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STUDIES ON CAMELS OF ERITREA: A REVIEW

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Abstract

Eritrean camels belong to the genus Camelus, species *Camelus dromedarius* or dromedary or one-humped camel. Camels in Eritrea, about 75 000 in number, are used as milk, pack animals for carrying fuel wood, agricultural by product and trade goods, and for riding, ploughing and for driving oil mills. Camels are rarely slaughtered for meat at slaughterhouses. Camel milk is an important food item among Eritrean pastoralists. The normal duration of lactation in Eritrean camel is about 12-14 months, milked 2-4 times a day depending on the amount of milk produced. Female at their 3rd-4th parity produce an average of 5-9 and 3-6 litres / day in wet and dry seasons, respectively. Diarrhoea, pox/contagious ecthyma are among the commonest ailments in suckling calves while in adult camels abscess, mange and respiratory pathologies appear to be the most common pathologies. Classification of Eritrean camels has been based on camel owning tribes and colour**,** region/location and function. However, camel breeds as such have not yet been well established and their real performance evaluated. In view of the importance of camel in Eritrea, it is necessary to assess their genetic potential and variability within and between populations using DNA polymorphism to identify / classify camel breeds / breed groups. This will help analysis of inter-relationship between nomadic animal husbandry practices, standard breeding management, animal performance and the genetic structure of camel population. There is a need to initiate collaborations with established camel research centres in regional countries and to establish a camel nucleus herd in Eritrea so that studies on genetic potential of Eritrean camels and on their productivity in the pastoral systems could be conducted.

Introduction

In Eritrea, about 49 % of the country is rangeland. Approximately 75 % of the country's population depends on livestock and livestock production (Assefaw et. al. 1999). Of the total national herd, some 60 %, including the majority of Eritrea camels, are located in the western and eastern lowlands where livestock owners are agro-pastoralists and pastoralists. Camels belong to the family Camelidae, order Artiodactyla, suborder Tylopoda. Camelidae originated in North America during the Eocene period (about 50 million years ago) and from there spread to South America and through the Bering Strait into Asia, the Near East (Arabia) and Africa via North Africa (Higgins, 1984). The Camelidae are divided into three genera: the Genus Camelus which includes the Old World Camels: the dromedary or the one-humped camel or Arabian camel (*Camelus dromedarius*) and the two humped camel or Bactrian camel (Camelus bactrianus) and the Genera Lama and Vicuña which includes the so called New World camels: llama (*Llama glama*), alpaca (*Llama pacos*), guanaco (*Llama guanicoe*) vicuña (*Vicugna vicugna*). All the species in the three genera are closely related and camelidae hybrids have been produced (Tibary & Anouassi 1997). Camels in Eritrea, as in all the rest of Africa, belong to the genus Camelus and are represented by the species Camelus dromedarius or dromedary or one-humped camel.

Material and methods

The study was conducted through field visits to several areas of Eritrea and subsequent interviews, using a standard questionnaire (Annex 1) with local camel owners of different ethnic groups. During these visits practical visual assessments of camel herds, at watering points and grazing areas, were also done.

Significance of camel to Eritrean pastoralists

Camel are very important for their unique ability to survive high temperatures, their reduced dependency on water supplies, their mobility and ability to browse and graze a wide range of plant species and their immunity to diseases of cattle and small stock that are endemic in sub-Saharan Africa such as Foot and Mouth, Contagious Bovine Pleuropneumonia, (CBPP) Contagious Caprine Pleuropneumonia (CCPP), and the almost eradicated Rinderpest. In Eritrea camels are the most important animal for the pastoralists in the semi-arid regions because of their highly nutritious: about 755 calories x Kg (Dahl & Hjort 1976) and abundant milk. The normal duration of lactation is about 12-14 months, but if the camel does not get pregnant it can continue to produce milk for 24 months. Lactating camels are milked 2-4 time a day depending on the amount of milk produced. Female at their 3^{rd}-4^{th} parity produce an average of 5-9 and 3-6 litres / day in wet and dry seasons, respectively. However, some milk breeds such as the hamra (Rashaida ethnic group) is quoted to be able to produce up to 30 litres/day in the wet season and 10 litres/day in the dry season. Camel milk is consumed by the owner, or given to/shared with neighbours or sold in small quantities. However, the importance of camel milk is mainly its availability in dry seasons and during times of drought when milk from other livestock is scarce. During such periods, camel milk contributes 50-100 percent of the nutrient intake of some of the pastoralist groups (Gebrehiwet, 1998).

Camels in Eritrea are frequently used as pack animals for carrying fuel wood, agricultural by product and trade goods, and for riding, ploughing and for driving oil mills known as “assara”. They are also used for transportation of persons and households during migrations and most importantly to carry water for household consumption. Camels, especially males/old animals/unproductive females may be sold for meat which is eaten on festivals or during rituals. Camels are rarely slaughtered for meat at slaughterhouses. Camel hides, although may be used for making leather goods, are often discarded.

Camel owning ethnic groups / tribes in Eritrea

The Eritrean pastoralists are found in 3 different ecological zones of Eritrea: in the northern plateau and eastern lowlands of Sahel region, in the eastern plains and semi-desert of Dankalia, and in the north-western lowlands of Barka and their livestock, mainly camels, goats and sheep, are their main source of income (Assefaw et al 1999).

Camel keeping pastoralists belong prevalently to the Tigre, Beni Hamer, Rashaida and Afar ethnic groups. Though they all are pastoralists and have pastoral production systems, variation in their pastoral way of life can be observed depending on which ecological zones each group lives in. Some of these variations are the species of livestock they predominantly raise, the pattern of their periodic migrations and the combination of activities they practice in addition of their pastoral production system. The Tigre raises mainly goats, cattle, sheep and occasionally camels. In addition they cultivate during the rainy seasons and also trade some of their herds to buy food or grain. The Beni Hamer raises camels and goats and cultivate during the rainy seasons and trade goats and camels to buy food or other things they need. The Rashaida are camel keepers although they engage in other business activities while Afars raise goats and camels and sometimes fish on the Red sea coast and also involve in trade activities, salt mining and coral picking from the sea.

Camel statistics and classification of Eritrean camels

Eritrea with a total land area of 122 000 sq. km., is divided into 6 agro-ecological zones: the Central Highland Zone (> 1500 m, cool, semi-arid, 400-700mm rain / year), the Western Escarpment Zone (600-1500 m , warm to hot, semi-arid, 600-700 mm rain / year), the South Western Lowland Zone (600-700 m, hot, semi-arid, >400 mm rain / year), the Green Belt Zone (750-2000+ m , sub-humid temperate to humid tropical, 700-1000+ mm rain / year), the Coastal Plains Zone (< 0-600 m asl,

hot desert, < 200 mm rain / year) and the North Western Lowland Zone (400-1500 m , hot arid, < 300 mm rain / year). Camels are found mostly in the western and coastal eastern lowlands.

Camel population of Eritrea is estimated to be 75 000 although earlier report suggests a figure of 185 000 camels (Anonymous 2002). No livestock census has been carried out since 1978 and the overall livestock population in Eritrea is reported to have decreased in the last 15-20 years because of recurrent droughts and war. Thus, no exact figures exist for the post-war situation. Ranking of Eritrea with respect to camel statistics is placed in Table 1. Camels as percent of Domestic Herbivore Biomass (DHB), as shown in Table 1, give an indication of their relative importance in the national and individual livestock economies of the countries in which they are found. In terms of DHB countries have been grouped into 4 categories: Category 1 (camels contributing < 1% of DHB), Category 2 (camels contributing 1- 8% of DHB), Category 3 (camels contributing 8-20% of DHB) and Category 4 (camels contributing > 20 % of DHB). As per this classification, Eritrea falls under Category 2 (Anonymous 1996).

Table 1 Comparative camel statistics

Ranking for No. of camels	**Ranking for No. of persons x camel**	**Ranking for No. of camels x sq. km. (camel density)**	**Camels as % of Domestic Herbivore Biomass (DHB)**
Somalia (1), Sudan (2), Mauritania (3), India (4), Ethiopia (5), Chad (6), Saudi Arabia (7), Niger (8), Mali (9), UAE (10), Yemen (11), Libya (12), Oman (13),	Somalia (1), Mauritania (2), Djibouti (3), Chad (4), Sudan (5), Qatar (6), UAE (7), Oman (8), Niger (9), Mali (10), Libya (11), Saudi Arabia (12),	Somalia (1), Qatar (2), Djibouti (3), UAE (4), Sudan (5), Mauritania (6), Ethiopia (7),	Mauritania , Djibouti, Somalia, Western Sahara, Qatar, UAE (Cat. 4); Niger, Chad, Tunisia, Sudan, Jordan, Yemen, Saudi Arabia, Kuwait, Bahrain (Cat. 3)
ERITREA (14) *75 000*	***ERITREA (13)*** *57.753*	***ERITREA (8)*** *0.569*	***ERITREA,*** *Egypt, Ethiopia, Morocco, Mali, Algeria, Kenya, Libya, Pakistan, Israel, Afghanistan, Oman, Iraq (Cat. 2)*
Djibouti (15), Qatar (16), Jordan (17), Kuwait (18),	Ethiopia (14), Yemen (15), Kuwait (16), Jordan (17), India (18)	Chad (9), Kuwait (10), India (11), Yemen (12), Oman (13), Niger (14), Mali (15), Jordan (16), Saudi Arabia (17), Libya (18)	*India, Nigeria, Senegal, Upper Volta, Turkey, Iran, Syria, Lebanon (Cat. 1)*

The concept of camel "breed" is quite a loose one. Even among long established camel breeding societies camel herds of a particular breed show camels with a wide variation in size, build and colour. Numerous methods have been used to try to classify and identify camel "breeds". Camel breeds are identified by the particular ethnic groups owning them, by their colour (white, brown, sand etc), geographical distribution / habitat (lowland-riverine, desert, mountain), main function (baggage, riding, milking) or by their body morphology: brachymorphic: large and heavy animal, mesomorphic: lighter animal and dolicomorphic: lean, swift animal, weight and other body parameters (Blanc & Enesser 1989, Wilson 1998). However, the production potential of camels differs between the various ethnic groups and pastoral husbandry systems. It is not very clear to what extent these differences result from genetic variability within and between the different camel breeds and environmental factors. Table 2 shows the classification of Eritrean camel according to tribal ownership, region / location, colour, and function.

In general camels of western lowlands have much in common with those of the Sudan, while camels

of the eastern lowlands are similar to camels of the Afar region of Ethiopia.

Table 2 Classification of Eritrean camels

Ethnic group	Region	Breed	Colour	Function	Characteristics
Beni Hamer, Tigre	Western lowlands: Gash-Barca, Anseba	Barka	Several from whitish to reddish	Multipurpose: used as pack/work, riding, and milk production	Brachimorphic to mesomorphic
Rashaida	Northern Red Sea: North of Massawa, Sahel	Annafi	only white	Only for riding	Dolicomorphic, small head, smooth skin
		Beza	sand	Riding and milk production	Dolico-mesomorphic
		Sahilian	brownish	Milk production	Mesomorphic, drought resistant
		Hamra	reddish	Milk production	Mesomorphic, hairy, not drought resistant, very good milk production with rapid gain of weight in the rainy season
Afar	Southern Red Sea: South of Massawa	Geleb	Several	Dual purpose: milk production and pack	Mesomorphic Carry weight up to about 120 kg, few males used for trade in salt.

Ownership

Ownership of camels in Eritrea is not well documented and vary among different pastoral ethnic group. As a general rule in the Horn of Africa and in Eritrea camels can be owned by individuals but without any absolute right on them. Camels are not sold without the consent of the close patrilineal kin group. Such groups are also responsible in case damages (in the form of camels) had to be paid as a compensation for a crime a member has committed or camels have to be received as a compensation for a crime received. The clan members or head of the family, who is invariably a male, also have the right to loan camels to deprived friends and relatives who have lost their animals and do not have enough milk or pack animals to survive. When the emergency is passed, the camels are returned to the individual or family who loaned them. As in other camel societies in the Horn of Africa the selling of male camels is common while females, particularly young adults, are rarely sold, unless such animals have permanent faults such as sterility, mastitis, severe faulty conformation or other faults. For identification purposes camels are marked with a specific clan brand and a subsidiary mark, which is unique to an individual or family.

In the lowlands camels are owned mostly by Muslims. In the highlands camels were introduced during the Eritrean war of independence for carrying trade goods and for transport. This has resulted to some camels being owned by Christian highlanders who keep them for transport but, with the exception of the Saho ethnic group, do not drink their milk or eat their meat.

In Eritrea as in many pastoral societies the acquisition of camels start at the birth of a son when the father gives his son a young or newly born female camel. Also the child receives gifts of camels from his close relatives and as the child grows, his herd also grows. When the person gets married, a portion of the family herd is allocated to him and 2 to 7 camels are given to the father-in-law.

Herd structure

Herd structure in the majority of subsistence societies result from a large variety of factors, some

intrinsic to the herd: production parameters, nutritional levels, death rates etc, and some other extrinsic to the herd: camel owner's requirements for milk, transport, meat. Other important factors influence the herd structure such as availability of labour for grazing and watering, possibility of getting milk from other livestock species, the carrying capacity of the land, the herd size. Since milk is the primary objective breeding females constitute the majority of the herd and female calves and immature females are in a higher percentage compared to male calves and immature males. Such difference in the proportion of male and female immature/calves in a herd is often caused by the owner who tend to allow female calves to suckle more freely than male calves and this translate in a higher survival rate for this class of animal. Table 3 represents the structure of a herd of 95 camels observed in Eritrea (Gebrehiwet 1998) and in Ethiopia: Afar (Ayele 1982, 1987) with percentages of each group of male/female calves, immature males/females, and mature males/females.

Table 3 Herd structure in Eritrea and Ethiopia

Category of camel	**Percentage (Eritrea)**	**Percentage (Ethiopia:Afar)**
Male calves	12.63	8
Female calves	11.58	14
Immature males	5.26	12
Immature females	15.79	40
Mature males	9.47	0
Mature females	45.26	26

Camel management and its system

Camel management involve periodic herd movements to take advantage of water and grazing available in certain areas and time of the year. Details are different between ethnic groups or families and they are dictated by several factors such as manpower availability, extent of the camel owned, migration patterns and other (Mugerwa 1981). Traditional camel production by pastoralists in Eritrea is characterized by a nomadic transhumant system with a communal use of pastures and seasonal migrations of herds and households. The frequency of migrations may range from 1-5 times per year and distance of migration may be very short to several hundred kilometres long. However, often milking camels are kept closer to the permanent home while breeding and dry animals are kept in the more favourable grazing areas, usually remote areas to take advantage of high quality forage available after seasonal but erratic rainfalls.

Breeding camels are invariably herded by unmarried men and boys. Although in the Northern and Southern Red Sea regions of Eritrea, women take care of pack camels, the role of women in camel husbandry is limited by numerous cultural taboos. For example among the Afar, married women are not allowed to drink milk from particular camels ("waloita" camel) and women who have delivered will not drink camel milk unless the child is 40 days old.

Pack camels, male animals, start to be trained when they are around 2-3 years old and begin really to work when they are 4-5 years. By the time they are 10 year old, they attain maximum productivity. In western lowlands of Eritrea, camels may be used for ploughing on farms and employed for dragging thorn bushes to make enclosures for livestock. When used for transporting, particularly when carrying heavy loads or very young children, weak or sick people and young animals, the journey is often done early in the morning or late afternoon and at night under moon light to avoid the mid-day heat. When on the move, each camel has a rope tied to a halter fitted on its head, the rope of the lead camel is held by a guide man and other camel follow in line with head ropes tied to the tail of the camel in front.

Feeding / watering / movement of camels

Calves begin to follow their dams as soon they are born. Milk intake of the calf is controlled by tying the teat of 1or 2 quarters of the udder of his mother. Weaning is achieved at around 10-12 months. Camels, in general, are selective feeders and if given a choice prefer to feed on bushes and trees (Schwartz 1992) and tend to avoid grasses. Camels in Eritrea browse and graze all the year round, without any supplementary feeding with the exception of working camels especially those used in an oil mill or "assara", which feed on sesame oilseed by-products and of riding camels which are supplemented with 3-4 kg of grain per day. Free grazing camels obtain adequate nutrient from a range of plant species such as *Boscia angustifolia* , *Cadaba farinosa*, *Maerua* spp., *Commiphora* spp. etc. and other large bushes/trees such as *Acacia mellifera, Acacia tortilis*. In the coastal area of Eritrea camel graze almost exclusively on the halophytic shrub *Suaeda aegyptiaca* while in the Tesenei district of Gash-Barca region in the western lowlands of Eritrea, camels graze the small annual grasses found on clay soils, which are seasonally flooded such as *Blepharis linariifolia*. Camels on natural range will browse and graze at any time of the day or night in a scattered group but tend to avoid feeding during the hottest time of the day.

During the dry season, from November onwards, Eritrean pastoralists start moving their camels to areas where evergreen bushes and small trees are found in the highlands. They stay there until the end of June and return to their lowland base from the beginning of July and stay there for 3-4 months. However, if there is sufficient rainfall to maintain the trees and bushes in the base areas green, the owners may decide to keep the animals there. Camel salt requirements, for maintenance alone, are between 6-8 times those considered adequate for other livestock and can be 120-150 g per day.

Water requirement is very much dependent on the type of grazing available and on the environmental temperature. It is well known that camels do not need to drink water for up to 30 days when green forage is available and temperatures are cooler (30º C). However, if the available fodder is dry or when doing work camels need to be watered. The usual water interval is 3-4 days but it can be extended to 10-14 days. It is estimated that pack camels working in the middle of the day have a water turnover of 3.4 L x 100kg bw. (Manefield & Tinson 1997). Reports in Eritrea, based on pastoralists interviewed, confirm that camel's need for water is minimized because of its ability to move long distances to find green forage. Water sources for camels in Eritrea are often deep wells, but seasonal dams, shallow wells in river beds and permanent springs are also used. Watering time is often from midday to late afternoon.

Breeding reproduction and work capacity

Interviewed camel owners by Gebrehiwet, 1998 and in the present study reported that the majority of the females in the herd were mated in the rainy season, the rest in the short rainy season when forage was plentiful and temperatures cooler. However, it is well known that if camels are in good condition and plenty of forage is available, they can be bred at any season. During the breeding season males go on rut displaying a typical behaviour: increase aggression towards other males (or humans), frequent extroflection of the "dulaa" or soft palate accompanied with gurgling sound, profuse salivation and grinding of teeth, the occipital glands also secrete profusely and the back of the head and neck are stained with blackish pungent smelling fluid. Males in rut also urinate frequently on their tail that is then violently slashed upward so that their rump is wet and stained with urine.

The breeding male will mate females by forcing them in the sitting position through bites on their front legs and by pushing their neck down with his powerful neck. Once the female is couched the male will "crouch" on her with his pedestal pads positioned behind her hump and his forelegs between her chest. However, breeding is often directly controlled by the camel owner himself.

When the owner decides that a particular female is ready to be mated, he will tie her in a sitting position and then allow the selected bull to mate her. This type of breeding is normally successful since in the case of the camel ovulation is stimulated by coitus.

Pregnancy is detected by pastoralists within 15 days of the mating by observing the female coiling her tail upwards and urinating when the bull, or a man, approaches the animal. Such signs can easily be recognized by man and, contrary to what is reported by many publications, they are a very reliable sign of pregnancy. In case of abortion these signs disappear within a few hours. The gestation period of a camel is between 12 and 13 months and the newborn weight between 25 and 30 kg. Pastoralists start selection of future breeding males at birth based on the history of the performance of the dam, and the colour and skeletal conformation of the male calf born. However, physical strength, resistance to disease, docility also play a role. As far as possible breeding males are not used for transport on the belief that this weakens them and make them less sexually active with a reduced life span.

Breeding males start to be used at around 4-5 years, however, they are still too young to perform fully and often need to be assisted by the herdsman to complete the mating successfully. Breeding males reach their full potential at 7-8 years of age when each bull is allocated 40-50 females. Breeding bulls are reported to be culled at around 20 years, but probably are culled at 15-17 years. Beni Hamer and Tigre report that the breeding bull is changed at around 10 years, reportedly to avoid the bull to breed his own daughters. Contrary to report by Gebrehiwet, 1998, castration is not usually performed since it is believed that it weakens the animal rendering it inferior for packing and riding purposes. Female camels are reported to be calving for the first time at around 4 years of age and can continue to breed until they are 15-20 years old, during this period they can produce about 8-10 calves with a calving interval of about 2 years. Because of such long calving interval the building up of a camel herd is a slower process in camels than in cattle. Barring outbreaks of serious diseases a normally composed camel herd can double in size in 15 years while a cattle herd takes 6 years (Dahl and Hjort 1976).

Reproductive and productive parameters of 27 female camels and work capacity of fully developed male camels are shown in Table 4, (Gebrehiwet, 1998, Knoess1976).

Table 4 Reproductive and productive parameters of 27 camels

Parameters	**Mean**	**Range**
Age at first calving (years)	6.9	6.1-7.6
Gestation period (days)	383.5	376-392
Annual birth rate (%)	48.6	43-56
Daily milk yield (litres)	4.7	3.6-5.8
Lactation period (months)	14.4	12.0-16.8
Mature body weight (kg)	410	357-463
Load carrying capacity of fully developed camel (10 years)	150 litres of water for 5-6 hours or 200 kg of sorghum for 5-8 hours, covering 25-35 km / day	
Oil extraction work	Crashing sesame seeds to extract 30-40 litres of sesame oil / day of 7-8 hours	
Ploughing work	Ploughing 1 ha in 20 hours	

Camel diseases

For all practical purposes camel diseases in Eritrea are the same as seen in the neighbouring countries (Schwartz & Dioli 1992, Wernery & Kaaden, 2002). For example in neighbouring Ethiopia the commonest camel diseases are: trypanosomosis, sarcoptic mange, pox/contagious

echtima and calf diarrhoea (Ayele 1987, Abebe 1991). Such diseases are also present in Eritrea Interviews with camel owner in the present study stated that Trypanosomosis, most probably caused by *Trypanosoma evansi*, is seasonally occurring in the eastern lowlands and that diarrhoea is among the commonest ailments in suckling calves together with camel pox/contagious ecthyma. Abscess and respiratory syndromes are also occurring. An investigation covering a total of 15,518 camels (Gebrehiwet 1998) revealed that almost 40% were affected by some sort of disease.

Disease prevalence was highest in the rainy season (47.7 %) and lowest in dry season (19.2 %) and the most serious and common diseases recorded were sarcoptic mange, abscess, respiratory problems, helminthiasis and mastitis. Helminths species involved are likely to be the same as the one found in Eastern Sudan: *Haemonchus* spp., *Trichostrongylus* spp., *Oesophagostomum* spp., *Impalaia* spp. (Fadl *et al* 1992) Brucellosis could likely be present among the camel population of Eritrea since in the neighbouring Eastern Sudan *Brucella abortus* was isolated and antibody rate of 13 % were detected among the adult female camel population (Yagoub *et al* 1990, Agab *et al* 1994). Ecto-parasite infestation appears widespread with the soft tick *Ornithodoros savignyi* especially common around permanent watering points. Other ectoparasites such as the camel nasal bot fly *Cephalopina titillator* and many species of ticks of the genera *Hyalomma*, *Rhipicephalus* and *Amblyomma* are extremely widespread infesting virtually all camels (Table 5). As in Kenya, Ethiopia and Somalia calves are particularly susceptible to the infestation of the nymphs of *Hyalomma dromedarii*. While the adult of *H. dromedarii* are found almost exclusively inside the nostril of the camel, nymphs are less site specific and may be collected from all over the body particularly in areas with long hairs. In camel calves thousands of nymphs may be found on the withers, shoulders, chest, hump, i.e. areas with longer hair (Schwartz & Dioli 1992). If the infestation is left unchecked it will readily cause the death of the calf. To avoid the infestation Eritrean camel owners, as in other countries, use to shear the hairs of calves from the hump and shoulder regions.

Table 5: Ticks species infesting the one-humped camel in Eritrea (adapted from Camicas et al 1998, Cankovic 1984, Hoogstraal 1956, Hoogstraal et al 1969, Morel 1980, Pegram et al 1981,Pegram & Higgins 1992)

Species	No. of Hosts in life cycle	Comments
Hyalomma a. anatolicum	2-3	Occasional
Hyalomma a. excavatum	2-3	Occasional
Hyalomma dromedarii	1-2-3	Very common
Hyalomma erythraeum	3	Locally common infest.
Hyalomma impeltatum	3	Locally common infest.
Hyalomma impressum	3	Locally common infest. (*suspected*)
Hyalomma marginatum rufipes	2-3	Very common
Hyalomma marginatum marginatum	2	Rare, mainly Asian tick (*suspected*)
Hyalomma marginatum turanicum	2	Rare, mainly Asian tick (*suspected*)
Hyalomma truncatum	3	Very common
Rhipicephalus camicasi	3	Locally common infest. (*suspected*)
Rhipicephalus e. evertsi	2	Occasional
Rhipicephalus guilhoni	3	Occasional (*suspected*)
Rhipicephalus lunulatus	3	Occasional (*suspected*)
Rhipicephalus muhsamae	3	Locally moderate infest. (*suspected*)
Rhipicephalus praetextatus	3	Locally moderate infest.
Rhipicephalus pravus	3	Locally moderate infest.
Rhipicephalus pulchellus	3	Very common
Rhipicephalus turanicus	3	Occasional (*suspected*)
Amblyomma gemma	3	Locally common infest. (*suspected*)
Amblyomma lepidum	3	Occasional to locally common infest.
Amblyomma variegatum	3	Locally common infest.

Discussion

Eritrea, with a total land area of 122 000 sq. km., about 49 % of which being rangeland, approximately 75 % of the country's population depending on livestock/livestock production, and 60 % of stock in low lands with agro-pastoralists and pastoralists, makes the country an ideal place for camels.

In the semi-arid lowlands of Eritrea camels are the most important animal for pastoralists. Their adaptations to dry harsh environments and unique ability to economically use water are well known. Perhaps the most important qualities of the camel are its capability to graze and browse a wide range of plants often unpalatable to other livestock species and to utilize remote grazing areas inaccessible to other livestock species as they are too far from watering points. These capabilities allow camels to produce abundant milk throughout the year while other livestock species simply struggle to survive in such areas. Camels, therefore, can be considered as an irreplaceable livestock species for pastoralists and it is quite appropriate to find that the camel is the national emblem of Eritrea. Interviews with camel pastoralists in the present study revealed that diarrhoea, pox/contagious ecthyma are among the commonest ailments in suckling calves while in adult camels abscess, mange and respiratory pathologies appear to be the most common pathologies. Classification of Eritrean camels has been based on the tribes who own them and also on their colours, tribal ownership, region/location and function. The production potential of camels differs between the various "breeds", ethnic groups and pastoral husbandry systems. Although pastoralists themselves distinguish between milk, meat and transport types, camel breeds as such have not yet been well established and their real performance evaluated. It is not very clear to what extent the existing differences result from genetic or environmental/husbandry factors. Thus, there is a need to assess genetic variability within and between camel populations using DNA polymorphism, which can lead to the identification and classification of camel breeds and breed groups. This will help the analysis of the inter-relationship between nomadic animal husbandry practices, standard breeding management, animal performance and the genetic structure of a given camel population. Such information will also help to understand how far the pastoralists themselves are in a position to exploit the production potential of their camels through their breeding strategies and selection methods and how far so called breed differentiation could simply be due to environmental/husbandry factors. The knowledge so acquired is a prerequisite for a rapid progress on camel development in Eritrea since such activities will help to assess the possibility for improvement of camel resources in the pastoral system. In this context the collaboration with established camel research centres in regional countries and the creation of a camel nucleus herd in Eritrea is of highest priority.

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Annex 1

DATE AREA ETHNIC GROUP

Herd composition

Total no:

Adult males:	castrated	entire	
Adult females:	pregnant	lactating	dry
Sub adult males:	weaned	suckling	
Sub adult females:	weaned	suckling	

Breeds

Name	uses	Main body characteristics
Name	uses	Main body characteristics
Name	uses	Main body characteristics

Important production parameters

Breed			
Age first delivery			
Calving interval			
Total number of life calves in a lifetime			
Weaned age of female calf			
Weaned age of male calf			
Lactation length			
Daily milk production rain season (for a camel at the 3rd-4th-5th pregnancy)			
Daily milk production dry season (for a camel at the 3rd-4th-5th pregnancy)			
Culling age for female			
Age bull start serving			
Age bull is culled			
Age packing camel start work			
Age packing camel is culled			

Health information

	Main sickness	**Main mortality cause**
Calves		
Adults		