

PARASITES OF DOMESTIC AND WILD ANIMALS IN SOUTH AFRICA. XXXI. ADULT IXODID TICKS ON SHEEP IN THE CAPE PROVINCE AND IN THE ORANGE FREE STATE

I. G. HORAK⁽¹⁾ and L. J. FOURIE⁽²⁾

ABSTRACT

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Four to 10 Dorper sheep on each of 12 farms in the Cape Province and 3 farms in the Orange Free State were examined for adult ixodid ticks at approximately 2- to 4-weekly intervals over periods varying from 4 to 18 months, commencing during January, February or April 1989. The farms in the Cape Province were located in the north-west, south-west and south of the province. Those in the Orange Free State were situated in the north-east and in the south.

The sheep in the Cape Province harboured 10 species of ixodid ticks and the seasonal abundances of *Ixodes rubicundus*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus gertrudae* and *Hyalomma truncatum* were determined. The animals in the Orange Free State were infested with 7 tick species and the seasonal abundances of *I. rubicundus*, *R. evertsi evertsi* and *Hyalomma marginatum rufipes* were determined.

INTRODUCTION

Sheep in sub-Saharan Africa may harbour adults of many different ixodid ticks (Theiler, 1962; Yeoman & Walker, 1967; Walker, 1974; Fourie, Horak & Marais, 1988b; Horak, Williams & Van Schalkwyk, 1991). They are, however, good hosts of only a few species.

Three studies on ticks infesting sheep in South Africa have recently been published. Fourie *et al.* (1988b) recovered the adults of 6 species from sheep in the south-western Orange Free State and described the seasonal abundances of *Hyalomma marginatum rufipes*, *Ixodes rubicundus* and *Rhipicephalus punctatus* [then identified as *Rhipicephalus* sp. (near *R. pravus*)]. Horak, Williams & Van Schalkwyk (1991) recovered 7 ixodid tick species, including the adults of 3 of them, from sheep in the north-eastern Orange Free State, and 15 species, including the adults of 12, from the eastern Cape Province. They determined the seasonal abundances of *Amblyomma marmoreum*, *Boophilus decoloratus*, *Haemaphysalis silacea*, *H. marginatum rufipes*, *Rhipicephalus appendiculatus*, *Rhipicephalus evertsi evertsi*, *Rhipicephalus glabroscutum* and *Rhipicephalus nitens* on these animals. In the third study Walker (1990) described *Rhipicephalus lounsburyi* and *Rhipicephalus neumanni* and also plotted their distributions. The latter 2 species parasitize the feet of sheep and other ungulates.

The present paper describes a survey of adult ticks on Dorper sheep on 12 farms in the Cape Province and 3 farms in the Orange Free State. This survey was conducted within the distribution range of *I. rubicundus*, with the specific intent of determining the commencement and peak of activity of this tick at various latitudes in South Africa. The opportunity was also taken to collect data on the distribution and seasonal abundance of other ticks parasitizing sheep.

MATERIALS AND METHODS

Survey localities

The farms on which the sheep were examined, the regions within which these farms are located and the vegetation types of these regions are summarized in Table 1.

Survey animals

Four to 10 Dorper sheep, which were individually identified, ran with commercial flocks of this breed on each of the 15 survey farms. The camps in which the sheep grazed encompassed hilly and/or mountainous as well as level terrain.

Tick collections

The marked sheep were examined at approximately 2- to 4-weekly intervals for periods ranging from 4 to 18 months, commencing in January, February or April 1989. Whole body searches for adult ixodid ticks were conducted on these sheep by the owner, or a State Veterinarian, or a stock inspector. Ticks from each sheep were collected separately and placed in 70 % alcohol in marked vials.

All the ticks were identified and counted under a stereoscopic microscope. The total numbers recovered of the major tick species have been summarized in separate tables for each species. The 3 *Hyalomma*s have been dealt with in a single table and the minor species have been combined in another table. Where collections were made at sufficiently regular intervals the seasonal abundances of the major tick species are graphically illustrated. If collections were irregular, or particular species occurred only in small numbers, seasonal trends for these species are mentioned in the text.

RESULTS AND DISCUSSION

General

Certain aspects of the methods employed in this survey can be criticized. Firstly various collaborators were used to collect the ticks from the sheep, secondly the proposed collection intervals were not strictly adhered to, thirdly the total length and timing of the collection periods were biased in favour of the seasonal occurrence of *I. rubicundus*, and finally no

⁽¹⁾ Faculty of Veterinary Science, University of Pretoria, Onderstepoort 0110

⁽²⁾ Department of Zoology and Entomology, University of the Orange Free State, Bloemfontein 9301

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TABLE 1 The regions in which ixodid ticks were collected from Dorper sheep

Farm	Co-ordinates	Nearest town	Vegetation type	Collection period
Far north-western Cape Province				
Bovlei	30° 12' S, 18° 05' E	Kamieskroon	Mountain Renosterbosveld	Jan.–Oct. 89
Olienfontein	30° 14' S, 18° 00' E		Mountain Renosterbosveld	Jan.–Jul. 89
Outuin	30° 10' S, 18° 02' E		Mountain Renosterbosveld	Jan.–Dec. 89
North-western Cape Province				
Diepvele	31° 40' S, 18° 50' E	Vanrhynsdorp	Succulent Karoo	Jan.–Jul. 89
Gifberg	31° 47' S, 18° 40' E		Succulent Karoo	Jan.–Oct. 89
Kantoorshoek	31° 47' S, 18° 45' E		Succulent Karoo	Jan. 89–Feb. 90
South-western Cape Province				
Pienaarskloof	33° 13' S, 20° 02' E	Touwsrivier	Macchia	Jan. 89–Jun. 90
Rheeboksfontein	33° 44' S, 20° 32' E	Barrydale	Karroid Broken Veld	Apr. 89–Jun. 90
Sandfontein	34° 05' S, 20° 03' E	Bonnievale	Karroid Broken Veld	Jan. 89–Feb. 90
Southern Cape Province				
Dieniedouw	33° 27' S, 23° 52' E	Willowmore	False Macchia	Jan.–May 89
Klipfontein	33° 20' S, 23° 19' E		Karroid Broken Veld	Feb.–May 89
The Knolls	33° 26' S, 23° 40' E		False Macchia	Feb.–Jun. 89.
Southern Orange Free State				
Goedemoed	30° 35' S, 26° 20' E	Bethulie	False Upper Karoo	Feb. 89–Jan. 90
North-eastern Orange Free State				
Driefontein	28° 09' S, 27° 59' E	Paul Roux	<i>Cymbopogon-Themed</i> Veld	Feb.–Nov. 89
Palmietfontein	28° 19' S, 27° 57' E		<i>Cymbopogon-Themed</i> Veld	Feb.–Nov. 89

attempt was made to collect immature ticks. Nevertheless valuable data on adult ticks infesting sheep in several regions of South Africa were obtained. These include new locality records for a number of species, the commencement of activity and months of peak abundance of *I. rubicundus* at different latitudes, and the determination of the seasonal abundance of adult *Rhipicephalus gertrudae* in this country.

A total of 10 ixodid tick species were recovered from the sheep in the Cape Province. Of these *I. rubicundus*, *R. evertsi evertsi*, *R. gertrudae* and *Hyalomma truncatum* can be considered major species. The sheep in the Orange Free State harboured 7 tick species of which *I. rubicundus*, *R. evertsi evertsi* and *H. marginatum rufipes* were the most numerous. Fourie *et al.* (1988b), Walker (1990) and Horak, Williams & Van Schalkwyk (1991) recorded a total of 22 species on sheep in the Cape Province and the Orange Free State during their recent investigations. To these can now be added *Hyalomma marginatum turanicum*, *Rhipicephalus follis* and *R. gertrudae*.

Ixodes rubicundus

The preferred domesticated hosts of adults of this species are sheep (Stampa, 1959; Fourie & Horak, 1991) while the wild hosts are mountain reedbeek, eland and caracals (Horak, Moolman & Fourie, 1987). The preferred hosts of the immature stages are rock elephant shrews and red rock rabbits and possibly also caracals (Stampa, 1959; Horak *et al.*, 1987; Fourie, Horak & Van den Heever, 1992). The numbers of ticks recovered from the sheep on the various farms in the present survey are summarized in Table 2.

The greatest total numbers of ticks were recovered from sheep on farms in the far north-western, the north-western and the southern Cape Province.

The distribution of this tick has recently been reviewed by Spickett & Heyne (1988). The farms in the current survey lie within or on the fringes of its previously known distribution range. It may be introduced to new localities by the large-scale transportation of sheep from infested regions to biotically suitable, uninfested regions in the autumn and winter months when the adult ticks are present on the animals.

With the possible exception of the north-eastern Orange Free State, the numbers of ticks recovered from sheep from one or more farms in each of the regions sampled indicate that these localities are all suitable for *I. rubicundus*. Excluding the south-western Cape Province and the north-eastern Orange Free State, *I. rubicundus* was the numerically dominant species in each of the regions. The disparity in the sex ratio (562 males to 2 449 females) is characteristic for this species, in which mating generally occurs off the host (Fourie *et al.*, 1988b). In addition those males which may be present on the host are seldom attached, and hence could have been overlooked during sampling.

The seasonal abundances of *I. rubicundus* on sheep on "Bovlei" plus "Outuin" in the far north-western Cape Province; on all 3 farms in the north-western Cape Province; on all 3 farms in the south-western Cape Province; and on "Goedemoed" in the southern Orange Free State are illustrated in Fig. 1.

TABLE 2 The geographic distribution, abundance and seasonal activity of *Ixodes rubicundus* recovered from Dorper sheep

Farm	No. of ticks recovered			Activity commenced	Activity period	Peak abundance
	Males	Females	Total			
Far N.W. Cape Province						
Bovlei	29	244	273	4th wk, March	March–October	June
Olienfontein*	1	13	14	3rd wk, May	May–July	July
Outuin	128	452	580	2nd wk, March	March–September	June
N.W. Cape Province						
Diepvelei*	8	42	50	3rd wk, May	May–July	June
Gifberg	63	396	459	1st wk, April	April–October	June
Kantoorshoek	54	248	302	3rd wk, April	April–November	May, June
S.W. Cape Province						
Pienaarskloof	34	144	178	5th wk, March	March–September	April, June, July
Rheeboksfontein	2	15	17	4th wk, March	March–August	July
Sandfontein	5	60	65	1st wk, April	April–December	June
S. Cape Province						
Dieniedouw*	0	9	9	4th wk, April	April and May*	April
Klipfontein*	36	149	185	4th wk, February	February–May*	April
The Knolls*	175	437	612	4th wk, February	February–June*	June
S. Orange Free State						
Goedemoed	18	116	134	1st wk, April	April–September	April
N.E. Orange Free State						
Driefontein	6	89	95	4th wk, April	April–June	May
Palmietfontein	3	35	38	1st wk, February	February–June	February

* Sheep examined only until May, June or July 1989

Activity commenced in March or April and continued until October, November or even December. Peak activity was recorded during April in the southern Orange Free State and during May or June in the north-western Cape Province. Fourie *et al.* (1988b) recorded the commencement of activity during April on sheep in the south-western Orange Free State and peak activity during May. On goats at the latter locality activity in 1988 commenced in April and peaked during May and in 1989 commenced during March and peaked during April (Fourie & Horak, 1991). Data on seasonal activity in the north-western and south-western Cape Province has not previously been published.

There is considerable variation in the commencement of seasonal activity of the tick even on nearby farms. This may be a result of differences in host behaviour, such as preferences for either hilly or level terrain, particularly in topographically variable regions or camps (Fourie & Kok, 1992).

Presently available information suggests that in the summer rainfall regions of the Cape Province and the Orange Free State the tick is usually active until only September or October, while in the winter rainfall regions it is active till November or December (Stampa, 1959; Fourie, Petney, Horak & De Jager, 1989; Fourie & Horak, 1991). Possibly, therefore, rainfall in winter enhances its ecological lifespan. These data seem to support the current concept that the adults can remain active for only one season.

Sheep are the most important livestock species affected by paralysis associated with *I. rubicundus* infestation (Stampa, 1959; Spickett & Heyne, 1988). Goats and cattle can also be affected, as well as wild herbivores (Stampa, 1959; Fourie & Horak,

1987; Fourie & Vrahimis, 1989).

Rhipicephalus evertsi evertsi

The preferred hosts of all stages of development are equids and eland (Norval, 1981; Horak, Fourie, Novellie & Williams, 1991). Sheep are also efficient hosts of the adults (Horak, Williams & Van Schalkwyk, 1991) and scrub hares of the immature stages (Horak & Fourie, 1991). The numbers of ticks recovered from sheep in this survey are summarized in Table 3.

The largest numbers were present on sheep in the north-western Cape Province, in Succulent Karoo, and the north-eastern Orange Free State, in *Cymbopogon-Themedra* Veld (Acocks, 1988). According to Howell, Walker & Nevill (1978), increasing aridity, with a critical annual rainfall of 250–280 mm, is the chief factor limiting the spread of *R. evertsi evertsi*.

The seasonal abundances of this tick on "Diepvelei", "Gifberg" and "Kantoorshoek" in the north-western Cape Province, and on "Driefontein" plus "Palmietfontein" in the north-eastern Orange Free State are graphically illustrated in Fig. 2.

In the Cape Province the greatest numbers were present during March and April compared with February to April in the Orange Free State. Substantial numbers were also present during October and November in the latter province. At both localities activity was markedly reduced during the cooler months from June or July to August or September. On Merino sheep on a farm near Vrede, which lies further to the north and east than the 2 farms in the present survey in the Orange Free State, peak adult activity was recorded from March to May, but other-

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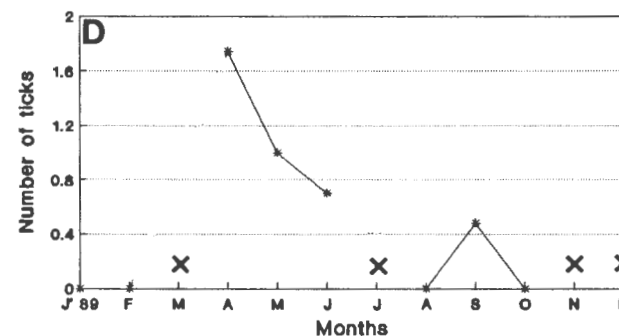
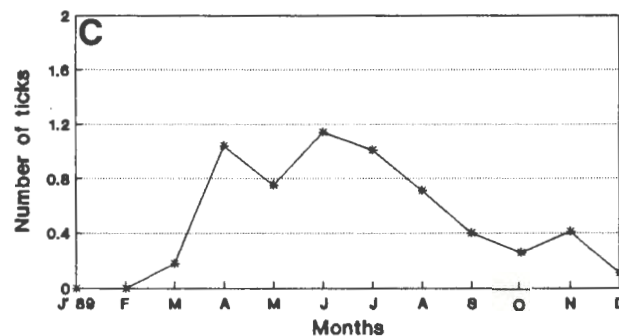
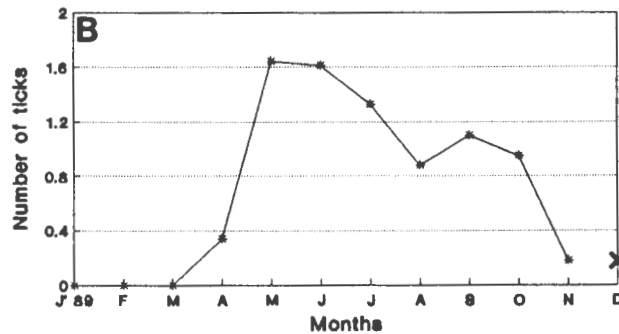
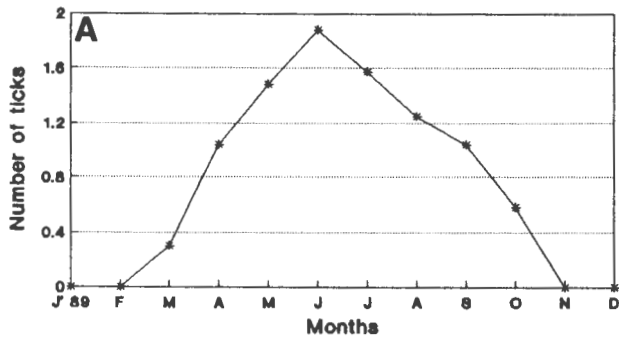


FIG. 1 The monthly mean total numbers of adult *Ixodes ricinus* [$\log_{10}(x+1)$] collected from Dorper sheep in (A) the far north-western Cape Province (B) the north-western Cape Province (C) the south-western Cape Province (D) the southern Orange Free State x = no collections made

wise the pattern of seasonal abundance was virtually identical to that observed on the latter farms (Horak, Williams & Van Schalkwyk, 1991). The con-

TABLE 3 The geographic distribution and abundance of *Rhipicephalus evertsi evertsi* recovered from Dorper sheep

Farm	No. of ticks recovered			Period of major activity
	Males	Females	Total	
Far N.W. Cape Province				
Olienfontein*	0	1	1	
N.W. Cape Province				
Diepvllei*	98	57	155	January–May
Gifberg	200	157	357	February–May
Kantoorshoek	71	53	124	March–July, September, October
S.W. Cape Province				
Pienaarskloof	0	1	1	
Sandfontein	66	37	103	January, March, April
S. Orange Free State				
Goedemoed	3	3	6	
N.E. Orange Free State				
Driefontein	277	179	456	February–April, October, November
Palmietfontein	693	323	1 016	February–June, October, November

* Sheep examined only until July 1989

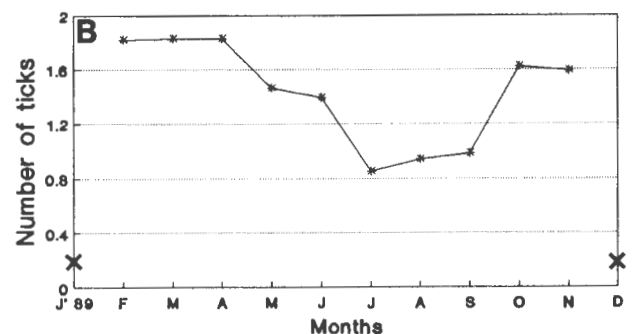
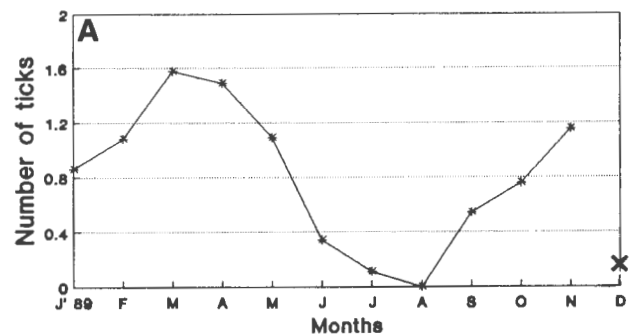


FIG. 2 The monthly mean total numbers of adult *Rhipicephalus evertsi evertsi* [$\log_{10}(x+1)$] collected from Dorper sheep in (A) the north-western Cape Province (B) the north-eastern Orange Free State x = no collections made

tinual, or almost continual, presence of adult ticks indicates that more than 1 life cycle can be completed annually as suggested by Matsui & Norval

(1977) and Horak, Knight & De Vos (1986).

Engorging females of this tick can cause paralysis in sheep (Hamel & Göthe, 1978). This usually occurs in young, spring-born lambs in the Highveld of the Transvaal and the Orange Free State (Howell *et al.*, 1978), probably owing to large numbers of overwintering nymphs moulting synchronously to adults in spring. The lambs are thus infested by many adults of both sexes simultaneously, and this increases the possibility of paralysis occurring (Göthe & Budelmann, 1980).

Rhipicephalus gertrudae

The adults of this tick prefer large herbivores and have been recorded from cattle, sheep, goats and horses (Biggs & Langenhoven, 1984; Walker, 1991; Fourie & Horak, 1991). Wild herbivores from which it has been recovered include mountain zebras (Walker, 1991), grey rhebok and bontebok (Horak, Sheppey, Knight & Beuthin, 1986) and gemsbok (Fourie, Vrahimis, Horak, Terblanche & Kok, 1991). The numbers of *R. gertrudae* recovered from sheep in the present survey are summarized in Table 4.

TABLE 4 The geographic distribution and abundance of *Rhipicephalus gertrudae* recovered from Dorper sheep

Farm	No. of ticks recovered			Period of major activity
	Males	Females	Total	
Far N.W. Cape Province				
Bovlei	1	6	7	May–October
Olienfontein*	1	0	1	
Outuin	192	147	339	
N.W. Cape Province				
Diepvllei*	28	21	49	May, June
Gifberg	46	76	122	May–August
Kantoorshoek	45	49	94	March–October
S.W. Cape Province				
Rheeboksfontein	89	145	234	May–October
Sandfontein	50	55	105	May–June
S. Cape Province				
The Knolls*	4	4	8	
S. Orange Free State				
Goedemoed	9	8	17	

* Sheep examined only until June or July 1989

The sheep examined in all the western regions of the Cape Province were most heavily infested. According to Walker (1991), *R. gertrudae* is widely distributed in the Cape Province, from which it extends northwards into Namibia in the west and into the southern and central Orange Free State in the east. The small numbers of ticks recovered from goats and gemsbok in the Orange Free State (Fourie & Horak, 1991; Fourie *et al.*, 1991), and from sheep in the southern part of this province and of the Cape Province in the present survey, indicate that this species prefers the more arid far western regions of this country.

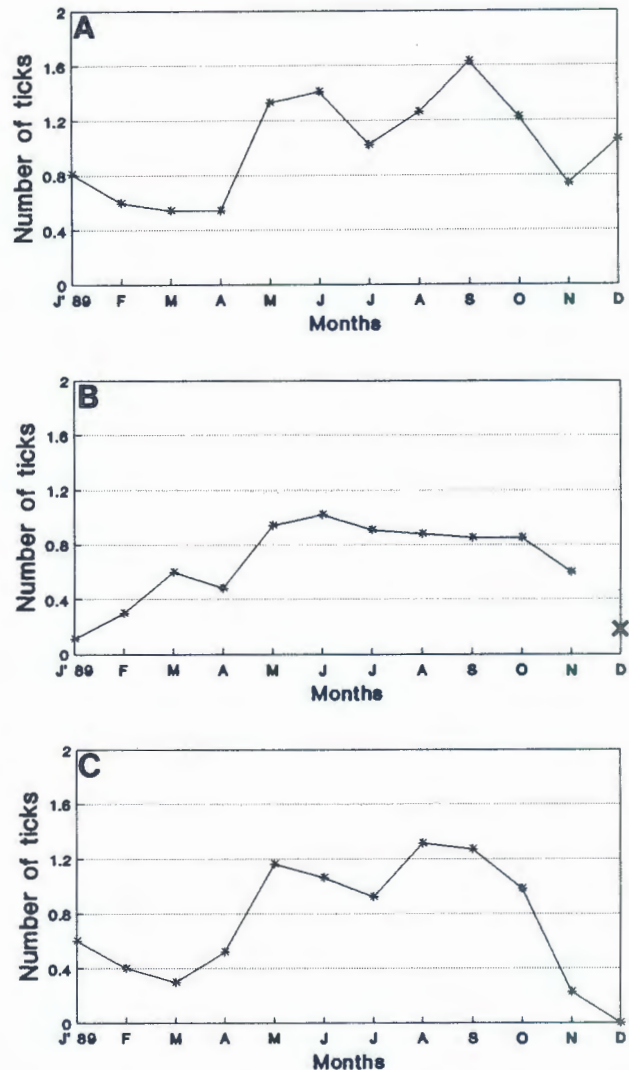


FIG. 3 The monthly mean total numbers of adult *Rhipicephalus gertrudae* [$\log_{10}(x+1)$] collected from Dorper sheep in (A) the far north-western Cape Province (B) the north-western Cape Province (C) the south-western Cape Province x = no collections made

The seasonal abundances of *R. gertrudae* on "Outuin" in the far north-western Cape Province; on all 3 farms in the north-western Cape Province, and on the 2 farms in the south-western Cape Province are graphically illustrated in Fig. 3.

In each of these localities the largest numbers of ticks were recovered from May to October. Biggs & Langenhoven (1984), who were unable to distinguish *R. gertrudae* consistently from another *R. capensis* group tick occurring on cattle in their survey near Windhoek, Namibia, recorded the largest numbers of these ticks from November to March.

Hyalomma spp.

The preferred hosts of the adults of the 3 ticks of this genus occurring in South Africa are large herbivores, such as cattle, eland and zebras (Horak,

1982; Rechav, Zeederberg & Zeller, 1987; Horak, Fourie, Novellie & Williams, 1991). It would, however, appear that when sheep are farmed in regions in which these ticks abound that they too are fairly good hosts of the adults. The immature stages of all 3 ticks prefer scrub hares as hosts (Horak & MacIvor, 1987; Rechav *et al.*, 1987; Horak & Fourie, 1991). These stages of the 2 subspecies of *H. marginatum* also infest ground-nesting birds and those of *H. truncatum* certain rodents (Walker, 1991; Horak, Fourie, Novellie & Williams, 1991).

The distributions and abundances of the 3 *Hyalomma* ticks are summarized in Table 5.

According to Howell *et al.* (1978) *H. marginatum rufipes* is more widely distributed in the Orange Free State than *H. truncatum*, while the converse is true

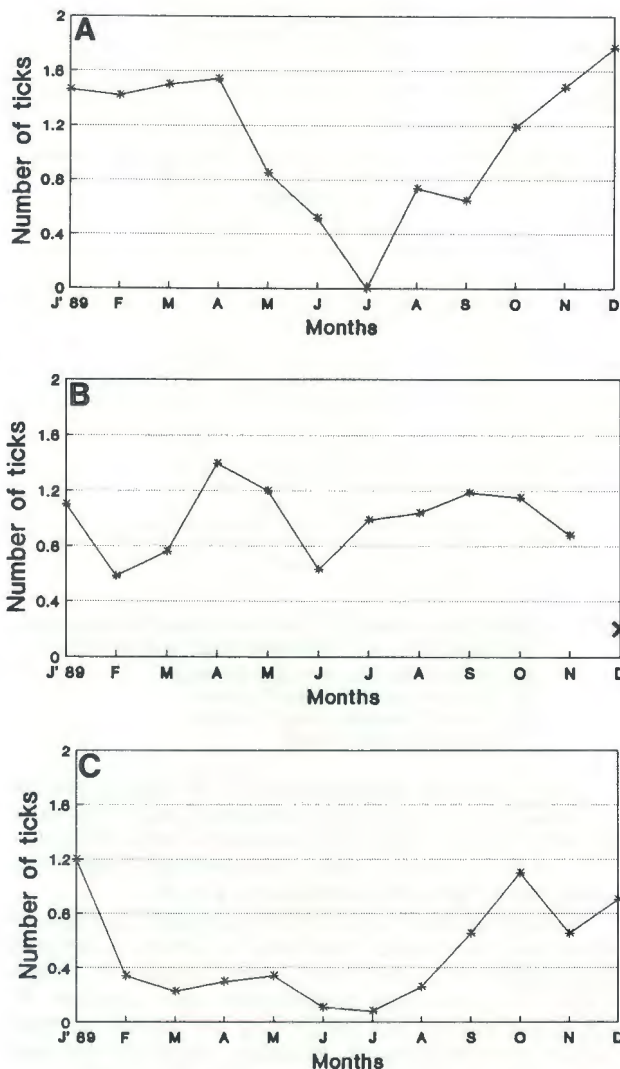


FIG. 4 The monthly mean total numbers of adult *Hyalomma truncatum* [$\log_{10}(x+1)$] collected from Dorper sheep in (A) the far north-western Cape Province (B) the north-western Cape Province (C) the south-western Cape Province x = no collections made

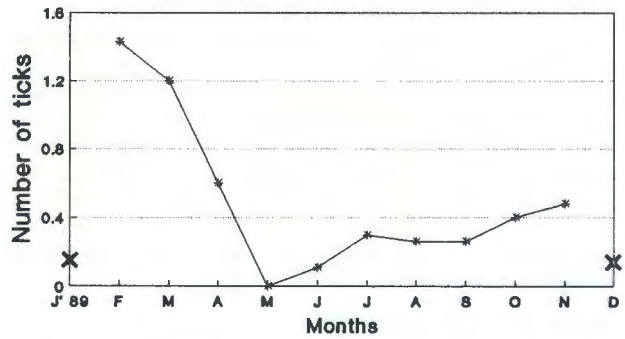


FIG. 5 The monthly mean total numbers of adult *Hyalomma marginatum rufipes* [$\log_{10}(x+1)$] collected from Dorper sheep in the north-eastern Orange Free State x = no collections made

for the Cape Province. The results of the present and other surveys indicate that, where their distributions overlap in the 2 provinces, *H. marginatum rufipes* is generally more numerous in the Orange Free State and *H. truncatum* in the Cape Province (Fourie *et al.*, 1988b; Fourie & Horak, 1990, 1991; Horak & Fourie, 1991; Fourie *et al.*, 1991).

The distribution of *H. marginatum turanicum* partially overlaps those of both the other ticks (Howell *et al.*, 1978). The recovery of a single specimen of this tick from a sheep on "Outuin", in the far north-western Cape Province, lies outside its previously known distribution range and possibly indicates the limit of the tick's distribution. However, it could have been transported there by a bird.

The seasonal abundances of *H. truncatum* on sheep on "Outuin" in the far north-western Cape Province, as well as on the 3 farms in the north-western Cape Province, and on the 3 farms in the south-western Cape Province are summarized in Fig. 4.

On "Outuin" the largest numbers were present from January to April and during November and December; in the north-western Cape Province they were present during April; and during January and October in the south-western Cape Province. These months of major abundance lie within the period spring to autumn and correspond to previous observations made for this tick in the Karoo regions of the Cape Province (Horak, Fourie, Novellie & Williams, 1991), the south-western Orange Free State (Fourie & Horak, 1990) and the south-western and northern Transvaal (Londt, Horak & De Villiers, 1979; Rechav *et al.*, 1987). The immature stages may be present on scrub hares in the largest numbers at any time from mid-summer to late winter (Horak & MacIvor, 1987; Rechav *et al.*, 1987; Horak & Fourie, 1991).

The combined seasonal abundance of *H. marginatum rufipes* on sheep on "Driefontein" and "Palmietfontein" in the north-eastern Orange Free State is illustrated in Fig. 5.

The survey on these farms commenced during February and ended during November (Table 1). The largest numbers of ticks were present during February and March, and few were recovered there-

TABLE 5 The geographic distribution and abundance of *Hyalomma truncatum*, *Hyalomma marginatum rufipes* and *Hyalomma marginatum turanicum* recovered from Dorper sheep

Farm	No. of <i>H. truncatum</i> recovered				No. of <i>H. marginatum turanicum</i>		
	Males	Females	Total	Period of major activity	Males	Females	Total
Far N.W. Cape Province							
Bovlei	33	23	56	Jan			
Olienfontein*	55	37	92	Jan–Apr			
Outuin	313	160	473	Jan–Apr, Nov–Dec	1	0	1
N.W. Cape Province							
Diepvlei*	238	123	361	Jan, Apr, May, July			
Gifberg	86	35	121	Sept & Oct			
Kantoorshoek	76	32	108	Jan, Feb, Apr			
S.W. Cape Province							
Pienaarskloof	50	16	66				
Rheeboksfontein	30	20	50	Sept & Oct			
Sandfontein	58	9	67	Jan, Feb, Nov, Dec			
S. Cape Province							
Dieniedouw*	2	4	6		1	1	2
Klipfontein*					2	0	2
The Knolls*	3	6	9		6	5	11
Farm	No. of <i>H. marginatum rufipes</i> recovered						
	Males	Females	Total	Period of major activity			
S. Orange Free State							
Goedemoed	16	4	20	Feb			
N.E. Orange Free State							
Driefontein	91	81	172	Feb & March			
Palmietfontein	22	6	28	Feb, July–Nov			

* Sheep examined only until May, June or July 1989

after. On sheep and cattle in the south-western Orange Free State the largest numbers were present from December to March and November to February respectively (Fourie *et al.*, 1988b; Fourie & Horak, 1990).

Certain strains of adult *H. truncatum* produce a toxin causing a condition known as sweating sickness in cattle (Howell *et al.*, 1978). On sheep the adults frequently attach around the feet and the damage caused by the long mouthparts may lead to secondary bacterial infections followed by foot abscess and lameness.

The results for the less abundant tick species are summarized in Table 6.

Boophilus decoloratus

The recovery of a few adults in the present survey probably indicates the presence of cattle on the farms on which the ticks were collected as these animals are amongst the preferred domestic hosts of this species (Howell *et al.*, 1978). Large numbers of larvae and smaller numbers of nymphs and adults of this tick have been recovered from Merino sheep in the north-eastern Orange Free State and from some farms in the eastern Cape Province by Horak, Williams & Van Schalkwyk (1991). The differences between the adult tick numbers recorded in the present survey compared with those in the earlier survey in the north-eastern Orange Free State could be due to the different recovery techniques employed, or breed or habitat dissimilarities.

Rhipicephalus follis

The problems surrounding the identification of this tick have been discussed by Walker (1991). In the Karoo eland appear to be the preferred hosts of the adults, while Cape mountain zebras, black wilde-

beest and springbok examined at the same locality as the eland were also infested (Horak, Fourie, Novellie & Williams, 1991). Adults have also been recovered from bushbuck (Horak, Keep, Spickett & Boomker, 1989), gemsbok (Fourie *et al.*, 1991) and bushpigs (Horak, Boomker & Flamand, 1991). Cattle are the most frequently recorded domestic hosts (Baker, Ducasse, Sutherst & Maywald, 1989; Walker, 1991).

Except on eland, *R. follis* never occurs in large numbers. Nevertheless it is widely distributed in the south-eastern Transvaal, central Orange Free State, Natal and the south-eastern and southern Cape Province (Walker, 1991). In the present survey it was recovered from sheep within this distribution range.

Rhipicephalus glabroscutatum

The domestic hosts of all stages of this 2-host tick are cattle, sheep and goats (MacIvor, 1985; Horak & Knight, 1986). The preferred wild hosts are common duikers, gemsbok, kudu, eland and mountain reedbuck (Horak, Potgieter, Walker, De Vos & Boomker, 1983; MacIvor & Horak, 1987; Horak, Fourie, Novellie & Williams, 1991). The immature stages are also found on scrub hares (Horak & Fourie, 1991). Very few ticks were recovered from sheep in the current survey and then only in the southern and south-western Cape Province.

According to MacIvor (1985) *R. glabroscutatum* is found mainly in the south-eastern Cape Province, with a few records from the central and southern parts of the province. The farms on which the tick was recovered in the present survey all lie within the latter region. Although too few adults were recovered to determine a pattern of seasonal abundance all these ticks were collected during the period De-

TABLE 6 The abundance and geographic distribution of various ixodid tick species recovered in small numbers from Dorper sheep

Tick species	No. of ticks recovered			Farm	Region
	Males	Females	Total		
<i>Boophilus decoloratus</i>	0	1	1	Sandfontein	S.W. Cape
<i>Rhipicephalus foliis</i>	0	9	9	Palmietfontein	N.E. O.F.S.
	4	14	18	Dieniedouw*	S. Cape
<i>Rhipicephalus glabroscutatum</i>	2	1	3	The Knolls*	S. Cape
	1	0	1	Palmietfontein	N.E. O.F.S.
	0	2	2	Pienaarskloof	S.W. Cape
	0	1	1	Sandfontein	S.W. Cape
	1	15	16	Dieniedouw*	S. Cape
<i>Rhipicephalus neumanni</i>	3	5	8	Klipfontein*	S. Cape
	3	nymphs	3	The Knolls*	S. Cape
	9	1	10	Bovlei	Far N.W. Cape
<i>Rhipicephalus sp. (near R. oculatus)</i>	1	0	1	Klipfontein*	S. Cape
<i>Rhipicephalus punctatus</i>	6	10	16	Klipfontein*	S. Cape
	3	6	9	Goedemoed	S. O.F.S.
	4	2	6	Driefontein	N.E. O.F.S.

* Sheep examined only until May or June 1989

ember to March. MacIvor & Horak (1987) recorded the largest numbers of adults from various hosts at several localities from July or August to February. The adults attach around and between the claws of their hosts' hooves and are a major contributory cause of foot abscess, and hence lameness, in goats. This condition is most frequently seen during the above-mentioned months (MacIvor & Horak, 1987).

Rhipicephalus neumanni

Sheep are the most commonly recorded hosts of this tick, whose adults also attach between the claws of the hooves and are a contributory cause of foot abscess and lameness (Walker, 1990).

Both localities at which *R. neumanni* was presently recovered lie outside its originally recorded distribution range. It is, however, common in southern Namibia (Walker, 1990) and its distribution probably extends into the far north-western Cape Province. The recovery of a specimen on the farm "Klipfontein" in the southern Cape Province supports the suggestion by Walker (1990) that it may be commoner in the Karoo than her records indicate.

All the ticks were collected during late January and during February.

Rhipicephalus sp. (near R. oculatus)

The species diagnosis of this tick and of *Rhipicephalus oculatus sensu stricto* have been discussed by Walker (1991). It has been recovered from cattle, sheep and goats (Horak & Knight, 1986; Walker, 1991) and from gemsbok, kudu, springbok and scrub hares (Horak & Knight, 1986; Walker, 1991; Horak & Fourie, 1991). In South Africa this tick has previously been recorded only in the south-eastern Cape Province (Walker, 1991). The farm "Klipfontein" in the southern Cape Province, on which ticks were found in the current survey, lies further to the west.

Rhipicephalus punctatus

The confusion surrounding the identity of this tick in South Africa has been addressed by Walker (1991). In this country the adults have been recov-

ered from goats (as a *Rhipicephalus pravus*-like tick), sheep [as *Rhipicephalus sp. (near R. pravus)*] and on cattle [as *Rhipicephalus sp. (near R. punctatus)*] (Fourie, Horak & Marais, 1988a,b; Fourie & Horak, 1990). It has also been recorded on various wild herbivores (Walker, 1991; Fourie *et al.*, 1991). All stages feed on scrub hares (Horak & Fourie, 1991) and only the immature stages on rock elephant shrews (Fourie *et al.*, 1988a; 1992).

In South Africa *R. punctatus* has been recorded in the western, northern and north-eastern Transvaal, the central and south-western Orange Free State and the adjacent north-eastern Cape Province (Fourie *et al.*, 1988a,b; 1991; Walker, 1991; Horak & Fourie, 1991). Its presence in the north-eastern Orange Free State in this survey constitutes a new record.

This tick has been associated with paralysis in Angora goat kids in the south-western Orange Free State (Fourie *et al.*, 1988a).

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