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Fleas and lice on scrub hares (*Lepus saxatilis*) in South Africa

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ABSTRACT

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A total of 380 scrub hares (*Lepus saxatilis*) from 5 localities, ranging from the north-eastern Transvaal to the eastern and the south-western Cape Province of South Africa, were examined for fleas and lice. *Ctenocephalides felis damarensis* was almost exclusively responsible for the flea infestations on hares at 4 of the 5 sites. At 4 localities the prevalence and abundance of this flea reached peaks between August and October and declined thereafter to their lowest levels between February and April. Its prevalence and abundance in the north-eastern Transvaal were not correlated with the breeding cycle of the hares in this region. The 2 louse species recovered, sometimes sympatrically, were *Haemodipsus lyriocephalus* and *Haemodipsus setoni*. *Listrophorus leporicolus* was the only mite species recovered.

INTRODUCTION

Scrub hares (*Lepus saxatilis*) are widely distributed in the Republic of South Africa and are particularly abundant in the eastern regions (Robinson 1982). In this country they are hosts of a number of flea species (De Meillon, Davis & Hardy 1961; Haeselbarth, Segerman & Zumpt 1966), lice (Ledger 1980) and ixodid ticks (Walker 1991).

The prevalence and seasonal abundance of various tick species on these hares in South Africa are well documented (Horak, Sheppey, Knight & Beuthin 1986; Rechav, Zeederberg & Zeller 1987; Horak & Fourie 1991) and the geographic distributions of several species have been plotted (Howell, Walker & Nevill 1978). There are no published data on the abundance of fleas on scrub hares in this country, but De Meillon *et al.* (1961) have provided distribution maps for some species. The identity of the louse recovered from a scrub hare in South Africa and described by Bedford (1934) as *Haemodipsus africanus* has been disputed by other authors, who state that the lice on these animals are either *Haemodipsus ventricosus* or *Haemodipsus setoni* (Ledger 1980).

From 1983–1992, I.G. Horak regularly collected ectoparasites from scrub hares in various regions of South Africa. The identity, monthly or bimonthly prevalence and abundance of their fleas and the identity and abundance of their lice are reported in this paper. Similar data for their ticks have been published separately (Horak *et al.* 1986; Horak, Fourie, Novellie & Williams 1991; Horak & Fourie 1991).

MATERIALS AND METHODS

Scrub hares sampled from 5 localities (Table 1) were processed for ectoparasite recovery as described by Horak *et al.* (1986) and Horak & Fourie (1991). Fleas were mounted in lactophenol, left for a few hours to clear and examined with a standard microscope. They were identified according to descriptions

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TABLE 1 The localities at which scrub hares were collected, the duration of the collection periods and the numbers of scrub hares examined in South Africa

Locality	Coordinates	Veld type (Acocks 1988)	Collection period	Collection intervals	Number of hares collected on each occasion	Total number of hares
North-eastern Transvaal						
Shingwedzi	23°08′S, 31°27′E	Mopani Veld	June 1989–Apr 1990	Bimonthly	3	18
Skukuza	24°58′S, 31°36′E	Lowveld	Aug 1988–July 1992	Monthly	5	240
Eastern Cape Province						
Mountain Zebra National Park	32°15′S, 25°27′E	Karroid *Merxmeullera* Mountain Veld replaced by Karoo	Feb 1983–Dec 1985	1–4 months	2	26
"Bucklands" [a]	33°05′S, 26°40′E	Valley Bushveld	Feb 1985–Jan 1987	Monthly	4 [b]	87
Andries Vosloo Kudu Reserve [a]	33°08′S, 26°40′E					
South-western Cape Province						
Bontebok National Park	34°02′S, 20°25′E	Coastal Renosterbosveld	Apr 1983–Feb 1984	Bimonthly	2 [b]	11

[a] These properties share a common ± 11 km boundary
[b] It was not possible to collect the required number of hares on each occasion

by De Meillon *et al.* (1961) and Haeselbarth *et al.* (1966). Lice were placed on filter paper, allowed to dry and examined using a stereoscopic microscope capable of 75 x magnification. The descriptions of Ferris (1932) were used to identify the lice. In order to confirm the identifications made under the stereoscopic microscope, a single male and female of each species were examined under a scanning electron microscope.

The mean numbers of fleas recovered from the scrub hares were plotted to depict seasonal and relative abundance, while the percentage of animals infested on each occasion represents the prevalence of infestation.

The numbers of scrub hares that were either pregnant or lactating were recorded during the survey at Skukuza. On completion of the survey, the mean cumulative percentage of pregnant or lactating hares was calculated for each calendar month and plotted to represent the mean monthly reproductive status of the animals.

Monthly mean maximum and minimum atmospheric temperatures and the total monthly rainfall were also recorded at Skukuza.

RESULTS

The numbers of fleas and lice recovered from the hares and the prevalence of infestation are summarized in Table 2.

Four species of fleas and 2 species of lice were recovered. *Ctenocephalides felis damarensis* was the most abundant and widely distributed flea, while *Haemodipsus lyriocephalus* was the most abundant and *H. setoni* the most widely distributed louse.

The seasonal abundances and prevalences of fleas on the hares examined at Shingwedzi, Skukuza, Mountain Zebra National Park, "Bucklands" combined with the Andries Vosloo Kudu Reserve, and the Bontebok National Park are graphically presented in Fig. 1–5 respectively.

TABLE 2 The total number of fleas and lice recovered from scrub hares examined at various localities in South Africa

Localities	No. of scrub hares examined	*Ctenocephalides felis damarensis*				*Echidnophaga* spp.		*Haemodipsus* spp.	
		♂	♀	X	Total	*E. gallinacea*	*E. larina*	*H. lyriocephalus*	*H. setoni*
Shingwedzi	18	241	307	0	548 (14)	0	0	0	0
Skukuza	240	575	839	140	1554 (183)	0	3 (3)	343 (8)	126 (23)
Mountain Zebra Park	26	55	76	0	131 (18)	3 (3)	0	0	1 (1)
Bucklands & Kudu Reserve	87	588	851	0	1439 (74)	166 (4)	0	0	0
Bontebok National Park	11 [a]	–	–	–	36 (7)	1 (1)	0	0	41 (5)

X = number of fleas damaged and impossible to determine species or sex
( ) = number of hares infested
[a] = 1 hare infested with *Dinopsyllus* sp.

At Shingwedzi the largest number of fleas was recorded during August; at Skukuza this peak occurred during September 1988 & 1990 and during October 1989 & 1991. No pattern of seasonal abundance was obvious for the fleas recovered in the Mountain Zebra National Park, while peak burdens were recorded during October 1985 on "Bucklands" combined with the Andries Vosloo Kudu Reserve, and August in the Bontebok National Park.

The mean monthly percentage of hares at Skukuza that were pregnant or lactating, or both, is graphically illustrated in Fig. 6. Breeding appeared to take place throughout the year with no clear indication of a seasonal peak.

Atmospheric temperatures and total monthly rainfall at Skukuza are graphically presented in Fig. 7.

The highest maximum temperatures were generally recorded during January and February. Most rain usually fell from November or December to January or February.

The difference in the shape of the sternal plates of the 2 louse species as well as the presence of distinct sclerotized paratergites protruding from the lateral borders of abdominal segments 3–6 of *H. setoni*, compared to mere sclerotized points in *H. lyriocephalus*, are evident from Fig. 8 & 9.

Listrophorus leporicolus was the only mite recovered from the scrub hares in the present study.

DISCUSSION

Fleas

A single species, *C. felis damarensis*, was responsible for almost all flea infestations on the scrub hares. The largest populations were found on hares at Shingwedzi in the north of the country, while those in the Bontebok National Park in the south were the lowest. *Echidnophaga gallinacea*, a flea of domestic fowls, was occasionally found, but significant numbers were recovered only once, namely in the Andries Vosloo Kudu Reserve in August 1986 (Fig. 4). The fairly large numbers present on this occasion suggest that the particular hares involved must have acquired the infestation near human habitation. A few *Echidnophaga larina*, a common flea of warthogs (Horak, Boomker, De Vos & Potgieter 1988), were present on 3 hares at Skukuza. A single specimen of a *Dinopsyllus* sp., a flea usually associated with rodents, was recovered from a hare in the Bontebok National Park. These aberrant infestations probably occurred as a result of intrusion or sharing of the habitat by the various hosts and is a common phenomenon (Avetisyan & Ezekelyan 1975). In Kenya Flux (1972) found that *Lepus capensis* was most commonly infested with *Ctenocephalides felis strongylus* and to a lesser extent by *E. gallinacea*.

In South Africa *C. felis damarensis* has long been recognized as the sole representative of this genus parasitizing scrub hares (De Meillon *et al.* 1961). These authors, however, questioned the status of this flea as a subspecies of *C. felis* and felt that it should be named *C. damarensis*, a species in its own right. The present study confirms that *C. felis damarensis* is a successful parasite of scrub hares and is established throughout the country.

For its reproduction, *Spilopsyllus cuniculi*, the European rabbit flea, is entirely dependent upon the steroid hormones circulating in pregnant does (Mead-Briggs 1964). Rothschild & Ford (1972) found that the ovaries of female *Cediopsylla simplex*, a flea infesting rabbits and hares in North America, only developed when the flea fed on either pregnant does or newborn rabbits. Feeding on oestrous does caused a resorption of all developing oocytes and a rapid regression of the ovaries of the female fleas. Thus the breeding cycles of these flea species are

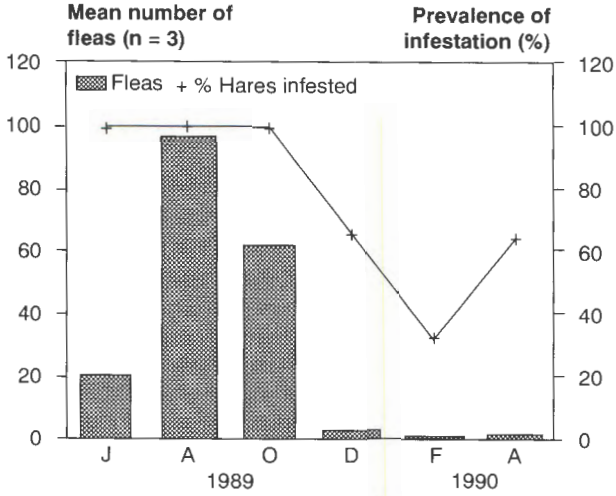

FIG. 1 The seasonal abundance and prevalence of *Ctenocephalides felis damarensis* on scrub hares around Shingwedzi, Kruger National Park, north-eastern Transvaal

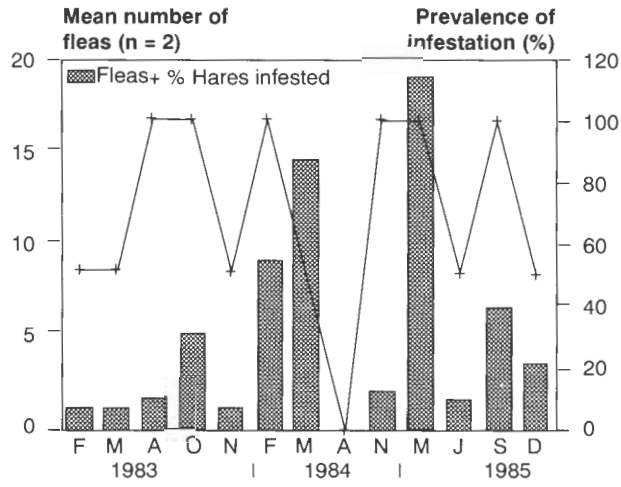

FIG. 3 The abundance and prevalence of *Ctenocephalides felis damarensis* on scrub hares in the Mountain Zebra National Park, eastern Cape Province

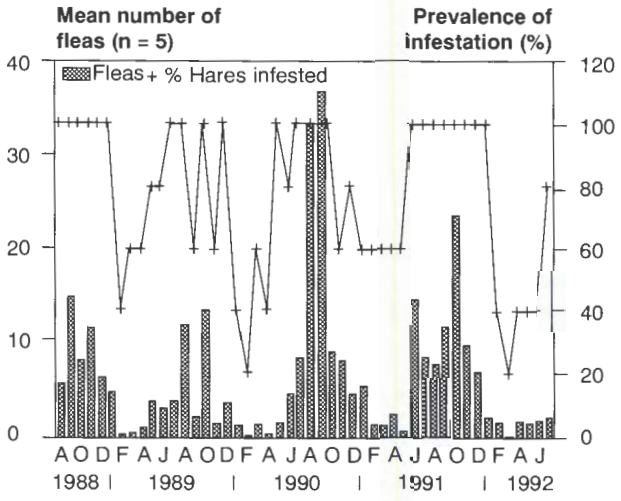

FIG. 2 The seasonal abundance and prevalence of *Ctenocephalides felis damarensis* on scrub hares around Skukuza, Kruger National Park, north-eastern Transvaal

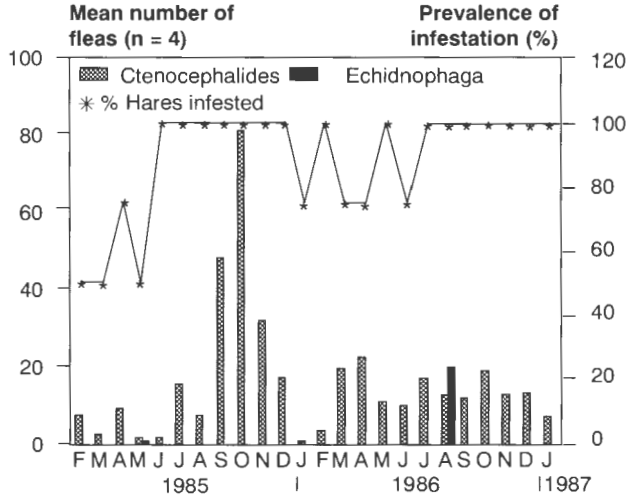

FIG. 4 The seasonal abundance and prevalence of *Ctenocephalides felis damarensis* on scrub hares on the farm "Bucklands" combined with the Andries Vosloo Kudu Reserve, eastern Cape Province

synchronized with the arrival of the leverets, which they then infest.

In the present study there was no evidence of an increase in the numbers of *C. felis damarensis* on pregnant or lactating females. During the period February–April, when all female scrub hares examined at Skukuza were either pregnant or lactating (Fig. 6), both the prevalence and abundance of flea infestations on the hares sampled at this locality were at their lowest (Fig. 2). However, in the lactating females the reason for this might have been that their flea populations had transferred to the newborn leverets. The abundance and prevalence of *C. felis damarensis* increased during mid- to late winter, reached a peak in August to October and then declined at 4 of the 5 localities (Fig. 1, 2, 4 & 5). This occurred in the sub-tropical north-eastern Transvaal, the hot and fairly dry Valley Bushveld of the eastern Cape Province and the Mediterranean climatic zone in the south-western Cape Province. At Skukuza the increase in flea numbers coincided with an increase in temperature at a time when there was little or no rain (Fig. 2 & 7). In the Mountain Zebra National Park, however, the numbers of fleas seemed to reach a peak in autumn (Fig. 3).

This region differs from the others in that minimum winter temperatures are considerably lower and that snowfalls may occur in winter and spring.

Cooke (1984) and Cooke & Skewes (1988) showed that survival of the larvae and adults of the European rabbit flea, *S. cuniculi*, was seriously affected

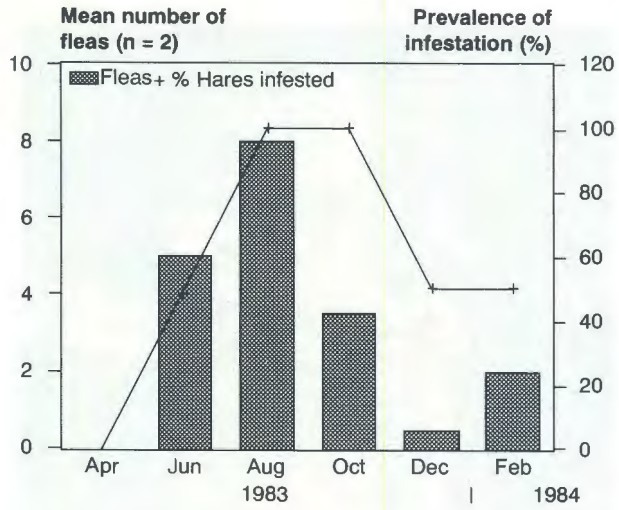

FIG. 5 The seasonal abundance and prevalence of *Ctenocephalides felis damarensis* on scrub hares in the Bontebok National Park, south-western Cape Province

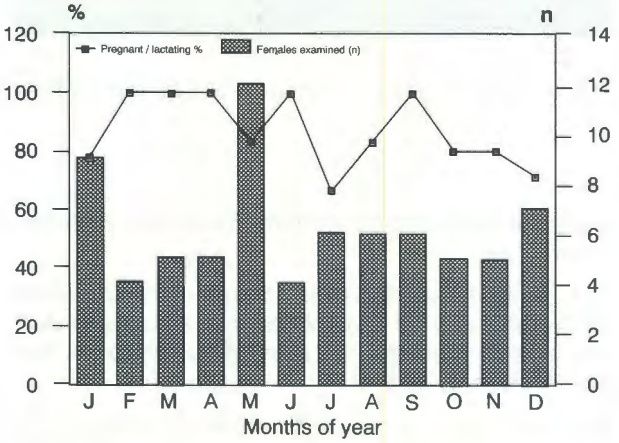

FIG. 6 Monthly reproductive status of female scrub hares around Skukuza, Kruger National Park, north-eastern Transvaal

by high temperatures, especially when conditions of low humidity prevailed. However, the eggs and pupae of this flea were more resistant to adverse climatic conditions and these authors postulated that fleas might persist in the rabbit warrens through the summer months as quiescent pupae.

The fact that the seasonal pattern of flea infestation was similar at all but 1 of the localities in the present survey, regardless of whether these were situated in winter or summer rainfall zones, indicates that humidity may not play a definitive role in the life-cycle of *C. felis damarensis*. Cooke (1990) showed that fleas in the wild are adapted to conditions of low humidity. For instance *Xenopsylla cunicularis*, the flea of the wild European rabbit, *Oryctolagus cuniculus*, can survive at relative humidities of

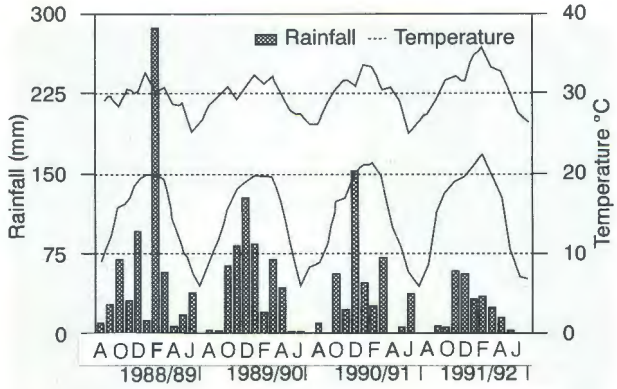

FIG. 7 Mean maximum and minimum atmospheric temperatures and total monthly rainfall at Skukuza from August 1988–July 1992

50 %. The low numbers of fleas and low prevalences of infestation recorded during the hot summer and early autumn months at nearly all localities in the present survey indicate that high temperature, rather than low humidity, is probably a more important climatic factor limiting flea infestations on scrub hares. Most rain generally fell during the period November–February, but these also include the hottest months (Fig. 7).

According to Smithers (1983) scrub hares may return to the same form for a number of days. The seasonal abundance of *C. felis damarensis* recorded in the present survey suggests that the same form or its vicinity may be used either regularly or erratically for a period of 2–3 months from June or July to September or October. This would not only allow the flea's life cycle to be completed, but also enable numbers to increase. It could equally imply that the same form, or the vicinity of the same form, is inhabited annually during these months. Fleas that had oversummered as pupae in the latter forms would then be immediately available to infest the hares inhabiting these structures during mid-winter to spring.

Horak (1982) found that once *Ctenocephalides* spp. had become established in a dog kennel in Pretoria North, in the central Transvaal, burdens rose rapidly in November–January and remained at a high level until approximately May. He ascribed this increase to a rise in humidity subsequent to substantial rainfall during October, rather than temperature which had already started to climb in August. In Cairo, Amin (1966) recorded 2 periods of peak abundance of *Ctenocephalides felis felis* on dogs. The 1st in spring followed an increase in temperature after winter; the other in autumn followed a rise in relative humidity after the dry summer.

Lice

Ferris (1932) listed 3 species of lice of the genus *Haemodipsus* from the Leporidae, namely *H. lyrio-*

FIG. 8 Scanning electron micrograph of *Haemodipsus lyriocephalus* (x 70)

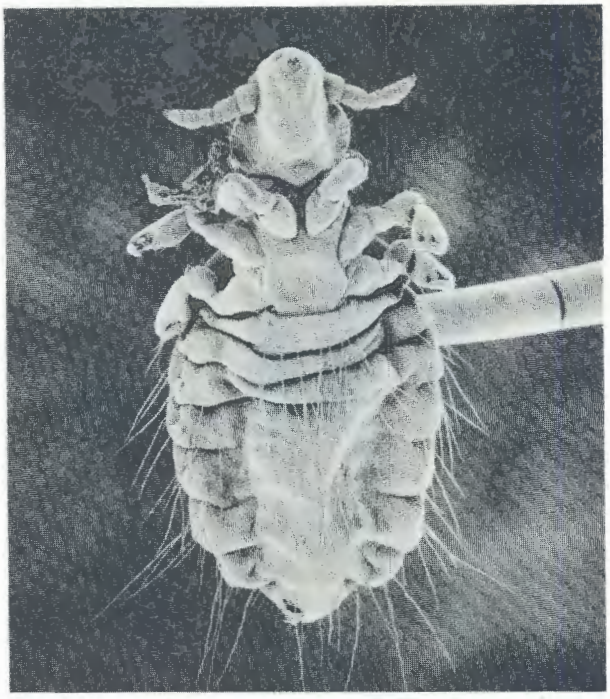

FIG. 9 Scanning electron micrograph of *Haemodipsus setoni* (x 70)

cephalus, H. setoni and *H. ventricosus*. Bedford (1934) described a 4th species, *H. africanus*, from a hare in South Africa. This species was based on a single female and has never been recorded since, nor can the type specimen be found for comparison. Subsequent to Bedford's finding, Kim & Emerson (1970, cited by Ledger 1980) recorded collections of *H. ventricosus* from *L. capensis* in this country.

In the present study only *H. lyriocephalus* and *H. setoni* were found on the scrub hares. The 2 occurred sympatrically at Skukuza, while only *H. setoni* was present on the hares in the Bontebok National Park. Two scrub hares collected at Vanrhynsdorp, near the west coast of South Africa, were also infested only with *H. setoni*.

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