



## First Record of Co – infection of Three Clinostomatid Parasites in Cichlids (Osteichthyes: Cichlidae) in a Tropical Freshwater Lake

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### Abstract

The present study investigated the effects of first record of co-infection of three *Clinostomum* sp.; *Clinostomum Complanatum* (Rudolphi, 1819), *C. tilapiae* (Ukoli, 1966), and *Eudlinostomum heterostomum* (1809) in *Tilapia zillii*. There was differential parasitic effects resulting in selection for relatively better adaptiveness to host's microhabitats, more population size, and frequent host location of these parasites during the one year survey (Nov 2007– Oct 2008) in Opi Lake, Nigeria. Prevalence of 9.4 % was recorded in *C. complanatum*, 10.4 % in *E. heterostomum* and 4.8% in *C. tilapiae*. The parasites were recovered from three major microhabitats of buccal cavity, skin and eye.

**Keywords:** Co-infection, *Tilapia zillii*, *Clinostomum* sp., Prevalence, Microhabitats, Nigeria

### Introduction

So many authors have studied *Clinostomum* parasites, for example, the few recent studies like (1-4) are well documented. However, record on the occurrence of co-infection among three *Clinostomum* species is unknown. The present study is the first record of co – infection of three *Clinostomum* species and report on the parasites of Opi Lake.

Opi lake 6° 45' 0" – 45° 28' N and 7° 29' 28" – 7° 29' 35" E is a tropical freshwater lake located in the valley of river Uhere, Northeast of Nsukka, Nigeria. The lake is about 300 meters from Uhere River, the soil is porous and subject to severe erosion (5). However, the best knowledge about the lake was information on the systematic and basic biology of the species of organisms other than parasites found there. For instance, the climate, hydrobiology, macro invertebrates, and vegetation of the dominant flora have been described (6-9). Therefore, investigation into its parasites and description of co – infection by three *Clinostomum* species was necessary.

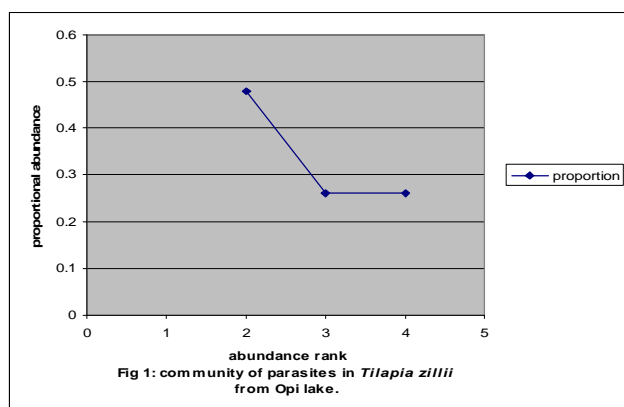
### Material and Methods

Species of *Tilapia zillii* (10) were collected using multiple fishing gear; cast nets, hook and line, and seine nets (150 mm – 200 mm) monthly for twelve months from Nov 2007 – Oct 2008. Freshly caught fish were examined for parasites using procedure in (11). Treatment, fixation and preservation of parasites were according to (12). Data generated were analyzed using the infection statistics of (13). Rank - abundance and species diversity of the parasites were determined using quantitative analysis of Shannon-Wiener index (14).

### Results

Three metacercariae of Clinostomatids were discovered to be the parasites associated with the *T. zillii* of Opi Lake. The parasites include: *Clinostomum tilapiae* Ukoli, 1966, *C. complanatum* Rudolphi, 1819, and *Eudlinostomum heterostomum* Rudolphi, 1809. The prevalence of the parasites was indicative of parasitic infection in the wild – *C. complanatum* (9.4 %), *E. heterostomum* (10.4 %), and *C. tilapiae* (4.8 %) with mean intensity; *C. complanatum* (4.2), *C. tilapiae* (4.6), and *E. heterostomum* (2.1) (Table 1-3). Out of 392 *T. zillii* exam-

ined, 38 were infected with *C. complanatum*; *C. tilapiae* 19, and 41 hosts had *E. heterostomum*. *C. complanatum* and *C. tilapiae* were equally abundant (pi 0.26), while *E. heterostomum* was most abundant (pi 0.48) (Fig. 1).



**Fig. 1:** Abundance – Rank of community of Clinostomatids in *T. zillii*

Three major microhabitats – buccal cavity, eye, and skin were seriously affected. In addition, the infection of the buccal cavity had the highest infection than the other two microhabitats of the eye and skin. Implications of their presence caused pronounced inflammation as well as roughening of the skin by the encysting metacercariae. There were more excysted forms of *E. heterostomum* than the other two parasite species. Out of 85 *E. heterostomum* only 15 were not excysted, 57 *C. tilapiae* and 112 of *C. complanatum* were encysted respectively. These excysted forms caused serious damages to the infected fish as they burrowed through the organs of the host. Because they could move, they migrated to various locations thereby causing damages. These effects include blindness, myositis, muscle bumps (yellow grubs) etc.

**Table 1:** *Clinostomum complanatum* composition, overall prevalence and prevalence in relation to microhabitats in *Tilapia zillii* from Opi Lake

Parasite specie	Host fish & No of infected hosts	Sex of hosts	No of infected host	Microhabitats in host fish	Total No of Parasites	*Prevalence (%)	†Mean intensity	‡Abundance
<i>Clinostomum complanatum</i>	<i>Tilapia zillii</i> (n = 392) infected hosts = 38	Male	8	B. cavity	89	2.04	2.34	0.23
		Male	10	Skin	29	2.55	0.76	0.07
		Male	10	Eye	17	2.55	0.45	0.04
		Female	2	B. cavity	13	0.51	0.34	0.03
		Female	6	Skin	6	1.53	0.16	0.02
		Female	1	Eye	4	0.51	0.11	0.01
						<b>9.44</b>		

B. cavity = Buccal cavity/ \*Prevalence: number of host infected divided by the number examined expressed as a percentage./ †Mean intensity: Mean number of parasites per infected host. ‡Abundance: Mean number of parasites per host examined/+ + is for values less than 0.01

**Table 2:** *Clinostomum tilapiae* composition, overall prevalence and prevalence in relation to micro-habitats in *Tilapia zilli* from Opi Lake

Parasite specie	Host fish & No of infected hosts	Sex of hosts	No of infected host	Microha-bitats in host fish	Total No of Parasites	*Prevalence (%)	†Mean intensity	#Abundance
<i>Clinostomum tilapiae</i>	<i>Tilapia zilli</i> (n = 392) infected hosts = 19	Male	4	B. cavity	39	1.02	2.05	0.10
		Male	7	Skin	19	1.79	1.00	0.05
		Male	6	Eye	10	1.53	0.53	0.03
		Female	1	B. cavity	11	0.26	0.58	0.03
		Female	1	Skin	8	0.26	0.42	0.02
		Female	-	Eye	-	-	-	-
							4.86	

B. cavity = Buccal cavity

\*Prevalence: number of host infected divided by the number examined expressed as a percentage.

†Mean intensity: Mean number of parasites per infected host. #Abundance: Mean number of parasites per host examined.

+ + is for values less than 0.01

**Table 3:** *Eudinostomum heterostomum* composition, overall prevalence and prevalence in relation to micro-habitats in *Tilapia zilli* from Opi Lake

Parasite specie	Host fish & No of infected hosts	Sex of hosts	No of infected host	Microha-bitats in host fish	Total No of Parasites	*Prevalence (%)	†Mean intensity	#Abundance
<i>Eudinostomum heterostomum</i>	<i>Tilapia zilli</i> (n = 392) infected hosts = 41	Male	8	B. cavity	18	2.04	0.44	0.05
		Male	12	Skin	12	3.06	0.29	0.03
		Male	8	Eye	8	2.04	0.20	0.02
		Female	2	B. cavity	27	0.51	0.66	0.07
		Female	7	Skin	13	1.79	0.32	0.03
		Female	4	Eye	7	1.03	0.17	0.02
						10.46		

B. cavity = Buccal cavity

\*Prevalence: number of host infected divided by the number examined expressed as a percentage.

†Mean intensity: Mean number of parasites per infected host. #Abundance: Mean number of parasites per host examined.

+ + is for values less than 0.01

## Discussion

Damages to the skin, blindness and bumps on the skin could affect the palatability and marketability of the infected fish as well as the acceptance of fish as the primary source of animal protein. For instance, Nigeria with population of over 120 million individuals is the largest consumer of fish in Africa and fish serve as primary source of animal protein to this huge population. The crowding population of Opi around the lake is also prone to the inflammation of the naso-pharynx known as pharyngitis. This is because ingestion of under cooked fish with *Clinostomum* infection results in the attachment of the trematode on the pharynx.

Spatial adaptation of these clinostomatids in the various microhabitats of *T. zillii* indicate selection for relatively better adaptiveness, and host location. Consequently, this resulted in a trade-off among excysted individuals, encysted individuals, damages to organs by scavenging large population size of the parasites in the host. Adaptation is a heritable trait that either spread because of natural selection or has been maintained by selection to the present or currently spreading relative to alternative traits because of natural selection. In all such cases, the trait in question has conferred and continues to confer or is just beginning to confer higher genetic or reproductive success on *C. complanatum* with highest population than the other two species of the parasites. Even with more encysted forms, adsorption of nutrients such as free proteins, amino acids and transaminases was readily very successful (15). In evolutionary biology, 'fitness' is a measure of an individual's reproductive or genetic success, so that 'fitness benefit' refers to the positive effect of a trait on the number of surviving offspring produced by an individual or the number of genes it contributes to the next generation whereas 'fitness cost' refers to the damaging effects of the trait on these measures of individual genetic success (16). Although, encysted larvae can feed from the host, excysted larvae could be more voracious feeder. These suggestive pressures on natural selection would favor *E. heterostomum* in *T. zillii* during the course of time and possible domination in the fish hosts in this freshwater lake.

Also, because the parasites do not depend on stored food of the host; the nutrients they can obtain from their intermediate hosts are sustainable. Therefore, these metacercariae can remain viable for the longest periods in the hosts. It might last throughout the lives of the host fish due to difficulty in locating their definitive hosts, piscivorous birds such as *Egretta egretta* (17).

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## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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