

EFFECT OF CHANGES IN RELATIVE HUMIDITY AND AMBIENT TEMPERATURE ON HATCHABILITY OF AFRICAN GIANT LAND SNAILS (*ARCHACHATINA MARGINATA*) REARED UNDER INTENSIVE MANAGEMENT DURING DRY SEASON

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ABSTRACT

Forty eight growing African Giant Land Snails (*Archachatina marginata*) with average weight of 400 to 600g were used to evaluate the effect of relative humidity and temperature on egg hatchability. The experiment lasted for 20 weeks (December-April) with eight snails per cage. Higher average daily temperature (31⁰C) was observed in the afternoon (12pm) compared with the 8am in the morning (22⁰C) while, the average relative humidity (92%) was recorded in the morning 8am compared with (61%) in the afternoon (12pm). A zig-zig egg laying pattern was observed across all the cages throughout the experimental period which suggest that snails observed a break period in egg laying. Fluctuation in relative humidity and temperature had a great influence on egg hatchability of *A. marginata*. For optimum egg production and hatchability, relative humidity of above 80% and temperature 25–30⁰C are recommended. There was no significant difference ($p>0.05$) in the number of eggs incubated, hatched eggs and % hatchability of experimental snails across the cages. It was concluded that snails provided with high humid condition during dry season can attain optimum reproductive performance in terms of hatchability under intensive management system.

Keywords: Snails, relative humidity, temperature, hatchability, dry season and egg production

INTRODUCTION

Success in snail production involves proper and optimum environmental condition that can meet its growth and reproductive requirements. The major environmental factors affecting Giant African Snails are temperature, photoperiod, humidity, water, space/transpecific competition, soil, shelter and food (Nnodim and Ekpo, 2019). The cyclic biological mechanism of activeness of snail during wet season and inactiveness in the dry season was as a result of changes in moisture and relative humidity in a year. Dryness inhibits growth and even stops activity of snails (Oyeagu *et al.*, 2022). The center for heliculture recommended 65-75 % humidity during the day and 85-95 % at night at 20°C. In any event, humidity higher than 95% should be avoided. Excessive humidity can kill snails. The percentage cumulative body weight gain of *Archachatina marginata* that is raised under very high humidity was highest when compared to medium and low levels of humidity (Oyeagu *et al.*, 2022). For commercial productions, eggs must be produced throughout the year. If aestivation can be prevented, production of snails is likely to increase during the dry season. Domestication and intensive management of the edible land snail is inevitable in order to combat the great demand on the conventional animal protein food leading to their exorbitant prices and thus becoming unaffordable to some average Nigerians (Onunkwo *et al.*, 2019). Temperature and relative humidity can adversely affect the egg hatchability (Ibom, 2009). Though, research in the tropics on climate change has focused more on crops, less on livestock and little on biodiversity conservation. This study was therefore, sought to identify the effect of immediate relative humidity and temperature on snail reproductive performance (in terms of egg production and hatchability) under intensive management system.

MATERIALS AND METHODS

The experiment was conducted at the Snailery unit of Bioresources Development Centre Ogbomoso, Oyo State, within the derived Savannah Zone of Nigeria. The agro-ecological description of the study area has been documented by Oguntoyinbo (1988). The rainy season is between April – October and dry season between November – March with annual rainfall range of 1680 – 1700mm (Breinholt *et al.*, 1981). African giant land snails (*Archachatina marginata*) were used in the experiment. The

growing snails were purchased from Iresapa Market around Ogbomoso and used for the study which lasted for 5 months (December-April). Wood shavings collected from sawmill around was sterilized and used as the rearing medium. Sterilization was done using hot water treatment. Water was heated to 100°C and then poured into the medium (wood shavings) to its level in the drum and left for an hour on fire. The water was later drained after cooling. Then the sterilized wood shavings was spread into the experimental pen as bedding and filled up to 5cm depth. The snails were characterized and separated into various pen tagged with cardboard paper as labels. The snails were fed with the natural diet (vegetables) and acclimatized for two weeks before the commencement of the experiment. The pens were kept cool by sprinkling with water to prevent dryness. The temperature and relative humidity of the ambient environment in morning and afternoon was monitored using Omsons dry and wet hygrometer. After acclimatization, the snails were fed *ad-libitum* with vegetables (moringa leaves, pawpaw fruit and pawpaw leaves) supplemented with concentrate diet (layers mash) thrice in a week and were provided clean water in the morning (between 8am-9am). The bedding materials were changed monthly. The feed was moistened before supply to allow for easy ingestion and to prevent respiratory difficulty that can be caused by dusty feed. Eggs produced by the snails were collected weekly per cage and incubated in a pen with sawdust for appropriate observation and assessment for the period of 28-32 days. The hatched eggs were recorded and the % hatchability was calculated. All data obtained for hatchability were subjected to Analysis of Variance (ANOVA) using SAS version 9.3.1. and the Duncan multiple range tests were used to detect significant differences among means.

Table 1: Composition of experiment diet (g/100 g)

Ingredients	Composition (%)
Maize	40.00
Groundnut cake	20.00
Wheat offal	31.75
Bone meal	5.00
Oyster shell	3.00
Vitamin premix	0.25
Total	100
Calculated analysis	
ME (Kcal/Kg)	2,474.53
Crude protein (%)	17.63
Ether Extract (%)	3.91
Crude fibre (%)	4.50
Calcium (%)	2.98
Phosphorus (%)	0.93
Cost/Kg of feed (₦)	100.00

RESULTS AND DISCUSSION

Inverse relationship occurred between relative humidity and temperature as shown in Figure 1. Relative humidity increases as temperature decreases. The time of day had effects on temperature and relative humidity. Higher average daily temperature was recorded in the afternoon (12pm) compared with the morning (8am). Average relative humidity was higher at 8am (morning) than 12pm (afternoon). This may account for snails' egg laying in cool time of the day during the observation. This agrees with report of Oyeagu *et al.*, 2022 that snails mated chiefly at night while egg laying usually occurs in the evening, night on warm days. Figure 2 shows the weekly egg production of the snails per cage. From this study, a zig-zig egg laying pattern was observed across all the cages throughout the experimental period which suggest that snails observed a break period in egg laying in which they rest (Figure 2). This suggest that snail adjust to prevalent climatic conditions in order to maintain homeostatic balance which affect nutrient utilization for other body functions such as egg production. Though there was production throughout the period, it was reduced at the period of high temperature and low relative humidity during the experiment. This is in line with the observation of (Bloszyk *et al.*, 2016) that growth and reproductive rates of snails

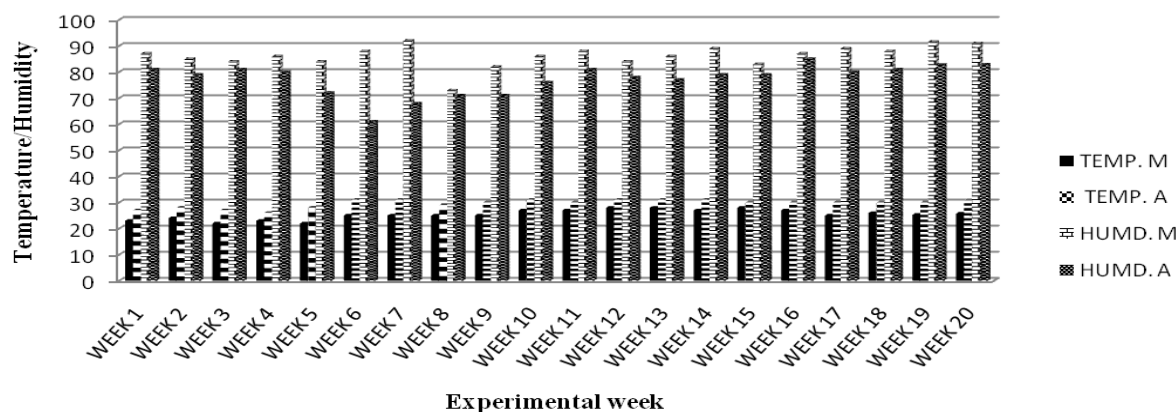


Figure 1: Effect of time of the day on temperature and humidity

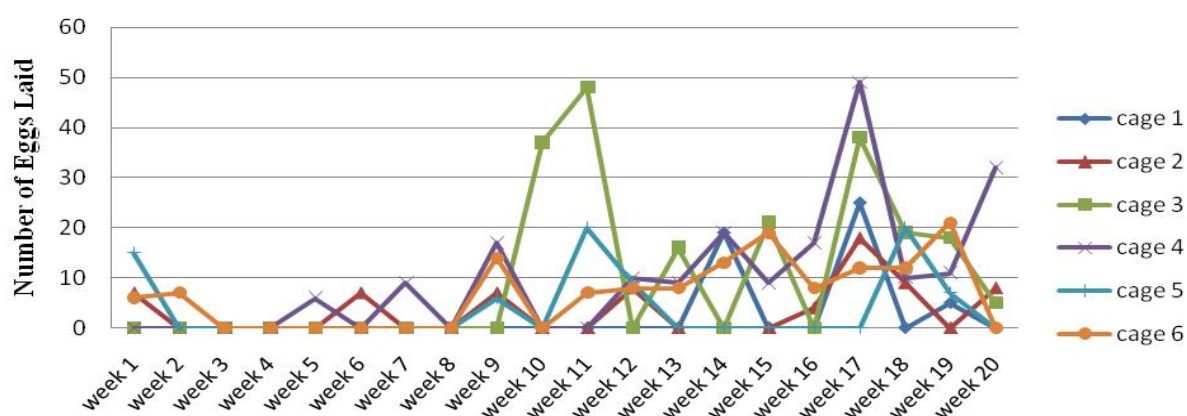


Figure 2: Weekly egg production of snails per cage

increase in the dry season when high humidity is provided. Oyeagu *et al.*, 2022 reported that snails can reproduce throughout the year if favourable humidity and adequate soil moisture are stimulated in the rearing unit and snails can be raised indoors at 21°C with relative humidity of 80% to 95%.

Table 2 shows the effect of temperature and relative humidity on egg hatchability. There was no significant difference ($p>0.05$) in the number of eggs incubated, hatched eggs and % hatchability of experimental snails across the cages. The number of incubated eggs of snails in cage 1 was higher than others, but not significantly different ($p>0.05$). Cage 6 had the highest number of hatched eggs (8.50) and % hatchability (73.00%). The average number of incubated eggs was 11.29 (6.80-14.00), while the average number of hatched eggs was 5.94 (3.80-8.50). It was observed that the percentage hatchability of the African Giant Land Snails raised under intensive management during dry season was 53% (41.67-

Table 2: Effect of temperature and relative humidity on egg hatchability

Parameters	Cage 1	Cage 2	Cage 3	Cage 4	Cage 5	Cage 6	SEM (±)	Probability
Incubated eggs	14.00	6.80	13.00	8.40	12.60	11.75	0.87	0.20
Hatched eggs	6.50	4.00	5.33	3.80	6.00	8.50	0.62	0.20
% Hatchability	42.80	63.00	41.67	47.60	44.40	73.00	4.30	0.11

^{a, b} means of different superscripts along the same row are statistically significant ($P < 0.05$).

SEM: Standard Error Of Mean

73.00%). The mean value of the incubated eggs (11.29) reported for this study was higher than the value (7.29) reported by Ukpong *et al.*, 2013. The authors carried out the effect of three feeding

treatments on hatchability of *A. marginata* under intensive management. The hatchability value obtained in this study is lower than the values (67.86% and 72.00%) reported by Ukpong *et al.*, 2013 and Ibom *et al.*, 2011, respectively. Okon *et al.*, 2009 reported lower mean percentage hatchability of 26.80% for black skinned ecotype and 22.80% for white skinned ecotype.

CONCLUSION

It was concluded that snails provided with high humid condition during dry season can attain optimum reproductive performance in terms of hatchability under intensive management system.

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