Introduction

Fish is one of the most widely consumed and cheapest protein source in the world today. Offering a wide variety of tastes as well as nutritive qualities, it is consumed all over the world. From the time aquaculture showed signs of becoming a commercial activity, it has faced various problems. The occurrence of fish mortality in cultured waters is a common phenomenon and is as old as the practice of fish culture itself. An increased production efficiency has resulted following integration of knowledge from a wide range of disciplines including reproduction, nutrition, genetics and immunology. Harmonization of these fields and their amalgamation with branches of engineering has not only facilitated the comparative rapid global expansion of the aquabusiness, but the intense rearing through high stocking densities, artificial feed and fertilizer use has also created conditions leading to physiological stress and an increase in the risk of disease outbreak (Pillay, 1996; McLean, 1996).

Various diseases have so far been reported worldwide. Bacterial diseases such as furunculosis (Ghittino, 1972; Ferguson and McCarthy, 1978; Dalsgaard, 1994; Ford *et al*, 1994), Vibriosis (Levin *et al*, 1972; Lewis, 1985; Egidius *et al*, 1986; Liu *et al*, 1994), bacterial kidney disease (Bruno and Munro, 1982; Bruno, 1986; Magnusson *et al*, 1994), enteric septicemia (Plumb and Sanchez, 1983; Plumb and Hilge, 1987; Kasomchandra *et al*, 1987; Chen and Kumlin, 1989; Morrison and Plumb, 1994), streptococcicosis (Ferguson *et al*, 1994; Al-Harbi, 1994), bacterial gill disease (Lumsden *et al*, 1994); viral diseases e.g. infectious carp dropsy or viral haemorrhagic septicemia (Schaperclaus, 1965; Ghittino *et al*, 1984; Trust, 1986; Meyers *et al*, 1992); fungal diseases (Noga *et al*, 1991; Kumar and Dey, 1991); metazoan and protozoan diseases (Paperna, 1980; Mishra *et al*, 1982; Kabata, 1985; Landsberg and Paperna, 1987) are some of the fish diseases which have plagued both wild and cultured waters throughout the world.

Nature has gifted India with an abundance of all types of fishery resources. There are big rivers and their tributaries, creeks and canals and also a long coastline. The most potential areas are the dug up impounded water bodies, *i.e.*, ponds and tanks which provide an ideal environment for the growth of fishes. The oxbow lakes popularly known as beels and baors are also highly

productive. The inland fish production in the state of West Bengal is quite substantial and contributes more than one third of the total inland production of India. The state is endowed with rich fishery resources represented by Indian major carps, catfishes, minor carps, murrels and air breathing fishes. The state has the largest brackishwater fishery resources in India. The rivers of West Bengal harbour 22 species of economically important fishes and the beel fishery comprise thirteen species of marketable fishes. (Jain, 1990). Hence a large section of the rural population is dependent on aquaculture. Not only in West Bengal, fish farming is the backbone of economy in many areas throughout India.

Occurrence of fish diseases in India till 1988 had not been of alarming nature compared to industrially advanced countries where intensive fish culture is practiced on a large scale. The common fish diseases which occurred in Indian traditional pond fish include ulcerative dropsy, columnaris disease, trichodiniasis, white gill spot disease, ligulosis, lernaeosis, ergasilosis, argulosis, gill rot and saprolegniasis. The predominant diseases of fin and shell fish cultured in estuarine wetlands are trichodiniasis and ergasilosis in mullets, soft shell diseases, cramped tail condition, external fouling and black spot in prawns and those cultured in sewage fed wetlands are gas bubble disease, white scale spot and trichodiniasis (Das and Das, 1995). However, the most destructive of all fish diseases occurring in Indian waters is a specific ulcerative disease, epizootic ulcerative syndrome (EUS) which first appeared in March, 1972 in estuarine fish stock of central Queensland, Australia. In India, the disease was first reported in May, 1988 in various states of north-eastern India such as Tripura, Meghalaya and Assam. Since then the disease resulted in insurmountable misery to the fishing community throughout the country (Das, 1988, Jhingran, 1990, Kumar *et al*, 1991, Pradhan, 1992).

The name epizootic ulcerative syndrome or EUS was adopted in 1986 at the FAO Consultation of Experts meeting in Bangkok (FAO, 1986). They recommended that further studies should take place in the areas of epizootiology and also into the virology, bacteriology and mycology associated with the different outbreaks (Chinabut, 1995).

The alarming spread of the disease and the misery of the fish farmers caused by this epizootic became a matter of grave concern for the scientists and administrators and investigation on this disease was given utmost priority by all the countries of the Asia-Pacific region. A collaborative research project on epizootic ulcerative syndrome was conducted in Australia, Indonesia Philippines and India between 1992 and 1995 (Callinan *et al*, 1996). Another project was granted by the Overseas Development Agency collaborating scientists from Bangladesh, Indonesia, Malaysia, Philippines and the Thailand. Scientists in Srilanka are also engaged in studies concerning this disease. But inspite of all the concerted efforts and the hectic researches, no firm conclusions have been reached regarding the exact causative agent of this disease.

As in other countries, the outbreak of EUS in India created panic in the affected areas with sizable loss of valuable fish. The disease appeared unprecedentally in May, 1988 in some areas of the north eastern states of India, such as Assam, Tripura and Meghalaya. By the month of October, the disease struck the northern districts of West Bengal. During the period of 1988-90, West Bengal became the worst victim of this ulcerative disease (Pradhan, 1992). In 1988, severe outbreaks occurred in the northern districts of the state of West Bengal such as Coochbehar, Jalpaiguri, Dinajpur, Malda and plains of Darjeeling district. The incidence of the disease has also been reported from some southern districts of West Bengal such as Murshidabad, Nadia, 24-Parganas and Midnapur (Pradhan and Pal, 1990). By the year 1990, entire West Bengal was reeling under the effects of this perilous ulcerative disease. A national workshop on the ulcerative disease was organized in 1990 jointly by the Government of West Bengal and the Ministry of Agriculture, Government of India. The outcome of this workshop in controlling the disease was only marginal and despite all efforts by scientists and administrators, the disease recurred every year in varying intensities, thus throwing a big responsibility to the fisheries' scientists to find out the etiology and means of control of this dreaded disease.

Investigations conducted by Pal and Pradhan (1990) during the initial outbreaks revealed the presence of two fluorescent Pseudomonads (R1 and

R2) and one Aeromonad (*Aeromonas caviae*) (R3) and one Coccus (C) (*Micrococcus* sp.) in the surface ulcers of air breathing fishes. R1, R2 and R3 were found to be pathogenic when injected to healthy fishes. A further study on the exact role of these pathogenic bacteria in causing the disease and an immediate and cost effective means to control the disease was awaited. In view of the importance and continuing existence of this serious disease, investigations on its present etiological state, the exact role played by the pathogenic bacteria and effective control measures have been taken up. The main objectives of this study are : 1) Histopathological studies on experimentally infected fishes 2) Effect of pathogenic bacteria on RBC count and haemoglobin content of fishes 3) Study on exotoxins that may be secreted by the pathogenic bacteria 4) Isolation of bacteria from external lesions of naturally infected fishes 5) Biochemical characterization and identification upto the genus level of the isolated bacteria 6) Pathogenicity testing of bacteria on fishes 7) Drug and antibiotic sensitivity assay of the bacteria 8) *In vivo* effect of drugs and antibiotics on diseased fishes.