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EFFECT OF VARIATION IN TEMPERATURE AND RELATIVE HUMIDITY ON THE REPRODUCTIVE PERFORMANCE OF GRASSCUTTERS HELD IN CAPTIVITY

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ABSTRACT

This study investigated the reproductive performance of grasscutter through oestrus, mating, parturition, abortion and litter size in establishing the success of this performance during the rainy season and dry season. Effects of the atmospheric temperature and relative humidity on the reproductive performance of grasscutter in captivity were duly observed. Twenty female grasscutters were used with ten males for mating and were subsequently individually caged to determine the outcome of male-female contact (i.e. mating, conception and parturition). The signs of mating were detected by observing the marks of climbing at the back of the female grasscutter (doe),observing the changes in the perineum of the female before and after mating, monitoring the changes in weight gained post-mating and presence of fetuses by abdominal palpation. Parturition was detected by monitoring the expectant mothers with successful mating signs and distended abdomens.

Keywords: Grasscutter, reproductive performance, reproduction, parturition, mating.

INTRODUCTION

Grasscutter is a harmless micro-livestock that belong to the order *rodentia* and sub-order Hystricomorpha, found in mangroves, swamps, rain forests and savanna areas of Africa. It is a monogastric herbivore that feed on several forages especially grasses, grains, legumes, root and tubers. It is a semi nocturnal animal that lives in colonies comprising of one male and several females with their young ones in their natural habitat. It is found mostly in West Africa (Ntiamoa-Badu, 1998), where it has been hunted aggressively for its meat (Yeboah and Adamu, 1995). Grasscutter may weigh up to 9 kg or more and may have a head and body length of up to 60 cm (Igbokwe, 2010). Indeed, the grasscutter is the second largest African rodent after the Porcupine (National Research Council, 1991).

As human activities expand into the grasscutter's native habitats, the animals likewise expanded from their habitats into the nearby farms and plantations, particularly the sugar cane plantations. Their tendency to adopt plantations as habitat, where they feed on agricultural crops such as maize, wheat, sugar-cane and cassava, often make farmers refer to them as agricultural pest.Grasscutters are prolific animals that attain sexual maturity at about five to six months and producing litters of up to eleven young. Domestication of theseanimals' offers an alternative to its poaching in the wild which alters their natural breeding activities and this gradually affects their numbers in the wild.

Climatic conditions affect animal performance (Birkelo *et al.*, 1991). Hot weather can strongly affect animal bioenergetics, with adverse effects on the performance and wellbeing of livestock. The reproductive seasonality is a phenomenon

influenced mainly by annual variations in the photoperiod, which increase the proportionally to latitude such that reproductive and non-reproductive seasons are well defined among seasonal species (Abecia *et al.*, 2012). However, in tropical regions, other ambient factors such as ambient temperature, relative air humidity, rain distribution, and nutrition also seem to have effects on reproductive physiology in seasonal animals (Rosa and Bryant, 2003). It has been recorded that seasonality variation has various effect in diverse performance in most domesticated animals ranging. Adaptation takes place continuously over the lifetime of an animal or over several generations, whereas seasonality has a well-known but complex effect on the reproductive physiology of the pig (Peltoniemi *et al.*, 2000; Gourdine *et al.*, 2006).

MATERIALS AND METHOD

Study Area

The study was carried out in the Grasscutter section of Wildlife and Ecotourism Department, Forestry Research institute of Nigeria (FRIN). FRIN is situated at Jericho Hill, Ibadan North Local government area of Oyo state. It lies between latitude 7° 26′ N and longitude 3°26′ E.

Experimental animals

20 adult female and 10 adult male grasscutters were selected from the set of adult animals held in captivity in the Grasscutter Research, Domestication and Multiplication Unit, Wildlife department of Forestry Research Institute of Nigeria (FRIN). The grasscutters weighing average of 2.5kg (males) and an average of 1.8kg (females) were mated to target their parturition period into the desired season (rainy and dry) and maintained in a breeding cages for about 5 months using a temporary mating method that lasted 3 months (male and female together) to confirm conception before being separated.

Animal management

The grasscutters were kept in concrete hutches with a dimension of 87cm x 58cm x 75cm (length, breadth and height), fed with elephant grasses (*Pennisetum purpureum*) and concentrate feed of the same quantity and quality as supplement during the rainy and dry season. Animals were given fresh provision of feed and water daily and the individual cage was swept and disinfected with 1% Virkon Sprior to the introduction of animals. Forages were served *ad libitum* every morning while concentrate feed was supplemented every afternoon. Feeding troughs and drinkers were cleaned before serving the feed every morning. Feeders and drinkers were sterilized twice weekly, while cages were scrubbed monthly.

Synchronization of oestrous

The does (female grasscutter) were brought to heat by introducing them to the buck cages at the same time after signs of oestrous were observed in the female grasscutters. The oestrous cycle length is defined as the interval between the first day of spontaneous vaginal membrane perforation through to the period of vaginal closure by an epithelial membrane, to the day before the next perforation (Weir, 1974).

Mating signs, pregnancy diagnosis and confirmation

Mating signs were observed by checking for marks of climbing at the back of the doe, diagnosis was conducted weekly for three months by monitoring for pregnancy-associated intermittent vaginal bleeding, weekly weighing to check for continuous increase in weight of the does and abdominal palpation of developing foetuses. Animals diagnosed pregnant by any of the two out of the above methods were separated from the buck and put in an isolation cage pending the time of parturition.

Reproductive performance

Since the gestation period of graasscutter is 152±2 days (5 months), it is expected that the animals will give birth by this period after pregnancy was confirmed. Number of does that gave birth out of the total, number that aborted, litter size, mortality at birth and no of survival at birth were adequately recorded during each season.

Data analyses

Simple descriptive statistical measures such as, frequency count, average, percentage were used for categorization and calculation of data

RESULTS

Measurement of temperature and relative humidity in the pen

The minimum and maximum temperature was measure with the use of digital thermometer and relative humidity was measure with the use of digital hygrometer. Rainy season temperature was between 24.56°C lowest to 29.62° C highest and relative humidity was between 86.67% maximum to 78.50% minimum. Dry season average temperature was between 27°- 40° C and the average relative humidity is between 45% – 65 %.This was done to detect the Heat Index. The higher the air temperature and/or the higher the relative humidity, the higher is the heat index and the hotter it becomes to animals.

Pairing of Grasscutter

Body weight is the first criteria observed prior to paring, as the body weight of the male must be higher than that of the female. This is because at times when females are bigger in size than the males, mating tends to be difficult for the male as both sexes may fight before copulation occurs, which may lead to brutality between the two animals. Body weight was measured and pairing was done. One male animal paired to two females at a time being ascertain that the male has a higher body weight than the females.

Detection of oestrus, Successful mating, Parturition, abortion and litter size (Rainy season)

Table 1 below shows the results of the reproductive performance (conception, gestation, parturition) of the female grasscutters during the rainy season. Table 2 shows the reproductive performance during the dry season.

During the rainy season, 20 female animals that were used in the research experiment all showed signs of oestrus following oestrus confirmation procedures and careful observation in detecting heat period in grasscutter. It was recorded that 17 female animals (85.0%) exhibit signs of successful mating while 3female animals representing (15.0%) did not show clear signs of mating. Nevertheless, 19 out of the 20 animals representing (95.0%) successfully delivered the young ones after the completion of the gestation period and 1 female animal (5.0%) did not give birth nor aborted. No abortion was recorded during the rainy season, 2 still-births was recorded from the female that littered seven kits. The litter size recorded ranges between 1 kit per litter (minimum) to 7 kits per litter (maximum). Total number of litter added together was 68 kits, mortality at birth was 2 kits and number of survival after complete parturition was 66 kits. Litter sizes of 3 kits appeared to be the highest with 5 female animals that gave birth to 3 kits each. Followed was the litter size of 5 kits with 4 female animals gave birth to 5 kits each. The illustrations of the activities were shown in the table below.

Detection of oestrus, Successful mating, Parturition, abortion and litter size (Dry season)

Table 2 below shows the results of the reproductive performance (oestrus manifestation, mating, conception, gestation, parturition) of the female grasscutters during the dry season. During the dry season of the following year, the 20 female grasscuttersand 10 male grasscutters that were used in the research experiment during the rainy season of the first year were repeatedly used during the dry season of the following year. All the female grasscutters showed signs of oestrus, 19 of the female grasscutters (95.0%) showed clear sign of successful mating and 1 (5.0%)female animal did not exhibit sign of successful mating. 1 female grasscutter (5.0%) aborted at about 3 month of gestation and 19 female animals successfully delivered (95.0%). During this season, the litter size recorded ranges between 1 kit per litter (minimum) to 6 kits per litter (maximum), the sum of the litters added together was 72 kits with zero mortality at birth and number of survival after complete parturition remained at 72 kits. During the dry season, litter sizes of 3 and 4 kits per litter appeared to be the highest where 5 female animals that gave birth to 3 kits each and 5 female animals also gave birth to 4 kits each. Table 2 below illustrates the activities occurred during the dry season.

Table 1: The reproductive performance of the female grasscutters during the rainy season (wet season) where average temperature is between 23° -30°C and the Relative humidity ranges between 73 to 96 %

No of animals (Cages)	Manifestation of oestrous cycle	Mating signs	Pregnancy diagnosis	Successful delivery	Litter size	No of mortality at birth	No of survival after complete parturition
1	Yes	yes	confirmed	successful	3	0	3
2	Yes	yes	confirmed	successful	3	0	3
3	Yes	yes	confirmed	successful	4	0	4
4	Yes	no	confirmed	successful	6	0	6
5	Yes	yes	confirmed	successful	2	0	2
6	Yes	yes	confirmed	successful	5	0	5
7	Yes	yes	confirmed	successful	1	0	1
8	Yes	yes	confirmed	successful	5	0	5
9	Yes	yes	not clear	successful	-	-	-
10	Yes	yes	confirmed	successful	4	0	4
11	Yes	no	confirmed	successful	7	2	5
12	Yes	yes	not clear	successful	5	0	5
13	Yes	yes	confirmed	successful	2	0	2
14	Yes	yes	confirmed	successful	2	0	2
15	Yes	yes	not clear	successful	4	0	4
16	Yes	no	not clear	successful	3	0	3
17	Yes	yes	confirmed	successful	3	0	3
18	Yes	yes	confirmed	successful	3	0	3
19	Yes	yes	confirmed	successful	5	0	5
20	Yes	yes	confirmed	successful	1	0	1
Total	**20**	**20**	**20**	**20**	**68**	**2**	**66**

Table 2: Showing the reproductive performance of the female grasscutters during the dry season where average temperature is between 27° - 40° C and the average relative humidity is between 45 – 65 %.

No of animals	**Manifestation of oestrous cycle**	**Mating signs**	**Pregnancy diagnosis**	**Successful delivery**	**Litter size**	**No of mortality at birth**	**No of survival after complete parturition**
1	Yes	yes	confirmed	successful	5	0	5
2	Yes	yes	confirmed	successful	1	0	1
3	Yes	yes	confirmed	successful	3	0	3
4	Yes	yes	confirmed	successful	4	0	4
5	Yes	no	not clear	successful	4	0	4
6	Yes	yes	confirmed	aborted	-	-	-
7	Yes	yes	confirmed	successful	3	0	3
8	Yes	yes	confirmed	successful	5	0	5
9	Yes	yes	confirmed	successful	3	0	3
10	Yes	yes	confirmed	successful	6	0	6
11	Yes	yes	confirmed	successful	3	0	3
12	Yes	yes	not clear	successful	4	0	4
13	Yes	yes	confirmed	successful	5	0	5
14	Yes	yes	confirmed	successful	4	0	4
15	Yes	yes	confirmed	successful	5	0	5
16	Yes	yes	confirmed	successful	2	0	2
17	Yes	yes	confirmed	successful	3	0	3
18	Yes	yes	confirmed	successful	6	0	6
19	Yes	yes	confirmed	successful	2	0	2
20	Yes	yes	confirmed	successful	4	0	4
Total	20	20	20	20	72	0	72

Table 3: Readings for ambient temperature (minimum and maximum) and Relative humidity in the grasscutter house for the rainy season (May– October)

Month	Temp AM (^{o}C)	Temp PM (^{o}C)	R/Humidity AM (%)	R/humidity PM (%)
May	24.90	32.02	88	61
June	21.65	30.90	88	78
July	25.55	31.57	85	77
August	24.19	27.31	76	97
September	24.75	27.35	87	70
October	26.55	29.38	96	88
Average	**24.56**	**29.62**	**86.67**	**78.50**

Table 4: Readings for ambient temperature (minimum and maximum) and relative humidityIn the grasscutter house for the dry season (November- April)

Month	Temp AM (^{o}C)	Temp PM (^{o}C)	R/Humidity AM (%)	R/humidity PM (%)
November	27.13	25.22	73	77
December	30.25	36.34	71	67
January	29.45	38.50	70	65
February	28.50	40.10	70	68
March	28.56	39.16	80	62
April	27.63	34.10	83	73
Average	28.57	35.57	74.5	68.12

DISCUSSION

This research work on grasscutter reproduction investigated the effect of environmental temperature and relative humidity in both the rainy and dry season on the reproductive characteristics (oestrus, mating, parturition, abortion and litter size) of grasscutter.

All the female grasscutters manifested oestrus in both seasons which is an indication that season does not have total effect on oestrus manifestation in grasscutter, this confirmed the statement by Stier *et al* (1991); Adjanohoun (1993) that the grasscutter is an induced ovulator. Mating was successful above 80% in both seasons indicating that the females were sexually receptive within a few days of pairing. This is an eye opener in grasscutter farming that breeding activities could be scheduled at any period of the year depending of the farmer's convenience. Since the females are very receptive, availability of fertile male can give the farmer to pair and mate the animals at any period of the year. Addo *et al*, (2001) confirms the statement that grasscutter breed all year round regardless of the season. Pregnancy occurred in more than 90% of the female animals, all animal gave that were diagnosed pregnant gave birth with the record of only 2 death at birth (still-birth). The gestation of most of the female grasscutters was about 152 days. This is in line with Stier et al (1991) who obtained a gestational length of 152 days and Addo (2002) reported a gestational length of 152 ± 2.98 days.

CONCLUSION

This study revealed that grasscutters have good reproductive performance even in captivity and can breed all year round. Seasons, temperature and relative humidity do not impose limitations on the system of breeding of grasscutter in captivity.

Recommendation

Grasscutter rearing should be encouraged among farmers; sensitization and training on the breeding programmes in captivity should be enhanced among all farmers.

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