Ixodid ticks infesting domestic goats in communal land areas of Zimbabwe

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ABSTRACT

The purpose of this study was to determine the species spectrum of ticks infesting goats owned by resource-limited farmers in the state-owned communal land areas of Zimbabwe. Ticks were collected from goats at a single locality within each of 5 communal land areas, and a total of 14 ixodid tick species was recovered. The most numerous tick was *Rhipicephalus evertsi evertsi,* which was present in all areas at each sampling, and a *Rhipicephalus* sp. (near *R. punctatus*), which was most abundant on goats in the central regions of Zimbabwe during the March rainy season. *Amblyomma hebraeum* was present on goats in all areas sampled. In the eastern central region its distribution overlapped that of *Amblyomma variegatum,* while in the northwest it overlapped those of both *Amblyomma marmoreum* and *A. variegatum. Hyalomma truncatum* was present at all localities, whereas only a single *Hyalomma rufipes* was recovered. *Rhipicephalus appendiculatus* was collected from goats in the moist, slightly cooler regions, while the few *Rhipicephalus zambeziensis* recovered were present in the hotter, drier regions. Species recorded in lower numbers were *Rhipicephalus (Boophilus) decoloratus, Rhipicephalus lunulatus, Rhipicephalus simus, Rhipicephalus tricuspis* and *Rhipicephalus turanicus.* Attachment in the inter-digital space of adult *A. hebreaum* and *H. truncatum* was sometimes associated with lameness.

Key words: communal lands, domestic goats, ixodid ticks, Zimbabwe.

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INTRODUCTION

The topography of Zimbabwe can be described as a series of plateaus[1]. The high central plateau, known as the 'highveld' (1200–1675 m above sea level), stretches from the southwest of the country to the northeast, culminating in the east in Mount Inyangani at an altitude of 2592 m. The low altitude areas (below 610 m) in the valleys of the Zambezi River in the northwest and the Limpopo and Sabi Rivers in the south and southeast constitute the 'lowveld'. Between the high- and the lowveld lies the middleveld plateau ranging from 600 to 1200 m in altitude[1]. Temperature and relative humidity on the high central plateau are moderate, whereas the climate in the lowveld tends to be very hot and dry. The country has been divided into 5 agro-ecological zones according to climate, land-use and vegetation, and these are known as Natural Regions (NR) I, II, III, IV and V[27]. Aridity increases from Region I to V.

The state-owned communal lands of Zimbabwe are predominantly located in areas of low agricultural potential in the middle and lowveld of regions IV and V, and are characterised by marginal rainfall, high temperatures and poor, acidic sandy soils[27]. In addition, irrespective of the agro-ecological zone in which they are located, decades of tree felling for fuel, clearing of land for crops, the construction of houses for an increasing human population, and high livestock densities, have contributed to sparse vegetation and poor quality pastures in many of the communal lands. Because of their adaptability to the conditions described above, goats are the predominant livestock kept by resource-poor farmers on the state-owned communal lands. Most of the goats owned by these farmers belong to the indigenous Matabele and Mashona breeds[6] and their crosses, and are grazed on the communal pastures together with cattle and other livestock.

Norval and his co-workers, in a series of papers published between 1980 and 1985, have recorded the tick species that occur in Zimbabwe and described their ecology[14–16,18–23]. In these publications they list a total of 14 tick species that have been collected from domestic goats in Zimbabwe. Despite the prevalence of ticks on goats, their control, as well as that of the pathogens that they transmit, by the state-run veterinary service is minimal, and tick control mostly targets cattle. The objective of the present study was to address this shortcoming by at least identifying those tick species that infest goats kept by resource-poor farmers on communal lands.

MATERIALS AND METHODS

Survey localities

Ticks were collected from goats in the communal lands of Chihota in Mashonaland East province (NR II; 18°19′S, 31°12′E; altitude 1481 m), Sanyati in Mashonaland West province (NR III; 18°07′S, 29°16′E; altitude 1064 m), Chirumhanzu in Midlands province (NR III; 19°34′S, 30°45′E; altitude 1370 m), and at Filabusi (NR IV; 20°31′S, 29°14′E; altitude 1076 m) and Beitbridge (NR V; 22°13′S, 30°00′E; altitude 467 m) in the Matabeleland South province (Fig. 1). Because Chihota lies within a moist region, most of the available land is under cultivation. The uncultivated areas have very sparse vegetation and are used for livestock farming. Although Filabusi is located in region IV, which is generally dry, it is situated at a slightly higher altitude and receives occasional showers during the dry season, while Beitbridge lies in the hot and dry Limpopo River valley.

Tick collections

The 1st collections, which were made between February and April 2001, were part of a larger study on the causes of kid mortality in Chihota and Filabusi. Visible adult ticks were picked off their predilection attachment sites on adult goats, without ensuring that all ticks were collected, or recording the number of goats that were examined.

The 2nd set of collections was more thorough and was made from goats at Chirumhanzu, Sanyati and Beitbridge during 2005 and 2006. During the preliminary visits made to Chirumhanzu and

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Beitbridge in July 2005, 10 goats were randomly selected from homesteads in each study area. During the December 2005 and March 2006 visits, which coincided with the rainy season and peak adult tick activity, at least 50 goats were sampled per area, randomly choosing 3–5 goats per homestead from easily accessible homesteads. The goats had to be at least 3 months old, free-grazing and resident in the area for a minimum of 1 month. The animals were physically restrained and all visible adult ticks and a sample of immature ticks were collected by means of forceps. The ticks from each goat were placed separately in stoppered vials containing 70 % methanol. At the same time lesions attributable to the attachment of ticks were recorded. The ticks were transported to the laboratory where they were identified and counted using a stereomicroscope. Because of a shortage of funds sampling was not done at Beitbridge during March 2006.

RESULTS

No tick control was applied to any of the goats. The tick species and numbers collected from goats at the various study sites are summarised in Tables 1–4.

A total of 14 ixodid tick species was recovered and the 2 most abundant species collected were *Rhipicephalus evertsi evertsi* and a *Rhipicephalus* sp. (near *R. punctatus*). Four species were present on goats at every sampling locality, namely *Amblyomma hebraeum, Hyalomma truncatum, R. evertsi evertsi* and *Rhipicephalus simus. Rhipicephalus appendiculatus* was collected from goats in regions II and III, while *Rhipicephalus zambeziensis* was present on the edge of region III and in region V. Other ticks recovered in lesser numbers were *Amblyomma marmoreum, Amblyomma variegatum, Hyalomma rufipes, Rhipicephalus (Boophilus) decoloratus, Rhipicephalus lunulatus, Rhipicephalus tricuspis* and *Rhipicephalus turanicus.* A total of 324 goats was examined during 2005 and 2006 and of these 230 (71 %) were tick-infested. The proportion of infested goats was higher at Chirumhanzu (97.3%) than at Sanyati (52.1%) and Beitbridge (68.1%). Very few ticks were collected from goats during the cool, dry season (July 2005), and tick-infested goats were sometimes only encountered after visiting a number of households (Tables 3, 4).

Amblyomma hebraeum was most prevalent in Chirumhanzu, and its presence in the inter-digital space was associated with purulent ulcers and abscesses accompanied by lameness in 15 goats. Similarly, the attachment of *H. truncatum* in the inter-digital space in March 2006 was associated with lameness in 3 goats at Sanyati and 7 at Chirumhanzu, suppurative lesions on teats and udders on 5 goats at Chirumhanzu, and abscesses on other parts of the body of 1 goat at Sanyati and 4 at Chirumhanzu. Adult *R. e. evertsi* were mostly attached in and around the anal region and the immature stages in the outer ear canals. Some of its peri-anal attachment sites were characterised by non-purulent to purulent ulcerations, which were present on 12 goats at Sanyati, 6 at Chirumhanzu and 5 at Beitbridge. Occasionally, lesions associated with the various tick species were concurrently present on a single goat.

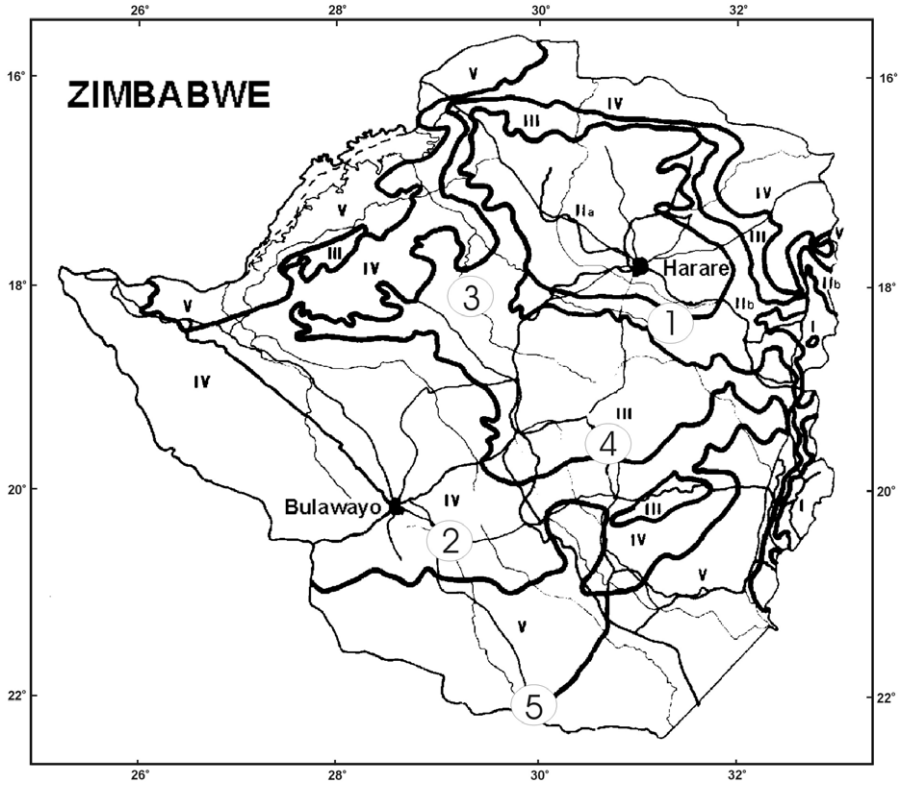

Fig. 1: **The agro-ecological zones of Zimbabwe[28] and the localities at which ticks were collected from goats. I, Specialised and diversified farming region – high rainfall; II a & b, intensive farming region – moderate rainfall; III, semi-intensive farming region – moderate but erratic rainfall; IV, semi-intensive farming – low rainfall; V, extensive farming region – low erratic rainfall. Sampling sites: 1, Chihota; 2, Filabusi; 3, Sanyati; 4, Chirumhanzu; 5, Beitbridge.**

DISCUSSION

The collections of ticks from goats in Chihota and Filabusi in 2001 were made rather haphazardly, and hence are not comparable with those made during 2005 and 2006, in which all adult ticks were collected.

Because of their role in the transmission of *Ehrlichia ruminantium,* the causative organism of heartwater in cattle, sheep, goats and wild ruminants[17,22], the distributions of *A. hebraeum* and *A. variegatum* in Zimbabwe have been well studied[25,26]. Historically Zimbabwe had successfully managed to control heartwater and its vectors, and by 1975 had virtually confined the disease to 3 relatively small areas in the south[12]. However, during and after the war of independence, *A. hebraeum* spread throughout the entire southern lowveld and to the middleveld districts of Masvingo and Midlands, as well as to the

Table 1: ***Amblyomma, Hyalomma* and *Rhipicephalus* ticks collected from goats at Chihota and Filabusi during February to April 2001.**

Tick species	Chihota (Region II)			Filabusi (Region IV)		
	Immatures	Males	Females	Immatures	Males	Females
A. hebraeum	1	0	1	38	12	21
H. rufipes	0	0	0	0	0	1
H. truncatum	0	1	2	5	6	6
R. appendiculatus	0	1	0	0	0	0
R. evertsi eversti	15	9	23	4	30	36
R. simus	0	4	3	0	0	1
R. turanicus	4	23	27	3	4	4

Table 2: ***Amblyomma, Hyalomma* and *Rhipicephalus* ticks collected from goats at Sanyati (Region III)**

Sampling date:	December 2005				March 2006			
Hosts examined (infested):	87 (32)				55 (42)			
Tick species	Imm.	Males	Females	Mean no. of adult ticks/ infested host	Imm.	Males	Females	Mean no. of adult ticks/ infested host
A. hebraeum	0	0	0	0	6	0	0	0.0
A. marmoreum	0	0	0	0	10	0	0	0.0
A. variegatum	0	8	3	0.3	0	0	0	0.0
H. truncatum	0	0	0	0	0	19	21	1.0
R. (*Boophilus*) *decoloratus*	0	1	1	0.1	9	16	43	1.4
R. appendiculatus	0	0	0	0	0	1	0	0.0
R. evertsi evertsi	0	29	14	1.3	9	148	99	5.9
R. (near *R. punctatus*)	0	3	3	0.2	0	148	102	6.0
R. simus	0	0	0	0	0	2	2	0.1
R. turanicus	0	0	0	0	0	11	9	0.5
Total	0	41	21	1.9	34	345	276	14.8

Imm. = immature ticks.

Table 3: ***Amblyomma, Hyalomma* and *Rhipicephalus* ticks collected from goats at Chirumhanzu (Region III).**

Sampling date:	July 2005				December 2005				March 2006			
Hosts examined (infested):	10 (10)				50 (47)				50 (50)			
Tick species	Imm.	M	F	Mean no. of adult ticks/ infested host	Imm.	M	F	Mean no. of adult ticks/ infested host	Imm.	M	F	Mean no. of adult ticks/ infested host
A. hebraeum	34	0	0	0	42	60	21	1.7	36	6	3	0.2
A. variegatum	0	0	0	0	0	0	0	0.0	1	0	0	0.0
H. truncatum	0	0	0	0	0	0	0	0.0	0	38	21	1.2
R. (*Boophilus*) *decoloratus*	0	0	0	0	0	0	3	0.1	11	1	14	0.3
R. appendiculatus	24	0	0	0	4	1	2	0.1	5	6	4	0.2
R. evertsi evertsi	3	34	8	4.2	10	111	28	3.0	21	28	14	0.8
R. lunulatus	0	0	0	0	0	3	1	0.1	0	0	0	0.0
R. (near *R. punctatus*)	0	1	0	0.1	0	31	33	1.4	0	219	353	11.4
R. simus	0	0	0	0	0	12	14	0.6	0	5	7	0.2
R. tricuspis	0	0	0	0	0	0	3	0.1	0	0	0	0.0
R. zambeziensis	0	0	0	0	0	1	0	0.0	0	1	0	0.0
Total	61	35	8	4.3	56	219	105	6.9	74	304	416	14.4

Imm. = immature ticks.; M = males; F = females.

northwest and to limited pockets in the northeast[22]. *A. variegatum* remained confined mostly to the northwest, where in comparison with *A. hebraeum* it was the dominant species. It was also present at a single locality on the eastern border[22]. At that time the highveld was apparently free of both these ticks. By 1997 *A. hebraeum* had spread towards the east and west as well as northwards onto the highveld, while *A. variegatum* had spread eastwards from the northwest to highveld areas such as Zvimba and Mhondoro[26]. In the present study *A. hebraeum* was present in all areas sampled and *A. variegatum* in the northwest (Sanyati). The single *A. variegatum* nymph collected from a goat at Chirumhanzu, where its distribution overlapped that of *A. hebraeum,* suggests that it could be spreading southwards.

Table 4: ***Amblyomma, Hyalomma* and *Rhipicephalus* ticks collected from goats at Beitbridge (Region V).**

Sampling date:	July 2005				December 2005			
Hosts examined (infested):	22 (11)				50 (38)			
Tick species	Imm.	Males	Females	Mean no. of adult ticks/ infested host	Imm.	Males	Females	Mean no. of adult ticks/ infested host
A. hebraeum	47	3	0	0.3	2	0	0	0.0
H. truncatum	0	2	0	0.2	0	0	0	0.0
R. (*Boophilus*) *decoloratus*	0	1	2	0.3	0	1	0	0.0
R. evertsi evertsi	24	22	7	2.6	38	51	29	2.1
R. simus	0	0	1	0.1	0	0	0	0.0
R. zambeziensis	0	1	0	0.1	0	0	0	0.0
Total	71	29	10	3.5	40	52	29	2.1

Imm. = immature ticks.

Larvae of the South African tortoise tick, *A. marmoreum,* were present on goats during the March collection at Sanyati, where coincidentally its distribution overlapped that of *A. hebraeum* and *A. variegatum. A. marmoreum* has previously been reported in all eco-climatic zones of Zimbabwe, and tortoises, which are the preferred hosts of its adults[10], seem to be a major factor in determining its distribution[22]. In addition to tortoises, the immature stages infest a variety of wild and domestic mammals, as well as ground-frequenting birds[10]. The ability of *A. marmoreum* to transmit *E. ruminantium* has been demonstrated experimentally[3], suggesting that it could play some role in the maintenance and transmission of this rickettsia.

Even though *A. hebraeum* was not encountered in large numbers, its attachment sites were occasionally associated with lesions on the posterior lower abdomen, including the udder, and the inter-digital space. Studies in the valley bushveld regions of the Eastern Cape Province, South Africa, have implicated *A. hebraeum* as a contributory cause of foot abscess and hence lameness in goats[13]. The small numbers of *A. variegatum* on goats in the present survey were not associated with any direct lesions, but the occurrence of large numbers on cattle at Sanyati and Mhondoro has been accompanied by dermatophilosis[5].

Although *H. truncatum* was present at all localities sampled, it was never very numerous. By contrast, only a single specimen of *H. rufipes* was collected. This is in agreement with earlier observations in Zimbabwe in which adults of *H. truncatum* were recorded on a much wider range of hosts, including sheep and goats, than those of *H. rufipes,* which prefer larger ungulates as hosts[18]. The immature stages of both these ticks feed on hares[9]. Similar observations have been made in Somalia, where *H. truncatum* was more commonly found on sheep and goats, while other *Hyalomma* spp., including *H. rufipes,* were most numerous on camels and cattle[24]. Despite the small numbers of adult *H. truncatum* collected, their attachment sites were sometimes associated with lesions on the posterior lower abdomen, including the udder. Attachment in the inter-digital space was occasionally associated with lameness, a condition that has previously been recorded in sheep[11].

Small numbers of *R.* (*B.*) *decoloratus* were collected from goats at Sanyati, Chirumhanzu and Beitbridge, and their occurrence coincided with the rainy season. Cattle are the domestic host most frequently parasitised by this tick in Zimbabwe[14], but it has also been collected from goats in South Africa[2,4].

The ecology of *R. appendiculatus* and *R. zambeziensis* has been thoroughly studied in Zimbabwe, where *R. appendiculatus* is widely distributed in the cooler moister areas in the east and the south and *R. zambeziensis* is largely restricted to the hotter, drier areas of the northern, north western and southern parts of the country[19]. A similar distribution pattern has been reported elsewhere in southern, central and East Africa, where *R. zambeziensis* replaces *R. appendiculatus* in several of the hotter and more arid regions[19,28]. In the present study, *R. appendiculatus* parasitised goats in Natural Regions II and III, which are moist. The 3 adult *R. zambeziensis* that were collected came from goats in the middleveld area of Chirumhanzu, in region III close to its border with region IV, where there is a gradual transition from cool, high plateau to hot, low altitude and very dry conditions, and from region V. *R. appendiculatus* was also present at Chirumhanzu, but not at Beitbridge. Cattle and some of the large wild ruminants such as African buffalo, eland and greater kudu are the major hosts of both ticks[19,28], while sheep and goats are usually not parasitised to the same extent[28].

Rhipicephalus e. evertsi was the most prevalent tick on goats in all agro-ecological zones sampled, and was present throughout the year. It tolerates a wide range of climatic conditions[28], and occurs on domestic and wild ungulates throughout Zimbabwe[16]. Skin damage was only noticed when adult ticks formed clusters in the peri-anal region. Female *R. e. evertsi* produce a paralysis-inducing toxin when they reach an engorgement weight between 15 and 21 mg[7]. However, it is only under certain climatic and management conditions that sufficient numbers of female ticks in this stage of engorgement are present to cause paralysis[8], particularly in young lambs and kids. Although adult *R. e. evertsi* were sometimes present in large numbers on some goats, no paralysis was observed in the current study.

The tick herein referred to as *Rhipicephalus* sp. (near *R. punctatus*) has been recorded as widespread in Zimbabwe[23], and is possibly an undescribed species of the *Rhipicephalus pravus* group[28]. It has been collected from cattle, sheep and goats, but seems to be particularly prevalent on greater kudus, duikers, steenbok and grysbok[23]. In the present study it was most abundant on goats at Sanyati and Chirumhanzu during the peak rainy season in March. It has not been associated with any disease condition in domestic livestock in Zimbabwe.

The glossy brown tick, *R. simus,* was collected in all 5 areas sampled. The adults have a preference for domestic and wild equids, suids and canids, but domestic and wild ruminants are also infested[15,28]. Although the tick is widespread, it is seldom collected in large numbers from a single host. The immature stages infest rodents[15,28]. It has been associated with paralysis in calves and lambs in some parts of southern Africa[15].

A species morphologically indistinguishable from *R. turanicus* has previously been reported in Zimbabwe, where it was most prevalent during the warm wet season from November to April[21]. It was common on sheep and goats, particularly in the north of the country, and especially severe infestations of the ears of sheep grazing communal lands at Urungwe were recorded. It also fed on other domestic and wild hosts[21]. At the time the authors were reluctant to refer to it as *R. turanicus,* as it was believed that the distribution of this species was confined to the Mediterranean countries of southern Europe and North Africa and to the Near and Middle East where it is common on cattle, sheep, goats and domestic dogs[28]. It has subsequently been confirmed that *R. turanicus* is widespread in sub-Saharan Africa, where it has been collected mostly from cattle, sheep, domestic and wild carnivores and hares[28]. In the present survey it was present on goats at Chihota, Filabusi and Sanyati.

Rhipicephalus lunulatus and *R. tricuspis* belong to the *Rhipicephalus follis* species group, and are morphologically very similar to each other[28]. The few adult ticks of both species recovered in the present study were restricted to the December collection from the Chirumhanzu district. *R. lunulatus* has previously been recorded as widespread, particularly in the north of Zimbabwe[20], while *R. tricuspis* has been found in Hwange, the most northern district in western Zimbabwe[20], and in the southeast of the country[28]. Although neither of these ticks is considered to be economically important, *R. lunulatus* (previously misidentified as *R. tricuspis*) has been mentioned as a possible cause of paralysis in calves and lambs[12].

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