Chapter 1
INTRODUCTION

Most rivers in recent decades are being polluted due to deforestation, urbanization, cultivation, industrialization and various other human activities. In tropical countries, considerable morbidity and mortality have been reported due to frequent epidemics of gastroenteritis of bacterial origin (Pathak et al., 1992). The indicators of pollution include *E. coli* and enteric group as a whole, *Vibrio* and *Clostridium* spp. These organisms are not only a threat to humans but also to the aquatic animals.

The genus *Aeromonas* is one of several medically significant genera. Although aeromonads were discovered more than 100 years ago, only during the past three decades, their role in a variety of human illnesses has been unquestionably proven (Janda and Abbott, 1998; Kannan and Nair, 2000). It is ubiquitous in aquatic environments and has been found in oligotrophic upland waters, eutrophic lowland rivers, sewage effluents, estuarine, marine and tap waters (Rippey and Cabelli, 1985; Gavriel et al., 1998).

One of the main reservoir for the enteric *Aeromonas* associated infections in humans is the domestic water supply (Kuhn et al., 1997) from which *Aeromonas* spp. have been frequently isolated, even after chlorination (Lechevallier et al., 1982) and chlorinated drinking water may represent a potential health hazard when contaminated by these organisms. Their presence is attributed to ineffective disinfection, or as a result of after growth within the distribution system (Havelaar et al., 1990; Knochel and Jeppessen, 1990).
The attachment capabilities of *A. hydrophila* provide evidence that, this organism, as well as other pathogens may colonize the interior walls of water distribution systems, to such levels that might lead to the spread of the pathogen, consequently might affect the microbiological quality of water that comes into contact with the surfaces. This could dramatically reduce the effectiveness of conventional methods of disinfection, such as chlorination (Assanta *et al*., 1998).

The presence of *Aeromonas* spp. has been considered to be indicative of nutrient rich conditions in water. It has been claimed that aeromonads serve to assess and predict deterioration or recovery of aquatic system (Rippey and Cabelli, 1985). It is important to understand factors that may contribute to the survival and proliferation of *Aeromonas* spp. in urban water used for recreational purposes. Flint (1996) observed the increase in numbers of *Aeromonas* spp. in the water just below the sewage outfall. The diversity among aeromonads increases in waters with less faecal pollution. It seems that there is an inverse relationship between *Aeromonas* species diversity and degree of water pollution (Araujo *et al*., 1991) and they are able to proliferate at refrigeration temperature, even in the presence of competing psychrotrops (Lidia *et al*., 2001).

They are not, in general considered to be normal inhabitants of the human gastrointestinal tract. However, different studies have shown that about 1 % of healthy adults carry them (Geldrich, 1978). Therefore, the human faecal origin of aeromonads found in urban waters cannot be excluded. However, the high aeromonad counts found in wastewater may indicate a rapid multiplication of these bacteria. Very few have tried to correlate the presence of *Aeromonas* in drinking water to its potential role as the
etiological agent of waterborne diseases and *Aeromonas* species isolated from a chlorinated water supply were potentially enteropathogenic (Alavandi *et al*., 1999).

*Aeromonas* species have been reported as a normal microflora of aquatic and terrestrial organisms as well as etiological agents of disease in numerous cold-blooded and warm-blooded animals including humans (Cahill, 1990). They sometime cause serious infections particularly in freshwater fish.

In South East Asia, fish mortality due to *A. hydrophila* contributes a substantial economic loss to the fish farming industry (Thampuran *et al*., 1995). *A. hydrophila* is an intracellular parasite in fish, which can survive and grow inside *Tilapia* phagocytes (Leung *et al*., 1995) and carp epithelial cells (Leung *et al*., 1996).

Attributes of the *Aeromonas* spp. that have the potential to contribute to their pathogenicity include the production of endotoxins, extracellular enterotoxins, cytotoxins and proteases, the ability to adhere to cells, and the possession of certain surface proteins (Cahill, 1990). A variety of virulence factors and potential enterotoxins have been characterized and pointed out that haemolysin is a good candidate for the main enterotoxin production and it has been claimed that this might be a modified aerolysin (Kirov, 1997).

Haemolysins are cytolytic extracellular proteins, which act by forming holes in cell membranes by inserting into the lipid bilayer, thus destroying the membrane permeability barrier. Aerolysin, which is a soluble cytolytic protein produced by *A. hydrophila*, is released by the bacteria as a protoxin that are activated by one or more
proteases (including extracellular *Aeromonas* proteases) in the culture supernatant fluids. It would appear that control of protease synthesis is an additional desirable parameter useful to prevent food borne illness due to *A. hydrophila* (Howard and Buckley, 1985).

Proteases may contribute to pathogenicity by causing direct tissue damage or enhanced invasiveness. They may also have an indirect effect in *A. hydrophila* by bringing about the proteolytic activation of the aerolysin (β-haemolysin). *A. hydrophila* and species of *Aeromonas* can produce cholera-like toxin. Hence the organism is kept under cholera-like toxin family (Chopra *et al.*, 1986).

**SCOPE OF THE WORK**

The distribution of the members of enterobacteriaceae in aquatic system has been very well documented throughout the world. The bacterial load on the aquatic fauna leads to many infections. These organisms are found as a normal flora of the aquatic environment. When stress occurs, they may become a pathogen. Apart from this many bacterial pathogens are being introduced from human source. In rural India lack of infrastructure turns the people to use the water as raw. The riverine environment receives many industrial and domestic wastes from both point and non-point sources.

Human activities like bathing, washing of animals and vehicles are found to be more in the River Amaravathy throughout the course of its flow. More than fifty thousand people are routinely using the river water for various purposes. The fish species such as Tilapia, Catla and Rogue are frequently caught and sold. Since *Aeromonas* spp. are normal / primary / secondary / opportunistic pathogen to fishes and human, we have taken up the work to collect data on the incidence / distribution of *Aeromonas* spp. in water, sediment and fish samples along with the physico-chemical quality of the River water.
Till date there is no systematic report available on the distribution of microorganism in River Amaravathy. Though *Aeromonas* spp. is normal flora of the aquatic environment, some strains are more pathogenic to fishes. Nowadays the antibiotic resistance of *Aeromonas* spp. seems to be in increasing trend. The abuse of antibiotics in various sources ultimately leads to these resistant strains that may create problem in controlling. Hence the work has been planned to carry out with the following objectives

**OBJECTIVES**

1. To enumerate *Aeromonas* spp. and *A. hydrophila* in water and sediment samples collected from River Amaravathy and to find out their relationship with abiotic parameters, besides the prevalence of *Aeromonas* spp. and *A. hydrophila* associated with freshwater fishes.

2. To investigate the antibiotic resistance pattern, haemolytic and protease activity of strains of *A. hydrophila* isolated from water, sediment and fish and

3. To study the susceptibility of selected *A. hydrophila* strains to various concentration of chlorine (commercial bleach) under predetermined time intervals.