Research Article

iMedPub Journals
http://www.imedpub.com

Journal of
Plant Biology and Agriculture Science

2020
Vol. 4 No.2

Isolation, identification and characterization of Epipelic algae in Tigris River within Baghdad City, Iraq

Fikrat M. Hassan,
Saja H. Al-Bdulameer

Department of Biology, College of Science for Women, University of Baghdad, Baghdad, Iraq.

*Corresponding author: Saja H. Al-Bdulameer
E-mail: s.habdul2017@gmail.com

Abstract

The present study conducted to study epipelic algae in the Tigris River within Baghdad city for one year from September 2011 to August 2012 due to the importance role of benthic algae in lotic ecosystems. Five sites have been chosen along the river. A total of 154 species of epipelic algae was recorded belongs to 45 genera, where Bacillariophyceae (Diatoms) was the dominant groups followed by Cyanophyceae and Chlorophyceae. The numbers of common types in three sites were 47 species. Bacillariophyceae accounted 88.31% of the total number of epipelic algae, followed by Cyanophyceae 7.14 % and Chlorophyceae 4.55%. A 85 species (29 genera) recorded in site 1, 103 species (34 genera) in site2, 112 species (35 genera) in site3, 96 species (32 genera) in site4, and 85 species (29 genera) in site5. Spatial and temporal distributions of epipelic algae were noticed in this study. The higher total number of epipelic algae (91504.01cell\ cm-2) was recorded at site 5 in spring 2012, while the lower was (37017.98cell\ cm-2) in summer 2012 at site1. Some genera have recorded higher number species during the study period; these genera were Nitzschia, Navicula, Cymbella, Gomphonema, Synedra, Achnanthes, Oscillatoria, and Lyngbya.

The study revealed that Bacillariophyceae were more prominent within all study sites and followed by Cyanophyceae, while a few numbers of Chlorophyceae was appeared.

Keywords: Quantitative, Qualitative, epipelic diatoms.

Introduction

Benthic algae include all algae that residing at the interface of water and mud such as sediments, clays, and slits or attached to biotic surfaces. They have a major role in aquatic ecosystems in nutrition cycling through water and sediments and considered as a primary producer. In addition, they have able to transform inorganic compound to organic compounds and toxic compounds to less or non-toxic compounds. Epipelic algae are groups of algae that live on or in association with substrata [1, 2]. Algae are considered as photosynthesis eukaryotes as they can convert CO_2 and minerals to biomass, and fast growing with complete growing life cycle for up to few days, in the availability of CO_2, nutrients and adequate amount of light [3, 4, 5]. Some aquatic microalgae species are an important productive source for biodiesel, due to high oil content of their dry biomass (60 %) [6,7]. The Biodiversity, distribution, and growth of algae are mainly influenced by several factors such as salinity, pH, CO_2 amount, and type of nutrients, since different species of algae have different growth requirements [8]. Environmental conditions are another factor affecting algal population and growth dynamics, by which the area with salinity and sufficient solar radiation during the year is a good cultivation region for microalgae [9]. However, it is assumed that the local microalgae that isolated from local natural habitat are more adaptable to such environmental conditions [10].

The eukaryotic microalgae generally consist of nine phyla; Glaucophyta, Chlorphyta, Chlorarachniophyta, Euglenophyta, Rhodophyta, Cryptophyta, Heterokontophyta, Haptophyta and Dinophyta, which are distributed from aquatic ecosystem to sediments. The dominancy of specific algal genera is mainly depends on the availability of phosphorus (P), and the abundance of nutrients-containing nitrogen (N) that flow into water body. The cultivation of some specie is determined for food, energy, pharmaceutical and industrial products; otherwise, the majority of them are cultivated mainly for biodiesel production [11, 12]. Because of their nutrient requirements, rapid reproduction and short life cycle, algae are considered as a significant unit in water quality assessment programs, and play a significant role in water pollution (from domestic or industrial wastes), due to their quick response to alteration in ecosystem situation and qualitative and quantitative composition of species and genera that live and adapt to such situation [12, 13]. In addition, changes in the physico-chemical characteristics of water effects on the composition and diversity of benthic diatom community [14]. The presence of epilpelic algae in rivers has gain a great concern due to their

Journal of
Plant Biology and Agriculture Science

2020

Vol. 4 No.2

importance in aquatic ecosystem, therefore, many researchers study the diversity of epipelic algae in rivers worldwide [15, 16, 17, 18].

The main target of this study is to investigate the diversity and distribution of epipelic algae qualitatively and quantitatively in Tigris River in Baghdad/Iraq.

Material and Methods

Sample collection and study area

Tigris River is the main river along with Euphrates River that flows down from the eastern mountains of Turkey. The river is passes through Baghdad city after passing many cities in the north of Iraq. Sediment samples were collected monthly from five sites along Tigris River inside and outside Baghdad city in Iraq from December 2011to August 2012 (Fig. 1).

Epipelion samples were isolated in each site from the surface using spatula (0.1-0.5 cm depth and 50 m2 surface areas) after removing the surface of sediments. All samples were stored in clean polyethylene bottles with vigours mix and away from light until all samples are transferred to the lab. The isolation of epipelic algae was done according to methods of [19].The non-diatomic algae were counted using haemocytometer, whereas, diatomic algae was numerated according to the method described by [20]. The identification of algae in all cities was done by following many references [21, 22, 23, 24, 25, 26, and 27]. The quantitative results foe epipelic algae are expressed as cell*104 cm-2.

Results and Discussion

In total, 154 epipelion algal species were identified and belong to 45 genera in all selected sites. The Bacillariophyceae are the most dominant phyla with approximately 136 species belong to 33 genera with a total percentage of 94, 93, and 91 % in all five sites respectively. The central diatoms Centrales represents 49.6 % from the total number (10 species of 4 genera), followed by Pennales with 18.81 % (129 species of 29 genera). In addition, 11 species from 6 genera were identified as Cyanophyceae, with a percentage of 7.14 %, followed by Chlorophyceae with 4.55 % (7 species from 6 genera) (table 1).

According to selected sites, 85 species belong to 29 genera was identified in site 1, whereas, in site 2, around 103 species from 34 general were isolated and characterised. In site 3, 4 , and 5, the total number of isolated algae was fluctuated and varied, where 122 species belong to 35 genera were identified in site 3, and the number of isolated species was decreased slightly in site 4 and 5 to get up to 69 species (32 genera) and 85 species (29 genera)for both sites respectively (Table 2).

In this study, it was noticed that the most identified species (26 and 18) was corresponding to Nitzschia and Navicula respectively, whereas, Cymbella and Gomphonema were represented by 11 species, although, Syndra and Achananthes were only represented by 9 and 6 species respectively. Moreover, Cyanobacteraceae were also identified and recorded in this study, by Oscillatoria and Lyngbya which involved 4 and 3 species respectively.

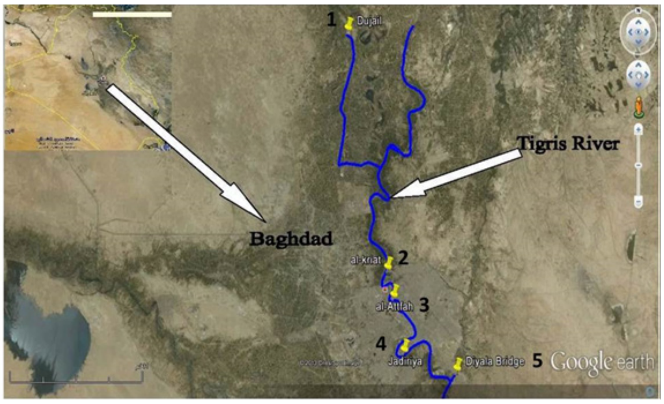

Figure 1: Tigris River location. The map illustrates the five selected sites along Tigris river within and out of Baghdad city in Iraq. The map was adapted by Google earth 2011).

The distribution and number of epipelic ditaoms in all selected sites are variable; depend on the seasonal variation and the place where the diatoms are taken and the environmental conditions. Generally, different diatom species promptly respond to the environmental variables such as pH, nutrients, organic matter and conductivity, due to their tolerance mechanism [28]. The prevalence of Bacillariophyceae in all studied sites is a common state in fresh water [29]. The high tolerance ability of such diatoms toward environmental changes may due to the cell wall composition. The presence of silica in the cell wall may facilitate the preservation, collection and classification of diatoms, and mediate the quick responses in aquatic ecosystem [30, 31]. The dominancy of such diatoms was also reported in Northern Thailand [32], and Turkey [33], and Russia [34, 35] and in the south of Iraq [36, 37]. The presence of Nitzschia and Navicula in all selected sites with variable percentage may due to their tolerance to organic pollution and pH, thus they are common in rich nutrient, high conductivity, slightly alkaline and calcareous water [28]. Cyanobacteraceae (Blue- green algae) were also indicated in this study, thus because they are tolerance to high temperature, organic and inorganic pollution as well as the pH [38]. However, their percentage was low compared to other phyla, due to the reduction in light during autumn season, or water movements by the current of air which caused the upper layer of sediments to be removed and transformation of benthos to plankton [39].

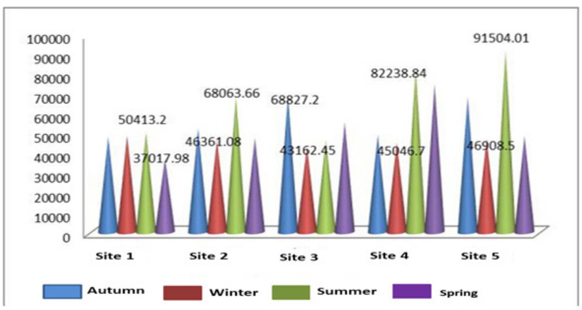

Figure 1: Spatial and Seasonal variation of the total number of algae (Cell*104 cm-2) between Dec. 2011- Aug. 2012.

The total number of diatoms was variable during the year and between each site as well (Fig. 2). The spatial and seasonal variation in the living mass of all identified diatoms are affected mainly by physico-chemical factors such as light, temperature, turbidity and water movements, all these factors may affect the distribution of diatoms either by separating them or force them to aggregates and mix different communities with each other [40, 41, 42, 43, 44].

References

1 Kara, H. and Sahin, B. (2001). Epipelic and epilithic algae of Degirmendere river (Trabzon-Turkey).Turk. J. Bot., 25: 177-186.

2 Richmond, A. (2004). Handbook of Microalgal Culture: Biotechnology and Applied Phycology; Blackwell Science Ltd.: Hudson County, NJ, USA.

3 Delwiche C. F. (2007). Algae in the warp and weave of life: Bound by plastids.In: Brodie J, Lewis J. editors. Unravelling the algae: The past, present and future of algal systematics, The Systematics Association Special Volume Series 75. Boca Raton, London and New York: CRC Press. p. 7-20

4 Li, Y.; Horsman, M.; Wang, B.; Wu, N.; La,n C.Q. (2008). Effects of nitrogen sources on cell growth and lipid accumulation of green alga Neochloris oleoabundans. Appl Microbiol Biotechnol.;81:629-36.

5 Liu, Z.Y.; Wang, G.C.; Zhou, B.C. (2008). Effect of iron on growth and lipid accumulation in Chlorella vulgaris. Bioresour Technol.99:4717-22.

6 Chisti, Y.(2007). Biodiesel from Microalgae. Biotechnol Adv. 25:294-306.

7 Hossain, A.B.; Salleh, A.; Boyce, A.N.; Chowdhury, P.; Naqiuddin, M. (2008). Biodiesel Fuel Production from algae as renewable energy. Am J Biochem Biotechnol. 4:250-4.

8 De Morais, M.G.; Costa, J.A.(2007). Isolation and selection of microalgae from coal fired thermoelectric power plant for biofixation of carbondioxide. Energy Conver Manage. 48:2169-73.

9 Grobbelaar,J.U.(2004).Algal biotechnology:Real opportunities for Africa. South Afr J Bot.70:140-4.

10 Megan, K. L.; Eisterhold, L.; ,Rindi, F.; Palanisami, P.; Nam, K. (2014).Isolation and screening of microalgae from natural habitats in the midwestern United States of America for biomass and biodiesel sources, Journal of Natural Science, Biology and Medicine . 5(2).