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COMPARATIVE EFFECT OF SELECTED FOREST LEAVES ON THE GROWTH OF *Archachatina marginata* (AFRICAN GIANT LAND SNAIL)

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ABSTRACT

This research was carried out to determine the effect of selected forest leaves on the growth of Archachatina marginata. Forty five growing snails were used for the experiments which lasted for sixteen weeks. The snails were allotted into five treatment groups with nine replicate laid in completely randomized design. The different treatment groups were fed with Carica papaya leaves (T1), Morus alba leaves (T2), Gliricidia sepium leaves (T3), Albizia lebbeck leaves (T4) and Triplochiton scleroxylon leaves (T5). The data generated were analyzed using analysis of variance (ANOVA). Parameters assessed were weight gain, shell length and shell circumference. From the result obtained in the study, snails fed with Morus alba leaves (T2) performed best in terms of weight gain (131.34g) followed by snails fed with Triplochiton scleroxylon leaves (T4) with mean value of 120.90g and the least performance was obtained from (T3) Gliricidia sepium leaves with mean value of 114.42g. Furthermore, snails fed with Triplochiton scleroxylon leaves (T4) performed best in terms of shell length with mean value of 11.47cm followed by (T3) Gliricidia sepium leaves with mean value of 11.46cm and the least performance was obtained from (T1) Carica papaya leaves with mean value of 9.46cm. Likewise, snails fed with Carica papaya leaves (T1) performed best in terms of shell circumference with the value of 3.27cm followed by Albizia lebbeck (T5) leaves with mean value 3.25cm and the least performance was obtained from T2 and T3 with value 3.04cm. It is concluded that the selected forest leaves had a positive effect on the growth of the experimented snails hence, Archachatina marginata should be fed with Morus alba leaves so as to have a maximum weight yield and to reduce the cost of snail production in terms of feed. Morus alba farming should be encouraged as its cultivation will as well provide more income to the farmers through the selling of its leaves to the snail farmers.

Keywords: Forest leaves, *Archachatina marginata*, Snailery, Weight yield, Shell length, Shell circumference.

INTRODUCTION

Snail meat commonly known as ‘Congo meat’ is one of the most popular delicacies in Nigeria and it forms a very important part of the diets of many households in rain forest belts (Hamzat, *et al.*, 2007). The meat is high in protein (12-16%), andiron (45-50%), and low in fat (0.05-0.08%) and contains almost all the amino acids needed for human nutrition (Abere and Lameed, 2008). Many species of edible land snails are recognized in Nigeria, but the popular species of economic interest is the West African giant snail (*Archachatina marginata*) (Oddian, 2002).

Naturally snails are left to wander about and search for food but this might cause their death when they encounter various insects and when they feed on poisonous leaves, so there is need to domesticate them and feed them. This enhances them to gain much weight; it also makes them available in much quantity in the market. So snail farming is the rearing of snails in captivity. The snails are confined in an enclosure and most of their requirements like feed and water are supplied on a regular basis. Snail rearing is necessary in order to save them from extinction, prevention of environmental degradation resulting to a balanced ecosystem. (Ubua *et al*., 2012).

The four different breeds of snail found in Nigeria include *Archachatina marginata*, *achatina*

achatina, *Achatina fulica* and *Limicolaria spp* (Omole *et al*., 2000 and Omole, 2002).

Carica papaya leaf is a tropical fruit tree leaf. *C. papaya* leaves contain powerful healing compounds that are very important for good health and vitality for curing cancer and dengue fever. Papaya leaves are necessary for getting rid of invading bacteria that upset stomach problems because they contain karpa which kills bacteria and contains amylase enzyme which helps to break down proteins. Also, it reduces inflammation from inflammatory bowel diseases.

Genus "Morus" is a flowering plant, in the family Moraceae which comprises 10-16 species of deciduous trees commonly known as mulberries, growing wild and under cultivation in many temperate world regions (Suttie, 2012; FAO, 2012). Among the selected varieties of *Morus alba*, S30 variety was recommended for snails by Ajibade (2014) because it gives the highest productivity.

Gliricidia sepium belongs to family 'Fabaceae' sub family Faboidaceae. The common name is Gliricidia. It is a small to medium sized, thornless, leguminous tree up to 10-12m high with its branching that is frequently from the base with basal diameter reaching up to 50-70cm. It serves as feed for ruminant animals, green manure and also has medicinal value. Ruminant animals have been found to be fed with *Gliricidia sepium* which is leguminous. Thus, the use of it as feed for snails arose because it will aid them to grow (Kehinde *et al* 2003).

Triplochyton scleroxylon is an indigenous tree species. The common name is Obeche. Its leaves contain crude protein whose percentage is 21.24% and water content is 76.00%. *Triplochyton scleroxylon* leaves contain adequate level of food nutrients required by snails for normal body functioning.(Agboola *et al.,* 2008).

*Albizia lebbec*k is of the Fabaceae family. The common name is Albizia. It produces an incessant rattle in the wind reminding women's chatter hence, the name "women tongue" (FAO, 2010.; Orwa *et al*.; 2009; Lowry *et al*.; 1992). .*A. lebbeck* is a multipurpose tree, as a fodder tree, its foliage, twigs, flowers and immature pods are relished by different classes of livestock (camels, cattle, small ruminants and rabbits) (FAO,2010).

This research was to evaluate and compare the effect of selected plant leaves on the growth performance of *A. marginata*, to identify the nutritional composition of the tree leaves (*C. papaya*, *G. sepium*, *M. alba*, *T. scleroxylon* and *A. lebbeck***)** and to examine the tree leaves that have a high growth impact on African giant land snails.

MATERIALS AND METHODS

Experimental site

The experiment was carried out within the premises of the Federal College of Forestry, Jericho, Ibadan. The college is located in the rain forest vegetation with mean annual rainfall of about 1400-1500mm and average relative humidity of about 65%. It lies between latitude 7^0 26^0N and longitude 3^0 36^0E (FRIN,2010).

Materials

The materials used in carrying out the experiment includes; 45 average sized *Archachatina marginata*, sensitive scale, wooden cage, loamy soil, ruler, thread, bucket, vernier caliper,.

The African giant land snails were procured from IAR&T, Ibadan, Oyo state. Leaves of *Triplochiton scleroxylon*, *Gliricidia sepium*, *Albizia lebbeck*, *Carica papaya* and *Morus alba* were collected within the Premises of forestry research institute of Nigeria (Forestry Research Institute of Nigeria). The loamy soil was also collected from FRIN environment.

Experimental Diets

Five different diets were used for the experiment. Each diet represents each treatment.

T1 control- *C. papaya* leaf (Pawpaw leaves)
T2 *M. alba* leaf (Mulberry)
T3 *G. sepium* leaf (Gliricidia)
T4 *T. scleroxylon* leaf (Obeche)
T5 *A. lebbeck* leaf (Albizia*)*

Method

The snails were domesticated in a wooden cage. The cage was divided into five rearing units with five treatments, 3 replicates per treatments and 3 snails per replicate. The floor of the cage was filled with loamy soil to a depth of 5cm.The snails were fed with the leaves which serves as treatment. Watering was done daily while feeding was done every three days throughout the period of the experiment. Cleaning was also done at three days interval as snails are not comfortable in a dirty environment. Proximate analysis of the leaves was carried out at Kappa biotechnology laboratory. Procedures for the analysis are as follows:

Moisture Content:

This was determined using the air oven method. Crucibles were washed and dried in an oven at a temperature between 103-105^0c until constant

weight were obtained. They were allowed to cool in the desiccators and weight was noted.

$$(\%) = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where
W1= Weight of empty moisture Can,
W2= Weight of empty Can + Sample before drying, W3= Weight of Can + Sample dried to constant weight.

Determination of Ash Content:
A known weight of finely ground sample was weighed into clean, dried previously weighed crucible with lid (w1). The sample was ignited over a low flame to char the organic matter with lid removed. The crucible was then placed in muffle furnace at 600^0c for 6hours until it ashed completely. It was then transferred red directly to desiccators, cooled and weighed immediately (W2).

$$(\%) = \frac{W_2 - W_1}{Weight\ of\ sample} \times 100$$

Where:
W1= Weight of empty crucible,
W2 = Weight of crucible + Ash.

Determination of Crude Fat:
The soxhlets extraction method (AOAC, 1996) was used. This method could only give the appropriate fat content in a sample because all the substances soluble in chosen solvent (petroleum ether, 40^0c-60^0c boiling range) were extracted from the sample. A known weight of sample was weighed into a weighed filter paper and folded neatly. This was put inside pre-weighed thimble (W1). The thimble with the sample (W2) was inserted into the soxhlets apparatus and extraction under reflux was carried out with petroleum ether (40^0c-60^0c boiling range) for 6hours. At the end of extraction, the thimble was dried in the oven for about 30 minutes at 100 ^{0}c to evaporate off the solvent and thimble was cooled in desiccator and later weighed (W3).
The fat extracted from a given quantity of sample was then calculated:

$$(\%) = \frac{W_2 - W_1}{Weight\ of\ sample} \times 100$$

Where:
W1=Weight of empty extraction flask,
W2=Weight of fat extract.

Protein Determination:
The crude protein content was determined using micro kjeldahl method as described in AOAC (1996). 0.2077g of sample was weighed into a long necked kjeldahl flask. 1 tablet of kjeidahl catalyst was added to the sample in the flask with $25cm^3$ of conc. H_2so_4. The flask was swirled gently clamped in an inclined position and heated electricity in a fume cupboard. The heating continue until a clear solution was obtained. The clear solution was cooled, poured into a $100cm^2$ volumetric flask and made up of mark with distilled water 10ml of the resulting mixture was measured into the distillation set through the funnel. $5cm^3$ boric acid was pipetted into a $100cm^3$ conical flask and placed at the receiving end of distillatory. The conical flask was place such that the delivery tube dipped completely into the boric acid inside the flask. 40% NaOH was used to liberated ammonia out of the digest under alkaline condition during the distillation 2 drops of methyl orange were always added to the round bottom flask containing the digested sample before 40% NaOH was added. As soon as the content became alkaline, the red colour change to yellow showing NaOH to be in exess. Steam was then generated into the distillation set using a steam chest. The liberated ammonia was trapped in the boric acid solution collected into a conical flask. The solution in the flask was titrated against 0.1M HCL until the first permanent colour changed was observed.
A blank sample was through the sample procedure and the titre value for the blank was used to correct the titre for samples.

$$N_2(\%) = \frac{100}{W} \times \frac{N \times 14}{1000} \times \frac{Vt}{Va} \times T.B$$

1mL of 1NH2SO4 = 14mg
Protein (%) = N2 (%) x 6.25

Where:
W = Weight of sample,
N = Normality of titrant,
Vt = Total digest volume,
Va = Volume of digest analysed,
T =Sample titre value,
B = Blank titre value.

Crude Fibre:

Volume of 200 mL of freshly prepared 1.25% H2SO4 was added to a known weight of the residue obtained from fat extraction and this was brought to quick boil. Boiling was continued for 30 minutes. The mixture was filtered and residue washed until it was free from acid. The residue was transferred quantitatively into a digestion flask, 1.25% NaOH was added and brought to boiling point quickly. Boiling was continued for 30 minutes. The mixture was filtered and residue washed free of alkali. The residue was then washed with methylated spirit, thrice petroleum ether using small quantities. It was allowed to properly drain and the residue was transferred to a silica dish (previously ignited at 600_o C and cooled).

The dish and its content were dried to constant weight at 105^{o}C.the organic matter of the residue was burnt by igniting for 30 minutes in a muffle furnace at 600^{o}C. The residue was cooled and weighed. The loss on ignition was reported as crude fibre.

Carbohydrate: The carbohydrate content was calculated by difference.

% CHO = 100 – (sum of the percentages of moisture, ash, fat, protein and crude fibre).

Parameters Assessed

The following were taken on weekly basis:

i. Weight of the snails were taken with the use of a sensitive scale

ii. Shell length: measured from the tip of the shell to the base using ruler and thread

iii. Shell circumference: this is the width of the shell measured with Vernier caliper at the top, middle and base.

Experimental Design

The experiment was laid in a complete randomized design (CRD) with five treatment, (3 replicates per treatment and 3 snails per replicate).

Data Analysis

The data collected were analyzed using Analysis of Variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT)

RESULT

It was shown that *A. marginata* fed with *T. scleroxylon* leaves (T_4) was found to have highest value of shell length (11.47cm), followed by *G. sepium* with value of 11.46cm, *A. lebbeck* leaves with value of 11.28cm, followed by *M. alba* leaves (T_2) which has a value of 10.77cm and *A. marginata* fed with *C. papaya* leaves was found to have the least average mean value of 9.46cm in term of shell length. Also, the result showed that T1 have the highest average mean value of 3.27 cm in term of shell circumference, followed by T_5 with average mean value of 3.25cm, followed by T_1 with average mean value of 3.07 cm and T_2 and T3 was found with the least average mean of 3.04cm. In terms of weight, T_2 was found with highest average mean value of 131.34 g, followed by T_4 with average mean value of 120.90 g, followed by T_1 with average mean value of 119.33 g, T_5 with average mean value of 118.09g, and T_3 with the least average mean value of 114.42 g.

Table1: Proximate Analysis of experimental leaves used as treatment

Parameters	**T1 (*C. papaya*)**	**T2 (*M. alba*)**	**T3 (*G. sepium*)**	**T4 (*T. scleroxylon*)**	**T5 (*A. lebbeck*)**
Moisture content %	81.6	80.7	77.5	84.8	82.0
Protein %	4.6	5.4	6.3	4.4	3.7
Ether extract %	0.4	0.6	0.7	0.6	0.6
Ash %	2.6	2.4	2.8	2.2	2.6
Crude fibre %	2.1	1.7	2.5	1.9	2.6
Carbohydrate (by difference) %	8.5	9.2	10.2	6.1	8.5

Table 2. Means and (DMRT) of shell length, weight and shell circumference of *A. marginata* fed with the different tree leaves

Leaves	Length(cm)	Weight(g)	Circumference(cm)
C.papaya	9.46±0.69	119.33±11.85a	3.27±0.08a
M. alba	10.77±0.54b	131.34±9.47a	3.04±0.09a
G. sepium	11.46±0.41b	114.42±15.18a	3.04±0.09a
T. scleroxylon	11.47±0.39b	120.90±16.16a	3.07±0.22a
A.lebbeck	11.28±0.21b	118.09±17.46a	3.25±0.12a

Mean value having the same alphabet are not significantly different

DISCUSSION

As shown in Table 2 above, *A. marginata* fed with *T. scleroxylon* leaves (T_4) have the highest value of shell length (11.47cm), followed by *G. sepium* with value of 11.46cm, *A. lebbeck* leaves with value of 11.28cm, followed by *M. alba* leaves (T_2) which has a value of 10.77cm and *A. marginata* fed with *C. papaya* leaves was found to have the least average mean value of 9.46cm in term of shell length. Also, the result in table 2 showed that T1 have the highest average mean value of 3.27cm in term of shell circumference. This was followed by T_5 with average mean value of 3.25cm, and T_1 with average mean value of 3.07cm respectively. However, T_2 and T3 were found with the least average mean of 3.04cm which agreed with the findings of Agbodidi *et al*., (2008), on the effect of two edible fruit on the growth performance of African giant land snail (*A. maginata)*. In terms of weight, T_2 was found with highest average mean value of 131.34g, followed by T_4 with average mean value of 120.90g This was again followed by T_1 with average mean value of 119.33g, T_5 with average mean value of 118.09g. T_3 was the least average mean value of 114.42g which was in line with the work of Kandylis *et al.,* (2008) who reported that *Morus alba* leaf has an appreciable potential influence in feeding small ruminant live stocks.

CONCLUSION

Having carried out this research of comparative effect of supplement on the growth of *A. marginata* (African giant snail), It can be concluded that *A. marginata* fed with *M. alba* leaves (T_2) performed best when compared to others in terms of weight gained.

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