

Seasonal prevalence of ticks and their association with dermatophilosis in cattle on the Accra plains of Ghana

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KONEY (E.B.M.), WALKER (A.R.), HERON (I.D.), MORROW (A.N.), AMBROSE (N.C.). Incidence saisonnière des tiques et leur association avec la dermatophilose du bétail dans les plaines d'Accra au Ghana. *Revue Élev. Méd. vét. Pays trop.*, 1994, 47 (2) : 163-167

Dans les plaines côtières d'Accra au Ghana, l'abondance saisonnière des tiques adultes sur le bétail et leur association avec la dermatophilose ont fait l'objet d'une recherche sur 5 troupeaux pendant une période de 26 mois. Quatre genres ont été identifiés : *Amblyomma*, *Boophilus*, *Rhipicephalus* et *Hyalomma*, l'espèce dominante étant *Amblyomma variegatum* présente toute l'année avec 2 pics d'infestation, l'un en avril-mai, l'autre en novembre. Une corrélation positive significative a été mise en évidence entre *A. variegatum* et la dermatophilose dans quatre des cinq troupeaux. Des corrélations positives significatives ont également été trouvées entre *H. m. rufipes* et la dermatophilose dans deux troupeaux et entre *Rh. senegalensis* et la dermatophilose sur un troupeau. À l'opposé, des corrélations négatives statistiquement significatives ont été observées entre *Boophilus* et cette maladie dans trois des troupeaux. Cependant, les auteurs considèrent qu'*A. variegatum* est le facteur concerné le plus important, en matière de tique, dans la pathologie de la maladie.

Mots clés : Bovin - Dermatophilose - Tique - *Amblyomma variegatum* - *Boophilus* - *Hyalomma* - *Rhipicephalus* - Prévalence - Infestation - Phéno-logie - Variation saisonnière - Ghana.

INTRODUCTION

Dermatophilosis, an exudative dermatitis caused by the bacterium *Dermatophilus congolensis* has frustrated many attempts to upgrade and improve meat and milk production in the tropics (7). Circumstantial evidence has implicated ticks, particularly *Amblyomma variegatum*, in the pathogenesis of dermatophilosis (2, 9, 12, 16) but the lesions do not always coincide with the predilection sites of the ticks (12). In an attempt to confirm or refute the role of ticks in dermatophilosis longitudinal studies were carried out on cattle in a number of herds on the Accra plains of Ghana.

MATERIALS AND METHODS

The study site was near the villages of Matesuru and Fafraha, north-east of Accra on the coastal savannah plain 5°40' north latitude and 0°10' west longitude. The average rainfall is between 750-1 000 mm per year with a

relative humidity of 85-90 % as a normal daily maximum, the normal minimum being 70 %. Temperatures vary little during the year with an average maximum of 28°C and minimum of 22°C. Vegetation comprises tree savannah with clumps of thicket. Common grasses include *Andropogon gayanus* (Gamba grass), *Panicum maximum* (Guinea grass), and *Pennisetum purpureum* (Elephant grass). These grasses are associated with thorny bush steppe largely of acacia species. The soils are tropical sandy soils with a shallow impermeable claypan with extreme seasonal moisture variations (6). The area of the study drained freely and was never waterlogged.

Five traditional herds of 75-160 cattle of all ages were selected for monitoring, on a continuous basis, the level of tick infestation and the prevalence of dermatophilosis under normal management conditions. Five animals, all females, and of a similar age (6-9 months) from each of the herds were ear tagged. For 26 consecutive months, the tagged animals in each herd were cast once a month and adult ticks on them identified to genus and counted *in situ*. Whole body counts were made of attached adult ticks of both sexes except for *Boophilus* where only partially engorged females were counted. Tagged animals which became too difficult to handle were replaced. All the animals in the herds were checked each month for the presence of skin lesions and those having exudative lesions typical of dermatophilosis were classified as positive.

Acaricides were used in all five herds at various times at the discretion of the owners, as practised under traditional management systems, and this modified the pattern of tick infestation. Animals in four of the herds were hand washed occasionally using lindane (Gammatox®, Coopers Animal Health Ltd., UK) or dioxathion (Delnav®, Coopers Animal Health Ltd., UK) while in the fifth herd a flumethrin based pour-on acaricide (BayticoI®, Bayer, Germany) was used periodically on a few animals over the final year of the study.

Meteorological data, including monthly rainfall totals, and mean monthly temperature and relative humidity values, collected at two sites, the Accra Airport and at a meteorological station at Mpehuasem, near the University of Ghana at Legon, over three years (1989-1991) was obtained from the Ghana Meteorological Services Department. The herds used in the study were within a radius of 6 km from the meteorological stations except for one herd (herd 2) which moved after 7 months to a new location some 40 km away.

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Reçu le 9.6.1993, accepté le 5.4.1994.

Statistical analyses

The data collected on the prevalence of dermatophilosis were normalized using arcsin transformation (18). The time-series data of dermatophilosis prevalence and the prevalence of each separate tick species were cross-correlated using Pearson's parametric correlation. It was also cross-correlated using a time lag of two months between the tick data and the dermatophilosis data, the lag period being based on clinical experience and from experimental observations that on sheep initially naive to *A. variegatum* but then experimentally infested with adult *A. variegatum* and infected with *D. congolensis*, chronic lesions became fully established between one and two months after infection (19).

Cross correlations were also carried out between the time series data of the prevalence of *A. variegatum* and dermatophilosis in herd 1 with meteorological data collected at Accra Airport and for the combined time series data from herds 3, 4 and 5 with meteorological data collected at the meteorological station at Mpehuasem.

RESULTS

Ticks observed

Five species of ticks were found on animals: *Amblyomma variegatum*, *Hyalomma marginatum rufipes*, *Rhipicephalus senegalensis*, *Boophilus decoloratus* and *Boophilus annulatus*. Because differentiation on the host was impossible, the two *Boophilus* species were counted together.

Prevalence and seasonal distribution of ticks

The most abundant species of tick infesting animals in the five herds was *Amblyomma variegatum* (table 1). There was considerable seasonal variation in the number of ticks of this and the other species found on animals. *A. variegatum* ticks were present on animals throughout the year with rising and peak numbers in April at the start of the early rains and November-December, just after the second rains, and decreasing numbers in January-February and July-September. Figure 1 shows the monthly rainfall totals and mean monthly temperature values for Accra Airport. The pattern of infestation found on animals in herd 1, which was typical for the group of herds involved in the study, is shown in figure 2. The number of *Rh. senegalensis* ticks on cattle in the study area showed dramatic fluctuations with highest numbers present in April-May and low infestation levels during most of the rest of the year. The level of infestation with *H. m. rufipes* and *Boophilus* species on the animals under investigation remained low throughout the study period with *Boophilus* being absent during some periods of the year (fig. 2).

TABLE 1. Cumulative monthly counts of the various tick species found on five tagged animals at each of five kraals over a period of 26 months.

Herd	<i>A. variegatum</i>	<i>Boophilus</i> species	<i>H. m. rufipes</i>	<i>Rh. senegalensis</i>	Total
1	3 535(48)	345(5)	1 135(16)	2 300(31)	7 315
2	3 650(79)	355(8)	150(3)	475(10)	4 630
3	2 555(52)	345(7)	490(10)	1 545(31)	4 935
4	1 780(47)	450(12)	385(10)	1 135(30)	3 750
5	1 865(54)	150(4)	275(8)	1 145(33)	3 435
Total	13 385	1 645	2 435	6 600	24 065

() = percentage of total tick numbers.

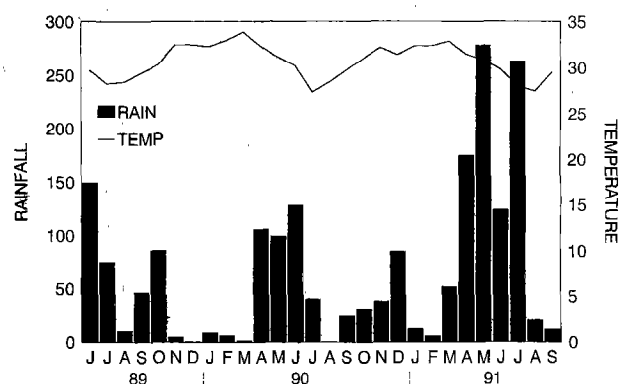


Figure 1: Monthly rainfall totals and mean monthly temperatures at Accra Airport, 1989-1991.

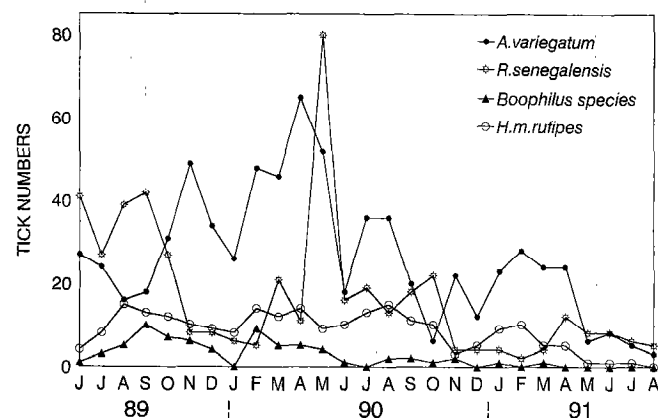


Figure 2: Mean monthly whole-body counts of adult ticks on 5 animals in herd 1.

Association between climatic factors and the occurrence of *A. variegatum* ticks and dermatophilosis

There were no significant correlations between the rainfall data and the prevalence of dermatophilosis in herd 1 or the combined data for herds 3, 4 and 5. There was a significant positive correlation between rainfall and *A. variegatum* tick counts ($r = +0.476$; $p < 0.01$) for herds 3, 4 and 5 combined but not for herd 1. The calculated correlation coefficients between relative humidity and the prevalence of dermatophilosis and *A. variegatum* tick counts for herd 1 and herds 3, 4 and 5 combined were not significant. A significant positive correlation ($r = 0.448$; $p < 0.01$) was present between temperature and *A. variegatum* tick counts in herd 1 but not in herds 3, 4 and 5 combined.

Association between ticks and dermatophilosis

A. variegatum numbers showed the highest and the most significant correlations with the occurrence of dermatophilosis (table II). Significant correlations between dermatophilosis and *H. m. rufipes* were observed in two herds and between dermatophilosis and *Rh. senegalensis* in one out of the five herds. The correlations with *Boophilus* species were all negative.

The data for *A. variegatum* tick numbers and the occurrence of dermatophilosis were analysed further by calculating the correlation coefficients which allowed for a two-month lag in the occurrence of dermatophilosis. This gave higher correlations which were significant for four of the five herds. The number of adult *A. variegatum* and the prevalence of dermatophilosis on animals in herd 1, are shown in figure 3. Allowing for a two month lag in the occurrence of dermatophilosis, the correlation coefficient between *A. variegatum* tick numbers and the prevalence of dermatophilosis increased to $+0.745$ and was highly significant ($p < 0.001$). The calculated trend line for these data incorporating a two month lag in the occurrence of dermatophilosis is shown in figure 4.

TABLE II Correlation between tick numbers and prevalence of dermatophilosis in five herds of cattle.

Herd	Correlation coefficient			
	<i>A. variegatum</i>	<i>H. m. rufipes</i>	<i>Rh. senegalensis</i>	<i>Boophilus</i> species
1	+ 0.41*	+ 0.44**	+ 0.15 ^{NS}	- 0.07 ^{NS}
2	+ 0.53**	+ 0.49**	+ 0.62**	- 0.52**
3	+ 0.50**	+ 0.31 ^{NS}	+ 0.29 ^{NS}	- 0.39*
4	- 0.01 ^{NS}	- 0.27 ^{NS}	+ 0.08 ^{NS}	- 0.14 ^{NS}
5	+ 0.003 ^{NS}	+ 0.02 ^{NS}	+ 0.31 ^{NS}	- 0.33*

Cross correlation of time series without lag.

*: significant ($0.01 < p < 0.05$); **: very significant ($p < 0.01$); NS: not significant.

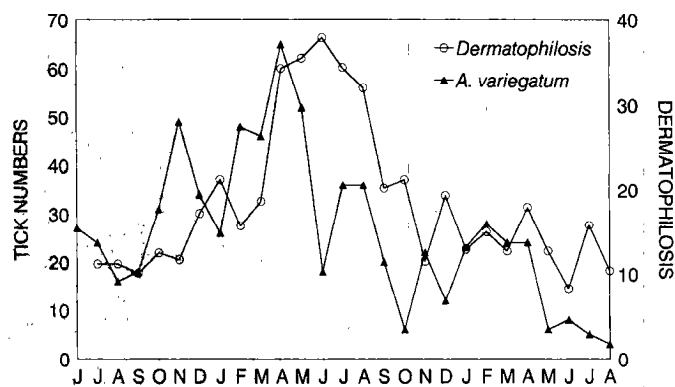


Figure 3: *Amblyomma variegatum* ticks and the prevalence of dermatophilosis on animals in herd 1. The values for *A. variegatum* are the mean monthly whole-body counts of adult ticks on 5 animals.

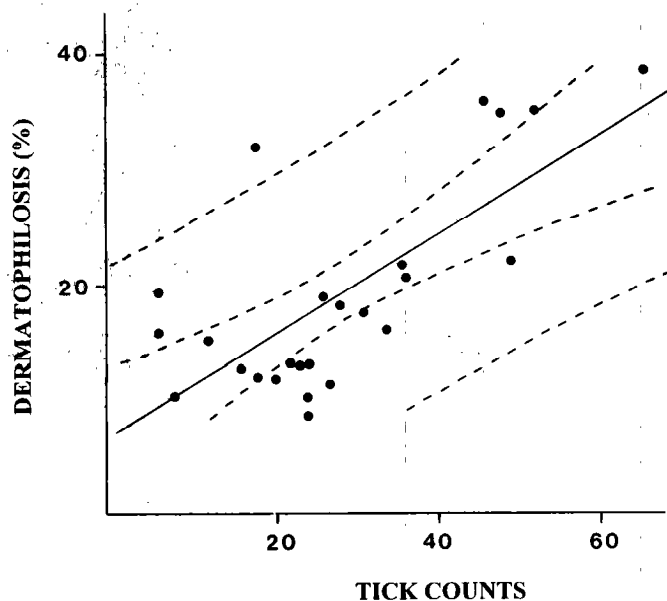


Figure 4: Regression line with 95 and 99 % confidence intervals of the arcsin transformed data for the prevalence of dermatophilosis in herd 1 against *Amblyomma variegatum* tick counts two months earlier.

DISCUSSION

Four genera comprising five species of ixodid ticks were found in varying numbers on cattle during a 26-month study on the Accra plains of Ghana. They included *A. variegatum*, *B. decoloratus*, *B. annulatus*, *Rh. senegalensis* and *H. m. rufipes*. MOHAMMED (10) and BAYER and MAINA (3) found a similar tick fauna on cattle in Nigeria. In contrast, only 3 genera of ticks namely *Amblyomma*, *Boophilus* and *Hyalomma* and 3 species of ticks namely *A. variegatum*, *H. m. rufipes* and *B. decoloratus* were identi-

fied on cattle on the Accra plains by the Animal Research Institute (ARI), Achimota, Ghana (1). The genus *Rhipicephalus* and two additional species, *B. annulatus* and *Rh. senegalensis*, were identified in the present study compared to the results of the ARI study (1). *Amblyomma variegatum* was found to be the predominant tick species infesting cattle in the area, with high levels of infestation in the early part of the rainy seasons, a finding in agreement with earlier observations by ARI (1). A recent study (WALKER, unpublished) revealed in the same area *B. geigy*, *Rh. evertsi*, *Rh. sanguineus* group.

The severe form of dermatophilosis which affects cattle in many parts of the tropics tends to be seasonal in character with a higher prevalence during the rainy season (4, 5, 13, 16). Ghana Sanga cattle, which are relatively resistant to dermatophilosis, are the predominant breed on the Accra plains. OPPONG (14) observed that the prevalence of dermatophilosis on cattle kept under traditional management on the Accra plains increased from 4.9 % in the dry season to 12.8 % in July, towards the end of the early rains, with up to 25 % of cattle in some herds affected. The present study showed a similar seasonal pattern in the occurrence of dermatophilosis, although in the case of individual herds this was modified sometimes by the use of acaricides reducing the seasonal increases in tick challenge, as occurred in the case of herd 1 in 1991.

There was a significant and moderately positive correlation between the prevalence of dermatophilosis and the occurrence of *A. variegatum* in four of the five herds investigated although in the case of one of the five herds this was only apparent when adjusted for a two-month lag in the occurrence of dermatophilosis. These findings substantiate earlier reports from Africa (15, 16) and the Caribbean (2, 9, 12, 17) which connected *A. variegatum* ticks with the occurrence of dermatophilosis. Animals in herd 4, where the correlation between the prevalence of dermatophilosis and the *A. variegatum* monthly tick counts was significant only after adjustment for a two-month lag in the occurrence of dermatophilosis, and herd 5, where a significant positive correlation between *A. variegatum* and dermatophilosis was not observed, had considerably fewer *A. variegatum* ticks than cattle in the other kraals. The higher frequency of application of acaricides by the herdsman at these two kraals which resulted in overall lower *A. variegatum* tick counts will have distorted the seasonal pattern in the natural occurrence of *A. variegatum* ticks and dermatophilosis while on occasions the monthly tick counts did not reflect the potential levels of natural infestation because acaricides were used not long before the tick counts were carried out.

It has been reported from the Caribbean that dermatophilosis was much more prevalent on cattle having low levels of infestation with *A. variegatum* in Martinique compared to cattle with similar levels of infestation on Guadeloupe (2). However, KONEY *et al* (8) showed that in West Africa cattle that are traditionally regarded as more resis-

tant to dermatophilosis carried much fewer *A. variegatum* than the highly susceptible European type cattle.

Infestation with *H. m. rufipes* gave significant positive correlations with the occurrence of dermatophilosis in two of the herds studied, as did *Rh. senegalensis* in one of the herds; hitherto these associations have not been reported. The literature on the association between ticks and dermatophilosis has almost invariably incriminated *A. variegatum* as the only tick species involved in the disease process. A positive correlation between 2 parameters does not necessarily imply a causative relationship. However one cannot preclude the involvement of other stress factors including infestation by other species of ticks as *D. congolensis* infections are sometimes seen in areas not infested with *A. variegatum*. Although dermatophilosis is more prevalent during the wet season, varying combinations of high rainfall and humidity possibly play little direct role as independent factors in the occurrence of the disease in cattle (8, 11). The increased use of acaricides in herd 1 during the final year of the study kept *A. variegatum* tick numbers and the prevalence of dermatophilosis much lower than over the same period the previous year when over 30 % of the cattle were affected by dermatophilosis during the early rains.

CONCLUSION

The occurrence of bovine dermatophilosis in indigenous cattle on the coastal plains of Ghana is closely associated with infestation by *A. variegatum* ticks. This association is particularly marked when the occurrence of dermatophilosis is compared with the level of infestation with *A. variegatum* two months earlier.

ACKNOWLEDGEMENTS

This investigation was supported by grants from the Overseas Development Administration of the Foreign and Commonwealth Office, London and the European Economic Community (Project TS2-0106-UK). We also gratefully acknowledge the helpful comments and advice of Dr. G.R. SCOTT and the support of the Director of the Veterinary Services Department, Accra, Ghana.

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KONEY (E.B.M.), WALKER (A.R.), HERON (I.D.), MORROW (A.N.), AMBROSE (N.C.). Seasonal prevalence of ticks and their association with dermatophilosis in cattle on the Accra plains of Ghana. *Revue Élev. Méd. vét. Pays trop.*, 1994, **47** (2): 163-167

The seasonal abundance of adult ticks on cattle and their association with dermatophilosis were investigated in five herds on the coastal plains of Ghana over a 26-month period. Four genera, *Amblyomma*, *Boophilus*, *Rhipicephalus* and *Hyalomma* were identified, *A. variegatum* being the predominant species occurring throughout the year with two peaks of infestation, one in April-May and the other in November. A significant positive correlation was revealed between *A. variegatum* and dermatophilosis in four of the five herds. Significant positive correlations were found between *H. m. rufipes* and dermatophilosis in two of the herds and between *Rh. senegalensis* and dermatophilosis in one herd. Negative correlations of statistical significance were observed between *Boophilus* species and dermatophilosis in three of the herds. Nevertheless, it was considered that *A. variegatum* was the most important tick factor involved in the pathogenesis of the disease.

Key words : Cattle - Dermatophilosis - Tick - *Amblyomma variegatum* - *Boophilus* - *Hyalomma* - *Rhipicephalus* - Prevalence - Infestation - Phenology - Seasonal variation - Ghana

KONEY (E.B.M.), WALKER (A.R.), HERON (I.D.), MORROW (A.N.), AMBROSE (N.C.). Prevalencia estacional de las garrapatas y relación con la dermatofilia, en el ganado de las planicies de Accra, Ghana. *Revue Élev. Méd. vét. Pays trop.*, 1994, **47** (2) : 163-167

Durante 26 meses se estudió la abundancia estacional de garrapatas adultas en el ganado y su asociación con la dermatofilia, en cinco hatos de las planicies costeras de Ghana. A lo largo del año se encontraron cuatro géneros predominantes: *Amblyomma*, *Boophilus*, *Rhipicephalus* y *Hyalomma*, siendo la especie predominante *A. variegatum* presente todo año con dos picos de infestación, en abril-mayo y en noviembre. Una correlación positiva estadísticamente significativa se determinó entre *A. variegatum* y la dermatofilia en cuatro de los cinco hatos. Se determinaron correlaciones positivas entre *H. m. rufipes* y la dermatofilia en dos de los hatos y entre *Rh. senegalensis* y dermatofilia en uno de ellos. Correlaciones negativas estadísticamente significativas se encontraron entre *Boophilus* y dermatofilia en tres de los hatos. Sin embargo, se consideró que *A. variegatum* es el factor más importante en la patogénesis de la enfermedad.

Palabras clave : Bovino - Dermatofilia - Garrapata - *Amblyomma variegatum* - *Boophilus* - *Hyalomma* - *Rhipicephalus* - Prevalencia - Infestación - Fenología - Variación estacional - Ghana.