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A Qualitative Study of Non-diatom Phytoplankton in East Al- Hammar Marsh

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ABSTRACT

The current study was organized to identify the phytoplankton at four sites of the East Hammar Marsh (Al-Sada, Al-Mansoury, Al-Dawody and Al-Baraka) from December 2019 to November 2020. Upon examining 135 phytoplankton species (non-diatom), it was noticed that 70 Chlorophyta species belonged to 27 genera (52%), 38 Cyanophyta (cyanobacteria) species belonging to 15 genera (29%), 12 Euglenophyta (Euglenozoa) species belonging to three genera (9 %), eight *charophyta* species belonging to two genera (6%), four Dinophyta (Miozoa)species belonging to three genera (3%) and two Chrysophyta (Ochrophyta) species belonging to two genera (1%) were detected. In addition, five new species were recorded in Iraqi algal flora, two of which are Cyanobacteria. *Chroococus mipitanensis* and *Gomphosphaeria semen-vitis* are all species of the Cyanophyceae class. Moreover, the study identified two species; namelt, *Tetrastrum heteracanthum* (class Chlorophyceae) and *Dicloster acuatus* (class Trebouxiophyceae) belonging to Chlorophyta, as well as one species from Ochrophyta, *Dictyocha fibula* (class Dictyochophyceae). On identifying the algal flora (phytoplankton) in the East Al-Hammar Marsh after it was forced dry (during the 1990s) and flooded in 2003, it was found that the ecosystem's characteristics changed, and some species disappeared while others arose.

INTRODUCTION

Phytoplankton are autotrophic microorganisms that can manufacture their own food with the help of the sunlight; they exist in oceans, lakes, rivers, and other water bodies **(Umami *et al.*, 2018)**. Photosynthesis by phytoplankton is a major part of the carbon cycle; it was estimated that roughly 40% of carbon dioxide is globally fixed on an annual basis, and it elevates the productivity of aquatic food webs **(Schaum *et al.*, 2017)**. The natural food chain is supported by the phytoplankton community in water bodies, which depends on it for the natural fauna to keep alive, including fish populations. They produce over 70% of the world's atmospheric oxygen at the same time. Phytoplankton respond quickly to environmental variations due to delicate alterations in nutrients and their short life cycle **(Taipale *et al.*, 2019; Bergstrom *et al.*, 2020)**. In a wetland ecosystem, phytoplankton act as a basic food and a hostess for other species, viz. zooplankton and fish **(Waniek & Holliday, 2006)**. Wetlands play a role in the flow of water, water storage and biological productivity. Many researchers have been interested in studying algae in Iraq's inland water over the past many years, including the Shatt al-Arab river and its branches and Al-Hammar Marsh. Studies have recently increased were conducted addressing algae with climate and environmental impacts. The study of **Keel and Saad (1975)** showed 138 species distributed across the three regions, consisting of three groups of 17 species of blue green algae, 27 species of green algae and 94 species of diatom, some of which are of marine origin. In Iraqi wetlands, one phytoplankton peak was observed in spring **(Al-Saboonchi *et al.*, 1982)**, while two peaks were detected in the spring and autumn **(Al-Zubaidi, 1985)**. **Al-Mousawi *et al.* (1994**) recorded two phytoplankton peaks at Al-Hammar wetlands, one in autumn 1987 and the other in July 1988. During the summer of 2004 to the spring of 2005, researchers at Al-Hewaizeh, Suq Shuyukh, and East Hammar Marshes observed the dominance of Bacillariophyceae, followed by Chlorophyta and Cyanophyta **(Hammadi *et al.*, 2007)**. According to **Talib (2009)**, phytoplankton has two peaks, one was detected in spring 2006 (March) and the other in May 2006 at Al-Hewaizeh Marsh, while two peaks were observed in April 2006 and October 2006 at Al-Hammar Marsh, and the first peak was in July 2006 and the second in October 2006 in the central marshes. **Al-Saad *et al.* (2010)** published a study on the physical and chemical properties of Al-Hammar and Al-Hewaizeh Marshes. **Hassan *et al.* (2011)** conducted a study on primary productivity and chlorophyll-a levels in Iraq's southern marshes " Al-Hewaizeh, central marshes, and AlHammar " after the restoration process. **AL-Shammary *et al.* (2015)** mentioned the East Al-Hammar Marsh after restoration using the Canadian model, while **Al-Saboonchi *et al.* (2015)** postulated the assessment of the East Al-Hammar Marsh using the trophic state Index. **Talib (2017)** examined the physical and chemical characteristics in the Al-Hammar Marsh. **Al-Hussieny and Thijar (2016)** recorded 38 algal species for the first time in Iraq in the Hawizeh, Chebaish, and Hammar Marshes, including 6 species of Chlorophyta, 7 species of Cyanophyta, 1 species of Chrysophyta, 15 species of Bacillariophyta, 7 species of Euglenophyta, and 2 species of Pyrrophyta.. Al Hammar Marsh's water quality index is the subject of the research of **AL-Musawi *et al.* (2018)**. The marsh water was brackish due to the high concentration of fully dissolved solids streaming in from the estuaries of the feeding channels coming from the Euphrates River, as well as from the tidal phenomenon via the river Shatt Al-Arab. **Alwaeli and Athbi (2021)** discovered nine algal species in the Shatt Al-Arab River; namely, six Chlorophyta species (*Eremosphaera tanganyikae, Microspora wittrockii*, *Monoraphidium komarkova*, *Mychonastes pusshpae, Scenedesmus similagineus*, and *Spongiococcum tetrasporum*), one Cyanophyta species (*Pseudanabaena catenata*), and one Dinophyta species (*Impagidiniumparadoxum*). Whereas, seven phytoplankton species were identified in the study of **Ali *et al.* (2021)** for the first time in Iraq, including *Characium debaryanum*, *C. gracilipes*, *Chlamydomonas cienkowskii*, *Oocystis apicurvata*, *Phacus acuminatus va r. drezoolskii*, *Monomorphina pseudonordstedtii,* and *Stipitococcus* sp.

The aim of this research was to identify the algal flora (non-diatom phytoplankton) in the East Al-Hammar Marsh since the ecosystem features have changed as a result of forced dehydration during the 1990s. The wetland was subjected to deliberate desiccation. After being inundated in 2003, the marsh restored its vegetation and wildlife.

MATERIALS AND METHODS

Description of study area

The East Al- Hammer Marsh is a representative of the south-eastern part of Iraq's vast southern marshes (Fig. 1). It runs for more than 33 kilometers and has a maximum depth of 1.1 to 6.0 meters, depending on the tide. It's a semi-diurnal tidal marsh fed by the Arabian Gulf's water via the Shatt Al Arab River **(Richardson & Hussain, 2006; Hussain & Sabbar, 2020)**. The study extended from December 2019 to November 2020, and phytoplankton were collected from four different locations as shown in Table (1) (Al-Sada, Al-Mansoury, Al-Dawody and Al-Baraka). Al-Sada is about 6km from the Karma Bridge, and it was dried up in the 1990s, with a depth of approximately 7m during the low tide. It represents a home of a variety of creatures, including birds, crustaceans, and a site for fishing activities for fish, shrimp and birds, which means that the region is the lowest islands; it was recently destroyed owing to the progression of the saline tongue. During the low tide, the depth of Al- Mansoury is approximately 2m, and it is located 4 kilometers away. Al-Dawody is a narrow water channel with limited depth, about 4m with a difference in the height of the muddy land on both sides, and the existence of a variety of aquatic plants and birds in the region. Al-Baraka is wide and characterized by its shallowness; its depth seldomly exceeds three meters, except at low tide, where it rarely exceeds 0.5 meters. It has several pits and is almost always moisturizing. It's 13 kilometers from the first location and is a home for a variety of aquatic species, including fish and shrimp, as well as a variety of birds, reptiles, and other animals.

Table 1. Locations of sample collection sites in the East Al- Hammar Marsh

Location	Site	North	East
S1	Al-Sada	30″37 ˚24.2	47″40 ˚07.7
S2	Al-Mansoury	30″40 ˚31.4	47″37 ˚22.9
S3	Al-Dawody	30″41 ˚30.5	47″35 ˚52.1
S4	Al-Baraka	30″41 ˚47.8	47″32 ˚59.6

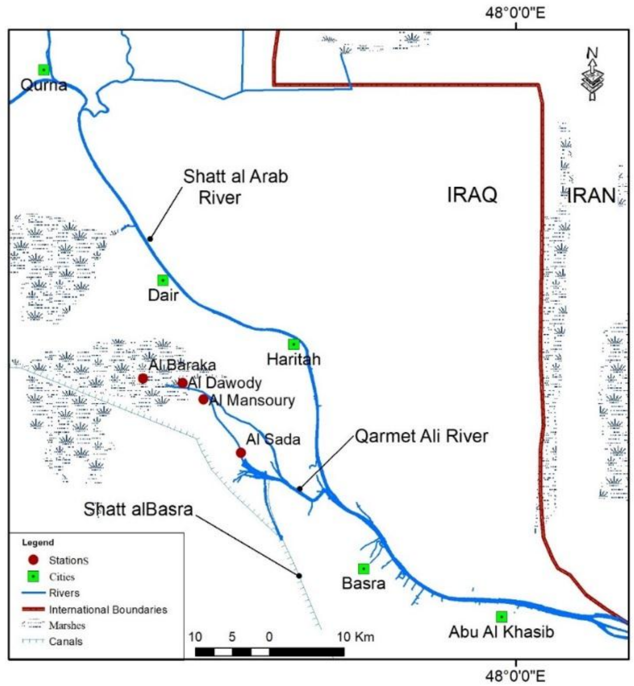

Fig. 1. A map of sample collecting sites in the East Al- Hammar Marsh

The samples were collected using a phytoplankton net with a mesh size of 20μm, the Phytoplankton net was thrown into the water and pulled at a proper speed for 15 minutes and then the contents of the net were collected in the polyethylene bottle and stored in the field using formalin solution with a concentration of 4%.

Diagnose of Phytoplankton

To identify algae (non diatom), one drop of sample was placed on a glass slide, covered with a glass cover slip, and examined with a microscope with magnification (40x). Silicoflagellates were examined either directly or by removing organic materials from cells and cleaning up their silicon structures for microscope investigation and species identification so that the valve structure can be seen, the frustules were cleaned by boiling them in hydrogen peroxide **(Taylor *et al.,* 2007; Al-Handal & Wulff, 2008)**10ml sample was heated for 30-45 minutes in 20mL of 30 % H2O2; the suspension was washed four times with distilled water and filtered using Whatman No. 1 filter paper (Fig. 2). Permanent slides were made using Naphrax®. Algae morphology and cell size (diameter, length, and width) (400x magnification). Studied algae were screened using a digital camera microscope (SCMOS03000KPA) and the references of **Desikachary (1959)**, **Prescott (1982)** and **WoRMS (2019)** to identify algae.

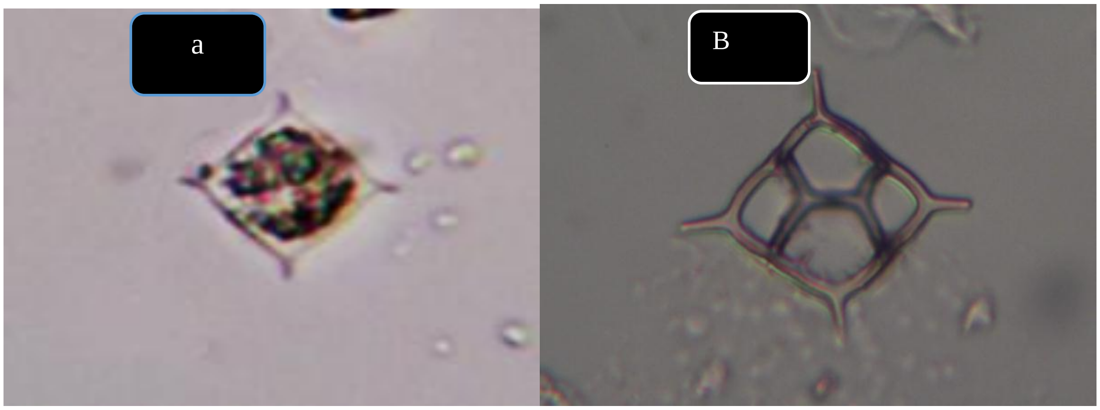

Fig. 2. Dictyocha fibula, a- (organic material before removed), b- (organic material after removed)

RESULTS AND DISCUSSION

In the current study, different species of non-diatom phytoplankton were shown at the four sampling sites. A total of 135 species from 52 genera were identified for phytoplankton belonging to Chlorophyta 70 species and 27 genera with (52 %), cyanobacteria 38 species and 15 genera with (29 %), Euglenozoa12 species and three genus with (9 %), charophyta eight species and two genera with (6%), Miozoa four species and three genus with (3 %) and Ochrophyta two species and two genera with (1%). The number of phytoplankton species differs among sites; 23, 17, 29 and 24 species of cyanobacteria were detected at Site1, Site 2, Site 3 and Site 4, respectively. Chlorophyta species recorded 36, 37, 48, and 40 species at Site1, Site 2, Site 3 and Site 4, respectively. Euglenozoa species recorded seven , nine, nine and five species at Site1, Site 2, Site 3 and Site 4, respectively. Miozoa species recorded three, three, one and two species at Site1, Site 2, Site 3 and Site 4, respectively. Moreover, Ochrophyta species recorded two, zero,one and zero species at Site1, Site 2, Site 3 and Site 4, respectively, and all are presented in Table (2). There were several species (Table 3) that were previously recorded in the Iraqi Flora Checklist **(Maulood *et al*., 2013)**, while there are five species in the current study that were recorded for the first time in Iraq. Two species belong to Cyanobacteria Cyanophyceae; namely, *Chroococus mipitanensis* and *Gomphosphaeria semen-vitis*, two species belong to Chlorophyta,*Tetrastrum heteracanthum*, *Dicloster acuatus* both from the class Trebouxiophyceae, and one species of Ochrophyta, Dictyochophyceae, is *Dictyocha fibula*. Fig. (5) shows a classification of new species based on taxonomic databases available online **(Guiry & Guiry, 2020; WoRMS, 2019)**.

Classification and Description:

Phylum: Cyanobacteria

Class: Cyanophyceae

Order: Chroococcales

Family: Chroococcaceae

Genus: *Chroococcus*

Species:*Chroococcus mipitanensis* (Wolszynska) Geitler (fig5-a)

((**Rosen & Mareš, 2016;** Fig. 39))

Homotypic synonym(s)

Chroococcus turgidus var. mipitanensis Wolszynska

Chroococcus mipitanensis

Rounded-deltoid (irregular shaped) cells consist of 4-8 celled colonies with transparent sheath. Themucilage has more space between and around the cells than in other species. The cells are about 9µm in diameter. This species is found in (S3) in conditions, where the water temperature ranges from (17.5-27) ^{o}C, salinity is from (2.2-2.9) ppt, pH is from (7.75-8) and dissolved oxygen is from (5.59-8.79) mg/l.

Family: Gomphosphaeriaceae

Genus: *Gomphosphaeria*

Species: *Gomphosphaeria semen-vitis* Komárek (Fig5c)

((**Rosen & Mareš, 2016;** Fig.63a-b))

Mucilaginous oval colonies with a diameter of 64µm hyaline sheath; peripheral cells 10 µm long and 5-7.5 µm wide, encircled by a sheath independently and compiled by mucilaginous segments starting from the colony's core. This species is found in (S1,S2.S3) in conditions where the water temperature ranges from (28-32) ^{o}C, salinity is from (2.7-5.3) ppt, pH is from (8-8.5) and dissolved oxygen is from (8.4-13) mg/l.

Family: Gomphosphaeriaceae

Phylum: Chlorophyta

Class: Chlorophyceae

Order: Sphaeropleales

Family: Scenedesmaceae

Genus: *Tetrastrum*

species: *Tetrastrum heteracanthum* (Nordstedt) Chodat (fig5-d)

((**Rosini *et al.*, 2013**, fig. 4i))

Homotypic synonym(s)

Staurogenia heteracantha Nordstedt

Cenobiums are made up of 4 cells that are placed in a specific way, leaving a small central area. Cells are triangular, with a height of 7 µm, straight contact borders, and concave outer margins with two unequally sized straight spines; the larger thorn is 8 µm long, while the smaller thorn is 3 µm long. This species is found in (S1,S2) in conditions where the water temperature ranges from (26.3-33.9) ^{o}C, salinity is from (2.1-3.8) ppt, pH is from (7.8-8) and dissolved oxygen is from (7.5-7.9) mg/l.

Class: Trebouxiophyceae

Order: Chlorellales

Family: Chlorellaceae

Genus: *Dicloster*

Species: *Dicloster acuatus* C.-C.Jao, Y.S.Wei & H.C.Hu (Fig5-e)

((**Komárek and Fott , 1983***):* p. 811, Fig. 224:4*;* **Krasznai and Béres , 2021**) : Fig. 3:b)

Cenobiums are made up of 4-8 cells, one of which is lunate and curved at a right angle to the others. Lunar cells are 8.5 µm long and 2.3 µm wide, with extremely long spines at each pole. 4.47 µm in diameter, with a distance between high points of 32-62 µm This species can be found in (S1) when the water temperature is between (15-18) C^{o}, the salinity is between (2.6-2.9) ppt, the pH is (8), and the dissolved oxygen is between (9.5-11.5) mg/l.

Phylum: Ochrophyta

Class: Dictyochophyceae

Order: Dictyochales

Family: Dictyochaceae

Genus: *Dictyocha*

species: *Dictyocha fibula* Ehrenberg (Fig5-f)

(**Ajuzie and Houvenaghel, 2015**)

A skeleton is made up of four protruding spines and four windows. The basal ring is quadrangular, with four radial rings of roughly equal length, and spines on the corners. The apical spine (4.8 µm) is taller than the side spine (4 µm), and the skeleton is 12 to 45 µm in length. This species is found in (S1,S3) in conditions where the water temperature ranges from (16-33.9) ^{o}C, salinity is from (2.2-3.5) ppt, pH is from (8-8.2) and dissolved oxygen is from (9.8-10.2) mg/l.

Table 2. Number of genus, species and percentage for different sites of East Al- Hammer

phylum	No.of genus	No.of species	S1		S2		S3		S4		percentage %
			Genus	Species	Genus	Species	Genus	Species	Genus	Species	
Cyanophyta	15	38	11	23	9	17	14	٢٩	11	24	29%
Chlorophyta	27	70	20	36	17	37	21	48	21	40	52%
charophyta	2	8	1	3	1	2	2	4	2	3	6%
Euglenophyta	3	12	3	7	3	9	2	9	2	5	9%
Dinophyta	3	4	2	3	2	3	1	1	2	2	3%
Chrysophyta	2	2	2	2	0	0	1	1	0	0	1%
Total	52	135	39	74	32	68	41	92	38	74	100 %

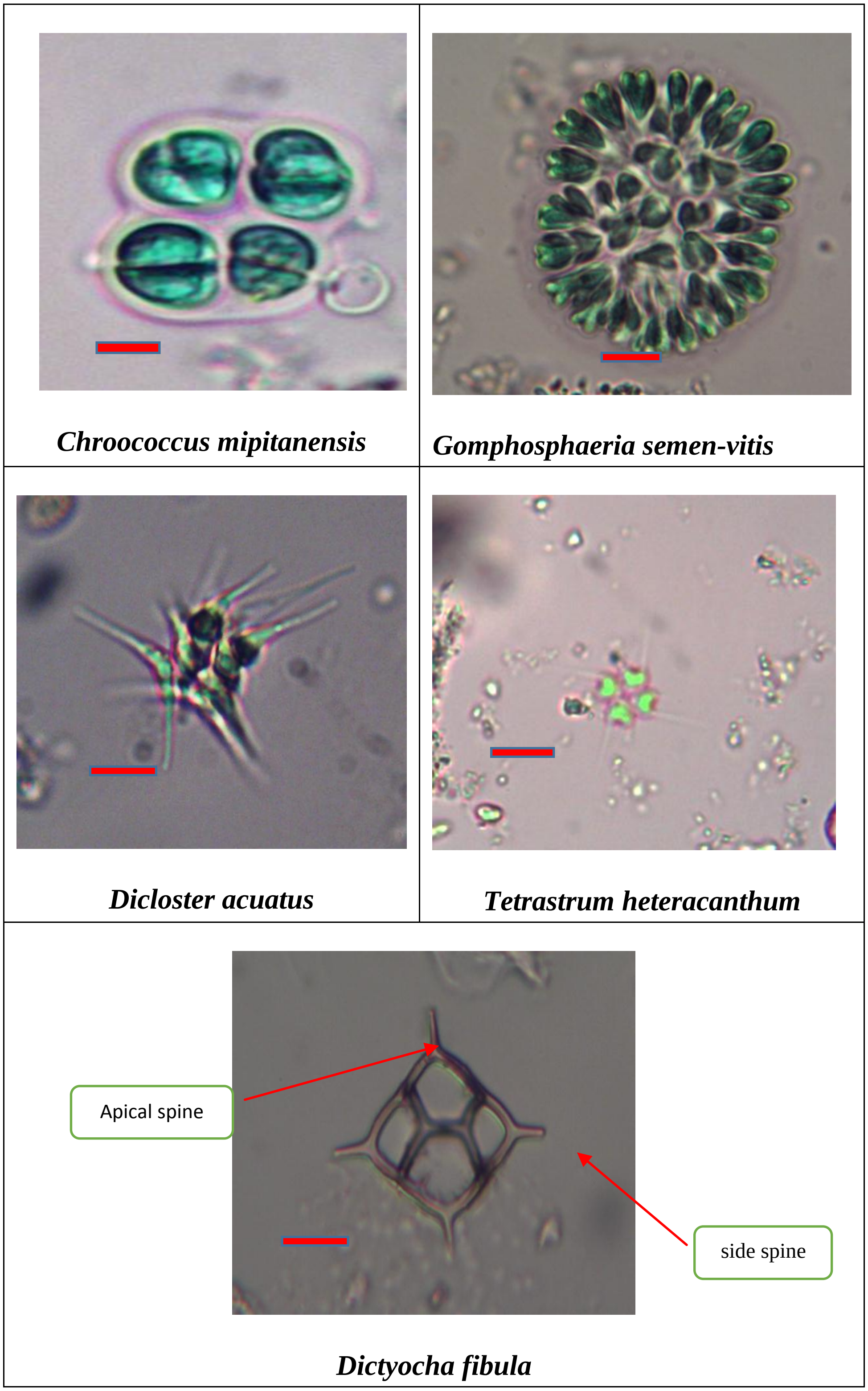

Fig. 5. The new species of phytoplankton in East Al-Hammar marsh during 2019 2020. ▬ 10 µ is each

***Table 3.occurrence of species in East Al- Hammer marsh, S1= Al-Sada, S2= Al-Mansoury, S3= Al-Dawody,S4= Al- Baraka (+ = available , - = unavailable)**

	species	S1	S2	S3	S4
	Cyanophyta (Cyanobacteria)				
1	*Anabaena flos-aquae* (Bornet & Flahault) Elenkin	+	-	+	+
2	*Anabaenopsis circularis* (G.S.West) Wołoszyńska & V.V.Miller	-	-	+	-
	Anabaenopsis elenkinii V.V.Miller	-	-	+	+
3	*Chroococcus dispersus* (Keissler) Lemmermann	+	+	+	-
	C. giganteus West	-	-	+	-
	C. limneticus Lemmermann	+	-	-	+
	C. minor (Kützing) Nägeli	-	+	-	-
	C. minutus (Kützing) Nägeli	-	-	+	+
	C. mipitanensis (Wolszynska) Geitler	-	-	+	-
	C. turgidus (Kützing) Nägeli	+	+	+	-
4	*Coelosphaerium dubium* Grunow	+	-	-	+
	Coelosphaerium kuetzingianum Nägeli	+	+	+	-
5	*Gloeocapsa aeruginosa* Kützing	+	-	-	-
6	*Gomphosphaeria aponina* Kützing	+	+	+	+
	G. aponina var. *cordiformis* Wolle	+	+	+	+
	G. aponina var. *delicatula* Virieux	-	-	+	+
	Gomphosphaeria semen-vitis Komárek	-	+	+	+
7	*Johannesbaptistia pellucida* (Dickie) W.R.Taylor & Drouet	+	+	+	+
8	*Komvophoron minutum* (Skuja) Anagnostidis & Komárek	+	-	+	-
9	*Merismopedia convoluta* Brébisson ex Kützing	-	-	+	+
	M. elegans A.Braun ex Kützing	+	-	+	+
	M.glauca (Ehrenberg) Kützing	+	+	+	+
	Merismopedia punctata Meyen, nom. illeg.	+	+	+	+
10	*Microcystis aeruginosa* (Kützing) Kützing	+	+	+	+
	Microcystis aeruginosa f. *flos-aquae* (Wittrock) Elenkin	+	+	+	+
11	*Lyngbya aerugineocaerulea* Gomont	-	-	+	-
12	*Oscillatoria agardhii* Gomont	+	-	-	-
	Oscillatoria brevis Kützing ex Gomont	-	-	+	+
	Oscillatoria curviceps C.Agardh ex Gomont	+	-	+	+
	O. limnetica Lemmermann	-	+	+	+
	O. limosa C.Agardh ex Gomont	+	-	+	+
	O. princeps Vaucher ex Gomont	+	+	+	+
	O. splendida Greville ex Gomont	+	-	-	+
	Oscillatoria tenuis C.Agardh ex Gomont	-	+	+	+
13	*Phormidium ambiguum* Gomont	-	+	+	-
14	*Pseudanabaena galeata* Böcher	+	-	+	+

15	*Spirulina gigantea* Schmidle	-	-	+	+
	Spirulina major Kützing ex Gomont	-	+	-	-
	Chlorophyta				
1	*Actinastrum hantzschii* Lagerheim	+	+	+	-
2	*Ankistrodesmus acicularis* (Braun) Korshikov	-	+	+	-
	A. convolutus Corda	-	-	+	+
	A.falcatus (Corda) Ralfs	-	-	+	+
	A.falcatus var. *acicularis* (A.Braun) G.S.West	+	-	-	-
3	*Carteria cordiformis* (H.J.Carter) Diesing	-	+	+	+
4	*Chlamydomonas angulosa* O.Dill	+	+	+	+
	C. globosa J.W.Snow	+	+	+	+
5	*Chlorella ellipsoidea* Gerneck	+	+	+	+
	C. vulgaris Beijerinck	+	+	+	+
6	*Chlorococcum humicola* (Nägeli) Rabenhorst	+	-	-	-
7	*Chodatella ciliata* (Lagerheim) Lemmermann	-	-	+	+
8	*Closteriopsis longissima* (Lemmermann) Lemmermann	-	-	+	+
9	*Coelastrum astroideum* De Notaris	+	+	+	+
	C.microporum Nägeli	+	-	+	+
	C.reticulatum (P.A.Dangeard) Senn	-	-	+	+
10	*Crucigenia crucifera* (Wolle) Kuntze	+	+	-	+
	C.quadrata Morren	+	-	-	+
	C.rectangularis (Nägeli) Gay	-	+	+	-
	C.tetrapedia (Kirchner) Kuntze	+	+	+	+
11	*Dicloster acuatus* C.-C.Jao, Y.S.Wei & H.C.Hu	+	-	-	-
12	*Dictyosphaerium ehrenbergianum* Nägeli.	-	+	+	+
	D.pulchellum H.C.Wood	-	-	+	+
13	*Eudorina elegans* Ehrenberg	+	+	+	+
14	*Gloeocystis gigas* (Kützing) Lagerheim	+	-	+	-
15	*Golenkinia radiata* Chodat	+	-	-	+
16	*Gonium pectorale* O.F.Müller	+	-	+	-
17	*Kirchneriella contorta* (Schmidle) Bohlin	-	+	-	+
	K. obesa (West) West & G.S.West	-	+	-	-
18	*Lagerheimia ciliata* (Lagerheim) Chodat	-	-	+	+
19	*Monoraphidium contortum* (Thuret) Komárková-Legnerová	+	-	-	+
20	*Oocystis borgei* J.W.Snow	+	+	+	+
	O.crassa Wittrock	+	+	-	-
	O. elliptica West	-	-	+	+
	O. lacustris Chodat	-	+	+	+
	O. natans G.M.Smith	-	-	+	-
	O. solitaria Wittrock	-	+	+	-

21	*Pandorina morum* (O.F.Müller) Bory	+	+	+	+
22	*Pediastrum boryanum* (Turpin) Meneghini	+	-	-	-
	Pediastrum duplex Meyen	-	-	+	+
	P.duplex var. *reticulatum* Lagerheim	-	+	+	-
	P. simplex Meyen	+	+	+	+
	P. tetras (Ehrenberg) Ralfs	+	+	+	-
23	*Pleodorina californica* W.R.Shaw	-	-	+	+
24	*Scenedesmus abundans* (O.Kirchner) Chodat	+	-	-	-
	S.acuminatus (Lagerheim) Chodat	+	+	+	+
	Scenedesmus acuminatus var. *inermius* (Playfair) Playfair	-	+	+	-
	S. acuminatus var. *minor* G.M.Smith	-	-	-	+
	S.acutus Meyen	-	-	+	+
	S.arcuatus (Lemmermann) Lemmermann	+	-	-	-
	S. armatus (Chodat) Chodat	-	+	-	-
	S. bernardii G.M.Smith	-	-	+	+
	S.bijugus (Turpin) Lagerheim	-	-	+	-
	S.bijugatus Kützing, nom. illeg.	+	+	+	+
	S.brasiliensis Bohlin	+	-	-	-
	S.dimorphus (Turpin) Kützing	+	-	+	+
	S.ellipticus Corda	-	+	+	+
	S. opoliensis P.G.Richter	+	+	-	-
	S. obliquus (Turpin) Kützing	+	+	-	-
	S.quadricauda (Turpin) Brébisson	+	+	+	+
	S.quadricauda var. *maximus* West & G.S.West	-	-	-	+
25	*Schroederia setigera* (Schröder) Lemmermann	-	+	+	+
26	*Tetraëdron caudatum* (Corda) Hansgirg	-	-	+	-
	T.incus (Teiling) G.M.Smith	-	-	+	-
	T.minimum (A.Braun) Hansgirg	-	-	+	+
	T.muticum (A.Braun) Hansgirg	-	+	+	-
	T. regulare Kützing	+	+	+	-
	T.trigonum (Nägeli) Hansgirg	-	+	-	-
27	*Tetrastrum heteracanthum* (Nordstedt) Chodat	+	+	-	-
	T. staurogeniiforme (Schröder) Lemmermann	+	+	-	-

	charophyta				
1	*Closterium moniliferum* Ehrenberg ex Ralfs	-	-	+	+
2	*Cosmarium abbreviatum* Raciborski	-	-	-	-

	C. angulosum Brébisson	+	-	-	+
	C. botrytis Meneghini ex Ralfs	+	-	+	-
	C. contractum O.Kirchner	-	+	-	-
	C. granatum Brébisson ex Ralfs	-	-	-	+
	C. hammeri Reinsch	+	-	+	-
	C. meneghinii Brébisson ex Ralfs	-	+	+	-
	Euglenophyta(Euglenozoa)				
1	*Euglena acus* (O.F.Müller) Ehrenberg	-	-	+	-
	E. convoluta Korshikov	+	+	-	-
	E. elongata W.Schewiakoff	-	-	+	-
	E. gracilis G.A.Klebs	-	+	+	+
	E.oxyuris Schmarda	-	+	-	-
	E.polymorpha P.A.Dangeard	+	+	+	+
	E. proxima P.A.Dangeard	+	+	+	+
	E. spirogyra Ehrenberg	+	+	+	+
2	*Lepocinclis glabra* Drezepolski	+	+	-	-
3	*Phacus acuminatus* A.Stokes	+	+	+	+
	P. caudatus Hübner	+	+	+	-
	P.curvicauda Svirenko	-	-	+	-
	*Dinophyta***(Miozoa)**				
1	*Glenodinium armatum* Levander	-	+	+	-
2	*Noctiluca scintillans* (Macartney) Kofoid & Swezy	+	-	-	+
3	*Peridinium bipes* F.Stein	+	+	-	+
	P. cinctum (O.F.Müller) Ehrenberg	+	+	-	
	Chrysophyta (Ochrophyta)				
1	*Dictyocha fibula* Ehrenberg	+	-	+	-
2	*Dinobryon sertularia* Ehrenberg	+	-	-	-

*Checklist of Iraqi Flora (**Maulood *et al.*,** 2013),

The area of pre-drying of Al-Hammar Marshes is 3500 km2. The eastern half of the marsh, known as East Al-Hammar wetland, was flooded in 2003, where the study area is located. The marsh was subjected to forced drying in the 1990s due to a drying campaign. As a result, the ecosystem's properties have changed, and all of its creatures, including algae, have been affected. Study of **Al-Thahaibawi *et al.*, (2021**) recorded phytoplankton's response to re-flooding. Flooding by the domestic population in 2003, when dehydrating areas were inundated in 2004, where 40% of the land had been flooded, and the area had arrived as water and rehabilitation continued. The wetlands are roughly 58% submerged (**UNEP, 2007**), resulting in phytoplankton blooms (**Al-Obaidi *et al.*, 2009**).

A total of 135 species from 52 genera were studied in the current study. Some. These genera include *Scenedesmus* (17 species), *Cosmarium* (7 species), *Oocystis* (6 species), *Tetraedron* (6 species), *Pediastrum* (5 species), *Crucigenia* (4 species), and *Ankistrodesmus* (4 species).There are eight species of Cyanophyta, including *Oscillatoria*. *Chroococcus* was found with 6 species, *Merismopedia* with 4 species, *Gomphosphaeria* with 3 species, *Anabaenopsis* with 2 species, *Spirulina* with 2 species, and also recorded *Komvophoron minutum*, *Pseudanabaena galeata*, Euglenophyta like *Euglena* was found with 8 species, *Phacus* was found with 3 species, *Lepocinclis glabra*, Dinophyta like *Peridinium* found with 2 species, *Glenodinium armatum, Noctiluca scintillans* .results indicated that the organization of communities living in freshwaters is drastically altered by falling water levels combined with increased nutrient concentrations, and the rising water temperature, as well as sediment resuspension and stratification, All of these factors contribute to influencing the presence of phytoplankton species in the eastern Hammar marsh.

The species recorded in Table 3 were mentioned in the checklist of algae in Iraqi waters that was published approximately every ten years (**Mauloud *et al.*, 2013; Aziz and Ahmed 2022**) except five species, *Chroococus mipitanensis, Gomphosphaeria semen-vitis, Staurogenia heteracantha Dicloster acuatus Dictyocha fibula*) were recorded them modern .*Dictyocha fibula* (Ochrophyta)species, have been identified as a marine species (**Guiry and Guiry, 2020**), as well as the oceans (**Throndsen, 1997**), and was previously recorded *Dictyocha fibula* in Kuwaiti water (**Al-Yamani *et al.*, 2004; Al-Kandari *et al.*, 2009**). It was discovered for the first time in Iraq's Eastern Al-Hammar marsh . Silicoflagellates are photosynthetic microalgae that reside at the top of the water column and have adapted to exist in both cold and warm conditions. They are distinguished from other phytoflagellates by their skeleton (**Parkinson and Ontogeny 2002**).*Dictyocha fibula* was founded in conditions the water temperature ranges from (16-33.9) ^{o}C, salinity is from (2.2-3.5) ppt, pH is from (8-8.2) and dissolved oxygen is from (9.8-10.2) mg/l. Four new freshwater algae species were discovered for the first time in Iraq in the eastern Al-Hammar marsh , two from the blue-green group including (*Chroococus mipitanensis*,conditions where the water temperature ranges from (17.5-27) ^{o}C, salinity is from (2.2-2.9) ppt, pH is from (7.75-8) and dissolved oxygen is from (5.59-8.79) mg/l. *Gomphosphaeria semen-vitis*,in conditions where the water temperature ranges from (28-32) ^{o}C, salinity is from (2.7-5.3) ppt, pH is from (8-8.5) and dissolved oxygen is from (8.4-13) mg/l, and two from the green group *Staurogenia heteracanth* aconditions where the water temperature ranges from (26.3-33.9) ^{o}C, salinity is from (2.1-3.8) ppt, pH is from (7.8-8) and dissolved oxygen is from (7.5-7.9) mg/l. *Dicloster acuatus* in conditions where the water temperature ranges from (15-18) ^{o}C, salinity is from (2.6-2.9) ppt, pH is (8) and dissolved oxygen is from (9.5-11.5) mg/l).

Some previous research on the marshes of Iraq indicates the change of the environment. **Maulood *et al.* (1981**) noted that the major body of the marshes has recently changed, and that man-made environmental changes will have an increasing impact on the marshes' ecology and the adaptation of algae in the future. Suggested (**Maulood and Hassan, 2021**)that research is still scarce after the conditions of drying and flooding to which they were exposed, particularly the southern marshes.The current study has added new species of phytoplankton found in the eastern Al- Hammar marsh.Due to significant changes in environmental circumstances in the region as a result of heat waves and their ramifications, such as a lack of water supplies, high temperatures, and salt tide, there is a chance of discovering unique types of algae, particularly phytoplankton.

CONCLUSION

Some of the species found in the current study suggest that the environment has changed and that saltwater organisms have adapted to live in fresh water, and by returning to the algae checklist, it is clear that aquatic environments in Iraq living species of phytoplankton not registered yet and need more research.

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