

A STUDY ON DIATOMS OF THE ARTIFICIAL PONDS AND LAKES OF THE NATIONAL BOTANICAL GARDEN, IRAN

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Five aquatic sites of National Botanical Garden of Iran monthly were sampled from December 2003 to November 2004. Total number of 68 genera in 18 families and 11 orders of the planktonic Diatoms were identified. Among the families *Bacillariaceae* with 19 genera and species showed the highest species richness. *Cymbellaceae* (11 species), *Naviculaceae* (7 species), *Surirellaceae* (6 species), *Pleurosigmataceae* (4 species), *Fragilariaceae* and *Achnanthaceae* each with 4 species, *Pinnulariaceae* and *Gomphonemaceae* each with 2 species and *Rhopalodiaceae*, *Cosmionoidaceae*, *Diadesmidiaceae*, *Amphipleuraceae*, *Catenulaceae*, *Melosiraceae*, *Mastogloiaceae*, *Stephanodiscaceae*, *Anomoeoneidaceae* each with 1 species respectively presented in the studied sites. High population densities of species were observed in the cold seasons.

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Key words. Phytoplankton, Diatom, Population, Botanical Garden, Iran.

مطالعه‌ای در مورد دیاتومهای دریاچه‌ها و برکه‌های باغ گیاهشناسی ملی ایران

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در طی این تحقیق دیاتومهای ۵ برکه مصنوعی در باغ گیاهشناسی ملی ایران با نمونه برداری ماهیانه از آذر ۱۳۸۲ تا آبان ۱۳۸۳ مورد مطالعه و شناسایی قرار گرفتند. در این مطالعه ۶۸ جنس و گونه متعلق به ۱۸ تیره و ۱۱ راسته از دیاتومها شناسایی گردید که تیره *Bacillariaceae* با ۱۹ جنس و گونه بالاترین تنوع گونه‌ای را نشان داد. تیره‌های *Cymbellaceae* (۱۱ گونه)، *Naviculaceae* (۷ گونه)، *Surirellaceae* (۶ گونه)، *Pleurosigmataceae* (۴ گونه)، *Fragilariaceae* و *Achnanthaceae* (هر کدام با ۴ گونه)، *Pinnulariaceae* و *Gomphonemaceae* (هر کدام با ۲ گونه) و تیره‌های *Rhopalodiaceae*, *Cosmionoidaceae*, *Diadesmidiaceae*, *Amphipleuraceae*, *Catenulaceae*, *Melosiraceae*, *Mastogloiaceae*, *Stephanodiscaceae*, *Anomoeoneidaceae* هر کدام با یک گونه در مراتب بعدی قرار گرفتند. حداکثر تراکم جمعیت گونه‌های مورد مطالعه در ماههای سرد سال مشاهده شد.

INTRODUCTION

Algae are major constituents of aquatic ecosystems (Zimba & Hopson 1997). Due to their minute size they are often overlooked in limnological studies. Their importance in terms of productivity and as a food source in higher trophic levels is well known (Burkholder & Wetzel 1990). Studies on algal flora have received little attention in Iran and there are few published surveys of algal floras (Hirono 1973, Wasylik 1975, Compere 1981). Moghaddam (1976) has reported diatoms from small portion of Zayandeh Rood river. Löffler (1961) reported different algal groups from several geographical areas of Iran. Depth distribution of epipelagic algae, seasonal distribution of epiphytic algae in Anzali Lagoon and vertical distribution of epiphytic diatoms on *Typha latifolia* L. and *Phragmites australis* Trim. in Amir Kalayeh Lagoon, were reported by Nejdassattari & al. (2002a and

b, 2003). Diatom flora of Neure lake was reported by Nejdassattari (2005) and Epiphytic algal flora of Anzali lagoon were studied by Nejdassattari, & al. (2005). Also, algal flora of lotic waters of Zayandehrood river were investigated by Afsharzadeh & al. (2003). Several lakes, ponds, wetlands and rivers in different areas were studied from 1997. In this work Diatoms flora of five artificial ponds and lakes in National Botanical Garden of Iran were studied. The present study is an attempt to contribute to the knowledge about Diatoms and their distribution in these aquatic ecosystems.

MATERIALS AND METHODS

Five aquatic sites were selected for sampling. Approximate area and depth of sites and their substratum were given in table 1.

Table 1. Approximate area and depth of study sites.

	Ponds & Lakes	Area (m ²)	Depth (m)	Substratum
1	Rock garden	2500	2.5	Plastic (Keltan)
2	Systematic garden	110	1	Cement
3	Trial area	102	1.2	Plastic (isogam)
4	Japanese garden	3000	2.5	Cement
5	Salt lake	1975	1.5	Plastic (Keltan)

Monthly Samples were obtained from each site from December 2003 through November 2004. All samples were collected between 10 AM-13 PM.

Sampling procedure. At each site three samples were collected in a 1 liter bottle from 0.5m depth of shore line. Water temperature and pH were measured immediately after collection. All samples were fixed in 3% formalin, labeled, and were carried to the laboratory in cool containers. Algal samples were allowed to settle for at least 7 days and the super liquid section moved, the final volume of concentrated sample was 130 ml. Diatoms was cleaned using the method described by Patrick & Reimer (1975). Oxidation by hydrogen peroxide and potassium dichromate was done. Slides of diatoms for microscopic analysis were

prepared. Identification of algae was done using a Sairan model (BM-22h) microscope at 400-1000X. Identification was based on Whittford and Schumacher (1973), Prescott (1970), Eileen J. Cox (1996), Krammer and Lange-Bertalot (1985) and Patrick & Reimer (1966, 1975). Enumeration of algae was done using Sedgwick-Rafter cell. At least 300 cells were counted and population density was reported as cell/ml. All statistical analysis was done using Excel ver. 2000.

RESULTS AND DISCUSSION

In this study 68 taxa of Bacillariophyta were identified. These belong to 11 orders and 18 families which 53 were identified at species level and other in generic level (Figs 1, 2).

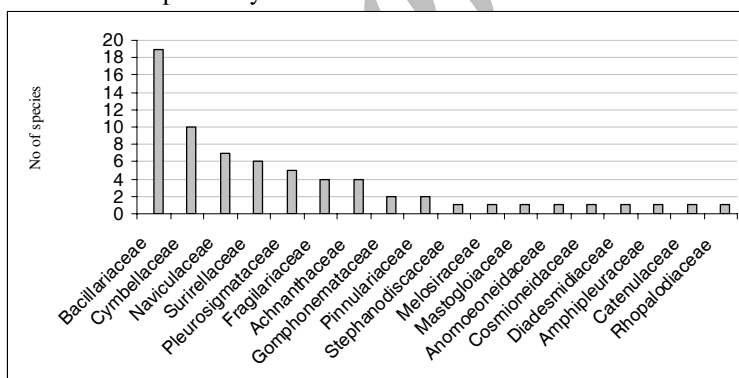


Fig. 1. Number of species among families of diatoms.

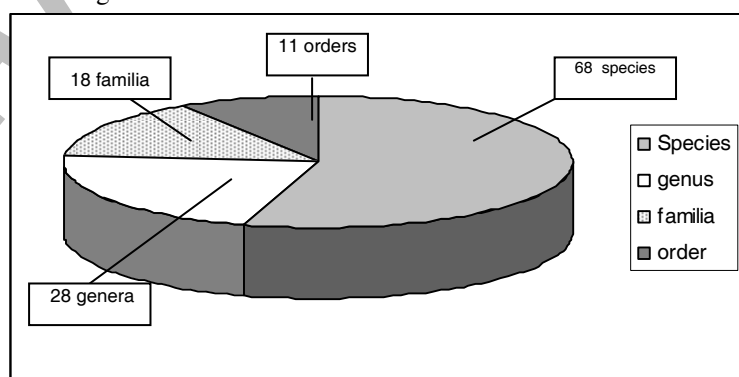


Fig. 2. Number of species, families and orders.

List of Diatom species**Bacillariophyta****Coscinodiscophyceae****Thalassiosirales****Stephanodiscaceae***Cyclotella meneghiniana* Kützing**Melosirales****Melosiraceae***Melosira varians* C. Agardh**Fragilariophyceae****Fragilariales****Fragilariaceae***Fragilaria* sp.*Ulnaria acus* (Kützing) M. Aboal*Synedra rumpens* Kützing.*Synedrella parasitica* (W. Smith) Round & Maidana**Bacillariophyceae****Mastoglolales****Mastogloiaceae***Aneumastus* sp.**Cymbellales****Cymbellaceae***Cymbella lanceolata* (Ehrenberg) Kirchner*Cymbella gretilis* (Rabenhorst.) Cleve*Cymbella turgida* W. Gregory*Cymbella naviculiformis* (Auerswald) Cleve*Cymbella affinis* Kützing*Cymbella cistula* (Hemprich & Ehrenberg) O. Kirchner*Cymbella tumida* (Brébisson.) von Heurck*Cymbella* sp.₁*Cymbella* sp.₂*Cymbella* sp.₃*Placoneis clementioides* (Hustedt) E. J. Cox**Gomphonemataceae***Gomphonema* sp.₁.*Gomphonema* sp.₂.**Anomoeoneidaceae***Anomoeoneis sphaerophora* (Kützing) Pfitz.**Achnanthes****Achnantheaceae***Achnanthes delicatula* Kützing*Achnanthes exigua* Grunow*Achnanthes pseudoswazi* J. A. Carter*Achnantheidium minutissima* (Kützing) Czarnecki**Naviculales****Cosmioneidaceae***Cosmioneis pusilla* (W. Smith) D. G. Mann & A. J. Stickle**Diadesmidiaceae***Diadesmis* spp.**Amphipleuraceae***Frustulia rhomboides* var. *saxonica* (Rabenhorst) Detoni**Pinnulariaceae***Caloneis amphisbaena* (Bory) Cleve.*Pinnularia* sp.**Naviculaceae***Navicula accommoda* Hustedt*Navicula cincta* (Ehrenberg) Kützing*Navicula cryptocephala* Kützing*Navicula gregaria* Donkin*Navicula lanceolata* var. *phyllepta* (Kützing) Cleve*Navicula subrhynchocephala* Hustedt*Navicula veneta* Kützing**Pleurosigmataceae***Gyrosigma acuminatum* (Kützing) Rabenhorst*Gyrosigma* sp.₁*Gyrosigma* sp.₂*Gyrosigma spencerii* (W. Smith) Griffith & Henfrey**Thalassiosiphysales****Catenulaceae***Amphora ovalis* (Kützing) Kützing**Bacillariales****Bacillariaceae***Denticula elegans* Kützing*Denticula kuetzingii* Grunow*Denticula* sp.*Denticula tenuis* Kützing*Nitzschia frustulum* (Kützing) Grunow*Nitzschia fonticola* (Grunow) Grunow*Nitzschia fossilis* (Grunow) Grunow*Nitzschia baciliformis* Hustedt*Nitzschia communis* Grunow*Nitzschia hantzschiana* Rabenhorst*Nitzschia intermedia* Hantzsch*Nitzschia lacuum* Lange-Bertalot*Nitzschia ovalis* H. J. Arnott*Nitzschia palea* (Kützing) W. Smith*Nitzschia paleacea* Grunow*Nitzschia radicularis* Hustedt*Nitzschia recta* Hantzsch*Nitzschia solita* Hustedt*Nitzschia subacicularis* Hustedt**Rhopalodiales****Rhopalodiaceae***Epithemia* sp.**Surirellales****Surirellaceae***Campylodiscus* sp.*Cymatopleura solea* (Breb.) W. Smith*Stenopterobia sigmatella* (W. Gregory) R. Ross*Surirella capronii* Brebisson*Surirella robusta* Ehrenberg*Surirella* sp.

Results showed in sites 3 and 4 diatoms have high density in spring and in site 2 the highest density of diatoms occurred in autumn and winter (Figs. 4, 5, 6). In sites 1 and 5 there were distinct population change

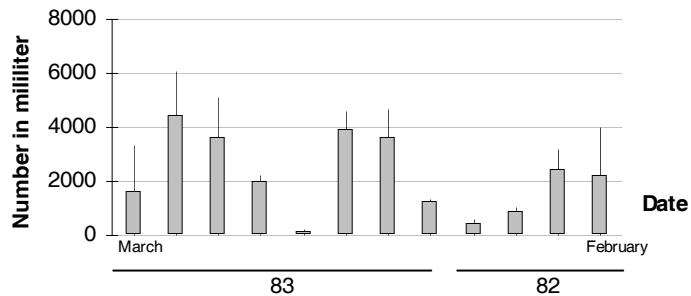


Figure 3. Monthly Variation graph of Bacillariophyceae ion station 1 $n = 3, \bar{X} \pm SD$

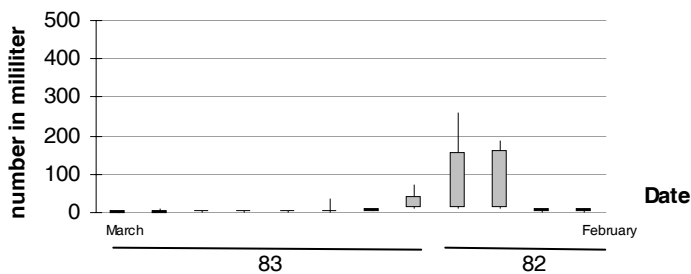


Figure 4. Monthly Variation graph of Bacillariophyceae in station 2 $n = 3, \bar{X} \pm SD$

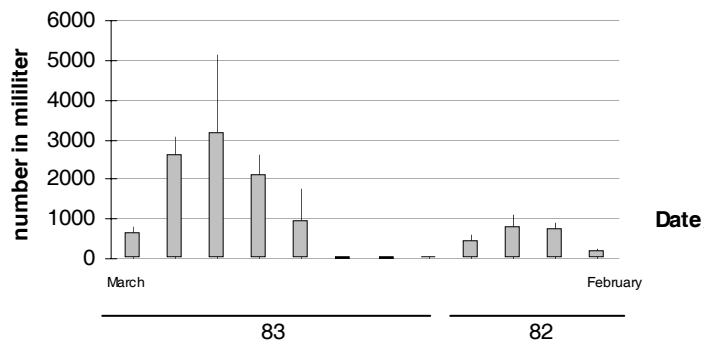


Figure 5. Monthly Variation graph of Bacillariophyceae in station 3 $n = 3, \bar{X} \pm SD$

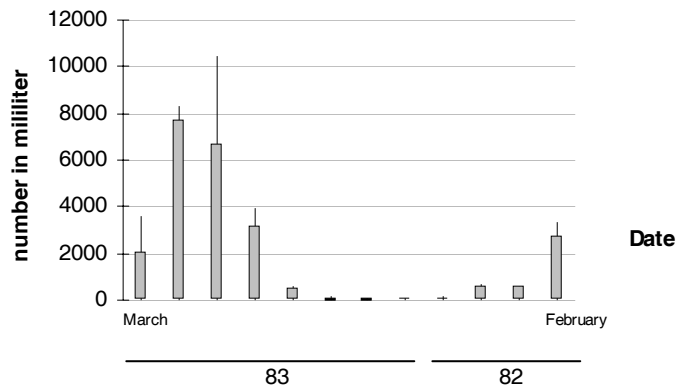


Figure 6. Monthly Variation graph of Bacillariophyceae in station 4 $n = 3, \bar{X} \pm SD$

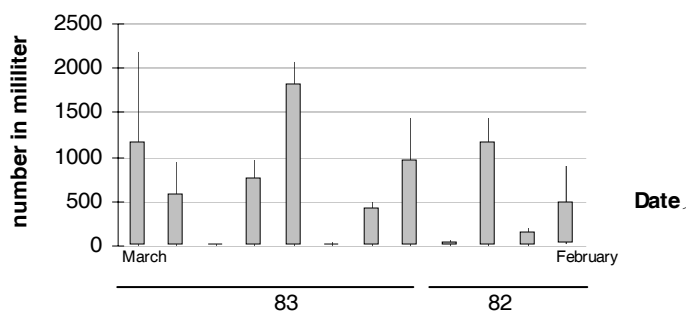


Figure 7. Monthly Variation graph of Bacillariophyceae in station 5 $n = 3, \bar{X} \pm SD$

during study period (Figs. 3, 7). The existing differences between different sites can impute to none similar sites condition. Studies show that light and temperature are important factors in growth of algae (Thebault & Rabouille 2003). In addition to light and temperature, nutrient sources are important factors affecting seasonal changes of phytoplanktons (Olsen & al. 1989, Grover 1991). During winter month, temperature and dissolved oxygen are the main factors affecting diversity of algae (Alam & al. 2001). Grazing activity of zooplanktons is also important factor which affects algal population changes through affecting competitive (Evans & Pablow 1985). The current study contributes to the knowledge of algal ecology and flora in Iran.

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REFERENCES

- Afsharzadeh, S., T. Nejadsattari, M. Rahiminejad, & Ebrahimnejad 2003: Study of algal flora in Zayandehrood river. -Iranian Journal of Biology vol. 14 (1): 32-45.
- Alam, M. G. M., N. Jahan, L. Thalib, B. Wei & T. Maekawa 2001: Effects of environmental factors on the seasonally change of phytoplankton populations in a closed freshwater pond. - Environment International 27: 363-371.
- Burkholder, J. M., R. G. Wetzel 1990: Epiphytic alkaline Phosphatase on natural and artificial plants in an oligotrophic lake: re-evaluation of the role of macrophytes as a phosphorus source for epiphytes. -Limnol. Oceanogr 35:736-747.

- Compere, P. 1981: Algues des desers d' Iran. -Buii. Jard. Bot. Nat. Belg. 51: 3-40.
- Eileen, J. Cox., 1996: Identification of freshwater diatoms from live material. -Chapman & Hall.
- Evans, G. T. and J. S. Parslow 1985: A model of annual plankton cycles. -Biol. Oceanogr 3: 327-347.
- Grover, J. P. 1991: Dynamics of competition among micro-algae in variable environments: experimental tests of alternative models. -Oikos 62:231-243.
- Hirano, M. 1973: Freshwater algae from Mesopotamia. -Contr. Biol. Lab. Kyoto. Univ. 24:105-119, 9 pl.
- Krammer, K., and H. Lange-Bertalot. 1985: Naviculaceae, Gebirder Borntraeger. -Berlin, Stuttgart, 230 pp.
- Löffler, H. 1961: Beiträge zur Kenntnis der Iranischen Binnengewässer. -2ed Int. Rev. Ges. Hydrobiol., 46: 309-406.
- Moghadam, F. 1976: Diatoms as indicator of pollution Zayandeh Rive, Iran. -Proceeding of the Academy of Natural Science of Philadelphia, 127 (19): 281-297
- Nejadsattari, T., S. Shojai & M. Fallahi. 2002a: Depth distribution of epipelagic algae in sediments of Anzali lagoon, Iran. -The first Iranian conference on plant science and biodiversity, Tehran.
- Nejadsattari, T., M. Noroozi & M. Fallahi 2002b: Taxonomy and distribution of epiphytic algae in Anzali lagoon, Iran. -The first Iranian conference on plant science and biodiversity, Tehran.
- Nejadsattari, T., M. Fallahi & H. Ramezanzadeh 2003: Vertical distribution of epiphytic diatoms on *Typha latifolia* and *Phragmites australis* in Amir Kalayeh Lagoon, Iran. -The 11th Biology conference of Iran, Urmia.
- Nejadsattari, T. 2005: The diatom flora of Neure lake, Iran. -Diatom Research. 20(2):313-333.
- Nejadsattari, T., M. Noroozi & M. Fallahi 2005: The composition and seasonal distribution of epiphytic algae in Anzali lagoon, Iran. -Cryptogamie, Algal. 26 (4): 387-398.
- Olsen, Y., Vadstein, O., Anderson, T. & A. Jensen, 1989: Competition between *Staurastrum leutkemullerii* and *microcystis aeruginosa* under varying modes of phosphate supply. -J. Phycol. 25:499-508.
- Patrick, R., and C. W. Reimer. 1966: the diatoms of the united states, Exclusive of Alaska & Hawaii. - Monographs of the academy of Natural science of Philadelphia no. 13,688 pp.
- Patrick, R., and C. W. Reimer. 1975: the diatoms of the United States. Exclusive of Alaska & Hawaii. - Monographs of the academy of Natural science of Philadelphia no.13. vol.2. art 1. 213 pp.
- Prescott, G. W., 1970: Algae of the western great lakes area. W.M. C. Brown company publishers pp: 977.
- Thebault, J. M. & S. Rabouille 2003: Comparison between two mathematical formulation of the phytoplankton specific growth rate as a function of light and temperature, in two simulation models (Aster & YoYo). -Ecological Modelling 163: 145-151.
- Wasylik, K. 1975: Notes on the freshwater algae of Iran. -Fragmenta Floristica et geobotanica. Ann.Xxi, part 3.
- Whitford, L. A., and G. J. Schumacher 1973: A Manual of Fresh-Water Algae press, Raleigh, N. C. pp: 337.
- Zimba, P. V. & Hopson. M. S. 1997: Quantification of epiphyte removal efficiency from submersed aquatic plants. -Aquatic Botany 58: 173- 179.