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Variation in plant preferences of indigenous goats in a False Thornveld rangeland in South Africa

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ABSTRACT

Plant preference of three goat genotypes; Xhosa lop-eared (XLE), Nguni (NGN) and Nguni×Boer crossbred (NBC) was studied using the micro-histological faecal analysis technique. Faecal samples were collected per rectum of goats in four seasons; hot-dry (September to October), hot-wet (November to February), cold-dry (June to August), and post-rainy season (March to May). Plant fragments were identified using a microscope at 400× magnification. Greater proportions ($P<0.05$) of *A. karroo* fragments were identified in faeces of the XLE goats in the hot-dry season compared to NGN and NBC goats. The NBC goats had a higher ($P<0.05$) proportion of *Sporobolus africanus* and *S. fimbriatus* in faeces compared to other genotypes. No significant differences ($P>0.05$) were found on the proportion of plant fragments identified in faeces of all goat genotypes during hot-wet season. The NBC goats had low ($P<0.05$) proportions of plant fragments of *Diospyros lycioides* and *Ehretia rigida* identified in faeces and had a higher proportion of *Sporobolus africanus* in the cold-dry season compared to NGN and XLE goats. The XLE and NBC goat genotypes had higher proportions of *S. fimbriatus* and *Panicum maximum* plant fragments during the post-rainy season. *Grewia occidentalis*, *P. maximum* and *D. lycioides* had greater preference index values for all goat genotypes, compared to other plant species. The XLE goats selected more browse than herbaceous plant species compared to other genotypes. Xhosa lop-eared goats, therefore, show a potential to browse more than the NGN and NBC goats. Use of the XLE goats in mixed livestock system with livestock species perceived to be grazers on rangelands of the False Thornveld is recommended.

1. Introduction

Natural pastures in Southern Africa form an invaluable feed resource for livestock species. These pastures are prone to changes in quality and quantity with season, thus, causing seasonal variation in performance of livestock on rangelands. Goats, unlike other livestock species, alternate foraging different plant species (browse and herbaceous plant species) in their diet, making them thrive on rangelands, regardless of season (Ngwa et al., 2000; Berhane and Eik, 2006). Several factors influence the choice of plant species by goats. Among them are morphological and physiological attributes each goat genotype exhibit, physical and chemical nature of plants and, plant species availability on rangelands (Makkar, 2003). Morphological and physiological attributes relate to the stature of goats and their ability to produce metabolites which help in the digestion process and to counteract the adverse effects of toxins from plants. Physical and chemical nature of plants describes the thorns, trichomes, waxes and also anti-nutritional factors which cause aversion from a particular plant in relation to others on rangelands.

Very few studies have been conducted to assess plant preferences of goat genotypes native to False Thornveld rangelands of South Africa. Xhosa lop-eared (XLE), Nguni (NGN) and Nguni×Boer crossbred (NBC) goats are the predominant goat genotypes inhabiting the False Thornveld. Xhosa lop-eared is large framed, whilst the NGN genotypes are small framed. Crossbred goats are a result of indiscriminate mating between indigenous and imported genotypes. The goat genotypes are adapted to utilisation of the available plant species, incorporating both herbaceous and browse species

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(Breebaart et al., 2002). The goat genotypes are popular among the rural populace and normally forage together on the rangelands, thus, compete with each other for the available limited resources. Different plant species within the biome are susceptible to deterioration as a consequence of over-utilisation (Nyamukanza and Scogings, 2008). This is further exacerbated by the unreliable rainfall, together with extreme temperatures which suppress vegetative growth.

For proper management of rangelands, preferences for plant species by goats need to be studied. The micro-histological faecal analysis technique can be used to determine plant preferences of goats (Hooimeijer et al., 2005). The technique does not interfere with the normal feeding behaviour of the animals whilst feeding on rangeland and does not place any restrictions on animal movements. Knowledge of dietary preferences could allow optimal forage allocation to the different goat genotypes and also other livestock species, selecting species for reseeding deteriorated rangelands and predicting the outcome of overgrazing by different livestock species (Holechek and Gross, 1982). The objective of the current study was, therefore, to compare plant preferences of the XLE, NGN and NBC goat genotypes on False Thornveld rangeland across seasons. The hypothesis being tested was that there are no differences on plant preferences for the three goat genotypes.

2. Materials and methods

2.1. Description of study site

The trial was conducted at the University of Fort Hare Farm which is situated 80 km inland from the Eastern Cape coastline in South Africa. The farm is located at 32°46′ S and 26°51′ E; and is 520 m above sea level. The topography is generally flat with a few steep slopes. The area receives unreliable rainfall of less than 500 mm per annum. Most of the rain falls during the hot-wet season. Extreme temperatures are evident in the hot-wet season. Vegetation is classified as the "False Thornveld of Eastern Cape" (Acocks, 1988). Details on the dominant plant species are described in Bakare and Chimonyo (2010).

2.2. Vegetation assessment

Composition of herbaceous and woody species for the study area was determined using the plant step-point method and belt transects method (Eggleton et al., 1995), respectively. Using the plant step-point method, approximately 100 points were located to each of the transect lines measuring about 200 m in length by dropping a pointed metal rod at each step. The plant nearest to each point was identified and recorded. The belt transects method involved the widening of the transect line by 2 m on both sides to form a continuous belt from which all the woody species were recorded. The size of rangeland used for the study was about 20 ha. The composition of browse and herbaceous plant species for the study site are shown in Tables 1 and 2, respectively.

Biomass for herbaceous plants in rangelands was randomly sampled using a pasture disc metre. Recordings were taken after every 5 m along the 200 m transect lines. Generally, rangeland biomass decreased gradually from hot-wet to hot-dry season. High biomass values of about 2400 kg/ha were obtained in hot-wet season whilst 1480 kg/ha in the cold-dry season. Biomass started to increase at the onset of the rainy season (hot-wet season). Tree density of the rangeland was about 2537.5 trees/ha and most of the trees were less than 2 m in height.

Table 1
Average species composition values of woody plant material for all seasons.

Browse species	Composition (%)
Acacia karroo	80.70
Azima tetracantha	0.12
Coddia rudis	2.41
Diospyros lycioides	2.53
Ehretia rigida	3.02
Grewia occidentalis	0.48
Lantana camara	0.48
Leucas capensis	0.24
Lippia javanica	1.45
Lycium ferocissimum	2.05
Maytenus heterophylla	1.57
Maytenus polyacantha	0.24
Maytenus capitata	0.24
Rhus longispina	0.36
Rhus refracta	1.93
Scutia myrtina	2.18

2.3. Experimental goats and their management

Twenty four clinically healthy goats, eight from each genotype of the XLE, NGN and NBC goats were used in the study. Average weights for the XLE, NGN and NBC goat genotypes were 40.1 ± 1.27, 32 ± 1.27 and 35 ± 1.27 kg, respectively. The goats were allowed to forage together on rangelands from 0800 to 1600 h. No supplementary feeding was provided during the trial. The goats were adapted to the rangeland conditions for two weeks before faecal samples were collected.

2.4. Micro-histological faecal analysis

2.4.1. Collection and preparation of faecal materials

Faecal pellets were collected as per rectum of individual goats of each genotype before they were kraaled after 1600 h. The observations were made on four consecutive days, twice in each season (hot-wet, post-rainy, cool-dry and hot-dry season).

Table 2
Average species composition values of herbaceous plant material for all seasons.

Herbaceous species	Composition (%)
Digitaria eriantha	28.0
Sporobolus africanus	12.7
Cynodon dactylon	15.7
Sporobolus fimbriatus	14.3
Panicum stapfianum	3.3
Panicum maximum	1.0
Microchloa caffra	1.3
Eragrostis obtusa	0.7
Eustachys mutina	4.7
Themeda triandra	14.3
Setaria neglecta	0.7
Eragrostis chloromelas	0.3
Cymbopogon plurinodis	3.0