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Water Quality and Biological Assessment of Ghazi Shah and Kai Springs of District Dadu, Sindh, Pakistan

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Abstract: Water samples from perennial natural Ghazi Shah and Kai springs located in Dadu district were collected for physico-chemical and biological analysis. Ghazi Shah spring indicated water temperature 38°C, conductivity and total dissolved solid of 1000 μs/cm and 856 mg/L similarly Kai spring indicated temperature 35°C, conductivity and total dissolved solids 680 μs/cm and 555 mg/L respectively. However some smell of hydrogen sulphide (H_2S) was observed from where Kai water, when it was oozing out. Algal flora (Cyanophyta) was dominant from where the water was coming out. In the channel down the flow *Chara zeylanica*, *Chara vulgaris* and some fish species *Puntius ticto* and Aplocheilus panchax were identified. The water quality is suitable for agricultural and fisheries development and as a source for drinking after about ½ km of travel.

Key words: Natural springs, linnological study

Introduction

The natural water resources are important within dry, arid mountainous ranges. A few studies are reported on physico-chemical and biological life indicated in springs of Pub and Lakki hills of Khirthar mountainous range of Dadu district (Leghari *et al.*, 1995; Leghari *et al.*, 1983; Khuhawar *et al.*, 1986).

Ghazi Shah spring is located at sheet No 35N/7 Latitude 26.27°. Longitude 67.3° about 32 km south west of Johi town, 4 km from village Ghazi Shah upon the hill of Khirthar mountain range at about 600 feet above sea level. Kai spring is located in sheet No. 35 N/12, Latitude 26.95° and Longitude 76.42° near village Kai, about 40 km west of Sehwan and 25 km from Janghara village.

Lieutenant Maclagen described Ghazi Shah spring as a hot spring at a considerable elevation (1844). Panhwar (1988) has described the location of the Ghazi Shah and Kai spring and Abu Bakr (1965) has listed both the springs among thermal springs of Pakistan. The water of the springs is used for the irrigation of about 250 to 300 acres of land and as a source of drinking water in the region. A number of natural springs are reported from district Dadu and Karachi area (Beg *et al.*, 1984; Khan and Husaini, 1987; Zahid 1989; Leghari *et al.*, 2001; Jahangir *et al.*, 2001). The present work examines the water quality and the biological life inhabiting in the water body.

Materials and Methods

The Ghazi Shah spring oozes out on the hill from the creck at the foot of the another ridge of the hills with opening of about 7.5 feet wide and 9 feet height with water depth of 1.5 feet. The water flows in the form of channel for about 1 km and then falls down the hill in a slopes. The water collected down is carried away in the form of channels for the agricultural lands. Kai springs oozes out from well type opening of area 20 x 25 $feet^2$ with water depth of about 6 to 8 feet. The water oozes out with a large number of bubbles from its bottom. The water is carried from the spring in the artificial channel to the agricultural lands. A smell of hydrogen sulphide was observed from the point where the water was oozing out. However as the water traveled along the channel, no smell of hydrogen sulphide (H_2S) was observed after about ½ km. The water samples one each from where the water oozes out was collected from both the springs and one samples down the hill, before Ghazi Shah shrine was collected from Ghazi Shah spring. The water samples were collected within depth 3-9 inches from the surface of water during 2000. Samples of 1.5 L was transferred to clear plastic bottle. The temperature of the water and air, conductivity salinity and total dissolved solids (TDS) by WTW 320 conductivity bridge were measured at the site, pH was evaluated with Orion 420 pH meter. The dissolved oxygen was determined by Wrinkler method, chloride, alkalinity and hardness were determined by titration with standard silver nitrate, hydrochloric acid and EDTA respectively (APHA, 1981). Nitrate nitrogen, phosphate-phosphorous and silicate-silica were determined by using spectrophotmeter. Nitrate was determined by brucine sulphate method. Orthophosphate was determined by reducing phosphomolybic acid formed with ascorbic acid to molybdenum blue. Sodium potassium, calcium and magnesium were determined by air-acetylene flame using Varian Spectr AA-20 spectrophotometer. The analysis was carried out in triplicate with integration time 3 sec and delay time 3 sec. The water discharge was calculated using the following relation.

$$Q = a \times v$$

where Q = quantity of water a = area of the water body (B x D) & V = velocity of flowing water (S/T)

$$Q = \{B \times D\} \times (S/T)\}$$

Where Q = quantity of water, B = breath, D= depth, S = specified distance in drains and T = time taken for the water for specified distance (Khurmi, 1978). All the biological samples were collected by plankton net # 25 μm, hand nets and by hand picking methods and preserved in 3 % commercial formaldehyde and identified with help of taxonomic keys of Prescott (1962), Desikachary (1961) for the algae and higher aquatic plant (Angiospermic) (Cook, 1996) and for fishes (Mirza, 1990).

Results and Discussion

The results of chemical analysis indicate a good water quality for the irrigation with electrical conductivity and TDS of 865 μs/cm and 554 mg/L for Kai spring and 728-1024 μs/cm and 466-680 mg/L for Ghazi Shah spring respectively (Table 1) [WHO, 1984]. The water temperature from where the water oozes out from the springs Kai and Ghazi Shah were 35-38.2°C as compared to air temperature of 30-32°C respectively. The water of both springs was transparent and did not have any visible turbidity. The pH of the springs was observed slightly alkaline within acceptable limit with 8.2 for Kai and 7.14-7.2 for Ghazi Shah. The hardness alkalinity and chloride were observed 270 mg/L as $CaCO_3$. 125mg/L as $CaCO_3$ and 106 mg/L for Kai spring and 222-360 mg/L, 85-318 mg/L and 80 -160 mg/L for Ghazi Shah spring respectively. Orthophsophate was observed below the detection limit but total acid hydrolyzable phosphate phosphorous was observed 0.21 mg/L in Kai spring. The metal ions sodium potassium calcium and magnesium from where the water oozes out indicated Na > Ca > Mg > K for Kai spring and Ca > Na > Mg > K for Ghazi Shah spring.

Table 1: Water analysis physico-chemical analysis of natural springs of Kai and Ghazi Shah district Dadu, Sindh.

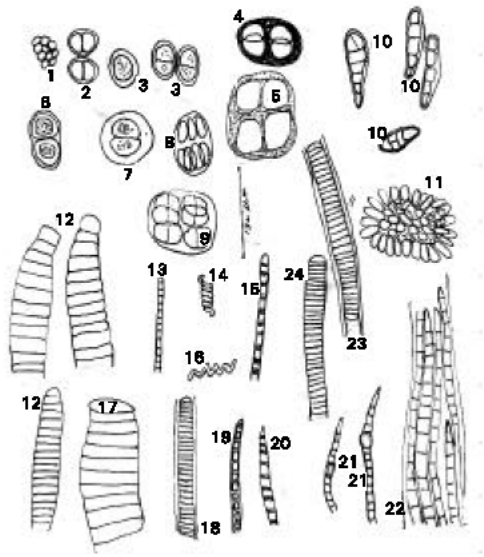
Parameters	Kai spring I	Ghazi Shah Spring II	Ghazi Shah village III Channel
Temp. Of air in °C	38	42	42
Temp. Of water in °C	35	38.2	27.2
Transparency in inches	Transparent	Transparent	Transparent
pH	8.20	7.14	7.28
Conductivity in µs/cm	865	1064	466
Salinity in g/L	0.10	0.20	0.10
TDS in mg/L	554	680	370
Hardness in mg/L	270	360	222
Malkalinitty in mg/L	125	318	85
Chloride in mg/L	106	160	80
COD in mg/L	-	64	Absent
Orthophsphate in mg/L	Absent	Absent	Absent
Total acid hydrolyzable Phosphate in mg/L	0.21	Absent	Absent
Nitrate in mg/L	1.40	-	-
Silica in mg/L	5	-	-
Na in mg/L	52	54	60
K in mg/L	8	13.6	10.70
Ca in mg/L	37	81	45
Mg in mg/L	31	52	46

Sampling stations

I. Kai spring district Dadu.

II. Ghazi Shah natural spring on the hill (Bhil) of mountain behind Ghazi Shah Taluka Johi.

III. Ghazi Shah spring drain. Samples collected from out side of village Ghazi Shah 2-3 km away from the source.



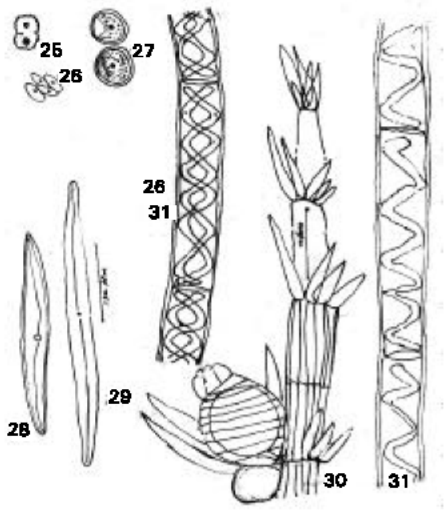


Plate 1: Figs. 1-22: Flora and fauna of Ghazi Shah and Kai springs of district Dadu, Sindh, Pakistan

1. *Holopedium irregularis* lager
2-3. *Chrocous minutus* (Kutz) Nag.
4. *Chroococcus turgidus v. maximus* Nyg.
5. *Chrococas giganteus* West and W.
6. *Chroococcus* sp.
7. *Chroococcus indicus*
8&9. *Chroococcus limneticus* lemm
10. Unknown fungal spores.
11. *Gomphosphaeria aponina* Kutz
12 & 17. *Oscillatoria princeps* Vauch.
13. *Oscillatoria minima* Gicklhorn
14. *Spirulina labyrinthiforms* Gom.
15. *Phormidium autumnale* (Ag) Goment
16. *Spirulina gigantea* Schmidle
18. *Lyngbya hieronymusii lemm.*
19. *Phormidium cf. foveolarum* (Montagne) Gom.
20. *Phormidium* sp.
21. *Anabaena* sp.
22. *Microcoleus lacustris* (Rab) Farlow
23. *Lyngbya hieronymusii* Lemm
24. *Oscillatoria nigra* Vauch

Plate 2, Figs. 25-31: Flora and Fauna of Ghazi (Gaji) Shah and Kai springs of district Dadu, Sindh, Pakistan

25. *Cosmarium bipunctatum* Borge
26. *Scenedesmus bijuga* (Trup) Lag
27. *Chlorococcum humicola* (Naeg.)
28. *Pleurosigma cf-salinarum* Grun.
29. *Pleurosigma elongatum* W. Sm.
30. *Chara zeylanica*
31. *Spirogyra* sp.

Ghazi Shah and Kai springs on the basis of water temperature 35-38°C may be classified as euthermal springs (Vouk, 1923) at source. In the Kai spring at the source a presence of H_2S was observed. There are Cyanophyta species dominant at the source in which *Lyngbya majuscula, Lyngbya aerugineo-coerulea* (Kutz) Gom, *Lyngbya martensiana, Oscillatoria princeps, Oscillatoria limosa, Oscillatoria tenuis,* Chroococcu sturgidus var. Maxmus, Chroococcus minor, *Aphanocapsa* sp. and *Microcystis viridis* (Plate 1, Figs. 1-24, Pl. 3, Figs. 32-45) and *Microspora amoena, Rhizoclonium hieroglyphicum* are found at the source and *Spirogyra* sp. *Mougeotia* sp, *Stigeoclonium stagnatile, Cladophopra glomerata* and *Microcoleus lacustrs, Phormidium* sp.

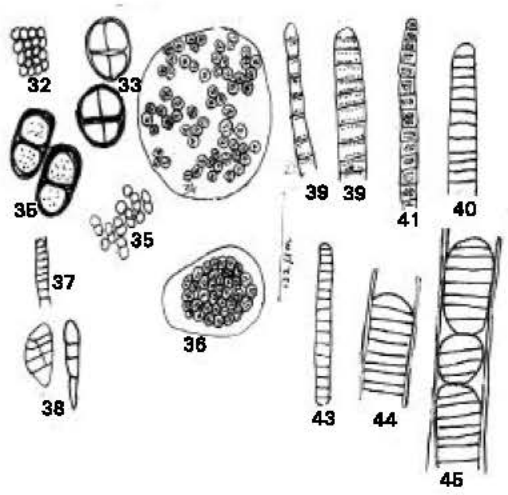


Plate 3: Figs. 32-45: Flora and fauna of Ghazi(Gaji) Shah and Kai springs of district Dadu, Sindh, Pakistan

32 *Holopedia irregularis* lag.
33. Chrococcus turgidus *V. maximus* Nygaard
34. *Microcystis viridis* (A Br.) Lem
35. *Aphanocapsa montana* Carmer
36. *Microcystis* sp.
37. *Phormidium* sp.
38. Fungal spore.
39. *Oscillatoria* sp.
40. *Oscillatoria limosa* (Roth) Ag.
41. *Oscillatoria prolifica* Gomant.
42. *Oscillatoria* sp.
43. *Oscillatoria tenuis* Ag.
44. *Lyngbya aerugineo-caerulea* (Kutz) Gm
45. *Lyngbya majuscula* Harv.

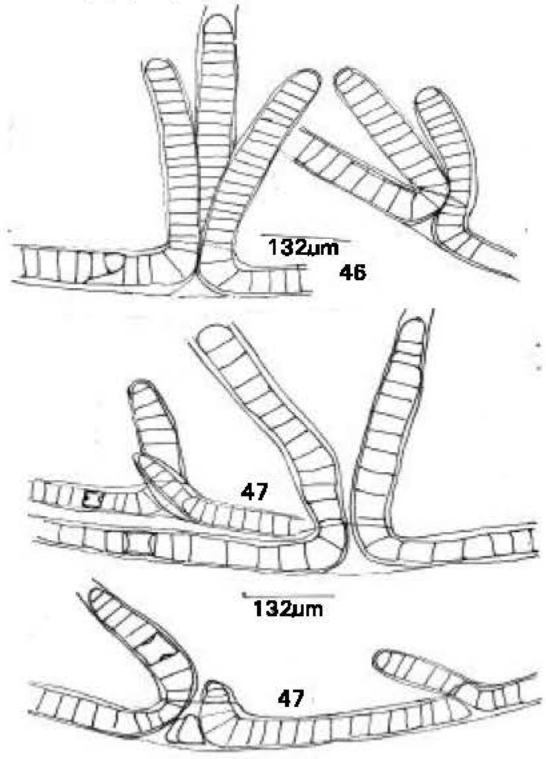


Plate 4: Figs. 46-47: Flora and fauna of Ghazi (Gaji) Shah and Kai springs of district Dadu, Sindh, Pakistan 46 & 47 *Scytonema coactile* Mont

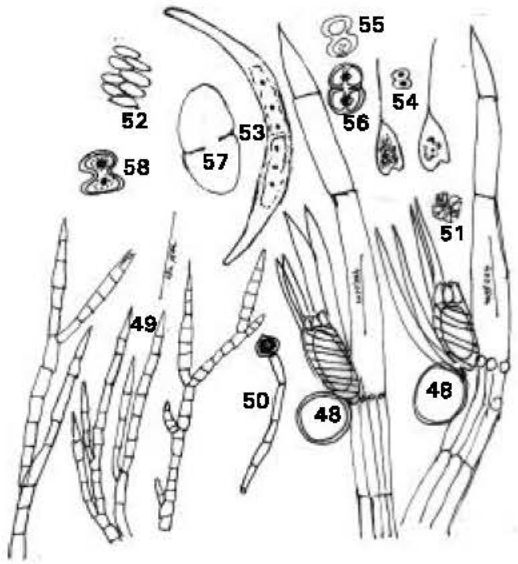


Plate 5: Figs. 48-58: Flora and fauna of Ghazi (Gaji) Shah and Kai springs of district Dadu, Sindh, Pakistan

48. *Chara vulgaris*
49. *Stigeoclonium subsecundum* Kutz.
50. *Oedogonium epiphytica*
51. *Pediastrum simplex*
52. *Scenedesmus arcuatus* Lemm.
53. *Closterium leibleinii* Kutz.
54. *Cosmarium globosum* Buhln var. Minus Hansg.
55. *Cosmarium moniliforme* Trp.
56. *Cosmarium* sp.
57. *Cosmarium granatum* Breb.
58. *Cosmarium* sp.

were found present on the side of the water channel (Plate 2. Figs. 25-31). As water flow, the oxygen dissolves with the loss of H_2S. At the middle of the channel *Chara zeylanica. Chara vulgaris, Scytonema* coatile (Plate 4. Figs. 38, 39 &42) and Finger Lings of *Puntius ticto* and *Aplocheilus panchax* were observed.

Ghazi Shah spring flow in the form of channel for 4-5 km before it is used for agricultural purposes on the way *Spirogyra rhizobrachialis, Spirogyra* sp. *Mougeotia* sp. *Cosmarium* sp. *Closterium leibleinii, Scendesmus arcuatus, Pediastrum simplex* is found growing together with *Chara zeylanica, Chara vulgaris,* (Plate 2, Figs. 25-31, Pl. 4. Figs. 46-47, Pl. 5, Figs. 48-58). *Potomogeton pectinatus, Potomogeton* sp. *Scrispus* sp. *Hydrilla vertcillata* as submerged species and Typha domingensis and *Phragmite communis* were found present as emergent which provides shelter to finger lings. A similar observation of flora and fauna were recorded from Lakki hot spring (Leghari *et al.*, 1983; Khuhawar *et al.*, 1986).

The water quality analysis indicated as acceptable source for irrigation and fisheries. The water contents indicate natural growth of algal flora as could be expected for fresh water reservoir.

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References

APHA, 1981. Standard methods for the examinations of water and waste water 15th Ed., Washington D.C.

Abu Bakr, M., 1965. Thermal springs of Pakistan Rec. Geo. Surv. Pakistan, 16: 1-3.

Baker, W. E. and C. A. Maclagan, 1884. Thermal springs of Sindh. Asiatic, Soc. Bengal. J., 17: 230

Beg, M. A. A., S. N. Mahmood and S. Naeem, 1984. Characterization of waters. Part-I. Spring waters in and around Karachi. Pak. J. Sci., Ind. Res., 27: 131-136.

Cook, C. D., 1996. Aquatic & wet land plants of India (Reprinted in 1978) William Dawson and Sons. London. pp: 778.

Desikachary, T. V., 1961. Cyanophyta, I.C.A.R. New Delhi, pp: 686

Jahangir, T. M., M. Y. Khuhawar, S. M. Leghari and Abdullah Laghari, 2001. Physico-chemical and biological study of Mangho Pir Euthermal spring. Karachi, Sindh, Pakistan. OnLine J. Biol. Sci., 1: 636-639.

Khurmi, R. S., 1978. "Text Book of Hydraulics. Fluid Mechanics and Hydraulic Machines" S. Chand & Company Ltd. Ram Nagar. New Delhi- 110055.

Khan, I. A. and S. M. Husaini, 1987. Geochemical study of some thermal springs of Sindh: Pakistan. Pak. J. Ind. Res., 30: 649-653.

Khuhawar, M. Y., S. N. Thebow and S. M. Leghari, 1986. "Physico-chemical investigation of hot Lakki Springs of Sindh" Pak. Phy. Chem., 5: 43-49.

Leghari, S. M., T. M. Jahangir, M. Y. Khuhawar and Abdullah Laghari, 2001. Physico-chemical study of Dhabeji springs, Malir, Karachi, Pakistan. OnLine J. Biol. Sci., 1: 623-627.

Leghari, S. M., G. N. Shaito and M. Y. Khuhawar, 1995. Physico-chemical and floral studies of Pokhan and Zai springs of Hilly areas near Thano Bola Khan Distt. Dadu, Sindh. Pakistan. Scientific Khyber, J., 8: 37-41.

Leghari, S. M. and S. N. Arbani, 1984. Survey of Freshwater algae (Cynaophyceae) from Ponds and lakes of lower Sindh Sindhological studies (Summer), pp: 67-90.

Leghari, S. M. and S. N. Thebo, 1983. "Cyanophyceae of hot spring at Lakki Shah Sadder Sindh, Pakistan". Sindh University. Res. J. (Sci. Ser.), 15: 147-150.

Mirza, M.R., 1990. Fresh water fishes of Pakistan. Under Science Board Lahore Pakistan, pp: 1-128

Panhwar, M. H., 1988. Some important spring of Mahal Kohistan Minning Eng. J. Pakistan, 7: 9-13.

Prescott, G. W., 1962. Algae of the Western great Lakes area.W. M. C. Brown company publishers Dbuque, lowa, pp: 977.

Vouk, K., 1923. Die problem der biologie der thermen internet Rev. Hydrobiol. Hyderogr, 11: 89-99.

WHO, 1984. Guidelines for drinking water quality. (Health critera and other supporting information). Geneva World Health Orgaization.

Zahid, P. B., 1989. Studies on some thermophilic algae at Karachi. Pakistan. Scientific Khyber. J., 2: 157-169.