Improving the survival and growth of African catfish (*Clarias gariepinus*) fingerlings by using Nile tilapia

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Abstract

In an attempt to improve the survival rate of African catfish, *Clarias gariepinus* fingerlings, an experiment was conducted in six cement ponds (15 m^3 per each). African catfish were cultured with Nile tilapia, *Oreochromis niloticus* as species combination at three different ratios with two replicates. Each pond was stocked by 40 *O. niloticus* (7.8 ± 1.3 g), meanwhile 40, 30 and 20 *C. gariepinus* (8.9 ± 1.7 g) were stocked at group 1, 2 and 3 for 10 weeks. Fish were fed for satiation on 30%-protein diet twice daily; five days a week for 10 weeks. At the end of the experiment, ponds were drained and fish were harvested, counted, and weighed. The catfish were classified by weight to four classes; class 1 (20-25 g), class 2 (25-30 g), class 3 (30-40 g), and class 4 (40-50 g). Growth performances of both fishes were significantly differenced among the different groups. The best growth for *C. gariepinus* and *O. niloticus* was recorded in groups 2 and 1, respectively. No significant difference in *C. gariepinus* length was recorded, while *O. niloticus* length was significantly differed (P>0.05) between treatment 1 and other treatments. *C. gariepinus* classes were significantly differed among the different fish groups. Among the different groups no significant differences in catfish survival (80-85%), while it was significantly differed in tilapia (89.9-98.3%). The results of the present study showed that using *O. niloticus* fingerlings has a positive impact on *C. gariepinus* growth and survival rate and it could be recommended using *O. niloticus* in *C. gariepinus* culture as a technique to minimize their cannibalism. Minimizing the use of grading and sorting of catfish which lead to avoid the stress resulting from their use on African catfish *Clarias gariepinus* and reduce the production costs

Key words: African catfish, *Clarias gariepinus*, Nile tilapia, growth, survival.

Introduction

African catfish, *Clarias gariepinus C. gariepinus* is distributed in Africa and Asia (Teugels and Adriaens, 2003). Nowadays, African catfish has more contribution in aquaculture production systems world-wide because of their fast growth rate, high disease resistance, aerial respiration, high feed conversion (El-Naggar *et al*., 2006; Ibrahim and El-Naggar 2010; Solomon and Boro, 2010). The economic study of catfish production in Egyptian fisheries was recorded by Abdel-Hafez and El-Caryony (2009). A review in the status of African catfish (*Clarias gariepinus*) aquaculture around

the world was reported by Gomaah and El Nagar (2004).

There are many studies on using *C. gariepinus* to control and reduce the overpopulation of Nile tilapia (El Gamal *et al.,* 1998; Abdel-Tawwab, 2005; El Naggar, 2007; Ibrahim and El Naggar, 2010; Abdel-Hakim and Amar, 2010). The above mentioned studies had assessed the efficiency of *C. gariepinus* in controlling unwanted Nile tilapia, *O. niloticus* recruits in grow out and to evaluate the performance of *O. niloticus* in polyculture system with catfish under low-input production system.

One of the problems restricts the *C. gariepinus* farming is cannibalism (large fish eat small one) among. Hecht and Pienaar (1993) focused on the two principal causes of sibling cannibalism which may be genetic and/or behavioral; the latter being influenced directly by environmental factors. To reduce cannibalism of *C. gariepinus* in hatcheries and fish farms it should be grading and sorting by size. It is expected that grading minimizes the stress imposed by the larger individuals over small ones resulting in improved fish growth and production (Seppa *et al*., 1999).

African catfish exhibits a strong differential growth rate leading the farmers to grade their fish once or twice during the production cycle (Verreth and Eding, 1993). Within fish farming grading, i.e. the process of sorting to approximate size, changes the group composition from heterogeneous to homogeneous (Martins *et al.,* 2005). On the other hand, grading and sorting processes are overcost and could cause a handling stress on fish, which may reduce their growth. Abdel-Tawwab *et al.* (2006) stated that fish cannibalism was affected by stocking density, feed quality and availability, and the presence of shelters such as submerged macrophytes. This hypnotized that the availability of food for *C. gariepinus* via their culture with *O. niloticus* may reduce their cannibalism resulting in enhanced growth and survival. Therefore, the objective of the present study is using *O. niloticus* to improve *C. gariepinus* growth and survival rate.

Materials and methods

The study was carried out in 6 cement ponds (15 m^2 per each), Central Laboratory for Aquaculture Research (CLAR), Abbassa, Abou Hammad, Sharkia. For all ponds inlet and outlet of each pond was screened using fine mesh screen to prevent entrance of undesirable fish. The water source was from Ismalia canal as a branch from Nile River. Nile tilapia, *Oreochromis niloticus* and African catfish, *C. gariepinus* were obtained from Egyptian Center for Applied Aquaculture, Kafer El Sheikh, Egypt. Fish were transformed in plastic tanks provided with aeration to CLAR lab and acclimatized for two weeks in the indoor wet lab, Department of Fish Genetics and Breeding, CLAR. After that the fish were distributed in complete randomized design to six ponds divided to three groups; two replicates for each. Each pond was stocked by 40 *O. niloticus* (7.8 ± 1.3 g), meanwhile 40, 30 and 20 *C. gariepinus* (8.9 ± 1.7 g) were stocked at group 1, 2 and 3 for 10 weeks. Fish were fed for satiation on 30%-protein diet twice daily; five days a week for 10 weeks. Water samples from each pond were collected every two weeks throughout the experiment. Water temperature was 27 ^{o}C ± 2, dissolved oxygen range between 3 - 5 mg/L, pH range between 7.2 - 8.3, nitrite range between 0.0 - 0.05 mg/L, and unionized ammonia range between 0.09 -

0.2 mg/L. These parameters are within the suitable ranges for fish farming (Boyd, 1990).

At the end of the experiment, ponds were drained and fish were harvested, counted, and weighed. The catfish were classified by weight to four classes; class 1 (20-25 g), class 2 (25-30 g), class 3 (30-40 g), and class 4 (40-50 g).

Results

The final weights of *O. niloticus* and *C. gariepinus* were significantly differed (P>0.05) among the different groups (Figure 1).

Moreover, *O. niloticus* length was significantly differed (P>0.05) between treatment 1 and other treatments, while no significant difference was recorded for *C. gariepinus* length (Figure 2)

There was significant difference in the percentage of fish classes among the different fish groups (Table 1). The highest percentage was recorded for class 1 (54.4%) in group 1, whereas the lowest one was obtained at group 3 (24.2%).

For class 2, no significant difference was recorded for fish groups 1and 2 (14.7 and 14.6%, respectively), while it was significant for fish group 3 (36.4%). However group 2 produced the highest percentage (35.4%) for class 3.

On the other hand, the lowest percentage for class 4 was recorded in fish group 1 (7.4%) and the highest one was obtained in fish group 2 (15.2%).

O. niloticus survival rate was significantly differed (P>0.05) among all fish groups (Figure 3), meanwhile no significant difference was observed for *C. gariepinus* survival rate.

Discussion

The present study has indicated that using *O. niloticus* at different ratio with *C. gariepinus* effected the growth of both fishes. The presence of *O. niloticus* in the ponds with *C. gariepinus* acted as a barrier, reduced the cannibalism, the aggressive behavior, and minimized the gap *C. gariepinus* size. From the results of this study, using 40 *O. niloticus* with 30 *C. gariepinus* gave the best growth followed by 40 *O. niloticus* with 20 *C. gariepinus*. These results were in full agreement with Abdel-Hakim and Ammar (2010) who reported that 1 *C. gariepinus*: 20 *O. niloticus* gave the optimum growth performance and net return.

In contrast, Offem *et al.*(2009) recorded that the final mean weight, average net and gross yields of *O. niloticus* indicated higher values for *O. niloticus* when polyculture with large and small *H. longifilis*. Van de Nieuwegiessen *et al.* (2009) stated that growth range of 102.1–288.6 g, both univariate and multivariate analyses indicated a significant effect of stocking density where at increasing density they observed an increase in African catfish activity. Almazán Rueda (2004) pointed out that juvenile *C. gariepinus* showed a positive effect of increasing density, reflected by increased growth performance.

The *C. gariepinus* survival was high among the different fish groups, because the *O. niloticus* presence had a positive effect in increasing the survival rate. The present results was in line with those given by Marimuthu *et al.* (2010), who reported that twice/day feeding regimen is the best to obtain the highest growth rate in the African catfish fingerlings. Otherwise, Abdel-Tawwab (2005) reported that the predation rate of *C.*

gariepinus increased with increasing predator size and *O. niloticus* stocking. Nonetheless, De Graaf *et al.* (1996) had mentioned to low *O. niloticus* survival when reared in combination with *C. gariepinus* at a low and high feeding level. Solomon and Boro (2010), stated that low survival rate for catfish *Heteroclarias*/ Nile tilapia at different stocking ratios (1:1, 1:2, and 1:4) survival decreases as stocking density increases.

Recommendation

The present study recommended using *O. niloticus* in combination with *C. gariepinus* with appropriate ratio to minimize *C. gariepinus* cannibalism resulting in an enhanced *C. gariepinus* growth and survival.

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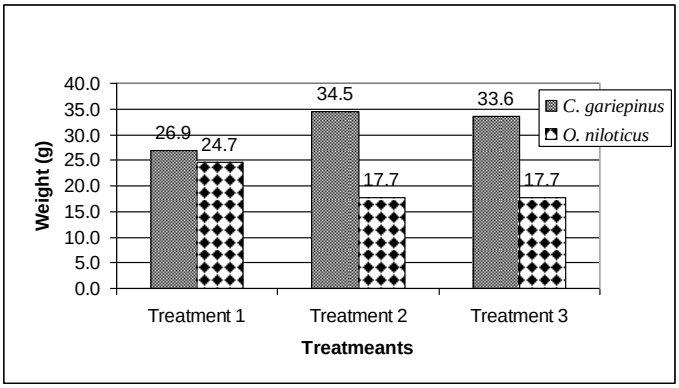

Figure (1) Growth rate of *C. gariepinus* and *O. niloticus*

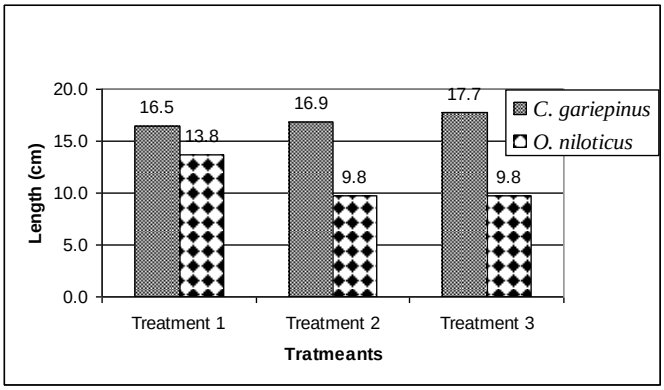

Figure (2) Length of *C. gariepinus* and *O. niloticus*

Table (1). The percentage of *C. gariepinus* classes among the different groups.

Weight classes	Group 1	Group 2	Group 3
Classe 1 (20-25 g)	54.4[a]	39.6[b]	24.2[c]
Classe 2 (25-30 g)	14.7[b]	14.6[b]	36.4[a]
Classe 3 (30-40 g)	23.5[b]	35.4[a]	24.2[b]
Classe 4 (40-50 g)	7.4[c]	10.4[b]	15.2[a]

تحسين معدل النمو والاعاشة لإصبعيات القرموط الأفريقي باستخدام البلطى

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الملخص العربى

في محاولة لتحسين معدل النمو والاعاشة لإصبعيات القرموط الأفريقي بـأستخدام البلطى فقد أجريت تجربة في ستة أحواض اسمنتية مساحتها 15 متر مكعب بأحواض التجارب بالمعمل المركزى لبحوث الأسماك بالعباسة شرقية. استخدمت ثلاثة معاملات بنسب مختلفة من أسماك القراميط مع أسماك البلطى بمكررين للمعاملة. تم استخدام 40 سمكة من البلطي بالإضافة الى40 ، 30 و 20 سمكة من القراميط لكل معاملة على التوالى . وكان متوسط الاوزان الأولية المستخدمة فى هذه الدراسة هى (8,7 ± 1,3) جرام لأسماك البلطي (9,8 ± 1,7)جرام لأسماك القراميط. تم تغذية الأسماك حتى الشبع بعلف 30% بروتين مرتين يوميا بمعدل خمس أيام اسبوعيا لفترة عشرة اسابيع. وعند نهاية التجربة تم تصفية الاحواض وصيد الأسماك وعدها وقياس اطوالها وكذلك اوزانها. ،

وقد أظهرت النتائج ان هناك فروق ذات دلالة إحصائية بين المعاملات في معدلات النمو. وسجل أعلى معدل نمو في المعاملة الثانية لأسماك القراميط. وكان أعلى معدل نمو لأسماك البلطي في المعاملة الاولى. لم يسجل أي اختلاف معنوى في اطوال القراميط، بينما أسماك البلطي كانت الفروق مختلفة بشكل ملحوظ (الاحتمال < 0.05) بين المعاملة الاولى وغيرها من المعاملات.

صنفت أسماك القراميط إلى أربعة مجموعات وفقا لنسبة عدد الأسماك لكل مجموعة للوزن والتى أظهرت تفاوتا واضحا بين المعاملات لكل مجموعة. المجموعة الاولى (20-25 جرام) اظهرت أعلى نسبة من الأسماك 54,4 في المعاملة الاولى ، في حين سجلت أدنى معدل 24,2 في المعاملة الثالثة. وأظهرت المجموعة الثانية (25-30 جرام) عدم وجود فروق كبيرة في المعاملات الاولى و الثانية ، في حين أنه كان هناك فرقا كبيرا في المعاملة الثالثة. وكانت الجموعة الثالثة (3-40 جرام) قد اوضحت بشكل كبير الفرق المعنوى بين المعاملة الثانية وكلا من المعاملة الاولى والثانية. المجموعة الرابعة (40-50 جرام) عبرت عن فروق معنوية بين المعاملات الثلاثة.

وكان معدل الاعاشة مرتفعة (80-85%) للقراميط ولكن عدم وجود فروق ذات دلالة إحصائية بين جميع المعاملات ، في حين كان الفرق معنويا (0.05) بين جميع المعاملات فى البلطي (89,9-98,3). وأشارت الدراسة أن استخدام اسماك القراميط مع البلطي في نسبة مختلفة كان له تأثير ايجابى على معد ل النمو والاعاشة لكلا من اسماك القرموط الأفريقى والبلطى.

وبناء على النتائج المتحصل عليها توصى الدراسة بلستخدام أسماك البلطى بكثافة 4 أسماك مع 3 أسماك للقراميط لتحسين النمو ونسبة الاعاشة كما يغنى ع ن استخدام عملية تدريج أسماك القراميط والذى يضيف تكاليف الى الانتاج بالاضافة الى الاجهاد الناتج من عملية التدريج على أسماك القراميط .