Arthropod burdens of impalas in the Skukuza region during two droughts in the Kruger National Park

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Ixodid ticks and lice were collected at monthly intervals from March 1980 to February 1981 from impalas of all ages and both sexes in Landscape Zone 4 (Thickets of the Sabie and Crocodile Rivers) in the south-west of the Kruger National Park. Similar collections were made from adult animals *in extremis* in the same landscape zone during October and November of the drought of 1982 as well as from 15 to 22-month-old male impalas examined at monthly intervals from March to October of the drought of 1992.

The louse burdens of the adult animals examined during the 1982 drought were significantly greater than those of adult animals examined during the same months of 1980, a year of normal rainfall. The tick burdens were also larger, but not significantly so. The tick and louse burdens of the young impalas examined during the drought of 1992 were significantly smaller than those of animals of the same age examined during 1980.

Key words: ixodid ticks, lice, impalas, drought.

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Introduction

During the past 14 years, the southern regions of the Kruger National Park have experienced two severe droughts. The first, during 1982/83, resulted in numerous deaths of animals, particularly impalas and warthogs. Deaths were less obvious in the second drought during 1991/92.

The ixodid tick and louse burdens of impalas in the Skukuza region of the park were monitored during these droughts and the results are presented here.

Materials and Methods

Study Site

All the impalas were collected within a 20 km radius of Skukuza in the thickets of the Sabie and Crocodile rivers landscape zone [Landscape Zone 4 of Gertenbach (1983)].

1980/81:
Each month from March 1980 to February 1981 an impala lamb, a 15 to 26-month-old ram born in November/December 1979, an adult male and an adult female were shot and examined for ectoparasites.

1982/83
A large number of impalas died in October and November 1982 during the drought of 1982/83. Three adult males and seven adult females, judged

to be terminally affected, were shot in these months and examined for ectoparasites.

1992/93
Each month from March 1992 to April 1993 three young impala rams aged from 15 to 28 months, and born in November/December 1990, were shot and examined for ectoparasites.

Ectoparasite recovery

Ixodid ticks and lice were recovered from the impalas, identified and counted as described by Horak *et al.* (1992).

Selection of data

The ectoparasite burdens of four adult animals (two rams and two ewes) examined during October and November 1980 were compared with those of the ten adult animals (three rams and seven ewes) shot *in extremis* during October and November 1982. The ectoparasite burdens of eight 15 to 22-month-old rams examined singly from March to October 1980 were compared with those of 24 similarly aged animals examined in sets of three from March to October 1992. (Six animals had been examined in March 1992 but using tables of random numbers the ectoparasite burdens of only three of these were used for comparative purposes. This was done to avoid bias as only three animals were examined in each of the other months).

Statistical procedures

The ectoparasite burdens of the three groups of impalas were compared by means of the Mann-Witney *U*-test for non-parametrically distributed data.

Rainfall

Rainfall was measured at a weather station at Skukuza.

Game counts

The numbers of impalas in the Nwaswitshaka region, in which most of the impalas were examined, were estimated annually by aerial census.

Free-living ticks

In an unrelated survey free-living ticks were collected in the Nwaswitshaka region by monthly drag-sampling of the vegetation from August 1988 until July 1994 (Spickett *et al.* 1995).

Results

The mean total tick and louse burdens of the various groups of impalas examined are summarised in Table 1.

The total tick burdens of the four adult animals (two males, two females) examined in October and November 1980, prior to the droughts, were smaller than those of the ten animals (three males, seven females) examined in October and November 1982 during the drought. The differences were, however, not statistically significant. Similar observations were made for the louse burdens, but here the differences were statistically significant ($P \geq 0{,}05$).

The total tick and louse burdens of the eight young male impalas examined in 1980 prior to the droughts were significantly larger than those of the 24 similarly aged animals examined during the 1992 drought ($P \geq 0{,}05$).

Total annual rainfall (July to June) at Skukuza from 1979/80 to 1992/93 is graphically illustrated in Fig. 1A. Figure 1B illustrates the numbers of impalas estimated to be present in the Nwaswitshaka region during the annual game census.

The two years preceding the 1982/83 drought had better than average and average rainfall respectively, while the two years preceding the 1991/92 drought were characterised by less than average rainfall. In fact, the year immediately preceding the latter drought had the second lowest rainfall of the previous 12 years.

With three exceptions, the numbers of impalas along the Nwaswitshaka River fluctuated between approximately 3 000 and 6 000. These three exceptions occurred during 1987, 1990 and 1992 when the numbers

Table 1

The mean total tick and louse burdens of impalas examined around Skukuza in normal and drought years

Period	Rainfall	No. of impalas	Sex	Age	Mean total numbers (range) of ticks and lice collected			
					Ticks	Significance	Lice	Significance
Oct-Nov 1980	Normal	4	Mixed	Adult	4 734 (2 654 - 5 713)		304 (8 - 920)	
Oct-Nov 1982	Drought	10	Mixed	Adult	7 461 (2 144 - 14 727)	$P \geq 0,35$	2 667 (323 - 7 666)	$P \geq 0,02$
Mar-Oct 1980	Normal	8	Male	15-22 mon	8 696 (2 526 - 16 831)		2 689 (192 - 17 872)	
Mar-Oct 1992	Drought	24	Male	15-22 mon	678 (152 - 2 176)	$P \geq 0,001$	461 (22 - 5 872)	$P \geq 0,02$

declined to approximately 2 800, 2 400 and 1 000 respectively.

The total numbers of free-living ticks as well as the numbers of larvae of *Amblyomma hebraeum*, *Boophilus decoloratus* and *Rhipicephalus zambeziensis* collected from the vegetation annually are graphically illustrated in Fig. 2A-D.

The total numbers of ticks as well as the numbers of *A. hebraeum* larvae declined on the vegetation from 1989/90 onwards. The total numbers of *B. decoloratus* larvae declined from 1988/89, with a particularly large reduction being evident in 1992/93. The lowest numbers of *R. zambeziensis* larvae were collected from the vegetation during 1992/93.

Discussion

The differences in the tick burdens of the impalas during the two droughts can probably be ascribed to differences in the rainfall in the years preceding the droughts. The rainfall in the two years preceding the 1982/83 drought was above average and average respectively, and it can be assumed that this ensured that there was a mat of decaying vegetation under the standing grass from which the ticks were collected. This mat supplied an ideal habitat for the survival of the ticks, even in the drought year, hence their high numbers.

The rainfall in the two years preceding the 1991/92 drought was below average in 1989/90 and well below average in 1990/91. This, coupled with a fire in part of the study area during September 1990, not only led to severe depletion of the standing grass, but also to the virtual disappearance of the mat of dead and decaying material under the grass. (The cloth tails by means of which the ticks were collected from the vegetation were frequently dragged over bare soil during 1991 and 1992).

With the disappearance of the mat the microhabitat, in which the female ticks laid eggs, the eggs developed and hatched, and the newly hatched larvae could shelter, no longer existed. In addition the sparseness of the standing grass meant that there was less vegetation from which the larval ticks could quest for a passing host animal. Compounding the reduction in tick numbers was the fact that few impalas remained in the Nwaswitshaka area (Fig. 1B) and thus fewer engorged female ticks detached and laid eggs there. All these factors led to a reduction of tick numbers on the vegetation (Fig. 2), which was in turn reflected in the small numbers of ticks collected from the impalas examined during 1992 (Table 1).

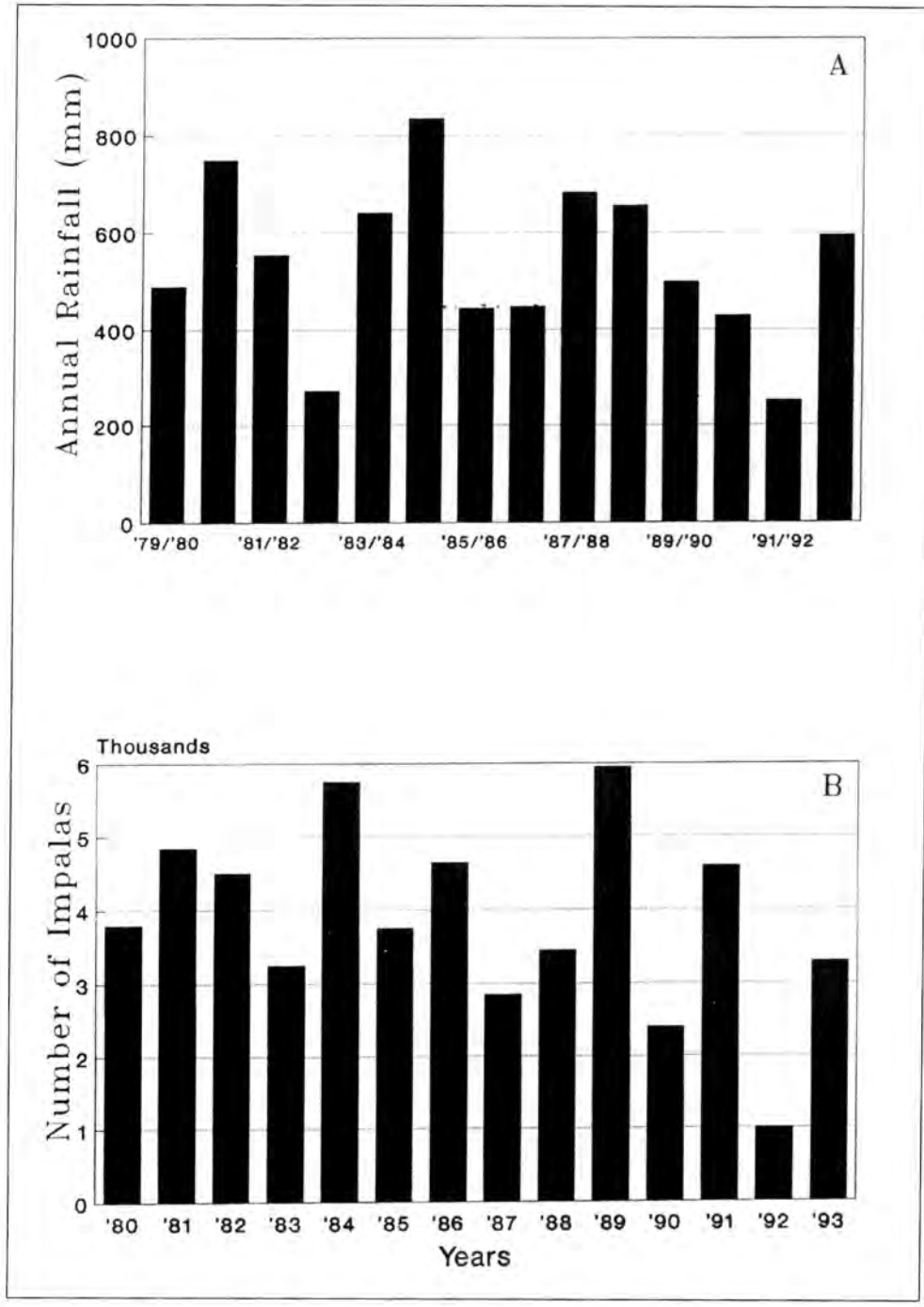

Fig. 1. (A) Annual rainfall at Skukuza 1979/80–1992/93. (B) Annual counts of impalas in the Nwaswitshaka census block, 1980-1993.

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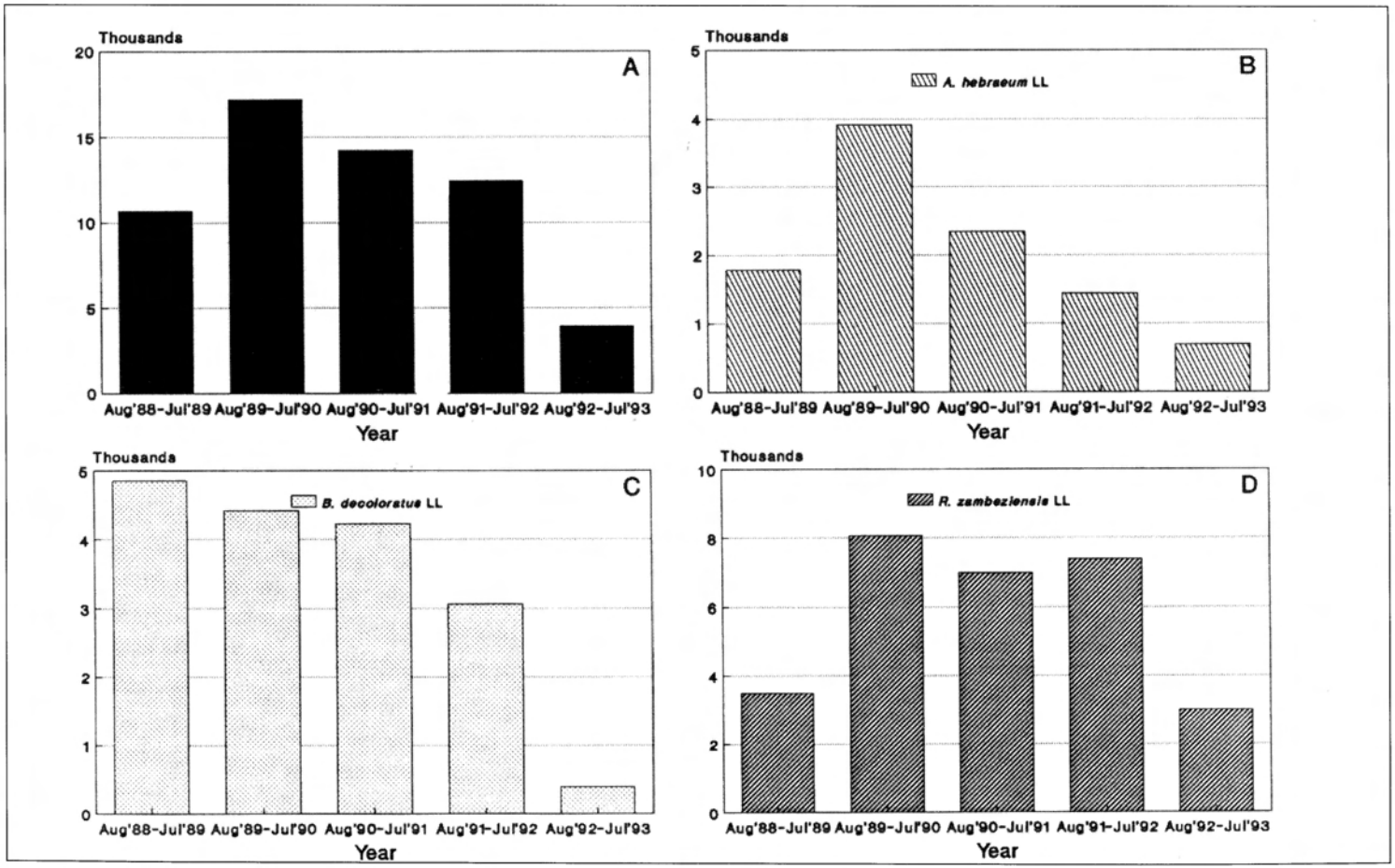

Fig. 2. Total numbers of ticks collected annually by monthly drag-sampling of the vegetation along the Nwaswitshaka River, 1988/89 - 1992/93. (A) All stages of all ticks. (B) Larvae of *Amblyomma hebraeum*. (C) Larvae of *Boophilus decoloratus*. (D) Larvae of *Rhipicephalus zambeziensis*.

Despite the fact that the numbers of larvae of *A. hebraeum* as well as those of *R. zambeziensis* may exceed those of *B. decoloratus* on the vegetation (Spickett *et al.* 1995), *B. decoloratus* is by far the most abundant tick on ruminants and zebras in the park (Horak *et al.* 1983a, 1983b, 1983c; 1984; 1992). This apparent anomaly can be explained by the fact that *B. decoloratus* is a one-host tick, with its three parasitic developmental stages present consecutively on the same host for a period of approximately three weeks (Howell *et al.* 1978). It also completes more than one life cycle per annum. The other ticks are three-host species probably completing only one life cycle per annum, with each of their three parasitic developmental stages spending approximately only one week on the host. In addition their immature stages may infest hares or birds, while *B. decoloratus* is confined to ruminants or zebras.

Although *B. decoloratus* is present in the park throughout the year it has a definite peak in abundance on the vegetation and on hosts during September to November (Spickett *et al.* 1992; Horak *et al.* 1983b, 1984, 1992). Burdens exceeding 10 000 ticks have been recorded on kudus in the park during these months (Horak *et al.* 1992). It is also precisely at this time of year that impalas in the park suffer the greatest degree of nutritional stress as graze and browse are both scarce and dry after the normally dry winters. Hence the large numbers of larvae on the vegetation during these months infest particularly susceptible hosts resulting in very large tick burdens. These large burdens would then exacerbate the effects of drought on already stressed animals. The ten adult animals examined in the drought during October and November 1982 had a mean total burden of 7 461 ticks (Table 1). Their mean burden of *B. decoloratus* comprised 6 381 ticks, with a range of 1 624 to 12 995.

Young impalas (15 to 22 months of age) appear to be more susceptible to tick infestation than older animals. The mean total burden of the eight young animals examined from March to October of 1980 (a year of normal rainfall) exceeded that of the adult animals examined *in extremis* at the peak of the *B. decoloratus* season in the drought of 1982 (Table 1). Yet the 24, 15 to 22-month-old impalas, examined during the drought of 1992, harboured a mean burden less than 10% of that of the young impalas examined in 1980. This is further evidence of the marked effect that the prolonged dry period, culminating in the drought of 1991/92, had on the tick population.

It would appear as if susceptibility to ticks and susceptibility to lice are concomitant phenomena. The adult impalas examined during the drought had high tick and louse burdens, as did the young male impalas examined before the drought (Table 1).

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References

GERTENBACH, W.P.D. 1983. Landscapes of the Kruger National Park. *Koedoe* 26: 9-121.

HORAK, I.G., J. BOOMKER, SHIRLEY A. KINGSLEY AND V. DE VOS. 1983a. The efficacy of ivermectin against helminth and arthropod parasites of impala. *Journal of the South African Veterinary Association* 54: 251-253.

HORAK, I.G., V. DE VOS AND MOIRA R. BROWN. 1983**b**. Parasites of domestic and wild animals in South Africa. XVI. Helminth and arthropod

parasites of blue and black wildebeest (*Connochaetes taurinus* and *Connochaetes gnou*). *Onderstepoort Journal of Veterinary Research* 50: 243-255.

HORAK, I.G., F.T. POTGIETER, JANE B. WALKER, V. DE VOS AND J. BOOMKER. 1983c. The ixodid tick burdens of various large ruminant species in South African nature reserves. *Onderstepoort Journal of Veterinary Research* 50: 221-228.

HORAK, I.G., V. DE VOS AND B.D. DE KLERK. 1984. Parasites of domestic and wild animals in South Africa. XVII. Arthropod parasites of Burchell's zebra, *Equus burchellii*, in the eastern Transvaal Lowveld. *Onderstepoort Journal of Veterinary Research* 51: 145-154.

HORAK, I.G., J. BOOMKER, A.M. SPICKETT AND V. DE VOS. 1992. Parasites of domestic and wild animals in South Africa. XXX. Ectoparasites of kudus in the eastern Transvaal Lowveld and the eastern Cape Province. *Onderstepoort Journal of Veterinary Research* 59: 259-273.

HOWELL, C.J., JANE B. WALKER AND E.M. NEVILL. 1978. Ticks, mites and insects infesting domestic animals in South Africa. Part 1. Descriptions and biology. *Department of Agricultural Technical Services, Republic of South Africa, Science Bulletin* No. 393: 1-69.

SPICKETT, A.M., I.G. HORAK, ANDREA VAN NIEKERK AND L.E.O. BRAACK. 1992. The effect of veld-burning on the seasonal abundance of free-living ixodid ticks as determined by drag-sampling. *Onderstepoort Journal of Veterinary Research* 59: 285-292.

SPICKETT, A.M., I.G. HORAK, HELOISE HEYNE AND L.E.O. BRAACK. 1995. The effect of severe drought on the abundance of ticks on vegetation and on scrub hares in the Kruger National Park. *Koedoe* 38(1): 59-64.