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Diversity of ectoparasites in racing pigs in the Poro region (northern Côte d'Ivoire)

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ABSTRACT

Objectives: In order to list the different ectoparasites present in racing pigs in the Poro region, an entomological survey was conducted on 570 pigs from traditional farms in the departments of Sinematiali, Korhogo and Dikodougou.

Methodology and results: This study was carried out from July 2021 to September 2021 and consisted of searching for and collecting ectoparasites from the pigs selected for this survey and then proceeding to identify them based on the systematic key. According to the results obtained, 467 of the 570 pigs examined were infested by ectoparasites, for an overall prevalence of 81.93%. In the department of Dikodougou, the prevalence of infested pigs was 90.69% (n= 195/215) compared to 78.26% (n=180/230) and 73.60% (n=92/125) for the departments of Sinématiali and Korhogo respectively. In total, 1704 ectoparasites were collected from these 467 infested pigs. The diagnosis of the collected specimens revealed the existence of 9 taxa, one of which belongs to the insect class and 8 species belonging to the arachnid class. *Haematopinus suis*. was the predominant ectoparasite in this study with a prevalence of 80.08% in the entire Poro region. In terms of mites, the taxa encountered were essentially from two families: the Amblyommidae and Sarcoptidae. The Sarcoptidae family consisted of a single species *Sarcoptes scabiei suis* with a prevalence of 07.71%, while in the Amblyommidae family, 7 species of ticks were identified: *A. variegatum* (05.78%), *R (B). geigyi* (03.85%), *H. truncatum* (01.28%). The species *H. rufipes*, *R. senegalensis*, and *B. decoloratus* were poorly represented with the same frequency (00.21%).

Conclusion and application of results: The majority of racing pigs from traditional farms in the Poro region are infested by ectoparasites due to a lack of care and training among farmers. This massive infestation can lead to losses in meat and milk production due to blood spoliation. They can also be dangerous as vectors of serious pathogens.

Ectoparasites identification and knowledge of the methods used by farmers to control them are important factors in improving pig production.

Keywords: ectoparasites, mites, insects, pigs, prevalence.

RÉSUMÉ

Objectifs : Dans l'optique de répertorier les différents ectoparasites présents chez les porcs dans la région du Poro, une enquête entomologique a été réalisée sur 570 porcs issus des élevages traditionnels des départements de Sinématiali, Korhogo et Dikodougou.

Méthodologie et résultats : Cette étude a été réalisée de Juillet 2021 à Septembre 2021 et a consisté à rechercher et à prélever des ectoparasites sur les animaux retenus pour cette enquête puis à procéder à leur identification sur la base de la clé systématique. . Selon les résultats obtenus, 467 porcs sur les 570 porcs examinés, étaient infestés par des ectoparasites soit une prévalence globale de 81,93 %. Dans le département de Dikodougou, la prévalence de porcs infestés était de 90,69 % (n= 195/215) contre 78,26 % (n=180/230) et 73,60 % (n=92/125) respectivement pour les départements de Sinématiali et de Korhogo. Au total, 1704 ectoparasites ont été collectés sur ces 467 porcs infestés. La diagnose des spécimens collectés a révélé l'existence de 9 taxons dont un appartient à la classe des insectes et 8 espèces appartenant à la classe des arachnides. L'insecte, *Haematopinus suis* a été l'ectoparasite qui prédominait dans cette étude avec une prévalence de 80,08 % dans toute la région du Poro. Au niveau des acariens, les taxons rencontrés sont essentiellement issus de deux familles : la famille des Amblyommidae et celle des Sarcoptidae. La famille des Sarcoptidae était constituée d'une seule espèce *Sarcoptes scabiei suis* avec une prévalence de 07,71 %, par contre au niveau de la famille des Amblyommidae, 7 espèces de tiques ont été identifiées : *A. variegatum* (05,78 %), *R (B). geigyi* (03,85 %), *H. truncatum* (01,28 %). Les espèces *H. rufipes*, *R. senegalensis*, et *B. decoloratus* étaient faiblement représentées avec la même fréquence (00,21 %).

Conclusion et application des résultats : Les porcs issus des élevages traditionnels de la région du Poro sont en majorité infestés par les ectoparasites du fait du manque de soins et de formation chez les éleveurs. Cette infestation massive peut entrainer des pertes en production de viande et de lait en raison de la spoliation sanguine. Ils peuvent être également dangereux par leur rôle de vecteur d'agents pathogènes graves. La détermination des ectoparasites et la connaissance des méthodes de lutte pratiquées par les éleveurs contre les ectoparasites constituent d'importantes données pour envisager une amélioration de la production porcine.

Mots clés : ectoparasites ; acariens ; insectes ; porcs, prevalence.

INTRODUCTION

Poverty reduction in Africa cannot be achieved without taking account of income-generating activities, including those of small-scale livestock farmers. Among these activities is pig farming, which is an important activity for the survival of people in the rural areas of many countries. The pig has enormous potentials, with a short reproductive cycle, a larger litter, the ability to transform agricultural products and by-products into better quality meat, and good adaptation to different ecosystems. It is firmly positioned as an animal of choice, providing additional incomes for almost all socio-professional strata of the African population (Mopate *et al*., 2011). As a result, it may be well suited to the fight against poverty in Africa. In Côte d'Ivoire, the growth of the pork industry is considered one of the central axes of the poverty reduction strategy. Because of its potential, this livestock species has always been used to significantly and sustainably improve the coverage of national demand for animal proteins (FIRCA, 2019**).** It is for this reason that, since the 1970s, the State has considered this sector in national livestock development policies in Côte d'Ivoire. State action in this sector led to a significant increase in pig production in Côte d'Ivoire between 1974 and 1996 (the SODEPRA year). Unfortunately, in 1996, the country was hit by its first African swine fever (ASF) epidemic. This highly contagious and fatal or deadly disease, together with the socio-political crisis that struck the country from 2002 to 2011, severely hampered the development of this important Ivorian livestock sector (Johan *et al*., 2011). Despite these losses, the pork industry, thanks to the dynamism of its stakeholders, has begun to recover with the creation in 2011 of INTERPORCI (Inter Profession Porcine de Côte d'Ivoire**)** under the impetus of the Ministry of Animals and Fisheries Resources (FIRCA, 2019). In the north of Côte d'Ivoire, the department of Korhogo has an important reputation for the production and consumption of pork (Brou *et al*., 2020). In this area, traditional pig farming is widespread and involves many small rural farmers. The majority of pig farmers are men (72%), compared with 28% of women (Koffi, 2018). Given the socio-economic importance of this activity, certain projects such as PRODEMIR and PROFIAB-Nord have decided to provide support to these producers. Despite this support, the sector faced a number of constraints, including the persistence of diseases, particularly those caused by ectoparasites, the impact of which has not been fully assessed. These ectoparasites, even if they are not the direct cause of mortality, give rise to sub-clinical parasitism that can have an impact on animal production and productivity (Tassou, 2009). Up to now, to our knowledge, there is currently no data on the ectoparasites found on traditional pig farms in Côte d'Ivoire, particularly in Korhogo. This study fills this gap and therefore aims at contributing to a better understanding of ectoparasites in pigs reared in the north of Côte d'Ivoire. Specifically, the aim is to compile an inventory of ectoparasite species in pigs reared on traditional farms in the Poro region, and to assess their abundance and even distribution.

MATERIALS AND METHODS

Study site: This study was conducted in the north of Côte d'Ivoire, more specifically in the Poro region. The region has four (04) departments: Korhogo, Sinématiali, Dikodougou and M'Bengué. This study covered three departments: Sinématiali, Korhogo and Dikodougou. The Poro region is headed by Korhogo commune. It covers a total

area of 13,400 square kilometres and is bordered to the north by Mali republic, in the south by the Béré region, in the east by the Tchologo and Hambol regions and in the west by the Bagoué region. Like all the regions of Côte d'Ivoire, agriculture is the bedrock of the Poro region economy. The region's tropical climate is conducive to a variety of crops, as well as pig, cattle and sheep farming **(Figure 1).**

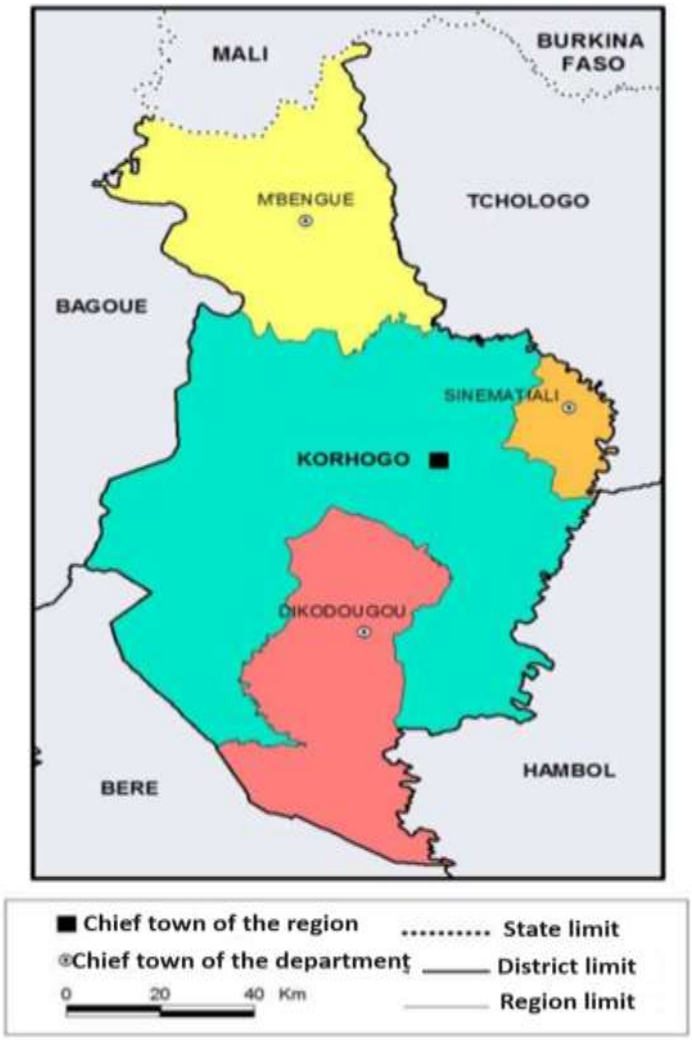


Figure 1: Poro region (RGPH, 2014)

METHODOLOGY

Sampling: Pigs investigated in this study were selected according to the protocol described below

Choice of villages: In the 4 departments of the Poro region (Dikodougou, Korhogo, M'bengué and Sinématiali), 3 departments were chosen by drawing lots. Similarly, in each of the departments selected, 3 sub-prefectures were also chosen in the same way. However, in each of the sub-prefectures selected, three villages

each with at least 32 pigs were chosen. In all, a sample of 18 villages was selected. The choice of villages was made possible thanks to the representatives of pig farmers (focal points) whose contacts were provided by the head of the northern branch of the Projet d'Appui au Développement de l'Elevage en Côte d'Ivoire (PADE-CI).

Choice of farms: The farms were selected after discussions with the farmers in the presence of the focal point of the area under investigation. These discussions focused on the health monitoring of the farms and the importance of the study. At the end of these discussions, an average of 4 farms were selected at random based on farmers who were willing to allow access to their farms.

Choice of animals: In each selected farm, sampling was carried out randomly on 8 pigs. However, suckling piglets (between 0 and 2 months), lactating sows and pregnant sows were excluded from the study, due to the aggressiveness of lactating mothers and the fragile health of pregnant sows. Based on an average of 32 pigs per village, the expected total number of pigs is 576.

Collecting ectoparasites: The technique involved external examination of the entire body of pigs restrained in lateral recumbency. On each animal, the hairs on the various parts of the body were brushed back to reveal macroscopically visible ectoparasites and their lesions. This approach also facilitated the sampling of these parasites using forceps or the skin lesions of the wasp. The number of samples taken from each animal varied according to the abundance of ectoparasites or their lesions. The ectoparasites were then immersed in labelled vials containing a 70% ethanol preservative. Each vial contained ectoparasites collected from animals from the same farm, and the label indicated the sampling locality, the date and the serial number of the sample.

Identification of ectoparasites: The ectoparasites were identified using a digital microscope connected to a computer. Identification was based on the morpho-anatomical characteristics described by Soulsby (1968); Franc (1994 a and b); Chartier *et al* (2000) and Pajot (2000) in objective 10. The ectoparasites were then counted and recorded by locality.

Interview with farmers: The survey procedure consisted of interviews during which guided discussions were held based on a structured questionnaire.

Data processing: The data were collected using Excel software version 2007. This software was used to carry out descriptive statistical analyses (frequency, prevalence and diversity indices) and to calculate the infestation rate (%), i.e. the ratio of infested animals to the total examined. The infestation rates obtained according to parasite species and location were compared using the X^2 test in XLSTAT 2015 software. The significance threshold for this study was 5%. Thus, when the P Value < 0.05, the differences observed were said to be significant.

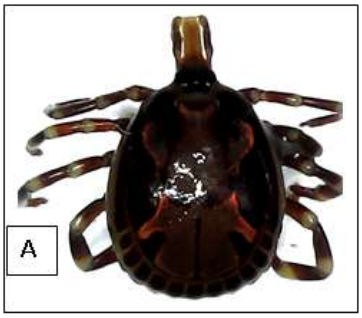
RESULTS

Identification of collected ectoparasites: A total of 1704 ectoparasites were collected from pigs during the field phase. Identification based on morpho-anatomical characteristics revealed the presence of nine species of ectoparasites grouped into two classes, insects and arachnids. *Haematopinus suis*, belonging to the Heamatopinidae family, was the only species observed in the insects' class. The arachnid class comprised eight species, including seven tick species belonging to the Amblyommidae family and one scabies agent, *Sarcoptes scabiei var suis* belonging to the Sarcoptidae family. This species was evaluated based on the lesions it caused in pigs and based on clinical signs. *S. scabiei* cannot be seen with the naked eye. Observation of the scabs taken from the pigs yielded no results. The tick

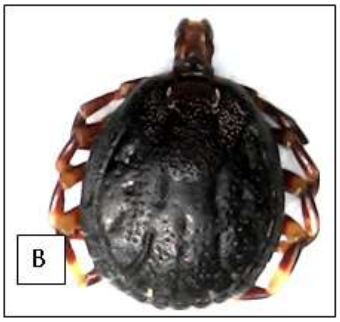
species recorded were *Amblyomma variegatum, Hyalomma marginatum, Hyalomma rufipes, Hyalomma truncatum, Boophilus decoloratus, Boophilus geigyi* and *Rhipicephalus senegalensis* (Plate 1 and 2).

Haematopinus suis (male ventral view)

Haematopinus suis (female ventral view)

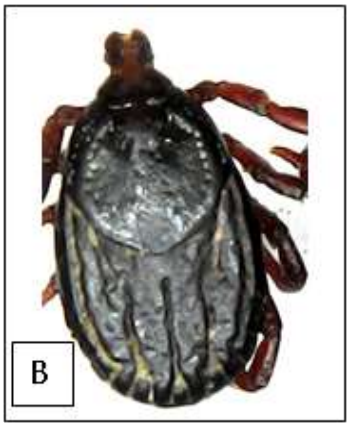


Amblyomma variegatum (male dorsal view)



Amblyomma variegatum (female dorsal view)

Hyalomma rufipes (male dorsal view)



Hyalomma rufipes (female dorsal view)

Plate 1: Species of ectoparasites in racing pigs in the Poro region

Hyalomma truncatum (male dorsal view)

Hyalomma marginatum *(female dorsal view)*

Rhipicephalus senegalensis (male dorsal view)

Boophilus decoloratus (female dorsal view)

Rhipicephalus (Boophilus) geigyi (female dorsal view)

Plate 2: Species of ectoparasites in racing pigs in the Poro region

Overall prevalence of infestations in the Poro region: Among the 570 pigs examined all over the Poro region, the overall prevalence of infestation by ectoparasites was 82% (n= 467/570) (Figure 2). Analysis of the samples revealed that the department of Dikodougou was more infested with a prevalence of 91% (n= 195/215) than the departments of Sinématiali 78% (n=180/230) and Korhogo 74% (n= 92/125) (Figure 3).

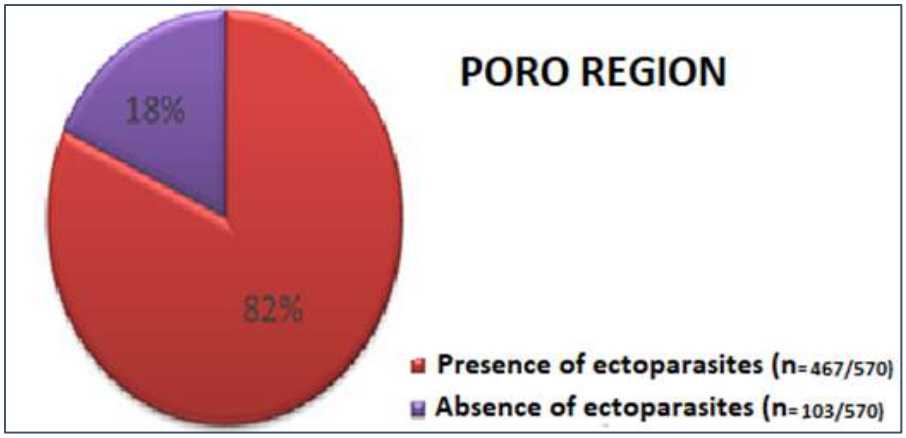


Figure 2: Overall prevalence of infestations in the Poro region

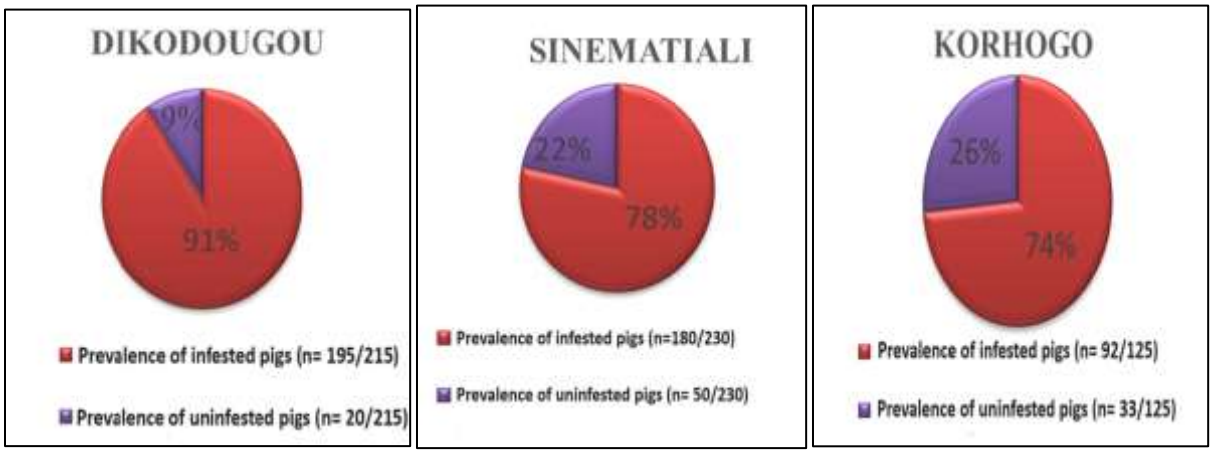


Figure 3: Prevalence of infested pigs by department

Frequency of ectoparasite species collected in the Poro region: Among the 467 pigs infested, the *Haematopinus suis* species was present in the majority of pigs in 80.08% of cases of infestation throughout the Poro region, followed by *S. scabiei* (07.71%), *A. variegatum* (05.78%) and *B. geigyi* (03.85%). The tick species *H. truncatum*, *H. rufipes*, *R. senegalensis* and *B. decoloratus* were poorly represented (Figure 4).The frequencies of ectoparasites by department are shown in Table 1.

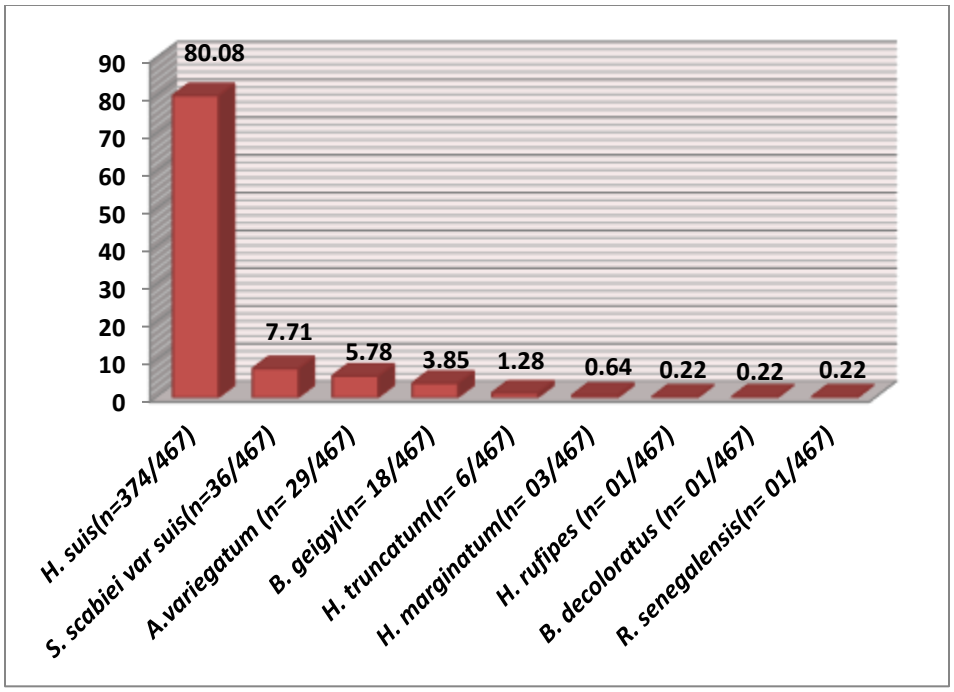


Figure 4: Frequency of ectoparasite species collected in the Poro region

Table1: Comparison of the distribution of ectoparasites by department

SPECIES	FREQUENCIES			P-value
	Korhogo	**Sinématiali**	**Dikodougou**	
H. suis	(62/92) 67.39[a]	(143/180) 79.44[b]	(169/195) 86.67[b]	< ***0.004 ******
A. variegatum	(05/92) 05.44	(13/180) 07.22	(09/195) 04.62	0.722
H. truncatum	(02/92) 02.17	(01/180) 0.55	(03/195) 01.54	0.621
H. rufipes	(00/92) 00.00	(00/180) 00.00	(01/195) 00.51	0.600
H. marginatum	(00/92) 00.00	(02/180) 1.12	(01/195) 00.51	0.559
R. senegalensis	(00/92) 00.00	(00/180) 00.00	(01/195) 0.51	0.600
R. (B) geigyi	(03/92) 03.26	(09/180) 05	(06/195) 03.08	0.734
R. (B) decoloratus	(00/92) 00.00	(01/ 180) 0.55	(00/195) 00.00	0.576
S. scabiei	(20/92) 21.7[a]	(11/180) 06.12[b]	(05/195) 02.56[b]	< ***0.0001****

*Values on the same line not bearing the same letter differ significantly at the 5% threshold for each parameter. * Significant*

Abundance of ectoparasite species in the different departments: The species *Haematopinus suis* were the most abundant in Dikodougou, Sinématiali and Korhogo (91.43%, 88.89% and 87.18% respectively), (Tables3 to 5. followed by *Amblyomma variegatum* (05.08%, 8.86% and 11%). However, the other tick species were poorly represented in these departments

Table 2: Abundance of ectoparasites in the Poro region

Species	Number of parasites	Abundance (%) Khi²	P-value
Haematopinus suis	1526[a]	89.55[a]	
Amblyoma variegatum	133[b]	7.81[b]	
Hyalomma rufipes	8[c]	0.47[c]	
Hyalomma truncatum	6[c]	0.35[c]	
Hyalomma marginatum	5[c]	[illegible]	
R. (Boophilus) geigyi	23[d]	[illegible]	
R. (Boophilus) decoloratus	1[e]	0.06[e]	
Rhipicephalus senegalensis	2[e]	0.12[e]	
Total	1704	100	

Values in the same column that do not have the same letter differ significantly at the 5% threshold for each parameter.

Table 3: Abundance of ectoparasites in the department of Sinématiali

Species	Number of ectoparasites sampled	Abundance (%)	Khi²	P-value
Haematopinus suis	712[a]	88.89[a]		
Amblyoma variegatum	71[b]	8.86[b]		
Hyalomma rufipes	0[c]	0.00[c]	45.337	<0.0001
Hyalomma truncatum	1[c]	0.10[c]	36.212	< 0.0001
Hyalomma marginatum	2[c]	0.20[c]		
R.(Boophilus) geigyi	14[d]	1.76[d]		
R.(Boophilus) decoloratus	1[c]	0.10[c]		
Rhipicephalus senegalensis	0[c]	0.00[c]		
Total	801	100		

Values in the same column that do not have the same letter differ significantly at the 5% threshold for each parameter

Table 4: Abundance of ectoparasites species in Korhogo

Species	Number of ectoparasites sampled	Abundance (%)	Khi²	P-value
Haematopinus suis	238[a]	87,18[a]		
Amblyoma variegatum	30[b]	11[b]		
Hyalomma rufipes	1[c]	0,37[c]	38,058	
Hyalomma truncatum	2[c]	0,73[c]		< 0,0001
Hyalomma marginatum	0[c]	0,00[c]		
R. (Boophilus) geigyi	2[c]	0,73[c]		
R.(Boophilus) decoloratus	0[c]	0,00[c]		
Rhipicephalus senegalensis	0[c]	0,00[c]		
Total	273	100		

Values in the same column that do not have the same letter differ significantly at the 5% threshold for each parameter.

Table 5: Abundance ectoparasites species in Dikodougou

Species	**Number of ectoparasites sampled**	**Abundance (%)**	**Khi²**	**P-value**
Haematopinus suis	576[a]	91,43[a]		
Amblyoma variegatum	32[b]	5,08[b]		
Hyalomma rufipes	7[c]	1,11[c]		
Hyalomma marginatum	3[d]	0,48[d]	652,564	< ***0,0001***
R. (Boophilus) geigyi	7[c]	1,11[c]		
R. (Boophilus) decoloratus	0[d]	0[d]		
Rhipicephalus senegalensis	2[d]	0,32[d]		
Total	630	100		

Values in the same column that do not have the same letter differ significantly at the 5% threshold for each parameter

Diversity indices: For the three departments studied, the diversity index trends were identical. There is no significant difference (P >0.05) between the species observed. The same species were practically represented in the three departments.

Tableau 6: Diversity indices

Indices	DEPARTMENTS			
	Sinématiali	Korhogo	Dikodougou	P-value
Shannon (H')	0,18	0,198	0,175	0,999
Simpson (D)	0,2019	0,2286	0,1615	0,993
Equirépartition (E)	0,214	0,254	0,194	0,995
Diversité spécifique (S)	7	6	8	0 0,922

DISCUSSION

The results of this study revealed that in the Poro region, the rate of infestation of pigs from traditional farms by ectoparasites was high (82%). This result is much higher than those observed by Zinsou (2008) in Benin (40.75%) and by Hantaniaina (2020) in Madagascar, who reported a prevalence of 31.3%. The difference between our results and those obtained by these authors could be explained by the difference in study area and season. According to a study conducted by Abdou in 2009 in Benin, the parasitism rate differs from wet to dry months. The prevalence of infestation due to insects (80.08%) was significantly higher than that due to mites (19.92%). In this class of insects, *Haematopinus suis* (louse) was the only species represented. For the three departments in which the study was carried out, the trends for the calculated indices were identical. The same species were practically represented in the three departments. However, the values of the Piélou equitability index or equi-partition (E) at Sinématiali (0.214), Korhogo (0.254) and Dikodougou (0.194) tended towards zero. This would indicate an imbalance in which a single species dominated the entire population in these three departments. This was *Haematopinus suis* (insects) in 80.08% of cases compared with 19.92% for mites. These results corroborate those of Emmanuel et al (2007) in Tanzania, who stated that infestation by *Haematopinus suis* (63%) was higher than infestation rates by other ectoparasites. Hantaniaina (2020) in Madagascar also stated that infestation by *Haematopinus suis* (66.7%) predominated in his study too. This high rate of infestation by *Haematopinus Sui* is thought

to be because this species carries out its entire life cycle on its host. It could also be explained by the fact that the savannah climatic conditions that characterise northern Côte d'Ivoire are favourable to the development of this louse. Two families of mites have been observed. These are the Sarcoptidae, represented by a single species, *Sarcoptes scabiei* (07.71%), and the Amblyommidae family (ticks), of which seven species were collected. These were *A. variegatum* (05.78%), *B. geigyi* (03.85%), *H. truncatum* (1.28%), *H. marginatum* (0.64%), *H. rufipes* (0.22%), *R. senegalensis* (0.22%) and *B. decoloratus* (0.22%). These same tick species were found on cattle and sheep by Abdou (2009) in Benin and by Knopf *et al* (2002) on cattle in northern Côte d'Ivoire. The presence of these ectoparasites in this study area is thought to be due to their adaptation to climatic conditions. The presence of these same tick species on cattle, sheep and pigs in the wild could be explained by the fact that they share the same pastures. However, the low rate of infestation of pigs by ticks could be explained by the fact that these ticks carry out only part of their life cycle on their host. Some ticks also have preference hosts, which can vary from one developmental stage to another within the same species (Morel P.C., 2003).

CONCLUSION AND APPLICATION OF RESULTS

This study identified nine species of ectoparasites in pigs in the Poro region. These species are: *Haematopinus suis* (louse), *Sarcoptes scabiei var suis* (scabies) and ticks: *Amblyomma variegatum, Hyalomma marginatum, Hyalomma rufipes, Hyalomma truncatum, Boophilus decoloratus, Boophilus geigyi* and *Rhipicephalus senegalensis*. *Haematopinus suis* was the most abundant species on roaming pigs in the Poro region, followed by *Sarcoptes scabiei* and *Amblyomma variegatum*. The majority of pigs roaming in the Poro region are infested by ectoparasites. Mass infestation of pigs by ectoparasites can lead to losses in meat and milk production due to blood spoliation. They can also be dangerous as vectors of serious pathogens. An inventory of ectoparasites in pigs provides important data for improving pig production.

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