

Physico-Chemical and Biological Study of Ali Murad Barijo and Karogar Springs of Thana Bula Khan, District Dadu, Sindh, Pakistan

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Abstract: Ali Murad Barijo and Karogar springs are present in a hilly area of Thana Bola Khan within Chanoir mountainous range. Biological and water samples were collected from the Ali Murad Barijo springs at the source and examined for chemical and biological analysis. pH and conductivity were observed in the range of 7.57 to 8.13 and 792 to 1600 μ S/cm with flow rates between 15 to 30 L/min. Biological samples were analyzed for algal flora and fauna along with higher aquatic plants. Karogar spring indicates TDS within the range 983 – 1025 mg/L and pH 7.6 – 7.8 with water out put of about 20–40 L/min. In the Ali Murad Barijo and Karogar spring having *Chara contraria*, *Chara zeylanica*, *Nitella hyalina*, *Nitellopsis obtusa*, *Phragmites communis* and *Typha domingensis* were found dominant along with *Puntius ticto* and *P. sophore*, fishes.

Key words: Flora – fauna, chemical analysis of natural springs

Introduction

Ali Murad Barijo and Karogar springs together with torrents of Ular Nai are located in Chanoir mountainous range of Kirthar. Ali Murad Barijo spring is indicated in sheet No. 35 O/11 [survey of Pakistan 1980 – 81] longitude 96.9N, Latitude 69.9E at about 360 feet above sea level. Karogar spring is in the bed of Ular Nai at longitude 97.4N and latitude 70E and is in a depression of about 50 feet (Panhwar, 1988)

Ali Murad Barijo spring are a series of two spring, placed close to each other and are located in north west of village Ali Murad Barijo at a distance of about 4 – 5 km in the hilly area. The spring I seeps from the rocky area and then collects in a pool of water of an area 40 x 40 feet² with a water depth of about 2.5-3.5 feet with a dark appearance. The second spring II oozes near by spring I with slightly higher flow rate from a narrow cave like structure. The water is transparent, cold and clear. The water falls from the hills and disappear in rocky bed. The water is used for drinking of animals as well human beings.

Karogar spring is located in Karogar hills. The water appeared green in color. The spring is perennial with a water pool of area 30x30 feet² with a water depth of about 10 to 15 feet. The water discharge, spreads in a large area with a depth of about 3-4 feet and is visible up to about half km in the bed of Ular Nai. The water reappears as torrents along Ular Nai about 6 km from Karogar springs.

A number of natural springs are reported from district Dadu and Karachi area (Leghari *et al.*, 1983; Khuhawar *et al.*, 1986; Beg *et al.*, 1984; Khan and Husaini, 1987; Zahid, 1989; Jahangir *et al.*, 2001; Leghari *et al.*, 2001 but the water resources of hilly area of Thana Bola Khan District Dadu are less reported. Water quality assessment and flora and fauna of two springs Zai and Pokhan have been reported from the Pub and Kanbho hills of Kirthar mountainous range (Laghari & Khuhawar., 1995). The present work examines the water quality and biological life inhabiting in natural springs of Ali Murad Barijo and Karogar springs along with natural plantation present in the area.

Materials and Methods

Water samples from spring I and spring II of Ali Murad Barijo and a sample from Karogar spring were collected in clean 1.5 L plastic bottle and were rinsed several times with water sample before collection. The temperature of the water and air, conductivity, salinity and total dissolved solids (TDS) were recorded on the site. The samples were transferred to laboratory and quickly analyzed by using standard procedures (APHA, 1981). pH was measured with orion 420A pH meter. Conductivity, salinity and TDS were

record with WTW 320 conductivity meter on the spot. Chloride, alkalinity and hardness were determined by titration with standard silver nitrate, hydrochloric acid and EDTA respectively. Phosphate, silicate, nitrate and sulphate were determined using spectrophotometer. Nitrate was determined by using brucine sulphate as derivatizing reagent. Orthophosphate was determined by reducing phosphomolybdic acid formed with ascorbic acid to molybdenum blue. Total hydrolyzable phosphate was determined by persulphate digestion method, followed by spectrophotometric determination as orthophosphate. Sulphate was determined by turbidimetric method as barium sulphate. Sodium, potassium, calcium and magnesium were determined by air acetylene flame atomic absorption using varian spectr AA – 20 atomic absorption spectrophotometer at the conditions recommended by the manufacture. Sodium, potassium, calcium and magnesium were determined at 589.0, 766.5, 422.7 and 285.2 nm respectively in triplicate with integration time 3 sec and delay time 3 sec. (APHA, 1981).

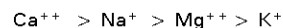
All the algal species & hydrophytes were collected by hand picking and plankton by plankton net # 25 μ m. Dip net was used for the collection fishes. The algal species identified after the reference of Desikachary (1959) and Prescott (1962).

Results and Discussion

The results of chemical analysis are summarized in Table 1. The observed water temperature of Ali Murad Barijo springs I and II was about 24 °C and was 12 °C lower than atmospheric temperature of 36 °C at the time of collection of sample.

The waters of the springs I and II of Ali Murad Barijo indicated conductivity and TDS within the limits 1537 – 1595 μ S/cm and 983 – 1020 mg/L. The pH was observed within the acceptable limits of 7.57 – 7.83. Chloride, alkalinity and hardness were observed within the range 240 – 260 mg/L Cl⁻, 50 – 60 mg/L CaCO₃ and 400 – 480 mg/L CaCO₃ respectively.

Phosphate-Phosphorus, silicate-silica and nitrate-nitrogen were observed at μ g/ml level. The metal ions Na⁺, K⁺, Ca⁺⁺ and Mg⁺⁺ analyzed indicated the concentration range 90 – 92 mg/L, 9 – 35 mg/L, 100 – 188 mg/L and 60 mg/L respectively. The metal ion concentration indicated with decreasing order.



The chemical analysis of the water samples collected from Karogar spring indicated a similar pattern as that of Ali Murad Barijo springs with water temperature here also lower by about 12°C than atmospheric temperature with conductivity 1600 μ S/cm, TDS 1025 mg/L, pH 7.66, chloride 277 mg/L, alkalinity 50 mg/L as

Table 1: Water analysis of Ali Murad Barijo and Karogar springs, Talkua Thana Bola Khan, District Dadu, Sindh. Date of collection of samples, 04-04-1999

Parameters	Ali Mured Barijo		Karogar spring	Torrents of Uler Nai	
	Spring I 1	Spring II 2	Spring I 3	Torrent I 4	Torrent II 5
Time	12	12.30	16.00	16.30	17.00
Temperature of air in °C	36.0	36.0	40.0	40.0	40.0
Temperature of water in °C	24.0	24.7	28.2	24.4	24.6
pH	7.83	7.57	7.66	7.80	8.13
Conductivity $\mu\text{S/cm}$	1537.0	1595.0	1802.0	792.0	1386.0
Total dissolved solids in mg/L	983.0	1020.0	1026.0	508.0	887.0
Chloride in mg/L	260.0	240.0	277.0	81.0	136.0
Salinity in mg/L	60.0	60.0	60.0	10.0	50.0
M-Alkalinity as CaCO_3 in mg/L	50.0	60.0	50.0	43.0	48.0
Hardness as CaCO_3 in mg/L	400.0	480.0	350.0	150.0	180.0
Sodium mg/L	92.0	90.0	76.0	83.0	112.0
Potassium mg/L	9.0	35.0	7.2	8.8	48.0
Calcium in mg/L	100.0	188.0	138.0	96.0	80.0
Magnesium in mg/L	69.0	60.0	48.0	30.0	36.0
Total acid hydrolyzable phosphate in mg/L	0.09	0.08	0.09	0.08	0.13
Ortho-phosphate in mg/L	0.071	0.073	0.076	0.072	0.076
Silica in $\mu\text{g/L}$	10.0	10	16.0	5.0	16.0
Sulphate in mg/L	136.0	245	288.0	152.0	245.0

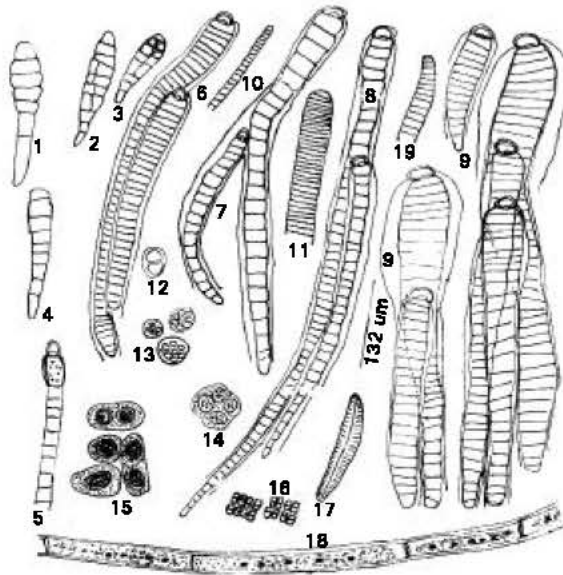


Plate 1 (Figs. 1-19): Flora & fauna of Ali Murad Barijo and Karogar springs

- 1-4 Unknown fungal spores.
- 5.0 *Cylindrospermum stagnale* (Kutz.) B. and F.
- 6-8 *Calothrix ramenskii* Elenkin
9. *Calothrix brevissima* West. G.S.
10. *Phormidium boryanum* Kutz.
11. *Oscillatoria limosa* Ag.
12. *Aphanocapsa testacea* Nageli
13. *Gloeocapsa livida* (Carm.) Kutz.
14. *Gloeocapsa magma* (Breb.) Kutz.
15. *Chroococcus montanus* Rao
16. *Merismopedia elegans* A.Br
17. *Cymbella tumidula* Gmn
18. *Mongeotia cf. viridis* (Kutz) Wittrock
19. *Oscillatoria proboscidea* Gom.

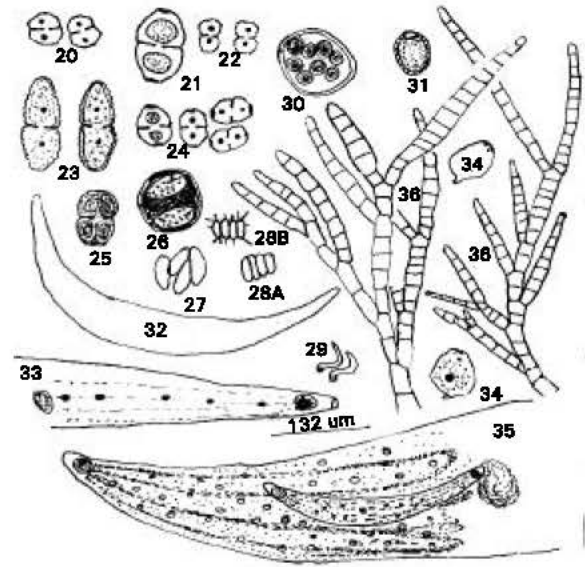


Plate 2 (Figs. 20-36): Flora & fauna of Ali Murad Barijo and Karogar spring district Dadu, Sindh, Pakistan

- 20 *Cosmarium abbreviatum*
- 21 *Cosmarium laeve* Rab. var. *laeve*
- 22 *Cosmarium impressulum* var. *octangularis* Hirano
- 23 *Cosmarium* sp.
- 24 *Cosmarium laeve* var. *reniforme* Hirano
- 25 *Cosmarium* sp.
- 26 *Gloeotaelium loitelsbergerianum* Hansg.
- 27 *Scenedesmus arcuatus* Lemm.
- 28 a. *Scenedesmus bijuga* (Turp) Lag
b. *Scenedesmus abundans* (Kirch.) Chodat.
- 29 *Kirchneriella contorta* (Sch) Bohlin
- 30 *Gloeobotrys limneticus* (G.M.Smith) Pascher
- 31 *Trachelomonas acanthostoma* (Stokes) Def.
- 32 *Closterium diana* var. *arcuatum* (Breb) Rab.
- 33 *Closterium* cf. *ralfsii* var. *hybridum* Rab.
- 34 *Phacus acuminatus* Stokes
- 35 *Closterium ehrenbergii* Meneghini var. *ehrenbergii*
- 36 *Stigeoclonium subsecundum* Kutz.

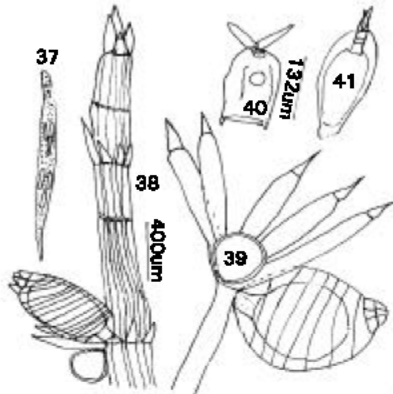


Plate 3 (Fig. 37-41): Flora & fauna of Ali Murad Barijo and Karogar springs
 37 *Euglena acus* Ehrenberg
 38 *Chara zeylanica*
 39 *Nitella hyalina*
 40 *Lepadella* sp.
 41 *Lepadella amphitropis* Harring

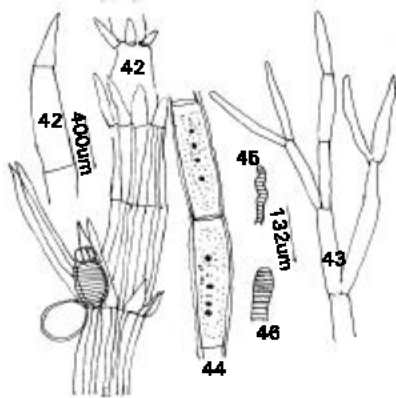


Plate 4 (Figs. 42-46): Flora & fauna of Ali Murad Barijo and Karogar springs district Dadu, Sindh Pakistan
 42 *Chara contraria* A. Br (*Chara f. hispida* (A.Br) R.D.W
 43 *Cladophora glomerata* fa. Kuetzingianum (Grunow) Heering
 44 *Mougeotia sphaerocarpa* Wble.
 45 *Lyngbya lagerheimii* (Mob.) Gom.
 46 *Oscillatoria irrigua* (Kutz.) Gom.

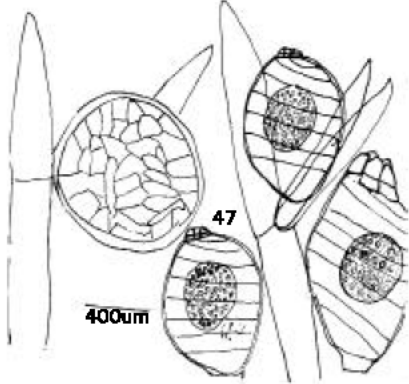


Plate 5 (Fig. 5): Flora & fauna of Ali Murad Barijo and Karogar springs district Dadu, Sindh, Pakistan
 47 *Nitellopsis obtusa* (Desv., in Lois) J. Gr.

Table 2: Flora and Fauna of Ali Murad Barijo and Karogar Springs Chanoir mountainous range of Thana Bola Khan, district Dadu, Sindh, Pakistan

Species	Ali Murad Barijo Spring	Karogar Spring
Cyanophyta		
<i>Calothrix ramenskii</i> Elenkin	+	+
<i>Calothrix brevissima</i> G.S West	+	+
<i>Cylindrospermum stagnale</i> Kutz	++	++
<i>Phormidium boryanum</i> Kutz.	+	+
<i>Lyngbya lagerheimii</i> (Mob)Gom	+	+
<i>Lyngbya majuscula</i> Harv.	++	++
<i>Oscillatoria princeps</i> Vauch.	+	+
<i>Oscillatoria proboscidea</i> Gom.	+	+
<i>Oscillatoria irrigua</i> Kutz.	+	+
<i>Oscillatoria limosa</i> Ag.	++	+
<i>Oscillatoria proboscidea</i> Gom.	++	++
<i>Aphanothece stagnina</i> A. Br.	+	+
<i>Aphanocapsa testacea</i> Nag.	+	+
<i>Chroococcus montanus</i> Hansg.	++	++
<i>Chroococcus minutus</i> (Kutz)Nag.	++	++
<i>Gloeocapsa magma</i> (Breb) Kutz.	++	++
<i>Meris mopedie elegans</i> A.Br	++	++
<i>Meris mopedie tenuis</i> Lem m	++	++
Chlorophyta		
<i>Chara contraria</i>	++	++
<i>Chara zeylanica</i>	+	++
<i>Nitella hyalina</i>	++	+
<i>Nitellopsis obtusa</i>	++	-
<i>Stigeoclonium subsecundum</i>	+	+
<i>Spirogyra rhizobrachialis</i>	+	+
<i>Mougeotia sphaerocarpa</i> Wolle	+	++
<i>Mougeotia viridis</i> (Kutz) Wittrock	+	+
<i>Kirchneriella contorta</i> (Sch) Boh.	+	+
<i>Cosmarium leave</i> Rab.	+	+
<i>Cosmarium impressulum</i>	+	+
<i>Gloeotarium lotels bergerianum</i> Hansg.	++	+
<i>Scenedesmus arcuatus</i> Lemm.	+	+
<i>Scenedesmus bijuga</i> (Turp) Lag	+	+
<i>Scenedesmus abundans</i> (Karch)	+	+
Chodat		
<i>Scenedesmus incrassatulus</i> Bohlin	+	+
<i>Phacus acuminatus</i> Stokes	+	+
<i>Euglena acus</i> Eh.	+	+
<i>Trachelomonas acanthostoma</i> (Stokes) Defl	+	+
<i>Closterium dianae</i>	+	++
<i>Closterium raffini</i> Rab	+	++
<i>Oedogonium</i> sp.	+	+
<i>Microspora floccosa</i>	++	++
<i>Glenodinium quadridens</i>	+	+
<i>Cladophora glomerata</i> fa. Kuetzingianum	+	+
<i>Rhizoclonium fontanum</i>	+	+
<i>Rhizoclonium hieroglyphicum</i>	+	+
Pteridophytes		
<i>Adiantum capillusveneris</i> L.	++	+
Spermatophyta		
<i>Najas major</i>	++	+
<i>Najas minor</i> Allioni	++	+
<i>Hydrila verticillata</i>	++	++
<i>Potamogeton pectinatus</i>	+	+
<i>Typha domingensis</i> Persoon	++	++
<i>Phragmites communis</i>	++	++
Fishes		
<i>Puntiusicto</i>	-	+
<i>Puntius sophoro</i>	-	+
<i>Barbus tor</i>	-	++
<i>Leaches</i>	+++	-

-- Absent, + = Present ++ = Abundant +++ = Dominant

CaCO₃ and hardness 350 mg/L as CaCO₃. The metal ions here also indicated a similar pattern with Ca > Na > Mg > K (Table 1). Similarly torrents I and II Uler Nai a similar water chemistry as Ali Murad Barijo and Karogar springs with pH, conductivity and TDS in the range 7.8-8.13, 792-1388 μ s/cm and 508-887 mg/L and lead to suggest the water are from same bed. From the springs I and II of Ali Murad Barijo and Karogar spring water contains species of

Cyanophyta in which *Chroococcus montanus*, *Chroococcus minutus*, *Chamaesiphon curvatus*, *Merismopedia tenuissima*, *Merismopedia elegans*, *Gloeocapsa magma*, *Oscillatoria princeps*, *O. limosa*, *O. proboscidea*, *Lyngbya majuscula*, *Lyngbya* sp. *Phormidium* sp. *Calothrix brevissima* and *Calothrix ramenskii* were found plank tonic. Figs. 1 –16 & 45 – 46.

Among Chlorophyta, *Cladophora glomerata*, *Rhizoconium fontanum*, *R. hieroglyphicum*, *Stigeoclonium subsecundum* Kutz (Fig. 43) were found epiphytic and epilithic. *Spirogyra rhizobrachiialis*, *Mougeotia viridis*, *Mougeotia* sp. *Kirchneriella contorta*, *Cosmarium abbreviatum*, *Cosmarium leave*, *Gloeotaenium loitelsbergerianum*, *Scenedesmus arcuatus*, *S. bijuga*, *S. abundans*, *S. incrassatus*, *Phacus acuminatus*, *Euglena acus*. were found free floating. (Figs. 18, 20 – 35 & 37).

Chara zeylanica, *Chara contraria*, *Nitella hyalina*, *Nitellopsis obtusa* (Figs. 38, 39, & 42 – 47) along with *Najas minor*, *Najas major*, *Hydrilla verticillata*, *Potamogeton pectinatus* were found submerged plants. *Typha domingensis* and *Phragmites communis*, *Scirpus affinis*, *S. littoralis* were found emergent dominant flora. A similar observation has been reported (Oberdorfer, 1977; Wilmanns, 1973). The vegetation on the side of the springs and hilly area contained *Saccharum officinarum* L. *Solanum nigrum* L. *Salvadora persica*, *Salvadora oleoides*, *Suaeda fruticosa*, *Tamarix dioica*, *Tamarix troupis* and *Nerium oleander*, *Prosopis spicigera*, *Prosopis glandulosa*. Ali Murad Barijo spring water is full with the Leaches & Toad bufo. However any fish species were not observed in the water.

In Karogar and torrents I and II of Ular Nai a similar flora were observed as at Ali Murad Barijo springs along with 3 species of the fishes. (*Puntius ticto*, *Puntius sophore*, *Aplocheilus panchax*).

Natural springs in Kohistan area have been characterized in terms of water quality, flora and fauna. The water quality of natural springs is acceptable for drinking and irrigation purposes, but become of their location and low water flow rate, the springs are not utilized for any commercial purposes but are being used as a source of water for cattle.

Acknowledgment

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