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Occurrence of bacteria in gills and buccal cavity of *Clarias gariepinus* (Burchell, 1822) and *Tilapia zillii* (Gervais) from Lekki lagoon, Southwest Nigeria

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Summary

Gills and buccal cavity of *Clarias gariepinus* and *Tilapia zillii* from Lekki lagoon, Southwest Nigeria were examined for bacterial flora and compared. *Bacillus sp*. Bacillus licheniformis, Enterobacter aerogenes, Escherichia coli, Klebsiella sp. *Proteus sp*. *Pseudomonas florescens Salmonella sp*. Staphylococcus aureus *Streptococcus sp*. were all isolated from gill and buccal cavity of both species. Buccal cavity of *C. gariepinus* recorded higher proportion of *E. aerogenes*, Klebsiella sp. and P. florescens but *T. zillii, E. aerogenes, E. coli, Proteus sp., P. florescens* and *S. aureus*. Bacterial counts were higher in the gills (cfu = 7.98+ 0.29, t<0.05) and (cfu = 6.65+0.38,t<0.05) with significant differences in *C. gariepinus* and *T. zillii*. The bacteria assemblage were of public health significance.

Key words: : *buccal cavity, gills, bacteria, Clarias gariepinus, Tilapia zilli*

Introduction

Poisoning or death from fish consumption and mass mortality in fish culture is not widespread in Nigeria and information on pathogenic, natural and spoilage bacteria flora of fish is severely limited (Korie-Siakpere and Evbakhare, 1992; Efiuvwevwere and Ajiboye, 1996; Molokwu and Okpokwasili, 2002) compared with other regions (Mackie et al., 1971; Barham et al., 1979; Al- Harbi, 1994; Wiklund and Lönnström, 1994; Varvarigos 1997; Babu 2000, Spanggaard et al., 2000). This study will provide information on bacterial flora from gills and buccal cavity of *Clarias gariepinus* (Burchell, 1822) and *Tilapia zillii* (Gervais) both of which supports huge artisanal and culture fisheries in Nigeria, highlighting their public health importance.

Materials and methods

Live or dying specimens of *C. gariepinus* and *T. zillii* from Lekki lagoon were purchased at Epe fishing jetty, Southwest Nigeria between January and May 2001. Lekki lagoon, earlier described by Ikusemiju (1975, 1976), lies between longitude 4000' and 4015' and latitude 6022' and 6037'. Standard length, head length, gill length and buccal depth in centimeters (cm) were measured after weighing the fish specimens in grams (g). Bacterial isolates from each specimen were obtained from the buccal cavity and gill surfaces by macerating a 5g portion aseptically and shaken in 10 ml distilled water. The stock solution was serially diluted ten folds. 0.1 ml of each dilution was spread onto Tryptone Soya Agar (TCA) and MacConkey agar (MCA), and incubated for 24 hours at 370C. The colony forming counts per gram of sample was determined using standard methods (Horsely 1977, APHA 1995). The results obtained were converted to logarithms in base ten. Each distinct colony on TCA was further subcultured on fresh TCA plates for evaluation of purity and colonial morphology. The isolates were identified using the following criteria: gram staining reactions, physiological and biochemical reactions such as: catalase production, acetoin production, methyl red test, starch hydrolysis, citrate utilization, gelatin liquefaction, urease activity, motility test, nitrate reduction oxidase test and carbohydrate fermentation of glucose, mannitol, maltose, sucrose, fructose, ribose, xylose and galactose.

Results

Summary of morphometric parameters from *C. gariepinus* and *T. zillii* are presented in Table 1 and all the parameters except head length were

significantly different in the fish species. Incidence on gills and buccal cavity of the 10 identified bacterial species is presented in Table 2. With the exception of *E. aerogenes, Klebshiella sp*., and P. fluorescens higher proportion of gills from *C. gariepinus* recorded higher incidences of other species of bacteria isolated.

Table 1. Summary of morphometrics for *C. gariepinus* and *T. zillii*

Morphometrics	***C. gariepinus***	*T. zillii*	$t_{statistic}$
Weight	78.41 ± 20.06	60.67 ± 13.84	5.51
Standard length	19.99 ± 2.51	11.50 ± 1.85	19.37
Head length	4.02 ± 0.43	4.16 ± 0.40	-1.43
Gill length	3.43 ± 0.31	3.18 ± 0.40	3.05
Buccal depth	2.17 ± 0.58	1.76 ± 0.21	4.77

Table 2. Diversity and incidence of bacterial flora from gills and buccal cavity *of C. gariepinus* and *T. zillii*

Bacterial species	***C. gariepinus***		***T. zillii***	
	gills	Buccal cavity	Gills	Buccal cavity
Bacillus sp.	16%	6%	16%	6%
Bacillus licheniformis	10%	14%	16%	14%
Enterobacter aerogenes	8%	6%	6%	10%
Escherichia coli	12%	6%	8%	12%
Klebsiella sp.	4%	6%	8%	8%
Proteus sp.	22%	10%	12%	16%
Pseudomonas fluorescens	4%	8%	4%	8%
Salmonella sp.	12%	4%	8%	6%
Staphylococcus aureus	18%	26%	18%	22%
Streptococcus sp.	18%	20%	20%	18%
Mean bacterial counts (cfu)	7.94 ± 0.29	7.85 ± 0.24	6.65 ± 0.38	6.62 ± 0.35
$t_{statistic}$	2.60		0.42	

In contrast buccal cavity in *T. zillii* recorded higher incidences for *E. aerogenes*, *E. coli*, *Proteus sp*. P. fluorescens and *S. aureus*. In both fish species the gills recorded higher bacterial counts with significant differences in *C. gariepinus* ($t < 0.05$) compared with *T. zillii* ($t > 0.05$).

Discussion

The lower susceptibility of finfishes in tropical waters to bacterial infections compared with fishes from temperate waters, according to Sarig (1976) and Balarin and Hatton (1979), probably resulted from long periods of optimal water temperature. This explains why like previous studies (Korie-Siakpere and Evbakhare, 1992; Molokwu and Okpokwasili, 2002) on bacterial infections in Nigeria, all fishes examined in this study appeared healthy.

Association of bacteria with specific fish disease has not been successful in *C. gariepinus* and *T. zillii*. *C. gariepinus* is regarded as a rather resistant fish (Huisman and Richter, 1987) and studies (Huisman and Richter, 1987; Haylor, 1993) did not establish bacteria-disease relationships in *C. gariepinus*.

Proteus sp. and *Streptococcus sp*. have been linked with certain disease conditions in tilapia. *Streptococcus* pyogenes was associated with infected liver and intestines (Balarin 1979) and *Proteus rettgari* implicated in huge loss of stock (Sagua, 1986). Both infections were associated with presence of organic manure from either human or non-human sources. These bacteria species may therefore be opportunistic, different from species isolated in our study, believed to be part of natural body flora.

Korie-Siakpere and Evbakhare (1992) and Molokwu and Okpokwasili (2002) working with Channa obscura from natural water and different stages of farm raised *C. gariepinus* respectively, isolated similar bacteria species in apparently healthy fish. Quantitative results did not depart significantly between studies.

Gill infections arising from bacteria was reported as inconclusive in Sarotherodon mossambicus by Balarin and Hatton (1979) while Flexibacter sp. was implicated for gill rot in young tilapia (Sagua, 1986).This differed from our results which included two genera: Bacillus and Pseudomonas, listed by Horsely (1977) as part of normal gill flora in temperate fishes. Sarig (1976) suggested predisposition of stressed fish to bacterial gill disease.

Information on mouth flora is not readily available. Studies involving the digestive systems (Horsely 1977; Korie-Siakpere and Evbakhare, 1992; Al-Harbi, 1994; Wiklund and Lönnström, 1994; Spanggaard et al., 2000) reported influence of ingested food on bacterial community found in the alimentary tract. This will apply to the mouth as the first contact with ingested food.

Although, pathogenicity was not the focus, many bacteria species encountered are no doubt potentially pathogenic in different fish species under certain conditions as reported for *Pseudomonas anguilliseptica* (Wiklund and Lönnström, 1994) *Streptococcus sp*. (Al-Harbi, 1994), *Pseudomonas sp*. and *Staphylococcus sp.* (Varvarigos, 1997). *Bacillus sp*., *E. coli*, *Salmonella sp*., *Streptococcus sp* and *S. aureus* were also implicated in fish-borne (Babu, 2000) shrimp-borne (Raghavan, 2003) diseases of humans.

The public health importance of bacterial flora of Nigeria fish species have not been adequately defined, due mainly to mode of food preparation which involved cooking for considerable length of time. The heat would have eliminated most, if not all the bacterial flora.

In different studies, Ekundayo (1977) on Lagos Lagoon, Ajiwe et al. (2000) on Ele river and, Ibe and Ozor (2000) on Otamiri river isolated different bacterial species with potential for causing high proportion of deaths and ill health, in population dependent on the water bodies for water related resources. Species isolated were similar to those isolated in course of our study. The floral richness in the present study was comparable to previous studies on wild fish species (Horsely, 1973, Korie-Siakpere and Evbakhare, 1992) which essentially reflected the prevailing conditions of water quality in the lagoon under study.

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