abo-Zarrag		0.8	1950	1015	7
St8-Right of impoundment		1.3	2.67	1472	7.7
St9-Karmashiah river		0.9	2.19	1131	7.91
St10-Al-Kamessiah		3.1	5.78	-	7.8

(-) out of illustration.

1-*Trachelomonas cylindrica*. Ehrenberg.

Test oblong-cylindrical broadly, rounded at the posterior end but somewhat flattened anterior, wall smooth, yellowish and flagellum opening surrounded by a short collar, test 8 - 10 μ in diameter 14.8 - 20 μ long (**Image 1**).

2-*T. dubia*. Swir.

Test cylindrical broadly, rounded posterior truncate at the anterior end and abruptly narrowed to form a short cylindrical neck, wall smooth, thickened at the base of the collar, test 11 - 14 μ in diameter 26 - 28 μ long. Euplanktonic and Tycho planktonic. Wis. (**Image 2**).

3-*T. playfairii*. Deflandre.

Test broadly ellipsoid or ovate and rounded both anterior and posterior, flagellum aperture in a short curved collar wall smooth and almost colorless or light yellow, test 19 - 21 (23) μ in diameter, 23 - 30 μ long, Tycho planktonic and Euplanktonic. Wis. (**Image 3**).

4-*T. pulchella*. Drezepolski.

Test oval to ovoid, small, flagellum aperture with a short ring-like collar, wall uniformly beset with blunt, wart-like roughening, test 5 - 17 μ in diameter, about 15 μ long. Tycho planktonic. Wis. (**Image 4**).



Image 1. *Trachelomonas cylindrica*. Ehrenberg. 400 \times .



Image 2. *T. dubia*. 400 \times .



Image 3. *T. playfairii*. Deflandre. 400 \times .

5-*Phacus pyrum*. Ehrenb. Stein.

Broadly rounded anterior but with 2 papilla between which the flagellum emerges, periplast spirally ribbed, papamylon bodies 2 ring-like plates, laterally situated, cells 7 - 21 μ in diameter, 27 - 30 μ long (**Image 5**).

6-*P. helikoides*. Pochmann.

Cells fusiform or elongate fusiform-pyriform, twisted throughout their entire length, cells 39 - 54 μ in diameter. 70 - 120 μ long (**Image 6**).



Image 4. *T. pulchella*. 400 \times .



Image 5. *Phacuspyrum*. Ehrenb. Stein. 400 \times .



Image 6. *P. helikoides*. Pochmann. 400 \times .

7-*P. crenulata*. Prescott.

Cell ovoid-pyriform, posterior extended to form a gradually tapering. Sharp-pointed caudus, cells 14 - 15 μ in diameter, 34 - 36 μ long (**Image 7**).

2-Division: Chlorophyta.

1-Class: Chlorophyceae.

Order: Oedogoniales.

Familia: Oedogoniaceae.

Genus: *Characium*.

8-*Characium hookeri*. Hansgirg. (Reinsch).

Cells mostly gregarious on *Cyclops*, club-shaped to subcylindric, stipe long or short without an attaching disc, chloroplast 1, with 1 - 3 pyrenoids, cells 9 - 12 μ in diameter, 27 - 30 μ long. On *Cyclops* in lakes and ponds, euplanktonic and tychoplanktonic, Wis. (**Image 8**).

2-Class: Chlorophyceae.

1-Order: Ulotrichales.

Genus: *Geminella*.

9-*Geminella crenulato-collis*. Prescott.

Uniseriate filaments of irregularly ovoid, subquadrate or oblong cells with emarginate, crenulate or wavy lateral walls, truncate or broadly rounded at the poles with folds and ridges sometimes present in the lateral walls. Cells inclosed by a broad gelatinous sheath and arranged in linear pairs but often evenly spaced Chloroplast an irregularly shaped, folded parietal plate which makes an almost complete cylinder within the wall, often showing a ridge or wing like flange extending radially toward the. Wall cells 12 - 15 μ in diameter, 18 - 24 μ long (**Image 9**).



Image 7. *P. crenulata*. Prescott. 400 \times .

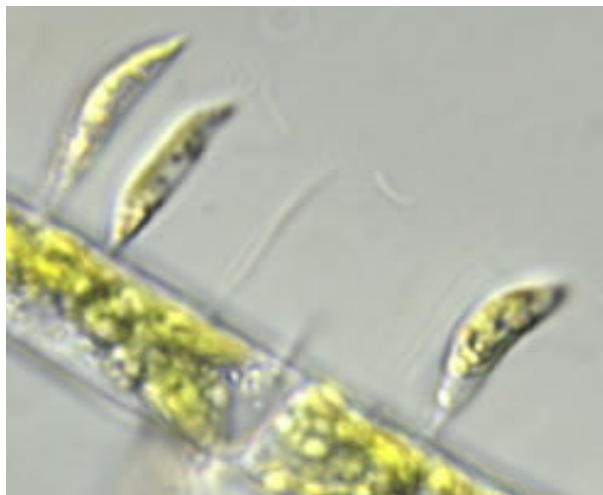


Image 8. *Characium hookeri*. 400 \times .

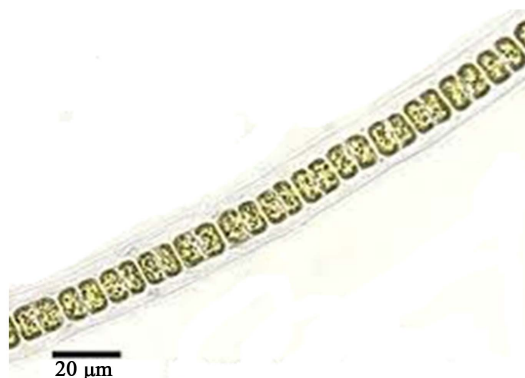


Image 9. *Geminellacrenu latocollis*. Prescott. 400×.

2-Order: Volvocales.

Family: Chlamydomonadaceae.

Genus: -*Chlamydomonas*.

10-*Chlamydomonas eipiphytica*. G. M. Smith.

Cells spherical to nearly pyriform, anteriorly narrowed into a papilla-like beak. Cells becoming non-motile, adherent to the colonial mucilage of *microcystis* without losing flagella. Chloroplast a thin parietal cup, pigment-spot lacking-cells 7 - 8 μ in diameter, 8 - 9 μ long. common in several lakes. Wis. (**Image 10**).

3-Order: Oedogoniales.

Family: Oedogoniaceae.

Genus: -*Oedogonium*.

11-*Oedogonium decipiens*. Var. africanum.

Vegetative cells capitellate, 8 - 14 μ in diameter, 20 - 65 μ long, Oogonia 28 - 35 μ in diameter, 23 - 38 μ long, Oospores 23 - 34 μ in diameter, 21 - 30 μ long. Andro sporangium 9.2 μ in diameter, 8 μ long. Antheridia 8 μ in diameter. Common in swamps and lakes. Mich. Wis. (**Image 11**).

12-*Oedogonium pratense*. Transeau.

Macrandrous, dioecious, vegetative cells cylindric, 9.2 - 17 μ in diameter, 24 - 95 μ long. Oogonia solitary, globose or subpyriform-globose, operculate, division median, 33 - 44 μ in diameter, 35 - 50 μ long. Wall smooth, 32 - 40 μ in diameter, 28 - 42 μ long. Antheridia 10 - 14 μ in diameter, 13 - 18 μ long (**Image 12**).

13-*Oedogonium pringsheimii*. Cramer.

Macrandrous, dioecious, vegetative cells cylindric, 14 - 20 μ in diameter, 43 - 100 μ long. Oogonia 1 - 6, globose or subovate-globose, operculate, division, 35 - 43 μ in diameter, 36 - 46 μ long. Wall smooth, thick, 30 - 37 μ in diameter, 35 - 46 μ long. Antheridia 10 - 16 μ in diameter, 6 - 9 μ long (**Image 13**).

3-Division: -Chrysophyta.

Class: Xanthophyceae.

Genus: *Chlorochromonas*.

14-*Chlorochromonas minuta*. Lewis.

Cells pyriform or cordate, with 2 flagella of unequal length attached at the broad anterior end, which is slightly concave, cell wall lacking, protoplast containing 2 elongate-ovate and somewhat curved chromatophores, characteristics as described for the genus, cells 4.5 - 9.5 μ long culture from lake Mendota (**Image 14**).

4-Division: -Cyanophyta.

1-Class: -Myxophyceae.

Order: -Chroococcales.

Familia: -Chroococcaceae.

Genus: *Glaucocystis*.

15-*Glaucocystis oocystiformis*. Prescott.

Cells solitary (or in colonies), broadly elliptic With nodular thickenings of the cell wall at the poles, Chromatophores numerous, irregular pads at the periphery of the cell about a central, Spherical, Colorless vacuole, cells 20 - 27.3 μ in diameter, 40 - 45 μ long. This species differs from the others in the shape of cell, the form of the Chromatophores and in its possession of polar nodules. Whether the absence of colonial association or the re-



Image 10. *Chlamydomonas eipiphytica*. G.M.Smith. 400×.

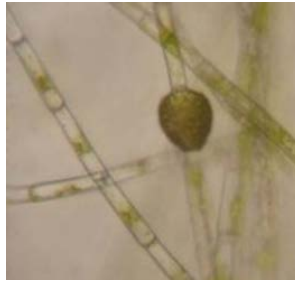


Image 11. *Oedogonium decipiens*. Var. *africanum*. 400×.

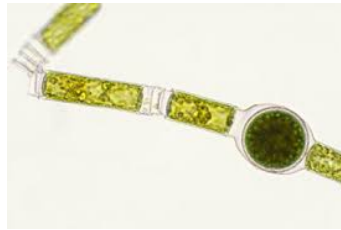


Image 12. *Oedogonium pratense*. Transeau. 400×.



Image 13. *Oedogonium pringsheimii*. Cramer. 400×.



Image 14. *Chlorochromonas minuta*. Lewis. 400×.

tention of autospores within the mother cell wall is a constant feature is under mind but in all cases observed the cells were solitary (**Image 15**).

2-Class: -Cyanophyceae.

1-Order: -Chamaesiphonales.

Familia: -Dermocarpaceae.

Genus: *Dermocarpa*.

16-*Dermocarpa olivacea*.

Plants forming a small or expanded and hemispherical layer, sporangia broad pyriform to spherical with a marked stalk like elongation at the base, 9.5 - 17 μ broad, 13 - 25 μ long, wall thick, lamellated, endospores many. spherical (**Image 16**).

2-Order Nostocales

Family Microchaetaceae

Genus *Camptylonemopsis*.

17-*Camptylonemopsis lahorensis*.

Thallus wolly, bright bluish green or bluish brown, terrestrial, partly embedded in mud and partly above it, sheath in conspicuous, thin and hyaline in the embedded region and firm, thick and lamellose, lightly adhering and brown in the exposed portion, the trichome bluish green 6 - 9 μ broad, slightly constricted at the joints. 12 - 21 μ long and 7 - 9 μ wide, spores 7 - 11 μ long and 5 - 7 μ wide (**Image 17**).



Image 15. *Glaucozystis oocystiformis*. Prescott. 400 \times .



Image 16. *Dermocarpa olivacea*. 400 \times .

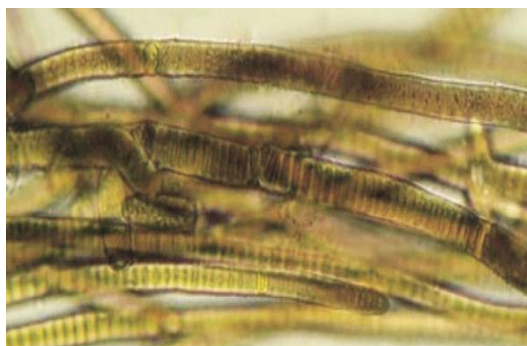


Image 17. *Camptylonemopsis lahorensis*. 400 \times .

3-Class: Myxophyceae.**Order: Nostocales.****Family: Nostocaceae.****Genus: -Anabaena.**18-*Anabaena iyengarii*. Bharadwaja.

Trichoma single or irregularly curved, 5.2 - 6.3 μ broad, end-cell conical with rounded apex, cells barrel-shaped, as long as broad, or slightly shorter or longer than broad, heterocysts barrel-shaped, rarely spherical, 7.3 - 8.4 μ broad and 7.3 - 10.5 μ long, spores ellipsoidal often in long or short chains, rarely single on both sides of the heterocysts, 8.4 - 10.5 μ broad and 10.5 - 21 μ long, episore thick, smooth and yellowish brown (**Image 18**).

19-*A. fertilissima*. Rao, C.B.

Trichoma single, straight or bent with almost rounded end cells, up to 350 μ long, 5 - 5.6 μ broad, at the apex 4 μ broad, cells barrel-shaped, 4.8 - 8 μ long, heterocysts almost spherical, 6.4 - 8.4 μ broad, spores in long chains often making the wide trachoma sporogenous, adjoining the heterocysts but formed centrifugally, almost spherical with a smooth hyaline outer wall, 4.8 - 8 μ broad and 3.2 - 8.8 μ long (**Image 19**).

20-*A. oryzae*. Fritsch.

Thallus soft, green, gelatinous, membranous, trachomas short, straight, densely aggregated, generally parallel cells 2.5 - 3 μ broad, more or less barrel shaped, 1½ - 2 times as long as broad, heterocyst steriminal and intercalary, broader than the vegetative cells, 3 - 3.5 μ broad, terminal ones conical and twice longer than broad, intercalary ones, single (**Image 20**).



Image 18. *Anabaena iyengarii*. Bharadwaja. 400 \times .

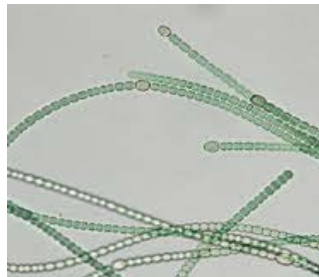


Image 19. *A. fertilissima*. Rao, C.B. 400 \times .



Image 20. *A. oryzae*. Fritsch. 400 \times .

21-A. *gelatinicola*. Ghose.

Thallus thick gelatinous, trichome mostly solitary, spirals densely arranged and coiled not screw like, sometimes straight, cells subspherical 6 - 7.5 μ broad, apex acute, heterocysts 7 - 8 μ broad, spherical, spores in series away from the heterocysts, spherical, about 14 μ diameter (**Image 21**).

5-Division: Pyrrophyta.

Class: -Dinophyceae.

Order: -Peridinales.

1. Family: -Glenodiniaceae.

Genus: -*Glenodinium*.

22-*Glenodiniumkulczynskii*. (Wolosz.) Scbillor.

Cells broadly ovoid or nearly round as seen in ventral view, flattened in polar view, the dorsal margin broadly convex, epitheca with 1 apical, 3 intercalary, and 6 precingular plates, hypotheca with 6 postcingular and 2 antapical plates, longitudinal furrow extending to the apex of the hypocone, cell 30 - 31.5 μ in diameter, 35 μ long. Tychoplankton. Wis. (**Image 22**).

2. Family: Peridiniaceae.

Genus: -*Peridinium*

23-*Peridinium cinctum*. var. Lemmermannii

Cells 62 - 70 μ in diameter, 56 - 70 μ long, 52 - 53 μ thick, a variety in which the right antapical plate is distinctly larger than the left. Euplanktonic and tychoplanktonic. Mich. Wis. (**Image 23**).



Image 21. *A. gelatinicola*. 400 \times .



Image 22. *Glenodiniumkulczynskii*. (Wolosz.) Scbillor. 400 \times .



Image 23. *Peridinium cinctum*. 400 \times .

6-Division: Bacillariophyta.

Class: Diatomatae.

Order: Pennales.

1-Family: Achnantheaceae.

Genus: -*Achnanthes*.

24-*Achnanthes inflata*. Kutz.

Cells 30 - 65 μm long. 10 - 15 μm wide. Stries 9 - 11 in 10 μm (**Image 24**).

2-Family: Coscinodiscaceae.

Genus: -*Coscinodiscus*.

25-*Coscinodiscus lacustris*

Very characteristic with its large pits, Irregularly radially aligned and are not protected strictly a reticulate provision has strong transverse ripple the surface area of the valve is very remarkable, the diameter varies from 20 to 50 μm the peripheral teeth very slightly prominent, 5 to 7 in 10 μm (**Image 25**).

3-Family: Eunotiaceae.

Genus: -*Eunotia*.

26-*Eunotia alpine*. Naegeli. Hust.

Cells long 25 - 120 μm , larger 1.5 - 2.5 μm and fine stries 16 - 21 in 10 μm (**Image 26**).

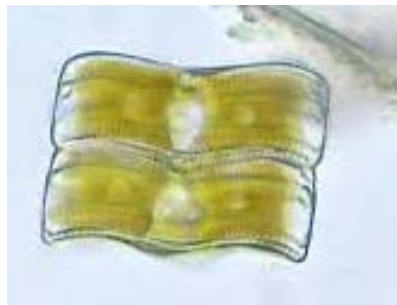


Image 24. *Achnanthes inflata*. 1000 \times .

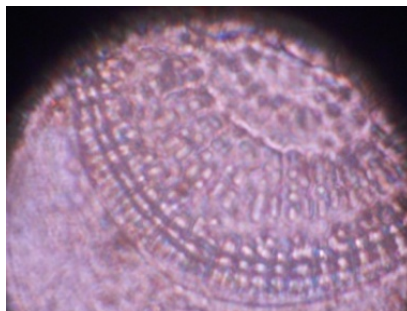


Image 25. *Coscinodiscus lacustris*. 1000 \times .

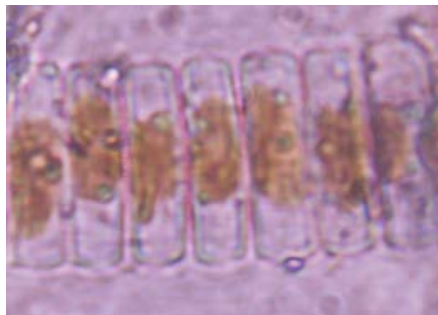


Image 26. *Eunotia alpine*. 400 \times .

4-Family: Naviculaceae.

Genus: -*Navicula*.

27-*Navicula bacilloides*. Ehe.

Cells 15 - 18 μm long and 7 - 8 large. Stries fines 23 - 25 in 10 μm (**Image 27**).

28-*N. goppertiana*. Bleisch. Grun.

Cells 10 - 30 μm long and 5 - 8 μm large. stries 16 - 18 in 10 μm (**Image 28**).

29-*N. standeriella*. Krasske.

Cells long 10 - 25 μm and large 5 - 7 μm . stries 20 - 22 in 10 μm (**Image 29**).

30-*N. saprophila*. Lange-Bertalot.

Cells long 6 - 8 μm , large 3 - 4 μm and stries 50 - 60 in 10 μm (**Image 30**).



Image 27. *Navicula bacilloides*. 1000 \times .

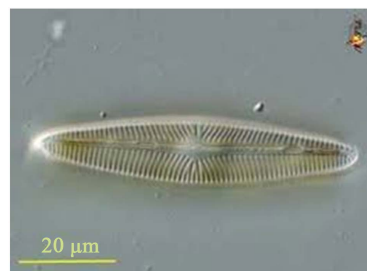


Image 28. *N. goppertiana*. 1000 \times .



Image 29. *N. standeriella*. Krasske. 1000 \times .



Image 30. *N. standeriella*. 1000 \times .

31-*N. seminulum*. Grunow.

Cells long 5 - 15 μm , 3 - 4 μm large and striae 20 - 22 in 10 μm (**Image 31**).

32-*N. tantula*. Hustedt.

Cells 7 - 16 μm long and 2.5 - 3.5 μm large. All fine Striaeradiating from 27 to 30 in 10 μm (**Image 32**).

5-Family: Bacillariaceae.

Genus: -*Nitzschia*.

33-*Nitzschia comunis*. Rabenhorst.

Cells long 20 - 35 μm . large 4 - 5 μm and striae 11 - 14 in 10 μm (**Image 33**).

34-*N. fruticosa*. Hustedt.

Cell long 20 - 55 μm , large 3 - 4 μm , and 14 - 15 fibulae in 10 μm striae (**Image 34**).

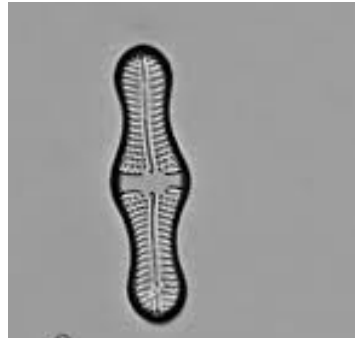


Image 31. *N. seminulum*. 1000 \times .

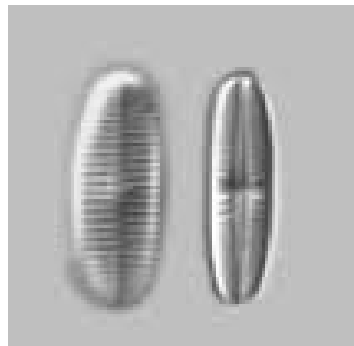


Image 32. *N. tantula*. 1000 \times .



Image 33. *Nitzschia comunis*. 1000 \times .

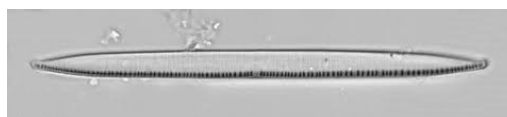


Image 34. *N. fruticosa*. 1000 \times .



Image 35. *N. littoralis*. 1000×.



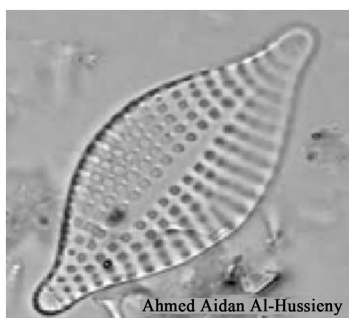
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Image 36. *N. minutula*. 1000×.



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Image 37. *Peronia fibula*. 1000×.



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Image 38. *Raphoneis amphicerus*. 1000×.

35-*N. littoralis*. Grun.

30 - 100 μm long, 13 - 30 μm large and 25 - 30 in 10 μm stries (**Image 35**).

36-*N.minutula*. Grun.

Cells long 15 - 25 μm , large 2.5 - 3 μm and 12 fibules in 10 μm stries (**Image 36**).

6-Family: Pinnulariaceae.

Genus: -*Peronia*.

37-*Peronia fibula*. Ross.

Long 20 - 50 μm , large 3 - 5 μm , and stries 15 - 17 in 10 μm (**Image 37**).

7-Family: Raphoneisceae.

Genus: -*Raphoneis*.

38-*Raphoneisamphicerus*. Ehr.

Long 20 - 100 μm , large 18 - 25 μm , and stries 6 - 7 in 10 μm (**Image 38**).

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