Reproductive and Growth Performance of the Cricetoma (*Cricetomys gambianus*) under Captivity

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Summary

*Studies were conducted on the reproductive and growth performance of the cricetoma (*Cricetomys gambianus*) under captivity in Dschang, Cameroon from January 1999 to March 2002. A total of 80 newborns recorded from 25 births of 28 giant rats (10 males and 18 females) were used in the study. No births were recorded for the heavy rainy season months (June, July and August) while the highest number of births were recorded in the dry season months of January, April and November to December. The age at sexual maturity for males and females was 7 and 7-8 months respectively. The gestation length, sex ratio (male/female), litter size and preweaning mortality were 30.0 ± 1.58 d, 1.2/1, 3.2 ± 0.19 and 42.50% respectively. There was a linear increase of the mean litter size with parity. Mismothering and cannibalism as causes of mortality amounted to more than half of the percentage of total causes while more than 80% of the mortalities recorded were in the first ten days of birth (stillbirth inclusive). The weaning and mature weights for males was significantly (P< 0.05) higher than for females while no significant (P> 0.05) differences were observed in the mean daily weight gains from birth to weaning and to 12 months of age. The results reveal that considerable improvements in productivity for these species could be achieved with a reduction in preweaning mortality.*

Résumé

Performances de reproduction et croissance du cricétome (*Cricetomys gambianus*) en captivité

*Les études ont été conduites sur les performances de croissance et reproduction du cricétome (*Cricetomys gambianus*) en captivité à Dschang au Cameroun de janvier 1999 à mars 2002. Un total de 80 ratons issus de 25 mises-bas de 28 cricétomes (10 mâles et 18 femelles) ont été utilisés dans cette étude. Aucune naissance n'a été enregistrée au cours de la saison d'intense précipitation (juin, juillet et août) alors que le maximum de naissance a été enregistré pendant la saison sèche durant les mois de janvier, avril et de novembre à décembre. L'âge à la maturité sexuelle pour les mâles et femelles était de 7 et de 7-8 mois respectivement. La durée de gestation, le sexe ratio (mâle/femelle), la taille de la portée et le taux de mortalité avant le sevrage étaient de 30,0 ± 1,58 jours; 1,2/1; 3,2 ± 0,19 et 42,50% respectivement. Il y a eu une augmentation linéaire de la taille de portée avec les mises-bas. La défaillance maternelle et le cannibalisme étaient les principales causes de mortalités et étaient à l'origine de la moitié de la mortalité totale enregistrée alors que 80% de la mortalité étaient observés pendant les 10 premiers jours de naissance (mort-nés inclus). Le poids au sevrage et à la maturité des mâles était significativement (P< 0,05) supérieur à ceux des femelles alors qu'aucune différence significative (P> 0,05) n'était observée dans les gains moyens quotidiens de la naissance au sevrage et à 12 mois d'âge. Les résultats révèlent qu'une amélioration considérable de la productivité de ces espèces peut être réalisée avec la réduction du taux de mortalité avant sevrage.*

Introduction

Although comprehensive data are not yet totally available, the importance of bush meat in the diet of African population particularly those of the forest and savannah zones, is well established (1). The high demand from towns for these animal species for food has sometimes led to their overexploitation. There has been therefore an increase interest in the production of species known as minilivestock which are little known or entirely unknown in developed countries.

However, a main drawback to minilivestock development is the ignorance by most governments, universities, research institutions and developers of the minilivestock potentialities hence the reluctance to support this sector as a component of the rural development in the tropics (2, 3). This has often reduced the impact of these species on the quality of life of many resource-poor rural dwellers.

One of the most popular species is the cricetoma (*Cricetomys gambianus* Waterhouse). It is eligible for domestication because of its small size, adaptation to the local environments and limited requirements for land and feeding. As opposed to the grasscutter

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(*Thryonomys*), cricetomas are more suited for these environments due to their shorter gestation duration and comparatively higher litter sizes, which means that very probably the total kg meat produced by year and by adult female could be higher with cricetoma than with the grasscutter. The animal is therefore appropriate for landless people or back-yard production (3, 4). In fact, the cricetoma has for a long time been accepted as a protein source in many African countries (5, 6, 7, 8, 9).

The rational production of any species supposes a better understanding of physiological processes governing its production and productivity. Although several schemes have been initiated on the domestication of the cricetoma (*Cricetomys gambianus* Waterhouse) in countries like Nigeria (10), Democratic Republic of Congo (7) and indeed in Cameroon (8), more emphasis has been paid to their utilisation of local feedstuffs as well as their aetiology. Very little is therefore known on the reproductive and growth performance of the animal.

The objective of the present study is to investigate the reproductive performance of the cricetoma under captivity.

Material and methods

Study site

The study was conducted at the teaching and research farm of the University of Dschang. Dschang is situated in the western highlands of Cameroon which is in the sudano – guinean zone (latitude 5 - 7 ^{o}N, longitude 8 - 12 ^{0}E). The mean annual temperature and relative humidity are 16 - 17 ^{0}C and 49 – 97% respectively. The mean annual rainfall is about 2000 mm with the wet season ranging from March to November and the dry season from late November to March.

Experimental animals

Between January 1999 and March 2002, 28 cricetomas made-up of 10 males and 18 females were caged in identical wire rabbit type cages of 0.45 sq. metres and height of 0.26 m (L-0.97 m, W-0.46 & H-0.26 m) per animal. Animals were allowed to mate naturally by introducing the females in the cages of the males. A total of 80 new-borns recorded from 25 births were observed within this period of the study.

Animal management

According to availability and acceptability, animals were fed normal feedstuffs that they were known to consume in the wild such as tubers (cassava, sweet and irish potato), grains (common beans, soybean and groundnuts), fruits (ripe bananas, plantains, papaw, guava, pumpkin, pears and palm nuts) and kitchen wastes (banana peels, waste bread). Diurnal feeding was adopted and animals were watered *ad libitum*.

Data collection and analysis

Data on birth weights were taken within 12 hours after delivery using an Ohaus-Triple beam balance (700-800 series) precise to 0.1 g. The litter size and sex were also recorded. The age at puberty and gestation lengths were collected while liveweight changes were recorded monthly (using the above mentioned scale) except for the weaning weights which were recorded at the presumed weaning time of three weeks. Data on the mortalities were recorded when they occurred. Data on the mean daily weight gains prior to weaning and for a period of twelve months were subjected to the one way analysis of variance while significant means were separated using the Duncan's multiple range test (11). Mean values for the other parameters were computed. The liveweight changes and the relationships between mean litter size and parity as well as the monthly distribution of births were represented graphically.

Results

Reproductive performance

Table 1 summaries some mean reproductive performance data of cricetomas.

Table 1

Some reproductive performance characteristics of cricetomas under captivity

Parameters	Males	Females	Average
Age at sexual maturity (Months)	7	7-8	–
Gestation length (days)	–	30.0 ± 1.58	–
Litter size	–	–	3.2 ± 0.19 (25)*
Sex ratio (male/female)	1.2	1	–
Preweaning mortality (%) (0- 21 days)	–	–	42.50 (34)

* Values in parenthesis represent the number of observations.

The age at puberty for males was 7 months while that for females was 7- 8 months. Meanwhile the gestation length had a mean value of 30.0 ± 1.58 days. Sex ratio between males and females was 1.2: 1 while the mean litter size for both sexes was 3.2 ± 0.19. The percentage preweaning mortality for the presumed weaning period of 21 days was 42.50%.

Table 2 shows results for the distribution of litter sizes as a function of parity. Results show that more than 50% of the total births were within the first and second parities with the second recording the highest number of births (10 animals).

Table 2

Distribution of litter sizes of cricetomas under captivity as a function of parity

	Litter size						
	1	2	3	4	Total	Total number of young	% Total born
Parity							
1	1	1	2	2	6	17	21.25
2	1	2	3	4	10	30	37.50
3	–	–	2	2	4	14	17.50
4	–	–	1	2	3	11	13.75
5	–	–	–	2	2	8	10
Total	2	3	8	12	25	80	100
% of total litter	8.0	12.0	32.0	48.0	100		

When consideration is given to litter sizes, the litter size of 4 recorded the highest number of births and this was about half (48%) of the percentage of total litter. There was an increasing tendency of litter size with increasing parity as reflected in figure 1 where there is a linear relationship between increasing parity and mean litter size.

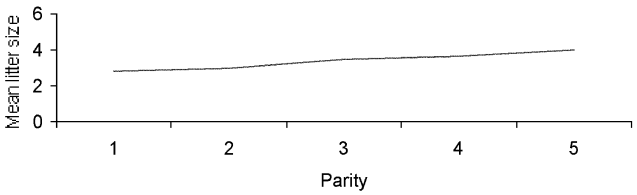

Figure 1: Evolution of litter size as related to parity.

Figure 2 shows the monthly distribution of births for the period of study. There were no births between the months of June and August. Meanwhile January and April recorded the highest number of births of 5 and 4 respectively. Identical numbers of 3 births were observed for October, November, December and May.

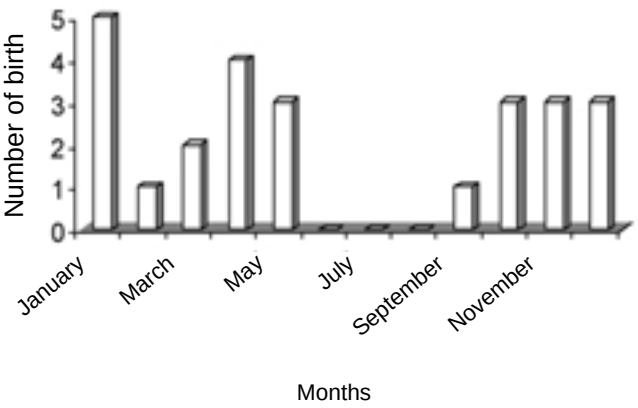

Figure 2: Monthly distribution of birth in cricetomas.

Growth performance

Table 3 shows values for sex differences in the growth performance of the cricetoma.

Table 3

Growth performance (grams) of the cricetoma under captivity according to sex

	Sex		
Parameters	Males	Females	Average
Birth weight	21.18 ± 1.200[a] (8) *	19.43 ± 0.603 [a] (8)	20.43 ± 1.297 [a] (16)
ADWG from birth to weaning (3 weeks)	4.35 ± 0.40[a] (12)	3.47 ± 0.38[a] (11)	3.90 ± 0.40[a] (23)
ADWG from birth to 12 months (grams)	4.31 ± 0.23 [a] (8)	4.01 ± 0.267 [a] (8)	4.18 ± 0.270 [a] (16)
MWW (3 weeks)	222.00 ± 98.24 [a] (12)	211.70 ± 72.21[b] (11)	217.15 ± 84.47 [b] (23)
MMW at 12 months	1573.15 ± 83.95 [a] (8)	1463.65 ± 98.55 [b] (8)	1525.70 ± 98.54[a] (16)

a, b means bearing different superscripts within the same row differ significantly (P< 0.05).

*Values in parenthesis represent the number of observations.

The mean birth weight for males, females and average of both sexes were 21.18 ± 1.20 g, 19.43 ± 0.60 g and 20.43 ± 1.3 g respectively. Average daily weight gain (ADWG) from birth to weaning followed a similar trend with males having a higher value of 4.35 ± 0.40 g/day than females 3.47 ± 0.38 g/day while 3.90 ± 0.40 g/day was recorded for both sexes. The same trend was also observed for the ADWG from birth to maturity (12 months). No significant differences (P> 0.05) were observed between these values.

Males recorded a significantly (P< 0.05) higher mean weaning weights (MWW) of 222.00 ± 98.24 g than females (211.70 ± 72.21 g). For the MMW, significant

differences (P< 0.05) were only observed between the sexes with males recording a higher value (Figure 3).

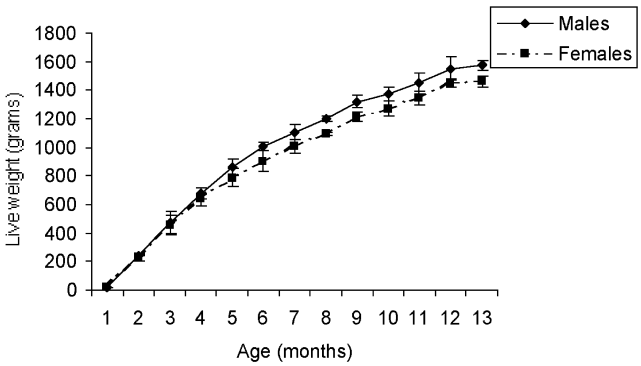

Figure 3: Live weight changes in cricetomas under captivity.

Pre-weaning mortality

Table 4 shows the neo-natal mortality and associated causes as reflected by the age. The highest mortality was within the first ten days which represented about two-thirds of the total number dead animals without considering stillbirths. After this period there was an increasing tendency of the animals to survive with increasing age.

For the causes of mortality mismothering and cannibalism represented more than half of the total number of causes followed by stillbirths which were about one-fifth of the causes.

Discussion

The age at sexual maturity of 7- 8 months for males and females are similar to figures reported by Ajayi (5) and NRC (2). The gestation length in this study is slightly higher than the value of 28 days reported by Ajayi (5) but within the range of 28- 42 days published by NRC (2) and in conformity with the observations of Malekani (9). The sex ratio of 1.2 males to 1 female reported in this study is similar to that of Ajayi (5).

The litter sizes recorded in the present study were also similar to previous reports (2, 5) although they were two litter sizes of up to 5. However the most frequent litter size observed in this study (four) was similar to that recorded by Ajayi (5). The linear increase of litter size with parity observed in cricetoma has also been reported in other species such as goats (12). The monthly distribution of births for the cricetoma in this study highlights the possible seasonality in the breeding behaviour of cricetoma as seen in figure 1. The absence of any births for the heavy rainy season months of June, July and August under captivity could suggest the natural synchronisation of breeding to birth occurring when the young have the greatest chances of survival. Since in the wild the animal lives in burrows, it could therefore be very natural for birth to occur when there are the least chances for flooding of their burrows as these can kill the young. High rainfall within this period may also have affected their movements and consequently their breeding habits. During this period, severe rainfall and run-offs have sometimes caused the animals to stay in their burrows and the limited time available for going out of it may have been allocated to foraging for food.

This observation is contrary to the observations made by Ajayi (5) who reported a year round breeding. The probable explanation for this is that while he worked with third generation animals who may have lost the survival instinct because of conditions under captivity, those of this study were of the first generation under captivity. They could therefore not have lost this instinct.

Values for the birth weights are within the range of 16.0 - 28.0 g reported by Ajayi (5). He however did not consider sexes in his study for birth weight.

Although, there was no significant difference in the ADWG between the sexes, the initial advantage of birth weight for males was reflected in the MWW where there was a significant difference between males and females. This observation corroborates with previous findings (5) with the existence of a high

Table 4

Neo-natal mortality of cricetomas under captivity distributed as a function of age and causes

	Age (Days)						
	0	1-10	11-20	21	Total	% of Total causes	% of Total born
Causes of mortality							
Stillbirth	7	–	–	–	7	20.60	8.75
Mismothering	–	7	2	–	9	26.47	11.25
Cannibalism	–	9	2	–	11	32.35	13.75
Accident	–	4	–	–	4	11.76	5.00
Unspecified	–	1	–	2	3	8.82	3.75
Total	7	21	4	2	34	100	42.50
% of Total dead	20.60	61.76	11.76	5.88	100		

positive correlation of 0.86 between birth weight and weaning weights.

The 4.18 ± 0.27 g value for the ADWG from 0-12 months for both males and females is higher than the values reported by Fonweban and Njwe (8) for cricetomas fed four different experimental rations. The value reported in this study is however lower than those recorded in Nigeria for the same species using different commercial rations (10,13,14). The differences in value between the present study and previous reports is probably because animals in this study were fed normal feedstuffs that they consumed in the wild whereas the other studies focussed on feed utilisation using manufactured diets.

Mean mature weight for males, females and average for both sexes in the present study are higher than values reported earlier by other workers (5, 8, 10).

The neo-natal mortality for this study is higher than observations of Ajayi (5) who recorded a value of 40.7%. This author however, attributed pre-weaning mortality to cannibalism exclusively while, in the present study mismothering and stillbirths were also recorded as major causes of mortality.

From this study, it was not clear whether increase in litter size was related to increase in preweaning mortality. A clear picture of this relationship could not be established since as earlier stated, two-thirds of the causes of death in this study were attributed to mismothering and cannibalism. As earlier stated by other worker (5), cannibalism is the greatest single factor affecting preweaning mortality of the AGR and the phenomenon of cannibalism did not appear to follow any fixed pattern. It was however observed in this study that cannibalism and mismothering (which usually amounted to refusal of suckling) against the young will ensue after bare hand manipulation of day-old new-borns.

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