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# Effects of Water Soluble Fractions from Parts of *Balanitesaegyptiaca* (Desert Date) on Growth and Survival of *Clariasgariepinus* (Burchell, 1822) Juveniles in a Static Culture System

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## ABSTRACT

*The effects of sub-lethal concentrations of water soluble fractions (WSF) of Balanitesaegyptiaca on growth, survival rate and some physiological responses of Clariasgariepinus juveniles were investigated for four weeks under laboratory conditions at the Biology laboratory, Adamawa state college of Education Hong to determine the reliable and adequate scientific data and information for the protection of adequate environment. The concentrations of WSF used were 0.03ml/l, 0.05ml/l, 0.06ml/l and 0.08ml/l respectively, and the exposure period lasted for 24hours. Results showed that the water soluble fraction led to significant reduction in growth of fish and mean weight gain were all negative after the exposure period. Fish exposed to WSF exhibited great loss as many died compared to control group. There was marked depletion in feed conversion ratio and condition factors of the exposed fish compared to the controlled group.*

**Keywords:** *Water Soluble Fractions, Balanitesaegyptiaca, Clariasgariepinus, Juveniles, Static Culture System*

## INTRODUCTION

*Balanites aegyptiaca* Del., also known as 'Desert date'a member of the family Zygophyllaceae, is one of the most common but neglected wild plant species of the dry land areas of Africa and South Asia (Schmidt and Jøker. 2001). the tree is native to much of Africa and parts of the Middle East. This is one of the most common trees in north eastern region of Nigeria. It can be found in many kinds of habitat, tolerating a wide variety of soil types, from sand to heavy clay. It is multibranched, spiny shrub or tree up to l0 m tall. Crown is spherical, in one or several distinct masses. Trunk is short and often branching from near the base. Bark is dark brown to grey, deeply fissured. Branches are armed with stout yellow or green thorns up to 8 cm long. Leaves have two separate leaflets; leaflets are obovate, asymmetric, 2.5 to 6 cm long, bright green, leathery, with fine hairs when young. Flowers are in fascicles in the leaf axils, and are fragrant, yellowish-green (Schmidt and Jøker. 2001). *Balanites aegyptiaca* Del. (Zygophyllaceae) is traditionally used in treatment of various ailments i.e. jaundice, intestinal worm infection, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhea, haemorrhoids, stomach aches, asthma, and fever. The fruit contains protein, lipid, carbohydrate, alkaloid, saponin, flavonoid, and organic acid. (Daya and Vaghasiya, 2011).

Fish products are very important for food security, providing more than 15% of total animal protein supplies (FAO, 2002). The cat fish for instance, offers great promise for aquaculture exploitation because of its omnivorous feeding habits, sedentary lifestyle, air breathing habit, favourable food conversion, high resistance to diseases, relatively low requirements for water quality, the possibility for high stocking density, yield of about 55%

quality meat of its body weight and good market potential (Appelbaum and McGeer, 1998).

Despite of this great importance of the tree (*Balanitesaegyptiaca*), the researcher observed that the local fishermen use it for fishing, hence the researcher's interest was to determine lethal physicochemical elements of the tree.

## MATERIALS AND METHODS

### Description of the Study Area

This study was carried out at Biology laboratory, Biology Department Adamawa state College of Education (COE), Hong. Hong in Adamawa state falls within the Sudan savannah zone, which is marked by short grass, interspersed by short trees, where many of the trees (desert date) are found.

### Duration of the Study

The study was conducted for a period of four weeks from 11 August to 2 September, 2014.

### Experimental Design

The experimental set-up consisted of seventeen plastic tanks of 40 litres volume each situated in the Biology laboratory. The tanks were cleaned and cleared of debris with water and treated with sodium chloride (NaCl) which is judged to be a good disinfectant for fish tanks. This was done as a prophylactic measure to eradicate any existing pathogens, parasites, cysts or spores of parasites. Then it was allowed to dry. The bowls were then filled with 30 litres of water.

### Experimental Fish

The total of five hundred and ten juveniles of *Clariasgariepinus* with average length of 12cm, average weight of 13g and average age of three weeks were obtained from Mevayi Farm, Bornoma Layout Sangere FUTY Girei local government. The juveniles were starved for overnight prior to the time of transportation in order to reduce metabolic activities during the course of the transportation. The juveniles were transported in well chlorinated free tap water (left open for 24 – 48 hours to allow the gas evaporate/dechlorinate) in a partially cut 50 litres jerry can to the Biology laboratory of COE, Hong. The transportation was done in cool weather (early morning) and maintained at low temperature conditions to prevent oxygen depletion and reduce fish respiration (Mohammed *et al*., 2013). On arrival, the fish were transferred to a holding tank and allowed to acclimatize for one week.

### Collection and Preparation of Specimens from Balanitesaegyptiaca

All the specimens for the research (fruits, barks and leaves) were collected in the bush of Maki, Gaya district of Hong local government. The specimens were ground into powdered form. Electronic weighing balance was used to measured equal weight (200g) of all the specimens. 24 – 48 hours prior to the experiment, the measured quantities of the specimens were soaked in one litre(1litre) of water, then on the day of experiments, solution was sieved or decanted to have water soluble fraction (WSF) of the specimens as; A (water soluble fraction of fruits), B (water soluble fraction of barks) and C (water soluble fraction of leaves).

### Water Soluble Fraction (WSF)

200g each of the powdered samples A (fruits), B (barks) and C (leaves) were diluted into one litre of water, then decanted. The decanted solution were used to prepare the WSF as; 100ml from each solution was diluted into 400ml of water (1WSF/ 4WATER) as treatment one, treatment two were also 150ml of each solution into 350ml of water (3WSF/7WATER), 200ml of each solution into 300ml of water to form treatment three (2WSF/3WATER) and 250ml of the each solution into 250ml of water as treatment four (1WSF/ 1WATER). Then, each of the treatment were used on the stocked fish in the plastic tanks labeled as $A_i$, $B_i$ and $C_i$and tank D as control experiment with ten (10) fish each (i.e. 10 X 17 = 170 fishes).

### Stocking of Fish

A total of One hundred and seventy juveniles were stocked in the plastic tanks containing 30 litres of water with 10 juveniles each. Each experiment was done thrice (triplicate) as; treatment $A_{1,\ 2,\ 3}$, $B_{1,\ 2,\ 3}$, $C_{1,\ 2,\ 3}$ and $D_{1,\ 2,\ 3}$. The initial mean weight and initial mean standard length were determined before stocking.

### Feeding of Fish

Fish in all the treatments were fed twice a day (morning 9am and evening 4pm) on multi feeds at the rate of 5% body weight per day. Feeding allowance was adjusted in accordance with the increase in body weight and diet allotments were increased fortnightly after length- weight determination. The experiment was a static culture system.

## Fish Length and Weight Measurement

The initial body weight of each set of fish was determined using an electronic weighing balance before stocking. Subsequently, batch weighing of the fish in each tank were carried out weekly during the course of the experiment. Likewise the initial standard length of each set of fish was measured using graduated meter rule by picking the distant between the snout tip and the base of the caudal before stocking into the experimental tanks and subsequently the length was measured weekly throughout the period of the experiment.

## Monitoring of Water Quality

Careful monitoring of the water quality parameters were necessary in order to know, manage and maintain conditions within acceptable limits as recommend by Boyd and Lichotkoper, (1979). The dissolved oxygen in each experimental tank was monitored and determined using the dissolved oxygen test kit. Temperatures were determined using glass bulb thermometer. pH will be determined using the pH meter and ammonia using the ammonia test kit. Waste water was completely drained and replaced weekly.

## Fish Growth and Nutrient Utilization Analysis

For this study growth was expressed as mean weight gain, specific growth rate, condition factor (Bagenal, 1978) and survival rate (Fasakin*et al*, 2001). Nutrient utilization indices were expressed as feed conversion ratio and protein efficiency ratio (Wilson, 1989)

### *Mean Weight Gain (MWG)*

The fish mean weight gain was determined as the difference between the final mean weights of the fish at the end of the experiment and the initial mean weight in grams (Castel and Tiews, 1980).

$$MWG = \frac{W_1 - W_0}{n}$$

Where $W_0$ = initial mean weight, $W_1$ = final mean weight and n = No of fish in the tank.

### *Specific Growth Rate (SGR)*

This is the mean percentage in body weight per day over given time interval (Brown, 1957).

$$SGR = \frac{L_n W_1 - L_n W_0}{T} \times 100$$

$W_1$ = final mean weight

$W_0$ = initial mean weight

T = time interval

### *Feed Conversion Ratio (FCR)*

The feed conversion ratio is the unit weight of feed given, divided by the live weight of fish (Wilson, 1989).

$$FCR = \frac{Amount\ of feedfed\ (g)}{\text{Weight gain by fish (g)}}$$

### *Condition Factor*

To ascertain the general robustness or plumpness of fish (Brown, 1957).

$$K = \frac{100\ X\ W}{L^3}$$

Where W = final weight  $L^3$ = final standard length

### *Survival Rate*

Survival rate was also determined (Bagenal, 1978)

$$S = \frac{N_1 X 100}{N_0}$$

Where $N_1$ = final number of fish at the end of experiment

$N_o$ = initial No of fish at the beginning of experiment

### *Statistical Data Analysis*

All the data were subjected to one - way analysis of variance (ANOVA) to test the level of significance.

# RESULTS

## Fish Growth

The initial mean weight recorded during the experiment were 16.15g, 14.53g, 18.43g and 25.33g in treatments A, B, C and D respectively. The final mean weight also recorded were; 11.3g, 8.52g, 12.25g and 18.50g in treatments A, B, C and D respectively. These showed that, there were statistical differences in both the mean weight in the treatments, while there were no significance differences in the groups (initial and final mean weight). The least mean weight gain obtained during the experiment was -7.29g in treatment C and the highest was 2.10g in treatment D, while treatments A and B had -6.90g and -7.12g respectively. This indicated that, there were significant differences at ($p< 0.05$) at each other. The standard lengths recorded were 12.55g, 12.36g, 12.91g and 11.83g in treatments A, B, C and D respectively.

This shows that, there were no statistical differences at each other (Table 1)

### Survival Rate

There were differences in the survival rates in all the treatments. The highest survival rate was recorded in treatment D (control) with 100%, treatment C was 84%, and treatment B 32%, while the lowest recorded was 28% in treatment A. There were significant differences ($p< 0.05$) between survivals of the fish in all the treatments, as shown in Table 1. There were significant differences in the survival of fish based on concentrations; at 0.08ml/l (0, 2 and 48 for A, B and C respectively), 0.06ml/l (3, 12 and 97 for A, B and C respectively), 0.05ml/l (10. 42 and 93 for A, B and C respectively) and 0.03ml/l (100, 72 and 100 for A, B and C respectively) as shown on Table 1.

### Feed Conversion Ratio

Table 1 indicated that the feed conversion ratio in treatment A, B, C and D were approximately 3.0, 4.0, 8.0 and 2.0 respectively. This shows that, there were significant differences ($p< 0.05$) between feed conversion ratios of the fishes in all the treatments.

## Discussion

The interpretation of the result on the comparative effects of fruits, barks and leaves of *Balanitesaegyptiaca* on *Clariasgariepinus* is complex as sample used were at different concentrations, it was observed that the higher the concentrations of water soluble fraction (WSF) the more the effects on the growth performances (mean weight gain, feed conversion ratio, condition factor and survival rate) of the fish.The gain in weight in the groups of fish exposed to concentrations of WSF was significantly different from the gain in weight of the groups of fish exposed to (control), it becomes obvious that the loss in weight and low weight gain in the concentration were due to the WSF from the various parts of *B. aegyptiaca* (Table 1). This investigation showed that water soluble fraction of *B. aegyptiaca* had significant effects on the survival rate of *Clariasgariepinus* juveniles exposed for 24hours. From the results, the 0.03ml/l concentrations, only those in treatment B were affected, in 0.05ml/l concentrations, only 10%, 42% and 93% in treatments A,B and C respectively survived, in 0.06ml/l concentrations, the survival rate were 3%, 12% and 97% for treatment A, B and C respectively were observed and concentrations of 0.08ml/l had the least survival rate of 0%, 2% and 48% for treatments A, B and C respectively; these could be attributed to the influence of WSF of the parts of *Balanitesaegyptiaca* on the water quality, particularly dissolved oxygen.

The good feed conversion ratio recorded in this study was in treatment D (control) of 1.8 as stated by Craig and Helfrich, (2001) that, feed conversion ratio of 1.5 – 2.0 are considered good two-third (3/4) growth for most species; other treatments with WSF were either lower or higher than the optimum, this implies that the fishes have not utilize the feed. Though ‘feed conversion ratio can vary from species to species for different types of food and different environments (Allison *et al*, 1979, Hepler and Prugine, 1982).There are no statistical differences in the condition factor of all the WSF treatment at the end of the experiment, the values recorded were 0.11667, 0.12333, 0.11333 and 0.04666 respectively for treatment A,B, C and D. This result varies with Zira *et al.* (2015) who reported monthly mean condition factor range between 0.65 and 1.21 with a mean value of 0.78±0.09 and 1.04±0.12 respectively for Kiri reservoir. This implies that feed were not properly utilized for better growth and sound health since the entire condition factor were below 1.0. Wade, (1992) gave 1.0 as the best natural condition factor. The low condition factor recorded in the experiments could be as a result of toxicity from the WSF of the *B. aegyptiaca*.

Therefore, the most lethal parts of the *B. aegyptiaca* on *C. gariepinus* is the fruits as obtained from the results of survival rate, growth rate, condition factor and food utilization (Table 1). The higher the concentration also the higher the negative effects on the survival rate, growth rate, and condition factor and food utilization of *C. gariepinus*. The water soluble fractions of the samples have no significant effects on the temperature and ammonia content of the water used in the experiment while WSF of the sample had significant effects on dissolved oxygen and hydrogen ion concentrations of the water.

## Acknowledgement

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## Appendix

**Table1.** *Results of effects of WSF of B. aegyptiaca on C. gariepinus juveniles after the Experiment*

| Treatment | A | B | C | D | *SEM* |
|---|---|---|---|---|---|
| Initial MW(g) | 16.15±0.13[a] | 14.53±0.61[b] | 18.43±2.16[a] | 25.33±2.17[c] | 2.38 |
| Final MW (g) | 11.3±0.53[a] | 8.52±0.14[b] | 12.24±1.48[a] | 18.5±1.62[c] | 2.11 |
| MWG (g) | -6.9[a] | -7.12[a] | -7.29[a] | 2.1[b] | 0.23 |
| Final SL (cm) | 12.55[a] | 12.36[a] | 12.91[a] | 11.83[a] | 0.23 |
| Survival (%) | 28.33[a] | 31.92[b] | 84.42[c] | 100[d] | 18.22 |
| FCR | 3.04[a] | 3.76[b] | 8.1[c] | 1.8[a] | 1.37 |
| K | 0.11667[a] | 0.12333[a] | 0.11333[a] | 0.046667[b] | 0.04 |

*Means with same superscript were not statistically different to each other along the row and vice versa. Mean ±SEM*

**Key:** *A = Sample from fruits, B = Sample from barks, C = Sample from leaves, D = Control, MW = Mean Weight, SL = Standard Length, FCR = Feed Conversion Ratio, K = Condition Factor*

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