

## PHENOTYPIC CHARACTERISTICS OF THE AFRICAN GIANT SNAIL, *Archachatina marginata* SWAINSON

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### ABSTRACT

*Observations were made on 'gigantism' and albinism in the giant snail, Archachatina marginata. Gigantic snails were initially about twice the size of normal snails of same age. However this growth superiority of 'gigantic' snails apparently slowed down with age. Albinism in the snails was expressed in form of creamy-white bodies instead of the normally brownish colour. Albino snails however retained normal shell colouration. All offspring of these albinos maintained these same characteristics. There was no difference in mortality rates of albino and normal snails. 'Gigantism' and albinism have serious implications for commercial snail farming.*

**Keywords:** Albinism, *Archachatina marginata*, Giant land snail, Gigantism

### INTRODUCTION

Giant land snails constitute an important protein source for many of the inhabitants of West Africa, especially the rainforest zone. Whether in the rural or urban areas in southern Nigeria, it is hard to find a market where giant land snails are not displayed for sale. The two main genera of giant land snails in W. Africa are *Achatina* and *Archachatina* both of which show preference for primary rainforest and moist secondary forest. The flesh of the giant snails is of remarkable nutritive value with high iron content (Ogbeide, 1974) and a protein content of 37.0 – 51.3 g/100g dry matter (Udedibie, 1989). Snail meat also has profound cultural and medicinal values in many rural W. Africa communities. Among the Igbo of south-eastern Nigeria, snail meat is an indispensable item in the diet of nursing mothers. Osemeobo (1992) listed 15 health conditions that are believed to be curable with the meat, fluid and shell of African giant snails.

Snail production in the wild has been on the decline due to the depletion of the rainforest, overharvesting of snails, bush burning and the increased use of agricultural pesticides. In many urban centres in Nigeria, the land snail has already attained the status of a highly priced delicacy within the reach of only a few. With growing awareness of the role of cholesterol in various heart and arterial diseases, the demand for low cholesterol meat

like snails has even become more acute. Interest is growing on commercial snail farming as a means of meeting the demand for snail meat. One of the greatest constraints to commercial snail farming is the slow growth rate of snails which may take as much as 8 – 15 months to reach market size/sexual maturity, depending on species and culture conditions. Considerable research effort on snails has therefore largely focused on growth.

Though previous studies have identified factors that enhanced growth in snails to include high levels of exchangeable cations like calcium and magnesium (Gomot *et al*, 1986), highly varied diet (Monney, 1994; Okorie, 2003) and humic acid (Elmslie, 1998), a lot more information on growth is needed to enhance the commercial viability of snail farming. This study is a preliminary report of two abnormal growth characteristics, namely, 'gigantism' and albinism in the giant land snail, *Archachatina marginata*, under culture conditions

### MATERIALS AND METHODS

Specimens of giant land snails, *A. marginata*, including few albino snails, collected from the wild were cultured indoors in wooden vivaria. Identification of snails was done with the aid of keys and descriptions from Bequaert (1950) and Hodasi (1984). The wooden boxes used for culturing the snails measured 30 cm x 60 cm x 35 cm with a 15 cm layer of humus soil in the

bottom. The snail in the cages was replaced with fresh soil every 8 weeks. The snails were fed *ad libitum* with a variety of local leaves and ripe fruits. The leaves fed the snails were paw-paw (*Carica papaya*), cocoyam (*Colocassia esculenta* and *Xanthosoma sagittifolium*), cassava (*Manihot utilissima*), banana (*Musa sapientum*) and plantain (*Musa paradisiaca*). Ripe fruits were paw-paw, banana and oil palm fruit (*Elaeis guineensis*). Humidity of the vivaria was maintained by daily sprinkling of water on the vivaria soil and keeping the culture houses fairly closed. Growth measurements were based on total shell lengths (Plummer, 1975) using vernier calipers, to the nearest 0.1mm. Other morphometric features taken were length of body whorl (L. bw), width of aperture (Wa), shell thickness (S.T), shell width (Wd) and length of aperture (La).

For purposes of comparing mortality records of normal and albino snails, the two populations were segregated into separate cages to avoid cross-breeding. The hatchlings from each clutch were isolated in a separate cage for future growth studies. For each clutch the number of surviving snails was noted at weekly intervals. The number of surviving snails was expressed as a percentage of total number of snails in each clutch per week. Altogether 10 clutches each of normal and albino snails were used for this study. In this way, the overall percent survival in the normal and albino snail populations was computed for a 48-week rearing period.

## RESULTS AND DISCUSSION

**Identification:** Based on the keys and descriptions provided by Bequaert (1950) the giant land snail identified in this study was *Archachatina marginata*. The distinguishing characteristic of the species is the presence of more or less strongly engraved subsutural lines on the shells. Based on the same identification keys, four subspecies were identified among the snails, namely, *A. marginata marginata*, *A. marginata suturalis*, *A. marginata grevillei* and *A. marginata eduardi*.

There is no mistaking the specimens for *Achatina* sp. While the shell of *Archachatina* sp is characterized by a wide, bulbous or dome-shaped apex, the shell of *Achatina* sp is broadly ovate and subglobular with regular conical spine and narrow apex (Hodasi, 1984). In addition, while *Archachatina* produces a few (rarely more than 10 in a clutch) and relatively large eggs,

*Achatina* produces numerous and usually small eggs.

**Gigantism:** Extraordinarily large young snails were observed on two occasions. In both cases the gigantic snails were the lone surviving hatchlings in their respective clutches. While the body and foot were more or less brownish like other snails, the shells of the gigantic snails were distinctly darker in colouration. Table 1 compares some morphological features in normal snails against gigantic snail. In terms of shell size, expressed as shell length, the gigantic snails were obviously larger than other snails of same age. On the second day of life, the shell of gigantic snail (A.1) was x 1.94 larger than the average shell length of the normal snails of same age. Similarly, a second gigantic snail (A.2) was x2.10 larger than the average size of snails of same age. However, with age, the size differences narrowed. By the 5<sup>th</sup> month, when A.1 died, it was only x1.43 larger than normal snails. Similarly, when A.2 died in 14 months, it was only x1.15 larger than the average normal snails of same age. Thus the growth superiority of the gigantic snails apparently slowed with age.

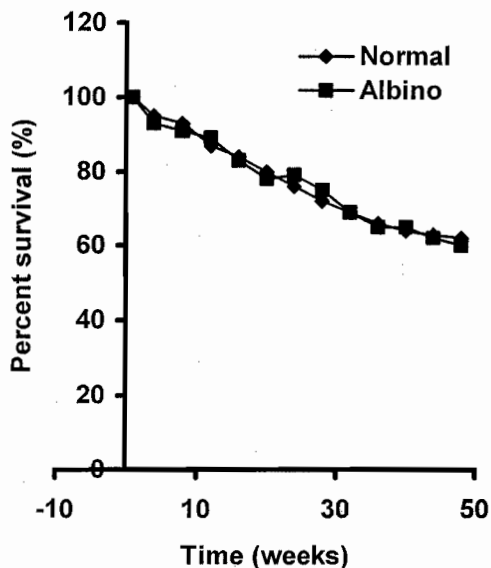
It is possible that the extraordinary snails were hybrids resulting from crosses between different subspecies in the vivaria. Such subspecific crosses have been reported (Stievenart and Backeljau, 1994) between *Achatina fulica hamelei* and *Achatina fulica rodatzki*, though there was no mention of any form of gigantism. It is also possible that the gigantic growth of the hatchlings was environmentally induced and has no genetic basis. Elmslie (pers. comm.) suggested that the early growth advantage was due to egg-cannibalism and does not affect the final body size. While acknowledging many instances of inbreeding depression in snails, the communication did not identify any instance of hybrid vigor in land snails. Elmslie was of the opinion that gigantism in young snails was as a result of egg-cannibalism. Elmslie's view on egg-cannibalism was opined from Baur (1988) who demonstrated that hatchlings of *Helix pomatia* (L.) possessed an innate propensity for egg-cannibalism. According to the study, hatchling *H. pomatia* first ate a hole in their own eggshell and then devoured it completely.

There is also a slim possibility that the gigantic snails were sterile, though the results here are far from conclusive: abnormal snail (A.2) had not laid any eggs by the time it died

**Table 1: Morphological comparisons of normal snails against cases of 'gigantism' in *A marginata***

Character	Range	Normal snails (84) *		
		Means $\pm$ S.E	Abnormal snail, A.1	Abnormal snail, A.2
S.L (mm)(at 2 days)	8.7-11.6	10.1 $\pm$ 0.77	19.6	21.2
S.L (mm)(at 5 mon)	43.2-52.4	47.00 $\pm$ 1.5	-	67.2
S.L (mm)(at 14 mon)	76.5 - 104.6	89.1 $\pm$ 1.4	102.5	-
L.bw/S.L	0.53-0.67	0.58 $\pm$ 0.003	0.57	0.58
Wd/S.L	0.55-0.64	0.59 $\pm$ 0.003	0.61	0.63
La/S.L	0.54-0.69	0.59 $\pm$ 0.005	0.59	0.60
Wa/S.L	0.30 - 0.38	0.34 $\pm$ 0.003	0.33	0.32
Wa/La	0.52-0.68	0.59 $\pm$ 0.005	0.58	0.57

S.L = Shell length, L.bw = Length of body whorl, Wa = Width of aperture, S.T = Shell thickness, Wd = Shell width, La = Length of aperture, \* Total number of snails.



**Figure 1: Survivorship curves of normal and albino snails**

in the 14th month, just about the upper age limit of sexual maturity in these snails. In spite of these controversies, there is need for a comprehensive investigation of possible interbreeding of subspecies of *A. marginata*, as this may have profound implication for commercial snail farming where the slow growth of snails is the major constraint.

**Albinism:** Albino snails had entirely creamy-white body and foot. Only the eyes showed dark pigment. The shells, however, displayed the usual variability of shell pigmentation seen in normal snails. The albino snail in this study laid several batches of eggs and 100% of the offspring were albinos.

Similarly, Plummer (1975) reported the appearance of a colour mutant in a laboratory

colony of *Archachatina marginata* subspecies *ovum*. According to the report, there appeared to be a general trend towards a paler body colour in cultured snails. But there was one abrupt colour change which the study attributed to a recessive mutation.

In view of the aversion for light by land snails, it was speculated that albino snails may be subject to a higher mortality rate than normal snails. However, this study showed no appreciable difference in the mortality rates between the two groups. Figure 1 shows survivorship curves of albino and normal snails during their first 48 weeks of life. Perhaps, there would have been a disparity in the mortality rates if the snails were subjected to stressful culture conditions involving more exposure to sunlight.

There is also some controversy as to whether albinism in snails should be defined in terms of the colour of the shell or colour of the body. Unlike all the other ten (10) subspecies of *A. marginata* described by Bequaert (1950) which all display considerable variety in shell pigmentation, only *A. marginata grevillei* has uniformly straw-yellow shells. In local parlance, they are referred to as 'white snails' and often looked on as albinos. A close look at the shells shows that the shell apex, parietal wall and columella are extensively red. Furthermore, the snail body (i.e. head and foot) is coloured, showing the same more or less brownish colouration as in other subspecies.

Albino snails are of little or no food value, as their lack of pigmentation is attributed to fetish beliefs in typical W. African communities and only a few persons would dare consume them. However, they may be highly useful research tools in the study of albinism in man and other animals. Also, in view of their

beauty, they may be used as ornamentals in indoor glass vivaria.

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