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An Epidemiological Survey of Ticks (Acari: Ixodidae) Infesting Cattle in the Eastern Free State Province of South Africa: Attachment Preferences

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ABSTRACT

Ticks were collected from cattle and their attachment preferences determined. The preferred site of attachment for *Boophilus decoloratus* was the neck, abdomen and inguineum. *Rhipicephalus evertsi evertsi* ticks attached predominantly to the perineal and inguinal areas. The other three tick species, *Rhipicephalus follis*, *Rhipicephalus gertrudae* and *Rhipicephalus punctatus* showed very similar sites of attachment, with most ticks preferring the neck and inguineum. *Rhipicephalus follis* and *R. gertrudae* was also found to prefer the tail area. The differences in attachment preferences should be considered when resource-poor farmers intend using acaricides sparingly in tick management and control.

INTRODUCTION

Ticks are of considerable veterinary, medical and economic importance as vectors of infectious diseases of man and animals throughout the world, especially in Africa. Although different species of ticks and tick-borne diseases occur in various ecological regions, their impact on animal production is similar in nature and importance. They are responsible for severe losses either by tick worry, blood loss, damage to hides and udders and the injection of toxins or through mortality or debility by the diseases transmitted. It has been estimated that 80% of the world's 1.3

billion cattle are infested with ticks. Of the roughly 800 tick species known in the world, about 100 occur in South Africa (Walker 1991).

During a 12-month study on the epidemiology of ticks infesting cattle in the Eastern Free State province, tick infestation patterns were analyzed with respect to their specific attachment sites on the bovine host. Attachment sites for most ticks in South Africa have been studied and are known (Walker 1991), however, in case of heavy infestations, some ticks tend to feed on alternative sites. There is less data available on ticks infesting cattle owned by resource-poor farmers in the Eastern Free State province. The aim of this study was to obtain information on the attachment preferences of tick species infesting cattle owned by resource-poor farmers in the study area.

MATERIALS AND METHODS

The Eastern Free State province was divided into three study sites according to geographical distribution and socioeconomic status of farmers in the area. The study sites included Harrismith (29°5'E, 28°18'S), Kestell (28°38'E, 28°20'S) and Qwa-Qwa (28°50'E, 28°35'S). These sites lie at the altitudes of 1,300 m, 1,465 m and 1,600 m above sea level, respectively. The Eastern Free State province belongs to the grassland biome with the mean annual rainfall of 800 mm.

Adult male and female ticks in all stages of engorgement were collected between May 1998 and April 1999 from different parts of the bovine body (n=30) and preserved in labeled bottles containing 70% alcohol. The collected ticks were counted, identified and recorded to species level using a standard stereo-microscope. Identification was done according to methods of Walker (1961). The data for each body region of each individual animal was recorded separately.

Predilection attachment sites were statistically tested by using a Student's *t*-test for paired samples (Barnard et al. 1993). To test for significant seasonal differences in sites of attachment among the six winter/spring months (May-October) and the six summer/autumn months (November-April), a non-parametric, binomial distribution test, the Two Sample Proportion tests were used (Zar 1974). The indicated attachment sites were not of uniform size, since specific body regions were used for sampling and not exact, measured areas. However the ultimate goal of determining sites of attachment was to suggest or develop a feasible tick control plan, and therefore the specific burden per cm^2 was not required, but the identification of

body regions where most ticks attached was needed. A significance level of $p< 0.05$ was used throughout.

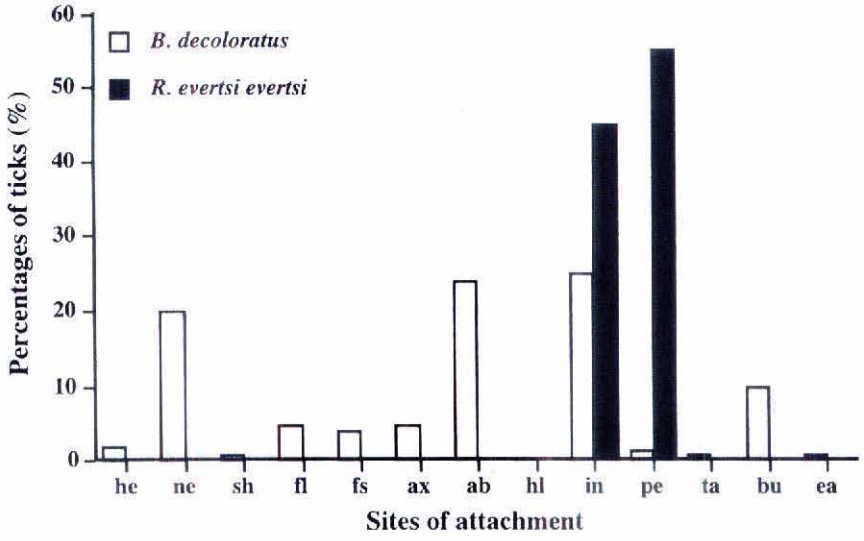

Figure 1. Percentages of *Boophilus decoloratus* and *Rhipicephalus evertsi evertsi* ticks attaching to different body areas of the bovine host (n=30). Ab: abdomen, ax: axilla, bu: buttocks ea: ear, fl: front leg, fs: flank/side, he: head, hl: hind leg, in: inguineum, ne: neck, pe: perineum, sh: shoulder, ta: tail.

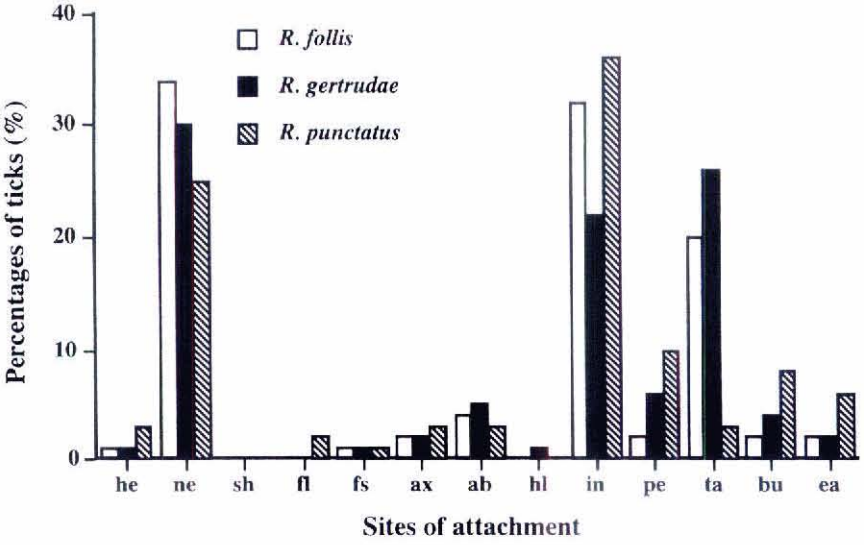

Figure 2. Percentages of *Rhipicephalus follis, R. gertrudae* and *R. punctatus* ticks attaching to different body areas of the bovine host (n=30). Ab: abdomen, ax: axilla, bu: buttocks ea: ear, fl: front leg, fs: flank/side, he: head, hl: hind leg, in: inguineum, ne: neck, pe: perineum, sh: shoulder, ta: tail.

RESULTS

The predilection sites of attachment of the six tick species occurring in the Eastern Free State province were determined. Most *Boophilus decoloratus* ticks occurred on the neck, abdomen, inguineum and buttocks areas. There were significantly ($p<0.05$) higher burdens on these areas compared to any of the other attachment sites. Significantly more *Rhipicephalus evertsi evertsi* ticks attached on the perineal and inguinal areas, compared to the other areas (Fig. 1). The results for *Rhipicephalus follis*, *Rhipicephalus gertrudae* and *Rhipicephalus punctatus* were very similar (Fig. 2). In all three species the percentages of ticks attaching to the neck and inguineum were significantly greater compared to other sites. For *R. gertrudae* and *R. follis*, numbers on the tail were also significantly higher than other sites. The statistical tests used to determine seasonal variation in sites of attachment eliminated the possible influence of seasonal changes in total tick burdens. Seasonal variations in attachment sites were only determined for the two most abundant and economically important tick species in the area, namely *B. decoloratus* and *R. e. evertsi*. Seasonal variations of the various tick species were mostly seen at those sites where most ticks attached. In *B. decoloratus*, significant differences between the winter/spring (May-October 1998) and summer/autumn (November 1998-April 1999) attachment sites were only observed for the neck and inguineum areas (Fig. 3). For *R. e. evertsi*, none of the seasonal changes in attachment sites were significant (Fig. 4).

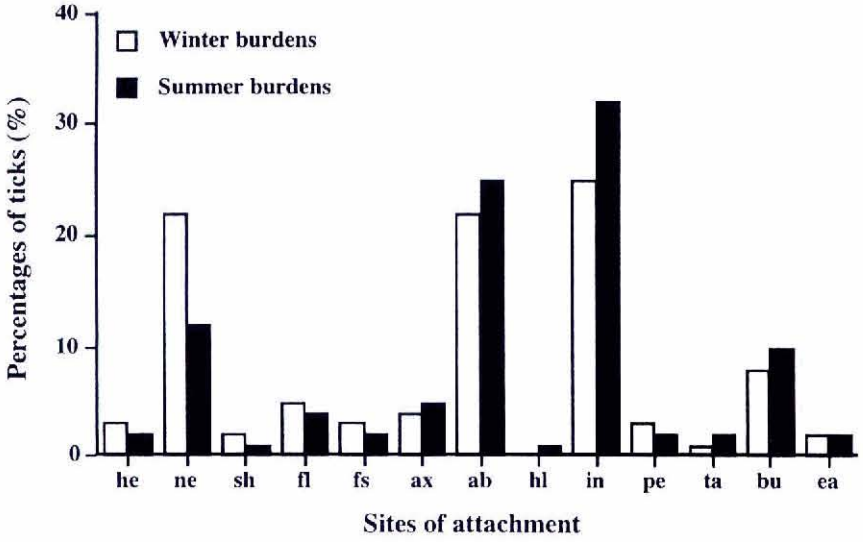

Figure 3. Percentages of *Boophilus decoloratus* ticks attaching to different body areas of the bovine host showing seasonal burdens (n=30). Ab: abdomen, ax: axilla, bu: buttocks ea: ear, fl: front leg, fs: flank/side, he: head, hl: hind leg, in: inguineum, ne: neck, pe: perineum, sh: shoulder, ta: tail.

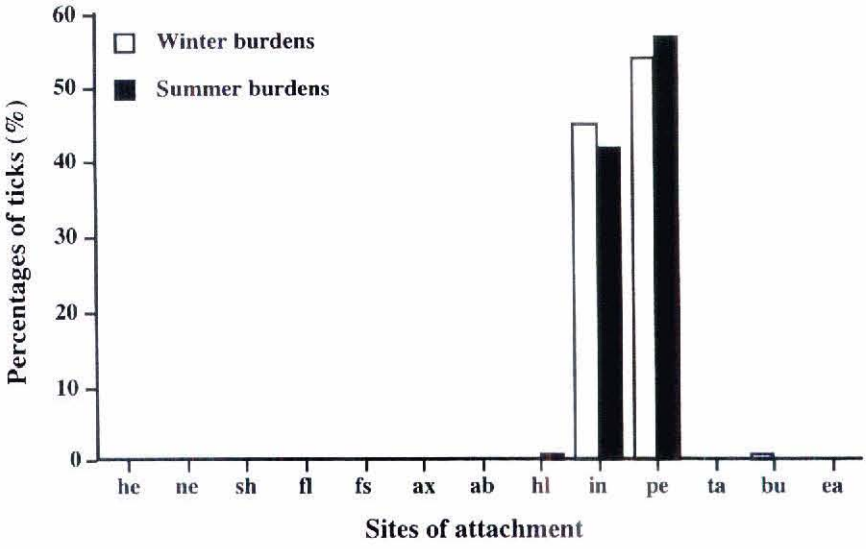

Figure 4. Percentages of *Rhipicephalus evertsi evertsi* ticks attaching to different body areas of the bovine host showing seasonal burdens (n=30). Ab: abdomen, ax: axilla, bu: buttocks ea: ear, fl: front leg, fs: flank/side, he: head, hl: hind leg, in: inguineum, ne: neck, pe: perineum, sh: shoulder, ta: tail.

DISCUSSION

Specificity in the site of attachment of ticks to hosts is common for many species of ticks (Nelson et al. 1975). A variety of factors such as host type (Bloemer et al. 1988), host age (Fourie et al. 1991), habitat type (Wilkinson 1985), and time of year (Evans 1952), can affect the preferential feeding sites of tick species. The results in the present study confirmed the concept of preferential attachment sites. The differences between tick species were relatively constant on the cattle observed, and possibly a result of a long association between ticks and their hosts (Nelson et al. 1975).

In the present study, 69% of the *B. decoloratus* burdens were found on the ventral body parts of the hosts, thus the ventral aspects of the neck, the whole of the abdomen, and the inguineum. In a study conducted in Natal (Kwazulu-Natal) (Baker and Ducasse 1967), only 42% of the ticks (all stages) were attached to the above mentioned ventral areas with relatively higher burdens on the flanks (24%) and the legs (13%), compared to the 4% and 5.5% respectively, recorded in the present study. In the study done in the northern Transvaal (Northern Province), the predilection feeding sites on the hosts were also the necks (36%) and legs (40%); in this study the

leg area also included the axilla (Londt et al. 1979). Tick burdens on the combined leg and axilla areas were still higher in the northern Transvaal study than the combined burdens (10.5%) in the present study. Results from an Eastern Cape study also indicated that predilection feeding sites on bovines were the neck and legs (Rechav 1982). In the present study, the layer of mud and manure on the legs of the cattle (a result of keeping of cattle in kraals overnight), could have resulted in lowered burdens on the legs.

Significant seasonal differences in attachment sites for *B. decoloratus* were only seen at the neck and the inguineum sites. In spring and summer, thus with early infestations, tick burdens were higher on the inguineum, but in autumn and winter higher burdens were seen on the neck. When cattle are grazing in the veld, most ticks are likely to be picked up on the fore regions (L'Hostis et al. 1994). The differences observed in the present study in the relative infestations on inguineums (hindquarters) during spring/summer and necks (forequarters) during autumn/winter, must be due to (a) a deliberate movement of ticks toward the hindquarters during the early summer infestations, and (b) the attachments of ticks near the site of a pick-up later in the season, i.e., neck sites in winter. Evans (1952), has stated that younger ticks (recently hatched) require a more prolonged stimulation to attach, compared to the older and more hungry individuals and, as a result, wander further from the site of a pick-up. At the beginning of the "tick season" young ticks will predominate and attachment will occur at a considerable distance from the site of a pick-up. The higher proportion of older individuals later in the season might result in attachment occurring near the site of a pick-up (Evans 1952). Two other possible reasons for the seasonal variation in attachment sites may be the better quality grazing in the spring and summer months as well as the warmer climate, resulting in shorter grazing spans and longer resting phases. With the taller summer grasses, the questing larvae on the grasses can potentially make contact with larger body areas of the hosts. While animals are resting as in summer, larger body parts are also nearer to the ground and in contact with the grasses carrying the larvae. Ticks then climb up on all parts of the body, fore and hindquarters, resulting in relatively higher numbers on the inguineum (L'Hostis et al. 1994). The main predilection feeding sites of the adult *R. e. evertsi* ticks in the present study were the inguineums (45%) and the perineums (55%) of the hosts, in contrast to the almost exclusively perineal infestations of cattle in Natal (Baker and Ducasse 1967) and the northern Transvaal (Londt et al. 1979), with perineal burdens

of 90% and 98.5%, respectively. No explanations for the higher burdens on the inguineums in the present study can be offered. No significant differences were observed in the attachment sites. As indicated previously, the immature stages are found almost exclusively in the ear (Baker and Ducasse 1967). Thus all stages of this tick have very specific feeding sites and occur on hosts throughout the year.

Significantly higher tick numbers for *R. gertrudae*, *R. follis* and *R. punctatus* were found on the ventral aspects of the necks and the inguineums for all three species. For *R. gertrudae* and *R. follis*, higher numbers were also observed on the tail, especially the tail brush. The findings on *R. punctatus* are in contrast to findings on Angora goats, where more than 80% of the ticks attached to the head and neck (Fourie et al. 1991). It is however possible that the long curly hair of the Angora could have limited the movement of ticks caudally to the inguineum. Our results indicate that differences exist between attachment-site preferences in ticks occurring on the bovine host. These differences should be considered when acaricides are being applied on cattle for the control of ticks, especially by resource-poor farmers who do not have enough money to buy large quantities of chemicals to be applied on the whole body of an animal.

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