



ANALYSIS OF BACTERIAL POPULATION IN WATER, SEDIMENT AND THE FISH *MYSTUS VITTATUS* COLLECTED FROM LOWER ANICUT, THANJAVUR DISTRICT, TAMIL NADU, INDIA

P. Balasubramanian¹ and R. Sivakami^{2*}

¹PG & Research Department of Zoology, Government Arts College (Autonomous), Kumbakonam-612002, India

²PG & Research Department of Zoology, Arignar Anna Govt. Arts College, Musiri-621211, Tamil Nadu, India

Article History: Received 25th April 2018; Accepted 27th May 2018; Published 31st May 2018

ABSTRACT

Even though India is presently ranked second in aquaculture production, the outbreak of infectious diseases has resulted in heavy losses to the aquaculture industry. Among the various groups of pathogens affecting fishes, bacteria appear to be the most common pathogen. Hence the present study was attempted to find the bacteria that occur in water, sediment and the common fish *Mystus vittatus* collected from Lower Anicut area in Tamil Nadu. A total of 20 bacteria were identified in both sediment and water samples. The skin of *Mystus vittatus* recorded 11 bacteria while the foregut 12, midgut 9 and hindgut, 17 bacteria. Out of these, eight bacteria were common to gut. During this study, bacteria that could pose a threat to human beings were also isolated. This warrants immediate action as well as dissipation of information to the fishermen and handlers.

Keywords: Fresh water, Sediment, Bacteria, *Mystus vittatus*, Skin, Digestive system.

INTRODUCTION

With increasing demand for food, aquaculture is rapidly developing throughout the world and today in many countries fish farming has already become an important economic activity. India with its exploding human population will now have to use all its avenues for increasing its food production. India is now presently ranked second in aquaculture production (Saraswathi *et al.*, 2015). However, the outbreak of infectious diseases in farm fishes has brought about a significant setback for successful aquaculture as it has resulted in losses to the farmers. Among the various groups of pathogens that cause diseases, bacterial diseases appear to be the most common fish pathogen.

Only recently has attention been given to microbiological studies focussing on isolation and establishing causes of fish disease and their medications (Saraswathi *et al.*, 2015). Ogbondeminu & Okaeme, (1989) reported that 50% of microorganisms recorded from fishes in ponds fertilized with annual faecal waste had members of the family Enterobacteriaceae. Recently, Saraswathi *et al.*

(2015) while analysing carps reared in a fresh water pond in Tamil Nadu, recorded enteric bacteria belonging to 10 genera involving a total of 13 species. Many scientists working on various farm fishes have been able to recover a wide range of potent bacteria that can cause diseases to man (Buras *et al.*, 1987; Hejkal *et al.*, 1983; Ogbondeminu, 1993; Sakata *et al.*, 1980; Saraswathi *et al.*, 2015). Hence the present study was attempted to identify the various bacteria in *Mystus vittatus* collected from Lower Anicut, Thiruppanandal Block, Thanjavur District, Tamil Nadu, India.

MATERIALS AND METHODS

Water samples for microbiological analyses were collected, put aseptically into sterile 500 ml sampling bottles and examined within 1-2 hours of collection in the laboratory. All water samples were analysed for the presence of total and faecal coliform bacteria, faecal Streptococci and pathogenic *Salmonella* by the most probable number (MPN) method following the American Public Health Association procedures. The total viable count (TVC) of all

*Corresponding Author: Dr. R. Sivakami, Assistant Professor, PG & Research Department of Zoology, Arignar Anna Govt. Arts College, Musiri -621211, Tamil Nadu, India., Email: drsiva17@gmail.com

heterotrophic bacteria was done on nutrient agar plates incubated at 28°C for 48 hours.

Ten specimens from each fish species were examined on the day of harvest. Swab samples of about 4-5cm² fish skin area were collected and inoculated onto media as those used for the water samples to estimate the MPN values. Pieces of fish skin, muscle and digestive tracts were collected separately under aseptic conditions and put into sterile petridishes. Corresponding organs from the same fish species were pooled, weighed and homogenized with a sterile warring blender with 10 ml of 0.1% phosphate buffer saline of pH 7.5 per gram of fish tissue. A volume of 0.1ml of the homogenate was plated subsequently onto nutrient agar and Mac Conkey agar and incubated at 37°C for 24-48 hrs. For qualitative identification of various bacteria from water and fish samples, fresh solid media of modified fecal coliform (M-FC) agar were inoculated in duplicate and incubated at 37°C for 24 h. After distinct colored colonies of various bacteria developed on the plates, the identification of the bacterial colonies were done according to (Brenner, 1984; Cowan & Steel, 2004; Edwards, 1972; Martin & Washington, 1980) and (Cheesbrough, 1981).

RESULTS AND DISCUSSION

The Table-1 records the various bacteria that were identified from water, sediments, skin and gut of *Mystus vittatus*. As evident from the table, a total of 20 bacteria belonging to 15 genera were identified. Of these, the genus *Vibrio* was represented by three species while *Bacillus* and *Proteus* were represented by two species each. The remaining genera were all represented by a single species each. A comparison of the bacteria flora in water and sediment reveals that all the 20 bacteria that were identified were found in both the water as well as sediment. Examination of the skin of *Mystus vittatus* reveals that a total of 11 bacteria could be isolated which were recorded in the water and sediment. However, bacteria like *B. cereus*, *C. perfringens*, *F. johnsoniae*, *P. vulgaris*, *S. marcescens*, *S. sonnei*, *S. faecalis* and *V. parahaemolyticus* which were recorded in both sediment and water could not be found in the skin of *Mystus vittatus*.

Table 1. Existence of bacterial population in various samples of *Mystus vittatus* collected from Lower Anicut area.

Name of the Bacteria	Name of the Samples					
	Sediments	Water	Epidermis	Foregut	Midgut	Hindgut
<i>Aerobacter aerogenes</i>	+	+	+	-	-	+
<i>Aeromonas hydrophila</i>	+	+	+	+	+	+
<i>Bacillus cereus</i>	+	+	-	-	-	+
<i>Bacillus subtilis</i>	+	+	+	+	+	+
<i>Clostridium perfringens</i>	+	+	-	-	-	+
<i>Enterobacter aerogenes</i>	+	+	+	+	-	-
<i>Escherichia coli</i>	+	+	+	+	+	+
<i>Flavobacterium johnsoniae</i>	+	-	-	-	-	+
<i>Klebsiella pneumoniae</i>	+	+	+	+	+	+
<i>Proteus mirabilis</i>	+	+	+	-	-	-
<i>Proteus vulgaris</i>	+	+	-	+	+	+
<i>Pseudomonas aeruginosa</i>	+	+	+	+	+	+
<i>Salmonella typhi</i>	+	+	+	+	-	-
<i>Serratia marcescens</i>	+	+	-	-	-	+
<i>Shigella sonnei</i>	+	+	-	+	+	+
<i>Staphylococcus aureus</i>	+	+	+	+	+	+
<i>Streptococcus faecalis</i>	+	+	-	-	+	+
<i>Vibrio alginolyticus</i>	+	+	-	-	-	+
<i>Vibrio cholerae</i>	+	+	+	+	-	+
<i>Vibrio parahaemolyticus</i>	+	-	-	+	-	+

+ denotes present; -denotes absent.

Examination of the gut of *Mystus vittatus* reveals that the foregut recorded a total of 12 bacteria while the midgut recorded nine bacteria and the hindgut recorded 17 bacteria. A closer examination reveals that the foregut

recorded two unique bacteria (*E. aerogenes* and *S. typhi*), which were not found in the midgut and hindgut while the hindgut recorded six unique bacteria (*A. aerogenes*, *B. cereus*, *C. pefrogens*, *F. johnsoniae*, *S. marcescens* and

V. alginolyticus) which were not found in the midgut and foregut. However, the midgut did not record the presence of any unique bacteria. Further, the midgut and hindgut recorded two species (*V. cholerae* and *V. parahaemolyticus*) which was not recorded in the midgut while the midgut and hindgut recorded *S. faecalis* which was not recorded in the foregut. However, *P. mirabilis* was the only species which was not recorded in the gut even though there were eight bacteria that were common to all regions of the gut (*A. hydrophila*, *B. subtilis*, *E. coli*, *K. pneumoniae*, *P. vulgaris*, *P. aeruginosa*, *S. sonnei* and *S. aureus*). Thus, it appears that bacteria can survive in all parts of the gut even though the hindgut is the most preferred habitat of these organisms.

A perusal of the bacterial load in water and the different regions of *Mystus vittatus* suggest that the bacteria are similar. No new species of bacteria could be identified from the *M. vittatus* suggesting that there is a close correlation between the bacteria present in water and the *M. vittatus*. Similar observations have also been reported by a number of workers (Buras *et al.*, 1987; Hejkal *et al.*, 1983; Ogbondeminu, 1993; Saraswathi *et al.*, 2015; Zmysłowska *et al.*, 2001). An analysis of the bacteria flora recorded in the gut of various fishes reveals that bacteria isolated in the present study was also documented by others. Thus the presence of genera like *Enterobacter*, *Salmonella*, *Pseudomonas*, *Proteus* and *Shigella* were all reported by Ogbondeminu, (1993), Souter *et al.* (1976), Surendraraj *et al.* (2009) and Saraswathi *et al.* (2015).

CONCLUSION

The present study has recorded the presence of several bacteria that can pose a threat to human beings (*E. coli* and *S. typhi*). This necessitates immediate action and also dissipation of information to the fishermen to be vigilant when coming in contact with these fishes.

ACKNOWLEDGMENT

The authors express sincere thanks to the PG & Research Department of Zoology, Government Arts College (Autonomous), Kumbakonam and PG & Research Department of Zoology, Arignar Anna Govt. Arts College, Musiri for the facilities provided to carry out this research work.

REFERENCES

- Brenner, D. J. (1984). Enterobacteriaceae. *Bergey's Manual of Systematic Bacteriology*, 1, 353-361.
- Buras, N., Duek, L., Niv, S., Hopher, B., & Sandbank, E. (1987). Microbiological aspects of fish grown in treated wastewater. *Water Research*, 21(1), 1-10.
- Cheesbrough, M. (1981). *Medical Laboratory Manual for Tropical Countries* (Vol. 1). M. Cheesbrough, 14 Beville's Close, Doddington, Cambridgeshire, PE15 OTT.1-519.
- Cowan, S.T., & Steel, K.J. (2004). Cowan and Steel's manual for the identification of medical bacteria. *Journal of Clinical Pathology*, 46(10), 975.
- Edwards, P. (1972). Ewing Wh Identifications of Enterobacteriaceae 3rd ed. Minneapolis: Burgess Publishing. New York, Elsevier, 1-536.
- Hejkal, T.W., Gerba, C.P., Henderson, S., & Freeze, M. (1983). Bacteriological, virological and chemical evaluation of a wastewater-aquaculture system. *Water Research*, 17(12), 1749-1755.
- Martin, W.J., & Washington, J. (1980). Enterobacteriaceae. *American Society for Microbiology*, Washington, D. C.(USA), 195-219.
- Ogbondeminu, F. (1993). The occurrence and distribution of enteric bacteria in fish and water of tropical aquaculture ponds in Nigeria. *Journal of Aquaculture in the Tropics*, 8(1), 61-66.
- Ogbondeminu, F., & Okaeme, A. (1989). Comparative analysis of bacterial flora associated with water and fish in manured pond. *Bioscience Research Community*, 1, 103-108.
- Sakata, T., Okabayashi, J., & Kakimoto, D. (1980). Variations in the intestinal microflora of Tilapia reared in fresh and sea water. *Bulletin of the Japanese Society of Scientific Fisheries*, 47, 421-427.
- Saraswathi, R., Sumithra, P., & Sivakami, R. (2015). Studies on the effect of Achlya species in various fish species cultured in different freshwater systems of Pudukkottai District, Tamilnadu, India. *International Journal of Current Microbiology and Applied Science*, 4(12), 670-674.
- Souter, B., Sonstegard, R., & McDermott, L. (1976). Enteric bacteria in carp (*Cyprinus carpio*) and white suckers (*Catostomus commersoni*). *Journal of the Fisheries Board of Canada*, 33(6), 1401-1403.
- Surendraraj, A., Farvin, K.S., Yathavamoorthi, R., & Thampuran, N. (2009). Enteric bacteria associated with farmed freshwater fish and its culture environment in Kerala, India. *Research Journal of Microbiology*, 4(9), 334-344.
- Zmysłowska, I., Lewandowska, D., Nowakowski, T., & Kozłowski, J. (2001). Occurrence of bacteria in water and in vendace (*Coregonus albula*) during rearing in tanks. *Polish Journal of Environmental Studies*, 10(1), 51-56.