

Qualitative Characteristics and Suture Measurements of Two Breeds of Snail Reared in Nigeria

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Authors' contributions

Author FAA designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript. Authors FAA and AAA managed the analysis of the study, and the literature search. Both authors read and approve the final manuscript.

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ABSTRACT

Heliculture is gradually gaining more attention in Nigeria. There are still constraint to snail production en mass which include breed and strain identification, feeding, management and health. In this study, the Qualitative characteristics and suture measurement of two breed of snails were observed. A total of 90 snails comprising of 50 *Archachatina marginata* and 40 *Achatina achatina* were purchased at different markets in towns around Ayetoro. Most (64%) of the *A. marginata* had brown shell colour, a few (36%) had brown with light yellow shell colour. 100% of *A. achatina* had brown with light brown-yellow shell colour. 22% of *A. marginata* had black foot, 64% had brown and 14% had brown-black foot colour. 100% of *A. achatina* had brown-black foot colour. There is a significant difference ($P<0.01$) in the brown-black foot colour of *A. achatina* and *A. marginata*. 94% of *A. marginata* had broad and wide apex, 6% had pointed apex, (0%) narrow and wider apex while 100% *A. achatina* had narrow and wider apex. *A. achatina* had zig zag thick brown lines on the shell which was significantly different ($P<0.01$) from the *A. marginata*. The distance between the 1st and 2nd suture, 2nd and 3rd suture of *A. marginata* respectively (1.69 ± 0.08 , 0.79 ± 0.04) cm is longer than the respective lengths (1.59 ± 0.03 , 0.78 ± 0.02) cm of *A. achatina*. This distance in suture of the 1st and 2nd, 3rd and 4th, 4th and 5th of *A. marginata* is not significantly different ($P>0.01$) from *A. achatina*, the 2nd and 3rd suture is significantly different ($P<0.01$). Snail live weight is highly positively correlated with the

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distance between the 1st and 2nd suture (0.889) and the 2nd and 3rd suture (0.718) in *A. marginata* and *A. achatina* respectively. The SLW is determined more by the distance between the 4th and 5th suture in *A. marginata*.

Keywords: Heliculture; *A. marginata*; *A. achatina*; broad and wide apex; pointed apex.

1. INTRODUCTION

The importance of protein can not be over emphasized in the nutrition of man [7]. Animal protein is of high biological value and posses all the essential amino acids in desirable quantities [3]. The major sources of meat protein for the Nigerian populace comes mainly from poultry, beef, mutton while the protein of animal source in Nigeria is inadequate because the demand exceeds supply [7]. Some sources of animal protein include macro and micro livestock species [1]. Micro livestock are excellent and cheaper sources of animal proteins [3,6]. Snail have been well known and highly appreciated as a valuable source of nutrition in many countries [4]. In ancient Rome, Snails were fattened up in cochlear gardens before they are eaten [9]. In Nigeria, Snails constitute an important component of the food of numerous rural dwellers especially in the rainforest belt as well as other area of the country where eating snail is not regarded as a taboo [4]. A type of snail known as prewinkle is being relished more among the Efik tribe in Nigeria in states like Akwa Ibom and Cross Rivers. In West Africa, the common breeds of snails reared are African giant land snail *Archachatina marginata*, *Achatina achatina*, *Achatina fulica*, *Limicolaria* species [5,2]. The most popular edible snails in West Africa are the giant Snail *Achatina achatina* and the big black *Archachatina marginata* [1]. [7] noted that the foot (skin) of *A. marginata* can be black or white in colour. *A. marginata* has bulbous shell with brown stripes and a wide apex [4]. *A. achatina* has a brown shell with conspicuous zig zag streaks and narrow pointed apex [4]. The shell of the matured snail form elongated cone which coils spirally around a central axis usually 4-5 whorls at maturity [7].

In this study the qualitative characters and suture measurement of *Archachatina marginata*, and *Achatina achatina* were observed.

2. MATERIALS AND METHODS

2.1 Study Location

The experiment was carried out at the Teaching and Research farm of Olabisi Onabanjo University, Ayetoro in Ogun State. Ayetoro is located in latitude 7° 15' N and longitude 3° 31'E in a deciduous/ derived savannah zone of Ogun State. Climate is sub-humid tropical with an annual rainfall of 1,909.3mm. Raining season is between early April and late October, Rainfall pattern is bimodial with two peaks in June and September. Maximum temperature varies between 29°C during the peak of the wet season and 34°C at the onset of the wet season. Mean annual relative humidity is 81% [8].

2.2 Measurement of Characteristics

Two breeds of Snails were used in this study. Fifty *Archachatina marginata* and forty *Achatina achatina*. Animals were purchased at different markets in towns around Ayetoro.

Animals were identified with numbers using paint to write on the shell. Snails were numbered 1-90. Suture was measured using the vernier caliper. A scout pro sensitive scale (0-600g) was used to take the weight. Data collected include shell colour (SC), foot colour (FC), shape of Apex Shell (SAS). Types of stripes on shell (TSS), Distance between first and second suture (DBS1 & 2), second and third suture (DBS2 & 3), third and fourth suture (DBS3 & 4), fourth and fifth suture (DBS 4 & 5) and snail have weight (SLW) (Fig. 1).

2.3 Statistical Analysis

Data collected were analysed using statistical package for social scientist 2006; which include chi square, descriptive statistics and T-test of means, correlation and regression analysis.

3. RESULTS AND DISCUSSION

36% of *A. marginata* snail had brown with light yellow shell colour and 64% had brown shell colour while 100% *A. achatina* had brown with light brown yellow shell colour. The brown with light brown yellow colour of *A. achatina* is significantly different from the brown with light brown yellow colour of *A. marginata* at $P < 0.01$ (Tables 1 and 2). The result agrees with Akinnusi (2004). In *A. achatina*, it was observed during this study that there is a red colouration on the aperture shell. 22% of *A. marginata* had black foot colour, 64% had brown and 14% had brown black while 100% of *A. achatina* had brown-black foot colour. The brown-black foot colour of *A. achatina* is significantly different from the brown-black foot of *A. marginata* at $P < 0.01$ (Tables 1 and 2). The result agrees with the statement of Akinnusi (2004), that the foot colour of *A. marginata* snail is usually brown black which is different from *A. Achatina*. 94% of *A. marginata* had broad-wider apex, 6% had pointed apex, there is no (0%) narrow-wider apex while 100% of *A. achatina* had narrow and wider apex.

The narrow and wider apex of *A. achatina* is highly significantly different from the broad and wider apex of *A. marginata* ($P < 0.01$). This result agrees with Akinusi (2004). 80% of *A. marginata* snail had straight lines with brown lines on shell, 20% had spotted stripes with straight stripes while 100% of *A. achatina* had zig zag thick brown lines. The zig zag thick brown lines on shell of *A. achatina* is highly significantly different from the straight lines with thick brown lines of *A. marginata*. This result agrees with Akinnusi (2004). In this study the result revealed that some of the *A. marginata* snail had spotted stripes with straight stripes on the shell, this could be due to the fact that random mating has occurred where these animals have had equal chance of mating with each other in the various habitat they were collected from. In the *A. marginata* snail, 5(10%) had 2+ 1 suture, 17 (34%) 3 + 1, 2(4%) 3 + 2, 1 (2%) 3 + 3, 21 (42%) 4 +1 and 4 (8%) with 4 + 2 while in the *A. achatina*, there is 0 (0%) 2 +1 suture, 2 (5%) had 3 + 1, 14 (40%) 3 + 2, none (0%) 3 + 3, 7 (17.5%) 4 + 1 and 15 (37.5%) 4 + 2 (Table 3). In the 3 + 1 suture animals, the mean distance between the second to fourth sutures (0.67 ± 0.07 cm, 0.26 ± 0.03 cm) in *A. achatina* is longer than those of *A. marginata* (0.70cm, 0.03 cm) but the first and second suture is longer in *A. marginata* (1.49 ± 0.09 cm) than (1.4cm) *A. achatina*. In the 3 + 2 suture animals, the mean distance between sutures in *A. Achatina* snail (1.48 ± 0.03 ; 0.69 ± 0.03 ; 0.27 ± 0.02) cm is longer than (0.95 ± 0.05 , 0.35 ± 0.05 , 0.10 ± 0.00) cm *A. marginata*. In animals with 4 + 1 and 4 + 2 suture, the mean DBS of *A. marginata* snail is longer than the *A. achatina* snail (Table 3).

Table 1. Qualitative characters of *Archachatina marginata* and *Achatina achatina*

Characters	A.M (%)	A.A (%)
Shell Colour		
Brown with light brown yellow	n 18 36.0	40 100
Brown	n 32 64.0	0 0
Total	n 50	40
Foot colour		
Black	n 11 22.0	0 0.0
Brown	n 32 64.0	0 0.0
Brown black	n 7 14.0	40 100.0
Total	n 50	40
Shape of shell	100.0	100.0
Broad-wider apex shell	n 47 94.0	0 0
Narrow-wider apex shell	n 0 0.0	40 100.0
Pointed apex shell	n 3 6.0	0 0
Total	n 50	40
Type of shapes on shell	100	100
Straight lines with thick brown lines on shell	n 40 80	0 0
Spotted stripes with straight stripes on shell	n 10 20	0 0
Ziz zag thick brown lines on shell	n 0 0	40 100.0
Total	n 80	40
Total	100.0	100.0

Table 2. Chi square for the qualitative characters

Variables	X²	d.f	Sig
Shell colour	39.724	1	0.000
Foot colour	84.072	2	0.000
Shape of shell	90.000	2	0.000
Types of stripes On shell	90.000	2	0.000

Chi square – Pearson Chi square; d.f – Degree of freedom; sig – significance

Table 3. Individual whorl population number and individual distance between sutures of *Archachatina marginata* and *Achatina achatina*

No. of sutures		D.B.S 1&2	D.B.S 2&3	D.B.S 3&4	D.B.S 4&5	SLW		D.B.S 1&2	D.B.S 2&3	D.B.S 3&4	D.B.S 4&5	Total	SLW
2+1	n	5	5	0	0	0	N	0	0	0	0	5	
	%	10	10				%						
	X	0.660	0.320			17.460	X						
	S.E	0.0510	0.583			3.7993	S.E						
3+1	n	17	17	17			N	2	2	2	0	19	
	%	34	34	34			%	5	5	5	0+		
	X	1.485	0.674	0.262		69.565	X	1.400	0.700	0.300			45.900
	S.E	0.0862	0.0725	0.0259		5.9332	S.E						
3+2	n	2	2	2	0		N	16	16	16	0	18	
	%	4	4	4	0		%	40	40	40	0		
	X	0.950	0.350	0.100		19.100	X	1.481	0.688	0.269			45.694
	S.E	0.0500	0.0500	0.000		1.2000	S.E	0.0332	0.0287	0.0218			3.7843
3+3	n	1	1	1	1		n						
	%	2	2	2	2		%						
	X	1.000	0.500	0.200	0.200	20.900							
	S.E						S.E						
4+1	n	21	21	21	21		n	7	7	7	7	28	
	%	42	42	42	42		%	17.5	17.5	17.5	17.5		
	X	2.167	1.029	0.476	0.148	142.771	X	1.586	0.771	0.343	0.100		50.986
	S.E	0.0433	0.0332	0.0206	0.0206	9.9099	S.E	0.0459	0.0360	0.0202	0.0000		3.5163
4+2	n	4	4	4	4		n	15	15	15	15	19	
	%	8	8	8	8		%	37.5	37.5	37.5	37.5		
	X	1.975	0.938	0.488	0.163	132.900	X	1.719	0.869	0.381	0.119		77.163
	S.E	0.1250	0.0375	0.0125	0.0239	11.6427	S.E	0.0600	0.0405	0.0164	0.0101		7.7347
Total	n	50	50	50	50		n	40	40	40	40		

* +1, +2,+3 are the tiny sutures; DBS – Distance Between Sutures SLW – Snail live weight

The fact that within the 3 + 1 suture and 3 + 2 suture, the suture of *A. achatina* snail is bigger than *A. marginata* snail may be due to age difference between the animals. In this research, it was observed that the mean DBS decreases towards the apex suture. Among the breeds, the distance between first and second suture, second and third suture of *A. marginata* respectively (1.69±0.08, 0.79±0.04) cm is longer than (1.59±0.03, 0.78±0.02) cm that of *A. achatina* (Table 4). It was observed in this study that the longer the distance between the suture the more conspicuous the stripes and colour on that specific suture. The mean DBS of the first and second, third and fourth, fourth and fifth sutures of *A. marginata* is not significantly different from *A. achatina* at P>0.01. The mean of the distance between the second and third suture of *A. marginata* snail is significantly different from *A. achatina* snail at P<0.01 (Table 5). The SLW is highly positively correlated with Distance between 1st and 2nd suture (0.889), 3rd and 4th (0.879), 2nd and 3rd (0.851), 4th and 5th (0.846) sutures in *A. marginata* and 2nd and 3rd suture (0.718), 1st and 2nd sutures (0.697) in *A. achatina* (Table 6). The parameter that could most significantly (P<0.01) determine SLW is the distance between 4th and 5th suture in *A. marginata*. The result was negative and highly not significant P>0.01) for the distance between sutures in *A. achatina* although the distance between the 3rd and 4th suture could still accurately determine SLW (Table 7).

Table 4. Mean of Distance between sutures

Variables	A.M	A.A
Distance between 1 st and 2 nd suture	50	40
S.E	1.693	1.593
Distance between 2 nd and 3 rd suture	50	40
S.E	0.792	0.775
Distance between 3 rd and 4 th suture	50	40
S.E	0.0455	0.0242
Distance between 4 th and 5 th suture	50	40
S.E	0.336	0.328
Distance between 4 th and 5 th suture	0.0260	0.0139
	50	40
	0.075	0.065
	0.0121	0.0098

A. M. – *Archachatina marginata*; A. A. – *Achatina achatina*

Table 5. Test of Significance between mean of distance between Suture of *Archachatina marginata* and *Achatina achatina*

Variables	Levens test of sig	Variance assumption	T-test of Sig
D.B 1 st and 2 nd suture	0.000	N.E.V	0.232
D.B 2 nd and 3 rd suture	0.000	N.E.V	0.742
D.B 3 rd and 4 th suture	0.000	N.E.V	0.774
D.B 4 th and 5 th suture	0.010	N.E.V	0.524

*N.E.V. -Equal variances not assumed

Table 6. Correlation analysis of *Archachatina marginata* and *Achatina achatina*

	SLW	DBS1&2	DBS2&3	DBS3&4	DBS4&5
SLW		0.697**	0.718**	0.460**	0.557**
DBS 1&2	0.889**		0.882**	0.710**	0.629**
DBS 2&3	0.851**	0.887**		0.721**	0.632**
DBS 3&4	0.879**	0.933**	0.867**		0.604**
DBS 4&5	0.846**	0.751**	0.706**	0.811**	

Table 7. Regression analysis OF *Archachatina marginata* and *Achatina achatina*

Distance between suture		B	S.E	Sig
Distance between 1 st and 2 nd suture	A.m	11.532	14.620	0.436
	A.a	-9.715	11.018	0.387
Distance between 2 nd and 3 rd suture	A.m	5.724	12.373	0.647
	A.a	-7.042	15.153	0.647
Distance between 3 rd and 4 th suture	A.m	-40.576	39.547	0.313
	A.a	-1.585	14.129	0.912
Distance between 4 th and 5 th suture	A.m	138.400	45.275	0.005
	A.a	-8.451	17.375	0.632

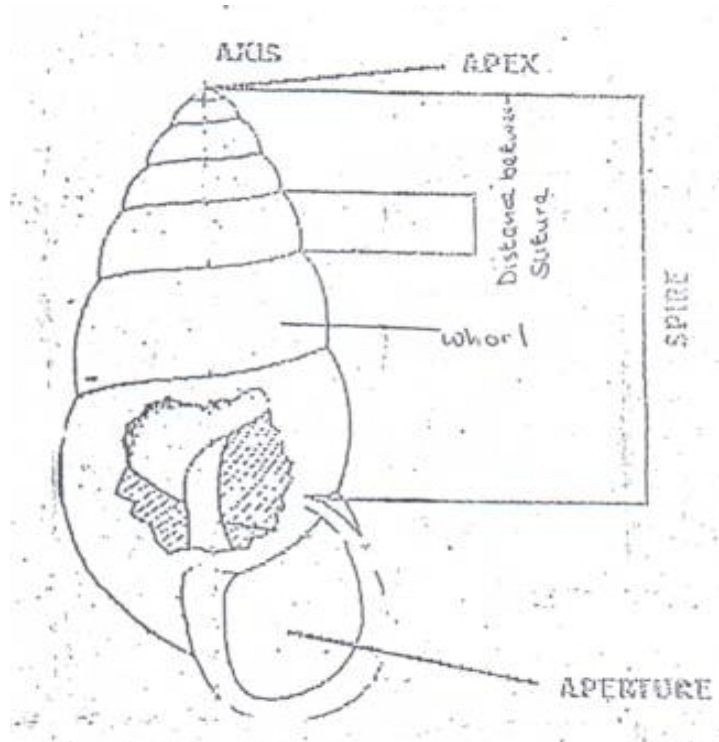


Fig. 1. The diagram of the snail showing the whorl, spire, aperture and distance between suture

4. CONCLUSION AND APPLICATION

This study has shed more light on the Mendelian (Qualitative) characters of *A. marginata* and *A. achatina*. A strain of *A. marginata* has been identified in this study. The longer the distance between the suture, the more conspicuous the stripes and colour on that specific suture. The snail live weight is highly positively correlated with the distance between 1st and 2nd suture, 2nd and 3rd suture in *A. marginata* and *A. achatina*. The prediction power is high for the distance between 4th and 5th suture in *A. marginata*.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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