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PRELIMINARY SURVEY OF PARASITES AND BACTERIAL PATHOGENS OF FISH AT LAKE ZIWAY

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ABSTRACT: Parasites and bacterial pathogens of fish at Lake Ziway, during 1996–97 were studied. A total of 613 fish were sampled. These included 495 Nile tilapia (*Oreochromis niloticus*), 75 Catfish (*Clarias gariepinus*), 24 *Barbus* species, 11 *Tilapia zillii* and 8 carp species. The fish were thoroughly examined both externally and internally for the presence of parasites and lesions and samples were taken for bacteriological investigations. Among the bacteria, *Edwardsiella tarda*, (new geographic record) isolated from the liver of one *O. niloticus* and kidney of another carp species is known to be pathogenic to fish. On the other hand *Shigella species*, *Escherichia coli*, *Citrobacter*, *Klebsiella oxytoca*, and *Yersinia enterocolitica* were the major bacteria identified from the apparently healthy fish. The major parasites identified included *Contracaecum* species from 77 (15.56 %) of *O. niloticus*, 3 (27.27%) *T. zillii*, 4 (5.33%) *C. gariepinus* and 2 (8.33%) *Barbus* species. *Clinostomum* species were recovered from the branchial cavity of 45 (9.09%) *Oreochromis niloticus*, 2 (18.18%) *Tilapia zillii* and 3 (4.00%) *C. gariepinus*. Only 1 *Euclinostomum* species (new geographic record) was recovered from the branchial cavity of *O. niloticus*. Moreover 13 (17.33%) *C. gariepinus* were carrying *Amplicaecum* species in their mesentery and one *C. gariepinus* was positive to *Bothriocephalus* species. The significance of these parasites and bacterial pathogens as causes of diseases to fish is discussed.

Key words/phrases: Bacteria, *Edwardsiella tarda*, fish diseases, Lake Ziway, parasites

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INTRODUCTION

Fishes have a very full complement of diseases like all animals with which to contend and many of these are due to external agencies while others arise internally. From external sources, viruses, fungi, bacteria and parasites are known to affect fish, while internally they suffer from almost all the common organic and degenerative disorders such as neoplastic conditions. Moreover, the fish must still survive in periodic adverse chemical conditions in water, from predators and the capturing devices of fishermen even if they are not killed by disease or disorder (Lagler *et al.*, 1977).

So far, very few diseases have been described from fish of Ethiopian waters (Amare Tadesse, 1986; Shibru Tedla and Tadesse G.E., 1979; Teferra Wondim, 1990). Moreover, there is no experience in farming fish in inland waters of the country at this stage and no knowledge of diseases in fish to be farmed in these waters. Along with the growing interest in the development of fish culture, there is an increasing awareness of the importance of disease as one of the major detrimental factors in culturing fish. At present, prediction of potential health hazards is largely extrapolated from data available on fish disease and infections in natural and semi-natural habitats (Paperna, 1980).

The present study was undertaken at Lake Ziway with the objectives of identifying the most common disease causing parasitic and bacterial pathogens of fish in the lake and studying their prevalence as part of the work which aims to gather baseline information on diseases of fish in the country.

MATERIALS AND METHODS

Study area

This work was undertaken in the Oromiya Regional State East Shewa Zone at Lake Ziway which is located some 165 km South of Addis Ababa. Lake Ziway is located 8°N and 38° 40' E at an altitude of 1840 m above sea level. The lake is 25 km long and 20 km wide (Balarin, 1986; LFDP, 1995). It covers an area of 434 km^2 and its average depth is 2.4 meters (LFDP, 1995). Lake Ziway is one of the Ethiopian lakes with an indigenous fishing population (Herrmann, 1993).

The major fish species in the lake include Nile tilapia (*Oreochromis niloticus*), *Tilapia zillii*, Barbus species, catfish (*Clarias gariepinus*) and carp species.

Fish sample collection

A total of 613 fish were sampled. These included 495 Nile tilapia (*Oreochromis niloticus*), 75 catfish (*Clarias gariepinus*), 24 *Barbus* species, 11 *Tilapia zillii* and 8 carp species which were examined from November 1996 to May 1997 during six visits.

All the fish were caught using gill nets with mesh size ranging from 60 to 120 mm that were used for the exploratory fishing work at the lake. All the specimens of fish were examined within less than 6 hours of capture.

Sampling for parasites

The fish were examined thoroughly both externally and internally by keeping the fish wet throughout the procedure. Scrapings were taken from the skin especially under the fins. These were mixed with a drop of water and examined on a slide under Olympus BH-2 compound microscope. The gills were removed, placed on a slide and in a Petri dish and examined under low power on the compound and stereo microscopes, respectively. For the rest of the organs an incision was made along the ventrum from vent to head and abdominal wall removed to expose the viscera. All the alimentary canal and associated organs such as the heart, liver, spleen, kidney, gonads and swim bladder were thoroughly examined and any observed abnormality recorded.

Most of the parasites were identified in the field at the fisheries laboratory at Lake Ziway based on the identification guidelines of earlier workers (Paperna, 1980; Lester, 1988; Roberts, 1989).

In the rest of the cases, the nematode parasites were collected in 70% alcohol, and the digenean and cestodes in Alcohol-Formol-Acetic (A.F.A.) solution and brought to the centre.

Sampling for bacteria

First, the external body surface of the fish were examined for the presence of lesions. The gills, tail and fins were also observed for visible signs of

infections. After opening the body the internal organs were exposed with care not to puncture any part of the intestinal tract.

In the absence of any visible lesion, samples of kidney, liver and spleen were taken after searing the surface of the organs with a hot scalpel blade. A total of 46 swab samples from 17 *O. niloticus* (liver, spleen, kidney, skin, fillets and abdominal lesions), 3 catfish (liver, kidney, gut content and skin bruising), 2 carp species (air bladder, kidney and peritoneal fluid) and 1 *Barbus* species (faeces, liver and kidney) one from each sample were aseptically taken. The swab was inoculated on Stuart's transport media (RINGERTZ, E-Merck, Germany) which were kept cool at 4° C and finally brought to the centre in cooler jugs for further studies.

Bacterial isolation and identification

After the aseptically taken swabs from the different organs were brought to NAHRC, they were inoculated onto 7.5 per cent sheep blood agar (Merck, KGaA, Darmstadt, Germany) and further subcultured on MacConkey agar (Merck, KGaA, Darmstadt, Germany). To prepare blood agar first 40 g of agar was suspended in one litre of demineralized water and steam sterilized in autoclave at 121° C for 15 minutes and after it was cooled to 45–50° C, 7.5 per cent sterile defibrinated sheep blood was added and poured on petri plates.

The MacConkey agar was prepared by suspending 50 g of the agar in one litre of demineralized water and steam sterilized in autoclave at 121° C for 15 minutes and when the temperature dropped to 45–50° C it was poured on petri plates.

Both the inoculated blood agar and MacConkey agar were aerobically incubated at 37° C for 24–48 hours. Colonies were Gram stained, morphology recorded and subjected to biochemical tests for further identification as described by Carter (1984) and Frerichs (1984).

RESULTS

The Digenean and nematode larval helminths were found encysted in the different organs. The *Clinostomum* species were found mostly in the branchial cavity of *O. niloticus* species and *T. zillii* while the larval nematodes such as *Amplicaecum* and *Contracaecum* species were found encysted in the mesenteries mostly in *C. gariepinus* (Table 1). However, most of the *Contracaecum* species recovered from *O. niloticus* and *T. zillii* were found in the pericardial cavity of the heart. The *Euclinostomum* species was recovered only from an individual of *O. niloticus*.

Table 1. Prevalence of nematode, digenean and cestode parasites in fish of Lake Ziway (1996-97).

Species of fish	Type of parasite	Site of localization	No of fish affected	%
O. niloticus (n=495)	*Contracaecum* spp	Pericardial cavity	76	15.35
	Contracaecum spp	liver	1	0.21
Tilapia zillii (n=11)	*Contracaecum* spp	Pericardial cavity	3	27.27
C. gariepinus (n=75)	*Contracaecum* spp	Mesentery	4	5.33
Barbus species (n=24)	*Contracaecum* spp	Mesentery	2	8.33
C. gariepinus (n=75)	*Amplicaecum* spp	Mesentery	13	17.33
O. niloticus (n=495)	*Clinostomum* spp	Branchial cavity	45	9.09
T. zillii (n=11)	*Clinostomum* spp	Branchial cavity	2	18.18
C. gariepinus (n=75)	*Clinostomum* spp	Branchial cavity	3	4.00
O. niloticus (n=495)	*Euclinostomum* spp	Branchial cavity	1	0.20
C. gariepinus (n=75)	*Bothriocephalus* species	Intestinal lumen	1	1.33

The maximum number of parasites belonging to the larval *Amplicaecum* species recovered from a single catfish was 26 and the longest had a length of 40 mm. The *Contracaecum* species recovered from the pericardial cavity were coiled larger in size and thicker, and up to 5 parasites were recovered ranging in size from 15 to 40 mm.

Contracaecum species was also found encysted in the liver of one *O. niloticus*. The *C. gariepinus* whose intestinal lumen was full of *Bothriocephalus* species, had empty stomach, emaciated and its condition was poor.

From the total of 46 swab samples analyzed bacteriologically, the major bacteria identified included; *Edwardsiella tarda*, *Shigella* species, *E. coli*, *Klebsiella oxytoca*, *Citrobacter*, *Yersinia enterocolitica*, and *Providencia* (*P. alcalifaceins* and *P. stuartii*) (Table 2).

Table 2. Major bacteria isolated and identified from fish in Lake Ziway (1996–97).

Species of fish	Organs sampled		Bacteria identified	
	Organ	No.	Bacteria spp	No. of organs (+)
O. niloticus (n=17)	Liver	9	*E. tarda*	1
	Spleen	10	*Citrobacter*	2
			Shigella spp	1
	Kidney	2	none	none
	Skin	1	none	none
	Lesion from abdomen	1	*P. alcalifac* *P. stuartii*	1
	Fillets	3	*Yersinia enterocolitica*	1
			Kl. oxytoca	1
	Skin	1	none	none
	Faecal sample	6	*E. coli*	1
			P. alcalifac	
			P. stuartii	1
C. gariepinus (n=3)	Liver	2	*P. alcalifac*	
			P. stuartii	1
	Kidney	2	none	none
	Skin bruising	1	*Kl. oxytoca*	1
	Gut content	1	none	none
Carp species (n=2)	Air bladder	1	none	none
	Kidney	2	*E. tarda*	1
	Peritoneal fluid	1	none	none
Barbus species (n=1)	Liver	1	none	none
	Kidney	1	none	none
	Faecal sample	1	none	none

DISCUSSION

The helminths larval parasites belonging to the genera *Clinostomum, Euclinostomum, Amplicaecum* and *Contracaecum* species are known to occur in most African fresh water fishes (Paperna, 1980; Shibru Tedla and Tadesse G.E., 1979). Adult stages are found in birds and most of the fresh water lakes in Ethiopia support a large population of aquatic birds (Shibru Tedla and Tadesse G.E., 1979). It is likely that the major aquatic birds at Lake Ziway support the adult stages of these parasites although post mortem examination of one moribund huge bird did not reveal any one of the adult stages of these parasites.

Clinostomum (trematode) infections are caused by the metacercarial stage of the parasite. The metacercariae are large and yellow or white giving the fish unattractive appearance.

The presence of *Euclinostomum* species in fish of Ethiopian waters is being reported for the first time and requires further study. Although no evidence is available in this country, *Clinostomum camplanatum* is known to cause laryngopharyngitis infection in humans as was reported in the Near East resulting apparently from ingesting inadequately cooked infected fish (Paperna, 1980).

Paperna (1980) reported that peak infections of *Tilapia* species by *Clinostomum* species in Nungba Dam in South Ghana occurred towards the end of the rainy season. However, since this work did not include all seasons of the year, it was difficult to compare the seasonal distribution pattern of parasites of fish in the lake. Infections with clinostomatid metacercariae is likely to be detrimental to fingerlings of *O. niloticus*, most sought fish in Ethiopia and other small fish species.

Helminth parasites can cause damages such as compression and disruption of vital organs including the gonads leading to sterility, eyes leading to blindness, poor growth rate and unthrifthyness especially in young fish when they are found in large numbers in their body cavity and sometimes cause human diseases (Paperna, 1980; Roberts, 1989).

Among the bacteria isolated, *E. tarda* is the most important fish bacterial pathogen. It is a pathogen of eels known to cause emphysematous putrefactive disease in catfish and it is frequently found in organically polluted water (Inglis, *et al.*, 1994). Moreover, it has also been isolated from domestic animals, rats, birds, frogs, turtles and healthy fish (Roberts, 1989). The organism was isolated from the kidney of carp species and liver of *O. niloticus*. As the presence of *E. tarda* in fish of Ethiopian waters is being reported for the first time, it needs further study.

As to the other bacteria isolated (*Citrobacter* and *Klebsiella* species), they are not considered to be important as causes of fish diseases. The rest of the bacteria including *Shigella* species and *E. coli*, indicate possible faecal contamination which could have certain public health significance. This suggests the requirement for further study on the major bacteria which could be associated with food poisoning. Furthermore, based on the observed findings strict sanitary control of fish products are required and the habit of raw fish eating as has been observed around the lake should be discouraged.

There is scanty information concerning fish diseases in the country, hence it is recommended that further investigations in other water bodies be carried out to see the possible presence of fish killing diseases and other conditions associated with mass fish kills.

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