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THE FOOD DIVERSITY AND CHOICES OF *ARCHACHATINA MARGINATA* RAISED IN CONCRETE TRENCH PENS

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ABSTRACT

Archachatina marginata is an economically useful gastropod, scientifically proven to be of huge benefit to human's health and wellbeing. Food varieties of *A. marginata* hunted from the immediate environment of Ovia North East, South-South, Nigeria, were investigated to select the most appropriate, in terms of preferences and availability. The study was conducted for five months (May to August, 2020) during the rainy season. Ten snails were selected from the wild with weights ranging from 340.21g to 355.32g and heights of 11.8cm to 13.3cm at the point of collection. The snails were housed each, in an escape-proof trench pen, covered with wire gauze and nylon net. They were fed with fourteen different types of food materials (water leaves, paw-paw leaves, sweet potato, white -boiled rice, corn powder, ripe paw-paw fruit, cocoyam leaves, millet powder, water melon, cucumber, formulated poultry mash, pineapple, white paper and cabbage). Water melon was very well consumed by all the snails (1323.30g; 66.17%) compared to other food items. The least consumed food items were millet powder (19.99%) and pineapple (20.28%). There was a marked increase in weight and length of the snails as the months progressed, with average length of 15.01 cm and average weight of 501.58g in August, relative to the initial measurements in May.

Keywords: *Achachatina marginata*, trench pen, food materials, diversity.

INTRODUCTION

The knowledge of snail's food diversity, preferences and their availability especially, for the *Archachatina* species are crucial for the wellbeing of the snails. *A. marginata* is a zoologically important big-sized species of snails, referred to as the giant African Land snail. The shell can reach up to 130mm in diameter, with 6 or 7 rings and a body length of up to 20 cm. The color can be described as white or cream background with long black or dark brown zigzag lines.

A. marginata belongs to the family Achatinidae and subfamily Achatininae (Galli, 2017). This species has some morphological differences from the other Archatininae snails especially, Achatina species, in skin texture (smoother), apex of

the shell (more blunt) and the shape of the tail (raising V shape) (plate 1).

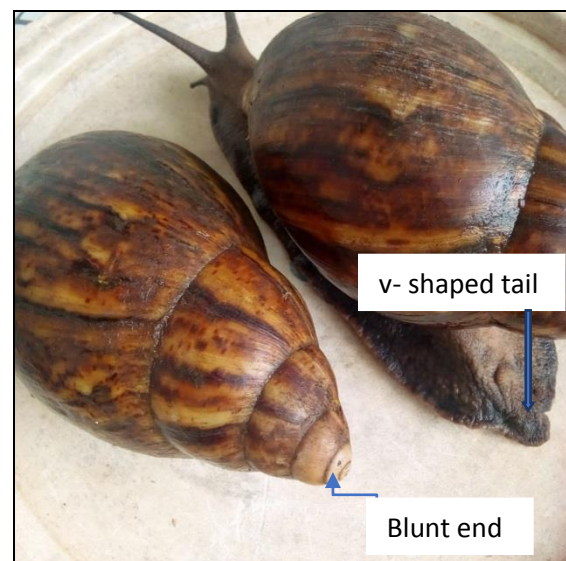


Plate 1: *A. marginata* showing some distinctive features (foot, shell and whorl).

Its value in the biosphere goes beyond food satisfaction for the humans. The nutritional composition of the snail includes high quality protein, water, fatty acids, vitamins (vitamins A, E, K and B12) and minerals (calcium, magnesium, selenium and iron (Ademolu, 2005; Gouveia et al., 2011).

The snail is however, also of medicinal, nutritional and aesthetic values. Many documented studies have indicated the importance of snail slime to humans. Preparations from snail slime are effective in the treatment of tuberculosis, anthrax, wound healing and enhancement of skin beauty (Harti et al., 2016; Jordan, 2020). The mucin contained in the lubricating mucous has potentials against Gram positive and Gram-negative bacteria and also stimulates activities of many elements of the immune system (Thomas, 2013).

The importance of snail's food diversity is to be understood because they depend so much on food to grow, develop and fight diseases. *A. marginata* can last as long as 10 years (Bank, 2017). Much as it appears that snails eat many varieties of plant materials, as well as other food items edible to humans, it is essential to note that some food items are preferred to others. The ability of the snail farmers to identify the choice foods of their snails, ensures more success and less regrets.

Different varieties of food for snails have been mentioned in previous studies (Nwadukwe, 2000; Thompson 2005; Okoye et al., 2009; Gouveir, et al., 2011; Nyoagbe, et al., 2016). A good number of them are essentially vegetable materials- waterleaf, pumpkin, cabbage, lettuce, pawpaw leaf, cocoyam leaf; fruits- such as pawpaw, mango, pineapple, tomato, cucumber and oranges; carbohydrates- yam, sweet potato, corn, millet and rice. Others include, egg shells, bone meal, poultry feed, feces of cattle, chickens and goats etc. and even papers (Okafor-Elenwo and Izevbuwa, 2020).

To maintain their size, *A. marginata* feeds voraciously on many choice food

materials. Calcium is essentially needed for the maintenance of their shell quality, as the shell is the snails' house which they carry about and in which they can withdraw. Feeding begins early after hatching from the eggs and on very soft food materials especially, plant materials.

Snails also need loose soil rich in calcium and moisture. Feeding is high during the wet seasons of the year and they are more active during the darker periods of the day (Nyoagbe, et al., 2016). They hibernate during dry periods, food scarcity and other discomforts. Attention should be given to the sanitary condition of the snailery. Dirty environment attracts pests and microbial pathogens which could be detrimental to the snails (Okafor-Elenwo and Imade, 2019). In addition to favorable environmental conditions such as temperature and humidity *Archachatina spp.* reared at home should be given constant care especially, during the period of growth to achieve better yield.

MATERIALS AND METHODS

Sample Collection

A. marginata were collected from the wild, washed and fed together for seven days. Thereafter, they were given only water for two days prior to the experimental study. Ten healthy snails weighing between 339.13g and 355.32g were selected and introduced into trench pens secured with wire gauze and nets with tiny pores.

Weight and Length Measurements

Each snail was given a number for identification and weighed using a digital weighing balance (CAMRY2000). This was repeated every week for a month and continued until the end of the experimental period from May 2020 to August 2020. Weights of the snails were taken and analyzed statistically to get the average weight for each month. Similarly, weight of the food materials given to the snails

was measured every day before giving to them, to achieve a uniform amount for all the snails. Length of the snails was measured using an experimental method described by Gouveia et al., (2011).

Food Materials for the Snails

Each of the snails was placed in a clean, well-ventilated pen, big enough to house five snails. The food materials fed to the snails included ; waterleaf, paw-paw leaves, sweet potato, white -boiled rice, corn powder, ripe paw-paw fruit, cocoyam leaves, millet powder, water melon, cucumber, formulated poultry mash, pineapple, white paper and cabbage.

Feeding Routine

The snails were fed once a day between 6.30 pm and 7.00 pm with the same type of food/ water and each type at a time. The quantity of food given to each snail was 16.261 grams from May to August (123 days). A total of 2000g of food was given to the snails in four months. Before the next meal, the left over (if any) from the previous meal was gathered, weighed and recorded. A new set of feeding plates and drinkers was used to feed the snails, while the dirty ones were thoroughly washed and kept for later use.

Statistical Analysis

The analysis of data was done using methods described by Sander et al., (2016). Chi-square test was used to find the level of significance in the rate and amount of food consumed by *A. marginata* as well as the differences in the weight and height of the snail.

RESULTS AND DISCUSSION

The food selection of *A. marginata* is shown in table 1. The food materials given to the snails were consumed, though the quantity eaten differed according to the type of food. The quantity administered was enough to satisfy them and, in each meal, there was a left over, which indicated that they were not starved. No snail was lost during the study rather there was much improvement in their weight and length compared to their initial measurements. It is evident that all these food materials can serve as food for *A. marginata* snail (Figure 2). Four new food items were introduced during this study to the snails other than existing ones (white paper, millet, corn and boiled rice). They were equally consumed and digested well by the snails. Food for snails has been reported previously by different researchers and many tend to believe that snails prefer vegetative material than other food stuffs (Okoye et al., 2009; Ozumba et al., 2013; Gouveir et al., 2011; Mbazu, 2019).

Food items most consumed by *A. marginate*, as found from this study were water melon, formulated chicken mash, sweet potato, boiled rice, cucumber and white paper. These six items were regarded as the choice foods for the snails in this study. More than 80 grams of each of the choice foods was consumed daily (Figure 2).

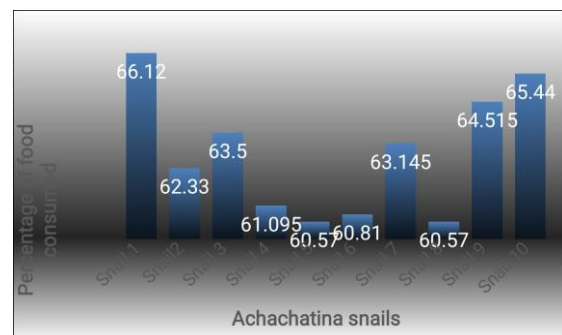


Figure 2: Percentage of food consumption by each snail

Table 1: Food types and quantity consumed by each snail.

| FOOD TYPES | SN1 | SN2 | SN3 | SN4 | SN5 | SN6 | SN7 | SN8 | SN9 | SN10 |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) | QC(gm) |
| Water leaves | 53.4 | 72.4 | 36.2 | 20.8 | 45 | 77.6 | 72.8 | 58.3 | 38.1 | 32.6 |
| Paw paw leaves- | 81.2 | 88.3 | 88.9 | 82.5 | 69.3 | 112.5 | 73.1 | 95 | 102.1 | 95.3 |
| Sweet potato | 103.4 | 128.5 | 105.1 | 136.2 | 117.1 | 141.1 | 128.3 | 83.1 | 115.5 | 119.1 |
| White boiled rice | 130 | 116.4 | 138.1 | 127.3 | 135.1 | 133.1 | 128.3 | 147.1 | 115.4 | 132.5 |
| Corn powder | 52.1 | 38.9 | 87 | 42.4 | 79.2 | 32.1 | 74.1 | 32.4 | 81.6 | 68.6 |
| Ripe paw-paw fruit | 103.2 | 58.3 | 98.1 | 78.5 | 93.2 | 91.7 | 80.1 | 72.1 | 95.3 | 93.2 |
| Millet powder | 25.3 | 21.8 | 38.4 | 23.2 | 56.1 | 31 | 54.2 | 81.9 | 24.6 | 43.4 |
| Coco yam leaves | 73.1 | 93.5 | 65.5 | 93.2 | 23.3 | 72.1 | 68 | 48.2 | 93.5 | 115.2 |
| Water melon | 113.4 | 137.6 | 126.1 | 156.4 | 97.8 | 143.3 | 116.3 | 123.1 | 152.2 | 157.1 |
| Cucumber | 111.4 | 138 | 137.2 | 130.1 | 121.8 | 116.3 | 136.2 | 115.1 | 137.2 | 123.4 |
| Formulated feed | 131.4 | 133.2 | 123.1 | 143.4 | 123.4 | 145.6 | 131.4 | 140.4 | 124.4 | 122.5 |
| Pineapple peels | 3.4 | 40.3 | 31.5 | 55.4 | 43.2 | 47.3 | 53.5 | 56.1 | 36 | 38.9 |
| White paper | 141.9 | 121.2 | 101.1 | 97.3 | 113.8 | 93.9 | 83.5 | 103.5 | 89.1 | 102.5 |
| Cabbage | 93 | 58.2 | 93.7 | 35.2 | 93.1 | 84.8 | 63.1 | 55.6 | 85.3 | 64.5 |

When snails were given the right type of food, they fed actively and grew faster, both in weight and in length (Figures 3-5). Snails derive healthy nutrients from the natural foods they consume especially vegetables and fruits (Odowu et al., 2004; Thompson, 2019). The micronutrients in sweet potato, water melon and cucumber provide antioxidants such as beta-carotene which is a provitamin and functions to prevent cellular damage and reduce infection (Odowu, 2004; Ademola et al., 2005; Okonta, 2012).

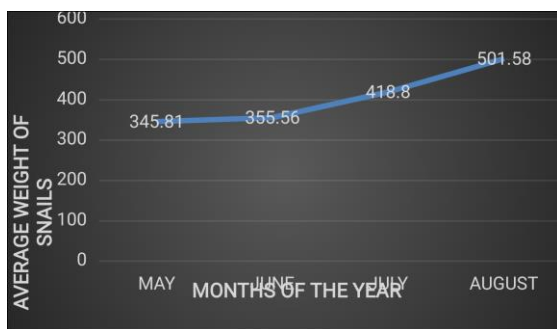


Figure 3: The average weight of *A. marginata* in four months.

The nutrients from fresh natural foods consumed by *Archachatina spp.* give their immunity a boost and protect them from pathogenic diseases. Research provides evidence that fruits and vegetables make available, vitamins, energy, minerals and fiber in the right proportion for the wellbeing of the animal in addition to checking the gut flora and healthy digestive system (Inderscience, 2009; Ibom and Okon, 2010).

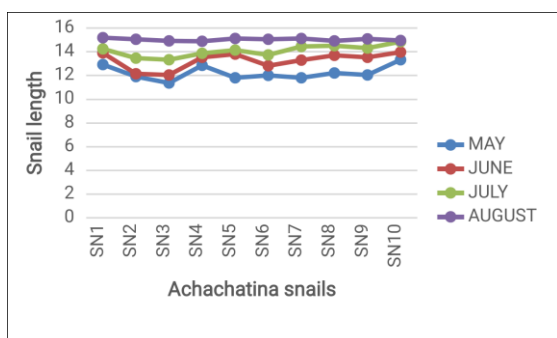


Figure 4: Length of each snail according to the months of study.

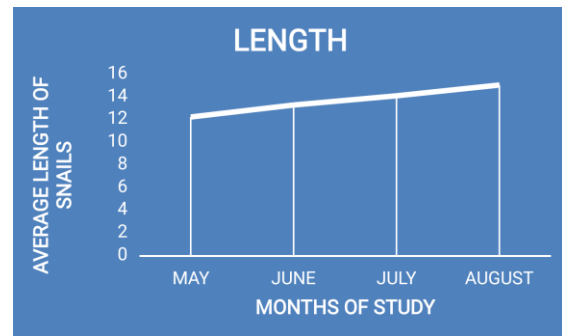


Figure 5: Progressive increase in the mean length of the snails

The snails benefit significantly from nutrients in poultry feed especially vitamins and minerals. Dicalcium phosphate from some aquatic mollusk shells, incorporated in the poultry feed is noted to provide calcium and phosphorus which strengthens the shells. Also, vitamin D3, vitamin K, vitamin C and A among others, added to poultry feeds are known to play very essential roles in the body of organisms that consume such foods (Okonta, 2012; Arcuri, 2019).

Snails would choose sweeter food items over bitter/sour ones, succulent leaves than the strong ones, smooth compared to hairy ones and powdery food to lumps. The preference of water melon more than the other food materials was probably because of its high-water content, soft smooth texture and a wide range of phytochemicals.

CONCLUSION

Diverse food materials are exposed to *A. marginata* in the wild, by virtue of their terrestrial habitat. These food items range from vegetable, fruits, complex carbohydrates, soil, and other complex nutrients to water. It was also observed that they eat younger snails, bone, egg shells, soil, faeces of other animals and hard wood. This wide range of food items could probably be the reason for their fast growth and big size. It may be necessary for snail breeders to follow snail pattern of feeding in the wild and possibly improve on it, to achieve a more positive result. It was observed that *A. marginata* from this

region preferred water melon, poultry mash, sweet potato and rice. They also consumed white papers and defecated the remnants. Consumption of papers by the snails was surprising to us initially because the papers were never added as part of their food. Further investigations are recommended to ascertain benefits of adding paper to *A. marginate* diet.

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