

## PARASITES OF DOMESTIC AND WILD ANIMALS IN SOUTH AFRICA. XXII. IXODID TICKS ON DOMESTIC DOGS AND ON WILD CARNIVORES

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### ABSTRACT

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Ixodid ticks were collected from 4 dogs on smallholdings near Grahamstown, eastern Cape Province, on 1 or more occasions each week for periods ranging from 9-36 months. Fourteen tick species were recovered and the seasonal abundance of adult *Haemaphysalis leachi* and adult *Rhipicephalus simus* was determined.

Complete collections of ticks were made from 50 caracals (*Felis caracal*) in the Cradock, Graaff-Reinet and Southwell regions in the eastern Cape Province. The animals from Cradock and Graaff-Reinet harboured 13 ixodid tick species. The caracals from Southwell were infested with 11 tick species and the seasonal abundance of *Ixodes pilosus* on these animals was determined.

A small-spotted genet (*Genetta genetta*), 1 bat-eared fox (*Otocyon megalotis*), 1 aardwolf (*Proteles cristatus*) and 6 black-backed jackal (*Canis mesomelas*) from various localities in the eastern Cape Province were examined for ticks and 9 species were collected.

Complete tick collections were made from a side-striped jackal (*Canis adustus*), 2 wild dogs (*Lycan pictus*), a spotted hyaena (*Crocuta crocuta*), a serval (*Felis serval*), 2 African civets (*Civettictis civetta*), 2 leopards (*Panthera pardus*) and a lion (*Panthera leo*) in the Kruger National Park in the north-eastern Transvaal. Twelve ixodid tick species were recovered from these animals.

### INTRODUCTION

Several ixodid tick species may be found on domestic dogs in South Africa (Theiler, 1962; Howell, Walker & Nevill, 1978). In our experience the 3 species most frequently encountered on dogs in this country are *Haemaphysalis leachi*, *Rhipicephalus sanguineus* and *Rhipicephalus simus*. The seasonal abundance of *H. leachi* is unknown in South Africa, while that of *R. sanguineus* has been determined in the central Transvaal (Horak, 1982a). The seasonal abundance of *R. simus*, whose adults have a wide range of hosts (Norval & Mason, 1981), has been determined on cattle and Burchell's zebra (*Equus burchelli*) in the northern and north-eastern Transvaal respectively (Horak, 1982b; Horak, De Vos & De Klerk, 1984).

Many tick species may also be encountered on wild carnivores in southern Africa (Hoogstraal, 1956; Theiler, 1962; Howell *et al.*, 1978; Norval, Daillecourt & Pegram, 1983; Norval, 1984).

Large numbers of wild carnivores, particularly caracals (*Felis caracal*) and black-backed jackal (*Canis mesomelas*), are trapped or hunted and killed in the rural areas of the eastern Cape Province and Karoo. This is done in an attempt to control predation of domestic stock such as sheep and goats. These carnivores represent a valuable source of research material and the skins of a number of them were processed for tick recovery. In addition a study of the biology of the caracal in the Cradock region of the eastern Cape Province necessitated the killing of a small number of animals and these too were examined for ticks.

Wild carnivores in the Kruger National Park, situated in the north-eastern Transvaal Lowveld, are sometimes killed in accidents with vehicles, while others that are sick or injured are occasionally shot by rangers. Some of these animals were also processed for the recovery of ticks.

In this paper we record the numbers and species of ticks on dogs on smallholdings near Grahamstown, eastern Cape Province. We also discuss the tick burdens of wild carnivores in the eastern Cape Province and from the Kruger National Park.

### MATERIALS AND METHODS

#### Survey localities

The locality at which the dogs were examined and the localities from which the wild carnivores were obtained are listed in Table 1.

#### Survey animals

##### Dogs

Four dogs were examined for various lengths of time. Those from the smallholding "Faraway" were an Aire-dale × Labrador with a golden, long, shaggy coat (examined from August 1983-July 1986), a crossbred Labrador with short, smooth coat (examined from February 1985-July 1986), and a crossbreed with short, light grey hair (examined from November 1985-July 1986). The dog from the smallholding "Hillandale", a crossbred Labrador with black, medium-length hair, was examined regularly from August 1984-January 1986.

##### Wild carnivores

A small-spotted genet (*Genetta genetta*), 1 serval (*Felis serval*), 50 caracal, 2 African civets (*Civettictis civetta*), 1 bat-eared fox (*Otocyon megalotis*), 1 aardwolf (*Proteles cristatus*), 1 side-striped jackal (*Canis adustus*), 6 black-backed jackals, 2 wild dogs (*Lycan pictus*), 1 spotted hyaena (*Crocuta crocuta*), 2 leopards (*Panthera pardus*) and 1 lion (*Panthera leo*) from various localities were examined.

#### Tick recovery and counting

##### Dogs

The dogs were examined once or more each week and all ticks visible to their owners were collected and placed in 70% alcohol. These ticks were counted and identified under a stereoscopic microscope at the Tick Research Unit, Rhodes University, and the total number of each species recovered from the dogs was determined. The seasonal abundance of the major species was also ascertained.

##### Wild carnivores

The wild carnivores were skinned by the hunters. Each skin was then placed in a separate sturdy plastic

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TABLE 1 The localities in the Cape Province and Transvaal at which dogs and wild carnivores were examined for ixodid ticks

Locality	Co-ordinates	Vegetation as classified by Acocks (1975)
<b>Cape Province</b>		
Farm "Bucklands" Cradock region	33° 05' S; 26° 41' E 32° 10' S; 25° 38' E	Valley Bushveld False Upper Karoo and False Karroid Broken Veld
Glennconor Graaff-Reinet region	33° 24' S; 25° 10' E 32° 15' S; 24° 32' E	Valley Bushveld False Karroid Broken Veld and False Central Lower Karoo
Grahamstown region Southwell region	33° 19' S; 26° 32' E 33° 32' S; 26° 41' E	False Macchia Eastern Province Thornveld, Valley Bushveld and Alexandria Forest
<b>Transvaal</b>		
Southern Kruger National Park	South of 24° 24' S between 31° 15' E and 31° 52' E	Arid Lowveld and Lowveld

TABLE 2 The total number of ticks recovered from 4 dogs kept on smallholdings in the Grahamstown region

Tick species	Total number of ticks recovered					Relative abundance %
	Larvae	Nymphae	Males	Females	Total	
<i>Amblyomma hebraeum</i>	1	5	1	0	7	0,08
<i>Amblyomma marmoreum</i>	0	5	0	0	5	0,06
<i>Boophilus</i> sp.	3	1	0	0	4	0,05
<i>Haemaphysalis leachi/spinulosa</i>	5	17	—	—	22	0,26
<i>Haemaphysalis leachi</i>	—	—	2 426	3 720	6 146	71,37
<i>Haemaphysalis spinulosa</i>	—	—	9	30	39	0,45
<i>Haemaphysalis silacea</i>	47	32	2	2	83	0,96
<i>Ixodes corwini</i>	0	0	3	17	20	0,23
<i>Ixodes pilosus</i>	260	337	38	130	765	8,88
<i>Rhipicephalus appendiculatus</i>	11	117	8	9	145	1,68
<i>Rhipicephalus</i> (near <i>R. capensis</i> )	0	0	0	1	1	0,01
<i>Rhipicephalus evertsi evertsi</i>	0	0	1	2	3	0,04
<i>Rhipicephalus nitens</i>	0	0	2	1	3	0,04
<i>Rhipicephalus simus</i>	0	0	612	739	1 351	15,69
<i>Rhipicephalus</i> sp.	0	10	4	3	17	0,20
<b>Totals</b>	<b>327</b>	<b>524</b>	<b>3 106</b>	<b>4 654</b>	<b>8 611</b>	<b>100,0</b>

bag with sufficient tick detaching agent<sup>1</sup> to thoroughly wet it. Some of these skins were processed for tick recovery the following day as described by Horak & Fourie (1986). In other cases a 40 % solution of formaldehyde was added to the tick-detaching agent after several hours and the skins were stored until a later date when they were processed for tick recovery. The ticks recovered from the skins were counted as described by Horak, Potgieter, Walker, De Vos & Boomker (1983).

When large amounts of hair had been dislodged from the skins by the scrubbing and washing necessary for complete tick recovery, the entire contents of the bottle in which the washings, scrubbings and hair had been collected were poured onto a sieve with 2 mm apertures held over a sieve with 150 µm apertures. The hair in the upper sieve was thoroughly washed using a strong jet of water and the material which passed through was collected in the lower sieve and retained for examination. The hair remaining in the upper sieve was collected and squeezed manually to remove as much water as possible. This water was also kept for examination. A mass-measured representative sample of the now partially dry hair was taken for microscopic examination. The remainder of the hair was examined macroscopically in a white plastic tray and all adult ticks were collected. The representative sample of hair, the material collected in the lower sieve and the ticks collected macroscopically were examined under a stereoscopic microscope and the total tick burden of each animal determined.

Caracals were killed in the Southwell region each month, with the exception of November, from January 1985–January 1986. Consequently it was possible to de-

termine the seasonal abundance of certain ticks on these animals.

RESULTS

Dogs

The 4 dogs were infested with 14 ixodid tick species, of which *H. leachi*, *I. pilosus* and *R. simus* were present in the greatest numbers (Table 2).

The seasonal abundance of adult *H. leachi* and adult *R. simus* is graphically illustrated in Fig 1. The largest numbers of adult *H. leachi* were generally present from May or June–January or February and those of *R. simus* from August–April or May. Although these are not illustrated the nymphae of *Rhipicephalus appendiculatus* were generally recovered from May or July–November or December and the adults erratically from December–June.

Adult *I. pilosus* were present throughout the year with no obvious periods of maximum abundance.

Wild carnivores

The caracals from the Cradock and Graaff-Reinet regions harboured 13 ixodid tick species altogether. *Boophilus decoloratus*, *Hyalomma marginatum*, *Margaropus winthemi* and an unknown *Rhipicephalus* species, all of which were present in small numbers only, were not found on these cats in the Graaff-Reinet region. Otherwise they harboured the same tick species. The total numbers of ticks recovered from these 2 groups of animals are combined and summarized in Table 3.

Caracals from these regions were examined only from May–October 1984 and during March 1985. During this time larvae and adults of *I. rubicundus* were present

<sup>1</sup> Triatix: Coopers SA (Pty) Ltd

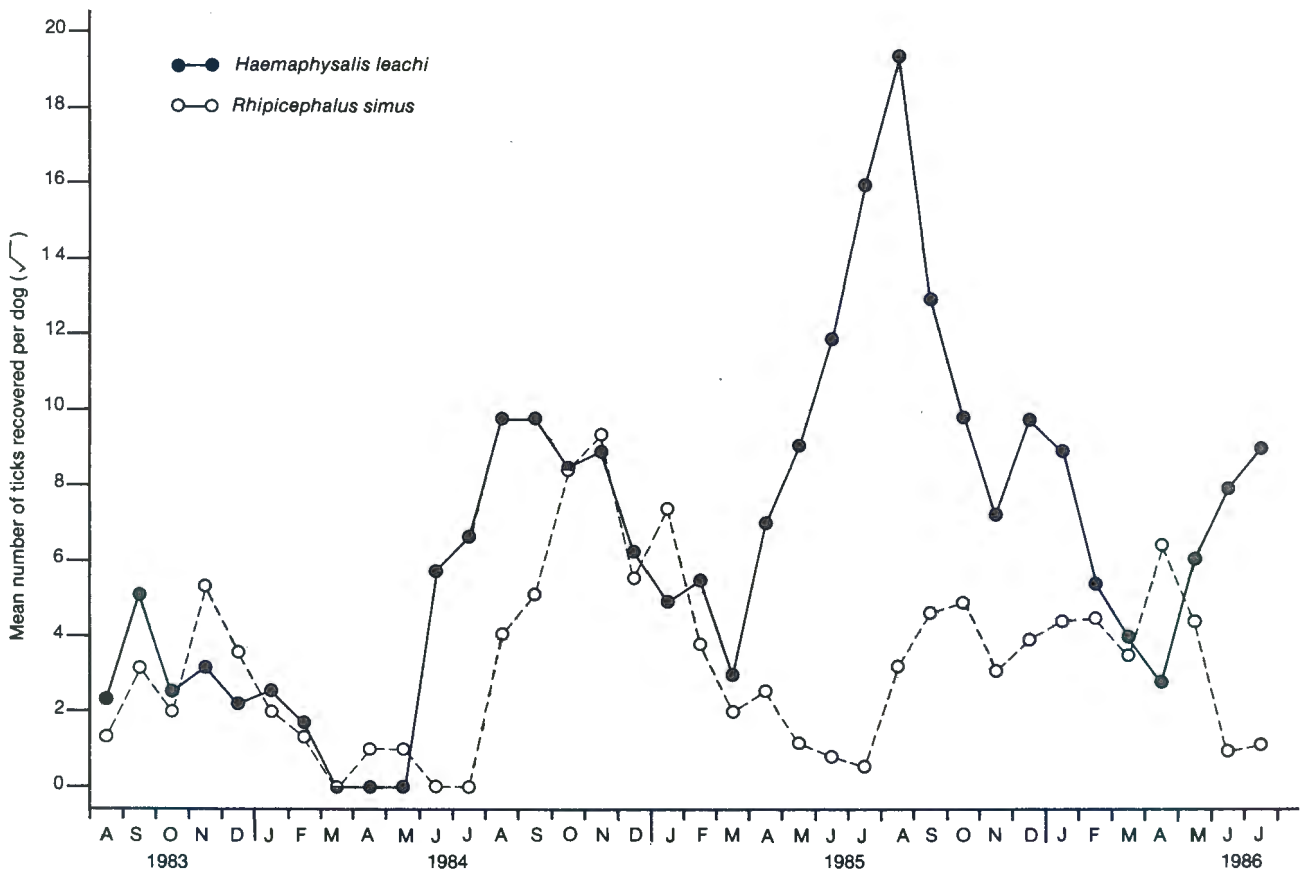


FIG. 1 The seasonal abundance of adult *Haemaphysalis leachi* and *Rhipicephalus simus* on dogs in the Grahamstown region

TABLE 3 The total number of ticks recovered from 28 caracals in the Cradock and Graaff-Reinet regions

Tick species	Total number of ticks recovered					Relative abundance %	Number of animals infested
	Larvae	Nymphae	Males	Females	Total		
<i>Amblyomma marmoreum</i>	253	1	0	0	254	23,24	15
<i>Boophilus decoloratus</i> *	1	0	1	0	2	0,18	2
<i>Haemaphysalis leachi/spinulosa</i>	4	0	—	—	4	0,37	2
<i>Haemaphysalis leachi</i>	—	—	51	24	75	6,68	8
<i>Haemaphysalis spinulosa</i>	—	—	44	15	59	5,40	20
<i>Hyalomma marginatum</i> *	1	0	0	0	1	0,09	1
<i>Ixodes rubicundus</i>	140	20	132	193	485	44,38	25
<i>Margaropus winthemi</i> *	12	2	0	0	14	1,28	2
<i>Rhipicephalus arnoldi</i>	19	1	0	0	20	1,83	2
<i>Rhipicephalus</i> (near <i>R. capensis</i> )	3	0	0	0	3	0,27	3
<i>Rhipicephalus distinctus</i>	5	1	0	0	6	0,55	4
<i>Rhipicephalus evertsi evertsi</i>	53	1	0	0	54	4,94	10
<i>Rhipicephalus glabroscutatum</i>	111	2	0	0	113	10,34	14
<i>Rhipicephalus</i> sp.*	0	0	2	1	3	0,27	3
Totals	602	28	230	233	1 093	100,0	

\* Not recovered from the caracals in the Graaff-Reinet region

from May–September and the larvae also in March 1985. Small numbers of nymphae were recovered from July–October 1984.

Eleven tick species were recovered from the caracals from the Swellendam region (Table 4). All animals were infested with *I. pilosus* and the majority with immature *Amblyomma marmoreum* and immature *Haemaphysalis silacea*.

Peak burdens of *I. pilosus* larvae were present during May and June, and of nymphae during June and August, while the adults were present mainly from January–May (Fig. 2).

Nine tick species were recovered from the other carnivores from the eastern Cape province (Table 5). *I. pilosus* was the dominant tick, and all the black-backed jackal examined during October were infested with adults of this species.

The carnivores from the Kruger National Park harboured 12 tick species (Table 6). *A. hebraeum* was the most abundant and all animals were infested with this tick, also with ticks of the *Rhipicephalus appendiculatus/Rhipicephalus zambeziensis* group. (We find it difficult to differentiate the larvae and adults of the latter species). Most animals were also infested with *H. leachi* and *R. simus*.

TABLE 4 The total number of ticks recovered from 22 caracals in the Southwell region

Tick species	Total number of ticks recovered					Relative abundance %	Number of animals infested
	Larvae	Nymphae	Males	Females	Total		
<i>Amblyomma hebraeum</i>	314	1	0	0	315	1,90	8
<i>Amblyomma marmoreum</i>	1 099	14	0	0	1 113	6,71	19
<i>Boophilus decoloratus</i>	10	8	0	0	18	0,11	4
<i>Haemaphysalis leachi/spinulosa</i>	87	9	—	—	96	0,58	9
<i>Haemaphysalis leachi</i>	—	—	6	10	16	0,09	4
<i>Haemaphysalis spinulosa</i>	—	—	16	5	21	0,13	9
<i>Haemaphysalis silacea</i>	942	8	0	0	950	5,73	19
<i>Ixodes pilosus</i>	11 898	1 883	1	39	13 821	83,32	22
<i>Rhipicephalus evertsi evertsi</i>	203	0	0	0	203	1,22	12
<i>Rhipicephalus glabroscutatum</i>	22	0	0	0	22	0,13	2
<i>Rhipicephalus simus</i>	9	0	0	3	12	0,07	5
<i>Rhipicephalus</i> sp.	0	0	1	0	1	0,01	1
Totals	14 584	1 923	24	57	16 588	100,0	

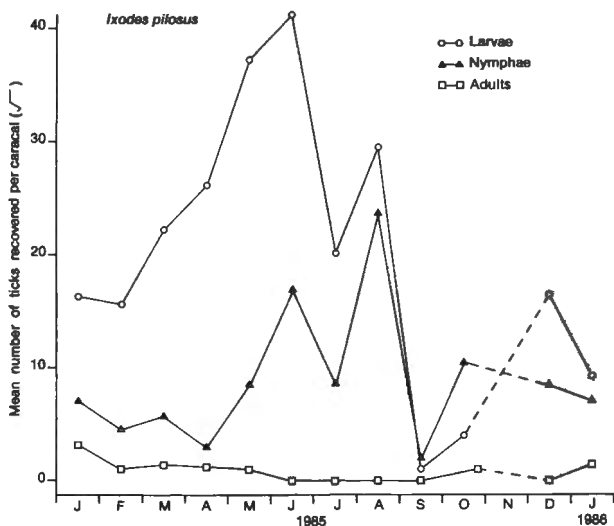


FIG. 2 The seasonal abundance of *Ixodes pilosus* on caracals in the Southwell region

DISCUSSION

The tick burdens of the dogs and those of the wild carnivores are not directly comparable. Live collections were made from the dogs whereas all the wild animals were dead and could be thoroughly processed, thus resulting in the recovery of large numbers of immature ticks and possibly also more adult males, which are not always easy to see with the naked eye.

*A. hebraeum*

The immature stages of this tick infest a large variety of mammals and birds (Theiler, 1962; Norval, 1974a), consequently many animals found within its distribution range may be infested. The infestations on the dogs from Grahamstown and on the carnivores from Glenconnor, the Southwell region, and the Kruger National Park are reflections of this fact. The distribution of *A. hebraeum* does not extend into the Karoo (Howell *et al.*, 1978), hence its absence on the caracal from the Cradock and Graaff-Reinet regions.

*A. marmoreum*

The immature stages have a fairly wide host range (Theiler, 1962; Norval, 1975b), while the adults prefer tortoises (Theiler & Salisbury, 1959; Norval, 1975b). *A. marmoreum* is common in the eastern Cape Province where tortoises are plentiful (Theiler & Salisbury, 1959) and the infestations on the carnivores from these regions are thus not unexpected.

Larvae were present on the caracals from the Cradock and Graaff-Reinet regions during most months, and they were recovered during each month of the survey in the Southwell region.

Compared with the carnivores from the other regions, the animals in the Kruger National Park harboured fairly large numbers of nymphae.

*H. leachi* and *H. spinulosa*

As we have difficulty in differentiating the immature stages of these ticks we are discussing these 2 species together. Few immature ticks were recovered from any of the carnivores but this is not surprising as the preferred hosts of these developmental stages are rodents (Hoogstraal, 1956; Norval, 1984; Hussein & Mustafa, 1985).

*H. leachi* adults are commonest on dogs and the large wild carnivores and wild cats, while adult *H. spinulosa* prefer the smaller carnivores (Norval, 1984). We recovered considerably more adult *A. leachi* than adult *H. spinulosa* from the dogs and from the carnivores in the Kruger National Park. The burdens of the 2 species were approximately equal on the caracals. Most of the other carnivores from the eastern Cape (which were generally small species) harboured more adult *H. spinulosa* than *H. leachi*.

There are at least 2 possible explanations for the fact that smaller numbers of male *H. leachi* were recovered from the dogs compared with the numbers of females. Firstly, the smaller males are more difficult to see and perhaps to collect than the females. Secondly, the regular collection of females, many of which had not started engorging, removed a source of attraction for the males, so possibly fewer attached to the dogs. Norval (1984) also noted that the number of females collected from domestic dogs was considerably larger than the number of males but, as in our case, he found that males outnumbered females on most other hosts.

Both Dipeolu (1975) in Nigeria and Norval (1984) in Zimbabwe found that adult *H. leachi* occurred throughout the year and did not show a clearly defined pattern of seasonal abundance.

In our survey, the seasonal abundance of adult *H. leachi* on the dogs followed a similar pattern each year, with the largest numbers generally present from May or June–February. However, the magnitude of the peak burdens differed considerably from 1 year to the next. The small numbers present from August 1983–February 1984 were collected from the only dog examined at that stage of the survey. Throughout the 3 year period of the survey this dog usually carried fewer ticks than the others.



In South Africa Theiler (1962) noted that *H. leachi* is absent from areas receiving less than 500 mm of rain per annum or more than 120 days of frost. Norval (1984), however, stated that there are extensive areas in the southern Lowveld of Zimbabwe which receive less than 500 mm of rain in which *H. leachi* is established. Both Cradock and Graaff-Reinet have annual rainfalls below 500 mm. Like Norval (1984) we are inclined to believe that the existence of a satisfactory rodent to carnivore relationship is probably more important than the climate, provided this is not extreme.

We were unable to determine a pattern of seasonal abundance for adult *H. spinulosa*, primarily because of the very small numbers of ticks recovered.

### *H. silacea*

Immature *H. silacea* may be found on a variety of mammals and birds (Theiler, 1962; Norval, 1975a; Horak & Williams, 1986), while the adults prefer bushbuck (*Tragelaphus scriptus*), kudu (*Tragelaphus strepsiceros*) and eland (*Taurotragus oryx*) (Norval, 1975a; Knight & Rechav, 1978; Horak *et al.*, 1983). This tick is found in thickly wooded ravines and river valleys in the eastern Cape and Natal (Howell *et al.*, 1978). The recovery of the immature stages from the dogs and from the carnivores from the Southwell region confirm both the wide host range of these stages as well as the tick's geographic distribution. The fact that the dogs harboured very few adults and the wild carnivores none indicates that these animals are not suitable hosts for this stage of development.

### *I. pilosus*

The geographical distribution of this tick includes the Sourveld regions of South Africa. In the Cape Province it is found along the coast, particularly along wooded ravines and streams (Howell *et al.*, 1978). The preferred hosts of the adults are cattle, dogs and various antelope, particularly bushbuck and grey rhebok (*Pelea capreolus*), while the immature stages feed on smaller animals including rodents and lagomorphs (Theiler, 1962; Howell *et al.*, 1978; Horak, Sheppey, Knight & Beuthin, 1986). Larvae are most abundant on grey rhebok, bontebok (*Damaliscus dorcas dorcas*) and scrub hare (*Lepus saxatilis*) in the south-western Cape Province during June; nymphae during August, and adults during June, October and December (Horak, Sheppey, Knight & Beuthin, 1986).

No pattern of seasonal abundance for adult ticks could be ascertained on the dogs, while those on the caracals at Southwell were present mainly from January–May. The seasonal abundance of the immature stages on the caracals was similar to that observed on the animals in the south-western Cape province.

The large numbers of immature ticks recovered from the caracals indicate that they are a preferred host of these development stages. Few male ticks were recovered in relation to females on any of the animals examined. This supports the observations of Norval (1974b) and Horak, Sheppey, Knight & Beuthin (1986).

### *I. rubicundus*

The level of infestation and seasonal abundance on the caracals from the Cradock and Graaff-Reinet regions have been discussed in some detail in a separate paper (Horak, Moolman & Fourie, 1987). There it was suggested that the caracal must be considered a preferred host of adult *I. rubicundus*, and that all stages of development preferred the colder months from autumn–spring rather than the warmer summer months. A considerably greater proportion of male to female ticks was recorded for this species than for *I. pilosus*.

### *R. appendiculatus*

The immature stages may be recovered from a large variety of mammals, while the adults prefer the larger ruminant species (Theiler 1962; Yeoman & Walker, 1967; Walker, 1974; Horak *et al.*, 1983).

According to Punyua & Newson (1985) carnivores play a negligible role in the maintenance of all development stages of *R. appendiculatus*. Goldsmid (1963) recovered a total of 6 male and 25 female *R. appendiculatus* from dogs in the Harare region of Zimbabwe. These comprised 3,4 % of all the ticks he collected from dogs. Eleven larvae, 117 nymphae, 8 males and 9 females were recovered from the dogs at Grahamston and comprised only 1,68 % of the total number of ticks recovered. The abundance of the nymphae on the dogs from May–December and adults from December–June corresponds to that observed on kudu and cattle in the same region (Knight & Rechav, 1978; Rechav, 1982).

### *R. evertsi evertsi*

This tick has a widespread distribution in South Africa (Howell *et al.*, 1978) and also a very wide host range (Theiler, 1962). It is thus not surprising that small numbers of ticks were recovered from the dogs and some of the wild carnivores even though these animals are not considered preferred hosts.

### *R. glabroscutatum*

Kudu and domestic goats are the preferred hosts of all stages of development (Horak *et al.*, 1983; MacIvor & Horak, 1984), and the distribution of this tick is restricted to a region mainly within the eastern Cape Province and Karoo (MacIvor, 1985). Within this region *R. glabroscutatum* is frequently a numerically dominant tick on its preferred hosts (MacIvor & Horak, 1984; Horak & Knight, 1986). The caracal is not a preferred host and the ticks recovered in the present survey reflect the large numbers of *R. glabroscutatum* present in the environment.

### *R. simus*

Norval & Mason (1981) state that in Zimbabwe the chief hosts of the adults of this species are domestic and wild ungulates and carnivores, and Horak *et al.* (1984) have recovered fairly large numbers from Burchell's zebra (*Equus burchelli*). The immature stages prefer rodents (Norval & Mason, 1981).

In this study the dogs at Grahamstown and nearly all the animals in the Kruger National Park were infested. Goldsmid (1963) found that in the Harare region of Zimbabwe *R. simus* constituted 9,5 % of ticks recovered from dogs after *H. leachi* (50,9 %) and *Rhipicephalus sanguineus* (31,1 %). In our study no *R. sanguineus* were recovered and *R. simus* comprised 15,69 % of the infestation on the dogs after *H. leachi* (71,63 %).

The size of the individual burdens can be considered large as this tick never seems to occur in substantial numbers (Norval & Mason, 1981). The absence or near absence of infestation on the caracals and on the wild carnivores from the Southwell region is, we think, due to the geographic distribution of the tick rather than host preference.

In the northern Transvaal, South Africa, Horak (1982b) recovered the largest numbers of adult *R. simus* from cattle from October–March, while in the north-eastern Transvaal Horak *et al.* (1984) recovered the largest numbers from Burchell's zebras during January, February, March and May. Norval & Mason (1981) state that in Zimbabwe adults of *R. simus* are most prevalent on cattle from November–March. The August–April or May abundance recorded in this survey encompasses the

periods of maximum abundance reported by the above-mentioned authors.

#### Other ticks

*Boophilus decoloratus*. Infestation with this tick reflects the fact that the dogs and wild carnivores shared their habitat with cattle or kudu, the preferred hosts of *B. decoloratus* (Howell *et al.*, 1978; Horak, unpublished data, 1985). In Zimbabwe Goldsmid (1963) also recovered small numbers from dogs.

*Ixodes corwini* has only recently been described from the Cape clawless otter (*Aonyx capensis*) and various mongooses and genets (Keirans, Clifford & Walker, 1982). The recovery from dogs indicates that these animals can also be infested.

*Margaropus winthemi* has a strict winter abundance: it occurs in very large numbers on Cape mountain zebra (*Equus zebra zebra*) in the Mountain Zebra National Park, in the Cradock region, during July (Horak, Knight & De Vos, 1986). The ticks on the caracals were recovered only during July and reflect the large numbers present in this region during this month.

*Rhipicephalus arnoldi* and *Rhipicephalus distinctus*. The preferred hosts of these ticks are red rock rabbits (*Pronolagus rupestris*) and rock dassies (*Procavia capensis*) respectively (Horak & Fourie, 1986). The caracals could have become infested with these ticks either because they occupy the same habitat as the rabbits and dassies or because these animals make up part of the caracals' diet and the ticks could have transferred during feeding.

*Rhipicephalus nitens*. The distribution of *R. nitens* is restricted to the south-western Cape Province (Morel, 1969). The recovery from the dogs near Grahamstown possibly represents a fairly recent introduction on domestic livestock, or may indicate that this tick has in the past been mistaken for *R. appendiculatus* in this region.

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Mr W. S. Murray of the farm "Bloemhof" collected the caracals from the Graaff-Reinet region for us. Mr D. Long of the Divisional Council of Dias collected the caracals and wild carnivores from the hunters in the Southwell region. Miss Patience Mafaya, the Sisters of the Community of the Resurrection and Messrs D. Nojoko and J. Maseti collected ticks from the dogs near Grahamstown. Messrs E. J. Williams and D. C. Willemse assisted with the processing of the dead animals for tick recovery. Dr Jane B. Walker supplied laboratory-reared specimens of *I. pilosus* and *I. rubicundus* for identification purposes and assisted with a number of identifications of ticks from the dogs.

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