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*, *Cosmioneidaceae*, *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 ٥ 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 ٦٨ جنس وگونه متعلق به ۱۸ تیره و ۱۱ راسته از دیاتومها شناسایی گردیدکه تیره *Bacillariaceae* با ۱۹ جنس و گونه بالاترین تنوع گونه‌ای را نشان داد. تیره های *Cymbellaceae* (۱۱ گونه)، *Naviculaceae* (۷ گونه) ، *Surirellaceae* (٦ گونه)، *Pleurosigmataceae* (٤ گونه)،*Fragilariaceae* و *Achnanthaceae* (هر کدام با ٤ گونه)، *Pinnulariaceae* و *Gomphonemaceae* (هر کدام با ۲ گونه) و تیره‌های *Rhopalodiaceae*, *Cosmioneidaceae*, *Diadesmidiaceae*, *Amphipleuraceae*, *Catenulaceae*, *Melosiraceae*, *Mastogloiaceae*, *Stephanodiscaceae*, *Anomoeoneidaceae* هر کدام با یک گونه در مراتب بعدی قرار گرفتند. حداکثر تراکم جمعیت گونه های 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 epipelic algae, seasonal distribution of epiphytic algae in Anzali Lagoon and vertical distribution of epiphytic diatoms on *Typha latifolia* L. and *Phragmites austuralis* Trim. in Amir Kalayeh Lagoon, were reported by Nejadsattari & al. (2002a and b, 2003). Diatom flora of Neure lake was reported by Nejadsattari (2005) and Epiphytic algal flora of Anzali lagoon were studied by Nejadsattari, & al. (2005). Also, algal flora of lotic waters of Zayandehrood river were investigated by Afsharzadeh & al. (2003). S sseveral 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).

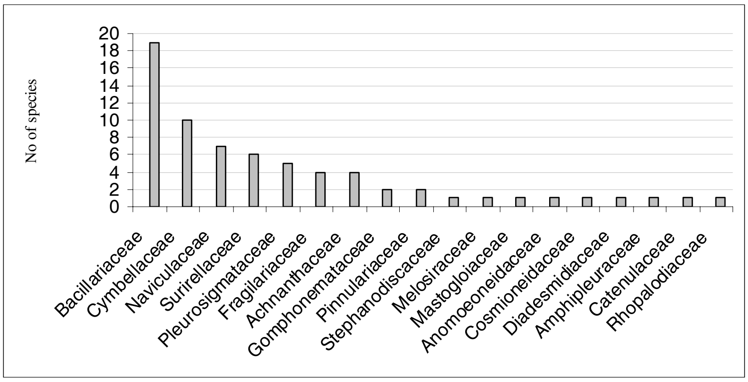

Fig. 1. Number of species among families of diatoms.

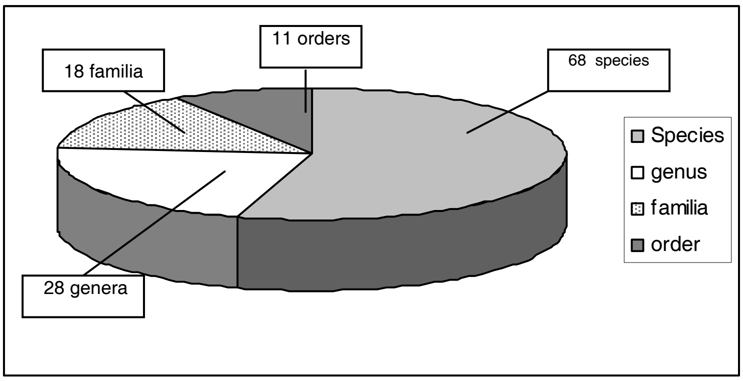

Fig. 2. Number of species, families and orders.

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 grecilis (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.
Achnanthales
Achnanthaceae
Achnanthes delicatula Kützing
Achnanthes exigua Grunow
Achnanthes pseudoswazi J. A.Carter
Achnanthidium minutissima (Kützing) Czarnecki
Naviculales
Cosmioneidaceae
Cosmioneis pusilla (W. Smith) D. G. Mann & A. J. Stickle
Diadesmidiaceae
Diadesmis spp.
Amphipleuraceae
Frustulia rhomboids 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
Thalassiophysales
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 (Grun) Grun
Nitzschia baciliformis Hustedt
Nitzschia communis Grunow
Nitzschia hantzschiana Rabenhorst
Nitzschia intermedia Hantzsch
Nitzschia lacuum Lange-Bertalot
Nitzschia ovalis H. J. Arnott
Nitzschia palea (Kutzing) W. Smith
Nitzschia paleacea Grunow
Nitzschia radicula 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

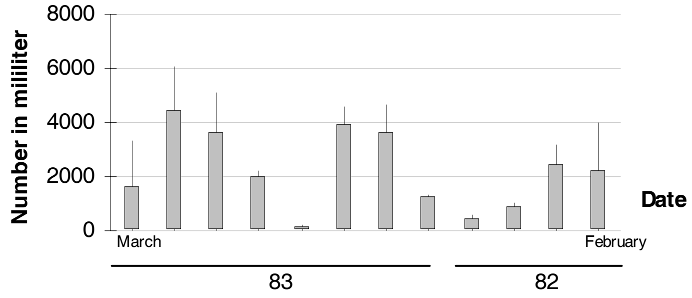

Figure 3. Monthly Variation graph of Bacillariophyceae ion station 1 $n = 3, \overline{X} \pm SD$

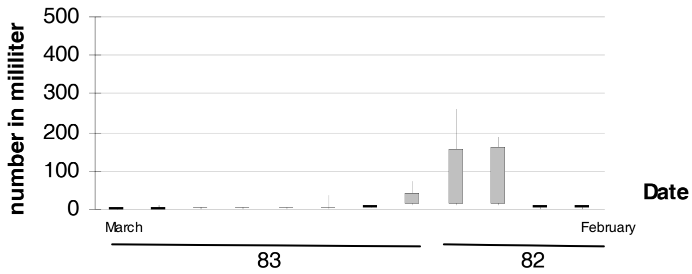

Figure 4. Monthly Variation graph of Bacillariophyceae in station 2 $n = 3, \overline{X} \pm SD$

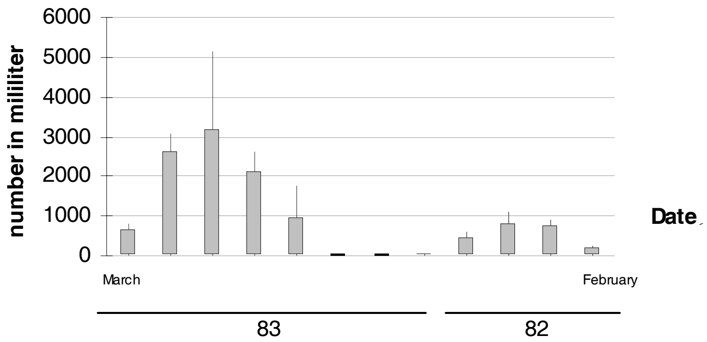

Figure 5. Monthly Variation graph of Bacillariophyceae in station 3 $n = 3, \overline{X} \pm SD$

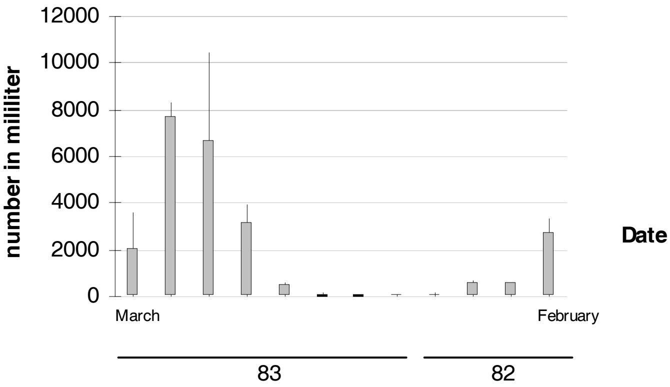

Figure 6. Monthly Variation graph of Bacillariophyceae in station 4 $n = 3, \overline{X} \pm SD$

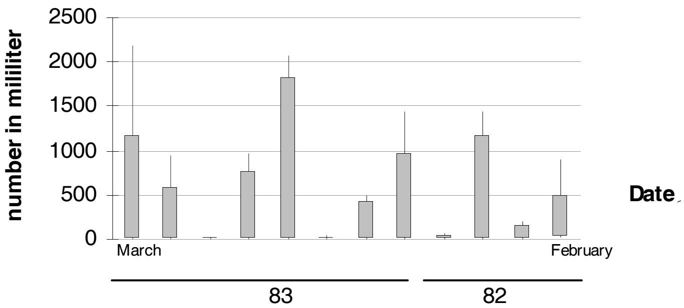

Figure 7. Monthly Variation graph of Bacillariophyceae in station 5 $n = 3, \overline{X} \pm SD$

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 artifical 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. Lannge-Bertalit. 1985: Naviculaceae, Gebriider Borntraeger. –Berlin, Stuttgart, 230 pp.

Löffler, H. 1961: Beitrage zur Kenntnis der Iranischen Binnengewasser . -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 epipelic 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 leutkemuellerii 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. WM. 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.