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Review Paper

Genetic Resources and Diversity of Sheep (*Ovis aries*) in Cameroon: A review

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Abstract

The present work aims at describing the different Cameroon breeds of sheep and this activity constitutes a crucial step in the development of a national plan for the management of animal genetic resources and diversity. Through an extensive literature search, our findings indicate six breeds of local sheep in Cameroon. By agroecological classification, three breeds were described in the Sudano-Sahelian zone, two breeds in the Sudano-Guinean zone, and one breed each in the highlands and in the forest zone of Cameroon. These prerequisites warrant endeavors for increasing domestic sheep production likely to meet internal demand apart from boosting sustainable research and development projects for the sheep farming sector in Cameroon.

Key words: Indigenous breeds, sheep, genetic diversity, Cameroon.

ملخص

يهدف هذ العمل إلى وصف السلالات المختلفة من الأغنام في الكاميرون وتعتبر هذه النشاطات خطوة حاسمة في تطوير خطة وطنية لإدارة الموارد الوراثية الحيوانية والتنوع الحيوي. من خلال بحث موسع في الأدبيات، تشير نتائجنا إلى وجود ست سلالات من الأغنام المحلية في الكاميرون. بحسب التصنيف الزراعي البيئي، تم وصف ثلاث سلالات في منطقة السودان الساحلية، وسلالتين في منطقة السودان الغينية، وسلالة واحدة في المرتفعات وسلالة واحدة في منطقة الغابات في الكاميرون. تستدعي هذه المتطلبات الجهود المبذولة لزيادة إنتاج الأغنام المحلية من المحتمل أن تلبي الطلب الداخلي بالإضافة إلى تعزيز مشاريع البحث والتطوير المستدامة لقطاع تربية الأغنام في الكاميرون.

الكلمات المفتاحية: السلالات المحلية، الأغنام، التنوع الجيني، الكاميرون.

Introduction

The Sheep (*Ovis aries*) industry is a major source of food, income and by-products that are beneficial to human livelihoods. Apart from serving as a dietary protein source, sheep also play important roles in cultural and social activities (Baiden *et al*, 2010), just like goats and village fowls.

Sheep domestication occurred some 10,000 to 11,000 years ago in the “Fertile Crescent” (Zeder, 2006). Domestic sheep have played multiples roles in human civilization equating to their worldwide distribution (Thornton, 2010; FAO, 2015). Indigenous African sheep genetic resources currently contribute to about 30% of agricultural gross domestic products (GDP) of African countries (Muigai and Hanotte, 2013). Sheep in Sub-Saharan Africa remains an important source of farm animal genetic resources, harboring most of the allele’s coding for traits associated with resistance to stress, resistance to diseases and ability to thrive on low quality feedstuffs. Genetic diversity, in animal breeds, allows for

the existence of livestock in all but a few environments, globally, providing a range of products and functions (Salako and Ngere, 2002). Genetic diversity does exist between and within breeds, hence it can provide the expected raw materials for breed improvements and for the adaptation of the populations to changing environments and changing demands (FAO, 2015). Furthermore, genetic diversity studies, in domestic animals, aim at evaluating genetic variation within and between breeds, since the breed is the management unit for which factors such as inbreeding are controlled (Tapio *et al.*, 2005).

It has been stressed (FAO, 2013) that the development of conservation and production programs for a sustainable livestock production requires both the implementation of the management strategies and indept information on animal genetic resources. At present, many countries are losing their genetic resources which may have lasting negative effects on food security and sustainable development, especially in the light of global warming (Hoffman, 2010). This is why the Food and Agriculture Organization of the United Nation deemed it necessary to promote the conservation of farm animal diversity with the view that human kind may need to keep this specific genetic biodiversity to face future unforeseeable challenges such as changes in demand for livestock products, spread of new diseases, uncomfortable environmental impacts and climate changes (FAO, 2011).

Cameroon sheep population is estimated at 10 202 369animals in 2018 (MINEPIA, 2021), contributing its own way to the livelihoods of rural masses. Despite this importance, knowledge on Cameroon sheep genetic diversity is scanty though a good number of zootechnical, morphobiometric and socioeconomic studies (Tchouamo et al., 2005; Manjeli *et al*., 1995; Sounchio 2003; Tendonkeng *et al*., 2013; Baenyi *et al*., 2019; Djoufack *et al*., 2020) have been carried out on the sheep of Cameroon, hence, the aim of this review was to present the diversity of Cameroon indigenous sheep.Specifically, we are going to present sheep reproduction, describe the various breeds of sheep found in Cameroon with their distribustion

1. Methodology

1.1. Cameroon agroecological areas

The Figure 1 presents the five Agroecological zones found in Cameroon.

From this Figure 1, it shows that there are five Agroecological zones in Cameroon (Soudano-sahelian zone, Guinean High Savanna Zone, Western Highland zone, Bimodal Humid Forest zone, Monomodal Humid Forest zone); they are well known and describes by Ambassa (2000).

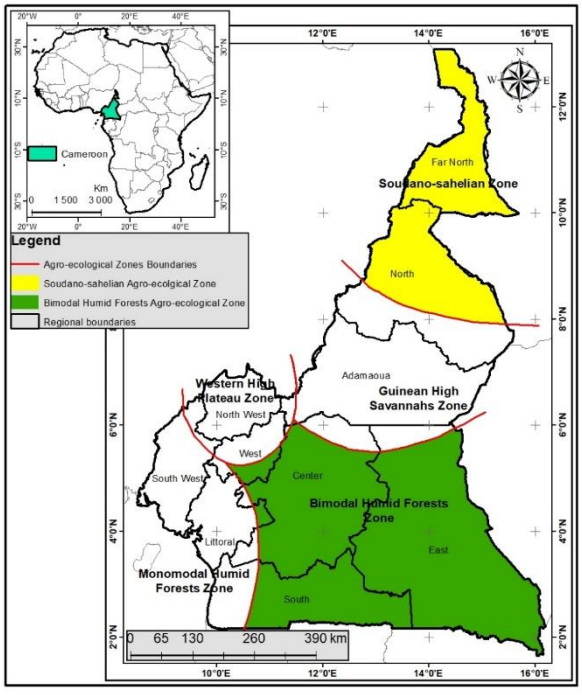

Figure 1: Cameroon agroecological zones *Source: Ambassa (2000)*

1.2. Data collection and analyses

The bibliographic search for this paper was carried out by consulting the databases Google, Google Scholar and HAL and previous studies done throughout Cameroon at all levels.

2. Results

2.1. Importance of sheep in the livelihoods of Cameroon farmers

Livestock contributes to job creation, income generation, food security and strengthening social ties. It constitutes within the systems of agricultural exploitation of Sub-Saharan Africa an essential element, as a means of mitigating risks in agriculture (Zoundi *et al*., 2003). In agricultural remote areas, farmers consider animals as living capital. They can exchange an animal for money in case of needs. The head of the family can offer a sheep as a wedding gift, sacrifice a sheep for organized festivities, thus avoiding a liquidity drain. Livestock also constitutes a savings from which the peasant draws during the fasting season. In fact, during this period, which covers the dry season and the beginning of the rainy season, exchanging living animals warrants possible shortages of liquidity.

Sheep production has been reported to play a key role in the livelihood of rural populations in sub-Saharan Africa as sales of the animals and their products help in stabilizing household income (Adjibode, 2016). Livestock offerings, especially sheep, are part of the religious and cultural traditions of some communities and regions in Africa. Certain breeds are the offerings of choice during the Adha festival among Muslims and at the receptions of major political, social or family personalities. In addition, their wool is sought after for making quilts and mattresses; while the skin is used as carpets or decorations (Hage, 2017).

2.2. Sheep reproduction in the tropics

The warm environment, with its characteristic harsh weather conditions, adversely affect meat and reproductive performance of animals (Adjibode *et al*., 2016).

The age of detection of the first oestrus in females is usually between 5 and 13 months. The age at first lambing varies from 13 and 23 months. In males, the age at first mating varies between 18 months and 24 months. Puberty is reached when the lamb weighs 40 to 50% of adult weight of its breed, corresponding to the age of 6 months. However, the lamb can be breeding later, when its live weight reaches 50 to 60% of the adult weight of its breed (Meyer *et al*., 2004). Age at puberty in Djallonke females varies between 5 and 13 months with a live weight varying from 2.1 kg to 15kg (Gbangboché *et al*., 2005).

The sexual cycle of sheep is continuous and lasts from 14 to 19 days with an oestrus of about 30 to 41 hours. The oestrus of the sheep is hardly detectable in the absence of a male (Gbangboché *et al*., 2005).

Gestation lasts about 5 months, with some variations reported: 149 ± 2 days, 147 to 157 days (Senou *et al*., 2009). Lambing normally takes place in 30 minutes and lamb takes 11 to 48 minutes to stand and 14 to 75 minutes to start suckling. The interval between successive lambing can vary from 220 to 360 days and is clearly influenced by the rearing conditions, especially the season of the year and the feeding level. Abortions as well as embryonic death lengthens lambing intervals and the term "temporary sterility" has been attributed to females whose lambing intervals exceed by 50% the average interval of the herd considered.

Puberty is reached when the lamb weighs 40 to 50% of adult weight of its breed, corresponding to the age of 6 months. However, the lamb can be breeding later, when its live weight reaches 50 to 60% of the adult weight of its breed (Meyer *et al.,* 2004).

In traditional farming, lambs are weaned naturally at 3-5 months of age with an average weight of 5-13 kg (Gbangboche *et al*., 2005). The ewe can perform an average of 7 lambings until she is 6 to 6.5 years-old (Vallerand and Branckaert, 1975). Longer maternity careers of 8 to 9 years with 11 to 12 lambings have been observed (Moulin *et al*., 1994).

(Gbangboche *et al*. 2005) had reported the rainy season being more favorable and beneficial by increasing the lambing rate in Djallonké ewes, by increasing weight of lambs at birth and at 12 months old and promote a reduction of the age at the first lambing and the lambing interval.

2.3. Description of Sheep breeds found in Cameroon

2.3.1. Djallonké breed

Also called West African Dwarf sheep, Forest Dwarf sheep or Grassland Dwarf sheep, this breed originated from Fouta Djallon and is now widespread in the area south of the 14th parallel in West and Central Africa. It is found in Senegal, Guinea, Benin, Nigeria, Ghana, Togo, Niger, Cameroon, Ivory Coast, Central African Republic, Burkina Faso and Chad. (Adjibode *et al*., 2016). This breed includes all trypanotolerant sheep populations in tsetse-infested areas of West and Central Africa. In Cameroon, the Djallonke breed is reared in all the five agroecological zones, mostly for meat, hide and religious rites.

The Djallonke sheep (Figure 2) has a straight profile, is short in stature (hypometric) and of medium size. Its tail is thin and of medium length (Gbangboche *et al.*, 2005). The Djallonke sheep genetic resources in Africa possess important adaptive traits. It survives and reproduces in harsh weather conditions, it is highly prolific and adapted to harsh humid environments as well as resistant to trypanosomiasis (Geerts *et al*., 2009). These traits help these animals to cope with harsh agro-pastoral productions systems such as lack of quality fodder and diseases, mainly Trypanosomiasis and ticks (Biguezoton, 2016, Diaha-Kouamé *et al*., 2018). Djallonké sheep have a good capacity of adaptation and are mainly raised for meat production. The carcass yield at slaughter varies from 43.6% to 55.8% of live weight respectively (Gbangboche *et al*., 2005; Alkoiret, 2007).

A B

Figure 2. Djallonké sheep (A : Ewe, B : Ram) ; *Source : A : Lepawouah (2024) ; B : Gbangboche (2005)*

2.3.2. Balami breed

Also known as Sahelian sheep (Fulani, Peulh, Balami, Bali-Bali, Maure, Tuareg, Guinea Long-legged, Sahelian, West African Long-legged). These are trypanosensitive animals, which originated from the dry regions of West Africa (Mauritania, Mali, Niger and Chad). Sahelian sheep are larger animals with a faster growth rate than the Djallonke, (Carles, 1983).

In Cameroon, Peuhl sheep (Figure 3) are reared mostly for meat in the Sudano-sahelian agroecological zone (Far North and North regions) and the high guinea savannah zone (Adamawa region). The dominant color of the coat is white. The animals have long legs with large, long and droopy ears. Females are pooled while males have long, spiral and horizontal horns. The height at the withers, heart

girth and body length are 70, 65, 100 centimeters respectively for males and 67, 60 and 94 centimeters in the same order for females. (FAO *et al*., 2003).

Figure 3. Balami sheep (ewe (a) and ram (b)) Source: Yaye *et al.,* (2019)

2.3.3. Kirdi Massa sheep

As the Kirdi goat breeds, the Kirdi Massa sheep breed (Figure 4) appeared to descend from the West African Dwarf. The breed is reared for meat in the Massa (Kirdi) area of the Far North region of Cameroon. The adult ewe weighs 20-25 kilograms and the ram 25-30 kilograms. The breed is characterized by a dark coat and short horns, and is further distinguished by a hardy and prolific nature (FAO *et al*., 2003). This Cameroon breed is stocky with short legs and a slightly rounded muzzle. The horns, which are only present in males, are moderately developed, prismatic and directed towards the back of the body. The ears are thin and short (Tobit, 1980).

Figure 4. Kirdi sheep *Source: Lepawouah (2024)*

2.3.4.The Poulfouli breed

As presented in Figure 5, the Poulfouli sheep breed is a very large breed (body length: 85 cm; body weight: 45 kg) which is represented only by animals bought each year from Chadians. The animal is fragile and produces meat of mediocre quality. Structurally, the breed is large, long, hypermetric and straight. Their ears are large and long similar to the tail that further goes down below the hocks (FA0 *et al*., 2003).

Figure 5. Poulfouli sheep *Source : Ouattara et al., (2021)*

2.3.5. Uda or Oudah or Bali-bali sheep

Uda sheep (Figure 6) are found in the northern Sudano-Sahelian agroecological zone but not as much as the Peuhl sheep. Their distinction comes from the fact that they all have a two-tone coat, black or brown in the fore quarters and white in the hind quarters. The legs are long and the ears are floppy. Adult rams and ewes weigh 65 kilograms and 45 kilograms respectively (FAO *et al*., 2003).

Figure 6. Uda sheep (female (a) and male (b)) *Source: Yaye et al., (2019)*

2.3.6. Blackbelly Sheep

These animals have a distinctive fawn coat and the belly is completely black as well as the lower part of the legs, earning them the name Blackbelly in English (Vallerand and Branckaer, 1975). Their coat color is reddish brown; but it may vary sometimes from light to dark brown; it has black spots on the head (around the eyes, mouth and throat), black ears and often a black spot or point above the eyes. Males have a characteristic mane that extends from the neck to the chest and have horns. They are medium-sized: adult males have a height at the withers of 55-65 cm and weigh 25-35 kg; females average 28 kg; they have small heads, a straight facial profile, and short, semi-pendulous ears (Meka et *al.*, 2019).

Blackbelly sheep (Figure 7) are very prolific. An average of 2.03 lambs per litter and an average lambing interval of 8.48 months (Meka *et al.*, 2019). Rastogi *et al.* (1980) observed 26.8% single births, 47.3% twins, 22.1% triplets, 3.4% quadruplets in this sheep breed. This state of prolificacy clearly distinguishes this breed, whose cradle is in eastern Cameroon (Epstein, 1971), from almost all other tropical sheep breeds, which generally produce only one or two lambs at a time.

Blackbelly sheep is a breed with a fine tail, small head with a straight profile. The ears are small and slightly droopy (Manjeli *et al*. 2003). It can reach 55 to 65 cm at the withers. This sub-type is genetically stable and the animals have a more advantageous outward appearance. This impression is confirmed by their average weight, which in adult females of this sub-type exceeds 28 kg (Vallerand and Branckaer, 1975). In Central Africa, the Blackbelly sheep is used solely for meat production, with males reaching 25 to 35kg. Nevertheless, the milk production of Cameroon Blackbelly sheep is not negligible reaching 2.95 to 3.52 liters per week (Manjeli *et al*., 2003). It is a breed with very good resistance to disease (such as trypanosomiasis) and is highly prolific and precocious (Meka *et al*., 2019).

From the above description of sheep according to the previous authors and studies, it can easily be seen that qualitative traits are made of epistatic genes from various cross breeding amount and within sheep populations, this is justified by the result obtained by the morphometric and molecular characterization done as we continued this study.

Figure 7. Blackbelly ram *Source: Meka et al., (2019)*

3. Conclusion

This paper describes the sheep genetic resources available in Cameroon and diversity amongst them. Biological diversity is now recognized as common concern of mankind and genetic diversity is the major driver of variation within and across breeds, which helps populations to adapt to environmental changes. Sheep is a widespread and well adapted indigenous breed that plays a key role in the socioeconomic life of people living in rural areas in many countries in sub-Saharan Africa and particularly in Cameroon. In any breed development effects, available genetic resources must be characterized at both phenotypic and molecular levels. In as much as our objective would be to meet our needs of the present, breed development endeavors should be done without compromising the ability of future generations to also meet their own needs. In fact, introgression of different genes into different sheep breeds could also lead to a serious threat to this animal genetic resources tantamount to the loss of some of their adaptive traits. Documentation of these genetic resources has been very sporadic and many breeds need to be described and their production performances recorded. Lack of a concerted approach in breed improvement and management leads to a situation where the breeds are taken for granted and there is need for a rationale exploitation of these genetic resources. This will ensure a good production base for future generations.

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Authors' contribution

Conceptualisation was done by Lepawouah Keubeng Ermine, Djoufack Tadakeng Yannick and Guessom Christel; Hako Blaise Arnaud and Meutchieye Felix revised the paper contents, and Aziwo Tatanja Niba and Jean Claude Fotsa supervised the work, revised and improved the paper contents.

Ethics

Authors declare that there are not ethical issues that may rise after the publication of this manuscript.

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