

Cyanophyta Recorded in Erbil, Kurdistan Region of Iraq

JANAN JABBARTOMA¹ and BAHRAM K MAULOOD²

¹College of Science, University of Salahaddin, Hawler, Kurdistan Region of Iraq.

²Hawler Botanical Garden, Hawler, Kurdistan Region of Iraq.

DOI : <http://dx.doi.org/10.12944/CWE.8.1.07>

(Received: March 22, 2013; Accepted: April 10, 2013)

ABSTRACT

Two hundred forty four species of blue green algae have been listed and recorded in this investigation. The listed species belong to five main groups of cyanophyta, making up all together forty six genus. It was found that blue green algae in Erbil represented (54%) of Iraqi blue green algae, and (11%) of all known algae in Iraq so far.

Key words: Cyanophyta, Erbil, Kurdistan, Iraq.

INTRODUCTION

The¹ may be regard as the first one who did a detail study on algae in Iraq as he studied phytoplankton in Razzah and Al-Habbaniyah. However (2 and 3) did published a preliminary study on algae around Baghdad, Mesopotamia and Kurdistan respectively.

Concurrently with establishing different universities in different parts of Iraq during seventy last century attention were given to algal studies in parallel with other branches of sciences. Tens of papers and M.Sc thesis were furnishing the local and international journals with various aspects of algal studies. The university of Sulaimaniah team under the leadership of Prof B.K. Maulood and Bassarah university under leadership of prof Al-Saadi and Haddi (4, 5 and 6).

One of the important outcome of these investigation was the addition of new division of algae to Iraqi & Kurdistan flora, the red algae with more than 6 species have been described in details (7 and 8).

Recently 3 successive check list of algae in Iraq have been produced every decade since 1983. The fourth one is underway for publication by the Maulood et al.

A series of keys for identification of different species of cyanophyta have been attempted by Maulood & Aziz but it have been realized that they are not so precise going to apply since quite many more species are continuously been added to the flora of Kurdistan & Iraq throughout continuous surveys this is in one hand, the survey should extend to all other part of the country. On the other hand because of this such attempt should be terminated and not applied.

The present study is dealing with the whole 244 known species of blue green algae within Erbil province and their distribution in various habitats such as pond, lake, river, stream, ditches etc—, and appeared in these figures (1, 2, 3, 4 and 5) are represented in different districts within Erbil province.

Description of the area

The Erbil province (Fig.1) is capital of Kurdistan and situated in the north east of Iraq. It is bounded to the north east and south east by the Greater and Lesser Zab rivers. Boundaries extend from longitudinal 43° 15' E to 45° 14' E and from latitude 35° 27' N to 37° 24' N (9).

The climate of the area is characterized by a wide diurnal and annual range of temperature (9). The climate most closely related to Irano-Turanian type. The average annual rainfall may exceed 1000mm. The annual average rainfall for

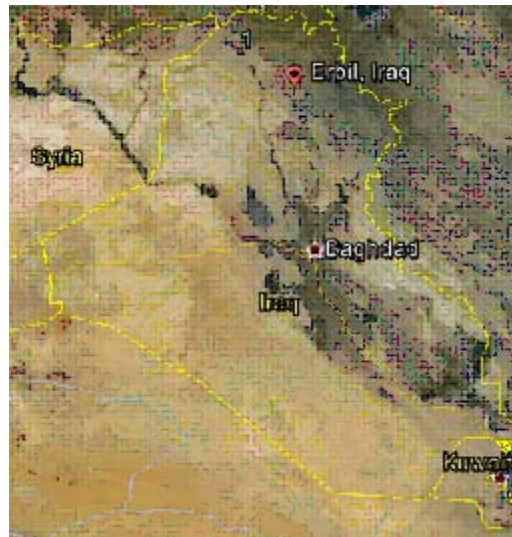


Fig. 1: Map of Iraq show Erbil Province

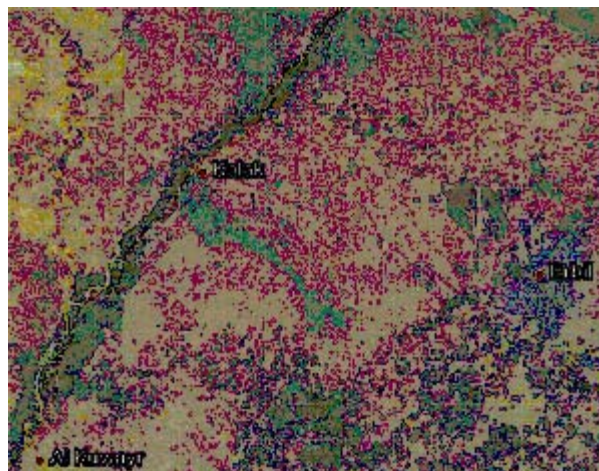


Fig. 2: Map of Erbil show Kalak and Al-Kuwayr districts

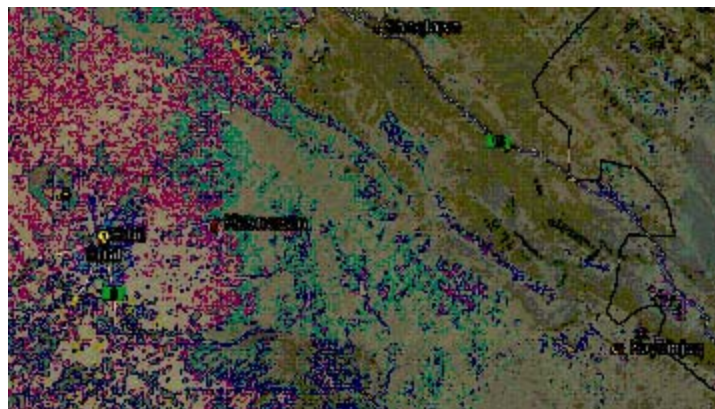


Fig. 3: Map of Erbil show Kasnazan, Shaqlawa and Koysinjaq districts

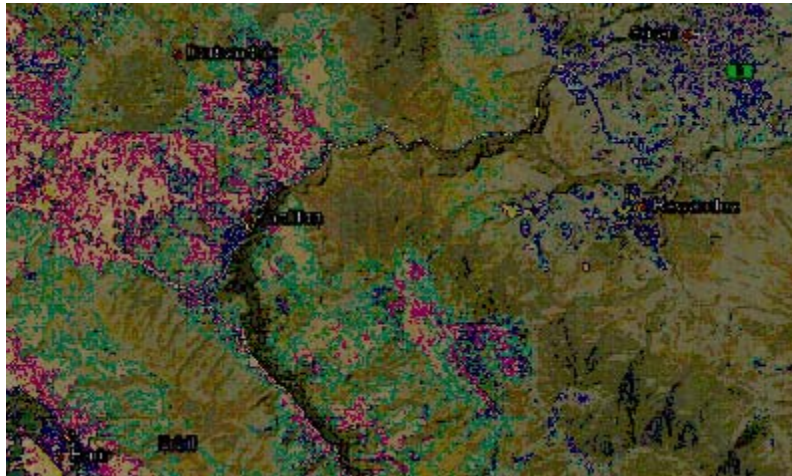


Fig. 4: Map of Erbil show Khalifan, Soran,Rawanduz and Harir districts

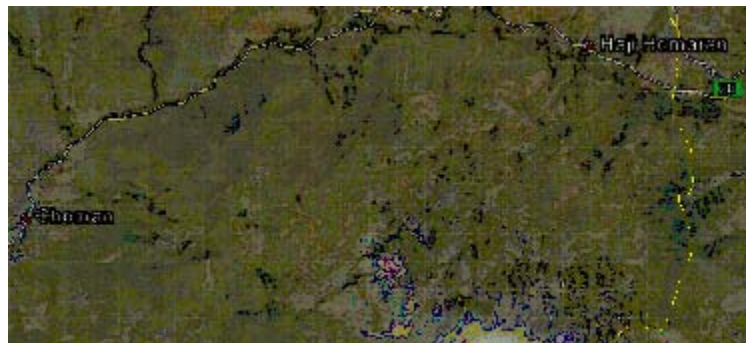


Fig. 5: Map of Erbil show Choman, and Haji Homaran

Erbil city estimated to be 440mm(10).. Details of geology, pedology and limnology of the area may given in¹¹.

In the present study the habitat and taxonomy of all species that was published in different journals and different periods of time where gather together and documented in these papers(12, 13, 14, 15, 16, 17, 18, 19, 20and 21) as seen in theses figures (1, 2, 3, 4 and5), then after may start such study on other of algae such as green, yellow green, red ect....., in Erbil and other different province of Kurdistan of Iraq will be dealt with in coming in future.

RESULTS AND DISCUSSIONS

Throughout a review of all published scientific reliable information about blue green

algae in Arbil, it was found that out of 244 species, that have been recorded in Arbil province(Table.1) almost 52.9% are belonging to Oscillatoriales, whereas 30.4% of the genres are belonging to chroococales. In contrast Oscillatoriales made up less than 22% of the genus, which was less than Nostocales which was more than of Chaemisphonaes & less than Chroococales as well.

Number of species of Oscillatoriales in Arbil was found to be almost double of that of species number of Chroococales and fourfold higher than Nostocales, whereas the number of species of Chaemisphonaes was almost ten folds less than that of Oscillatoriales.

The total number of blue green algae in Arbil province makeup almost (54%) of total blue

Table 1: Number of genus and species of blue green algae that recorded during this study

Orders of Cyanophyta	Number of genus	Percent of genus	Number of species	Percent of species
Chroococales	15	32.6	60	24.6
Chamaesiphonales	2	4.3	4	1.6
Pleurocapsales	5	10.9	7	2.9
Oscillatoriales	10	21.7	129	52.9
Nostocales	14	30.4	44	18.0
	46		244	

Type of Algae	Site
Division : CYANOPHYTA	
1-Order: Chroococales	
1-Aphanocapsadelicatissima West and West	Kasnazan impoundment, Dlopa basin
A. elachista West and West	Degala stream
A. elachista var. planctonica G.M. Smith	Deygella Mountain stream
A. endophytica G.M. Smith	Kasnazan impoundment , Dlopa basin
A .montana Cramer	Degala stream, Dermanawa spring
2-Aphanothececastagnei (Breb.) Rabenhorst	Hamammok spring, Kany Gawra spring
	Dermanawa spring, Jale thermal spring,
	Kasnazan impoundment, Dlopa basin
A.nidularis var endophytica West & West	Kasnazan impoundment, Dlopa basin,
	Wastewater(at Hawera subdistrict, at Gamsh
	Tapa village, Greater ZabRiver at Kunder
	area)
A. saxicola Naegeli	Dermanawa spring, Kassnazan
	impoundment Dilope basin
3-Chroococcus dispersus Lemmermann	Kasnazan impoundment ,Dlopa basin
C. dispersus var minor G..M.Smith	Wastewater(at Tooraq village, at Arab-Kand
	village, at Tarijan village), Kassnazan
	impoundment , Dlopa basin
C. giganteus West and West	Kasnazan impoundment, Dlopa basin
C. hansgirgi Schmidle	Gali Ali-Bag area
	Kasnazan impoundment, Shekhi Balakan
	spring, Sarta spring, Chneran spring, Aqubani
	saru spring
C. limneticus Lemmermann	
C.limneticus var elegans G.S.Smith	Wastewater(at Tooraq village, at Arab-Kand
	village) , Kasnazan impoundment , Dlopa
	basin
C. limneticus var subsalsus Lemmermann	Basstora stream, wastewater(at Jimakah&
	Binberz village, at Saadawa village, at
	Hawera subdistrict,at Gamesh Tapa village)
C. minimus var careneus	Wastewater(at Tooraq village)
C. minor (Ktz.) Naegeli	Dlopa spring, Jale thermal spring,

	wastewater(at Tooraq village, at Arab-Kand village, at Tarjan village) , Shekhi Balakan spring, Sarta spring, Chneran spring, Sheraswar spring, Haji Marg, Haji Agha, Haji Ahmad, Kasnazan impoundment, Kasnazan Kahreeze
C. minutus (Ktz.) Naegeli	Dlopa spring, Bahrka spring, Hamammok spring, Basstora stream, Jazshnakan stream, Jazshnakan Kahreeze, Degala stream, Sardaw spring, wastewater(at Jimakah & Binberz village, at Saadawa village, at Hawera village, Greater Zab River at Kunar area), Kasnazan impoundment, Dlopa basin, Debaga spring
C. tenax (Kirchn.) Hieron	Hamammok spring, Gomaspan darband, wastewater
C. turgidus (Ktz.) Naegeli	Bahrka spring, Basstora stream, Rubary Koya, Gomaspan darband, Sulauke stream, Geli Muzik stream, Shekhi Balakan spring, Azadi spring, zar gali thermal spring, Sheraswar spring, Kani Piawan, Haji marg, Qalasnji Khwaru, Seta spring, Kasnazan impoundment ,Dlopa basin, wastewater(at Jimkah & Binberz village, at Trjan village, at Saadawa village).
4-Coelosphaeriumdubium Grunow	Kasnazan impoundment, Dlopa basin
C. kuetzingiana Naegeli	Degala stream
5-Dactylococcopsisfascicularis Lemmermann	Kasnazan impoundment, Kasnazan Kahreeze
6-Eucapsisalpina Clem .and Schantz	Degala stream
7-Gloeocapsaaeruginousa (Garm) Keutzing	Kasnazan impoundment, Dlopa basin, wastewater(at Tarjan village, at Gamsh Tapa village)
G. calcarea Tilden	Gomasheen pond, Kassnazan impoundment, Dlopa basin, wastewater(at Tarjan village, at Saadawa village)
G. compacta Kuetz	Degala stream, wastewater(at Saadawa village, at Hawera subdistrict, at at Gamsh Tapa village, Greater Zab River at Kudar area)
G. dermochroe Naegeli	Gomasheen pond
G. fusco-lutea Naegeli	Gali Ali-Bag area
G. gelatinosaKuetz	Suse stream
G. kuetzingiana Naegeli	Kanya gawra(concret tank), Dlopa spring,
Hamammok spring, Dermanawa spring	
G. luteofusca Martens	Kasnazan Kahreeze, Jale thermal spring
G. pluerocapsoids Novacek	Bahrka spring
G. polydermatica Kutz	Gali Ali-Bag area
G. punctate Naegeli	Bahrka spring, Dlopa spring, Kassnazan impoundment, Dermanawa spring
G. quaternaria Keutzing	Dermanawa spring

G. rupestris Kutz	Gali Ali-Bag area, Kasnazan impoundment, Dlopa basin
8-Gloeothecalinear is Naegeli	Kehres Qoritan
9-Gomphosphaeriaaponina Kuetzing	Degala stream
G. mauloodianum Kuetzing	Degala stream
10-Gleocystisgigas Kuetz	Wastewater(at Tooraq village, at Tarajan village, at Saadawa village, Gamesh Tapa village, at Greater Zab River at Kudar area)
11-Merismopediaconvolute de Brebison district, at Gamesh Tapa village)	Degala stream, wastewater(at Hawera sub
M. elegans A.Braun	Basstora spring, Hamammok spring, wastewater(at Tooraq at village, Gamesh Tapa village)
M. glauca (Ehr.) Naegeli	Deygella Mountain stream, Basstora spring, Hamammok spring, Dermanawa spring, Rubary Koya, Gomasheen pond, Jazshnekan stream, Kasnazan impoundment, Degala stream
M. marsoni A.Braun	Gomaspan darband
M. minima Heck	Basstora spring, Jazshnekan spring, Degala stream, Dlopa stream, Sheraswar spring, Piawan spring
M. punctata Heyen	Bistana spring and stream, Deygella mountain stream, Basstora spring, Hamammok spring, Rubary Koya, Jazshnakan stream, Degala stream, Gomaspan stream, Kasnazan impoundment, Kani -Hunjir spring, wastewater(at Hawera sub district, Greater Zab River at Kudar area)
M. tenussima Lemmermann	Serta springs(Batas), Azadi spring, Zar gali thermal spring, Aqubani saru spring, Piawan spring, Kasnazan impoundment
M. trolleri Bachmann	Bistana spring and stream, Gomaspan darband, Geli muzik stream, Degala stream, Sulauke stream
12-Microcystisaeruginosa Kuetzing	Degala stream, wastewater(at Saadawa village, at Hawera sub district)
M. elongata Nov	Wastewater(at Saadawa village, at Hawera sub district)
M. elabens Breb	Bahrka spring, Dlopa spring, Dermanawa spring, wastewater(at Tooraq village, at Gamesh Tapa village, Greater Zab River at Kudar area)
M. flos-aquae (Witr.) Kirchner	Basstora spring
M. marginate (Menegh) Kuetzing	Bahrka spring, Basstora spring, Degala stream, wastewater(at Tooraq village, at Hawera sub district, Gamesh Tapa village)
13-Rhabdoderma irregularare Geitler	Dibaga spring, Jale thermal spring
14-Synechococcus aeruginosus Naegeli	Jale thermal spring
S. elongatus Naegeli	Dibaga spring, Mersaid thermal spring

- 15-Synechocystissaline Wisloush
 Spevalekii Erecegevic
 2-Order : Chamaesiphonalis
 1-Chamaesiphoncurvatus Nordst
 C. siderophilus Starmach
 C. siderophilus var. glabra C.B. Rao
 2-Chlorogloeamicrocystoides Geitler
 3-Order: Pleurocapsales
 1-Hyellaespitosa Born and Flah
 2-Myxosarcinaburmensis Skuja
 M. amathystina Skuja
 M. spectabilis Printz
 3-Pleurocapsaminor Hansginosa
 4-Stichosiphon regularis Skuja
 5- Xenococcuskernerii Hansgirg
- 4-Order: Oscillatoriales
 1-Arthrospiramassarti Kuffareth
 2-Borziatrilocularis Cohn
 3-Lyngbyaaerugineo-coerulea (Ktz.) Gomont
- L. allorgi Frey
 L. bipunctata Lemmermann
 spring, Piawan spring, spigra spring,
 L. birgei G.M. Smith
 L. chaetomorpha lynger and Deskachary
 L. circumerata G.M. Smith
 L. contorta Lemmermann
 L. corbierei Frey
 L. cryptovaginata Schkorbatow
 L. digueti Gomont
 L. epiphytica Hieron
 L. gardneri (Setchell and Gardner Geitler)
 L. gracilis Rabenh
 spring, Dlopa spring, Degala stream
 L. hojdenii Gomont
 L. infixata Frey
- Bahrka spring, Kanya Gawra spring (concret tank)
 Jale thermal spring, Mersaid thermal spring
 Lesser Zab River(Altun Kopre)
 Bekhal spring, Rubary Koya
 Bekhal spring, Beer a Baraza small spring
 Gomaspan darband
 Rubary Koya
 Rubary Koya
 Smaqulu bridge
 Kasnazan Kahreeze
 Kahreeze Qoritan, Kasnazan Kahreeze,
 Gomasheen pond, Rebury Koya
 Degala stream
 Degala stream, Gomasheen stream,
 Jazshnakan Kahreeze, Kanya Gawra (concret tank)
 Graw Haji Omaran thermal spring
 Degala stream
 Kanya Gawra, Dlopa spring, Dermanawa
 spring, Rubary Koya, Kasnazan Kahreeze,
 Wastewater(at Saadawa village, Greater Zab
 River at Kudar area)
 Darbandy Gomaspan
 Serta spring, Graw Haji Omaran thermal
 Degala stream, Jazshnakan stream
 Bekhal spring, Graw Haji Omaran thermal
 spring, Shekhi Balakanspring, Azadi spring
 Sisawa spring, Khrwatan spring, Sardaw
 spring
 Qush Tepe(silted channel on Arbil-Kirkuk
 road), Khrwatan spring, Sardaw spring
 Degala stream
 Degala stream, Smaqulu spring
 Lesser Zab River (Altun Kopre), Karhres
 Qoritan, Dolpa spring, Kassnazan
 impoundment, Dlopa basin
 Kassnazan impoundment, Dlopa basin
 Debaga spring, Beer a Baraza spring,
 Basstora spring, Degala stream
 Kany- Hanjir, Piawan spring, Hamammok
 Degala stream
 Khres Qoritan, Shekhi Balakanspring, Graw
 Haji Omaran thermal spring, Chneran spring,
 Spigra spring

L. kashiapii Ghose	Gomaspan stream
L. kuetzingii Schmidle	Korre stream, Jazshnakan Kahreeze, Wastewater, Azadi spring, Zar- gali thermal spring, Piawan spring, Qalasnji Khwara spring
L. lachneri (zimm.)Geitler	Qush Tepe(silted channel on Arbil-Kirkuk road), Kanya Gawra(concret tank), Dermanawa spring, Rubary Koya, Basstora stream, Kasnazan Kahreeze, Gomasheen pond
L. lagerheimii Gomont	Kuna Dlopa spring, Korre stream,Shekhi Balakanspring,Zar gali thermal spring, Aqubani Saru spring, Piawan spring
L. laxespirialis Skuja	Suse stream
L. limnetica Lemmer	Wastewater(at Tarjan village) , Suse stream, Kasnazan impoundment, Kasnazan Kahreeze, Dlopa basin
L. lutea (Ag.) Gomont	Wastewater(at Saadawa village, Gamesh Tapa village)
L. martensiana Meneghini	Jale thermal spring, Suse stream, Wastewater(at Tarjan village, Gamesh Tapa village), Kasnazan impoundment, Dlopa basin
L. mesotrica Skuja	Shekhi Balakanspring,Zar gali thermal spring, Sheraswar spring
L. nordgardhiiWille	Chneran spring Kany Gawra, Dlopa spring, Hamammok spring, Dermanawa spring, Mersaid thermal spring
L. perelegans Lemmermann	
L. putealis Montagne	Darbandy Gomaspan stream
L. semiplenaWille	Kany Shekh spring
L. taylorii Drouet and Strickland	Kasnazan impoundment, Dlopa basin
L. versicolor (Wartmann)Gomont	Kasnazan impoundment, Dlopa basin, Wastewater(at Tooraq village, at Hawera sub district, Greater Zab River at Kudar area)
4- Microcoleusacutissimus Gardner	Darbandy Gomaspan stream
M. paludosus (Ktz.) Gomont	Darbandy Gomaspan stream, Gomasheen stream, Shekhi -Balakan spring, Graw Haji Omaran thermal spring, Piawan spring, Qalasnji saru spring, Haji Ahmad spring
M. vaginatus (Vauch.) Gomont	Basstora stream, Graw Haji Omaran thermal spring, Sheraswar spring, Aqubani saru spring, Spigra spring, Seta spring
5-Oscillatoriaacuta Bruhl and Biswas	Basstora stream,Zar gali thermal spring, Qalasnji Khwaru spring, Haji Ahmad spring, Wastewater(at Tooraq village, at Jimakah & Binberz village)
O. acuminatum Gomont	Kasnazan impoundment, Sulauke stream, Wastewater(at Arab-Kand village, at Tarjan

- O. acutissima* Kufferath
village, Gamesh Tapa village)
Shekhi Balakan spring, Qalasnji Khwaru spring
- O. agardhii* Gomont
Serta spring, Korre small stream, Bistana stream and spring, Khrwatan spring, Kany Shekh, Smaqulu spring, Kasnazan impoundment, Dlopa basin
- O. amoena* (Ktz.) Gomont
Kuna Dlopa spring, Rubary Koya, Hamammok spring, Sarta spring, Kany Harir, Sardaw spring, Sorad spring, Shekhi Balakan spring, Zar gali thermal spring, Grawi Haji Omaran thermal spring, Azadi spring, Aquabani Sara spring, Piawan spring, Haji Agha spring, Qalasnji Khwaru spring, Smaqulu spring, Wastewater(at Tooraq village, at Arab-Kand village), Gomasheen pond, Jazshnakan stream, Degala stream, Kasnazan spring, Kasnazan impoundment, Dlopa basin
- O. amoena* var. *nongranulata* Ghose
Shekhi Balakan spring, Zar gali thermal spring, Sarta spring, Haji Agha spring, Sheraswar spring
- O. amphibia* Agardh
Qush Tepe silted channel on Arbil –Kirkuk road, Pir Dawood pond, Grawi Haji Omaran thermal spring, Sarta spring, Kasnazan impoundment, Dlopa basin
- O. amphigranulata* Van Goor
Bawyan spring near Batas, Mulla Omer fouled channel on Arbil Massif road
- O. anguina* (Bory) Gomont
Bawyan spring near Batas, Bekhal spring, Grawi Haji Omaran thermal spring, Azadi spring, Aquabani saru spring, Spigra spring
- O. animelis* Agardh
Dermanawa spring
- O. annae* Gomont
Grawi Haji Omaran thermal spring, Azadi spring
- O. articulata* Gardner
Kahres Qoritan outflow on Arbil Makhmur road, Wastewater(at Saadawa village, Hawera sub district, Greater Zab River at Kudar area)
- O. boryana* Bory
Wastewater(at Tooraq village, at Jimakah & Binberz village, Gamesh Tapa village)
- O. brevis* (Ktz.) Gomont
Kasnazan impoundment, Dlopa basin
- O. chalybea* Mertens
Darbandy Gomaspan stream, Degala stream, Wastewater(at Tarjan village, Greater Zab River at Kudar area)
- O. chlorina* Kuetz
Wastewater(at Jimkah & Binberz village, Gamesh Tapa village), Grawi Haji Omaran thermal spring, Azadi spring, Shekhi Balakan spring, Zar gali thermal spring, Qalasnji Khwaru spring, Haji Ahmad spring, Seta spring, Kasnazan Kahreeze
- O. curviceps* Agardh
Zar gali thermal spring, Azadi spring,

	Sheraswar spring, Seta spring, Pond near suse
O. decolorata	Kasnazan impoundment, Degala stream, Smaqulu spring
O. framyii De Joni	Smaqulu spring, Dlopa spring
O. formosa Bory	Kuna Dlopa spring, Jale thermal spring, Mersaid thermal spring, Wastewater(Gamesh Tapa village, Greater zab river at Kudar area), Degala stream, Shekhi Balakan spring, Grawi Haji Omaran thermal spring, Azadi spring, Sarta spring, Hanjir spring, Piawan spring, Haji Marg spring, Spigra spring, Haji Ahmad spring , Kasnazan impoundment, Dlopa basin
O. granulata Gardner	Kasnazan impoundment, Dlopa basin, Wastewater(at Arab-Kand village, at Hawera sub district)
O. irrigua Kuetzing	Degala stream, Grawi Haji Omaran thermal spring, Azadi spring, Spigra spring, Sartka spring
O. jasorvensis Vouk	Smaqulu spring
O. laete-virens (Crouan) Gomont	Wastewater(at Tooraq village, at Jimkah & Binberz village, at Tarjan village, Greater Zab River at Kudar area) , Grawi Haji Omaran thermal spring, Azadi spring, Chneran spring, Aquabani saru spring, Spigra spring, Dlopa spring
O. limnetica Lemmermann	Mama-Jalka spring, Sarta spring, Kany Hanjir spring, Sisawa spring, Bawyan spring, Khrwatan spring, Harir spring, Sardaw spring, Jale thermal spring, Mersaid thermal spring, Grawi Haji Omaran thermal spring, Haji Marg spring, Qalasnji saru spring, Seta spring
O. limosa Roth Agardh	Kasnazan Kahreeze, Darbandy Gomaspan stream, Mama Jalka spring, Sarta spring, Sisawa spring, Grawi Haji Omaran thermal spring, Azadi spring, Sheraswar spring, Piawan spring, Degala stream, Kasnazan impoundment, Dlopa basin
O. martini Fremy	Wastewater(at Tarjan village, at Saadawa village)
O. minima Gicklhorn	Kasnazan impoundment, Dlopa basin, Kasnazan Kahreeze
O. mougeotti Gomont	Kasnazan impoundment, Dlopa basin, Degala stream, Tweska stream, Pond near suse, Sulauke stream
O. nigra Vaucher	Gomasheen stream, Hamammok spring, Bahrka spring, Sarta spring, Sisawa spring, Kany Shekh spring, Sorad spring, Wastewater(

	at Tooraq village, at Saadawa village, Greater Zab River at Kudar area), Grawi Haji Omaran thermal spring, Tweska stream, Kasnazan impoundment, Dlopa basin, Kasnazan Kahreeze
O. obscura Bruhl	Wastewater(at Tarjan village, Saadawa village), Grawi Haji Omaran thermal spring, Shekhi Balakan spring, Degala stream
O. okeni Agardh	Shekhi Balakan spring, Azadi spring, Zar gali thermal spring, Sarta spring, Hanjir spring, Chneran spring, Aquabani saru spring, Piawan spring, Spigra spring
O. perornata Skuja	Mama Jalka spring, Khrwatan spring, Sardaw spring, Degala stream
O. princeps Vaucher	Hamammok spring, Rubary Koya, Jale thermal spring, Degala stream, Bistana spring
O. prolifica (Grev.) Gomont	Kasnazan impoundment, Dlopa basin
O. proteus Skuja	Mulla Omer fouled channel on Arbil Massif road, Pir Dawood pond on Arbil-Makhmur road, Wastewater(at Arab-Kand village, at Hawera village, Gamesh Tapa village), Grawi Haji Omaran thermal spring, Sheraswar spring, Dlopa spring
O. pseudogeminata G.Schmidle	Debaga spring, Dlopa spring, Hamammok spring, wastewater(at Tarjan village, at Hawera sub district)
O. pseudogeminata var. unigranulata Biswas	Dibaga spring, Korre stream, Pir Dawood pond on Arbil-Makhmur road, Jale thermal spring, Mersaid thermal spring
O. raoi Detoni	Dlopa spring, Basstora stream, Darbandy Gomaspan stream, wastewater(at Tooraq village, at Tarjan village, at Saadawa village), Zar gali thermal spring, Chneran spring, Piawan spring
O. rubescens de Candolle	Gomasheen pond, Mama Jalka spring, Sarta spring, Hanjir spring, Kany Shekha, Wastewater(at Hawera sub district), Shekhi Balakan, Grawi Haji Omaran thermal spring, Azadi spring, Sarta spring, Aquabni saru spring, Piawan spring, Haji Marg spring, Qalasnji saru spring, Qalasnji Khwaru spring, Haji Ahmad spring
O. sancta (Ktz.) Gomont	Shewa- sur stream on Koya-Kirkuk road, Degala stream
O. simplicissima Gomont	Kasnazan Kahreeze, Degala stream, Smaqulu spring, Qelasinc spring, Suse stream
O. splendida Greville	Jazshnakan stream, Grawi Haji Omaran thermal spring, Hanjir spring, Qalasnji saru spring, Sheraswar spring, Degala stream, Kasnazan Kahreeze

- O. subbrevis Schmidle
Bawyan spring near Batas, Degala stream, Gomaspan stream, Darbandy Gomaspan stream, Sarta spring, Sisawa spring, Bawyan spring, Sardaw spring, Wastewater(at Tooraq village, Hawera sub district), Grawi Haji Omaran thermal spring, Hanjir spring, Haji Marg spring, sartka spring, Haji Ahmad, Kasnazan impoundment, Dlopa basin
- O. sublifformis Kuetz
Wastewater(at Jimkah & Binberz village, Gamesh village, Greater Zab River at Kudar area), Grawi Haji Omaran thermal spring, Azadi spring, Sheraswar spring, Chneran spring, Smaqulu spring
- O. subtilissima
Dlopa spring
- O. tenuis Agardh
Shewa sur stream on Koya-Kirkuk road, Qush Tepe silted channel on Arbil -Kirkuk road, Dermanawa spring, Gomasheen pond and stream, Gomaspan stream, Darbandy Gomaspan stream, Wastewater(at Tarjan village, at Saadawa village, at Hawera sub district), Grawi Haji Omaran thermal spring, Zar gali thermal spring, Sarta spring, Aquabani spring, Piawan spring, Haji Marg spring, Sartka spring, Degala stream, Samqulu spring, Kasnazan impoundment, Dlopa spring
- O. tenuis var. tergestina Rabenhorst
Jazshnakan stream, Wastewater(at Tarjan village, at Saadawa village, at Hawera sub district) , Kasnazan impoundment, Dlopa spring
- O. terebriformis Agardh
Bawyan spring near Batas, Mulla Omer fouled channel on Arbil Massif road, Qush Tepe silted channel on Arbil -Kirkuk road, Hamammok spring, Dernamawa spring, Gomasheen pond and stream, Degala stream, Jale thermal spring, Mersaid thermal spring, Grawi Haji Omaran thermal spring, Zar gali thermal spring, Azadi spring, Sheraswar spring, Chneran spring, Aquabani saru spring, Piawan spring, Spigra spring, Dlopa spring, Sulauke stream, Suse stream
- O. willei Gardner
Hamammok spring, Wastewater(at Tarjan village, Hawera sub district), Shekh Balakan spring, Grawi Haji Omaran thermal spring, Zar gali thermal spring, Azadi spring
- O. vizagapatensis
Shekh Balakan spring, Grawi Haji Omaran thermal spring, Zar gali thermal spring, Azadi spring, Sarta spring, Chneran spring, Piawan spring, Haji Agha spring, Qalasnji Saru spring
- 6-Phormidiumambiguum Gomontspring
Hamammok spring, Rubary Koya,

P. anomala C.B. Roa	Jazshnakan Kahreeze, Gomaspan stream, Darbandy Gomaspan stream, Smaqulu spring, Kasnazan impoundment, Dlopa Degala stream
P. autumnale (Ag.) Gomont	Hamammok spring, Gomasheen stream, Sartka spring, Hanjir spring, Bawyar spring, Khrwatan spring, Kany Shekh, Sardaw spring, Sorad spring, Shekhi Balakan, Azadi spring, Sarta spring
P. calcicola Gardner	Shekhi Balakan, Grawi Haji Omaran thermal spring, Zar gali thermal spring
P. corium Gomont	Wastewater(at Hawera sub district, Gamesh Tapa village), Kasnazan Kahreeze, Degala stream
P. dimorphus Lemm	Grawi Haji Omaran thermal spring, Azadi spring, Sheraswar spring, Chneran spring
P. favosum(Bory) Gomont	Wastewater(at Greater Zab River at Kudar area), Grawi Haji Omaran thermal Spring, Azadi Spring, Rubary Koya, Gomasheen pond, Gomasheen stream, Gomaspan stream, Kasnazan Kahreeze, Kasnazan impoundment
P. formosum Gomont	Wastewater(at Jimkah & Binberz village, at Tarjan village)
P. foveolarum Gomont	Kahres Qoritan outflow on Arbil-Makhmur road
P. fragile Gomont	Shewa sur(large sandy stream on Koya Kirkuk road), , Grawi Haji Omaran thermal Spring, Hanjir spring, Haji-Agha spring, Haji Ahmad
P. inundatum Ktz	Kasnazan impoundment, Dlopa spring
P. jadinianum Gomont	Degala stream, Kasnazan impoundment
P. laminosum (Gom..) ex. Gomont	Bahrka spring
P. luciduis Ktz	Wastewater(at Hawera sub district , Greater Zab River at Kudar area)
P. molle Gomont	Kuna Dlopa spring, Degala stream, Gomasheen pond, Gomasheen stream
P. mucicola Huber-pest and Naumann	Dibaga spring
P. mucosum Gardner	Dermanawa spring, Kasnazan impoundment, Kasnazan Kahreeze
P. pachydermaticum Fermy	Sarta spring, Hanjir spring, Bawyan spring, Harir spring, Kany Shekh, Sardaw
spring, Degala stream	
P. papyraceum (Ag.) Gomont	Degala stream
P. purpurascens Kuetz	Grawi Haji Omaran thermal Spring, Azadi spring
P. retzii(Ag.) Gomont	Shekhi Balakan, Grawi Haji Omaran thermal Spring, Azadi spring, Zar Gali thermal spring, Sarta spring, Haji Marg spring, Spigra spring, Qalasnji Khwaru spring, Sartka spring,

	Hamammok spring, Degala stream, wastewater(at Saadawa village, at Hawera sub district)
P. subfuscum Ktz	Kasnazan impoundment, Dlopa basin
P. subincrustedatum Fritsch	Gomasheen stream
P. submembranaceum Gomont	Grawi Haji Omaran thermal spring, Azadi spring
P. tenue (Menegh) Gom	Jale thermal spring, Mersaid thermal spring, Grawi Haji Omaran thermal Spring, Sarta spring, Hanjir spring, Sulauke stream
P. uncinatum Gom	Gomaspan stream, Hamammok spring
P. valderianum Fritsch	Suse stream, Jale thermal spring, Mersaid thermal spring
7-Romeriagracilis Koezwara	Qush Tepe silted channel on Arbil -Kirkuk road
8-Schizothrixferiesii Gom	Kasnazan impoundment, Dlopa basin
S. lacustris A.Braun	Kasnazan impoundment, Dlopa basin,
Dermanawa spring,	Darbandy Gomaspan stream
S. lardacea (Cesati)Gom	Dermanawa spring
S. rivularia(Wolle) Drouet	Kasnazan impoundment, Dlopa basin
S. tenctoria Gom	Kasnazan impoundment, Dlopa basin
S. vaginata (Naeg.)Gom	Suse stream
9-Spirulinalabyrinthiformis Gom	Degala stream
S. laxissima G.S. West	Dlopa spring, Bawyan spring, Grawi Haji Omaran thermal Spring, Sarta spring
S. laxissima var. major G.S. West	Dlopa spring
S. major Ktz	Dlopa spring, Rubary Koya, Jazshnakan Kahreeze, Gomasheen pond, Degala stream, Kasnazan impoundment, Wastewater(Hawera sub district, Gamesh Tapa village, Greater Zab River at Kudar area)
S. meneghiniana Zanard	Dlopa spring
S. princeps West and west	Gomaspan stream, Grawi Haji Omaran thermal spring, Degala stream, Kasnazan impoundment, Dlopa basin
S. subsalsa Oersted	Grawi Haji Omaran thermal spring
S. subtilissima Ktz	Qush Tepe silted channel on Arbil -Kirkuk road, Pir Dawood pond on Arbil -Mukhmur road, Jale thermal spring, Mersaid thermal spring, Grawi Haji Omaran thermal spring,
Dlopa spring	10-Raphidiopsissubtilissima Dlopa spring
5- Order : Nostocales	
1-Albrightiartortnosa Copeland	Sawerdy stream
2-Anabaenaeaequalis Borge	Kasnazan impoundment, Dlopa basin
A. circinalis Rabenhorst	Kasnazan impoundment, Dlopa basin
A. constricta (Szafer) Geitler	Kasnazan impoundment, Wastewater(Hawera sub district, Greater Zab River at Kudar area)
A.enlenkini Borge	Kasnazan impoundment, Dlopa basin
A. felisi Borner	Kasnazan impoundment, Dlopa basin
A. sphaerica Barnet at Elahault	Suse stream

A. spiroides Klebahn	Kasnazan impoundment, Dlopa basin
3-Calothrixbraunii Born and Flahault	Kasnazan impoundment, Dlopa basin
C. breviarticulata West and west	Serta spring, Kahreeze Qoritan outflow on Arbil-Mukhmur road
C. brevissima West and West	Degala stream
C. castlelii Massal	Darbandy Gomaspan stream, Dlopa spring, Kasnazan impoundment
C. elenkinii Kuetz	Degala stream
C. epiphytica G.S.West	Dlopa spring, Jazshnakan Kahreeze, Gomasheen pond, Gomasheen stream
C. flusca Kuetz	Samqulu spring
C. fusca (Ktz.) Bornet and Flahault	Kasnazan Kahreeze, Bahrka spring, Dlopa spring, Hamammok spring, Basstora stream, Jazshnakan stream, Darbandy Gomaspan stream, Kasnazan impoundment
C. marchica Lemmermann	Bahrka spring, Dlopa spring, Rubary Koya
C. parietina Thuret	Kasnazan Kahreeze, Bahrka spring, Basstora stream
C. stellaris Bornet and Flahault	Gomasheen Pond, Gomasheen stream
C. viguieri Lemmermann	Smaqulu spring
4-Cylindrospermummajus Kuetzing	Kasnazan impoundment, Dlopa basin
C. minimum G.S.West	Kasnazan impoundment, Dlopa basin
C. muscicolaKtz	Kasnazan impoundment
C. stagnale (Ktz.) Bornet and Flahault	Kasnazan impoundment, Dlopa basin
5-Homoeothrixjanthina (Born and Flah.)Starmach	Dlopa spring, Rubary Koya
H. juliana (Born and Flah.) Kirchner	Rubary Koya, Dlopa spring, Gomasheen Pond, Gomasheen stream, Gomaspan stream, Kasnazan impoundment
6-Michrochaetecalothrichoides Hansg	Smaqulu spring
M. diplosiphon Gomont	Smaqulu spring
M. tenera Thurt	Smaqulu spring
7-Nodulariaspumigena Martens in Jergens	Degala stream
8-Nostoccommune Vaucher	Kasnazan impoundment, Dlopa basin
N. paludosum Ktz	Kasnazan impoundment, Dlopa basin
N. sphaericum Vaucher	Smaqulu spring
N. spongiaeformeKtz	Sawerdy stream, Smaqulu spring
N. verrucosum Vaucher	Smaqulu spring, Bekhal spring
9-Plectonemanotatum Schmidle	Kasnazan impoundment, Dlopa basin
10-Pseudoanabaena Schmidle Taago	Kasnazan impoundment, Kasnazan Kahreeze
11-Rivulariahaematites (D.C.) C.A. Agardh	Degala stream
12-Scytonemaarchangella Born	Pond near suse, Smaqulu spring, Gomaspan darband stream,
S. myochrous Schmidle	Kasnazan impoundment, Dlopa basin
13-Stigonemaminutum Agardh	Degala stream
14-Tolypothrixboutilie (Breb. Et. Desm.) Forti	Gali Ali-Bag area
T. distorta var. penicillata (Ag.)Lemmer	Bekhal spring
T. nodosa Bharadus	Degala stream

green algae in Iraq, whereas the total blue green algae make up (11%) of all algae of Iraq.

Therefore we may say that Arbil province

represent (11%) of blue green algae in Iraq that are distributed throughout different lakes, rivers, stream, pond ect, and throughout the altitude in Kurdistan.

REFERENCES

1. Al-Kaisi, K.A., Study on algae of water system in Iraq. Ph.D. Thesis. Univ of North Wales Pangor. U.K. (1964).
2. Abdin, G.; Al-Kaisi, K., and Naib, F., Some observation on algal flora in and around Baghdad. *Bull. Coll. Arts & Sciences, Baghdad*. **2**: 21-43 (1957).
3. Kolb, R.W and Krieger, W., Susswasserlagen and Mesopotamien & Kurdistan, *Ber. Dutsch. Bot. Ges.* **60**: 336-355 (1942).
4. Hinton, G.F.C and Maulood, B.K. Checklist of the algae from inland water in Iraq. *J of University of Kuwait*. **10**: 191-256 (1983).
5. Maulood, B.K ; Hadi, R.A.M ; Saadalla, H.A.A; Kassim, T.I and Al-Lami-A.A, Checklist of algae in Iraq. *Marine Mesopotamica suppl.* (1): 1-128 (1993).
6. Maulood, B.K and Toma, J.J., Checklist of algae in Iraq. *Scientific Journal of Babylon Univ.* **9**(3):1-62 (2004).
7. Hinton, G.C.F. and Maulood, B.K., Fresh water red algae anew addition to the Iraqi flora. *Nova Hedwigia* **32**:487-497 (1980 b).
8. Maulood, B.K. ; Hinton, G.C.F., Further observations on the distribution of red algae in Iraq, with spacial reference to their ecology. *Zanco (Sci.J. Univ. Sulaimaniya Iraq)*, Series A. **6**(3):1-14 (1980 a).
9. Shalash, A .H .A., The Climate of Iraq. Baghdad. Univ. Co. Op. Printing press work soc. Amman, Jordan, P.85 (1966).
10. Zohary, M. The flora of Iraq and its phytogeographical subdivisions. *Dept. Agr. Iraq. Publ.* **31**: 1-201 (1950).
11. Razoska, J. Euphrates and Tigris, mesopotamion ecology and destiny, Vol: 38. *Monogr. Biol. W. Junk. The Hague-Boston, London.* 122pp (1980).
12. Maulood, B.K. ; Hinton G.C.F. and Al-Dosky, H.S., A study on the blue –green algal flora of Erbil province, Iraq. *Zanco (Sci.J. Univ. of Sulaimaniya, Iraq)*, Series A, **6**(2): 67-90 (1980).
13. Al-Barzingy, Y.O.M., Phycological study within Arbil Province, M.Sc. Thesis, Univ. of Salahaddin –Arbil. (1995).
14. Maulood, B.K. and Raof, I.Y., Further observation on distribution of blue - green algae in Arbil, Kurdistan of Iraq. *J. D. University*, accepted for publication (2002).
15. Aziz, A.H., A phycological study on springs within Arbil province. M.Sc. Thesis. University of Salahaddin, College of Education. Arbil. Iraq (2004).
16. Bapeer, U.H.K., Ecological study on the distribution of algae in different aquatic habitats within Erbil province. Ph.D. Thesis. University of Salahaddin. College of Sciences. Erbil. Iraq (2004).
17. Toma, J. J., Weekly and spatial variation of physico-chemicals variables and algal composition in Kasnazan impoundment, Erbil. Iraq. Accepted for publication in *Journal of Babylon University*. **10**(3) (2004).
18. Goran, S.M.A., Limnology and non-Diatom phytoplankton composition of Dilope spring and Kesenzan impoundment, Hewler. Kurdistan region of Iraq. M.Sc. Thesis. University of Salahaddin. College of Sciences. Hewler. Iraq. (2006).
19. Al-Sofi, B.A., An ecological study on the main sewage channel of Erbil city, with particular reference to self purification. M.Sc. Thesis. University of Salahaddin. College of Science-Education. Hawler. Iraq (2008).
20. Abdul-Wahid, S.J., A phycological study on some springs within Harir sub-district. Hawler-Kurdistan region of Iraq. M.Sc. Thesis. University of Salahaddin. College of Science-Education. Erbil. Iraq (2008).
21. Al-Barzingy, Y.O.M.; Goran, S.M., and Toma, J.J. An ecological study on water to some thermal springs in Koya-Erbil province. Iraq. Accepted for publication in *Journal of Education and Sciences* (2009).