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Evaluation of Dry Season Rearing of African Giant Land Snail *Archachatina marginata* on Different Food Types and Apartments

B.N. Ejidike and I.A. Omisade
Department of Fisheries and Wildlife, Federal University of Technology,
P.M.B. 704, Akure, Nigeria

Abstract: The effects of different food types and apartment conditions (dry and damp) on the growth performance of the African giant land snail *Archachatina marginata* during dry season were investigated. Juvenile *Archachatina marginata* (n = 54±0.8 g) were randomly grouped into three snails per group for three replicates in each diet treatment and apartment conditions. The snails were randomly stocked in plastic baskets with lids filled 15 cm thickness with loamy soil. The different diet treatments were: diet treatment I 20% crude protein diet; diet treatment II papaw leaves (*Carica papaya*), diet treatment III papaw leaves (*Carica papaya*) plus 20% crude protein diet. Each of the diet treatments was fed to the experimental snail at 2% body weight once daily for 70 days in each of the apartment setting. At the end of 70 days of the study, body weight gain of *Archachatina marginata* fed 20% crude protein diet and those fed papaw leaves + 20% crude protein diet were positively influenced ($p<0.05$) than those *Archachatina marginata* fed papaw leaves. The results from both apartment conditions revealed that damp condition in experiment 1 due to water application influenced the body weight gain of *Archachatina marginata* to increase daily throughout the study period while those in dry apartment lost body weight. *Archachatina marginata* reared on dry apartment condition had mean mortality of 18% while those reared on damp apartment recorded 0% mortality.

Key words: *Archachatina marginata*, dry season rearing, growth performance and nutrient content, food types

INTRODUCTION

The nutrition pattern of most people in the third world is characterized by low animal protein intake due to poverty as well as harsh economic conditions. In this part of the world greater populace are known to consume a lot of carbohydrates in their daily food. Consistent farming of indigenous animal species of different sizes has potentials in augmenting animal protein in the diet of the people. On this line research into various means of boosting constant animal protein supply to the people is to be considered paramount. In Nigeria, *A. marginata* is highly accepted and cherished. The animal feed on varieties of plant materials, decaying organic matters as well as artificial diets. However, its plant food sources are seasonal and the animal depends on availability of water for survival and better performance (Ejidike, 2004b). African giant land snail *A. marginata* has a good potential for farming in humid areas; it survives under captive rearing and it is a good source of income to the peasant farmers in rural areas (Ejidike *et al*., 2002). The animal undergoes aestivation during dry season of the year (Segun, 1975) causing its scarcity. There is need therefore to investigate into various ways of maintaining constant supply of the animal all year round. Aim of present study was to investigate survival, growth performance and nutrient content of *A. marginata* reared during the dry season of the year in the tropics (where dryness adversely affect activities of land snails) under damp environment in the presence of its choice food.

Corresponding Author: B.N. Ejidike, Department of Fisheries and Wildlife, Federal University of Technology, P.M.B. 704, Akure, Nigeria

Table 1: Ingredient and chemical composition of the experimental diet formulated

Ingredient	(%)
Maize	45.0
Brewer's waste	10.0
Groundnut cake.	15.0
Fish meal	13.0
Oyster	10.0
Oil	5.0
Vitamin premix	2.0
Composition	
Dry matter	85.1
Crude protein	18.8
Crude fibre	1.3
Ether extract	3.7
Ash	24.3

MATERIALS AND METHODS

The studies were conducted in two different experiments during the same period. Experiment 1 (damp apartments) and Experiment 2 (dry apartments); three diet treatments were used in each of the experiments: diet treatment I - 20% crude protein diet (Table 1), diet treatment II - papaw leaves (*Carica papaya*); diet treatment III - papaw leaves (*Carica papaya*) plus 20% crude protein diet.

The studies were carried out at the Teaching and Research farm of Fisheries and Wildlife Department, Federal University of Technology, Akure, Nigeria between December, 2005-early February, 2006.

Fifty four Juvenile *Archachatina marginata* purchased from a snail farmer at Akpomu a near by village to the University were grouped three snails per group and randomly allocated to each of the replicates of the three diet treatments in each experiment. Nine plastic baskets with lids in each of the experiments were used for rearing the snails. The bottom of each of the plastic basket was perforated; loams soil was filled inside the plastic basket up to 15 cm thickness. The snails were fed at 2% body weight daily at 1800 h with their respective diet treatments

Experiment 1

Damping of the soil in the baskets for *A. marginata* reared in damp apartments was done daily at 0730 and 1800 h with well water.

Experiment 2

The apartments in experiment 2 were maintained dry during the study.

Prior to the experiment and at the end of the experiment *A. marginata* was randomly selected from each of the treatments, killed and used to determine carcass proximate compositions using AOAC (1990). Also mineral content of the carcass were determined at the end of the study.

Data collected on growth performance were subjected to analysis of variance (Steel and Torrie, 1980) and the means were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The body weight gain and loss of *A. marginata* reared on damp and dry apartments are presented on Table 2 and 3, respectively. The results revealed the necessity of water in the growth performance of land snails as well as possibility of successful farming of *A. marginata* during the dry season in the tropics based on regular water supply. During the studies the attempt made to disrupt the cyclic biological mechanism of aestivation in *A. marginata* during the dry season through daily application of water and food in the damp apartment was achieved. This was evidenced in the daily body weight

Table 2: Growth performance of *A. marginata* fed on different diets in damp apartment

	Diet treatments		
Parameters	I	II	III
Initial mean wt. (g)	43.3[a]	44.1[a]	43.5[a]
Final mean wt. (g)	117.5[a]	92.6[b]	110.5[a]
Mean wt. gain (g)	74.2[a]	48.5[b]	67.0[a]
Daily wt. gain (g)	1.1[a]	0.8[b]	1.0[a]
Mean initial shell Length (cm)	6.5[a]	6.6[a]	6.4[a]
Mean final shell Length (cm)	8.1[a]	8.0[a]	8.0[a]
Mean shell length gain (cm)	1.6[a]	1.4[a]	1.6[a]
Mean initial shell width (cm)	3.4[a]	3.5[a]	3.5[a]
Mean final shell width (cm)	4.3[a]	4.3[a]	4.4[a]
Mean shell width Gain (cm)	0.9[a]	0.8[a]	0.9[a]
Mean initial thickness (cm)	0.4[a]	0.4[a]	0.4[a]
Mean final thickness (cm)	0.4[a]	0.4[a]	0.4[a]
Mean shell thickness gain (cm)	0.0[a]	0.1[a]	0.0[a]
Mean initial aperture (cm)	3.8[a]	3.8[a]	4.1[a]
Mean final aperture (cm)	5.2[a]	5.1[a]	5.1[a]
Mean aperture gain (cm)	1.4[a]	1.3[a]	1.0[a]
Survival %	100.0	100.0	100.0

[a,b]Means followed by the superscripts are not significantly different ($p>0.05$)

Table 3: Growth performance of *A. marginata* fed with varying diet treatments in dry apartments

	Diet treatments		
Parameters	I	II	III
Initial mean wt. (g)	41.7[a]	38.8[a]	39.3[a]
Final mean wt. (g)	34.5[a]	28.5[a]	29.8[a]
Mean wt. loss (g)	7.2[a]	10.3[a]	9.5[a]
Daily weight loss (g)	0.1[a]	0.2[a]	0.2[a]
Mean initial shell length (cm)	6.3[a]	5.9[a]	5.6[a]
Mean final shell Length (cm)	6.5[a]	6.5[a]	6.1[a]
Mean shell length loss (cm)	0.2[a]	0.6[a]	0.5[a]
Mean initial shell width (cm)	3.5[a]	3.3[a]	3.1[a]
Mean final shell width (cm)	3.8[a]	3.5[a]	3.4[a]
Mean shell width loss (cm)	0.3[a]	0.2[a]	0.3[a]
Mean initial thickness (cm)	0.4[a]	0.4[a]	0.4[a]
Mean final thickness (cm)	0.4[a]	0.4[a]	0.4[a]
Mean shell thickness loss (cm)	0.0[a]	0.0[a]	0.0[a]
Mean initial aperture (cm)	4.2[a]	4.0[a]	3.6[a]
Mean final aperture (cm)	4.2[a]	4.4[a]	4.1[a]
Mean aperture loss (cm)	0.0[a]	0.4[a]	0.4[a]
Survival (%)	89.0	67.0	89.0

[a,b]Means followed by the superscripts are not significantly different ($p>0.05$)

gain of the *A. marginata* reared on damp apartment during the study period (Table 2). In the dry apartment it was observed that despite the presence of food *A. marginata* were generally inactive and consistently lost body weights. These findings are in accordance with the report of Howes and Wells (1943) that the activities of the mollusc species have been influenced by environmental factors, most especially relative humidity, length of growing season and water flow. Hundred percent survival was recorded on *A. marginata* reared on the different diet treatments on damp apartment while 33 and 11% mortality each were recorded on *A. marginata* reared on dry apartment on diet treatments II, I and III, respectively. The mortality recorded on *A. marginata* reared on dry apartment might be due to the hostile nature of the dry apartment to the *A. marginata* thereby causing the animal to loose weight and aestivate. These findings agree with the report of Imevbore (1990) that adverse environmental conditions lead to loss of body weight and high mortality in *A. marginata*. The significant difference ($p<0.05$) in the body weight gain of *A. marginata* on diet treatments of the damp apartment prove artificial diet (treatment II) and diet + papaw (treatment III) to be highly utilized and better converted

to snail flesh. This finding of *A. marginata* performing best on compounded diet is contrary to the report of Ejidike (2004a) that *A. marginata* performs better when fed with papaw leaves than artificial diet. This discrepancy may be due to different source of protein in the experimental diets; hence groundnut cake and blood meal were the sources of protein in the diet of Ejidike (2004a) while groundnut cake and fishmeal were the protein source in this study. No significant difference ($p>0.05$) in the body weight of *A. marginata* reared on diet treatments on dry apartment proves that the activities, especially growth, to be highly influenced by the environmental factors-temperature and rainfall hence all the *A. marginata* on this condition lost weight. This is in agreement with the report of Stievenart (1996) that dryness inhibits growth and even stops activity in *A. marginata*.

The morphological parameters of *A. marginata* (shell length, width and aperture) reared on the different diet treatments on damp apartment were observed to increase while reverse was the case on those reared on dry apartment during the period of the studies (Table 2 and 3). This increase in body weight gain, shell length, width and aperture of the *A. marginata* reared on damp apartment and the reverse situation on the parameters on the *A. marginata* reared on dry apartment proved water and food to have positive influence on the entire body growth of the animal. The fact that all *A. marginata* reared on dry apartment aestivated despite the presence of food demonstrated the importance of moisture and ranks it high in the growth activities of *A. marginata*. From these findings adequate food and moist from rainfall or regular water supply are highly required for optimal growth and high yield of *A. marginata*. The result of the proximate composition and mineral contents of the experimental snail showed that aestivated *A. marginata* retained more protein and more minerals in the body (Table 4-7). This might be as a result of aestivation that forced the snail to remain inactive thereby preventing use of protein in replenishing tears and wears on the flesh and the use of the minerals in

Table 4: Chemical composition of *A. marginata* reared on damp apartments

		Diet treatments		
Chemical composition	Initial	I	II	III
Crude protein	30.2	43.3	49.2	33.0
Fat	3.7	5.3	41	2.1
Fibre	Nil	Nil	Nil	Nil
Ash	5.9	4.6	5.2	4.7
Moisture	5.7	15.0	16.3	15.3

Table 5: chemical composition of *A. marginata* reared on dry apartments

		Diet treatments		
Chemical composition	Initial	I	II	III
Crude protein	30.2	75.7	64.0	56.9
Fat	3.7	6.4	5.4	4.2
Fibre	Nil	Nil	Nil	Nil
Ash	5.9	6.1	5.3	4.8
Moisture	5.7	15.6	15.4	15.1

Table 6: Mineral content of *A. marginata* reared on damp apartments

	Diet treatments		
Minerals	I	II	III
Mg	0.2	0.2	0.2
Ca	0.8	0.8	0.8
K	0.8	0.8	0.7
Fe	267.5	110.2	85.9
Na	52.6	63.0	40.4
P	0.5	0.5	0.4
Mn	35.0	33.5	44.6
Cu	58.4	64.9	31.5
Zn	53.7	58.6	49.7

Table 7: Mineral content of *A. marginata* reared on dry apartments

	Diet treatments		
Mineral	I	II	III
Mg	0.3	0.3	0.2
Ca.	1.1	1.2	0.9
K.	0.8	0.8	0.8
Fe	400.3	113.0	81.2
Na	128.8	88.2	132.0
P	0.5	0.5	0.4
Mn	22.4	17.5	25.5
Cu	77.6	55.2	17.0
Zn	63.4	49.7	53.7.

maintaining the body of the animal. The study has demonstrated that relative humidity is an important environmental factor that needs to be established for the survival of snails during the critical period of the year. More research should also be carried out into the areas of after effect of aestivation on growth and reproduction of *A. marginata*. From these studies it could be suggested that land snail farmers in the tropics have to establish constant water flow to their farms throughout the year for daily active performance of their animals.

CONCLUSION

From the results farmers investing into snail farming in the tropics could have their animals active all time provided constant food and water/moist environment are assured. This development would go a long way in meeting the demand for the animal especially during the dry season thereby making the animal affordable always.

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