A survey of free-living ixodid ticks on a commercial game farm in the Thabazimbi District, Limpopo Province, South Africa

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ABSTRACT

Free-living stages of ticks on a commercial game farm in the Thabazimbi District, Limpopo Province, South Africa, were collected by drag-sampling with flannel strips during the period September 2003 to August 2004. A total of 5 tick species was collected from 4 sites. *Boophilus decoloratus* was the most abundant species, followed by *Amblyomma hebraeum*. Seasonal abundance of the ticks was quantified and an optimum time to implement control measures against the ticks is proposed.

Key words: blood parasites, commercial game farm, drag-sampling, free-living ticks, seasonal abundance, tick-borne diseases, tick infestation.

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INTRODUCTION

Tick infestation is considered to be one of the main constraints for successful game ranching[6,7,13]. Several blood parasites are transmitted by ticks and have been incriminated as the cause of diseases or death in various wildlife species[2,7,22]. Although wild animals native to a specific area are seldom affected by the endemic tick-borne blood parasites, translocations of hosts and/or ticks into non-endemic areas can cause severe losses amongst susceptible animals[7]. The direct effects of ticks on their host cattle include tick toxicosis, anaemia and tick worry, which can result in production losses and/or death[14]. Tick-bite wounds can become secondarily infected with bacteria and maggots (fly larvae)[7]. Game farming for commercial purposes is replacing beef cattle ranching in several Bushveld regions of South Africa. On 1 such farm, Hoopdal KQ96, in the Thabazimbi district of Limpopo Province, roan antelope (*Hippotragus equinus equinus*) and African buffalo (*Syncerus caffer*) are intensively bred for commercial and biodiversity purposes. The animals are bred until the population reaches a predetermined stocking rate, whereafter they are sold to established commercial game farmers. Their sale not only generates an income to sustain the farming activities on Hoopdal, but also serves to establish small pockets of rare and endangered game species throughout southern Africa, with the aim of ensuring the survival of these species. The farm has operated commercially since 2000 and has been stocked with several wildlife species, including giraffe (*Giraffa camelopardalis*), African buffalo, roan antelope, sable antelope (*Hippotragus niger*), white rhinoceros (*Ceratotherium simum*) and black rhinoceros (*Diceros bicornis*). Other species originally found on the farm included kudu (*Tragelaphus strepsiceros*), impala (*Aepycerus melampus*), steenbok (*Raphicerus campestris*), common duiker (*Sylvicapra grimmia*), warthog (*Phacochoerus aethiopicus*), jackal (*Canis mesomelas*), cheetah (*Acinonyx jubatus*), zebra (*Equus burchelli*), blue wildebeest (*Connochaetes taurinus*), gemsbok (*Oryx gazella*) and eland (*Taurotragus oryx*).

The roan antelope are kept separately from other species on the farm because of their low tolerance to competition, and all predators have been excluded from the breeding camps to limit mortalities.

The buffalo share camps, ranging from 450 to 1100 ha, with giraffe, blue wildebeest, white rhinoceros, black rhinoceros, impala, kudu, waterbuck (*Kobus ellipsiprymnus*), gemsbok and zebra. The main tick-related problem affecting animals in this semi-intensive commercial game farming operation is corridor disease in buffalo as well as acute theileriosis in juvenile roan antelope. It should be noted that buffaloes are only carriers of corridor disease. The disease has little to no affect on the buffaloes but can be fatal to cattle. In order to implement a suitable tick control programme on the property, a survey of tick larvae was undertaken to determine the tick species composition and the seasonal abundance of the ticks present.

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MATERIALS AND METHODS

Study area

The wildlife breeding farm Hoopdal KQ96 is 2210 ha in area and is located in the Thabazimbi district, Limpopo Province, South Africa. It is bounded by longitudes 24°16′16.07″ and 24° 20′43.56″S latitudes 27°29′42.89″ and 27°26′57.85″E with altitudes ranging from 993 to 1035 m above sea level. The farm consists mainly of plains[21] and is located in the Waterberg region in the northwestern corner of the mixed Bushveld[1]. The vegetation comprises Mixed Bushveld and Sourish Mixed Bushveld of the Savanna Biome[8]. Rainfall during the study period amounted to 849 mm (Fig. 1). The mean annual minimum temperature during the study period was 16.4 °C, ranging from 5.9 °C in July to 24.4 °C in December. The mean annual maximum temperature during the same period was 28.2 °C ranging from 22.0 °C in July to 34.5 °C in December (Fig. 2).

Drag-sampling

Drag-sampling with flannel strips was chosen as a means of recovering immature ticks on vegetation[24] using a technique described by Petney and Horak[15]. Drag-sampling was performed monthly at the same time each month (20–26th) for a period of 1 year from September 2003 to August 2004. A grassland and a woodland zone were selected for dragging in each of the roan and buffalo camps. Ten (1 m × 10 cm) flannel strips were attached with Velcro tape to a 1.2 m-long wooden spar. Each collection was made by dragging the spar by means of a loop of rope attached at either end for a distance of 100 m over the vegetation. Each month 1 drag was made in the woodland and 1 in the grass-

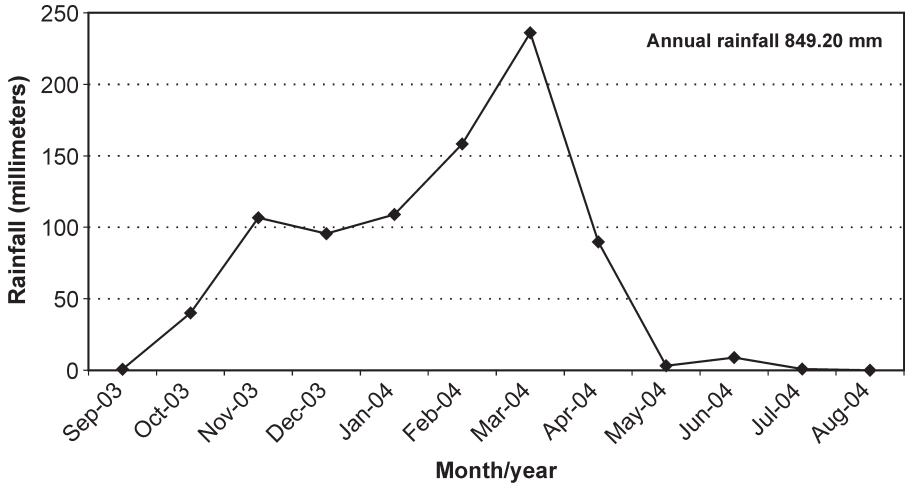

Fig. 1: **Annual rainfall on the farm Hoopdal KQ96 (September 2003 to August 2004).**

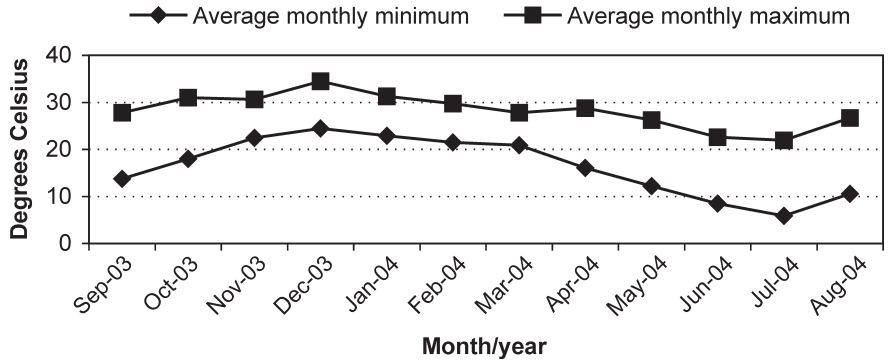

Fig. 2: **Mean minimum and maximum temperatures on the farm Hoopdal KQ96 (September 2003 to August 2004).**

land, both in the roan antelope camp and in the buffalo camp. After each drag all the ticks were removed from the flannel strips with fine-point tweezers and placed in 70 % alcohol. The ticks were identified at the Faculty of Veterinary Science, University of Pretoria. As the tick drag-data were over-dispersed, these were sampled and logarithmically transformed [log $(x + 1)$][16]. The transformation to standard logarithms and not natural logarithms was chosen because the mean to variance ratio approached 1.

RESULTS

The tick species recovered and the total numbers of ticks collected during the 12-month monitoring period are summarized in Table 1 and illustrated in Fig. 3. Of the 3838 ticks collected 99.8 % were larvae, 0.1 % nymphs and 0.1 % adult females. Five tick species were recovered, namely *Amblyomma hebraeum, Rhipicephalus evertsi evertsi, Rhipicephalus appendiculatus, Rhipicephalus zambeziensis* and *Boophilus decoloratus*. The most abundant species was *Boophilus decoloratus* and its seasonal occurrence is illustrated in Fig. 3.

There are 2 distinct peaks shown in grassland and woodland: the 1st peak coincided with the period of high rainfall in January to March. The result showed that more ticks were collected in the woodland than the grassland. The 2nd peak coincided with the winter season from June to August. The results showed that more ticks were collected in the grassland than the woodland. This demonstrates the possible occurrence of 2 generations of ticks per year.

Table 1 also clearly shows that all the tick species identified on this farm are more abundant in woodland than grassland, apart from *Boophilus decoloratus.*

DISCUSSION

On average, 80 ticks were recovered per drag-sample per month. This is lower than the 168 ticks collected during monthly dragging in the Kruger National Park[3] and the 138 ticks collected per drag in Zambia[23]. The number of ticks removed by dragging depends on many factors such a microclimatic conditions at specific site at a particular time, host numbers at the site, host species/favourability and host utilisation of the habitat. Thus, variations are expected between sites and even at the same site over time.

Boophilus decoloratus

Larvae of *B. decoloratus* were present throughout the year. Of the 3838 ticks collected, 3209 (83.6%) were *B. decoloratus.* A total of 3209 *B. decoloratus* larvae was collected, and of these, 2054 were collected in the grasslands and 1155 in the woodlands. This shows that *B. decoloratus* is more prevalent in the grasslands in this area.

They were most abundant from January to March and again from June to August. Larger numbers of larvae were recovered in the woodland areas during the high rainfall months of February and March compared to greater numbers in the grassland areas during the drier months of June to August (Fig. 4). A similar pattern of seasonality has been recorded by Macleod[9], Rechav[17] and Zeiger *et al.*[23]. *B. decoloratus* was found in larger numbers in the woodlands areas during the warmer months and found to be more prevalent in the grassland areas during the cooler months. This is probably because *B. decoloratus* requires grass for

Table 1: **Ticks collected on the farm Hoopdal KQ96 from September 2003 to August 2004.**

Tick species	Number of ticks collected							
	Larvae	Nymphs	Males	Females	Total	Woodland	Grassland	Total
Ambylomma hebraeum	231	0	0	0	**231**	152	79	**231**
Boophilus decoloratus	3209	0	0	0	**3209**	1155	2054	**3209**
Rhipicephalus appendiculatus	160	5	0	3	**168**	153	15	**168**
Rhipicephalus zambeziensis	2	0	0	0	**2**	1	1	**2**
Rhipicephalus evertsi evertsi	228	0	0	0	**228**	151	77	**228**
Total number	**3830**	**5**	**0**	**3**	**3838**	**1612**	**2226**	**3838**
Percentage	99.8%	0.1%	0%	0.1%				

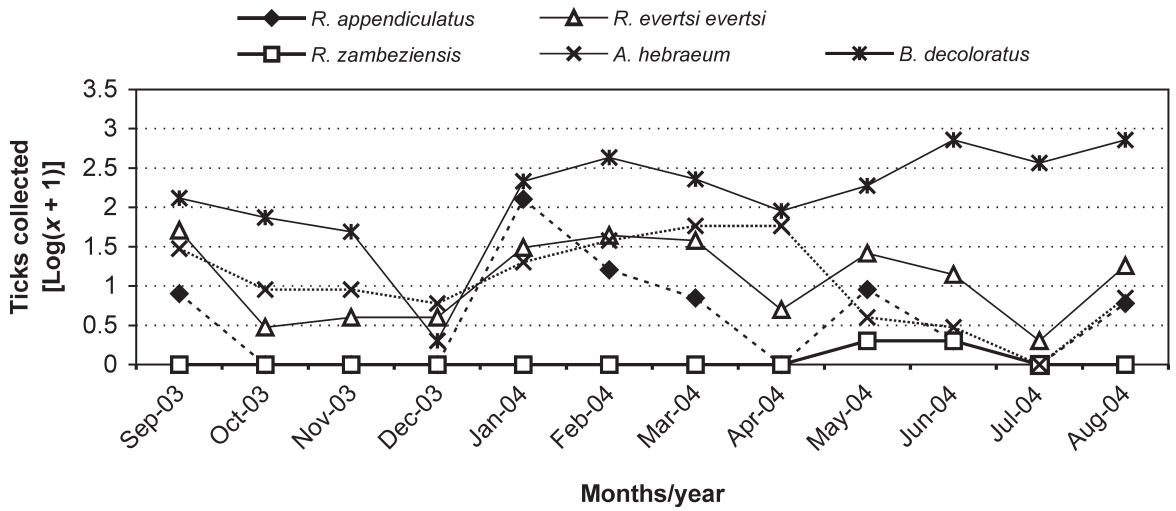

Fig. 3: **Tick species and the total monthly tick numbers collected during the study period.**

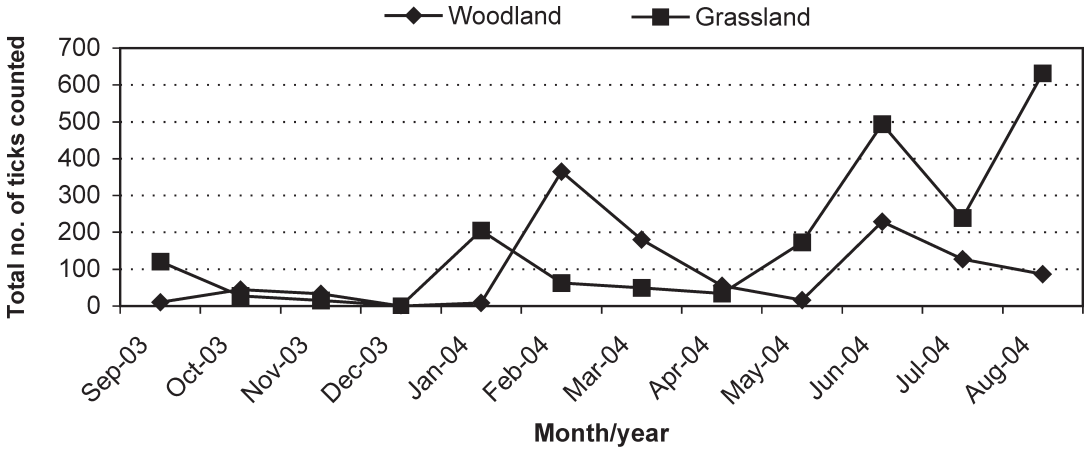

Fig. 4: **Comparative numbers of *Boophilus decoloratus* collected in woodland and in grassland areas**.

optimal survival, and is therefore found in the highest numbers in the grasslands during the winter months, but in the summer months it seeks shade, hence the increase in the number found in the woodlands[5]. It is a 1-host tick, which parasitises ungulates[18], and it is consequently only the larvae that are collected from the vegetation. All stages of development are found on cattle, large wild ruminants and on zebras, attached to the sides of the body, the dewlap, the shoulders and the neck.

Rhipicephalus appendiculatus

The largest numbers of *R. appendiculatus* larvae were collected in January (Fig. 3). Only 168 *R. appendiculatus* were found, representing 4.4 % of all ticks collected, and of these 11 were collected in grassland and 157 in woodland, indicating that it prefers woodland sites in this area. *R. appendiculatus* is a 3-host tick. Its preferred hosts include cattle, African buffalo, eland, waterbuck and various tragelaphine antelope.[6,12]

Rhipicephalus appendiculatus is responsible for the transmission of *Theileria parva lawrencei,* the agent of the disease generally known in South Africa as corridor disease in cattle–buffalo associations (since 1989 the different forms of the parasite are referred to as *Theileria parva* buffalo: buffalo to cattle transmission; and *Theileria parva* cattle: cattle to cattle transmission). A high infection rate of suspected *T. parva* in the buffaloes on Hoopdal has recently been reported. The collection of very few *R. appendiculatus*, the vector of corridor disease, does not explain the high incidence of the parasite in the resident buffalo population.

Rhipicephalus zambeziensis

A single *R. zambeziensis* larva was collected during May and another in June (Fig. 3). A survey of ixodid ticks undertaken on crested francolins on the farm Sandspruit in the Waterberg, showed evidence of this species being prevalent in this area[20]. Sandspruit is situated approximately 30 km from the farm Hoopdal. One of the larvae was collected in woodland and the other in grassland. The mean annual rainfall and temperature as well as the altitude of the survey area all suggest that it is a transitional habitat between *R. appendiculatus* and *R. zambeziensis*. *R. zambeziensis* prefers an altitude generally below 900 m with an annual rainfall of 400–700 mm[12]. The high rainfall during the study period could be the cause of the low numbers of *R. zambeziensis* collected. Madder *et al.*[10] also recorded that 'low rainfall favoured *R. zambeziensis,* whereas in years with above average rainfall, mainly *R. appendiculatus* was collected'[10]. Speybroeck *et al.*[19] collected *R. zambeziensis* ticks in the Swartwater area of the Limpopo Province. *R. zambeziensis* is a 3-host tick species. Its preferred hosts include cattle, impala, lions (*Panthera leo*) and kudu[12]. *R. zambeziensis* can transmit *Theileria parva* and other *Theileria* species.

Rhipicephalus evertsi evertsi

A total of 228 *R. evertsi evertsi* larvae was collected, mostly in August and September and again in January to March. Of these larvae, 77 were collected in grassland and 151 in woodland, indicating that that *R. evertsi evertsi* is more prevalent in woodlands in this area.

Rhipicephalus evertsi evertsi is a 2-host species, and its preferred wildlife hosts include zebras and eland[11].

Amblyomma hebraeum

The largest numbers of *Amblyomma hebraeum* were present during August and September and again in January to April (Fig. 3). In total, 231 *Amblyomma hebraeum* larvae were collected and of these 79 were collected in grassland and 152 in woodland, thus showing a strong preference for woodland in this area.

Amblyomma hebraeum is a 3-host tick and the preferred hosts of its adults are large herbivorous mammals, including cattle, eland, buffalo, giraffe and white rhinoceros. This tick is restricted to southern Africa and it is the chief vector for *Rickettsia ruminantium,* the causative organism of heartwater in several of the tick's ruminant hosts.

CONCLUSIONS

The most effective control measures established during this study for the farm Hoopdal KQ96 can only be recommended for parasitic ticks (ticks feeding on animals) and not for questing ticks on pastures (host-finding ticks). This has been established through the type of study undertaken on this farm. The use of feed bins placed in the camps has been judged to be the most effective measure for tick control on this farm. These bins have been adapted to include an outer porous rim, which is soaked with an acaricide (Drastic Deadline, Bayer AH, Isando), which is oxpecker friendly. When the animals feed from the bin the acaricide is passively applied to the hair around the neck, causing tick mortality. The re-introduction of red-billed oxpeckers (*Buphagus erythrorhynchus*) should also be considered, as the birds' main source of nutrition is ticks. This is a symbiotic relationship, the oxpecker obtains food and the mammal has its parasites removed. The correct time to implement more stringent methods would be during the rainy season from from December to March, when the highest numbers of ticks are present. *Boophilus decoloratus* is present all year round, but acaricides should not be used continuously, as ticks are known to have become resistant to acaricides in South Africa.

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