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The Grasscutter I: A Livestock of Tomorrow

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Abstract: The grasscutter (*Thryonomys swinderianus*), variously known as the marsh cane-rat, ground hog and in francophone West Africa, the aulacode or incorrectly, the agouti is a rodent but not a rat proper, since it belongs to the Hystricomorpha (porcupine family). This rodent subclass embraces similar species in both the old and new world, species which were originally classified according to the differentiation of the masticatory musculature. Due to their spatial separation, a common origin has often been contested and the hystricomorphic rodents of the new world have now been classified as Caviomorpha (guinea pig relatives). Hystricomorpha are correctly comprised of hystricidae (family of porcupines), Bathyergidae (family of sand-diggers), Thryonomydae (family of grass-cutters) and Petromuridae (family of African rock-rats) with the Phiomydis (African tertiary) as the common tribe group. Grasscutters are found only in Africa, where they are represented by a single genus, *Thryonomys* (identical with Aulacodes). Most of the species, subspecies or breeds described can be allied to one of the two following groups of species: *Thryonomys swinderianus* the larger grasscutter and *Thryonomys gregorianus*, the lesser grasscutter.

Key words: Grasscutter, livestock, *Thryonomys swinderianus,* weaning

INTRODUCTION

Globally, wildlife has great potentials for meat production and serves as an important source of the highly desired animal protein to the people of Africa, both in urban areas and rural communities (Fonweban and Njwe, 1990). The preference for bush meat or the meat of commercially available game animals is widely accepted (Baptist and Mensah, 1986; Fonweban and Njwe, 1990). However, with ever increasing human population and obvious protein shortage in Africa, there is the need for an exploration of other means to provide readily acceptable meat on short term basis.

Wildlife domestication has been recognized as a way of achieving this objective. A few number of small mammal and crop farmers, trade or breed wild rodents (Fonweban and Njwe, 1990; NRC, 1991), but research studies in their domestication are producing conflicting results (Baptist and Mensah, 1986; NRC, 1991).

Among the wild rodents, the grasscutter, or cane rat or cane cutter is the most preferred (Asibey and Eyeson, 1973; Clottey, 1981). Grasscutter (*Thryonomys swinderianus*) is a wild hystricomorphic rodent widely distributed in the African sub-region and exploited in most areas as a source of animal protein (Vos, 1978; Asibey, 1974a; NRC, 1991). Being the most preferred (Martin, 1985) and most expensive meat in West Africa including Nigeria, Togo, Benin, Ghana and Cote d' voire (Baptist and Mensah, 1986; Asibey and Addo, 2000), it

contributes to both local and export earning of most West African Countries (Asibey, 1969; NRC, 1991; Baptist and Mensah, 1986; Ntiamoa-Baidu, 1998) and is therefore hunted aggressively. Unfortunately its collection from the wild is attended by destruction of the environment through the setting of bush fires by hunters (NRC, 1991; Yeboah and Adamu, 1995; Ntiamo-Baidu, 1998). To alleviate this problem, attempts are being made in the sub-region to domesticate the grasscutter (NRC, 1991; Addo, 2002) and make it more readily available, gain economic benefit and also reduce the environmental destruction that accompanies its collection from the wild. For example, a major research programme on grasscutter has been initiated in Benin Republic under the project Benino-Allemand d' Aulacodiculture (PBAA) to select genetically improved grasscutter stocks adapted to life in captivity and to promote the rearing of the animal in rural and sub-urban environments (Baptist and Mensah, 1986).

CHARACTERISTICS OF THE GRASSCUTTER

The grasscutter has thickset body, measuring up to 40 to 60 cm in addition to a 20-25 cm tail (Fitzinger, 1995). Its average weight fluctuates between 2 to 4 kg in the females and 3 to 6 kg in the males (Baptist and Mensah, 1986; Jori *et al*., 1995; Merwe, 2000). Its furs comprise a mixture of brown reddish and gray hairs that vary depending on its habitat (Jori and Chardonnet, 2001). Some other authors reported that the skin and hair (fur) as well as limbs and tails are easily torn out (Rosevear, 1969; Kingdom, 1974). This makes the animal very difficult to catch and even more difficult to handle after capture.

The grasscutter is a quick runner and a skilled swimmer, despite the blunt snout. Its visual powers are relatively poor, making communication to be based only on hearing and well developed sense of smell. This rodent can live up to four years in captivity (Jori and Chardonnet, 2001). It is a monogastric herbivore like the rabbit and other rodents; it is a good food converter and often practices coprophagy (Hemmer, 1992). They are considered delicacy, high prized source of protein and agricultural pest of cereals and other crops (Yeboah and Adamu, 1995).

Distribution and Habitat of the Grasscutter

The grasscutter is found only in Africa (Rosevear, 1969; Baptist and Mensah, 1986; Adoun, 1993). In West Africa where grass provides its main habitat and food, it is commonly known as the grasscutter or the cutting grass, while in other parts of Africa particularly Southern Africa, where it is closely associated with cane fields, it is called the Cane rat.

The grasscutter is found in grasslands and wooded savannah throughout the humid and sub-humid areas, south of the Sahara (NRC, 1991), specifically from Senegal to parts of the Cape Province in South Africa (Rosevear, 1969). The giant cane rat can also be found in any where there is dense grass, especially reedy grass growing in damp or wet places (Ajayi, 1971; Abioye *et al*., 2008). They do not inhabit the rain forest, dry scrub or desert regions (NRC, 1991). Its distribution is determined basically by the availability of adequate or preferred grass species for food (NRC, 1991).

In West Africa, the grasscutter is not considered a threatened or disappearing species of wildlife (Baptist and Mensah, 1986). On the contrary, forest clearance in the Guinea zone has expanded its ecological habitat from the Savannah region into cropped areas and secondary forest, following agricultural encroachment on forests (Baptist and Mensah, 1986).

Similarly in Ghana, the grasscutter has penetrated the high forest where there is intensive maize, cassava, sugarcane, young cocoa, coconut, oil-palm, pineapple and egg

plant cultivation (Asibey, 1974a). However, *Thryonomys swinderianus* has often been encountered in the vicinity of water courses just as both species have also been found in the same environment in East Africa (Kingdom, 1974).

Mode of Life of the Grasscutter

Grasscutters live above ground and are considered to be nocturnal. However, during the rainy season when sufficient security, shade and moisture are available, they are sometimes active during the day. After a certain period of acclimatization to their enclosure, grasscutters under studies have also started to feed by day (Rosevear, 1969; Kingdom, 1974; Ajayi and Tewe, 1980). Grasscutters are harmless and their response to danger is generally to flee. They often live in groups of 3 to 12 individuals: 1 male and 2 to 3 females with their offspring. The search for food and mating by the grasscutter is generally done between 5 pm and midnight and again at first light. The rest of the period is spent in rest, chiefly grooming and searching for nest (Centre for Biodiversity Utilization and Development, 2004).

Dentition in the Grasscutter

The dental formula of the grasscutter according to Merwe (2000) is 2(I 1/1 CO/O Pm 3/3).

The orange or yellow colored or incisors (gnawing teeth) and broad, strong and very sharp with longitudinal groves on their surfaces. Despite their apparent strength, the teeth are believed to be brittle. According to studies of prepared grasscutter skull, they are composed mainly of dentine with very thin layer of dental enamel (Rosevear, 1969). There are four enamel covered cheek teeth, one premolar (persisting milk molar) and three molars on either side of the jaws (Rosevear, 1969). On the bases of the molars teeth development, it is possible to a certain extent, determine the age of a grass cutter.

Feeding in Grasscutter

The grasscutter is a herbivorous animal with a wide nutritional intake. The major part of its diet is composed of grasses with fairly high crude fibre content. It can apparently tolerate a certain level of tannin found in leaves and bark as well as cyanogenic glycosides present in green maize, sorghum and Manihot (Ewer, 1969). Under-altered condition, the grasscutter is able to adapt itself to another diet.

Thus Ewer (1969) reported that shrubs and bushes growing in the enclosure where grasscutters are kept were neglected at first but were later-eaten readily. They always prefer grasses with lots of moisture and so soluble carbohydrate (Ajayi and Tewe, 1980; Onadeko, 1996; Agbelusi, 1997). They equally eat fallen fruits, nuts and many kinds of cultivated crops (Fitzinger, 1995).

The grasscutter is a wasteful feeder, cutting the grass at a characteristic angle with its very powerful incisors to cut the more nutritious succulent inner nodes, leaving behind scattered pieces on the ground (Ewer, 1969; Asibey, 1974b). Grasscutter can equally be raised on the backyard to provide meat for the family by feeding them kitchen. Left-overs (Agbelusi, 1997; Addo, 1997).

However, the feeding strategy for the grasscutter is rudimentary and inadequate for growth and reproduction (Adu *et al*., 2000; Adu and Wallace, 2001).

Adu (2002) had compiled a list of feed items for the grasscutter based on indigenous knowledge (Table 1). He reported that certain varieties of cassava could be poisonous to the animal, particularly when fed fresh leguminous plant such as *Centrosema pubescens* and *Leucaenia* sp. could be poisonous when fed in large quantities.

Table 1: Food items fed to captive-reared grasscutters in Southern Ghana

English name	Scientific name
Cassava	*Manihott utilissima*
Guinea grass	*Panicum maximum*
Elephant grass	*Pennisetum purpureum*
Spear grass	*Heteropogon coutrotus*
Plantain pseudo-stem	*Musa paradisiacal*
Fresh maize stover	*Zea mays*
Fresh groundnut tops	*Arachis hypogea*
Jobs tears	*Croixlacryma jobi*
Centro	*Ceutrosema pubescens*
Spurage weed	*Euphobia heterphylla*
Sand paper tree	*Ficus Exasperate*
Sweet potato	*Ipomea batatas*
African grant star grass	*Eynodon nlemfuensis*
Cane sugar	*Saccharum officinarium*
Oil palm seedling	*Elaesis guineusis*
Yam	*Discorea* sp.
Mango (unripe)	*Mangifera indica*
Oil palm	*Elaesis guineusis*
Pineapple	*Ananas sativa*
Wheat bran	
Bread	
Kitchen leftovers	
Salted corncobs	

Adu (2002)

However, the nutritional status of grasscutter is improved through the provision of pelleted concentrate for supplementary feeding (Addo, 1997). Adu (2002) and Opara and Fagbemi (2009) had reported that the practice of not giving the animals water (Adu, 1999) would be responsible for the high still birth weight. The lower birth weight registered in Ghana compared to Benin where water was provided (Adu, 2002), confirmed this fact. The provision of water has also been found to have positive effects on feed utilization, growth rate, health and reproductive performances (Aitken and Wilson, 1962). Adu (2002), also reported that lack of drinking water is partially responsible for digestive disorders leading to enterotoxaemia.

Management System

The grasscutter is easy to house, though its handling requires skills. Among rural communities and even some urban people with adequate space, the animal has been bred and kept in boxes, empty drums, Poly Vinyl Chloride (PVC) pipes and exclosures (Adu, 2002). However, the grasscutter cloud be properly managed under these three systems: enclosure, cage and floor.

REPRODUCTION AND REPRODUCTIVE MANAGEMENT

Sex Determination

Most farmers rely on the shapes and or size of the head to distinguish between the 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 10 mm in the males and less them 5 mm in the females. In adults, it measures an average of 38 mm in males (n = 68) and 12 mm in females (n = 67) (Asibey, 1974b).

The Male Genital Tract

The paired testicles are situated abdominally and there is no scrotum (Addo *et al*,, 2003). Appertaining to the accessory sex glands are a pair of seminal vesicles, the prostate gland, composed of three lobes and a pair of compact pea-sized Cowper's glands. There is another pair of glands (glands coagulate) between the base of the seminal vesicles and prostate glands (Addo *et al*., 2003).

The Female Genital Tract

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 (*Myocoaster coypus*), studied so far.

Perforation of the membrane normally occurs only during estrus and at birth (Weir, 1974). The vagina is simple (V. Simplex), while the uterus is bicornuate and the horns open into the vagina through two slit-like ora cervices (U. duplex). A transuterine migration of blastocysts is therefore excluded (Oduor-Okelo and Gombe, 1982), but two pregnancies independent of each other are possible at the same time (Addo *et al*., 2003). The ovaries contain strikingly vasculose interstitial tissue.

Sexual Maturity

Knowledge of sexual maturity in the male grasscutter is a key management factor in grasscutter production (Adu, 2002). The male animals housed together can engage in fatal fights, particularly in the presence of females.

Sexual maturity in the male is usually determined using the presence of ano-genital region stain (Adu, 1999). Males are usually housed singly or castrated on attainment of sexual maturity. It has also been reported that certain animals may not develop the ano-genital region stain on attainment of sexual maturity (Adu and Yeboah, 2002), therefore males should be separated before four months of age without regard to the development of ano-genital region stain.

Sexual Cycle

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. Most of the hystricomorphas 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 is regular and the vaginal opening is not caused by other factors (Weir, 1974).

In Myomorphic rodents (rats and mice), cycling is accompanied by typical cellular modifications of the vaginal mucosa so that the exact stage of cycling can easily be determined by a vaginal smear (Oduor-Okelo and Gombe, 1982).

Mating in Grasscutter

Grasscutters are induced ovulators (Steir *et al*., 1991; Addo *et al*., 2001) and breed all year round (Asibey, 1974b); therefore no consideration is given to the time of mating. However, grasscutters sometimes show variations in their reproductive activity or sexual

circle (Adjanahoun, 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 (Adjanahoun, 1989).

The female is normally transferred to the males cage but prior to this, the females body weight, vaginal status (open, sealed, closed), date and time-of the transfer should be noted, after which they are left till mating occurs (Addo, 2002).

During the females stay with the male, it should be examined daily before post pairing perineal changes namely: perforation of vaginal membrane (in females that presented closed or sealed vaginal membranes at the time of pairing), nature of vaginal secretion if any and presence of copulatory plug in the vagina (Addo, 2002). Other mating signs looked for are copulatory plug on the cage floor and scratches on the females trunk inflicted by the male in its attempt to mount the female (Asibey, 1974b). On the observation of any these signs, the female is immediately and permanently separated from the male, weighed, transferred to its own cage and the date and time of the appearance of the mating (s) noted (Addo, 2002).

Successful mating in the grasscutter is manifested by vulval congestion, which is sometimes accompanied by vulval oedema and protrusion of the vaginal walls. The female thereafter is monitored either daily or weekly for signs of fertile mating.

Pregnancy and Birth

The grasscutter develops anatomically speaking, a placenta discoidalis. According to histological classification, this is placenta haemochorials (Oduor-Okelo and Gombe, 1982), in which important diaplacental transmission of antibodies takes place. According to Addo *et al.* (2003), the degeneration of uterine/mucosa in rodents starts as early as the end of pregnancy. At birth, nothing is left except a stalky connection between the parsfetalis and the parsuterina, which after the placenta has been released, leaves only a small injury enabling new fertilization and implantation to take place immediately after birth.

Studies on various hystricomorphic rodents have shown that internalized interstitial tissue and accessory corpora lutea act as additional progesterone sources (Tanı, 1974). It is supposed that the high percentage of interstitial tissue and the transformation of atretic follicles into corpus luteum tissue are necessary for steady progesterone production to maintain the relatively long pregnancy duration of a hystricomorphic rodent (Weir, 1974; Oduor-Okelo and Gombe, 1982).

The exact gestation period results from interval between observed mating or presence of a copulatory play or spermatozoa in the vaginal source and after normal birth.

Since, mating is not synonymous with fertilization, it seems advisable to separate the animals after mating. Hypothesis had it that stress released by disease, insufficient nutrition or change of environment may disturb the pregnancy or affect its length by delaying or blocking the embryonic development or that sperm is preserved in the female genital tract unit, a more favourable moment for fertilization (Addo *et al.*, 2003) compared with other hystricomorphic rodents which in relation to the body size, exhibit extreme gestation length, despite the observed large variations. The shortest gestation length observed is 52 days (Galea), the longest, 213 days (Erethizon) or 223-283 days (Dinomys). According to Weir (1974) this is not only a question of delayed (fertilization or implantation) but also a question of very slow embryonic and foetal development. Placental development takes up approximately one quarter of the total gestation length.

Pregnancy Diagnosis

The grasscutter has both partial and total resorption and reproduction problem (Asibey, 1974b; Adu and Yeboah, 2000), so there is a need for proper pregnancy diagnosis all year round. Pregnancy diagnosis is conducted either daily or weekly, depending on the parameter under investigation. The daily monitored parameters are: status of the vaginal membrane (closed, sealed or opened) and the presence and characteristics of vaginal secretion. The weekly monitored parameters are: change in body weight and the presence of developing fetuses in-utero which is determined by abdominal palpation (Addo, 2002).

Early pregnancy diagnosis allows for early identification of animals not conceiving at first mating (Adu, 2002). It also allows for specialized management of pregnant animals so as to minimize the incidence of abortion and dystocia (Adu, 2002).

However, to conduct abdominal palpation, the animal is partially restrained in a net while the attendant holds the animal gently on the shoulders. The examiner holds the animal by the tail and places one arm between its hind legs, moves the head gently until animal's lower abdomen is cupped in the hand. The uterine horns are gently passed in between the fingers and the fetuses are felt as small, slippery marbles during the early stage of gestation but gets progressively larger and elongated as the pregnancy advances. At the early stage, the diagnosis is categorized as tentative due to the semblance of the fetuses to faecal pellets, which would be felt during the palpation.

In the third week, the paired uteri are as one swollen mass with an elongated content and in the fourth week, as a voluminous bag of soft constituents. In the 5th week, the uterine horns maintain their voluminous nature but contain long rods in the 6th week, the uterus becomes comparatively less voluminous and the fetuses are felt as distinct soft rods until the 8th week (Addo, 2002). The vaginal plug formation after mating has been shown to have some merit as a pregnancy diagnostic tool (Addo, 2002).

The intermittent vaginal bleeding 5 weeks after mating could be used for pregnancy diagnosis. This bleeding is in implantation bleeding rather than embryo resorption or abortion (Addo, 2002).

All the methods, except change in body weight are used for the first weeks after mating. Weight changes are monitored until the twenty-first week of pregnancy because it is considered to be least stressful of all the pregnancy diagnostic methods (Addo, 2002).

Gestation Length

The gestation length in animals 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 farrow twice a year (Addo, 1997).

Detection of Imminent Parturition and Parturition

Parturition is the act of giving birth to young ones. In all species the on set of Parturition is manifested by the occurrence of myometrial activity (Arthur *et al*., 1982).

Pregnant animals are monitored for peculiar signs that could be indicated by imminent delivery, therefore, those with distended abdomen are observed unobtrusively daily, from 6am to 6pm at three hours interval for changes in eating and drinking habits as well as changes in behavior and posture (Arthur *et al*., 1982; Universities Federation for Animal Welfare, 1999).

The abdomen of the animal distends and takes on the shape of rugby ball (Addo, 2002). The expected mother walks on only the hind limbs termed Penguin Posture (Addo, 2002), three days before delivery. A day before delivery, it combines the penguin posture with frequent down ward looks at the lower abdomen (Onadeko and Amubode, 2002).

The grasscutter litters while standing on only the hind limbs. They eat the placenta after delivery of each baby before proceeding on to deliver the next 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 32-40 min after their delivery (Addo, 2002).

Parturition lasts for 40-57 min (Asibey, 1974b; Addo, 2002; Addo *et al*., 2003) and has a modal litter size of 4-6 with sex ration of unity (Addo, 1997; Addo *et al*., 2003). The off springs 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).

Litter Size, Birth Weight and Suckling Position

Addo (2002), analysed the weights of 46 female grasscutters and their off springs at birth as well as the weights of 66 killed females and their fully developed fetuses.

The most frequent litter size is four, but litters of eight or more have also been observed (Onadeko and Amubode, 2002; Abioye *et al*., 2008).

Birth weight varies from 70-130 grammes. The sex ratio is well balanced. Both number and size of the young seem to be influenced by the dams' nutritional state (Asibey, 1974b). There is also an indication that larger females tend to produce larger litters. The weight of each off spring 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 mother and the ventral position of the mouth on the young, dictate the particular nursing posture of the grasscutter dam that suckles her off springs, taking some of her weight on the fore and hind limbs 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 lies 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; Kingdom, 1974).

Weaning

The economic and management factors influencing efficient animal production include the length of time between successive births (Chupin, 1992). The grasscutters are weaned within one month after birth. Adu (1999), suggested a weaning age of 6 weeks based on the high post weaning mortality when animals are weaned at 4 weeks. However, 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 rodents under stress cuddle themselves into corners and may suffocate each other to death in the process. It has been possible to reduce the post weaning mortality to 1.4% for animals weaned at 4 weeks (Adu, 2002), compared to 11% for those weaned at 6 weeks by keeping not more than five animals per unit space post weaning.

Reproductive Performance

According to the observations made by Asibey (1974b), sexual maturity in female grasscutter in the wild coincides with the eruption of the third molars, i.e., 5 months of age

and with a weight of about 1 kg. In captivity, female grasscutters at this age exhibited perforation of the vaginal membrane but none of the observed animals became pregnant. Age at first littering varies from 12-18 months (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 births 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, but gave no indication of site. 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.

HAEMATOLOGICAL AND BIOCHEMICAL VALUES IN THE GRASSCUTTERS

Studies have shown that certain factors influence haematological and biochemical parameters (Weldy *et al*., 1964). Haematological and biochemical analyses of an animal's blood represent a good diagnostic aid for the assessment of physiological, nutritional and pathological conditions of animals (Jain, 1986; Bush, 1991; Awah and Nottidge, 1998). Nutrition age, sex, genetics (breed and crossbreeding), reproduction, housing, starvation, environment factors, stress, transportation and diseases are known to affect haematological and biochemical values (Coles, 1986) and thought to play major roles in the differences in haematological and biochemical parameters observed between tropical and temperate animals (Ogunriade *et al*., 1981; Bush, 1991; Ogunsanmi *et al*., 1994). Ogunsanmi *et al.* (2002) determined the haematological, plasma biochemical and whole blood electrolytes profile in the normal live-captive and rehabilitated adult African grasscutters. They reported no statistical evidence of sexual dimorphism in the values of these parameters of the cane rats, except plasma alanine transaminase (ALT), which was significantly higher ($p<0.001$) in the males than in the females. In their studies, Owolabi (2002) and Opara *et al.* (2006) reported a significantly ($p<0.05$) higher lymphocyte, eosinophil and basophil values for both the female and male wild grasscutters, compared with those of captive- reared. They equally reported a significantly higher white blood cell counts in female than male wild grasscutters and attributed these differences to the free nature of the wild rodents which are more prone to all kinds of infections (Gotoh *et al*., 2001; Dinh, 2002). The significantly high levels of basophils and eosinophils among the wild grasscutters (Opara *et al*., 2006) were due to the presence of inhabiting parasites in the animals.

Reasons for Losses in Captive Grasscutters

In Benin, losses among captive grasscutters amount to nearly 80%, the majority (74%) being due to accidents, injures at the time of captive, refusal to eat, poisoning (Manioc) and disorders of the digestive system after treatment with antibiotics (Jori and Chardonnet, 2001).

Another 17% of the losses are due to diseases including abscesses (under the tongue), pneumonic and cardio-splenic dilation.

Coccidiosis, which may be treated with Coccidiostats (used for fowls and rabbits), helminthiasis, coughs and bacterial infections of the eyes, also occurred (Addo *et al*., 2003; Abioye *et al*., 2008).

Parasitic Diseases of the Grasscutter

The grasscutter unlike many other livestock species such as rabbits, sheep and goats requiring an appreciable drug input, is very hardy and requires little or no drug input (Adu, 2002; Opara and Fagbemi, 2008a).

Incidence, severity and disease prevalence have been shown to vary with the management systems (Smith and van Hautert, 1984; Adu, 2002; Opara and Fagbemi, 2010). Again, Adu (2002) reported that the major disease conditions include pulmonary congestion, septic wounds, ruptured uterus, orchitis with septicaemia, gastro-intestinal obstruction, gastroenteritis and pneumonia. The gastrointestinal obstruction and gastro enteritis may be caused by helminthes parasites (Jori *et al*., 2001; Awah-Ndukum *et al*., 2001).

Gastrointestinal Helminthes

The study of helminth parasites of domestic animals began as early as 1884 in America where on Act was enacted to prevent the exportation of diseased cattle and to provide means for the suppression and extirpation of diseases among domestic animals (Blood and Radostits, 1994). The idea came up as a result of hardship and large economic losses brought about by these parasitic helminthes, hence the need for control and eradication of these parasites. As a result of this, many researches on gastrointestinal helminthes parasites have been reported.

Blood and Radostits (1994), observed that the incidence of helminthes diseases varies between areas depending on the climate, nutritional status of the animal, pasture management as well as the animals' immunity to worm infestation. As a result Schillhorn van Veen *et al.* (1974) reported that environmental factors such as topography, climate and husbandry practice have led to a situation where a number of helminthes parasites common to many parts of the world are rare or do not occur at all in Nigeria and that some helminth parasites common in Nigeria have not been reported elsewhere.

The incidence, severity and disease prevalence have been shown to vary with management systems. Smith and van Hautert (1984) reported that, while infections accounted for over half of the disease conditions observed in a group of intensively managed ruminants, they were of negligible prevalence in a controlled group raised semi-intensively. In the later group, parasitic gastroenteritis was the most prevalent disease condition.

A study conducted by Baptist and Mensah (1986) in Ghana reported the infestation of grasscutters by *Ascaris* sp., *Schistosoma haematobium* and *Trichuris* sp., including ticks of *Dermacentor* sp. and *Rhipicephalus* sp. But the *Ascaris* sp., encountered in the grasscutter is non-pathogenic to the domestic stock until proved otherwise since each animal species has its specific ascarid (Blood and Radostits, 1994). The observation of *Schistosoma haematobium* eggs in the grasscutter is very important in the spread of infection to both livestock and man and the infection can only occur when part of its life cycle passes through an intermediate fresh water mollusc host. The identification of the eggs of *Trichuris trichuria* is important, in that various species attack various domestic stock and possibility of infection of domestic stock would be by sharing the same pasture and by domestic stock hanging around where the wild-stock are slaughtered and faeces disposed of in the nearby bushes.

Jori *et al.* (2001) revealed the presence of *Paralibyostrongylus hebreniticus*, *Trichuris* sp. and *Taenia* sp. in the gastrointestinal tracts of the grasscutters. Matamorous *et al.* (1991) in Costa Rica also reported the incidence of *Trichuris* sp., *Taenia* sp., *Strongyloides* sp. and *Ascaridia* sp., as the helminthes parasites of the grasscutters.

Yeboah and Simpson (2004) in Ghana, again reported some ecto and end-parasites of the grasscutters. Four species of ticks found included *Rhipicephalus simpsoni*, *Ixodes aulacodi Ixodes* sp. and *Haemaphysalis parmata*. The six helminthes parasites they reported comprised of two genera of cestode and four of nematodes. The cestodes were *Furhmanella transvaalensis*, *Railletina mahonae*; while the nematodes were *Longistriata spira*, *Trachypharynx natalensis*, *Paralibyostrongylus vondewei* and *Trichuris paravispicularis*.

A study carried out in Cameroon by Mpoame (1994) and Awah-Ndukum *et al.* (2001) had also reported the presence of a flea (*Xenopsylla* sp.), cestode (*Hymenolopsis* sp.) and Nematode (*Heterakis* sp.) from a dead grasscutter in captivity. Opara and Fagbemi (2008b) in Nigeria reported a wider array of helminthes in the wild grasscutters, which comprised of 14 nematode species, 5 trematodes, 4 cestodes and 1 acanthocephala.

Blood Protozoan Parasites

There have been reports of few cases of naturally occurring blood parasites of the cane rats (Namso and Okaka, 1998) since, they co-habit with other animal species. For example Ntekim and Braide (1981) reported the occurrence of *Trypanosoma lewisi* in the blood of wild rats, while Opara and Fagbemi (2008c) reported the natural occurrence of *Trypanosoma congolense, T. vivax, T. simiae, Plasmodium* and *Babesia* species among wild grasscutters and *Trypanosoma congolense, T. vivax, Plasmodium* and *Babesia* species in the captive - reared grasscutters.

Reasons for Grasscutter Domestication

The grasscutter has desirable attributes for domestication. There is an ever-present demand for its meat (Asibey, 1969; Ntiamoa-Baidu, 1998), so every effort should be made to domesticate it. The importance of domesticating the species is underscored (NRC, 1991) by the fact that successful domestication of the grasscutter species would make it equivalent of South American Guinea pigs and bring about a reduction in Africa's protein shortage.

The most recent study of the animal has over come some of the hitherto set backs to its domestication and established that the animal can be tamed and even used as laboratory animal under both controlled and natural environmental conditions (Addo, 1997). However, continued dependence on hunted wild population for the grasscutter meat does not lend itself to quality control of the meat nor does it enhance planned production, availability and use as and when required for any reasonable purpose. Domestication or captive breeding is a necessity if grasscutter meat industry is to be developed because of these major reasons.

Nutrients Derived from Grasscutter Meat

The grasscutter is a prominent and steady source of alterative dietary animal protein in many rural areas of Nigeria and other West African countries like Benin, Ghana, Togo, Cote D' voire (Ogunsanmi *et al.*, 2002).

Asibey (1974a) reported that the grasscutter meat is of high protein quality, but lower fat content than the meat from cattle, sheep and goat and is greatly appreciated for its tenderness and taste. The approximate composition (%) and mineral content (mg 100 g^{-1}) of the grasscutter meat in relation to that of other domesticated animal meat is shown in the Table 2 by Asibey (1974b).

In Ghana, grasscutter is an important source of animal protein (Asibey, 1978; Falconer, 1992; Ntiamo-Baidu, 1998) and the rest of West Africa (Baptist and Mensah, 1986). The meat is appreciated because of its culinary properties (Table 2) (Ajayi, 1971; Den Hartog and

Table 2: Proximate composition (%) and mineral content of the grasscutter meat in relation to other domestic animal meat

Meat	Moisture	Ash	Protein	Fat	Fe	Ca	P
Beef	73.8	1.0	19.6	6.6	5.1	3.9	57
Mutton	78.5	1.0	17.2	2.9	3.1	9.0	80
Pork	64.8	0.8	19.4	13.4	1.0	3.0	72
Grasscutter	72.3	0.9	22.7	4.2	2.8	8.3	111

de Vos, 1973; NRC, 1991) with high protein, calcium, phosphorous and moisture contents. The relatively low fat content makes the grasscutter meat a choice meat for patients with cardiac problems.

ECONOMIC POTENTIALS OF THE GRASSCUTTER

Grasscutter contributes to both the local and export earnings of the country (Asibey, 1974b; Baptist and Mensah, 1986; Ntiamo-Baidu, 1998; NRC, 1991). At the local market level, for example, approximately 73 tons of grasscutter meat representing more than 15,000 animals can be sold in a year (NRC, 1991). According to recent survey, the grasscutter continues to dominate the bush meat trade (Falconer, 1992; Ntiamo-Baidu, 1998). The Ghana Export Promotion Council (GEPC), included the grasscutter on the non-traditional export trade of the country (Asibey, 1974b). Smoked grasscutter meat is exported to Europe and the United States of America (Yeboah and Adamu, 1995).

However, international trade as well as regional and continental interests in the grasscutter meat provides economic bases for the development of the grasscutter industry. The industry will be greatly enhanced through the establishment of breeding centres to provide stocks for farmers and other growers who will multiply its' production.

Also it would provide additional source of income, desperately required in the quest to help the rural poor to meet their basic necessities and sustain their food security (Asibey, 1986).

Conservational Problems Associated with Grasscutter Demand

Over 90% of the grasscutter farmers depend on the Wild stock of their animals (Yeboah and Adamu, 1995), yet initial high mortality resulting from the trauma of their capture from the wild is frustrating and expensive to breeders. Consequently, there is great demand for captive reared breeding stock for starters. There is the need to develop the grasscutter industry to the status of a viable commercial venture capable of meeting both local and foreign demands without depending largely on hunting from the wild.

Moreover, continual hunting with dogs and fire has negative environmental and economic implications in the locality where the hunting goes on. Although, it is illegal, fire is frequently used in hunting the grasscutter (Martin, 1985; Adu, 2002). There have been complaints by farmers that their crops got damaged by communal hunters through trampling and fire that get out of hand. Besides the destruction of farms and other properties, the bush fires adversely affect other animals and plants, creating immediate and long-term ecological problems. Captive breeding of the animal will reduce risks associated with the hunting of the grasscutter.

Grasscutter as Minilivestock

Conventional livestock such as cattle, sheep and goats are usually kept extensively, requiring substantial areas of land. Most of the land is threatened by human population growth, poverty, increased urbanization and increased pressure on land for other uses with higher economic benefits (Asibey and Addo, 2000).

On the other hand, the grasscutter does not require much land and can even be raised in the backyard and on flat rooftops by the landless (Asibey and Addo, 2000). They also do not produce great quantities of body waste, which in addition to being barely odourless, can easily be disposed off. Also the grasscutter could provide an important source of part-time job opportunities, particularly for the landless women and children (NRC, 1991; Ehui, 1999). Therefore, in situations where agricultural land is scarce or unavailable, small sized animals such as the grasscutter (Anandajayasekeranı, 1999) whose meat is generally referred to as conventional meat (Ntiamo-Baidu, 1998) could be developed along with livestock.

The grasscutter meat is a popular food item and has high market demand and also commands high price (Ntiamo-Baidu, 1998; Addo, 1997). Therefore, the NRC (1991), included the grasscutter in its list of Minilivestock, little known animals with a promising economic future.

Scientific Potentials of the Grasscutter

Africa's advent into scientific research in general and biomedical research in particular, has come along with the need to import research animals for these purposes. These research animals are maintained in facilities whose environment is controlled with electricity and unreliable utility service in many parts of Africa (Asibey and Addo, 2000). Failure to maintain the animals in the special facilities results in their destruction, besides the generation of incorrect research data, which becomes a waste of research resources and time. The development of an indigenous research animal such as grasscutter (Rosevear, 1969; Baptist and Mensah, 1986; Adoun; 1993) which does not need to be placed in rigidly controlled facilities would help eliminate these problems (Asibey and Addo, 2000).

CONCLUSION

In conclusion, literatures have established that the grasscutter, a wild African rodent can be domesticated. The distribution in Africa, south of Sahara, the management system required, nutrition and reproductive performance have all been studied. However, detailed information on health and diseases of these rodents are scanty. Furthermore, the grasscutter is known to be economically important as an agricultural pest and its' meat is widely accepted by all classes of people. It is also a good laboratory animal for research studies.

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