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Observations on Some Climatic Variables and Dietary Influence on the Performance of Cultivated African Giant Land Snail (*Archachatina marginata*): Notes and Records

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Climatic variables are among the determining factors in the survival, growth and sustenance of any existing organism in its niche. Performance of an organism is directly or indirectly dependent upon innate of the organism as well as the totality of its surrounding. Physical surrounding of an animal plays vital role on its activities. Most micro-climatic variables (relative humidity, rainfall, photoperiod, temperature) are very important determinants of extent at which some animals such as earthworm, frog, and snail can perform and their survival depends greatly on these variables. Land snails prefer humid environments for their optimum performance in the presence of their choice food. Most of the land snails of West African origin (*Archachatina spp., Achatina spp., Limcolaria spp.*) are forest dwellers found mostly along the coastal zone (Imevbore, 1990). Temperature is one of the determinants of the amount of moisture in an environment and it is inversely proportional to relative humidity. According to Pollard (1975), activities of land snails are closely related to humidity and rainfall. In West Africa, snail farming has great potential (Imevbore and Ajayi, 1993). In harnessing these potentials and establishing sustaining farming of the animal knowledge of the influence of certain climatic variables as well as food on the performance of the land snails has to be established. Hence, this study focuses on the effects of temperature, relative humidity, rainfall, and food type on the growth performance of African giant land snail reared on both artificial diet and natural plant food materials for 52 weeks.

A total of 30 juvenile *Archachatina marginata* (average weight 10.2±1.3g) were obtained from a snail pen in the Department of Fisheries and Wildlife, Federal University of Technology, Akure. The snail pen is situated approximately 100m from the Meteorology Research Laboratory of the University where the data on the climatic variables were read using their respective instruments. The snails were acclimated to experimental condition in a rectangular wooden cage (0.8m x 0.6m x 0.5m) for two days. The cages were filled with top soil each of 15cm thickness. Snails were weighed and randomly grouped into five snails per replicate. The snail was randomly stocked into the replicate treatment cages prepared for the study as follows: treatment I (combined plant leaves), treatment II (25% crude protein diet) and treatment III (combined plant leaves + 25% crude protein diet in ratio 1:1). The plant leaves were cocoyam (*Xanthosoma maffafa*), pawpaw (*Carica papaya*), Fluted pumpkin (*Telifixia occensentalis*) and sweet potato (*Ipomea batata*). The ingredients composition of the 25% crude protein diet is shown in Table 1. The snails on each treatment were fed *ad libtum* with the specific diet treatment and their enclosures were kept damp for 52 weeks. The snails were weighed using a beam balance scale while a veneer caliper was used to measure the shell length and shell diameter once monthly. Observations were made on the survival, weight gain, shell length, shell diameter and aestivation of the snails on the various treatments in relation to temperature, rainfall, relative humidity and food type.

Table 1: Ingredient composition of the 25% crude protein (c.p.) diet

Ingredient	%
Groundnut cake	10.94
Blood meal	18.22
Yellow maize	42.84
Brewer's waste	10.00
Palm oil	6.00
Oyster shell	6.00
Vitamin premix	6.00

The average body weight gain of *A marginata* in all the treatments were inversely proportional to temperature and were directly proportional to relative humidity and rainfall (Fig. 1, 2 and 3). Shell length and shell diameter also increased as the body weight increased. Significant correlation (R^2 98) existed between average weight gain of snail and temperature; relative humidity and rainfall in all the treatments. *A. marginata* in all the treatments had remarkable body weight gain at lower temperature, higher relative humidity as well as higher rainfall that falls within July to November, and April to June of the experimental period. It was observed from Figure 1 that at temperature >30°C, there was a sharp decrease in the body weight gain of *A. marginata* in all treatments. This low body weight gain was maintained in all the treatments during December to March that were the months of dry season in the study area. Regular wetting of the enclosure and provision of nutritious snail food are assumed to play important role in the body weight

Table 2: Growth performance of *A. marginata* reared for 12 months

	Combined plant leaves	25% c.p. diet	Combined plant leaves + 25% c.p. diet
Initial weight (g)	10.9±1.5[a]	9.7±1.4[a]	9.9±1.0[a]
Final weight (g)	208.8[a]	187.7±1.2[b]	227.9±2.0[c]
Weight gain (g)	197.9[a]	178.3[b]	218.0[c]
Initial shell length (cm)	3.6±0.2[a]	3.6±0.1[a]	3.7±0.2[a]
Final shell length (cm)	11.3±0.2[a]	10.0±0.2[a]	10.6±0.1[a]
Initial shell diameter (cm)	2.4±0.1[a]	2.6±0.1[a]	2.4±0.1[a]
Final shell diameter (cm)	7.1±0.1[a]	5.9±0.1[b]	6.3±0.1[b]

Figures in the same row having the same superscript (a, b,c) are not significantly different (p>0.05)

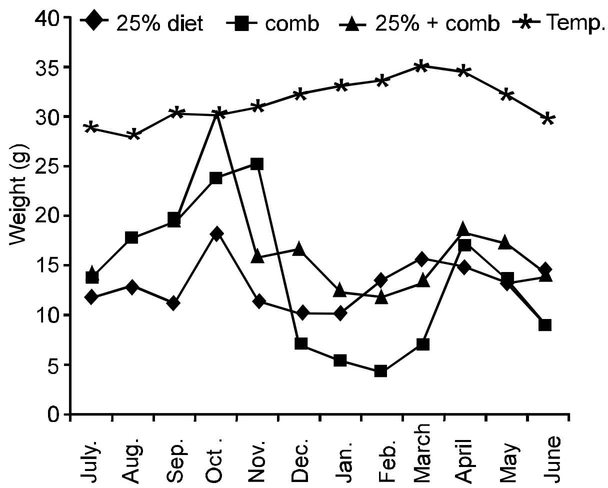

Fig. 1: Mean monthly weight gain-temperature relationship of A. marginata fed different diets

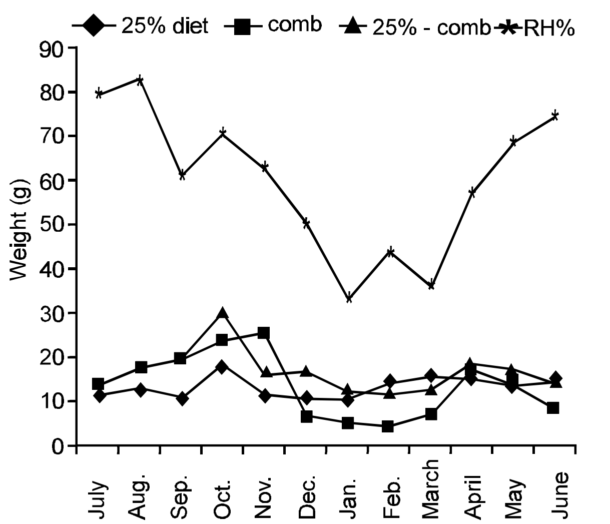

Fig. 2: Mean monthly weight gain-relative humidity relationship of A. marginata fed different diets

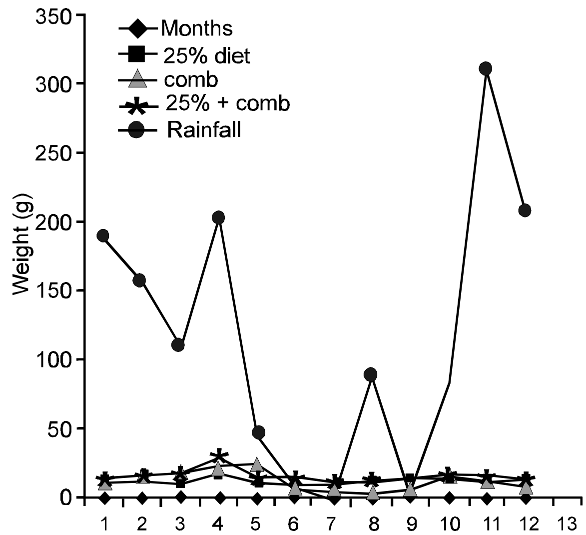

Fig. 3: Mean monthly weight gain-rainfall relationship of A marginata fed different diets

increase of the *A. marginata* between December and March during which their counterparts in the wild undergo aestivation, thus indicating that food was better utilized for growth. It is known that food is one of the essential factors in the survival and performance of an organism. This was confirmed by the significant differences ($p<0.5$) in the average body weight of *A. marginata* on the three different food treatments. The body weight of *A marginata* fed on combined plant leaves + 25% crude protein diet (treatments III) was significantly influenced ($p<0.05$) than the other two treatments. This agrees with the report of Imevbore and Ajayi (1993) that *A. marginata* consumes more food if the food material is highly acceptable to them, thereby gaining more body weight. However, no significant difference ($p>0.05$) existed between shell length and shell diameter of *A. marginata* in all the treatments at the end of 52 weeks of the observation. Both morphological parameters continued growth throughout the period Table 2. The consistence in body weight gain and 100% survival of *A. marginata* during the 52 weeks signify that the presence of food and moisture stimulated the normal activities of feeding and growth even during dry season of the area. This contradicts the report of Imevbore (1990) that *A. marginata* undergo aestivation during dry season even under captive management. This necessitates more studies on the growth of *A. marginata* during the dry season in order to confirm and establish this research finding. Egonmwan (1988) reported that *A. marginata* laid eggs in Britain during the months that corresponded to dry season in Nigeria from where the experimental snails were obtained. Ejidike (2002) also reported that *A. marginata* laid eggs during the dry season in Nigeria under captive rearing. On and off aestivation was observed in *A. marginata* in treatment II, as yellowish mucous covered the surface of few of the *A. marginata*, which broke few minutes after wetting their enclosure with well water. This on and off aestivation occurred during dry season, a time that corresponds with the period snails normally aestivate in the wild or under poor captive management. This agrees with Howes and Wells (1934) that aestivation might be as a result of natural cycle that occurs in phases in snails. Aestivation in *Helix aspersa* is governed not only by current temperature and humidity but also by internal ‘clocks’ or ‘calendars’ that regulate activity to a daily and to an annual rhythm (Elmslie, 1992). *H. aspersa* under farming system can lose the clock in their generation by the same individual snail (Elmslie, 1992).

From this study it was deduced that the growth performance of *A. marginata* is affected by temperature, rainfall, humidity and food. Though there was growth during both dry and wet season of the year, it was reduced at the period of high temperature and low relative humidity during the observation.

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