

PARASITES OF DOMESTIC AND WILD ANIMALS IN SOUTH AFRICA. XXVII. TICKS ON HELMETED GUINEAFOWLS IN THE EASTERN CAPE PROVINCE AND EASTERN TRANSSVAAL LOWVELD

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ABSTRACT

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Seventy-six helmeted guineafowls (*Numida meleagris*) were shot in the Andries Vosloo Kudu Reserve and on an adjacent farm in the eastern Cape Province during the period May 1985 to January 1987 and their tick burdens determined. A total of 10 ixodid tick species were recovered, of which *Amblyomma hebraeum*, *Amblyomma marmoreum* and *Haemaphysalis silacea* were the most abundant. The seasonal abundances of these 3 species and of *Hyalomma marginatum rufipes* were ascertained. A marked difference between the total number of *A. hebraeum* recovered from the birds in the reserve and those on the farm is ascribed to the treatment of domestic stock on the farm with an acaricide.

The tick burdens of 118 helmeted guineafowls, shot in the southern part of the Kruger National Park, eastern Transvaal Lowveld, from August 1988 to August 1990, were also determined. Ten ixodid tick species and the larvae of an argasid species were recovered. *A. hebraeum*, *A. marmoreum* and the *Argas* sp. were the most abundant and their seasonal abundances and that of *Rhipicephalus zambeziensis* were determined.

Only 2 of the 54 659 ixodid ticks recovered from the birds at the 3 localities were adults and the presence of these is ascribed to accidental infestations.

INTRODUCTION

The tick species infesting guineafowls have been recorded in a number of studies (Theiler, 1962; Norval, 1974; Fabiyi, 1980; Horak & Williams, 1986; Horak & Knight, 1986; Rechav, Zeederberg & Zeller, 1987; Okaeme, 1988). The actual tick burdens of free-ranging helmeted guineafowls (*Numida meleagris*) were determined in those investigations conducted by Norval (1974), Horak & Williams (1986), Horak & Knight (1986) and Rechav *et al.* (1987). The results of these surveys indicate that guineafowls are good hosts of the immature stages of *Amblyomma hebraeum*, *Amblyomma marmoreum*, *Haemaphysalis silacea* and the 2 subspecies of *Hyalomma marginatum* as well as the larvae of *Argas* spp. The seasonal abundances of *A. hebraeum*, *A. marmoreum*, *H. silacea* and the 2 subspecies of *H. marginatum* on helmeted guineafowls have also been determined (Horak & Williams, 1986; Rechav *et al.*, 1987).

Recent research has shown that it is possible to infect helmeted guineafowls with *Cowdria ruminantium*, the causative organism of heartwater in cattle, sheep and goats, and that *A. hebraeum* feeding on these birds can acquire infection (Oberem & Bezuidenhout, 1987). The fact that free-living guineafowls are also naturally infested with the immature stages of at least 3 *Amblyomma* species that can act as vectors of *C. ruminantium*, namely *A. hebraeum*, *A. marmoreum* and *A. variegatum* (Walker & Olwage, 1987; Petney, Horak & Rechav, 1987) indicates that these birds may play a role in the epidemiology of the disease.

The present paper describes surveys in which the tick burdens of free-ranging helmeted guineafowls were determined in the Valley Bushveld of the eastern Cape Province and in the eastern Transvaal Lowveld. In the eastern Cape Province the surveys were conducted on the same properties as those reported by Horak & Williams (1986) and Horak & Knight (1986). The present surveys are a direct

extension of that conducted by Horak & Williams (1986) and include in greater detail the tick burdens of 24 guineafowls examined by Horak & Knight (1986).

METHODS AND RESULTS

Andries Vosloo Kudu Reserve and "Bucklands"

Study site

The Andries Vosloo Kudu Reserve (AVKR) is 6 497 ha in extent and shares a common 11 km boundary with the farm "Bucklands", which is 5 480 ha in extent. The reserve and the farm are located at approximately 33° 07' S, 26° 40' E with altitudes ranging from 335-538 m. The vegetation of the region is described as Valley Bushveld (Acocks, 1975). A detailed description of the vegetation on "Bucklands" has been given by Rechav (1982). The reserve contained approximately 54 hartebeest, 450 kudu, 140 eland and 100 buffalo, and the farm 300 Dorper sheep, 4 000 Angora goats, 185 cattle and 300 kudu at the time of the survey. The numbers of helmeted guineafowls on both properties are unknown.

Survey birds

At monthly intervals from May 1985 to January 1987 an attempt was made to shoot 2 helmeted guineafowls in the AVKR and 2 on "Bucklands". This was not always possible and no birds were obtained in the AVKR during July and December 1985, only 1 bird was shot during February and 1 during June 1986 and 3 birds each during March, May and December 1986. On "Bucklands" no birds were obtained during November and December 1985 and only 1 during November 1986.

Necropsy and counting procedures

The guineafowls were processed for tick recovery and the ticks were counted as described by Horak & Williams (1986).

Results

The species and numbers of ticks recovered from the 39 guineafowls examined on the reserve and 37 on the farm are summarized in Table 1 & 2.

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TABLE 1 Total numbers of ticks recovered from 39 helmeted guineafowls in the Andries Vosloo Kudu Reserve

Tick species	Total numbers recovered				No. of birds infested
	Larvae	Nymphs	Females*	Total	
<i>Amblyomma hebraeum</i>	22 152	995	0	23 147	39
<i>Amblyomma marmoreum</i>	341	27	0	368	26
<i>Haemaphysalis silacea</i>	1 226	318	0	1 544	33
<i>Hyalomma marginatum rufipes</i>	131	9	0	140	21
<i>Rhipicephalus appendiculatus</i>	18	1	1	20	6
<i>Rhipicephalus evertsi evertsi</i>	3	0	0	3	2
<i>Rhipicephalus glabroscutatum</i>	12	3	0	15	5
<i>Rhipicephalus sp.</i>	1	0	0	1	1
Total	23 884	1 353	1	25 238	

* No males were recovered

TABLE 2 The total numbers of ticks recovered from 37 helmeted guineafowls on the farm "Bucklands"

Tick species	Total numbers recovered			No. of birds infested
	Larvae	Nymphs	Total*	
<i>Amblyomma hebraeum</i>	670	19	689	24
<i>Amblyomma marmoreum</i>	447	33	480	29
<i>Haemaphysalis silacea</i>	1 705	186	1 891	35
<i>Hyalomma marginatum rufipes</i>	51	3	54	12
<i>Ixodes sp.</i>	1	0	1	1
<i>Rhipicephalus appendiculatus</i>	1	1	2	2
<i>Rhipicephalus evertsi evertsi</i>	4	0	4	1
<i>Rhipicephalus glabroscutatum</i>	6	0	6	2
<i>Rhipicephalus oculatus</i>	3	4	7	4
<i>Rhipicephalus sp.</i>	1	0	1	1
Total	2 889	246	3 135	

* No adult ticks were recovered

The birds on the reserve were infested with the immature stages of 8 ixodid tick species and a single adult tick. Of these *Amblyomma hebraeum* followed by *Haemaphysalis silacea* and *Amblyomma marmoreum* were the most abundant and prevalent.

The guineafowls on the farm were infested with the immature stages of 10 ixodid tick species. *H. silacea* followed by *A. hebraeum* and *A. marmoreum* were the most abundant and *H. silacea* followed by *A. marmoreum* the most prevalent.

Comment: Because of the marked difference between the numbers of *A. hebraeum* recovered from the birds in the reserve and on the farm, which will be discussed later, only the burdens of those in the reserve have been graphically illustrated (Fig. 1). The burdens of *A. marmoreum*, *H. silacea* and *Hyalomma marginatum rufipes* were fairly similar at the 2 localities and these have been combined for each species and graphically illustrated (Fig. 2-4).

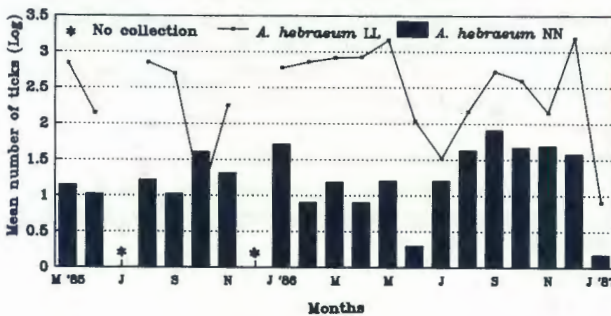


FIG. 1 The seasonal abundance of *Amblyomma hebraeum* on helmeted guineafowls in the Andries Vosloo Kudu Reserve

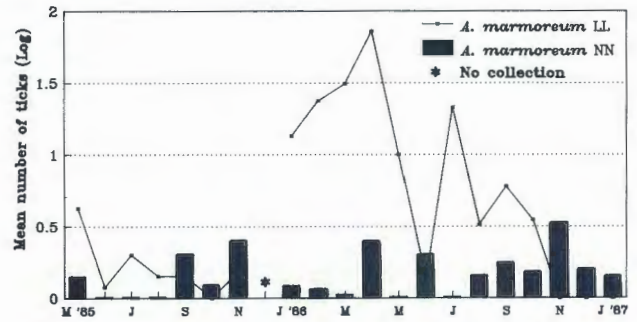


FIG. 2 The seasonal abundance of *Amblyomma marmoreum* on helmeted guineafowls in the Andries Vosloo Kudu Reserve and on the farm "Bucklands"

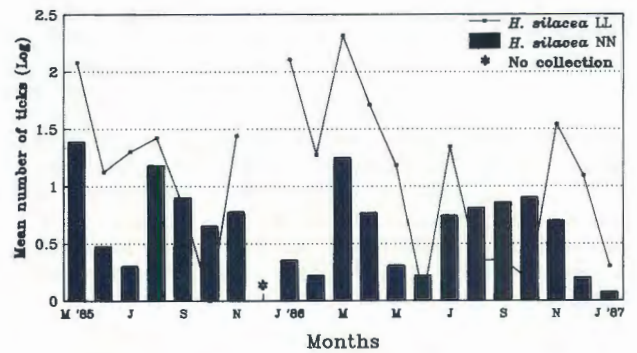


FIG. 3 The seasonal abundance of *Haemaphysalis silacea* on helmeted guineafowls in the Andries Vosloo Kudu Reserve and on the farm "Bucklands"

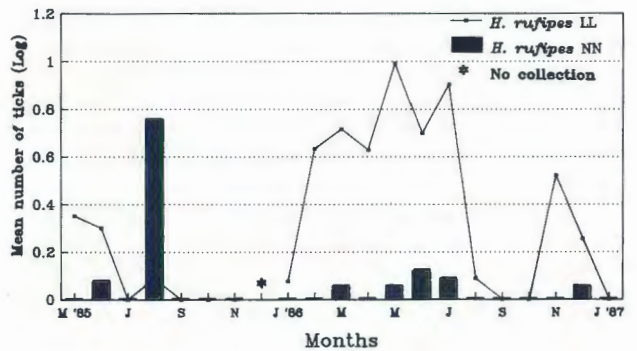


FIG. 4 The seasonal abundance of *Hyalomma marginatum rufipes* on helmeted guineafowls in the Andries Vosloo Kudu Reserve and on the farm "Bucklands"

No clear pattern of seasonal abundance was evident for the immature stages of *A. hebraeum*, and both larvae and nymphs were always present. The largest numbers of *A. marmoreum* larvae were present from January to May and during July 1986,

TABLE 3 The total numbers of ticks recovered from 118 helmeted guineafowls in the Kruger National Park

Tick species	Total numbers recovered				No. of birds infested
	Larvae	Nymphs	Males*	Total	
Ixodid ticks					
<i>Amblyomma hebraeum</i>	21 813	1 965	0	23 778	117
<i>Amblyomma marmoreum</i>	2 284	103	0	2 387	89
<i>Boophilus decoloratus</i>	15	0	0	15	7
<i>Haemaphysalis leachi</i>	3	2	0	5	2
<i>Hyalomma truncatum</i>	9	1	0	10	7
<i>Rhipicephalus appendiculatus</i>	4	0	1	5	3
<i>Rhipicephalus evertsi evertsi</i>	2	0	0	2	2
<i>Rhipicephalus punctatus</i>	0	1	0	1	1
<i>Rhipicephalus simus</i>	11	0	0	11	7
<i>Rhipicephalus zambeziensis</i>	68	4	0	72	15
Total	24 209	2 076	1	26 286	
Argasid ticks					
<i>Argas</i> sp.	1 274	0	0	1 274	26

* No females were recovered

nymphs were present in the largest numbers during November 1985 and 1986. The immature stages of *H. silacea* exhibited no clear pattern of seasonal abundance. Larvae and or nymphs of *H. marginatum rufipes* were present in May, June and August 1985, January to August and during November and December 1986.

Kruger National Park

Study site

The Kruger National Park (KNP) is 1 945 528 ha in extent and is situated in the eastern Transvaal Lowveld. The vegetation of the southern section of the park (South of 24° 50' S) in which this survey was conducted, is classified as Lowveld with small areas of Lowveld Sour Bushveld and Arid Lowveld (Acocks, 1975). A more detailed description of the vegetation of the various landscape zones that make up this region has been given by Gertenbach (1983). Impala, kudu, Burchell's zebras, blue wildebeest, buffalo and giraffe account for the major portion of the population of large herbivores present in this locality. Small flocks of helmeted guineafowls are scattered throughout the region with several hundred birds concentrated around the Skukuza rest camp, where they feed on the refuse dump. Tortoises, and particularly the mountain tortoise, abound in this part of the park.

Survey birds

Each month, from August 1988 to August 1990, 2 helmeted guineafowls were shot on or near the refuse dump at Skukuza, and 3 were shot at other sites in the southern part of the park. It was not always possible to obtain birds at the latter sites and none were shot during January and February 1990 and only 2 during May 1990. We attempted to shoot only adult birds, but 7 sub-adult birds, approximately 7–10 months old were shot and included in the sample, which comprised 118 birds.

Necropsy and counting procedures

After the guineafowls had been shot, blood was collected from the jugular vein when possible and blood smears were made from each bird. Thereafter the carcasses were placed in sturdy plastic bags, which were securely closed, and transported to the laboratory at Skukuza.

At the laboratory the birds were removed from the plastic bags, mass-measured and various mor-

phometric measurements taken. Each bird was then skinned, the wing-tips and feet being left attached to the skin. The tail including pygostyle and the head with the unfeathered portion of the neck were severed from the skin and placed in a plastic bottle. The remainder of the skin was divided in half lengthwise and 1 half was returned to the plastic bag. Sufficient tick detaching agent¹ was added to the plastic bottle and the plastic bag in order to thoroughly wet the contents and these were left overnight. The following morning formalin was added to the contents of the plastic bottle and bag which were transported to the Faculty of Veterinary Science, Onderstepoort. There the contents of the bottle and bag were separately washed with a strong jet of water over a sieve with 150 µm apertures. The washed head, tail and skin and the fine material retained by the sieve, were collected for microscopic examination.

The head and neck, tail and half portion of skin and all the material retained by the sieve were examined separately under a stereoscopic microscope. Ticks present on or in this material were collected, identified and counted. The number of ticks recovered from the half-portion of skin was doubled and added to the numbers recovered from the remainder of the material in order to calculate the total tick burden of each bird.

Results

The species and numbers of ticks recovered from the 118 guineafowls examined in the park are summarized in Table 3.

The birds were infested with the immature stages of 10 ixodid tick species and a single adult tick. They also harboured the larvae of an *Argas* species. *A. hebraeum* and *A. marmoreum* were the most numerous and prevalent of the ixodid ticks. The guineafowls shot at sites other than the Skukuza refuse dump were infested with significantly more larvae and nymphs of *A. hebraeum* and larvae of *A. marmoreum* than those shot on the refuse dump. Too few nymphs of *A. marmoreum* were recovered for valid comparisons.

The seasonal abundances of *A. hebraeum*, *A. marmoreum*, *Rhipicephalus zambeziensis* and the *Argas* sp. are graphically illustrated in Fig. 5–8.

¹ Triatix: Coopers (SA) (Pty) Ltd

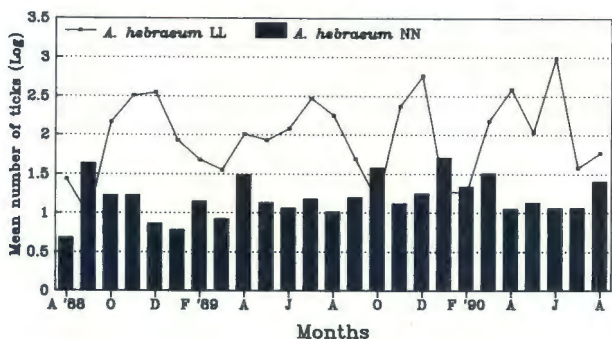


FIG. 5 The seasonal abundance of *Amblyomma hebraeum* on helmeted guineafowls in the Kruger National Park

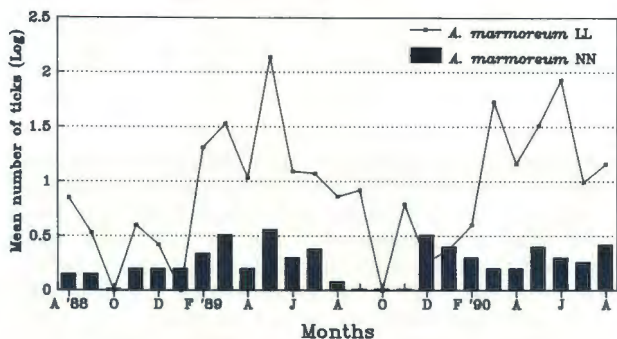


FIG. 6 The seasonal abundance of *Amblyomma marmoreum* on helmeted guineafowls in the Kruger National Park

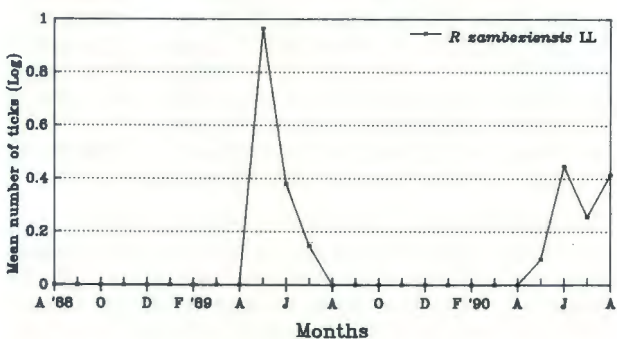


FIG. 7 The seasonal abundance of *Rhipicephalus zambeziensis* on helmeted guineafowls in the Kruger National Park

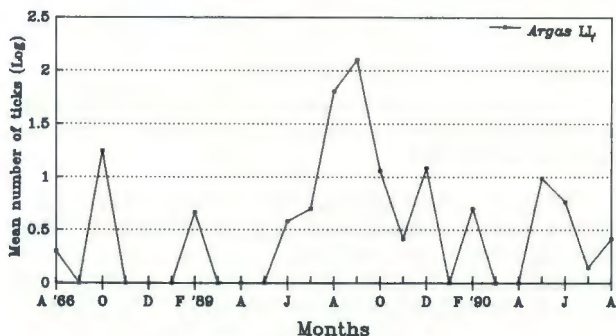


FIG. 8 The seasonal abundance of *Argas* sp. larvae on helmeted guineafowls in the Kruger National Park

No definite pattern of seasonal abundance was evident for *A. hebraeum*, with both larvae and nymphs being present during each month of the survey. The largest numbers of *A. marmoreum* larvae were present from February to September 1989 and March to August 1990. With the exception of Octo-

ber 1988 and September to November 1989, when no nymphs were recovered, these were always present. Larvae of *R. zambeziensis*, which appeared not to have attached, were present on the birds from May to July 1989 and May to August 1990. *Argas* sp. larvae were consistently present from June to December 1989 and May to August 1990.

DISCUSSION

Theiler (1962) lists 13 ixodid tick species that have been recovered from helmeted guineafowls in the Ethiopian region. Although she reported the adults of 3 species as occurring on these birds, Horak & Williams (1986) in discussing her records suggested that the adults of only *Haemaphysalis hoodi* are parasites of guineafowls in South Africa. This tick was not recovered during any of the current surveys.

Horak & Williams (1986) recovered the immature stages of 9 ixodid tick species from helmeted guineafowls they examined in the Mountain Zebra National Park, Cradock district and in the AVKR. Four of these they ascribed to incidental infestations. A total of 16 ixodid species was recovered during the present surveys 12 of which we consider to be incidental infestations. Combining the findings of Theiler (1962) for those species that she listed as occurring in South Africa, and of Horak & Williams (1986) with the present results, 20 ixodid tick species have been found on helmeted guineafowls in this country. Of these we consider only *A. hebraeum*, *A. marmoreum*, *H. hoodi*, *H. silacea*, *H. marginatum rufipes* and *H. marginatum turanicum* to be true parasites of these birds, the remainder representing incidental infestations.

The majority of attached larval ticks recorded by Horak & Williams (1986) on the guineafowls in the AVKR were recovered from the head and upper necks of the birds and the majority of nymphs from the wings. In the present study in the KNP the majority of larvae and nymphs of *A. hebraeum* were recovered from the heads of the birds and those of *A. marmoreum* from the skins including the lower neck, wings, sides and feathered portions of the legs. These differences in preferred sites of attachment by the 2 species would avoid competition for a limited resource.

A. hebraeum

The marked difference between the burdens of *A. hebraeum* of the guineafowls in the AVKR and those on the farm "Bucklands" can be ascribed to the regular treatment of the domestic stock on the farm with an acaricide² containing a synthetic pyrethroid with a residual effect. This resulted in a reduction in the numbers of *A. hebraeum* not only on the guineafowls but also on scrub hares and kudu and on the vegetation on the farm. This has been discussed in greater detail by Horak & Knight (1986) and Petney & Horak (1987).

The smaller tick burdens of the guineafowls shot at the refuse dump at Skukuza, when compared with those shot at other sites in the KNP, are probably due to the dilution of the available number of questing immature ticks amongst the very large flocks of birds concentrated around the dump. The guineafowls do not themselves directly generate larvae as they carry no adult *A. hebraeum*. These are present on the large herbivores in the vicinity and while the

² Sumitok, Shell SA (Pty) Ltd

densities of some of these animals are also slightly higher near Skukuza, they are proportionately not nearly as high as that of the guineafowls at this locality.

The immature stages of *A. hebraeum* were the most abundant and prevalent on the guineafowls in both the AVKR and the KNP, and but for 1 bird all the guineafowls examined at these localities were infested. The mean burdens were 568,0 larvae and 25,5 nymphs for birds in the AVKR and 184,9 larvae and 16,7 nymphs for those in the KNP. The ratios of larvae to nymphs were thus 22,3:1 and 11,1:1 respectively for the 2 reserves. The ratio of larvae to nymphs in the AVKR is thus double that in the KNP suggesting a ceiling to the number of nymphs that guineafowls can harbour. However, if individual burdens are considered, the largest number of larvae harboured by a single bird was 1 757 in the AVKR and 2 429 in the KNP and of nymphs 143 and 97 respectively. This seems to negate the possibility of a ceiling to the number of nymphs a guineafowl can carry.

The ratio of larvae to nymphs need not be an accurate reflection of the successful translation of larvae to the nymphal stage. The immature stages of this tick have a very wide host range (Theiler, 1962; Norval, 1974; Horak, MacIvor, Petney & De Vos, 1987) and hence the tick burdens of all host species within a particular region have to be considered in order to assess accurate larval to nymphal ratios. Using the data of Horak *et al.* (1987), larval to nymph ratios of 16,9:1 on guineafowls; 2,3:1 on scrub hares, and 5,1:1 on kudu in the AVKR can be calculated. In the KNP their data would give ratios of 1,3:1 on warthogs; 7,2:1 on impala; 28,8:1 on blue wildebeest; 6,9:1 on kudu, and 6,3:1 on Burchell's zebras. As indicated earlier these species are only some of the hosts that are present in each of the reserves and each of the other host species is likely to have different ratios of larvae to nymphs. The ratios may also differ for the same host species in different localities, as seen with the guineafowls in the AVKR and in the KNP. The latter differences could be due to differences in the diversity and/or density of the host fauna at the 2 localities.

Petney & Horak (1987), during a survey lasting from August 1985 to July 1986, recovered the largest numbers of free-living larvae of *A. hebraeum* from the vegetation of the AVKR during August and September 1985 and from March to June 1986. The larval burdens on the guineafowls slaughtered during the same period in the present survey, were high in August and September 1985 and from January to May 1986. These periods of larval abundance during spring and from late summer to autumn correspond to those observed by Rechav (1982) on cattle on a farm near East London in the eastern Cape Province.

No pattern of abundance was evident for the nymphs on the guineafowls in the AVKR or for the larvae and nymphs on the guineafowls in the KNP.

A. marmoreum

This tick is listed by Hoogstraal & Aeschlimann (1982) as having a strict-total host specificity for tortoises in the Ethiopian region. However, Theiler (1962), Norval (1975b) and Horak *et al.* (1987) have found that several bird and mammal species can serve as hosts for the larvae and nymphs. Although tortoises are the preferred hosts for all stages of development (Theiler, 1962; Norval 1975b; Dower, Petney & Horak, 1988), helmeted guineafowl, caracal, kudu, eland and cattle are all good hosts of the

larvae judging by the numbers recovered and the percentage of hosts infested (Horak *et al.*, 1987). With the possible exception of guineafowls, none of these latter animals are good hosts of the nymphs (Horak *et al.*, 1987).

The percentage of guineafowls infested at the 3 localities was AVKR 66,7 %, "Bucklands" 78,4 % and KNP 75,4 %. The mean burdens of infested birds were 13,1; 15,4 and 25,7 larvae and 1,0; 1,1 and 1,2 nymphs respectively. Combining the total burdens of the birds in the AVKR and on "Bucklands", the ratio of larvae to nymphs was 13,1:1 compared with 22,2:1 for the birds in the KNP. These ratios are nearly the exact opposite of those recorded for *A. hebraeum* on the birds at the two localities.

Acaricidal treatment of the domestic stock on "Bucklands" did not have an adverse effect on the *A. marmoreum* burdens of the guineafowls on the farm. This is because the adult ticks are on tortoises and thus unaffected by the acaricide.

The pattern of seasonal abundance in the present surveys differs somewhat from that described by Norval (1975b), Horak, Sheppey, Knight & Beuthin (1986) and Rechav *et al.* (1987). In the eastern Cape Province the larvae appeared to be most numerous on the guineafowls from late summer to spring and the nymphs during early summer. In the KNP larvae were most numerous from late summer to spring and nymphs from spring or mid-summer to the end of winter. Both these patterns of seasonal abundance seem to indicate a 2-year life cycle as suggested by Norval (1975b). This seems quite likely, taking into account the extended time all stages spend on tortoises (Dower *et al.*, 1988).

H. silacea

This tick is found in well-wooded ravines and river valleys in the eastern Cape Province and, to a lesser extent, Natal (Howell, Walker & Nevill, 1978), hence its abundance in the Valley Bushveld regions of both provinces. Theiler (1962), Norval (1975a) and Horak & Williams (1986) have all recorded the helmeted guineafowl as a host of the immature stages. Its abundance on the birds in the eastern Cape Province in the present survey confirms these observations.

Although earlier surveys indicate that the larvae are most numerous from autumn to winter or spring and the nymphs from winter or spring to early summer (Norval, 1975a; Knight & Rechav, 1978; Rechav, 1982; Horak & Williams, 1986), no such pattern was obvious in the present study.

Hyalomma spp.

The immature stages of *H. marginatum rufipes* and *H. truncatum* both prefer hares as hosts (Horak & MacIvor, 1987; Rechav *et al.*, 1987). Those of *H. marginatum rufipes* may also be found on ground-frequenting birds (Horak & Knight, 1986; Rechav *et al.*, 1987), while those of *H. truncatum* prefer rodents as alternate hosts (Horak & MacIvor, 1987). The *H. marginatum rufipes* recovered from the guineafowls in the eastern Cape Province are therefore true parasites of these birds. The small number of *H. truncatum* recovered from the birds in the KNP are incidental parasites and are only a reflection of the considerable number of larvae available in the environment. This is confirmed by the large numbers recovered from scrub hares examined at the same time (Horak, Spickett & Braack, 1990, unpublished data).

The presence of immature *H. marginatum rufipes* on the guineafowls in the eastern Cape Province from January to August 1986 is similar to that on scrub hares at the same locality and on Cape and scrub hares in the S.A. Lombard Nature Reserve, southwestern Transvaal (Horak & MacIvor, 1987; Rechav *et al.*, 1987). In the Mountain Zebra National Park, near Cradock, where the winters are colder, the immature stages of *Hyalomma marginatum turanicum* were present on scrub hares in their largest numbers from April to August (Horak & MacIvor, 1987) and on guineafowls only during May and July (Horak & Williams, 1986). Adult ticks of these two subspecies prefer large hosts such as eland and zebras (Horak & MacIvor, 1987; Rechav *et al.*, 1987).

Other ixodid ticks

All the other ixodid ticks recovered from the guinea fowls must be considered incidental parasites and merely a reflection of the seasonal abundance of their free-living stages in the environment.

None of the *R. zambeziensis* larvae recovered appeared to have attached to the birds. Their presence from May to July or August corresponds to that observed for *Rhipicephalus* spp. larvae (*Rhipicephalus appendiculatus* and *R. zambeziensis*) on blue wildebeest and Burchell's zebras in the KNP (Horak, De Vos & Brown, 1983; Horak, De Vos & De Klerk, 1984).

Argas sp.

In northern Nigeria, Fabiyi (1980) recovered the larvae of *Argas persicus* from 30% of guineafowls he examined, while in southern Guinea savanna, also in Nigeria, Okaeme (1988) recovered the larvae of this tick from 2% of semi-wild guineafowls and none from wild guineafowls. In the present survey 22% of the guineafowls from the KNP and none from the eastern Cape Province were infested with *Argas* sp. larvae.

Although considerable variation occurred in the presence and numbers of *Argas* sp. larvae on the guineafowls in the KNP, they were recovered consistently from June to December 1989. None were present during January, March and April in both years of the survey. Rechav *et al.* (1987) collected *Argas* sp. larvae from helmeted guineafowls in the S.A. Lombard Nature Reserve throughout the summer, with a peak in October or November.

In Zimbabwe, Norval, Short & Chisholm (1985) recovered variable numbers of *Argas walkerae* larvae throughout the year on domestic fowls kept in a run constructed of poles and thatch. The larvae were most abundant on an artificial perch in the run during early summer. Norval *et al.* (1985) suggested that 2 cohorts of larvae were responsible for this rise, the first in September from overwintering eggs and the second in November from eggs laid by females that had overwintered.

Bloodsmears made from the guineafowls in the KNP revealed the presence of an *Aegyptianella* sp. (Huchzermeyer, Horak & Braack, 1991). Whether the *Argas* sp. collected from the birds play a role in the transmission of this rickettsia could not be determined in the present survey.

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