

## Ixodid ticks on cattle belonging to small-scale farmers at 4 communal grazing areas in South Africa

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### ABSTRACT

Ixodid ticks were collected during the period September 1991 to August 1993 from cattle belonging to small-scale farmers utilising 4 communal grazing areas. Three of these were in North West Province and 1 in Mpumalanga province, South Africa. Ten tick species were collected in North West Province and 7 in Mpumalanga. The adults of *Amblyomma hebraeum*, *Rhipicephalus appendiculatus* and *Rhipicephalus evertsi evertsi* were most numerous in North West Province, while in Mpumalanga *Boophilus decoloratus* comprised more than 75% of the total population. *Amblyomma hebraeum* was present on all grazing areas, and heavy infestations of adults occurred during the period October to May on 1 of these. Few *B. decoloratus* were collected in North West Province, chiefly because the sampling method was inadequate, and most of these were present during early summer (October to December) and late summer and autumn (March to May). The initially low population of *B. decoloratus* in Mpumalanga increased substantially towards the conclusion of the survey, probably because of the cessation of dipping. *Boophilus microplus* was present in small numbers on 2 grazing areas in the North West Province. Adult *Hyalomma marginatum rufipes* reached peak numbers from December to February and *Hyalomma truncatum* from February to April in the North West Province. Only *H. marginatum rufipes* was collected in Mpumalanga. *Rhipicephalus appendiculatus* was present on all the grazing areas, with most adults present from December to April. Most adult *Rhipicephalus evertsi evertsi* were collected from September to April and *Rhipicephalus simus* was present during the period October–April.

**Key words:** cattle, communal grazing areas, ixodid ticks, Mpumalanga province, North West Province, seasonal occurrence, small-scale farmers, South Africa.

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### INTRODUCTION

Two distinct cattle production systems have evolved in South Africa, namely a commercial system where profit is the chief driving force, and secondly a small-scale, traditional, subsistence-farming system in which cattle are raised on communal grazing areas (CGAs). Historically most agricultural funding went to commercial farmers in South Africa, but recently this has changed, with resources now available to assist small-scale farmers.

Numerous surveys to determine the ixodid tick burdens of cattle have been conducted in South Africa<sup>2,3,9,10–13,19,29,30</sup>, but only 2 of these were devoted to animals

belonging to small-scale farmers<sup>3,9</sup>. In KwaZulu-Natal *Boophilus decoloratus*, *Rhipicephalus appendiculatus* and *Rhipicephalus evertsi evertsi* were the species most prevalent on cattle on commercial farms<sup>2</sup>, while in the Limpopo Province (formerly Northern Province) *Hyalomma marginatum rufipes*, *R. appendiculatus* and *R. evertsi evertsi* were the most numerous species, with *Amblyomma hebraeum*, *B. decoloratus*, *Hyalomma truncatum* and *Rhipicephalus simus* also present<sup>12,19,30</sup>. A 5-year survey in the Eastern Cape Province yielded *A. hebraeum*, *B. decoloratus*, *R. appendiculatus* and *R. evertsi evertsi* as the most common tick species collected<sup>29</sup>. By contrast *A. hebraeum*, *Haemaphysalis silacea*, *R. appendiculatus* and *Rhipicephalus glabroscutatum* were the species most prevalent on yearling cattle in a 2-year survey conducted in Valley Bushveld in the same province<sup>13</sup>. In the semi-arid southwestern regions of the Free State province *Amblyomma marmoreum*, *H. marginatum rufipes* and *H. truncatum* were

the predominant species<sup>10</sup>, whereas in a 2nd survey in the same region *Ixodes rubicundus* and *H. marginatum rufipes* were the most prevalent tick species<sup>11</sup>.

In neighbouring countries *H. marginatum rufipes*, *H. truncatum*, *R. evertsi evertsi* and ticks of the *Rhipicephalus capensis* group were the most numerous species on cattle in central Namibia with only small numbers of *B. decoloratus* being collected<sup>4</sup>. In Zimbabwe 9 tick species were collected from cattle on 2 Highveld commercial farms<sup>16,20</sup>. Although *A. hebraeum* was not recorded during these surveys it has subsequently spread into large areas of the Zimbabwe Highveld<sup>28</sup>.

In 1 of the 2 surveys conducted on traditionally managed cattle in South Africa the population composition of ticks on CGAs in KwaZulu-Natal was compared with that on cattle on commercial farms<sup>3</sup>. Confirming observations made in Zimbabwe<sup>23</sup>, *R. appendiculatus* was more prevalent on commercial farms than on the CGAs, while both systems seemed equally favourable for *R. evertsi evertsi*<sup>3</sup>. In the other survey, conducted in a resource-poor urban environment in the Free State, *B. decoloratus* followed by *R. evertsi evertsi* and *H. marginatum rufipes* were the predominant species<sup>9</sup>.

The proportional distribution of tick species in Zimbabwe was significantly influenced by land utilisation practices before and during the 1970s. Commercial farms supported a variety of species, including *A. hebraeum*, *R. appendiculatus* and *R. evertsi evertsi*, whereas the most common species on cattle on overgrazed CGAs was *B. decoloratus*<sup>21,23</sup>. The latter tick was also the first to increase to significant numbers when dipping was disrupted during the independence struggle, usually between 12 and 36 months after dipping ceased<sup>23</sup>.

Research on ticks and tick-borne diseases affecting the livestock of small-scale farmers has been overlooked in South Africa and it is apparent that the approach to and application of control in this farming sector will differ considerably to that on commercial farms. The present surveys were initiated to address the deficiency in our knowledge of the species composition and dynamics of

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ticks infesting livestock of small-scale farmers in the northwestern and north-eastern regions of this country.

## MATERIALS AND METHODS

The surveys were conducted between September 1991 and August 1993 and were part of a larger project assessing the dynamics of ticks and tick-borne diseases in 4 CGAs<sup>31</sup>. The materials and methods have been described in detail previously<sup>31,32</sup> and a brief resumé follows.

### Study sites and collection periods

**Rietgat** (25°24'S, 27°49'E) and much of the surrounding area in the North West Province has been set aside for communal grazing. A dip-tank was operational in 1992, but because of managerial problems it was closed down. With the exception of December 1991, April and August 1992 and January 1993, when no collections were made, ticks were collected at monthly intervals from September 1991 to May 1993.

**Madinyane** (25°22'S, 27°52'E) is close to Rietgat and the CGA is divided into camps used by individual stockowners. There is no dip-tank in the area, and ticks were collected during the same months as at Rietgat.

**Bethany** (25°31'S, 27°33'E) is also in the North West Province, and the CGA, which was divided into 16 rotationally grazed camps, is 5 km northwest of Bethany. With the exception of April, September and December 1992, and January, May and July 1993, when no sampling was done, ticks were collected at monthly intervals from February 1992 to August 1993.

**Geluk** is 50 km east of the town Badplaas (25°00'S, 30°54'E), Mpumalanga province. The CGA was not divided into camps, and the owners used the grazing when required. A dip-tank had been efficiently run at no cost to the farmers since 1975. Recently, however, they were charged for the use of the facility, and consequently fewer use it now. With the exception of December 1991, May, August, October and December 1992, and February, April, May and June 1993, during which the CGA was not visited, ticks were collected at monthly intervals from November 1991 to August 1993.

### Vegetation/climate

Rietgat, Madinyane and Bethany are all located within the same vegetation type, described as Sourish Mixed Bushveld<sup>1</sup>. The CGAs were overgrazed and encroachment by *Acacia karoo*, *Acacia caffra* and *Acacia robusta* common. Rain falls mainly in summer, and temperatures range from a mean monthly low of 5 °C in mid-

Table 1: Ticks collected from cattle at the Rietgat, Madinyane and Bethany communal grazing areas, North West Province, South Africa.

Tick species	Number of ticks collected				
	Larvae	Nymphs	Males	Females	Total
<i>Amblyomma hebraeum</i>	539	640	2569	892	4640
<i>Boophilus decoloratus</i>	6	201	179	524	910
<i>Boophilus microplus</i>	0	0	5	9	14
<i>Hyalomma marginatum rufipes</i>	0	0	381	163	544
<i>Hyalomma truncatum</i>	0	0	220	75	295
<i>Rhipicephalus appendiculatus</i>	72	287	1054	333	1746
<i>Rhipicephalus evertsi evertsi</i>	5509	1304	524	312	7649
<i>Rhipicephalus simus</i>	0	0	67	68	135
<i>Rhipicephalus tricuspis</i>	0	0	1	0	1
<i>Rhipicephalus zambeziensis</i>	0	1	10	10	21
<b>Total</b>	<b>6126</b>	<b>2433</b>	<b>5010</b>	<b>2386</b>	<b>15955</b>

Table 2: Ticks collected from cattle at the Geluk communal grazing area, Mpumalanga Province, South Africa.

Tick species	Number of ticks collected				
	Larvae	Nymphs	Males	Females	Total
<i>Amblyomma hebraeum</i>	0	0	50	22	72
<i>Boophilus decoloratus</i>	0	416	67	104	587
<i>Hyalomma marginatum rufipes</i>	0	0	7	1	8
<i>Rhipicephalus appendiculatus</i>	0	6	15	23	44
<i>Rhipicephalus evertsi evertsi</i>	0	1	25	12	38
<i>Rhipicephalus simus</i>	0	0	0	4	4
<i>Rhipicephalus zambeziensis</i>	0	0	11	3	14
<b>Total</b>	<b>0</b>	<b>423</b>	<b>175</b>	<b>169</b>	<b>767</b>

winter, to a mean monthly high of 32 °C in summer. The vegetation at Geluk, classified as Piet Retief Sourveld<sup>1</sup>, was more verdant than that on the CGAs in the North West Province, and although overgrazed, there was little evidence of bush encroachment or erosion. Most rain fell in summer when maximum temperatures can rise to 35 °C.

### Collection of ticks

At Rietgat, Madinyane and Geluk, 3 cattle belonging to and chosen by a single owner at each locality were sampled monthly. Except in Bethany, where no attempt was made to do so, an effort was made always to sample the same 3 animals at each locality. This, however, was not always possible as animals were sold, or sometimes the whole herd was not mustered and other available cattle had to be sampled. Details of the dipping history of the survey cattle were obtained whenever sampling was performed, and sampling was never done within 7 days of the application of an acaricide.

Total tick collections similar to those done in KwaZulu-Natal were not possible as it would have taken 3½ h to sample a single animal<sup>2</sup>. Instead sampling was done using a combination of techniques<sup>17,19,29</sup>. The animals were restrained either by casting them with ropes or by tying their heads and legs to the sides of a cattle race. Thirteen sites, comprising 1 side of the face, the inner and outer sur-

faces of 1 ear and its canal, 100 cm<sup>2</sup> sites around any one tick on the neck, dewlap, a shoulder, and on the lateral aspect of a front leg respectively, the foot below the fetlock, the peri-anal region, 1 side of the perineum and of the ventral abdomen, and the whole tail and tail-brush of each animal, were sampled. The sample sites were closely scrutinised for ticks, and those found were removed with forceps and placed in a labelled bottle containing 70% ethanol. Collections from some of the sites were pooled, as it was not always possible to collect from within the boundaries of individual sites. In the laboratory the ticks were identified and counted under a stereoscopic microscope.

Because the 3 CGAs in the North West Province were close to each other the numbers of ticks collected at each locality have been combined in a single table. Only at Rietgat in the North West Province were tick numbers adequate to warrant graphic illustration of their seasonality, and this has been done by calculating the average number of ticks collected per animal per month irrespective of the year.

## RESULTS

A total of 177 whole-body samples were taken from cattle during the survey (Rietgat, *n* = 51; Madinyane, *n* = 51; Bethany, *n* = 39; and Geluk, *n* = 36). The numbers of ticks collected from the cattle in the North West Province are summa-

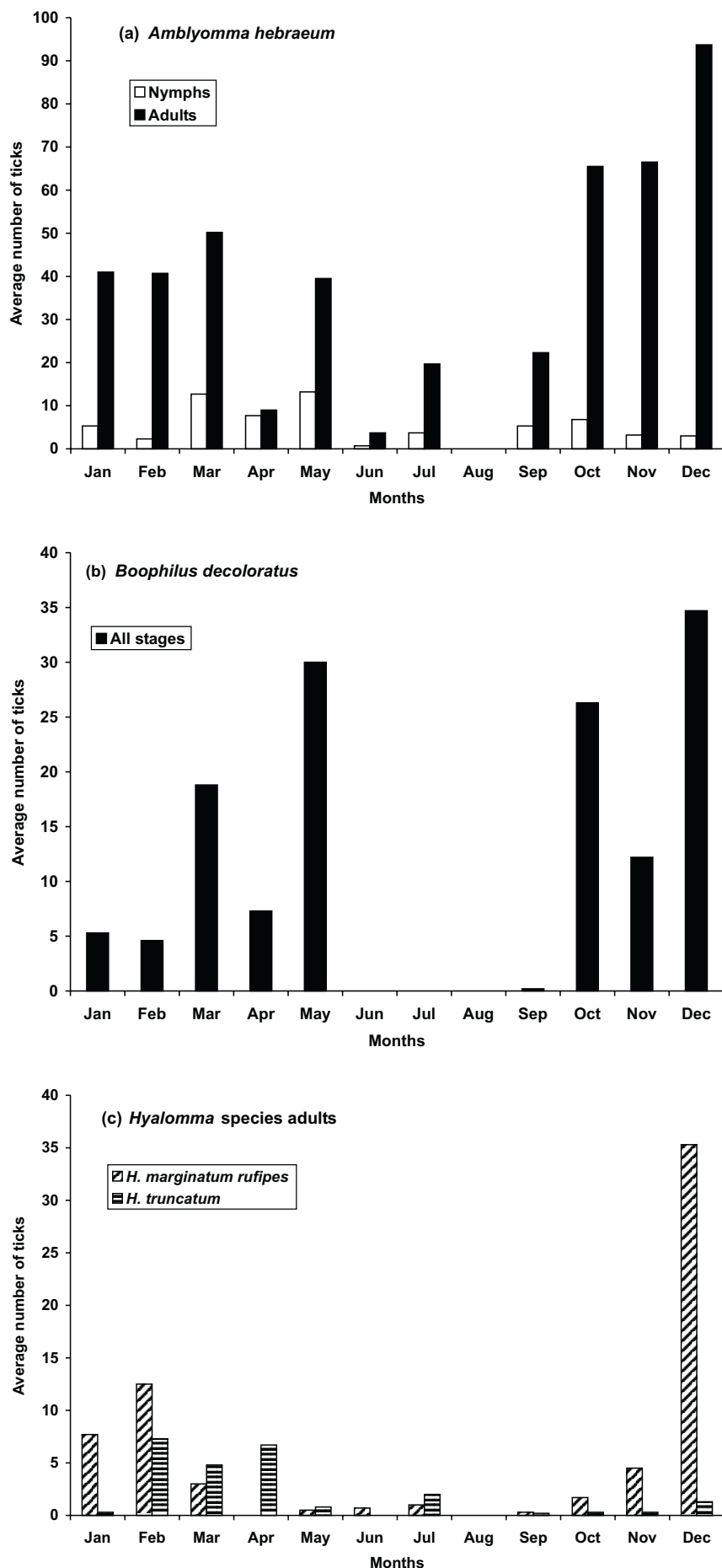


Fig. 1: Monthly average numbers of (a) *Amblyomma hebraeum*, (b) *Boophilus decoloratus* and (c) *Hyalomma marginatum rufipes* and *H. truncatum* collected from 3 cattle at the Rietgat communal grazing area. No collections were made in August.

rised in Table 1, and in Mpumalanga in Table 2.

Ten species of ixodid ticks, of which a large proportion were immature, were recovered from the cattle in the North West Province, with *A. hebraeum*, *R. appendiculatus* and *R. evertsi evertsi* accounting for the major portion of the population. At Geluk in Mpumalanga 7 tick species were collected and *B. decoloratus* was the most numerous.

Adult *A. hebraeum* was present throughout the year at Rietgat, while most were collected during the period October to May (Fig. 1a). Peak numbers of *B. decoloratus* were collected during the early summer from October to December, and the late summer and autumn from March to May (Fig. 1b). The numbers of *B. decoloratus* collected at Geluk were initially low followed by a substantial increase. Some *B. microplus* were collected at the North West Province CGAs, and none at Geluk.

*Hyalomma marginatum rufipes* and *H. truncatum* were common on cattle in the North West Province, with peak numbers of the former recorded during the period December to February, and the latter species from February to April (Fig. 1c). Small numbers of *H. marginatum rufipes* and no *H. truncatum* were collected at Geluk.

*Rhipicephalus appendiculatus* was common on cattle at Rietgat and less so at Madinyane and Bethany. Adult numbers peaked during the period December to April, with most nymphs recovered in September and October (Fig. 2a). *R. evertsi evertsi* was the most numerous tick species at Rietgat and Madinyane, with immature ticks accounting for the major portion of the population. Adult ticks were common from September to April and immature ticks were numerous in February, November and December (Fig. 2b). Few *R. evertsi evertsi* were collected at Geluk.

Although *R. simus* was present on all the CGAs, numbers were generally low. Adult ticks were collected at Rietgat from October to April (Fig. 2c). A single male *Rhipicephalus tricuspis* was collected at Bethany and small numbers of *Rhipicephalus zambeziensis* both in North West and Mpumalanga provinces.

## DISCUSSION

With the exception of *R. evertsi evertsi*, of which the larvae can easily be collected from the ear canals, the method of tick collection in this survey was biased towards the recovery of nymphs and adults. Hence the relatively larger numbers of the latter stages compared to the number of larvae collected (Table 1).

There were almost 3 times as many male as female *A. hebraeum* collected from cattle

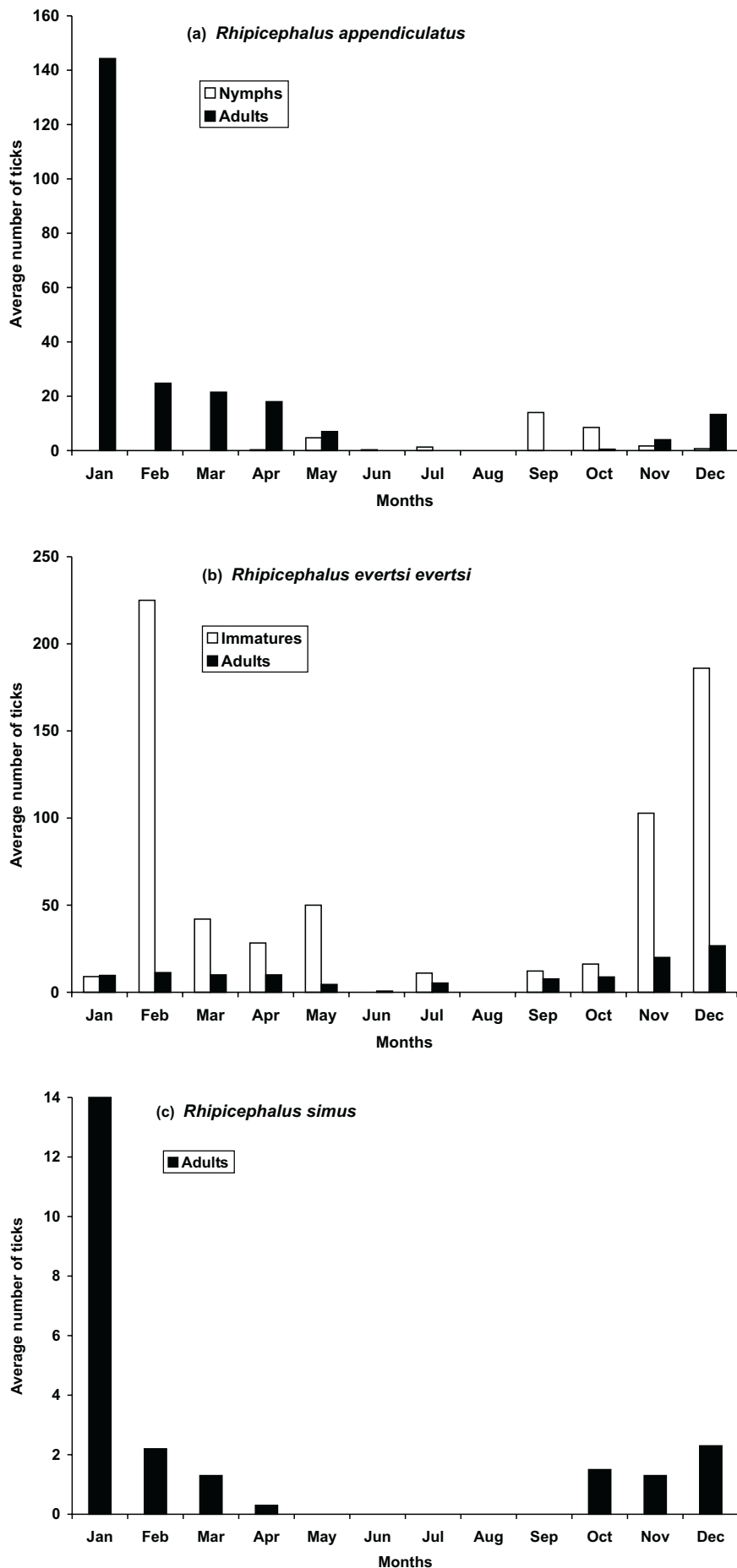


Fig. 2: Monthly average numbers of (a) *Rhipicephalus appendiculatus*, (b) *Rhipicephalus evertsi evertsi* and (c) *Rhipicephalus simus* collected from 3 cattle at the Rietgat communal grazing area. No collections were made in August.

in the North West Province (Table 1). The accumulation of male *A. hebraeum* on cattle has been observed by several authors, and occurs because they remain attached to hosts for long periods. This permits multiple mating and extends the period during which male ticks produce an attraction, aggregation and attachment pheromone, thus assisting unfed nymphs and adults to locate already infested hosts<sup>26</sup>. The many adult *A. hebraeum* collected at Rietgat reflect a large population of free-living, unfed ticks, and this has been confirmed by collecting nearly 2000 adult *A. hebraeum* by means of attraction-aggregation-attachment-pheromone/carbon dioxide traps at this locality<sup>5,6</sup>.

The summer seasonal occurrence of adult *A. hebraeum* in the North West Province was not as apparent as in the Eastern Cape Province<sup>29</sup>. It was closer to that in the southern lowveld of Zimbabwe and northeastern Mpumalanga, where adults and nymphs are present on cattle and greater kudu, respectively, throughout the year<sup>14,26</sup>. The absence of a clearly defined pattern of seasonal occurrence would diminish the effect of acaricides administered strategically during summer in the North West Province.

Few *A. hebraeum* were collected at Geluk, probably because of the regular plunge-dipping of cattle in acaricides that had been supplied free of charge over the past decades. During the survey period the farmers had to start paying for acaricide and consequently most stopped dipping. Surveys in wildlife reserves to the north of the CGA (Songimvelo and the Kruger National Park) have indicated that there are large populations of *A. hebraeum* within the region<sup>7,14</sup>, and its numbers may well increase at Geluk now because of the disruption in the dipping programme. In Zimbabwe *A. hebraeum* spread rapidly from commercial farms and wildlife in the Lowveld into the adjoining tribal regions when dipping was abandoned in the latter during the struggle for independence<sup>18,22</sup>. It is now well established on the Zimbabwe Highveld<sup>28</sup>, where it was not recorded 36 years ago<sup>16,20</sup>.

Not only is *A. hebraeum* the only effective vector in South Africa of *Cowdria ruminantium*, the causative organism of heartwater in domestic and wild ruminants, but its long mouthparts and its tendency to form clusters can cause serious damage to hides, udders and scrota.

Few *B. decoloratus* were collected in the North West Province, with only 5.7% of the ticks collected here belonging to this species. If, however, more sensitive methods of tick collection had been employed,

considerably more ticks would undoubtedly have been recovered. Because this is a 1-host tick with all developmental stages present on a single host at the same time, the 524 female ticks collected are indicative of a total immature and adult population of approximately 9300 ticks<sup>14</sup>, possibly making this the most numerous species in the region. The same extrapolation would apply to the numbers of *B. decoloratus* collected at Geluk in Mpumalanga. The seasonal dynamics of *B. decoloratus* in the North West Province is similar to that in earlier surveys in KwaZulu-Natal and the Eastern Cape Province, during which most ticks were usually collected during the warmer summer months<sup>2,3,29</sup>.

The initially low numbers of *B. decoloratus* at Geluk followed by a rapid increase probably resulted from the cessation of dipping during the survey period. It has been reported in Zimbabwe that *B. decoloratus* was the first tick to increase to significant levels on cattle on CGAs after dipping ceased<sup>23</sup>. The results at Geluk support this observation. The chief difference between the Zimbabwe experience and that at Geluk was the total absence of clinical outbreaks of tick-borne disease in cattle at Geluk<sup>31,32</sup>. To our knowledge no deaths have been reported here subsequent to the cessation of regular dipping more than 10 years ago.

Serum samples collected from cattle in the North West Province indicated that *Babesia bovis* was present<sup>31,32</sup>, but only 14 specimens of *B. microplus*, the vector of this organism, were collected during the current survey.

*Hyalomma* species are widespread in South Africa, but tend to be more numerous in the arid western regions of the country. Both *H. marginatum rufipes* and *H. truncatum* adults were commonplace on cattle on the 3 grazing areas in the North West Province and the seasonally earlier occurrence of the former tick compared to that of the latter is similar to observations made on cattle on the Highveld of Zimbabwe<sup>16,20</sup>. Their long mouthparts and tendency to form clusters can cause serious damage to the udder or scrotum, particularly as the wounds are subject to invasion by the larvae of the screwworm fly *Chrysomya bezziana*. In addition the females of certain strains of *H. truncatum* transmit an epitheliotrophic toxin causing sweating sickness in cattle, resulting in substantial economic losses. Control of these ticks on cattle would be most effective from December to April and the acaricide, which can be applied locally, would also affect adult *A. hebraeum* that share similar predilection attachment sites. No immature ticks were collected,

but this is to be expected as these parasite hares and birds<sup>15,25</sup>.

Although *R. appendiculatus* has a very wide host range, domestic cattle are its preferred hosts<sup>27</sup>. The animals in the North West Province harboured more than 3 times as many male as female ticks; since the females feed rapidly and detach, and the males remain attached for longer, this could be expected. The low population of ticks at Geluk was possibly due to the after-effects of the dipping programme that had been in place. Strategic control of adult ticks could be applied from December to April in the North West Province.

Nearly half (47,9%) of all the ticks collected in the North West Province were *R. evertsi evertsi*. This resulted from the large numbers of larvae collected from the ears of cattle at Rietgat ( $n = 3183$ ) and Madinyane ( $n = 2314$ ). It has been noted in Zimbabwe that there is a definite association between the occurrence of *R. evertsi evertsi* and the number of donkeys on CGAs<sup>24</sup>. Donkeys are common in the North West Province and represent an integral part of the transport system of local communities<sup>5</sup>. At Geluk *R. evertsi evertsi* comprised only 4.9% of the total tick population and all but 1 were adults. This seems unusual in that in a concurrent survey on goats at this locality this was the dominant species, comprising 96,2% of the total population<sup>8</sup>. Control of *R. evertsi evertsi* could be directed at the immature ticks in the ear canals or at the adults in the peri-anal region.

Although *R. simus* is widely distributed it is seldom present in large numbers<sup>2,12,16</sup>. The adults prefer cattle, on which they attach predominantly in the tail brush and feet, and horses and dogs as hosts and the immature stages certain rodent species<sup>29,33</sup>. *R. zambeziensis*, which was present in low numbers on all 4 CGAs, seldom builds up to the same high numbers as *R. appendiculatus*<sup>27</sup>.

Endemic stability to most of the important tick-borne diseases was present at the CGAs, in the North West Province and few clinical cases of these diseases were reported<sup>31,32</sup>. However, the long mouthparts of *A. hebraeum* and the 2 *Hyalomma* spp. caused considerable injury at certain times of the year, and any control programme must therefore be aimed at strategically controlling these species while attempting to maintain endemic stability to the diseases they transmit. As plunge-dipping in this area has ceased to operate effectively, the use of hand sprays, hand dressing and pour-on acaricides could prevent damage to the udder, scrotum and other common predilection sites of tick attachment.

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