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Qualitative and quantitative study of Epiphytic algae on *Hydrilla verticillata* at Al-Dora site in Tigris River within Baghdad City, Iraq

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Abstract:

In current work we study epiphytic algae on Hydrilla verticillata in Tigris River within Al-Dora region of Baghdad city during the period between March and December 2013. Total of (128 species, 39 genera) of epiphytic algae on H.verticillata were identified during study. Bacillariophyceae (Diatoms) was dominting group (97species,24genera,80%) followed by Chlorophyceae (18 species,9 genera 11%) and Cyanophyceae (13 species,6 genera,9%).An impressive and temporal distributions of epiphytic algae on H.verticillata was observed in this study. The higher total number of epiphytic algae (523.3×104individual/g WW) was recorded in summer 2013, while the lower was (194.9×104individual/g WW) in winter 2013.Three biodiversity indices (Shannon- Weaver, richness, and evenness) were calculated. And different indces values were evaluated in seasons.

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Keyword: Epiphytic algae, Hydrilla verticillata , Dora site ,Qualitative & Quantiative study, Tigris River.

Introduction

Benthic algae are vital primary producers in running water, lake and shallow freshwater ecosystems[1;22]. The term "epiphytic algae" used Wetzel [2] refer to the algae attached on the surface of plants.In correlation with this ,Allen [3]used the term "epiphytic periphyton" to describe both the attached algae and bacteria on aquatic plants[4].Benthic algae exist in aquatic environment effect many environmental factors such as intensity of light and the length of period, salinity, temperature , and the velocity of the current [5]. In Iraq there are some studies for the epiphytic algae in different aquatic system,[6] in Al-Habbina lake, [7] in Shatt Al-Arab and in the southern Iraqi Marshes[8;9]. However local studying for Tigris river on environmental epiphytic algae exist change seasons of groups diagnosed for also diatoms was the dominant in all seasons study [10;11;12;40]. This is due to the growth and diatoms can reproduction in a wide range of environmental changes.In our recent work,we are focusing on explore and differentiation the species of epiphytic algae on Hydrilla verticillata in Tigris River within Al-Dora site of Baghdad city.

Materials and Methods

Water samples for were collected four season (Winter,Spring,Summer andAutumn) during the period between March and December 2013. Taken sampling from within Al-Dora of Baghdad city on Tigris river on western bank (Al-Karkh side) facing University of Baghdad fig.[1].Then the biogenic samples for the study were identified with Separation of epiphytic algae from their host was carried out following the method described by scraping and manual shaking[9;10;11;12;14] subsequently, the epiphytic algae cells were preserved with 1ml Lugol's iodine solution. The identification of algal species followed several references [15;16;17;18;41;50]. Three biodiversity indices were used in this study for refrences [46;47;48].

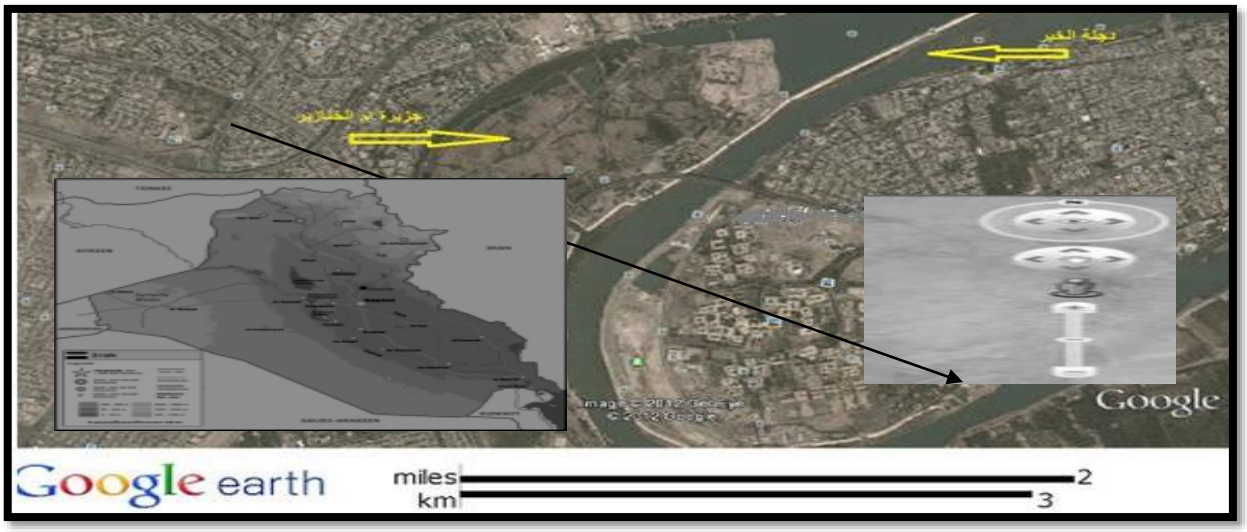

Fig. 1:Map of the study in Tigris river of Baghdad city(Al-Dora sit).

Results and Discussion:

The number of species identified epiphytic algae on *Hydrilla verticillata* in the current study was128 species according to the [19]. Table[1] the species is related to 39 genera, and the Bacillariophyceae (Diatoms) which the dominant groups to was formed relative 80% in all seasons of classes of epiphytic algae. This predominance important of this phenomenon is common in Iraqi internal waters which has been recorded by many researchers [7;8;20;21;30;42].And in different region of the world [43;44]. Diatoms of algae dominant is due to have the ability to stay as a result of fluctuations and environmental factors [5;34].As well as the dominant pennales diatom (88species ,20 genera) on order centrales diatom which formed (9species,4genra), this is one of the properties of freshwater [9;31;32;45]. For Chlorophyaceae (18 species, 9genra) relative to 11% which belong this numerical superiority in species on Cyanophyacae which formed (13 species,6genera) relative to 9%Fig.[2].This results due to less species Cyanophyaceae in basin of the Tigris and Euphrates[23]. Species Cyanophyaceae also showed the availability nutrients as well as on other factors such as pollution and toxins and high temperatures [24].The current study was recorded seasons variation of the number of genera and species epiphytic algae *H.verticillata*. In addition ,it was recorded the highest number of algae was in the autumn (86species) as show in Tabel [2] and Fig.[3] while less number species of diagnosed was in the spring(45 species). This increment effected by different environmental conditions such ashigh and low temperatures and the availability of nutrients as well as elements[25]. Moreover, the the nature of adhesive substrata and spread of algae in the aquatic environment effected the results [26]. The dominant of some *Nitzschia,Gomphonema,Navicula,Cymbella,Cocconeis,Synedra,Achnanthes,Oscillatoria,Scenede-smues,Pediastrum,Gomphonema and Surirella* could be due to the existence of a set of adaptation that enable them to be present as an adherent to some species of algae the ability to produce mucus secretions to help them adhesion[27].

A temporal variation of the total number of epiphytic algae on *H.verticillata* to study seasons, it was found that the higher number of epiphytic algae (523.3×10^4individual/g WW) was recorded in Summer.However,the lower number was (194.9×10^4individual/g WW)Winter as shown inTable [3].This increment is due to the length of daylight hours,light intensity ,high temperature in this season and accumulation of important nutrients for algae which in turn increases algal growth[28;29]. In addition, plant taxa and exotic in Iraqi aquatic environment, ability to tolerant variation in environmental conditions ,salinity and few light. It as well as appearance characteristics and nature of surface of leaves [13;33;37].Fig [4] showed the seasonal variation in total number among the main algal groups, the diatoms is dominance during the study period. This diatoms dominance was very known in Iraqi aquatic ecosystems[36] due to this algae have ability tolerate environment conditions [34;36]. The second abundance algal groups were Chlorohyceae followed Cyanophyceae this because of the proximity of site refinery Dora. This results are in good a accordance with a study [38] .

The results of this study show the diversity by Shannon-Weaver index value(2.5-3.5) in spring and Summer respectively while evenness index was recorded (1.2 -1.7) for the same seasons, these results related to the rise of identified algal species and proportion stability this result converged to recorded in Tiger river[12]. Richness index value (5.8-9.2) in Autumn and Winter respectively Fig.[5] and the result depended on the characterized host plant and nature of environmental factors [39;49].

Table (1): List of species of epiphytic algae on *Hydrilla verticillata* in the Tigris river-Dora site all study seasons of 2013.

Seasons / Taxa	Winter	Spring	Summer	Autumn
CYANOPHYCEAE				
1-Chroococcusdispersus (Keis.) Lemmermann	-	-	+	-
*2-C. limneticus*Lemmermann	-	+	+	+
3-Lyngbya sp.	+	-	-	+
4-Merismopedia minimum Beck	-	+	-	+
*5-M. tenuissima*Lemmermann	+	-	-	-
6-Oscillatoria limosa(Ag.) Gomont	-	-	+	+
*7-O. princeps*Vaucher	+	-	-	+
*8-O. tenuis*Agardh	-	-	-	+
9-O. sp.	+	-	-	-
10-Phormidium sp.	+	-	-	-
11-Spirulina major (Wittr.) Kirchner	-	-	+	+
12-S.subsalsa Kützing	+	-	+	+
*13-S.*sp.	-	-	+	+
CHLOROPHYCEAE				
*14- Cladophoraglomerata (*Lemm.) Kützing	-	-	+	+
15-Coelastrum intermedium(Bohl.) Korščhikov	-	-	-	+
16-Cosmarium botrytis Meneghinii	+	-	-	+
*17-C. granatum*deBrébisson	-	-	-	+
*18-C. laeve*Rabenhorst	-	+	+	-
*19-C. subtumidium*Nordstedt	+	-	-	-
20-Oedogonium sp.	-	-	+	-
21-Pediastrumboryanum(Turp.) Meneghinii	+	-	-	-

22- P.simplex(Meyen) Lemmermann	-	+	-	+
23-P. tetras (Ehr.) Ralfs	+	-	+	+
*24-P.tetras*var. *tetradron*(Corda)Rabenhorst	-	-	+	+
*25- Scenedesmusarcuatus*Lemmermann	-	-	+	-
26- S. bijuga (Turp.) Lagerheim	+	+	+	+
27-S. dimorphus(Turp.) Kützing	-	-	-	+
28-S. quadricauda(Turp.) de Brébisson	-	-	-	+
29-Spirogyra sp.	-	+	+	+
30-Staurastrum sp.	+	-	-	-
31-Ulothrix sp.	+	-	-	-
BACILARIOPHYCEA				
Order 1 : Centrals				
32-Aulacoseira granulate (Ehr.) Ralfs	+	+	+	+
33-A.itaclica (Ehr.) Ralfs	-	+	-	-
*34-A. varians*Agardh	-	-	-	+
35-Cosinodiscus sp.	-	-	-	+
36-Cyclotella KuetzingianaThwaites	+	-	-	+
*37-C. meneghiniana*Kützing	+	-	-	-
38-C. striata(Kütz.) Grunow	+	-	+	-
*39-Stephaenodicus hantzschii*Grunow	+	-	-	-
40-Stephaenodiscus sp.	+	-	-	-
Order 2 : Pennales				
*41-Achnanthes brevipes*var. *Intermedia*(Kütz.) Cleve	-	-	-	+
*42-A. hungarica*Grunow	-	-	-	+
43-A. microcephala(Kütz.)Grunow	-	-	-	+
*44-A. minutissima*Kützing	+	-	-	-
45-A.plonensis Hust.	+	-	-	-

*46-A. affinis*Grunow	+	-	+	+
*47-A .linearis*W.simth	-	-	+	-
*48-Amphora coffeaeformis*Agardh	-	-	+	+
*49-A. ovalis*Kützing	-	-	+	+
*50-A.venata*Kützing	+		+	+
51-Anomoeoneis exilis(Kütz.) Cleve	+	+	+	+
52-Caloneis bacillum(Grun.) Mereschkowsky	-	+	-	+
*53-Cocconeis pediculus*Ehrenberg	-	-	+	+
*54-C. placentula*Ehrenberg	-	-	-	+
*55-C. placentula*var. *euglypta*(Ehr.)Cleve	-	+	-	-
*56-C. placentula*var. *Lineate* (Ehr.)Cleve	-	-	+	+
*57-Cymbella affinis*Kützing	-	-	+	-
58-C. aspera(Ehr.) Cleve	-	-	-	+
59-C. cistula(Hemp.) Grunow	+	+	+	+
60-C. Helvetica Kützing	+	+	-	+
61-C. turgidus(Kütz.) Nägeli	+	-	+	-
62-C. tumida (Bréb.)V. Heurck	+	+	+	+
*63-C .cybiformis*Font	-	-	-	+
*64-C. turgidula(*Kütz.) Nägeli	-	-	-	+
*65-C .prostate*Kützing	-	-	+	-
*66-C. ventricosa*Kützing	-	-	-	+
*67-Cymatopleura solea*W. Smith	+	-	+	-
*68-C. elliptica*Kützing	+	-	+	-
*69-Diatoma vulgare*Bory	-	-	+	+
70-Diploneis ovalis(Hisle) Cleve	-	-	+	-
71-E. zebra (Ehr.) Kützing	+	-	+	+
*72-Eunotia validia*Hustedt	+	+	+	+

*73-Fragilaria brevistriata*Grunow	-	-	-	+
*74-F. intermedia*Grunow	+	+	-	+
*75-Gomphonema acuminatum*Ehrenberg	+	+	-	-
76-G. augur Ehrenberg	+	+	+	+
*77-G. constrictum*Ehrenberg	+	+	+	+
*78-G. constrictum*var.*capitata*(Ehr.)Cleve	-	-	+	-
*79-G. gracile*Ehrenberg	-	+	+	+
*80-G. gracile*fo. *torris*(Ehr.) Hustedt	+	+	+	+
*81-G. intricatum*Kützing	-	+	-	+
*82-G. intricatum*var. *lunata* nov.	-	-	-	+
*83-G. intricatum*var. *pumila*Grunow	-	+	+	+
*84- G. lanceolatum*Ehrenberg	+	-	+	+
*85-G. lanceolutum*fo. *torris* (Ehr.)Huestedt	+	-	+	+
86-G. olivaceum (Lyng.)Kützing	+	+	-	+
87- G. parvulum(Ehr.) Grunow	+	+	-	-
*88- G.fanensis*Maillard	+	+	+	+
*89-G. sphaerophorum*Ehrenberg	+	+	+	+
*90-G.angustatum*var.*producta*(Kutz.)Rabhorst	-	-	+	+
91- Gmphonisolivacea(Lyng.) Dawson	+	+	+	+
92- Gyrosigmaacuminatum(Kütz)Rabhorst	-	+	+	+
*93- Gyrosigmaspencerii*W.Simith	+	-	-	-
*94- Gyrosigmakutzingii*Grunow	-	-	+	-
*95-Mastogloia smithii*var. *amphicephala*Grunow	+	+	-	+
96- Naviculacincta(Ehr.) Kützing	-	-	+	-
*97- N. cryptocephala*Kützing	-	+	+	+
*98- N. cryptocephala*var. *Veneta*(Kütz.) Grunow	+	+	+	-
99- N. halophila(Grun.) Cleve	+	-	+	+

100-*N. inflata*Donkin	+	+	+	+
*101-N. parva*Ralfs	-	-	-	-
*102-N. radiosa*Kützing	+	-	-	+
*103- N. radiosa*var. *tenella*(Bréb.) Grunow	-	-	+	-
*104- N. rhyncocephala*Kützing	-	-	+	-
105-N. specula (Dick.) Cleve	+	-	+	+
*106- N. viridula*var. *rostellata*(Kütz.) Cleve	+	+	-	+
107- Nitzschia amphibian Grunow	+	-	-	+
108- N. apiculata(Greg.) Grunow	-	+	+	-
*109- N. clausii*Hantzsch	-	+	+	+
110-*N. dissipata*(Kütz.) Grunow	+	-	-	-
*111- N. fasciculata*Grunow	+	+	+	+
112- N. filiformis (W. Smith) Hustedt	-	+	-	+
*113- N. frustulum*Kützing	+		+	+
*114- N. gracilis*Hantzsch	+	+	+	-
*115- N. hungarica*Grunow	-	-	+	+
*116- N. intermedia*Hantzsch ex Cleve &Grunow	-	+	+	+
*117- N. kützingiana*Hilse	+	-	+	+
*118- N. microcephala*Grunow	+	-	+	-
*119- N. obtusa*W. Smith	-	-	-	+
120- *Rhoicospheniacurvata*(Kütz.)Grunow	-	-	+	+
*121- Surirellaovalis*Kützing	-	+	+	+
122-S.ovate Kützing	-	+	-	+
*123- Syandra. Capitata*Ehrenberg	+	-	+	+
124- S. ulna (Nitz.) Ehrenberg	+	+	+	+
*125- S. ulna*var. *biceps* Kützing	-	-	+	-
*126- S. ulna*var. *oxyrhynchus*Kützing	-	-	+	-

*127- S.pulchella*Kützing.	-	-	-	+
*128- S. affinis*Kützing	-	-	+	+
Total 128	**61**	**45**	**73**	86

Table 2 :-Total number of epiphytic algae on *Hydrilla verticillata* in the study seasons Tigris river Dora site in the study period

Seasons / Classes	Winter		Spring		Summer		Autumn		Genera
	No.	%	No.	%	No.	%	No.	%	
CYANOPHYCEAE	6	9.8	2	4.4	6	8.2	9	10.5	6
CHLOROPHYCEAE	7	11.5	4	8.9	8	11	11	12.8	9
BACILLARIOPHYCEAE	48	78.7	39	86.7	59	80.8	66	76.7	24
Total	61		45		73		86		39

Table (3): Total number of epiphytic algae on *Hydrilla verticillata* (individual/g WW) in the Tigirs river Dora site in the study period.

Taxa	w.	%	Sp.	%	S.	%	A.
Cynophyceae	5.41×10^4	2.91	1.3×10^4	0.6	2.48×10^4	0.84	8.49×10^4
Chlorohpyceae	5.4×10^4	2.6	89.79×10^4	35.5	252.57×10^4	87.5	181.78×10^4
Bacillarophyceae	186.14×10^4	97.8	214.86×10^4	100.0	268.27×10^4	76.2	301.64×10^4
Total	196.95×10^4		305.95×10^4		491.91×10^4		523.32×10^4

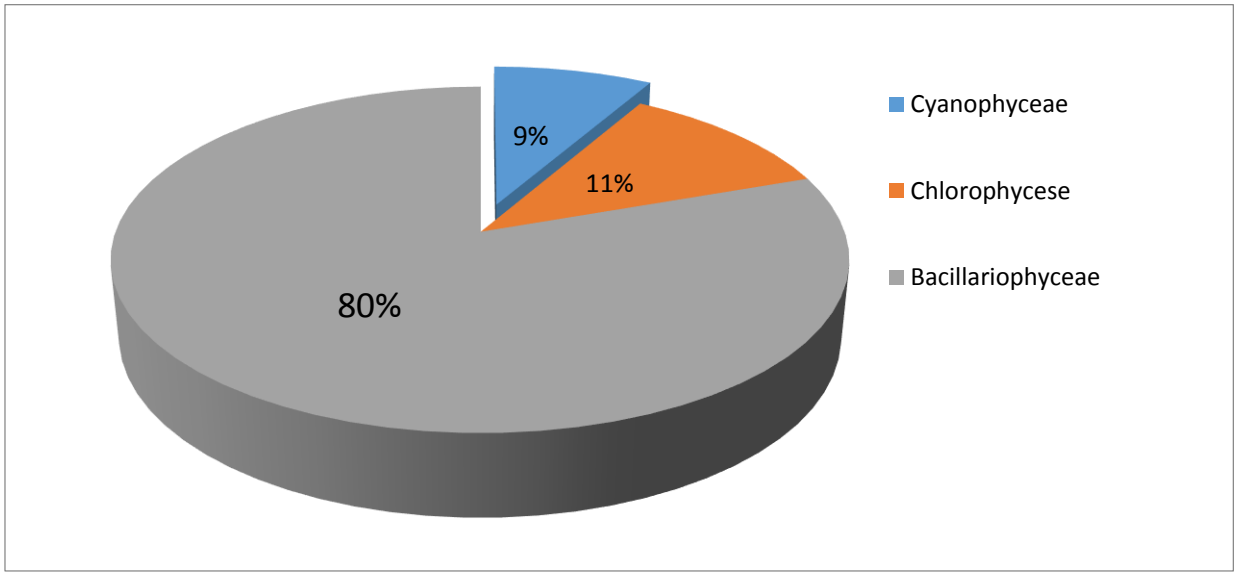

Fig.2 : The percent of identifying classes of epiphytic algae on *Hydrilla verticillata* in theTigris river in Al- Dora site in the study period.

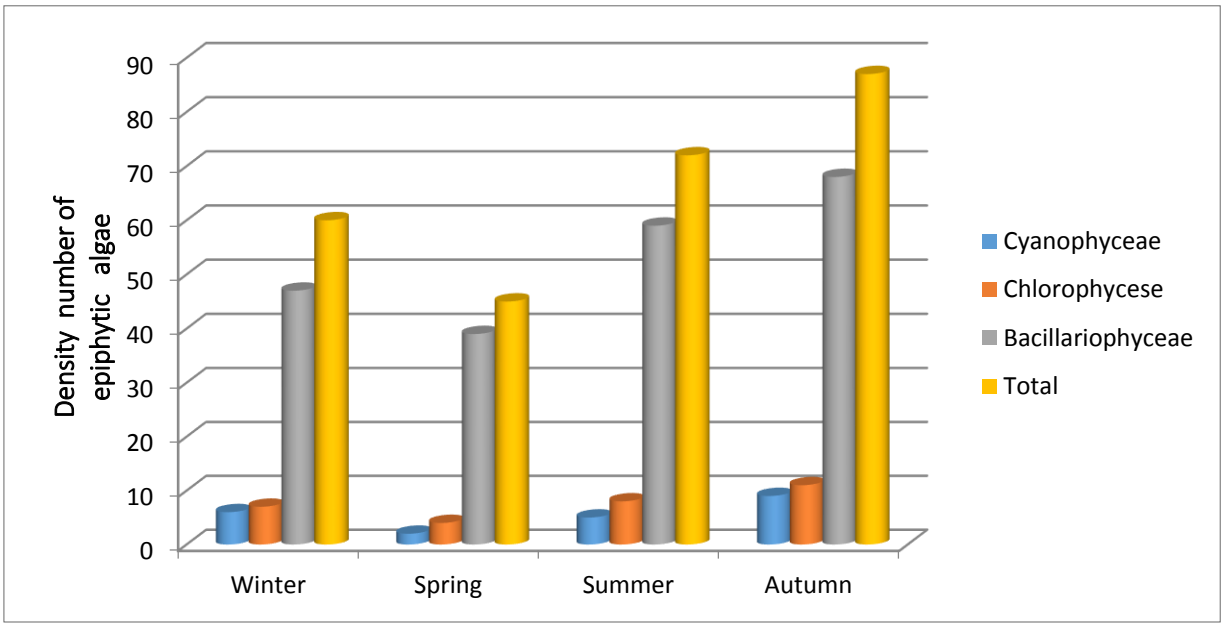

Fig.3: The seasonal variation of the total number of class epiphytic algae on *Hydrilla verticillata* of the Tigris river in Al-Dora site in the study period.

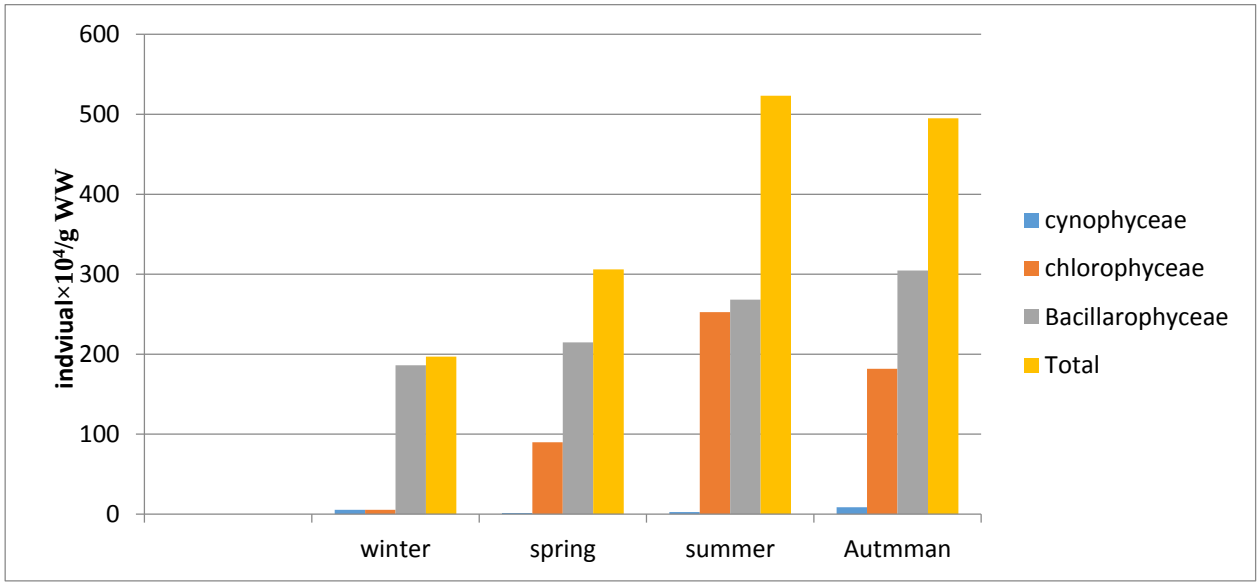

Fig.4: Seasonal variation of the total count number of the epiphytic algae on *Hydrilla verticillata* inTigris River in the study period.

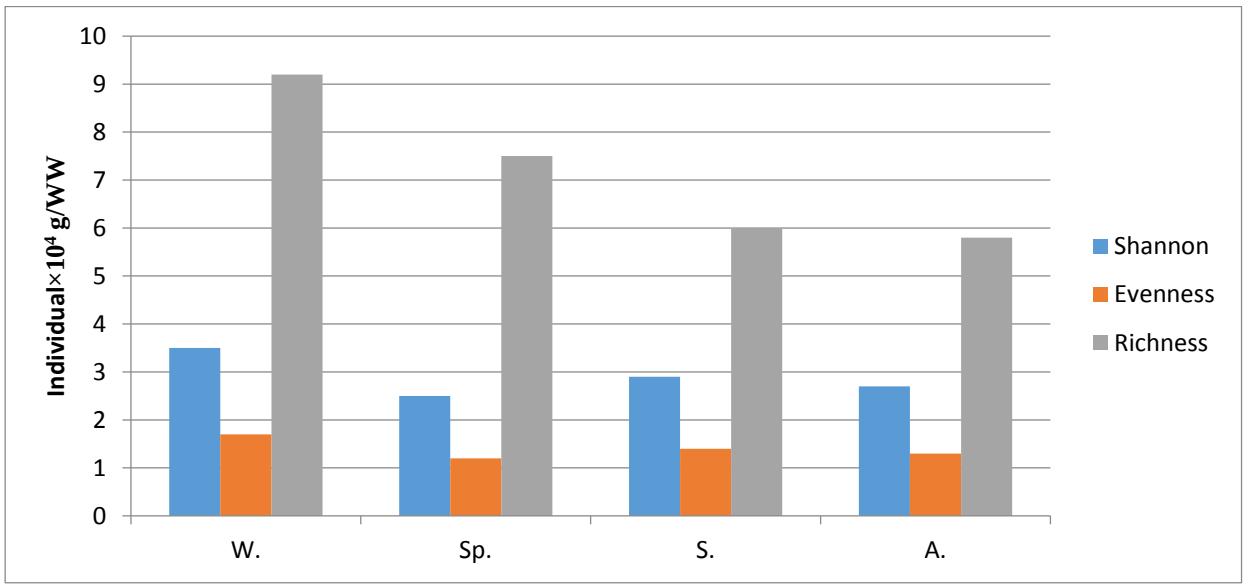

Fig.5: Seasonal variation in biodiversity indices of epiphytic algae on *Hydrilla verticillata* inTigris River in Al- Dora sitin the study period.

Conclusion

The benthic algae is vital for primary producers in freashwater ecosystem. This study recorded seasonal varation for qualitative and quantitative of algae. Diatoms algae were dominant group of algae in all seasones study which due to ability to stay fluctuation environmental factors

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