Morphological characterization and distribution of bacterial diversity in Dal Lake, Kashmir

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ABSTRACT

Microorganisms are widely distributed in nature, and their abundance and diversity can be used as an indicator for the portability of water. This preliminary research work determined the bacterial characteristics of waters of Dal Lake, Kashmir. The study was carried out from June 2013 to October 2013 at four different sites. Two different techniques i.e., Serial dilution and Spread plate (Sharp and Lyles, 1969) were used. During the study, the bacterial flora showed variation in relation to the conditions prevailing at the different sites. Thirty bacterial isolates coded from B1 to B30 with 63.33% of the bacterial strains as Gram negative and 36.33% Gram positive bacteria were isolated. The highest viable count of bacteria was observed at site II with a cfu/ml of 132×10^2 in the month of July and the lowest viable count at site III with a cfu/ml of 18×10^2 in the month of October. Further, it was observed that 16.66% of strains were Gram +ve Cocci, 20% Gram -ve Bacilli, 20% Gram +ve Bacilli, 43.33% Gram -vecocci. Nishat basin showed the highest load of bacteria.

Keywords: Bacteria, dal lake, kashmir

INTRODUCTION

Water is essential to sustain life, without it life becomes impossible (WHO, 1977). Water is an indispensable commodity, which should be easily accessible, adequate in quality, free of contamination, safe, affordable and available throughout the year in order to sustain life (Salem *et al*., 2008). Thus, the protection of water resources from contamination is the first priority (Daud *et al*., 2001). Water used for drinking, cooking and food processing should have no color, no odour and essentially no turbidity (Katyal and Satake, 1990). Unsafe water is a global public health threat, placing

persons at risk for a host of diarrhoeal and other diseases as well as chemical intoxication (Hughes and Koplan, 2005). Children are generally more vulnerable to intestinal pathogens and it has been reported that about 1.1 million children die every year due to diarrhoeal diseases (Steiner *et al*., 2006). It is therefore important to determine the quality, microbial diversity and antibiotic susceptibility profiles of microbial isolates from water sources consumed.

Aquatic microbiology is the branch of microbiology that deals with microscopic living organisms in fresh or salt water system (Hughes and Koplan, 2005). While aquatic microbiology can compass all micro-organisms including microscopic plants and animals, it more commonly refers to the study of bacteria, fungi and viruses and their relation to other organisms in aquatic environment. It is concerned with the structure, function and classification of these organisms and with ways of controlling and using their activities. In aquatic system especially those receiving some allochthonous organic input, the secondary production of planktonic bacteria can be co-equal or even larger than that of primary production of phyto-plankton (Findlay *et al*., 1991). The number and kind of bacteria found in different types of ecosystems vary and are influenced by the ecosystem processes maintaining plant primary productivity (Griffth *et al*., 2003). Bacterial flora shows variation in relation to the prevailing conditions (Shafi *et al.,* 2011).

MATERIALS AND METHODS

Study Area

The Dal lake, located at 34^0 07' N, 74^0 52' E, situated in the northeast of Srinagar (the capital of Jammu and Kashmir) in Kashmir valley (1584 m above mean sea level), is one of the most beautiful lakes in India and the second largest lake in Jammu and Kashmir. The lake is probably of fluvial origin, formed from the oxbows of river Jhelum (Dianelle, 1922; De and Paterson, 1939). Around 1200 AD, the lake spread over an area of 75 km^2. At present, it covers an area of about 11.4 km^2 with a maximum depth of 5.4 m. Four sites were selected for the present study, Hazratbal basin (a perennial inflow channel known as Telbal nalah enters the lake from the north in Hazratbal basin, another inlet Bot Kol, also joins in the Hazratbal basin, just west to Telbal stream), Nishat basin (within the lake basin, there are number of springs which act as a permanent water source to the lake), Gagribal basin 'a' (large number of houseboats are located within this basin, it is the busiest location in the Dal, Nehru park is also located within this area) and Gagribal basin 'b' (this is the market area of the Dal having floating markets and

floating gardens).

Sampling

Samples of water were collected from the selected sites in suitable plastic bottles, which were previously carefully cleaned, rinsed three to four times with distilled water (A.P.H.A, 1998). The collected samples were later processed for microbial analysis.

Characterization

Inoculum from the serial dilution tubes was spread onto the Petridishes containing Nutrient agar medium by two different techniques which are Serial dilution (Clesceri *et al*., 1998) and Spread plate (Sharp and Lyles, 1969) and were incubated at a temperature of 28°C for 24-48 hours. Growing colonies were counted on the Digital Quebec colony counter to determine the number of colony forming units (cfu/ml). For identification of bacteria, Gram staining was used.

RESULTS

On the basis of morphological characters, different types of colonies were obtained during the study period. Colonies differ in their shape, some were circular, some irregular and some rhizoidal. A total of 30 colonies were obtained during the study. They were assigned the names from B_1 to B_{30}(Table 1).

The developed colonies were enumerated in plates and the bacterial load assessed in terms of colony forming units (cfu/ml) revealed that total monthly bacterial population was high in the months of June and July, and low in the months of September and October. The overall bacterial density throughout the study area was maximum at site II with a cfu/ml of $268x10^{-2}$ in the month of July and minimum at site III with a cfu/ml of 23×10^{-2} in the month of October (Table-2).

The isolates were tested for Gram's reaction and subsequently examined under microscope for their cell shape. Out of 30 bacterial isolates, 6 were Gram negative bacillus, 13 Gram negative cocci, 6 Gram positive bacillus and 5 were Gram positive cocci. It was also observed that 63.33% of the bacterial strains were Gram negative and 36.33% were Gram positive.

Table 2: Monthly distribution of bacterial colonies (cfu/ml) at 10^{-2} dilution.

Months	Site I	Site II	Site III	Site IV
June	184	221	89	103
July	197	268	96	193
September	76	140	37	81
October	46	83	23	80

Table 1: Macro morphological characteristics of isolates obtained from four sites

Isolate name	Appearance	Margin	Elevation	Colour	Gram's reaction	Cell shape
B1	Circular	Entire	Flat	Yellow	+ve	C
B2	Circular	Entire	Raised	Creamish	+ve	C
B3	Irregular	Undulated	Flat	Yellow	-ve	C
B4	Irregular	Undulated	Flat	White	-ve	B
B5	Rhizoid	Filamentous	Flat	White	-ve	C
B6	Circular	Entire	Convex	Creamish	-ve	C
B7	Irregular	Undulated	Raised	Creamish	-ve	C
B8	Irregular	Entire	Flat	White	+ve	B
B9	Circular	Entire	Convex	Yellow	-ve	C
B10	Rhizoid	Filamentous	Flat	Yellow	+ve	B
B11	Circular	Curled	Flat	White	-ve	B
B12	Circular	Undulated	Flat	Yellow	-ve	B
B13	Circular	Curled	Raised	White	+ve	C
B14	Irregular	Undulated	Raised	White	+ve	B
B15	Circular	Entire	Raised	Yellow	-ve	B
B16	Circular	Entire	Convex	White	+ve	C
B17	Circular	Undulated	Convex	White	-ve	B
B18	Circular	Undulated	Flat	White	+ve	C
B19	Irregular	Entire	Convex	White	+ve	B
B20	Circular	Curled	Convex	Yellow	-ve	C
B21	Circular	Entire	Flat	White	-ve	C
B22	Circular	Entire	Raised	Yellow	-ve	B
B23	Circular	Curled	Flat	Yellow	+ve	B
B24	Rhizoid	Filamentous	Raised	White	-ve	C
B25	Circular	Entire	Raised	White	-ve	C
B26	Circular	Undulated	Convex	Creamish	-ve	C
B27	Circular	Entire	Raised	Yellow	-ve	C
B28	Circular	Curled	Flat	Creamish	-ve	C
B29	Circular	Entire	Flat	Creamish	+ve	B
B30	Circular	Undulated	Convex	Yellow	-ve	C

C = Cocci, B = Bacilli

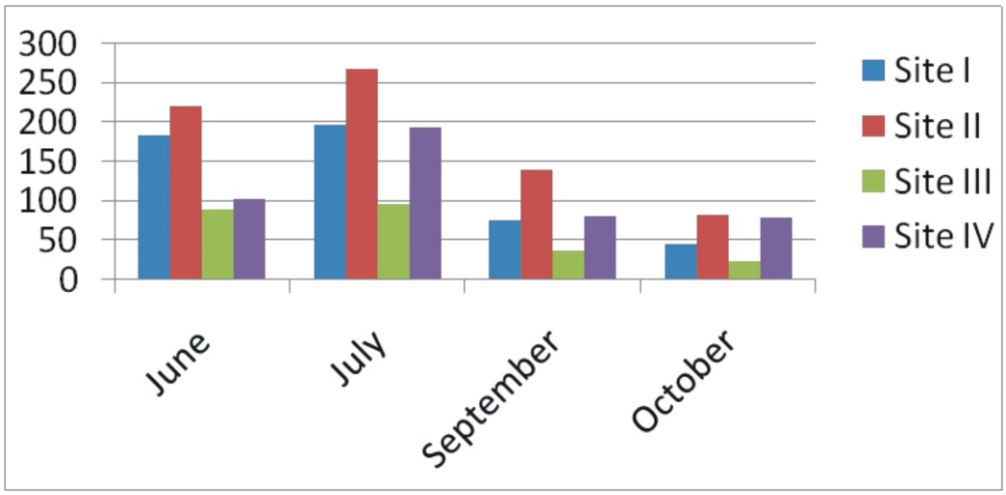

Fig.1: Colony forming units (cfu/ml) at different Sites at 10^{-2} dilution

DISCUSSION

In our study, we observed that the colony count was highest in the months of June and July and low in the months of September and October. This variation may be attributed to favorable conditions during the summer period. Our results draw support from Shafi *et al*., 2011. During their study, they observed that bacterial flora showed variation in relation to the conditions prevailing at the different sites. The total bacterial population was highest at site II (268) in the month of July. Similar trend was followed by other sites. This may be attributed to the temperature variation in different months. Murphy (2000) reported that bacteria grow fast at higher temperature and the growth rate slows down dramatically at low temperature. Another study carried out by Lokoska *et al.* (2004) also supports our findings by showing that bacterial community composition in any aquatic system is determined by various physical and chemical characteristics of the water, with temperature playing a key role.

The highest colony count at site II in comparison to other sites could be attributed to the anthropogenic activities in that vicinity. Our results draw support from the studies of Griffin *et al.* (2001) who reported the effect of non-point source discharges on water quality. The abundance of the Gram negative bacteria observed at different sites may be attributed to the increased addition of the excretory substances to the water. As the gram negative bacteria have a reservoir in the intestines of man and other warm blooded animals, are excreted in faeces and are known to survive in the environment but do not reproduce (Feachem *et al.,* 1983).

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