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Relationships among Body Traits of African Giant Land Snail (Achachatina Marginata) at Different Age Groups

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Relationships among Body Traits of African Giant Land Snail (Achachatina Marginata) at Different Age Groups

Samuel Oladipo Kolawole Fajemilehin [α], Maria Kikelomo Adegun [σ], Fagbuaro [ρ] & Sola Sunday [ω]

Abstract- The experiment designed to investigate the various body parameters of African Giant Land Snail and their relationships was carried out at the Teaching and Research Farm, Ekiti state University, Ado – Ekiti between 21st of November 2011 and 2nd of January 2012 using a total of 182 snails of four different age groups defined as >2 years; >1year<2years; >6months < 1 year and <6months. The variables examined include whole weight, whorl number, whorl length and shell opening. Data collected were subjected to ANOVA, correlation and regression analyses using SPSS statistical package. Results showed significant ($p < 0.05$) differences between age and all the parameters investigated except whorl number in all the age groups. The correlation between age and whorl length showed that there was significant effect ($p < 0.05$) among the variables. A negative correlation between the whorl number and shell opening (-0.14) was recorded. The regression of whole weight on whorl length and shell opening were highly significant ($p<0.01$) with R2 values of 0.67 in both cases while the regression of whole weight on whorl number was significant ($p<0.05$) with R2 value of 0.19.

Conclusively, age and weight of African Giant Snail have significant effects on the body measurements.

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I. Introduction

Achachatina marginata is one of the two most popular breeds of snails in Nigeria (Okon and Ibom 2011). Hunting of Achachatina marginata defined as gathering of snails from bush around homesteads, thick forest and cash crop plantations during clearing is an age long farming activity by both children and adults living in farming and rural areas of South Western Nigeria. The need for such farming activities arose probably out of inquisitiveness and pleasure derived by snail – gatherers, ease with which they are handpicked, provision of supplemental food for the household and the need to meet/supplement the hunters' financial needs.

The initial aim of raising snails just for sustenance has changed. Snail farming is now an enterprising business in most parts of the world. This is probably because snails have numerous advantages over the conventional domesticated animal species. These advantages include; management ease; requirement for small rearing space; source of high quality animal protein (Ajayi et al 1998; Cobbinah 1998); its high contents iron and phosphorus; low content of sodium, fat and cholesterol (Akinnusi, 2002, Ejidike, 2002); its shell usefulness as calcium salt in animal formulated feeds, making ornaments, ashtrays, scouring powder and ceramic materials (Awesu 1980); its therapeutic values and the usefulness of the shell and the facial droppings as valuables in fertilizer production.

To ensure the sustainability of this enterprise, the productive capability of the animal must be improved optimally. Okon and Ibom (2011) asserted that genetic improvement of animal species can be achieved by quantitative measurements, correlation among performance traits and development of selection programme for effective planning. They opined that regression and correlation are the two most common techniques used to determine the relationships between and/or among two or more variables. This study is therefore designed to carry out a quantitative measure of the animal's morphometric traits and to determine the interrelationships among the traits using correlation and regression techniques.

II. Materials and Methods

a) Location and Housing

The experiment was carried out at the Teaching and Research Farm, Ekiti state University, Ado – Ekiti between 21st of November 2011 and 2nd of January 2012. The snails were reared in 3 movable cages with each cage measuring 180 x 120 cm in length and breadth respectively. Each cage was partitioned into six compartments and raised by 25 cm off ground with their legs placed in plastic bowls containing used engine oil to protect invasion by soldier ants and other insects. The cages were sheltered with wire mesh and mosquito nets with hinges and padlocks for each compartment. The floor of each of the compartments was covered with sack on which loamy soil was laced to a depth of 15 cm.

b) Experimental animal and Design

A total of 182 African Grant Land Snails (Archachatina marginata) of four different age groups as detailed in Table 1 below were used for the study. Each

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age group was identified with a permanent Schneider made blue marker. Snails belonging to the different age groups were randomly allocated into the cages under Completely Randomized Design. Dry plantain and banana leaves were used to cover up the snails mainly to protect them from direct sun rays. The leaves were replaced 4 times in a month before the end of the experiment.

Table 1 : Number of snails examined according to age group

Age group	Number of animals/compartment	Number of compartments	Total
>2 years	4	9	36
>1year<2years	4	9	36
>6monthsr<1year	5	10	50
<6months	5	12	60
Grand Total			182

c) Feeding

The snails in all the age groups were uniformly fed with sliced unripe pawpaw, plantain peel and pawpaw leaf. The feeding was done once daily. The leftover feed was removed daily before fresh ones were served. Adequate amount of water was supplied by wetting them regularly because the study was conducted during dry season.

d) Data collection

Data were collected on the following variables at 2 weeks interval: whole weight, whorl number, whorl length and shell opening. The whole weight was measured using Harvard air sensitive weighing balance to the nearest gram; whorl number examined by counting the numbers of whorls (rings) on the shell; whorl length measured as distance from the apex to the end of each whorl using a thread and latter placed on a tape to the nearest centimetre and the shell opening was measured in a similar way the whorl length was measured. To enhance accuracy and objectivity, the average length of all the whorls measured on each snail was taken as the whorl length of that animal and the average of the vertical and horizontal lengths of the opened region of the foot was considered as the shell opening of each experimental unit.

e) Statistical analysis

The means of each body trait were obtained for each age group. After checking the normality of data distribution and the equality of variances, the traits were treated statistically like independent variables. The values of each trait were subjected to an analysis of variance using the SPSS (1990) statistical package to evaluate the significance of sources of variation affecting measurements of each animal. Where significant differences were obtained, DMRT (Duncan, 1995) was used to verify significant differences among the means of the different age groups. Regression and Correlation analyses were done using the Correlation and Regression procedures of the same package. The regression model used was $Y = a + b x$. where : Y = Dependent variable; a = Intercept on y-axis; b = Regression coefficient and x = independent variable.

III. Results and Discussion

Table 2 showed the effects of age on all the variables measured. A look at the table revealed significant differences ($p<0.05$) in whorl length, whole weight and shell opening in all the age groups and periods examined with age Group 4 consistently showing superiority over all the other age Groups. However, the whorl number values showed that there were no significant ($p > 0.05$) differences among all the age Groups. Interestingly, the whorl numbers were constant within the same age Groups in the four periods investigated. The ranges recorded were 145 g, 2.17 cm, 0.510 cm and 1.55 cm; 142. g, 1.76 cm, 0.510 cm and 1.38 cm; 132 g, 1.75 cm, 0.510 cm and 1.34 cm; 116 g, 1.75 cm, 0.510 cm and 1.32 cm for Whole weight, Whorl length, Whorl number and Shell opening for periods 1, 2, 3 and 4 and for age groups 1, 2, 3 and 4 respectively. Succinctly, it was observed that as the snail aged in the different periods the whorl length, whole weight and shell opening increased progressively. The implication of this is that growth occurred from age group 1 – 4. It is important to note from this result, that in age groups 1 - 3, there were increases in the values recorded for whole weight, whorl length and shell opening among the different periods the data were collected but in age group 4 they were the same. This is most probably because the matured body weight of the animal had been fully attained at this age Group and so no further increment could occur in the parts investigated.

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Table 2 : Effects of age on measured variables at periods 1 - 4

Periods	Variables	1	2	3	4	SEM
Period1	Whole weight (g)	178^{d}	194^{c}	291^{b}	323^{a}	0.12
	Whorl length (cm	4.32^{d}	4.75^{c}	5.66^{b}	6.49^{a}	0.14
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.15
Period 2	Shell Opening (cm)	6.24^{d}	6.59^{c}	7.11^{b}	7.79^{a}	0.17
	Whole weight (g)	181^{d}	195^{c}	292^{b}	323^{a}	0.12
	Whorl length (cm	4.74^{d}	5.04^{c}	5.95^{b}	6.50^{a}	0.14
Period 3	Whorl number (cm)	4.96	5.00	5.00	5.47	0.13
	Shell Opening (cm)	6.41^{d}	6.75^{c}	7.30^{b}	7.79^{a}	0.15
	Whole weight (g)	192^{d}	201^{c}	296^{b}	323^{a}	0.12
Period 4	Whorl length (cm	4.76^{d}	5.17^{c}	6.11^{b}	6.51^{a}	0.15
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.17
	Shell Opening (cm)	6.46^{d}	6.79^{c}	7.48^{b}	7.80^{a}	0.16
	Whole weight (g)	207^{d}	223^{c}	314^{b}	324^{a}	0.12
	Whorl length (cm	4.76^{d}	5.18^{c}	6.16^{b}	6.51^{a}	0.14
	Whorl number (cm)	4.96	5.00	5.00	5.47	0.16
	Shell Opening (cm)	6.48^{d}	6.80^{c}	7.50^{b}	7.80^{a}	0.15

^{abcd} means on the same row with different superscripts are significantly ($p<0.05$) different.

1 = Age group <6months; 2 = Age group > 6months < 1 year; 3 = Age group > 1year < 2years and 4 = Age group > 2 years. Period 1 = First fortnight, Period 2 = Second fortnight, Period 3 = Third fortnight and Period 4 = Fourth fortnight,

Table 3 showed the results of phenotypic correlations between morphometric traits of the snails evaluated in periods 1 and 2. The results indicated positive and high significant phenotypic correlations (r_p) between whole weight and whorl length (r=0.55) and between whole weight and shell opening (r=0.41) in the upper matrix and between whole weight and whorl length (r=0.49) in the lower matrix. Positive and significant phenotypic correlations (r_p) were recorded between whole weight and whorl number (r=0.25), between whorl length and whorl number (r=0.12) and between whorl length and shell opening (r=0.07) in the upper matrix and between whole weight and whorl opening (r=0.37), between whorl length and whorl number (r=0.16) and between whorl length and shell opening (r=.11) in the lower matrix. Negative and significant phenotypic correlations (r_p) were recorded between whorl number and shell opening (r=-0.14) in the upper matrix and between shell opening and whorl number (r=-0.12) in the lower matrix.

Table 4 showed the results of phenotypic correlations between morphometric traits of the snails studied at periods 3 and 4. The results revealed positive and significant phenotypic correlations (rp) between whole weight and whorl length (r=0.15), between whole weight and shell opening (r=0.37) and between whorl length and whorl number in the upper matrix and between whole weight and whorl length (r=0.40) and between whorl number and whorl length (r=0.19) in the lower matrix. Negative and significant phenotypic correlations (rp) was recorded between whorl number number (r=0.20), between whole weight and shell and shell opening (r=-0.15) only in the lower matrix.

Table 3 : Correlation of Whole weight and body dimensions of African Giant Land Snail (*Achachatina marginata)* for Periods 1 and 2

	Whole weight	Whorl length	Whorl number	Shell opening
Whole weight	-	0.55**	0.25*	0.41**
Whorl length	0.49**	-	0.12*	0.07*
Whorl number	0.20*	0.16*	-	-0.14*
Shell opening	0.37*	0.11*	-0.12*	-

Upper matrix = Period 1; Lower matrix = Period 2

** = ($P<0.01$) and * = ($P<0.05$)

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Table 4 : Correlation of Whole weight and body dimensions of African Giant Land Snail (*Achachatina marginata)* for Periods 3 and 4

	Whole weight	Whorl length	Whorl number	Shell opening
Whole weight	-	0.15*	0.01	0.37*
Whorl length	0.40**	-	0.13*	0.01
Whorl number	0.01	0.19*	-	-0.15*
Shell opening	0.35*	0.01	-0.01	-

Upper matrix = Period 3; Lower matrix = Period 4
** = (P<0.01) and * = (P<0.05)

Correlation, a dimensionless quantity having values ranging from -1 to +1 is a measure of the intensity of association. A positive correlation means that the values of both variables rise or fall together while negative coefficient implies that an increase in one variable associates with a decrease in the other. The magnitude of the coefficient is an indication of how closely linear the variables are. In the present study, low positive relationships among the traits measured were recorded. This suggests that the traits affected are likely to be weakly under the effect of same gene action meaning that selection for an improvement of one trait will lead to a marginal positive improvement in the other traits. The proportional relationships with age reported in this study is in agreement with the work of Ojo (2011) who reported low proportional relationships with age for whorl length, whorl number, whole weight and shell opening in matured Achachatina marginata. Also, similar weak relationships have been reported by few authors in chicken (Tamer et al 2011) between live weight and head length and Sheila et al (2009) who investigated the relationships of body weight to external body abdominal girth, tibiotarsal, tarsometatarsal, wing length, and height from ground to the top of the back in adult fighting cocks. The results also corroborate the reports of earlier researchers (Okon et al. (2009) and Okon Ibom (2011) although, the values reported by these researchers were much higher than the values obtained in this study. The differences were most probably due to differences in the breed and strains and/or the age of snails studied.

The regression of weight on the whorl length, whorl number and shell opening as presented in Table 4 were highly significant (p<0.01) with R2 values of 0.67, 0.19 and 0.67 respectively. The R values measured the proportion of the total variance in the dependent variable (Y) explained by the independent variable (x). From the result it was evident from the R values that the weight of the animal can be predicted with equal accuracy from whorl length and shell opening. It can however be predicted using the whorl number but with less accuracy. This report corroborates in part the work of Olawoyin and Ogogo (2006) who reported shell length as a better predictor of body weight for growing snails.

Table 5 : Regression of Whole weight on Whorl length, Whorl number and Shell opening in matured African Giant Land Snail

Variable (X)	Y = a + bx	R^2	Sig
Whorl length	Y = -175 + 74.76x	0.67	**
Whorl number	Y = -318 + 107x	0.19	**
Shell Opening	Y = -401 + 91.01x	0.67	**

** means p<0.01

IV. Conclusion

The results obtained in this study revealed that age and weight of African Giant Snail had significant effects on the body measurements. The correlations among the variables were generally low. Also, weight of the examined snails can be predicted with reasonable accuracy from Whorl length and Shell opening.

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