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RELATIVE RESISTANCE OF SIX CATTLE BREEDS TO THE TICK *BOOPHILUS DECOLORATUS* IN SOUTH AFRICA

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ABSTRACT

RECHAV, Y. & KOSTRZEWSKI, M. W., 1991. The relative resistance of six cattle breeds to the tick *Boophilus decoloratus* in South Africa. *Onderstepoort Journal of Veterinary Research*, 58, 181–186 (1991).

Adult females of the tick *Boophilus decoloratus* were removed from 6 breeds of cattle on 2 farms in the Northern Transvaal. Highest numbers of female ticks were collected from Simmentaler, followed by Santa Gertrudis, Bonsmara, Afrikaner, Brahman and Nguni. Resistence levels of each breed to *B. decoloratus* was positively correlated with the amount of *Bos indicus* genes in the breed, with the exception of Nguni, which is a sanga type but not pure *B. indicus*.

INTRODUCTION

Resistance of various breeds of cattle to different species of ticks is well established and has been recently reviewed by Wikel & Whelen (1986) and Morrison (1989). Early work showed the Australian one-host tick *Boophilus microplus* to be more abundant on European dairy cattle *(Bos taurus)* than on Zebu *(Bos indicus)* types of cattle (Johnston & Bancroft 1918). Specific variations in resistance to ticks by cattle was studied intensively by Australian researchers and subsequently incorporated into agricultural practices in that country (Utech, Wharton & Kerr, 1978; Powell & Reid, 1982; Waters, Round & Bond, 1982; Norton, Sutherst & Maywald, 1983; Sutherst, Maywald, Bourne, Sutherland & Stegeman, 1988).

In Africa, more breeds of cattle are found and tick species are more numerous (Rechav, 1987; Newson & Chiera, 1989; De Castro, Newson & Herbert, 1989; Rechav, Dauth & Els, 1990). However, very little has been published on the density of *B. decoloratus* populations on the various cattle breeds. A long period of coexistence between *B. decoloratus* and its endemic cattle breeds may have influenced the resistance levels of these breeds. Control of ticks using resistant cattle requires information on the relative resistance of available breeds to prevailing tick species.

This paper provides data on: (a) the relative adundance of *B. decoloratus* females on 6 breeds of cattle of which 3, Afrikaner, Bonsmara, and Nguni are indigenous to South Africa; and (b) the assessment of the level of resistance of each of the indigenous breeds of cattle to the tick *B. decoloratus*.

MATERIALS AND METHODS

Study area

The study was conducted on 2 farms "Delftzyl" and "Naauwpoort" in the northern Transvaal, South Africa. "Delftzyl" is situated in the Springbok Flats area of northern Transvaal (24° 42′ S; 29° 16′ E) while "Naauwpoort" is situated in the north-western part of the Waterberg Mountain (24° 10′ S, 28° 20′ E).

Climate

The northern Transvaal exhibits 2 distinct seasons, a hot and wet summer (October–March) and a cool, dry winter (April–September). Rainfall, atmospheric temperaturs, and relative humidities were recorded on both farms throughout the study period. Annual rainfall for each farm is shown in Fig. 1. Mean monthy rainfall, temperature and humidity records for each farm are illustrated in Fig. 2 & 3.

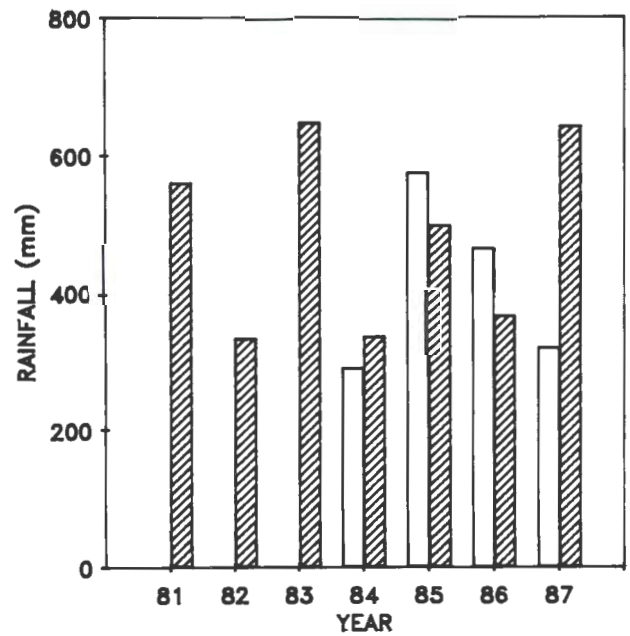

FIG. 1 Mean annual rainfall for the farms, "Naauwpoort" ▨ from 1981–1987, and "Delftzyl" □ from 1984–1987

Vegetation

Acocks (1975) defines the respective vegetations as *Acacia* avariation of mixed bushveld for "Delftzyl" and a sour bushveld type for "Naauwpoort". Both these are characteristic open savanna dominated by various species of the genera *Acacia, Faurea* and *Dichrostachys*. Tall grass between shrubs and trees was common at "Naauwpoort", while short grass *(Digitaria* and *Panicum* spp.) predominated at "Delftzyl".

Fauna

Game animals such as kudu *(Tragelaphus strepsiceros)*, impala *(Aepyceros melampus)*, common duiker *(Sylvicapra grimmia)*, steenbok *(Raphicerus campestris)*, and black-backed jackals *(Canis mesomelas)* were present on both farms. Rodents, mongooses and numerous birds were also observed.

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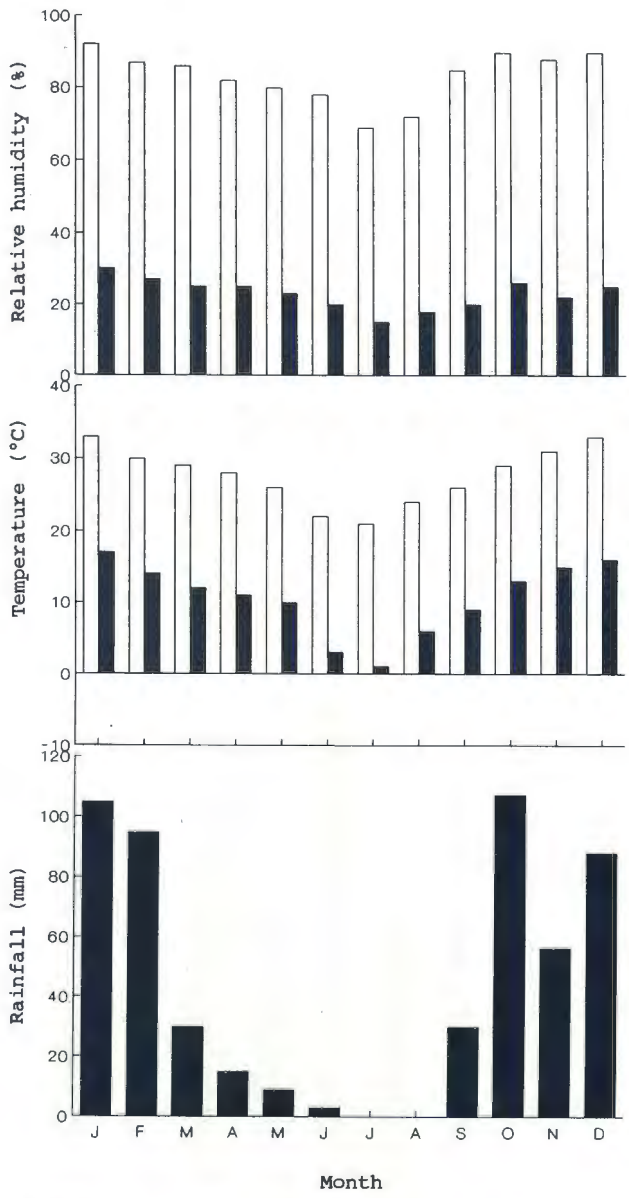

FIG. 2 Mean monthly records of rainfall (a), temperature (b) and humidity (c) for "Delftzyl" farm. For temperature and humidity, ▭ = maximum and ▬ = minimum records

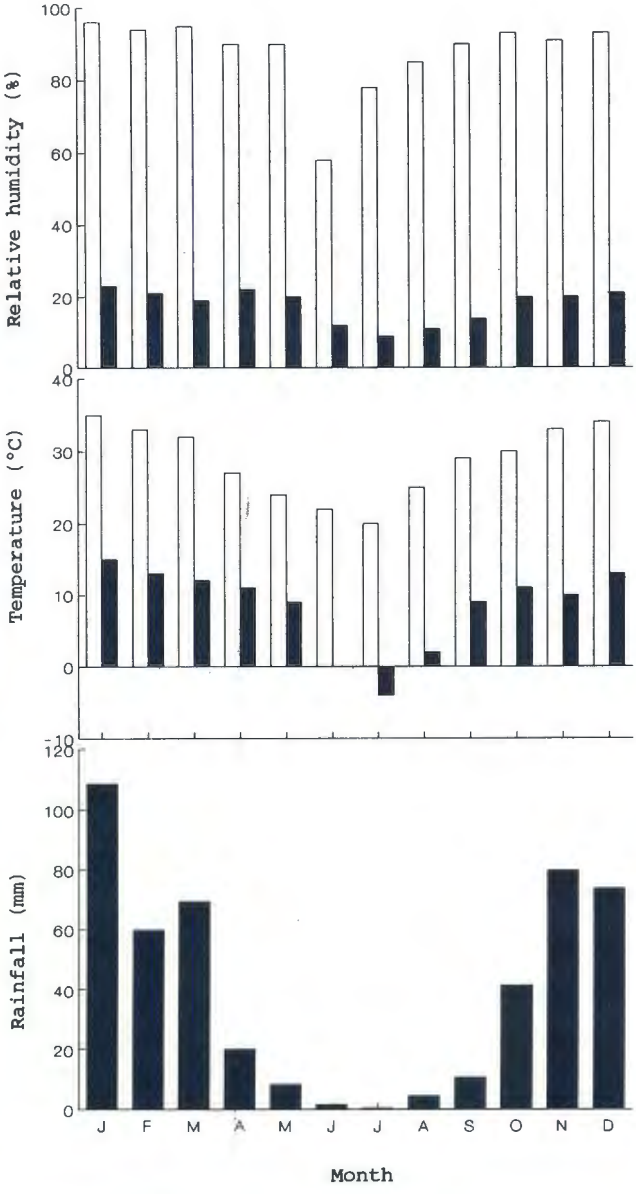

FIG. 3 Mean monthly records of rainfall (a), temperature (b) and humidity (c) for "Naauwpoort" farm. For temperature and humidity, ▭ = maximum and ▬ =minimum records

Livestock

Ticks were removed monthly off 3 animals per breed at "Naauwpoort", and 5 animals per breed at "Delftzyl" (total of 37 individuals). The cattle had been previously exposed to ticks on the farms and were not treated with acaricides during the study period. The breed chosen from "Naauwpoort" farm were: (a) Simmentaler, pure *Bos taurus* originating from Switzerland; (b) Santa Getrudis, a cross breed of 5/8 *B. taurus* (shorthorn) and 3/8 *B. indicus* (Brahman); (c) Brahman, a pure *B. indicus* breed imported to South Africa about 40 years ago from the gulf coast of America; (d) Nguni, a sange type abundant amongst the Zulu and Swazi tribes. From "Delftzyl" farm, Bonsmara, a composite breed of 3/8 *B. taurus* (Shorthorn/Hereford) and 5/8 *B. indicus* (sanga) (Afrikaner); Afrikaner, a sanga type of *B. indicus;* as well as Simmetaler, Brahman, and Nguni were used.

Removal of ticks

The same cows were used throughout the study period. Ticks were removed from each indivudual cow, placed in bottles containing 70 % alcohol and later identified. Further methodology has been described in Rechav *et al.* (1990).

Presentation of data

Data is presented as mean number of female ticks removed monthly from each of the six breeds ($\bar{x} \pm$ S.D.). ANOVA tests followed by Neuman Keuls multiple range tests were used in data analyses.

RESULTS

The results show that the various breeds of cattle were infested with different numbers of females of *B. decoloratus*. Results were presented separately for each breed as well as for each of the 2 farms studied.

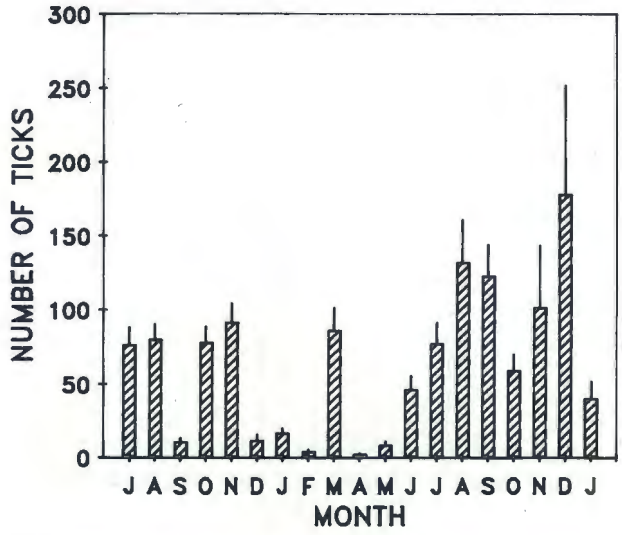

FIG. 4 Mean number of *B. decoloratus* females found on 3 Simmentaler cows at "Naauwpoort" farm for the period July 1986–January 1988

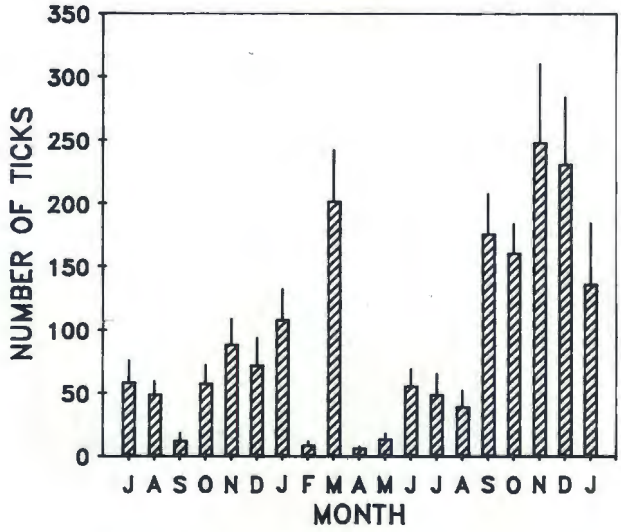

FIG. 5 Mean number of *B. decoloratus* females found on 3 Santa Getrudis cows at "Naauwpoort" farm for the period July 1986–January 1988

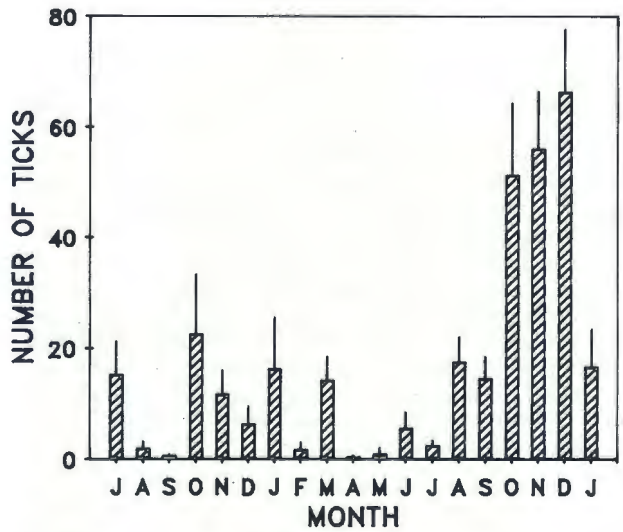

FIG. 6 Mean number of *B. decoloratus* females found on 3 Brahman cows at "Naauwpoort" farm for the period July 1986–January 1988

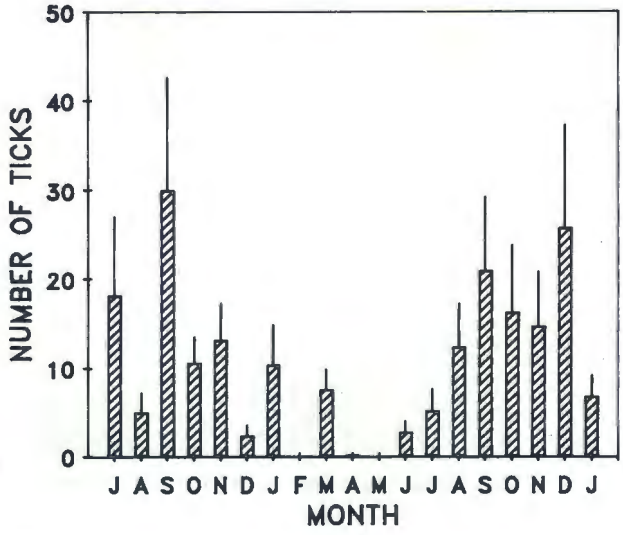

FIG. 7 Mean number of *B. decoloratus* females found on 3 Nguni cows at "Naauwpoort" farm for the period July 1986–January 1988

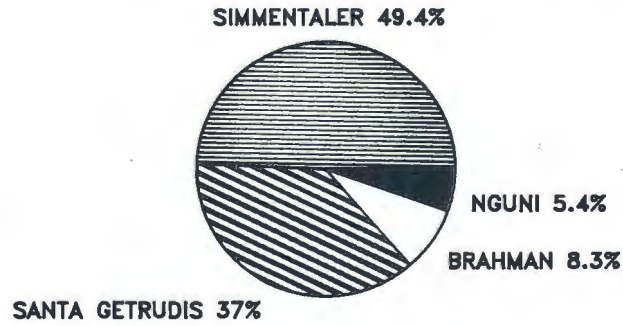

FIG. 8 Percentage of *B. decoloratus* females found on the different breeds of cattle on "Naauwpoort" farm from July 1986–January 1988

Numbers of *B. decoloratus* ticks at "Naauwpoort" were approximately 3 to 4 times higher than at "Delftzyl". The highest number of female *B. decoloratus* was found on Simmentaler (Fig. 4), followed by Santa Getrudis (Fig. 5). The difference in these tick numbers were significant ($P < 0,05$) during summer, but not during winter, when the numbers were low ($P < 0,3$). Numbers of *B. decoloratus* females removed from Brahman (Fig. 6) and Nguni (Fig. 7) were significantly lower ($P < 0,01$) than those collected from Simmentaler and Santa Getrudis (Fig. 4 & 5 respectively). Of the total number of ticks collected during the 19 month period, 49,4 % were from Simmentaler, 37,0 % from Santa Getrudis, 8,3 % from Brahman, and 5,4 % from Nguni (Fig. 8).

Similar results were found at "Delftzyl". Numbers of female ticks collected from Simmentaler (Fig. 9) were significantly higher than those from Bonsmara ($P < 0,05$) (Fig. 10), Afrikaner ($P < 0,05$) (Fig. 11), Brahman ($P < 0,01$) (Fig. 12) and Nguni ($P < 0,01$) (Fig. 13). Differences between the number of *B. decoloratus* females of 4 breeds were not significant when compared to each other ($P < 0,2$). Of the total tick population collected during the 28 month study period, Simmentaler yielded 61,1 %, Bonsmara 16,6 %, Afrikaner 10,1 %, Brahman, 8,2 % and Nguni 4,2 % (Fig. 14). Seasonal fluctuations between summer (Fig. 15) and winter (Fig. 16) were observed for Simmentaler and Bonsmara, while other breeds carried similar proportions of the overall population throughout the year.

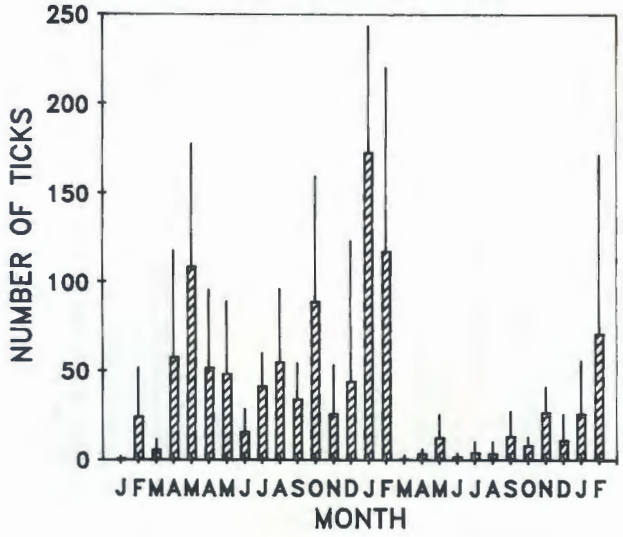

FIG. 9 Mean number of *B. decoloratus* females found on 5 Simmentaler cows a "Delftzyl" farm for the period January 1985–April 1987

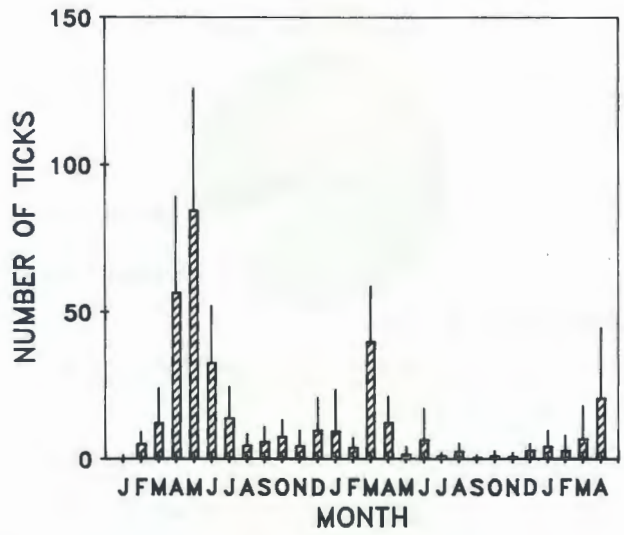

FIG. 10 Mean number of *B. decoloratus* females found on 5 Bonsmara cows at "Delftzyl" farm for the period January 1985–April 1987

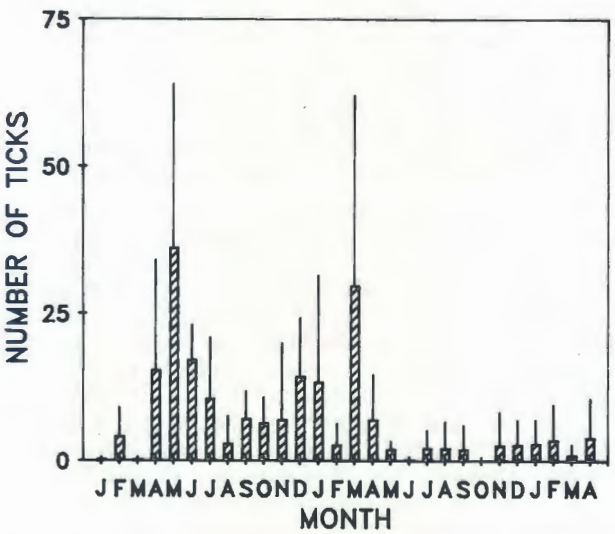

FIG. 11 Mean number of *B. decoloratus* females found on 5 Afrikaner cows at "Delftzyl" farm for the period January 1985–April 1987

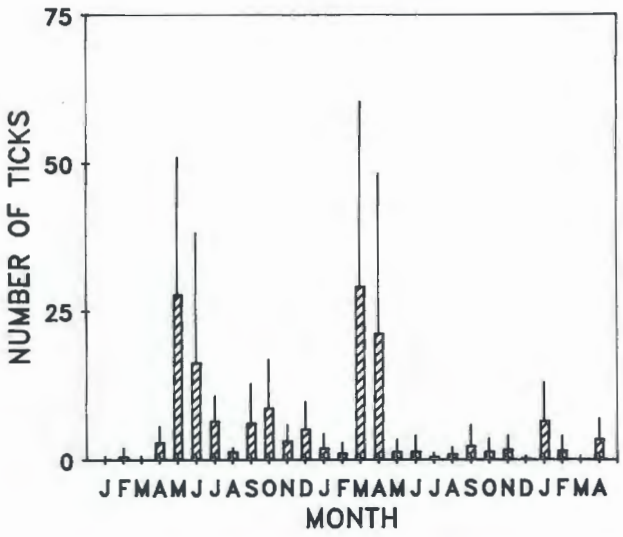

FIG. 12 Mean number of *B. decoloratus* females found on 5 Brahman cows at "Delftzyl" farm for the period January 1985–April 1987

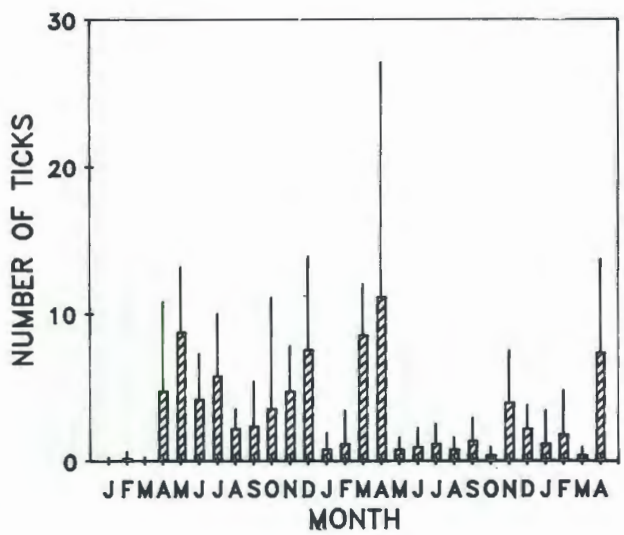

FIG. 13 Mean number of *B. decoloratus* females found on 5 Nguni cows at "Delftzyl" farm for the period January 1985–April 1987

DISCUSSION

Boophilus decoloratus showed a clear pattern of seasonal activity. This tick demonstrates three and sometimes even four generations per year, with peaks in July, September–October, December–January, and March–April. This was observed on both farms irrespective of the breed of cattle. The female ticks of this species also showed significant differences in abundance between different breeds. The most sensitive breed carrying the highest number of *B. decoloratus* was Simmentaler followed by Santa Getrudis, Simmentaler, basically pure *B. taurus*, and Santa Gertrudis, a cross breed containing a high proportion of *B. taurus* were significantly less resistant than the predominately *B. indicus* breeds Brahman and Bonsmara, and the indigenous sanga breeds Afrikaner and Nguni.

These results conform to those found in Australia, that *B. indicus* breeds are more resistant to the cattle tick *B. microplus* than European, *B. taurus* breeds (Willadsen, 1980; Sutherst *et al.*, 1988). The increase in resistance level from Simmentaler to Nguni indi-

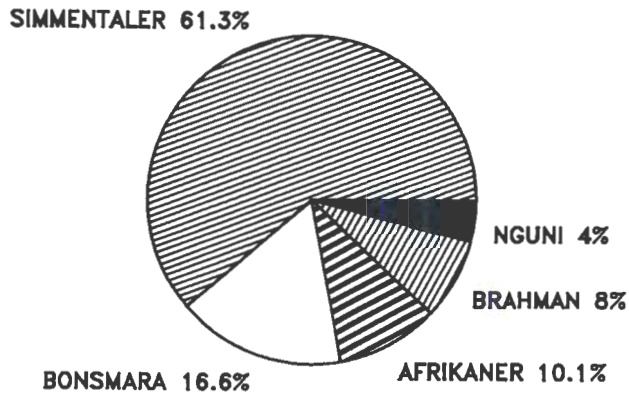

FIG. 14 Percentage of *B. decoloratus* adults found on the different breeds of cattle on "Delftzyl" farm from the period January 1985–April 1987

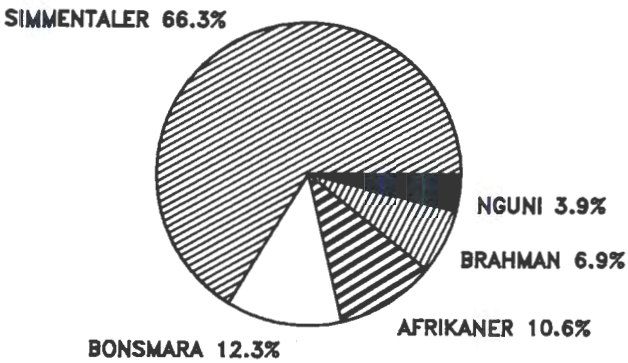

FIG. 15 Percentage of *B. decoloratus* adults found on the different breeds of cattle on "Delftzyl" farm during the summer months from January 1985–April 1987

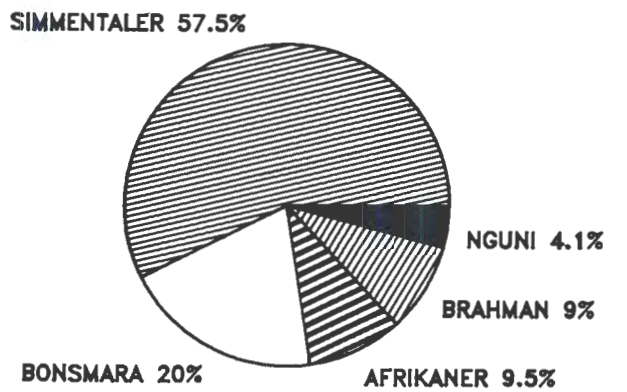

FIG. 16 Percentage of *B. decoloratus* adults found on the different breeds of cattle on "Delftzyl" farm during the winter months from January 1985–April 1987

cate that the higher the percentage of *B. indicus* or sanga in a breed, the greater the resistance of the breed to *B. decoloratus*. This conclusion is further substantiated by the fact that *B. decoloratus* females were less abundant on Simmentaler (49,4 %) from "Naauwpoort" (where both sensitive Simmentaler and Santa Getrudis breeds were present together), than they were on Simmentaler from "Delftzyl" (61,1 %), where Santa Getrudis were absent.

The Nguni, an indigenous South African breed demonstrated the highest level of resistance against *B. decoloratus* yielding less than 4,2 % of the total number of females collected off all 6 breeds. This substantiates previous suggestions (Rechav & Zeederberg, 1986), that indigenous breeds of cattle which co-evolved with indigenous tick species, showed a higher level of resistance than imported resistant breeds such as Brahman.

Previous reports (Kaiser, Sutherst & Bourne, 1982; Rechav 1987; Spickett, De Klerk, Enslin & Scholtz, 1989; Rechav *et al.*, 1990) indicate that breeds which show greater resistance to one tick species also express resistance to other species of ticks. It is unclear whether this interspecific resistance is as a result of cross-resistance between tick species or as a result of each tick species stimulating its "own" resistance. Kostrzewski (1990) suggests that no positive correlation between the number of *B. decoloratus* on various breeds and the number of *Amblyomma hebraeum* adults on the same breeds exists. Recent reports indicate that cross-resistance between African tick species does not exist, (Rechav, Heller-Haupt & Varma, 1989; Clarke, 1990 unpublished data), suggesting that *B. decoloratus* probably stimulates its "own" resistance irrespective of previous exposure to other tick species.

ACKNOWLEDGEMENTS

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