A GUIDEBOOK

HARMFUL ALGAE IN THE EGYPTIAN MEDITERRANEAN WATERS

2024

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PREFACE

This is the first guidebook to document and reviews the harmful and/or toxic microalgae along the Egyptian Mediterranean waters. In this book the expressions toxic and harmful have been considered and according to that, the species are classified into three groups: (i) producers of toxins affecting man through food consumption, (ii) high biomass bloom-forming species (harm from oxygen depletion and/or physical effects), and (iii), other phytoplankton species (neither harmful or toxic species).

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Introduction

Algae are essential for life on Earth and for fisheries. Some 5,000 species of phytoplankton (Single celled marine algae), form the foundation of aquatic food chains, help control atmospheric CO_2 levels, and produce roughly half of the world's oxygen. But when some species "bloom" they can cause harm in various ways. These microalgae are collectively known as harmful algal bloom species (HABs). A harmful algal event is broadly defined as "any event where humans, animals or other organisms are negatively affected by algae." These include: 1) A bioaccumulation of toxins in seafood reaching levels unsafe for human consumption, or a ban on harvesting wild or farmed shellfish or other seafood. 2) An abundance of harmful algae causing the closure of a beach or desalination plant. 3) A bloom of toxic or non-toxic microalgae causing discoloured water, scum or foam causing damage totourism (Hallegraeff etal., 2021). The first-ever global statistical analysis launched by IOC in 2021, examined about 9,500 HABs events over 33 years and found that the harm caused by HABs rises in step with growth of the aquaculture industry and marine exploitation. Harmful algal blooms (HABs) have been increasing in prevalence in Alexandria for the past 50 years to the point where they occur along most of our coastlines and are common in many places (HANA, 2021). The impacts of these blooms are felt in many ways: human health is placed at risk; ecosystems are altered; the fishing, aquaculture, and recreation industries suffer substantial economic losses. Since the 1980s there has been an increase in frequency, intensity and geographical distribution of HABs around the world, including the Mediterranean. Five explanations for this apparent increase in algal blooms have been proposed: (l) a greater scientific awareness of toxic species; (2) the growing utilization of coastal waters for aquaculture; (3) the stimulation of plankton blooms by domestic, industrial and agricultural wastes; (4) climate change; and (5) transportation of algal cysts either in ships' ballast water or associated moving shellfish stocks from one area to another (Hallegraeff etal., 2021).

In Egyptian waters, HABs have caused massive mortalities of marine fish and shellfish due to anoxia or the production of toxins. There have also been sporadic reports of human illness

associated with HAB toxins which have accumulated in shellfish or fish. A less conspicuous effect of HABs is the loss of consumer confidence that occurs when fish begin dying in local waters or shellfish intoxications are reported. When this happens, consumer confidence in local seafood quality and safety plummets, resulting in significant economic losses to local fishermen, seafood restaurants and tourist related industries. The HAB problem in Egypt is particularly severe in Alexandria Harbor and surrounding systems (Ismael and Khadr 2003). The potential HAB causing species that occur in Egyptian waters include dinoflagellates, diatoms and cyanobacteria species as well as several euglenophytes. Collectively, these taxa have the potential to produce a large range of algal toxins, all of which pose serious hazards to human health and marine resources. Based on algal cell abundance, the most prevalent microalgal toxins in Egyptian coastal waters include saxitoxins, brevetoxins, ciguatoxins and Okadaic acid, all of which are produced by marine dinoflagellates as well as domoic acid which is produced by marine diatoms. Overall, nearly 250 algal species around the world are now known or suspected to produce toxins, eighty-four potentially toxic species have been detected in the Mediterranean Sea (Zingone *et al*., 2021), at least 76 of these occurred in the Egyptian waters.

The aim of this guidebook is to update and prioritize list of potential HAB species in the Egyptian Mediterranean coast (Fig. 1). This guidebook will be a useful resource for training scientific personnel and for monitoring HAB species in Egypt (Table 1).

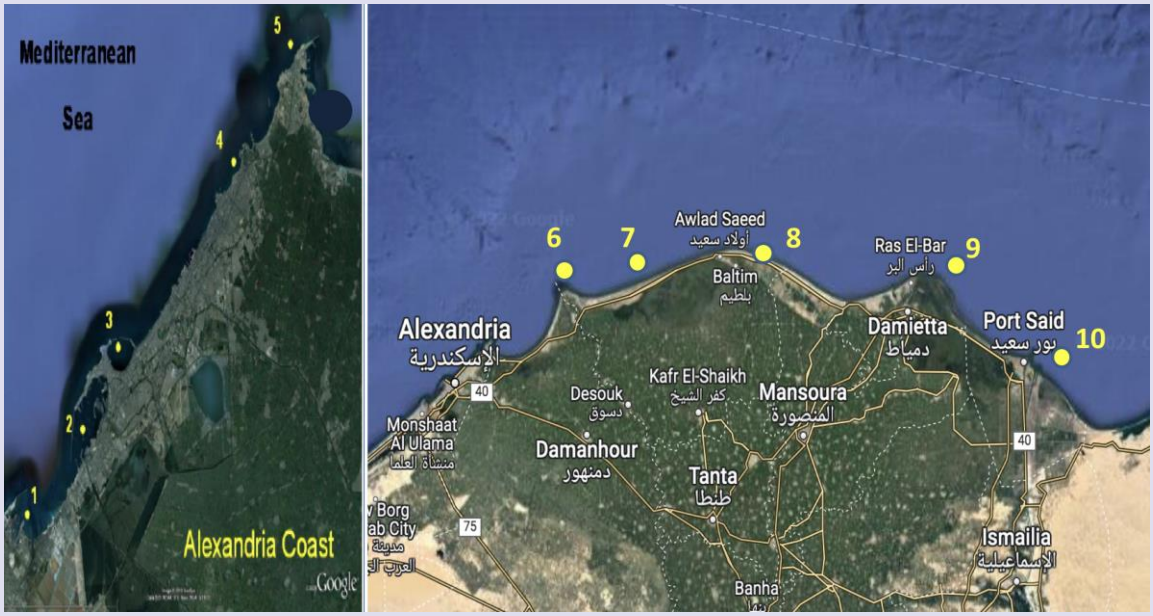


Fig. 1: Map of sampling sites in the Nile Delta region and Alexandria coastal area.

1	Mex Bay	6	Abu Qir Bay
2	Dekhaila Harbour	7	Rosetta mouth
3	Eastern Harbor	8	Lake Burullus
4	Miami beach	9	Damietta Port
5	Abu Qir coast	10	Port Said

Table1: List of HAB and bloom-forming species recorded from the Egyptian Mediterranean waters.

Class	Species
Bacillariophyceae	*Bacillaria paradoxia* *Bellerochea malleus* *Cerataulina pelagica* *Chaetoceros affinis* *Chaetoceros curvisetus* *Chaetoceros socialis* *Cylindrotheca closterium* *Leptocylindrus danicus* *Lyptocylindrus minimus* *Nitzschia longissma* *Melosira nummuloides* *Pseudo-nitzschia brasiliana* *Pseudo-nitzschia multistriata* *Pseudonitzschia pungens* *Pseudonitzschia cf seriata* *Pseudonitzschia* spp. *Rhizosolenia hebetate* *Rhizosolenia imbricate* *Rhizosolenia setigera* *Thalassionema nitzschioides* *Skeletonema costatum* *Stephanocyclus meneghinianus* *Sundstroemia setigera*
Dinophyceae	*Akashiwo sanguinea* *Alexandrium minutum* *Alexandrium tamarense* *Alexandrium sp.* *Amphidinium carterae* *Centrodinium punctatum* *Coolia monotis* *Dinophysis acuminata* *Dinophysis acuta* *Dinophysis caudata* *Dinophysis fortii* *Dinophysis ovum* *Dinophysis sacculus* *Dinophysis tripos* *Gambierdiscus* sp.

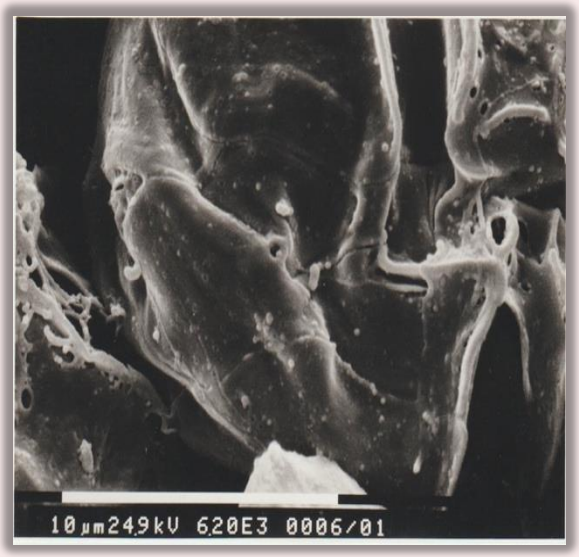
	Gonyaulax polygramma *Gonyaulax spinifera* *Gymnodinium catenatum* *Karenia mikimotoi* *Lingulodinium polyedra* *Noctiluca scintellans* *Ostreopsis* cf. *ovata* *Ostreopsis siamensis* *Peridinium quadridentatum* *Phalacroma rotundata* *Phalacroma* sp. *Prorocentrum* sp. *Prorocentrum concavum* *Prorocentrum cordatum* *Prorocentrum gracile* *Prorocentrum lima* *Prorocentrum micans* *Prorocentrum triestinum* *Protoceratium reticulatum* *Scrippsiella (trochoidea)acuminata*
Raphidophyceae	*Chattonella* sp.
Cyanophyceae	*Anagnostidinema acutissimum* *Kamptonema formosum* *Lyngbya majuscula* *Microcystis aeruginosa* *Oscillatoria limosa* *Oscillatoria rubescens* *Phormidium nigroviride* *Planktothrix agardhii* *Planktothrix planktonica* *Pseudanabaena catenata* *Spirppaulina* sp.
Euglenophyceae	*Euglena gracilis* *Euglena viridis* *Eutreptia sp.* *Lepocinclis acus*
Chlorophyceae	*Lacunastrum gracillimum* *Micromonas pusilla*
Chrysophycea	*Dictyocha fibula*

References:

- Hallegraeff GM, Anderson DM, Belin C, Bottein MY, Bresnan E, Chinain M, Enevoldsen H, Iwataki M, Karlson B, McKenzie CH, Sunesen I, Pitcher GC, Provoost P, Richardson A, Schweibold L, Tester PA, Trainer VL, Yñiguez AT, Zingone A. (2021). Perceived global increase in algal blooms is attributable to intensified monitoring and emerging bloom impacts. Commun Earth Environ.;2:117.
- HANA/IOC working group. Fourth Workshop on Harmful Algal Blooms in North Africa. IOC-UNESCO.
- Ismael, A.A. and Khadr, A.M. 2003. *Alexandrium minutum* cysts from the sediment cores of the Eastern Harbour of Alexandria, Egypt. Oceanologia, 45(4):721-731.
- Zingone A., Aligizaki K., Escalera L., Fernández-Tejedor M., Ismael A., Montresor M., Mozetiç P. Tas S. and Totti C. 2021. Toxic microalgae and noxious blooms in the Mediterranean Sea: a contribution to the global HAB status report. Harmful Algae. Vol. 102, 101843.

Toxin producing microalgae

Alexandrium minutum Halim, 1960



Harmful Effect: produce saxitoxins (PSP)

Local Distribution: Eastern Harbor of Alexandria

Description: marine species. Cell spherical or slightly ellipsoidal with an antapical depression. Epitheca hemispherical to rounded conical. Cingulum well-excavated with thickened margins. A small ventral pore, most often present but may be absent in some strains. Motile cell 15 – 29 µm long.

References:

- Halim Y. (1960). Alexandrium minutum, n. gen. n. sp. dinoflagellé provocant des “eaux rouges”. Vie et Milieu. 11: 102-105.
- Hallegraeff G.M., Anderson D.M. and Cembella A.D. (2003). Manual on Harmful Marine Microalgae. UNESCO publishing. Paris, 793 pp.

Alexandrium sp.

Harmful Effect: produce saxitoxins (PSP)

Local Distribution: Mex Bay

Description: marine species. Small, subspherical without horns or spines. Cingulum median with poorly developed lists, descending and displaced 1-1.5 girdle width. Motile cell 24 µm long and 19 µm width.

Amphidinium carterae Hulburt, 1957

Harmful Effect: produce Haemolysins

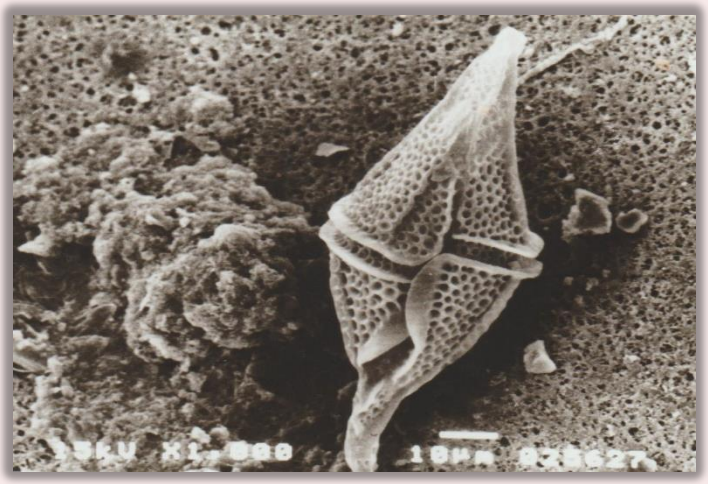
Local Distribution: Eastern Harbor of Alexandria, Abu Qir coastal area & Abu Qir Bay

Description: unarmored marine species, cells oval, dorsoventrally flattened. Epicone crescent-shaped, clearly deflected towards the left. Cingulum beginning 0.3–0.4 of the cell length from the apex, midway across the ventral face, ascending initially, then descending on the ventral side. Sulcus beginning 1–2 μm below the proximal end of the cingulum.

References:

- Hulburt, E. M. (1957). The Taxonomy of Unarmored Dinophyceae of Shallow Embayments on Cape Cod, Massachusetts. Biol. Bull. mar. biol. Lab. Woods Hole. 112(2): 196-219.
- Tomas, C.R. (Ed.). (1997). Identifying marine phytoplankton. Academic Press: San Diego, CA [etc.] (USA). ISBN 0-12-693018-X. XV, 858 pp.

Centrodinium punctatum (Cleve) F.J.R.Taylor, 1976



Harmful Effect: Produce saxitoxin (PSP)

Local Distribution: Abu Qir coastal area & Abu Qir Bay – Port Said

Description: marine species. Living cells were solitary, broadly fusiform. The cells were 40.7-80.6 μm in length, 19.5-40.9 μm in width, and 21.4-39.9 μm in depth (dorso-ventral axis). The epitheca was prolonged in an apical horn,The hypotheca also extended into a horn and it was longer than the epitheca. The cingulum is displayed by only one cingular width. The species has only one anterior inter-calary plate and five posticinular plates. The sulcus was not broader than the cingulum. The thecal surface was strongly areolated, which was visible under a light microscope. The species is quite similar to Gonyaulax birostris and Spiraulax jolliffei. However, the cell sizes of the two species are much larger than C. punctatum.

References:

- Gómez, F. (2005). A list of free-living dinoflagellate species in the world's oceans. Acta Bot. Croat. 64(1): 129-212.
- Lundholm, N.; Churro, C.; Escalera, L.; Fraga, S.; Hoppenrath, M.; Iwataki, M.; Larsen, J.; Mertens, K.; Moestrup, Ø.; Murray, S.; Tillmann, U.; Zingone, A. (Eds) (2009 onwards). IOC-UNESCO Taxonomic Reference List of Harmful Micro Algae.

Dinophysis acuminata Claparède & Lachmann, 1859

Harmful Effect: Produce Diarrhetic Shellfish Poison (DSP)

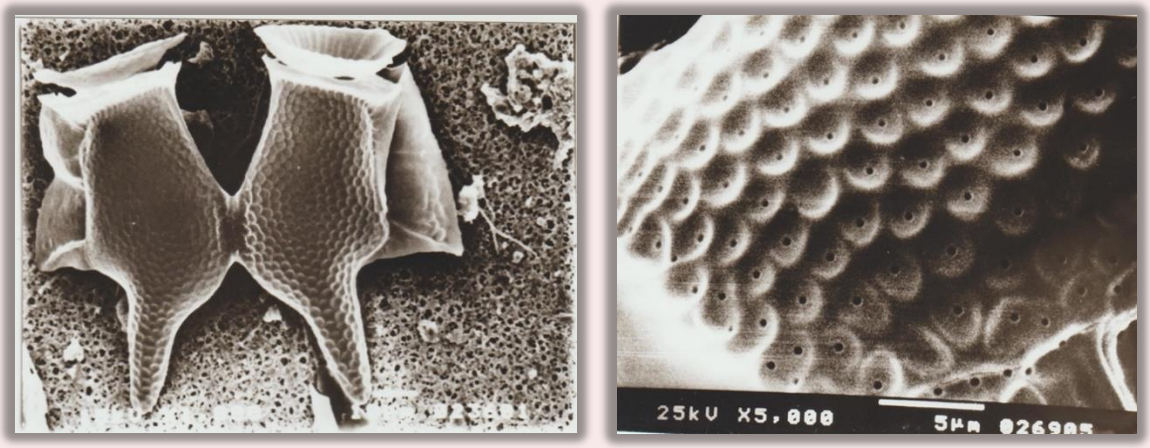
Local Distribution: Abu Qir Bay- Port Said

Description: marine species. Cell oval, 38 – 58 µm in length, dorso-ventral depth 30 -38 µm sometimes decorated with protrusions on the hypocone. Thecal plate thick, areolated.

References:

- Claparède E. & Lachmann J. (1858). Etudes sur les Infusoires et les Rhizopodes. Mém. Inst. Genev. 5, 6: 489 pp.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Dinophysis caudata Saville - Kent, 1881



Harmful Effect: Produce Diarrhetic Shellfish Poison (DSP)

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species. Large cell strongly flattened laterally, 71-110 µm in length, with long ventral projection, a wide anterior list supported by thin rays and a very small epitheca. The sulcal list extends over half the total length of the cell. Thecal plates thick, areolated

References:

- Kent, W.S. (1880-1881). A manual of the infusoria, including a description of all known flagellate, ciliate, and tentaculiferous protozoa, British and foreign and an account of the organization and affinities of the sponges. Vol. I pp. 289-720. London.

- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Dinophysis fortii Pavillard, 1924

Harmful Effect: Produce Diarrhetic Shellfish Poison (DSP)

Local Distribution: Port Said

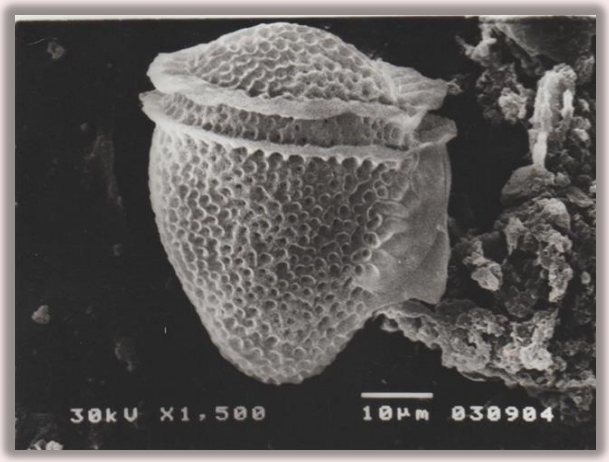
Description: marine species. Large bag-shaped cell with well-developed sulcal lists. Cells 60-80 µm in length and 33-40 µm in dorso-ventral depth. Cell long and subovate ending in a broadly rounded posterior. Left sulcal list well developed and very long.

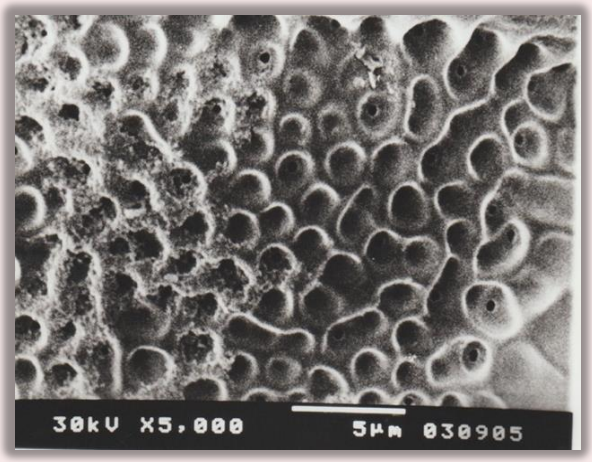
References:

- Pavillard J. 1916. Recherches sur les Péridiniens du Golfe du Lion. Trav. Inst. Bot. Univ. Montpellier 4: 9-70.

- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Dinophysis ovum T.H.Abé, 1967





Harmful Effect: Produce Okadaic Acid (OA)

Local Distribution: Abu Qir coastal waters – Port Said

Description: marine species. Small to medium sized cells, 32-42 µm in length. Irregularly egg-shaped, rather asymmetrical with a apex narrower than the broad rounded antapex. The large hypthecal plates exhibit a rough areolation, and most of the areolae have a central pore.

References:

- Abé, T.H. (1967). The armoured Dinoflagellata: II. Prorocentridae and Dinophysidae (B) - Dinophysis and its allied genera. Publications of the Seto Marine Biological Laboratory. 2: 37-78

- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Gonyaulax Polygramma Stein 1883

Harmful Effect: fish kills and/or damage to other marine organisms.

Local Distribution: Eastern Harbor of Alexandria, Abu Qir waters, Port Said

Description: marine species. Medium-sized cells elongated and pentagonal. 29-66 µm in length and 26-56 µm in dorso-ventral depth. The tapered epitheca bears apical horn, and exceeds the symmetrical hypotheca.

References:

- Steidinger, K. A., M. A. Faust, and D. U. Hernández-Becerril. 2009. Dinoflagellates (Dinoflagellata) of the Gulf of Mexico, Pp. 131–154 in Felder, D.L. and D.K. Camp (eds.), Gulf of Mexico-Origins, Waters, and Biota. Biodiversity. Texas A&M Press, College.

- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Gonyaulax spinifera (Claparède & Lachmann) Diesing, 1866

Harmful Effect: Produce yessotoxins

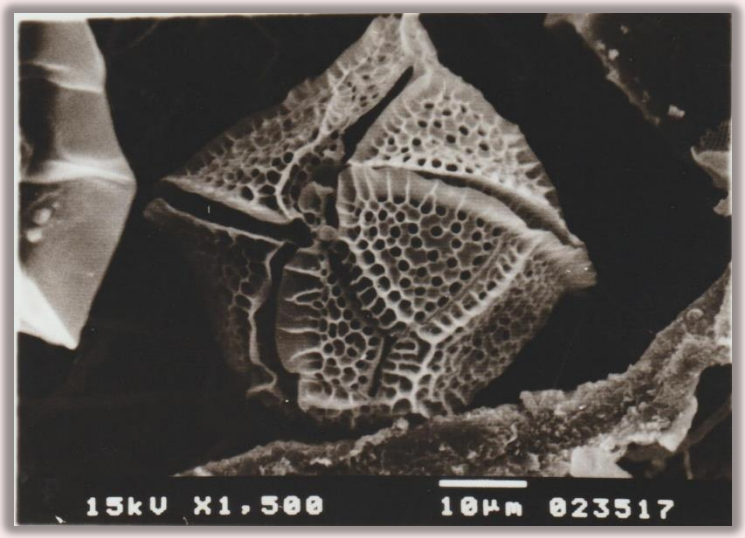
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species, Cells are slightly longer than board, 24-50 µm long, 30-40 µm wide. The epitheca has convex sides and a small apical horn. The hypotheca has two antapical spines. The cingulum is deeply excavated and displaced by two or more widths.

References:

- Steidinger, K. A., M. A. Faust, and D. U. Hernández-Becerril. 2009. Dinoflagellates (Dinoflagellata) of the Gulf of Mexico, Pp. 131–154 in Felder, D.L. and D.K. Camp (eds.), Gulf of Mexico-Origins, Waters, and Biota. Biodiversity. Texas A&M Press, College.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Lingulodinium polyedra (F.Stein) J.D.Dodge, 1989



Harmful Effect: Produce saxitoxin (PSP)

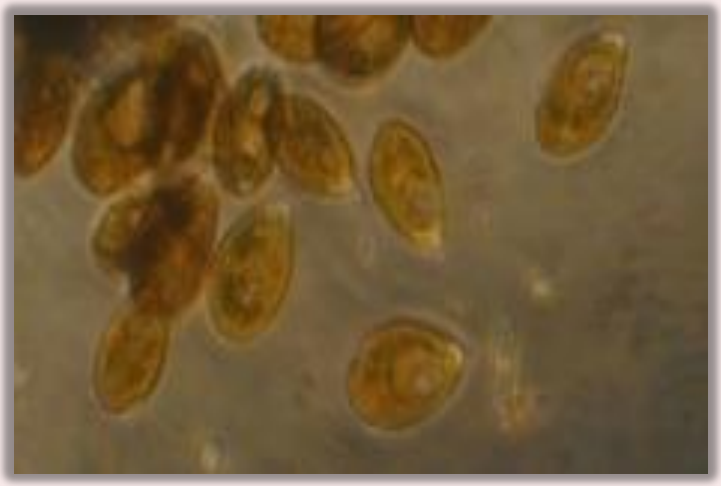
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species. Cell size for all strains ranged from 37.6 to 52.5 µm in length and 33.8 to 47.9 µm in width. The cells' outlines were heptagonal in ventral or dorsal view. The epitheca had a small, raised apical pore complex. The hypotheca was trapezoidal in outline with straight lines and a flat antapex without projections. The cingulum was almost median, narrow, incised and exhibited narrow cingular lists.

References:

- Stein F.R.von. (1883). Der Organismus der Infusionstiere. III Abth. Der Organismus der Arthrodelen Flagellaten. Einleitung und Erklarüng der Abbildungen. II Hälfte: 23-26.
- Moestrup, Ø., Akselman, R., Cronberg, G., Elbraechter, M., Fraga, S., Halim, Y., Hansen, G., Hoppenrath, M., Larsen, J., Lundholm, N., Nguyen, L. N., Zingone, A. (Eds) (2009 onwards). IOC-UNESCO Taxonomic Reference List of Harmful Micro Algae.

Ostreopsis ovata Fukuyo, 1981



Harmful Effect: Producer of aerosol, which may cause high fever and serious respiratory distress due to the presence of toxic compound, ovatoxins

Local Distribution: Abu Qir coast – Port Said

Description: marine species. Cells ovate and ventrally slender. Antero-posterior length nearly equal to the transdiameter (width). Dorsoventral diameter 1.5 to 2 times larger than transdiameter. The shape and configuration of thecal plates are similar to those of O. siamensis. Thecal plates with numerous minute pores visible in LM. The size of 0.07 μm given by Faust et al. (1996) is probably mistaken. In the Mediterranean Sea and Atlantic Ocean, Penna et al. (2005) found specimens smaller than O. ovata and genetically different from the Pacific populations. They named it O. cf. ovata and reported pores ranging from 0.16 to 0.55 μm in two classes: 0.25–0.30 μm and 0.45–0.50 μm.

References:

- Fukuyo Y. 1981. Taxonomical study on benthic dinoflagellates collected in coral reefs. Bull. Jap. Soc. Sci. Fish. 47: 967-978.

- Hoppenrath, M.; Chomérat, N.; Horiguchi, T.; Murray, S.A.; Rhodes, L. (2023). Marine benthic dinoflagellates-their relevance for science and society.2. revised edition, 376 pages, 122 figures, 8 plates. Senckenberg Bücher, Nr.8.

Ostreopsis siamensis Johs.Schmidt, 1901

Harmful Effect: Producer of ostreocin A, B, D and E1, analogues of PLTX.

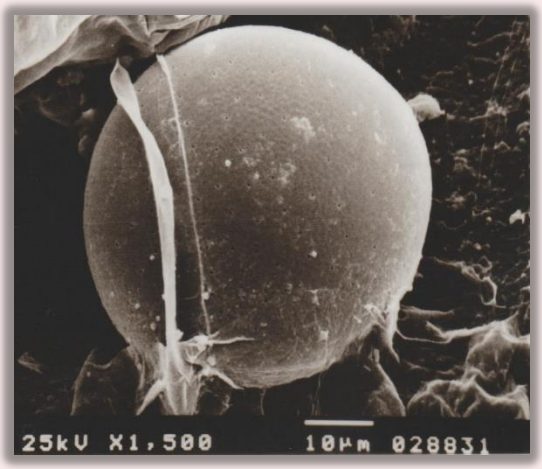
Local Distribution: Abu Qir coast – Port Said

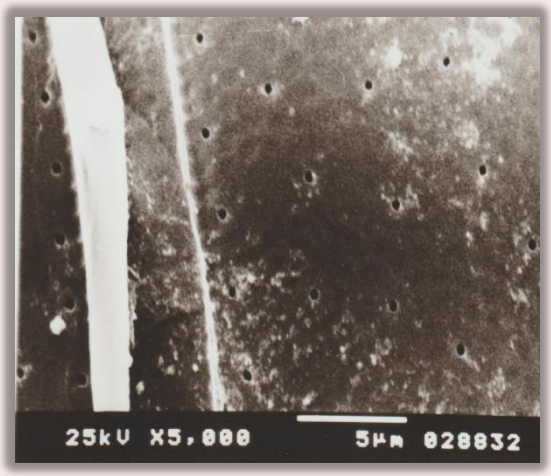
Description: marine species.Cells are oval, with a DV diameter of 60-70 µm (average 65 µm), and a trans- diameter of 35-48 µm (average 41.5 µm). The AP diam- eter ranged from 19 to 31 µm (average 25 µm) and the DV/AP ratio value was 2.25 - 3.15 (average 2.7). The cells are distinctly larger than O. ovata, although the L/W ratio is comparable. The thecal surface is smooth and covered with one type of pores, 0.9 µm in diameter, visible under the light microscope.

References:

- Schmidt, J. (1901). Flora of Koh Chang. Contributions to the knowledge of the vegetation in the Gulf of Siam. Peridiniales. Botanisk Tidsskrift. 24: 212-221
- Ismael A. A. and Y. Halim. 2012. Potentially harmful *Ostreopsis* cf. *ovata* and *Ostreopsis* sp. in Alexandria coastal water – Egypt. Mediterranean Marine Science. 13 (2):208-212.

Phalacroma rotundatum (Claparéde & Lachmann) Kofoid & J.R.Michener, 1911





Harmful Effect: produce Okadaic acid (OA), DTX2 & PTX2

Local Distribution: Eastern Harbor – Abu Qir Bay

Description: marine species. Cells medium-sized (36–56 µm in length and 36–43 µm in dorso-ventral depth), regularly oval in lateral view and broadly rounded in lateral view with convex ventral and dorsal margins. Left sulcal list (LSL) extends over 1/2 to 3/4 of cell length. Thecal surface covered with poroids and scattered pores.

References:

- Claparède E. & Lachmann J. (1858). Etudes sur les Infusoires et les Rhizopodes. Mém. Inst. Genev. 5, 6: 489 pp.

- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Prorocentrum concavum Y.Fukuyo, 1981

Harmful Effect: Produce Okadaic acid.

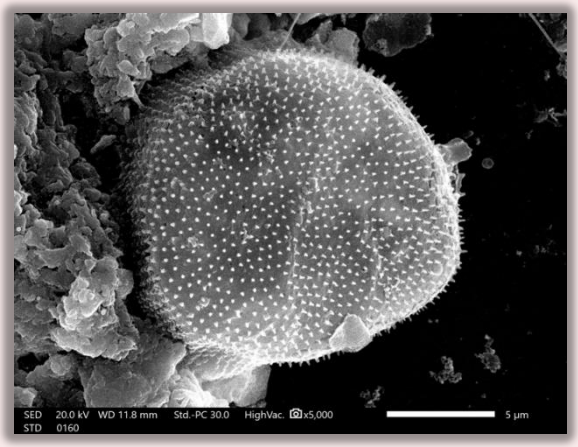
Local Distribution: Port Said

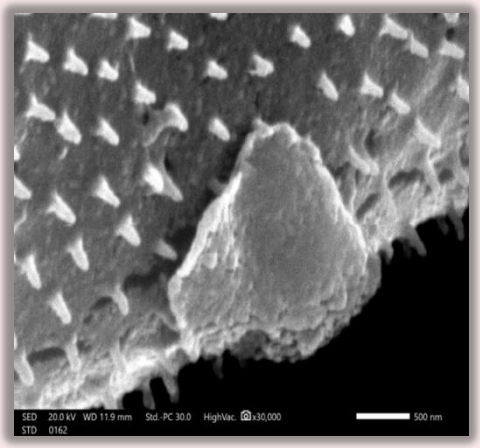
Description: marine species. Broad oval to ovoid cells, 38-58 µm in length, 35-48 µm in width. Periflagellar area V-shaped, composed of 9 plateletes.Thecal pores scattered on the valve surface, absent in the centre.

References:

- Fukuyo Y. 1981. Taxonomical study on benthic dinoflagellates collected in coral reefs. Bull. Jap. Soc. Sci. Fish. 47: 967-978.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Prorocentrum cordatum (Ostenfeld) J.D.Dodge, 1976





Harmful Effect: Diarrhetic poisoning (DSP)

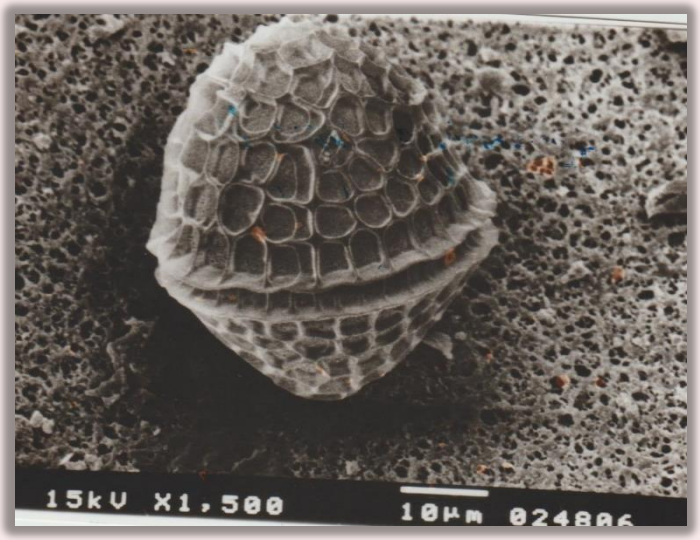
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species. Small pelagic dinoflagellate with two valves and measuring 14-22 µm in length. Heart-shaped or triangular cells, rounded in the posterior part. Valves covered with tiny spines.

References:

- Pavillard J. 1916. Recherches sur les péridiniens du Golf de Lion. Inst. Bot. Univ. Montpellier et Stat. Zool. Cette. Trav., sér. mixte, Mém. 4: 1-73.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Protoceratium reticulatum (Claparède & Lachmann) Bütschli, 1885



Harmful Effect: Producer of yessotoxin.

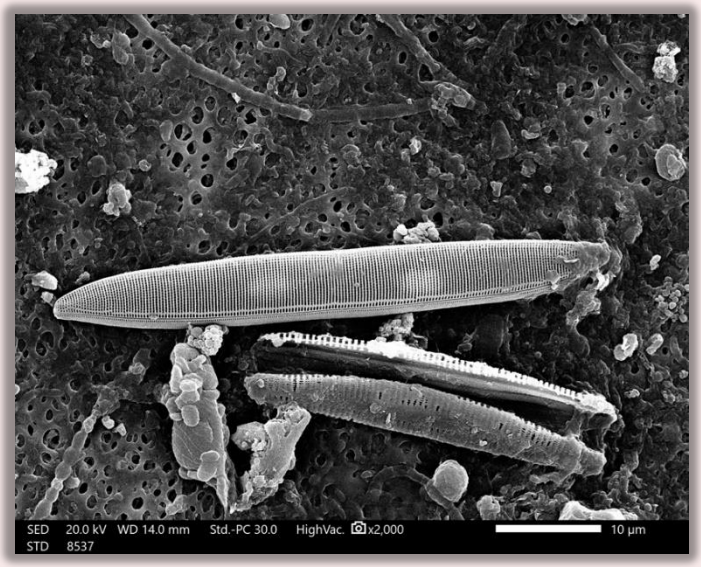
Local Distribution: Port Said

Description: marine species. Cells oval, occasionally becoming polygonal. Cingulum displaced about its own width, and located anterior to the cell midpoint, making the hypotheca larger than the epitheca. Sulcus not reaching the antapex. Cell surface highly reticulated, which makes the plate patteren difficult to evaluate.

References:

- Claparède E. & Lachmann J. (1858). Etudes sur les Infusoires et les Rhizopodes. Mém. Inst. Genev. 5, 6: 489 pp.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Pseudo-nitzschia brasiliana
N.Lundholm, G.R.Hasle & G.A.Fryxell, 2002



Harmful Effect: produce domoic acid.

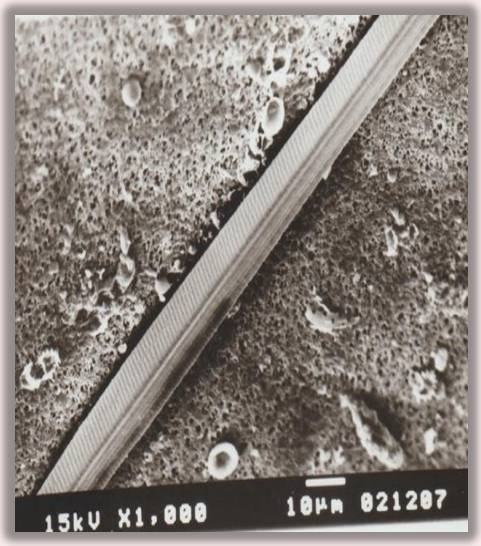
Local Distribution: Ras El-Bar- Damietta Port

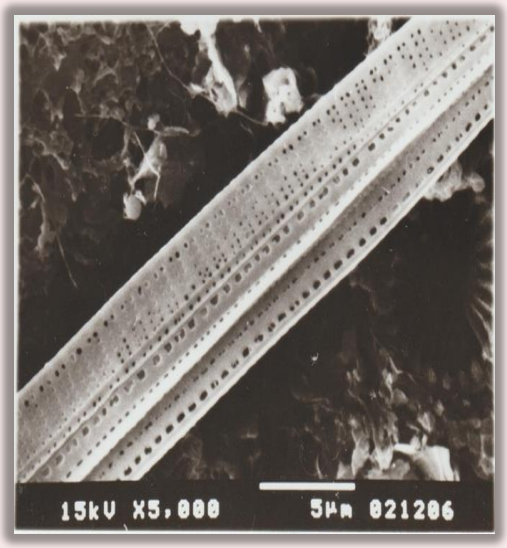
Description: marine species. Cells 12-65 µm in length (apical axis) and 1.8-3 µm in width (transapical axis), arranged in chains of 4-6 cells and overlapping. Cells linear in girdle view with truncate ends. Valves rectangular to lanceolate with ends broadly rounded.

References:

- Lundholm, N.; Hasle, G. R.; Fryxell, G. A.; Hargraves, P. E. (2002). Morphology, phylogeny and taxonomy of species within the Pseudo-nitzschia americana complex (Bacillariophyceae) with descriptions of two new species, Pseudo-nitzschia brasiliana and Pseudo-nitzschia linea. Phycologia. 41(5), 480-497.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Pseudo-nitzschia multistriata (Takano) Takano, 1995





Harmful Effect: produce domoic acid.

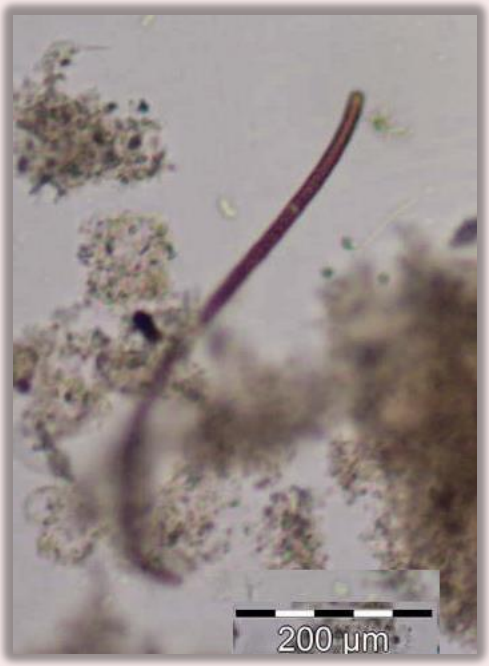
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species. Cells 46-75 µm in length (apical axis) and 2.9-3.7 µm in width (transapical axis), sigmoid in girdle view. In chain cell overlapping is short. Valves linear in the middle part, with margins tapering towards rounded ends. Surface structures not visible by L.M.

References:

- Takano H. 1993. Marine diatom Nitzschia multistriata sp. nov. common at inlets of Southern Japan. Diatom 8: 39-41.
- Lassus P.; Chomérat, N.; Hess, P.; Nézan, E. 2016. Toxic and Harmful Microalgae of the World Ocean/ Micro-alues toxiques et nuisibles de l'océan Mondial. Denmarl, International Scociety for the Study Harmful Algae/ Intergovernmental Oceanographic Commission of UNESCO. IOC. Manuals and Guides, 68.

Anagnostidinema acutissimum (Kufferath) Strunecky, Bohunická, J.R. Johnsen & J. Komárek 2017 (*Oscillatoria acutissma*)



Harmful Effect: dermatoxin

Local Distribution: Freshwater. Mex Bay – Dekhaila harbor – Eastern Harbor-Rosetta mouth- Lake BurulusRas

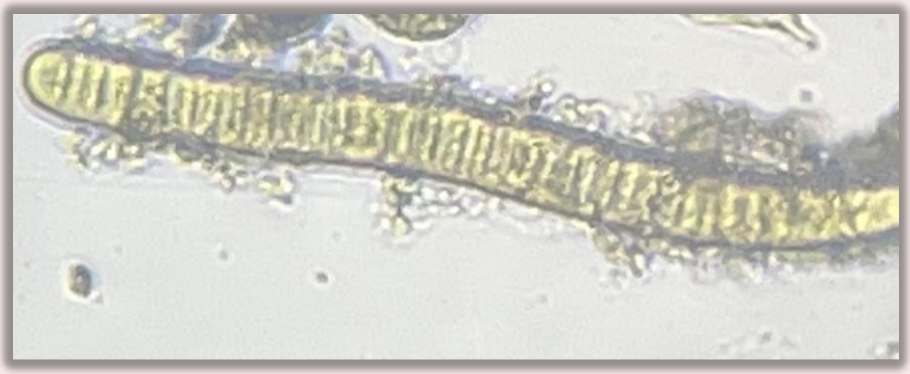
Description: simple filaments without specialized cells as heterocytes or akinetes and without true branching of trichomes. Cells are 1.5–2 µm in diameter,1.5–3 times longer than wide, blue green in colour and without calyptra. The trichomes are not constricted at the cross walls, but have long, tapering end cells.

Reference:

- Hallegraeff, G.M., Anderson, D.M. & Cembella, A.D., Eds (2003). Manual on harmful marine microalgae. Paris: UNESCO.

Kamptonema formosum (Bory ex Gomont) Strunecký, Komárek & J.Smarda.

(*Oscillatoria formosum*)



Harmful Effect: Neurotoxic

Local Distribution: Mex Bay – Dekhaila harbor – Rosetta mouth- Lake Burulus

Description: freshwater species. Trichomes straight, long, 4-6µm wide, intensely motile with oscillation and clockwise rotation, slightly or sometimes not (with the exception of the cells at the ends) constricted at the usually finely granulated, sometimes ungranulated cross-walls, slightly attenuated at the ends and bent. Sheaths thin, rarely developed, usually missing. Apical cells obtuse-conical, rounded-conical or acutely rounded, not capitate, without calyptra or thickened outer cell wall.

References:

- Gomont, M. (1892 (1893)). Monographie des Oscillariées (Nostocacées Homocystées). Deuxième partie. - Lyngbyées. Annales des Sciences Naturelles, Botanique. 7(16): 91-264.
- Guiry, M.D. & Guiry, G.M. (2024). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway.

Lyngbya majuscula Harvey ex Gomont, 1892

Harmful Effect: produce the dermatotoxin lyngbyatoxin

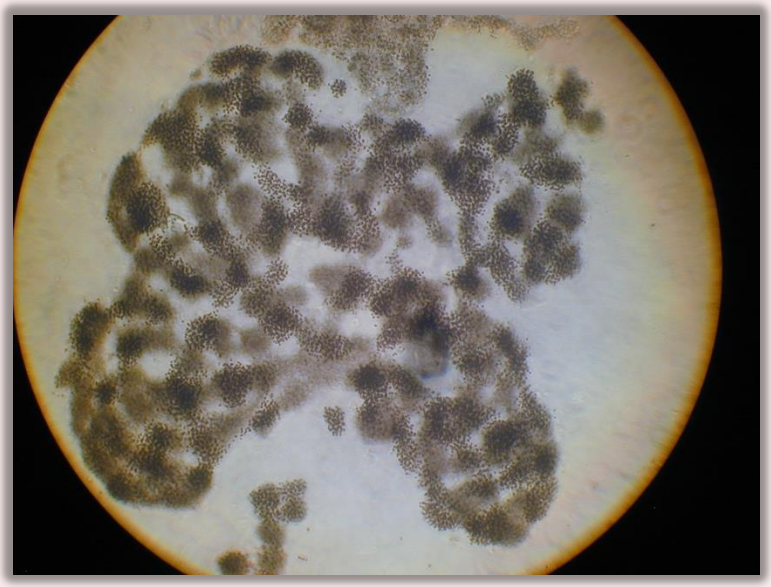
Local Distribution: Mex Bay – Dekhaila harbor – Lake Burulus

Description: marine, brackish, freshwater species. Thallus widely expanded, up to several (5-7) cm in length, dark blue-green or black-green, brown to yellowish brown. Filaments very long, often strongly curved or wavy, rarely slightly coiled.

References:

- Gomont, M. (1892 (1893)). Monographie des Oscillariées (Nostocacées Homocystées). Deuxième partie. - Lyngbyées. Annales des Sciences Naturelles, Botanique. 7(16): 91-264.
- Guiry, MD & Guiry, GM (2024). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. searched on YYYY-MM-DD., available online at http://www.algaebase.org

Microcystis aeruginosa (Kützing) Kützing, 1846



Harmful Effect: Produce microcystin.

Local Distribution: Damietta Port – Port Said

Description: marine and freshwater species. Colonies mucilaginous, microscopic, spherical, lenticular or feebly elongate, later macroscopic, irregular, lobate, distinctly elongate, usually 600-900µm, rarely up to 8 mm long, usually net-like clathrate with distinct holes, or composed of subcolonies, with irregular outline and with a large number of irregularly arranged and ± densely packed cells. Mucilage colourless, structureless, diffluent, sometimes forming a distinct, but not very wide margin around cells (usually to 5-8 µm). Cells spherical, sometimes slightly elongate before division.

References:

- Hällfors, G. (2004). Checklist of Baltic Sea Phytoplankton Species (including some heterotrophic protistan groups). Baltic Sea Environment Proceedings. No. 95: 210 pp.,
- Guiry, MD & Guiry, GM (2024). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. searched on YYYY-MM-DD. , available online at http://www.algaebase.org

Phormidium nigroviride (Thwaites ex Gomont) Anagnostidis & Komárek, 1988 (*Oscillatoria nigroviridis*)

Harmful Effect: dermatoxic

Local Distribution: Eastern Harbor – Abu Qir Bay

Description: marine. The trichomes are olive-green incolour. Cells are constricted at the cross walls, 7–11 µm wide and 3–5 µm long. The trichomes taper at the tips and terminate in a cone-shaped apicalcell.

Reference:

- Komárek, J. & Anagnostidis, K. (2005). Süßwasserflora von Mitteleuropa. Cyanoprokaryota. Oscillatoriales. Vol. 19/2 pp. 759, 1010 figures. München: Elsevier Spektrum Akademischer Verlag.
- Hallegraeff, G.M., Anderson, D.M. & Cembella, A.D., Eds (2003). Manual on harmful marine microalgae. Paris: UNESCO.

Planktothrix agardhii (Gomont) Anagnostidis & Komárek, 1988

Harmful Effect: produce microcystins

Local Distribution: From Rosetta mouth to Port Said

Description: freshwater species. Trichomes mostly solitary, free-floating, up to 300 µm long, straight or somewhat curved, loose fascicles, occasionally forming benthic membranaceous coat (thallus), without sheaths, or very rarely and facultatively, especially in young stages, with fine sheaths. Trichomes 4 - 6 µm wide, immotile, not constricted (or very slightly constricted) at the granulated cross-walls.

References:

- Gomont, M. (1892 (1893)). Monographie des Oscillariées (Nostocacées Homocystées). Deuxième partie. - Lyngbyées. Annales des Sciences Naturelles, Botanique. 7(16): 91-264.
- Maris, T.; Beauchard, O.; Van Damme, S.; Van den Bergh, E.; Wijnhoven, S.; Meire, P. (2013). Referentiematrices en Ecotoopoppervlaktes Annex bij de Evaluatiemethodiek Schelde-estuarium Studie naar "Ecotoopoppervlaktes en intactness index". Monitor Taskforce Publication Series, 2013-01. NIOZ: Yerseke. 35 pp.

Planktothrix planktonica (Elenkin) Anagnostidis & Komárek 1988

Harmful Effect: Produce microcystins.

Local Distribution: Along Alexandria coast

Description: freshwater species. The trichomesare twisted at the ends and have constrictions at the cross walls, 9–11 µm wide. The cells are much shorter than they are wide, 2–5 µm long and granulated at the cross walls. End cells are rounded without thick membranes.

References:

- Hallegraeff, G.M., Anderson, D.M. & Cembella, A.D., Eds (2003). Manual on harmful marine microalgae. Paris: UNESCO.
- NOGUEIRA, I.; VASCONCELOS, V. 2001. Toxicity of two filamentous cyanobacteria species - Planktothrix planktonica and Planktothrix perornata. 5th Int. Conf. Toxic Cyanobac-teria (ICTC V), Noosa, Queensland, Australia.

Harmful non-toxic microalgae

Chaetoceros affinis Lauder, 1864

Harmful Effect: Mechanical, harmful to fish

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: Marine. Cells in straight chains, usually long. Apertures elliptical to lanceolate. One large chloroplast per cell. Frustule rectangular in girdle view. Valve elliptical in outline. Valve surface slightly concave. Mantle high. Rimoportula centrally located on terminal valves only. Intercalary setae, circular in cross-section, with rows of small spines.

Reference:

- Sunesen, Inés & Hernández-Becerril, David & Sar, Eugenia. (2008). Marine diatoms from Buenos Aires coastal waters (Argentina). V. Species of the genus Chaetoceros. Revista de Biologia Marina Y Oceanografia. 43. 303-326.

Chaetoceros curvisetus Cleve, 1889

Harmful Effect: Mechanical, harmful to fish

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine. Chains curved and relatively long. Apertures wide and lanceolate, elliptical to almost circular. Cells rectangular in girdle view. One chloroplast per cell. Valves elliptical to almost circular. Mantle low. Sibling cells connected each other by corners of valves. Intercalary setae thinner than terminal ones, circular in cross-section, with minute spines and poroids arranged in spirals. All setae curved towards the same direction. Resting spores smooth, with valve mantle surrounded by siliceous filaments.

Reference:

- Sunesen, Inés & Hernández-Becerril, David & Sar, Eugenia. (2008). Marine diatoms from Buenos Aires coastal waters (Argentina). V. Species of the genus Chaetoceros. Revista de Biologia Marina Y Oceanografia. 43. 303-326.

Bellerochea malleus (Brightwell) Van Heurck, 1885

Harmful Effect: mechanical, harmful to fish

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: Ribbons usually straight. Cells biangular, triangular or quadrangular, united to form chains or flat colonies. Intracellular spaces drop shaped, open only near elevations, costae interrupted in valve surface. Valve surface slightly inflated in the middle and furnished with circlet or puncta near the margin. No visible structures of the cell wall are seen under the light microscope.

Reference:

- Fourtanier, E. & Kociolek, J. P. (compilers). (2011). Catalogue of Diatom Names. California Academy of Sciences.
- Tomas, C.R. (Ed.). (1997). Identifying marine phytoplankton. Academic Press: San Diego, CA [etc.] (USA). ISBN 0-12-693018-X. XV, 858 pp.

Leptocylindrus danicus Cleve, 1889

Harmful Effect: mechanical, harmful to fish

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: Cells are cylindrical and form long, straight chains. Cells are connected by the whole valve surface. The central parts of the valve face may be slightly convex/concave, fitting into the concavity/convexity of an adjacent valve. Cells are thin-walled and do not have any obvious spines or processes. Chloroplasts are numerous small ovoid plates, distributed throughout the cell. Intercalary bands are not visible with LM.

Reference:

- Kociolek, J.P.; Blanco, S.; Coste, M.; Ector, L.; Liu, Y.; Karthick, B.; Kulikovskiy, M.; Lundholm, N.; Ludwig, T.; Potapova, M.; Rimet, F.; Sabbe, K.; Sala, S.; Sar, E.; Taylor, J.; Van de Vijver, B.; Wetzel, C.E.; Williams, D.M.; Witkowski, A.; Witkowski, J. (2024). DiatomBase. *Leptocylindrus danicus* Cleve, 1889. Accessed through: World Register of Marine Species at: on 2024-07-15
- Hasle, G. R. and Syvertsen, E. E. 1997. Marine diatoms. In: Tomas, C. R. (ed.) Identifying marine Phytoplankton. Academic Press, Inc., San Diego. 5-385.

Sundstroemia setigera (Brightwell) Medlin in Medlin et al., 2021 (*Rhizosolenia setigera*)

Harmful Effect: mechanical, harmful to fish

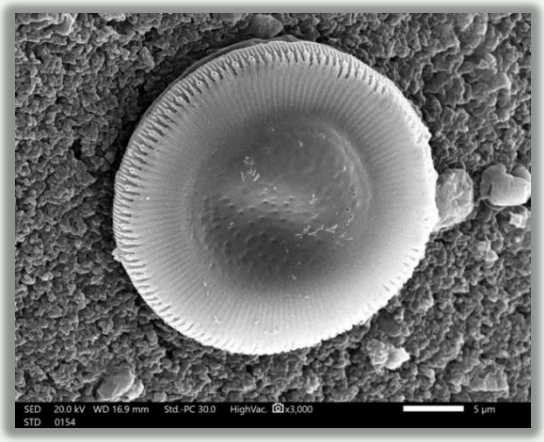
Local Distribution: Ras El-Bar

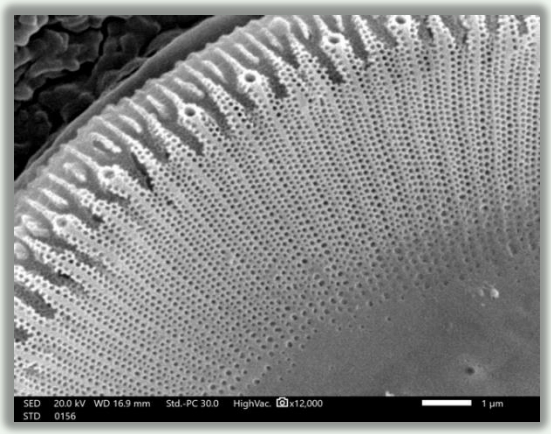
Description: marine. Cells are cylindrical, with conical valves narrowing into a long, straight and needle-like spine. Cells are much longer than they are wide and valves do not have otaria. Cell frustule is weakly silicified. *R. setigera* cells are wider in the centre and gently narrow towards either end. Cell has many chloroplasts located through out the cell. Cells are often solitary.

Reference:

- Brightwell, T. (1858). Remarks on the genus Rhizosolenia of Ehrenberg. Quarterly Journal of Microscopical Science, London, 6: 93-95, page(s): 95; note: Plate 5, fig. 7.
- Medlin, L. K.; Boonprakob, A.; Lundholm, N.; Moestrup, Ø. (2021). On the morphology and phylogeny of the diatom species Rhizosolenia setigera: comparison of the type material to modern cultured strains, and a taxonomic revision. *Nova Hedwigia, Beihefte.* 151: 223-247.

Stephanocyclus meneghinianus (KÜtzing) Kulikovskiy, Genkal & Kociolek 2022 (Cyclotella meneghiniana)





Harmful Effect: water quality

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: freshwater species. Valves are disc-shaped, with a narrow mantle. The valve face may be flat or transversely undulate. The central area is distinct and isolated from the marginal chambered striae. The central area covers 1⁄2 to 1⁄3 of the valve face. The central area contains 1-4 fultoportulae, which are distinct in LM. In the SEM, marginal fultoportulae are positioned on each costa. One to two rimoportulae are present near the valve margin, in line with a costa. The number of costae (interstriae) in 10 µm is 12-15.

Reference:

- Kützing, F.T. (1844) Die kieselschaligen Bacillarien oder Diatomeen. Nordhausen. 152 pp., 30 pls.
- Houk, V., Klee, R. and Tanaka, H. (2010) Atlas of freshwater centric diatoms with a brief key and descriptions, Part III. Stephanodiscaceae a. cyclotella, tertiarius, discostella fottea 10 (supplement): 1-498.

Thalassionema nitzschioides (Grunow) Mereschkowsky, 1902

Harmful Effect: Thalassionema is nontoxic, but it can clog the gills of fish.

Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: Cells are usually in star-shaped or zigzagged chains connected by mucilage pads on the ends of valves. Cells are rectangular in girdle view, with valve ends that are similar in shape and width, and are narrowly elliptical in valve view. Chloroplasts are small and numerous. Cells are yellow-brown in colour.Each valve has two labiate processes, one on each end; a small apical spine is sometimes also present. "Marginal areolae are visible as ribs with LM.

Reference:

- Hasle, G. R. and Syvertsen, E. E. 1997. Marine diatoms. In: Tomas, C. R. (ed.) Identifying Marine Phytoplankton. Academic Press, Inc., San Diego. 5-385.

Noctiluca scintillans (Macartney) Kofoid & Swezy, 1921

Harmful Effect: depletion of oxygen

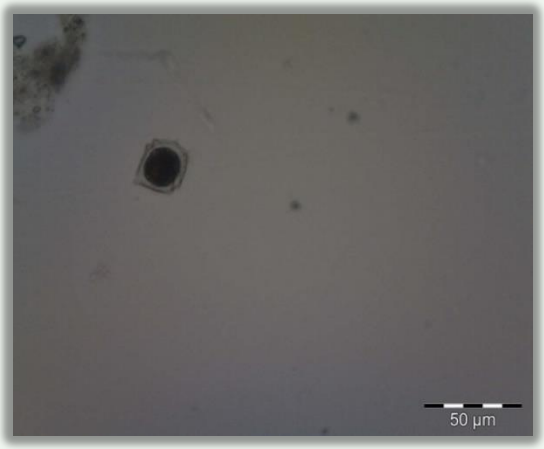
Local Distribution: Ras El-Bar – Port Said

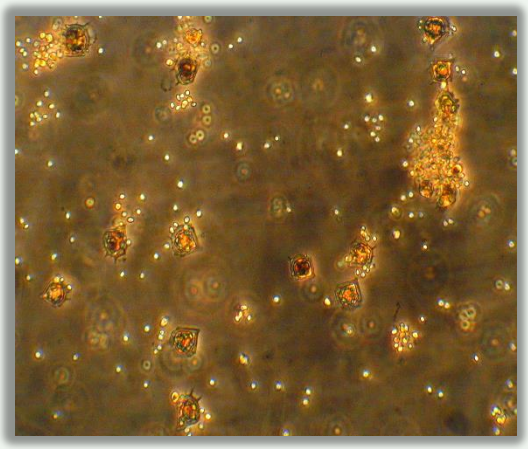
Description: marine, planktonic, phagotrophic unarmored dinoflagellate usually floating near sea surface. Cells 200-1000µm in diameter. Cells transparent and the bloom apparently red in color. Cells have many endosymbiotic flagellates and thus this green Noctiluca forms green colored bloom.

Reference:

- Omura, T.; Iwataki,M.; Borja, V.M.; Takayama, H. & Fukuyo, Y. 2012. Marine phytoplankton of the Western Pacific. Kouseikaku, Tokyo, 160pp.

Peridinium quadridentatum (F.Stein) Gert Hansen, 1995
(Peridinium quinquecorne)





Harmful Effect: High cell concentrations deplete oxygen causing fish kills.

Local Distribution: Eastern Harbor- Miami Beach – Abu Qir Bay

Description: marine. A small, peculiar species with four antapical spines. Body is rotund posteriorly and pointed anteriorly. The epitheca is subconical with an indistinct short apical horn. The girdle is comparatively wide and is deeply impressed with distinct side lists of the body wall. It is quite post-median, so that the epitheca exceeds the hypotheca. The hypotheca is somewhat polygonal in ventral view, four spines on each angle. The central right spine is displaced dorsally while the rests are middle or slightly ventral, but the central left is the longest of the four though.

References:

- Abé TH (1927). Report of the Biological Survey of Mutsu Bay, Notes on the Protozoan Fauna of Mutsu Bay.
- Gárate-Lizárraga, Ismael & Muneton-Gomez, Maria. (2008). Bloom of Peridinium quinquecorne Abe, in La Ensenada de La Paz, Gulf of California (July 2003). Acta botánica Mexicana. 83. 33-47.

Prorocentrum micans Ehrenberg, 1834

Harmful Effect: This species has previously been toxic, but there is presently no evidence for this. The bloom of the species may cause oxygen depletion in the water column.

Local Distribution: marine and freshwater species. the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: Morphologically, P. micans is similar to P. gracile, P. sigmoides, and P. texanum. Cells of *PROROCENTRUM MICANS* are highly variable both in shape and size. It is heart-shaped and broadest at its centre. Cells are round anteriorly and pointed posteriorly. There is a well-developed, short and winged spine originating from the anterior of the cell. Small pores originate from the cell margins forming a unique pattern that runs towards the centre of the cell. The cell also has large pores posteriorly. Pores are most easily seen in SEM.

References:

- Ehrenberg, C.G. (1834). Dritter Beitrag zur Erkenntniss grosser Organisation in der Richtung des kleinsten Raumes. *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin.* 1833: 145-336, pls I-XIII [1-11].
- Tomas, C.R. (Ed.). (1997). Identifying marine phytoplankton. Academic Press: San Diego, CA [etc.] (USA). ISBN 0-12-693018-X. XV, 858 pp.

Prorocentrum gracile F.Schütt, 1895

Harmful Effect: *Prorocentrum gracile* is not a known toxin producer. It might deplete nutrients during blooms and cause anoxia

Local Distribution: Abu Qir coast & Bay- Lake Burulus – Ras El-Bar- Damietta port

Description: marine. *Prorocentrum gracile* is similar to *P. micans*, but *P. micans* has a broader body than *P. gracile* The posterior of the cell is pointed while the anterior is round. *Prorocentrum gracile* has a long and strong winged apical spine anteriorly. It has a kidney-shaped nucleus located posteriorly. Length: 45 - 55 µm, Width: 25 - 30 µm.

References:

- Dodge, J. D. 1982. Marine Dinoflagellates of the British Isles. Her Majesty's Stationery Office, London, UK. 303.
- Horner, R. A. 2002. A Taxonomic Guide To Some Common Phytoplankton. Biopress Limited, Dorset Press, Dorchester, UK. 200.

Prorocentrum triestinum J. Schiller 1918

Harmful Effect: The bloom of the species may cause oxygen depletion in the water column.

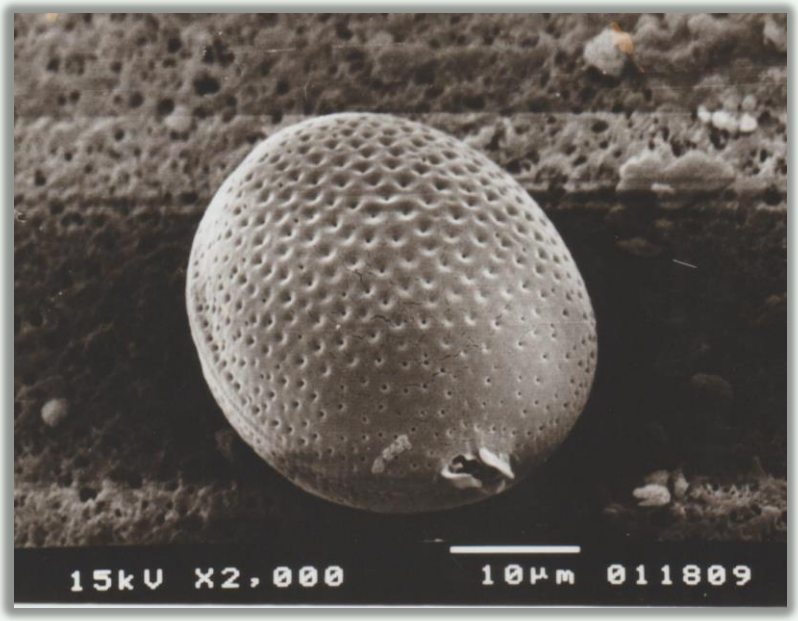
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine species. Small posteriorly pointed cell resembling a thin, narrow P. micans. Depressions few and mainly peripherally located. Cell with a thin anterior spine. Length < 30 µm.

References:

- Steidinger, K.A. and Tangen, K. 1997. Dinoflagellates. In identifying Marine phytoplankton Toma C.R (Ed.). London: Academic press
- Brandt, S. (2001). Dinoflagellates, ***in***: Costello, M.J. *et al.* (Ed.) (2001). *European register of marine species: a check-list of the marine species in Europe and a bibliography of guides to their identification. Collection Patrimoines Naturels,* 50: pp. 47-53.

Prorocentrum sp.



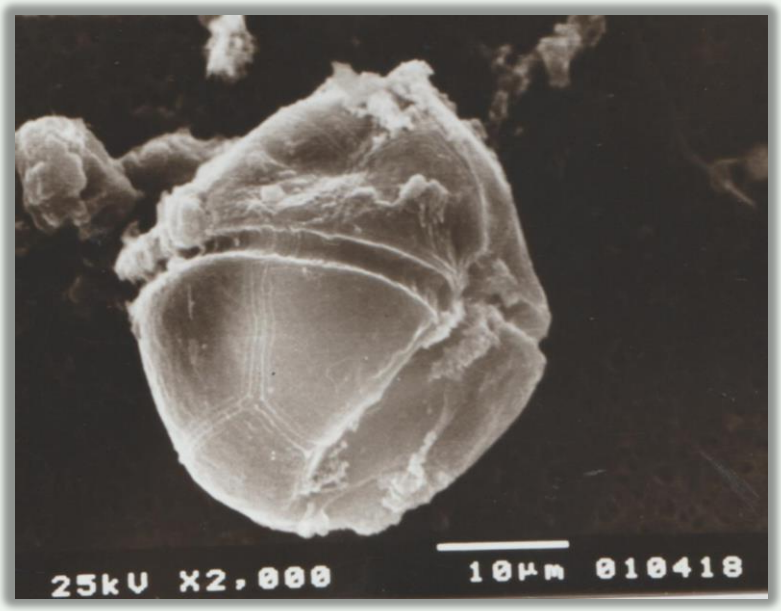
Environment: marine

Harmful Effect: oxygen depletion

Local Distribution: Eastern Harbor

Description: cell oval, not much compressed. Each valve with a very small tooth near the exit of the flagella. Theca covered with conspicuous poroids. Length 34-46 µm.

Scrippsiella (trochoidea)acuminata (Ehrenberg) Kretschmann, Elbrächter, Zinssmeister, S. Soehner, Kirsch, Kusber & Gottschling 2015



Harmful Effect: Blooms can cause water discolouration and oxygen depletion.

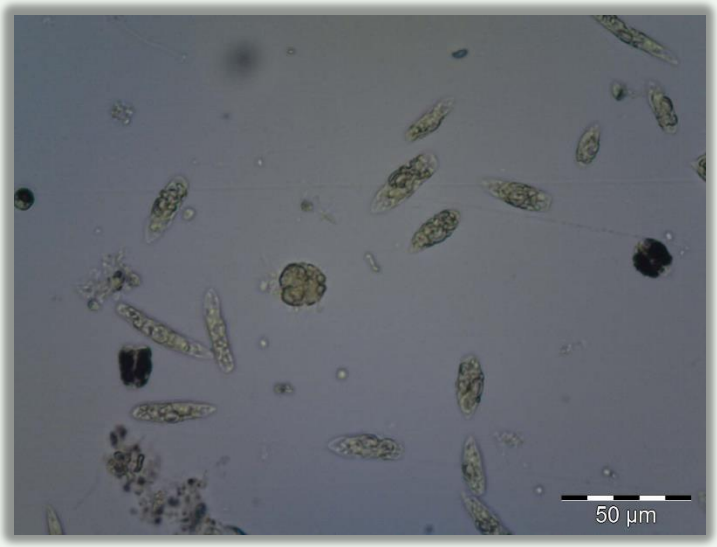
Local Distribution: the species is widely distributed and recorded from all stations along the Egyptian waters.

Description: marine. Cells are relatively small and pear-shaped. The epitheca is conical and has a short apical process. The hypotheca is round and does not have any projections.

References:

- Horner, R. A. 2002. A Taxonomic Guide To Some Common Phytoplankton. Biopress Limited, Dorset Press, Dorchester, UK. 200.
- Wang, Z. H., Qi, Y. Z. and Yang, Y. F. 2007. Cyst formation: an important mechanism for the termination of Scrippsiella trochoidea (Dinophyceae) bloom. Journal of Plankton Research. 29(2): 209-218.

Euglena gracilis G.A. Klebs 1883



Harmful Effect: Blooms can cause water discolouration and oxygen depletion.

Local Distribution: Mex Bay – Dekhaila Harbor- Rosetta – Lake Burulus

Description: freshwater species. Characterized by the presence of a pellicle, a series of proteinaceous strips beneath the outer membrane. Together with their flagella, the pellicle contributes to the locomotion of euglenid cells and can give the cell a striped appearance under the scanning electron microscope. It has a highly flexible cell surface, allowing it to change shape from a thin cell up to 100 µm long to a sphere of approximately 20 µm.

References:

- Lemmermann, E. (1913). Flagellatae II. Eugleninae. In: Die Süsswasserflora Deutschlands, Österreichs und der Schweiz. Heft 2. (Pascher, A. & Lemmermann, E. Eds), pp. 115-174. Jena: Verlag von Gustav Fischer.
- Wołowski, K, & Hindák, F. (2005). Atlas of Euglenophytes. pp. [1]-136, 417 figs. Cracow: VEDA Publishing House of the Slovak Academy of Sciences.

Lepocinclis acus (O.F. Müller) B. Marin & Melkonian 2003 (*Euglena acus*)

Harmful Effect: Blooms can cause water discolouration and oxygen depletion.

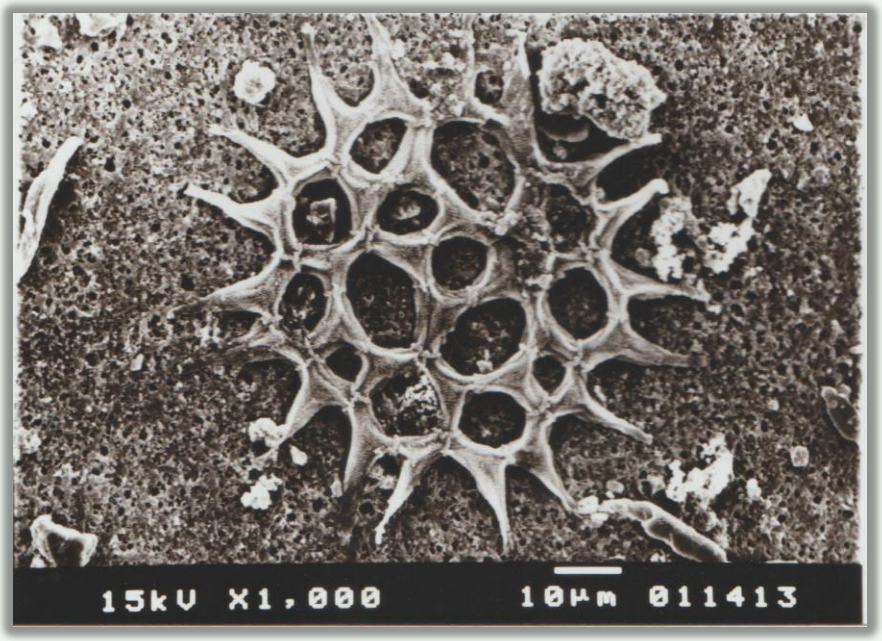
Local Distribution: Mex Bay – Dekhaila harbor- - Rosetta – Lake Burulus

Description: marine, freshwater. Body long spindle or cylinder, with a sharply pointed posterior end; flagellum short, about one-fourth the body length; spiral striation of pellicle very delicate; numerous discoid chromatophores; several paramylon bodies, rod-form and 12-20 μm long; nucleus central; stigma distinct.

References:

- Chaber, K., Lukomska-Kowalczyk, M., Fells, A., Milanowski, R. & Zakrys, B. (2022). Toward the robust resolution of taxonomic ambiguity within Lepocinclis (Euglenida) based on DNA sequencing and morphology. Journal of Phycology 58(1): 105-120.
- M.D. Guiry in Guiry, M.D. & Guiry, G.M. 2024. AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. https://www.algaebase.org; searched on 14 July 2024.

Lacunastrum gracillimum (West & G.S. West) H.A. McManus 2011 (*Pediastrum duplex* var. *gracillimum*)



Harmful Effect: Blooms can cause water discolouration and oxygen depletion.

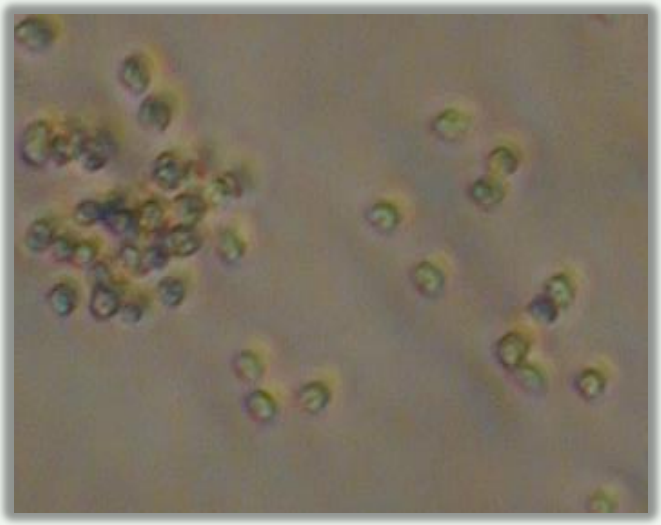
Local Distribution: Mex Bay - Dekhaila harbor- Abu Qir Bay- Rosetta - Lake Burulus

Description: Freshwater. Colonies with very large intercellular spaces. Cells very narrow, as broad or narrower than the processes. Cells 10-18.5 (-22)µ broad, 12- 25 (-32) µ long. Perforations 4-16µ in diameter. Sixteen celled colonies 65-140µ in diameter.

References:

- Raut, L.. 2018. Diversity of Pediastrum species in Tapti Pond Multai (M.P.). International Journal of Botany Studies, volume 3; Issue 5: Page No. 25-27.
- M.D. Guiry in Guiry, M.D. & Guiry, G.M. 2024. AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. https://www.algaebase.org; searched on 14 July 2024.

Micromonas pusilla (Butcher) Manton & Parke, 1960



Harmful Effect: Blooms can cause water discolouration and oxygen depletion.

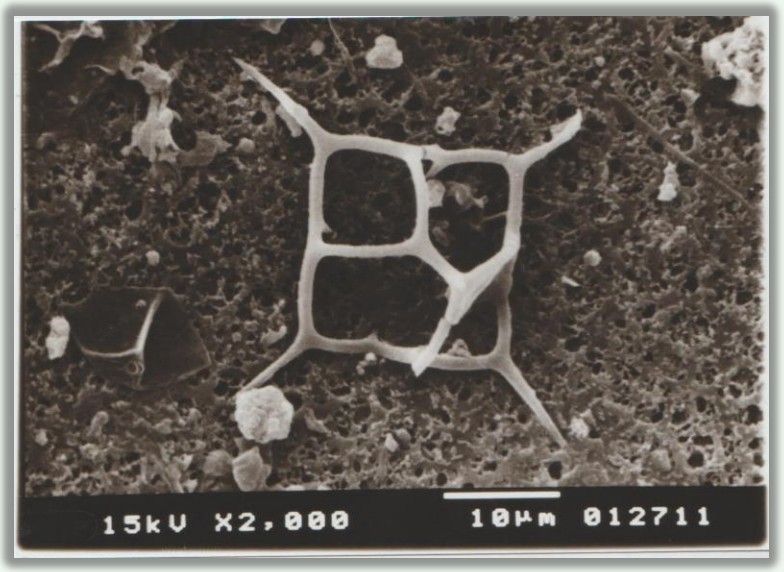
Local Distribution: Miami beach (St.4)

Description: marine. M. pusilla is an aquatic microorganism which is distributed worldwide. It is currently the only classified species within the genus Micromonas. M. pusilla is generally less than 2 µm in length and is therefore classified as a picophytoplanktonic species. It is pear-shaped with a single flagellum which has microtubules at the end. M. pusilla is one of the most abundant microorganisms within marine ecosystems and it is the smallest known single-celled eukaryotic organism.

References:

- Guiry, M.D. & Guiry, G.M. (2024). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway (taxonomic information republished from AlgaeBase with permission of M.D. Guiry). *Micromonas pusilla* (Butcher) Manton & Parke, 1960. Accessed through: World Register of Marine Species at: https://www.marinespecies.org/aphia.php?p=taxdetails&id=134564 on 2024-07-14.

Dictyocha fibula Ehrenberg, 1839



Harmful Effect: Harmful to fish gills at high concentrations

Local Distribution: Eastern Harbor – Abu Qir Bay – Port said

Description: marine. Cells are solitary, roughly spherical and are slightly flattened with one anterior flagellum. Length: 10 - 45 µm (skeletal form), ~90 µm with spines The external silica skeleton is composed of tubular elements and consists of four protruding spines and four windows, with the flagellum extending along one of the spines. Cells have many golden-brown, discoid chloroplasts.

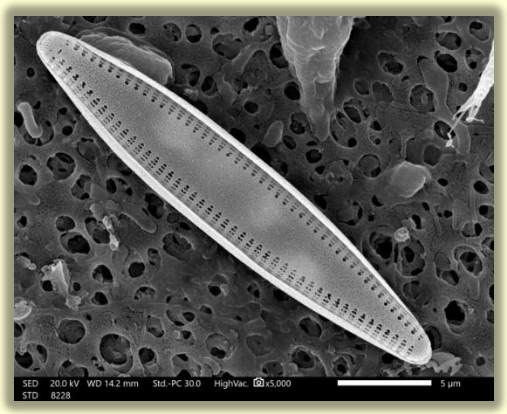
References:

- Throndsen, J. 1997. The planktonic marine flagellates. In: Tomas, C. R. (ed.) Identifying marine Phytoplankton. Academic Press, Inc., San Diego, California, US. 591-730.
- Guiry, M. D. and Guiry, G. M. 2021. AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. http://www.algaebase.org. searched on 14Jul 2024.

Other Phytoplankton

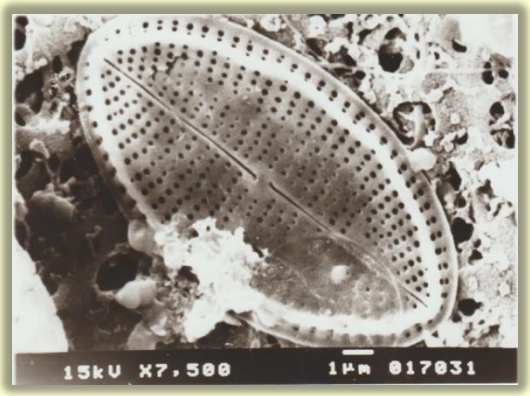
Diatoms

Navicula cryptocephala

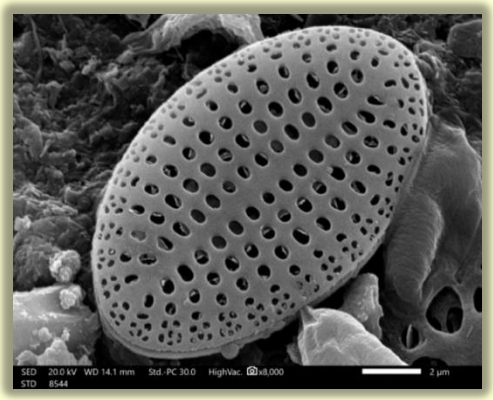


Nitzschia sp.

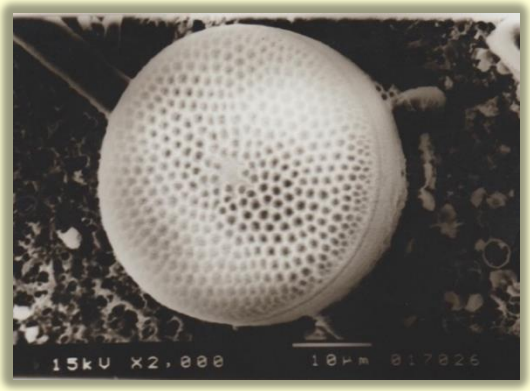
Cocconeis placentula



***Cocconeis* sp.**

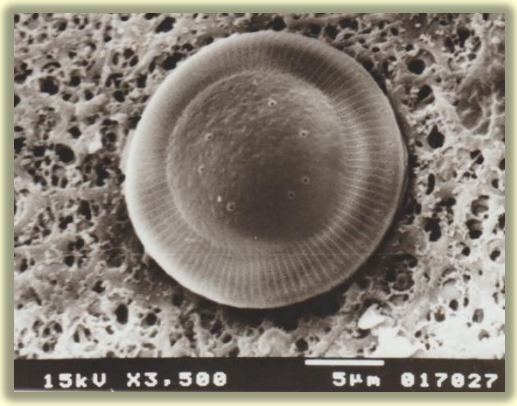


Stellarima stellaris



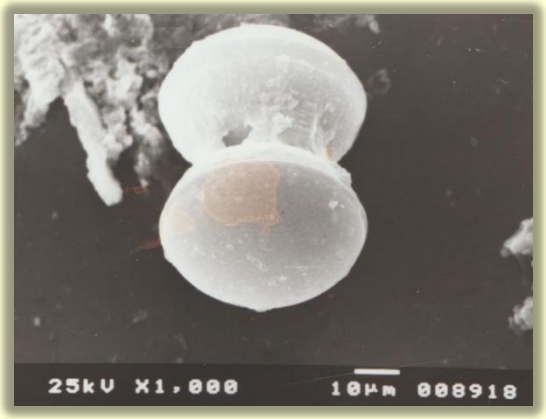
Coscinodiscus radiatus

Cyclotella striata

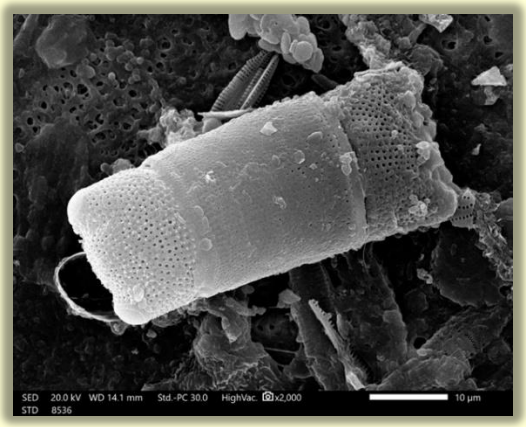


Ralfsiella smithii

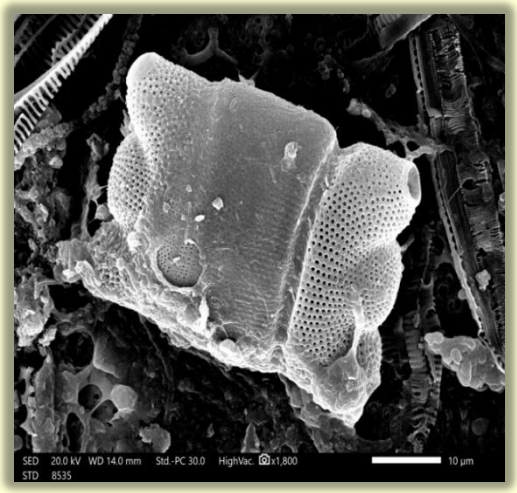
***Melosira* sp.**

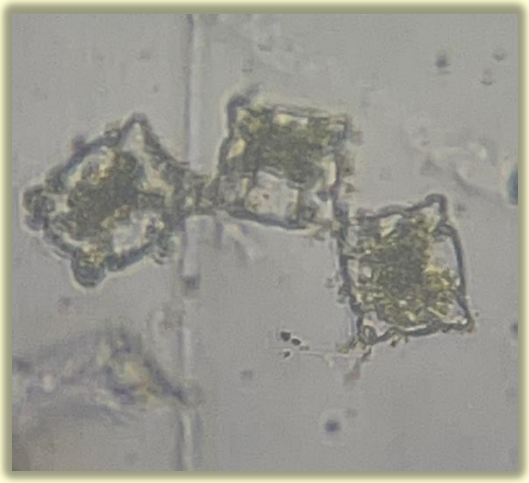


Biddulphia biddulphiana

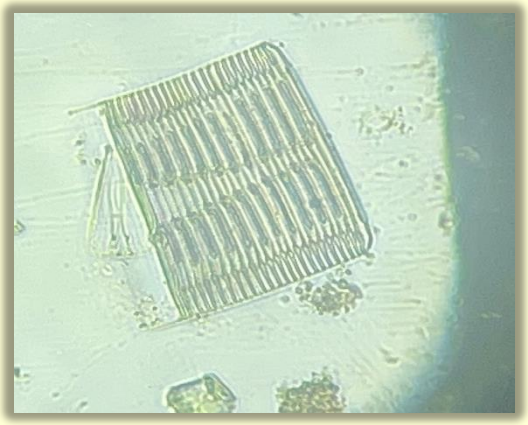


Odontella aurita





***Fragilaria* sp.**

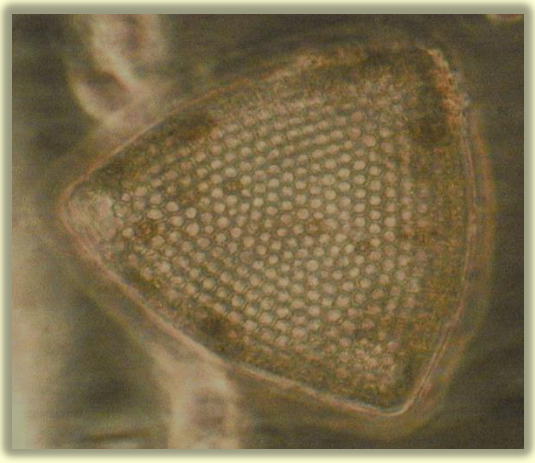


***Amphiprora* sp.**

***Licmophora* sp.**

Achnanthea inflata

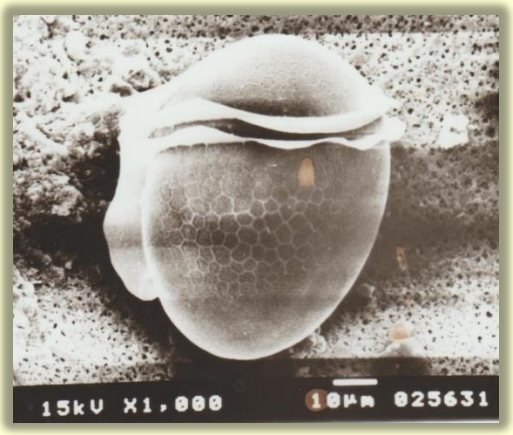
Triceratium favus

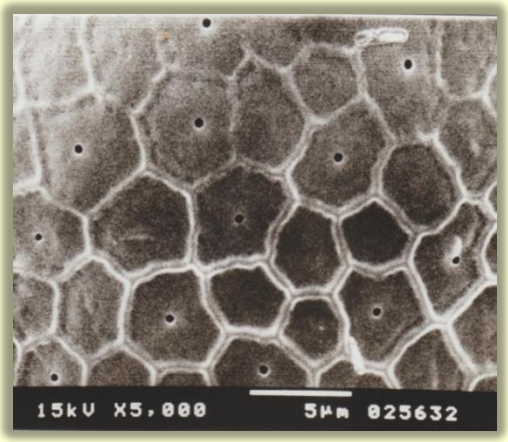


***Navicula* sp.**

Dinoflagellates

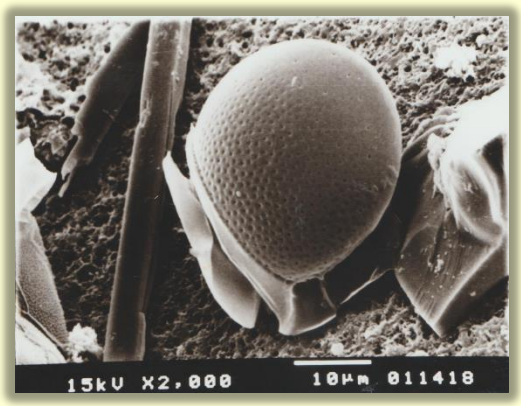
Dinophysis argus





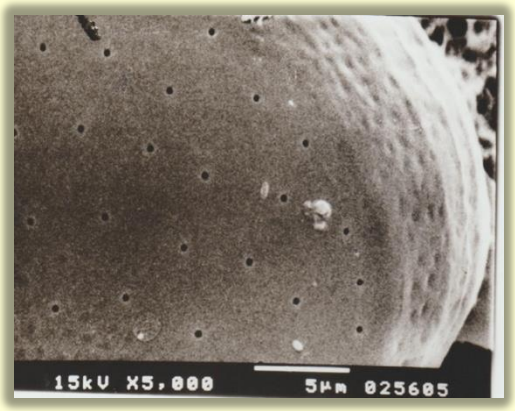
Dinophysis exigua

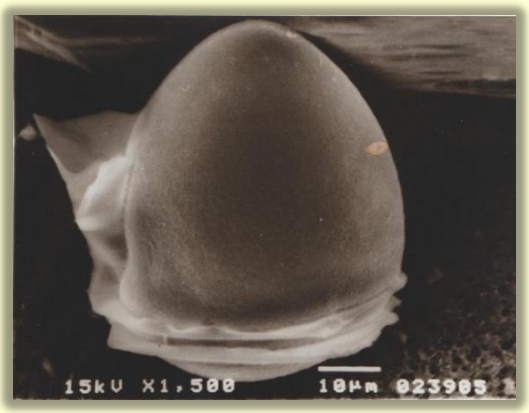
Dinophysis monacantha



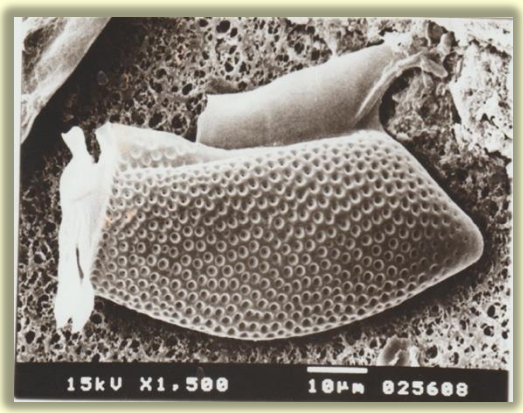
Dinophysis monacantha

Dinophysis operculoides

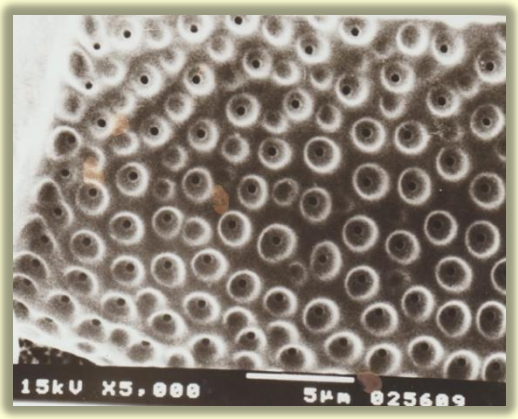




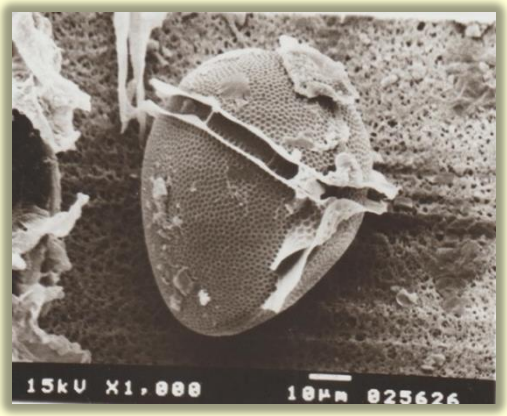
Dinophysis schroederi



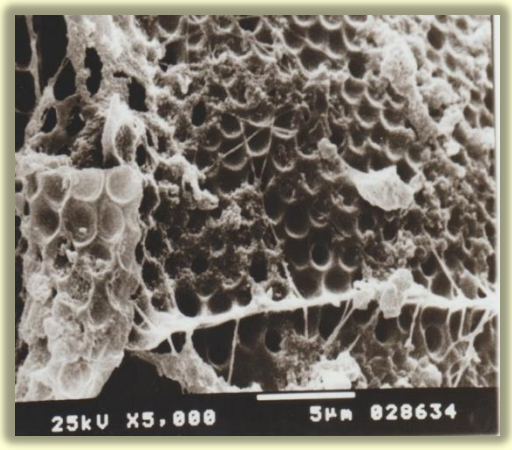
***Phalacroma* sp.**



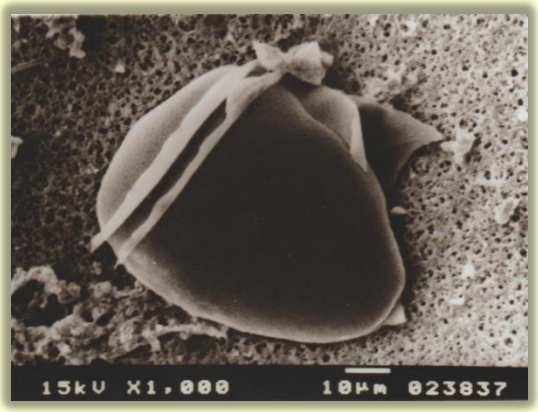
Phalacroma acutum

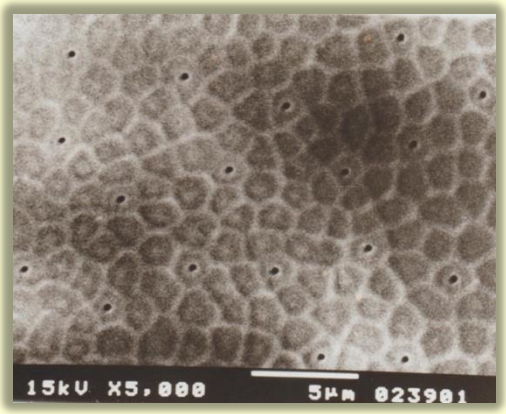


Phalacroma apicatum

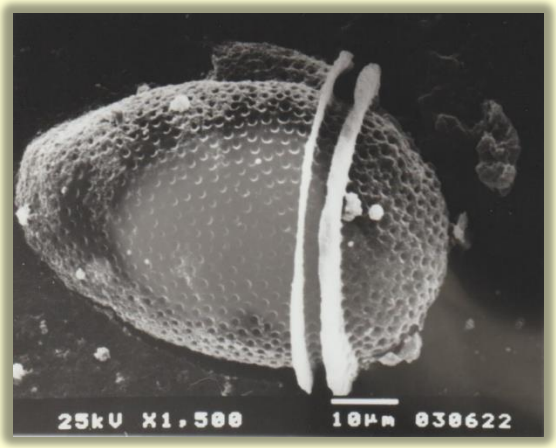


Phalacroma doryphorum

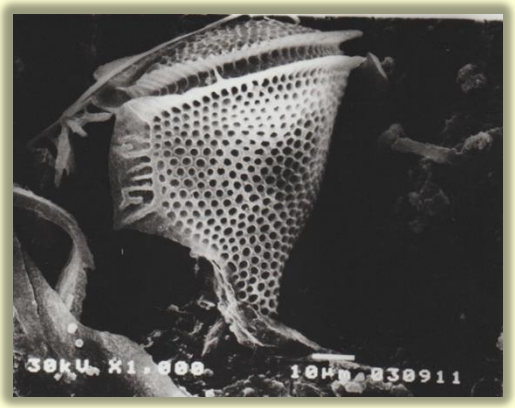


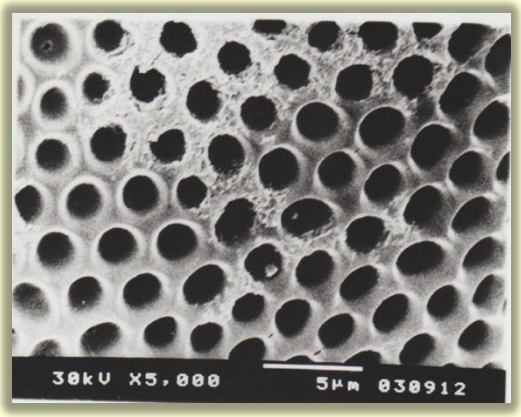


Phalacroma elongatum

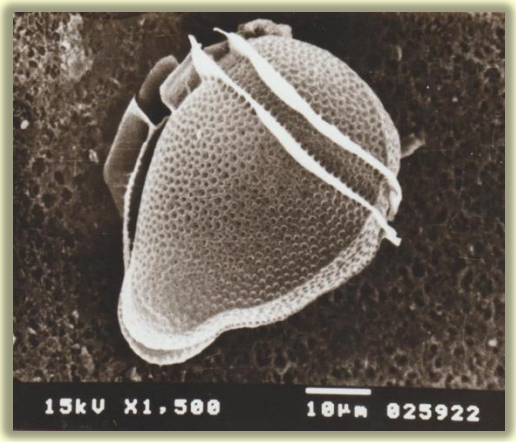


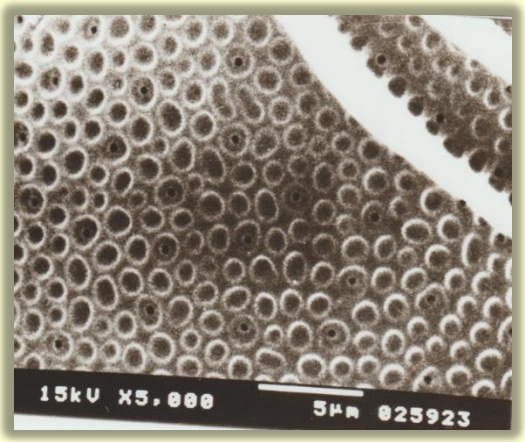
Phalacroma favus



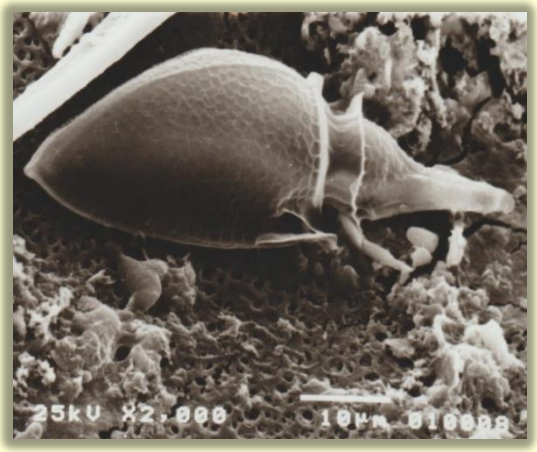


Phalacroma hindmarchii

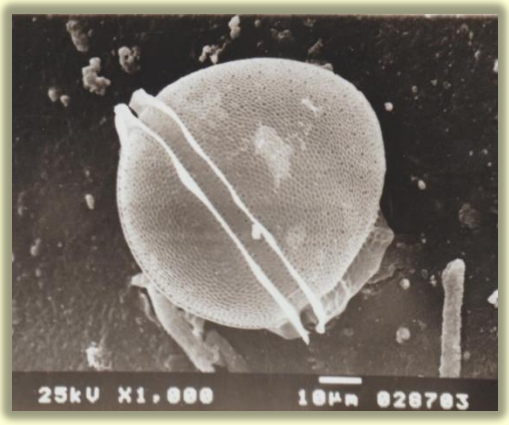


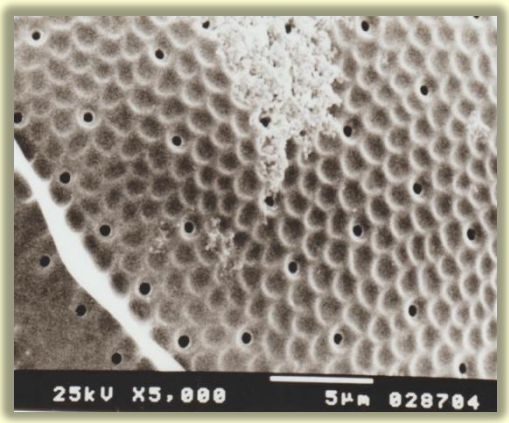


Phalacroma oxytoxides

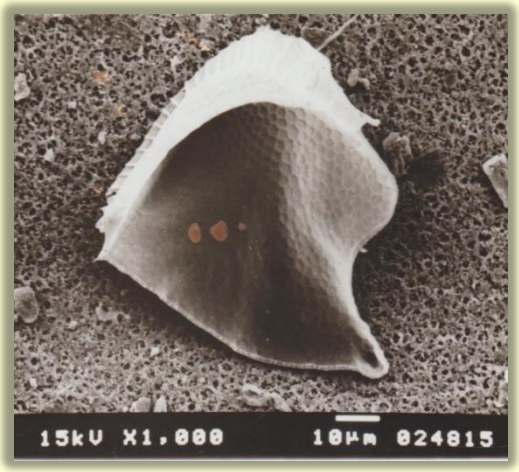


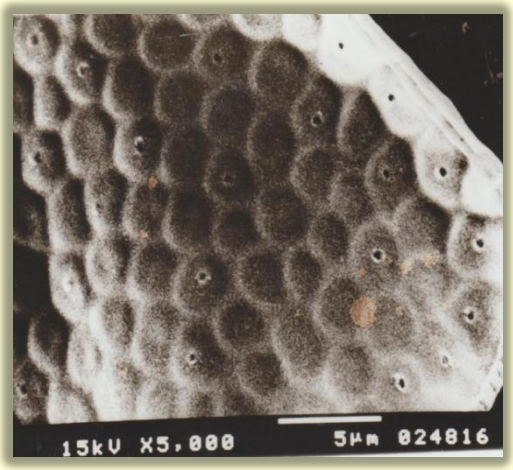
Phalacroma porodictyum



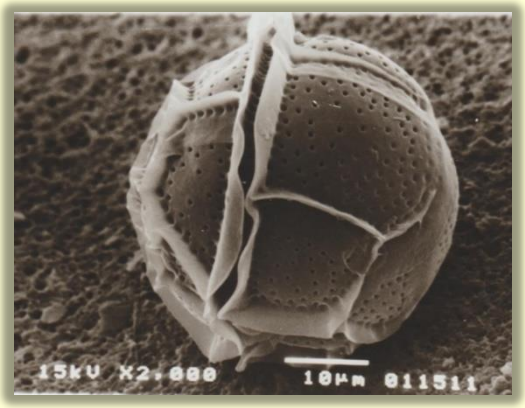


Phalacroma rapa



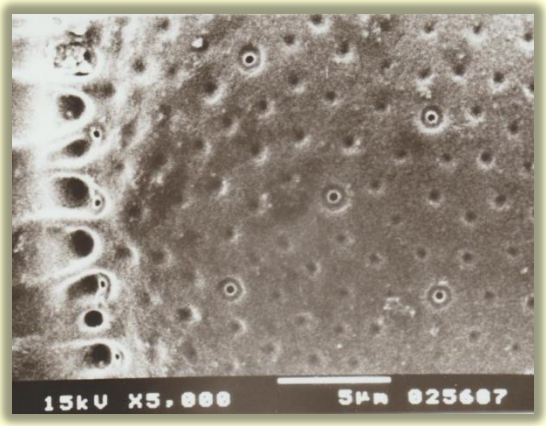


Gonidoma sphaericum

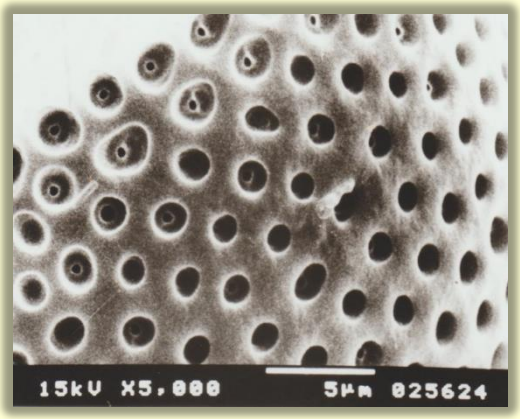


Gonidoma polyedricum

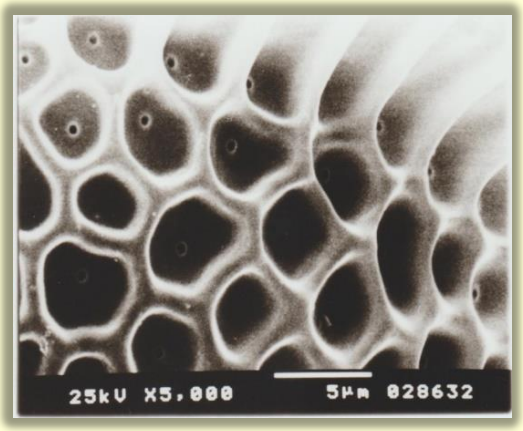
Ornithocercus magnificus



Ornithocercus carolinae

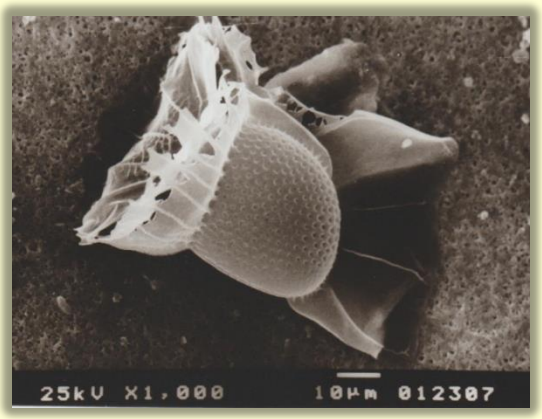


Ornithocercus steinii

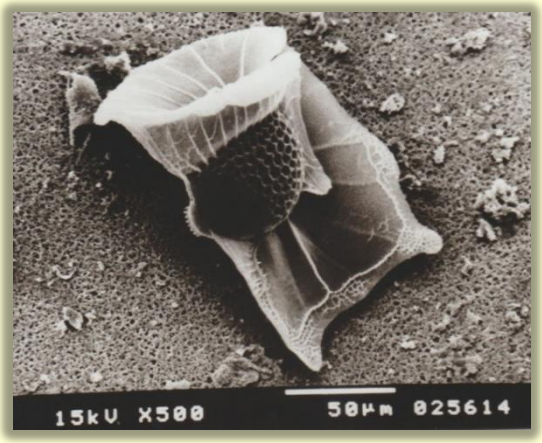


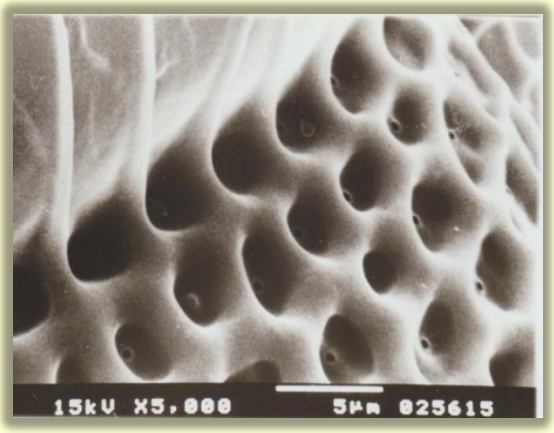
Ornithocercus thumii

***Ornithocercus* sp.**

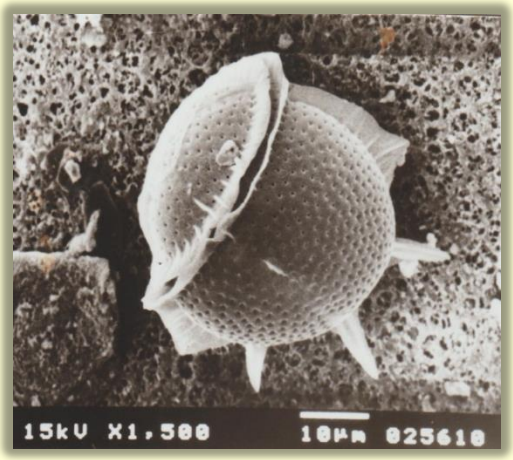


Ornithocercus quadratus

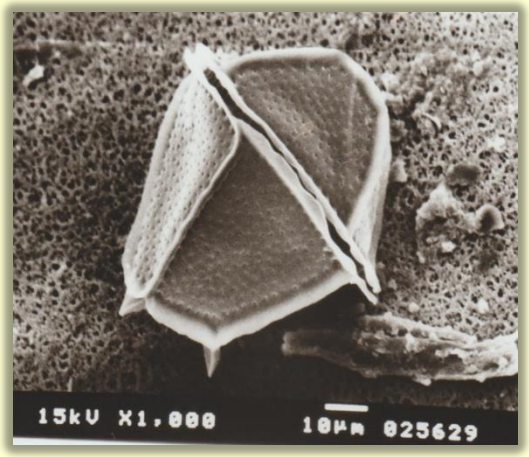




Ceratocorys gourretii



Ceratocorys reticulata

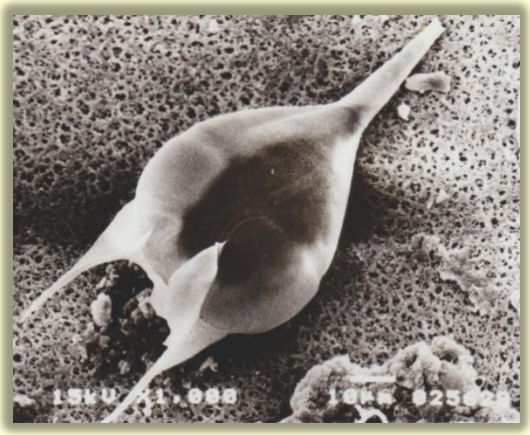


Ceratocorys horrida

Cladopyxis hemibrachiata

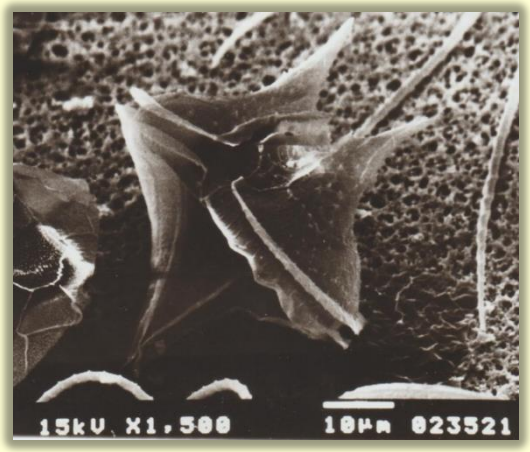
Podolampas elegans

Podolampas palmipes



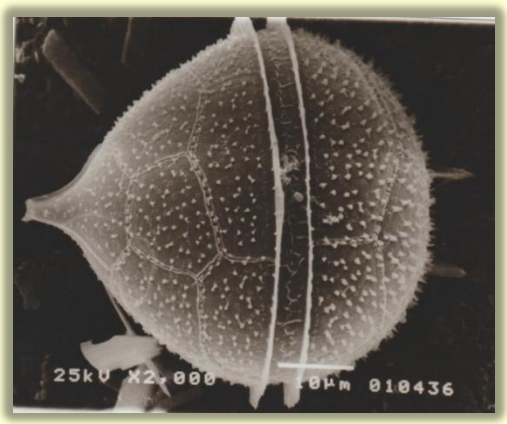
Protoperidinium depressum

P. divergens



P. pyriforme subsp. breve

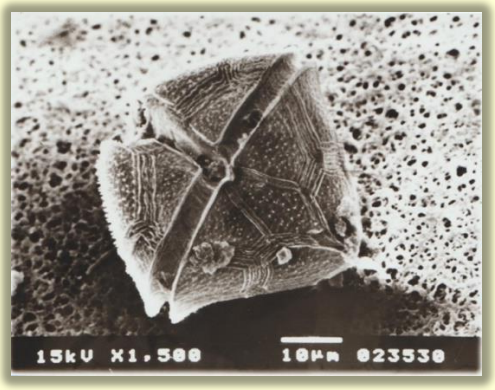
P. pyriforme



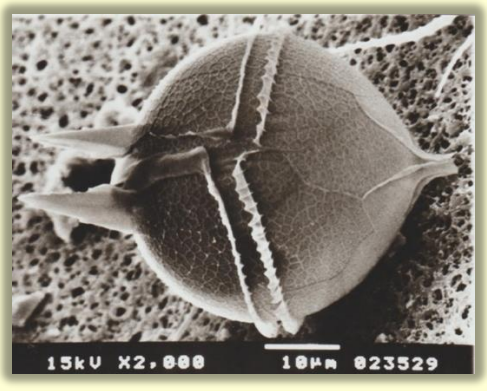
P. pellucidum

P. quarnerense

P. subinerme



P. steinii



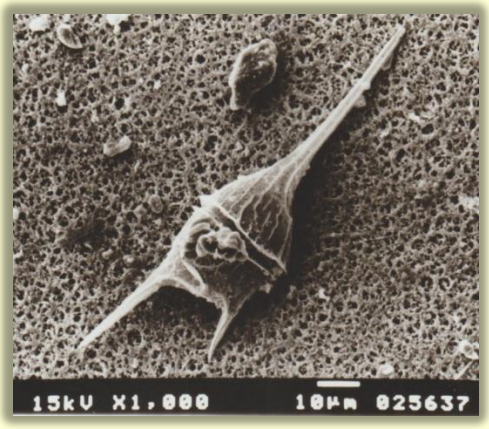
Gonyaulax scrippsiae

Oxytoxum sceptrum

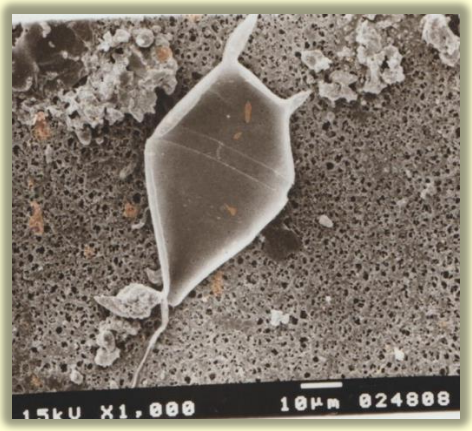
Tripos pulchellus

Tripos furca

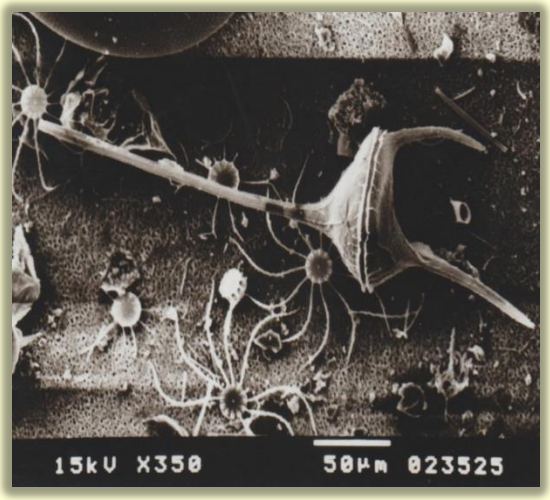
Tripos kofoidii



Tripos teres



Tripos candelabrum



Tripos massiliensis