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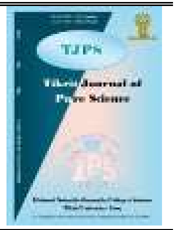

Qualitative and Quantitative study of Epipelic diatoms in Tigris River within Wasit province, Iraq

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Abstract

The present study conducted to study epipelic diatoms in the Tigris River within Wasit province for one year from June 2015 to May 2016, five sites have been chosen along the river between Al-Aziziyah and Kut .The aim of the study was to identify and main distributed to them in the Tigris River data were collected by the qualitative and quantitative study of epipelic diatoms. A total number of 161 species of epipelic diatoms was recorded belongs to 36 genera, where the number of central diatoms species recorded were 14 diatoms belonged to 7 genera by (8.69%) and The pinnate diatoms species were 147 species belonging to 27 genera by (91.30%). Seasonal and spatial variations were observed in the total numbers of benthic diatom during the study period, the results recorded the lowest rate of both central and pinnate diatoms were ($745.29\times 10^4/cm^3$) in site1 and the highest rate ($1122.92 \times 10^4 /cm^3$) in site4.Some genera have recorded higher number species during the study period; these genera were *Nitzschia, Navicula, Cymbella, Gomphonema, Amphora, Cyclotella, Melosira, Cocconies, Caloneis, Diatoma, Fragiaria, Surirella* and *Synedra.* The study revealed that Bacillariophyceae were abundant, reflecting the quality of water and mud and determine the extent of pollution and polluted type.

Introduction

Benthic algae are an important part of algae community and have been widely used as a tool to assess water quality [1]. Diatoms have a high degree of diversity and have a role in the flow of energy and nutrient cycling in aquatic systems; many have been used as indicators of environmental conditions in the water ecosystem [2]. The benthic algae community has a rapid response to disturbance in the water, as the water affected by pollution often changes the composition of species or diversity, which vary from one watercourse to another. Because of this feature, the benthic diatom community is useful and an important tool in the detection of human induced effects of the aquatic environment [3]. The benthic algae are affected by a number of factors including light intensity, duration, temperature, concentration of mineral salts, grazing, sediment nature, predators, current flow and the center of the River [4].

Benthic diatoms are used as ecological indicators and regarded as valuable in water quality assessment and monitoring [5]. Many studies on epipelic algae in the Tigris River were referred to the dominant of diatoms more than other species [6-10]. This study is an attempt to fill the gap about epipelic diatomic communities by conducting a qualitative and quantitative study of epipelic diatoms and their distribution in the Tigris River in Wasit province south of Iraq, because of the lack or few studies on this area.

Materials and Methods

The Tigris River was selected for application indices. Monthly sampling was taken from five sites along Tigris River during the period from July 2015 to May 2016 and the results presented seasonally (Fig. 1, Table1). Mud samples were collected from the study sites approximately once per month from July 2015 to May 2016 and the results presented seasonally (Figure 1). Collected by scrapping off the clay from area (50 m^2) and (3-5 mm) from the surface of the clay (randomly) using a spatula, and stored with little amount of sample water in polyethylene containers. It is shake and kept it in dark till it is returned to the laboratory. The prepared permanent slides by Eaton and Moss method [11] to isolate the epipelic algae. Calculated diatom cells by light microscope using oily compound lens 100X following the Microtransect method [12].

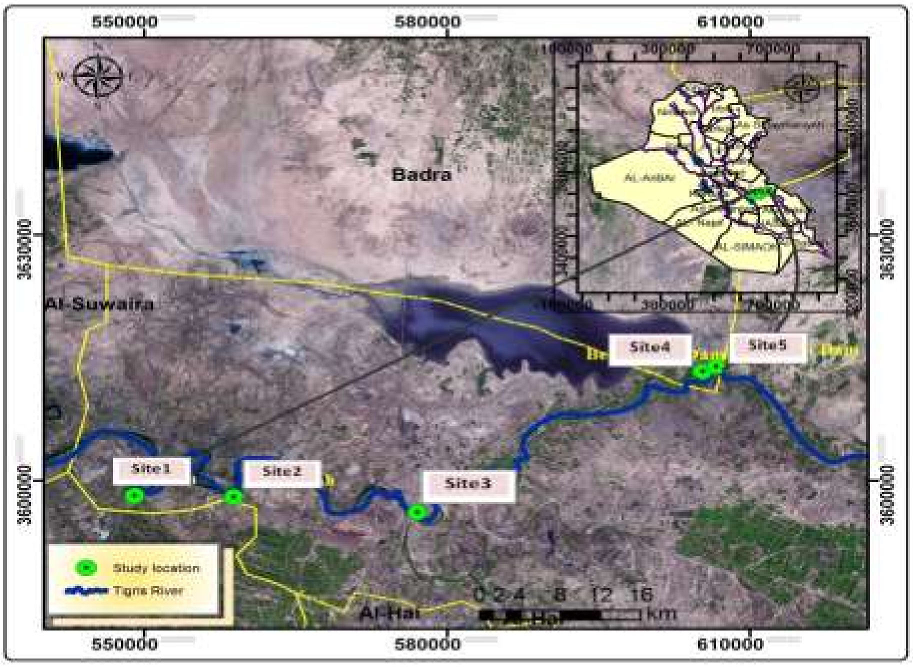

Figure (1): Map of study areas (Used Arc-GIS Map program)

Table 1. **The geographical positions (GPS) of the five study sites**

Sites	Longitude (eastwards)	Latitudes (northward)
S1: Al-Aziziyah	98°.1835′	54°.9050′
S2: Zubaidiyah	35°.9799′	55°.8840′
S3: Numaniyah	35°.9611′	57°.7080′
S4: Before Kut dam	36°.1336′	60°.5320′
S5: After Kut dam	36°.1395′	60°.6604′

Results & Discussions

The number of epipelic diatoms recorded during the present study on the Tigris River in the five sites was 161 species belonging to 36 genera. The number of central diatoms species recorded during the present study in the five sites was 14 diatoms belonged to 7 genera by (8.69%). The pinnate diatoms species were 147 species belonging to 27 genera by (91.30%). The number of diatoms diagnosed in site1 was 151 belonging to 36 genera, and the site2 there were 144 species belonging to 36 genera, while in site3 the total number of diatoms were 140 species belonging to 34 genera. The site4 recorded 136 species belonging to 34 genera, and the site5 recorded 141 species belonging to 36 genera (Table1).

Some species recorded the highest number of species in the study sites, these genera were *Nitzschia, Navicula, Cymbella, Gomphonema, Achnanthes, Amphora, Cyclotella, Melosira, Cocconies, Caloneis, Diatoma, Fragiaria, Pinnularia, Surirella and Synedra* (Table 2).

Nitzschia is considered a biological monitoring that indicator for organic pollutant and high pollutant contaminants in sediments [13] and *Cymbella, Navicula,* are considered to be diatoms that predominate in brackish waters [14]. In the present study showed the appearance of the genus *Navicula* and their species, because it can be found in the polluted and non-polluted areas [15]. The emergence of the dominance of these species and species because they have many qualities that allow them to exist in inappropriate conditions and their susceptibility to vertical migration in the sediment and the secretion of mucous membrane is easy to move and protects them [16]. As can be attributed to the possibility of these species adhered to the mud to withstand the difficult conditions of the speed of the flow and the lack of nutrients and contaminants in the sediments or the medium that adhere to the surface [17], and may be the variance in the number of species adhered to the clay in this study because it sensitive organisms to polluted substances in the water and sediments of the studied site, and the composition and abundance of species are also related to the trophic state and velocity of water in the site [18].

The dominance of diatoms within the epipelic algae is a known phenomenon recorded by the studies [19]; [20]; [21]; [22], and because they are adaptive to low illumination compared to other algae clusters present in the water surface [23].The differences in the proportions between the sites studied on the Tigris River may be due to the different environments inhabited by these diatoms or as a result of different exposure to pollutants and nutrients in addition to the different conditions that are exposed to them, including predators [24].As may be due to high temperature, low flow velocity and increase the appropriate lighting and the availability of nutrients from the decomposition of organic matter in the sedimentary sediments, which reflects positively on the process of photosynthesis and on the growth and multiplication and increased numbers [25], as the results of the present study on the river common some of the genera, such as *Nitzschia, Navicula, Mastigloia, Gyrosigma and Amphora,* are of different species, because the water of the river is low salinity, hard and basic in nature.

The emergence of the following species during the present study with a large number of species: *Cymbella, Amphora, Caloneis, Gomphonema, Fragilaria, Navicula, Nitzschia* and *Synedra* agrees with the study of epipelic diatoms in the Tigris River [9].Changes in sediment quality, nutrient availability and salinity affect the diversity of diatoms in the body of the water surface [26]. The lack or absence of some species between sites during the seasons may be due to the fact that they have become impure as a result of the flow velocity and increased discharge of water in the river [27]. The exposure of sites to pollution, which affects the specific structure of the diatoms attached to the sediments because sediments are a repository of the products of natural and human activities [28].

While the quantitative study of epipelic diatoms were recorded the lowest rate of both central and pinnate diatoms was (745.29 × $10^4/cm^3$) in site1 and the highest rate (1122.92 × $10^4/cm^3$) in site4.The total number of central diatoms was the lowest number (25.18×$10^4/cm^3$ in site 3 and the highest was (58.19 × $10^4/cm^3$) in site1.While the number of pinnate diatoms was the lower number (694.44 × $10^4/cm^3$) at site2, and the higher total number of diatoms was recorded (1064.78 ×$10^4/cm^3$) at site4 (Table 2).The epipelic diatoms have been used in the water environment as evidence of pollution, as they are affected in several ways. Pollution causes their growth to be blocked due to their deprivation of sunlight or may cause a change in physical and chemical factors to inhibit growth and reproduction. The polluted species are growing and multiplying. They also change the species to become dominant and less common ones, which leads to an increase or decrease in the total aggregates of algae living in the water system. This led to a difference between the five sites and the seasons in the study [29]. They are more effective than other algae in their bottom, more tolerant and resistant to the water currents. They have adhesion to submersible surfaces and are more stable on benthic sediments and are more adaptive to environmental conditions at the bottom [30]. Also increased grazing rate and flow velocity that move the bottom sediments, which increase the turbidity that obscures the light enough for growing diatoms [21].

Table (1): Number of types and types of Diatoms algae and the percentage of epipelic diatoms diagnosed during the study period in the five sites for the years 2015-2016 in the Tigris River

Sites	S1		S2		S3		S4		S5	
Types of Diatoms	Centriales	Pennales	Centriales	Pennales	Centriales	Pennales	Centriales	Pennales	Centriales	Pennales
Species	14	137	12	132	13	127	14	122	14	127
Genus	7	29	7	29	7	27	7	27	7	29
Percentage of Species %	9.27	90.72	8.33	91.66	9.28	90.71	10.29	89.70	9.92	90.07
Total number of Species	151		144		140		136		141	
Total number of Genus	36		36		34		34		36	

Table (2): Species, numbers and percentages of epipelic diatoms algae (cell x $10^4/cm^3$) on mud and is known during the study period in the five sites for 2016-2017 in the Tigris River. (-) = Type does not exist

Types of Diatoms / Sites	S1	Perce ntage %	S2	Percen- tage %	S3	Percen tage %	S4	Percen tage %	S5	Percen- tage %
Bacilariophyceae										
Centrales										
Aulacoseira ambigua (Grunow) Simonsen	0.38	0.05	0.28	0.04	6.06	0.78	2.31	0.21	1.34	0.16
A. granulata (Ehr.) Simonsen	1.48	0.20	0.43	0.06	1.23	0.16	0.13	0.01	1.55	0.18
Coscinodiscus asteromphalus Ehrenberg	-	-	-	-	-	-	0.16	0.01	0.26	0.03
C. granii L.F.Gough	0.02	0.00	0.15	0.02	0.18	0.02	0.14	0.01	-	-
C. denarius A. Schmidt	0.11	0.01	-	-	0.08	0.01	1.24	0.11	-	-
Cyclotella comta Kützing	0.74	0.10	0.04	0.01	0.46	0.06	10.4	0.93	0.25	0.03
C. meneghiniana Kützing	45.33	6.08	25.92	3.58	12.24	1.57	32.25	2.87	3.1	0.37
C. ocellata Pantocsek	6.15	0.83	0.04	0.01	-	-	0.62	0.06	0.18	0.02
Melosira. ambigua (Grunow) Otto Müller	-	-	0.69	0.10	-	-	1.39	0.12	31.37	3.72
M. granulate (Ehr.) Ralfs	-	-	0.06	0.01	1.47	0.19	0.07	0.01	0.39	0.05
M. varians Agardh	0.67	0.09	0.34	0.05	0.88	0.11	7.72	0.69	0.14	0.02
Stenopterobia delicalissinia (F.W.Lewis) Brébisson ex Van Heurck	0.58	0.08	0.09	0.01	0.09	0.01	0.92	0.08	0.36	0.04
Stephanodiscus agassizensis Håkansson & Kling	1.2	0.16	0.36	0.05	2.39	0.31	0.27	0.02	1.07	0.13
Thalassiosira baltica (Grunow) Ostenfeld	1.53	0.21	0.46	0.06	0.1	0.01	0.52	0.05	0.37	0.04
Total of Centrales	**58.19**	**7.81**	**28.86**	**3.99**	**25.18**	**3.23**	**58.14**	**5.18**	**40.69**	**4.83**
Pennales										
Achnanthes affinis Grunow	37.76	5.07	29.49	4.08	10.39	1.33	35.59	3.17	38.84	4.61
A. lanceolata (Brébisson ex Kützing) Grunow	0.1	0.01	0.09	0.01	0.64	0.08	0.18	0.02	16.78	1.99
A. minutissima var. affinis (Grunow) Lange-Bertalot	16.97	2.28	11.23	1.62	14.63	1.88	19.82	1.77	11.1	1.32
A. longipes C.Agardh	5.82	0.78	0.04	0.01	0.14	0.02	6.42	0.57	6.8	0.81
A. microcephala (Kütz.) Grunow	0.16	0.02	0.33	0.05	2.63	0.34	0.3	0.03	1.04	0.12
Achnanthidium exiguum Grunow	0.06	0.01	0.25	0.04	-	-	9.74	0.87	0.12	0.01
Amphora bioculata Cleve	16.1	2.16	0.75	0.11	10.7	1.37	16.12	1.44	5.79	0.69
A. ovalis (Kütz) Kützing	23.64	3.17	20.93	3.02	5.89	0.76	0.92	0.08	0.68	0.08
A. ovalis var. pediculus (Kütz.) Van Heurck	10.88	1.46	0.11	0.02	4.85	0.62	6.76	0.60	0.08	0.01
A. pediculus (Kütz) Grunow ex A.Schmidt	0.77	0.10	1.5	0.22	0.55	0.07	0.84	0.07	0.04	0.00
A .veneta Kützing	25.4	3.41	7.84	1.13	6.9	0.89	33.1	2.95	0.55	0.07
Anomoeoneis sphaerophora Pfitzer	0.19	0.03	4.95	0.71	3.21	0.41	25.8	2.30	17.82	2.11
Bacillaria paradoxa J.F.Gmelin,	0.3	0.04	2.1	0.30	0.07	0.01	1.26	0.11	2.98	0.35
B. paxillifera (O.F.Müller) T.Marsson	6.2	0.83	0.29	0.04	1.28	0.16	3.15	0.28	0.2	0.02
Caloneis amphisbaena (Bory.) Cleve	7.24	0.97	5.46	0.75	40.6	5.21	58.96	5.25	14.2	1.69
C. amphisbaena var. subsalina (Donkin) Cleve	35.3	4.74	32.3	4.47	31.9	4.10	41.3	3.68	17.42	2.07
C. bacillum (Grunow) Cleve	0.82	0.11	3.19	0.44	11.8	1.52	8.46	0.75	0.21	0.02
C. permagna (Bailey) Cleve	0.12	0.02	-	-	0.04	0.01	-	-	0.45	0.05
C. ventricosa (Ehr.) F.Meister	0.05	0.01	-	-	0.04	0.01	-	-	0.05	0.01

Cocconeis pediculus Ehrenberg	2.75	0.37			2.2	0.28	1.34	0.12	0.1	0.01
C. placentula Ehrenberg	19.74	2.65	19.38	2.68	29.3	3.76	69.02	6.15	45.13	5.36
*C. placentula var. euglypta (*Ehr.) Cleve	41.91	5.62	28.04	3.88	33.2	4.26	71.2	6.34	74.1	8.79
C. amphisbaena var. subsalina (Donkin) Cleve	24.5	3.29	39.83	5.51	-	-	-	-	-	-
C. placentula var. lineata (Ehr.) Van Heurck	-	-	-	-	15.35	1.97	-	-	0.12	0.01
Cymatopleura elliptica (Bréb) W.Smith	1.8	0.24	3.5	0.48	0.1	0.01	0.06	0.01	0.19	0.02
C. solea (Breb.) W.Smith	5.73	0.77	6.59	0.91	2.02	0.26	18.68	1.66	7.34	0.87
C. solea var. apiculata (W.Smith) Ralfs	-	-	0.1	0.01	0.03	0.00	0.15	0.01	0.06	0.01
Cymbella affinis Kützing	0.64	0.09	-	-	23.94	3.07	10.74	0.96	37.8	4.49
C. aspera (Ehr.) Cleve	0.44	0.06	4.47	0.62	6.54	0.84	16.23	1.45	9.94	1.18
C. cistula(Hemp.) Grunow	5.74	0.77	1.37	0.19	0.32	0.04	6.67	0.59	6.29	0.75
C. lanceolata (C.Agardh) Kirchner	-	-	0.23	0.03	-	-	0.36	0.03	0.16	0.02
C. lange-bertalotii Krammer	2.22	0.30	0.08	0.01	0.26	0.03	0.04	0.00	2.2	0.26
*C. ovalis (*Kütz.) Brébisson & Godey	6.4	0.86	0.86	0.12	-	-	0.42	0.04	0.16	0.02
C. prostrate (Berk.) Cleve	1.02	0.14	0.36	0.05	-	-	0.05	0.00	0.67	0.08
C. tumida (Breb.) Van.Heurck	7.77	1.04	4.8	0.66	2.1	0.27	31.58	2.81	15.66	1.86
C. turgid (Greg.) Cieve	4.68	0.63	0.94	0.13	5.84	0.75	18	1.60	17.7	2.10
C. turgida (Greg.) Cleve	0.32	0.04	2.78	0.38	2.94	0.38	0.23	0.02	-	-
C. turgidula var. kappii Cholnoky	-		2.84	0.39	14.38	1.85	2.8	0.25	3.54	0.42
C. ventricosa (C.Agardh) C.Agardh	-	-	-	-	-	-	-	-	1.24	0.15
Diatoma vulgare Bory	7.5	1.01	0.3	0.04	0.79	0.10	30.69	2.73	1.91	0.23
Diploneis elliptica (Kütz.) Cleve	5.23	0.70	0.19	0.03	-	-	1.32	0.12	-	-
Encyonema silesiacum (Bleisch) D.G.Mann	0.07	0.01	-	-	0.16	0.02	0.71	0.06	0.4	0.05
Encyonema reichardtii (Krammer) D.G.Mann	0.5	0.07	0.02	0.00	0.16	0.02	0.17	0.02	0.16	0.02
Fragilaria capucina Desmazieres	1.42	0.19	1.19	0.16	0.15	0.02	0.54	0.05	6.88	0.82
F. capucina var. gracilis (Oestrup) Hustedt	-	-	-	-	-	-	-	-	-	-
F. capucina var. rumpens (Kütz.) Lange-Bertalot ex Bukhtiyarova	0.28	0.04	0.08	0.01	6.56	0.84	0.89	0.08	0.04	0.00
F. construens (Ehr.) Grunow	0.15	0.02	0.4	0.06	24	3.08	6.03	0.54	0.68	0.08
F. construens f. binodis (Ehr.) Hustedt	1.14	0.15	-	-	-	-	-	-	-	-
F. elliptica Schumann	0.52	0.07	1.19	0.16	0.95	0.12	3.82	0.34	0.17	0.02
F. intermedia Grunow	1.62	0.22	0.2	0.03	0.4	0.05	0.54	0.05	-	-
F. ulna (Nitzsch) Lange-Bertalot	0.53	0.07	15.1	2.09	2.57	0.33	1.17	0.10	14.52	1.72
F.ulna var. acus (Kütz.) Lange-Bertalot	22.74	3.05	26.5	3.66	24	3.08	50.87	4.53	16.93	2.01
F. ulna var. biceps (Kütz.) Compère	2.37	0.32	2.22	0.31	0.54	0.07	0.14	0.01	0.91	0.11
F. virescens Ralfs	-	-	-	-	-	-	-	-	-	-
Gomphoneis olivecum (Horne)P.Dawson ex. Ross et Smith	8.7	1.17	0.33	0.05	11.4	1.46	1.08	0.10	54.7	6.49
Gomphonema. Affine Kützing	1.05	0.14	23.5	3.25	13.1	1.68	19.28	1.72	38.91	4.62

G. clavatum Ehrenberg	0.22	0.03	1.24	0.17	-	-	0.04	0.00	0.12	0.01
G. insignaffine E.Reichardt	0.89	0.12	3.98	0.55	0.12	0.02	19.8	1.76	0.64	0.08
G. lagenula Kützing	-	-	-	-	27.49	3.53	-	-	-	-
G. mesta (S.I.Passy-Tolar & R.L.Lowe) E.Reichardt	0.05	0.01	-	-	0.1	0.01	0.2	0.02	0.33	0.04
G. minuta P.Fusey	1.54	0.21	11.35	1.57	0.35	0.04	-	-	7.58	0.90
G. minutum (C.Agardh) C.Agardh	17.1	2.29	10.99	1.52	12.44	1.60	4.59	0.41	8.94	1.06
G. olivaceum (Lyng.) Kützing	0.86	0.12	6.46	0.89	3.05	0.39	10.04	0.89	24.16	2.87
G. paravalum (Kütz.) Grunow	-	-	-	-	-	-	-	-	-	-
G. rhombicum Fricke	0.07	0.01	0.08	0.01	0.12	0.02	-	-	0.06	0.01
G. truncatum Ehrenberg	0.36	0.05	1.04	0.14	0.13	0.02	0.08	0.01	0.28	0.03
Gyrosigma acuminatum (Kütz.) Rabenhorst	0.04	0.01	5.42	0.75	1.49	0.19	5.01	0.45	0.32	0.04
G. attenuatum (Kütz.) Rabenhorst	0.07	0.01	7.33	1.01	0.39	0.05	2.66	0.24	2.23	0.26
G. fasciola (Ehr.) J.W.Griffith & Henfrey	-	-	-	-	8.49	1.09	0.22	0.02	0.23	0.03
Mastogloia elliptica (C.Agardh) Cleve	-	-	0.31	0.04	0.35	0.04	-	-	0.49	0.06
M. smithii Thw. Ex. W. Smith	0.12	0.02	0.26	0.04	1.83	0.23	0.16	0.01	0.66	0.08
Mayamaea atomus (Kütz.) Lange Bertalot	0.02	0.00	0.23	0.03	0.08	0.01	0.1	0.01	0.09	0.01
Meridion circulare Agardh	0.04	0.01	1.24	0.17	0.04	0.01	-	-	0.12	0.01
Navicula affinis Ehrenberg	-	-	-	-	-	-	-	-	-	-
N. ambigua Ehrenberg	0.09	0.01	0.19	0.03	-	-	6.22	0.55	1.78	0.21
N. bacillum Ehrenberg	0.06	0.01	-	-	0.14	0.02	0.15	0.01	0.09	0.01
N. capitatoradiata H.Germain	0.3	0.04	5.4	0.75	-	-	-	-	0.8	0.09
N. cryptocephala Kützing	0.07	0.01	0.08	0.01	1.54	0.20	0.52	0.05	1.39	0.16
N. cuspidata (Kutz.) Kutzing	0.39	0.05	3.25	0.45	11.42	1.47	0.72	0.06	-	-
N. decussis Oestrup	0.05	0.01	0.32	0.04	0.16	0.02	-	-	-	-
N. gregaria Donkin	20.4	2.74	29.3	4.05	30.55	3.92	31.43	2.80	10.2	1.21
N. halophila (Grun.) Cleve	17.6	2.36	13.48	1.86	37.3	4.79	33.4	2.97	8.91	1.06
N. lanceolata Ehrenberg	1.8	0.24	5.04	0.70	25.96	3.33	0.73	0.07	0.14	0.02
N. mutica Kützing	0.58	0.08	-	-	-	-	-	-	-	-
N. protracta Grunow	2.2	0.30	0.07	0.01	0.06	0.01	0.36	0.03	-	-
N. pygmaea Kützing	0.08	0.01	0.16	0.02	0.08	0.01	0.06	0.01	0.07	0.01
N. radiosa Kützing	23.12	3.10	17.9	2.47	62.98	8.09	36.08	3.21	75.1	8.91
N. rhynchocephala Kützing	0.09	0.01	0.05	0.01	0.07	0.01	0.08	0.01	-	-
N. seminulum Grunow	0.05	0.01	-	-	0.18	0.02	-	-	-	-
N. veneta Kützing	0.75	0.10	15.18	2.10	23.26	2.99	0.15	0.01	12.13	1.44
N. viridis (Nitzsch) Ehrenberg	21.54	2.89	14.24	1.97	1.76	0.23	24.03	2.14	0.46	0.05
N. viridula (Kütz.) Ehrenberg	0.16	0.02	14.68	2.03	0.25	0.03	-	-	13.35	1.58
N. viridula var. rostellata (Kütz.) Cleve	-	-	0.16	0.02	0.03	0.00	0.37	0.03	-	-
Nitzschia acicularis (Kütz.) W.Smith	1.2	0.16	15.14	2.09	0.64	0.08	0.85	0.08	7.5	0.89
N. amphibia Grunow	2.28	0.31	0.12	0.02	0.08	0.01	0.05	0.00	0.05	0.01
N. apiculata (Greg.) Grunow	0.05	0.01	0.06	0.01	0.05	0.01	0.08	0.01	-	-
N. commutata Grunow	-	-	2.17	0.30	-	-	0.4	0.04	-	-
N. constricta (Gregory) Grunow	4.8	0.64	22.4	3.10	0.48	0.06	0.47	0.04	1.21	0.14
N. dissipata (Kütz) Grunow	5.4	0.72	0.73	0.10	0.19	0.02	8.76	0.78	0.19	0.02
N. draveillensis Coste & Ricard	0.02	0.00	3.22	0.45	0.02	0.00	0.05	0.00	-	-
N. filiformis (W.Sm.) Hust	11.68	1.57	8.63	1.19	6.13	0.79	-	-	0.34	0.04

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N. fonticola (Grunow) Grunow	-	-	1.17	0.16	6.97	0.89	17.54	1.56	0.16	0.02
N. frustulum Kützing	0.07	0.01	0.18	0.02	0.75	0.10	4.61	0.41	0.27	0.03
N. fruticosa Hustedt	0.07	0.01	0.15	0.02	11.1	1.43	0.13	0.01	0.42	0.05
N. gracilis Hantzsch	24.9	3.34	0.28	0.04	5.56	0.71	0.12	0.01	0.49	0.06
N. granulata Grunow	0.25	0.03	0.13	0.02	2.64	0.34	-	-	0.04	0.00
N. hyngarica Grunow	0.08	0.01	2.18	0.30	0.02	0.00	0.42	0.04	-	-
N. linearis W.Smith	2.48	0.33	0.43	0.06	0.1	0.01	2.71	0.24	0.38	0.05
N. nana Grunow	18.22	2.44	0.55	0.08	0.06	0.01	-	-	0.05	0.01
N. obtusa W.Smith	23.1	3.10	0.24	0.03	-	-	-	-	9.97	1.18
N .palea (Kütz .) W.Smith	16.1	2.16	1.29	0.18	20.93	2.69	9.4	0.84	8.46	1.00
N. palea var. debilis (Kütz.) Grunow	4.64	0.62	16.7	2.31	0.08	0.01	0.39	0.03	0.33	0.04
N. paleacea Grunow	0.11	0.01	6.63	0.92	1.66	0.21	0.14	0.01	0.08	0.01
N. paleaeformis Hustedt	-	-	2.08	0.29	-	-	1.35	0.12	-	-
N. reversa W.Smith	2.64	0.35	2.22	0.31	2.28	0.29	13	1.16	13.5	1.60
N.rectilonga Takano	1.2	0.16	2.22	0.31	1.5	0.19	18.85	1.68	5.73	0.68
N. sigma (Kütz .) W.Smith	0.14	0.02	6.52	0.90	0.44	0.06	0.19	0.02	0.08	0.01
N. sigmoidea (Ehr.) W.Smith	3.89	0.52	6.8	0.94	0.86	0.11	1.07	0.10	5.69	0.68
N. thermalis (Ehr.) Auerswald	0.21	0.03	0.33	0.05	2.2	0.28	16.73	1.49	3.77	0.45
N. vermicularis (Kütz .) Grunow	0.04	0.01	0.04	0.01	0.15	0.02	0.08	0.01	0.08	0.01
N. vidovichii (Grunow) Grunow	0.25	0.03	0.24	0.03	0.23	0.03	0.11	0.01	0.04	0.00
N. umbonata (Ehr.) Lange-Bertalot	0.13	0.02	0.32	0.04	0.06	0.01	0.09	0.01	-	-
Peronia fibula (Breb & Arn) Ross	0.14	0.02	0.09	0.01	0.19	0.02	0.07	0.01	0.1	0.01
P. intermedium (H.L. Smith) Patrick	-	-	-	-	0.06	0.01	1.55	0.14	-	-
Pinnularia acuminate W.Smith	0.24	0.03	0.03	0.00	-	-	0.12	0.01	0.14	0.02
P. brebissonii (Kütz.) Rabenhorst	0.37	0.05	2.4	0.33	0.2	0.03	1.3	0.12	0.36	0.04
P. divergens W.Smith	0.18	0.02	0.04	0.01	0.18	0.02	0.05	0.00	-	-
P. viridis(Nitzs.) Ehrenberg	0.15	0.02	0.28	0.04	1.34	0.17	0.13	0.01	0.14	0.02
Pleurosigma elongatum W.Smith	-	-	3.83	0.53	-	-	-	-	0.06	0.01
Rhoicosphenia abbreviate (C.Agardh) Lange-Bertalot	0.86	0.12	0.66	0.09	1.35	0.17	3.09	0.28	0.91	0.11
R. curvata(Kütz .) Grunow	0.81	0.11	0.04	0.01	0.12	0.02	0.61	0.05	4.61	0.55
Rhopalodia gibba (Ehr.) Otto Müller	0.07	0.01	0.02	0.00	0.06	0.01	0.06	0.01	0.14	0.02
Surirella brebissonii Krammer & Lange-Bertalot	0.04	0.01	0.08	0.01	0.18	0.02	8.44	0.75	0.16	0.02
S.linearis W.Smith	0.08	0.01	13.34	1.84	0.49	0.06	0.1	0.01	0.95	0.11
S. linearis var. constricta (Ehr.) Grunow	7.6	1.02	4.9	0.68	0.05	0.01	6.17	0.55	2.36	0.28
S. minuta Berbisson ex Kützing	2.64	0.35	0.53	0.07	8.2	1.05	0.42	0.04	7.59	0.90
S. ovalis Berbisson	16.6	2.23	7.3	1.01	3.62	0.46	63.38	5.64	0.6	0.07
S. robusta Ehrenberg	18.96	2.54	34.51	4.77	5.31	0.68	0.25	0.02	7.97	0.95
S. robusta var. splendida (Ehr.) Van Heurck	1.04	0.14	0.6	0.08	0.04	0.01	0.72	0.06	0.07	0.01
S. splendida (Ehr.) Kützing	-	-	0.44	0.06	0.11	0.01	47.18	4.20	0.09	0.01
Synedra acus Kützing	0.42	0.06	0.09	0.01	35.9	4.61	0.07	0.01	12.04	1.43
S. capitata Ehrenberg	0.04	0.01	6.67	0.92	0.06	0.01	16.78	1.49	0.1	0.01
S. fasciculate(C.Agardh) Kützing	18.4	2.47	2.26	0.31	0.06	0.01	-	-	0.25	0.03
S. rumpens Kützing	14.1	1.89	30.32	4.19	14.38	1.85	0.06	0.01	8.96	1.06
S tenera W.Smith	0.49	0.07	-	-	-	-	-	-	0.12	0.01
S. ulna (Nitzs.) Ehrenberg	0.4	0.05	0.48	0.07	6.7	0.86	0.17	0.02	27.1	3.22
S. ulna var. biceps (Kütz.) Schönfeldt	0.85	0.11	4.59	0.63	7.42	0.95	4.51	0.40	0.12	0.01
Tabellaria fenestrate (Lyng.) Kützing	0.42	0.06	0.1	0.01	4.4	0.56	1.22	0.11	0.18	0.02

Total of Pennales	**1033.96**	**94.67**	**694.44**	**96.01**	**753.65**	**96.77**	**1064.78**	**94.82**	**798.38**	**94.74**
Total (Cell × 10^4 / cm^3)	**745.29**	**100.0**	**723.3**	**100.00**	**778.83**	**100.00**	**1122.92**	**100.00**	**842.69**	**100.00**

Conclusions

We conclude from this study that there is a difference in the quantitative and qualitative composition of the epipelic diatoms according to the seasons and study sites. The environmental factors have a significant effect on the quality and quantity of epipelic diatoms . As we note that some genera exist in all study sites such as: *Nitzschia, Navicula, Cymbella, Gomphonema, Amphora, Cyclotella, Melosira, Cocconies, Caloneis, Diatoma, Fragiaria, Surirella and Synedra*. It may be due to a number of adaptations that allow it to reproduce under extreme environmental conditions.

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دراسة نوعية وكمية للدايتومات الملتصقة على الطين في نهر دجلة ضمن محافظة واسط ، العراق

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الملخص

تناولت هذه الدراسة الدايتومات الملتصقة على الطين في نهر دجلة ضمن محافظة واسط لمدة سنة من شهرحزيران 2015 الى شهر آيار 2016، تم اختيار خمسة مواقع على طول النهر بين العزيزية والكوت. وهدفت الدراسة تشخيص وتوزيع الانواع الرئيسية للدايتومات من خلال البيانات التي تم جمعها على نهر دجلة للدراسة النوعية والكمية للدايتومات الملتصقة على الطين. سجلت 161 نوعاً من الدايتومات الملتصقة على الطين تعود الى 36 جنساً، حيث بلغ العدد الكلي للدايتومات المركزية 14 نوعاً تعود الى 7 اجناس بنسبة (8.69%) وبلغ عدد انواع الدايتومات الريشية 147 نوعاً تعود الى 27 جنساً وبنسبة (91.30%). لوحظت تغايرات فصلية وموقعية في معدلات الاعداد الكلية للدايتومات القاعية خلال مدة الدراسة، اذ سجلت النتائج أقل معدل للدايتومات المركزية والريشية (723.3×10^4 /سم^2) في الموقع2 وأعلى معدل (1122.92×10^4/سم^2) في الموقع4. بعض الاجناس تمايزت وسجلت اعلى عدد من الانواع خلال فترة الدراسة وهي: *Gomphonema, ،Nitzschia, Navicula, Cymbella, Surirella , Caloneis ,Diatoma, Fragiaria, , Amphora, Cyclotella,Melosira, Cocconies, Synedra* وبينت الدراسة وفرة وغزارة الطحالب العصوية وخاصة الدايتومات الريشية، مما يعكس نوعية المياه والطين وتحديد مدى ونوع الملوث.

الكلمات المفتاحية: الدايتومات الملتصقة على الطين، دراسة نوعية، دراسة كمية، نهر دجلة.