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 differed 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 m² 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 °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 1 and 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.

**REFERENCES**


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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.**

<table>
<thead>
<tr>
<th>Weight classes</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
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<tbody>
<tr>
<td>Classe 1 (20-25 g)</td>
<td>54.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>24.2&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Classe 2 (25-30 g)</td>
<td>14.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Classe 3 (30-40 g)</td>
<td>23.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>35.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24.2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Classe 4 (40-50 g)</td>
<td>7.4&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15.2&lt;sup&gt;a&lt;/sup&gt;</td>
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تحسين معدل النمو والاعاشة لاصبعيات القرموم الأفريقي باستخدام البليط

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المتخصص العربي

في محاولة لتحسين معدل النمو والاعاشة لاصبعيات القرموم الأفريقي باستخدام البليط، فقد أجريت تجربة في ستة أحواض استمرت شهرين. اعتبرت احذاء بحريان تجاربي، يحتوي Each ماء لحية الأحذاء الفضية والمياه، تم استخدام 40 سكة من البليط بالإضافة إلى 40، 20 سكة من القرموم لكل معاملة. وكان متوسط الوراثة الأولية المستخدمة في هذه التجربة هي (8.7 ± 1.3) جرام لأعاص القرموم. تم تغذية الأسماك حتى الشيخ بـ 30% بروتين يومياً بمعدل خمس أيام أسبوعياً لفترة عشرة أسابيع. وعند نهاية التجربة تم تصنيف الاحذاء وصيد الأسماك وعددها وقياس أطوالها وكذلك أوزانها.

وقد أظهرت النتائج أن هناك فروق ذات دلالة إحصائية بين المعاملات في معدلات النمو. وسجل أعلى معدل نمو في المعاملة الثانية لأعاص القرموم. وكان أعلى معدل نمو لأعاص البلطي في المعاملة الأولى. لم يسجل أي اختلاف معين في أطوال القرموم، بينما أسماك البلطي كانت الفروقات فلوكية بشكل ملحوظ (الاختبار > 0.05) بين المعاملة الأولى وغيرها من المعاملات.

صنفت أسماك القرموم إلى أربعة مجموعات وفقاً لفروق في مراياها نسباً عدد الأسماك لكل مجموعة للوزن الذي أظهرت تفاوتاً وضحاً بين المعاملات لكل مجموعات. المجموعة الأولى (20-25 جرام) أظهرت أعلى نسبة من الأسماك 54.4 في المعاملة الأولى، في حين سجلت دني معدل 24.2 في المعاملة الثالثة. وأظهرت المجموعة الثانية (25-30 جرام) عدم وجود فروق كبيرة في المعاملات الأولى والثانية، في حين أنه كان هناك فروق كبيراً في المعاملة الثالثة. وكانت المجموعة الثالثة (30-40 جرام) قد انتشرت بشكل كبير الفروقات المعنية بين المعاملة الأولى وثانية، وكاراً من المعاملة الأولى والثانية. المجموعة الرابعة (40-50 جرام) عبرت عن فروق معينة بين المعاملات الثلاثة.

وكان معدل الاعاشة مرتفع (85-90%) للقرموم وقود وجد وجود فروق ذات دلالة إحصائية بين جميع المعاملات، في حين كان الفرق معيناً (0.05) بين جميع المعاملات في البلطي (89.9-98.3). وأشارت الدراسة أن استخدام أسماك القرموم مع فترات متصلة يمكن أن يستخدم أعراض القرموم في نسبة مختلفة كان له أثر إيجابي على معدل النمو والاعاشة لكلا من أسماك القرموم الأفريقي والبلطي.

وبناءً على النتائج المتحدث عليها توصي الدراسة باستخدام أسماك البلطي بكمية ٤ أسماك مع ٣ أسماك للقرموم لتحسين النمو ونسبة الاعتشة كما ينصح عن استخدام عملية تدريج أسماك القرموم والذي يضيف تأكيل من الاتجاه بالإضافة إلى الجهود الناتجة عن عملية التدريج على أسماك القرموم،