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

T. Nejadsattari, Z. Shariatmadari and Z. Jamzad

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Five aquatic sites of National Botanical Garden of Iran monthly were sampled from December 2003 through November 2004. 68 genera and species of 10 families and 6 orders of the planktonic *Chlorophyceae* were identified. Among the families *Desmidaceae* with 22 genera and species showed the highest species richness. *Scenedesmaceae* (15 species) and Oocystaceae (14 species), *Hydrodictyaceae* (7 species), *Ulotrichaceae* (3 species), *Zygnemataceae* (2 species), *Volvocaceae* (2 species) and *Cladophoraceae*, *Oedogoniaceae* and *Trentephliaceae* each with 1 species respectively presented in the studied sites. High population densities of species were observed in the warm months.

Taher Nejadsattari, Department of Plant Biology, Faculty of Basic Sciences, Islamic Azad University Science and Research Branch, Tehran. –Ziba Jamzad, Reasearch Institute of Forests and Rangelands, P. O. Box 13185-116, Tehran, Iran. –Zeinab Shariatmadari, Department of Plant biology, Faculty of Basic Sciences, Islamic Azad University Science and Research Branch, Tehran.

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مطالعه‌ای در مورد جلبکهای سبز دریاچه‌ها و برکه‌های باغ گیاهشناسی ملی ایران

طاهر نژاد ستاری، زینب شریعتمداری و زیبا جم زاد

در طی این تحقیق جلبکهای سبز ۵ برکه مصنوعی در باغ گیاهشناسی ملی ایران با نمونه‌برداری ماهیانه از آذر ۱۳۸۲ تا آبان ۱۳۸۳ مورد مطالعه و شناسایی قرار گرفتند. ٦٨ جنس و گونه متعلق به ۱۰ تیره و ٦ راسته از جلبکهای سبز شناسایی گردید. تیره *Desmidaceae* با ۲۲ جنس و گونه بالاترین تنوع گونه ای را نشان داد. تیره‌های *Scenedesmaceae* (۱۵ گونه) و *Oocystaceae* (١٤ گونه)، *Hydrodictyaceae* (۷ گونه)، *Ulotrichaceae* (۳ گونه)، *Zygnemataceae* (۲ گونه)، Volvocaceae (۲ گونه)، وتیره‌های *Cladophoraceae*، *Oedogoniaceae* و *Trentephliaceae* هر کدام با یک گونه در مراتب بعدی قرار گرفتند. حداکثر تراکم جمعیت گونه‌های مورد مطالعه در ماههای گرم 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 survays of algal floras (Hirono 1973, Wasylik, 1975, Compere 1981). Moghaddam (1976) 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, b, 2003). Also algal flora of lotic waters of Zayandeh Rood river were investigated by Afsharzadeh & al. (2003). Starting in 1997 several lakes, ponds, wetlands and rivers in different area were selected for algal distribution. In this work green algal flora of five artificial ponds and lakes in National Botanical Garden of Iran were studied. The garden is located by the freeway between Tehran and Karaj at an altitude of about 1320m. Seven artificial lakes and ponds have been built in the garden for special purposes. They have been filled up with the water provided by the wheals of the garden. The present study is an attempt to contribute to the knowledge about green algae 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.

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. Water analysis was done only in one occasion for 2, 3, 4 and 5 sites (Fig. 7). 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.

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) and corrected based on algaebase site**.** (WWW.algaebase.org)

Enumeration of algae was done using Sedgwick-Rafter cell. At least 300 cell were counted and population density was reported as cell/ml. All statistical analyses were done using Excel 2000.

Results and Discussion

In this study 68 taxa of Chlorophyta were identified (Table 2). These belong to 6 orders and 10 families which 46 were identified at species level and other in genera level (Fig. 1).

Oocystaceae in site 1 showed high abundance in spring (93%) and high abundance of *Scenedesmaceae* occurred in winter (Fig. 2). In site 2 also high abundance of *Oocystaceae* observed in spring (Fig. 3) and in sites 3 and 5 the most abundance of Oocystaceae occurred in the late winter. In site 3 *Scenedesmaceae* has the most abundance in autumn, while presence of *Scenedesmaceae* in site 5 is not sensible (Figs. 4, 6).

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)

Table 2. Occurrence of Chlorophyta in sampling sites.

Species	Site 1	Site 2	Site 3	Site 4	Site 5
Oocystis solitaria Wittrock	+	-	-	+	-
Oocystis pusilla Hansgirg	+	+	-	+	-
Oocystis elliptica West	+	+	-	+	-
Oocystis borgei J.Snow	-	+	-	+	-
Oocystis sp.$_1$	-	-	-	+	-
Oocystis sp.$_2$	-	-	-	+	-
Oocystis sp.$_3$	-	-	-	+	-
Oocystis sp.$_4$	-	-	-	+	-
Tetraedron minimum (A.Braun) Hansgirg	+	+	+	+	+
Selenastrum capricornutum Printz.	-	-	-	-	+
Planktosphaeria gelatinosa G.M.Smith	-	-	+	-	-
Ankistrodesmus nannoselene Skuja	+	+	-	-	+
Trochiscia zachariasii Lemmermann	-	-	+	+	+
Trochiscia reticularis (Reinsch) Hansgirg	-	-	-	+	+
Scenedesmus communis E.H.Hegewald	+	-	+	-	-
Scenedesmus quadricauda var. *longispina* (Chod)G.M.Smith	+	-	+	-	-
Scenedesmus quadricauda var. *quadrispina* (Chod)G.M.Smith	-	+	+	+	-
Scenedesmus quadricauda var. *maximus* West & West	-	-	+	-	-
Scenedesmus quadricauda var. *westii* G. M. Smith	+	+	+	-	-
Scenedesmus quadricauda var. *parvus* G. M. Smith	+	+	-	-	-
Scenedesmus magnus Meyen	+	-	+	-	-
Scenedesmus acuminatus (Lagerheim) Chodat	+	+	-	+	-
Scenedesmus dimorphus (Turpin) Kützing	+	+	-	+	-
Scenedesmus bernardii G. M. Smith	-	-	+	-	-
Scenedesmus raciborskii Woloszynska	+	+	-	+	+
Scenedesmus sp.$_1$	+	+	-	-	-
Scenedesmus sp.$_2$	+	-	-	+	-
Scenedesmus sp.$_3$	+	-	-	-	-
Scenedesmus sp.$_4$	-	-	+	-	-
Pediastrum boryanum (Turpin) Meneghini	-	-	+	-	-
Pediastrum integrum Nägeli	-	-	-	-	+

Pediastrum duplex Meyen	-	-	+	-	-
Pediastrum duplex var. *clathratum* (A.Braun) Lagerheim	+	-	-	-	-
Pediastrum duplex var. *cohaerens* Bohlin	-	-	+	-	-
Pediastrum muticum Kuetzing	-	+	-	+	-
Pediastrum sp.	-	-	-	+	-
Pandorina sp.	+	+	+	-	+
Volvox sp.	-	-	-	+	+
Cladophora sp.	+	-	-	+	-
Oedogonium sp.	+	+	+	-	+
Ulothrix sp.	-	-	-	+	-
Binuclearia sp.	+	-	-	+	-
Klebsormidium montanum (Hansgirg) S. Watanabe	-	-	-	+	-
Trentepohlia aurea (L.) C. F. P.Martius	+	-	-	+	+
Mougeotia scalaris Hassall	+	-	-	-	-
Mougeotiopsis sp.	-	-	-	+	-
Cosmarium pyramidatum Brébisson.	-	+	+	+	+
Cosmarium pyramidatum var. *convexum* Krieger & Gerloff.	+	+	-	+	-
Cosmarium granatum Brébisson	-	-	-	+	-
Cosmarium exiguum W. Archer	-	+	-	-	+
Cosmarium circulare Reinsch	+	+	-	+	-
Cosmarium subreniforme Nordstedt	+	+	-	+	+
Actinotaenium obcuneatum (W.West) Teiling	-	-	-	-	+
Cosmarium botrytis Meneghini ex Ralfs	-	-	+	-	+
Cosmarium botrytis var. *tumidum* Wittrock	+	-	+	-	-
Cosmarium botrytis var. *gemmiferum* (Brébisson) Nordstedt.	-	-	+	+	+
Cosmarium pokornyanum (Grunov)W. West & G. S. West	-	-	-	+	-
Cosmarium obtusatum Schmidle.	-	+	+	+	-
Cosmarium sp.$_1$	+	-	-	-	+
Cosmarium sp.$_2$	-	+	-	-	-
Cosmarium sp.$_3$	-	+	-	-	-
Cosmarium sp.$_4$	-	-	-	+	-
Closterium littorale F. Gay.	+	+	-	-	+
Closterium moniliferum Ehrenberg ex Ralfs	-	-	-	-	+
Closterium pseudodianae Roy.	-	-	-	-	+
Closterium parvulum Nägeli	-	-	-	-	+
Closterium sp.	-	-	+	-	-
Euastrum sp.	-	-	-	+	+

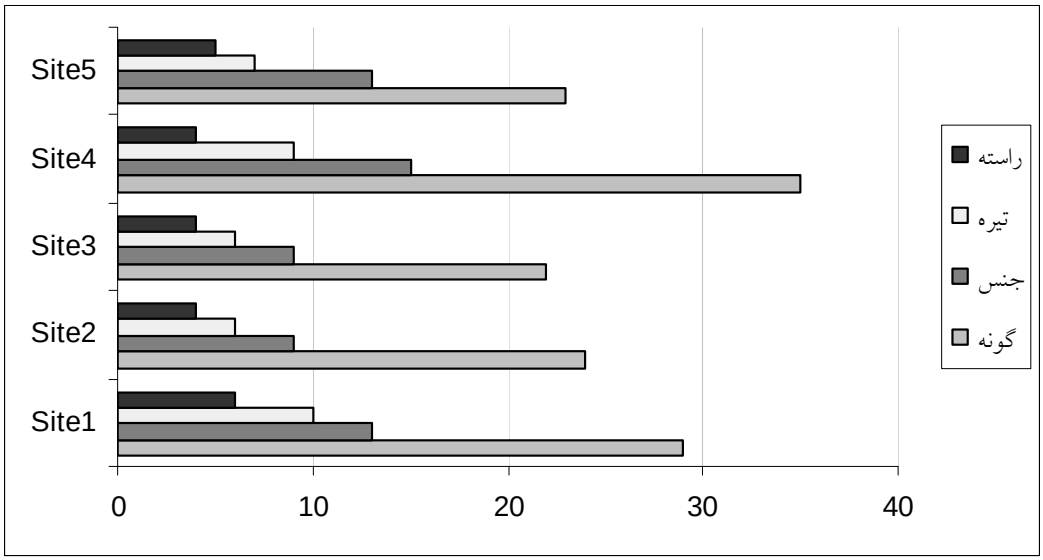

Fig. 1. Number of family, order, genera and species of Chlorophyta.

In site 4, *Oocystaceae* showed its most percent of abundance in autumn and the *Scenedesmaceae* presence in this site is very confined (Fig 5). The existing difference among the sites can impute to different conditions of the sites.

Studies show that light and temperature are important factors in growth of algae (Thebault & Rabouille, 2003). In addition to light and temperature, nutrient supply are important factors affecting seasonal changes of phytoplanktons (Olsen & al. 1989, Grover 1991). During winter temperature and dissolved oxygen are the main factors affecting diversity of algae (Alam & al. 2001). Grazing activity of zooplanktons is also important factor affects algal population (Evans & Parslow 1985). *Tetraedron* and *Oocystis*, dominant genera of Chlorophyta, showed maximum abundance in spring and summer, whereas members of *Scenedesmaceae* showed the highest abundance in late autumn early winter. It seams that physicochemical conditions of ponds favored growth of the same species with high abundance in a specific site. Percent abundance of different families of Chlorophyceae in study sites are shown in figures 2-6.

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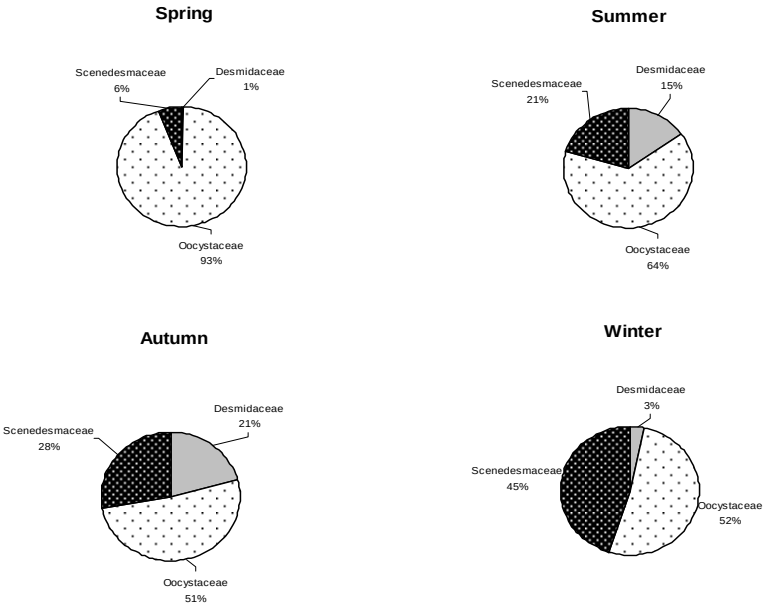

Fig. 2. Percent abundance of major *Chlorophyceae* families in site 1.

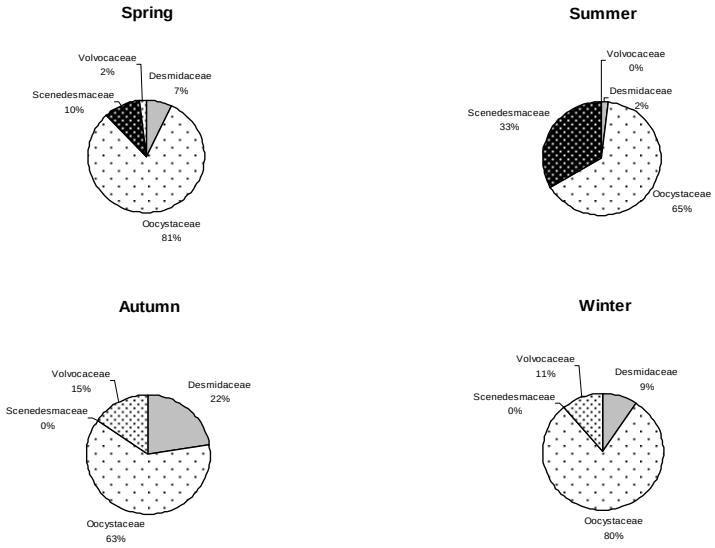

Fig. 3. Percent abundance of major *Chlorophyceae* families in site 2.

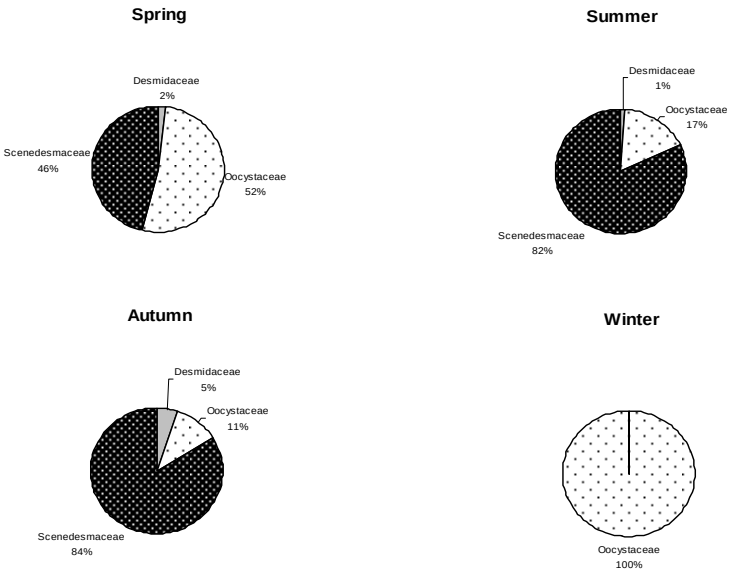

Fig. 4. Percent abundance of major *Chlorophyceae* families in site 3.

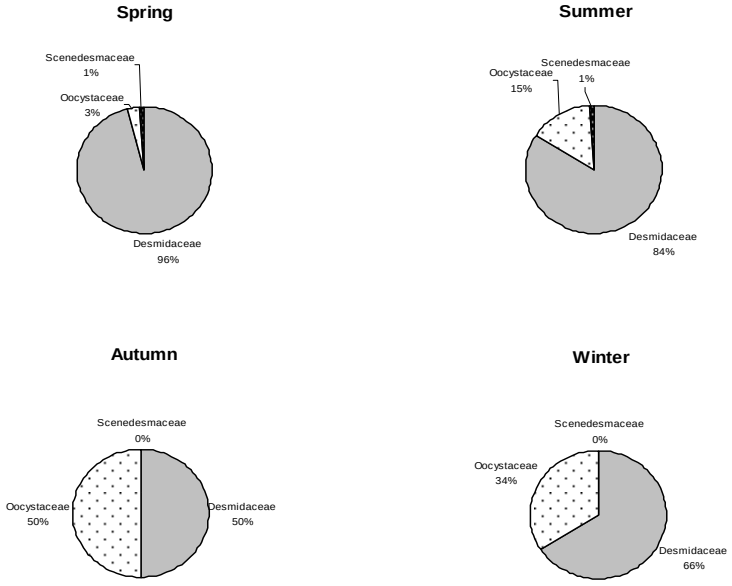

Fig. 5. Percent abundance of major *Chlorophyceae* families in site 4.

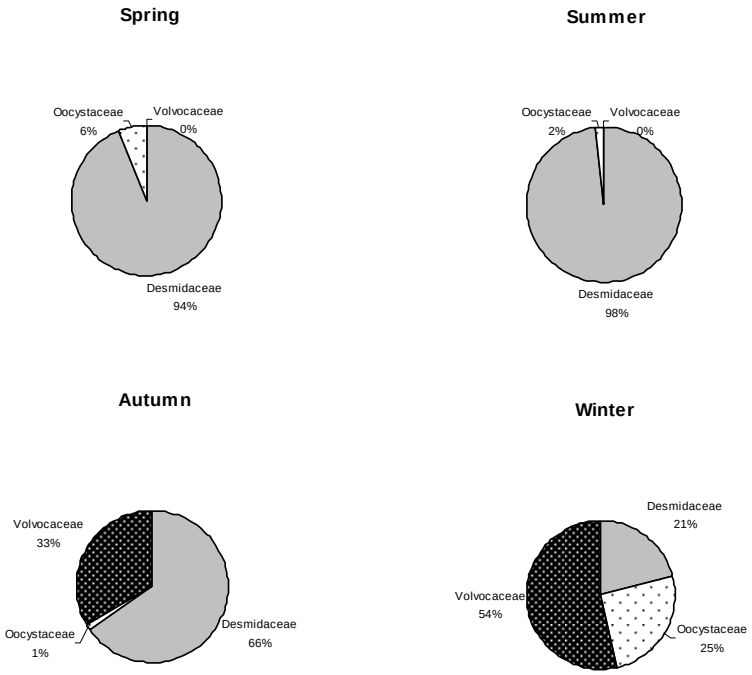

Fig. 6. Percent abundance of major *Chlorophyceae* families in site 5.

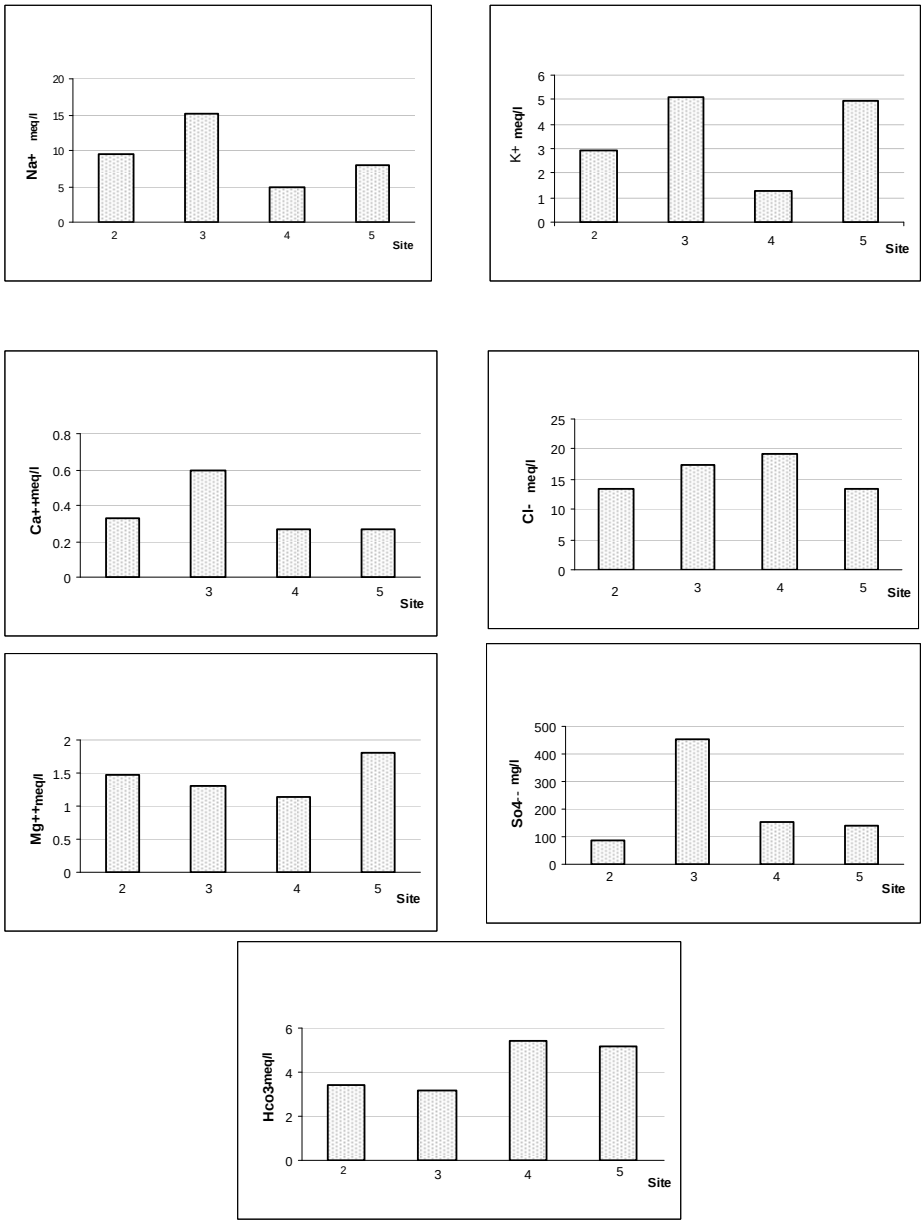

Fig. 7. Mean of chemical parameters Na^{+}, K^{+}, Ca^{++}, Cl^{-}, Mg^{++}, So_4^{-} and Hco_3^{-} for sites 2, 3, 4 and 5.

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