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Comparative study of ectoparasites on Nile tilapia *(Oreochromis niloticus)* cultured under integrated and unintegrated pond systems

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A survey of occurrence of ectoparasites on *Oreochromis niloticus* (Linneaus) in a fish-cum-piggery pond and a pond stocked with fish only was carried out at the African Regional Aquaculture Centre, Aluu near Port-Harcourt. There was occurrence of ectoparasites from fish samples collected in both systems. Monogenean trematodes (83.8 and 79.8%), Protozoa (15.9 and 19.7%) and Copepods (0.3 and 0.5%) were found in integrated and unintegrated ponds respectively. There was no significant difference (P>0.05) in the incidence of these ectoparasites on *O. niloticus* obtained from the two pond systems. However, rank correlation analysis revealed a higher level of fish parasitic infestation in the integrated pond compared to the unintegrated pond. The regular piggery waste supply to the integrated pond probably facilitated the propagation of the parasites.

Key words: *Oreochromis niloticus*, parasites, organic manure, pond culture, comparative study.

INTRODUCTION

Tilapias are becoming increasingly important as culture species particularly in the tropics (Smith and Pullin, 1984) including Nigeria (Balogun et al., 2005). They constitute a very important source of protein and subsistence income for fish farm operators. Notably among the Tilapias is *Oreochromis niloticus* which is a fast growing fish and of great importance in aquaculture (Okoye and Nnaji, 2005). This fish is popular and grows to a maximum size of 600 mm (Horsfall, 2006). *O. niloticus* is omnivorous in diet, has indiscriminate appetite feeding on algae, diatoms, insects larvae (Chironomids), fish eggs, fry of fish and detritus (Idodo Umeh, 2003; De Graaf, 2004).

Besides the growing interest in fish culture development, there is an increasing awareness of the importance of disease outbreaks in systems which affect production levels. In Nigeria, not much information is available on the fish parasites raised in standing waters such as reservoirs and ponds. Okaeme and Ibiwoye (1988) revealed that the protozoans constitute an important economic disease of catfishes in Lake Kainji area in Nigeria. Ibiwoye et al. (2006) reported the prevalent rate of 22.5, 76.25 and 1.25% for gastro-intestinal parasites, *Procamallanus laevionchus* and *Spripronoura petriea* (Nematodes), *Polyonchobothrium clariae* (Cestode) and *Clinostomum clarias* (Trematode) in *Clarias anguillaris* in Onitsha area along River Niger. Nyaku et al. (2007) also reported the occurrence of platyhelminthes parasites as the most common ectoparasites of three species of

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Table 1. Percentage and Frequency of Occurrence of ectoparasites on *Oreochromis niloticus* in integrated and unintegrated pond systems.

Group of ectoparasite	Integrated pond		Unintegrated pond	
	Number of parasite observed	**Percentage (%) of parasites observed**	**Number of parasites observed**	**% of parasites observed**
Protozoa				
Trichodina sp.	152	7.55	185	16.44
Costia sp.	100	4.97	36	3.20
Ichthiophthirius sp.	69	3.43	-	-
Total	**321**	**15.95**	**221**	**19.64**
Monogenean Trematodes:				
Dactylogyrus sp.	1302	64.68	253	22.50
Gyrodactylus sp.	384	19.08	645	57.33
Total	**1,686**	**83.76**	**898**	**79.83**
Copepods				
Lernaea sp.	6	0.29	6	0.53
Grand Total	**2,013**	**100**	**1,125**	**100**

fish (*O. niloticus, Auchenoglanis occidentalis* and *Bagrus bayad*) in River Benue, Nigeria. Elsewhere, Raissy et al. (2008) reported the presence of *Dactylogyrus spiralis* in the gills of *Cyprinus carpio* in Iran.

Parasites constitute serious problems in ponds because temperature regimes in these ecological waters favour the rapid cycling of both fish and parasites. Fish mortalities and consequent loss during production are still most likely to occur in cases of heavy infestations with bacteria, Protozoa, Monogenean trematodes and crustacean parasites. These parasites attack the vital organs of fish and with rapidity, their incidence build up to epizootic proportions (Ezenwa and Anyanwu, 1983). The predisposing factors of fish to parasitic infections under aquaculture rearing systems include age, poor nutrition, high stocking densities, poor water quality and poor culture facility (Odunze et al., 2003; Mdegela et al., 2011).

The objective of this study was therefore to compare the relative abundance of prevalent ectoparasites in *O. niloticus* in an integrated pond (fish-cum-piggery) and unintegrated pond where fish were fed with only compounded feed.

MATERIALS AND METHODS

A total of 200 *O. niloticus* comprising of 100 each from a fish-cum-piggery pond and an unintegrated pond were captured using seine nets at the African Regional Aquaculture Centre at Aluu near Port Harcourt in Nigeria. Each group was separately transported and acclimatized in plastic aquaria. The fish sizes varied between 4.0 to 13.2 cm length.

In the laboratory, the fish were thoroughly examined for ectoparasites using a hand lens. Smear of scrapings from the skin, fins and gills were made with scalpels and placed on slides. A drop of sodium chloride solution was added to each scrapping, covered with a cover slip and mounted under a microscope and examined for ectoparasites. This method of obtaining parasites was made separately for fish samples from integrated and unintegrated pond culture systems as described by Paperna (1996) and Nyaku et al. (2007). The parasites were isolated, counted and preserved in 70% alcohol. Pond water temperature was measured with a laboratory mercury thermometer (0-100°C) and dissolved oxygen by the traditional Winkler procedure. The pH was determined using a portable pH meter (Model Jenway 3150) according to Ademoroti (1996). Keys presented by Hoffman and Meyer (1974) were used in the identification of the parasites isolated in this study.

Analysis of variance was used to determine the variation between means of incidence of parasites in the culture systems. The rank correction (rho) analysis was also carried out to rank the intensity of the parasites recovered in both integrated and unintegrated ponds.

RESULTS

Surveys of the parasites encountered in this study were Monogenean trematodes, Protozoans and Copepods occurring in both the integrated and unintegrated ponds (Table 1). In the integrated pond, the occurrence of the parasitic groups was Monogenean trematodes (83.8%), Protozoans (15.9%) and Copepods (0.3%). In the unintegrated pond the commonest groups of ectoparasites were similar with monogenean trematodes (79.8%), protozoans (19.6%) and copepods (0.5%). The percentage of parasitized fish in the integrated pond was 90% compared to 82% in the unintegrated pond (Table 2). There was no significant difference between parasitized *O. niloticus* in integrated and unintegrated ponds (P>0.05). However in Table 3, the rank order of parasite intensity in integrated pond was *Dactylogyrus* sp. (1), *Gyrodactylus* sp. (2) as Monogenean trematodes, *Trichodina* sp. (3), *Costia* sp. (4), *Ichthiophthirius* sp. (5) as Protozoans and *Lernaea* sp. (6) being Copepods. In the unintegrated pond,

Table 2. Percentage of parasitized fish in integrated and unintegrated pond systems.

Pond system	Number of fish examined	Number of fish parasited	% of fish parasited	Number of parasites on skin	Number of parasites on gill
Integrated	100	90	90	1554	459
Unintegrated	100	82	82	298	827

Table 3. Rank correlation analysis (rho) of the intensity of infestation of ectoparasites on *Oreochromis niloticus cultured* under integrated and unintegrated pond system.

Parasite	Integrated pond	Unintegrated pond	R1	R2
Trichodina sp.	152	185	3	3
Costia sp.	100	36	4	4
Ichthiophthirius sp.	69	-	5	6
Dactylogyrus sp.	1302	253	1	2
Gyrodactylus sp.	384	645	2	1
Lernaea sp.	6	6	6	5
Total	2,013	1,125		

R1, Integrated pond ranking; R2, uninterested pond ranking.

Table 4. Comparison of range values of physico-chemical parameters with W.H.O Standards.

Parameter	Experimental range value	WHO Standard
Temperature (°C)	27.0 - 32.8	<35
Dissolved oxygen (mg/l)	9.8 - 13.2	8 -10
pH	7.3 - 9.5	6.5 - 8.5

Source: WHO (1986) cited by Ewa et al. (2011).

the ranking was *Gyrodactylus* sp. 1, *Dactylogyrus* sp. 2 (Monogenean trematodes), *Trichodina* sp. 3, *Costia* sp. 4 (Protozoans) and *Lernaea* sp. 5 (Copepods). This ranking also revealed a difference in the level of infestation of ectoparasites between integrated (2013) and unintegrated (1125) pond systems.

Table 4 shows the comparative analysis of the range values of the obtained water quality parameters with standards outlined by World Health Organization (WHO) for water and survival of fish. The observed range values showed temperature as 27.0 to 32.8°C, dissolved oxygen of 9.8 to 13.2 mg/l and pH of 7.3 to 9.5 in both integrated and unintegrated ponds.

DISCUSSION

The study reveals that three types of ectoparasites infected the Cichlid, *O. niloticus* in the fish-cum-piggery pond as well as in the unintegrated pond (Table 1). The Monogenean trematodes (*Dactylogyrus* and *Gyrodactylus* spp.) were mostly on the skin in their metacercariae stage. For the purpose of this study, the metacercariae observed on the skin were regarded as *Gyrodactylus* sp., while those on the gills were indentified as *Dactylogyrus* sp. as previously noted by Ezenwa and Anyanwu (1983). The Monogenean helminthes are among one of the most common parasites in cultivated fish (Martins et al., 2002). These parasites develop different modes of attachment associated with mechanical and chemical factors to the specific host (Buchmann and Lindenstrom, 2002). There was no discernible deleterious effect of the metacercariae seen on the *O. niloticus* examined in this study. The finding corroborated the observation of Umoeren et al. (1988) in *Tilapia zilli* and *O. niloticus.*

The three genera of Protozoa identified in the integrated pond were *Trichodina* sp. (Saucer-shaped), *Costia* sp. (Flagellate) and *Ichthyophthirius* sp. (Holotrichous Ciliate). In the unintegrated pond, only *Trichodina* sp. and *Costia* sp. were observed. The Protozoans were observed more on the body surface (skin) than on the gills as in the integrated system. Copepod (*Lernaea)* infestation was minimal in both systems with only 0.3% in integrated and 0.5% in unintegrated ponds.

Parasitic infestation on *O. niloticus* was observed to be higher in the integrated pond by 8% than in the unintegrated pond (Table 2). This observation corroborated those of Ghiraldelli et al. (2006) who also observed high number of parasites in *O. niloticus* samples collected from a facility fed with restaurant scraps that had organic matter content. High content of organic load in the water and unfavourable environmental temperature were impor-tant contributing factors for parasitic disease outbreaks (Jadhav, 2009). These factors induce quick succession of the parasites. When fish are exposed to adverse stress situation, the disease occurs (Buchmann and Bresciani, 1997). The intensity in ecto-parasite population in the integrated pond (Table 3) could be attributed to the pig waste (urine and faeces) discharged in excess into the pond as organic fertilizer to produce natural fish food for the cultured *O. niloticus*. The left over of the uneaten arti-ficial feed disintegrate and decompose on the pond bot-tom and could create favourable environment for the parasites to flourish and thrive in the integrated pond (Alfred-Ockiya and Ovuru, 1995).

Water quality plays a crucial role in disrupting the balance between the host and the pathogen (Jadhav, 2009). Ideally suited water quality parameters neces-sary to maintain good growth and healthy conditions in cul-tured fish such as *Tilapia* sp. are dissolved oxygen (>5.0 ppm), pH range (6.5 to 8.5) and temperature (25 to 35°C) accordingly to Gupta and Gupta (2006). In the acid waters, fishes become prone to attacks of para-sites and diseases. Also, in insufficient dissolved oxygen (DO) levels, fish will succumb to stress and become vulnerable to diseases and parasitic outbreaks leading to their death. Temperature and DO values obtained in this study corroborate those of Gupta and Gupta (2006) and W.H.O Standard (1986 cited by Ewa et al., 2011) except for the pH that varied slightly (7.3 to 9.5) (Table 4). The influence of pH and other inherent factors in the two ponds pro-bably favoured parasite multiplication and survival as similarly observed by Ezenwa and Anyanwu (1983) in their study.

Conclusion

Fish parasites are of economic importance because they lower the quality of the fish meat. It is therefore important that fish farmers should endeavor to reduce or eliminate environmental factors and conditions that would favour increase in parasites infestation on fish as observed in the integrated pond culture system. These measures being good pond management strategy would reduce parasitic epizootic and mortality in fish production systems.

REFERENCES

Ademoroti CMA (1996). Standard methods for water and effluents analysis. Foludex Press, Ibadan.pp.28-76.

Alfred-Ockiya JF, Ovuru SS (1995). A Comparative study of incident of parasitic infestation of the African catfish (*Clarias gariepinus*) in Rivers State. Nig. J. Agric. Teacher Educ. Vol. 4:65-73.

Balogun JK, Auta J, Abdullahi SA, Agboola OE (2005). Potentials of castor seed meal *(Ricinus communis L.)* as feed integredient for *Oreochromis niloticus.* In: Proc. 19th Annual Conf. of FISON, Ilorin, Nigeria, Nov. 29 Dec. 3, 2004, pp. 838-843.

Buchmann K, Bresciani J (1997). Parasitic infections in pond reared rainbow trout *Oncorhynchus mykiss* in Denmark. Dis Aquat. Org., 28:125-138.

Buchmann K, Lindenstrom T (2002). Interactions between monoge-nean parasites and their fish hosts. Intl. J. Parasitol., 32:309-319.

De Graaf GT (2004). Optimisation of the pond rearing of Nile Tilapia (*Oreochromis niloticus* L). The impact of stunting processes and recruitment control. Ph.D Thesis, Wageningen University, The Netherlands, p.179.

Ewa EE, Iwara AI, Adeyemi JA, Eja EI, Ajake AO, Otu CA (2011). Impact of Industrial Activities on water quality of Omoku Creek. Sacha J. Environ. Stud. 1 (2):8-16.

Ezenwa B, Anyanwu J (1983). Incidence of parasites in Lagos lagoon and some selected fish ponds. NIOMR/ARAC Tech. 32: 18.

Ghiraldelli L, Martins ML, Jerônimo GT, Yamashita MM, Adamante WDB (2006). Ectoparasites Communities from *Oreochromis niloticus* Cultivated in the State of Santa Catarina, Brazil. J. Fish. Aquat. Sci. 1 (2): 181-190.

Gupta SK, Gupta PC (2006). General and Applied Ichthyology (Fish and Fisheries). S Chand and Company Ltd. New Delhi-110 055, p.1133.

Hoffman GL, Meyer FP (1974). Parasites of Freshwater Fishes. A review of their control and treatment. TFH Publication Inc. Neptune City, N.J., p. 224.

Horsfall JD (2006). Tilapia as a staple culturable fish species for the Nigerian Rural Fish Farmers. A Review of its porentials. In: Proc. 20th Annual Conf. of FISON, Port Harcourt, Nigeria, Nov. 14-18, 2005, pp. 30-36.

Ibiwoye TII, Nweke SU, Sogbesan AO (2006). Parasitic fauna of the gastrointestinal tract of *Clarias anguillaris* (Geoffrey, Pisces: Clariidae) in Onitsha Area of Nigeria. In: Proc. 20th Annual Conf. of FISON, Port Harcourt, Nigeria, Nov. 14-18, 2005, pp.266-271.

Idodo-Umeh G (2003). Fresh water fishes of Nigeria (Taxonomy, Ecological notes, Diet and Utilization). Idodo-Umeh Publishers Ltd. Benin City, Nigeria, p. 232.

Jadhav U (2009). Aquaculture Technology and Environment. PH1 Learning Private Ltd., New Delhi -110001., p. 334.

Martins ML, Onaka EM, Moraes FR, Bozzo FR, Paiva AMFC, Goncalves A (2002). Recent studies on parasitic infections of freshwater cultivated fish in the state of Sao Paulo, Brazil. Acta Scientiarum, 24:981-985.

Mdegela RH, Omary AN, Matthew C, Nonga HE (2011). Effect of Pond Management on Prevalence of Intestinal Parasites in Nile Tilapia (*Oreochromis niloticus)* under Small Scale Fish Farming Systems in Morogoro, Tanzania Livestock Research for Rural Dev. Newl., 23 (6).

Nyaku RE, Okayi RG, Kolndadacha OD, Abdulrahman M (2007). A Survey of ectoparasites associated with 3 species of fish *Auchenoglanis occidentalis, Oreochromis niloticus* and *Bagrus bayad*, in River Benue, Makurdi, Benue State, Nigeria. In: Proc. 22nd Annual Conf. of FISON, Kebbi, Nigeria, Nov. 12-16, pp.10-14.

Odunze FC, Ibiwoye TII, Iyolnyoon PA (2003). Citrus Lime *(Citrus aurantifolia)* as an Efficacious Bio-Therapy in the control of Macrogyrodactylosis in the African Catfishes, *Clarias spp.* Nig. J. Fish. 1:99-102.

Okaeme AN, Ibiwoye TII (1988). Parasite and Disease of Cultured Fish of Lake Kainji Area of Nigeria. J. Fish. Biol., 32:479-481.

Okoye FC, Nanji JC (2005). Effect of substituting fishmeal with grasshopper meal in growth and food utilization of the Nile Tilapia, *Oreochromis niloticus fingerlings. In: Proc 19th Annual Conf. of* FISON, Ilorin, Nigeria, Nov. 29-Dec. 3, 2004 pp. 37-44.

Paperna J (1996). Parasites, infections and diseases of fish in Africa – An update. CIFA Tech. Paper, 31:p. 200 FAO, Rome, Italy.

Raissy M, Barzegar M, Rahimi E, Jalahi B (2008). Identification of worm Parasites of Fishes in Choghakhor lagoon, Iran. Proc. of Taal 2007: The 12th World Lake Conference, pp.2177-2180.

Smith IR, Pullin RSV (1984). Tilapia production booms in the Philip-pines. ICLARM Newslett., 7(1):7-9.

Umoeren NA, Onwutiri CO, Anadu DI (1988). Comparative studies on Endoelminth parasites of cultured and uncultured fish from Plateau State. Nig. J. of Appl. Fish. and Hydrobiol., 3:45-48.

WHO (World Health Organization) (1986). International Standards for drinking water, 3rd ed. WHO, Geneva.