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Interactions Ticks, Hosts and Pastures: Case of the Girolando Dairy Cattle and the Artificial Pastures of *Panicum maximum* and *Panicum maximum* var. C1

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Abstract: On the Kpinnou ranch in Benin, it was observed that the Girolando dairy cattle which graze *Panicum maximum* var. C1 are more susceptible to infestation of ticks. The purpose of this study was to highlight the interactions between ticks and their bovine hosts and two types of artificial grazing pastures. Nineteen young Girolando dairy cattle were used during the big rainy season (March-June) 2009. All present ticks on the animals have been counted according to the body region. The bovine have been divided into two relatively homogeneous groups of ten and nine animals. The group 1 of 10 animals had been grazed on *Panicum maximum* whereas the group 2 of 9 animals had been grazed on *Panicum maximum* var. C1. During the two months of grazing, a weekly monitoring of the evolution of the load in ticks has been achieved. Four genera of ticks were identified on the bovine Girolandos (*Amblyomma, Hyalomma, Rhipicephalus* and *Boophilus*). The *Boophilus* genus is the most abundant ($P < 0.05$). The animals having grazed *Panicum maximum* var. C1 are more infested than those that have been grazed *Panicum maximum*. A variation of the rate of infestation of the animals has been observed in relation to the different body areas. The colour of the coat also has an effect on the load in tick of the bovine. The bovine of dark coat are in general more infested ($P < 0.05$) than those of clear colour.

Key words: Ticks, cattle, *Panicum maximum*, *Panicum maximum* var. C1, Kpinnou ranch.

1. Introduction

Infestations by ticks are very important in animal economy. Infestation of cattle by ticks causes two kinds of problem; health problems (traumatism, despoiling, transmission of pathogens, toxins injection, etc.) and economic problems [1-3]. Ticks conspire thus, big losses in livestock and hinder the introduction of improved breeds in developing countries [4-6]. Indeed, Stachurski [7] observed that exotic cattle breeds introduced in Africa are more sensitive to ticks infestations and induced diseases. Ristic & McIntyre [8] reveal that economic losses due to damages provoked by ticks are huge (mortalities, anemia, decreased production, growth arrest, damages to hides, etc.). Expenses incurred to fight against ticks and stop the damages, are considerable. Stachurski [7] showed that in sub-humid zone of West Africa, the infestation of bovine frequently reaches 400 to 500 ticks during the rainy season causing a valued production loss between 3,500 and 5,000 F CFA.

The profitability of any livestock is based on the health of animals. Therefore all productions (meat, egg, hide, hairs or milk) are intimately related to the health of animals. Thus ticks have a tremendous impact on the health of animals and consequently on their dairy

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production. It is the case on the Kpinnou ranch in Benin where it has been observed that the Girolando dairy cattle (imported from Brazil) that graze *Panicum maximum* var C1 are more susceptible to infestation of ticks, from which tendency to abandon the direct grazing of this highly productive forage. Therefore, the purpose of this study is to seek the causes in order to consider the possible solutions to mitigate this scourge.

2. Material and Methods

2.1 Study Environment

This study was conducted on the Kpinnou ranch (FEK) (Fig. 1). The FEK is located in the municipality of Athiémé, department of Mono. It is within a latitudinal North range of 6°33′22.0″-6°33′76.8″ and a longitudinal East range of 1°46′36.0″-1°47′80.0″. Almost in the form of a square, the FEK covers a surface of 380 ha. This study was carried out on the cattle farming of Kpinnou (Fig. 1).

Kpinnou ranch enjoys a subtropical climate characterized by two wet seasons and two dry seasons:

- A big rainy season from April to July and a small rainy season from mid-September to mid-November;
- A big dry season from mid-November to March and a small dry season from August to mid-September.

During the last thirty years (1979 to 2008), the height rainfall ranged between 633 mm and 1,270 mm with an annual average of about 950 mm. Mean yearly temperatures oscillate around the 25 ℃ to 28 ℃.

As for the relative humidity, it is constantly high from a month to the other of the year. The minima are around 40% to 72% while the maxima adjoin 100% (95% to 97%). The duration of sunshine is about of 8.18 h per day. The higher sunshine average values are

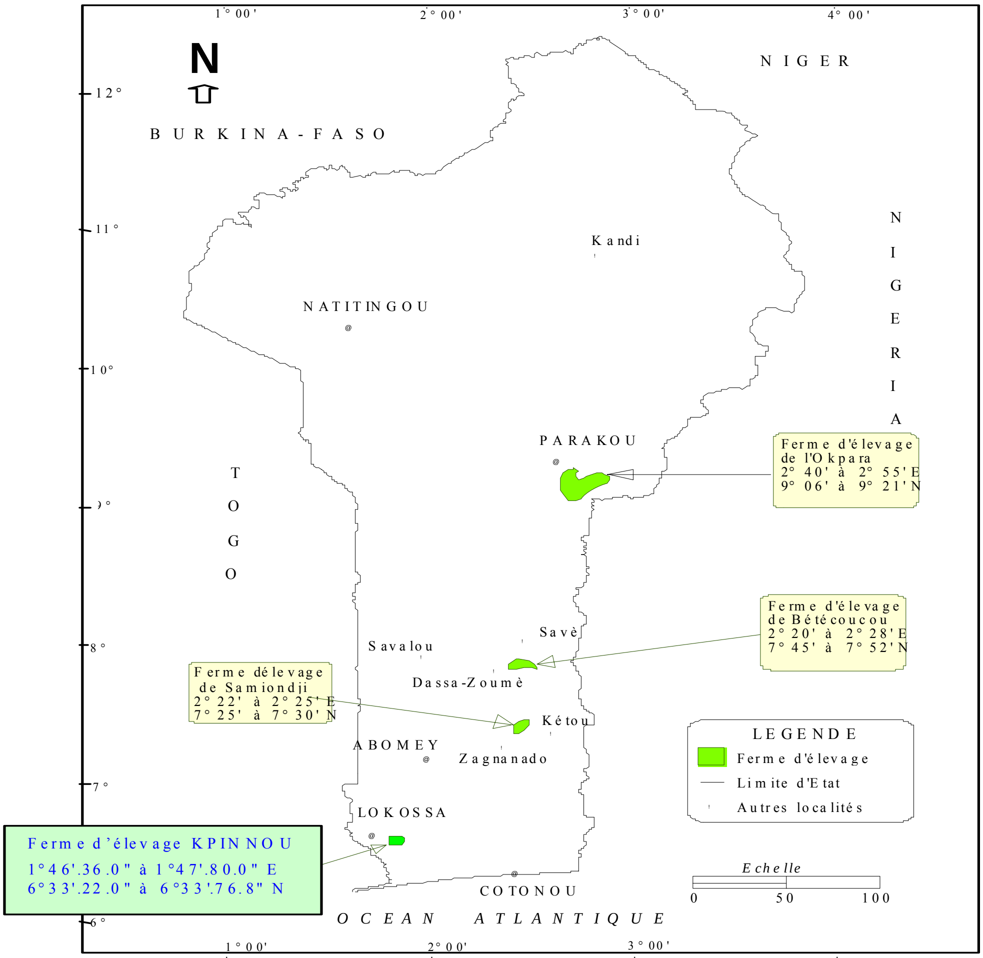

Fig. 1 Localisation des differentes fermesd'etat du BENIN.

obtained during the big dry season (10.28 h/day in December).

The climax vegetation is a dense dry forest that has left up to a mosaic of vegetation ranging from the dense forest islets, the shrubby and raised thickets and the artificial pastures to fallow vegetations.

Azontondé [9] regroups the soils of Kpinnou ranch in 3 categories: the alluvial soils of the valley Sazué, the black soil and the tropical ferruginous soils.

2.2 Animal Material

Nineteen young Girolando dairy cattle (8 females and 11 males) aged of 153 to 555 days (average 393 ± 114.37) and heavy of 95 Kg to 359 Kg (average 245.26 ± 80.14) have been used for this study. The coat colors of the animals were variable (fawn burnt (n = 9), magpie black (n = 1), magpie fawn (n = 1), gray (n = 2), fawn (n = 2) and black (n = 4). Table 1 shows the characteristics of the animals used.

2.3 Plant Material

The study was conducted on two type of artificial pastures which one of *Panicum maximum* and the other of *Panicum maximum* var C1 of 5.000 m^2 (100 m × 50 m) each.

2.4 Study Methods

2.4.1 Characterization of the Two Types of Pasture: Harvest of Phytomasse

Some cuts are done inside the productivity plots (10 m × 10 m). The geographical coordinates of plots are reported.

On each site, 7 small plots of 1 m × 1 m were randomly selected within every plot and cut. The number of retained small plots was determined according to the method of the progressive averages of Snedecor and Cochran [10] used by Sinsin [11]. The phytomasse of the herbaceous stratum thus harvested is sorted out in two categories: gramineous and other species. The fresh weights of each category are measured by appropriate weight within every plot.

A sample of 100 g of grass is collected in each plot in nylon productivity bag to determine the weight of dry matter. A first solar drying is done on the field. The dry weights of all samples collected for evaluation of biomass are noted after drying in an oven at 105 ℃ in laboratory until constant weight.

The measurement data of phytomasse served to the calculation of the potential productivity of the two types of pasture.

2.4.2 Characterization of the Two Types of Pasture: Measure of the Densities of Tufts and the Recovered Surface of Stumps

By type of pasture, 7 small plots of 1 m^2 repeated 3

Table 1 Characteristics of Girolando cattle used.

LOT 1						LOT 2					
N° Animal	N° of loop	Gender	Age (days)	Coat color	Weight (kg)	N° Animal	N° of loop	Gender	Age (days)	Coat color	Weight (kg)
1	KO157	M	455	Fawn burnt	357	1	KO144	F	536	Magpie black	345
2	KO201	M	411	Fawn	272	2	KO136	F	555	Fawn burnt	359
3	KO202	F	505	Fawn burnt	285	3	KO155	M	455	Fawn burnt	331
4	KO169	M	360	Black	268	4	KO168	F	291	Fawn burnt	177
5	KO153	M	451	Gray	245	5	KO177	M	168	Fawn burnt	100
6	KO161	M	447	Gray	271	6	KO171	M	350	Black	291
7	KO164	F	372	Black	205	7	KO142	F	545	Fawn burnt	286
8	KO175	M	399	Magpie fawn	225	8	KO154	F	399	Fawn burnt	228
9	KO173	M	340	Black	145	9	KO179	M	153	Fawn	95
10	KO170	F	275	Fawn burnt	175						
TOTAL					2448	TOTAL					2212
Mean					244.8	Mean					245.77

times are installed. In each plot, the number of tufts is counted as well as the number of stumps and the diameters of the recovered area of the stumps are measured. The length of stumps and the length and width of leaves are also measured. The valued parameters are:

- *Average density of tufts*

$$Nave = \frac{\sum ni}{N} \qquad (1)$$

where

ni is number of tufts counted per small plot of $1m^2$;

N is total number of sample plots;

Nave is average density of tufts (number of the recovered surface of the stumps per m^2).

- *Average area covered by the stumps*

$$A = \Sigma\ \Pi\ di^2/4 \qquad (2)$$

where di is the diameter of the recovered surface of the stumps in centimeter;

A is the average area covered by the stumps of vivacious species expressed in cm^2 / m^2.

2.4.3 Inventory of Ticks on Animals

This operation aims to determine the load of cattle ticks. It consisted of counting all the ticks on the animal by bodily region (head, ears, neck, back, declivitous region, ano-genital region, paws and tail). Ticks are then taken from the animals and maintained by bodily region, in plastic tubes with alcohol 70°. The tubes are labeled with information on: the number of loops of the host animal, date of collection, the body region on which the sample has been taken.

2.4.4 Identification of the Genera and Species of the Ticks

The observation of the ticks has been made with a dissecting microscope (MOTIC Stéréo Zoom microscope SMZ-140/143). The morpho-anatomical characteristics described by some authors served for basis to identify the genera and species of ticks [12-15].

2.4.5 Constitution of Groups of Cattle

The following parameters have been used to constitute two relatively homogeneous groups of ten and nine animals: age, weight, gender, coat color and loads in ticks.

Group 1 of 10 animals grazed on *Panicum maximum*.

Group 2 of 9 animals grazed on *Panicum maximum* var. C1.

2.4.6 Grazing of the Bovine

The grazing lasted two months. During this period, a weekly monitoring of the evolution of the load in ticks is achieved as well on the animals as in both types of pasture. Samples of ticks are then collected on one or two animals in each group. Samples of ticks are also preformed in each of pasture.

2.4.7 Statistical Analysis

To evaluate the effect of the type of pasture and coat color, we used as statistical method the variance analysis considering each factor separately. This amount to an ANOVA variance analysis. This variance analysis was completed by the Newman and Keuls method of multiple comparisons of means. So the conditions of application of the variance analysis may be verified, the transformation $\sqrt{x + 0.5}$ has been applied to the upset data.

3 Results and Discussion

3.1 Characterization of the Two Types of Pasture

The characteristics of both types of pastures *Panicum maximum* and *Panicum maximum* var. C1 are mentioned in Table 2. For the studied parameters, this table highlights fundamental differences between these two types of pasture.

These differences noted in the characteristics of pastures of *Panicum maximum* and *Panicum maximum* var C1 will probably be decisive in the behavior of ticks. Indeed, *Panicum maximum* has proved twice as high as *Panicum* C1 (151 cm *vs.* 79 cm) with longer leaves (77 cm *vs.* 58 cm) and wider (30 mm *vs.* 10 mm). On the other hand, *Panicum* C1 is more recovering than *Panicum maximum* (80.86% vs. 74.14%) with five times more stumps per unit of area ($483/m^2$ vs. $97/m^2$) and a pilosity more pronounced especially in the limb of the leaves.

Table 2 Characteristics of the two types of pasture.

Forage species	*Panicum maximum*	*Panicum* C1
Age of regrowth after burning (day)	41	55
Average recovery (%)	74.14a	80.86b
Biomass (kg DM/ha)	2042.67a	2210.75a
Average height (cm)	151.11a	78.75b
Average number of tuft (m^2)	2.11a	14.00b
Average number of stumps (m^2)	96.99a	483.13b
Average area of tuft (cm^2/m^2)	1594.81a	1444.02b
Average length of leaves (cm)	76.85a	58.23b
Average width of leaves (mm)	30.23a	10.05b
Pilosity of the leaf sheath *	hairs radiating dense short	hairs short dense
Pilosity of the lamina *	Glabrous	hairs short

There is no significant difference between the values carrying the same letters at 5%.
*: Source: Internet access www.tropicalforages [16].

3.2 Identification of Genera and Species of Ticks

Four genera of ticks have been identified on the Kpinnou ranch namely *Amblyomma, Hyalomma, Rhipicephalus* and *Boophilus.* Of these four genera of ticks observed, eight species have been identified and allocated as follows according to the genera:

- *Amblyomma* (1 specie): - *Amblyomma variegatum*;
- *Hyalomma* (2 species): - *Hyalomma truncatum*; - *Hyalomma rufipes*;
- *Rhipicephalus* (2 species): -*Rhipicephalus sanguineus*; - *Rhipicephalus evertsi*;
- *Boophilus* (3 species): - *Boophilus decoloratus*; - *Boophilus geigy*: - *Boophilus annulatus*.

The characteristics of the four genera of ticks identified on the Kpinnou farm are [12-15]:

Its cycle is qualified as triphasic. It is a tick longirostris with ornamentation at the scutum. It has eyes and festoons. The thorn of the first hip is double and short. It has no ventral escutcheons.

Its cycle is triphasic or biphasic. It is also a tick longirostris. It has eyes and festoons. The thorn of the first hip is double and long. There is presence of ventral escutcheons in the male. It has no ornamentation at the scutum.

The cycle is triphasic or biphasic. It is a tick brevirostris with festoons and eyes. The thorn of the first hip is long and double. The perimeters are small.

Its cycle is monophasic. It is also a tick brevirostris, without festoons and eyes. The thorn of the first hip is moss in scale. The perimeters are oval with absence of anal furrow.

Several studies put in evidence that the life of ticks and their impact on the health of host animals are function of the characteristics described above [12, 13, 15, 17, 18].

Some studies already proved the existence in Benin of numerous species of ticks of which those identified in the present study [6, 19-22]. It is therefore difficult in these conditions, to be pronounced on the origin of the present ticks on these imported animals.

3.3 Behavior of Ticks on the Two Types of Pasture

The observations were essentially made on the larvae of ticks and reveal a different behavior of the latter according to the type of pasture. These observations deal with the positioning of the larvae on the leaves of forage, their number and their mobility.

On *Panicum maximum* larvae cluster on the inner surface of the leaves while on *Panicum maximum* var. C1, they cling to the tips of the leaves.

This phenomenon occurs early in the morning until sunrise (around 10 o'clock AM). It is important to note that at this moment of the day, the larvae are immobile. At the end of the day, they were found on the ground at the basis of forage with considerable mobility.

In the pastures of *Panicum maximum,* few larvae are observed, contrary to the *Panicum* C1 where the infestation rate is very high.

3.4 Effect of Pasture Type

The evolution in the time of the load of ticks of cattle on pastures of *Panicum maximum* and pastures of

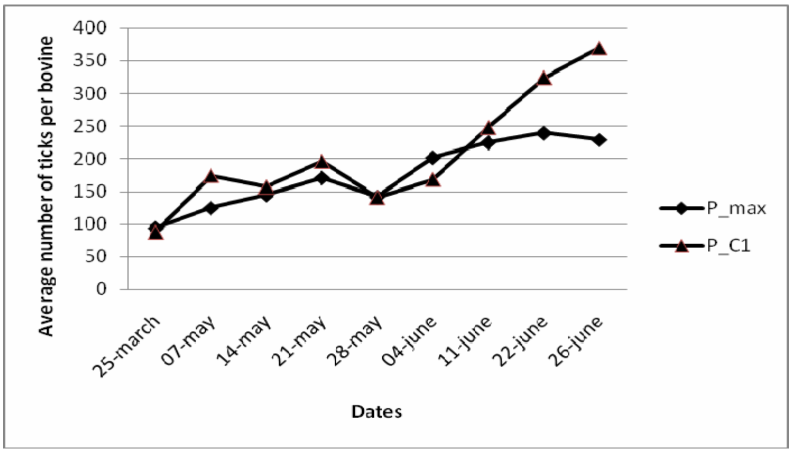

Fig. 2 Evolution of the load of ticks of cattle in both types of pasture.

Panicum maximum var. C1 is shown in Fig. 2 with two different curves.

Table 3 reflects the variation in density of cattle ticks, according to different bodily regions on both types of pasture at the beginning and end of the experiment.

Fig. 2 and Table 3 reveal that the animals grazed *Panicum C1* are more infested with ticks in this case by the larvae and the nymphs than those that have grazed *Panicum maximum*.

Observations on the pastures of *Panicum maximum* and pastures of *Panicum maximum* var. C1 reveal a difference in the number of larval ticks and their positioning on the leaves of forage. In the pastures of *Panicum maximum,* few larvae were observed, contrary to the pastures of *Panicum C1* where the infestation rate is very high. In the same way the bovine which have grazed *Panicum* C1 are more infested by ticks than those which have grazed *Panicum maximum*.

This variation of the infection rate observed among these animals from one pasture to another could be explained by fundamental differences noted in characteristics of pastures of *Panicum maximum* and *Panicum maximum* var C1. Indeed, *Panicum* C1 is a tufted basophilic specie that appeared more covering than *Panicum maximum* (80.86% *vs.* 74.14%) with a density of stumps five times higher (483/m^2 vs. 97/m^2) creating thus better hygrometric conditions for the development of ticks.

According to Chartier et al. [23], the favorable surroundings to the ticks are constituted, among others, by dense plant masses in humid areas. In the same vein, Boyard [24] pointed out that ticks are mostly encountered in humid places, protected by an important plant cover, where the passage of hosts' animals is frequent. This confirms that the type of vegetation affects the life of ticks, because the ambient humidity has been identified as one of the key factors to life and survival of ticks [18]. That is why they are especially active at the cool moments of the day. Milne [25] who studied the daily activities of the ticks during the free life observed differences in behavior over time. He concludes that the behavior of ticks seems to follow the diurnal variation of temperature.

It therefore appears that the forage species affects life in the environment, not only on ticks' life, but may also have impact on associated plant communities. Zoffoun et al. [26] showed that plant communities associated to cultivate forages are different depending on forage planted specie and that these plant communities established under artificial pastures are specific to the planted species.

Some plants are also recognized for their repulsive or lethal effect on ticks. These rules have been highlighted by several researchers [27-31]. Among the identified plants for their anti-ticks effects, forage species were also listed, but not *Panicum maximum* nor

Table 3 Effect of pasture type on the density of cattle ticks.

Period	Pasture type	Ears	Head	Neck	Back	Declivitous regions	ANO genital regions	Tail	Paws	Total
START	P_C1	21.22 a	5,22 a	56.22 a	8.67 a	22.44 a	25.00 a	16.00 a	19.89 a	174.67a
	P_max	19.00 a	2,20 a	33.60 a	1.20 a	16.70 a	22.70 a	13.20 a	16.30 a	124.90a
END	P_C1	71.78 a	32,56 a	56.11 a	24.22 a	36.67 a	66.33 a	42.33 a	40.56 a	370.56a
	P_max	45.40 b	5,50 b	44.50 a	1.90 a	30.50 a	24.30 b	31.30 a	33.80 a	229.20b

There is no significant difference between the values carrying the same letters at 5%.

Panicum maximum var. C1. According to the authors the decreasing order of efficiency is: *Gynandropsis gynandra, Melinis minutiflora, Stylosanthes humilis,* S*tylosanthes hamata* and *Andropogon gayanus.* Prates et al. [28] tested the essential oil of *Melinis minutiflora* against larvae of *Boophilus microplus* and got a lethal effect before 10 min.

3.5 Effect of Different Body Regions and Coat Color of Cattle

The infestation rate of different body parts of cattle on pastures of *Panicum maximum* and pastures of *Panicum maximum* var. C1 are presented in Figs. 3 and 4.

On the two types of pasture, the variation rate of infestation of cattle in relation to different parts of the body occurs along the gradient of decreasing affinity below:

- Too infested: ears (internal face);
- Moderately infested: neck, ano-genital region, paws, tail and declivitous regions;
- Low infested: back and head.

The highest rates are observed on the internal face of the ear conversely to some region such as back and head which are less infested.

Figs. 5 and 6 show the degrees of infestation of the bodily regions of bovine according to their different coat colors in both types of pasture.

The color of the coat was found to have an effect on the load in tick of the bovine. The cattle of dark coat are in general more infested than those of clear color in the order of nuance below: black, gray, fawn burnt, fawn and magpie. On animals of dark coat all parts of the body are infested, while on those of clear coat, only the hidden regions are infested (declivitous regions, ears etc.).

Our observations showed that the rate of infestation of cattle varies from a bodily region to another. The

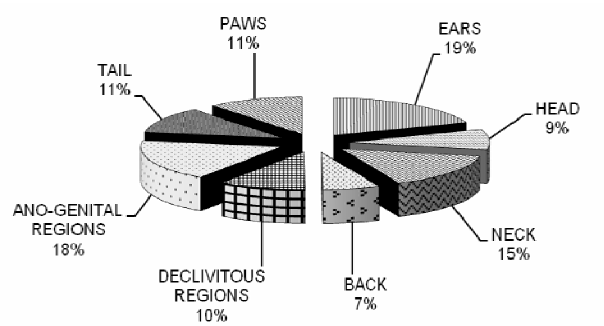

Fig. 3 Infestation rates of cattle in relation to different body parts on *Panicum C1*.

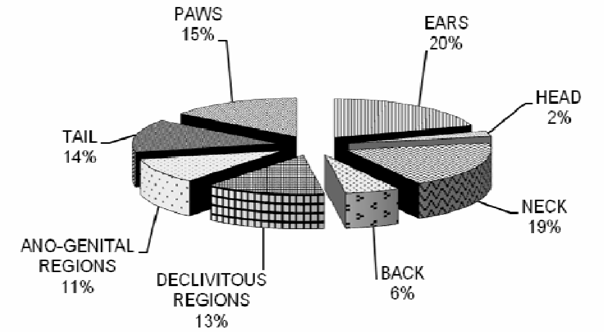

Fig. 4 Infestation rates of cattle in relation to different body parts on *Panicum maximum.*

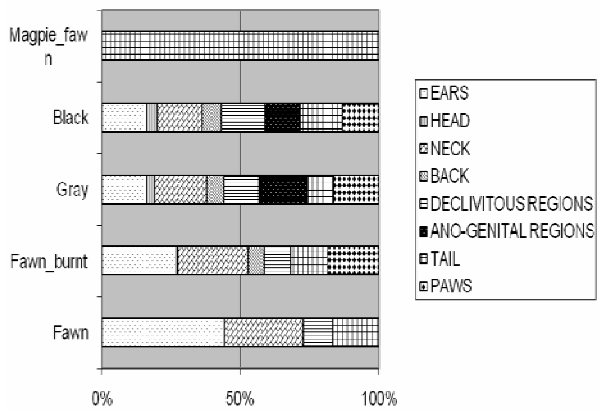

Fig. 5 Infestation degrees of the bodily regions of cattle in relation to the coat color on *Panicum maximum.*

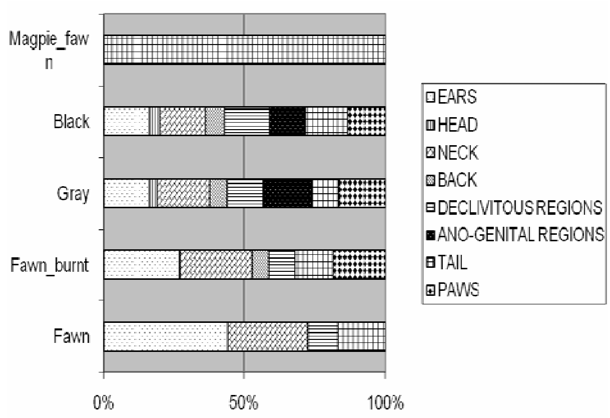

Fig. 6 Infestation degrees of the bodily regions of cattle in relation to the coat color on *Panicum* C1.

location of the tick on the host animal has been studied by several authors who agree to recognize ticks preference for certain body parts of animals. According to these authors, the major criteria are the resistance of the skin. Oliver [13] estimated that for an easier location, ticks attach themselves more readily to areas of the body where the skin is very thin (ars, ear, dewlap, groin...) [21]. For Pérez-Eid [15], ticks are in search of an area where the skin is thin (ears, abdomen) to stick their rostrum, and thus feed on their hosts' blood. Yousfi-Monod & Aeschlimann [17] specify that the localization of the tick on the host animal is bound to the possibilities of penetration of the rostrum. Generally on the ungulate hosts, ticks species with short rostrum (brevirostris) bind on the thin-skinned areas as the head (interior of the auricular small horn, bun), the neck, the anal margins and the toupillon. Species with long rostrum (longirostris) have more varied opportunities and can set on the declivitous parts where the skin is thicker: dewlap, ars, abdomen, groin, breast, testicles, and perineum. The ticks of small size notably larvae and pupae of some species especially set on the head and the neck.

Several species of ticks have developed, depending on the stasis, a preference for some bodily regions of host animals. It is thus possible to objectify a relationship between the number of ticks fixed to a specific zone and the total quantity of ticks on the whole body [32-34]. For Evans [33], the counting of adult females of *Ixodes ricinus* on the back end gives a good reflection of the global number of females. Other studies propose mathematical models for extrapolation from a fixing site [35] or the combination of several sites [36].

In light of our results, other factors that were not reported by the cited authors, account for the location of the tick on the host animal. The highest rates are observed on the internal face of the ear that presents to our opinion other advantages that make it a favorite place for ticks. Besides he thinness of skin at this zone, the internal face of the ear is hidden and well vascularized, which facilitates the fixing of the tick and permits him to hide and be protected from the risk of abduction/extraction (predators, rubbings, treatments etc.) and against heat and desiccation. This need of camouflage of the ticks and thus be undetected is best expressed through the choice of the coat color of the host animal. Indeed, the coat color was found to have an effect on the load of cattle tick (Figs. 5 and 6). The cattle of dark coat are in general more infested than those of clear color and on the latter ticks are mainly found in hidden regions (ears, declivitous regions etc.).

3.6 Density of the Genera of Ticks

The results of the identification of ticks found on cattle are recorded in Table 4. This table reflects the variation of the density of the genera of ticks in relation to the two types of pasture used in our experiment.

It is evident from the analysis of Table 4 that on the two types of pastures (*Panicum maximum* and *Panicum* C1), there is no significant difference at 5% between the proportions of ticks of the genera *Amblyomma*, *Hyalomma* and *Rhipicephalus*. On the contrary, there was a significant difference between the proportions of ticks of the genera *Boophilus* and those of the other genera. The genera *Boophilus* is the most abundant. The effect of pasture type has not been demonstrated for the degree of infestation of the same genera of ticks.

Table 4 shows that the effect of pasture type has not been demonstrated for the degree of infestation of the same genera of ticks. We did not note a specificity of the genera of ticks according to the different types of

Table 4 Variation in density of the genera of ticks in relation to the pasture type.

	Ticks number	*Amblyomma*	*Hyalomma*	*Rhipicephalus*	*Boophilus*
Panicum maximum	418	3	4	2	412
	100%	0.92% a	0.96% a	0.48% a	98.56% b
Panicum maximum var.C1	451	2	13	05	433
	100%	0.44% a	2.88% a	1.11% a	96.01% b

There is no significant difference between the values carrying the same letters at 5%.

pastures. There is also no significant difference between the proportions of ticks of the genera *Amblyomma, Hyalomma* and *Rhipicephalus.* On the other hand there was a meaningful difference between the proportions of the genera *Boophilus* and those of the other genera which are weakly represented. The high density of *Boophilus* can be justified by his monophasic cycle. Unlike the other three genera *(Amblyomma, Hyalomma* and *Rhipicephalus),* which have a biphasic or triphasic cycle, *Boophilus* has a monophasic cycle, where all the stasis succeed on the same vertebrate landed by the larva. There is one parasitic phase and only the punter, the incubation and movement of larvae in quest of a host happen over the ground, the cycle is then shortened [13, 15, 23]. Chartier et al. [23] explain that this kind of cycle is the result of a selection tailored to different microclimatic conditions. The chances of pupation and the research of the following hosts have been eliminated. Furthermore, by deletion of waiting times and shortening of the durations of pupation, the monophasic cycle on the host is reduced, which can be brought back to 3-4 weeks. The species of this type are very few, but important of the veterinary point of view.

4. Conclusion

In a nutshell, it can be retained that four genera of ticks have been identified on Girolando cattle at Kpinnou ranch *(Amblyomma, Hyalomma, Rhipicephalus and Boophilus).* The genera *Boophilus* is most abundant. It was noted that the animals having grazed *Panicum* C1 are more infested with ticks in this case by the larvae and the nymphs than those that have grazed *Panicum maximum*. A variation of the rate of infestation of the animals was observed in relation to the different bodily regions. The colour of the coat also has an effect on the load in tick of the bovine. The bovine of dark coat are in general more infested than those of clear colour.

The results of this study are interesting, notably for the effect of the pasture type and the effect of the color of the coat and suggest a deepening of the topic.

References

[1] F. Stachurski, N. Barre, E. Camus, Impact of natural infestation by the tick Amblyoma variegatum on the growth of cattle and creole goats, Revue Elev. Méd. Vét. Pays trop. 41 (1988) 395-405. (in French)

[2] M. Mourad, J. Balde, Causes of mortality in small ruminants on the tray of Sankara, Guiné 46 (1993) 84-88. (in French)

[3] N.H. Ogden, E. Swai, G. Beauchamp, E. Karimuribo, J.L. Fitzpatrick, M.J. Briyant, N.P. French, Risk factors for tick attachment to smallholder dairy cattle in Tanzania, Prev. Vet. Med. 67 (2004) 157-170.

[4] H.T.B. Hall, Diseases and Parasites of Livestock in the Tropics. London, Longman, 1985.

[5] M. Teglas, E. Matern, S. Lein, F. Foley, S. Mahan M., J. Foley, Ticks and ticks-borne diseases in Guatemalan cattle and horses, Veterinary Parasitology 131 (2005) 119-127.

[6] S. Farougou, A.W. Tasou, D.M. Tchabode, M. Kpodekon, C. Boko, A.K.I. Youssao, Tiques and blood parasites of livestock in northern Benin, Revue Méd.Vét. 158 (2007) 463-467. (in French)

[7] F. Stachurski, Protect cattle against the tick *Amblioma variegatum,* Animal health in West Africa, Technical card N° 1, CIRDES & CIRAD, 2004, p. 8. (in French)

[8] M. Ristic, I. McIntyre, Diseases of Cattle in the Tropics; Economic and Zoonotic Relevance, The Hague, Nijhoff, 1981.

[9] A. Azontonde, Pedological Survey of Kpinnou Ranch, 1991, p. 55. (in French)

[10] G.W. Snedecor, W.G. Cochran, Statistical Methods, 6th ed., The Lowa State University Press, 1957, p. 649. (in French)

[11] B. Sinsin, Plant sociology, ecology, pastoral value, productivity and stocking rate of natural pastures in the scope of Nikki-Kalalé in North Benin, 1993, p. 390. (in French)

[12] P.C. Morel, Ticks of domestic animals of French West Africa, Pays Trop. (1958) 153-189. (in French)

[13] J.H.O. Jr. Oliver, Biology and systematics of ticks (Acari: Ixodida), Ann Rev. Ecol. Syst. 20 (1989) 397-430.

[14] J.L. Camicas, P.C. Morel, Systematic position and classification of ticks (Acarida: Ixodida), Acarologia 1 (1977) 410-420. (in French)

[15] C. Pérez-Eid, Ticks: Identification, biology, medical and veterinary importance, Monograph of Microbiology, Tec & Doc EMinter- Lavoisier, 2007. (in French)

[16] Available online at: www.tropicalforages.info/key/Forages/Media/htmlPanicum_maximum.htm. Internet consultation 28/04/2009.

[17] R. Youssfi-Monod, A. Aeschlimann, Research on ticks (Acarina, Ixodidae) parasites of cattle in Western Algeria. Annals of Human Parasitology and Comparative 61:33, Masson, 1986, pp. 341-358. (in French)

[18] E. Williams, I. Barker, Infectious Diseases of Wild Animals, Manson Publishing/The Veterinary Press, London eds, UK, 2001.

[19] P.C. Morel, Ticks of domestic animals of French West Africa, Pays Trop. (1958) 153-189. (in French)

[20] S. Lafia, The ticks (Amblyommidae) parasites of cattle in the Peoples Republic of Benin, Dakar, 1982, p. 91. (in French)

[21] S. Farougou, M. Kpodekon, A.W. Tasou., Seasonal abundance of ticks (Acari: Ixodidae) infesting cattle in the Sudan zone of Benin: Case of Borgou and Alibori departmentsi, RASPA 5 (2007) 1-2. (in French)

[22] S. Farougou, M. Kpodekon, H. Adakal, P. Sagbo, C. Boko., Seasonal abundance of ticks (Acari: Ixodidae) infesting sheep in the southern region of Benin, *Revue Méd. Vét* 158 (2007) 627-632. (in French)

[23] C. Chartier, J. Itard, P. Morel, M. Troncy, Handbook of Tropical Veterinary Parasitology, 2nd ed., International Medical Publishing, Paris, 2000. (in French)

[24] C. Boyard, J. Barnouin, P. Gasqui, G. Vourc'H, Local environnemental factors caracterizing Ixodes ricinus nymph abundance in grazed permanent pastures for cattle, Parasitilogy 134 (2007) 987-004.

[25] A. Milne, The ecology of the sheep tick, Ixodes ricinus L. Some further aspects of activity, seasonal and diurnal, Parasitology 38 (1947) 27-33.

[26] A.G. Zoffoun, M. Houinato, G.L. Houessou, B. Sinsin, Impact of forage culture on the rangeland plant diversity on the Kpinnou ranch, Int. J. Biol. Chem. Sci. 2 (2008) 85-103. (in French)

[27] M.M. Malonza, Laboratory and field observations on anti-tick properties of the plant *Gynandropsis gynandra* (L.) Brig, Veterinary Parasitology 42 (1992) 123-136.

[28] H.T. Prates, A.B. Oliveira, R.C. Leite, A.A. Craveiro, Anti-tick effect and chemical composition of the molasses grass essential oil, Pesquisa Agr Brasil 28 (1993) 621-625.

[29] E.N. Mwangi, S. Essuman, G.P. Kaaya, E. Nyandat, D. Munyinyi, M.G. Kimondo, Repellence of the tick Rhipicephalus appendiculatus by the grass Melinis minutiflora, Tropical Animal Health and Production 27 (1995) 211-216.

[30] M. Fernandez-Ruvalcaba, C. Cruz-Vazquez, J. Solanovergara, Z. Garcia-Vasquez, Anti-tick effects of Stylosanthes humilis and Stylosanthes hamata on plots experimentally infested with Boophilus microplus larvae in Morelos, Mexico, Experimental and Applied Acarology 23 (1995) 171-175.

[31] M. Fernandez-Ruvalcaba, F. Preciado-De-La Torre, C. Cruz-Vazquez, Z. Garcia-Vazquez, Anti-tick effects of Melinis minutiflora and Andropogon gayanus grasses on plots experimentally infested with Boophilus microplus larvae, Experimental and Applied Acarology 32 (2004) 293-299.

[32] E.E. Edward, D.R. Arthur, The seasonal activity of the tick, Parasitology 38 (1947) 27-33.

[33] G.O. Evans, The distribution of *Ixodes ricinus* (L.) on the body of cattle and sheep, Bull. Entomol. Res. 41 (1951) 709-723.

[34] S.E. Randolph, D.J. Rogers, A generic population model for the African tick Rhipicephalus appendiculatus, Parasitology 115 (1997) 265-279.

[35] M. L'Hostis, H. Dumon, B. Dorchies, F. Boisdron, A. Goenflot, Seasonal incidence and ecology of the tick *Ixodes ricinus* (Acari : Ixodidae) on grazing pastures in Western France, Exp. Appl. Acarol. 19 (1995) 211-220.

[36] R. De la Vega, A. Moreno, G. Diaz, Sampling method for the cattle tick (*Boophilus microplus)* in dairy cows, Revista Salud Anim, 1984.