Communication

Comparative study of tick burdens in Gudali and Wakwa cattle under natural infestation in the subhumid highlands of Wakwa, Cameroon. Preliminary observations

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TAWAH (C.L.). Étude comparative des populations de tiques sur des bovins Goudali et Wakwa dans un parcours naturel infesté de la zone subhumide du plateau de Wakwa, Cameroun. Observations préliminaires. *Revue Élev. Méd. vét. Pays trop.*, 1992, **45** (3-4) : 310-313

Des populations de tiques ont été observées sur des taurillons Goudali et Wakwa pendant quatre semaines, sur un parcours naturel infesté de la zone sub-humide du plateau de Wakwa au Cameroun, durant une période où le climat est reconnu pour être très favorable aux stades libres des tiques. L'objectif était de déterminer la résistance relative aux tiques des races Goudali et Wakwa, respectivement pure sang zébu et demi-sang Brahman. Cinq taurillons de chaque race ont été mis dans un même parc pendant les mois de juillet-août. Les dénombrements des tiques ont été effectués chaque semaine pendant un mois, par stade, espèce et sexe. Les résultats ont montré que les espèces adultes recueillies étaient, par ordre décroissant d'abondance : *Amblyomma variegatum*, *Rhipicephalus lunulatus* et *Hyalomma* spp. Les taurillons Wakwa présentaient davantage de tiques que les Goudali (en particulier *A. variegatum* et *Hyalomma* spp.) sans que cette différence soit statistiquement significative. La signification d'une variabilité intra-raciale montre qu'une sélection pour la résistance aux tiques, surtout *Amblyomma variegatum*, pourrait être effective. Ces observations indiquent clairement qu'une étude de plus longue haleine serait nécessaire pour déterminer l'importance réelle de la différence de populations de tiques observée chez les deux races bovines, pour évaluer les mécanismes biologiques de résistance à *Amblyomma variegatum* et pour estimer l'héritabilité de la résistance aux tiques. *Mots clés* : *Amblyomma variegatum* - *Hyalomma* - *Rhipicephalus* - Tique - Zébu Goudali - Bovin Wakwa - Résistance - Zone tropicale - Cameroun.

Introduction

Ticks are ectoparasites which directly affect animal production and are responsible for the transmission of various animal diseases like cowdriosis, babesiosis, theileriosis and anaplasmosis (11). Tick-borne diseases account for about 63 % of the mortalities in Wakwa (8). Ticks, particularly *Amblyomma variegatum*, have been implicated in the clinical expression of dermatophilosis in Wakwa (20) and elsewhere (7). The effect of tick infestation on animal production has been adequately documented in Wakwa (17) and elsewhere (15). Resistance of various breeds of cattle to different species of ticks is well documented and was recently reviewed by MORRISON (10). Recent studies on resistance to cattle ticks in Australia (19), Africa (2, 13) and elsewhere (3, 18) have shown that Zebu *(Bos indicus)* cattle carry fewer ticks than European (*Bos taurus*) cattle. The degree of resistance to *Boophilus* ticks in Zebu x Taurine crosses is dependent on the level of Zebu blood (6, 19). UTECH et al (22) showed that animals selected for higher resistance to cattle ticks consistently had a lower tick burden than contemporaries selected for lower resistance. Resistance is affected by breed, age, physiological status of cattle and season of the year (22), and level of challenge (4).

In Africa, there are more breeds of cattle and more abundant tick species than elsewhere (12). However, there is paucity of information on the density of the various African species of ticks among the different breeds of cattle. It is apparent that the long coexistence of these tick populations with the cattle populations may have influenced the resistance levels of these breeds (13). Recent work has shown a positive correlation between the number of *Amblyomma variegatum* and the extent of dermatophilosis in beef cattle (7). Also, exotic *Bos taurus* cattle in Wakwa carry more ticks than the indigenous *Bos indicus* cattle (20). Furthermore, DUMAS et al (1) found Wakwa cattle to be more susceptible than Gudali to dermatophilosis. The cost of controlling ticks by chemical treatment is exhorbitant coupled with its adverse impact on the environment. A cost effective and efficient control of ticks requires the simultaneous application of dipping and use of resistant breeds of cattle. Recent tick studies in Cameroon have limited their investigations to tick populations and their relationships to seasonal weather conditions and animal growth (17). Therefore, no information is available on the relative resistance of Gudali and Wakwa cattle to prevailing tick species in Cameroon.

This paper compares the relative abundance and distribution on the host of the different species of ticks present simultaneously in Gudali and Wakwa cattle and assesses the relationship between ticks and their hosts. Such information is necessary for modelling of tick populations and formulation of tick control strategies. Also, this will facilitate the understanding of the extent to which tick resistance of the synthetic breed is compromised.

Materials and methods

Management

The environment of the Wakwa station has been described by MBAH *et al* (9). Major health problems include dermatophilosis and tick-borne diseases. The breeds involved in the study were described by TAWAH and MBAH (21). Briefly, Gudali is a purebred Zebu breed indigenous to the region while Wakwa is a synthetic breed involving 0.5 American Brahman and 0.5 Gudali.

Experimental device

A cattle herd consisting of 5 two-year old bulls from each Gudali and Wakwa breed, were randomly selected among young bulls from different sire herds of the Wakwa Animal Production and Extension Station of the Ministry of Livestock, Fisheries and Animal Industries. Only bulls were selected for this study because the selection of individuals for the perpetuation of cattle tick resistance genotypes is more efficient with bulls. These animals had previously been exposed to ticks on the station, although they were routinely dipped prior to the study. They had also been previously vaccinated against pasteurellosis,

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anthrax, brucellosis and rinderpest as well as dewormed. All the experimental animals were grazed together in a separate paddock for a five-days adaptation period. They were then thoroughly sprayed with a deltamethrine (Butox) emulsion in a knapsack sprayer on day zero and maintained in the experimental paddock for 7 days on the Wakwa Animal and Veterinary Research Station. This paddock had been used for a non-dipped cattle tick study the previous year (17). It was therefore expected to have a high tick challenge, particularly in the months of July and August when the rains peak. Tick counting started on day 7 after spraying. The same animals were used throughout the study.

Counting of ticks

The counting and identification of ticks were carried out by a trained team. For the counting of ticks in the hosts, the animals were tethered with ropes to a wooden fence and their legs restrained. Ticks were counted (and identified on the basis of sex and species) on each part (head, back, scrotal area, abdomen, legs, hooves, ears, perinal areas, neck and shoulders) of the animal body on days 7, 11, 14 and 18 of exposure of animals to natural infestation. Adult, nymphal and larval ticks were counted. Immediately after each counting session animals were returned to the paddock. Cattle were not treated with acaricides during the study period which extended from July 27 to August 13, 1990. They were only acaricide-dipped at the end of the study. Tick counts are repeatable and tick resistance is heritable (10). Therefore, only a few tick counts are needed to determine the susceptiblity of cattle to tick infestation. Relative resistance of cattle to ticks is assumed to be a function of the density of ticks. Therefore, lower tick burdens should reflect the ability of the individual animals to resist to the attachment of ticks on their body.

Statistical analysis

One Wakwa bull, that must have strayed into a neighbouring herd of dipped cattle because all ticks on its body were found dead the next day of counting, was eliminated from the herd. Normal plots of tick counts suggested that the data were not normally distributed. Hence, tick count data were transformed by natural logarithm transformation and then analysed by the General Linear Models in S.A.S. (14) using a repeated measures analysis of variance technique.

Separate analyses were done for each sex of ticks. The repeated model consisted of effects of breed, within-breed, and counting date-breed interaction.

Results

Figure 1 shows that *Amblyomma variegatum* was the predominant tick species followed by *Rhipicephalus lunulatus* which was mostly found on the body of the animal (*R. turanicus* of the ears were few, in numbers and not counted on all ears) and *Hyalomma* spp. *Boophilus* spp. were few in numbers with only 5 counted on a Wakwa bull. Very few nymphae were observed during the study period. However, only adult ticks were considered in the analysis. Male *Amblyomma* and female *Rhipicephalus* ticks were generally more abundant in these animals (fig. 2) than their female and male counterparts.

There was a positive and significant correlation between the number of *Amblyomma* and *Hyalomma* (0.76) in Gudali and of *Hyalomma* and *Rhipicephalus* (0.61) in Wakwa. The correlation was also positive between the number of *Amblyomma* and *Hyalomma* (0.52) and of *Amblyomma* and *Rhipicephalus* (0.44) in Wakwa and bet-

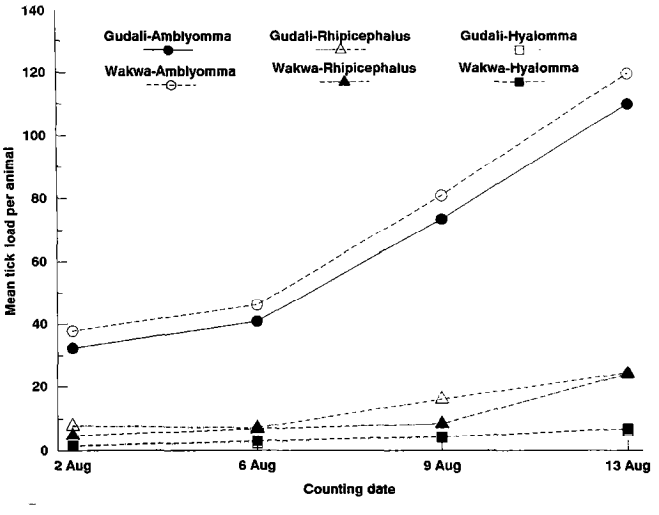

Fig. 1 : Mean tick load per animal for cattle breed and tick species.

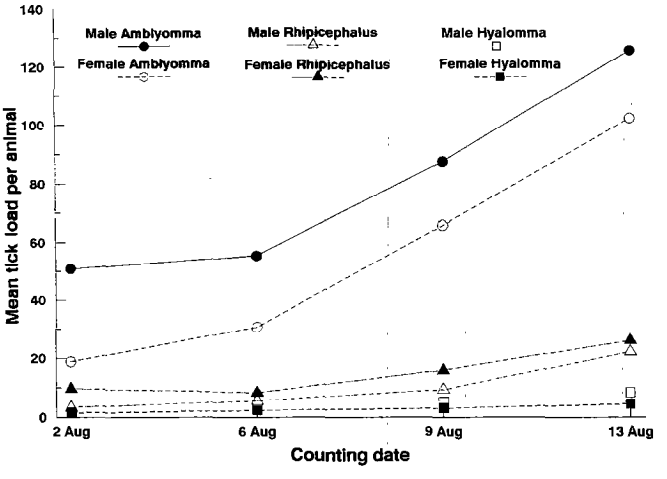

Fig. 2 : Mean tick load per animal for each species and sex of tick.

ween the number of *Amblyomma* and *Rhipicephalus* (0.42) and of *Hyalomma* and *Rhipicephalus* (0.39) in Gudali.

The overall model showed significance ($P < 0.001$) for both sexes. Within-breed effects (date effects) were highly ($P < 0.001$) significant for male and female ticks. Least-squares means for cumulative tick counts during the counting periods of day 7, 11, 14 and 18 were 6.6, 9.0, 14.0 and 26.7, respectively for male ticks and 5.6, 7.1, 13.2 and 21.5 for female ticks. Between-breed effects and the interactions between breed and date of counting were generally not significant for either sex. However, Wakwa cattle carried slightly more male ticks (12.9 ± 0.08 vs 11.9 ± 0.07) while Gudali cattle hosted slightly more female ticks (10.7 ± 0.09 vs 10.2 ± 0.10).

Tick species within breed of cattle significantly ($P < 0.001$) influenced tick counts for each sex of tick. Least-squares estimates of *Amblyomma, Hyalomma* and *Rhipicephalus* in Gudali were 61.7 ± 0.13, 2.9 ± 0.13 and 7.6 ± 0.13, and 35.9 ± 0.16, 1.9 ± 0.16 and 13.9 ± 0.16 for male and female ticks, respectively, while in Wakwa they were 79.6 ± 0.15, 3.4 ± 0.15 and 6.6 ± 0.15 as well as 46.2 ± 0.18, 2.2 ± 0.18 and 8.3 ± 0.18, respectively. There were clearly many more *Amblyomma variegatum* than *Hyalomma spp.* and *Rhipicephalus spp.* ticks in these animals. Males and females of *Amblyomma* and *Hyalomma* were more abundant in Wakwa than in Gudali cattle. On the other hand, Gudali hosted more *Rhipicephalus* ticks than Wakwa.

Discussion

Collections of ticks from the 2 breeds of cattle showed the most common species of ticks to be *A. variegatum*, *Hyalomma spp.* and *Rhipicephalus lunulatus*. *Amblyomma variegatum* was clearly the most numerous in both Gudali and Wakwa. Previous work of STACHURSKI *et al* (17) similarly showed the preponderance of *Amblyomma variegatum* in Wakwa. The results revealed significantly more male and female *Amblyomma* and *Rhipicephalus* than *Hyalomma* ticks in each cattle breed. Generally, male ticks were more abundant than females as expected. Similar results were also reported in Uganda by KAISER et al. (5).

The density of these species, except for *Rhipicephalus lunulatus*, was higher in Wakwa than in Gudali bulls. This suggests that Wakwa bulls are slighlty more sensitive than Gudali bulls, although the difference in tickload was not statistically significant. In addition, there was a positive correlation between the number of ticks of different species in each cattle breed. These results suggest that cattle resistant to one species of ticks also tend to manifest resistance to other tick species present. Previous reports (5, 12) have also suggested that breeds which manifest greater resistance to one tick species also express resistance to other species of ticks. It has also been assumed that animals which manifest excellent resistance to different tick species are generally immunocompetent. However, the number of tick counts was limited and the study too short to allow sound generalizations on cross-resistance among tick species. The positive correlations between the burdens of different tick species in cattle were also reported in Uganda (5). A different pattern of behaviour was observed for *Rhipicephalus lunulatus* ticks among these two cattle breeds, with Gudali hosting more ticks than Wakwa.

Although the study indicates that Wakwa animals are not significantly different in tick load from Gudali animals, Wakwa animals have been shown to be more susceptible to dermatophilosis than the latter (1, 20). Studies have also shown that the incidence of dermatophilosis in these populations can be reduced by the use of a well-controlled tick management strategy (7, 20). Recent studies in South Africa have shown that Brahman cattle when exposed to natural tick challenge tend to carry fewer ticks than crossbred *Bos indicus x Bos taurus* cattle (13, 16). However, these studies involved mainly *Boophilus* ticks. Moreover, American workers (3, 18) have also shown that Brahman cattle carry fewer *Amblyomma americanum* ticks than *Bos taurus* cattle in the southern part of the United States. However, the low tick density, the short duration of the study and the inadequate examination of the incidence of dermatophilosis in these herds make it difficult to generalize.

These results, however, indicate significant within breed variations in tick counts, particularly *A. variegatum*. An examination of the *A. variegatum* data confirmed this outcome, particularly with respect to Gudali bulls. It is therefore possible that selection for tick repellance and/or resistance within Gudali bulls could be effective. This behaviour of Gudali and Wakwa cattle to tick attachments under Wakwa conditions may, in fact, explain in part the individual differences in these populations with regards the incidence of dermatophilosis.

Conclusion

This study showed a tendency for Wakwa cattle to carry slightly more ticks than Gudali cattle. This difference was not significant suggesting that a similar dipping calendar could be used for both breeds as currently performed in Wakwa. It was also evident that significant within breed variation exists in tick counts. This offers an opportunity for individual selection within breed, particularly against *A. variegatum*. However, long-term studies would be necessary to clarify these findings and to determine the basis of resistance to cattle ticks.

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The relative resistance to different cattle ticks of Gudali and Wakwa cattle with different levels of Brahman breeding, grazed on natural pastures in the subhumid tropics of Wakwa, Cameroon, was assessed using pasture tick infestations. The basic design consisted of 5 young bulls of each breed from different sire herds. Tick populations were observed in Gudali and Wakwa bulls over a period of four weeks when the climate was thought to be highly favourable for the free-living stages of ticks. Counting of adult, larval and nymphal ticks was carried out in the morning of each counting day on the body surface of cattle after restraining them. Ticks were identified by species and sex. Repeated measures analysis of variance technique was used to account for time trends and breed differences. Results showed that Wakwa cattle carried slightly more ticks than Gudali cattle. However, this difference was not statistically significant. Significant within breed differences in tick counts suggested that selection for resistance to ticks, particularly *Amblyomma variegatum*, can be effective within each breed. The tick species recorded by order of decreasing abundance were *Amblyomma variegatum*, *Rhipicephalus lunulatus* and *Hyalomma* spp. It was clear from this study that long-term investigations would be necessary to ascertain the extent of the differences in tick counts between these two breeds of cattle and to assess the biological mechanisms of resistance to *Amblyomma variegatum* as well as to estimate the heritability of tick resistance. *Key words* : *Amblyomma variegatum* - *Hyalomma* - *Rhipicephalus* - Tick - Gudali Zebu cattle - Wakwa cattle - Resistance - Tropics - Cameroon.

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