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Physico-chemical and Biological Study of Dhabeji Springs, Malir, Karachi, Sindh, Pakistan

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Abstract: Water samples from two natural springs located at Dhabeji, (I) Baba Bukhari spring near railway station, (II) Dhabeji main spring were collected and analyzed for water quality. pH, total dissolved solids (TDS), chloride and hardness were observed in the range of 6.9 – 7.78, 1943 – 2732 mg/L, 630 – 850 mg/L and 450 – 600 mg/L respectively. Kjeldahl nitrogen, ammonia, nitrate nitrogen and hydrolysable phosphate phosphorus were observed with in range of 0 – 0.06 mg/L, 0.4 – 0.6 mg/L and 0.08 – 0.18 mg/L respectively. Water samples were also examined for biological life in which 2 of species of Bacterial, 24 species of Cyanophyta, 11 species. Chlorophyta, 1 specie of Compsopogon coeruleus Mont of Rhodophyta, 5 species. Bacillarophyta, Riccia fluentans & Moss, 12 species. of aquatic plants (spermatophyta), 2 sp. of zooplankton, 4 sp. of fishes also *robranchium* were identified and spring are classified chliarothermic type (18-30°C).

Key words: Dhabeji springs water quality, flora and fauna

Introduction

The Dhabeji Main spring (II) about 3 km on the east of the Dhabeji Railway station oozes out from the calcareous rock from a cave type in form cavity of about 4x6 feet with water depth of 1 to 2 feet. The water than flows in the form of, a small channel, which runs about 2-3 km, forming a number of pools connected with each other. Finally the water is collected in the pond joining the spring I. The water is pumped for irrigation and drinking purposes. Beg *et al.* (1984) have reported some preliminary water chemical analysis of the both springs. The present work examines the physico-chemical parameters for water quality measurements along with the biological life developed into the spring waters.

Materials and Methods

The Dhabeji springs are located near Dhabeji railway station at longitude 67.5′ N and 24.95 E longitude and 66 feet above sea level in Malir district of Karachi. Water samples from both the springs were collected from where water was oozing out. The samples were collected from the surface at the depth of about 3 to 9 inches. The water was collected in clean 1.5L plastic bottle which was rinsed several times with water before collection of samples. The sampling scheme was repeated twice during 1999. The temperatures of water and (1 m above the surface of water) were noted. The conductivity, salinity and total dissolved solids were recorded from WTW 320 conductivity meter at the sampling site. The pH were measured with Orion 420 pH meter. Nitrate, phosphate, silica and ammonia were determined by spectrophotometery using Hitachi 220 spectrophotometer. Nitrate was determined using brucine sulphate as derivatizing reagent. Orthophosphate was determined by reducing phosphomolybdic acid (formed with ascorbic acid to molybdenium blue). Total phosphate was determined by persulphate digestion method followed by spectrophotometric method as for orthophosphate. Kjadhal nitrogen was evaluated using mercuric oxide red as catalyst. Ammonia nitrogen was determined by phenate method. Silica was determined as molybdosilicic acid (APHA, 1981).
Chloride, alkalinity and hardness were determined by titration with standard silver nitrate, hydrochloric acid and EDTA respectively. Dissolved oxygen was evaluated by Wrinkler method. Sodium, potassium, calcium and magnesium were determined by Varian spectr AA20 atomic absorption spectrophotometer with air-acetylene flame using standard burner at the condition recommended by the manufacturer. The sodium, potassium, calcium, magnesium were determined at 589.0 nm, 766.5 nm, 422.7 nm and 285.2 nm respectively with integration time 3 sec and delay time 3 sec. The sodium absorption ratio (SAR) was calculated using following relation (concentration of each in milliequivalent).

$$SAR = \frac{Na}{\sqrt{Ca + Mg}}$$

All the biological samples were collected by using plankton net # 25μm, hand nets and hand picking methods preserved in 3 – 4 % commercial formaldyhyde and identified with the help of taxonomic keys of Desikachary (1961), Prescott (1962) for the algae, higher aquatic plants (spermatophyta) Cook (1996), Zooplankton, Ward and Whipple (1959).

Results and Discussion

The springs were sampled for water quality measurements and bilological life inhabitating in the waters. The flow of the water from spring I was about 3-4 L/min, but water flow from the spring II was significant, about 300-400 L/min and has an importance. The results of physico-chemical analysis are summerized in Table I.
The water temperaure varied between 29.7 to 31°C as compared to 25 to 36 .2°C of atmosphore during the study. The conductivity, salinity and TDS of spring (I) 3037-3290 μS/cm, 1.4-1.5 g/L, and 1943-2196 mg/L were observed as compared to 4000-4270 μS/cm, 1.9-2.0 g/L and 2561-2732 mg/L for spring (II) respectively. The pH of the springs was within 6.9-7.78. The chloride, alkalinity and hardness of the spring (I) were observed 603-744 mg/L, 100-112 mg/L and 450-470 mg/L as compared to 850 mg/L, 92-128 mg/L and 560-600 mg/L for spring II respectively. Ammonia and orthophosphate were below the detection limits from both the springs, however acid hydrolizable phosphate-phosphorous and nitrate-nitrogen were observed in the range of 0.08-0.18 mg/L and 0.3 to 0.6 mg/L respectively. WHO standards for the water used the irrigation suggests that the water with

Table 1: Water Analysis of Dhabeji Springs, District Malir, Karachi, Sindh, Pakistan

S. no. Parameters	Dates of collection of samples			
	31-7-1999		12-12-1999	
	I	II	I	II
1. Time	12.30	13.30	12.00	10.55
2. Temp. of air in °C	36.00	36.2	25	25
3. Temp. of water in °C	30.7	31.0	30	29.7
4. Salinity in g/L	1.4	2.0	1.5	1.9
5. Conductivity µS/cum	3290	4270	3037	4002
6. TDS mg/L	2105	2732	1943	2561
7. Dissolved Oxygen	-	-	3.0	4.8
8. Chloride in mg/L	603	650	744	850
9. M-Alk. in mg/L	100	128	112	92
10. Hardness in mg/L	470	600	450	560
11. pH	6.90	6.90	7.48	7.78
12. Kjeldahl Nitrogen mg / L	-	-	0.112	0.056
13. Ammonia N mg / L	-	-	0.00	0.00
14. Nitrate N mg / L	0.5	0.6	0.3	0.4
15. Silica µg / L	9	8	15	15
16. Total phosphate in mg/L	0.15	0.08	0.18	0.1
17. Orthophosphate in mg/L	0.00	0.00	0.00	0.00
18. Na in mg/L	380	528	387	520
19. K in mg/L	10	13	24	34
20. Ca in mg/L	50	85	110	126
21. Mg in mg/L	48	78	102	115
22. SAR	5.08	4.27	2.40	2.85

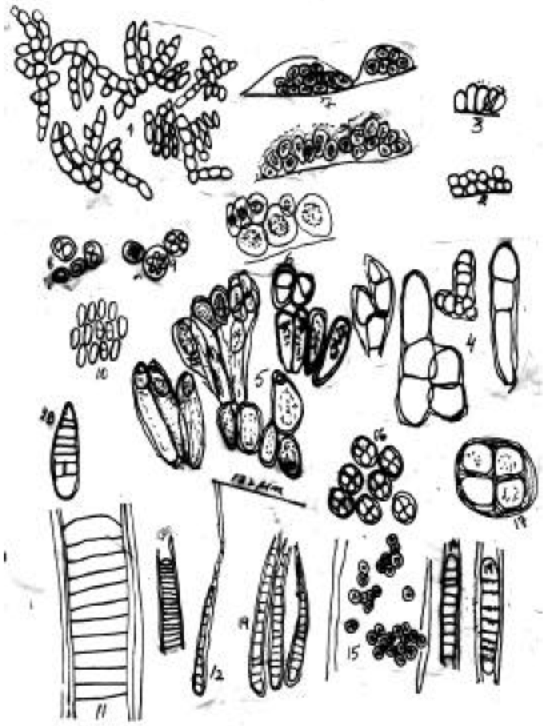
I Natural spring near tomb of Baba Bukhari, Dhabeji.
II Dhabeji spring about 3 Km far from Dhabeji town.

Table 2: Flora & Funa of Dhabeji Springs District Malir, Karachi, Sindh, Pakistan

	I	II
Bacteria		
Beggiatoa alba (Vauch.) Trevisanii	+	+
Beggiatoa minima Winogradsky	+ +	+ +
Cyanophyta		
Aphanocapsa biformis A.Br.	+	+
Merismopedia elegans A.Br	+	+
Merismopedia tenuissima Lemm.	+	+
Synechocystis pevaleckii Erceg	+	+
Synechocystis salina Wislouch	+ +	+
Johannesbaptistia pellucida (Dickie) Taylor	+	+ +
Chroococcus minor (Kutz) Nag.	+ +	+ +
Chroococcus tenax (Kirch) Hier.	+	+ +
Chroococcus turgidus (Kutz) Nag.	+ +	+ +
Cylindrospermum stagnale Kutz.	+	+
Gomphosphaeria aponina Kutz.	+ +	+
Tolypothirix sp.	+	+
Microcoleus chthonoplastes Thur.	+ +	+ +
Chamaesiphon cylindricus Boye-petersen	+ +	+ +
Chamaesiphon curvatus Nordst.	+ +	+
Xenococcus kerneri Hansg.	+ +	+ +
Xenococcus minimus Geitler	+ +	+ +
Hydrococcus rivularis (Kutz) Menegh	+	+ +
Hyella fontana var. *maxima* Geitler	+ +	+ +
Chamaesiphon incrustans Grunow.	+ +	+ +
Dermocarpa aquae-dulcis (Rein) Geitler	+	+
Chroococcus pallidus Nag.	+ +	+ +
Lyngbya majuscula Harv.	+ +	+ +
Lyngbya martensiana Menegh.	+ +	+ +
Lyngbya sp.	+ +	+
Lyngbya epiphytica Hiero	+ +	+ +
Osillatoria limosa Ag.	+ +	+ +
Osillatoria cuviceps Ag.	+	+
Osillatoria geitleriana Elkin	+	+
Osillatoria princeps Vaucher	+ +	+ +
Osillatoria okeni Ag.	+	+
Homoeothrix articulata Starmach.	+	+ +
Homoeothrix endophytica Lemm	+	+ +
Scytonema bohneri	+	+
Chlorophyta		
Chlorella vulgaris	+	+
Rhizoclonium fontanum	+	+
Chaetophora attenuata Hazen	+ +	+
Chaetophora elegans (Roth) Ag.	+ +	+ +
Ankistrodesmus falcatus (Corda) Ralfs	+	+
Coelastrum microporum Nag.	+	+
Cosmarium laeve Rab	+	+
Cosmarium sp.	+	+
Mougeotia sp.	+	+
Spirogyra sp.	+	+
Zygnema sp,.	+	+
Euglena cf proxima Dang	+ +	+ +
Scenedesmus arcuatus lemm	+ +	+ +
Enteromorpha salina Kutz.	+	+
Chara zeylanica	+ +	+ +
Rhodophyta		
Compsopogon coeruleus (Balbis) Mon.	+ +	-
Bacillarophyta		
Cyclotella Kuetzingana Thwaits	+ +	+
Cocconeis pediculus Ehr	+	+
Brayophyta		
Riccia fluitans L.	+ +	+ +
Spermatophyta		
Najas minor Allioni	+ + +	+ + +
Najas major L.	+ +	+ +
Hydrilla verticillata (L) Royle	+	+
Potamogeton pectinatus L.	+	+
Pota mogeton nodosus Poiret	+ +	+
Potamogeton crispus L.	+	+
Polygonum barbatum	+	+
Scirpus lineatus	+	+
Scirpus debilis	+	+
Eleocharis obtusa	+	+
Scirpus fluviatilis	+	+
Typha domingensis	+ + +	+ +
Phragmites vallatorn	+ + +	+ + +
Rotefera		
Centrophyxis acureata	+	+ +
Lepadella cf. *amphitropis*	+ +	+
Monostyla .sp.	+	+
Pran		
Macrobranchium sp.	+	+
Fishes		
Barbus tictio (Popri)	+ + +	+ + +
Labeo rohita (Kurroro)	+ +	+
Channa sp.	+ +	+
Talipia nalotica	+ + +	+ + +

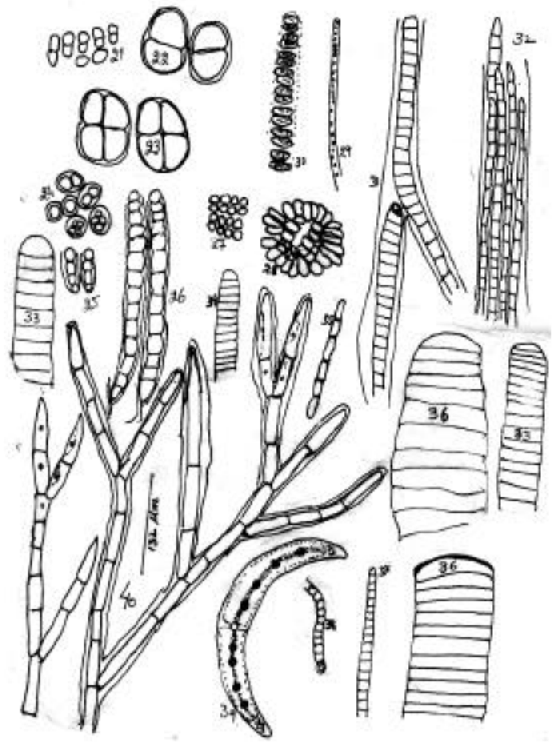
electrical conductivity >3mS/cm or TDS > 2000 mg/L may cause severe effect for irrigation if used for longer time and may be used with caution. The water from both the springs indicate high electrical conductivity and TDS side than the recommended limits of WHO. However the soil is calcarious in nature and there is acute shortage of fresh water in the region. Therefore the water is being used for plantation. The results of metal contents in the Table-1 indicates in the following decreasing order Na>Ca>Mg>K.

The results suggest that the water contained sodium chloride and calcium carbonate as dominant salts. Sodium absorption



Dhabeji Spring Figs. 1-20

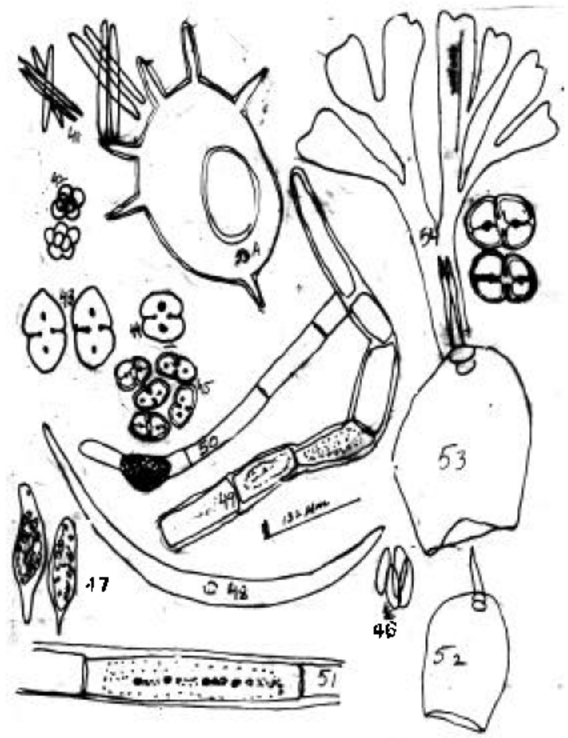
1. *Hydrococcus rivularis* (Kuetz) Menegh
2.&15 *Xenococcus minimus* Geitler
3. *Xenococcus kerneri* Hansg.
4. *Hyella fontana var. maxima* Geitler
5. *Chamaesiphon carpaticus* Starmach
6. *Chamaesiphon incrustaus* Grunow
7. *Dermocarpa aquae-dulcis (Rein.)* Geitler.
8. *Chroococcus pallidus* Naeg.
9.&16 *Chroococcus minor* (Kuetz) Naeg.
10. *Merismopedia tenuissima* Lemm.
11. *Lyngbya majuscula* Harv.
12. *Homeothrix articulata* Starmach.
13. *Lyngbya epiphytica* Hiero.
14. *Homoeothrix endophytica* Lemm.
17. *Chroococcus turgidus* (Kuetz) Naeg.
18. *Lyngbya* sp.
19. *Lyngby martensiana* Meneg.
20. Un-known fungal spores.



Dhabeji Spring Figs. 21-40

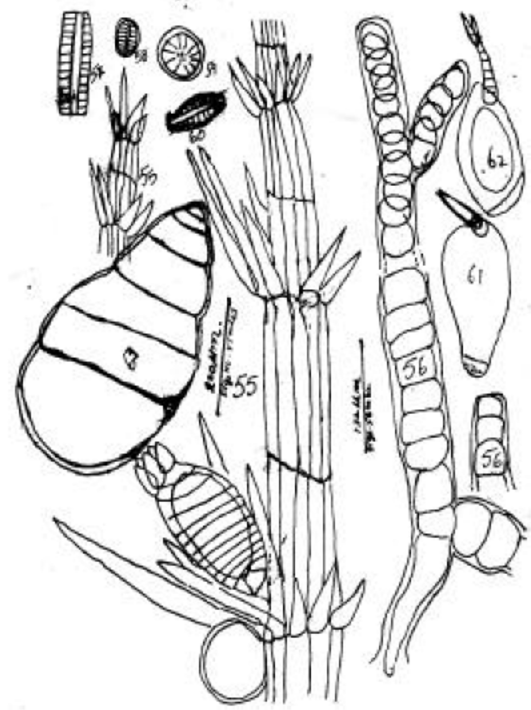
21. *Synechocystis pevaleckii* Ercegovic
22.&23. *Chroococcus tenax* (Kirch.) Hier.
24. Aphanocapsa biformis A. Br.
25. *Chamaesiphon cylindricus* Boye-petersen
26. *Chamaeisiphon curvatus* Nords.
27. *Merismopedia tenuissima* Lemm.
28. *Gomphosphaeria aponina* Kuetz.
29. *Beggiatoa minima* Wino.
30. *Johannesbaptistia pellucida* (Dicki) Taylor
31. *Tolypothrix* sp.
32. *Microcoleus chthonoplastes* Thur.
33. *Oscillatoria limosa* Ag.
34. *Oscillatoria curviceps* Ag.
35. *Oscillatoria geitleriana* Elenkin.
36. Oscillatoria principes Vaucher ex Gomont.
37. *Oscillatoria okeni* Ag.
38. *Cylindrospermum stagnale* Kuetz.
39. *Closterium calosporum* var. *maius* W. et. G.S. West.
40. *Chaetophora attenuata* Hazen.

rartio of both the springs was observed in the range 2.5-5. Dhabeji springs are slightly saline at the sources where water oozes out. Two species of Bacteria *Beggiatoa* minima and *Beggiatoa* alba were found along with *Phormidium* sp, *Oscillatoria*, sp, *Lyngbya* sp, *Chroococcus minor, Chroococcus* turgidus, *Synechocystis pevalekii* and *Synechocystis salina*. On the sides of pools and channel a mat of the algae are found and cover together with *Lyngbya* majuscula, *Lyngbya martensiana, Lyngbya* sp, *Homoeothrix articulata, oscillatoria sp, Johannesbaptistia pllucida* and these species belongs to Cyanophyta. The *Rhizoclonium heighrophicum, Cladophora glomerata, stigeoclonium* sp. and *Chara zeylanica* represen t to Chlorophyta and Compsopogon *coeruleus* to Rhodophyta.The *Riccia fluentans* (Bryophyta) were forming mat at the source and commonly found in water intangled masses just below the surface of water (Fassett, 1940). Some species were found epiphytic such as *Chamaesiphon* sp. *Xenococcus, Hydrococcus rivularis, Hyella fontana, Lyngbya epiphytica, Hemoeothrix endophytica* and *Calothrix epiphytica, Calothrix fusca Chaetophora attenuata, Chaetophora elegans* and were attached on the filamentus algae on the submerged aquatic plants by sticky cell wall and out growth of barral cell protection (Schwoerbel, 1987) in the ponds and channel. Spring water initially flow with fast speed and forms a series of pools with considerable decrease in flow in the channel resulting the growth of *Spirogyra* sp, *Mougeotia* sp., *Cladophora glomerata*,



Dhabeji Spring Figs.41-54

41. *Ankistrodesmus falcatus* (Corda) Ralfs.
42. *Coelastrum microporum* Nag.
43 *Cosmarium granatum* Breb.
44. *Cosmarium* sp.
45. *Cosmarium laeve* Rab.
46. *Scenedesmus arcuatus* Lemm.
47. *Euglena cf. proxima* Dang.
48. *Closterium parvulum* Naeg.
49. *Microspora* sp.
50. *Mougeotia* sp.
51. *Mougeotia* sp.
52. *Monostyla* sp.
53-A. *Centropyxis acurleata* (Ehr.) Stein.
53-B. *Lepadella* cf. *amphitrois* Harring.
54. *Riccia fluitans*



Dhabeji Spring Figs.55-63

55. *Chara zeylanica*
56. *Compsopogon coeruleus* Montag.
57. *Epithemia* sp.
58. *Cocconeis pediculis* Ehr.
59. *Cyclotella Kuetzingiana* Thwaites.
60. *Rhopalodia* sp.
61. *Lepadella* sp.
62. *Colurella* sp.
63. *Molluscas* sp.

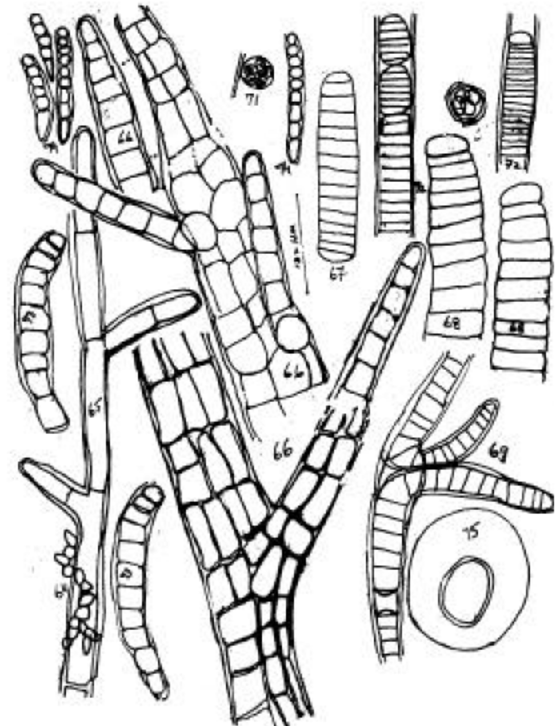
Stigeoclonium sp. *Rhizoclonium hieroglyphicum, Chaetophora* sp. producing green boll with mucilage attached with *Najas minor, N. major, Potamogeton pectinatus, Potamogeton crispus* and *Hydrilla verticillata* along with *Typha domningensis, Phragmites vallatoria* (P. communis) *and scirpis* species. These species are emergent vegetation in waterlogged land and ponds. The bank zones are colonized by higher emergent aquatic plants as have been reported earlier within a similar ecological regions (Oberdorfer, 1977).

Chara zeylanica are found submerged through out the channel and also reported from mesohaline water (Imahori, 1954), *Najas minor, Najas major. Hydrilla verticillata, Potamogeton pectinatus, P. nodosus, P. crispus* are submerged vegetation in the ponds and channel.

In the series of ponds *Ankistrodesmus falcatus, Coelastrum microporium, Pediastrum duplex, Scenedesmus arcutus, Scenedesmus bijuga, Scenedesmus dimorphus, Chlorococcum* sp, *Cosmarium leave, Cosmarium* sp, *Mougeotia* sp, *Spirogyra, Euglena* sp. of Chlorophyta; *Merismopedia tenuissima. M. punctuata, Chroococcus minor, Chroococcus turgidus Gomphospharia cardiformis var. aponina, Osillatoria princeps, O. limosa, Oscillatoria* sp, *Lyngbya majuscula, Lyngbya martensiana, Spirulina major, Spirulina laxissima* of Cyanophyta and some species of Bacillarophyta, *such as Pinnularia virdis, Fragilaria intermedia, Navicula protracta, Gymphonema* sp. *Cymbella turgida. Amphora* sp, *Synedera ulna* were found planktonic and periphytic (Table 2).

In zooplnakton Centropyxis acureata, *Lepadella* cf. *amphitropis* and *Monostyla* sp belonging to the rotifera were identified. One species of *Macrobranchium* sp. and four species of fishes, *Brabas tictio* (Popri), fingerilings of *Labeo rohita, Tallipa nolotica, Channa* species and *Molluscus* sp. were found in spring I and spring II (Table 2). Evans (1959) has found that a number of algae found dominant condition in the surface layers of the water at the time of low water level.

Dhabeji springs indicate natural water resources within the region and spring II has higher flow and some importance. Water contains higher amounts of TDS, with Sodium chloride as a main salt. The water could not be recommended for human consumption, but could be used satisfactorily for livestock, poultry and fish farming.



Dhabeji Spring Figs. 64-75

64. *Hydrococcus rivularis* (Kutz) Meneg.
65. *Rhizoclonium fontanum* Kutz.
66. *Enteromorpha salina* Kutz.
67. *Oscillatoria subbrevis* Sch.
68. *Oscillatori princeps* Vauch.
69. *Scytonema cf. bohneri* Schmiddle
70. *Chlorella vulgaris* Baj.
71. *Dermocapsa sphaerica* Setchell.
72. *Lyngbya martensiana* Meneg.
73. *Stichosiphon sansibaricus* (Hier) Drouet and Daily.
74. *Chamaesiphon cf. rostaffinskii* (Ro.) Hansg.
75. *Arcella cf. vulgaris* Ehernberg.

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