International Journal of Fisheries and Aquatic Research
ISSN: 2456-7248
Impact Factor: RJIF 5.44
www.fishjournals.com
Volume 2; Issue 6; November 2017; Page No. 07-10

Screening of *Oreochromis niloticus* strains for their important production traits in high stocking density and low CP feed quality without aerating devices in concrete Tanks, Batu, Oromia, Ethiopia

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Abstract
The experiment was conducted to screen *Oreochromis niloticus* strains for their better production through selecting the strain with superior growth performance from four origin Lakes namely Chamo, Koka, Zeway and Awassa. The produced offspring from wild parents were reared in separate concrete tanks for 240 days in similar conditions in between June 2016 and January 2017. Only at the fry age in hapa for 1.5 months they were fed 30- 35% CP feed consisted of 50% fishmeal, 25% fine wheat bran and Noug cake 25% at 10% body weight in powder form. After, fries were stocked at the density of 5.2fish/ m^2 in separated grow-out concrete tanks and supplied 22.5% CP feed of 50% wheat bran and 50% Noug cake at 5% body weight 2 times a day for 240 experimental days. Final body weight and specific growth rate(SGR%d^{-1}) of mixed sex *O.niloticus* progeny for Chamo, Koka, Zeway and Awassa populations were 22.168±1.06g and 1.53%.d^{-1}; 17.20±1.86g and 1.42%.d^{-1}, 14.94±0.73g and 1.35%.d^{-1} and 14.691±0.77% and 1.34^{-1} respectively. The average final body weight of Chamo was significantly ($P < 0.05$) higher than of Koka Zeway and Awassa strains. There was no significant ($P > 0.05$) difference among Koka, Zeway and Awassa strains. Finally, it was concluded that mixed sex *O.niloticus* of Chamo strain attained best growth performance followed by Koka while growth performance of Zeway and Awassa strains were found at 3rd and 4th steps respectively under concrete tank culture.

Keywords: aquaculture, concrete tank, Mixed- sex, *Oreochromis niloticus*, strain, traits

Introduction
Tilapia species are prominent aquaculture candidate because of their fast growing, hardy and tolerant to adverse environment such as high salinity, low oxygen tension, wide range of water temperature, high ammonia concentrations and have adaptable feeding habits than most commonly farmed freshwater fish as well as to their good commercial demands [1, 2, 3, 4, 5]. Tilapia is one of the major sources of commercial and home-grown animal protein, good sources of vitamins, and oils. Tilapia culture provides diversified income, job opportunity and compensating the fish supply in depleted wild capture [6, 7, 8]. Nile tilapia (*Oreochromis niloticus*) is one of the most important cultured fish species in the 21st century as currently ranking second only to carps in global aquaculture production because of their faster growth rate [4, 9, 10]. As a result, they accounted more than 81% of the total cultured tilapias [11].

In Ethiopian case, fish culture is a very recent practice, which has started at small scale level in farmers' ponds by stocking wild fish species, mostly Nile tilapia (*O. niloticus*), collected from lakes. However, tilapias from different lakes of the Ethiopian Rift valley have different growth performances under pond culture [12]. Consequently these fish farms stocked with wild fish are operating below sub optimally and below capacity because of fish adaptation problem, lack of expertise in technical support, management and reasons like lack of supplementary feed, lack of male mono sex and untimely harvest. The excessive reproduction caused by mixed-sex culture which results in stunted fish growth because of the feed and space competition among the over populated fish has been the major problem observed in the ponds. A Tilapia strain that is fast growing in one location can be slower in others due to different external factors.

This study is aimed to screen and select fish of superior growth performance and survival rate of four *Oreochromis niloticus* strains (lakes, Chamo, Koka, Zeway and Awassa) for their important production traits through rearing in separate concrete tanks at Batu, the Ethiopian Rift Valley.

Materials and Methods
Description of the Study Area
The Study was conducted on station at Batu Fishery and other Aquatic Life Research Center located at 7.918^0'N and 38.727^{0}E at an altitude of 1650m.a.s.l. The center is situated in Batu town onshore of Lake Zeway within the Ethiopian rift Valley system characterized by arid agro ecology. The site is 160km south of Addis Ababa on the way to Hawassa in Adami Tulu district, East Shoa, Oromia regional state, Ethiopia.

Parent fishes stocking and feeding
As the parent stock, juvenile fish were collected from four different lakes, Chamo, Awassa, Koka and Zeway stocked in separate experimental concrete tanks at Batu/Zeway to acclimatized to the tank environment grow into adult age. Each tank has an area of 35m^2 with the water depth of1.10m regularly recharge with pumped well water after exposed in big reservoir. After the fish became adult, they were sex identified in to males and females separated in to isolated ponds and conditioned for three months. Three males and

three females of each the Chamo, Awassa, Koka and Zeway with an average body weights of 375g and 217 g, 377g and 180g, 488.3g and 283g, 207g and 156g were used. Feed of 22.5% CP prepared by mixing wheat bran and Noug cake (1:1ratio) at 5% body weight rate was supplemented twice (morning and afternoon) a day. Those conditioned parents (males and females of the four lakes origins) were then re-combined with their corresponding sex partners of the same lake for breeding after which similar age batch of fries were produced for progenies comparison.

Progenies production and rearing

Fry were started to be observed around the wall of each the breeding concrete pond in two to three weeks after putting the 1male with female parents together. The parents were then isolated from these progenies and kept in other ponds within a month. The off springs were grown from June 2016 to the end of January 2017 in separate concrete tanks. Mixed feed of 30-35% CP feed consisted of 50% fishmeal, 25% fine wheat bran and Noug cake 25% at 10% body weight in powder form for 1.5 months. Then, after the quality CP dropped to 22.5% CP from mixed feed of 50% wheat bran and 50% Noug cake at 5% body weight 2 times a day for 240 experimental days.

At the end of three months, 182 fingerlings from each hapa were collected, counted, measured (TL and TW) and stocked in to assigned tanks separately by origin at a stocking density of 5.2fish.m^{-2}. The fish were then fed a mixed feed prepared from 50% wheat bran and 50% Noug cake provided by hand casting over the water at 10% body weight for three months and after gradually reduced to 5% body weight to the end of experiment twice a day (from 9.00 to 10.00 AM. and from 4.00 to 5.30 PM) for 240 rearing days. The feeding rate was adjusted every month based on fish weight after fish sampling. The water source used to fill and refresh the experimental tanks was from the well the experimental tanks by gravity and water quality controlled through frequent measuring temperature, pH, and secchi depth.

Fish sampling and data collection

Monthly fish data was collected using beach seine having 1cm mesh size from each tank and measure their TL (cm) using measuring board to 1mm and TW (g) using sensitive balance to a minimum 0.10g. After the fish caught they were kept in the bucket filled with water and measure each specimen from25-35 then after returned to their tanks.

Fish growth analysis

The monthly collected data was fed in to computer in SPSS and Microsoft excel programs in order to perform statistical analysis. The mean weights of the fish were analyzed using one way analysis of variance (ANOVA). The difference in mean of the fish weight among the populations analyzed using one way ANOVA was subjected to significance testing using Tukey test. Statistical significance was determined at P<0.05. Standard deviation in each growth parameter and population was expressed as mean ±SD.

Specific growth rate (SGR %) in weight is defined as the percentage increases in body weight per day which was calculated as follows:

$$\text{Specific Growth Rate (SGR \%/day)} = \frac{ln(Final\ weight(g)) - \ln(Intial\ weight(g))}{Culturing\ days} X100$$

The survival rate (%) of the four *O.niloticus* strains was analyzed as follows:

$$\text{Survival rate}(\%) = \frac{(Number\ of\ harvested\ fish - Number\ of\ dead\ fish)}{Number\ of\ stocked\ fish}\ X\ 100$$

Results

The experiment was conducted on station from June 2 016 to end January 2017 to compare the growth performance of the four different strains of Nile tilapia (*Oreochromis niloticus)* progenies originated from Lakes (Chamo, Koka, Zeway and Awassa) under onstation condition in concrete tanks for 240 days. At the end of experimental period in 240 days, the Nile tilapia of Lakes Chamo, Koka, Zeway and Awassa strains were attained final body weight ranged from 11.1 to 31.4g with a mean of 22.17± 1.06g; from 10.5 to 34.97g with a mean of 17.20±1.86g; and from 10.6 to 24.04 g with a mean 14.94± 0.73g and 14.691± 0.77g and from 10.0 to 22.81g with a mean 14.691± 0.77g respectively. The average final weight of Chamo population was significantly (P < 0.05) higher than the Koka population. Also Chamo was with significantly (P < 0.05) highest than Zeway and Awassa populations. There was no significant (P >0.05) difference among Koka, Zeway and Awassa origins. The mean growth rate of the fish was highest in Chamo and lowest in Awassa progenies. The mean Specific growth rate (SGR% day^{-1}) of the mixed sex *O.niloticus* populations originated from Lakes (Chamo, Koka, Zeway and Awassa) were 1.53% day^{-1}, 1.42% day^{-1}, 1.35% day^{-1} and 1.34% day^{-1} per fish respectively. The mean Specific growth rate was highest in Chamo strain and lowest in Awassa strain. The survival rate of four *O.niloticus* populations calculated for 240 days was 83%, 79%, 89% and 63% for Chamo, Koka, Zeway and Awassa populations respectively. Survival rate of Awassa population was far lower than the other three. This might be attributed either to adaptation of the fish to the tank environment in low lands or to predators. The growth patterns of the Chamo, Koka, Zeway and Awassa tilapia progenies were demonstrate in terms of body weight (Fig. 1).

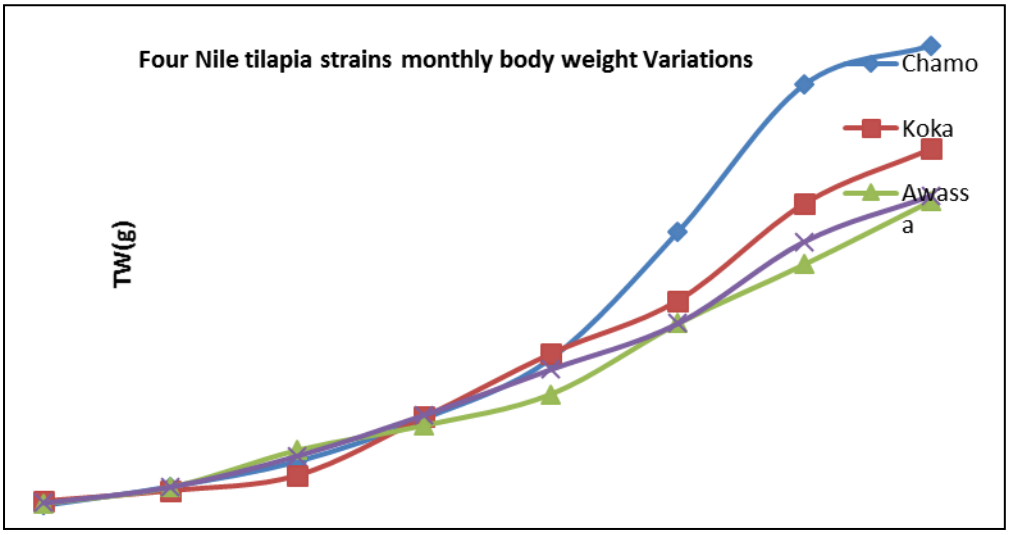

Fig 1

Discussions

Fish growth variation is among the basic factors considered in any fish culture system (pond, tank, cage and others) to increase the fish production. Screening the growth of native *O.niloticus* different strains is the priority issue in order to have best seed for sustainable development of fish culture in the region. Growth rate determination also helps in parent stock characterization and selection for better seed production.

In present study, the growth performance of mixed-sex *O.niloticus* progenies of Chamo population was the superior from the four strains followed by Koka and Zeway least Awassa. The mean final body weight of Awassa strain was found at significantly ($P < 0.05$) lowest level than the mean of Chamo. Koka and Zeway strains were on better growth than Awassa. The mean Specific growth rate (SGR% day^{-1}) of the mixed sex *O.niloticus* populations originated from Lakes (Chamo, Koka, Zeway and Awassa) were 1.53%day^{-1}; 1.42% day^{-1}; 1.35% day^{-1} and 1.345% day^{-1} per fish respectively. The SGR values obtained from the present study of four strains were in the values ranged to the SGR values obtained during the evaluation of Nile tilapia juveniles collected from four different Lakes (Abbassan, Asswan, Manzalah and Maryut) in Egypt, the SGR of which ranged from 0.976±0.04 to 1.277±0.03 in mixed sex culture [13]. The average final weight also varied among the evaluated strains.

Similarly, Ridha (2006) [9] conducted comparative study on growth performance of three strains of Nile tilapia, Non improved strain (NS), the genetically improved farmed tilapia (GIFT) and Fast selected tilapia line (SL). Different growth performance values in final weight, daily and specific growth rates were obtained among the strains. The author finally realized that different strains had different growth performance and feed conversion ratio where the selected line (SL) and GIFT strains had higher mean body weight, daily and specific growth rates than the non-selected strain.

Workagegn *et al.* (2010) [12] studied growth performance of juveniles of four Nile tilapia strains collected from Lakes Hawassa, Zeway, Koka and Hora for 60 days at Sebeta, at an altitude of 2240m during rainy/cold season. They found that the Chamo strain performed better than the three other strains, similar to the present result obtained, though there is a difference in source of the fingerling, culture environment and culture duration. The results obtained at Sebeta, Specific growth rate for Koka was 2.73±0.22; Zeway 2.61±0.14 and Hora 2.50±0.10 respectively. These results were higher as compared to the current results perhaps due to the difference in culture period.

The early breeding problem in mixed-sex *O.niloticus* culture affects their growth performance, which even resulted in often culture failure in the past because of the production of large number of fry stunting the entire population. The problem starts at the onset of sexual maturity and leads to various sizes of small fish production.

Conclusion and Recommendation

The experiment was conducted by rearing over recommended stocking density5.2fih/m^2 with the absence of aerating devices and fries with low 22.5% CP consisted from only plant source. During experimental period *O.niloticus* fish of Chamo, Koka, Zeway and Awassa strains were attained final body weight ranged from 11.1 to 31.4g with a mean of 22.168± 1.06g; from 10.5 to 34.97g with a mean of 17.20±1.86g; and from 10.6 to 24.04 g with a mean 14.94± 0.73g and 14.691± 0.77g and Awassa from 10.0 to 22.81g with a mean 14.691± 0.77g respectively.

The study was conducted intentionally to screen four Nile tilapia strains with their better growth and survival rate in Batu/Zeway, arid agro-ecology, for future better seed production thereby boosting fish production in Aquaculture condition. The study investigated that the Chamo strain attained the highest final weight (average weight of 22.168± 1.06g) followed by Koka (17.20±1.86g). The Awassa strain showed least growth with the average weight of 14.691± 0.77g at the end of the experimental period.

Based on the obtained results of the current screening study, the Chamo strain followed by Koka population is recommended for further line and cross breeding, seed production and to develop fish culture, in arid agro-ecology like mid rift Valley of Oromia.

Further research work is needed to produce male dominated

tilapia through crossing, hybreed and selection and evaluate the growth performance of each *O.niloticus* strain in different agro-ecologies to identify genetically superior strain which helps in fish breeding strategy of the region.

Acknowledgement
We express our gratitude to technical staffs of Batu Fisheries and Aquatic Life Research Center especially Technical Assistants, Field Assistants and Field works take apart on fish feeding, water exchange and pond management. We also thank Oromia Agricultural Research Institute for fund releasing to conduct experiment.

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