ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-5051 (Print)
ISSN: 2521-506X (Online)
CODEN: ASMCCQ

Acta Scientifica Malaysia (ASM)

DOI: http://doi.org/10.26480/asm.01.2025.09.12

RESEARCH ARTICLE

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

Taiwo Abiola Otunla*, Olu Faith Omolade, Abiodun Oluwasesan Olosunde, Osanaiye Folake Gloria and Olusegun Julius Oyedele

Bioresources Development Centre Ogbomoso, National Biotechnology Agency, Abuja, Klm 5, Iresaapa/Ogbomoso Road, Onipanu, Ogbomoso, Oyo State, Nigeria
****Corresponding Author Email: otunlataiwo@gmail.com***

ARTICLE DETAILS

Article History:

Received 10 May 2025
Revised 15 June 2025
Accepted 19 June 2025
Available online 02 July 2025

ABSTRACT

The objective of this study was to evaluate the effect of relative humidity and temperature on egg production and hatchability Forty eight growing African Giant Land Snails (*Archachatina marginata*) between average weight of 400 to 600 grams were used for this experiment, with eight snails per cage for a period of 20 weeks (December-April). Records of the temperature and relative humidity of the ambient environment of the snail cages were taken in the morning and afternoon using Omsons dry and wet hygrometer. Data obtained were subjected to descriptive statistics such as charts, percentages, and analysis of variance (ANOVA) with general linear model of SAS (2011) and Duncan's Multiple Range Tests were used to detect significant differences among the hatchability parameters. Lower average daily temperature (22^{0}C) was observed in the morning (8am) compared with the 12pm in the afternoon (31^{0}C) while, the average relative humidity (61%) was obtained in the afternoon (12pm) compared with (92%) was recorded in the morning (8am). A zig-zig egg laying pattern across all the cages throughout the experimental period suggested that snails observed a break period in egg laying. Egg production and hatchability of *A. marginata* were greatly influenced by the fluctuation in relative humidity and temperature. Relative humidity above 80% and temperature 25–30^{0}C are recommended for optimum egg production. There was no significant difference (p>0.05) in the number of eggs incubated, hatched eggs and percentage 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 egg production and hatchability under intensive management system.

KEYWORDS

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

1. INTRODUCTION

Giant African Land Snails is one of the prominent snail species found extensively in the Southern parts of Nigeria and West African coastal area, South and Central Africa, with favourable weather for proliferation (Herbert and Kilburn, 2004). Proper and optimum environmental condition required for growth and reproductive performance of snail must be met for successful snail farming industry (Ezemonye et al., 2018). Some of the major environmental factors affecting Giant African Snails are temperature, humidity, water, photoperiod, seasonal fluctuations, space/transpacific competition, food, soil and shelter (Adewumi et al., 2019; Nnodim and Ekpo, 2019; Opara et al., 2020; Abdulazeez et al., 2025). The result of changes in moisture and relative humidity in a year is the wet season cyclic biological mechanism of activeness and the dry season inactiveness of snails. The period of dryness inhibits growth and productivity of snails, thereby reducing egg production (Adewumi et al., 2019; Oyeagu et al., 2022).

Studies carried out on the effects of environmental factors on productivity of snails showed that temperature and humidity significantly impact growth and production of snails. Temperatures ranging from 24^{o}C to 31^{o}C and relative humidity of 60-80% were recommended for optimal growth and reproduction of snails (Opara et al., 2020; Pokryszko et al., 2020). The center for heliculture recommended 65-75 % humidity during the day and 85-95 % at night. Humidity higher than 95% can kill snails and should be avoided. 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). There must be production of eggs by snails throughout the year for commercial production. Egg production during the dry season can be increased by preventing snail aestivation. Commercial rearing of *Archachatina marginata* is recommended for both late dry and early wet seasons, by replicating their natural environment and required food sources (Abdulazeez et al., 2025).

In order to meet the great demand for non-conventional animal protein and making it affordable for average Nigerians, domestication and intensive management of the edible land snail is inevitable Nigerians (Onunkwo et al., 2019). Animal protein intake can be increased through exploiting the potentials of non-conventional animal protein sources like snail. *Archachatina marginata* can serve as a readily available and cheap source of animal proteins for the humans populations where it is thriving widely (Ngoupayou, 1992). Though, research in the tropics on climate change has focused more on crops, less on livestock and little on biodiversity conservation of snails (Oyeagu et al., 2020). This study was therefore, sought to identify the effect of immediate relative humidity and temperature on snail reproductive performance (in term of egg production and hatchability) under intensive management system.

Quick Response Code	Access this article online	
	Website: www.actascientificamalaysia.com	**DOI:** 10.26480/asm.01.2025.09.12

Cite The Article: Taiwo Abiola Otunla, Olu Faith Omolade, Abiodun Oluwasesan Olosunde, Osanaiye Folake Gloria and Olusegun Julius Oyedele (2025). Effect of Changes in Relative Humidity and Ambient Temperature on Reproductive Performance and Egg Hatchability of African Giant Land Snails (Archachatina Marginata) Reared under Intensive Management During Dry Season. *Acta Scientifica Malaysia, 9(1): 09-12.*

2. MATERIALS AND METHODS

2.1 Experimental Site

The research work carried out 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).

2.2 Source of Experimental Animal and Management

Growing African giant land snails (*Archachatina marginata*)) were purchased from Iresapa Market around Ogbomoso and used for the study which lasted for 5 months (December-April). Wood shavings collected from sawmill were sterilized and used as the medium for rearing the snails. Hot water treatment was used for the sterilization of the wood shavings. Water was heated to 100^{o}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. The sterilized wood shavings were then spread into the experimental pen as bedding, filling up to 5cm depth. The snails were characterized and separated into various pen tagged with cardboard paper as labels. The snails were fed with vegetables and acclimatized for two weeks before the commencement of the experiment. The pens were kept cool by sprinkling with water to prevent dryness and the bedding materials were changed monthly. The temperature and relative humidity of the ambient environment in morning and afternoon was monitored using Omsons dry and wet hygrometer.

2.3 Experimental Diet Composition

After acclimatization, the snails were fed *ad-libitum* with vegetables (moringa leaves, pawpaw leaves fruit and pawpaw fruit) supplemented with concentrate diet – layers mash (Table 1) thrice in a week and were provided clean water in the morning (between 8am-9am). The feed was moistened before supply to allow for easy ingestion and prevention of respiratory difficulty that can be caused by dusty feed.

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 (N)	100.00

2.4 Data Collection

Their reproductive performance records were taken in terms of egg laying (weekly egg clutches per cage). 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.

2.5 Statistical Analysis

Data obtained were subjected to descriptive statistics such as charts and percentages. All data obtained for hatchability were subjected to Analysis of Variance (ANOVA) using general linear model and the Duncan's Multiple Range Tests were used to detect significant differences among hatchability parameters (SAS, 2011).

3. RESULTS

Figure 1 presents the effect of time of the day on temperature and humidity. 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).

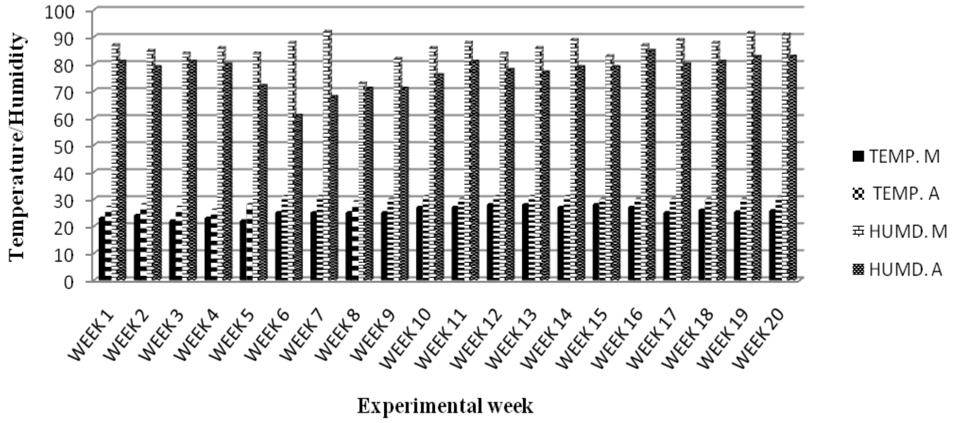

Figure 1: Effect of time of the day on temperature and humidity

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. Fluctuation in relative humidity and temperature had a great influence on egg production of *A. marginata*; with almost all the snails producing eggs during stable relative humidity and temperature.

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% (41.67-73.00%).

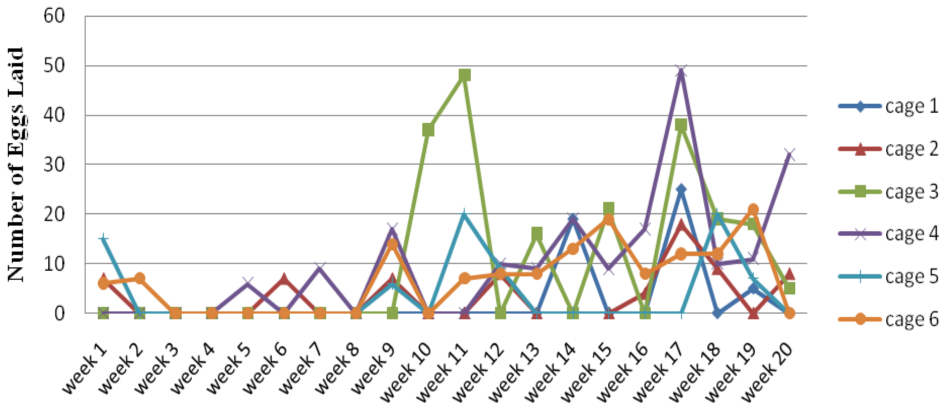

Figure 2: Weekly egg production of snails per cage

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

4. 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 that snails mated chiefly at night while egg laying usually occurs in the evening, night on warm days (Oyeagu et al., 2022).

The zig-zig egg laying pattern observed across all the cages throughout the experimental period was an indicator that snails observed a break period in laying egg while resting (Figure 2). Fluctuation in relative humidity and temperature had a great influence on egg production of *A. marginata*; with almost all the snails producing eggs during stable relative humidity and temperature. Snails adjust to prevalent climatic conditions in order to maintain homeostatic balance required for nutrient utilization for egg production and other body functions. Production of eggs reduced during the period of high temperature and low relative humidity during this experiment. This is in line with the reports that growth and reproductive rates of snails increase in the dry season when high humidity is provided (Bloszyk et al., 2016; Abdulazeez et al., 2025). This is consistent with previous research, which reported that snails can reproduce throughout the year in favourable humid environments; optimal food availability and adequate soil moisture are stimulated in the rearing unit (Imevbore, 1990; Oyeagu et al., 2022). They agreed that snails can be raised indoors at 21°C with relative humidity of 80% to 95% (Oyeagu et al., 2022).

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 experiment on 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, respectively (Ukpong et al., 2013; Ibom et al., 2011). The hatchability of eggs (%) of *A. marginata* reared under different stocking rates (75.00-97.30%) reported was higher the values reported for this study (Oyeagu et al., 2020). They reported lower mean percentage hatchability of 26.80% for black skinned ecotype and 22.80% for white skinned ecotype (Okon et al., 2009).

5. Conclusion

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

References

Abdulazeez, G. O, Kareem, K. O., Mohammed, A. A. and Asiyanbik, A., 2025. Evaluation of the seasonal effects on laying performance of African Giant land snails, (Archachatina marginata), (Achatina achatina) and (Achatina fulica), in captivity. International Journal of Organic agricultural Research and Development, 20 (1), Pp. 80-85.

Adewumi, A. A., Oyedele, D. J. and Omitoyin, B. O., 2019. Reproductive biology of Achatina achatina. Journal of Molluscan Studies, 85 (2), Pp. 147-155.

Amubode, F. O. and Ogogo, A. U., 1994. Performance of snail (A. Marginata) fed with varying levels of calories-protein supplementary diets Nigerian Journal of Forestry, 24 (1 and 2), Pp. 34-43.

Bloszyk, J., Kacprowicz, J. and Ksiazkiewicz-Parulska, Z., 2016. Notes on the activity of the Roman snail (Helix pomatia L.). Folia Malacologia, 24 (2), Pp. 103-106.

Breinholt, K. A., Gowen, F. A. and Nwosu, C. C., 1981. Influence of Environmental and Animal Factors on Day and Night Grazing Activity of Imported Holstein Freisian Cows in the Humid Lowland Tropics of Nigeria. Tropical Animal Production, 6 (4).

Ezemonye, L. I., Ewere, E. and Oghenegweke, E. E., 2018. Snail ecology and environmental preferences. Journal of Environmental Science and Health, Part B, 53, Pp. 137-144.

Herbert, D. and Kilburn, D. 2004. Field Guide to the Land Snails and Slugs of Eastern South Africa. Natal Museum: Pietermaritzburg. South Africa. Pp. 336.

Ibom, L. A., 2009. Variations in Reproductive and Growth performance traits of white skinned x black skinned African Giant Snail hatchlings (Archachatina marginata (Swainson) in Obubura, Nigeria. Ph.D. Thesis. Department of Animal Science, University of Calabar, Calabar, Nigeria.

Ibom, L. A., Okon, B. and Adinya, I. B., 2011. Evaluation of Growth and Body traits of snailets obtained from the crossbreeding of black skinned x white skinned snails (Archachatina marginata) in the Niger Delta area of Nigeria. African Journal of Agricultural Research. 6 (21), Pp. 4962-4972.

Imevbore, E.A. (1990). Management techniques in rearing the African giant land snail Archachatina marginata swainson. Ph.D. Thesis University of Ibadan, Ibadan, Nigeria.

Ngoupayou, D., 1992. Guinea pig raising for meat production. Proceedings of Seminar Research on Feed and Feeding Summary, Pp. 15–19.

Nnodim, A. U. and Ekpo, S. U., 2019. Factors Constraining Commercial Farming of Snail among Farmers in Rural Areas of Rivers State. International Journal of Rural Development, Environment and Health Research, 3 (5), Pp. 151-157.

Oguntoyinbo, J. S., 1988. Climate. In: Oguntoyinbo, J. S., Areola, O .O.and Filani, M. O. (eds). Geography of Nigeria Development,Heinemann Nigeria Ltd, Ibadan; 1988, Pp..78.

Okon, B., Ibom, L. A., Williams, M. E. and Akpakpan, I. E., 2009. Comparative evaluation of reproductive performance and some egg quality parameters of black and white skinned snails. Global Journal of Agricultural Science, 8 (1), Pp. 77-80.

Onunkwo, D. N., Anyaegbu, B. C., Ezike, J. C. and Daniel-Igwe, G., 2019. Dietary substitution of soya bean meal with processed African yam bean meal as protein source in the diets of finisher broilers. Nigerian Journal of Animal Production, 46 (2), Pp. 118 – 127.

Opara, S. N., Udeh, I. E. and Nwosu, C. E., 2020. Optimal temperature and humidity ranges for egg laying in Archachatina marginata. Journal of Agricultural Science and Practice, 10 (1), Pp. 1-8.

Oyeagu, C. E., Omumuabuike, J. N., Adetunji, A. T. and Lewu, F. B., 2022. Effect of Different Humidity Levels on weights of Reproductive Organs and Growth Traits of Archachatina marginata Snails. International Conference on “Chemical, Biological and Environmental Engineering” (ICCBEE-22) November 28-29, 2022, Johannesburg (South Africa), Pp. 40-44.

Oyeagu, C. E., Uberu, N. P. and Lewu, F. B., 2020. Reproductive Traits, Growth Performance, and Economic Efficiency of Archachatina marginata Snail under Captive with Different Stocking Density. 18th South Africa International Conference on Agricultural, Chemical, Biological and Environmental Sciences (ACBES-20) November 16-17, 2020 Johannesburg (SA), Pp. 371-377.

Pokryszko, B. M., Auffenberg, K. and Hlaváč, J. Č., 2020. Gastropod mollusks: A review of their systematics, biology, and ecology. Journal of Molluscan Studies, 86 (1), Pp. 1-13.

SAS, 2011. SAS Version 9.3. Procedure Guide. SAS institute Inc., Cary, NC, USA.

Ukpong, E. E., Jacob, D. E., Ekpa, N. E. and Nelson, I. U., 2013. Hatchability and Morphometric Growth Rate of African Giant Land Snail (Archachatina Marginata) under Three Feeding Treatments. Journal of Bioprocess Technology, 97, Pp. 189-192.

Cite The Article: Taiwo Abiola Otunla, Olu Faith Omolade, Abiodun Oluwasesan Olosunde, Osanaiye Folake Gloria and Olusegun Julius Oyedele (2025). Effect of Changes in Relative Humidity and Ambient Temperature on Reproductive Performance and Egg Hatchability of African Giant Land Snails (Archachatina Marginata) Reared under Intensive Management During Dry Season. *Acta Scientifica Malaysia, 9(1): 09-12.*