



Occurrence of *Babesia* spp in bovine breeding in Poro area (Côte d'Ivoire)

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Article published on March 28, 2017

Key words: *Babesia*, Prevalence, Bovine, Poro area, Côte d'Ivoire

Abstract

Babesia spp is an emergent pathogenic which constitute a major constraint in bovine breedings in Côte d'Ivoire. Little information on *Babesia* exists in Poro area. A study was carried out on 120 bovine blood samples, with an aim to evaluate *Babesia* prevalence. Microscopic technique was used to determine prevalence of *Babesia* (19.17%). Hematocrit values varied from $20 \pm 0.00\%$ to $41.44 \pm 7.47\%$. *Babesia* was observed in male calves (27.27%), female calves (12%), heifer (25%) and cows (24.49%). Bovines from department of Korhogo were the most infected (30%). The prevalences were 26.67%; 16.67% and 3.33% respectively for departments of Sinematiali, Dikodougou and M'Bengue. Two *Babesia* species: which are *Babesia bovis* and *Babesia bigemina* were met. *Babesia bovis* was the most encountered on bovines of Sinematiali and Korhogo departments (13.33%), while, *Babesia bigemina* was the most present on ones of Sinematiali department (26.67%). In addition, mixed infections were observed in bovines breeding of Sinematiali and Korhogo (6.67%). These results suggest that, measures should be taken against *Babesia* infections, must be reinforced to improve the productivity of the bovines in Poro area of Côte d'Ivoire.

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Introduction

Babesia is responsible for morbidity, abortions, weight falls and fall of production dairy. This pathogenic agent is an emergent zoonotic agent known universally and transmitted by ticks (Maria *et al.*, 2016). Babesiosis is mainly caused by *Babesia bovis* and *Babesia bigemina* (Mc Cosker, 1981). The disease is characterized in the world by a significant morbidity and mortality (Mohamad *et al.*, 2011). The related economic loss for breeder is significant (Moses *et al.*, 2013). Symptoms include anaemia, fever and blood in the urine (Martins *et al.*, 2008). *Rhipicephalus (Boophilus) microplus* is the main vector of *B. bovis* and *B. bigemina*. This tick is present in tropical and subtropical countries (Friedhoff, 1988). It was identified for the first time in 2007 in Côte d'Ivoire (Madder *et al.*, 2011), then in Benin (De Clercq *et al.*, 2012) and more recently in Burkina Faso, Mali and Togo (Adakal *et al.*, 2013). In South Africa, the diseases responsible of almost 18% of all the mortalities caused by tickborn pathogens (De Waal, 2000).

These pathogens have a considerable negative economic impact in Africa where the population depends on the livestock products (Perry and Sones, 2007). It is important to assess *Babesia bovis* and *Babesia bigemina* infection on cattle breeding in the Poro area (Côte d'Ivoire). This area is the most favorable for the development of livestock (Tangui, 2008). There exists very little epidemiologic data on *Babesia* spp. It thus appears necessary to study the epidemiologic situation of *Babesia* spp in bovine breedings of Sinematiali, Korhogo, Dikodougou and M'Bengue departments in the Poro area. The aim set by this study is to determine the prevalence of *Babesia* spp on bovines of the Poro area departments.

Materials and methods

Study environment

The study has been carried out on 120 bovines from four departments of Poro area, in Côte d'Ivoire: Sinematiali, Korhogo, M'Bengue and Dikodougou (Fig. 1).

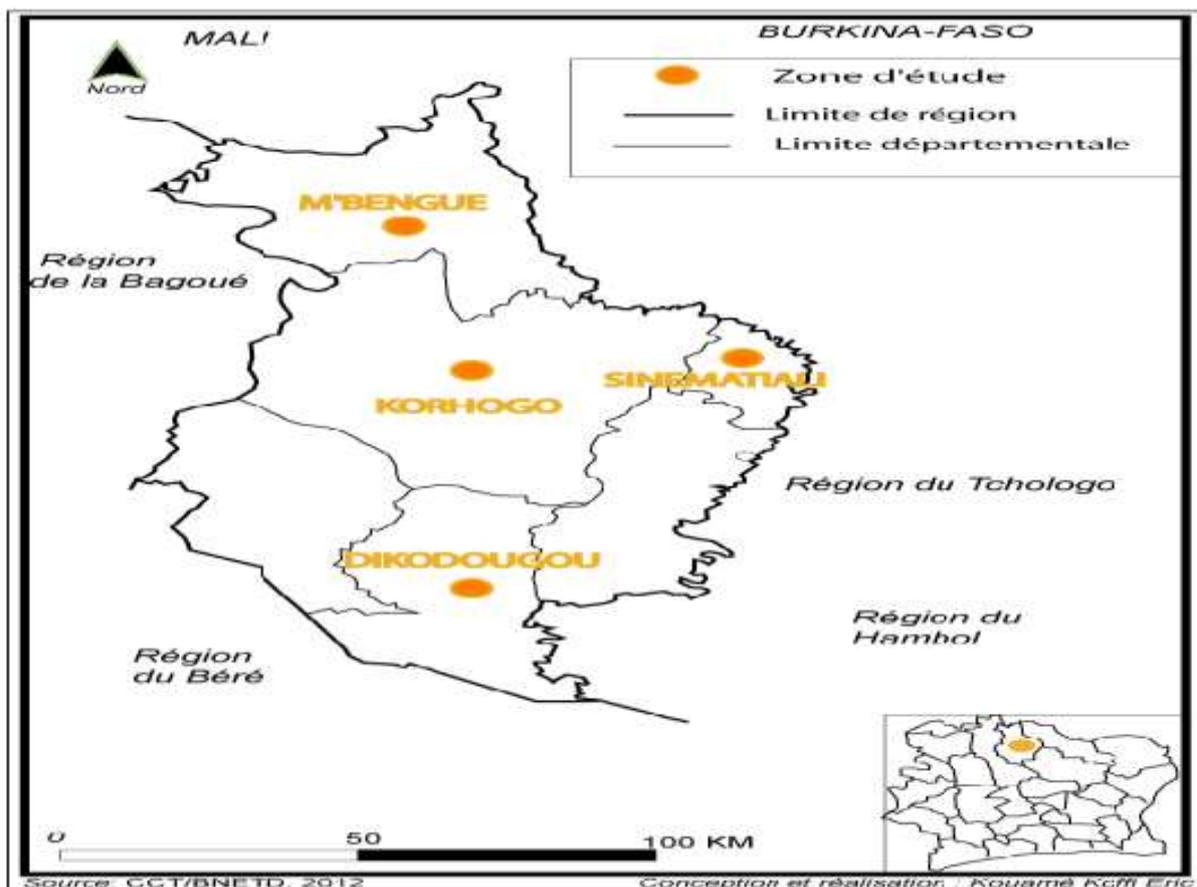


Fig. 1. Area of Poro within the study departments.

This area was chosen because of its strong density in bovine breeding.

Blood collection and examination

Blood samples were collected from the auricular veins of 30 bovines of each department: Sinematiali, Korhogo, M'Bengue and Dikodougou. Indeed, 120 bovines were sampled, particularly 11 male calves, 25 female calves, 20 heifers, 49 cows, 2 bulls and 13 bull-calves (Table 1). Blood smears were prepared from each sample and protected from dust, sun and flies. At the Parasitology department of the Regional Laboratory of Korhogo, the smears were fixed in methanol 95% for 3 to 5 minutes and then dried for about one hour and stained within Giemsa 1/10 for 20 to 30 minutes. After the step of staining the blood smear were dried for at least one hour before examined under high power (100 X) of the optic microscope. At least twenty microscopic fields of each slide were examined for search of blood parasites.

Blood sampling and determining hematocrit values

Blood samples (3-5 ml) were collected from the jugular veins of the bovines in EDTA containing vacutainers and transported to the Regional Laboratory of Korhogo, department of Parasitology. The hematocrit tubes were filled directly by capillarity and centrifuged at 12000 rpm for 3 minutes.

The values obtained were divided into two groups as described by Farougou *et al.*, (2012): hematocrit below 20% and anaemic animal hematocrit greater or equal to 25%: non-anaemic animal.

Data analysis

The prevalences were calculated as follows:

$$\text{Prevalence (\%)} = \frac{\text{Number of positive blood smears}}{\text{Total number of smears examined}} \times 100$$

Statistical analyzes were performed within R Version 3.2.1. The proportions of the various studied parameters were subjected to a Chi₂ (χ₂) test to evaluate their significant level. The different was significant when p value was lower than 0.05 (p < 0.05).

Results and discussion

Hematocrit and prevalence of Babesia according to the sampled site

Babesia was met in bovines in four departments. Its global prevalence in Poro area was 19.17%. The department of Korhogo was the most infected. The prevalence in this department was 30%. This value was significantly different from ones of the departments of Sinematiali (26.67%), Dikodougou (16.67%) and M'Bengue (3.33%) (p < 0.05).

Table 1. Distribution of bovines sampled according to the age and the sex in the departments studied.

| Departments | Male calves | Female calves | Heifers | Cows | Bull-calves | Bulls | Total |
|-------------|-------------|---------------|---------|------|-------------|-------|-------|
| Sinematiali | 5 | 7 | 10 | 6 | 2 | 0 | 30 |
| Korhogo | 3 | 4 | 3 | 15 | 5 | 0 | 30 |
| Dikodougou | 1 | 0 | 3 | 21 | 3 | 2 | 30 |
| M'Bengue | 2 | 14 | 4 | 7 | 3 | 0 | 30 |
| Total | 11 | 25 | 20 | 49 | 13 | 2 | 120 |

The difference between prevalences obtained in these three departments was significant (p < 0.05). The average hematocrit values were ranged from 32.60 ± 10.38% to 41.44 ± 7.47% excepted for that obtained in the department of M'Bengue 20 ± 0.00%. The analysis of these values made it possible to note that the bovines presented a good hematocrit (above 25%) in the departments of Korhogo, Sinematiali and Dikodougou.

In addition, in the department of M'Bengue, the value of the hematocrit was lower than 25% (Table 2).

The presence of *Babesia* in bovine farms could be explained by the presence of the tick species *Rhipicephalus (Boophilus) microplus* in the Poro area. Knopf *et al.*, (2002) and Achi *et al.*, (2012) had successively met this tick species in bovine breeding in the North of Côte d'Ivoire.

These results obtained are similar to those of Chaudhry *et al.*, (2010). Indeed, these authors obtained from microscopic observations a prevalence of 18% for *Babesia* at experimental crossbred bovines of the Qadirabad station.

However, Kirupanathan *et al.*, (2016), in a study led in the localities of Sri Lanka, obtained 14 positive samples for *Babesia* on a total of 30 samples collected with the microscopic examination.

Table 2. Average hematocrit values and prevalence of *Babesia* throughout all the bovine breedings sampled.

| Departments | Number of samples | Average hematocrit (%) | Babesia | |
|-------------|-------------------|------------------------|-----------------|---------------------|
| | | | Number of cases | Prevalence (%) |
| Sinematiali | 30 | 39.50 ± 8.26 | 8 | 26.67 ^a |
| Korhogo | 30 | 41.44 ± 7.47 | 9 | 30 ^{ab} |
| Dikodougou | 30 | 32.60 ± 10.38 | 5 | 16.67 ^{ab} |
| M'Bengue | 30 | 20 ± 0.00 | 1 | 3.33 ^b |
| Total | 120 | 37.91 ± 9.41 | 23 | 19.17 |

Prevalences in the same column, which bear the same letter, are not statistically different from the 5% threshold.

The prevalence obtained by those authors (46.67%) was higher than that obtained in the present study (19.17%). Moreover, the bovines presented a good average hematocrit (above 25%). A hematocrit value lower than 25% is an indicating sign of anaemia and thus of disease in bovines (Farougou *et al.*, 2012).

The departments of Korhogo and Sinematiali were highly infected by *Babesia*. The control breeding could be at the origin of the strong presence of *Babesia* in the study area. Indeed, bovines and sheep of the visited breeding divided the same pasture and yet the fight against the ticks was not systematic at these two animal species.

Table 3. Average hematocrit values and prevalence of *Babesia* in the calves according to the departments.

| Departments | Male calves | | Female calves | |
|-------------|------------------------|--------------------------|------------------------|----------------|
| | Average hematocrit (%) | Prevalence (%) | Average hematocrit (%) | Prevalence (%) |
| Sinématiali | 37.50 ± 3.54 | 40 ^a (2/5) | - | 0 (0/7) |
| Korhogo | 37 ± 0.00 | 33.33 ^a (1/3) | 38.33 ± 11.93 | 75 (3/4) |
| Dikodougou | - | 0 (0/1) | - | - |
| M'Bengué | - | 0 (0/2) | - | 0 (0/14) |
| Total | - | 27.27 (3/11) | - | 12 (3/25) |

Prevalences in the same column, which bear the same letter, are not statistically different from the 5% threshold.

The sheep whose breeding constitutes an ancillary activity for the stockbreeders do not undergo treatment against the ticks and constitutes a chronic tank. Moreover, these departments constitute a corridor of transhumance of bovines from Mali and Burkina Faso and, most-favored infestation of local livestock.

Hematocrit and prevalence variations according to age and sex

In terms of bovine age and sex, all the categories of bovines were infected by *Babesia* excepted bulls and young bulls.

Babesia was found in male calves in the Poro area and the total prevalence in these animals was 27.27%. The infected calves were from departments of Sinematiali (40%) and Korhogo (33.33%). However, there was no significant difference (p = 0.44) between prevalences of the infection of male calves in the different departments. The hematocrit values varied between 37 ± 0.00% (Sinematiali) to 37.50 ± 3.54% (Korhogo). Analysis of these values made it possible to confirm that, in general, the male calves presented a good average hematocrit (above 25%). In addition, 12% of total female calves were infected by *Babesia*.

The female calves of Korhogo department were only infected and the prevalence was 75%. The average value of the hematocrit ($38.33 \pm 11.93\%$) for female calves was higher than 25% (Table 3). In the heifers, *Babesia* was found in 25% in the Poro area. It was met in heifers of Dikodougou and Korhogo with the

same prevalence of 33.33%, then Sinematiali (30%). However, there was no significant difference ($p = 0.34$) between prevalence of the infection in heifers in the different departments infected. But, it was missing in the heifers of M'Bengue.

Table 4. Average hematocrit values and prevalence of *Babesia* in the heifers and the cows according to the departments.

| Departments | Heifers | | Cows | |
|-------------|------------------------|--------------------------|------------------------|---------------------------|
| | Average hematocrit (%) | Prevalence (%) | Average hematocrit (%) | Prevalence (%) |
| Sinematiali | 45.33 ± 11.85 | 30 ^a (3/10) | 35 ± 2.65 | 50 ^a (3/6) |
| Korhogo | 51 ± 0.00 | 33.33 ^a (1/3) | 42.50 ± 2.38 | 26.67 ^b (4/15) |
| Dikodougou | 20 ± 0.00 | 33.33 ^a (1/3) | 35.75 ± 8.81 | 19.05 ^b (4/21) |
| M'Bengue | - | - | 20 ± 0.00 | 14.29 ^b (1/7) |
| Total | - | 25 (5/20) | - | 24.49 (12/49) |

Prevalences in the same column, which bear the same letter, are not statistically different from the 5% threshold.

The hematocrit values varied between $20 \pm 0.00\%$ to $51 \pm 0.00\%$. In general, the heifers presented a good average hematocrit (above 20%). In addition, *Babesia* was found in cows in all departments of the Poro area, with a prevalence of 24.49%. The higher prevalence was obtained in the department of Sinematiali (50%) followed departments of Korhogo (26.67%), Dikodougou (19.05%) and M'Bengue (14.29%). There was a significant difference ($p < 0.05$) between these prevalences. As in the preceding cases, in general, the cows presented a good average hematocrit (above 25%). The hematocrit values varied between $35 \pm 2.65\%$ to $42.50 \pm 2.38\%$ (Table 4).

The presence of *Babesia* in these bovine categories could be explained by the presence of the tick species *Rhipicephalus (Boophilus) microplus*. However, the sign of anaemia observed in heifers and cows in Dikodougou and M'Bengue departments could be justified by an inappropriate application of the veterinary medicinal products to fight against ticks and pathogens. Similarly result was obtained in sheep by Opara *et al.*, (2016). *Babesia* was observed in the adult sheep with a higher prevalence (18.2%). But, the younger sheep was not infected by this parasite.

Prevalence of different Babesia species

Two *Babesia* species were identified in the Poro area in this study: *Babesia bigemina* and *Babesia bovis* with respective prevalence of 12.50% and 10%. The higher prevalence of *Babesia bovis* (13.33%) was obtained in departments of Sinematiali and Korhogo, while *Babesia bigemina* was more observed in the departments of Sinematiali (26.67%). Mixed infections cases of bovines by *Babesia bigemina* and *Babesia bovis* were also noted with a global prevalence of 3.33%. Mixed infections were observed in the departments of Sinematiali and Korhogo (6.67%). However, there was significant difference ($p < 0.05$) between prevalence of the infection in cows in the different departments of Sinematiali and Dikodougou (Fig. 2).

Babesia bovis was also observed in the North of Côte d'Ivoire by Djakaridja *et al.*, (2014) in bovine breeding with a prevalence of 45.28%, and by Komoin-Oka *et al.*, (2004) (5.4%) in the Center of Côte d'Ivoire.

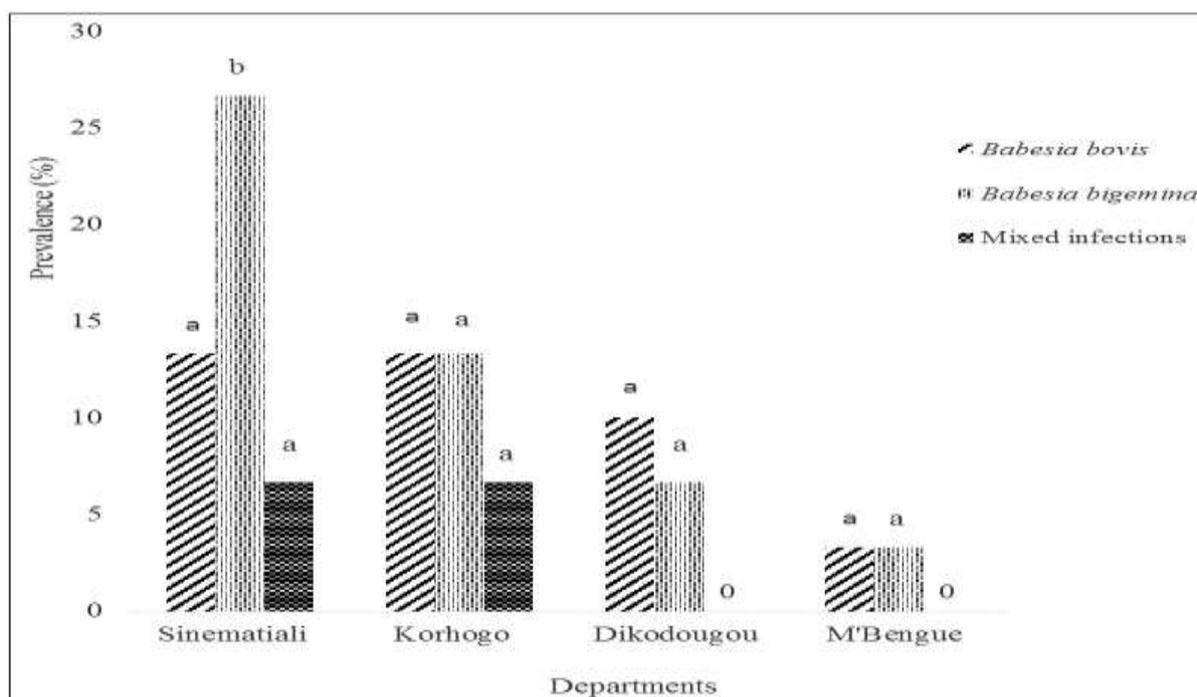


Fig. 2. Prevalence of different *Babesia* species.

This difference could be related to the strong pressure of acaricides used to fight against ticks in the herds followed by Komoin-Oka *et al.*, (2004). The regular treatment of the sheep against ticks would significantly reduce their load and the prevalence of blood parasites.

In addition, Lorusso *et al.*, (2016), found *Babesia bovis* (2%) and *Babesia bigemina* (7.9 %) in Nigeria bovines. These percentages remain lower than those obtained in the present study. It is the same for Mahoney and Mirre (1971) who found *Babesia bovis* (0.04%) and *Babesia bigemina* (0.23%). On the other hand, Yéo *et al.*, (2017) found in the bovine of Ferkessedougou department in the north of Côte d'Ivoire a higher prevalence for *Babesia bovis* (55%) and *Babesia bigemina* (26.67%).

Mixed infections were observed in the departments of Sinematiali and Korhogo with the same prevalence (6.67%). The presence at the same time of *Babesia bovis* and *Babesia bigemina* could be justified by the transmission at the same time of these blood parasites by *Rhipicephalus (Boophilus) microplus*. These results are in conformity with those of Moses and Phillip (2013) who observed mixed infection (27.2%) of *Babesia bovis* and *Babesia bigemina*.

Conclusion

This study has enabled us to confirm the presence of *Babesia* in bovine breedings in the Poro area of Côte d'Ivoire. Its prevalence has been greater in bovines of the departments of Sinematiali and Korhogo. Bovines did not suffer from advanced anaemia. Mixed infections were met in the bovines from the departments of Sinematiali and Korhogo. The male and female calves, the heifers and the cows were infected by *Babesia*.

This situation represents a constraint for the introduction of foreign races in Poro area of Côte d'Ivoire. It is therefore important, for successful farming, that combative measures about *Babesia* and stopping mixed control breeding of bovines and all other animal species in particular the sheep of the stockbreeders are implemented, in order to improve sanitary conditions in these areas.

Acknowledgement

The authors gratefully acknowledge the technical staff of Regional Laboratory of Korhogo (LRK) and the farmers who accepted to participate at this study.

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