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COMPARATIVE STUDIES AND PERFORMANCE CHARACTERISTICS OF CLARIAS GARIEPINUS (BURCHELL, 1822) LARVAE USING MICRO WORMS (*Paragrellus redivivus*) AND COPPENS CRUMBLES

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ABSTRACT: *An experiment was conducted on the comparative growth performance of Clarias gariepinus larvae using Micro worms (Panagrellus redivivus) and Coppens crumbles respectively. Three thousand pieces of Clarias gariepinus larvae of 2 days old having mean weight of 4.5±0.05mg and length of 5.18±0.04mm was randomly distributed into two separate feeding trials A & B, and replicated thrice in each feeding trial. Clarias gariepinus larvae were stocked at the rate of 500 larvae per replicate in a slow flow-through system water vats measuring 0.9 x 0.45 x 0.45m^3. Larvae on feeding trial (A) were fed with 0.2mm Coppens crumbles while larvae on feeding trial (B) were fed with Micro worms. The larvae were fed thrice a day base on 5% body biomass for 28 days. There is significant difference (P≤ 0.05) in the feeding trials. Larvae on feeding trial (B) had higher weight gain, feed intake, specific growth rate, protein efficiency ratio, survival rate (%) and feed conversion ratio than Larvae on feeding trial A. Therefore, Panagrellus redivivus could be recommended for the feeding of Clarias gariepinus larvae due to their better growth performance.*

KEYWORDS: micro worms, coppens crumbles, clarias gariepinus, larvae

INTRODUCTION

Supplemental feeds for instance Coppens (56% crude protein) is a scientifically formulated floating fish feed with high feed conversion efficiency and water stability that provide essential nutritional requirements needed for optimum weight gain (Onyia *et al.*, 2015). This type of feed could be are given to the fish at a minimal level to add to the natural food available for the fish in the pond. These natural foods are in the form of phytoplankton and zooplankton. However, these types of feed depend on the nature of the pond and the type of production the farmer is involved in (Michael, 1987).

The free-living nematode *Panagrellus redivivus* (common name micro worms) is one of the natural food for fish and it belongs to genus *Panagrellus*. *P. redivivus* females are small in size (0.5 mm-2 mm) but males that are slightly smaller than females in size (Stock and Nadler, 2006, Atchison, 2009). Once *P. redivivus* females reach maturity (~3 days), males mate with them via a curved tail with two long, split spicules (Stock and Nadler, 2006). Females do not lay eggs as some other nematode species do, but lay 10-40 live larvae every day or so for their three week lifetime (Atchison, 2009). *Panagrellus* nematodes do not have many distinguishing anatomical characteristics, but a relatively wide, long mouth and several sets of teeth in adults are consistent with their diet of yeast (Ferris, 2009). Nutritionally, *Panagrellus redivivus* contain 48.3% crude protein (Watanabe and Kiron, 1994, New, 1998 and Pronob *et al.*, 2012)

African Catfish (*Clarias gariepinus* Burchell, 1822). In Africa, more than one hundred different species (100) have been identified for which about nine species features prominently in African aquatic ecology (Idodo-Umeh, 2003). The investigations on feeding biology of the African Catfish have indicated that they are omnivorous feeder, preying on zooplankton, insects, fish preys, detritus, phytoplankton, worms and macrophytes. These are the most important food items in the diet (Elias *et al*., 2014)

LITERATURE/THEORETICAL UNDERPINNING

Fish foods are known to be the source of nutrients to fish and these feeds can be natural and manufactured. Supplemental feeds which are usually rich in protein but nutritionally incomplete may be used to expand production in aquaculture practices where foods are a major source of nutrition (FAO, 2016). Nutrients for cultured fish may be obtained from different food sources, such as plankton, bacteria, insects and other fish within the aquatic ecosystem, or from organic matter and processed feeds added to the aquatic environment.

Cultured fish require protein, lipids, energy, vitamins and minerals in their diet for growth, reproduction, and other normal physiological functions. These feeds requirements vary sometimes among species and within species relative to stage of life cycle, sex, reproductive state and environment.To fully bring aquaculture to its desired level, one of the major problems in fish production is the problems of feeding the fish stock in the pond with the right feed, the cost of feeding and the availability (FAO, 2008)

METHODOLOGY

The research work was carried out in hatchery unit of Fisheries Technology Department, Lagos State Polytechnic, Ikorodu, Lagos, Nigeria. The experiment was carried out using six slow flow-through system water vats measuring 0.9 x 0.45 x 0.45m^3 for rearing three thousand (3,000) mixed sexes of African catfish larvae (*Clarias gariepinus*) sourced from Fisheries Technology Department hatchery, and two rectangular glass tanks measuring (0.9m× 0.45m× 0.45m) for culturing *Panagrellus redivivus*.

Five (5) grams biomass of matured *P.redivivus* sourced from slow moving waste water coming from government established Fish Farm Estate, which was established on 34 hectares parcel of land that covers 4.65km at Odogunyan, Ikorodu, Lagos. 0.2mm in size of Coppens crumbles purchased from fish feed retail shop.Yeast powder as bio-encapsulation for media enrichment for *P. redivivus*culture (Rouse *et al.,* 1992), pH Meter, Dissolved Oxygen Meter and Thermometer for water quality measurements. Sensitive digital scale model EHA251 for weight measurement, water aerator, 1.0µm mesh size net and 0.5µm plankton scoop net for test animal sampling.

Biomass of matured *P.redivivus* was introduced into the two rectangular glass tanks fixed with air pump. Each tank having 2grams of *P. redivivus* and fed thrice a week with pinches of yeast for growth and reproduction before harvesting for feeding trial experiment. Changing of water in the glass tanks are done fortnightly Harvesting of *P.redivivus* was carried out with 0.5µm zooplankton net for feeding the African catfish larvae (*Clarias gariepinus)* at 5% body biomass.

African Catfish Larvae were stocked in the water vat and acclimatized for 24hours before commencement of feeding trials and subsequently, the fish larvae were allotted into each of the experimental tanks (500 fish larvae per tank) on the basis of similar body weight and randomly divided into two experimental groups, A and B with three replicates each. The fish larvae initial weights were determined and recorded and were fed three times daily at 5% body weight. Experiment (A) with extruded commercial feed coppens crumbles (0.2mm) and experiment (B) with *P. redivivus* live food. The weights of the fish fry were taken every week during the experimental period.

Fish growth and nutrients utilization parameters that were measured are; Live Weight Gain of Fish = Final body weight of fish – Initial body weight gain of fish.Feed conversion ratio (FCR) = total feed intake (g)/total wet weight gain (g).Protein Efficiency Ratio (PER) = wet weight gain (g)/total protein intake.Specific Growth Rate = Final body weight of fish – Initial body weight of fish/No of Days reared. Mortality rate (M= (N_o-N_tx 100%/N_o) where $N_o$is the number at the start of the experiment and N_1 is the number at the end of the experiment (Babalola *et al.*, 2016). Also, water quality parameters measured were Dissolved Oxygen using the dissolved oxygen meter, water temperature using the thermometer and water pH using the pH meter. Ammonia and Nitrite in water were determined in the chemistry laboratory. All data was analyzed using t-test and one-way analysis of variance at 95% confidence level using statistical package, SPSS version 12.

RESULTS/FINDINGS

The results from the experiment shows the mean standard deviations on feeding trial using Coppens crumbles in the following sequence; weight gain (29.91±1.02mg), feed intake (1.18±0.05mg), specific growth rate (0.24±0.01), protein efficiency ratio (0.48±0.02), survival rate (%) (98.67±0.58) and feed conversion ratio (0.18±0.01). while mean standard deviations on feeding trial using *Panagrellius redivivus* (Live food) experiment are reported in the following order; weight gain (36.09±4.83mg), feed intake(1.38±0.15mg), specific growth rate (0.32±0.07), protein efficiency ratio(0.72±0.10), survival rate (%) (96.0±3.61) and feed conversion ratio (0.16±0.02). All differ significantly at ($p<0.05$). Comparatively, it shows that there is significant difference ($p\leq0.05$) in the growth performances of the larvae fed with Coppens crumbles and *Panagrellius redivivus* respectively (Table1).

Table 1: Comparative Feeding Trials of *Clarias garipenus* larvae

	Feeding Trial A Coppens crumbles (formulated feeds)				Feeding Trial B *Panagrellius redivivus* (Live feeds)			
Growth Parameters	T_1R_1	T_1R_2	T_1R_3	Mean(±SD)	T_2R_1	T_2R_2	T_2R_3	Mean(±SD)
Number of weeks	4.0	4.0	4.0	4.00±0.00	4.0	4.0	4.0	4.00±0.00
Initial weight (mg)	4.0	4.0	4.0	4.5±0.05	4.0	4.0	4.0	4.5±0.05
Final weight (mg)	6.11	6.31	6.61	25.41±0.97	8.06	6.86	10.66	31.59±0.88
Weight gain (mg)	28.81	30.81	30.11	29.91±1.02	35.06	31.86	41.36	36.09±4.83
Feed intake (mg)	1.35	1.25	1.54	1.38±0.15	1.14	1.23	1.18	1.18±0.05
F.C.R	0.16	0.18	0.14	0.18±0.01	0.18	0.19	0.17	0.16±0.02
S.G.R(%/day)	0.23	0.23	0.25	0.75±0.92	0.30	0.25	0.40	0.99±0.83
P.E.R	0.70	0.64	0.83	0.48±0.02	0.46	0.49	0.48	0.72±0.10
Mortality (%)	2.0	1.0	1.0	4.0±2.61	3.0	1.0	8.0	1.33±0.58
Survival Rate (%)	98	99	99	96.0±3.6	97	99	92	98.7±0.8

*F.C.R= feed conversion ratio *S.G.R (%/day) = specific growth rate *P.E.R= protein efficiency ratio

Table 2 shows the essential physicochemical characteristics recorded during the feeding trials. The mean (±SD) water temperature, pH, Dissolved oxygen, Salinity, TDS, E.C, Ammonia, and Nitrite were recorded and significant at 0.01 % level of probability.

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Table 2: Mean Values of Physicochemical Parameters

Water Parameters	Feeding Trial A Coppens crumbles (formulated feeds)				Feeding Trial B *Panagrellus redivivus* (Live food)			
	T_1R_1	T_1R_2	T_1R_3	Mean(±SD)	T_2R_1	T_2R_2	T_2R_3	Mean(±SD)
pH	5.43	5.36	5.45	5.41±0.05	5.33	5.42	5.38	5.38±0.05
D.O (mg/l)	5.3	5.2	5.0	5.17±0.15	5.0	5.4	5.3	5.23±0.21
Temperature (ºC)	25.6	25.5	25.3	25.5±0.15	25.2	25.1	25.5	25.30±0.21
Salinity(mg/l)	0.61	0.60	0.61	0.61±0.01	0.61	0.60	0.59	0.60±0.01
TDS(mg/l)	68	69	80	72.33±6.66	67	68	80	71.67±7.23
E. C (mg/l)	1.23	1.20	1.22	1.22±0.02	1.22	1.23	1.20	1.22±0.02
Ammonia (mg/l)	0.45	0.42	0.46	0.44±0.02	0.44	0.43	0.45	0.44±0.01
Nitrite (mg/l)	0.03	0.02	0.03	0.03±0.01	0.03	0.02	0.04	0.03±0.01

*D.O= Dissolved Oxygen *TDS = Total Dissolved Solids *E.C= Electrical Conductivities

DISCUSSION

The dietary requirements of fish larval provides relevant evidence on the nutrient needs of the larval which required quantitative and qualitative amount of feeds especially in the diet of domesticated larval fish for optimum growth. Nevertheless, acceptability of food by fish larval depends on nutritional values, digestibility and taste (Babalola *et al.,* 2016 and Pronob *et al.,* 2012).

The outcome of this experiment shows the significant effects of using *Panagrellius redivivus* (Live feeds) on the growth performance of *Clarias garipenus* larvae and Coppens crumbles (formulated feeds).The general increase in mean weight gain, food intake and food conversion ratio of larval in feeding trial B shows that fish larvae prefer to *Panagrellius redivivus* (Live food) with 48.3% crude protein (Watanabe and Kiron, 1994) to Coppens crumbles with 56% (Onyia*et al.,*(2015) despite the fact that Coppens crumbles has higher crude protein than *Panagrellius redivivus.* This corroborates the report of Ukwe *et al.,* (2017) on the effect of Artemia and branded formulated feed on *Clarias garipenus* larvae.

In addition, *Panagrellius redivivus* contain all the nutrients such as essential proteins, lipids,carbohydrates, vitamins, minerals, amino acids and fatty acids for the maximum growth and survival of the fish larval, this could perhaps contributed to the better performance indices observed larvae in feeding trial B than larvae feeding trial A. This is in agreement with the publication of Atchison, (2009). Aside from the nutritional advantage live food offers, previous authors such as David (2003) and Pronob *et al.*, (2012) reported that live foods stimulate fish larval feeding response especially when swim in water column and are constantly available for the fish to feed on. This in addition, could also responsible for the high growth rate observed in *Clarias garipenus* larvae fed with *Panagrellius redivivus*

However, weight gain observed in feeding trial A fed with Coppens crumbles were relatively lower than that of feeding trial B This might be due to feed quality deterioration as a result of long term or inappropriate storage. Also, Coppens crumbles might not be recognized on time as feed by newly domesticated species or too large as a first feed for the larvae because they are too small to eat artificial feed and this may result to their slow growth response in relation to larvae fed with *Panagrellius redivivus*. This agreed with the report of aquaafrica, (2019) and supported by Ukwe *et al.*,(2017) and Atchison, (2009) publications on nutritional values of live food to fish larvae.

FCR is a method that determines the amount of feed it takes to grow a kilogram of fish and by implication, the lower the FCR the higher the quality of feed fed to the fish (USAID, 2011). The FCR in feeding trial B is lower than that in feeding trial A. This shows that feeding fish larvae with *Panagrellius redivivus* gives better yield than formulated feeds. The differences in FCR in both trials are in agreement with FAO, (1987), David, (2003) and Ukwe *et al.*, (2017).The specific growth rate in feeding trials A and B can be rated at 75% and 99% respectively. This is another good indication that live food is better than manufactured feed in terms of feed quality and acceptability as reiterated by FAO, (2019) on Milkfish fry feeding trials.

Similarly, it is obvious from the results that fish larvae fed with *Panagrellius redivivus* utilized the crude protein in the diet effectively than that of fish larvae fed with Coppens crumbles. Similar results were reported by Nalawade and Bhilave (2011) on freshwater *Labeo rohita*. The reason for effective utilization of protein in the diet could be the ease of digesting the live food because fish larvae are poor in digesting food especially formulated feeds as reported by previous authors, Pearson, (1989) and Ukwe *et al*., (2017).

Fish mortality and survival rate are negatively correlated. In table 1, it was reported that the percentage mortality in experiment A is higher than B. Feed induced mortality could cause this occurrence in larvae fed with Coppens crumbles from digestive stress of the feed due to their poor digestibility, contaminated floating feed, and high level of Aflatoxin in certain feed ingredients used in feed formulation, leading to feed poisoning. Also, fish metabolites could as well increase fish mortality (Eniola, 2016). This is not differ from the reports of Person (1989) and sales (2011) who stated that using formulated feeds promote high mortality of fish.

Good water management is one of the keys to successful aquaculture practices especially in hatchery management (Babalola *et al.,* 2018). Water quality parameters measured were in the range of tolerance for *Clarias garipenus* larvae culture. Consequently, the presence of *Panagrellius redivivus* as live food in water could contribute to the improved water quality in the facility by imposing bioremediation effect as previously mentioned by aquaafrica (2019).

IMPLICATION TO RESEARCH AND PRACTICE

Live food such as *Panagrellius redivivus* all the nutrients such as essential proteins, lipids, carbohydrates, vitamins, minerals, amino acids and fatty acids for the maximum growth and survival of the fish larval, if fed to satiation. Mass culturing of this live food to feed fish larvae will reduce production cost while promoting fast growth of domesticated fish.

CONCLUSION

It is evidence from the results obtained from feeding trials conducted that fish larval respond to the use of *Panagrellius redivivus* as live food than formulated fish feed. Moreover, the cost of Coppens crumbles (formulated feeds) in this part of the world is high whereas, *Panagrellius redivivus* offers alternative diets which can be cultured alongside the larvae with minimal cost. Consequently, the results from this study clearly established that *Panagrellius redivivus* could be used to replace Coppens crumbles to feed *Clarias garipenus* larvae. Feeding *Clarias garipenus* larvae with *Panagrellius redivivus* live food (*ad-libitum*) is hereby recommended to be used as diet for *Clarias garipenus* larvae from economic point of view and the attendant nutritional value it adds.

FUTURE RESEARCH

This experiment should be repeated with other fish species and other live food in order to evaluate their performances as well as combination with other feed ingredients so that an all-embracing conclusion could be drawn on using live food to nurse fish larvae.

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