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Comparison of the growth performance of Achatina fulica and Achatina achatina as influenced by housing types

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Research Paper

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This research carried out for a period of thirty six (36) weeks, compared the influence of housing types on growth performance of two edible snail species (Achatina fulica and Achatina achatina). One hundred and eighty (180) juvenile snails were used (90 0f each species) and thirty (30) snails of each species were subjected to each of the three housing treatments in replicates of 15 snails per replicate. The housing treatments had the same dimensions (120 cm x 60 cm x 30 cm) and were labeled: Treatment A (Hutch box), Treatment B (Trench pen) and Treatment C (Mini-paddock pen). The housing treatments and their surroundings were fitted with a digital thermometer and hygrometer to take daily readings of internal and ambient temperature and humidity respectively. The snails in each replicate were fed daily rations of 60 g of dry Guinea corn bran, 50 g ground egg shell and water was also supplied. The growth parameters investigated were: weekly weight gain, weekly shell length increase and weekly shell circumference increase. Other parameters investigated were mortality, hibernation, temperature and humidity variations. Treatment C produced the highest yield in all the growth parameters for both Achatina fulica and Achatina achatina and the means of the weight gain and shell circumference were statistically significant ($P \leq 0.05$) at 3, 6 and 9 months for Achatina achatina but were not significant for Achatina fulica. The means of the shell length increase was also not significant ($P > 0.05$) for both snail species at 3, 6 and 9 months. The least snail mortality and hibernation for both snail species was observed in treatment C. The temperature variation was lowest in Treatment C (4.0^{o} C) and highest in Treatment B (6.9^{o} C). The humidity variation was also lowest in C (14.5%) and highest in Treatment B (15.9%). Treatment C proved to be the best housing type for the production of snail and the study recommends that it be used as nursery, growing and fattening pens for rearing Achatina achatina in the tropics to produce best result while any of the housing types can be used for rearing Achatina fulica.

Key words: Achatina fulica, Achatina achatina, Snail, Housing.

INTRODUCTION

Snails are bilaterally symmetrical invertebrates with soft segmented exoskeleton in the form of a calciferous shell. They belong to the class gastropoda and phylum Molusca, which is the second largest invertebrate group in the animal kingdom after insects (Yoloye, 1994). There are about 112,000 species within this phylum of which 3 are very common in Nigeria (*Achatina achatina, Archachatina marginata* and *Achatina fulica*) (*Cobbinah et al.*, 2008). Snail farming is a form of micro-livestock production; gathering and marketing snail from the wild provide economic sustenance to rural women in Nigeria (Moyin-Jesu and Ajao, 2008). Snail farming is also a tool for poverty alleviation (Moyin-Jesu and Ajao, 2008).

Snail meat is consumed all over the world by the rich and the poor (Murphy, 2001; Paoletti, 2005); this could be attributed to the fact that snail meat is tasty, tender and highly nutritional (Eruvbetine *et al.*, 1997). Besides the high quality of the snail meat, it is very rich in protein and

has a lot of medicinal properties (Orisawuyi, 1989); snail meat has been reported to cause reduction in labour pain and loss of blood during labour, restoration of virility and fertility in human beings (Imevbore and Ademosun, 1988). Serotonin secreted in the snail's body is effective in the maintenance of normal behaviour after mental depression (Imevbore and Ademosun, 1988). Snail meat is recommended for patients with hypertension and heart attack because of its low cholesterol level. The shells can be used for Ornamental purposes and also as a source of calcium and phosphorous in mixing rations for animals. Snail meat contains anti-tuberculosis qualities.

Growth performance in snails is dependent on so many factors: soil composition, food, seasons and availability of calcium supplement. However, temperature and humidity are the chief environmental factors that are known to influence performance (Ejidike, *et al*., 2004) in snails. Soofia *et al.* (2006) reported that different housing conditions have different effects on the modification of their internal temperature and humidity with respect to that of their surroundings. Researches on snail production in the past have concentrated on aspects of nutrition and environmental factors (Agbogidi et al., 2008; Ejidike et al., 2004; Siyanbola, 2008) but no researcher has tried to compare the performance of *Achatina fulica* and *Achatina achatina* subjected to the three housing conditions proposed by Cobbinah et al. (2008) for snail production in the tropics. This research however investigated the effect of the modified internal temperature and humidity of three housing types on the growth performance of two species of snails and compares findings.

MATERIALS AND METHODS

The study was carried out in MOGBO Farm in Ngene Amawbia in Awka South Local Government Area, Anambra State of Nigeria. Amawbia is a town located between latitude 6^0N and 7^0N and longitude 7^0N and 8^0N. One hundred and eighty (180) juvenile snails belonging to two species were used for the study: Ninety (90) *Achatina achatina* species and ninety (90) *Achatina fulica* species. The snails were obtained from Ministry of Agriculture Awka and were transported to the study site in baskets covered with banana leaves. Thirty snails of each species were subjected to each of the three housing treatments in replicates of 15 snails per replicate. The housing treatments were labeled thus: Hutch box (Treatment A), Trench pen (Treatment B) and Mini – Paddock Pen (Treatment C) and they were each filled with soil rich in humus to a depth of 10cm to serve as bedding material and provide a soft substrate for the snails. Each housing treatment and its surrounding were fitted with a digital thermometer and hygrometer to take daily temperature and humidity readings and the battery of the instrument was replaced every two months.

Weekly data collections included: weight gain, shell length increase and shell circumference increase while daily data collections included: mortality, hibernation, temperature and humidity readings. The weight of the snails was measured with a sensitive electronic balance (Citizen Mp 600-A) while the length and shell circumference were measured with a vernier caliper. The snails were fed daily rations of 60g guinea corn bran and 50g ground egg shells to serve as calcium supplement. Fresh water was also supplied daily. Data collected for growth was analyzed at 3, 6 and 9 months for significant difference (ANOVA) and when significant; LSD value was used to separate the means (Figure 1).

RESULTS

Snails subjected to treatment C had the highest weight gain for both *Achatina fulica* and *Achatina achatina* (Tables 1 and 2).Similarly, Treatment C showed the best performance for other growth parameters for both snail species. The means of the growth parameters investigated were not significant ($p > 0.05$) for *Achatina fulica* (Table 1). The weight gain and shell circumference of *Achatina achatina* however, varied significantly ($p < 0.05$) in their means. Treatment C was found to be statistically different from Treatment B but statistically the same with Treatment A (Table 2). There was no statistical difference ($p > 0.05$) in the shell length of *Achatina achatina* as influenced by the housing treatments (Table 2). Snail mortality was least in treatment C and B with reference to treatment A for *Achatina achatina* (Figure 2). Snail mortality was also higher in *Achatina achatina* when compared to *Achatina fulica* (Figure 2). Hibernation was least in treatment C and lower in *Achatina fulica* when compared to *Achatina achatina* (Figure 3). Temperature and humidity variations were least in Treatment C (Tables 3 and 4).

DISCUSSION

The high growth parameters recorded in treatment C for *Achatina fulica* was due to chance since there was no statistical difference ($P > 0.05$) in the means of their growth parameters at three, six and nine month's interval (Table 1); any of the three housing treatments can be used as nursery pens and fattening pens in rearing *Achatina fulica.* This could be attributed to the fact that *Achatina fulica* is a highly invasive species which has established itself in different climates and also in many places where it is illegally released into the wild (Cowie *et al*., 2009). They have high adaptation to environmental fluctuations and are pests surviving in agricultural areas, coastlands, natural forests, planted forests, riparian zones, scrublands, urban areas and wetlands (Cowie *et al*., 2009). The high yield of treatment C for *Achatina*

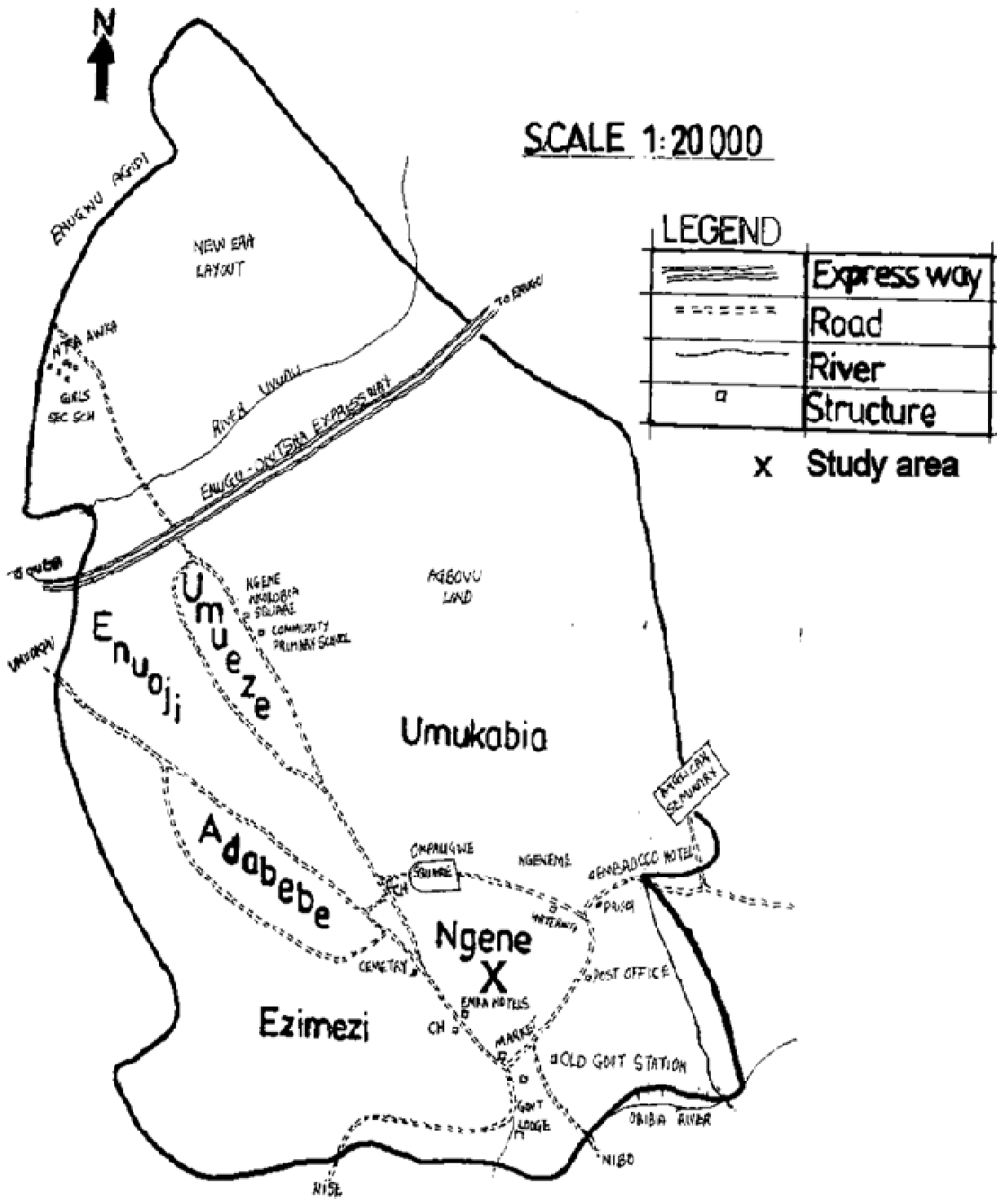

Figure 1. Map of Amawbia showing location of Study Area.

achatina varied significantly ($p<0.05$) and could be attributed to a number of factors: The type of material used for the construction of treatment C (Appendix Tables 5a,b and c) could be responsible for its high yield; Treatment C was well aerated and allowed for cross ventilation of air thereby ensuring a more stable microclimate. Water could also easily drain off ensuring that the soil is not waterlogged. A study on the thermal performance of different building materials by Soofia et al., (2006) reported that different materials have different

Table 1. Growth parameters of *Achatina fulica.*

Growth parameters	A	B	C
Initial weight (g)	18.3	18.2	18.0
Final weight (g)	58.2	57.8	60.5
Weight gain (g)	39.9[a]	39.6[a]	42.5[a]
Initial shell length (cm)	4.82	4.72	4.98
Final shell length (cm)	7.25	7.37	7.70
Shell length increase (cm)	2.43[a]	2.66[a]	2.72[a]
Initial shell circumference (cm)	6.87	6.79	6.91
Final shell circumference (cm)	14.15	14.16	14.89
Shell circumference increase (cm)	7.28[a]	7.37[a]	7.99[a]

Rows with the same superscript are not significantly different.

Table 2. Growth parameters of *Achatina achatina.*

Growth parameters	A	B	C
Initial weight (g)	16.3	16.3	16.0
Final weight (g)	84.7	72.2	103.5
Weight gain (g)	68.4[a]	55.9[b]	87.5[a]
Initial shell length (cm)	4.61	4.60	4.70
Final shell length (cm)	9.11	9.07	9.39
Shell length increase (cm)	4.50[a]	4.47[a]	4.70[a]
Initial shell circumference (cm)	7.18	7.00	7.29
Final shell circumference (cm)	15.45	15.34	17.07
Shell circumference increase (cm)	8.27[a]	8.34[b]	9.80[a]

Rows with the same superscript are not significantly different.

Table 3. Average maximum and minimum temperatures in the housing treatments, environment and temperature variation.

Treatments	Min. average temp (C^o) (a)	Max. average temp (C^o) (b)	Min. average ambient temp (C^o)	Max. average ambient temp (C^o)	Temp variation (b – a)
A	23.0	29.0	22.6	31.5	6.0
B	22.4	29.3	22.6	31.5	6.9
C	22.7	27.6	22.6	31.5	4.9

Table 4. Average maximum and minimum humidity in the housing treatments, environment and humidity variation.

Treatments	Min. average humidity (%) (a)	Max.average humidity (%) (b)	Min. average ambient humidity (%)	Max. average ambient humidity (%)	Humidity variation (b – a)
A	75.5	90.3	73	89	14.8
B	76.1	92.0	73	89	15.9
C	75.6	90.1	73	89	14.5

effects on their modified internal temperature and humidity when compared to that of the environment. The modified internal temperature and humidity of treatment C proved to be best for production of *Achatina achatina* in the tropics. This study is in line with the findings of Omole et al. (2000) who reported that *Achatina fulica* can endure a wider range of fluctuation in its environment than *Achatina achatina.* Temperature and humidity variations were least in treatment C (Table 3 and 4) and this proves treatment C had a more stable micro-climate than other housing treatments. This could be responsible for the low mortality and hibernation observed in treatment C for

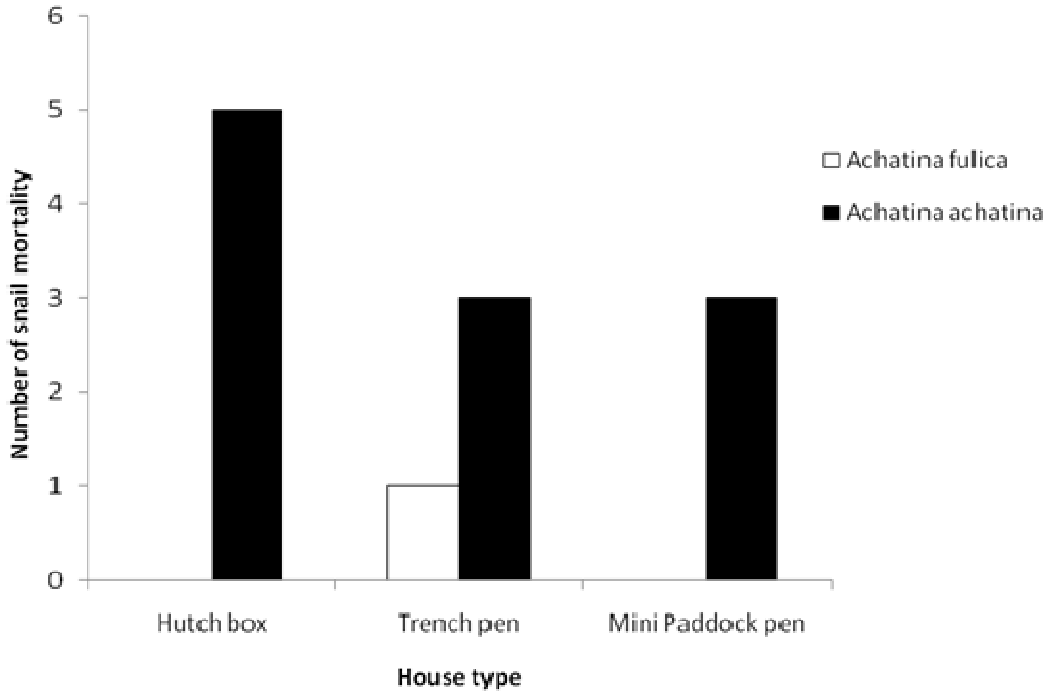

Figure 2. Mortality in snails subjected to the housing treatments.

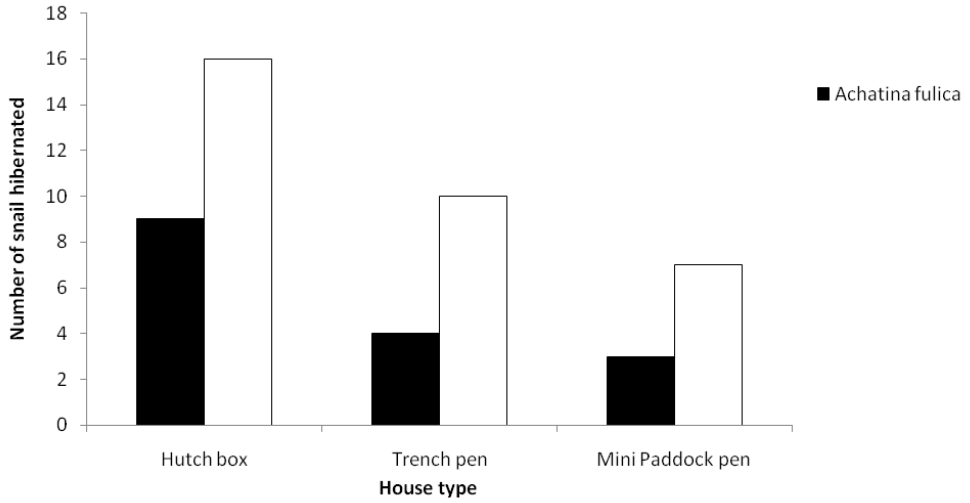

Figure 3. Hibernation in snails subjected to three housing treatments.

both snail species.

CONCLUSION

The study reveals that, though housing has a modification on their internal temperature and humidity with respect to ambient, this modification is not enough to bring about a significant difference in the growth parameters of Achatina fulica. However, this modification has a significant influence on the growth performance of Achatina achatina and as such Treatment C (Mini-paddock pen) should be used for rearing them to boost performance.

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Appendix Tables

Table 5a. Cost of construction of a hutch box(Treatment A).

Item	Description	Quantity	Price
1	5 x 7 x 488 cm timber	1.5	N 1350
2	2.5 x 30 x 366 cm wooden board	1	N 700
3	Nylon mesh	1.0 m	N 350
4	Wire gauze	1.0 m	N 600
5	Nails (2.5 and 7.5 cm)	0.5 kg	N 150
6	Labour	1 person-day	N 700
Total			N 3850

Table 5b. cost of construction of a raised trench pen (Treatment B).

`Item	Description	Quantity	Price
1	Sandcrete blocks (6 inches solid)	8	N 1040
2	Nylon mesh	1.0 m	N 350
3	Wire gauze	1.0 m	N 600
4	2.5 x 5 x 330 cm timber	1	N 300
5	Nails (5cm)	0.5 kg	N 150
6	Cement	¼ bag	N 425
7	Labour	1 person-day	N 1000
Total			N 3865

Table 5c. Cost of construction of a Mini paddock pen (Treatment C).

Item	Description	Quantity	Price
1	Nylon mesh	2.0 m	N 700
2	Wire gauze	2.0 m	N 1200
3	2.5 x 5 x 330 cm timber	2	N 600
4	Nail (4 cm)	0.5 cm	N 150
5	Nail (1.5 cm)	0.75 cm	N 225
6	Labour	1 person-day	N 700
Total			N 3575