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REPRODUCTIVE HISTORY OF CANE RAT: A REVIEW OF THE REPRODUCTION AND REPRODUCTIVE PERFORMANCE

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ABSTRACT
This study evaluates in a review the reproduction and reproductive performance of cane rat. Breeding time in cane rat depends on which part of Africa the Animal is found and the weather. In the wild, cane rat lives in groups of males and females during the breeding season. The wet season of the year is the usual breeding season. Cane rat lives in groups of males and females during the breeding season. The wet season of the year is the usual breeding season. The doe when sexually ready or estrus present a perforated vaginal membrane which is sealed or open with a thin membrane. During this period, the vaginal mucus is colourless and the buck mates the doe. When the doe is not sexually ready or in estrus, it may present a closed membrane and the buck do not mate the doe. In captivity, cane rat breed all year round. Immediately after weaning the kits at four weeks, the vulva is still opened and the male is introduced to mate the female. Once there is mating, the doe's vulva starts to close 5 – 7 days later. The mating ages in males is between 7 – 9 months and females 5 – 7 months with a mating ratio of 1 male to 4 females. Most farmers rely on the shapes and size of the head to differentiate sexes but ano-genital distance is the most popular method of sex determination. Gestation period in cane rat is 132-172 days. At birth, offspring birth weight is between 70 – 130 grammes. The litter size is 4 – 9. Cane rat is an hystricomorphic rodent. Most rodent species have flexible mating system that can vary between monogamy polygyny and promiscuity.

INTRODUCTION
The behaviour of animals plays an important role in reproduction, affecting both the success of mating and survival of the young (Alexander *et al*., 1980). Behavioural patterns associated with courtship and copulation, with birth and with maternal care and suckling attempts of newborn have a dramatic quality that has attracted researchers of mammalian behaviour and has led to the development of an extensive literature that covers wild and domestic animals. Alexander *et al*. (1980) observed that the encounter of sexual partners is the first of reproductive behaviour. A free living animals, this occurs largely under the influence of pre-existing several structure of the territorial or home range behaviour of males and females and leads to an organized pattern of reproduction that varies with the socio spatial or territorial characteristics of the species. In the wild rabbit and bearer, the territory is occupied by a permanent couple or harem and the male avoids any encounter outside his territory. This pattern persists under artificial environments and this is noticed in male rabbits breeding in cages displaying sexual behaviour toward receptive female only after the male occupies the cage for a sufficiently long time to consider it as his territory. Territorial behaviour is intensified during the season of reproduction and in fact in a number of species (Alexander *et al*., 1980). Many farmers are still confused about the reproductive behavior of cane rat, age to breed and when to breed the

animal; to mention a few of the problems. This study was carried out with the primary aim of evaluating the reproduction and reproductive performance in cane rat.

SEX DETERMINATION

Male cane rat have black/thick brownish stains around the genital areas (Odusanwo, 2012). These do not give a clear separation because sometimes some females do have black stains around their anus and sometimes close to the clitoris area too. In some males at five month of age, colour stain may not be seen. The male genital is distant from the anus. Odusanwo (2012) reported that in the female, there are no color stains. The female clitoris is closer to the anus. Sexing is also done at weaning age of four weeks old. This gives a clearer separation of the males and the females. The males have small testicles close to their anus and the penis is distant from the anus. Sometimes the testicles retros inside the body and can not easily be seen. The female clitoris is very near to the anus.

Most farmers rely on the shapes and size of the head to distinguish between sexes. The use of ano-genital distance is the second most popular method of sex determination (Adu, 1999). The study by Adu and Yeboah (2002) has led to the promotion of the use of ano-genital distance as the gold standard of sex determination in the grasscutter. At birth, the ano-genital distance is 10mm in the males and less than 5mm in the females. In adults, it measures an average of 38mm in males and 12mm in females (Asibey,1974b). The paired testicles are situated abdominally and there is no scrotum (Addo *et al*., 2003). The vaginal opening between the urinary papilla and the anus is sealed with a thin membrane, the vaginal closure membrane, (Asibey, 1974b; Oduor-Okelo and Gombe, 1982). This membrane has been observed in all hystricomorphic rodents, except the nutria (*Mycoaster coypus*). Perforation of the membrane normally occurs only during estrus and at birth (Weir, 1974).

REPRODUCTION

The reproduction of cane rat remains a major point, it is difficult to control breeding but through various changes in the genital organs anatomy, the behavior and the level of sexual hormones, one can distinguish two periods, the sexual rest and the sexual activities (Adjanohoun, 1992). The sexual period is characterized by a vaginal closure membrane closing the vulva, a thick and yellow mucus called 'gelee vaginale' while oestrogen level in the blood is almost nil and the male do not pay attention to females. During the sexual activity period, the vulva is closed by a crust, the vaginal mucus is colourless and polymorphous, the male courts and mate the female. Oestrous appears only during this period mainly due to the male's court and some environmental and rearing factor (Adjanohoun, 1992).

Little information is available on the reproductive pattern of grasscutters and thus, nothing is known about the process and duration of the cycle, expression of estrous, estrous detection and kind of ovulation (Opara,2010). Most of the hytricomorphas examined so far ovulate spontaneously (Addo, 1997). The average cycle length ranges from 30 -40 days indicating a long luteal phase (Oduor-Okelo and Gombe, 1982). In female hystricomorpha kept separate from males, the interval between the first day of vaginal opening and the day prior to the next reopening corresponds to the cycle length, provided that the animals' cycle of regular and the vaginal opening is not caused by other factors (Weirs, 1974). Grasscutters are induced ovulators (Steirs *et al*, 1991; Addo *et al*, 2001) and breed all year round (Asibey, 1974b); therefore no consideration is giving to the time of mating. Grasscutter sometimes shows variations in their reproductive activity or sexual cycle (Adjanohoun, 1989), which is manifested

by their vaginal membrane. Sometimes when sexually ready or estrus, the female grasscutter may present a perforated vaginal membrane with (sealed) or without (open) a hardened vaginal secretion. When not sexually ready or in estrus, it may present an intact (closed) membrane (Adjanohoun, 1989).

On a cane rat farm in Ogun state, Odusanwo (2012) reported that matured females between the ages of 6 – 8 months are mated. Any female less than this are exempted from mating. Matured males between the ages of 7 – 9 months are used for mating. Males less than this age are not used. A male is introduced to four females hence the mating ratio is 1: 4. Once the male is introduced to the females, it mates immediately. The male is brought to the females in their hutch for mating. After mating, the male is left with the female until it kits, then the male is withdrawn. Immediately after weaning of kits at four weeks, the dam is allowed to rest for ten days. During this period, the vulva is still opened. The male is introduced into the female's hutch for mating. Immediately there is mating, the does vulva starts to close. After the closure of the vulva at 5-7 days later, the male can be withdrawn or left with the females until it kits. This is done so as to be sure the animal is mated and is pregnant. The gestation length observed on this farm is five months. Animal kits twice in a year. This is assured by allowing the doe to rest for ten days after weaning and mating is done. Animals do not have a specific breeding time. It could be mated anytime in the year depending on the last parturition. And for fresh mature females, they could be mated when they are grown fully to the age of 5 – 7 months. Once mated and the doe is pregnant, there is a gradual closure of the vulva until it is completely closed. The newly parturated does have opened but red vulva full with blood. The weaned does have the vulva opened with small colourless mucous which wet the vulva. No dam has kitted less than four or five. It has been recorded once on this farm that a dam kitted nine offsprings. Kits are weaned four weeks after parturition and at weaning, sexing is done (Odusanwo, 2012).

T. *Swinderianus* lives in groups of males and females during the breeding season (Fitzinger, 1997). The breeding time depends on which part of Africa the animal is found and also depend on the weather; wet season of the year is the usual breeding season (Fitzinger, 1997; Mills and Hes, 1997). Females generally have two litters per year with usually four offsprings (Mills and Hes, 1997). Greater cane rats have a gestation period of 132-172 days (Fitzinger, 1997). Offspring weigh about 129grams and are relatively well developed. T. *Swinderianus* become sexually matured at about 1year old (Fitzinger, 1997).

REPRODUCTIVE PERFORMANCE

The gestation length in animal has been estimated to be from the day of appearance of mating sign (day one) to the day of parturition (Addo, 2002). The grasscutter gives birth to precocious young after 148 to 170 days of gestation (Adu, 1999; Addo, 2002; Onadeko and Amubode, 2002). This gestation length makes it possible for the animal to kit twice a year (Addo, 1997). Parturition is the act of giving birth to young ones. The pregnant doe abdomen distends and takes on the shape of the rugby ball (Addo, 2002). The expected dam walks on the hindlimbs termed penguin posture three days before delivery (Addo, 2002). A day before delivery, it combines the penguin posture with frequent downward looks at the lower abdomen (Onadeko and Amubode, 2002). The grasscutter litters while standing on only the hindlimbs. They eat the placenta after delivery of each kit before proceeding on to deliver the kit baby (Asibey, 1974b; Addo, 2002). The neonates are born fully haired with their eyes open. They stand by their mother during the delivery of the litter mates and follow their mother 32-40min after their delivery (Addo, 2002). Parturition lasts for 45-57min (Asibey, 1974b; Addo, 2002; Addo *et al*., 2003) and has a modal litter size of 4-6 with sex ratio of unity (Addo, 1997; Addo *et*

al., 2003). The offspring weigh 70-130 grammes at birth with a clear difference being observed between both litter mates and litters. Parturition in the grasscutter as is also usual in most species is very infrequent during the day (Baptist and Mensah, 1986). Addo (2002) analyzed the weights of 46 female grasscutters and their offspring at birth as well as the weights of 66 killed females, and their fully developed fetuses. The most frequent litter size is four, but litter of eight or more have also been observed (Onadeko and Amubode, 2002; Abioye *et al*., 2008). Birth weight varies from 70-130grammes. The sex ratio is well balanced. Both number and size of the young seem to be influenced by the dam's nutritional state (Asibey, 1974b). There is also an indication that larger females tend to produce larger litters (Addo, 2002). The weight of each offspring is much more independent on its position in the uterine horn during embryonic development (Addo *et al*., 2003). The special position of the teats on the dam and the ventral position of the mouth on the young, dictate the particular nursing posture of the grasscutter dam that suckles her offsprings, taking some of her weight on the fore and hindlimbs so that her abdomen is not flattened too much. The position of the teats permits the young despite their ventral mouths, to suck on either side. If the dam lives on her flank, it would be extremely difficult, or even impossible for the young to suck the lower row of teats (Ewer, 1969; Asibey, 1974b; Kingdon, 1974).

Sexual maturity in female grasscutter coincides with the eruption of the third molars, i.e 5months of age and with a weight of about 1kg (Asibey, 1974b). In captivity, female grasscutters at this age exhibited perforation of the vaginal membrane but none of the observed animals become pregnant (Asibey, 1974b). Age at first littering varies from 12-18months (Ewer, 1969; Asibey, 1974b). It is not clear whether the grasscutter has a definite reproductive season. In South and South-West Africa, it is considered to be a seasonal breeder (Shortridge, 1934; Paradiso, 1968). But there is conflicting evidence on seasonality in West Africa. Ewer (1969) reported birth during the periods of January to March and July to August. Rosevear (1969) reported that juveniles had been collected between September and the beginning of January. Onadeko and Amubode (2002) reported that baby grasscutters were born in captivity in Nigeria between November and July of every year, although no birth was recorded in February and May. It has finally been ascertained that grasscutters in Ghana reproduce throughout the year but reproduction is more frequent in certain seasons (Asibey, 1974b). There is an indication that breeding is related to seasonality of rainfall and thus feed availability (Opara, 2010). The grasscutters are weaned within one month after birth (Opara, 2013). Adu (1999) suggested a weaning age of 6 weeks based on the high post weaning mortality when animals are weaned at 4 weeks. Adu (2002) reported that animals could still have a lower post weaning mortality rate. Factors influencing the post weaning mortality rate include the number of animals per unit space (Hemmer, 1992). Hemmer (1992) posited that rodent under stress cuddle themselves into corners and may suffocate each other to death in the process. It has been possible to reduce post weaning mortality to 1.4% for animals weaned at 4 weeks compared to 11% for those weaned at 6 weeks by keeping not more than five animals per unit space post weaning (Adu, 2002).

RODENT REPRODUCTIVE BEHAVIOUR

Several rodent species have flexible mating system that can vary between monogamy, polygyny and promiscuity (Waterman, 2008). Waterman (2008) explained that some species of rodents are monogamous, with an adult male and female forming a lasting pair bond. Monogamy can be obligate and facultative. In obligate monogamy, both parents care for the offspring and play an important part in their survival, this occurs in beavers. In the facultative monogamy, the males do not provide direct parental care and stay with one female because they cannot access

others due to being spatially dispersed example is the pairie voles. In polygamous species, males will try to monopolize and mate with multiple females. Polygyny in rodents can be defense and non- defense. Defense polygyny involves males controlling territories that contain resources that attracts females, this occurs in the ground squirrels. Males with territories are known as residents males and the females that lives within the territories are know as resident females. Some species of rodents are known to directly defend their resident females and ensuing fights can lead to severe wounding. In species with non-defence polygyny, males are not territorial and wander widely in search of females to monopolize. These males establish dominance hierarchies with the high males having access to the most females. This occurs in some tree squirrels. Promiscuity, in which both males and females mate with multiple partners also occurs in rodents. Solomon and Keane (2008) stated that in most rodent species, ovulation occurs on a regular cycle while in others, it is induced by mating. During copulation, males of some rodent species deposit a mating plug in the female's genital opening both to prevent sperm leakage and to protect against other males inseminating the female. Female can remove the plug and may do so either immediately or after several hours. Rodents may be born either altricial that is blind, hairless and relatively underdeveloped or precocial which are mostly furred, eyes opened and fairly developed depending on the species (McGuire and Bernis, 2008).

CONCLUSION

Cane rat is an hystricomorphic rodent. It breeds all year round although they shows variations in their sexual cycle. Animal reproduce twice a year with a gestation period of 132-172days. Larger females tend to produce larger litters. Age at first parturition is between 12-18months. Weaning is done between the ages of 4-6weeks. Ano- gental distance is the most popular method of sexing cane rat. Sexual maturity in the female grasscutter coincides with the eruption of the third molars at 5month of age with a weight of about 1kg.

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