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Original Research Article

Prevalence and Abundance of Ticks Infesting Cattle and Sheep in Poro Region (Côte d'Ivoire)

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Abstract

In order to determine ticks' prevalence and abundance on cattle and sheep in the Poro Region of Côte d'Ivoire, 809 ticks were collected from 120 cattle and 311 ticks from 120 sheep. Six species have been identified: *Amblyomma variegatum*, *Rhipicephalus* (*Boophilus*) *microplus*, *Boophilus annulatus*, *Boophilus geigyi*, *Hyalomma truncatum* and *Rhipicephalus senegalensis*. Cattle were more infested by these ticks excluding *Rhipicephalus senegalensis*, which had a higher prevalence in sheep (12.5% in sheep versus 4.17% in cattle). The species *Boophilus geigyi* was most abundant in cattle of Dikodougou department (42.96%), then in sheep of Sinématiali (60%) and M'Bengué (51.72%) departments. In addition, *Rhipicephalus senegalensis* was more abundant in sheep in Korhogo Department with a proportion of 51.39%. These results suggest that tick control needs to be strengthened to improve the productivity of domestic ruminants in the Poro Region of Côte d'Ivoire.

Keywords: Ticks, prevalence, abundance, sheep, cattle, Poro Region, Côte d'Ivoire.

INTRODUCTION

In the world, ticks are considered as the second most important diseases vectors after mosquitoes [1]. They are cosmopolitan, but are present mainly in the tropical and subtropical regions with the hot and humid climate suitable for metamorphosis [2, 3]. They can transmit zoonotic parasites that can cause a public health problem [4]. Tick-borne diseases are an important source of morbidity for domestic animals [5, 6]. Studies have shown the existence of many species of livestock ticks [7]. Strong mortalities bound to the ticks were indicated at cattle of exotic races and half-bloods in Nigeria [8], in Cameroon [9] and in Ghana [10, 11]. According to Achi *et al*., [12], the only exhaustive data on ticks in Côte d'Ivoire are those of the works of Aeschlimann [13] and Morel [14] dating from 1950 to 1970. The present study has for objective to determine prevalence and abundance of ticks on farmed cattle and sheep in the Poro Region of Côte d'Ivoire.

MATERIAL AND METHODS

Study Areas

The North of Côte d'Ivoire is composed of more than 80% of savanna formations which are the woody savanna, the raised savanna, the shrubby savanna and the grassy savanna. The climate is Sudanian with a single rainy season lasting six and a half months (mid-April to October), with a peak from July to October; a dry season with maximum influence from November to the end of March (FAO, 2005). The cattle production systems encountered in northern Côte d'Ivoire are sedentary livestock (43%) and transhumant livestock (50%) [15]. The sedentary herds include, in order of decreasing importance, the Baoulé, Zébu, N'Dama, half-blood Zébu-Baoulé and other half-bloods. The transhumant herd is essentially composed of zébus (63%) [12].

Tick Collection

Tick collection was done from November to December 2015 in four departments of Poro region: Sinématiali, Korhogo, Dikodougou and M'Bengué (Figure-1). In each department, the collect was done on 30 cattle and 30 sheep, overall on 120 cattle and 120 sheep in the study area. Height hundred and nine (809) and 311 ticks were collected respectively on cattle and sheep. Ticks were collected with a pair of tongs after a good contention of animals, preventing the hypostom from breaking. Seven anatomical regions were observed

on animals during this harvest. They are the anal region and the tail, the mammary region or of the scrotum, the stomach, the armpit, the plate of baleen, the head and the legs. Each bottle was labeled with the following: farm where sample was collected (name of the District or the region), date of harvest, ordinal number of the animal.

Tick Counting and Identification

Tick identification has been performed at the Animals Biology and Cytology Laboratory of Nangui Abrogoua University in Abidjan. The content of each bottle was poured into a kneaded box, and then the parasites were separated and counted by the ornamentation of the body, by the sex and by the physiological stage.

The species identification was completed under binocular lens at 80-fold magnification and a digital microscope (optical microscope) was used at 100-fold magnification for taking photos. This identification has focused on the morpho-anatomical characteristics of certain body parts (rostrum, punctuation of the scutum, the tint (coloring) of legs, shape of stigmas, shape of furrows(grooves), shape of festoons, shape of plates (patches) and eyes). It was possible thanks to the key of Walker *et al*., [16].

The tick species identified were organized by animal species and by department.

Data analyzing and statistical treatments

Microsoft Office Excel 2007 program was used to calculate prevalence and abundance of each tick species. Formulas used:

Ticks prevalence on animals

The formulas used to calculate prevalence of each tick species:

$$\text{Prevalence}(\%) = \frac{\text{Number of animals carrying a given tick species}}{\text{Total number of animals}} \times 100$$

Ticks abundance

The formulas used to calculate abundance of each tick species:

$$\text{Abundance}(\%) = \frac{\text{Total number of a given tick species}}{\text{Total number of ticks collected}} \times 100$$

Statistical analyzes were performed within R Version 2.12.1 software. The statistical comparisons of those prevalence and abundances respectively by animal species and by department have been done respectively by G test. The different was significant when p value was lower than 0.05 ($p< 0.05$).

RESULTS AND DISCUSSION

Ticks collected on bovines and sheep

A sample of 809 ticks was considered in Bovines. Concerning sheep, 311 ticks were collected (Table-1). All the tick species identified were present on the two animal species (bovines and sheep). Identification mainly based on morpho-anatomical characters has revealed the presence of six species of ticks from four genera *Amblyomma*, *Rhipicephalus*, *Boophilus* and *Hyalomma*. These species were *Amblyomma variegatum*, *Rhipicephalus senegalensis*, *Boophilus microplus*, *Boophilus annulatus*, *Boophilus geigyi* and *Hyalomma truncatum* (Photography 1 to 12).

These tick species had also found by Knopf *et al.*, [17] on cattle in the north of Côte d'Ivoire and by Farougou *et al.*, [6] on sheep in the meridional region of Benin. Their presence in cattle and sheep farms of Poro regions in northern Côte d'Ivoire could be explained by their adaptation to humidity and survey conditions in this area.

Furthermore, the presence of these tick species on cattle and sheep could be explained by mixed control of cattle and sheep in the breed sampled in this area. Indeed, cattle and sheep used the same pasture and yet the fight against ticks was not systematic at these two animal species. In addition, the absence of artificial pastures could favor the chronic infestation of animals.

Prevalence of the different tick species identified

In this study, the prevalence of *A. variegatum*, *B. microplus*, *B. annulatus*, *B. geigyi* and *H. truncatum* obtained on cattle were higher than ones of sheep, excluding that of *R. senegalensis* which was higher for sheep (12.5% for sheep and 4.17% for cattle). Moreover, the prevalence of the species *B. geigyi* on cattle (53.33%) was higher than ones of *A. variegatum* (48.33%) and *B. microplus* (47.50%). As far as concerning sheep, the prevalence of *B. geigyi* (38.33%) was once again higher than the one obtained for *A. variegatum* (32.50%), which also was higher than one of *B. microplus* (3.33%) (Figure-2).

Among all the ticks collected in this study, the species *B. geigyi* was the most abundant one the two animal species. It represented 53.33% of ticks collected on cattle and 38.33% of ticks collected on sheep. This species was followed by *A. variegatum* which represented 48.33% of ticks collected on cattle and 32.50% of ticks collected on sheep. However, This was not in agreement with previous study undertaken by Achi *et al.*, [12] on cattle reared in traditional farms in northern Côte d'Ivoire. According to these authors, the species *A. variegatum* was the most encountered (66 to 90% of ticks collected), followed by *Boophilus* spp (8

to 33% of ticks collected). It was the same for Farougou *et al.,* [18] and Hasen *et al.,* [19]. Hence, the results of Farougou *et al.,* [18] shown that *A. variegatum* was the most abundant tick (89.70%) on sheep in Benin meridonial region. For Hasen *et al.,* [19] in Ethiopia, *A. variegatum* was also the most present on farmed cattle (83.72%). On the other hand, for Nateneal *et al.,* [3], Kibruyesfa and Achuna [20], the proportion of this tick species was the lowest on cattle reared in Ethiopia. Indeed, these authors obtained respectively 6.5% and 3.9% of all ticks collected on cattle.

The abundance of the species *B. geigyi* in the study area could be explained by the fact that the climatic conditions of savanna which characterize the northern Côte d'Ivoire [16], are favor to this tick's development. In addition, *A. variegatum* was abundant because ticks were collected in its development period which is from October to February [16].

Abundance of different tick species on cattle and sheep according to departments

Ticks were more present on cattle in Dikodougou and Korhogo departments (Respectively 35.97% and 31.27%) than departments of Sinématiali and M'Bengué (Respectively 16.44% and 16.32%). On the other side, concerning sheep, ticks were most present only in the department of Korhogo (46.30%) (Figure-3).

Among all the ticks collected on cattle, the species *B. geigyi* and *B. microplus* was the most abundant in Dikodougou department. They represented respectively 42.96% and 36.43% of ticks' total number in this department. In the department of M'Bengué, they were also the most abundant (33.33% for *B. microplus* and 29.55% for *B. geigyi*). As far as concerning the species *A. variegatum*, it was the most abundant in korhogo and Sinématiali departments and represented respectively 48.22% and 34.59% of ticks collected on cattle.

The species *B. annulatus* was most encountered in the department of Sinématiali (24.06%) whereas the proportions of the species *H. truncatum* and *R. senegalensis* were the lowest in all departments (Table-2).

Among all the ticks collected on sheep in Sinématiali and M'Bengué, the species *B. geigyi* was the most abundant. Its proportion was 60% in Sinématiali and 51.72% in M'Bengué. On the other side, the species *R. senegalensis* was the most present on sheep of Korhogo department with a proportion of 51.39%. Concerning the Dikodougou department, *A. variegatum* was the most encountered (35.59%) on sheep (Table-3).

This abundance of ticks on farm animals in these departments is due to a loosening of the de-tagging of animals during the harvest period. In addition, the use of the same natural pasture by cattle and sheep in these different localities could be the source of infestations observed in these two animal species**.**

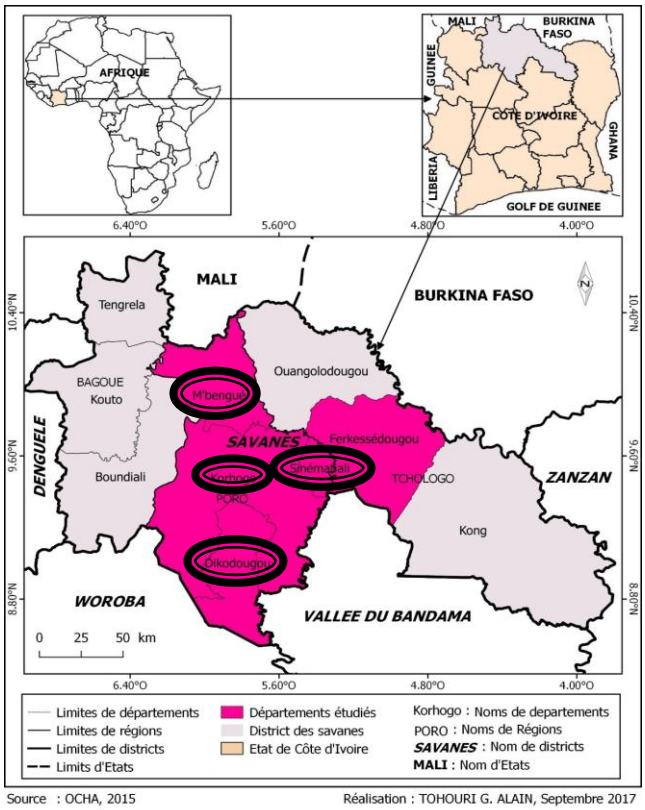
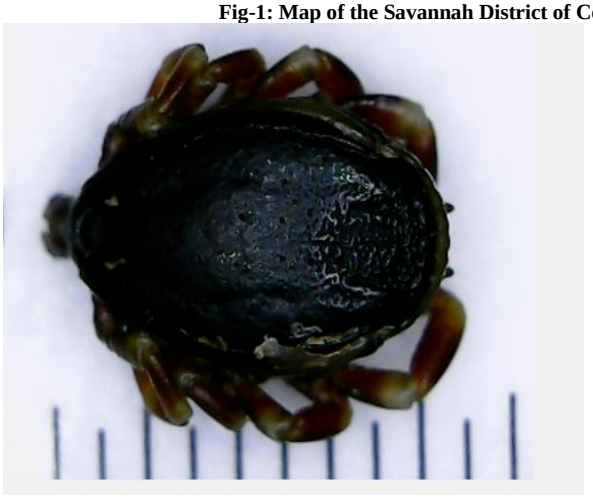


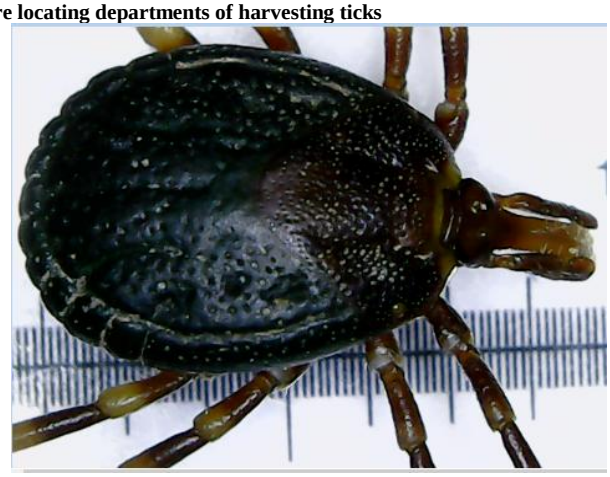
Fig-1: Map of the Savannah District of Côte d'Ivoire locating departments of harvesting ticks



Photography 1: *Hyalomma truncatum* (Male, dorsal sight)
Echelle: 1cm for 10mm

Photography 2: *Hyalomma truncatum* ((Male, ventral sight)
Echelle: 1cm for 10mm

Photography 3: *Amblyomma variegatum* (Female, ventral sight)
Echelle: 1cm for 10mm



Photography 4: *Amblyomma variegatum* (Femelle, dorsal sight)
Echelle: 1cm for 10mm

Photography 5: *Rhipicephalus (Boophilus) microplus* (Male, dorsal sight)
Echelle: 1cm for 10mm

Photography 6: *Rhipicephalus* (*Boophilus*) *microplus* (Male, ventral sight)
Echelle: 1cm for 10mm

Photography 7: *Rhipicephalus senegalensis* (Male, ventral sight)
Echelle: 1cm for 10mm

Photography 8: *Rhipicephalus senegalensis* (Femelle, ventral sight)
Echelle: 1cm for 10mm

Photography 9: *Boophilus geigyi* (Femelle, dorsal sight)
Echelle: 1cm for 10mm

Photography 10: *Boophilus geigyi* (Femelle, ventrale sight)
Echelle: 1cm for 10mm

Photography 11: *Boophilus annulatus* (Femelle, dorsale sight)
Echelle: 1cm for 10mm

Photography 12: *Boophilus annulatus* (Femelle, ventral sight)
Echelle: 1cm for 10mm

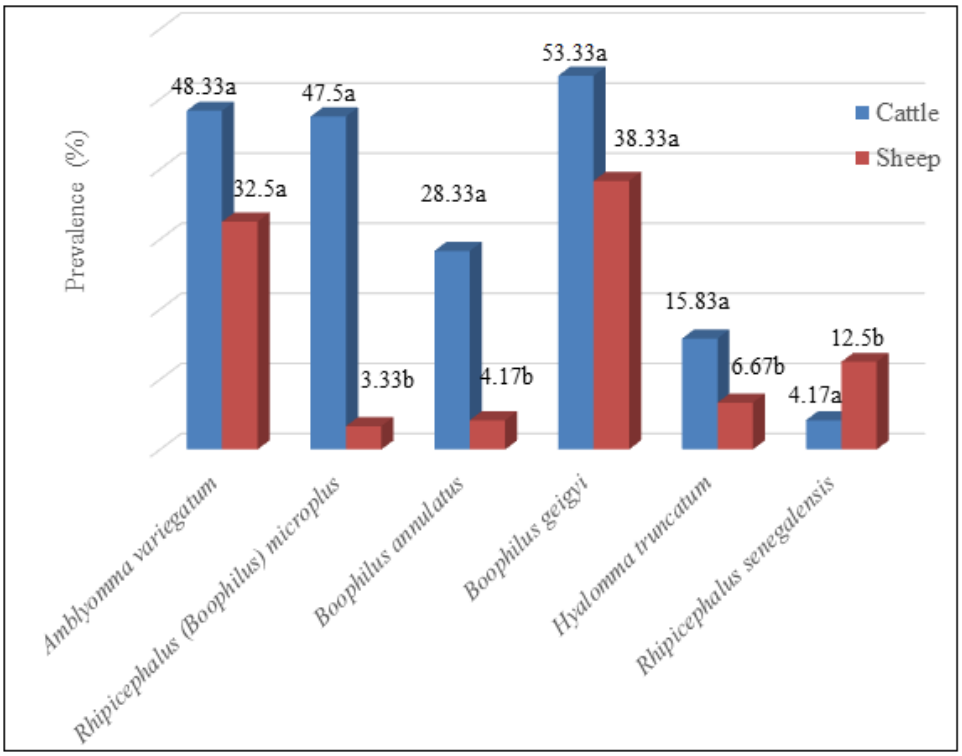


Fig-2: Comparison of prevalence of cattle and sheep tick species in the Poro Region

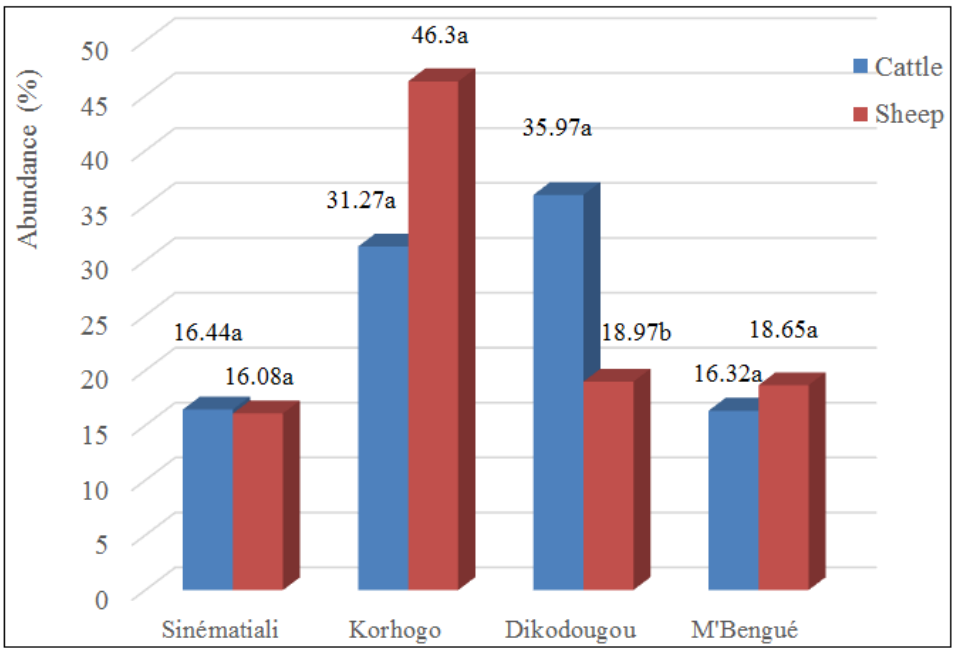


Fig-3: Comparison of tick abundances on cattle and sheep according to collection site

Table-1: Taxonomic structure of ticks collected from cattle and sheep in the Poro region

Genres	Tick species	Tick numbers on cattle	Tick numbers on sheep
Amblyomma	*Amblyomma variegatum*	208	75
Hyalomma	*Hyalomma truncatum*	40	18
Boophilus	*Boophilus annulatus*	118	11
	Boophilus geigyi	233	98
Rhipicephalus	*Rhipicephalus* (*Boophilus*) *microplus*	195	33
	Rhipicephalus senegalenis	15	76
Total		**809**	**311**

Table-2: Tick Species in Cattle by Department

Tick species	Departments				P>F
	Sinématiali	Korhogo	Dikodougou	M'Bengué	
Amblyomma variegatum	34.59[a] (46/133)	48.22[a] (122/253)	4.81[b] (14/291)	19.7[c] (26/132)	<0.0001*
R (Boophilus) microplus	14.29[a] (19/133)	10.28[a] (26/253)	36.43[b] (106/291)	33.33[b] (44/132)	<0.0001*
Boophilus annulatus	24.06 (32/133)	11.46 (29/253)	13.75 (40/291)	12.88 (17/132)	0.1180
Boophilus geigyi	19.55[a] (26/133)	17[a] (43/253)	42.96[b] (125/291)	29.55[ab] (39/132)	<0.002*
Hyalomma truncatum	7.52 (10/133)	7.51 (19/253)	2.06 (6/291)	3.79 (5/132)	0.1954
Rhipicephalus senegalensis	0 (0/133)	5.53[a] (14/253)	0 (0/291)	0.76[b] (1/132)	<0.047*

The values of the same line not bearing the same superscript letter differ significantly with the threshold from 0.05 for each parameter

* Significant

Table-3: Tick species in sheep by department

Tick species	Departments				P>F
	Sinématiali	Korhogo	Dikodougou	M'Bengué	
Amblyomma variegatum	8[a] (4/50)	16.67[a] (24/144)	35.59[b] (21/59)	44.83[b] (26/58)	<0.0001*
R (Boophilus) microplus	22[a] (11/50)	2.08[b] (3/144)	28.81[a] (17/59)	3.45[b] (2/58)	<0.0001*
Boophilus annulatus	4 (2/50)	5.56 (8/144)	1.69 (1/59)	0 (0/58)	0.297
Boophilus geigyi	60[a] (30/50)	15.97[b] (23/144)	25.42[b] (15/59)	51.72[a] (30/58)	0.0001*
Hyalomma truncatum	2 (1/50)	8.33 (12/144)	8.47 (5/59)	0 (0/58)	0.059
Rhipicephalus senegalensis	4[a] (2/50)	51.39[b] (74/144)	0 (0/59)	0 (0/58)	<0.0001*

The values of the same line not bearing the same superscript letter differ significantly with the threshold from 0.05 for each parameter

* Significant

CONCLUSION

This study highlighted that farmed cattle and sheep of Poro region in Côte d'Ivoire carry six tick species. These species are: *Amblyomma variegatum*, *R.* (*Boophilus*) *microplus*, *Boophilus annulatus*, *Boophilus geigyi*, *Hyalomma truncatum* and *Rhipicephalus senegalensis.* Bovines were generally the most infested. The species *Boophilus geigyi* was the most abundant on cattle of Dikodougou department and one sheep of Sinématiali and M'Bengué departments.

The presence of these mites on cattle and sheep represents a major constraint to the development of domestic ruminant breeding in Côte d'Ivoire. Tick control measures through regular cattle and sheep removal in the same locality as well as a better pasture management are needed in order to reduce parasitic loads and to improve livestock production.

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