THE EFFECTS OF MOINA, ARTIFICIAL DIET AND NUTRASE XYLA SUPPLEMENTED ARTIFICIAL DIET ON GROWTH AND SURVIVAL OF *CLARIAS GARIEPINUS* LARVAL.

BY

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ABSTRACT

An experiment was carried out to investigate the effects of moina, artificial diet (55% CP) and nutrase xyla supplemented artificial diet on growth performances and survival rates of Clarias gariepinus larvae. A combination of moina and artificial diet (with or without nutrase xyla) resulted in higher growth performance and survival rates during a 12-day nursing time with specific growth rates of 30.04 – 32.15 % d^{-1} and survival rates of 87.5 – 90%. Best growth performance and survival rate was obtained with a combination of moina and artificial diet supplemented with nutrase xyla. Feeding of moina and artificial diet supplemented with nutrase xyla alone to the larval led to a lower growth performance of 25.60 – 27.04 % d^{-1}. However, the survival rate of moina (85%) was not significantly different to that of larvae fed a combination of moina and artificial diet (with or without nutrase xyla supplementation). artificial diet without nutrase xyla addition proved relatively less suitable for larval rearing of Clarias gariepinus owing to a low survival rate of 69% and growth performance of 19.7% d^{-1}. This study showed the feasibility of feeding a combination of moina and nutrase xyla supplemented artificial diet to the larvae of Clarias gariepinus.

INTRODUCTION

Nutrition of fish larvae is one of the dominant factors influencing their survival in culture. To ensure high survival, a continuous supply of suitable and acceptable diet is therefore needed. There are two major developmental trends in larval rearing: use of live food organisms such as cladocera, artemia, salima etc. and the use of formulated microdiets. It has been observed that the supply of live food can be interrupted by a sudden collapse of culture (Watanabe *et al.*, 1979; 1980; Fukusho *et al.*, 1980; Tandler, 1985). Also, the mass culture of live food requires considerable space and expense due to energy, equipment and man power (Kolkovski *et al.*, 1993). In contrast, micro diet offers off-the-shelf availability, lower production costs and greater diet flexibility (Gatesoupe and Luquet, 1981; Teshima *et al.*, 1982). However, in studies with larvae reared on artificial diets, the larvae have not matched the growth and survival performance of larvae fed live food organisms (Andron *et al.*, 1974; Kanazawa *et al.*, 1982; Teshima *et al.*, 1982; Kanazawa and Teshima 1988).

This poor performance may result from incompletely developed digestive tract in the early stage of larvae growth, which cause low digestive enzyme activity in these fish (Dabrowski, 1984; Lauff and Hofer, 1984). It was reported that juvenile (Jancaric, 1984) and larval fish (Dabrowski and Glogowski, 1977) utilize the exogenous enzymes of the live food they consume as activators of zymogens in their gut to help complete digestive process. The fact that these enzymes are not usually included in microdiets, could explain greater success of live foods. if larvae were infact utilizing exogenous enzyme.

The present study aims at comparing growth performance and survival rates of *Clarias* *gariepinus* larvae fed *Moina* (Mo) to those of larvae fed artificial diet supplemented with nutrase xyla (AdN), artificial diet without nutrase xyla supplementation (Ad), combination of *Moina* and artificial diet supplemented with nutrase xyla (Mo + AdN) or combination of *Moina* and artificial diet without nutrase xyla supplementation (Mo + Ad).

MATERIALS AND METHODS

A static indoor rearing system was used to conduct the experiment. Forty litre capacity rectangular glass aquaria containing 30l water with aeration was used.

Brood fish was induced to spawn by treatment with pituitary hormone. Twenty-four hour after hatch 50 larvae were placed into each of the fifteen aquaria. Feeding of the experimental diet (Table 1) started from 96 h post-hatching (Verreth and Tongeren, 1989). Weight and total length at that time ranged from 2.4 to 2.6 mg and from 7.0 to 8.3 mm respectively.

The present study tested five diets: *Moina* (Mo), artificial diet with nutrase xyla supplementation (AdN), artificial diet without nutrase xyla supplementation (Ad), combination of *Moina* and artificial diet with nutrase xyla supplementation (M + AdN) and combination of *Moina* and artificial diet without nutrase xyla supplementation (M + Ad). The nutrase xyla (Nutrex N.V. Co. Ltd, Belgium) consists of enzymes with endo-1,4-β-xylanase, β-glucanase and amylase activities from *Bacillus subtilis*. Level of nutrase xyla supplementation (0.10 g kg^{-1}) was chosen according to the manufacturer's recommendation.

Moina were cultured in earthen ponds fertilized with chicken manure. They were collected daily, screen through a sieve of 100μm and treated with formalin (50ppm) for 1 – 2 min to eliminate pathogens (Hung *et al.*, 2002). They were still alive and move actively after treatment. The composition and proximate analysis of the artificial diets are presented in table 1. The size of the artificial diet particles was 0.2 – 0.4 mm.

Fish were fed four times a day 0800, 1400, 2000 and 0200 h. Live feed was fed at 160% fish biomass (wet fed basis), on the basis of fish weight registered every 4 days. The artificial diet was distributed at 20% fish biomass. The fish fed diets Mo + Ad and Mo + AdN were fed Mo at 80% and Ad and AdN at 10% fish biomass, adjustment was made every 4 days after weighing.

Water quality parameters were monitored throughout the experimental period following the procedure recommended by APHA (1980). Water quality parameters were similar between different test tanks throughout the experimental period. The ranges were temperature 25 – 28^{0}C; pH, 6.3 – 7.5; dissolved oxygen 4.7 – 6.8 mg/l.

The experimental diets were analysed for their proximate composition according to AOAC (1990).

Mean weight, specific growth rate and survival rates were subjected to one – way ANOVA, followed by Duncan's multiple range test to determine significant difference among treatments.

RESULTS

Weight gain, specific growth rates (SGR) and survival of *Clarias gariepinus* larvae are presented in Table 2. The best growth performance was observed in larvae fed Mo + AdN (32.15% d^{-1}). The growth performance of larvae fed Mo and those fed AdN were not significantly different ($p<0.05$) but were significantly lower than that of larvae fed with Mo + AdN or Mo + Ad. The poorest performance was observed with the larvae fed diet Ad. During the first four feeding days Mo, Mo + AdN and Mo + Ad gave the highest growth performance when compared to Ad and AdN. However, larvae fed with Mo + AdN and Mo + Ad grew faster over the subsequent days so as to overtake the larvae fed with Mo. As a result larvae fed Mo + AdN and Mo + Ad had higher weight from 8 d onwards.

The survival rates of larvae fed diets Mo, Mo + Ad and Mo + AdN were not significantly different (85.00 – 90.00 %) while those on diet Ad gave the lowest survival rate (69.00 %), $p < 0.05$.

DISCUSSIONS

The positive effect of diet Mo + AdN on *C. gariepinus* larvae support the hypothesis that provision of micro particulate diets in addition to live feed enhances both growth and survival rates (Kanazawa, 1991). Studies on morphology and enzymatic capacity of the digestive tract of larval fish suggest that it is not fully developed (Baragi and Lowell, 1986; Cousin *et al.*, 1987; Segner *et al.*, 1989). Further studies revealed that digestive capacity increase with larval age as a result of enzymatic activity associated with the more developed digestive tracts of older larvae (Buckley and Dillman, 1982; Govoni *et al.*, 1986). The result of this trial shows that endogenous enzyme activities in *C. gariepinus* larvae was not sufficient for the digestion of microdiets as is evident in the low growth performance recorded in larvae fed diet Ad. However, supplementation of micro diet with nutrase xyla affected the larval growth positively. This could be as a result of better digestibility of nutrients in artificial diet due to the activities of exogenous enzyme like amylase which catalyses the hydrolysis of ingested starch yielding short-chain oligosaccharides and these oligosaccharides are hydrolysed by glucosidase to glucose (Robinson, 1991). Better performance of larvae fed enzyme supplemented micro diet supports the findings in the studies on the influence of enzyme (trypsin) supplemented diet in a larvae freshwater fish *Cyprinus carpio* (Dabrowski and Glogowski, 1977; Dabrowski *et al.*, 1979).

The lower growth and survival rates of larvae fed diet Ad agrees with findings in other fish species. When *H. longifilis* larvae (Kerdchuen and Legendre, 1974), *C. gariepinus* larvae (Hogendoorn, 1980) and *P. bocourti* larvae (Hung *et al.*, 2002) were fed on trout-starter feed, they had low survival rates of 32%, 12% and 67.5% respectively. This may be related to a number of factors which includes: the primary development of digestive systems at first feeding; feed quality and digestibility or rapid degradation of the excess feed, resulting in a subsequent increase in ammonia in the water. Also, the growth of pathogenic microbes could have been enhanced in the presence of excess feed (Charlon and Bergot, 1984). In this study *C. gariepinus* larvae fed diet Ad apparently showed a better survival rate; 69% when compared to 12% earlier reported by Kerdchuen and Legendre (1994).

The improved growth performance and survival of larvae fed Mo + AdN throws light on the possibility of using it for larval rearing of African catfish *Clarias gariepinus*.

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Table 1.

Formulation and proximate composition of experimental diet[a]

Ingredients	g kg^{-1}
Maize	92.50
Soybean meal	345.00
Fish meal	520.00
Vitamin / mineral premix	10.00
Vegetable oil	30.50
Crude protein	550.8
Crude lipid	129.0
Ash	115.0
Fibre	215.0
NFE	185.2

[a] Enzyme was added to a separate batch of the above diet to form further treatment.

Table 2: Mean weight, specific growth rate and survival rate of *Clarias gariepinus* larvae fed on moina, combination of moina and microdiet with or without enzyme supplementation and microdiet with or without enzyme supplementation after 8 days of nursing from D4 to D12.

Feeding treatments	Moina sp	Microdiet	Microdiet + enzyme	Moina + microdiet	Moina + microdiet + enzyme
Initial weight at D4 (mg)	2.40 ± 0.22	2.50 ± 0.08	2.50 ± 0.16	2.50 ± 0.17	2.50 ± 0.23
Weight at D8 (mg)	8.94 ± 0.37	5.72 ± 0.08[d]	7.30 ± 0.62[c]	8.60 ± 0.52[b]	9.46 ± 0.22[a]
Final weight at D12 (mg)	21.75 ± 0.89[c]	12.05 ± 0.54[d]	19.38 ± 0.83[c]	27.03 ± 0.36[b]	32.75 ± 0.54[a]
SGR (% day-1)	27.04 ± 0.36[c]	19.69 ± 1.16[d]	25.59 ± 0.33[c]	30.04 ± 0.36[b]	32.15 ± 0.33[a]
Survival rate (%)	85.0 ± 4.08[ab]	69.00 ± 6.12[c]	80.0 ± 3.56[b]	87.50 ± 2.04[a]	90.00 ± 3.27[a]

Figures in the same row having same superscripts are not significantly different by Duncan's multiple range test (P<0.05). Mean ± S.D. (based on three replicates).

SGR = 100 X (ln (W2) – ln (W1)) / (T2 – T1)