Effect of Varying Incubation Days on Hatchlings of African Giant Land Snail (*Achachatinamarginata*)

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ABSTRACT

The study examines the effect of different incubation days on the growth rate and colour changes of hatchlings of African Giant Land Snail (Achachatinamarginata). A total of 100 eggs were incubated for the experiment, 10 eggs were hatched on each day from the 16th to 30th day of incubation, at an interval of 2 days, while those left to hatch naturally served as control for the experiment. The viscous yolk fluid of the eggs hatched on different incubation days were observed, the initial weight of hatchlings were taken while the weight gain and colour changes were monitored for two weeks. The result of the experiment revealed that the quantity of the viscous fluid reduced as the incubation days increased. Initial mean body weight of the hatchlings varied from 1.50g on the 16th day of incubation to 2.73g on the 30th day of incubation and the control weighed 3.90g. The colour of the shell ranged from light yellow to coffee brown while the head-foot changed from light yellow to black in hatchlings. Those hatched on the 16th died after five days when the viscous yolk fluid dried up. This implies that at this stage, the hatchlings cannot survive outside the egg's shell. The incubation period of eggs of African giant land snail has great effect on the growth rate and colour changes of the hatchlings, especially those hatched below 22nd day of incubation. Since there is no significant difference in the growth rate of the snails hatched from the 22nd day of incubation, the incubation days of African giant land snails' eggs can therefore be reduced to 22 days so as to be able to increase snail meat production in Nigeria.

Keywords: *Incubation day, viscousyolk fluid, weight gain, Achachatinamarginata*

INTRODUCTION

Snails are classified as mini-livestock (Ebenso, 2006) that serves as important source of animal protein in the diet of both rural and urban households in many parts of Nigeria (Adinya and Ibekwe, 2010; Agbogidi and Okont 2011; Nwandu, 1999). The supply of snail meat in Nigeria is limited to what is gathered in the wild (Agbelusi and Adeparusi, 1999), despite the fact that tropical weather has been found to be the best and most conducive for snail farming (Adinya and Ibekwe, 2010). A short supply of wild population of snail is on the increase due to decline in snail population resulting from human impacts and other anthropogenic factors such as deforestation, slash and burn agricultural practices and over exploitation of this animal (Eneji, Ogogo, Emmanuel-Ikpeme and Okon, 2008; Raut and Barker, 2002). It has been reported that snail's availability is seasonal (Ugwu,

Ogbu and Ikechiuno, 2011), being much more available in the rainy season (Akinnusi, 1998) and scarce during the dry season (Oshiyemi, 2011), because they aestivate during the dry season (Okafor, 2001). This seasonality has to be controlled to allow for all seasons availability of snail meat because Amubode and Ogogo (1989) aver that snails can reproduce throughout the year if favourable humidity and adequate soil moisture are stimulated in the rearing unit. In Nigeria, successive governments had embarked on policies and programme aimed at boosting sustainable macro-livestock and micro/mini-livestock production (Effiong and Onyenweaku, 2006). Snails have become a tool for poverty alleviation (Ebenso, 2006), and it has been discovered that snail production is associated with rapid returns per unit investment (Adinya, 2006). Also, ready markets exist for snail from both domestic consumption and foreign markets (Cobbinah, Vink and Onwuka, 2008; Moyin-Jesu and Ajao, 2008; Raut and Barker, 2002).

In recent years, the production and marketing of snail products is a thriving business that provides employment to hundreds of people in Nigeria (Adinya and Ibekwe, 2010) but this production is still inadequate to bridge the demand-supply gap (Ebenso, 2003; Murphy, 2001; Paoletti, 2005). To increase productivity of snail in Nigeria and to effectively fill the demand-supply gap and enhance captive breeding of snail, there is the need for the understanding of their biology (Omole, 1998). Snail shows great advantages and potential in the areas of nutrition, growth and reproductive biology (Ekanem and Umoh, 1997). It has high reproduction rate (Datuin, 1993), and its growth potentials makes it possible to have very good outputs (Lameed, 2006). The embryonic development of snail has also been reported by various researcher such as Adenuga (2012), Bhramachery (1992), Demian and Yousif (1975), Md. Moniruzzanam, Badrun and Md. Sarwar (2007); Okon, Ibom, Ebenso and Bassey (2013). At present, there is no report on the effect of varying incubation periods of the *A. marginata* eggs on growth rate and colour changes of the hatchlings. It is in this light that this study was carried out to provide information on this subject and to see if the incubation days of snails can be reduced to increase snail production in Nigeria.

MATERIALS AND METHOD

This study was carried out at the Wildlife Domestication Unit of the Federal University of Technology, Akure, Ondo State, Nigeria as described by Agbelusi and Adeparusi (1999). A total of 100 eggs used for the experiment were collected from parent stocks reared in the snail pen of the Wildlife Domestication Unit. The incubation chambers were well-ventilated 26 × 26 × 30 cm^3 baskets, with perforated base to allow drainage of excess water. The eggs were incubated by burying them in the incubation medium – a mixture of loamy and sandy soil – to a depth of about 2.5cm as described by Awesu (1980). The average temperature and relative humidity during the experimental period ranged from 25°C to 30°C and 50% to 70% respectively. Okon *et al*. (2013) report the development of some specific organs of the snailet on the 12th day of incubation but complete condensation of the body part into the shell bearing the mantle during the 16th day. It is as a result of their finding that the hatching of eggs for this experiment started on the 16th day

of incubation because the embryo of *A. marginata* is fully developed on this day. The eggs were hatched by the researchers starting from the 16th day to 30th day of incubation, with a two-day interval. Some eggs were left to hatch naturally and this occurred on 34th day of incubation, serving as control for the experiment. The natural hatching of the eggs was taken to mean when the hatchlings were seen crawling out of their egg shells after cracking on their own. On each sampling day, 10 eggs incubator were carefully removed, cleaned them thoroughly to remove soil from the shell and kept them in a petri dish. Afterwards, the eggs were manually hatched by cracking the shell of each egg with a spatula and the content poured inside petri dishes for observation. After observing the contents and taking the initial records of the hatchlings, they were then transferred into an incubation chamber where they were observed for two weeks before the experiment was terminated. The hatchlings were fed with fresh shoot of pawpaw (*Carica papaya*) leaves (Omole, Obi, Soetan and Olaseinde, 2010). Parameters evaluated included initial weight, viscous yolk fluid, weight gain and colour changes. The weight gain of the hatchlings were taken every other day while the colour of the hatchlings were observed at three days interval. The growth rate was calculated as the total increase in weight over the duration as shown below:

$$Growth\ \ Rate = \frac{Final\ weight - InitialWeight}{Number\ of\ Observation\ Days}$$

Data collected during the experiment were subjected to one-way Analysis of Variance (ANOVA) in order to test for significant difference between the mean weight-gain of the hatchlings hatched on different incubation days.

RESULTS AND DISCUSSION

The results of the experiment are presented in figure 1 and tables 1 - 4. The natural hatching of the incubated eggs in this research which occurred on the 34th day is similar to the finding of Ogogo (1989) which occurred between 24 -37 days but differed from those of Okon, Ibom and Odido (2011), Okon, Ibom, Ebenso and Bassey (2013), and Omole and Kehinde (2005), that reported 25 – 27 days, 29 days and 25-32 days, respectively. The variation and disparity in incubation periods may be due to variation in genetic factors like breed, strain, age and size of the brood stock, egg size or environmental factors such as temperature and relative humidity (Okon, Ibom, Ebenso and Bassey, 2013), or exposure of eggs to fluctuating environmental conditions which differed from their near constant uterine environment (Md. Moniruzzanam, Badrun and Md. Sarwar, 2007). The initial and final mean weight of the hatchling is summarized with Figure 1. It was observed that the weight of the hatchlings increased as the incubation days increased, except those hatched on the 24th and 28th day of incubation. The relative low weight observed in these hatchlings might be as a result of the size and weight of the eggs or the strain of the brood stock. The mean body weight of the hatchlings as presented on table 1 shows that the initial body weight of the hatchlings ranged from 1.05g on the 16th day to 3.90g on 34th day of incubation. The initial weight of hatchlings in this finding is a little higher than those of Okon,

Ibom and Odido (2011) which was 1.01 on the 27th day of incubation. After two weeks of observation, the final weight of the hatchlings ranged from 1.95g to 5.73g for hatchlings hatched on the 18th and 34th day of incubation respectively.

Hatchlings hatched on the 16th day of incubation died after the 5th day of observation. There was no significant difference in the mean body weight of hatchlings hatched on days 22nd, 26th and 30th of incubation (table 1). The growth rate of the hatchlings is represented on table 2. A decrease in weight of hatchlings hatched on the 16th and 18th day of incubation was observed while those hatched from the 20th to 34th day of incubation showed a positive increase. There was no significant difference in the growth rate of hatchlings whose means are represented with the same superscript. The growth rate of hatchlings hatched on the 22nd day of incubation had no significant difference from those hatched on the 30th day of incubation.

The viscous fluid of the eggs observed on different incubation day revealed that the colour of the viscous fluid became lighter and reduced in quantity as the incubation days increased. The colour of the fluid changed from lemon on the 16th day of incubation to light milk on the 26th day of incubation. It was noted that the hatchlings hatched on 16th and 18th day were embedded in large quantity of viscous fluid, which reduced as the incubation days increased. Large quantity of the viscous fluid observed in this study agrees with the findings of Demian and Yousif (1975) and Okon, Ibom, Ebenso and Bassey (2013). Ibom (2009) posits that the reduction in egg liquid mass during the embryonic development is as a result of baby snail feeding on the liquid mass. The large quantity of viscous fluid in the hatchlings hatched on the 16th and 18th day of incubation might have resulted in the weight loss of the hatchling because as the fluid dried up, the weight of the hatchlings reduced.

Unlike the hatchlings hatched from the 18th day of incubation that survived after the fluid dried up, those hatched on the 16th day of incubation were found dead after the 5th day of observation. This suggests that hatchlings hatched on the 16th day, still depended on the yolk's fluid and could not survive outside the egg's shell though all the organs were developed. The observations made on the colour changes of the hatchlings' shell and dead-foot (edible part) is shown on table 3 and table 4 respectively. The colour of the shell of the hatchlings varied from light yellow on the 16th day to dark brown on the 34th day (Table 3). Okon, Ibom, Ebenso and Bassey (2013) report that the shell of hatchlings hatched on the 16th day of incubation was yellowish, dark yellow for those incubated for 20 days and dark brown for those hatched on the 24th day.

It was noted that hatchlings from eggs incubated for 20 days retained the light yellow colour for a longer period while those incubated for 22 days upward had their shells attain the colour of those that hatched naturally (dark brown) within seven days. This shows that it would take more than 15 days for snails hatched on the 20th day and below to attain the dark brown colour observed in the natural hatchlings. The colour of the head-foot varied from light yellow for those incubated for 16 - 20 days to black and white dots for those incubated for 24 - 30 days (Table 4). Okon, Ibom, Ebenso and Bassey (2013) described the colour of the edible part of hatchlings hatched on the 20th day as milky

colour. It was also observed that those hatched on 16th – 20th day took up to 7 days before they attained the grey colour observed in hatchlings incubated for 22 days and took 15 days before attaining the dove grey colour present in day 4 of those hatched on the 22nd day.

Table 1: The mean body weight of the hatchlings

Observation	**Incubation days *(mean weight in grammes)***								
Days	**16th**	**18th**	**20th**	**22nd**	**24th**	**26th**	**28th**	**30th**	**34th**
1 (Day 1)	1.05	2.00	2.20	2.40	2.12	2.50	2.28	2.73	3.90
2 (Day 3)	1.04	2.02	2.28	2.66	2.14	2.74	2.32	2.87	3.97
3 (Day 5)	1.03	2.05	2.31	2.96	2.26	2.79	2.37	2.90	4.40
4 (Day 7)		2.04	2.34	2.99	2.36	2.82	2.44	3.07	4.50
5 (Day 9)		2.01	2.38	3.14	2.52	2.92	2.50	3.27	4.58
6 (Day 11)		1.90	2.40	3.30	2.56	3.18	2.64	3.75	5.00
7 (Day 13)		1.93	2.48	3.58	2.59	3.28	2.62	3.90	5.53
8 (Day 15)		1.95	2.51	3.64	2.73	3.50	2.64	4.30	5.73
Mean	**1.04^{a}**	**1.99^{b}**	**2.36^{bc}**	**3.08^{d}**	**2.41^{bc}**	**2.97^{d}**	**2.48^{c}**	**3.35^{d}**	**4.70^{c}**

Means not followed by the same superscript are significantly different (P<0.05)
Source: Experimentation, 2013

Table 2: Growth rate of hatchlings hatched on different incubation days

Incubation Days	**16th**	**18th**	**20th**	**22nd**	**24th**	**26th**	**28th**	**30th**	**34th**
Initial Weight	1.05	2.00	2.20	2.40	2.12	2.50	2.28	2.73	3.90
Final Weight	1.03	1.95	2.51	3.64	2.73	3.50	2.64	4.30	5.73
Weight Gain	-0.02	-0.05	0.31	1.24	0.61	1.00	0.36	1.57	1.83
Growth Rate	-0.004^{a}	-0.003^{a}	0.02^{b}	0.08^{de}	0.04^{bc}	0.07^{cd}	0.02^{d}	0.10^{de}	0.12^{e}

Means not followed by the same superscript are significantly different (P<0.05)
Source: Experimentation, 2013

Table 3: Colour changes of the hatchlings' shell

Incubation days	**Observation days**	
	Initial day (Day 1)	**Final day (Day 15)**
16	Light yellow	-
18	Light yellow	First 5 whorls light yellow, last whorl light brown
20	Light yellow	First 3 whorls light yellow, fourth light brown, last 2 brown
22	First 3 whorls light yellow, fourth light brown last 2 brown	First 2 whorls light brown, third brown, others dark brown
24	First 2 whorls light yellow, others light brown	First whorl brown, others dark brown
26	First 2 whorls light yellow, others light brown	First whorl brown, others dark brown
28	First 2 whorls light brown, others brown	Dark brown
30	First whorl light brown, others brown	Coffee brown
34	First whorl brown, others dark brown	Coffee brown

Source: Experimentation, 2013

Table 4: Colour changes of hatchlings' head-foot

Incubation days	Observation days Initial day (Day 1)	Final day (Day 15)
16	Light yellow	-
18	Light yellow	Grey
20	Light yellow	Dove Grey
22	Grey	Dove Grey
24	Grey	Black with white dots
26	Grey	Black with white dots
28	Dove Grey	Black
30	Black with white dots	Black
34	Black with white dots	Black

Source: Experimentation, 2013

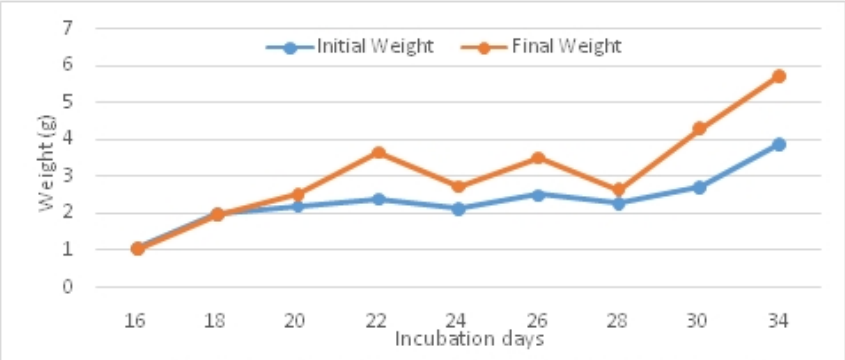

Figure 1: Initial and final mean weight of hatchlings

CONCLUSION

The incubation period of eggs of African giant land snail has great effect on the growth rate and colour changes of the hatchlings, especially those hatched below 22nd day of incubation. Eggs of African giant land snails hatched on the 22nd day of incubation, with proper feeding and management, can attain maturity at the same time with those hatched naturally, which can help increase the production of snail by reducing the incubation periods. Since there is no significant difference in the growth rate of the snails hatched from the 22nd day of incubation, the incubation days of African giant land snails' eggs can therefore be reduced to 22 days so as to be able to increase snail meat production in Nigeria.

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